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CVISN

MODEL DEPLOYMENT INITIATIVE SUMMARY EVALUATION PLAN

July 1998

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CVISN

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16. Abstract

The purpose of the Commercial Vehicle Information Systems and Networks Model Deployment Initiative (CVISN MDI) is to demonstrate the technical and institutional feasibility, costs, and benefits of the primary Intelligent Transportation Systems (ITS) user services for commercial vehicle operations (CVO) and to encourage further deployment of these services. The Model Deployment Initiative focuses on three primary CVISN user services: Credentials Administration, Safety Information Exchange, and Electronic Screening. These services are expected to improve the administration of revenue, safety, and other regulatory functions in two prototype (Maryland and Virginia) and eight pilot (California, Colorado, Connecticut, Kentucky, Michigan, Minnesota, Oregon, and Washington) states.

This Document (1) Describes the CVISN user services that are being deployed in the model deployment states, (2) Presents the overall strategy for evaluating CVISN services, (3) Presents the technical approach for implementing the evaluation strategy, (4) Identifies potential sources of CVISN evaluation data, and (5) Provides a plan for managing the CVISN MDI evaluation.

The main work of the evaluation will be carried out in four study areas (Safety, Customer Satisfaction, Costs, and Institutional Benefits). Within these four study areas, several tests and analysis efforts are planned. They include literature searches, surveys of motor carriers and drivers, focus groups and personal interviews, site visits to state agencies and motor carriers, and special field test. Data collection began in early 1998 and will continue through mid 1999. Interim results will be available in late 1999.

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EXECUTIVE SUMMARY

The purpose of the Commercial Vehicle Information Systems and Networks Model Deployment Initiative (CVISN MDI) is to demonstrate the technical and institutional feasibility, costs, and benefits of the primary Intelligent Transportation Systems (ITS) user services for commercial vehicle operations (CVO) and to encourage further deployment of these services. The Model Deployment Initiative focuses on three primary CVISN user services:

- Credentials Administration (electronic credentialing and clearinghouses)
- Safety Information Exchange
- Electronic Screening.

These services are expected to improve the administration of revenue, safety, and other regulatory functions in two prototype (Maryland and Virginia) and eight pilot (California, Colorado, Connecticut, Kentucky, Michigan, Minnesota, Oregon, and Washington) states.

This CVISN Evaluation Plan

1. Describes the CVISN user services that are being deployed in the model deployment states
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5. Provides a plan for managing the CVISN MDI evaluation.

CVISN MDI USER SERVICES

The CVISN deployments in each of the ten model deployment states include elements of each of the major CVISN user services. At a minimum, the prototype and pilot states have agreed to deploy the basic CVISN for credentialing and roadside enforcement, referred to as the "Level 1 Deployment." However, some states plan to deploy more fully developed systems, especially those supporting the roadside enforcement functions.

CVISN will incorporate a variety of changes to existing commercial vehicle credentialing and roadside enforcement operations, and the key features and schedules for deploying these two services vary considerably among the CVISN pilot and prototype states. One of the first steps in developing the evaluation strategy for CVISN was to identify the key innovative features that are expected to be deployed in one or more states, along with the major benefits that will result from their deployment. The key features include

- **Credentials Administration**
  - End-to-end electronic application and processing of credentials (including electronic submittals, direct links to legacy systems, edit checks, fee calculation, invoice generation, funds transfer, and production of credentials)
  - Use of PC-based versus Web Carrier Automated Transaction (CAT) System for submitting applications for credentials

- Printing of permanent or temporary credentials in carrier offices – especially for trip-related credentials (e.g., oversize/overweight)

- Interface with International Registration Plan (IRP) and International Fuel Tax Agreement (IFTA) clearinghouses.

- **Roadside Enforcement (Electronic Screening and Safety Information Exchange)**

  - Mainline screening for weight, credentials, and safety
  - Sorter lane screening using automated vehicle identification
  - Mobile units equipped with networked screening data
  - Real-time access to screening data at fixed sites and in mobile units
  - Facilities for screening on bypass routes.

EVALUATION STRATEGY

The evaluation of the CVISN MDI will furnish information to Federal Highway Administration (FHWA), Congress, states, public interest groups, and others on the desirability of making CVISN investments and corresponding enhancements to national, state, regional, and local transportation programs. It should permit comparisons between, and aid in developing priorities among, alternative investments within the FHWA's ITS program and between ITS and non-ITS programs. For this reason, the evaluation will include a comprehensive benefit/cost analysis (BCA) to determine the economic worth of CVISN deployments. However, it is equally important to document other benefits associated with the national ITS/CVO goals and to learn as much as possible about how CVISN changes the way in which commercial vehicle operations are carried out. Thus, a dual strategy has been developed to achieve two objectives:

1. Conduct a rigorous BCA to determine the net economic benefits of the CVISN MDI

2. Analyze and document additional outcomes and benefits of interest to various stakeholders in the CVISN model deployments that are not included in the BCA.

The measures for which data need to be collected, both for input to the BCA and for providing information on additional outcomes of interest to stakeholders, were established by considering the potential changes to the transportation system, identifying groups impacted by the changes, and obtaining their input on potential benefits and costs.

The "customer" groups affected by the deployment of CVISN are

- Motor carriers
- State governments
- Law enforcement agencies
- Shippers/receivers
- Members of the public
- Federal government.

The interests of these stakeholders or customers were considered early in the evaluation planning process. This was achieved in part through an evaluation workshop involving over 100 state, federal, and private partners. The potential benefits identified by the partners can be grouped under the five traditional Intelligent Transportation Systems (ITS) goal areas as follows:

Safety

- Fewer crashes involving trucks
- Increased personal safety of the motoring public.

Efficiency (increased throughput or capacity)

- Increased throughput at inspection sites
- Increased throughput of credentialing process.

Productivity (cost savings, revenue increases, increased output)

- Reduced time, cost, and uncertainty in credentialing
- Reduced cost of inspections
- Transit time reduced by bypassing inspection sites
- Transit time reduced by shorter stops at inspection sites
- Reduced accident costs
- Decreased tax and fee evasion
- More equitable treatment in paying taxes and fees
- Transit time decreased as a result of fewer crashes
- Reduced accident cleanup costs.

Mobility

- Reduced cost of goods movement to shippers/receivers and the public
- Decreased goods movement transit time and increased reliability of delivery schedules to/from shippers/receivers
- Increased cargo safety and security
- Reduced highway delays to public from fewer accidents.

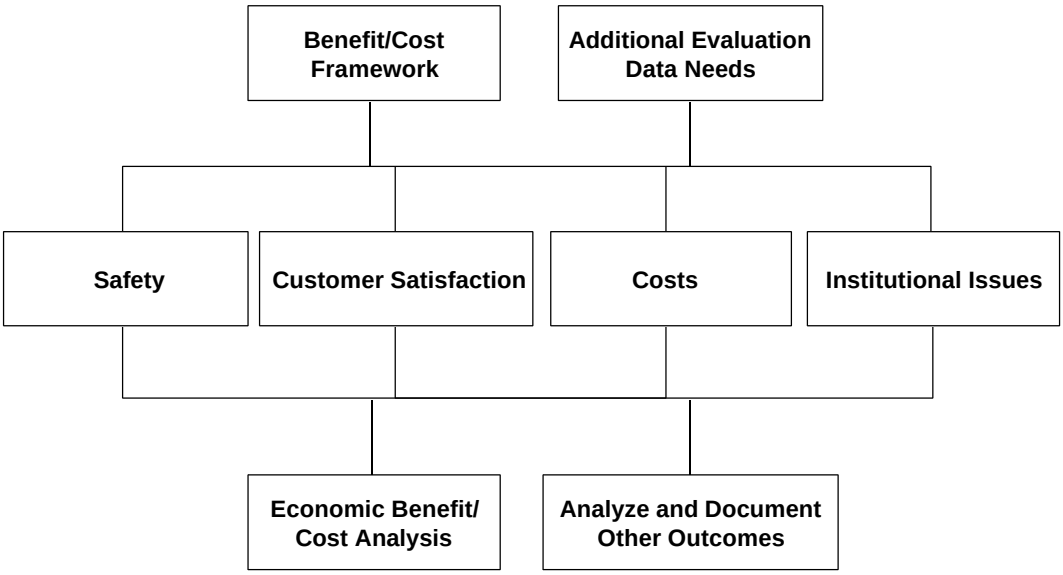
Energy/Environment

- Reduced energy consumption of trucks
- Reduced environmental impacts of trucks.

To help establish priorities for the evaluation strategy, the participants in the evaluation workshop were asked to rate the potential benefits according to their perceived importance. This was done after considering both the value of the benefits and the potential magnitude of the benefits. All of the groups participating in the workshop rated safety benefits the highest and efficiency second. Mobility, productivity, and energy/environment, in that order, were rated lower. Recall, however, that the relative importance of these benefits is inherently linked to their potential for achievement.

TECHNICAL APPROACH

The main work of the evaluation will be carried out in four study areas, as shown below. The first three study areas correspond to the major anticipated benefits. The institutional issues area will answer questions related to institutional and nontechnical benefits of, and impediments to, deploying CVISN. All of the study areas derive data requirements from and will provide data and analyses for the economic BCA and document the other outcomes of interest to stakeholders.



Major Study Areas in the CVISN MDI Evaluation

Within the four study areas, several tests or analysis efforts are being planned. The tests, along with selected evaluation measures, are shown in the following table.

Planned Evaluation Tests

Tests	Selected Evaluation Measures
Literature Reviews	- Value of property damage, fatalities, personal injuries - Value of time savings (motor carriers) - Value and incidence of highway delays from accidents involving CVs - Value of noise and emissions reduction
Baseline National Motor Carrier Survey	- Awareness, attitudes, and satisfaction related to credentialing and enforcement practices - Factors affecting involvement in CVISN - Information to plan survey on motor carriers involved in electronic credentialing
Survey of Drivers	- Attitudes and opinions regarding roadside enforcement practices
Survey of Motor Carriers Using Electronic Credentialing	- Value of productivity increases - Overall satisfaction with credentialing services
Focus Groups	- Detailed information about attitudes, behaviors, and issues - Survey design information
Site Visits to State Offices	- CVO operating costs before and after CVISN deployment - Other inputs to BCA
Site Visits to Motor Carriers	- Credentialing costs before and after CVISN deployment - Other inputs to BCA - Input to motor carrier surveys
Accident Analysis	- Number of crashes and injuries, and amount of property damage related to CVs
Compliance Rate Study	- Proportion of trucks complying with safety regulations before and after CVISN
Screening Assessment Study	- Probability of inspection for "high risk" and "low risk" carriers
SAFER Data Mailbox Studies	- Amount of time to upload and download safety data from roadside - Number of out-of-service order violators identified (actual and potential)

Sources of Evaluation Data

The CVISN deployment plans of the ten prototype and pilot model deployment states present many opportunities to evaluate the costs and benefits of CVISN services. Every state has plans to deploy at least the basic CVISN services for credentialing and roadside enforcement (i.e., "Level 1 Deployment").

However, the schedule and level of deployment vary considerably from state to state. For example, some states will deploy fully operational CVISN services in 1998, while others will only begin testing certain systems and are less certain about the timeframe for full-scale deployment. Also, some states are focusing their resources on credentialing services, while others are putting more emphasis on roadside enforcement applications.

Rather than evaluate every CVISN component deployed in each state, deployments that provide the best opportunities to assess the impacts and benefits of selected CVISN services will be evaluated. In

addition to being an efficient way to use evaluation resources, this approach is consistent with the national perspective for evaluating the costs and benefits of CVISN services, not specific deployments.

Initially, data collection for each type of system will be focused in one or two states. However, because it is of interest to learn how the benefits are affected by differences in operating procedures and institutional factors, diverse applications will be sought when selecting the second and third deployment of each type of system to evaluate.

Before initiating new data collection efforts other sources of information will be considered. For example, many field operational tests and other programs related to ITS/CVO have been completed recently or are concurrent with CVISN deployment. Some of these tests could provide valuable information about CVISN benefits. Examples include Advantage I-75, Oregon Green Light, SAFER data mailbox, field operational tests of credentialing and safety enforcement services from the I-95 Corridor Coalition CVO Working Group, and the "one-stop" tests (midwest, southwest, and HELP). Recently completed studies conducted by the American Trucking Association and the National Governors Association will provide useful information on ITS/CVO costs to motor carriers and state agencies, respectively.

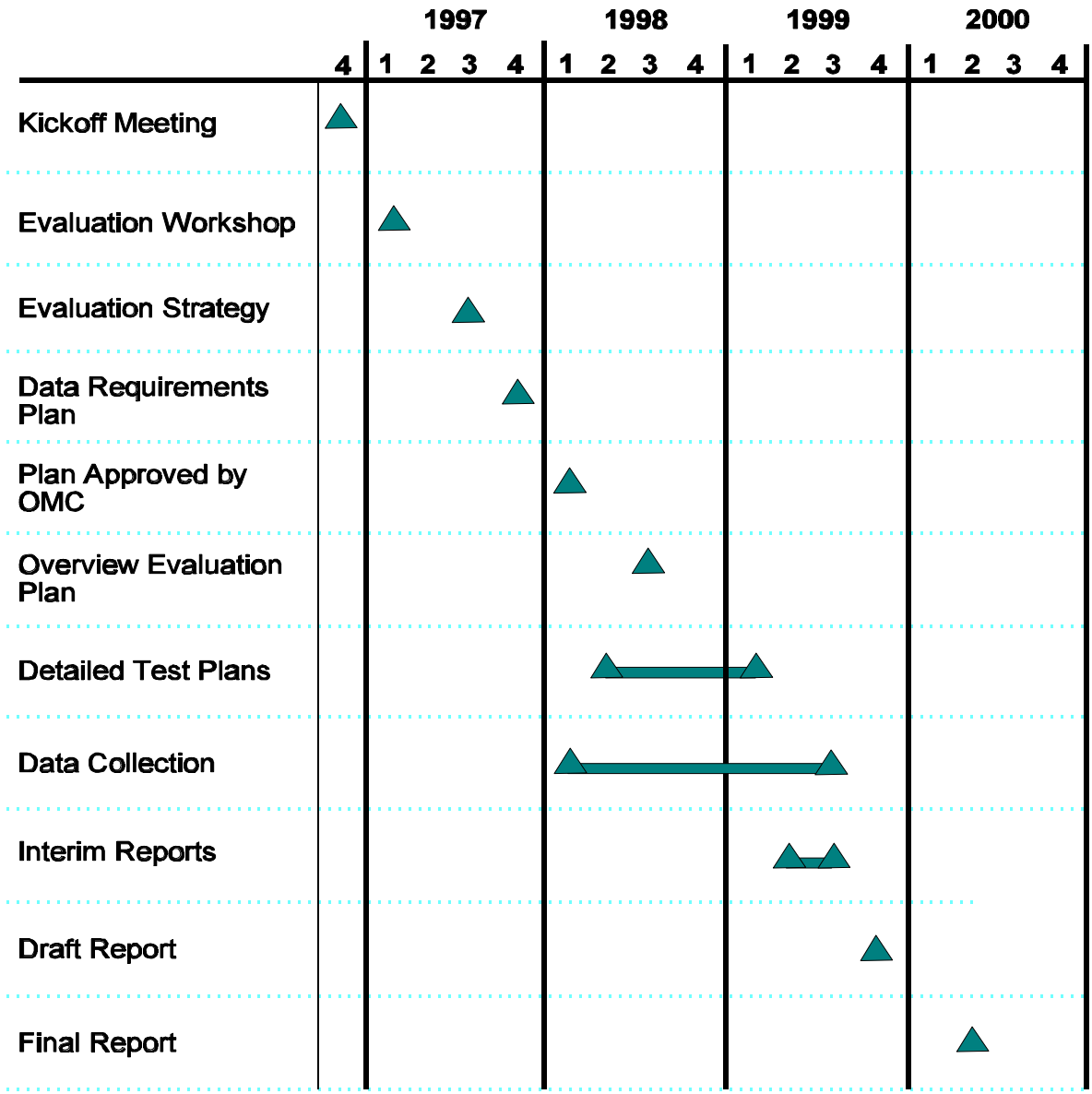
There will be significant collaboration with the evaluation efforts of several ongoing programs. For example, the CVISN and Oregon Green Light evaluation teams are cooperating on two safety-related tests in Oregon. Also, the SAFER Data Mailbox and I-95 CVO field operational tests will share data with the CVISN MDI safety studies in achieving their respective evaluation objectives.

MANAGEMENT PLAN AND EVALUATION SCHEDULE

The CVISN evaluation project is a cooperative effort among a large number of federal and state agencies and private contractors. As part of its mission to provide strategic leadership for ITS research, development, and deployment across DOT, the ITS Joint Program Office (JPO) has the ultimate responsibility for assessing (evaluating) the CVISN (MDI). The prime contractors supporting this effort are Battelle and SAIC. Battelle was assigned the primary responsibility for planning the national evaluation of CVISN. In addition, SAIC and several subcontracting organizations are also participating in this effort. Other participants include the John A. Volpe National Transportation Systems Center, FHWA (especially the Office of Motor Carriers), and, of course, the CVISN project teams from the ten prototype and pilot model deployment states. Johns Hopkins University's Applied Physics Laboratory, through its role as a system developer and CVISN program facilitator for the FHWA, is also providing valuable support to the CVISN evaluation effort.

Joe Peters of the JPO has the overall responsibility for ITS program assessment and is the COTR for the IPAS contracts with Battelle and SAIC. Mike Freitas (FHWA) is the Work Assignment Manager for CVISN evaluation. He is responsible for overseeing the technical approach of the evaluation project and serves as the JPO's principal government contact with state and federal partners. He provides technical guidance to Battelle and SAIC IPAS teams on all matters related to CVISN evaluation. John Orban, Battelle's Evaluation Leader and CVISN Evaluation Project Manager, is responsible for the day-to-day management of the technical activities and communications between the project team and various partners. Other team members include the four study area leaders and eight evaluation coordinators assigned to the ten model deployment states.

The planning schedule and milestones for the CVISN evaluation project are shown on the next page.



Schedule and Milestones

CHAPTER 1

INTRODUCTION

The purpose of the Commercial Vehicle Information Systems and Networks Model Deployment Initiative (CVISN MDI) is to demonstrate the technical and institutional feasibility, costs, and benefits of the primary Intelligent Transportation Systems (ITS) user services for commercial vehicle operations (CVO) and to encourage further deployment of these services. The CVISN user services deployed in ten participating states include Credentials Administration (electronic credentialing and clearinghouses), Safety Information Exchange, and Electronic Screening. These services are expected to improve the administration of revenue, safety, and other regulatory functions in two prototype (Maryland and Virginia) and eight pilot (California, Colorado, Connecticut, Kentucky, Michigan, Minnesota, Oregon, and Washington) states.

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The dual strategy for evaluation includes plans for conducting a comprehensive economic benefit cost analysis of CVISN services, as well as documenting other benefits of interest to various stakeholders.

1.1 INTELLIGENT TRANSPORTATION SYSTEMS

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) established the basic framework for the national ITS program, which is managed by the U.S. Department of Transportation (DOT). The ITS program promotes the development and application of electronics, communications, and information systems to improve the efficiency and safety of surface transportation systems. ITS technology has been evolving over the last 10 years with deployment in field tests, in pilot applications, and as parts of state and local transportation systems.

In 1995, DOT produced its national ITS program plan, which describes DOT's program organization and outlines the Department's role in promoting the development and deployment of ITS.

The goals of the national ITS program are to

1. Improve the *safety* of the nation's surface transportation system
2. Increase the operational *efficiency* and capacity of the surface transportation system
3. Enhance the personal *mobility* and the convenience and comfort of the surface transportation system
4. Enhance present and future *productivity*
5. Reduce *energy and environmental costs* associated with traffic congestion
6. Create an environment in which the development and deployment of ITS can flourish.

These were intended to be broad goals representing aspirations across ITS user services in three application areas: metropolitan transportation, rural transportation, and commercial vehicle operations (CVO).

The ITS/CVO Strategic Communications and Outreach Plan (October 1996) describes more specifically the goals of ITS as they relate to CVO. The program goals in the five-year plan for the ITS/CVO are

- Improve highway safety
- Reduce congestion costs for motor carriers
- Streamline credentials and tax administration
- Ensure regulatory compliance and equitable treatment.

Although there is not a one-to-one mapping of the national ITS program goals to the goals in the ITS/CVO five-year plan, the themes of safety, mobility, efficiency, and productivity are still present.

In 1994, the ITS Joint Program Office (JPO) of DOT was established to provide strategic leadership for ITS research, development, testing, and deployment. Working with the various surface transportation modes [the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), the National Highway Traffic Safety Administration (NHTSA), the Federal Railroad Administration (FRA), and the Research and Special Programs Administration (RSPA)], the JPO and ITS America collaborated to publish the National ITS Program Plan (NPP) in March 1995. Among other things, the NPP describes the national ITS program, provides guidance on investment decisions and program activities, promotes coordination among public and private partners, focuses programs and activities on deployment, and facilitates the assessment of ITS programs.

During this period, the Field Operational Test (FOT) program was established to conduct formal tests of ITS services, functions, and technologies in "real world" conditions. As specified by ISTEA, each FOT requires formal evaluations to determine how well the technologies work and to document their benefits and costs. The FOT program is continuing as new technologies are developed and tested.

In 1996, DOT announced three new initiatives aimed at accelerating the deployment of ITS. The Metropolitan Model Deployment Initiative (MMDI) in four U.S. metropolitan areas (New York, Phoenix, Seattle, and San Antonio) will showcase deployment of an integrated ITS infrastructure. As many as nine distinct ITS services for metropolitan applications are being deployed in each of the four MMDI sites. The DOT also initiated the Advanced Rural Transportation Systems (ARTS) program to plan and deploy ITS technologies in rural settings. The ARTS strategic plan was developed in 1996, and a model deployment program began in 1997. The third major initiative, aimed at promoting the deployment of ITS services in the area of commercial vehicle operations, is the CVISN Model Deployment Initiative.

1.2 CVISN MODEL DEPLOYMENT INITIATIVE

The CVISN MDI began with prototype deployments in Maryland and Virginia; then it was expanded to include eight pilot states: California, Colorado, Connecticut, Kentucky, Michigan, Minnesota, Oregon, and Washington. The Johns Hopkins University's Applied Physics Laboratory (JHU/APL) is playing a major role in developing selected CVISN systems and supporting the deployment in the ten prototype and pilot states.

To help promote the deployment of CVISN in other states, DOT sponsored the CVO mainstreaming program to help states and the motor carrier industry work together to find common solutions to the development and deployment of CVISN services. Regional "mainstreaming champions" were recruited

to develop policies, plans, and agreements to expedite the regional deployment of CVISN. The CVISN prototype, pilot, and mainstreaming champion states are shown in Figure 1.1.

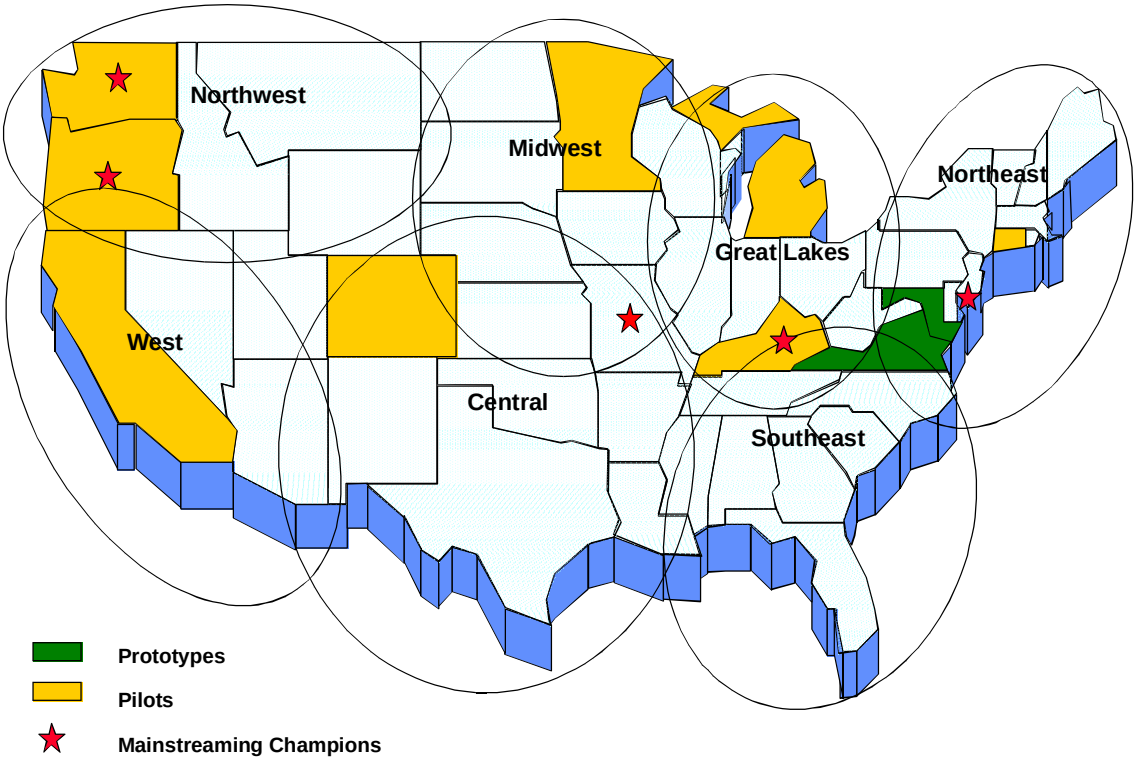


Figure 1.1. Prototype, Pilot, and Mainstreaming States

The primary focus of the CVISN MDI is on three ITS/CVO user services: Credentials Administration (including electronic credentialing and clearinghouses), Safety Information Exchange, and Electronic Screening. Model deployment states were selected, in part, because they agreed to deploy some level of each of these services. The other five services (International Border Clearance, Automated Inspection, On-Board Safety, HAZMAT Incident Response, and Fleet and Freight Management) are being developed or undergoing operational testing. Descriptions of the three CVISN services (elements), including the software and hardware systems that provide these services, are provided in Chapter 2.

1.3 SCOPE OF THE CVISN MDI EVALUATION

This evaluation of the CVISN MDI is designed to furnish information to FHWA, Congress, states, public interest groups, and others on the desirability of making CVISN investments and corresponding enhancements to national, state, regional, and local transportation programs. The evaluation should permit comparisons between, and development of priorities among, alternative investments within the FHWA's ITS program and between ITS and non-ITS programs. For this reason, the evaluation will include a comprehensive benefit/cost analysis (BCA) to determine the economic worth of CVISN deployments. However, it is equally important to document other benefits associated with the national ITS/CVO goals and to learn as much as possible about how CVISN changes the way in which commercial vehicle operations are carried out. Thus, a dual strategy has been developed that meets the data needs of BCA

and the information needs of various stakeholders (states, motor carriers, federal agencies). This dual strategy is discussed in Chapter 3.

The evaluation will involve collecting data and analyzing costs and benefits in some or all of the eight CVISN pilot and two prototype states. However, the project will not evaluate every system deployed in every state. Instead, resources will be focused on collecting data that provide the best opportunity to assess the impacts and benefits of selected CVISN services.

The remainder of this section discusses a variety of programmatic issues that will have an impact on the scope of the evaluation effort. Specifically, it discusses (1) which CVISN services are important to evaluate, (2) the relative importance of the evaluation goals, (3) criteria for selecting the best opportunities to collect evaluation data from CVISN MDI states, and (4) coordination with related ITS/CVO programs.

CVISN Services to Be Evaluated

The CVISN deployments in each of the ten prototype and pilot states include elements of two major CVISN user services:

1. Electronic credentialing and linkages to electronic clearinghouses
2. Roadside enforcement, including electronic screening of trucks at highway speeds and strategies for transmitting safety data to and from the roadside.

Each of these two services incorporates a variety of changes to existing commercial vehicle credentialing and roadside enforcement operations, and the key features and schedules for deploying these two services vary considerably among the CVISN pilot and prototype states.

The first step in developing the evaluation strategy for CVISN is to identify the key innovative features that are expected to be deployed in one or more states, along with the major benefits that will result from their deployment. Table 1.1 identifies some of the key features and anticipated benefits of credentials administration. Table 1.2 provides the same information for roadside enforcement.

Relative Importance of Evaluation Goals

The resources that should be devoted to collecting data on the benefits or costs of CVISN services are related both to the relative importance or value of the benefit or cost and the *a priori* estimate of the magnitude of the benefit or cost. That is, the importance of an objective is inherently linked to its potential for achievement. Nevertheless, in advance of estimates of the achievement of certain objectives, state planners involved in CVISN deployment were polled during an evaluation workshop in January 1997 to help focus the evaluation plan on at least the objectives that were of greatest importance to the participants. Following a brief presentation on the meaning of the different goal areas, the participants were divided into four functional groups: law enforcement, International Registration Plan (IRP) processing, International Fuel Tax Agreement (IFTA) processing, and FHWA (regional and headquarters) employees. Each group was asked to allocate 100 points among the five goal areas (safety,

Table 1.1. Key Features and Anticipated Benefits of CVISN Credentials Administration Deployments

Key Features	Anticipated Benefits
End-to-end electronic application and processing of credentials. Includes electronic submittals, direct links to legacy systems for automated processing (i.e., edit checks, fee calculation, invoice generation), funds transfer, and production of credentials.	Time and cost savings and increased customer satisfaction for both carriers and states. Fewer delays to carriers for obtaining credentials.
Use of PC-based and Web-based Carrier Automated Transaction (CAT) software to submit applications for credentials.	Time and cost savings and increased satisfaction for both carriers and states. Relative benefits of PC- and Web-based CATs may depend on size of carrier.
Printing of permanent or temporary credentials in carrier offices – especially for trip-related credentials; e.g., oversize/overweight (OS/OW).	Avoids delays in getting vehicle on the road.
Interface with IRP and IFTA clearinghouses.	Cost savings to states.

Table 1.2. Key Features and Anticipated Benefits of CVISN Roadside Enforcement Deployments

Key Features	Anticipated Benefits
Mainline screening with Dedicated Short-Range Communication (DSRC) and Weigh-in-Motion (WIM).	Time and cost savings and increased customer satisfaction for registered carriers. Improved targeting of high-risk carriers.
Sorter lane screening using license plate reader (LPR), optical character reader (OCR), automated vehicle identification (AVI), and/or low-speed WIM.	Improved targeting of high-risk carriers through application of screening criteria on a broader population of trucks (i.e., of carriers not registered for mainline screening).
Mobile units equipped with networked screening data.	Improved targeting of high-risk carriers Identification of and reduction in number of out-of-service (OOS) order violators.
Timeliness of the screening data used in the inspection units (fixed or mobile).	Increased compliance with safety regulations. Improved targeting of high-risk carriers. Identification of and reduction in number of OOS order violators.
Facilities for screening on bypass routes.	Increased safety through identification of violators of safety regulations.

efficiency, mobility, productivity, and environment) according to their perceived importance. The results are shown in Figure 1.2. All four groups rated safety benefits the highest and efficiency second; mobility and productivity nearly tied for third, and energy and environment ranked a distant fifth. It is important to understand that the results were obtained from individuals exposed to the evaluation plan for the first time. Furthermore, the ranking did not include input from other interested parties (e.g., carriers and shippers). Nevertheless, the results in Figure 1.2 indicate a strong interest in documenting safety benefits.

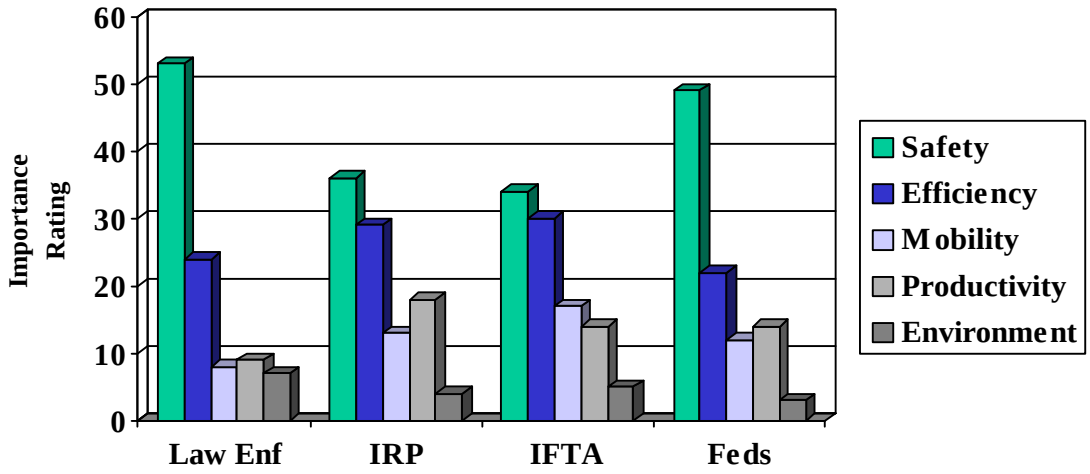


Figure 1.2. Rating of Evaluation Goals by CVISN Workshop Participants

Selecting Opportunities to Collect Evaluation Data

Because evaluation resources are being focused on deployments of key CVISN features rather than being allocated to every deployment of CVISN technology, some states may not receive a detailed analysis of the benefits and costs of their own CVISN deployment. However, every state, including those not involved in the pilot and prototype projects, will receive valuable information about the benefits and costs of the key CVISN features. Following are some of the criteria used for selecting specific deployments to provide data for the evaluation:

1. The deployment of CVISN represents a significant change from current operating procedures and may produce benefits not previously documented.
2. The change is typical and representative of those included in the CVISN program and may be repeated in other states.
3. The deployment will occur within the funding period of the evaluation.
4. The size and importance of the impacts (cost and benefits) are expected to be significant.
5. It is cost effective to collect the data needed for evaluation.
6. Other factors that might impact the measurement of CVISN benefits can be controlled.
7. Interactions between planned CVISN components or between CVISN services and the state's CV operating procedures are important to evaluate.

Initially, data collection for each type of system would be focused in one or two states. However, because it is of interest to learn how the benefits are affected by differences in operating procedures and institutional factors, diverse applications will be sought when selecting the second and third deployment of each type of system to evaluate. In addition, some impacts of integration are best observed by evaluating the way different states package the CVISN functions. In these cases, the states would have some basic CVISN elements in common, and elements would vary in others.

Coordination With Related ITS/CVO Programs

Many programs related to ITS/CVO have been completed recently or are concurrent with CVISN deployment, and many of the CVISN pilot and prototype states are participating in one or more ITS operational tests. Some of these tests could provide valuable information about CVISN benefits. For example, the Advantage I-75 field operation test is providing information on the benefits of mainline preclearance systems. Also, one of the most promising sources of information related to roadside screening is the Oregon Green Light project. Through a separate funding source, Oregon plans to deploy roadside screening devices at a large number of sites. The Safety and Fitness Electronic Records (SAFER) data mailbox project, conducted by eight eastern states (including three CVISN states), may be the only opportunity to evaluate the benefits of real-time safety information exchange. The Midwest, Southwest, and HELP electronic one-stop shopping tests are also potential sources of information on the benefits of electronic credentialing systems.

In addition to these programs, other benefit/cost studies are related to the CVISN evaluation effort. For example, in August 1996, the American Trucking Association (ATA) completed a "qualitative" BCA from the carrier's perspective. Also, in November 1997, the National Governors' Association (NGA) completed its study of budgetary implications of ITS/CVO for state agencies. The NGA study involving data collection in eight states (including five CVISN states) focused on estimating the *direct* benefits and investment requirements to state agencies for deploying electronic credentialing, safety, and clearance systems over the next 10 years. The scope of the study was limited to analyzing the costs and benefits to public sector agencies.

The CVISN evaluation team reviewed planning documents and evaluation reports from the completed studies to find ways to incorporate the results into the CVISN evaluation effort. Several opportunities to collaborate on data collection and analyses for ongoing ITS/CVO studies were also identified.

1.4 Organization of This Plan

The remainder of this CVISN Evaluation Plan contains a discussion of the CVISN services implemented under the MDI (Chapter 2), plus an overview of the evaluation strategy and approach (Chapters 3 and 4). The sources of data for the CVISN evaluation are described in Chapter 5 and a management plan is provided in Chapter 6.

CHAPTER 2

CVISN SERVICES IMPLEMENTED UNDER THE MODEL DEPLOYMENT INITIATIVE

This section provides a general overview of the Commercial Vehicle Information Systems and Networks (CVISN) user services and a description of the Level 1 deployments that are planned for the Model Deployment Initiative (MDI).

2.1 CVISN SERVICES

CVISN is composed of three major services: Credentials Administration, Electronic Screening, and Safety Information Exchange. There are other intelligent transportation systems (ITS) commercial vehicle operations (CVO) services (such as Hazardous Material Incident Response, International Border Crossing, and Intermodal Transportation) that are not a part of the MDI.

Credentials Administration includes a combination of carrier and state government systems. These systems will automate the complete credential life-cycle process. All aspects of the commercial vehicle credentialing process will be integrated to include electronic submittal of applications, automated processing and cross-checking of applications, automated fee calculation and invoice transmittal, electronic fee payment, and automated issuance and printing of credentials. Credentials Administration will also encompass and integrate with systems that electronically share data among states (also known as "base-state" agreements), including the International Registration Plan (IRP) and International Fuel Tax Agreement (IFTA) clearinghouses. In addition, Credentials Administration will encompass electronic filing and payment of commercial vehicle fuel taxes.

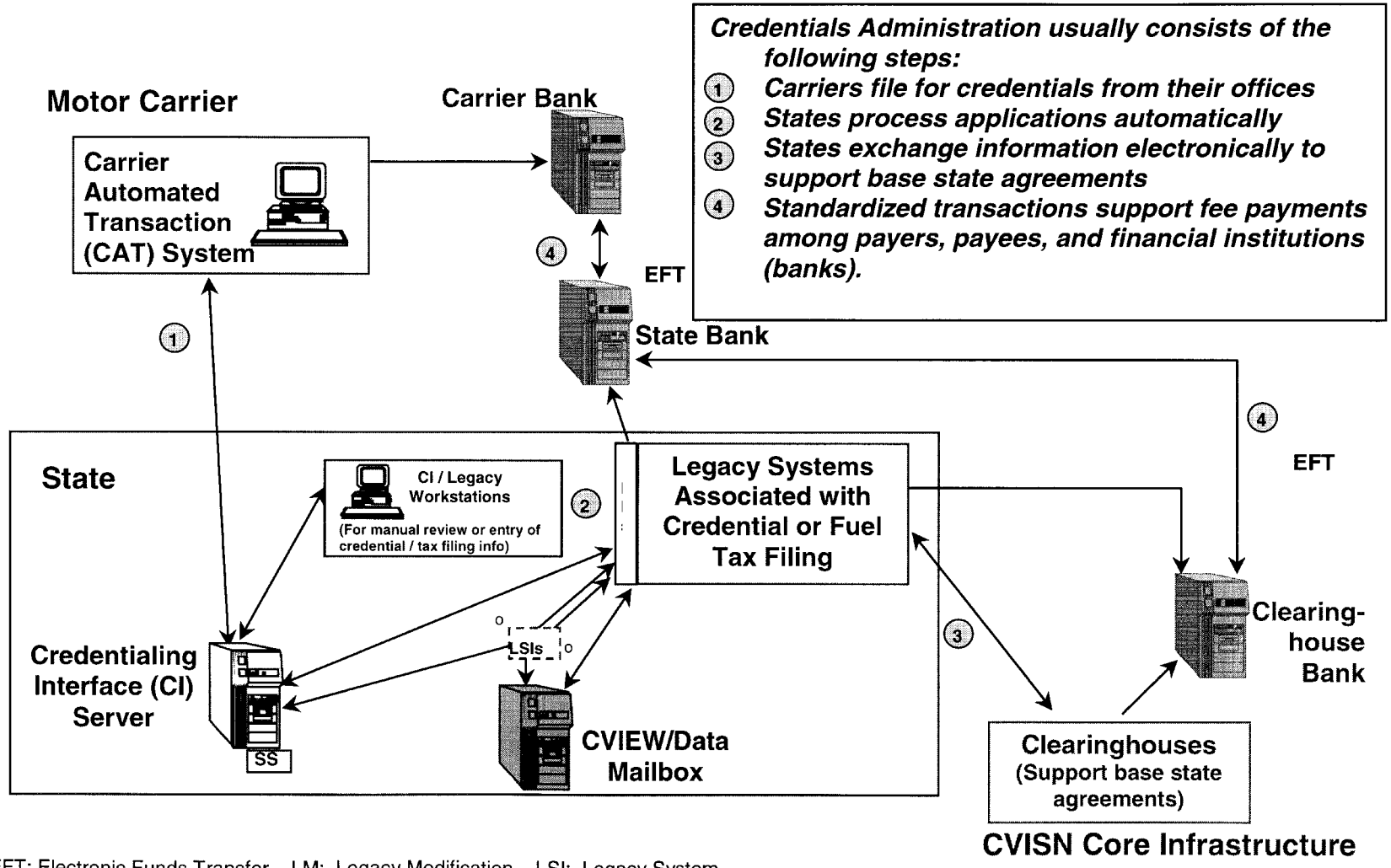
Electronic Screening includes electronically screening vehicles at fixed (e.g., weigh stations) and mobile sites to confirm that they are safe, are at proper weight, have appropriate credentials, or have not been placed out of service. The CVISN Electronic Screening systems are intended to perform this screening in such a way that safe, compliant trucks can proceed on the highway without stopping, while potentially unsafe or non-compliant trucks can be pulled in for closer inspection and confirmation of proper operating credentials.

Safety Information Exchange includes automatically recording vehicle inspection data, issuing citations if appropriate, and exchanging safety data among agencies within a state and among other states.

2.1.1 Credentials Administration

The illustration on the following page depicts the typical CVISN components of Credentials Administration.

Credentials Administration



EFT: Electronic Funds Transfer LM: Legacy Modification LSI: Legacy System

The Carrier Automated Transaction (CAT) system is a personal computer with commercially available software that has been developed specifically for CVISN Credentials Administration. Two companies, RS Information Systems (RSIS) and Intelligent Decisions Technology (IDT), offer CAT systems. These systems will reside in either motor carrier offices or service provider offices. These systems provide for credential application data entry and error checking, fee calculation (for certain types of credentials), fee payment (via electronic funds transfer), conversion of the application data to open standard electronic data interchange (EDI) formats, and electronic submission of the EDI data to the appropriate state's credentialing interface (CI). CAT also provides for receipt of invoice or credential information from the CI and local printing of commercial vehicle credentials.

Some CVISN states plan to test the Web CAT, in which a motor carrier only needs to have a personal computer that has access to the Internet. The states will build a Web page on a state server that will perform all functions of the CAT, including interface with the state CI.

The CI provides the state's single point of entry for all electronic credential applications and fuel tax transmittals. The CI validates application completeness and will not accept incomplete applications. States may deploy legacy system interfaces (LSIs) that would provide electronic interfaces from the state's CI to the legacy system. Implementation of LSIs prevents states from having to manually rekey data into the legacy systems. The CI will also provide an interface to the state's Commercial Vehicle Information Exchange Window (CVIEW) to enable the passing of credential and tax status flags to the roadside.

The state legacy systems calculate the respective registration or permit fees for IRP, IFTA, and (in some states) intrastate registration, oversize/overweight permits, and hazardous materials permits. A state may develop and maintain its own legacy systems for calculating the registration fees or may contract with a service provider to perform the calculations. Currently, three service providers have developed IRP and IFTA legacy systems to calculate fees: Lockheed Martin (VISTA), R.L. Polk (COVRS), and CACI.

The IRP Clearinghouse supports the International Registration Plan base-state agreement and acts as a repository that stores data related to fees for the states participating in IRP. Initially, the states send the IRP Clearinghouse a recap (data from approved applications). The Clearinghouse provides the state with transmittals (reports on data processed), then generates a netting report that summarizes the fees due from or owed to states.

The IFTA Clearinghouse supports the International Fuel Tax base-state agreement and acts as a repository that stores data related to fees for the states participating in IFTA. It performs the same functions as the IRP Clearinghouse, except that it does not generate the netting report.

Types of Credentialing Systems

Following are brief descriptions of the types of applications that states may decide to test.

International Registration Plan. IRP is a base-state reciprocal annual registration program for commercial vehicles that are operated in more than one state. On at least an annual basis, each motor carrier is required to submit an IRP application for each fleet. This application includes the estimated mileage and the maximum weight for all vehicles in the fleet for each state of travel. There are four types of IRP: (1) initial application (when the motor carrier first submits an application for the fleet), (2) renewal application (annual renewal of the previously registered fleet), (3) supplemental application (a change to the initial or renewal application (such as the addition of a newly purchased vehicle to the fleet), and (4) single-trip application (a one-time trip for one vehicle to operate in a state).

International Fuel Tax Agreement. The IFTA is a base-state reciprocal annual registration program for commercial vehicles that operate in more than one state. The motor carrier is required to report the types of fuel that will be used and the states of travel. Four types of IFTA applications are similar to the IRP applications.

IFTA Quarterly Tax. The IFTA quarterly tax report is a base-state reciprocal program for commercial vehicles that operate in more than one state. The motor carrier is required to report and pay a fuel tax based upon the type of fuel used, the mileage traveled in each state, and the gallons of fuel purchased in each state.

OS/OW Permits. The Oversize/Overweight (OS/OW) permit is applied for and issued for commercial vehicles that transport loads that are "over dimension" or exceed state weight limits. The motor carrier must describe load information, as well as trip origin and destination. The state will approve the specific route that the vehicle must take.

Single State Registration System (SSRS). SSRS is a base-state reciprocal registration program that is required for motor carriers that operate in more than one state and have Interstate Commerce Commission authority. Motor carriers must have the proper amount of insurance coverage to receive the SSRS registration. Thirty-eight states currently participate in the SSRS program.

Intrastate Registration Program. The Intrastate Registration Program is for commercial vehicles that operate within a single state. Motor carriers are required to register and provide proof of insurance for these vehicles annually. California, Kentucky, Michigan, Minnesota, Oregon, Virginia, and Washington plan to include Intrastate Registration as a part of their CVISN testing and deployment. In addition, these states plan to implement an electronic interface from their intrastate legacy systems to CVIEW.

Hazardous Materials (HAZMAT) Permits. Some states require motor carriers that transport hazardous materials to apply for and receive a permit before transporting hazardous materials within their borders. Minnesota is planning to implement the capability for motor carriers to electronically apply for and receive HAZMAT permits as part of their CVISN Credentials Administration deployment.

Weight Distance Tax Report. The Weight Distance Tax Report must be filed by motor carriers to report mileage for commercial vehicles that travel in participating states at a gross vehicle weight above 80,000 pounds for Kentucky and 26,000 pounds for Oregon. Both Kentucky and Oregon participate in this program and plan to include this reporting capability in their CVISN Credentials Administration deployment.

Potential Electronic Credentialing Capabilities

The CVISN pilot program allows states to choose which electronic credentialing capabilities they wish to implement. The following paragraphs briefly describe the six most common capabilities.

Electronic Application Submittal. The CAT, Web CAT, and CI will provide many attractive functions for motor carriers and states, including data entry screens for credential applications and fuel tax filing, validation for application data completeness to prevent state receipt of incomplete motor carrier applications, automatic calculation of fees, and many other functions targeted for accuracy and time savings. The types of applications that can be submitted electronically are IRP, IFTA, quarterly tax reports, OS/OW, SSRS,, intrastate, and HAZMAT registration or permits. This capability allows the motor carrier or state permit agency to complete a credential application or an IFTA quarterly tax filing

and electronically send it to the state's CI. This may be accomplished either by using a personal computer with the CAT system software or through a state-maintained Web page, or both. The architecture of the CAT and state systems will be developed as an open standard that is modular and adaptable to allow for data exchange among systems. The transactions will be sent and received among state systems and the public (motor carriers, permit services, shippers, and insurance companies, etc.) using the American National Standards Institute (ANSI) X12 EDI standard.

Integration With Legacy Systems. An electronic interface between a state's CI and legacy system may be accomplished either via the development of a LSI, a modification to the legacy system (LM), or, in many cases, both, such as in the case of states using the VISTA system for IRP. The LSI or LM will convert the EDI transaction sets into file formats that are compatible with the legacy system. It will also support data exchange from the legacy system, such as for invoices, credential approvals, and renewal notices.

Electronic Funds Transfer. States may elect to implement Electronic Funds Transfer (EFT), which allows the motor carrier or service provider to pay for credentials and quarterly tax filings electronically. The states are considering EFT for credit accounts, debit accounts, and credit cards, such as VISA or MasterCharge. Most of the CVISN states plan to offer carriers some form of EFT.

Electronic Issuance of Credentials. Some states plan to implement the capability for electronic transmission of official credentials from the CI to the CAT and the capability for the CAT to print the credentials on a local printer. Motor carriers will be able to print the official credential on printers in their offices on the same day they apply for the credential and place the credential in the vehicle cab. Most states plan to implement electronic issuance of at least the IRP credential. Some states may elect to offer the capability for the CI to fax credentials, such as OS/OW permits, to a designated fax machine.

Interface With IRP and IFTA Clearinghouses. States may elect to implement an electronic interface from their IRP legacy system to the IRP Clearinghouse. Data will be exchanged for fee recaps and transmittals with other states. States also may elect to implement an electronic link from their IFTA legacy system to the IFTA Clearinghouse. This will provide exchange of rate information, tax violator information, and other tax-related data for transmittals between other states.

Interface With Internal State Databases. States may also elect to implement an electronic interface between the CI and their internal databases to capture data for state-specific processing and maintenance.

2.1.2 Electronic Screening

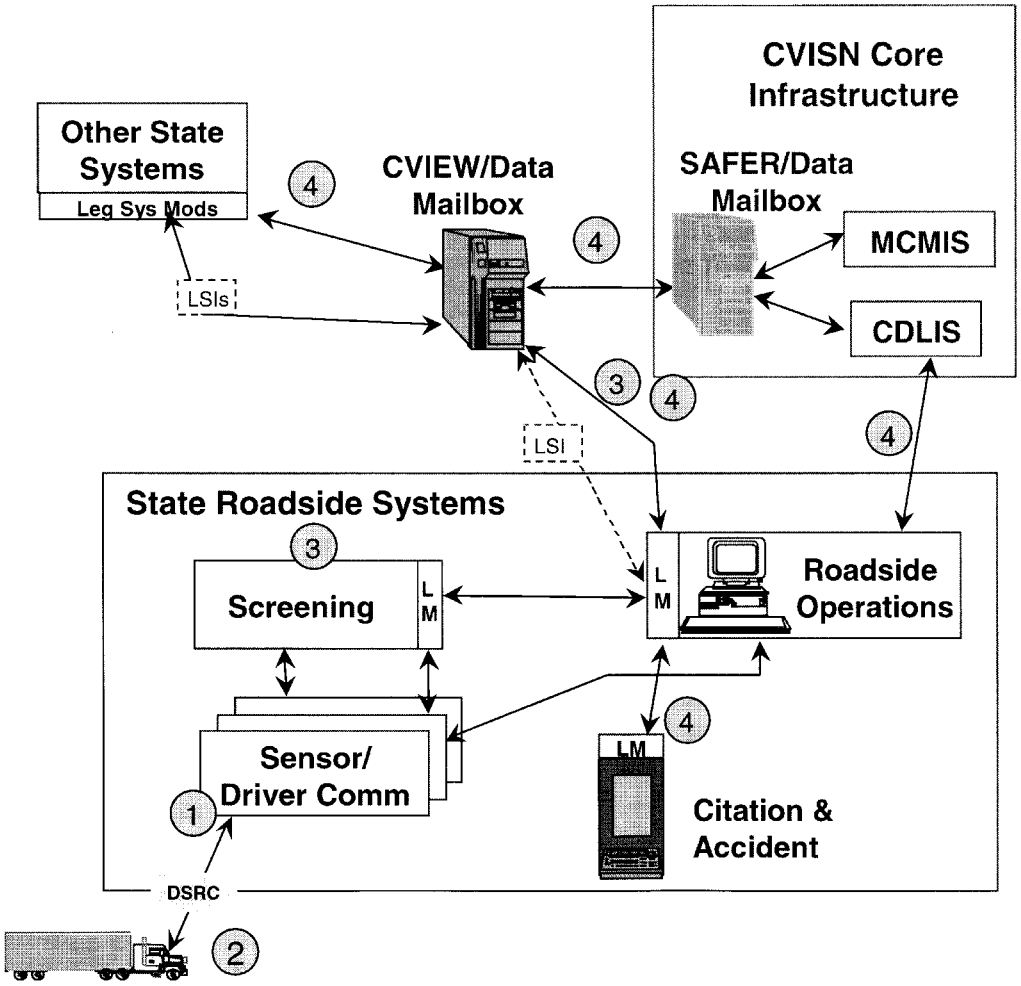
The illustration on the following page depicts the CVISN components of Roadside Screening.

There are two basic types of Electronic Screening operations: (1) fixed-site or scalehouse screening and (2) mobile operations screening.

Fixed-Site Screening

Fixed-site screening uses the technology of CVISN systems to access data about carriers, vehicles, and drivers, to prevent unnecessary inspections and delays of vehicles. Fixed-site screening is implemented at stationary roadside inspection sites for commercial vehicles. Some of the technology applications involved in fixed-site screening are described below.

Roadside Electronic Screening



DSRC: Dedicated Short Range

Roadside Electronic Screening usually consists of the following steps:

1. ***Identify carrier, vehicle, driver via DSRC transponder & standard messages***
2. ***Pull in untagged vehicle to identify carrier, vehicle, driver***
3. ***Check snapshot information when making screening decisions***
4. ***Before issuing citation, check with authoritative source for latest status***

Mainline Screening. Mainline screening is a method of screening commercial vehicles without the need for the vehicle to stop at an inspection site. A vehicle sensor is placed a short distance up the road from the vehicle inspection site. When the vehicle traveling at mainline highway speed passes the sensor, the screening system reads a transponder on the vehicle and identifies the carrier, vehicle, and driver. In some configurations, the sensor may also read the last screening event from the transponder. At the same time, weigh-in-motion (WIM) equipment and automatic vehicle identifier equipment weigh and classify the vehicle.

Sorter Lane Screening. Sorter lane screening is a method of screening vehicles that have pulled off the mainline approaching the scalehouse. Sorter lane screening entails a vehicle sensor and is typically deployed in conjunction with WIM and license plate readers.

Weigh-in-Motion Equipment. WIM equipment calculates gross commercial vehicle weight, as well as per-axle weight. As stated above, states may incorporate WIM in either the mainline screening or sorter lane screening processes. WIM equipment is placed in the road surface and, when the vehicle passes over it, reads the weight of the vehicle and its axles and sends the weight to the screening computer.

Dedicated Short-Range Communications Equipment. Dedicated short-range communications (DSRC) transponders are installed in participating motor carriers' trucks, and DSRC sensor equipment is installed at the roadside. The information that the DSRC transponder transmits to the sensor contains identification numbers for the carrier, vehicle, driver, and, in the future, may also contain load-type identifiers. Once the DSRC sensor receives this information, it can be used to perform a number of checks at mainline speeds.

License Plate Reader/Optical Character Recognition Systems. License plate readers (LPRs) scan and recognize a vehicle's license plate number and transmit this information to the screening computer. The license plate number maps to the vehicle identification number and, in many cases, to the carrier's U.S. Department of Transportation (DOT) number.

Mobile-Site Screening

Mobile-site screening is similar to fixed-site screening except that the equipment is not stationary and can be placed in different sites within a state. The states are planning to implement different options with respect to the WIMs, DSRC sensors, and LPRs for mobile-site screening.

Potential Screening Criteria

States may elect to implement different types of screening criteria to decide if a truck should pull into the inspection site for closer examination or can bypass the inspection site. These screening criteria include vehicle weight, axle weight, conditional and unsatisfactory carrier safety ratings, vehicle and driver out-of-service citations, improper credentials, and delinquent IFTA tax payment. States can determine that a percentage of the vehicles must be randomly inspected, even if verification of all the screening information shows that the carrier seems to be in compliance.

Overweight. States will determine if a truck's gross vehicle weight, or one or more per-axle weights, is above the legal limit using WIM technology. States have the option of performing weight screening against OS/OW credentials. Virtually all states will include overweight as a screening criterion.

Safety Rating Verification. States may employ algorithms to determine if a carrier has an unsatisfactory safety rating. For example, most states will use the SAFER-provided Inspection Selection System (ISS) or SAFESTAT scores to determine the level of a carrier's fitness.

Vehicle or Driver Out-of-Service Rating Verification. A flag indicating a current out-of-service citation on a vehicle or driver might be included in the screening process. California, Kentucky, and Minnesota plan to use the out-of-service rating as a screening criterion. Connecticut, Maryland, and Virginia plan to include this rating as a part of their SAFER data mailbox programs.

Proper Credential Verification. States can elect to automate verification of valid credentials at roadside inspection sites for all vehicles. The credential verification may include IRP, IFTA, OS/OW, SSRS, intrastate, and HAZMAT credentials. The verification can also include IFTA quarterly tax status. Most of the states plan to include checks for IRP and IFTA credentials as a part of their screening processes.

Insurance Verification. Some states will verify the carrier's insurance as part of their screening processes.

IFTA Tax Payment Status Verification. States may elect to include a check for a carrier's IFTA tax payment status. At present, Virginia and Minnesota plan to include this in their screening processes.

Random Vehicle Inspection Percentage. Some states will implement the capability to randomly select vehicles to be pulled in for inspection.

Additional Screening Alternatives. Another screening criterion that states plan to use is Washington's electronic citations system. Washington's screening process may lead to a safety inspection, which in turn may result in the issuance of a citation. The Washington inspectors will enter citation information into a pen-based system and electronically send it to the state court system over Washington's MCN network.

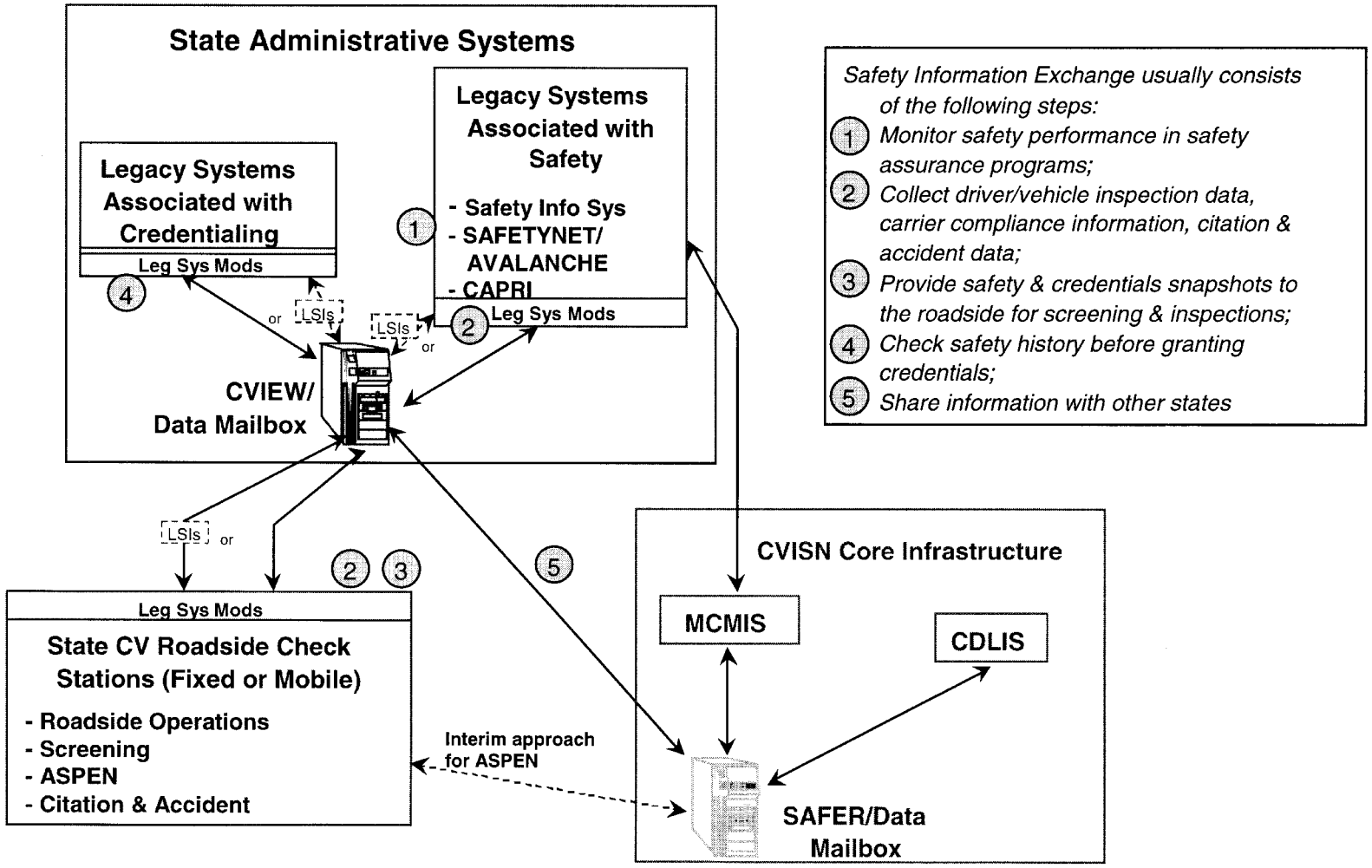
2.1.3 Safety Information Exchange

Safety Information Exchange is a process where safety information related to carriers (credentials and safety rating), vehicles (inspections and citations), and drivers is collected, stored, and exchanged. The illustration on the following page depicts the CVISN components of Safety Information Exchange.

Automated Safety Inspection Reporting

CVISN states plan to use hardware and software tools to automate the safety inspection reporting process. Most states plan to use laptop or pen-based computers equipped with software that enables safety inspectors to electronically collect and disseminate inspection data at the roadside. Most states are using the ASPEN software, developed by the Office of Motor Carriers, to collect and distribute inspection data.

Safety Information Exchange



Safety Information Exchange usually consists of the following steps:

1. *Monitor safety performance in safety assurance programs;*
2. *Collect driver/vehicle inspection data, carrier compliance information, citation & accident data;*
3. *Provide safety & credentials snapshots to the roadside for screening & inspections;*
4. *Check safety history before granting credentials;*
5. *Share information with other states*

Methods of Distributing Data

The CVISN states plan to use a number of methods to distribute safety data from/to roadside inspection sites. Several states will use the current ASPEN data distribution method. On a periodic basis, the SAFER system will create CDs with snapshot carrier (and later vehicle) safety data, which will be distributed to all ASPEN sites within those states. The snapshot data consist of carrier compliance review reports, safety inspections, citations, credential, and tax information. State inspectors will record safety inspection records using ASPEN and will upload this data on a daily basis to their respective state systems. The state systems will electronically transmit their data into the Motor Carrier Management Information System (MCMIS), which will process the data and forward it to SAFER. The time between the creation of the safety inspection at the roadside and the entry of this data into SAFER is expected to be at least a week.

Other CVISN states will accelerate the above process by establishing a link between SAFER and the state's CVIEW system, as well as a link between the CVIEW system and the ASPEN units. CVIEW also provides the capability to distribute intrastate carrier safety and credential information within the state and to distribute interstate safety and credential information to computers at the roadside for screening and enforcement.

A number of CVISN states on the Interstate 95 corridor plan to use the SAFER data mailbox to further accelerate their safety data exchange process. For these states, inspection data from the roadside will be transmitted from ASPEN to the SAFER data mailbox, which in turn will distribute portions of this data to other states. These states plan to use cellular, cellular digital packet data (CDPD), and satellite technology to enable the ASPEN units to communicate directly to CVIEW or SAFER.

Electronic Interfaces

CVISN states plan to implement electronic interfaces with other preexisting databases that provide commercial vehicle information. This includes Connecticut's plan to link its ASPEN units to the National Crime Information Center (NCIC), Commercial Driver's License Information System (CDLIS), and National Law Enforcement Telecommunication System (NLETS).

2.2 LEVEL 1 CVISN DEPLOYMENT PLANS

The CVISN deployment plans of the ten prototype and pilot model deployment states present a variety of opportunities to evaluate the costs and benefits of CVISN services. The ten model deployment states have plans to deploy at least the basic CVISN services for credentialing and roadside operations. These basic services, sometimes referred to as "Level 1 Deployment," include

- Credentials Administration
  - End-to-end electronic processing of IRP and IFTA
  - Connection to IRP and IFTA clearinghouses
  - At least 10 percent of transaction volume handled electronically.

- Electronic Screening
  - Implemented at a minimum of one fixed or mobile inspection site.

- Safety Information Exchange
  - ASPEN (or equivalent) at all major inspections
  - Connection to SAFER
  - CVIEW (or equivalent) for "snapshot" exchange within state and to other states.

However, the schedule and level of deployment vary considerably from state to state. For example, some states will deploy fully operational CVISN services in 1998, while others will only begin testing certain systems and are less certain about the timeframe for full-scale deployment. Also, some states are focusing their resources on the credentialing services, while others are putting more emphasis on roadside enforcement applications.

Rather than evaluate every CVISN component deployed in each state, we will focus the data collection effort on deployments that provide the best opportunities to assess the impacts and benefits of selected CVISN services. In addition to being an efficient way to use evaluation resources, this approach is consistent with our national perspective for evaluating the costs and benefits of CVISN services, not specific deployments. Preliminary plans for collecting evaluation data from model deployment states are discussed in Chapter 5.

CHAPTER 3

EVALUATION STRATEGY

3.1 DUAL STRATEGY FOR EVALUATION

The Commercial Vehicle Information Systems and Networks (CVISN) Model Deployment Initiative (MDI) evaluation is designed to achieve two objectives:

1. Conduct a rigorous benefit/cost analysis (BCA) to determine the net economic benefits of the CVISN MDI
2. Analyze and document additional outcomes and benefits of interest to various stakeholders in the CVISN model deployments that are not included in the BCA.

With regard to the first objective, the CVISN MDI BCA is designed to answer the following questions:

- Are the benefits of the CVISN model deployments greater than their costs?
- Which CVISN components or packages produce the greatest payoff from the resources expended?

However, not all outcomes of interest to the groups impacted by the CVISN model deployments are, or should be, included in a BCA. Therefore, a dual strategy will be employed that supports the BCA and analyzes and documents additional outcomes of interest to various stakeholders. These additional outcomes of interest include

- Intermediate measures needed to calculate specific benefits included in the BCA
- Attitudes (favorable or unfavorable) toward CVISN of carriers, drivers, administrative personnel, and enforcement officers
- Institutional and nontechnical impediments to deploying CVISN, or those that reduce its effectiveness
- Lessons learned on how best to operate the CVISN systems.

By achieving both evaluation objectives, it will be possible to evaluate the CVISN MDI's effects on safety, customer satisfaction, costs, crashes, productivity, energy consumption, and the efficiency of the transportation system.

An overview of the dual evaluation strategy is shown in Figure 3.1.

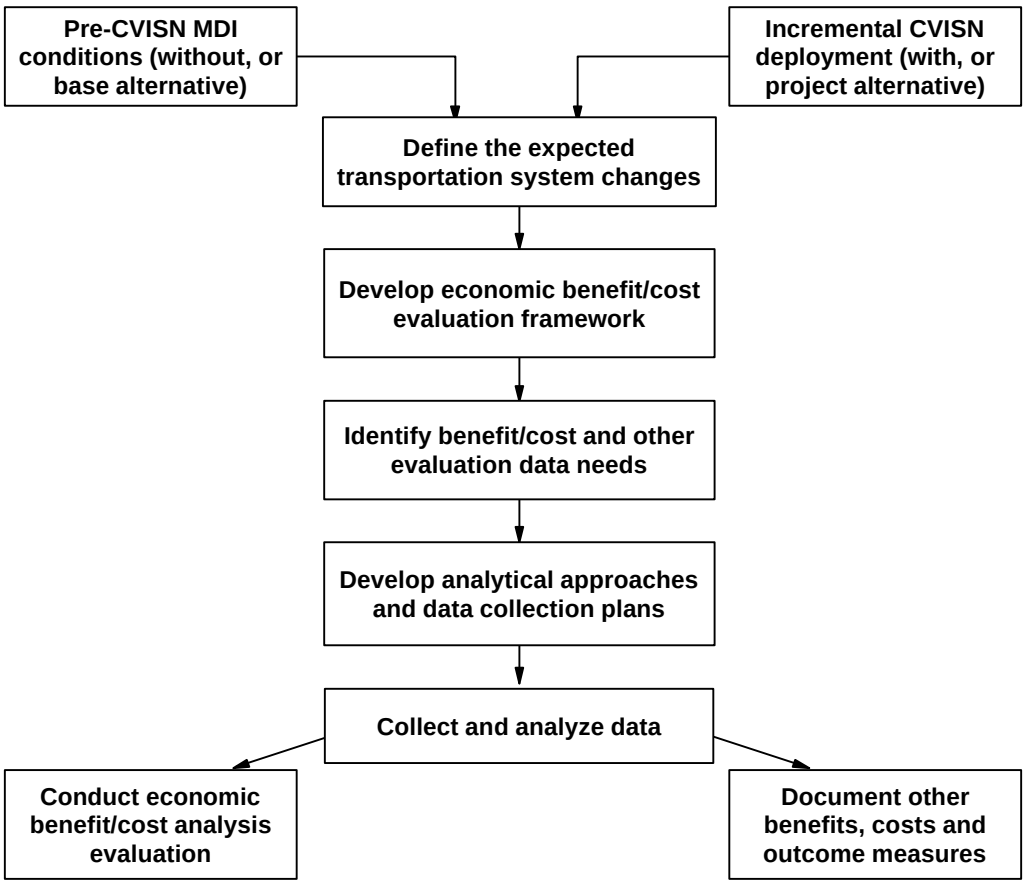


Figure 3.1. Overview of CVISN MDI Program Evaluation

Economic Benefit/Cost Analysis

BCA is a tool for maximizing overall economic efficiency. This means that all goals and measures of goal achievement used in a BCA must have some inherent value to society. Therefore, while the final summing of the benefits and costs in a BCA is straightforward, identifying the right inputs, and collecting and analyzing the required data, are not. Agreement on these inputs is critical because evaluation studies requiring new data collection are expensive.

BCA (often referred to from the viewpoint of society at large as "social BCA") seeks to gauge the return on public-sector investments by identifying the social benefits likely to result, estimating their size, reducing them all to dollar value terms, and comparing the total benefit to the cost over the expected useful life of the investment. Considerable care is necessary to ensure, not only that the analysis includes all the costs and benefits to society, but also that the analysis does so only once. Double counting must be avoided, including counting costs and transfers as benefits. (Transfers simply shift welfare from one person or jurisdiction to another without affecting the total.) While not a specific requirement of BCA, this evaluation will identify the major beneficiaries of CVISN (e.g., state governments, motor carriers, etc.), and their respective costs and benefits.

In the private sector, rational investment planning typically involves identifying which of several candidate opportunities will maximize the lifetime return on the investment, after making corrections for the fact that the streams of expenditures and income may occur at different points in time. In the public sector, objectives are much more diverse. Correspondingly, the criteria or measures for evaluating potential investments using BCA are more varied.

In a BCA, the terms "evaluation measures" and "benefits" are often used interchangeably. Benefits consist of all impacts that make society better or worse off, other than those items already counted as costs. Typically, costs are the one-time start-up costs (capital and labor), and the ongoing operating and maintenance (O and M) costs (including equipment replacement), stated as dollar expenditures. All other gains and losses to society as a whole — whether positive or negative — are benefits (transfers within society are analyzed separately). Accident savings may be positive or negative, but are called benefits (or disbenefits) rather than costs because they are consequences of the CVISN action, not the costs of implementing it. How impacts are classified into costs and benefits does not matter in the estimation of net benefits, so long as the arithmetic sign is correct.

In summary, BCA has strict rules governing the inclusion of benefit and cost measures. In particular, the input measures are those that

- Have economic value (e.g., fewer crashes)
- Don't involve transfers between affected groups (e.g., tax revenues)
- Don't double count the same benefits or costs (e.g., motor carrier cost savings passed on to shippers and consumers).

Thus, not all benefits of the CVISN deployments are properly included in a BCA. In addition, BCA is not concerned with "balancing" the benefits among particular societal goals or affected groups. Therefore, a dual strategy for the CVISN evaluation will satisfy all parties to the CVISN deployments that the outcomes of interest to them have been properly measured, analyzed, and documented.

Other CVISN MDI Outcome Measures of Interest

The additional measures needed to satisfy the dual strategy for the CVISN MDI evaluation include performance measures and status indicators that provide insight into what is taking place, why benefits are large or small, what institutional factors are affecting the success or failure of the project, and what are the attitudes of the participants. These additional outcome measures generally fall into one or more of the following four categories:

1. Intermediate measures needed to calculate specific benefits included in the BCA (e.g., number of accidents, fuel savings, number of inspections per hour, improved accuracy and completeness of inspection data, and time between application and issuance of credentials)
2. Value-laden outcomes that are of interest to stakeholders, but are excluded from the BCA because they are "transfers" (e.g., added tax and fee revenue), are "double counted" benefits (e.g., motor carrier cost savings passed on to shippers/receivers or consumers), or are not expressed in quantitative dollar terms (e.g., qualitative measures of customer satisfaction with particular CVISN services)
3. Measures that describe the CVISN deployments themselves (i.e., deployment level tracking indicators)

4. Engineering measures of direct interest to designers of CVISN projects (e.g., data transmission rates, storage capacities, and hardware failures).

The dual strategy for evaluation is primarily concerned with additional outcomes in the first two categories. The Joint Program Office has a separate initiative to track the deployment of CVISN in all 50 states. The deployment tracking project is monitoring the country's progress toward achieving a paperless commercial vehicle operation by the year 2005. The field operational tests (FOTs) have focused a great deal of attention on the measures in the fourth category. This evaluation is also concerned with these measures, but primarily only when they help explain the benefits, or lack of benefits, associated with a particular user service. For example, if a license plate reader used in electronic screening is not reliable, it may explain why the service (electronic screening) did not achieve the expected benefits.

3.2 EVALUATION MEASURES

The measures for which data need to be collected, both for input to the BCA and for providing information on additional outcomes of interest to stakeholders, are identified in accordance with the standard transportation evaluation planning process. This process consists of four steps:

1. Define the transportation system changes
2. Identify the groups impacted by the changes and the potential benefits and costs of the changes
3. Design and conduct studies, including data collection, to measure the costs and benefits to the impacted groups
4. Document the outcomes of the transportation system changes and the lessons learned.

The process of identifying the measures to be used in this evaluation begins by defining the transportation system changes expected from the CVISN model deployments. As noted earlier, elements of two major ITS/CVO user services involved in the deployments are Credentials Administration (including electronic credentialing and clearinghouses) and Roadside Enforcement (including electronic screening of trucks at highway speeds and strategies for transmitting safety data to and from the roadside). The major expected changes resulting from each element are listed below.[1]

- Expected changes due to electronic credentialing and clearinghouses
  - Faster turn-around time
  - Fewer errors
  - Reduced costs to carriers
  - Increased information sharing among agencies
  - Increased fairness and uniformity of fee collection among jurisdictions
  - Improved accuracy and data completeness
  - Increased costs for network and information systems support
  - Time saved.

[1] The list is based on input from state planners attending the CVISN Planning and Evaluation Workshop, Johns Hopkins University Applied Physics Laboratory, January 28-31, 1997.

- Expected changes due to roadside enforcement
  - Industry savings and increased output for compliant carriers
  - Fewer delays at roadside
  - Reduced industry costs for noncompliant carriers
  - More effective use of inspection resources
  - Real-time out-of-service verification
  - Better decisions on whom to inspect
  - Increased safety compliance
  - Crash reductions
  - Improved throughput at scales
  - Increased revenue recovery
  - Increased access to information from other states.

The second step in identifying evaluation measures requires identifying the various stakeholders or "customers" of CVISN and the potential benefits and costs to them of the CVISN model deployments. CVISN's customers are

- Motor carriers
- State governments
- Law enforcement agencies
- Shippers/receivers
- Members of the public
- Federal government.

Taking each of these customers in order, specific hypotheses can be developed about the impacts of the CVISN model deployments.[2]

Motor carriers (truckers) are interested in

- Reducing the time, cost, and uncertainties involved in registering their vehicles and obtaining permits
- Saving time by bypassing inspection sites
- Minimizing time spent at inspection sites, avoiding lines, and speeding up actual inspections
- Receiving equitable treatment in paying taxes and fees
- Increasing vehicle, driver, and cargo safety and security through fewer accidents
- Improving data accuracy.

State governments (administrators) are interested in

- Reducing the cost of truck registration and permitting
- Reducing tax and fee evasion and fraud
- Reducing the cost and increasing the effectiveness of inspections
- Reducing accidents on state highways.

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[2] This list is derived in part from Motor Carrier and Motor Coach Presentation at the CVISN Planning and Evaluation Workshop, Johns Hopkins University Applied Physics Laboratory, January 28-31, 1997.

Law enforcement agencies are interested in

- Reducing the cost and increasing the effectiveness of inspections
- Reducing crashes involving trucks.

Shippers/receivers are interested in

- Reducing the cost of moving goods as a result of possible savings passed on by motor carriers
- Increasing reliability of delivery schedules
- Decreasing time in transit to reduce inventory costs
- Increasing cargo safety and security through better access to carrier safety records and fewer accidents.

Members of the public are interested in

- Decreasing costs of goods and services as a result of possible savings passed on by shippers
- Reducing deaths, injuries, property damage, and highway delays from fewer accidents
- Increasing fairness in paying for use of highways
- Reducing environmental and energy impacts of trucking.

The federal government is interested in

- Increasing highway safety
- Learning whether CVISN is a worthy investment
- Disseminating information on the results of the CVISN MDI program
- More uniform and effective compliance enforcement
- Improving data and analysis on highway use.

Classifying the Benefit Measures

The interests of these stakeholders or customers can be grouped under the five traditional Intelligent Transportation Systems (ITS) goal areas (i.e., safety, efficiency, mobility, productivity, and energy/environment).

Safety

- Fewer crashes involving trucks
- Increased personal safety of the motoring public.

Efficiency (increased throughput or capacity)

- Increased throughput at inspection sites
- Increased throughput of credentialing process.

Productivity (cost savings, revenue increases, increased output)

- Reduced time, cost, and uncertainty in credentialing
- Reduced cost of inspections
- Transit time reduced by bypassing inspection sites
- Transit time reduced by shorter stops at inspection sites

- Reduced accident costs
- Decreased tax and fee evasion
- More equitable treatment in paying taxes and fees
- Transit time reduced as a result of fewer crashes
- Reduced accident cleanup costs.

Mobility

- Reduced cost of goods movement to shippers/receivers and the public
- Decreased goods transit time and increased reliability of delivery schedules to/from shippers/receivers
- Increased cargo safety and security
- Reduced highway delays to public from fewer accidents.

Energy/Environment

- Reduced energy consumption of trucks
- Reduced environmental impacts of trucks.

The five ITS goal areas deal only with benefits (including cost savings). The costs of CVISN consist of one-time start-up costs and the ongoing costs of CVISN programs, including equipment replacement at appropriate intervals. CVISN costs include incremental capital and operating costs for hardware and software, including computers and electronic data communications, and labor and administrative overhead costs for performing the functions associated with the CVISN pilot program. In contrast to defining the cost savings of CVISN, defining the incremental expenditures of resources on CVISN is relatively straightforward.

Satisfying the dual strategy of this evaluation requires sorting through the requirements of BCA for each of the five ITS goal areas and then identifying the additional outcome measures that map onto each goal. Table 3.1 summarizes the results of this process for the inputs to BCA. Since the five ITS goal areas double count some benefits and include benefits that make no contribution to economic efficiency (and thus have no economic value), only four of the five major ITS goal areas include potential benefits (or disbenefits) that should be input to the CVISN BCA. These are shown in Table 3.1 in the form they most directly take as benefits to society.

All of the benefit measures in Table 3.1 are derived from the hypothetical impacts of the CVISN pilots on each of the customers of CVISN. The CVISN project may alter the administration of commercial vehicle regulatory and enforcement processes in various ways, but the *net economic benefits* cannot be assessed until the impacts are translated into the categories in Table 3.1.

Table 3.1. CVISN Benefits for Input to BCA Arranged by ITS Goal Area

ITS Goal Area	Benefit Measures for Input to Benefit/Cost Analysis
Safety	Accidents (fatalities, injuries, property damage)
Efficiency	*
Productivity	Cost savings, increased output
Mobility	Shipper satisfaction (safety and transit time) CV accident delays to public
Energy and Environment	Noise, emissions

*The absence of a benefit measure for the ITS efficiency goal is explained in the text.

Deriving BCA Inputs and Other Outcome Measures

The remainder of this chapter describes the derivation of the BCA inputs and the additional outcome measures potentially of interest to CVISN stakeholders.

BCA Safety Benefit Measures

The anticipated safety benefits of CVISN from increased motor carrier compliance with state safety regulations is extremely important, although difficult to quantify. It consists primarily of reductions in crashes caused by trucks. The safety benefit will take the form of decreased property damage costs and decreased fatalities and personal injuries from accidents. However, in quantifying this benefit, the accident cost savings to carriers and shippers (to the extent carrier insurance covers shipper losses) should be subtracted from the productivity cost savings input to the BCA.

Other Safety Outcome Measures

Because of the difficulty in quantifying the reduction in accidents from the CVISN deployments, surrogate measures, as well as other measures useful in calculating or inferring accident reductions, will be important. These measures may include

- Changes in compliance rates
- Accident rates of carriers with different compliance
- Causes of changes in compliance rates
  - Number/percent of vehicles screened/inspected
  - Number/percent of vehicles screened/inspected that pass/fail (i.e., increased targeting of high risk vehicles for inspection)
  - Increase in completeness/accuracy/timeliness of screening/inspections.

In addition, reductions in accidents in their natural units (crashes, fatalities, injuries — to the extent these can be quantified) will also be documented and reported separately from their aggregate economic values input to the BCA.

BCA Efficiency Benefit Measures

Note that in Table 3.1 no evaluation measures in the ITS goal area of efficiency are listed as input to the BCA. A major source of confusion on the proper inputs to an ITS BCA stems from the fact that economists and engineers sometimes use the same term to mean different things. Most important, in economics, efficiency means maximizing total net benefits from an investment or policy. This means the economic efficiency goal includes *all* the ITS goals that have (a dollar) value to society. However, engineers use the term efficiency much more narrowly to mean *more output per unit of input* ("engineering efficiency").

The efficiency goal that is well accepted as one of the five major ITS goals is the *engineering efficiency goal, not the economic efficiency goal.* Measures of achievement of the engineering efficiency goal don't enter into a BCA. This is because increased output per unit of input is best measured in transportation as increased throughput or capacity (e.g., vehicles per hour, inspections per hour, inspections per person-hour). Converting this benefit to a dollar value to society falls under the productivity goal.

Other Efficiency Outcome Measures

For the sake of consistency, and because most CVISN efficiency measures are of interest as they relate to cost savings (or accident reductions), these additional outcome measures are listed under the productivity goal.

BCA Productivity Benefit Measures

The ITS (engineering) efficiency goal should not be confused with the productivity goal. Productivity means *lower costs to produce a given level of output*. Cost savings are an important measure of achievement of the CVISN productivity goal (e.g., cost per vehicle registration, cost per inspection, reduced truck transit time). This benefit includes the savings to motor carriers and government agencies that result from CVISN implementation. These cost savings certainly have value to society and enter into a BCA of the net worth of CVISN investments.

In addition, we can anticipate that there will be *increased levels of output* from CVISN since state governments can be expected to make adjustments in their behavior in response to the new functionality of CVISN (e.g., substitutions in credentialing or inspection processes toward inputs whose "prices" are decreased by the new policy). For example, the locations of many fixed weigh stations predate changes in traffic patterns caused either by finishing the interstate system or by locating manufacturing and distribution facilities on the outskirts of cities or in smaller towns as a result of the interstate system. Instead of automating weigh stations in old fixed locations, it seems clear that states and law enforcement agencies will rethink their enforcement procedures, including how and where to conduct inspections to catch violators at minimum cost and with maximum effect on regulatory compliance, safety, and tax collection. Portable equipment will certainly facilitate this process.

For this reason, the increased output provided by CVISN projects to states and law enforcement can be an important benefit, over and above the cost savings for the same level of output. Government officials, including law enforcement officials, would like to be evaluated not only by what they cut, but by what they do. However, while any output increases in state regulatory and inspection functions should be anticipated and measured, significant or measurable levels of increased output for motor carriers (i.e., goods shipped) are not anticipated as a result of the CVISN pilot program. This is discussed under the mobility section below.

Other Productivity Outcome Measures

From the perspective of many CVISN customers, particularly those interested in the day-to-day operation of the system, many measures of increased productivity are useful in evaluating the success of the pilot deployments. From the state and law enforcement points of view, these measures may include

- Vehicles inspected per site hour; per person hour
- Non-compliant vehicles inspected per site hour; per person hour
- Vehicles credentialed (including oversize/overweight) per labor hour.

From the motor carrier's point of view, these productivity outcome measures may include

- Time from application to issuance of credentials
- Number/percent trucks not in use due to credentialing/permitting process
- Number/percent trucks stopping at inspection sites.

As noted earlier, other outcome measures may have economic value, but should be excluded from a BCA because they represent transfers or double-counted economic benefits. In this regard, an economic effect of CVISN may be the added fee revenue "production" that can come from more effective regulatory enforcement and compliance with CVISN. However, this should not be treated as a net benefit since it is really a transfer from the carriers to state government. It is, nevertheless, an important additional outcome measure because equitable treatment and fairness in paying taxes is seen by many (complying) carriers as a benefit of CVISN.

Examples of other double-counted economic productivity benefits will be encountered at many points in this evaluation. For example, particularly subtle distinctions will occur when the dual benefits of cost savings to produce the same output and the value of the increased output caused by changes in credentialing and inspection are considered. Care will also be needed in deciding how much of the benefit is from increased output versus lower time and costs. Also, the extent to which the increased output is a valid input to the BCA needs to be decided.

Other double-counted benefits will also be of interest in the CVISN evaluation. Examples of the additional outcome measures of interest to motor carriers are

- Gallons of fuel saved by motor carriers (cost included in the BCA cost saving)
- Accident cost savings to carriers and shippers (to the extent they are covered by insurance, and the insurance premiums are not correspondingly reduced, these should be subtracted from the BCA productivity cost savings).

BCA Mobility Benefit Measures

Mobility is measured by the net benefits to travelers or other transportation consumers from a transportation improvement. To avoid double counting, the most important measure of achievement of the mobility goal is purposely omitted as an input to our BCA. This is the portion of the CVISN productivity cost savings benefit (if any) that is passed on to the shipper/receiver (e.g., a value-added manufacturer, wholesaler, retail store), or to the final consumer. We can avoid the very difficult problem of collecting data on some elusive cost savings passed on to customers, and measure and include in the BCA only the direct

CVISN productivity benefit (the cost savings to motor carriers and the government). Whether these cost savings are passed on to customers is immaterial for the overall BCA since the total benefit is the same.

Three non-motor carrier cost saving mobility measures *are* valid inputs to a CVISN BCA:

- Reduced highway delays to the public due to reduced motor carrier (truck) crashes
- Increased shipper/receiver satisfaction with carriers (e.g., use of SIE safety rating data)
- Increased shipper/receiver satisfaction from improved service (i.e., more reliable delivery schedules, shorter transit time, and less damage to goods shipped due to fewer crashes).

The first measure impacts the public in a completely different way than the CVISN productivity measure. (It impacts public benefits differently from the costs of the shipped goods.) With regard to the second measure, to the extent that shippers are willing to pay separately for (i.e., that they value) the SIE data, this benefit is additive to the carrier cost savings from reduced accidents. The second measure also directly affects the volume of carrier business and, therefore, revenues. However, additional revenues are presumably mostly transfers, not increases, in output or total goods shipped. Therefore, they don't provide net benefits for input to a BCA.[3] The third measure is clearly additive to the CVISN productivity measure in that transit time savings (rather than cost savings) passed on to the shipper is the measure. Thus, the benefit is accrued by the shipper, not the carrier.

Other Mobility Outcome Measures

The most important additional mobility outcome measure of interest is likely to be the economic benefit of the motor carrier cost savings passed on to shippers/receivers or even to retail customers. For the BCA, these savings are included in the motor carrier cost savings.

Other possible outcome measures of interest are changes in satisfaction levels measured using qualitative survey methods. For example, shippers/receivers could be surveyed before and during CVISN to find changes in the percent of shippers/receivers who are satisfied or very satisfied with the service from their carriers.

BCA Energy and Environment Benefit Measures

Energy savings in the form of decreased fuel use should be included in cost savings to motor carriers and not measured as a separate benefit for input to the BCA. However, air and noise pollution externalities reductions are separate benefits from CVISN and should be input to the BCA.

Other Energy and Environment Outcome Measures

CVISN customers may be interested in documenting and reporting the energy and environmental benefits of CVISN in their natural units, separate from their economic value input to the BCA. Therefore, the following energy and environmental outcome measures can be identified:

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[3] To the extent that additional revenues accrue to more efficient, profitable (and compliant) carriers, there is a net benefit to society. However, evaluating the relative profitability of different carriers is well beyond the scope of our evaluation.

- Gallons of fuel saved by motor carriers
- Reductions in pounds/tons of air pollutants by type
- Reduction in noise pollution.

3.3 SUMMARY

Table 3.2 summarizes the evaluation benefit measures that are needed for BCA or to evaluate other outcomes of interest in each of the ITS goal areas. These evaluation measures determine the type of data that need to be collected and analyzed in the CVISN evaluation.

The "few good measures" (FGMs) associated with the five ITS goal areas are often used to define the evaluation goals and focus attention on the most important benefits. However, the FGMs are not all input to the BCA. Throughput, for example, is an efficiency measure and not a benefit input to BCA, as discussed above. In addition, customer satisfaction will be used to convert the nonmonetary benefits in all categories to dollar values of worth to society, as will be discussed in Chapter 4. FGMs are mapped onto benefits and other outcome measures and their relevance to the BCA are shown in Table 3.3.

Table 3.2. CVISN Evaluation Measures

ITS Goal Area	Benefit Measures	
	For Input to BCA	Additional Outcome Measures
Safety	Accidents (fatalities, injuries, property damage)	Same (in their natural units); surrogate measures (e.g., changes in compliance rates, vehicles inspected, completeness/accuracy/timeliness of inspections, etc.)
Efficiency	None	Included under productivity goal area
Productivity	Cost savings, increased output	Vehicles inspected/credentialed (total, per person and site hour); calendar time for credentialing; number/percent trucks out of service for credentialing/permitting/stopping at inspection sites; increased tax/fee revenues
Mobility	Shipper satisfaction (safety and transit time); commercial vehicle accident delays to public	Cost savings passed on to shippers/receivers; qualitative changes in shipper/receiver satisfaction with motor carrier service levels
Energy and Environment	Emissions, noise	Same (in their natural units); fuel savings

Table 3.3. Use of the "Few Good Measures" in the CVISN Evaluation

The "Few Good Measures"	Use in Evaluation
Crashes and Fatalities	Costs of accidents (fatalities, injuries, property damage) — are benefit measures input to BCA; accidents by category are additional outcome measures
Throughput	Primarily an input to measuring or assessing productivity cost savings [e.g., increased inspections per hour times site cost per hour (before and after) equals cost savings; increased registrations processed per hour, times cost per hour for clerks and equipment (before and after) equals cost savings, etc.] — an additional outcome measure
Travel Time	Changes in truck travel time times its value for the motor carrier aggregated over all applicable output equals a cost saving — a productivity benefit input to BCA
Customer Satisfaction	Used to value nonmonetary benefits; subjective satisfaction levels are additional outcome measures
Cost Savings	User and agency labor and material costs, not including initial capital costs* — a productivity benefit input to BCA
Emissions and Energy	Air and noise pollution externalities reductions — direct benefit measures input to BCA; fuel savings are included under operating cost savings input to BCA; all these can be additional outcome measures in their natural units

* Capital costs included in the without CVISN alternative that are avoided in the CVISN project scenario can also be counted as benefits.

The next chapter describes the evaluation approach summarized in Figure 3.1 and describes the four study areas (safety, customer satisfaction, costs, and institutional issues) in which the main work of the evaluation will be carried out.

CHAPTER 4

EVALUATION APPROACH

Chapter 3 outlined the dual strategy for the Commercial Vehicle Information Systems and Networks (CVISN) evaluation. The objectives of the dual strategy are to produce a rigorous economic benefit/cost analysis (BCA) for evaluating the net worth of the CVISN model deployments and to document additional outcome measures needed by CVISN's stakeholders.

This chapter begins with a brief overview of the methodology for implementing the evaluation strategy. The rest of the chapter is devoted to describing the four major study areas (safety, customer satisfaction, costs, and institutional issues) in which the main work of the evaluation will be carried out. For each area, study questions and associated cost/benefit measures are identified; then, specific data collection and analysis approaches are proposed. Most (but not all) of the data collection activities discussed in this chapter will be undertaken. Several factors will be considered in selecting the specific evaluation tests. These include the cost of data collection, whether there are opportunities to use data or results from other studies, and whether the states' deployment plans provide the necessary opportunities to collect evaluation data. Chapter 5 describes the specific tests (data collection and analysis efforts) that will be conducted and identifies the best opportunities to collect useful data from the model deployment states.

The four main study areas in this evaluation are shown in Figure 4.1. The first three study areas correspond to the major anticipated benefits of CVISN described in Chapter 3. Safety was chosen as a study area because of its importance to the state and federal partners in the CVISN deployments. Customer satisfaction was selected because it is the primary means of converting nonmonetary benefits to dollar values of worth to society. The costs study area includes the direct measurement of the electronic credentialing and roadside inspection time and cost savings from CVISN. Institutional issues are being studied by the John A. Volpe National Transportation Systems Center to answer questions related to the institutional and non-technical benefits of, and impediments to, deploying CVISN. As indicated in

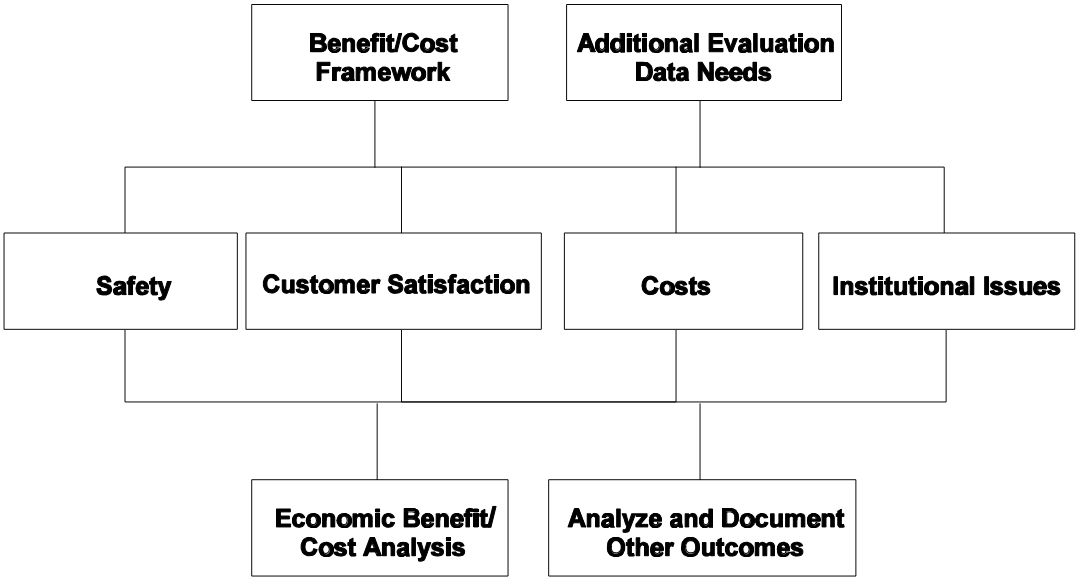

Figure 4.1. Major Study Areas in the CVISN MDI Evaluation

Figure 4.1, all the study areas provide data and analyses for the economic BCA and document the other outcome measures needed for the evaluation.

4.1 Overview of Evaluation Methodology

Three major steps in the CVISN evaluation can be highlighted to summarize the approach we will follow in this evaluation (see also Figure 3.1). These are: defining alternatives, identifying impacts, and evaluating alternatives.

Defining Alternatives

Figure 3.1 showed two sets of conditions to be compared: a "without" or base alternative, and a "with" or project alternative. The base case is the level of information technology that would exist in the future without the CVISN deployment. Defining the CVISN project alternative(s) to be evaluated involves identifying CVISN projects that add an important increment of automation to carry out certain functions. A "with" or project alternative is the additional CVISN technology directed at a particular function or service (e.g., electronic permit application and approval) at a single site. The corresponding base case describes the conditions that would have resulted at the specific site had the CVISN project not occurred.

Identifying Impacts of the Project Alternatives

CVISN technology is hypothesized to have outcomes of value that are inputs to the BCA, as well as additional outcomes or impacts of interest to CVISN customers. Table 3.2 summarized the impacts of the project alternatives that were identified in Chapter 3. These impacts or outcomes are the result of changes in administrative and compliance costs, motor carrier behavior, vehicle registrations, accidents, and other quantitative and qualitative characteristics of commercial vehicle regulatory administration and transportation.

Evaluating the Alternatives

After the alternatives have been defined and the potential impacts have been identified, the next step is to design studies to estimate the important benefit and cost measures. This effort is organized into the four areas selected for study: safety, customer satisfaction, costs, and institutional issues. Within each study area, methods for estimating these measures are developed to satisfy the requirements of the dual strategy.

For the BCA, unit prices in dollars will be applied to those impacts whose natural units are not dollars. Customer satisfaction methods will be used to monetize these benefits. The time streams of benefits and costs will be discounted, aggregated, and summarized as net benefits, in either present worth or annualized form. An example of this aggregation is shown in Table 4.1. Listing the benefits and costs in the format shown in Table 4.1 makes it clear how they are aggregated in their common dollar units to calculate the net benefits from a CVISN project alternative.

Other outcome measures of interest will also be observed or estimated in the dual evaluation strategy. These will supplement the BCA by providing greater insight into what is happening in the transportation system that gives rise to the costs and benefits of the project.

In the next sections we present specific evaluation goals and measures related to the safety, customer satisfaction, and cost study areas and describe the types of data that are needed to carry out these studies.

Table 4.1. Example Summary Benefit/Cost Calculation for a CVISN Project

Benefits	Value
Accident Savings (MCs, Shippers, Public)	$
Cost Savings (States, MCs)	$
Increased Output (MCs, States)	$
Reduced Highway Delays (Public)	$
Increased Shipper Satisfaction (Shippers/Receivers)	$
Reduced Air/Noise Pollution (Public)	$
(minus) Costs	
Start-up Costs of the CVISN Improvement	$
Ongoing Costs of the CVISN Improvement	$
(equals) Net Benefits	$

4.2 THE SAFETY STUDY AREA

The primary goal of the CVISN safety study is to identify and document the safety benefits of deploying CVISN technologies. The safety benefits are expected to include a reduction in the number of highway crashes involving trucks, the number of related injuries and fatalities, and the cost of property damage from these crashes. However, the particular CVISN technologies that are included in the model deployment initiative achieve these benefits only through improvements in carrier and driver compliance with safety regulations. Thus, the main focus of this study will be on the relationship between CVISN deployment and its impact on enforcement practices. The relationship between enforcement practices and safety impacts (i.e., reduced crashes and fatalities) needs to be established to link safety benefits to the deployment of CVISN services. Results from the literature, as well as new analyses, will help determine this relationship. We will also attempt to observe aggregate reductions in accidents from the CVISN deployments. However, this has significant challenges because the CVISN-related reduction in crashes and fatalities is expected to be small compared to the impacts of other factors (e.g., weather, road construction, traffic changes).

CVISN technologies are expected to help improve compliance with safety regulations in two ways both resulting from increased effectiveness of roadside inspection operations. The direct, but smaller, impact is the removal of unsafe drivers and vehicles from the highways. It is anticipated that the screening and safety information exchange technologies will allow inspectors to rapidly select commercial vehicles for inspection based on the carrier's safety record. Also, on-line access to driver violation records and results of recent truck inspections will help target unsafe drivers and trucks.

The indirect effect, which is expected to be much larger, is that drivers and carriers will modify their behavior in response to the improved, more targeted inspections. Specifically, it is assumed that carriers will expend more resources to ensure that their vehicles stay in compliance. Carriers with good safety records (low risk) will have a small probability of being inspected. High-risk carriers will try to improve their safety rating to avoid increased inspections. Of course, if CVISN does not help inspectors target the high-risk carriers, there will not be any added incentive for a carrier to maintain a good safety rating.

Table 4.2 contains the study questions, data collection activities, and analysis approaches to be employed in carrying out the safety study area.

Table 4.2. Safety Study Area Evaluation Activities

Evaluation Issue/Goal	Customer Impacted	Benefit/Cost Measure	Data Collection Activity	Analysis Issues and Procedures
What is the impact of CVISN on numbers of crashes, injuries, and fatalities involving CVs?	Public Commercial Drivers	Numbers of crashes, fatalities, and injuries before and after the deployment of CVISN.	Direct Approach: · Obtain crash data from MCMIS and/or state safety databases. · Data search to be limited to carriers operating within specific geographic and temporal bounds corresponding to CVISN deployment in targeted states. · Collect data on contributing factors (e.g., VMT, weather, fleet characteristics).	Use Poisson regression to establish a functional relationship between safety impacts and CVISN deployment after accounting for other factors.
			Indirect Approach: · Estimate impact of CVISN on safety compliance rates through "Compliance Rate Study" (see below). · Establish relationship between compliance rates and crash/fatality rates using results from literature.	Use compliance rate change data in the model to estimate safety benefits; compare results, as appropriate, with safety benefits predicted through direct approach.
What is the impact of CVISN on rates of driver and carrier compliance with the FMCSR?	Motor Carriers Commercial Drivers	Proportion of trucks on the road in which the driver and vehicle are in compliance with safety regulations before and after the deployment of CVISN.	Compliance Rate Study: · Scope may be statewide, regional, or site-specific. · Select time and location of inspection sites according to a statistical design. · Select trucks randomly, but allow for targeted enforcement of obvious safety violations.	Compliance rate estimates should account for traffic volumes and differences in site and vehicle selection probabilities. Compare rates before and after deployment of CVISN. Results used to estimate potential impact on crash/fatality reduction (see above).
			· Design study to minimize impact on normal enforcement practices.	
			· Record type and severity of violations during Level I inspections. (Inspection reports are available through MCMIS or state system.) · Collect truck volumes at roadside during study period.	

Table 4.2. Safety Study Area Evaluation Activities (Continued)

Evaluation Issue/Goal	Customer Impacted	Benefit/Cost Measure	Data Collection Activity	Analysis Issues and Procedures
Does CVISN help roadside safety enforcement officials identify high-risk commercial vehicles and motor carriers?	Safety Enforcement Officials	Relative proportions of high-risk and low-risk drivers and motor carriers that are inspected at the roadside – with and without CVISN.	Roadside Screening Assessment Study: · Select inspection sites that utilize specific types of CVISN screening and safety data exchange technologies. Also select control sites without CVISN or use before / after approach. · Record ID's for all commercial vehicles at selected inspection sites. · Assign vehicles to risk categories based on carrier's safety rating. This off-line analysis uses various data sources (MCMIS, SAFER, state databases) and rating techniques (e.g., ISS, Safestat, accident rates). · Record actual screening and inspection results at roadside. Additional data required for simulation model: · Queue lengths, inspection times, site characteristics, traffic patterns, etc.	Estimate proportions of high-risk and low-risk carriers that are selected for inspection at sites employing various screening methods. Compare inspection probabilities and OOS rates for different MC risk categories and for different roadside screening methods. Use simulation modeling to assess impacts of screening protocols under various scenarios (i.e., combinations of site geometry, screening protocols, traffic volume, etc.). Also useful for evaluating impacts on CV transit time.
Does CVISN help roadside safety enforcement officials identify OOS violators? **Aimed at technologies that provide concurrent access to safety data (i.e., SAFER Data Mailbox or similar state system).**	Safety Enforcement Officials	Number of commercial drivers and trucks on the road that are identified as OOS violators.	Three-step approach: 1. Obtain data from SAFER on timeliness of inspection data uploads and data access at roadside in states utilizing real-time safety information exchange 2. Collect vehicle ID numbers at tollbooths or POEs; then, determine potential for identifying OOS violators based on timeliness of inspection data found in SAFER. 3. Record frequency of catching OOS violators at actual roadside inspection sites utilizing timely/concurrent safety information exchange.	Data from Steps 1 and 2 will be used to determine the number of OOS violators that could be identified under optimal screening conditions at the roadside. Compare with numbers detected at both CVISN equipped and non-CVISN equipped inspection sites. Extrapolate results to estimate impact under full deployment (i.e., when all sites employ real-time safety data exchanges). (This also yields a lower bound estimate of improved compliance behavior due to CVISN. That is, MCs may be expected to improve their compliance behavior as the targeting of OOS inspections increases.)

Table 4.3. Anticipated CVISN Benefits for Each ITS Goal Area and Customer

Benefits	Customer					
	Motor Carrier	State Govt.	Law Enforcement	Shippers	Public	Federal Govt.
Safety						
Accidents	B1	B2	B2	B1	B1	B2
Mobility						
Highway Delays From Accidents	B2			B2	B1	
Increased Satisfaction With Service				B1		
Productivity						
Cost Savings	B1	B1				B2
Increased Output		B1	B1			
Energy and Environment						
Emissions			B2		B1	
Noise					B1	

B1 = Primary Customer; B2 = Secondary Customer

4.3 THE CUSTOMER SATISFACTION STUDY AREA

Improved customer satisfaction is key to the success of the CVISN pilot program. For CVISN to proceed successfully to widespread deployment, its customers must value its benefits more than its cost. Measuring customer satisfaction is the phase of the CVISN evaluation in which (1) quantitative values are assigned to the benefits of CVISN, and (2) changes in the subjective satisfaction levels of CVISN customers are measured.

Chapter 3 identified the benefits and outcomes of CVISN that satisfy both objectives of the dual evaluation strategy. Table 4.3 summarizes which customers receive (or pay for) the benefits that are inputs to the BCA. Additional outcome measures for the dual strategy were identified in Table 3.2. The benefits needing quantitative valuation in dollar terms are generally of three types:

1. *Cost savings* from reduced direct outlays to carry out existing functions (e.g., cost savings to state governments from automating truck credentialing)

2. *Increases in the value* of particular products or services that are "newer" or "better" (e.g., shorter credentialing times, shorter truck transit times, more reliable trucking service)

3. *Increases in output* from changes in credentialing and enforcement processes in response to the new functionality provided by CVISN.

Customer satisfactions methods (CSM) will be used to assign a value to the second and third of these benefits. The first type of benefit, namely cost savings from reduced direct outlays, will be valued at the appropriate wage and materials costs in these markets (see Section 4.4).

Valuing the benefits from the CVISN deployments requires applying quantitative analysis. The values applied to monetize benefits such as safer highways, travel time savings, and increased shipper/receiver satisfaction resulting from more reliable service are the "prices" or additional dollar amounts that the

customers of CVISN are willing to pay for these benefits. These willingness-to-pay values, or prices, will be estimated using values from the relevant literature or from the observed or stated preferences of customers in response to the particular "markets" or choices they confront as part of the actual CVISN deployments, or to hypothetical choices that are equivalent to the circumstances of the CVISN deployments.

Scaling surveys will be used to measure the change in subjective satisfaction levels as CVISN is deployed. These survey methods ask respondents how much they agree or disagree with a statement. Respondents are asked to choose an answer on a scale of 1 to 5, where 1 may be "strongly agree," and 5 "strongly disagree" (with 2, 3, and 4 being "agree," "neither agree or disagree," and "disagree," respectively). Scaling surveys can establish, for example, the percent of motor carriers that were very/extremely satisfied with the credentialing process prior to electronic credentialing, and measure the change in this percentage after electronic credentialing is deployed.

To help determine the discrete dimensions or attributes of the new CVISN service to be included in the trade-off surveys, focus groups will be used. Focus group discussions with sample members of the affected customer groups offer a cost-effective method for obtaining qualitative information about the factors influencing customer choices and the ways customers make the choices.

Table 4.4 contains the study questions, data collection activities, and analysis approaches to be employed in carrying out the customer satisfaction study area.

4.4 THE COST STUDY AREA

The cost study area of the CVISN evaluation plan is designed to answer two major cost-related questions: (1) What are the current costs associated with CVO administrative and enforcement processes? and (2) What are the new system costs of CVISN?

Current Costs

The administrative costs include the costs currently borne by state CV regulatory agencies. These costs include labor costs for processing and reprocessing credentials and permits, costs for inspections and safety monitoring, costs for operation and maintenance of existing equipment, data collection and reporting costs. This category of costs, in effect, represents the baseline costs against which "new" costs associated with CVISN need to be compared. Without a clear understanding of the structure and magnitude of baseline costs, it will be difficult to measure the potential cost savings and other benefits of migrating to an automated environment.

New System Costs

In this category, all costs associated with CVISN deployment will be included. These costs, in general, will include one-time start-up costs such as hardware and software costs, systems integration, planning and design-related expenditures, and outreach efforts, as well as the ongoing operating and maintenance costs for running the system, including replacement costs at appropriate intervals. For tracking purposes, all costs will be organized under two subcategories: (a) electronic credentialing costs and (b) safety and clearance costs.

Table 4.5 contains the study questions, data collection activities, and analysis approaches to be employed in carrying out the cost study area.

Table 4.4. Customer Satisfaction Study Area Evaluation Activities

Evaluation Issue/Goal	Customer Impacted	Benefit/Cost Measure	Data Collection Activity	Analysis Procedures
VALUE OF SAFETY BENEFITS				
What is the value of reduced CV crashes?	Motor Carriers	Property damage to trucks.	Literature review and IRP or state registration databases	Adjust unit damage values from literature by state-specific CV fleet composition differences from IRP or state registration databases (fleet age, vehicle types, etc.). Multiply by number of truck PD accidents.
	Public	Property damage to autos.	Literature review and state safety databases	Use unit values from literature times state-specific estimates from state safety databases of proportion of truck accidents involving autos. Multiply by number of PD auto accidents.
		Property damage to highway infrastructure.	Literature review	Multiply unit values from literature times number of truck accidents.
	Motor Carriers	Personal injuries and fatalities.	Literature review	Use unit values from literature. Multiply by number of truck PI/F accidents.
	Public	Personal injuries and fatalities.	Literature review and state safety databases	Use unit values from literature times state-specific estimates from state safety databases of proportion of truck accidents involving autos. Multiply by number of PI/F auto accidents.
VALUE OF MOBILITY BENEFITS				
What is the value of reduced highway delays from CV crashes?	Public	Travel time.	Literature review and law enforcement personal interviews	Use unit values from literature times state-specific law enforcement estimates of total highway delays due to a truck crash. Multiply by number of truck accidents.
What is the value of SIE (on-line) safety data to shippers and receivers?	Shippers/ Receivers	$	Survey of shippers/receivers, preceded by focus group(s)[1]	Trade-off surveys analyzed using discrete choice methods to value increased customer satisfaction. Multiply by number of affected shippers/receivers. Scaling survey data tabulated to analyze changes in subjective satisfaction levels.
What is the value of improved services to shippers and receivers?	Shippers/ Receivers	$	Survey of shippers/receivers, preceded by focus group(s)[1]	Trade-off surveys analyzed using discrete choice methods to value increased customer satisfaction. Multiply by number of affected shippers/receivers. Scaling survey data tabulated to analyze changes in subjective satisfaction levels.

[1]Focus groups precede the trade-off surveys to help define the CVISN service attributes being valued.

Table 4.4. Customer Satisfaction Study Area Evaluation Activities (Continued)

Evaluation Issue/Goal	Customer Impacted	Benefit/Cost Measure	Data Collection Activity	Analysis Procedures
VALUE OF PRODUCTIVITY BENEFITS				
What is the value of motor carrier transit time savings?	Motor Carriers	Transit time.	Literature review and motor carrier personal interviews from cost study, and possibly the IRP or state registration database	Adjust unit values from literature by state-specific factors from participating motor carrier personal interviews, and possible IRP or state registration databases (fleet age, composition, etc.). Multiply by transit time savings from the cost and safety studies.
What are the reduced direct cost outlays of CVISN?	Motor carriers, State Government, Law Enforcement	$	See cost study	See cost study.
What is the value of the increased output due to CVISN elements?	State Government, Law Enforcement	Output.	Surveys of state government and law enforcement, preceded by focus groups[1]	Trade-off surveys analyzed using discrete choice methods to value increased output.
VALUE OF ENERGY AND ENVIRONMENT BENEFITS				
What is the value of reduced air and noise pollution?	Public	Emissions, dBA.	Literature review	Apply unit values to emissions and noise reductions. (Noise values are specific to [and multiplied by] the impacted population.) Apply to unit values for time savings per truck bypassing the inspection stations and time savings per truck in the inspection stations from the cost and safety studies.
OVERALL VALUE OF CUSTOMER SATISFACTION				
What is the value, to the various customers of CVISN, of specific deployment alternatives?	Motor Carriers, State Government, Law Enforcement	$	Surveys of motor carriers, state governments, and law enforcement, preceded by focus groups[1]	Trade-off surveys analyzed using discrete choice methods to value increased customer satisfaction. Multiply by number of affected shippers/receivers. Scaling survey data tabulated to analyze changes in subjective satisfaction levels.

[1]Focus groups precede the trade-off surveys to help define the CVISN service attributes being valued.

Table 4.5. Cost Study Area Evaluation Activities

Evaluation Issue/Goal	Customer Impacted	Benefit/Cost Measure	Data Collection Activity	Analytical Issues and Procedures
COSTS FOR CREDENTIALING				
What are the current costs for credentialing activities?	Public Agency, Motor Carriers	Labor and equipment, operating, and maintenance costs.	On-site visits/ personal interviews to discuss procedures and collect (historical or current) cost information.	Describe the calendar time and the level of effort required and costs for credentialing, note number of applications / renewals / supplementals processed per person-day and supporting equipment.
What investment is required for development of standardized credentialing protocols and programs (e.g., IRP)?	Federal Government	Labor and equipment costs for new software development and outreach.	Literature review and on-site visits/personal interviews to discuss development and outreach programs.	Identify development activities as distinct from ongoing support; estimate person-days for development and capital equipment devoted to program development.
What investments in new technology are required to implement electronic credentialing?	Public Agency, Motor Carriers	Cost of new computer equipment and software.	On-site visits/ personal interviews to observe processes, discuss changes implemented, and collect information on new equipment. Determine how much system can expand without incurring additional investment costs.	Identify equipment/software added only to implement ITS credentialing; describe expected useful life of equipment and software and determine method for annualizing investment costs; for motor carriers, extrapolate costs for companies visited to estimate costs incurred by all participating companies (costs prorated by company size).
What are the costs of training personnel to implement electronic credentialing?	Public Agency, Motor Carriers	Cost of training personnel on new programs.	On-site visits/ personal interviews to discuss approach to training, and gather data on training materials and labor inputs.	Separate general (new and continuing) employee training from additional training necessitated by new system; evaluate employee time spent in training and instructor costs; for motor carriers, extrapolate costs for companies visited to estimate costs incurred by all participating companies (costs prorated by company size).
Are new facilities or remodeling of old facilities required and, if so, what are the costs incurred?	Public Agency, Motor Carriers	Investment in changing work environment to accommodate new systems.	On-site visits/ personal interviews to observe work conditions and discuss changes introduced, if any.	Determine whether space required is greater or less than for previous systems and what capital improvements are uniquely associated with electronic systems (e.g., new telecommunications lines); for motor carriers, extrapolate costs for companies visited to estimate costs incurred by all participating companies (costs prorated by company size).

Table 4.5. Cost Study Area Evaluation Activities (Continued)

Evaluation Issue/Goal	Customer Impacted	Benefit/Cost Measure	Data Collection Activity	Analytical Issues and Procedures
Are there other conversion costs such as maintenance of legacy systems during the transition period?	Public Agency, Motor Carriers	Length of transition; operational costs of legacy systems or procedures; other transition support costs.	Review of project plans and on-site visits/personal interviews to discuss transition program (labor and system) costs.	Estimate labor costs and equipment maintenance costs of sustaining legacy system per month including cost of interface systems; determine how transition labor will be handled after overlap period and whether or not that adds to ITS costs; for motor carriers, extrapolate costs for companies visited to estimate costs incurred by all participating companies (costs prorated by company size).
What are the changes in costs of operating an electronic credentialing program compared to the existing program?	Public Agency, Motor Carriers	Changes in communications costs and number and salary level of personnel required to operate system.	On-site visits/ personal interviews to determine size of staff (or staff hours on credentialing), skills/training, and whether or not these staff differ from staff prior to electronic credentialing (include technical and programming staff).	Determine whether communications cost and numbers of staff and average salary levels (i.e., total staff costs) have increased or decreased compared to previous system (and by how much); for motor carriers, extrapolate costs for companies visited to estimate costs incurred by all participating companies (costs prorated by company size).
What are the costs of maintaining the equipment required for electronic credentialing?	Public Agency, Motor Carriers	Costs of equipment servicing (including parts).	On-site visits/ personal interviews to describe servicing/ parts needs and estimate associated costs.	Estimate average annual costs for equipment maintenance and note anticipated life of important components that may require early replacement.
Are there other new costs associated with electronic credentialing systems?	Public Agency, Motor Carriers	Additional costs such as greater use of telecom, contracted computer maintenance.	On-site visits/ personal interviews to discuss new or expanded purchase of services from outside.	Compute increase in costs and estimate how these might change over time in response to improved technology.
COSTS FOR ROADSIDE ENFORCEMENT				
What are the current costs of operating the current roadside enforcement program?	Public Agency	Labor and equipment operating and maintenance costs.	On-site visits/ personal interviews to discuss procedures and collect (historical or current) cost information.	Describe the level of labor effort and supporting equipment and information costs required for clearance / inspections, note number of vehicles processed per site.

Table 4.5. Cost Study Area Evaluation Activities (Continued)

Evaluation Issue/Goal	Customer Impacted	Benefit/Cost Measure	Data Collection Activity	Analytical Issues and Procedures
What are the types and costs of new (electronic and other) equipment required at roadside stations and in mobile units to implement CVISN functions?	Public Agency	Types of new equipment and investment costs for each activity.	On-site visits/ personal interviews to observe activities, discuss supporting equipment (both electronic and auxiliary equipment by function: pre-clearance, WIM, etc.), and collect cost information.	Identify equipment/software added only to implement CVISN; describe expected useful life of equipment and software and determine method for annualizing investment costs. Multiply single site costs for each activity by number of sites implementing that activity.
What is the cost of construction required to accommodate new equipment at roadside sites?	Public Agency	Construction costs to install new scales, telecom lines, directional lights, etc.	On-site visits/ personal interviews to observe activities, discuss site modifications, and collect cost information.	Distinguish between site improvements required for any roadside program and those required for CVISN; differentiate among improvements by type of ITS activity supported; annualize one-time costs; extrapolate from single site to all sites in state that may be automated taking variation in site activities/size into account.
What are the costs of training personnel to implement CVISN technologies for roadside enforcement?	Public Agency	Staff hours in training, salary levels of these persons, costs of instruction.	On-site visits/ personal interviews to observe staff activities, and discuss special skills involved and training received (both prior to employment and as part of CVISN program).	Note whether such training is in addition to other training or replaces other training programs; compute staff hours in training and multiply by average wage; add costs of materials and instructor wages per training group.
Do ITS roadside operations require additional (or fewer) and/or *different* personnel? If so, what are the differences in costs?	Public Agency	Number and salary levels of personnel required for new systems.	On-site visits/ personal interviews to observe staff activities and number of persons required, and discuss special skills involved and education or training required.	Compare staff required under previous system and staff required for CVISN-based roadside and mobile activities; control for changes in output (inspections, etc.); estimate net change in staff hours and cost differentials per hour for accomplishing the same functions.
What other operating costs are incurred for CVISN (e.g., communications)?	Public Agency	Non-labor operating costs.	On-site visits/ personal interviews to observe operations, and identify non-labor inputs to CVISN activities.	Identify non-labor operations inputs unique to CVISN, estimate costs; adjust for number of operating units (roadside and mobile) to estimate statewide costs.
What are the changes in costs to maintain CVISN roadside sites and equipment?	Public Agency	Costs of electronic and other CVISN equipment servicing (including parts but not vehicles, roadbed or buildings).	On-site visits/ personal interviews to observe operations, identify servicing/ parts needs, and estimate associated costs.	Estimate average annual costs for equipment maintenance and note anticipated life of important components that may require early replacement; assign costs to individual activities where possible; multiply by number of sites (taking differences among sites into account).

Table 4.5. Cost Study Area Evaluation Activities (Continued)

Evaluation Issue/Goal	Customer Impacted	Benefit/Cost Measure	Data Collection Activity	Analytical Issues and Procedures
What additional on-board equipment is required by motor carriers to participate in the CVISN screening program and what is the investment cost of such equipment?	Motor Carriers	Type of on-board equipment and cost per unit.	On-site visits/ personal interviews with motor carriers to determine level of participation, and equipment required.	Identify equipment purchased specially for CVISN partici-pation, i.e., distinct from on-board computers, AVI, communications equipment used by carrier for company activities; estimate cost per vehicle and multiply by the number of participating vehicles for each carrier.
What special training is required for drivers partici-pating in CVISN screening activities and what are the costs of such training?	Motor Carriers	Staff hours in training, salary levels of these persons, costs of instruction.	On-site visits/ personal interviews to discuss training received.	Distinguish between training required for CVISN and that needed for carrier systems; compute driver hours in training and multiply by average wage; add costs of materials and instructor wages per training group.
What additional maintenance and operations costs are incurred by carriers to participate in the CVISN screening program?	Motor Carriers	Maintenance and operation costs of CVISN equipment per vehicle.	On-site visits/ personal interviews with motor carriers to estimate upkeep activities and costs.	Multiply per vehicle costs by number of participating vehicles.
What cost reductions (time savings) are provided by CVISN?	Motor Carriers	Vehicle and driver time and operating cost savings.	Record actual screening results at roadside and in inspection sites (see roadside screening assessment study).	Multiply per vehicle costs by number of participating vehicles. Use simulation model from the roadside screening assessment study to assess MC time savings.

4.5 THE INSTITUTIONAL ISSUES STUDY AREA

The study of institutional issues is being carried out by the Volpe National Transportation Systems Center to identify and evaluate institutional issues associated with the deployment and integration of ITS products and services at the CVISN sites. The study will address nontechnical impediments, identify lessons that were learned from addressing these impediments, and document the institutional benefits and costs of addressing them. Five questions will be addressed:

- What institutional and other nontechnical impediments did the public sector participants encounter while establishing partnerships and deploying an integrated CVISN system?

- What were the causes of these impediments?

- What institutional changes were made to address these impediments?
- What benefits did the public sector MDI participants achieve from making these changes?

- What costs were involved?

The institutional issues study was conducted by the Volpe Center during the early phases of the CVISN model deployment (see "Early Institutional Lessons from the CVISN Model Deployment: Checklist for Success," October 1998, prepared for the ITS Joint Program Office by the Volpe National Transportation Systems Center). The report presents guidelines (rules of thumb) that can be offered to public sector agencies to assist them in their consideration of deployment of ITS products and services.

4.6 DATA COLLECTION METHODS AND SPECIAL STUDIES

As presented in the previous section, a variety of data collection activities and special studies will be used in this evaluation. The methods include literature searches (including the use of findings from related field operational tests), site visits and personal interviews, and focus groups and formal surveys. Also, two special field studies are planned for assessing safety benefits. Finally, data from existing safety and registration databases will be used extensively in the evaluation.

Table 4.6 summarizes how the three major study areas in the evaluation will use the different data collection methods. The safety study area designed to answer the questions in Table 4.2 includes two specially designed field studies to obtain data for estimating motor carrier regulatory compliance rates and improvements in screening effectiveness (i.e., the ability to target high-risk carriers for inspection). Data from existing safety and registration databases will also be used extensively in the safety study. To determine the value of customer satisfaction and the customers' attitudes toward CVISN services (Table 4.4), we will rely primarily on findings from the literature and new data collected using focus groups and formal surveys. Site visits to the offices of state agencies and private motor carriers will be the primary means of data collection for the cost study (Table 4.5). Results from the literature and data from existing databases and the customer satisfaction surveys also will be used in the cost study.

Table 4.6. Data Collection Methods Used in the CVISN Study Areas Evaluation

Data Collection Method	Study Area		
	Safety	Customer Satisfaction	Costs
Literature Search		P	S
Site Visits		S	P
Focus Groups & Surveys		P	S
Compliance Rate Study	P		
Screening Assessment Study	P		
Registration Databases	S		S
Safety Databases	P		

P = Primary Method, S = Secondary Method

In the remainder of this section we provide a brief overview of the data collection methods and special studies that will be used in the evaluation.

Literature Reviews

Literature reviews are structured searches of the literature, and possibly discussions with reigning experts, to obtain relevant information and results from previous studies. The information will be used, when available, to analyze CVISN benefits and costs without requiring new primary data collection. Literature reviews will be used to establish such values as

- Average property damage to trucks, automobiles, and infrastructure from crashes involving commercial vehicles
- Emissions and fuel consumption from commercial vehicles stopped for safety inspections
- Value of reduced air and noise pollution
- Value of personal injuries and lives lost due to crashes involving commercial vehicles
- Value of motor carrier transit time savings.

The cost analysis also will use data collected from literature reviews, including case study evaluations, system studies, and empirical databases. Literature reviews will be initiated prior to site visits to help prepare for personal interviews and will also be consulted for information to supplement data collected on site.

Other examples of types of information that will be obtained from the literature include general characteristics of motor carrier registration processes, methods used to develop carrier safety ratings (e.g., ISS and Safestat), and relationships between motor carrier safety compliance rates and their accident rates.

Site Visits and Personal Interviews

Site visits and personal interviews are non-random, fact-finding, on-site discussions with specific, knowledgeable persons. Unlike surveys (discussed below), personal interviews are interactive discussions used to gain an understanding of complicated processes such as the logistics and costs of motor carrier credentialing and roadside enforcement. They will also be used to obtain background information and data for study design and subsequent analyses. Examples of background information include the states' current motor carrier registration, taxing, and roadside enforcement practices.

The CVISN evaluation coordinators assigned to the pilot and prototype states are responsible for collecting background information on CVISN deployments and schedules and serving as the principal liaison between the evaluating team and the local partners. Prior to initiating any new data collection effort involving state personnel (e.g., site visits, surveys, interviews), the coordinators will first obtain the approval of the CVISN project manager for each state and inform the FHWA Office of Motor Carrier field person. The coordinators will either participate in the data collection or, at a minimum, arrange for other members of the evaluation team to work with designated persons at the appropriate site.

Focus Groups

Focus groups are structured, two-hour group conversations with 10 to 12 members of a specific affected customer group (market segment) to obtain *qualitative information about the factors influencing customer satisfaction* with CVISN elements. We will use information from the focus groups in three ways:

- As a precursor to designing trade-off survey questionnaires, to be sure that the important factors influencing choice behavior or attitudes are addressed
- In its own right, as input to decisions that require information on priorities, rather than quantitative estimates of responses
- Following examination of the findings from more quantitative techniques, to discuss their credibility and the acceptability of policies based on them.

Surveys (Trade-off and Scaling)

As discussed above, two types of formal surveys will be used in the evaluation. Trade-off surveys answer the question: How much are particular non-monetary benefits of CVISN worth in dollars? They are used to assign monetary value to the benefits of CVISN for use in benefit/cost analysis when the natural units of these benefits are not dollars (e.g., motor carrier customer satisfaction with electronic credentialing). Scaling surveys, on the other hand, answer an easier question: How much do non-monetary measures of customer satisfaction change over time as CVISN is deployed? For example, scaling surveys can measure the percent of motor carriers that were "very" or "extremely satisfied" with the credentialing process prior to electronic credentialing, and then measure the change in this percentage after electronic credentialing is deployed.

Each survey will be carefully designed to achieve its intended purpose of collecting usable data that can be analyzed to estimate customer satisfaction levels and valuations ("willingness-to-pay"). The major design decisions for each survey include:

- Data items to be collected
- Sampling frame and size
- Type of survey (telephone personal interview, mailback, etc.)
- Survey timing and location
- Questionnaire design.

The survey questionnaire will obviously vary in its design depending on its content and the location and activity or status of the respondents. However, most questionnaires will be divided into four "blocks:"

1. Behavioral questions on the activity engaged in (when, where, how often, etc.)
2. Attributes of the activity engaged in (timeframes, costs, reliability, etc.)
3. Valuation of benefits and attitudes about the service or activity (the trade-off and scaling questions)
4. Identifiers (e.g., customer group affiliation, socioeconomic status, etc.) for statistical tabulation and modeling only.

The surveys will sample the appropriate market segments in a way that allows us to compare the results for different samples and to aggregate the results for the national evaluation. For example, in surveying motor carriers, we will select a stratified sample based on selected characteristics (e.g., size of company, location, type of trucks, commodities carried, etc.).

Special Safety Studies

Compliance Rate Study. A major anticipated benefit of deploying CVISN technologies for roadside enforcement is that motor carrier compliance with safety regulations will increase. To measure this, it is necessary to collect roadside enforcement data in a statistically meaningful manner. For example, it is not sufficient to simply observe the difference in the proportion of vehicles inspected that are placed out-of-service (OOS) before and after deployment of CVISN. This is because the OOS rates are influenced by both the screening method and data available, and by the changes in the compliance behavior of motor carriers that may be expected as inspection targeting improves. To measure compliance rates in a statistically valid manner, the times and locations for inspections, as well as vehicles undergoing inspection, must be selected according to a probability-based sampling design. The compliance rate study will be conducted in only a few selected states and is expected to impact only a small portion (e.g., 10 percent) of the inspection activities for a limited period of time.

Screening Assessment Study. The CVISN model deployments are also expected to improve the ability of enforcement personnel to identify high-risk vehicles at the roadside. Specifically, the safety information exchange technologies will provide more timely and accurate data at the roadside with which to screen vehicles for inspection. The screening assessment study will be employed to obtain data to evaluate this important aspect of the CVISN deployments.

We start by selecting inspection sites that use various screening procedures (e.g., safety ratings and other "flags") and have access to different levels of CVISN safety information exchange technologies (e.g., laptop computers, wireless communication, direct access to SAFER). The screening and inspection processes at these sites will be observed for 3 to 5 days. At each site, we will make a record of each approaching truck; and, afterwards, we will do an off-line analysis to assign a risk rating to the vehicle. This off-line analysis will take advantage of any resources at hand (e.g., Safestat, ISS, carrier and driver accident/inspection history). Each vehicle observed can then be tagged as either high-risk or low-risk. Then, we will combine this information with actual inspection results on the day observed. This will allow us to estimate the proportions of high-risk and low-risk vehicles that are selected for inspection.

At the roadside, we will also collect information related to queue lengths, inspection times, and the frequency with which the queue overflowed and caused the inspection site to close (allowing vehicles to bypass). This information will be used in a *simulation study* to evaluate the impact of CVISN technologies on identifying high-risk carriers under different screening approaches. Additional information on the simulation study and the previous two special safety studies is provided in Table 4.2.

4.7 SUMMARY

This chapter of the Summary Evaluation Plan presented an overview of our CVISN evaluation methodology, including BCA, and described the safety, customer satisfaction, and cost study areas in some detail. Tables 4.2, 4.4, and 4.5 presented the major evaluation issues and goals in the form of the research questions to be answered in the evaluation. Descriptions of the various data collection methods referred to in the tables were also described in this chapter. Once the costs and benefits have been measured, we will carry out the BCA and document the other outcomes and benefits of interest in accordance with the evaluation strategy described in Chapter 3.

CHAPTER 5

SOURCES OF CVISN EVALUATION DATA

The previous chapter of this Commercial Vehicle Information Systems and Networks (CVISN) evaluation plan described the types of data that are needed to carry out the evaluation strategy. The data will be obtained from various sources, including a series of "evaluation tests" conducted in one or more CVISN model deployment states, special studies (e.g., surveys and focus groups) not tied to specific states, completed and ongoing ITS/CVO field operational tests, and the literature. Both technical and programmatic, including cost and schedule, issues were considered in selecting data sources.

Some of the programmatic issues that define the scope of the evaluation effort were discussed in Chapter 1. Specifically, answers to the following questions were provided:

1. Which CVISN services should be evaluated and what are the expected benefits?
2. What is the relative importance of the various evaluation goals?
3. What are the criteria for selecting CVISN deployments to provide evaluation data?
4. What other sources of data are available?

This chapter defines specific evaluation tests that will be conducted, identifies potential opportunities to collect useful data from the model deployment states, and describes opportunities to make use of existing information and coordinate with ongoing ITS/CVO programs.

5.1 PLANNED EVALUATION TESTS AND STUDIES

Table 5.1 lists specific tests and studies that will be conducted as part of the evaluation effort. A summary of the key evaluation measures and comments related to the scope of these studies is also presented. These studies are the key components of the evaluation approach described in Chapter 4. Detailed test plans are being prepared for each of the primary data collections efforts (field tests, site visits, and surveys). Each plan will describe the overall approach to the study, hypotheses to be tested, data to be collected, and analysis and reporting plans.

The final selection of evaluation tests, as well as the distribution of evaluation resources to the various tests (and other evaluation activities), was determined after considering several factors. These factors include the importance of the data needs relative to the evaluation approach (as presented in Chapter 4), the cost of data collection, and the availability of alternative data sources from the literature or related studies.

As discussed in Chapter 1, most of these data collection activities, especially the field studies, will be carried out in an iterative fashion. Initially, data collection will be focused in one or two states that meet established criteria. Depending on resources available and the need to evaluate CVISN systems deployed under a variety of operating procedures and institutional factors, diverse applications will be sought when selecting additional states to provide evaluation data. Some of CVISN deployments in states that are candidates for providing benefits data in the timeframe of the evaluation project are described in the next section.

Table 5.1. Planned Evaluation Tests

Tests	Selected Evaluation Measures	Scope/Comments
CUSTOMER VALUE/SATISFACTION		
Literature Reviews	- Value of property damage, fatalities, personal injuries - Value of time savings (motor carriers) - Value and incidence of highway delays from accidents involving CVs - Value of noise and emissions reduction	- Published reports, discussions with experts, information from related studies
Baseline National Motor Carrier Survey	- Awareness, attitudes, and satisfaction related to credentialing and enforcement practices - Factors affecting involvement in CVISN - Information to plan survey on motor carriers involved in electronic credentialing	- National survey of interstate carriers plus some intrastate carriers from selected CVISN states - Before deployment
Survey of Drivers	- Attitudes and opinions regarding roadside enforcement practices	- Post-deployment - Scaling survey - 3 states using CVISN roadside services
Survey of Motor Carriers Using Electronic Credentialing	- Value of productivity increases - Overall satisfaction with credentialing services	- Post deployment - Trade-off and scaling survey - Carriers from 3 states using CVISN credentialing services
Focus Groups	- Detailed information about attitudes, behaviors, and issues - Survey design information	- 2 motor carrier groups - 1 group each for drivers, state CVO officials, and enforcement staff
COSTS		
Site Visits to State Offices	- CVO operating costs before and after CVISN deployment - Other inputs to BCA	- 3 states using CVISN roadside services - 3 states using CVISN credentialing services - Before and after deployment
Site Visits to Motor Carriers	- Credentialing costs before and after CVISN deployment - Other inputs to BCA - Input to motor carrier surveys	- Up to 10 motor carriers in each of 3 states using CVISN credentialing services - Before and after deployment

Table 5.1. Planned Evaluation Tests (Continued)

Tests	Selected Evaluation Measures	Scope/Comments
SAFETY		
Accident Analysis	- Number of crashes and injuries, and amount of property damage related to CVs	- Limited and focused effort - Subject to availability of useful data
Compliance Rate Study	- Proportion of trucks complying with safety regulations before and after CVISN	- 1 state using CVISN roadside services - Focused on a corridor
Screening Assessment Study	- Probability of inspection for "high risk" and "low-risk" carriers	- 2 or 3 states using CVISN roadside services - With and without CVISN - Multiple deployment strategies
SAFER Data Mailbox Studies	- Amount of time to upload and download safety data from roadside - Number of out-of-service order violators identified (actual and potential)	- 1 or 2 states testing SAFER Data Mailbox - Certain efforts may be combined with screening assessment study

5.2 CANDIDATE CVISN DEPLOYMENTS TO PROVIDE EVALUATION DATA

Tables 5.2 and 5.3 describe deployments of CVISN roadside enforcement and credentialing services that incorporate the key CVISN features discussed in Section 1.3. Because of the uncertainties of funding sources and unexpected problems in resolving technology solutions, the plans described below may not reflect current deployment plans, which are subject to change at any time. States may choose alternative solutions, delay deployment, or possibly abandon portions of the plan. On the other hand, other states may find additional sources of funds or reinstate a plan to deploy certain features after resolving technical issues. The implications for evaluation planning is that it will be important to maintain frequent contact with the participating states and continue to refine the data collection plan to ensure that the data collection resources are focused on the appropriate deployments.

As shown in Table 5.2, California (CA) is planning to use wireless data exchanges with mobile inspection units, in addition to deploying an extensive mainline screening service. California will have more trucks operating with transponders than any state in the country. Connecticut (CT), on the other hand, offers a unique opportunity to evaluate the benefits of real-time safety information exchange technologies in mobile enforcement units. With more than four years of experience using roadside laptop computers containing "static" safety data on commercial carriers, Connecticut's inspectors will be among the first in the country to have real-time access to safety data through a wireless communication network. Also, Connecticut is a member of the SAFER Data Mailbox project with the Eastern States Coalition and is participating in two CVISN-related field operational tests with the I-95 ITS/CVO program. Kentucky (KY) will build on its experience at mainline screening with Advantage I-75 by creating a data exchange network involving the mainline screening sites. Kentucky also is adding additional criteria to its mainline screening protocols. Washington (WA) is listed as a potential site for data collection because it is involved in safety information exchange with Oregon (OR); plus, it has plans to significantly increase its use of laptop computers.

On the credentialing side (Table 5.3), California presents an attractive opportunity to collect cost and benefit data because it has plans to enroll the largest number of carriers. Also, California plans to use both PC-based and Web CATs. Colorado (CO), Kentucky, Minnesota (MN), and Virginia (VA) also have plans to deploy the same technologies; but there are differences in the types of services included, as well as the levels of deployment (i.e., number of carriers enrolled). These differences are important to evaluate.

In addition to the special studies and data collection activities that will be undertaken in targeted states, we also plan to collect certain types of data from all CVISN states. This includes operational data obtained through continuing site visits from state evaluation coordinators and, possibly, surveys of the motor carrier industry operating within the state. All data collection efforts will be undertaken after obtaining the approval of the state CVISN program manager.

In general, the costs of data collection for the evaluation project will be borne by the evaluation project team. However, the states will be asked to support the evaluation effort by allowing state employees to provide information on current and planned operations and providing access to electronic versions of safety and registration data. The states that agree to participate also will be asked to provide opportunities for the evaluation team to collect data as they carry out their credentialing and roadside enforcement operations.

5.3 DATA FROM RELATED ITS/CVO PROJECTS

The CVISN evaluation will rely on results from related studies and, to the extent possible, coordinate data collection and analysis with related ongoing ITS/CVO programs. Some of these program are described below.

Advantage I-75 Mainline Automated Clearance Project

The Advantage I-75 program is applying ITS/CVO technologies to enforcing vehicle weight and dimension regulations along the I-75 corridor. A partnership of public and private interests, the goal of Advantage I-75 is to reduce congestion, increase state and industry productivity, and improve safety. The partners include the Federal Highway Administration, the six states served by the I-75 corridor and the province of Ontario, the Canadian Ministry of Transportation, U.S. and Canadian trucking associations, and various trucking firms. The lead state is Kentucky, with the University of Kentucky Transportation Center managing the operations center. Iowa State University's Center for Transportation Research and Evaluation serves as the independent project evaluator.

The total, cumulative, public sector cost of Advantage I-75 from 1990 to 1997 is about $12 million. Approximately 80 percent of this is being provided by the federal government; the balance is coming from the Advantage I-75 states and province. A significant amount of effort is being directed toward identifying and quantifying the benefits of the system.

Oregon Green Light

The Oregon Green Light Project, managed by the Motor Carrier Transportation Branch (MCTB) of the Oregon Department of Transportation (ODOT), is implementing the roadside portion of Oregon's Strategic Plan for ITS/CVO. Implementation will occur in four phases between 1995 and the year 2000, at a cost of just over $39 million.

Table 5.2. Deployment of CVISN Roadside Enforcement Services That Are Candidates for Providing Useful Evaluation Data

State	Key Features
CA	1. Mainline screening of 50,000 vehicles at 21 sites. 2. Enhanced screening data (safety, vehicle OOS, weight, credentials, insurance status, and tax payments. 3. Sorter lane screening for weight (using low-speed WIM) at seven sites by 9/98. 4. 92 mobile units using wireless communication (CDPD) for near real-time data exchanges.
CT	1. Over four years of experience at using laptop computers in roadside enforcement activities. 2. Plan to have 36 CDPD units that can upload inspection data, including OOS orders, into SAFER Data Mailbox in a near real-time basis. Access to real-time safety data when available. 3. Regional cooperation with neighboring states through I-95 CVO and SAFER Data Mailbox programs. 4. Plans to exchange safety data with RI and MA and coordinate enforcement policies with NY and PA.
KY	1. Experience (through Advantage I-75) in mainline screening at five sites. 2. Plans to "network" mainline screening sites and develop more extensive screening criteria (safety, vehicle OOS, weight, credentials, insurance status, tax payments) for 10 carriers. 3. Sorter lane screening (using OCR) at five sites to be able to screen all vehicles. 4. Three "satellite" sites linked to mainline screening network to detect violators attempting to bypass fixed sites.
OR	1. Mainline screening of 5,000 to 15,000 vehicles at 9 to 22 sites. 2. Enhanced screening criteria (safety, weight, credentials, tax payments, and date of last inspection). 3. Sorter lane screening for weight (using low-speed WIM) and height at three sites. 4. Exchange of safety information with Washington. 5. Four integrated tactical enforcement network (ITEN) units for detecting violators bypassing fixed sites.
WA	1. Significant increase (100+ units) in the use of laptop computers for mobile enforcement. 2. Enhanced screening criteria (safety, vehicle OOS, weight, credentials, and tax payments). 3. Port of entry site receives OOS data from OR.

Table 5.3 Deployment of CVISN Electronic Credentialing Services That Are Candidates for Providing Useful Evaluation Data

State	Key Features
CA	1. Large number (50) of carriers participating in electronic credentialing. 2. End-to-end electronic processing of IRP, IFTA, IFTAQT, and OS/OW. 3. Deployment of both PC-based CAT and Web CAT. 4. EFT and printing of OS/OW permits by carriers.
CO	1. Deployment of both PC-based CAT and Web CAT. 2. End-to-end electronic processing of IRP, IFTA, IFTAQT, SSRS, and OS/OW. 3. EFT and printing of OS/OW permits by carriers.
KY	1. End-to-end electronic processing of IRP, IFTA, IFTAQT, OS/OW, intrastate, and weight distance using Web CAT. 2. Printing of IRP temporary credentials at carrier's office.
MD	1. End-to-end electronic processing of IRP and IFTA. 2. Deployment of PC CAT (Web CAT if possible).
MN	1. End-to-end electronic processing of IRP, IFTA, IFTAQT, OS/OW, SSRS, intrastate, and HAZMAT. 2. Deployment of both PC-based CAT and Web CAT. 3. Printing of permanent IRP, IFTA, OS/OW, intrastate.
VA	1. End-to-end electronic processing of IRP, IFTA, IFTAQT, OS/OW, intrastate, and titling and registration using PC CAT. 2. Printing of permanent IRP, IFTA, OS/OW, intrastate, and titling and registration credentials at carrier's office (for carriers with inventory of license plates and decals).

Green Light and the CVISN MDI are closely linked. For example, Green Light's roadside screening components are included in the CVISN program plan. In general, the CVISN program supports and supplements Green Light's preclearance system by integrating it with automated credentialing, registering, and permitting, as well as the exchange of truck safety information between the roadside and state safety offices.

An independent evaluation of the Green Light program is being conducted under a contract through Oregon State University. The evaluation of the Oregon CVISN program is being coordinated with the Green Light evaluation in a way that avoids overlap and allows for sharing of data and information. The Green Light evaluation will assess the viability (benefits and impacts) of various CVO technologies and systems, both for Oregon applications and for potential national deployment. Because of the extensive deployment of roadside screening and preclearance systems under Green Light, there will be significant collaboration between the two evaluation efforts. In particular, the data being collected for the Green Light evaluation may be incorporated into the overall assessment of electronic screening systems in the CVISN evaluation. Also, the CVISN evaluation may focus on integrating the roadside and administrative functions that are being deployed in Oregon.

SAFER Data Mailbox

The Safety and Fitness Electronic Records (SAFER) data mailbox project, conducted by a coalition of seven eastern states (Connecticut, Delaware, Maryland, New Jersey, New York, Pennsylvania, and Virginia), is testing new technologies for providing roadside safety enforcement officers with direct access to carrier safety information. The SAFER system, developed by the Federal Highway Administrations (FHWA's) Office of Motor Carriers, contains carrier-, vehicle-, and driver-specific safety information for all interstate carriers.

The technologies being evaluated in this field test represent a major component of CVISN's Safety Information Exchange user service. They include upgraded ASPEN and SAFER software, laptop or pen-based computers, mobile file servers, and wireless communication devices.

There is significant overlap in the goals and methodologies of the CVISN and SAFER data mailbox evaluation efforts. Furthermore, three states (Connecticut, Maryland, and Virginia) are participating in both projects. Because these programs are concurrent, involve some of the same states, and have the same evaluation lead contractor (Battelle), there will be significant collaboration in the evaluation efforts.

"One-Stop" Electronic Credentialing Field Operational Tests

The FHWA financed three electronic credentialing projects: the Southwest One-Stop, developed by In-Motion Inc.; the HELP One-Stop, developed by Lockheed Martin IMS; and the Midwest Electronic One-Stop, developed by AAMVANet and RSIS. These projects demonstrated the potential to increase productivity for both motor carriers and state program administrators by automating and integrating common motor carrier functions. A total of 13 states participated, including three CVISN pilot states: California (HELP One-Stop), Colorado (Southwest One-Stop), and Minnesota (Midwest One-Stop).

Booz Allen Hamilton is the evaluation contractor for both the Southwest One-Stop (in conjunction with Arkansas State University) and the Midwest One-Stop. The Western Highway Institute is the evaluator for the HELP One-Stop. These three evaluation efforts used different approaches. However, in general, the evaluations employed various combinations of a strong qualitative survey approach (to determine customer satisfaction and functionality responses) and system-generated cycle time data (to measure the potential benefits/cost savings of one-stop services). Preliminary results show that both motor carriers and state regulatory agencies feel very positive about the concept of one-stop electronic credentialing. The potential cost savings, both in terms of real dollar savings and staff time, are attractive to both motor carriers and state agencies.

ATA Foundation Assessment of ITS/CVO User Services

In August 1996, the American Trucking Association (ATA), with support from the National Private Truck Council and Iowa State University, completed a benefit/cost study on the impact of ITS/CVO technologies on regulatory compliance costs for motor carriers. Six ITS/CVO user services (Credentials Administration, Electronic Clearance, Safety Information Exchange, On-Board Safety Monitoring, HAZMAT Incidence Response, and Carrier Traveler Information Systems) were assessed. The study had two focuses: evaluation of benefits and costs and determination of market potential. Data for the analyses were obtained from 900 motor carriers responding to mail-in questionnaires or phone interviews. Nearly 200 technology vendors were also contacted.

The study provides valuable insight and potentially useful data on motor carrier usage of, and attitudes toward, ITS/CVO technologies. Information on regulatory compliance costs is also available. The

CVISN evaluation effort will consider these results in planning data collection efforts involving motor carriers.

National Governors' Association Assessment of Budgetary Implications of ITS/CVO for State Agencies

In January 1997, the National Governors' Association (NGA) commissioned a study of budgetary implications of ITS/CVO for state agencies. The study involves data collection (mostly from secondary sources) in eight states. Five of the states (California, Colorado, Connecticut, Kentucky, and Minnesota) are CVISN pilot states. The study, entitled *Budgetary Implications of ITS/CVO for State Agencies*, focuses on estimating the *direct* benefits and investment requirements for deploying electronic credentialing, safety, and clearance systems over the next 10 years. The scope of the study is limited to analyzing the costs and benefits to public sector agencies. In other words, costs and expected benefits to the private sector are not included in the analysis. Moreover, general societal benefits, such as reduced accidents (or improved safety) and air quality, are also excluded.

Field Operational Tests of the I-95 Corridor Coalition ITS/CVO Working Group

The I-95 Corridor Coalition provides a forum for convening and coordinating state, regional, and federal CVO activities in the eastern United States. In 1997 the Coalition's CVO Working Group established a $3 million ITS/CVO field operational test (FOT) program to promote the use of ITS for credentials administration, roadside safety, electronic clearance, and safety management. Ten eastern states, including CVISN MDI states of Connecticut, Maryland, and Virginia, are participating in these FOTs. Nearly all of the ITS/CVO technologies being deployed by the participating states are consistent with the architecture and focus of the CVISN program. There will be significant collaboration between the evaluation efforts for I-95 CVO FOTs, SAFER Data Mailbox FOT, and CVISN MDI for several reasons: all projects involve the deployment of CVISN technology, many states are involved in more than one program, and all programs are evaluated by IPAS contractors—Battelle and SAIC.

CHAPTER 6

MANAGEMENT PLAN

In Section 6.1 of this Commercial Vehicle Information Systems and Networks (CVISN) evaluation plan, the organization of the CVISN project team is described, specific roles and responsibilities of the team members are defined, and the work breakdown structure is presented. Section 6.2 discusses milestones, deliverables, and issues related to the project schedule and budget.

6.1 ORGANIZATION OF THE CVISN EVALUATION TEAM

As part of its mission to provide strategic leadership for intelligent transportation systems (ITS) research, development, and deployment across the Department of Transportation (DOT), the ITS Joint Program Office (JPO) has the ultimate responsibility for assessing (evaluating) the CVISN Model Deployment Initiative (MDI). To support its efforts in the area of program assessment, the JPO awarded ITS Program Assessment Support (IPAS) contracts to Battelle and SAIC in 1996. These contracts provide technical and program support for evaluations of a variety of field operational tests and model deployments. Battelle was given the primary responsibility for planning the national CVISN evaluation. However, SAIC and several subcontracting organizations are also participating in this effort. Other participants include the John A. Volpe National Transportation Systems Center, the Federal Highway Administration (FHWA) (especially the Office of Motor Carriers), and, of course, the CVISN project teams from the ten prototype and pilot model deployment states. Johns Hopkins University's Applied Physics Laboratory, through its role as a system developer and CVISN program facilitator for the FHWA, is also providing valuable support to the CVISN evaluation effort.

Organizational Structure, Roles, and Responsibilities

The organizational structure of the CVISN evaluation team is shown in Figure 6.1.

Joe Peters of the JPO has the overall responsibility for ITS program assessment and is the COTR for the IPAS contracts with Battelle and SAIC. His team includes a coordinator, to ensure communication among the various partners, and a group of evaluation advisors, sometimes referred to as the "few good measures" experts, who provide guidance in specific evaluation subject areas.

Mike Freitas (FHWA) is the Work Assignment Manager for CVISN evaluation. He is responsible for overseeing the technical approach of the evaluation project, serves as the JPO's principal government contact with state and federal partners, and is the Task Manager for the Battelle and SAIC IPAS teams on all matters related to CVISN evaluation.

John Orban, Battelle's Evaluation Leader and CVISN Evaluation Project Manager, is responsible for the day-to-day management of the technical activities and communications between the project team and various partners. In particular, he provided technical direction to the team that prepared this CVISN evaluation strategy and plan and will oversee the evaluation data collection and analysis activities. As the CVISN Evaluation Leader, Dr. Orban reports directly to the government's Task Manager, Mike Freitas. Dr. Orban's evaluation team includes four study area leaders and eight state evaluation coordinators.

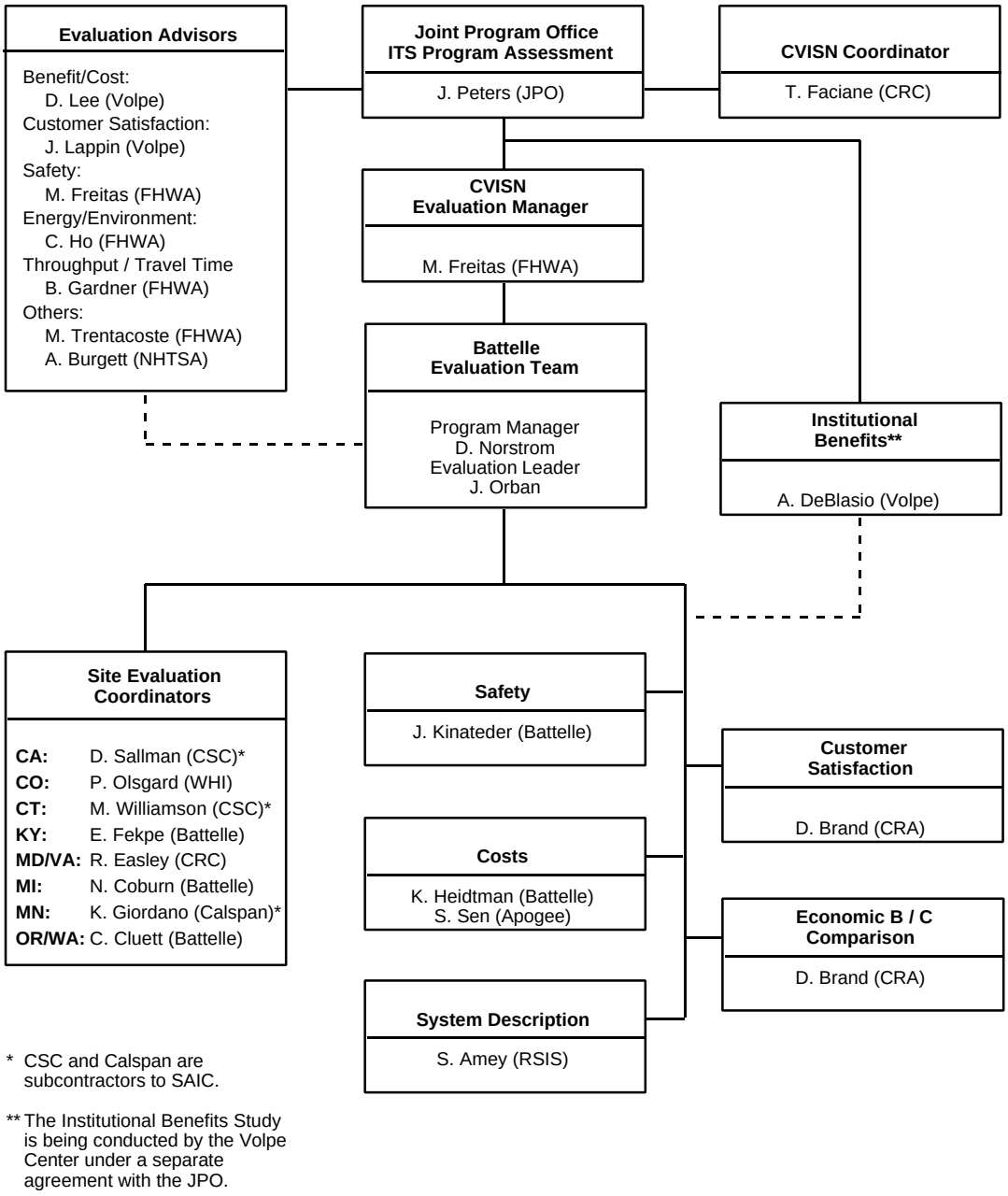

Figure 6.1. Organizational Structure of the CVISN Evaluation Team

The evaluation coordinators are the principal contacts with the state partners. They are responsible for collecting information on commercial vehicle operations and CVISN deployment plans within their assigned states. They will also support local data collection efforts (including interviewing state agencies and obtaining access to existing data sources) and assist in communicating the evaluation strategy and plan to the state partners.

As a team, the study area leaders are responsible for developing the evaluation strategy and, individually, are responsible for preparing data collection and analysis plans in designated areas to carry out the strategy. Currently, the four study areas are safety, customer satisfaction, costs, and institutional benefits. Although the latter study is being integrated with the overall CVISN evaluation, the institutional benefits study, led by Allan DeBlasio of the Volpe Center, is being performed under a separate contract with the JPO.

David Norstrom, Battelle's IPAS Program Manager, oversees programmatic and contractual issues with the JPO and subcontractors. Battelle subcontractors include Charles River Associates (CRC), Apogee Research, Castle Rock Consultants (CRC), RS Information Systems (RSIS), and the Western Highway Institute (WHI). Cambridge Systematics Corporation (CSC) and Calspan, subcontractors to SAIC, are also participating in the evaluation effort.

Work Breakdown Structure

The CVISN evaluation project is divided into two phases: planning and execution. During the planning phase, the work breakdown structure (WBS) closely follows the organizational structure shown in Figure 6.1. Each of the work elements, a brief description, and the person responsible for that work element are shown in Table 6.1.

The WBS structure for phase 2 will include related tasks to coordinate detailed planning and data analysis in each study area. It will also include tasks related to the specific data collection efforts (e.g., survey operations, roadside data collection), as well as a data management task. The phase 2 WBS will be included in the detailed test plan.

6.2 Milestones, Deliverables, and Schedule/Budget Issues

The planning schedule and milestones for the CVISN evaluation effort are shown in Figure 6.2. The schedule is tentative and depends on CVISN deployment plans in participating states, available funds for evaluation, and the government's need for timely information on CVISN benefits and costs.

The planning process began in November 1996 when Battelle and SAIC Inc. were each awarded IPAS contracts with the JPO. Preliminary ideas on the goals, measures, and methodologies for conducting the CVISN evaluation were first presented to DOT stakeholders in December 1996. This was followed by an evaluation workshop involving partners from the ten model deployment states and the U.S. DOT held at the Johns Hopkins University Applied Physics Laboratory (JHU/APL) on January 28-31, 1997. Since that time, the CVISN evaluation team has been working in three areas:

- Gathering information on state commercial vehicle operations and CVISN deployment plans in the ten prototype and pilot states

Table 6.1. CVISN Evaluation Planning — Phase 1 Work Breakdown Structure

Work Element	Description	Responsibility
Technical Integration	Organize and manage the project team; oversee the development of the strategy and technical approach; direct communications with JPO, OMC, and other evaluation partners.	John Orban
Coordination with States	Collect information on state CVO processes and CVISN deployment plans, identify opportunities for collection of evaluation data, communicate with state CVISN planning organizations.	State Evaluation Coordinators, (Task Leader: John Orban)
Coordination Support for JPO	Provide direct support to JPO for activities such as information gathering, coordination among CVISN-related projects (deployment, evaluation, deployment tracking, and institution benefits). Support deployment tracking project.	Terri Faciane
Description of CVISN Services	Prepare descriptions of CVISN components for evaluation planning, support state coordinators in the preparation of consistent definitions of "CVISN alternatives."	Scott Amey
Institutional Benefits*	Plan Institutional Benefits study, conduct baseline interviews.	Allan DeBlasio*
Customer Satisfaction	Plan customer satisfaction data collection and analysis efforts in support of benefit cost analysis.	Daniel Brand
Safety	Plan safety investigation.	John Kinateder
Costs	Plan data collection efforts related to CVISN costs.	Shaurav Sen and Kurt Heidtman
Economic Benefit/ Cost Analysis	Develop benefit/cost strategy and technical approach.	Daniel Brand
SAFER Data Mailbox	Plan evaluation of the SAFER Data Mailbox project.	John Orban and Richard Easley

* The Institutional Benefits study is being conducted under a separate contract with the JPO.

- Developing the national evaluation strategy
- Defining the data collection and analysis methods that will be used to carry out the strategy.

Following the January workshop, the state evaluation coordinators continued to gather information about state CV organizations, operations, and CVISN deployment plans. With the help of two CVISN workshops and site visits of JHU/APL facilitators, many CVISN states made significant progress in preparing their CVISN project plans during 1997.

Meanwhile the evaluation team prepared the evaluation strategy and plan based on the best available information on state deployment plans. Two planning documents were completed in 1997: The Evaluation Strategy and Plan (August 1997) and the Evaluation Data Requirements Plan (November 1997). Key parts of these documents have come together in this summary evaluation plan.

Following approval of the plan by the Office of Motor Carriers in February 1998, the team began preparing detailed test plans and initiated data collection. Data collection is expected to continue through mid 1999. However, delays in the deployment of certain CVISN services could extend the schedule for

data collection. Interim reports will be available in the third and fourth quarters of 1999. The draft evaluation report will be completed in December 1999. Figure 6.2 shows the schedule for this effort.

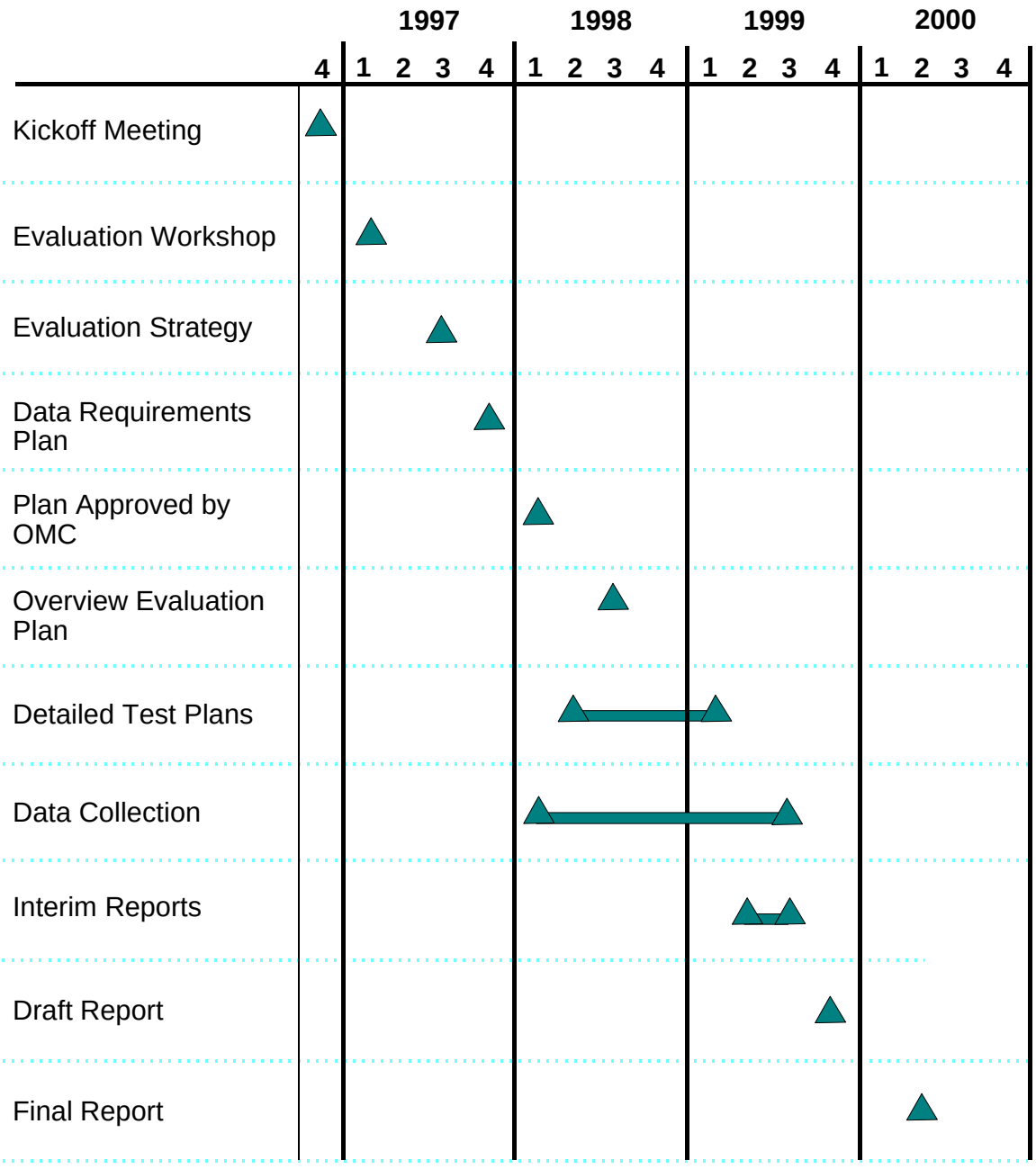

Figure 6.2. CVISN Evaluation Schedule