CVISN Guide to Electronic Screening

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Note

The Motor Carrier Safety Improvement Act was signed into law on December 9, 1999. This act established a new Federal Motor Carrier Safety Administration (FMCSA) within the U.S. Department of Transportation (DOT), effective January 1, 2000. Prior to that, the motor carrier and highway safety program was administered under the Federal Highway Administration (FHWA).

The mission of the FMCSA is to improve truck and commercial passenger carrier safety on our nation's highways through information technology, targeted enforcement, research and technology, outreach, and partnerships. The FMCSA manages the Intelligent Transportation Systems (ITS) / Commercial Vehicle Operations (CVO) program, a voluntary effort involving public and private partnerships that uses information systems, innovative technologies, and business practice re-engineering to improve safety, simplify government administrative systems, and provide savings to states and motor carriers. The FMCSA works closely with the FHWA ITS Joint Program Office (JPO) to ensure the integration and interoperability of ITS/CVO systems with the national ITS program.

DRAFT ISSUE

IT IS IMPORTANT TO NOTE THAT THIS IS A DRAFT DOCUMENT. The document is incomplete and may contain sections that have not been completely reviewed internally. The material presented herein will undergo several iterations of review and comment before a baseline version is published.

Note: This document and other CVISN-related documentation are available for review and downloading by the ITS/CVO community from the JHU/APL CVISN site on the World Wide Web. The URL for the CVISN site is: **http://www.jhuapl.edu/cvisn/**

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CVISN Guide to Electronic Screening

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1 INTRODUCTION

Commercial Vehicle Information Systems and Networks (CVISN) is the collection of state, federal, and private sector information systems and communications networks that support commercial vehicle operations.

Electronic screening is one of the three key program areas in CVISN Level 1. The *CVISN Guide to Electronic Screening* provides reference information and offers advice about implementing electronic screening functions in CVISN.

This is one in a series of guides. The other guides are available from the CVISN web site (http://www.jhuapl.edu/cvisn/). CVISN concepts and program areas are outlined in the *Introductory Guide to CVISN* (Reference 1).

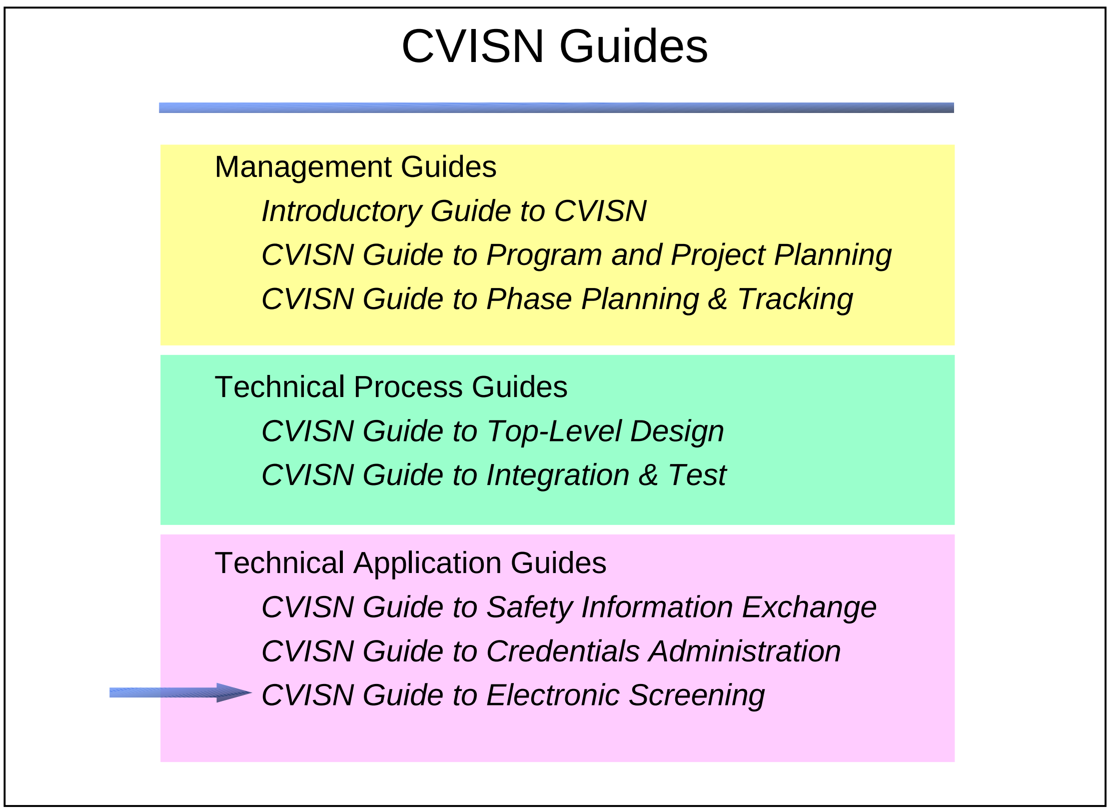

Figure 1–1. CVISN Guides

Subsequent chapters of this guide discuss the concepts, systems, development processes, and issues associated with electronic screening.

General Recommendations

The following general recommendations should be incorporated throughout the design and implementation of electronic screening systems:

- The implementation should be based on a simple and expandable design.
- The design should allow for refinement of key standards as they continue to develop, including the Dedicated Short Range Communications (DSRC) standards and the Safety and Fitness Electronic Records (SAFER) snapshot definitions.
- The system design specification should be consistent with the CVISN architecture specifications, which are derived from the National Intelligent Transportation Systems (ITS) Architecture.
- Periodic technical reviews should be held with the contractors and system integrators to ensure consistency with the CVISN architecture, design, and standards.
- The final system should pass a set of CVISN interoperability tests.
- A comprehensive set of technical documentation should be provided by the vendor to the state, upon completion of the effort.

This recommended development path should ensure that the deployed system is consistent with the CVISN architecture and achieves technical interoperability with other electronic screening programs.

2 WHAT IS ELECTRONIC SCREENING?

Screening is a selection mechanism to target high-risk operators and make efficient use of weigh station and inspection resources. **Electronic screening** is the application of technology to make more informed screening decisions. Properly implemented, electronic screening results in improved traffic flow, focuses vehicle inspections and ultimately achieves the goals of increased safety and reduced operating costs. In electronic screening:

- Dedicated Short Range Communications (DSRC) is used to identify the vehicle, store and transfer other screening data, and signal the driver of the pull-in decision.
- Electronic Data Interchange (EDI) may be used to transmit safety and credentials history (snapshot) data from the information infrastructure to the roadside systems to assist in the screening decision.

The application of electronic screening will be affected by many constraints, including site limitations, availability of support staff, and funding. Each roadside check station is likely to have a unique design. Each station's design is unique because of:

- State policy and practices
- Traffic flow, volume, and number of lanes
- Available site space
- Legacy system characteristics
- Existing proprietary solutions
- Vintage of roadside facilities and communications equipment
- Resources available for making changes

2.1 Technologies

There are a variety of technologies that can be applied to electronic screening in support of the commercial vehicle weigh and inspection process. There are also a number of ways in which these technologies can be applied. The purpose of this section is to briefly describe some of the basic technologies used in electronic screening.

2.1.1 Dedicated Short Range Communications (DSRC)

DSRC is used to provide data communications between a moving vehicle and the roadside equipment to support the screening process. This is accomplished by means of a transponder (also known as a "tag") mounted in the cab of the vehicle, and a reader and antenna mounted at the roadside. The tag may contain identifiers specific to the vehicle (carrier and vehicle IDs), plus optional prior screening event information. The transponder has audio and visual indicators which may be used to signal the driver.

The term **Automated Vehicle Identification (AVI)** is often used when referring to DSRC systems. Strictly speaking, AVI is any technology, including DSRC, used to identify vehicles. This category also includes optical, audio, and other RF identification systems.

2.1.2 Weigh In Motion (WIM)

WIM is used to measure approximate axle weights as a vehicle moves across the sensors, and to determine the gross vehicle weight and classification based on the axle weights and spacings. Although not as accurate as a static scale, WIM allows the weight of a vehicle to be estimated for screening purposes, while maintaining traffic flow.

2.1.3 Automatic Vehicle Classification (AVC)

Axle detectors are used to classify the various vehicle types. This information is necessary at WIM-equipped sites because vehicle classification plays a role in the determination of legal weight. AVC units are also used in compliance subsystems to detect vehicles bypassing the station.

2.1.4 Vehicle Tracking Loops

Inductance loops may be used to track vehicle positions as they proceed through the site. This information is required to synchronize lane signaling with the correct vehicles, and to verify compliance with these signals.

2.1.5 Automatic Signing

Lane signals and variable message signs should be automatically controlled by roadside operations and coordinated with the detected location of the vehicle. Precise timing and control of these signals is required in order to ensure that unambiguous direction is given to the intended vehicle. Misdirection, confusion and ambiguity may result if signals intended for one vehicle are visible to and misread by another.

2.2 Data Exchange

A critical component of the CVISN architecture is the standardization of two interfaces: computer-to-computer exchanges using EDI and vehicle-to-roadside exchanges via DSRC. The EDI interfaces are primarily used to transfer information between public (e.g., state government to state government) agencies or between a public agency and private sector entity (e.g., state government to motor carrier).

Another component to standardization of data exchange between state and/or public systems is the use of common data “snapshots.” Snapshots contain information to provide a quick picture of carrier/vehicle/driver safety performance history and basic credentials information. Carrier and vehicle snapshots exchange safety and credentials data between state and national systems. The snapshots are used in conjunction with DSRC messages to support roadside operations as shown in Figure 2-1.

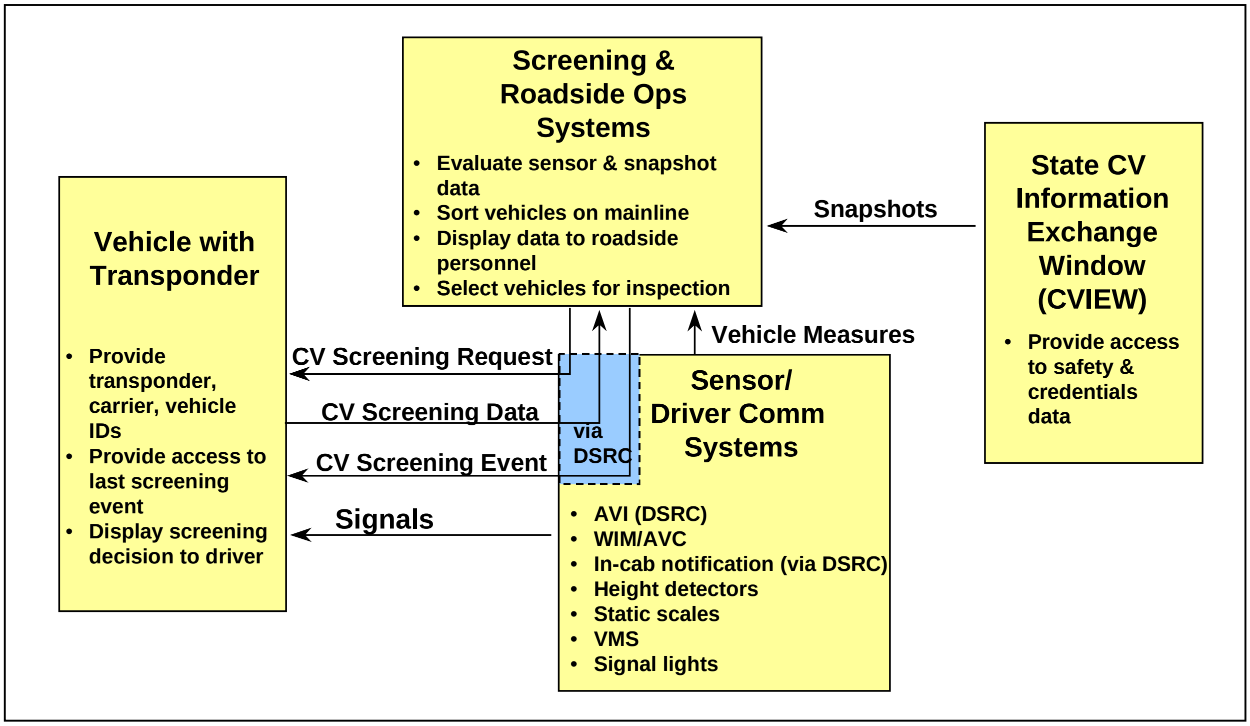

Figure 2–1. Roadside Systems Use Technology to Support Electronic Screening and Inspections

Figure 2-1 shows the data flow between the various systems supporting electronic screening.

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3 WHAT ALREADY EXISTS?

A large body of knowledge and experience already exists for deploying electronic screening systems and technologies. Member states of two major multi-state electronic screening programs, Heavy Vehicle Electronic License Plate (HELP) PrePass™ and North American Preclearance and Safety System (NorPass), have deployed a number of sites that are currently in operation. The CVISN Pilot and Prototype states have completed or are in the process of developing electronic systems that meet CVISN Level 1 requirements.

Software products and design documents, developed for CVISN with FMCSA funds, are available in the public domain. These products include the Roadside Operations Computer (ROC), screening computer, Commercial Vehicle Information Exchange Window (CVIEW), and E-screening enrollment applications.

3.1 Programs

Heavy Vehicle Electronic License Plate (HELP) PrePass™ is the largest North American electronic screening program with operational sites in Alabama, Arizona, Arkansas, California, Colorado, Illinois, Mississippi, Montana, New Mexico, Oklahoma, Tennessee, West Virginia, and Wyoming. The PrePass™ central site manages pre- and post-enrollment verification checks of carriers and provides transponders for vehicles. At the roadside station, transponder-equipped vehicles are checked against a pre-clearance list and weighed using WIM equipment. More information can be found at the HELP PrePass™ website: http://www.cvo.com/.

As of this date, states participating in HELP PrePass™ do not meet the CVISN Level 1 Roadside requirements. The primary shortcoming is not using snapshot data as the basis for safety and credential checks. California (CA), one of the CVISN Pilot states and a HELP PrePass™ member, has developed a roadside systems design that should meet CVISN Level 1 requirements, when deployed. States that are current members of HELP PrePass™, or considering joining the program, may want to use the CA electronic screening design as a starting point in their development.

North American Preclearance and Safety System (NorPass) was created in the merger of Advantage CVO and Multi-jurisdictional Automated Preclearance System (MAPS). States which have signed the NorPass agreement include: Florida, Georgia, Kentucky, Louisiana, Oregon and Washington. Information based on safety and credential records is passed to the roadside stations via an enrolled vehicle list. Weight enforcement may be conducted using WIM, prior event data, or weight compliance history. For more information on NorPass, contact Gene Bergoffen (E-mail: GENE.BERGOFFEN@saic.com].

Kentucky (KY) and Washington (WA), two CVISN Pilot states that are also NorPass members, are nearing completion of electronic screening sites which should meet the roadside CVISN Level 1 requirements. Both KY and WA are scheduled to conduct the CVISN Interoperability roadside tests in late 1999.

Virginia (CVISN Prototype State) has implemented electronic screening, based on the CVISN architecture, at the Stephens City inspection station. By successfully conducting several of the CVISN Interoperability tests, Virginia became the first state to meet the roadside CVISN Level 1 requirements. Virginia is moving forward with enrolling carriers and distributing transponders; development of a mobile screening van (NOMAD); and implementation of electronic screening at a second fixed site (Suffolk).

3.2 Products

Commercial Vehicle Information Exchange Window (CVIEW) systems are used in some states to store and exchange safety and credential data. In CVISN Level 1, there is a requirement to implement a system called CVIEW or its equivalent for snapshot exchange within the state. The functions that CVIEW, or its equivalent, will perform are listed below.

- Provide for the electronic exchange of state-based interstate carrier and vehicle credential data between state source/legacy systems, users, and SAFER
- Provide for the electronic exchange of intrastate carrier and vehicle snapshot data between state source systems and users
- Serve as the repository for a state-selected subset of interstate carrier and vehicle safety and credential data
- Serve as the repository for a state-selected subset of intrastate carrier and vehicle safety and credential data
- Provide inter- and intrastate carrier and vehicle safety and credential data to the roadside to support electronic screening and other roadside operations.

The JHU/APL-generated version of the CVIEW software is available to states at no cost.

Roadside Operations Computer (ROC) software provides an operator interface for inspection station personnel and performs the following functions:

- Process snapshots and control site traffic.
- Interface to CVIEW – get snapshot data
- Support legacy operator interfaces [Static Scale, Commercial Driver's License Information System (CDLIS), National Law Enforcement Telecommunications System (NLETS), Traffic Flow]
- Control "pull around back" messages and signal lights
- Interface to the Screening Computer (send criteria, get screening results, get sensor data, send snapshot summaries)
- Interface to report activities from other roadside systems to infrastructure, and vice versa
- On request, retrieve report data and display
- Process snapshot data into local database
- Track position of each vehicle moving through the station
- Allow operators to set/view screening criteria
- Display sensor data to operator

- Display snapshot data to operator
- Display vehicle position data to operator (e.g., mainline, ramp, scale lane, inspection area)

The JHU/APL-generated version of ROC software developed for Maryland and Virginia is available to states at no cost.

Screening Computer software receives screening criteria from the ROC and collects inputs from all roadside sensors. An algorithm implemented in the Screening Computer is used to make the screening decision based on sensor inputs and the screening criteria. The specific functions of the Screening Computer are as follows:

- Make pass/pull-in decision
- Interface to sensor/driver communications system
- Interface to Roadside Operations system (get snapshot summaries, send sensor data, send screening results)
- Sort vehicles on mainline or ramp, using: sensor data, snapshot data, availability of inspector, operator configuration selections
- Output screening results to tag via DSRC (includes driver notification)
- Control screening messages and signal lights
- Configure screening based on operator control (via Roadside Operations system) data

Screening Computer software for Maryland is being developed by JHU/APL and will be made available to states at no cost.

Model Mainline Automated Clearance System (MACS) performs electronic screening based on snapshot data received from SAFER/CVIEW. The functions provided by MACS are equivalent to the combination of the ROC and Screening Computer. The MACS software is available from the Kentucky Transportation Center at no cost to states.

3.3 Data

Safety and Fitness Electronic Records (SAFER) is a CVISN Core Infrastructure system, which collects and distributes snapshots. Snapshots contain safety and credentials information to support safety assurance, credentials administration, and electronic screening activities.

In electronic screening, snapshots are exchanged between SAFER and CVIEW; and also sent to the roadside systems using the American National Standards Institute (ANSI) Accredited Standards Committee (ASC) X12 EDI transaction sets (TS). TS 285 is used for exchange of snapshots and snapshot segments. Figure 3-1 summarizes the snapshot data stored in SAFER/CVIEW.

Data → ↓Snapshot	Identifier/Census Data	Safety Information	Credential Information
Carrier	[1]Primary Carrier ID; Other IDs (e.g., Taxpayer ID, DUNS, IRP account, etc.); Names; Addresses; Type; Operations Characterization	Safety Ratings; Accident, Inspection & Violation Summaries; Safety Review History; [1] Last OOS; PRISM Data	Carrier Registration; Fuel Tax Data Insurance Data; HazMat Registration; [1]Permit Data; Electronic Screening Enrollment; Carrier Check Flags (e.g., IRP & IFTA flags)
Vehicle	[1]VIN; [1]Vehicle Plate ID Other IDs (e.g., Plate, IRP Account, CVIS Default Carrier, Transponder, Title Number); Vehicle Description	Last Inspection Overview; Inspection & Violation Summaries; [1]Last OOS; CVSA Decal Data; PRISM Data	Apportionment (i.e. Cab Card Data); [1]Permit Data; Electronic Screening Enrollment; Vehicle Check Flags: (e.g., Registration Check Flag)
Driver (Future)	[1]Driver Unique ID; [1]Home State; Names; Address; DOB, Sex; Citizenship	Last Inspection Overview; Accident Summary; Inspection & Violation Summaries; [1]Last OOS	Driver Check Flags (e.g., DMV Check Flag)

Figure 3–1. Snapshot Data Stored in SAFER/CVIEW

3.4 Standards

3.4.1 DSRC Standards

The following subsections briefly describe the status of the current DSRC standards and specifications applicable to electronic screening. The current recommended policy from United States Department of Transportation (USDOT) (Reference 2), regarding DSRC for electronic screening, is as follows:

1. For the immediate future, all Commercial Vehicle Operations (CVO) and Border Crossing projects will continue to utilize the current DSRC configuration employed by the programs. This is the American Society for Testing and Materials (ASTM) E17.51 version 6 (v6) active tag.
2. Beginning January 1, 2001, all CVO and Border Crossing projects will use an active configuration that is backward compatible with the current configuration and yet consists of the following:
   A. "ASTM version 6" defines the data link layer.
   B. The Institute of Electrical and Electronics Engineers (IEEE) 1455-1999 application layer standard and the ASTM Provisional Standard (PS) 111-98, Layer 1 active physical layer standard will be implemented.

3.4.1.1 ASTM E17.51 Version 6

Although never approved as a formal standard, ASTM E17.51 v6 (Reference 3) defines the DSRC equipment currently used in all US electronic screening projects. USDOT has stated that for the immediate future, all CVO and International Border Crossing (IBC) deployments should continue to use DSRC equipment complying with ASTM E17.51 v6. Raytheon (formerly Hughes Aircraft) and Mark IV Industries are the two hardware vendors for these products.

3.4.1.2 ASTM PS 111-98

In 1996, ASTM and IEEE, with support from USDOT, began development of a new set of formal DSRC standards for North America. ASTM completed development of the E17.51 version 7 (v7) draft standards for Layer 1, Physical layer, and Layer 2, Data Link layer, in late 1998.

The Physical layer, Layer 1, defines the RF characteristics of the communications link. The ASTM E17.51 v7 Layer 1 document was approved as provisional standard PS 111-98 (Reference 4).

The Data-Link layer, Layer 2, defines the protocol for transmission and reception of information over the radio link. The Layer 2 document was not accepted by ballot, and no further activity is planned for this Version 7 of the standard. The DSRC vendors have also stated that there are no plans to develop products based on ASTM E17.51 v7 Layer 2.

3.4.1.3 IEEE 1455

The IEEE 1455 standard defines the data message formats and how DSRC applications, such as electronic screening and Electronic Toll Collection (ETC), interface with the readers and transponders. This standard has been designed to accommodate multiple DSRC applications with a single transponder. The IEEE P1455 document was approved as a standard in 1999 (Reference 5).

3.4.1.4 Sandwich Specification

DSRC hardware vendors are unwilling to expend the necessary research and development funds to build new products based on ASTM PS 111-98 Layer 1, ASTM E17.51 v7 Layer 2, and IEEE 1455. The primary issue is that the potential market for the new products does not justify the additional development risk and expense, particularly to implement a new data link layer.

USDOT has proposed that the current vendors for DSRC equipment used in CVO, Mark IV and Raytheon, attempt to specify a product configuration, based on existing technology, which implements features of the new standards. This active “sandwich” protocol would consist of the existing data link layer, ASTM E17.51 v6 Layer 2, along with the new ASTM 111-98 Layer 1 and IEEE 1455 standards. JHU/APL is currently working with Mark IV and Raytheon to define this sandwich specification.

3.4.2 EDI Standards

Use of ANSI ASC X12 EDI transaction sets is part of the CVISN architecture. The following transaction sets are used in electronic screening:

- TS 285 CV Safety & Credentials Information Exchange (snapshots)
- TS 824 Application Advice
- TS 997 Functional Acknowledgement

TS 285 is used to request and transmit snapshot data. Specifically, TS 285 is used to transmit carrier and vehicle snapshots or snapshot segment updates between SAFER and the state credential system. TS 824 is used report the results of processing a 285 transaction. TS 997 is used to functionally acknowledge that a transaction is received, and to report syntax problems. See Reference 6, 7, and 8 for more information about the ANSI ASC X12 EDI standards.

4 OPERATIONAL CONCEPTS AND SCENARIOS

The term "operational concept" generally means "how a system is used in various operational scenarios". "System" is used here in a broad sense to include people and manual processes as well as automated information, sensors, and control systems. New operational concepts are adopted in order to solve a problem in the current operations or to take advantage of new knowledge or technology that enables improvements in current operations.

The operational concepts in this section are related to the guiding principles developed by the stakeholder community. The concepts were derived by first analyzing the user services that discuss how to improve commercial vehicle operations, then interpreting the stakeholder-developed guiding principles, and finally applying knowledge about the state of existing and emerging technologies. The combination of the desired commercial vehicle operations improvements, guiding principles about making those improvements, and the reality of technological advances are reflected in the operational concepts.

CVISN electronic screening operational concepts include necessary steps toward achieving the goal of national interoperability among electronic screening systems. Realizing this goal will promote seamless and safer movements, equitable treatment, increased productivity, and uniform enforcement for the motor carrier community.

4.1 Key Operational Concepts

The CVISN Operational and Architectural Compatibility Handbook (COACH) Part 1, Operational Concept and Top-Level Design Checklists (Reference 9), includes a comprehensive checklist of key operational concepts relating to Electronic Screening. The operational concepts should be used to guide the state design process. The electronic screening operational concepts stated in the COACH Part 1 are:

<u>Widespread participation in electronic screening programs is encouraged.</u> A basic Intelligent Transportation Systems (ITS)/CVO Guiding Principle is voluntary participation. If motor carriers do not choose to equip their vehicles with DSRC transponders, then electronic screening can not occur. States must actively market their electronic screening programs to increase the population of transponder-equipped vehicles. To the extent possible, enrollment restrictions should be minimized in order to maximize the eligible population of vehicles.

<u>Jurisdictions disclose practices related to electronic screening.</u> The *ITS/CVO Interoperability Guiding Principles* (Reference 10) and the *Fair Information Principles for ITS/CVO* (Reference 11), both adopted by the Intelligent Transportation Society of America (ITSA) CVO Technical Committee, advise jurisdictions to fully disclose electronic screening practices and policies. The disclosure should include the following information:

- Enrollment criteria
- Transponder unique identifier standards
- Price and payment procedures for transponders and services
- Screening standards

- Use of screening event data
- Business interoperability agreements with other programs

Electronic screening is provided for vehicles equipped with FMCSA-specified DSRC transponders. For the immediate future, all CVO and Border Crossing projects will continue to utilize ASTM v6 active transponders and readers. In the long term, systems should migrate to equipment conforming to the sandwich specification (see Section 3.4.1).

Credentials and safety checks are conducted as part of the screening process. Credential and safety data from SAFER/CVIEW carrier and vehicle snapshots should be used in the screening algorithm.

Fixed and/or mobile roadside check stations are employed for electronic clearance functions, according to the jurisdiction's needs and resources. Deployment of electronic screening in each jurisdiction is unique because of variations in policies and practices, geography, traffic flow and volume, site configuration and characteristics, legacy system characteristics, existing roadside and communications equipment, and available resources.

Jurisdictions support a common set of screening criteria. A common performance standard for electronic screening is desired to ensure equity in enforcement. However, carriers and vehicles must continue to meet all legal requirements established by the jurisdiction.

Screening systems are interoperable with those in different jurisdictions. National interoperability of electronic screening systems is the goal of USDOT and provides maximum benefit to both the states and the motor carrier industry.

4.2 Electronic Screening Functions

4.2.1 Electronic Screening Enrollment

Prior to participation in e-screening programs, the carrier, vehicle and transponder information must be provided through an enrollment process. By restricting each transponder to installation on a specific vehicle, a direct relationship is established between the transponder ID and the vehicle identification number (VIN). Vehicle snapshots contain a transponder ID field to record this information. SAFER restricts access of the transponder ID fields to only those states requested by the motor carrier. To support this capability, elements have been added to the carrier and vehicle snapshots, designating the jurisdictions that are granted access to the transponder ID field. This request/permission information is submitted along with the vehicle VINs and corresponding transponder IDs during the E-screening enrollment process.

When applying to an electronic screening program, the motor carrier may also request participation in other screening programs or states. The jurisdiction request elements and transponder IDs in the snapshots are updated, during the enrollment process, and sent to SAFER. The requests are then forwarded to the external jurisdictions via the SAFER subscription process.

As transponder-equipped vehicles approach the roadside station, the transponder IDs are read using DSRC. The E-screening system uses the transponder ID to uniquely identify the corresponding vehicle (VIN). The VIN relates to a vehicle snapshot, which contains the default carrier ID. Safety and credential checks can then be made using the appropriate carrier and vehicle snapshots.

4.2.2 Electronic Screening Algorithm

There are four major components to the recommended electronic screening algorithm:

1. Weight and size screening
2. Safety screening on the carrier and vehicle safety history derived from snapshots
3. Credentials screening, based on specific credential violations or history information contained in snapshots
4. A random selection factor to randomly pull in a selected percentage of vehicles

Selection for pull-in should be made even if only one component denies bypass, regardless of the other conditions.

4.2.2.1 Weight and Size Screening

The purpose of weight and size screening is to ensure compliance with these regulations. Three basic methods are discussed here: sensor data, prior event data or compliance history.

4.2.2.1.1 Weight and Size Screening with Sensors

Weight screening may be based on the weight estimates from the WIM sensors mounted either on the ramp or mainline. There are several elements to this method of weight and size screening:

- A weight pass/fail threshold set to some percent of the legal or registered weight
- A check of vehicle speed, position, or other factors that may void the WIM reading
- Overall vehicle size based on AVC
- An over height detector

These sensor inputs are used as a real-time estimate of vehicle compliance.

4.2.2.1.2 Weight Screening Using Prior Event Data

The results of a prior screening event stored on the DSRC tag, or forwarded from an upstream station, may be used to grant a bypass at the current station. This method assumes that a vehicle has previously been weighed at a station equipped with either WIM or static scale. The date and time of the previous event are checked to ensure that the data are current.

4.2.2.1.3 Weight Screening Based on Compliance History

Compliance history can be used as an effective and economical method of enforcement in lieu of constantly weighing vehicles. Historical data may be used to rate carriers and vehicles on their demonstrated compliance with size and weight restrictions. These ratings could form the basis for a pull-in probability, rewarding operators who have maintained a good weight compliance record with more frequent bypasses than those that have performed poorly. Weight compliance information is being considered for inclusion in the snapshots.

4.2.2.2 Safety Screening

Safety screening should be based on SafeStat carrier safety ratings and inspection history data derived from SAFER/CVIEW snapshots. The goals of safety screening are:

- To focus resources on those carriers and vehicles with poor safety histories
- To provide a benefit to those carriers that have good safety histories
- To provide incentive for carriers to maintain safe vehicles and safe driving practices

To meet the goals defined above, the selection process should be weighted to pull in mostly unsatisfactory or unidentified vehicles, while stopping only a small portion of the transponder-equipped DSRC vehicles not otherwise flagged by the screening algorithm. The continued occasional sampling of all vehicles will provide the incentive to maintain a good safety rating.

4.2.2.3 Credential Screening

Credential screening looks for vehicles that have very specific inspection or review needs. The following snapshot data elements should be included in the credential check:

- Missing or invalid credentials
- International Fuel Tax Agreement (IFTA) check status for carrier
- International Registration Plan (IRP) or trip permit status for vehicle
- Manual selection for specific carrier or vehicle

The elements incorporated into a specific credential screening algorithm should be tailored to the requirements, enforcement authority, and objectives of the particular jurisdiction.

4.2.2.4 Random Selection Component

The random selection component can serve several purposes, including random viewing for visual inspection selection, expanded data collection and compliance monitoring. Even the best-rated operators should be occasionally examined to verify their continued compliance. Jurisdictions with "probable cause" legislation in effect should check the legality of using a random selection component. It may be necessary to eliminate the random element to comply with the law.

It may be valuable to allow the site operator to have control over the overall screening rates and the resulting traffic flow through the station. A "control valve" factor can be applied, referred to as the "maximum random sort rate." This factor can be applied to adjust the pull-in rate for all vehicles by an equal amount. The actual pull-in rate for any individual vehicle would be the product of the screening pull-in rate and the maximum random sort rate. If there is any clear reason for pull-in (other than random), such as a weight or credential violation, that would take precedence.

4.2.3 Mainline Screening

Mainline screening allows vehicles to be cleared without pulling into the station. DSRC readers and sensors are located far enough ahead of the station ramp so that the screening system has time to complete all necessary processing as the vehicle approaches. A signal is transmitted to the DSRC transponder in the vehicle to signal the screening decision to the driver.

The advantages of screening on the mainline are to reduce traffic volume entering the station facility and to minimize the delay for safe and legal vehicles. A disadvantage is that in-road equipment repairs on the mainline can be very costly and disruptive. If mainline WIM is used, it will not be as accurate as either a static scale or ramp WIM, although the weight estimates should be sufficient to clear a significant portion of the vehicle traffic.

4.2.4 Ramp Screening

Ramp screening is performed at lower speeds within the confines of the station and approach ramp. Upon entering the approach ramp, vehicles are identified and screened. Bypassed vehicles will be directed to proceed back to the mainline after only a brief delay. The remainder will be required to proceed to the static scales.

4.2.5 In Cab Notification (ICN)

Vehicles equipped with a DSRC tag can receive visual and audio signals informing the driver of the screening decision. This is done by a DSRC command sent, by the reader to the vehicle tag, to set the audio and visual indicators on the tag. The driver should bypass only on receipt of green signal and tone. If a red signal is received, then the driver must pull in unless roadside signs specifically show the station is closed. If no signal is received, the driver should obey the station roadside signs. These guidelines should handle situations where the station is otherwise closed, the DSRC operations are secured, the tag fails to receive the message, or the equipment malfunctions. ICN is typically used in mainline screening systems.

4.2.6 Lane Signals

Within the station perimeter, off the mainline road, all vehicles should see automated lane signals such as those indicating whether to proceed to the static scale, or whether to return to mainline. All vehicles are expected to follow the lane signals. ICN should not be used within the station where conflicts may arise between the ICN and the lane signals.

4.2.7 Compliance Checking

Prior to the addition of mainline screening, station operators could easily detect individual vehicles that bypass the station in violation of the signs. However, when mainline screening and ICN are used, it is not obvious to the station personnel when a particular vehicle has been cleared to bypass. AVC equipment is used to cover all mainline lanes and detect any commercial vehicles that bypass the station. A DSRC reader, collocated with the AVC, should interrogate the transponders on vehicles which bypass the station, to verify that they are in compliance with the ICN signal. The compliance system should be positioned past the station entrance but before the return for traffic processed through the station.

4.3 Operational Scenario

The e-screening system being deployed at Perryville, Maryland is described in this section along with the associated operational scenario. This site is unique because it will include both mainline and ramp screening systems. Due to cost, most electronic screening systems are either mainline-only or ramp-only. Maryland has elected this dual-capability configuration in order to compare the relative performance of the two methods.

The listed scenario describes the combined operation of the two subsystems and function of the various components. The operational scenario for a ramp-only or mainline system can easily be derived from the information presented.

4.3.1 Site Layout

Figure 4-1 illustrates the site layout for the E-screening system being deployed at Perryville, MD. All major roadside equipment components are shown in the figure. The key features of this layout are:

- Mainline Piezo WIM/AVC in the right-hand southbound lane on I-95, approximately 1 mile upstream of the station
- Over-height detector collocated with Mainline WIM
- DSRC reader (Advance) collocated with Mainline WIM
- DSRC reader (Notification) located approximately ¼ mile upstream of the ramp approach. The location of the Notification Reader must allow sufficient time for the vehicle operator to receive the bypass/pull-in signal via DSRC and safely maneuver back onto I-95 or pull-in to the static scale
- AVCs across all three South-bound lanes of I-95, downstream of the station ramp.
- DSRC reader (Compliance) collocated with AVCs. The compliance readers shall cover only the right-hand lanes on I-95. Trucks will be restricted to these lanes when bypassing the station
- Load-cell WIM in ramp lane
- DSRC reader (Ramp) on ramp, upstream of WIM
- Over-height detector installed near Ramp Reader
- Overhead signs directing traffic back to I-95 or onto the static scale
- DSRC reader (Static Scale) collocated with the station static scale
- Tracking loops installed as necessary

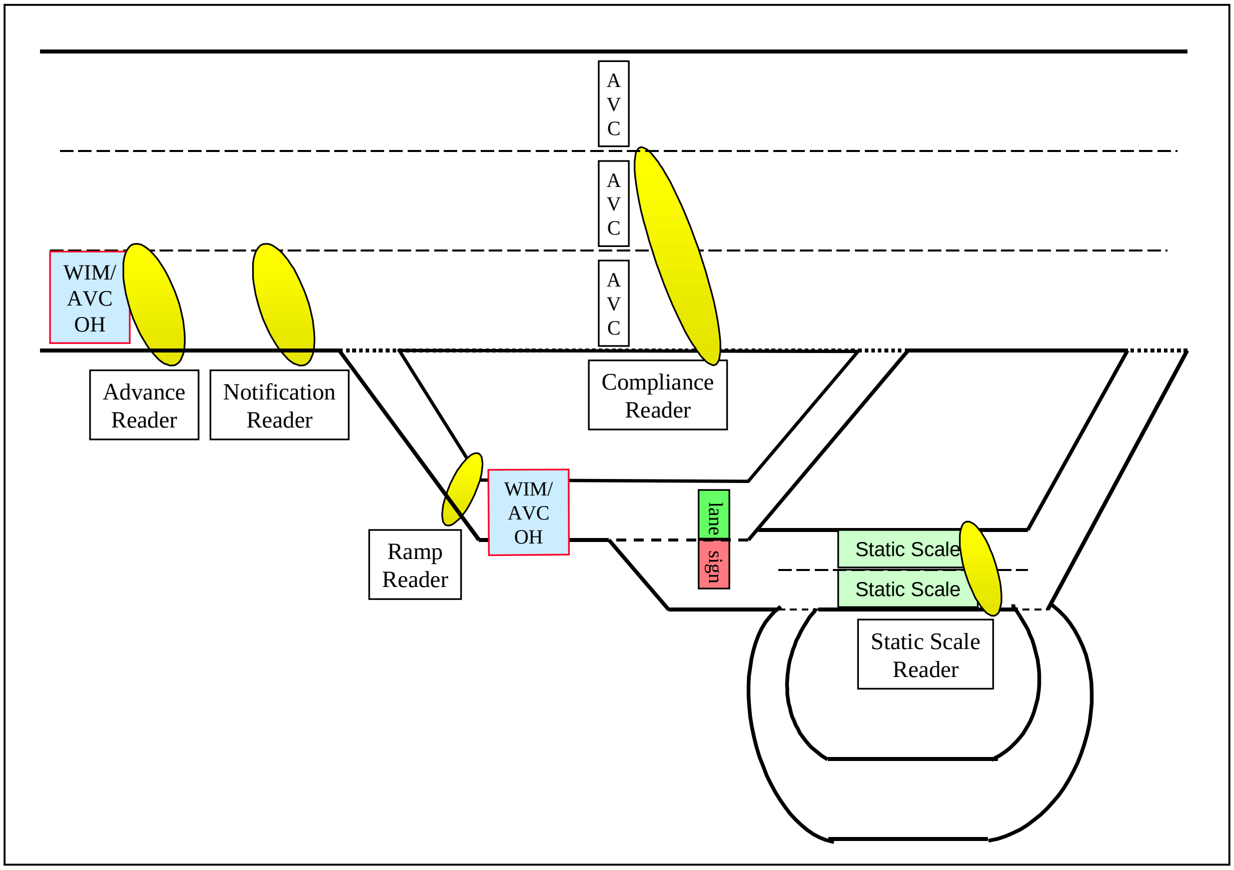

Figure 4–1. Perryville, Maryland Site Layout

4.3.2 E-Screening Operational Scenario

In the site layout shown in Figure 4-1, there are five DSRC readers along with both ramp and mainline WIM. The five DSRC readers shown in this configuration are: Advance Reader, Notification Reader, Compliance Reader, Ramp Reader and Static-Scale Reader.

The Advance Reader's function is to read the screening message, including the carrier and vehicle identifiers, and to send this information to the screening computer for use in determining whether to clear the vehicle without pulling into the station. The reader is located far enough ahead of the Notification Reader so that the mainline screening subsystem has time to complete all necessary processing as the vehicle approaches. The advantages of screening on the mainline are to control traffic volume entering the station facility and to minimize the delay for safe and legal vehicles.

The mainline WIM/AVC provide vehicle weight estimates as input to the mainline screening decision. Gross vehicle weight along with axle weights and spacing are available. Although not as accurate as either a static scale or ramp WIM, the weight estimates are sufficient to clear a significant portion of the vehicle traffic.

At the Notification Reader, a signal is transmitted to the vehicle to convey the screening decision status to the driver. Since a DSRC-equipped vehicle could be signaled to pull in, the Notification Reader must be deployed far enough from the roadside check facility for the vehicle's driver to be able to react without endangering other vehicles on the roadway. Reaction time budgets should account for slowing and turning off the mainline, as well as crossing lanes of traffic.

By the time the vehicle has passed the Advance and Notification Readers, it has been electronically cleared. However, it is also necessary to verify that vehicles are not illegally bypassing a check station. Therefore, a Compliance Reader and an AVC system are located on the mainline, past the entrance ramp to the station. The AVC identifies un-tagged commercial vehicles that have illegally passed the station. The reader checks tagged vehicles to verify that the vehicle was cleared to bypass the station. If a violation is detected, an indication is given to enforcement personnel.

Vehicles entering the check facility ramp would fall into one of the following categories:

- DSRC-equipped, valid legal weight – the vehicle has been identified via DSRC, a valid weight has been recorded and an active screening decision has been made to stop the vehicle for some type of closer review. This may be based on specifically identified problems, or may be due to random selection. Closer review may be limited to a visual check while on the static scale, or may include an inspection based on the visual review, on data reported back in the screening process, or on random selection.
- DSRC-equipped, invalid or over weight – the vehicle has been identified via DSRC, however, either the WIM failed to properly register the weight or the detected weight exceeded the criteria.
- DSRC-equipped, unrecognized – the vehicle is equipped with a transponder, however, the tag may either be incompatible with or not valid for use at the site.
- No DSRC.

Upon entering the facility ramp, vehicles will be processed by the ramp WIM. The DSRC Ramp Reader would interrogate the vehicle tag to retrieve the relevant identification data. A screening decision would be made and the vehicle would be subsequently directed by visual lane signals. Cleared vehicles would be signaled to return to the mainline. Vehicles receiving a pull-in decision on the ramp would be directed to the static scale. The Static-Scale Reader is used to identify transponder-equipped vehicles that are on the scale. Snapshot-based safety and credential data for the vehicle would be available to the static scale operator.

4.4 Functional Thread Diagram

A state must develop or otherwise acquire new systems and modify some existing systems to implement the CVISN Level 1 capabilities. There are many ways to do this and still be in conformance with the architecture and standards. Chapter 6 illustrates several approaches to electronic screening that are consistent with the architecture.

Regardless of the design approach chosen, all states need to model their intended business processes in a way that is easy for all stakeholders to review and understand. The functional thread diagram is the tool recommended to illustrate operational scenarios.

This section depicts an example functional thread diagram. The scenario chosen is one of the CVISN Level 1 capabilities. The high-level CVISN Level 1 operational scenarios related to electronic screening are listed below:

- Query for a snapshot
- Screen vehicles electronically at least one weigh station/inspection site, using snapshots

The example illustrates the basic function of electronically screening a vehicle. The method used to demonstrate the scenario is called a “functional thread diagram.” The activities in the scenario are listed as steps. To differentiate between different time schedules, numbers are used to show the steps which occur in real time as a vehicle passes through the station. Letters are used to show the transfer of the screening data down to the roadside station, since that occurs in advance of the screening events.

A diagram corresponding to the steps listed is presented in Figure 4-2 for a graphical view of the scenario. The lines represent data flow between products, with arrows indicating the direction of flow. Each line is labeled with a number or letter. The complete set of lines constitutes a thread of activities that accomplish a function. Hence, the diagram is called a “functional thread diagram.”

Additional examples of operational scenarios and functional thread diagrams are in Appendix B. They are included for reference, and as starting points for states that plan to implement similar processes.

4.4.1 Example Scenario: Screen Vehicles Electronically Using Snapshots

The following steps (A–C) occur on a periodic basis to establish screening values for the site:

A. SAFER sends subscription updates to the state CVIEW for carrier and vehicle snapshots, based on state-specified subscriptions. These snapshots are sent as TS 285 transactions.

B. CVIEW distributes carrier and vehicle snapshots to roadside sites, also based on specified subscriptions. These are also sent as TS 285 transactions.

C. Enrolled vehicles are identified from the snapshots. Site operators may interact with Roadside Operations to control local screening criteria, which will be based on the snapshot information. The resulting carrier and vehicle specific screening "scores" or values are sent to the screening system. This is a local interface that is not subject to standards.

The following steps (1–4) are steps that occur in real time for each vehicle:

1. Transponder ID (or carrier and vehicle specific identifiers) is transmitted from the DSRC transponder on board the Commercial Vehicle to the Sensor/Driver Communications interface using an ASTM version 6 reader.
2. If carrier and vehicle identifiers are used, the identifiers are extracted from the DSRC message in accordance with the IEEE P1455 message set for use in the Screening system. A screening decision is made based on snapshot data and sensor inputs.
3. The screening decision is communicated back to the driver, again using the ASTM version 6 standards and the IEEE P1455 message set.
4. Screening information is communicated back to Roadside Operations for use by site staff. This is a local interface that is not subject to standards.

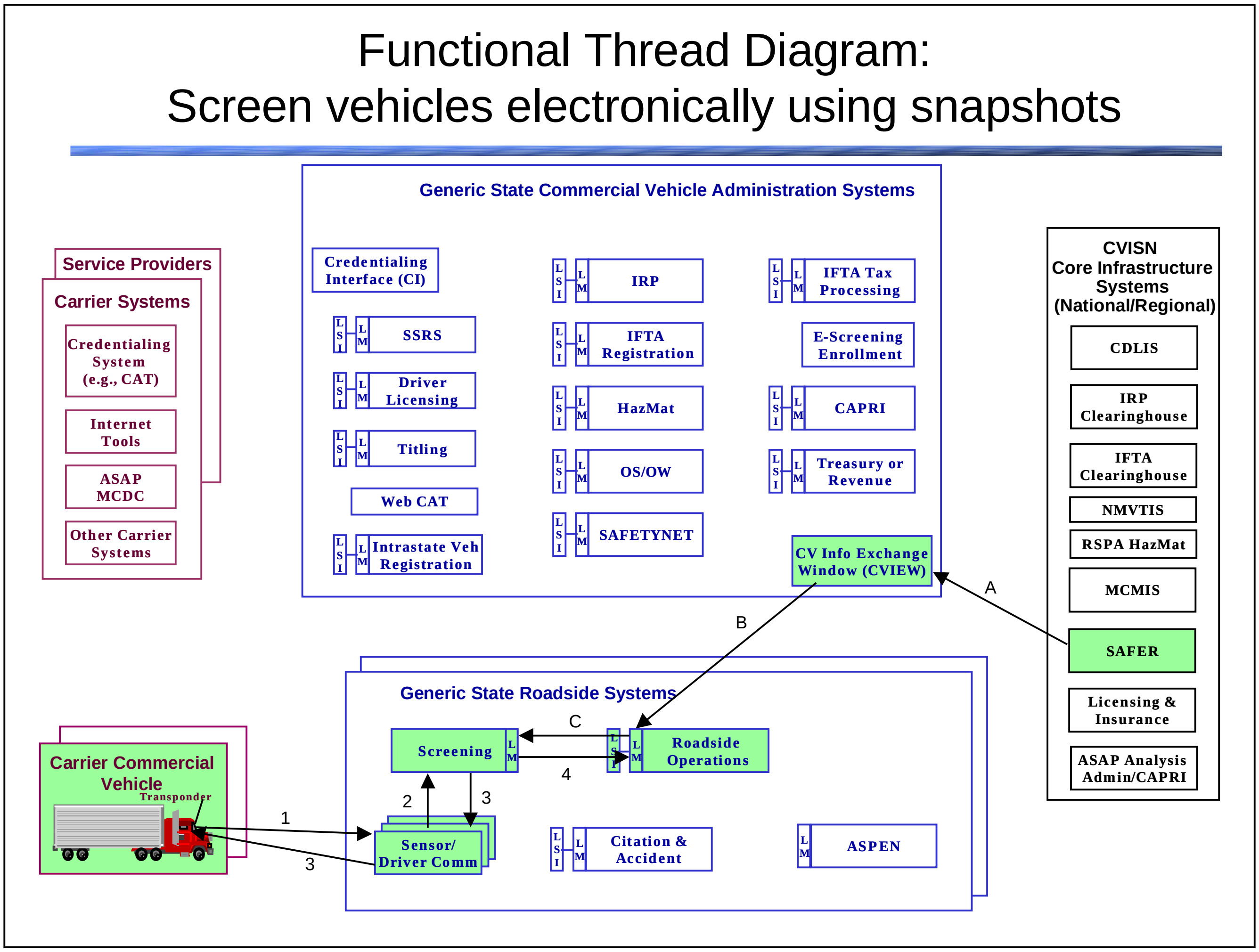

Figure 4–2. Screen Vehicles Electronically Using Snapshots

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5 CRITICAL DECISIONS

In this chapter, some of the decisions that are critical to successful implementation of CVISN Level 1 electronic screening functions are identified. The chapter is intended to serve as a checklist to remind states about some of the major planning and design issues they should settle as early in the process as possible. Other decisions may be just as critical for a given state; this list reflects the critical electronic screening-related decisions commonly faced by states implementing CVISN Level 1.

When making these decisions, it is important to consider the motor carrier's interests, along with the state perspective. Participation by the carrier community is essential to achieve long-term success. Carrier outreach should begin at the early stages of development in order to build support for the program.

5.1 Design Decisions

The decisions listed below are categorized as "design" because they have a significant impact on the design approach. They all impact planning as well.

Do you already belong to, or will you join, an existing screening program? Joining an existing E-screening program has the benefit of immediate access to an existing population of transponders and operational sites. Jurisdictions may also choose to remain independent and seek interoperability agreements with existing programs. Two multi-state E-Screening programs are HELP PrePass™ and NorPass. Information about these two programs may be found in Chapter 3.

Will screening be performed at fixed sites? Mobile sites? Or both? Electronic screening implemented at fixed sites improves station traffic flow and focuses inspections. Other factors, such as access to alternate routes, may make mobile sites a more effective enforcement tool. Each jurisdiction should examine its situation and objectives to reach the best solution.

Which site will you upgrade first to handle electronic screening? Each roadside station design is unique because of state policies and practices, traffic flow and volume, site configuration and characteristics, legacy system characteristics, existing roadside and communications equipment, and available resources. The initial deployment site should be chosen early in the process, so that specific design decisions can be made.

At what other sites will electronic screening be deployed? A long-term deployment strategy for electronic screening should be developed. Design decisions should not be short-sighted and should consider the overall program objectives and goals.

Will you deploy WIM on the mainline? On the ramp? Both? Neither? The pros and cons of the various WIM configurations are listed below:

- Mainline — *Pro*: Vehicles receiving bypasses encounter minimal delay; improved station traffic flow. *Con*: Reduced WIM accuracy; requires lane closure for installation and maintenance; bypassed vehicles are not visually checked.
- Ramp — *Pro*: More accurate weight; does not require mainline lane closure. *Con*: Every vehicle enters the station.
- Both — *Pro*: Maximum station throughput; investigate both options in first site. *Con*: High cost.
- Neither (Weight history) — *Pro*: Minimal equipment costs. *Con*: Every vehicle is not weighed.

Will you screen using both carrier and vehicle data? SAFER carrier and vehicle snapshots allow screening factors applied to both carrier and vehicle data. Some systems have chosen to screen on only carrier information, in order to reduce complexity and quantity of data. See Figure 3-1 for a list of data available in the vehicle snapshot.

What screening factors will you use? The three basic categories of screening factors are size and weight, safety and credentials. Size and weight compliance may be measured with sensors or based on historical performance. The safety category is composed of safety ratings, such as SafeStat and Inspection Selection System 2 (ISS-2), and Out-of-Service (OOS) information. Credentials include registration, taxes, insurance and permits. Jurisdiction-specific policies and laws may require additional screening factors.

Will you have an open enrollment policy? Enrollment policies are either open or restricted. The differences between the two types are highlighted below:

- Under an open enrollment policy, any carrier legally operating in a jurisdiction may participate in electronic screening, and therefore receive transponders. Bypass privileges are granted at the roadside based on screening criteria.
- For jurisdictions with restricted enrollment policies, additional scrutiny is performed prior to acceptance in the electronic screening program. Enrollment checks may include registration, fuel and highway use taxes, insurance and safety history. In this scheme, bypass privileges are restricted to those carriers who meet a higher set of standards imposed by the program. Periodic checks are required to verify compliance with the enrollment criteria is maintained.

Will the safety and credential checks be made at the roadside or at a central site?

- Safety and credential checks, based on carrier and vehicle snapshots, may be performed at a central pre-processing site. Lists of these “pre-clearance” decisions are passed to the roadside on a periodic basis. Real-time processing of the screening events consists of a table look-up, in addition to weight and size checks. This configuration simplifies the design of the roadside system.
- If snapshot data are available at the roadside, then the safety and credential checks may be performed on site. Snapshot data may already be present to support inspection activities. This design allows the station operator to modify the screening criteria.

How will you carry out the electronic screening enrollment function? States may choose to implement applications to support electronic screening enrollment, or subcontract the task to a third-party administrator. The HELP PrePass™ and NorPass programs also handle enrollment administration for their member states.

How will you share enrollment information with other programs? The CVISN architecture provides for sharing enrollment request and acceptance information via snapshots.

5.2 Planning Decisions

The decisions listed in this category usually do not impact design as much as they impact the preparation of task lists, assignments, schedules, and budget considerations.

What state agency will be the lead during development of electronic screening? Multiple state agencies have jurisdiction over various aspects of deploying and operating electronic screening. A lead agency should be identified to take responsibility for the project and to coordinate with the other state agencies.

What strategy will you use to build a sufficient population base of transponders? Marketing electronic screening to motor carriers is difficult if only a few inspection stations are equipped and operational. Interoperability agreements, joining an established screening program or linking to electronic toll collection programs are ways to quickly build the transponder population and increase benefits to motor carriers.

What new equipment do you need to support electronic screening? Or, conversely, what equipment can be reused in the electronic screening system? Use of existing equipment, such as WIMs, computers, variable message signs, signals, tracking loops, mounting structures and poles, cabling and conduit, can significantly reduce costs.

Who is the system integrator? A decision closely related to the build-vs.-buy decision is who will provide the system integration function. System integration refers to the process of integrating each subsystem into the whole, testing the interfaces, testing the functionality, testing the overall flow, and testing for interoperability, performance and reliability. Some alternatives are:

- The state builds everything in-house and does the system integration with in-house staff.
- The state buys some products, builds some in-house, and integrates them with in-house staff.
- The state hires a system integrator to integrate all the purchased and in-house systems.
- The state contracts with a system integrator to serve as prime contractor and deliver a complete working system.

Should the state have an independent verification and validation (V&V) agent? Some states have policies that encourage them to hire an independent verification and validation agent to provide independent technical assessment and guidance as the project proceeds. It can be helpful if the agent has experience from other similar projects. The agent may serve as an acceptance test conductor or witness to ensure independence in the test process.

Sole Source or Competitive Contracting? Sole source contracting is sometimes selected if the state believes that a particular vendor is uniquely qualified. In some cases, sole source contracts can be put in place more quickly than contracts established through a competitive bidding cycle. Sole source contracting may not be an option since most states require competition whenever possible.

Has the state planned to involve its carriers at each step in the planning process? Carrier involvement is crucial to project success. Knowing what improvements the carriers in the state are capable of and interested in making helps drive the state's decisions. It is worthwhile for both sides to set realistic expectations about the improvements that carriers and the state can make.

5.3 Funding and Contracting Phase Key Decisions

These are issues that must be faced during the funding and contracting phase of the project. They are not unique to electronic screening.

- How much funding is required to complete the project?
- Where will the funding be obtained?
- How will O & M costs be funded?
- What type of procurement should be used for each product or service?
- What can be done to expedite procurements?
- What type of incentives and remedial mechanisms should be included in the contracts?
- What software rights should be included in the contracts?

5.4 Development Phase Key Decisions

These are issues that must be faced during the development phase of the project. They are not unique to electronic screening.

- How should the initial design be modified based on the experience gained in each phase?
- How should the initial phase plan be modified based on progress actually made in each phase?

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6 REQUIREMENTS AND DESIGN GUIDANCE

According to the Transportation Equity Act for the 21st century (TEA-21), states using federal funds (Highway Trust Funds) must conform with the National Intelligent Transportation System (ITS) architecture and standards, which include the CVISN and International Border Clearance (IBC) architecture and standards. References 12 and 13 contain initial draft guidance from the United States Department of Transportation related to conformance. Rulemaking related to architecture conformance is expected in 1999. Broadly stated, for electronic screening, "conforming with the architecture" means:

- agreeing with the principles and following the guidance in the *CVISN Operational and Architectural Compatibility Handbook (COACH) Part 1* (Reference 9)
- using the DSRC standards; EDI standards and common identifiers as explained in the *CVISN Operational and Architectural Compatibility Handbook (COACH) Part 4* (Reference 14)
- conducting interoperability tests to demonstrate the criteria defined in the *CVISN Operational and Architectural Compatibility Handbook (COACH) Part 5* (Reference 15).

In TEA-21, Congress strongly supports the theme of interoperability. Section 5206(a)(2), "Interoperability and Efficiency", states that "to the maximum extent practicable, the national architecture shall promote interoperability among, and efficiency of, ITS technologies implemented throughout the U.S." The ITS America (ITSA) CVO Technical Committee, with representatives from most CVO stakeholder groups, has adopted a set of guiding principles (Reference 10) in recognition of the importance of promoting interoperability. The ITSA CVO Technical Committee has also adopted the Fair Information Principles for ITS CVO (Reference 11). These principles were developed in recognition of the importance of protecting individual privacy in implementing ITS for CVO.

The CVISN Level 1 requirements in the electronic screening capability area, as stated in Reference 9, are as follows:

- Implemented at a minimum of one fixed or mobile inspection site
- Ready to replicate at other sites

The *CVISN System Design Description* (Reference 16) includes the top-level requirements for electronic screening, and shows the generic CVISN state design approach. The *CVISN COACH Part 3* (Reference 17) takes the *CVISN COACH Part 1* state screening-related requirements and allocates them to components of the generic CVISN state design, providing a model for states to tailor.

6.1 Electronic Screening – Conforming with the Architecture

In this section, we illustrate various approaches to electronic screening which conform to the architecture. The approaches illustrated here represent several of the electronic screening options being pursued by CVISN prototype and pilot states. The examples do not exhaust the possibilities, but do represent a variety of choices that have been considered by early implementers.

To achieve interoperability, the CVISN architecture calls for the use of open standards for carrier-state and state-state (via the CVISN Core Infrastructure) interfaces. Use of DSRC and EDI X12 standards for these interfaces is required for architecture conformance. Interfaces that are wholly within a state government's control (e.g., between state agencies) are not required to use open standards. Most CVISN Model Deployment States have chosen to use open standards for some within-state interfaces, and have chosen to use existing custom interface agreements for others.

Figure 6-1 illustrates the various interfaces using a generic functional thread diagram for electronic screening. The following list summarizes the interface requirements related to electronic screening from the *CVISN COACH Part 4* (Reference 14).

- To conform with the architecture, ASTM E17.51, v6-compliant DSRC readers and transponders should be used for vehicle-to-roadside communications
- To conform with the architecture, EDI standard transactions (285, 824, 997) should be used to transfer snapshots between the state systems and SAFER

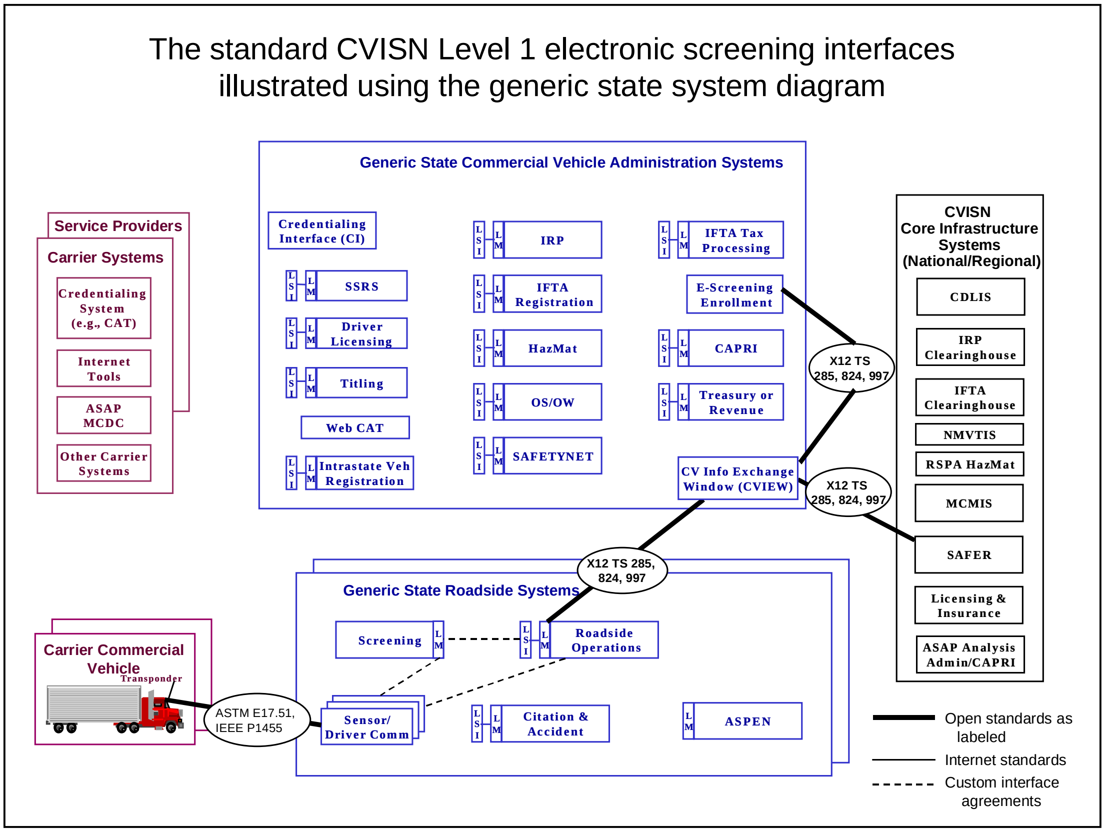

Figure 6–1. CVISN Level 1 Interfaces Related to Electronic Screening

Figure 6-2 illustrates the interface between the commercial vehicle and the roadside facilities using DSRC. DSRC is used to provide data communications between a moving vehicle and the roadside equipment to support the screening process. In electronic screening, DSRC may be used to:

- Transmit the factory-programmed transponder ID, which can be used to derive carrier and vehicle identifiers, to the roadside
- Transmit the carrier and vehicle identifiers to the roadside
- Store and transmit data from a prior screening event, to the roadside
- Signal the vehicle with the bypass/pull-in decision

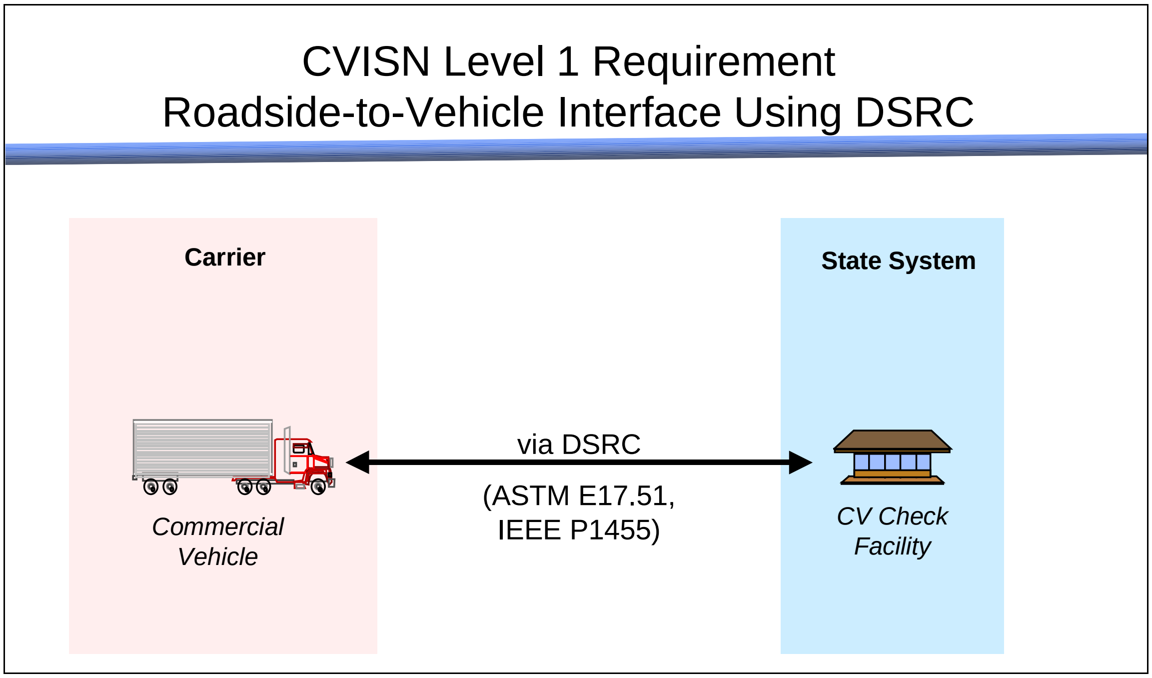

Figure 6–2. CVISN Level 1 Interface Requirement: DSRC

To conform with the architecture and current USDOT policy, ASTM E17.51, v6-compliant DSRC readers and transponders should be used for the immediate future. Raytheon (formerly Hughes Aircraft) and Mark IV Industries are currently the only hardware vendors manufacturing DSRC equipment using this protocol.

USDOT is in the process of defining a new policy for DSRC in CVO applications (see Section 3.4.1). According to the current draft policy, "Beginning January 1, 2001, all CVO and Border crossing projects will use an active sandwich configuration that is backward compatible with the current configuration…" JHU/APL is currently working with both Raytheon and Mark IV Industries to define the DSRC active sandwich specification. Equipment meeting this specification is designed to be backwards compatible with current ASTM v6 products, allowing a smooth migration to the new configuration.

Figure 6-3 illustrates the CVISN Level 1 requirement to transmit and receive carrier and vehicle snapshots, via EDI, between SAFER and the state credential system. As required to meet CVISN Level 1, these carrier and vehicle snapshots are used to perform safety and credential checks in support of the screening decision.

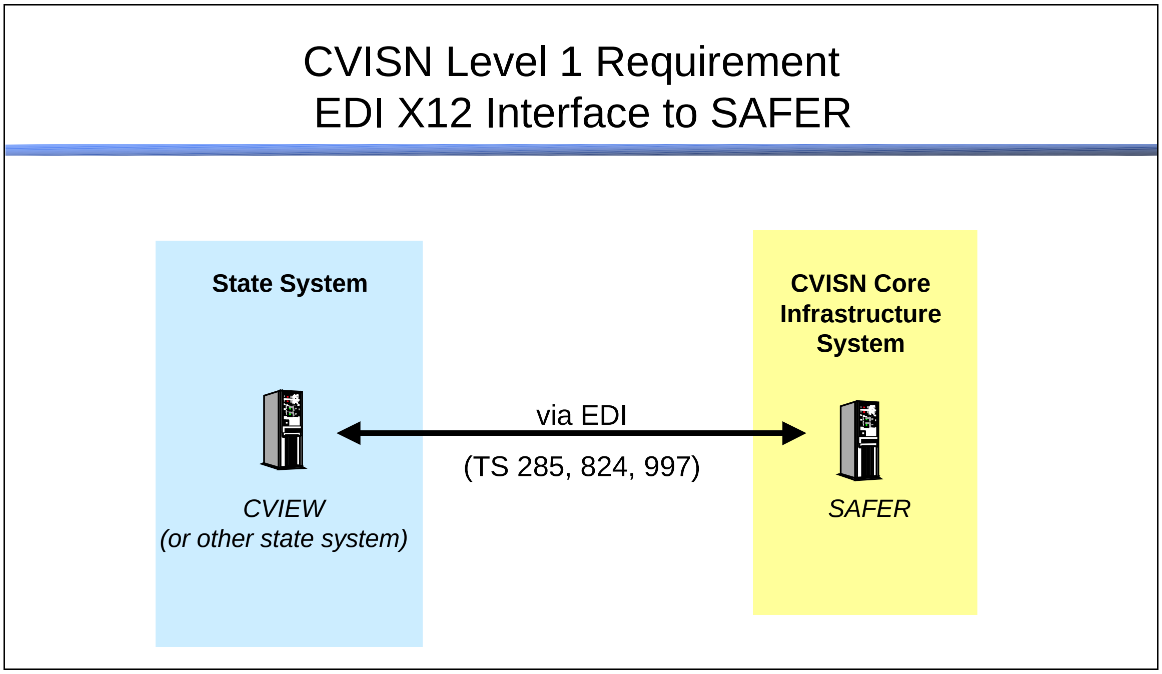

Figure 6-3. CVISN Level 1 Interface Requirement: EDI

The X12 EDI Transaction Set (TS) 285 is used to carry snapshot information. TS 824 is used to report the results of processing the TS 285 request. TS 997 acknowledges the receipt of EDI messages.

Complete snapshots or snapshot views may reside in a local database at the Roadside to support electronic screening or query functions. For these systems, the EDI X12 standard transactions (285, 824, 997) are used to transmit the snapshots from the state credential system to the Roadside, as shown in Figure 6-4. The electronic screening systems implemented in both MD and VA use this configuration, with a local database of snapshots residing in the ROC. Snapshots are downloaded from the state CVIEW to the ROC, using EDI transactions.

Also shown in Figure 6-4 is the option to transmit and store safety and credential data in a form, other than snapshots. In this design, derived data, such as a pre-clearance list, resides in the Roadside system. A non-standard, state-specific interface may be used to transfer the data. In KY, a NorPass state, an Enrolled Vehicle List is transmitted from the operations center to the roadside stations. HELP PrePass™ states also use a similar configuration, where stations typically receive a pre-clearance list from the PrePass™ Processing center.

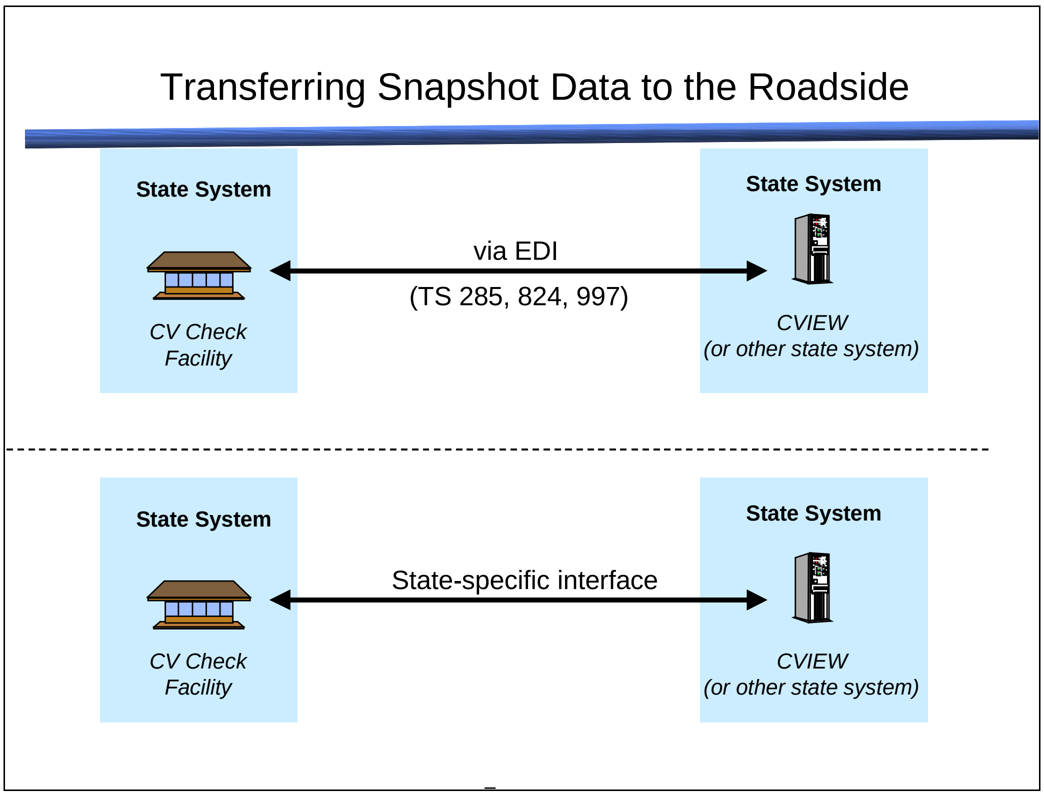

Figure 6-4. Transferring Snapshot Data to the Roadside Systems

E-screening enrollment data are stored in SAFER carrier and vehicle snapshots. A state may choose to have separate E-screening enrollment software that processes applications and generates snapshot segment updates. These snapshot segment updates are transmitted to the state CVIEW (or other system), using EDI X12 standard transactions (285,824, 997), then forwarded to SAFER.

An alternative is to have a state agency or administrator accept the E-screening enrollment applications and transmit the required information over a state-specific, non-standard interface, as shown in Figure 6-5. The snapshots in the state CVIEW (or other system) are modified using existing mechanisms, which also populate other snapshot data fields.

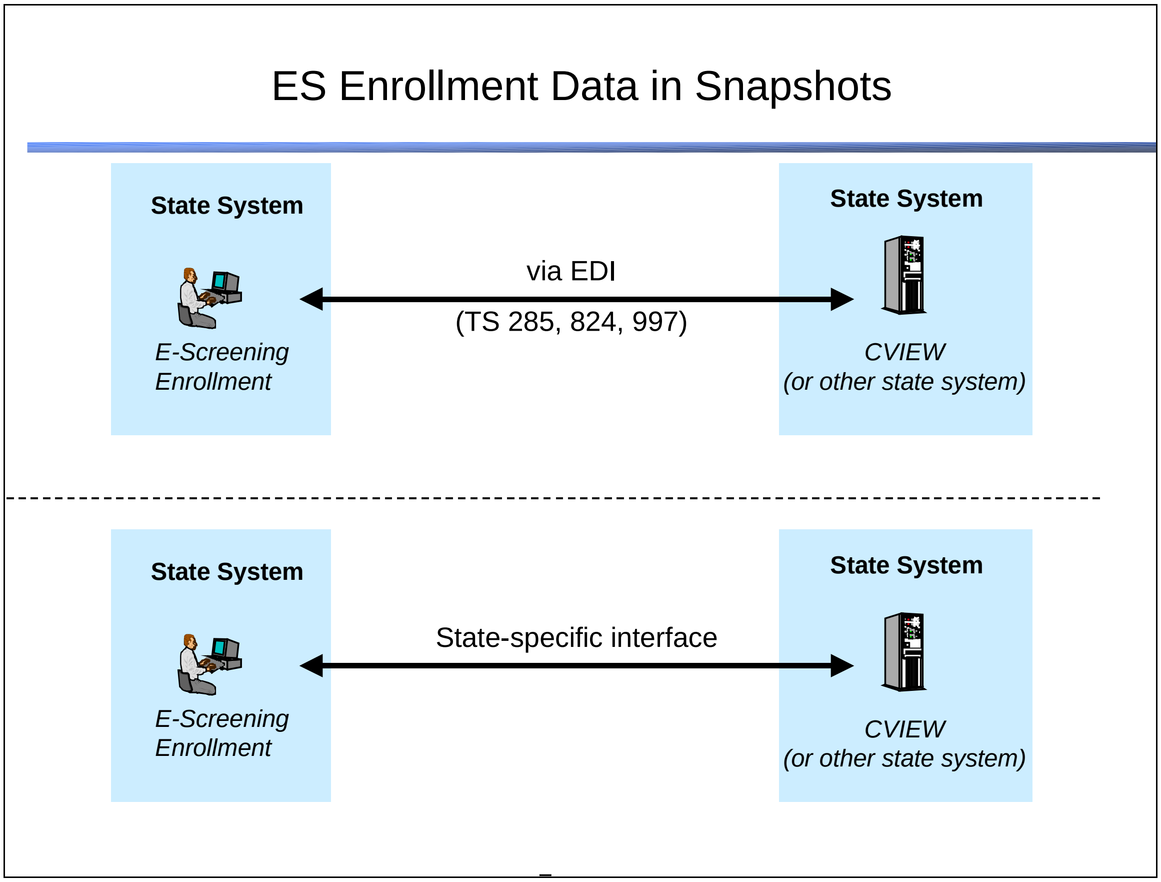

Figure 6-5. Accessing E-Screening Enrollment Data in Snapshots

HELP PrePass™ handles transponder administration and enrollment functions for its member states. NorPass is contracting with a separate transponder administrator to process enrollment requests. Currently, the enrollment data from these programs are not stored in SAFER snapshots. In the future, these programs may choose to populate the snapshots with enrollment data for their member states.

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7 RECOMMENDED DEVELOPMENT PROCESS

The *CVISN Guide to Top-Level Design* and the *CVISN Guide to Program and Project Planning* describe fundamental principles and generic processes. This chapter applies and tailors this guidance to the electronic screening area. Some states may already have a well-documented methodology for system development and integration. If so, the state should follow that process, possibly making some adjustments to incorporate any ideas included here that are not reflected in the state's standard procedures.

The first section in this chapter provides an overview of the entire process. Subsequent sections address each successive phase of the process, including these topics:

- Phase Process
- Phase Products
- Factors to Consider
- List of Key Decisions (refer to Chapter 5 for a description of each)
- Advice and Lessons Learned

A final section addresses requirements specification, a topic that impacts all phases.

7.1 Development Process Overview

The *Introductory Guide to CVISN* outlined a model development process for implementing CVISN capabilities. Figure 7-1 is repeated from that document as a reminder of the model.

Deploying CVISN Level 1 capabilities is a major undertaking that typically takes several years. In order to reduce risk, it is strongly recommended that states use an incremental deployment approach. It is critical that this large program be broken into a series of 3 to 6 month time periods called program phases. Specific results or products are defined for each phase. These are defined in detail for each phase just before it begins, and more broadly for subsequent phases. The use of phases allows a big job to be broken into small, manageable pieces. If a state completes the first couple development phases on time and meets all the objectives, this provides assurance that the plan is realistic. If not, it allows the state to revise the plan and take other corrective actions prior to committing extensive resources to a program that is not properly structured for success. Incremental development and measurable milestones ensure stakeholder participation and feedback and real visibility into program progress.

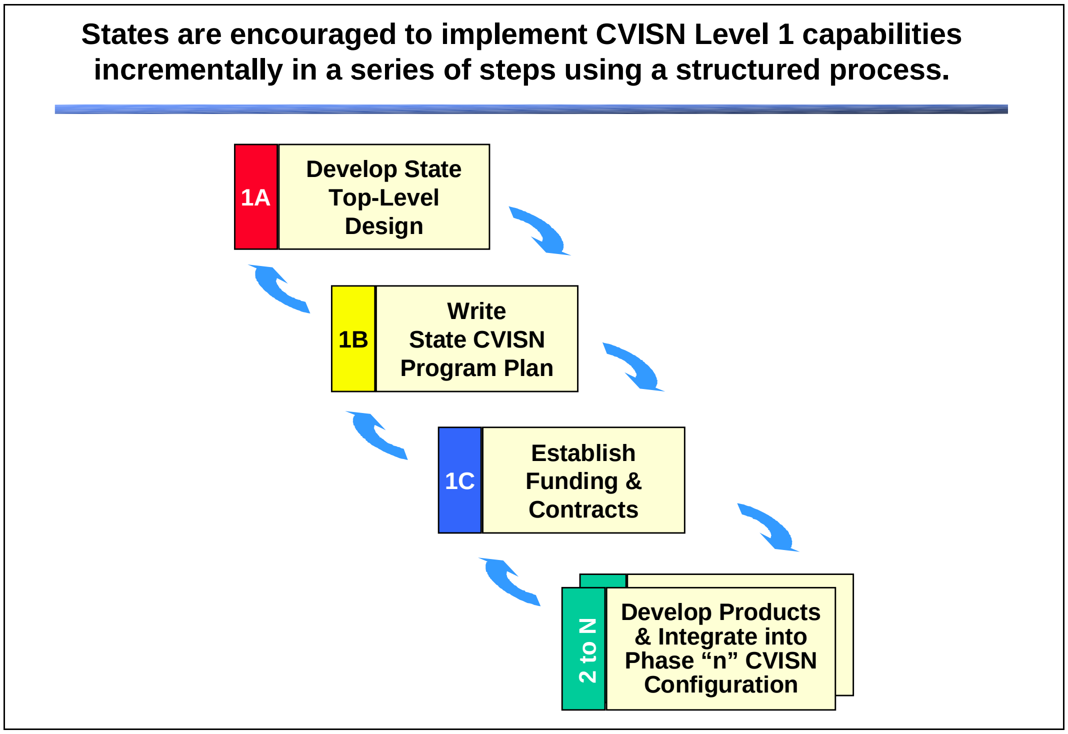

Figure 7–1. Overview of CVISN Deployment Process

The figure shows that the first phase is devoted to developing the state top-level design, preparing the State CVISN Program Plan, establishing full funding for the program, and issuing major contracts for products and technical services. Each subsequent phase is a development phase that results in some type of demonstration or operational capability. More information on phases is provided in the *CVISN Guide to Program and Project Planning* and the *CVISN Guide to Phase Planning and Tracking*.

This *CVISN Guide to Electronic Screening* has been prepared with the experience of early CVISN deployments in mind. It assumes that states will have to do considerable requirements analysis and state-specific planning. As time goes on and CVISN moves into the mainstream, this will be less the case. Some of the aspects of CVISN will become routine. This may be true for your state even now.

For example, both the HELP, Inc. PrePass™ system and the North American Preclearance and Safety System (NorPass) systems are investigating making changes that would incorporate the features and design characteristics required for conformance with the CVISN architecture and national interoperability. If these programs eventually conform to the architecture and your state is already a participant in one of them, you can move quickly through these processes and eliminate some of the detailed requirements analysis.

The approach defined herein assumes that your state is providing some level of system integration. If you decide to subcontract the role of system integrator, you may not follow the detailed steps outlined herein. Most likely, your system integrator will propose an approach based on previous methodology. Nevertheless, the material herein can help you to understand what they must accomplish.

7.2 Top Level Design Phase

Top-Level Design Phase Process

The *CVISN Guide to Top Level Design* describes the general process for developing a top-level design. Figure 7-2 describes this process.

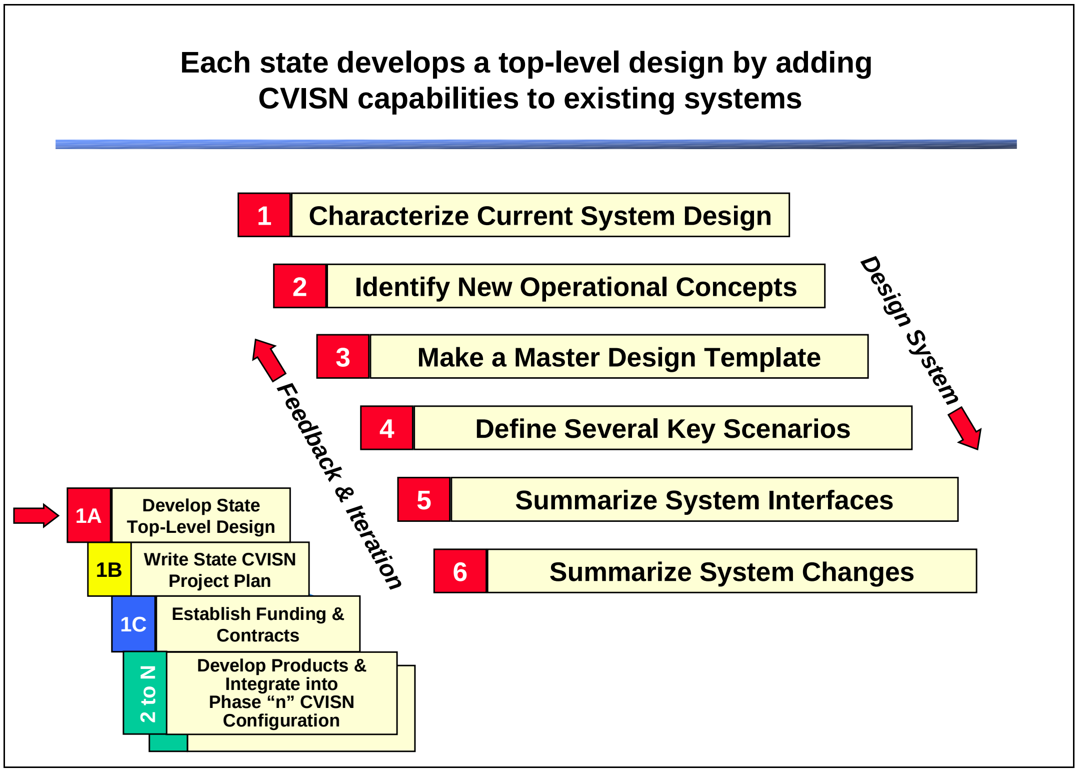

Figure 7–2. Top-Level Design Process

Even though the steps are shown as sequential, the process actually involves a great deal of feedback and iteration. Throughout the process, identify issues, actions and decisions. At the end of this process, your state will have decided what products it wants to develop or acquire, what modifications it wants to make to existing systems, and how it wants to interface systems to each other. This phase establishes the technical framework for everything that follows.

Top-Level Design Phase Products

A State CVISN Top-Level Design Description that shows how electronic screening fits into the statewide CVISN design. It should include:

- System Requirements
  - State-specific goals
  - *CVISN Operational and Architectural Compatibility Handbook (COACH) Part 1* tables from Chapters 2, 3, 4, 5, 6
  - *CVISN COACH Part 4* tables
  - Other state requirements
- System Design
  - Allocation of requirements to system components
  - *CVISN COACH Part 3* tables, tailored as needed
  - Description of functions for each new component
  - System Interface Summaries
  - Top-Level Physical System Design
- System Change Summary
- Operational Scenarios
- Issues

In addition to the State CVISN Design Description, your state may want to prepare a separate, more detailed Electronic Screening Specification document based on information included in this guide. This document should include the following information:

- Screening algorithm
  - Bypass/pull-in criteria
  - Data elements and source
  - Sensor information
- Snapshot data flow from SAFER and state credential system to the roadside
- Real-time information flow as vehicle approaches and passes through station
- Basic site layout and components
- Assessment of existing roadside equipment

Factors to Consider in the Top-Level Design Phase

The electronic screening area is different from the other two CVISN Level 1 capability areas in that it involves several sensors and real-time embedded computer systems. This mix of sensors and computer hardware and software requires a different type of system integration experience and skill than in the other areas.

Correlation of multiple sensors and timing issues are likely to be a problem in e-screening system design. The system must collect inputs from a series of sensors in a specific sequence and respond within fixed time limits determined by the movement of the vehicle being screened and the basic physics of the situation. You must do a careful analysis of timing, considering sensor requirements, interface speeds and computer processing requirements, and operator reaction time.

Remember that although CVISN Level 1 requires only one weigh station, you want to position yourself to duplicate this functionality at other weigh stations in your state. You should keep this goal in mind and develop a modular approach for hardware and software elements that can be reconfigured to meet the needs of various sites without significant redesign.

Key Decisions

- Do you already belong to or will you join an existing screening program?
- Will screening be performed at fixed sites? Mobile sites? Or both?
- Which site will you upgrade first to handle electronic screening?
- At what other sites will electronic screening be deployed?
- Will you deploy WIM on the mainline? On the ramp? Both? Neither?
- Will you screen using both carrier and vehicle data?
- What screening factors will you use?
- Will you have an open enrollment policy?
- Will the safety and credential checks be made at the roadside or at a central site?
- How will you carry out the electronic screening enrollment function?
- How will you share enrollment information with other programs?

Advice and Lessons Learned

- Visit e-screening sites in several other states early in your project.
- Develop requirements in multiple levels of detail. Use clear, concise, top-level, testable requirements as the basis for procurements and contracts. Develop more detailed screening process descriptions as required by each phase as the work proceeds. (Please see section 7.6 Requirements Specification for more discussion.)
- Separating the processing to be performed into two computers, the ROC and the Screening Computer, has proven to be a useful concept. It allows the more time critical functions to be isolated into the Screening Computer. It allows the ROC to be more site-independent and reusable at multiple sites with minimal changes.
- It is important to think about operation and maintenance in designing the e-screening system. Sensors exposed to the highway environment are prone to failure. The

system should be designed from the outset to support self-tests, status monitoring, and fault isolation.

- Do an analysis of the processing load on the e-screening computer systems. There may be tens of thousands of vehicle and carrier snapshot records in the system. Your screening algorithm will have to operate on each of these. This process needs to operate quickly, in a manner of minutes. If it is not done carefully, it may take hours.
- Remember that e-screening enrollment can be a complex process in its own right. It is essentially a new credentialing process. Make sure to address it in your design. You may want to consider treating it as a new credentialing process and incorporating it into your credentials administration plan.

7.3 Project Planning Phase

Electronic Screening Project Planning Phase Process

The *CVISN Guide to Program and Project Planning* describes the general process for developing a project plan and organizing the project. Figure 7-3 portrays this process.

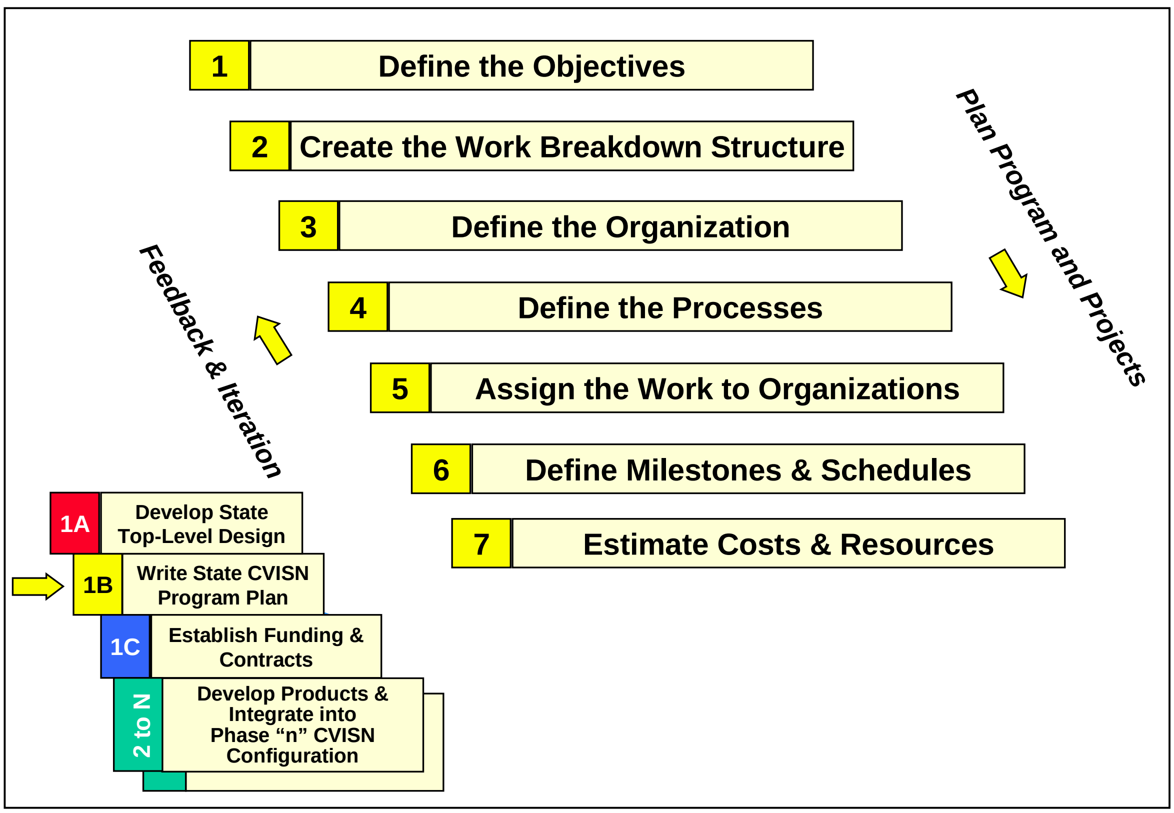

Figure 7–3. Project Planning Process

Planning Phase Products

- A completed electronic screening project plan that reflects the results of all the decisions made in this step. The top-level plan for electronic screening should be reflected in the State CVISN Program Plan.
- Documents necessary to support acquisition of full project funding. The plan should support this, but other proposals and state-specific documents may be required.
- Preliminary Phase Schedule for electronic screening systems and capabilities.

Factors to be Considered in the Project Planning Phase

What other projects are going on in your state that may impact the electronic screening project. For several of the pilot states, Y2K efforts had such a high priority that resources were not available for CVISN tasks. Are there any major projects ongoing in your state that will compete for resources? Are major upgrades already taking place in the computer systems that support weigh station operations? Are major upgrades planned in the sensor and communications systems that will support the weigh station operations?

Does your state have a program to network together state facilities over a wide area network? Can you get high-speed connections to your weigh stations via such a program?

If you are modifying existing systems in-house, will state staff be able to dedicate sufficient time to accomplish the modifications? Does this project have sufficient priority among all the on-going efforts? Does the management structure support the project?

What type of internal methodology has your state used in the past for system development in the screening area? Is the process outlined in the CVISN guide series compatible with that approach? Are there any special requirements for feasibility studies or cost/benefit analysis studies?

What is the typical procurement cycle in your state? What steps are required? How long does it take? What can be done to expedite this?

What have other nearby states done towards implementing electronic screening? Can you leverage what they have done, learn from them or partner with them in some way?

Key Decisions

- What state agency will be the lead during development of electronic screening?
- What strategy will you use to build a sufficient population base of transponders?
- What new equipment do you need to support electronic screening?
- Who is the system integrator?
- Will sole source or competitive contracting be used?

Advice and Lessons Learned

- Conducting a marketing program for enrolling motor carriers and distributing transponders is a major undertaking. You should strongly consider joining a national program or partnering with other states in your region to accomplish these tasks.
- If you join a national or regional program, be sure they have demonstrated conformance to the CVISN architecture before you make a final commitment.

7.4 Funding and Contracts Phase

Funding and Contracts Phase Process

The *CVISN Guide to Program Project Planning* describes the general process for the funding and contracting phase. Figure 7-4, which portrays this process, is repeated below as a reminder. The process for this phase is very dependent on state specific details. The figure is intended to give a conceptual framework and starting point. You should develop a specific process that meets the needs of your state.

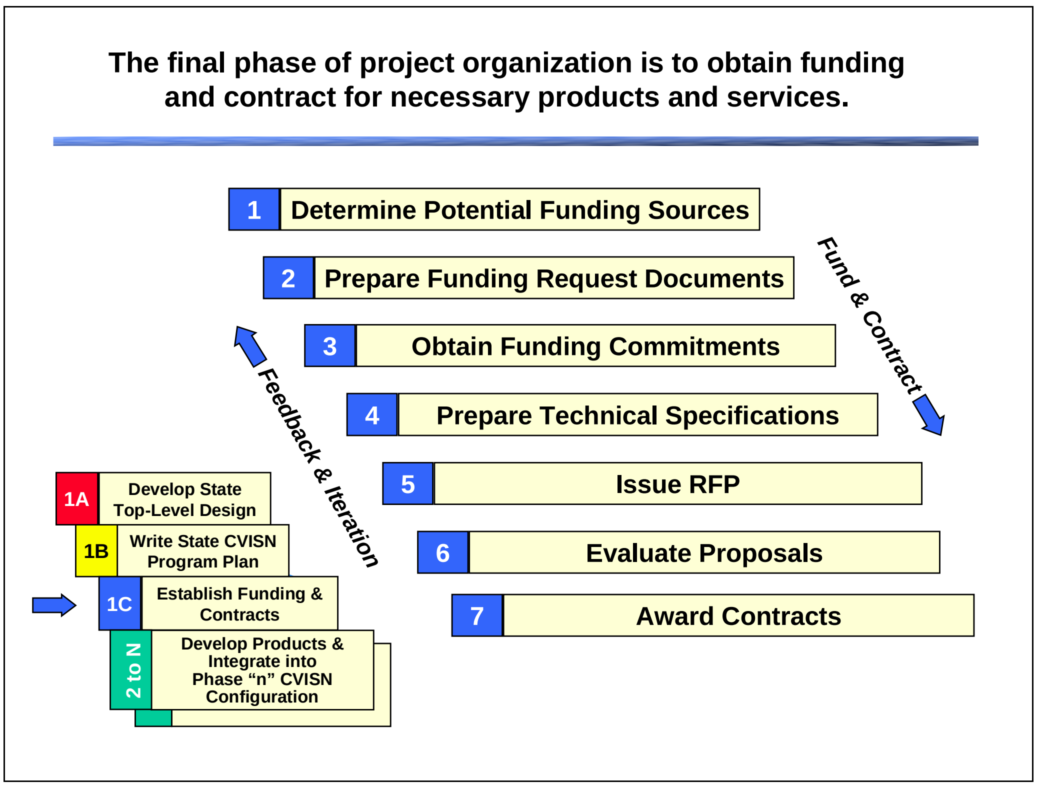

Figure 7–4. Funding and Contracts Phase Process

Funding and Contracts Phase Products

- Documents needed (PR material, feasibility studies, cost/benefit studies, grant applications or proposals) to obtain funding
- Commitments for funding from state, federal and private sources on a schedule that meets project cash flow requirements.
- Procurement documents (e.g., request for proposal (RFP), evaluation plan, feasibility study, and sole source justification) to acquire hardware and software products as well as software development, system integration, communication, and verification and validation services.
- Flexible contract mechanisms are in place to support a team of contractors as required to complete all aspects of the project.

Factors to be Considered in the Funding and Contracts Phase

- The electronic screening area involves contracting for multiple hardware, software and communications products and services. It includes facility work and probably roadwork. Procurement and contract management are key activities in this area.
- Consider hiring a system integrator to do the whole job. Generally, they are much better positioned to do the subcontracting necessary to acquire and install all the required pieces.
- Be sure to include measurements of performance and remedies for non-performance in contracts.
- Be sure to account for operations and maintenance in the budget estimates.

Key Decisions

These are issues that must be faced during the funding and contracting phase of the project. They are not unique to electronic screening.

- How much funding is required to complete the project?
- Where will the funding be obtained?
- How will operation and maintenance (O & M) costs be funded?
- What type of procurement should be used for each product or service?
- What can be done to expedite procurements?
- What type of incentives and remedial mechanisms should be included in the contracts?
- What software rights should be included in the contracts?

Advice and Lessons Learned

- If possible, set up some type of indefinite delivery/indefinite quantity (ID/IQ) contract vehicle with your systems integration agent and software services vendors. This allows you to define specific task orders as the work proceeds. It lessens the need to have a "frozen" set of requirements up front. It allows the team a lot more flexibility in solving problems. It allows adapting to changes in technology as the project proceeds.
- To assure architecture conformance, be sure to require that vendors prove that their deliverables conform to the architecture through the execution and analysis of interoperability tests. Also require design reviews so that the state's Conformance Assessment Team can check the design for conformance.
- When states decide to follow a mostly commercial off-the-shelf (COTS) approach, they expect the costs to be very small. This expectation is often not met. For example, if your state uses screening software based on an existing site in another state, it is likely to require substantial modification and customization to fit in your site-specific situation. Your state may have slightly different or additional requirements. Roadwork and installation may still cost hundreds of thousands of dollars. Nevertheless, it is still cost effective when compared to a development from scratch.

7.5 Development Phase "n"

Development Phase "n" Process

The CVISN Guide to Phase Planning and Tracking describes the general process for developing and maintaining a Phase Plan and tracking progress as the phase proceeds. Figure 7-5, which portrays this process, is repeated below as a reminder.

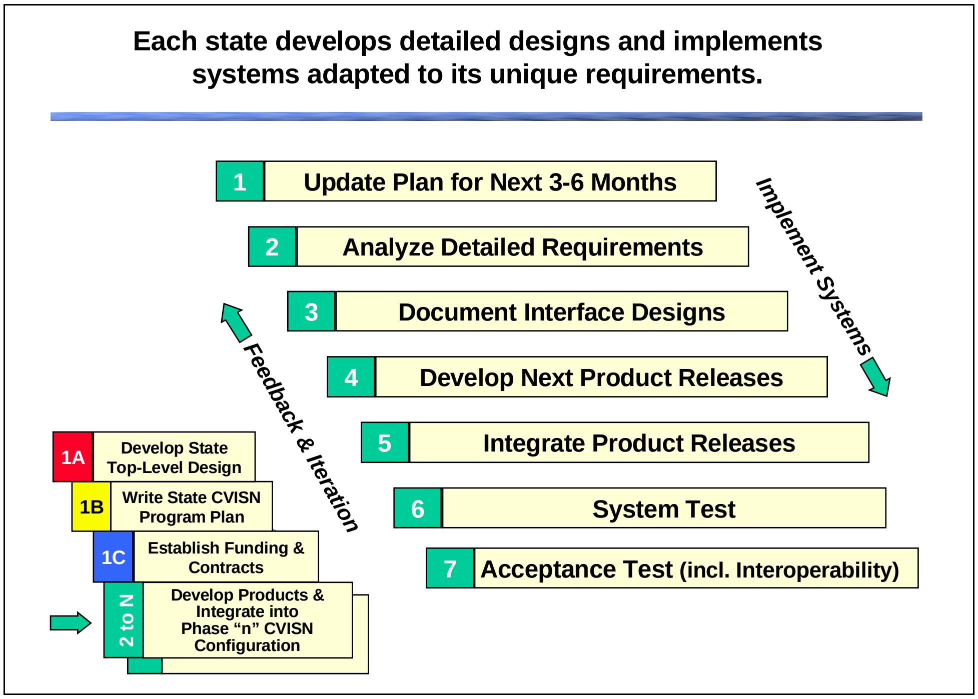

Figure 7–5. Development Phase "n" Process

Development Phase "n" Products

- Working products (e.g., screening computer, ROC)
- Products integrated into the operational environment
- Test documentation showing proof that products worked as required
- Operation and maintenance documentation
- Net result: New operational capabilities

Factors to be Considered in Development Phase "n"

You need to be able to incrementally define details. Specific hardware configuration and interface requirements may not be known until the vendor/component selection process is complete. Timing and sensor correlation issues will not be fully understood until the equipment has been installed. Allow time in the schedule to integrate components and to document the details of specific hardware interface requirements at the beginning of each phase.

As components are developed, tests should be executed to verify that the components meet the design. As components are integrated, interoperability tests should be executed to verify that the standard interfaces were implemented correctly, and that the components and products work together correctly.

Configuration management becomes very important when integrating products from multiple vendors. A change management process must be in place. As changes are made to interface designs, everyone must be kept informed of changes and planned updates. Updates to systems on each end of the interface must be synchronized. Version numbers must be systematically assigned to all products and version description documents prepared to coordinate updates and make sure that compatible versions are installed together.

Key Decisions

- How should the initial design be modified based on the experience gained in each phase?
- How should the initial phase plan be modified based on progress actually made in each phase?

Advice and Lessons Learned

- Incremental deliveries reduce the risk for both the state and the vendor. Use them.
- Assuming that you are doing incremental development, allow time at the beginning of each phase for a quick re-study of just the processes and requirements for that phase. Think about lessons learned from the prior phase and incorporate them. Allow a few days to define detailed processes. Also, refine the interface specifications at this time. Finalize any state specific details related to sensor or communications interface design at this time. This “just-in-time” analysis will present topics to the development team when they are ready to handle them and need the results. It will avoid “warehousing” a thick specification on a shelf to gather dust.
- An early delivery that shows tangible progress is critical to building the team, establishing forward momentum, establishing credibility, and securing funding. For example, Maryland installed a Roadside Operations Computer (ROC) at its West Friendship and Perryville sites as a first step, even though no WIM, DSRC or other sensors were available. This first step allowed site personnel to understand the type of information they would get from SAFER snapshots and to see screens used to monitor e-screening in a site at another state (e.g., Stephens City, Virginia). It was a good first

step, because it allowed site personnel to really understand the system and validate requirements with a relatively small investment.

- Plan to do testing at multiple levels: unit, integration, and complete system. There are lots of components and interfaces involved and each must be tested individually before trying to get the entire system to work. Diagnostics should be built into the design to help in the integration process, as well as to support maintenance of the final system.
- Schedule management is especially important in the electronic screening area because of the need to coordinate multiple vendors. The state needs an integrated schedule that has top level milestones and any external dependencies among the various vendors and organizations involved. The system architect needs to have clear authority to adjust the schedule details in response to technical issues. However, everyone must make a firm commitment to meet major milestones.
- The screening area will probably require close coordination among a number of vendors. Vendors will be dependent on each other for achieving their goals. These external dependencies need to be identified and carefully managed. When problems come up (as they always will, even in the best programs) there will be a tendency for everyone to blame the problem on someone else. You need a strong system integrator and problem resolution process to deal with this.
- An early indicator of a vendor's ability to perform is to check the level of effort being applied. There is no substitute for a visit to the vendor's development facility. Ask to meet the people working on your system. Ask what other assignments they are working on. Step back and perform a "sanity check" on staffing levels. Ask yourself if it is realistic to expect the work you want with the effort that is being applied.
- Hopefully, careful planning will allow things to go well with your vendors. But be sure to have contractual remedies in place just in case they don't. These can include progress payments based on performance, incremental funding, and cancellation clauses.
- Test data can be time consuming to prepare. Build on existing test data (e.g., the CVISN interoperability test suite package) when possible. Lack of test data can cause insufficient testing and allow problems to go undetected until systems are put into production.
- Changes in requirements can kill project schedules and cause cost overruns. An effective configuration management (CM) process is necessary to ensure that changes are only made when the impacts on cost and schedule are understood and approved. For more information about CM, please see Reference 19.

7.6 Requirements Specification

Development of accurate requirements specifications that are detailed enough (but not too detailed) is a critical success factor in an electronic screening project. It is discussed here as a separate topic because it is a consideration that has impact on all phases of the development process, from top-level design through final acceptance testing. Several alternatives to specifying requirements are discussed below.

Alternative A: Simplified Requirements Specification Document.

Generating a detailed requirements specification for an electronic screening project prior to commencing development is difficult. Specific hardware configuration and interface requirements may not be known until the vendor/component selection process is complete. Planning the site layout requires detailed information about existing equipment and facilities along with the requirements of the new hardware components. Timing and sensor correlation issues will not be fully understood until the equipment has been installed. Software requirements are dependent on all of the factors above.

Consider not writing a very detailed electronic screening requirements specification up-front. Some folks think that a thick, detailed requirements document will ensure that the contractor will produce what you want. Experience has shown that this is not necessarily the case. Instead, a concise requirements document that states the end results and leaves the details to be developed as part of the phased development process is more likely to succeed. Remember that your objective is to produce a top-level requirements specification that limits the project scope and is concise, testable, and provides a basis for establishing and managing a contract.

One suggested approach is to use your State CVISN Top-Level Design Description and a State Electronic Screening Specification (both described in Section 7.2) as the sources for requirements. The system design description should include the completed sections of the various parts of the COACH:

- COACH Part 1, Operational Concept and Top-Level Design Checklists
- COACH Part 3, Detailed System Checklists
- COACH Part 4, Interface Specification Checklists

Review and edit these, filling them out and customizing them as required to meet the needs of your state.

Your request for proposal (RFP) should refer to specific sections of these documents relevant to the product or services being procured. It can also reference these guides and any other state specific documentation (e.g., strategic plans) that provide background or describe your concept of operations. The RFP should require that the product pass the interoperability tests. Please see the COACH Part 5 (Reference 15) and the CVISN Interoperability Test Suite Package (References 20-22) for further information. The RFP should require that as part of the project, the vendor perform systems analysis and develop more detailed process descriptions and related requirements with operations personnel during each phase of the project. These process descriptions may be done in joint application design sessions using participant flows or some equivalent method and diagramming technique. When evaluating proposals, pay particular attention to the vendors' experience and proposed approaches to working with your team to develop these detailed process designs.

Alternative B: Delta Requirements

If your state electronic screening system is to be based on the software and design of an existing system, such as HELP PrePass™, NorPass, MD CVISN Prototype system at Perryville, or VA CVISN Prototype system at Stephens City, you may wish to consider a variation on Alternative A. Prepare the simplified requirements specification based on your State System Design Description and Electronic Screening Specification as described above. Then define a "delta" (i.e., difference) requirements specification that just describes the changes to be made to the software and system design. Work with the contractor to adapt the system design to the specific site and define the hardware configuration.

Preparation of the delta requirements is in lieu of a detailed description of the electronic screening method. If you are basically satisfied with the process as it exists, there is no need to spend a lot of effort reinventing or documenting it.

Alternative C: Comprehensive Requirements Specification Document

Traditional software life cycle models advise having comprehensive, detailed, requirements nailed down in a requirements specification before the project starts. We have noted some problems with this approach, including:

- Developing the document is costly and time consuming
- Processes change and the document quickly becomes obsolete
- If the people developing the document aren't the ones developing the system, much of the investment remains locked in the heads of the analysts who wrote the specs and is not transferred to the developers. The developers will likely want to redo this work themselves and get the users' perspective first hand.
- User personnel often don't have time to invest in really studying requirements documents and making sure the documents reflect their needs
- It is very difficult for even the most dedicated user personnel to review the documents and actually understand what they are getting. When they finally see the system, they will realize that there were lots of things they wanted that didn't occur to them when reviewing the specs.
- Specific hardware configuration and interface requirements may not be known until the vendor/component selection process is complete.
- Timing and sensor correlation issues will not be fully understood until the equipment has been installed.

However, if your state has worked successfully with comprehensive, detailed requirements specifications before and this is what you want on this project, consider issuing a partial draft of the requirements specification as part of your RFP. Then have the successful bidder complete the draft as part of their contract. The contractor should update the draft based on a detailed site evaluation and using the specific hardware components to be installed. Have them finalize sections with each phase of the project as it proceeds.

In Maryland, a functional specification (Reference 23) was initially drafted which included the following information:

- Site description and proposed layout
- High level software functional design
- Functional description of hardware components
- If known, identification of specific hardware vendor and component model or configuration
- Specification of electronic screening algorithm and data elements
- Roadside operational scenarios
- Roadside data flow
- Snapshot-based information flow

During the development process, the document was revised to contain additional detail and reflect hardware component selection and the design decisions being made. Additional documents such as detailed site layouts, wiring diagrams, and software design were also generated, when required.

8 ELECTRONIC SCREENING IN THE CVISN MODEL DEPLOYMENT STATES

Several of the CVISN Model Deployment States provided information about how they are implementing electronic screening functions (see subsequent sections in this chapter). This information is included below as written by the states without further editing. All information is as of April 1999 unless otherwise noted. It is subject to change and is provided as background only.

8.1 California

Highlights of California electronic screening modifications and planned or existing capabilities include:

- Installed electronic screening (PrePass™) hardware/software at 24 fixed inspection facilities statewide.
- PrePass™ carrier participation includes pre and post enrollment verification which includes valid credentials (vehicle registration, IRP, SSRS, MCP, and IFTA) and safety rating.
- Plan to equip electronic screening capabilities in seven additional fixed inspection facilities to complete California's electronic screening deployment.
- Developing an interface through CI with the PrePass™ administrators for enrollment/verification processes.
- Develop an interface with the CVIEW/SAFER snapshot data systems for enrollment/verifications processes.
- Investigating the use of performance based inspection selection systems, in lieu of the current safety criteria.

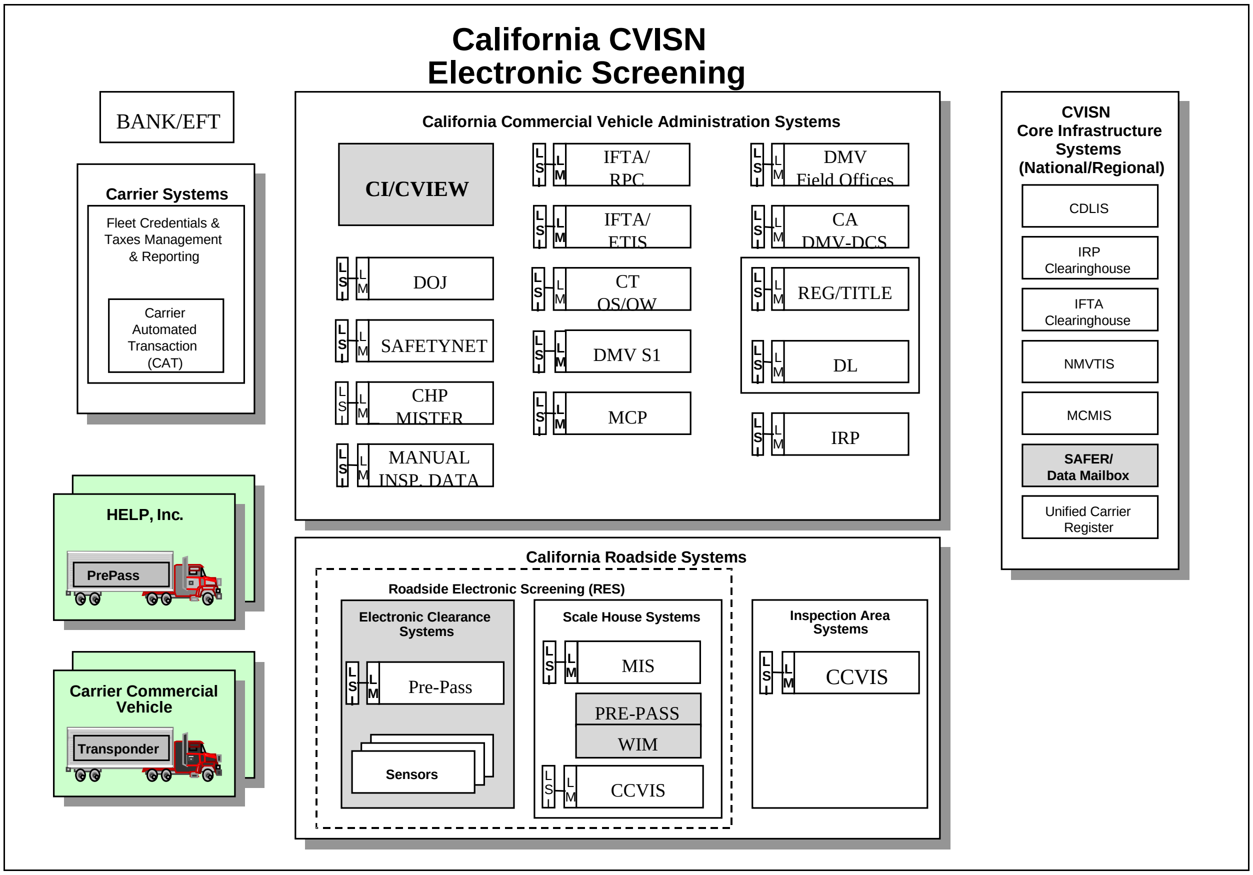

Figure 8–1. California Electronic Screening Design

8.2 Colorado

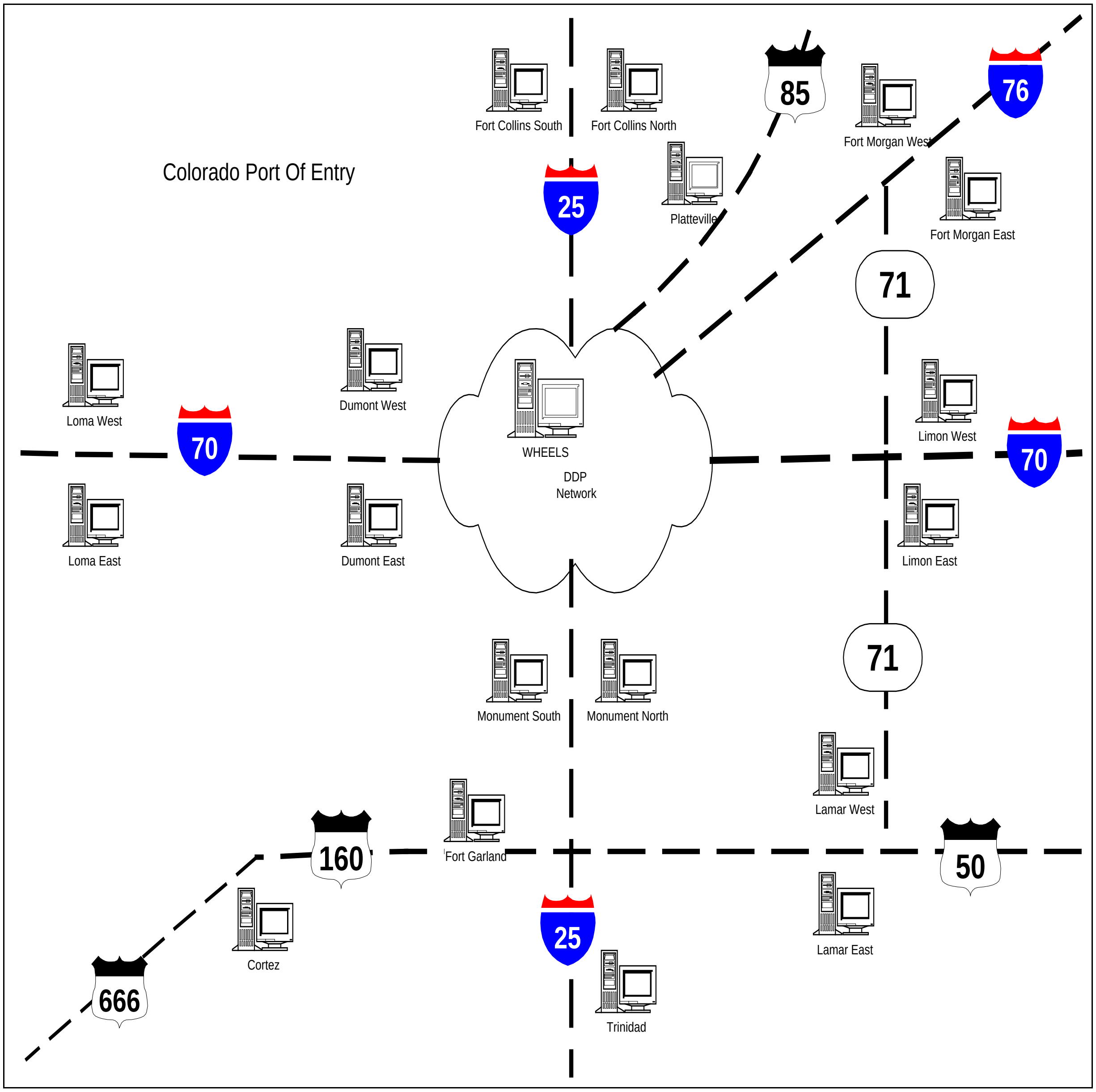

Figure 8–2. Colorado Commercial Vehicle Computer Systems

Colorado has been maintaining a database of commercial vehicle credentials for many years. This process began in 1985 with the installation of computer systems in each port of entry location. By July of 1986, the Fort Collins Port of Entry (POE) became automated. In a few months, the remaining ports were also up and running. These computers were gathering and displaying credential information, issuing clearances and receipts, and providing reports needed for the daily operations.

In 1990, a bill was implemented by the legislature, SB159, which eliminated the Gross Ton Mileage (GTM) tax and replaced it with a registration-based fee system. The loss of data (account numbers) and the elimination of the need to speak to each driver allowed us to explore ways to enhance the port operations. A primary improvement that was identified was to use Automatic Vehicle Identification (AVI), Automatic Vehicle Classification (AVC), and Weigh-In-Motion (WIM) technologies.

By 1994, with the cooperation of the Colorado Department of Transportation (CDOT) and with the assistance of our vendor, International Roadway Dynamics (IRD), Colorado had issued 350 Mark IV transponders to vehicles, associated these transponders to our credential database, and began clearing trucks at mainline speeds at our Trinidad site.

Currently (Spring of 1999), we have two locations that are AVI/WIM-equipped, have contracts in place for the installation of five additional facilities, and may potentially receive state funding for two more sites.

Colorado has 18 fixed buildings in the state, located in 11 cities and towns that are known as Port of Entry offices (sometimes called weigh stations). Of these dual locations, it is our intent to primarily service the "in-bound" traffic lanes with AVI/WIM technologies. Any site not receiving both AVI and WIM will have an AVI reader and the PrePass system installed in the 1999 calendar year.

8.3 Connecticut

No information was available from Connecticut at the time of publication of this document.

8.4 Kentucky

Kentucky's CVISN plans call for:

- Rewrite (next generation) of electronic screening software to include the capability for multiple configuration options
- Use of Ethernet LAN's and 56KB WAN links to provide for data communication links
- Use of CVIEW to receive snapshot information containing safety and credential information
- Use of CVIEW snapshot data to automatically generate and update (as necessary) the screening database for electronic screening
- Establishing an unmanned remote monitoring site on a bypass route with the images projected/communicated back to a nearby weigh station. Communications are planned as land lines currently

Kentucky serves as a prime partner in NorPASS – a continuing and combined effort of the MAPS and Advantage I-75 electronic screening programs. Kentucky's efforts include a second generation of electronic screening software that offers compliance with the CVISN architecture as well as backward compatibility with the enrollment list concepts of Advantage (CVO) I-75. Additional information relating to CVISN and CVO activities can be found at http://www.kytc.state.ky.us/motorcarrier/Motorcar.htm and http://acvo.uky.edu.

A high-level overview of the involved systems in Kentucky's CVISN plans is contained in Figure 8-3.

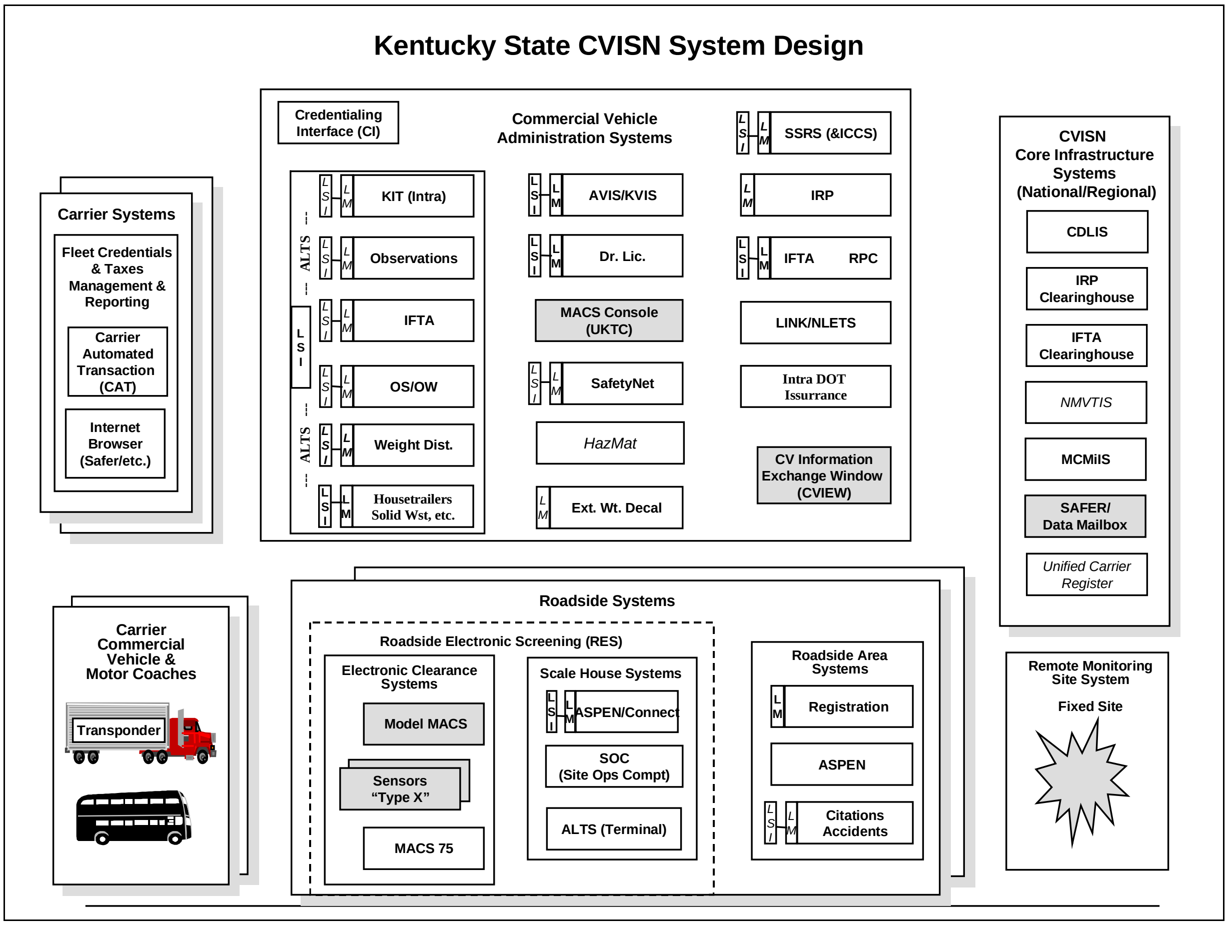

Figure 8–3. Kentucky CVISN System Design Template

8.5 Maryland

Figure 8–4 show Maryland's system design template, with the electronic screening-related functions highlighted. More information about the Maryland CVISN project can be found at http://www.mdot.state.md.us/mmcp/index.html. Information about the Maryland Business Licensing Information System can be found at http://www.blis.state.md.us/.

Highlights of Maryland's electronic screening modifications and planned or existing capabilities include:

- Installed Roadside Operations Computer (ROC) and software at State Highway Administration.
- Installed Roadside Operations Computer (ROC) and software at West Friendship.
- Subscribed to CVIEW to receive snapshots at West Friendship.
- Developing detailed requirements to implement electronic screening at Perryville site.
- Established connectivity between CVIEW and West Friendship.
- Improved existing connectivity between MVA and weigh station facilities for carrier and vehicle snapshots.

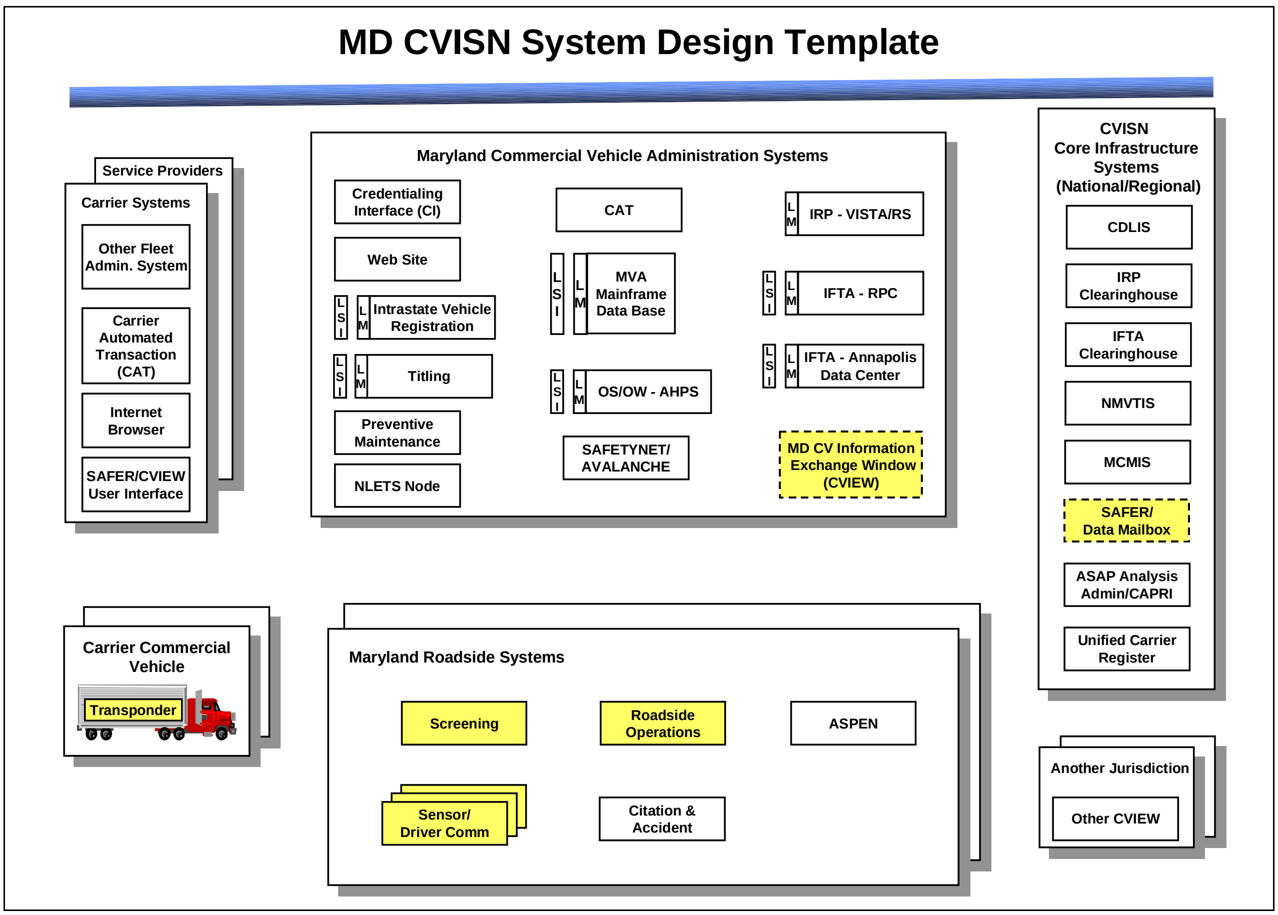

Figure 8–4. Maryland CVISN System Design Template

8.6 Michigan

Compliance and enforcement activities are conducted by two organizations in Michigan. The Bus and Limousine Department of the Michigan Department of Transportation (MDOT) inspects buses and motor coaches, while the Michigan State Police inspect all other commercial vehicles.

Michigan does not use "probable cause" as a mechanism for targeting inspections. Therefore, data about a motor carrier or a vehicle is not required until the vehicle has stopped for an inspection.

Figure 8–5 shows the MDOT Bus and Limousine unit view of the recommended CVISN architecture. Legacy system interfaces will be needed to handle the translation of information between the legacy systems for credentials and an integrated CI/CVIEW.

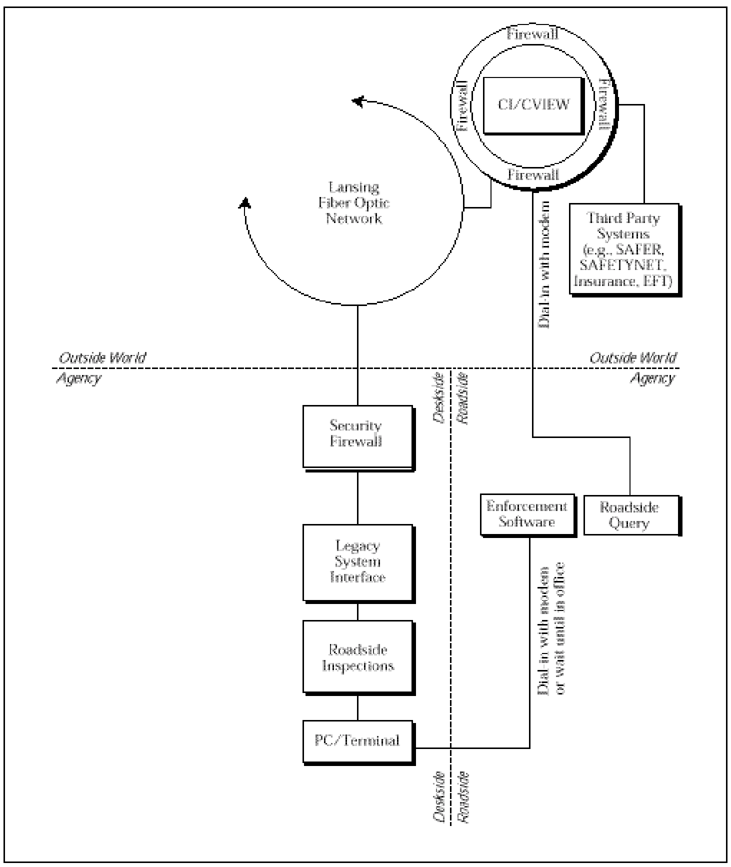

Figure 8–5. MDOT Bus and Limousine View

ASPEN enforcement software loaded on laptop computers is used for entering commercial bus inspection data at the roadside. ASPEN data will be transferred by modem or diskette to the deskside files. State staff will continue to perform manual processing and review as necessary using their desktop PCs. Software loaded on the PCs also will perform data manipulation. All inspection data will be transferred to the CI/CVIEW on an hourly or nightly basis for storage in the vehicle snapshot. Selected bus inspection data will be forwarded from the CI/CVIEW to both SAFETYNET and SAFER on a nightly or weekly basis.

The registration system may access credentials, safety, and enforcement information generated by Michigan agencies, packaged into snapshots, and delivered by the CI/CVIEW. The system also may access similar data in SAFER and other third party systems through the CI/CVIEW. Therefore, the CI/CVIEW will receive electronic filings from insurance companies and will enable the legacy system to access SAFER for additional insurance and safety information. Operating authority and insurance information will be transferred to the CI/CVIEW on a nightly basis to update the carrier snapshot. In turn, SAFER and other third party systems will be updated with information transmitted by the CI/CVIEW on a periodic basis.

The Michigan Department of State Police performs safety inspections of trucks at the roadside. Most inspections are conducted at weigh stations. One deskside legacy system is involved in this operation. This system contains inspection information.

Figure 8-6 shows the State Police view of the recommended Michigan CVISN architecture. A legacy system interface will be needed to handle the translation of information between the legacy system and the CI/CVIEW.

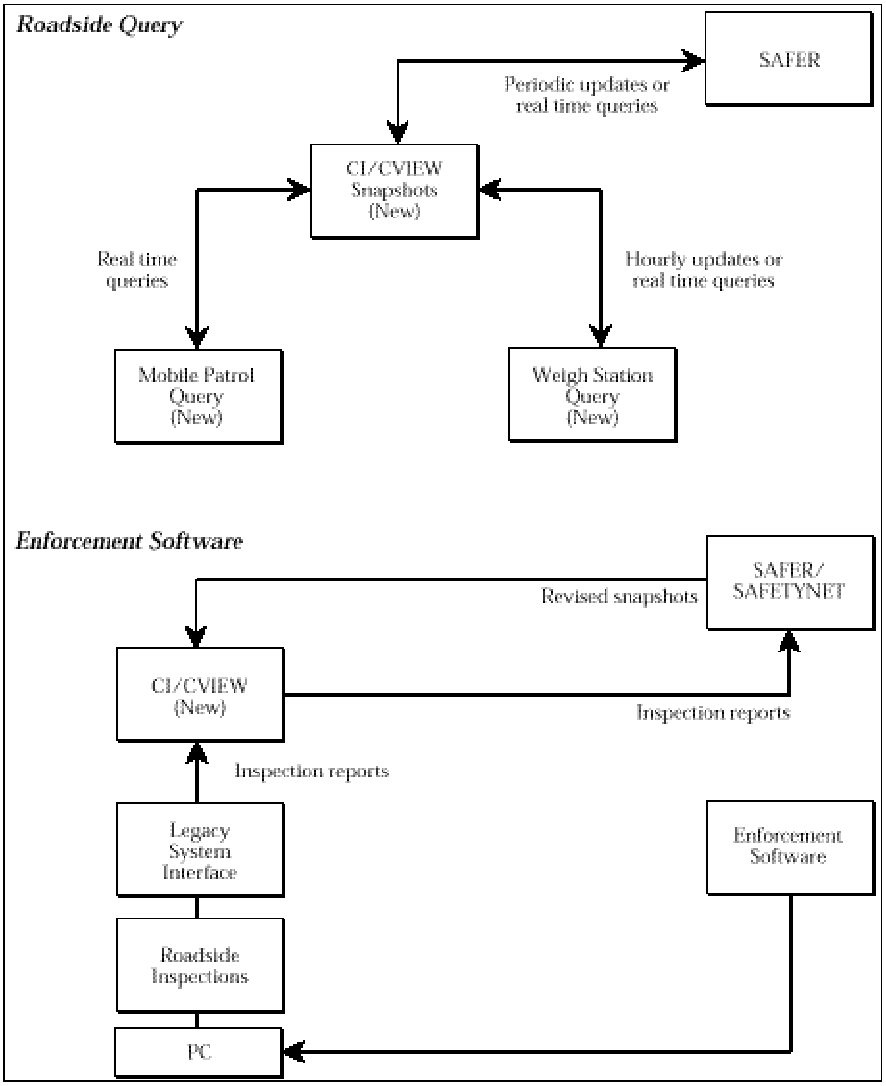

Figure 8–6. Michigan State Police View

ASPEN enforcement software loaded on laptop computers is used to record inspection results at the roadside. ASPEN data will be transferred by modem or diskette to the deskside files. State staff will continue to perform manual processing and review as necessary using their desktop PCs. Software loaded on the PCs also will perform data manipulation. Inspection data will be transmitted from the legacy system to SAFETYNET and SAFER via the CI/CVIEW.

Delivery of safety, registration, and taxation information on interstate and intrastate carriers to the roadside is accomplished by the roadside query element of the architecture. The CI/CVIEW delivers information generated by Michigan agencies (snapshots) and from third party systems such as SAFER. For fixed roadside assets such as weigh stations, the CI/CVIEW will deliver carrier safety data from the carrier and vehicle snapshots to the roadside on an hourly basis, as well as allowing for ad hoc query requests in real time (for example, when a carrier states that its taxes were paid only a few minutes earlier). For mobile roadside assets, a “pull” approach will be used that will allow enforcement officers to request full carrier and vehicle snapshots in real time.

8.7 Minnesota

Highlights of Minnesota's electronic screening include:

- Demonstration site at the I-94 St. Croix Weigh Station will allow screening of vehicles on the ramp with the ability to send cleared vehicles back to the mainline.
- Developing customized Roadside Operations Computer (ROC) and Screening System software.
- Sensor technology being installed or integrated includes WIM, AVI, LPR and overheight detector.

Figure 8–7 summarizes the system interactions in Minnesota's electronic screening design.

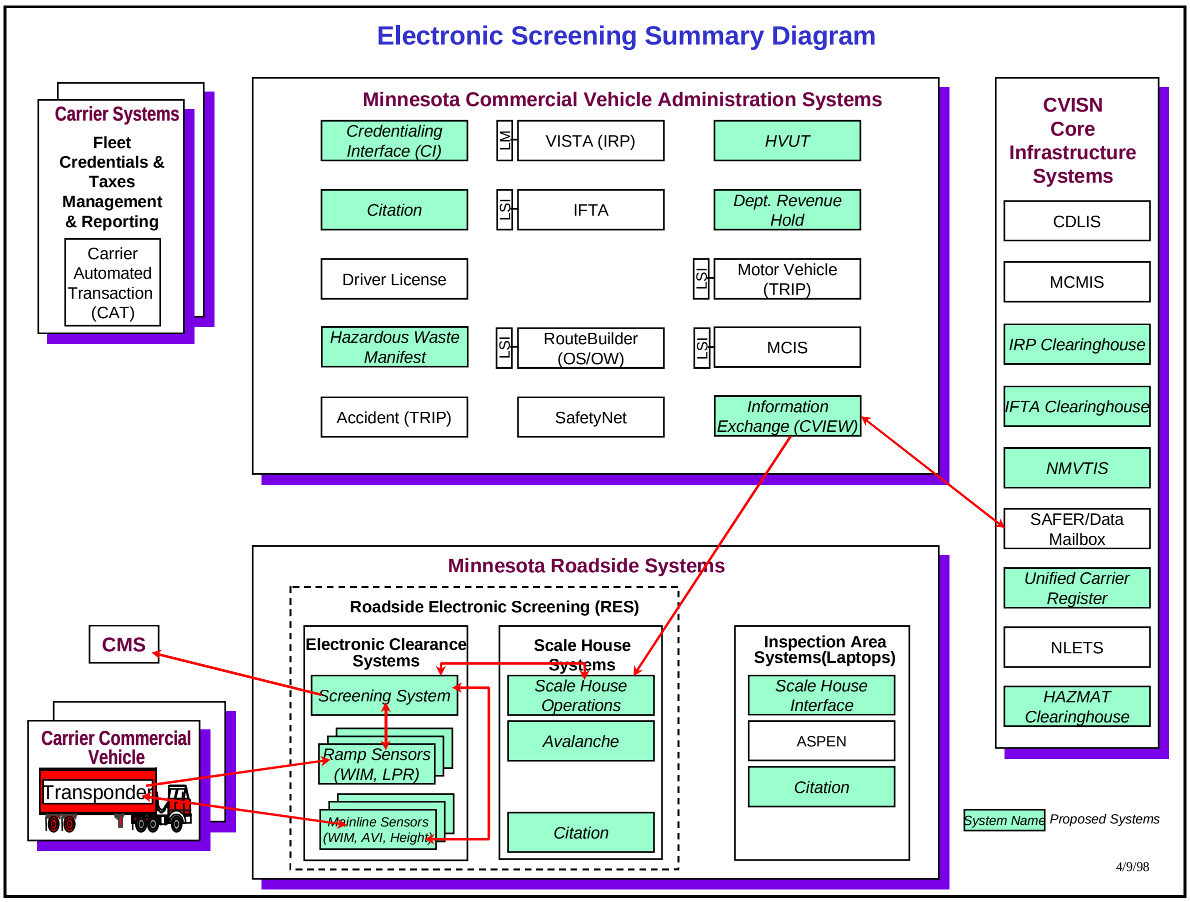

Figure 8–7. Minnesota Electronic Screening Design

8.8 Oregon

No information was available from Oregon at the time of publication of this document.

8.9 Virginia

Highlights of Virginia's Roadside Electronic Screening's current and planned capabilities include:

- Upgraded Stephens City Weigh Station (I81) infrastructure with fiber-optics network and AVI readers to accommodate electronic screening in addition to Weigh-In-Motion (WIM).
- Completed integration and acceptance testing of Roadside Operations Computer (ROC) & Sorter Computer.
- Tested SAFER to CVIEW to Roadside connectivity for download of TS285 Carrier snapshot records (safety data).
- Completed end-to-end technical demonstration to FHWA Administrator in July 1998. Demonstrated ability to read a truck's transponder to identify the vehicle, dynamically check vehicle's weight and safety/credential "weighting factor", and to signal the vehicle to either bypass or pull-in to the fixed scale.
- Purchased and outfitted NOMAD (mobile screening vehicle) for full electronic screening capability. Currently field testing unit.
- Completed performance tuning and interoperability testing scenarios to validate site capability under real-world load.
- Developing deployment plans to increase carrier involvement. Marketing and transponder interoperability issues need resolution.

Figure 8–8 shows Virginia's Top Level Data Flow for electronic screening.

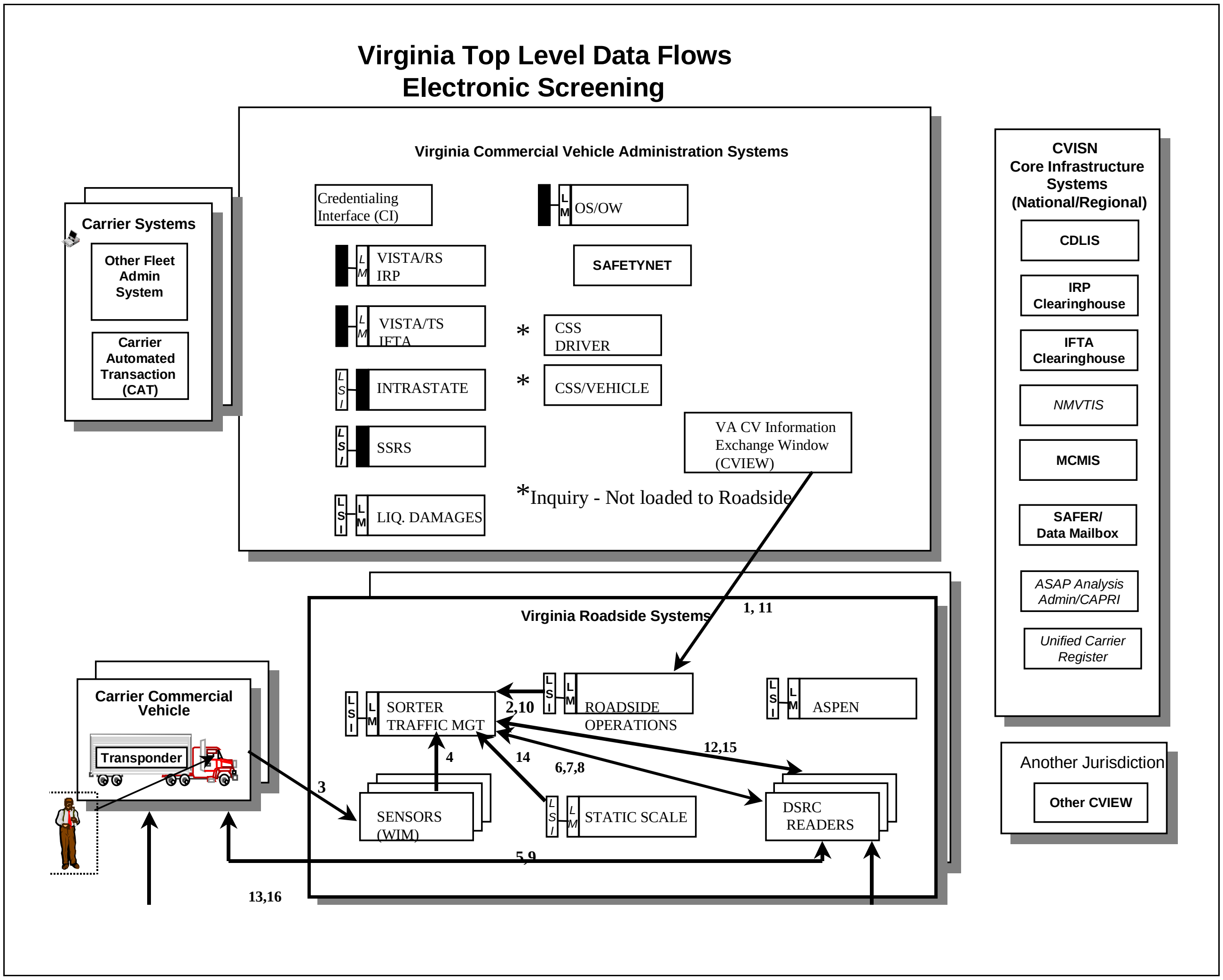

Figure 8–8. Virginia Electronic Screening Design

8.10 Washington

Highlights of Washington's electronic screening modifications and planned or existing capabilities include:

- Installed Screening Server and software at Ridgefield (Port of Entry)
  - Communications software between WIM and Screening Server
  - Installed screening routine software
  - Installed screening results application (modified ROC)
- Installed Screening Server at WSDOT headquarters
- Installed WEB Server at WSDOT headquarters
- Created interfaces to Department of Licensing (DOL) vehicle registration system (VRS) and Washington State Patrol (WSP) Safetynet

- Obtained and installed Oregon vehicle data on WSDOT headquarters Screening Server
- Obtained IRP information from Lockheed and installed on WSDOT headquarters Screening Server
- Obtained IFTA information from Lockheed and installed on WSDOT headquarters Screening Server
- Put together LAN at Ridgefield with connection to WSDOT WAN
- Established mailbox at SAFER and installed safety information on Screening Server
- Developed Transponder Administrator contract and used transponder ID at roadside for screening

Figure 8–9 shows Washington's approach to electronic screening.

Washington used:
Microsoft NT Server
Windows Based Applications
in VB6 and C++6
MS SQL Database

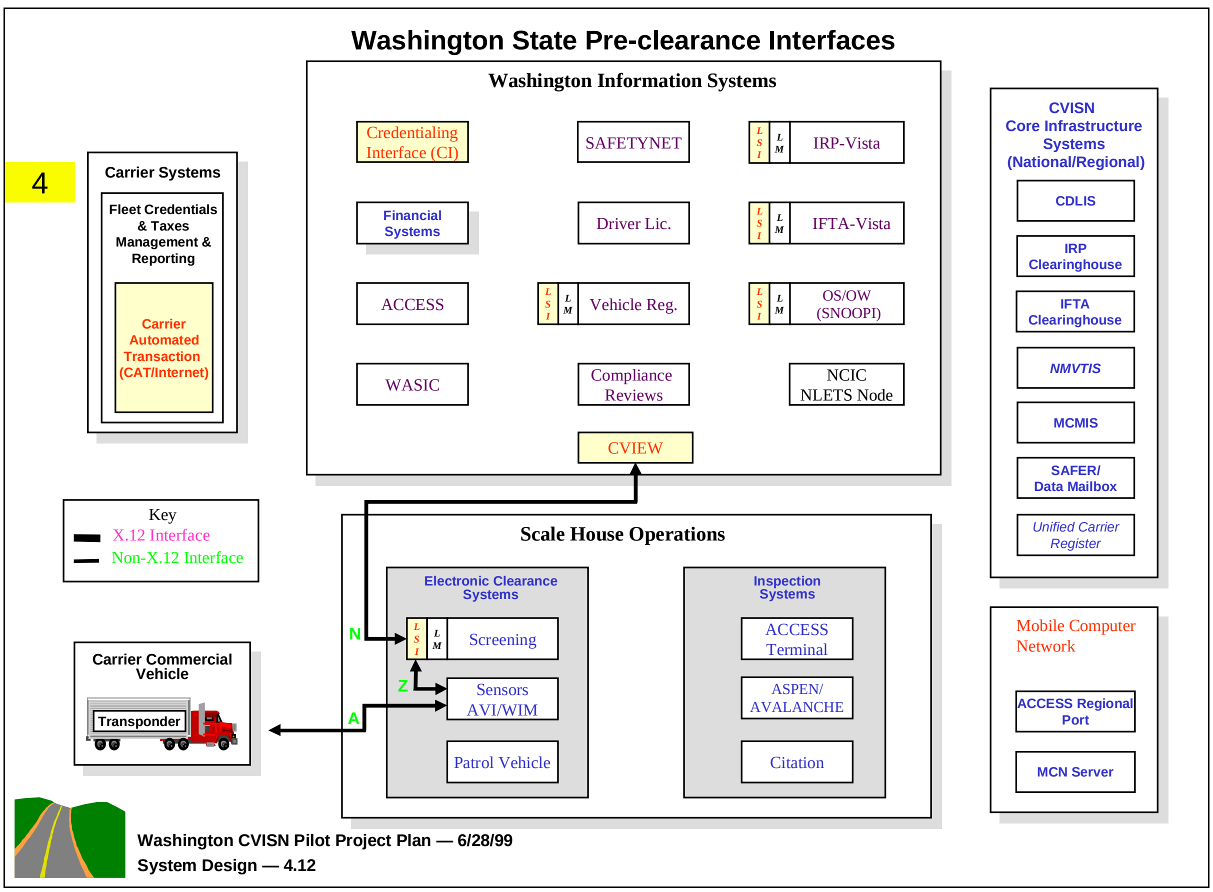

Figure 8–9. Washington Electronic Screening Design

More information about the Washington CVISN project can be found at
ftp.CVISN.WSDOT.WA.Gov
Please note: this is a secured site and you will need a user id and password for access. Call Anne Cline, CVISN Project Coordinator, at (360) 705-7341 for a user id and password.

9 INTEROPERABILITY ISSUES/STATUS

USDOT has a goal of achieving national interoperability between electronic screening systems. Realizing this goal will promote seamless and safer movements, equitable treatment, increased productivity and uniform enforcement for the motor carrier community. Congress strongly supports the theme of interoperability in TEA-21. Section 5206(a)(2), “Interoperability and Efficiency”, states that “to the maximum extent practicable, the national architecture shall promote interoperability among, and efficiency of, ITS technologies implemented throughout the U.S.”

Statements of principle are being used to document fundamental concepts and guidelines supported by the CVO community. The ITS America (ITSA) CVO Technical Committee has adopted a set of interoperability guiding principles related to ITS for CVO, which includes electronic screening. The committee, with representatives from most CVO stakeholder groups, developed the principles in recognition of the importance of promoting interoperability in the implementation of ITS for CVO. More information can be found at the ITSA website: http://www.itsa.org/.

The ITSA CVO Technical Committee has also adopted the Fair Information Principles for ITS CVO. These principles were developed in recognition of the importance of protecting individual privacy in implementing ITS for CVO.

JHU/APL is conducting a technical E-screening interoperability demonstration in four key states: VA (CVISN Prototype), KY (NorPass/Advantage CVO), WA (NorPass/MAPS) and CA (HELP PrePass™). The objective of the test is to demonstrate the feasibility of national E-screening interoperability with a single transponder, using SAFER snapshots as the common source of data. The demonstration is scheduled for completion in late 1999.

9.1 ITS/CVO Interoperability Guiding Principles

The ITS/CVO Interoperability Guiding Principles (Reference 10) represent a composite of multiple electronic screening interoperability resolutions passed by various organizations including: AASHTO, WASHTO, SASHTO, HELP PrePass™, I-95 Corridor Coalition, Advantage CVO and MAPS. The principles expressed in these resolutions were similar and used as the basis for the ITS/CVO document. The ITSA CVO Technical Committee included members from all of these organizations, and many who were involved in drafting the original resolutions.

The ITS/CVO Interoperability Guiding Principles are organized into the following five categories:

- General
- Hardware – issues related to the interoperability of DSRC devices and other roadside equipment used for electronic screening, toll collection and other activities.

- Systems/Software – issues related to the interoperability of ITS/CVO software, information systems, and networks for the electronic interchange of data among motor carriers, states and third-party service providers.
- Operations – issues related to the consistency of ITS/CVO operating procedures and criteria for weight enforcement, safety screening, and other activities.
- Program – issues related to the compatibility of ITS/CVO programs with respect to enrollment eligibility, pricing and data access.

The ITS/CVO Interoperability Guiding Principles are listed below.

9.1.1 General

IGP #1: The CVO community will work to implement interoperable ITS/CVO systems in all United States jurisdictions.

IGP #2: The CVO community will work with the CVO communities in Canada and Mexico to implement interoperable ITS/CVO systems throughout North America.

IGP #3: The CVO community will work to ensure that ITS/CVO systems, where appropriate, are interoperable with other ITS systems (e.g., electronic toll systems).

IGP #4: Interoperable ITS/CVO systems will be achieved through the development, adoption, and adherence to common standards for hardware, systems/software, operations, and program administration.

IGP #5: Each jurisdiction will support the national ITS/CVO information system architecture and data exchange standards developed under the Commercial Vehicle Information Systems and Networks (CVISN) program.

IGP #6: *Transponders shall have a unique identifier.* DSRC equipment vendors have voluntarily kept transponder identifiers unique. At this time, there is no organization responsible for overseeing the process of assigning transponder IDs to manufacturers.

IGP #7: Information systems supporting electronic screening, credentials administration, and safety assurance will use:
7a. US DOT numbers for the identification of both interstate and intrastate motor carriers.
7b. Commercial Drivers License (CDL) numbers for the identification of commercial drivers.
7c. Vehicle Identification Numbers (VIN) and license plate numbers for the identification of power units.

9.1.2 Hardware

IGP #8: Commercial vehicle operators will be able to use one transponder for power unit-to-roadside communications in support of multiple applications including electronic screening, safety assurance, fleet and asset management, tolls, parking, and other transaction processes. This principle represents the long-term goal of the USDOT and the commercial vehicle community. The DSRC transponders currently used in electronic screening use different communications protocols than used in ETC systems.

IGP #9: Public and public-private DSRC applications will support open standards that are consistent with the national ITS architecture.

9.1.3 Systems/Software

IGP #10: Public and public-private organizations will support open data exchange standards for the state-state, state-federal, state-provincial, and carrier-agency exchange of safety and credentials information as described in the national ITS architecture.

9.1.4 Operations

IGP #11: Jurisdictions will support common standards for placement of DSRC transponders on trucks and buses to ensure the safe and cost-effective use of transponders. The Society of Automotive Engineers (SAE) is attempting to develop standards that will include guidelines for transponder mounting.

IGP #12: Jurisdictions will support a common set of recommended practices concerning the selection, layout, and signage of roadside screening sites (i.e., weigh stations, ports-of-entry, international border crossings, and temporary inspection sites) to ensure safe operations. A comprehensive document covering these subjects does not exist.

IGP #13: Jurisdictions will support a common performance standard for roadside electronic enforcement screening and passage of transponder-equipped motor carriers to ensure equity in enforcement. CVSA has made the following recommendation for minimum safety standards based on SafeStat categories: Motor carriers identified in SafeStat categories -
"A through F" are ineligible to benefit from electronic clearance programs.
"G through H" are eligible to benefit from electronic clearance programs.
"I" may be eligible to benefit from electronic clearance programs at the discretion of individual jurisdictions while CVSA continues its review.

IGP #14: Roadside electronic enforcement screening criteria will include the following: motor carriers must be enrolled in the jurisdiction's program; must meet the jurisdiction's enrollment criteria; and must meet all legal requirements established by the jurisdiction.

IGP #15: Jurisdictions will support quarterly reviews of carrier qualifications to ensure that the standards evolve to meet the changing needs of government and motor carriers.

IGP #16: A jurisdiction will not retain the identification codes or other data from the DSRC transponders of passing motor carriers who are not enrolled in the jurisdiction's program.

IGP #17: *Jurisdictions will support a common performance standard for selection of vehicles and drivers for roadside safety inspection.*

IGP #18: *Jurisdictions will support a common performance standard for recording and reporting roadside safety inspection results.*

IGP #19: *Jurisdictions will support a common performance standard for reconciling disputed roadside safety inspection results.*

9.1.5 Program

IGP #20: Motor carrier participation in ITS/CVO roadside electronic screening programs will be voluntary; motor carriers will not be required to purchase or operate DSRC transponders.

IGP #21: Motor carriers will have the option of enrolling in any ITS/CVO roadside electronic screening program.

IGP #22: Jurisdictions will support uniform criteria for enrollment of motor carriers in ITS/CVO roadside screening programs. CVSA has made a recommendation for minimum enrollment standards based on SafeStat categories.

IGP #23: Enrollment criteria will include consideration of safety performance and credentials status (e.g., registration, fuel and highway use taxes, and insurance).

IGP #24: No jurisdiction will be required to enroll motor carriers that do not meet the criteria for enrollment.

IGP #25: Motor carriers may obtain a DSRC transponder from the enrolling jurisdiction or a compatible DSRC transponder from an independent equipment vendor of the motor carrier's choice.

IGP #26: Each jurisdiction will determine the price and payment procedures, if any, for motor carriers to enroll and participate in its ITS/CVO electronic screening program.

IGP #27: Jurisdictions shall work to establish business interoperability agreements among roadside electronic screening programs. The two largest programs, HELP PrePass and NorPass, are conducting interoperability discussions.

IGP #28: A jurisdiction will make a motor carrier's DSRC transponder unique identifier available to another jurisdiction upon written request and authorization by the motor carrier.

IGP #29: Jurisdictions will work toward development of a single point of contact for motor carriers enrolling in more than one ITS/CVO roadside screening program.

IGP #30: Each jurisdiction will fully disclose and publish its practices and policies governing, at a minimum:

30a. Enrollment criteria;
30b. Transponder unique identifier standards;
30c. Price and payment procedures for transponders and services;
30d. Screening standards;
30e. Use of screening event data; and
30f. Business interoperability agreements with other programs.

9.2 Fair Information Principles for ITS/CVO

The Fair Information Principles for ITS/CVO (Reference 11) address the key issues associated with the privacy of commercial vehicle information collected through the use of ITS technologies. Concerns about data privacy and control are perceived by some as a major impediment to motor carrier participation in ITS/CVO projects. The Fair Information Principles are:

FIP #1: Privacy *- The reasonable expectation of privacy regarding access to and use of personal information should be assured. The parties must be reasonable in collecting data and protecting the confidentiality of that data.*

FIP #2: Integrity *-Information should be protected from improper alteration or improper destruction.*

FIP #3: Quality *- Information shall be accurate, up-to-date, and relevant for the purposes for which it is provided and used.*

FIP #4: Minimization *- Only the minimum amount of relevant information necessary for ITS applications shall be collected; data shall be retained for the minimum possible amount of time.*

FIP #5: Accountability *- Access to data shall be controlled and tracked; civil and criminal sanctions should be imposed for improper access, manipulation, or disclosure, as well as for knowledge of such actions by others.*

FIP #6: Visibility *- There shall be disclosure to the information providers of what data are being collected, how they are collected, who has access to the data, and how the data will be used.*

FIP #7: Anonymity *- Data shall not be collected with individual driver identifying information, to the extent possible.*

FIP #8: Design *- Security should be designed into systems from the beginning, at a system architecture level.*

FIP #9: Technology - *Data encryption and other security technologies shall be used to make data worthless to unauthorized users.*

FIP #10: Use - *Data collected through ITS applications should be used only for the purposes that were publicly disclosed.*

FIP #11: Secondary Use - *Data collected by the private sector for its own purposes through a voluntary investment in technology should not be used for enforcement purposes without the carrier's consent.*

10 LESSONS LEARNED – ELECTRONIC SCREENING

This chapter contains "lessons learned" in the area of electronic screening. Specifically, the states were asked to respond to the following questions:

- What you did right that you'd recommend to other states.
- What you didn't do that you wish you had.
- What issues you wish you could have settled earlier.
- What requirements turned out to be key drivers for design.
- What design choices you considered and rejected/chose and why, etc.

10.1 Lessons Learned – California

- What you did right that you'd recommend some other state repeat?
  - Agreed to the concept that CVISN required a multi-agency and industry effort.
  - Approved over 100 carriers who volunteered to participate in this demonstration project either directly, through agents, or through leasing companies.
  - Established an industry advisory council early in the project.

- What you didn't do that you wish you had?
  - Seek federal funding through earmarks for funds committed.
  - State teams attending the workshops should demand significant break out sessions for open state interaction.
  - Be proactive in discussing multi-state development contracts to minimize cost.

- What issues you wish you could have settled earlier?
  - Finalize and encumber all federal funds early in the project, rather than on a year-by-year basis.

- What requirements turned out to be the key drivers for design?
  - Development of the interfaces to all legacy systems in their native mode rather than EDI.
  - Combining the CI/CVIEW functionality into a single computer platform.

- What design choices you considered and rejected/chose and why, etc.?
  - Choosing to produce final documents versus temporary documents as requested by the industry.

10.2 Lessons Learned – Colorado

- Colorado was using transponders and clearing vehicles at mainline speed before it became a popular option. The lesson there is that it can be done internally with state resources, if a state desires to do it this way.
- The increasing commercial vehicle traffic is making it necessary to either clear a vehicle at mainline speeds or to begin doing a random sampling of this population. It will become physically impossible to stop and clear each vehicle in the very near future.
- Cooperation between the vendors in transponder interoperability is slow at best. Something must be done on a national level to insure that any vehicle, using any transponder issued by the competing vendors, can clear your site without an undue burden on the state or the carrier.
- Minimum bypass criteria needs to be standardized among the states in order to ensure that each any transpondered vehicle will have met the requirements of each state they wish to travel in. No sense getting into the vendor brouhaha (above) unless the states can agree to this.

10.3 Lessons Learned – Connecticut

No information was available from Connecticut at the time of publication of this document.

10.4 Lessons Learned – Kentucky

- What you did right:
  - Transponder distribution needs dedicated marketing group and/or personnel to market overall program.
  - The technology works.
  - In order for public agencies to benefit from electronic screening, high participation levels are required. Thus marketing and outreach must be emphasized.
  - States must deal with the “chicken and egg” syndrome. Truckers are waiting for expanded deployment. States are waiting on increased trucker participation. States wishing to lead must demonstrate a high level of commitment by deploying first and allowing the trucker participation to grow in response.
  - Electronic screening is truly just a mainline sorting function. It should not be made more complex than necessary.
  - After initial skepticism, support by enforcement personnel is very high.
  - Truckers who use the system are very pleased with it.

- Issues and considerations include:
  - Costs tend to increase dramatically.
  - Interoperability is needed across jurisdictional and functional lines.
  - The lack of multiple vendors for the technology is a concern.
  - States need availability of a turnkey system (ideally, from more than one vendor) that is non-proprietary and integrated with CVISN. While Kentucky is developing such a system, it is not yet available as a turnkey product.

10.5 Lessons Learned – Maryland

10.6 Lessons Learned – Michigan

In summary, Michigan has found that proper staffing and a strong commitment at the very beginning can avoid many pitfalls and lead to a much smoother project.

10.7 Lessons Learned – Minnesota

No information was available from Minnesota at the time of publication of this document.

10.8 Lessons Learned – Oregon

No information was available from Oregon at the time of publication of this document.

10.9 Lessons Learned – Virginia

- What went right:
  - Developed a collaborative roadside screening algorithm representing industry, operations, and technical interests in advance of development.
  - Employed enforcement personnel with computer knowledge to test equipment prior to deployment.
  - Trained enforcement personnel with knowledgeable peers using a tiered approach.
- What issues should have been settled earlier:
  - Adopt DSRC standards for transponder interoperability.

10.10 Lessons Learned – Washington

- What we did right:
  - All partners (Enforcement Officers, Trucking Association members, and state agencies) were involved at the start.
    Example: Early in the project we partnered with the Washington Trucking Associations without any clue as to the importance of that decision. Our intent was noble, in that we thought we wanted them on board so they could "see what we were going to do for (to) them"! In actuality, they become our biggest asset in terms of "insider information" (finding out what really will and will not work) and lobbying for funding. They were the folks that eventually sold CVISN to our state legislators.
  - Established weekly meetings for information exchange and open agenda.
    Example: We conducted team meetings once a week (every Thursday morning) that lasted from 1 – 3 hours long. Rule number one…an open agenda with everybody speaking their minds. These meetings proved to be most productive in terms of good communications, sharing ideas and workloads, and sharing lessons learned. Management representatives from various state agencies dropped into these meetings to find out what was going on. They quite often raved about the process and results. We would also conference the vendors/consultants into these meetings.
  - Upgraded Port of Entry and scalehouse equipment
    18.3" flat screen monitor
    400mhz Pentiums
    Upgraded permit computers
    Provided LAN at the scale house
    Example: We bought the best equipment possible for use by the scale house enforcement officers. Not only did it look good to the public, but also it instilled a since of pride in the officers, who became our ambassadors of good will. Also, by buying the state of art, our agency IS folks were "thrilled" to work with the installation of new toys and creating the LAN/WAN.
  - Chose an experienced vendor
- Wish list:
  - Provide plenty of time (more than you'll ever think you'll need!).
    Example: We opted for an aggressive schedule, knowing that up front we couldn't pull it off unless we got lucky. We set an aggressive schedule because we wanted to showcase the CVISN concept during legislative session. We made our deadline, but will have to come back and do a lot of polishing. In retrospect, I am glad we pushed because I think we would have taken the easy way out on some issues…like waiting for some other states to develop some components. In this manner we develop a product that the legislature could see, touch and feel. As a result, they funded us for another two years!
  - Investigate options such as Thin Client
  - Subcontracting creates communication/schedule/specification problems.
    Example: The more subs involved, the harder it was to control the deliverables/time frames. It was frustrating to have one vendor hold up the others. This is a real life hurdle!
  - SAFER inspection data is not current enough for effective screening.
    Example: We found that the JHU/APL model (which had us going to MCMIS) for SAFER/safety information isn't current enough for enforcement use. The officers want to be able to see information from their own, and adjoining states, SAFTEYNET database. They also want to be able to directly input out of service data and corrections to out of service data for use by the officers at the next (upstream) scale house.

- Key drivers for design:
  - Internal support and expertise and infrastructure
  - Agency standards dictate use of Microsoft NT Server; Windows Based Applications in VB6 and C++6 and MS SQL Database
  - Existing WIM computer
    Example: We already had a WIM installed without an AVI. After installing AVI, we had to interface with the WIM computer, and will eventually do away the WIM server. It just slows the process down.
- Design choices considered/rejected:
  - Agency standards did not allow for the use of JHU/APL ROC and CVIEW. Developed own and modeled our ROC and CVIEW after JHU/APL's.
    Example: We want to make use of the Internet and realize that JHU does not mention that in their architecture. We think increasing use of the Internet will enhance CVISN and interoperability. When JHU reviews our system, we will discuss this notion in more detail.
  - Another concern is that the early CVISN model did not take into account that some one had to issue transponders to the trucking community. This has taken on an entirely new avenue that bears plenty of discussion with new CVISN states. We contracted with a vendor to market and sell transponders, which has been a good thing, but it would have been terrible if there were no experienced vendors available.

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APPENDIX A.

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APPENDIX B.

OPERATIONAL SCENARIOS AND FUNCTIONAL THREAD DIAGRAMS

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Operational Scenarios and Functional Thread Diagrams

- An “operational scenario” is a description of how a state intends that their customers and the state, or the state and core infrastructure systems should interact to accomplish key CVISN functions. An example was given in chapter 4. More examples are provided here.
- The operational scenario is shown as a list of sequential steps. To differentiate between different time schedules, numbers are used to show the interaction between the applicant and the state, and the state’s update of snapshots. Those interactions occur as soon as possible after the initial application is received by the state. Letters are used to show the state’s connections to the clearinghouses, since that occurs at a regular period instead of being triggered immediately by the carrier’s actions.
- Each operational scenario is illustrated by overlaying information onto the state system design template. The lines represent data flow between products, with arrows indicating the direction of flow. Each line is labeled with a number or letter. The complete set of lines constitutes a thread of activities that accomplish a function. Hence, the diagram is called a “functional thread diagram.”
- This appendix provides examples of operational scenarios and functional thread diagrams. They are included for reference, and as starting points for states that plan to implement similar processes.

CVISN Level 1 Electronic Screening Key Operational Scenarios

- **Electronic Screening Enrollment**
  - ***Example 1:*** Operational Scenario: Carrier submits Electronic Screening Applications to a Carrier Automated Transaction (CAT)
  - ***Example 2:*** Operational Scenario: Electronic Screening Administrator Handles Enrollment Function

- **Screen Vehicles electronically at a weigh/inspection site, using snapshot data**
  - ***Example 3:*** Operational Scenario: States using the HELP PrePass system
  - ***Example 4:*** Operational Scenario: States using the NorPass system

Example 1 Operational Scenario: Electronic Screening Enrollment

Carrier submits Electronic Screening Applications to a CAT

Note: Prior to enrolling, the carrier will examine the electronic screening policy disclosures of the states in which it operates and determines where it would like to participate in electronic screening.

1. The carrier submits Electronic Screening Applications, via a Carrier Automated Transaction (CAT) system which submits it to the Enrollment Agent State's Credentialing Interface (CI), via an EDI X12 TS 286. Using the CAT, the carrier may perform any of the following functions. The input required for each function is also listed.

   - Carrier Enroll request: Carrier ID, participating request, other state required data.
   - Vehicle enroll request: Carrier ID, Vehicle ID (VIN), Transponder ID, participation requests, other state-required data.
   - Add/update carrier supplemental: Carrier ID, Vehicle ID (VIN), Transponder ID, participation requests, other state-required data.
   - Transponder ID, participation requests, other state-required data.
   - Status query

   Note: The state in which the carrier enrolls is referred to as the Enrollment Agent State, and the other states that the carrier enrolls to participate in are referred to as Additional E-Screening States.

Example 1 Operational Scenario: Electronic Screening Enrollment

Carrier submits Electronic Screening Applications to a CAT

2. The Enrollment Agent State CI will check for existing carrier and vehicle snapshots (This process assumes that these snapshots exist, based on prior vehicle registration). The CI queries the Enrollment Agent State CVIEW for a carrier and vehicle snapshot, via an EDI X12 TS 285.
3. CVIEW passes the carrier and vehicle snapshot to the CI, via EDI X12 TS 285.

   Note: If snapshots do not exist, the enrollment request will be rejected and the CI sends an EDI X12 TS 286 to the CAT. The carrier is required to perform vehicle registration prior to E-screening enrollment.
4. The Enrollment Agent State CI stores the enrollment request data and is the authoritative source for this information. The CI processes the request and sends carrier and vehicle snapshot segment updates to CVIEW, via an EDI X12 TS 285. These segment updates modify the E-screening participation fields in the affected snapshots.
5. If the request includes carrier participation in the Enrollment Agent State's E-screening program, CVIEW forwards the carrier snapshot to the E-Screening Enrollment system, via an EDI X12 TS 285.

Example 1 Operational Scenario: Electronic Screening Enrollment

Carrier submits Electronic Screening Applications to a CAT

6. The state either approves or disapproves carrier's participation in this state's E-screening program. The E-Screening Enrollment system is the authoritative source for the state acceptance decision. The Enrollment Agent State's decision is transmitted to CVIEW as a carrier snapshot segment update, via an EDI X12 TS 285.

   Note: The state may choose to contact the carrier for reasons such as

   - Set up a billing account
   - Sign agreements or documents
   - Obtain additional information

7. The Enrollment Agent State CVIEW sends carrier and vehicle snapshot segment updates to the Roadside Operations system, via EDI X12 TS 285. Snapshots are used at the roadside when making the bypass/pull-in decision.
8. The Enrollment Agent State CVIEW sends carrier and vehicle snapshot segment updates to SAFER, via EDI X12 TS 285. These updates include the participation request data and Enrollment Agent State acceptance decision.
9. SAFER sends the carrier and vehicle snapshot segment updates to Additional E-Screening state CVIEWs, via EDI X12 TS 285. Transponder ID information is passed only to states where the Carrier has requested participation.

Example 1 Operational Scenario: Electronic Screening Enrollment

Carrier submits Electronic Screening Applications to a CAT

A. The Additional E-Screening State CVIEW forwards the carrier snapshot to the E-Screening Enrollment system, via an EDI X12 TS 285.

B. The Additional E-Screening State Enrollment system processes the request and either approves or disapproves the Carrier's participation. The E-Screening Enrollment system transmits the state's decision to CVIEW as a carrier snapshot segment update, via an EDI X12 TS 285.

C. The Additional E-Screening State CVIEW sends carrier and vehicle snapshot segment updates to the Roadside Operations system, via EDI X12 TS 285. Snapshots are used at the roadside when making the bypass/pull-in decision.

D. The Additional E-Screening State CVIEW sends carrier and vehicle snapshot segment updates to SAFER, via EDI X12 TS 285. These updates contain the acceptance decisions.

E. SAFER sends the carrier and vehicle snapshot segment updates to the Enrollment Agent State CVIEW, via EDI X12 TS 285.

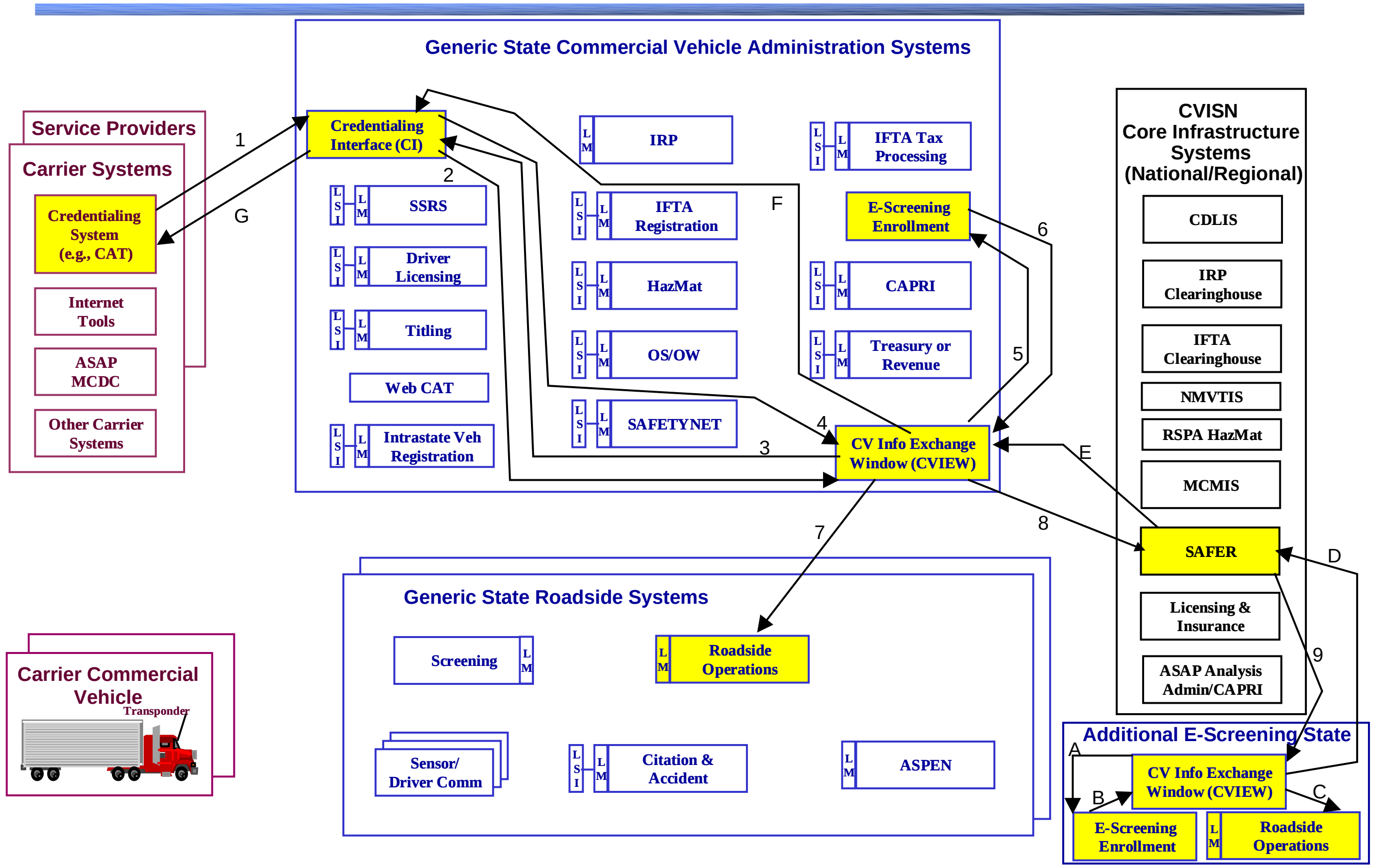
F. The Enrollment Agent State CVIEW sends the carrier and vehicle snapshot segment updates to the CI, via EDI X12 TS 285.

G. Enrollment Agent State CI passes acceptance status to CAT, via EDI X12 TS 286.

   Note: Multiple TS 286 messages may be transmitted at various times as each state modifies its acceptance decision.

Example 1 Functional Thread Diagram: Electronic Screening Enrollment

Carrier submits Electronic Screening Applications to a CAT



Example 2 Operational Scenario: Electronic Screening Enrollment

Electronic Screening Administrator Handles Enrollment Function

Note: Prior to enrolling, the carrier will examine the electronic screening policy disclosures of the states in which it operates and determines where it would like to participate in electronic screening.

1. The carrier contacts the Electronic Screening Administrator for the Enrollment Agent State and manually submits applications to perform any of the following functions. The input required for each function is also listed.

    - Carrier Enroll request: Carrier ID, participating request, other state required data.
    - Vehicle enroll request: Carrier ID, Vehicle ID (VIN), Transponder ID, participation requests, other state-required data.
    - Add/update carrier supplemental: Carrier ID, Vehicle ID (VIV), Transponder ID, participation requests, other state-required data.
    - Transponder ID, participation requests, other state-required data.
    - Status query

    Note: The state in which the carrier enrolls is referred to as the Enrollment Agent State, and other states that the carrier enrolls to participate in are referred to as Additional E-Screening States.

Example 2 Operational Scenario: Electronic Screening Enrollment

Electronic Screening Administrator Handles Enrollment Function

2. The Electronic Screening Enrollment administrator processes the request and performs enrollment criteria checks and data verification. The carrier application is either approved or disapproved, based on the state's enrollment criteria. Note: The carrier is required to perform vehicle registration prior to E-screening enrollment.

   The Electronic Screening Enrollment administrator sends carrier and vehicle snapshot segment updates to CVIEW, via an EDI X12 TS 285. These segment updates modify the E-screening participation fields and the Enrollment State's decision in the affected snapshots.

3. The Enrollment Agent State CVIEW sends carrier and vehicle snapshot segment updates to the Roadside Operations system, via EDI X12 TS 285. Snapshots are used at the roadside when making the bypass/pull-in decision.

Example 2 Operational Scenario: Electronic Screening Enrollment

Electronic Screening Administrator Handles Enrollment Function

4. The Enrollment Agent State CVIEW sends carrier and vehicle snapshot segment updates to SAFER, via EDI X12 TS 285. These updates include the participation request data and Enrollment Agent State acceptance decision.
5. SAFER sends the carrier and vehicle snapshot segment updates to Additional E-Screening state CVIEWs, via EDI X12 TS 285. Transponder ID information is passed only to states where the Carrier has requested participation.

Example 2 Operational Scenario: Electronic Screening Enrollment

Electronic Screening Administrator Handles Enrollment Function

A. The Additional E-Screening State CVIEW forwards the carrier snapshot to the E-Screening Enrollment administrator, via an EDI X12 TS 285.

B. The Additional E-Screening State Enrollment administrator processes the request and either approves or disapproves the Carrier's participation. The E-Screening Enrollment system transmits the state's decision to CVIEW as a carrier snapshot segment update, via an EDI X12 TS 285.

C. The Additional E-Screening State CVIEW sends carrier and vehicle snapshot segment updates to the Roadside Operations system, via EDI X12 TS 285. Snapshots are used at the roadside when making the bypass/pull-in decision.

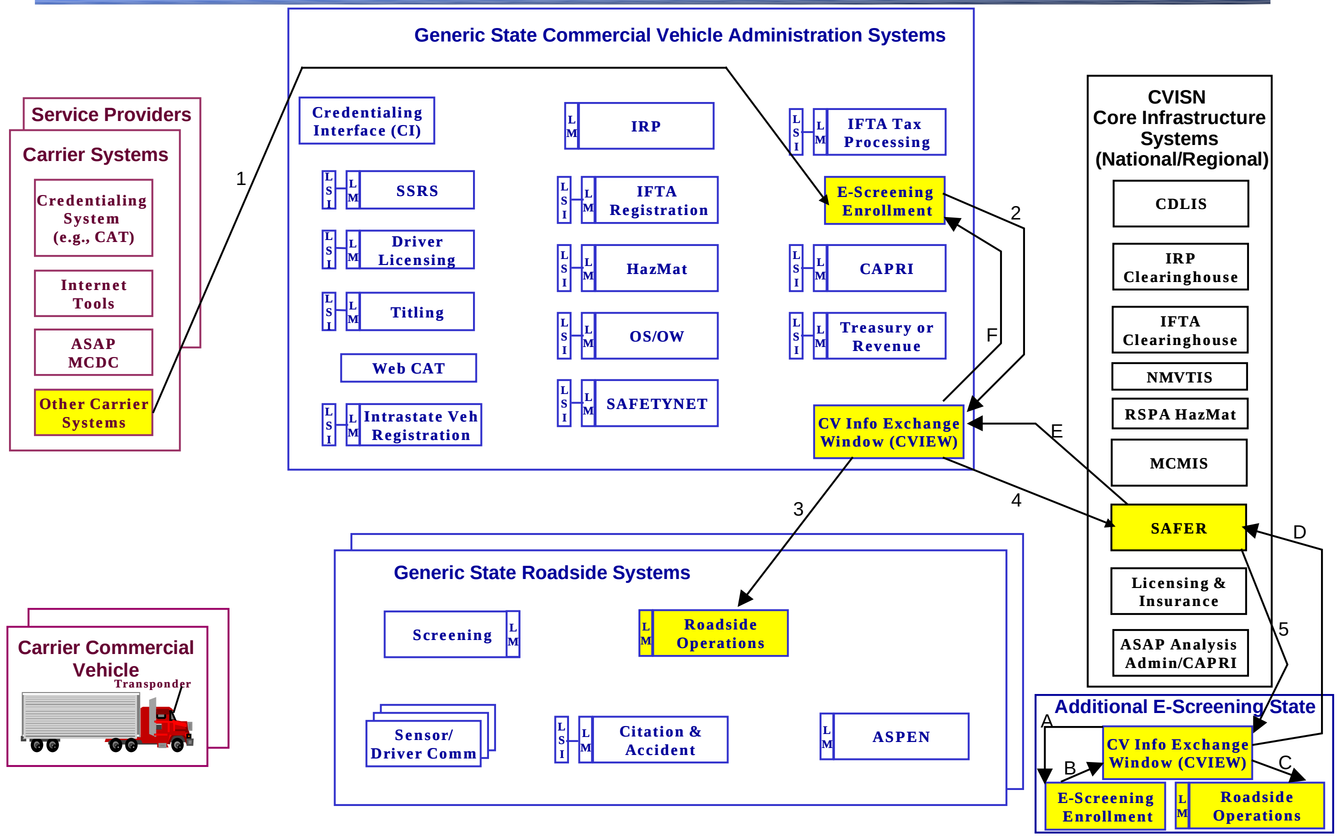
D. The Additional E-Screening State CVIEW sends carrier and vehicle snapshot segment updates to SAFER, via EDI X12 TS 285. These updates contain the acceptance decisions.

E. SAFER sends the carrier and vehicle snapshot segment updates to the Enrollment Agent State CVIEW, via EDI X12 TS 285.

F. Carrier and vehicle snapshots may be viewed by the Electronic Screening Enrollment administrator by performing queries against the Enrollment Agent State CVIEW. The query responses from CVIEW will be via EDI X12 TS 285.

Example 2 Functional Thread Diagram: Electronic Screening Enrollment

Electronic Screening Administrator Handles Enrollment Function



Example 3 Operational Scenario: Screen Vehicles electronically, using Snapshot data

States using the HELP PrePass system

Note: The following steps (1 - 4) occur in real time for each vehicle.

1. Transponder ID is transmitted from the Dedicated Short Range Communications (DSRC) transponder on board the Commercial Vehicle to the Sensor/Driver Communications interface using ASTM version 6.
2. A screening decision is made.
3. The screening decision is communicated back to the driver, again using the ASTM version 6 standards.
4. Screening information is communicated back to Roadside Operations for use by site staff. This may be a non-standard interface.

Example 3 Operational Scenario: Screen Vehicles electronically, using Snapshot data

States using the Prepass system

Note: The following steps (A - D) occur on a periodic basis to establish screening values for the site.

A. SAFER sends subscription updates to the state CVIEW for carrier and vehicle snapshots based on state-specified subscriptions, via EDI X12 TS 285.

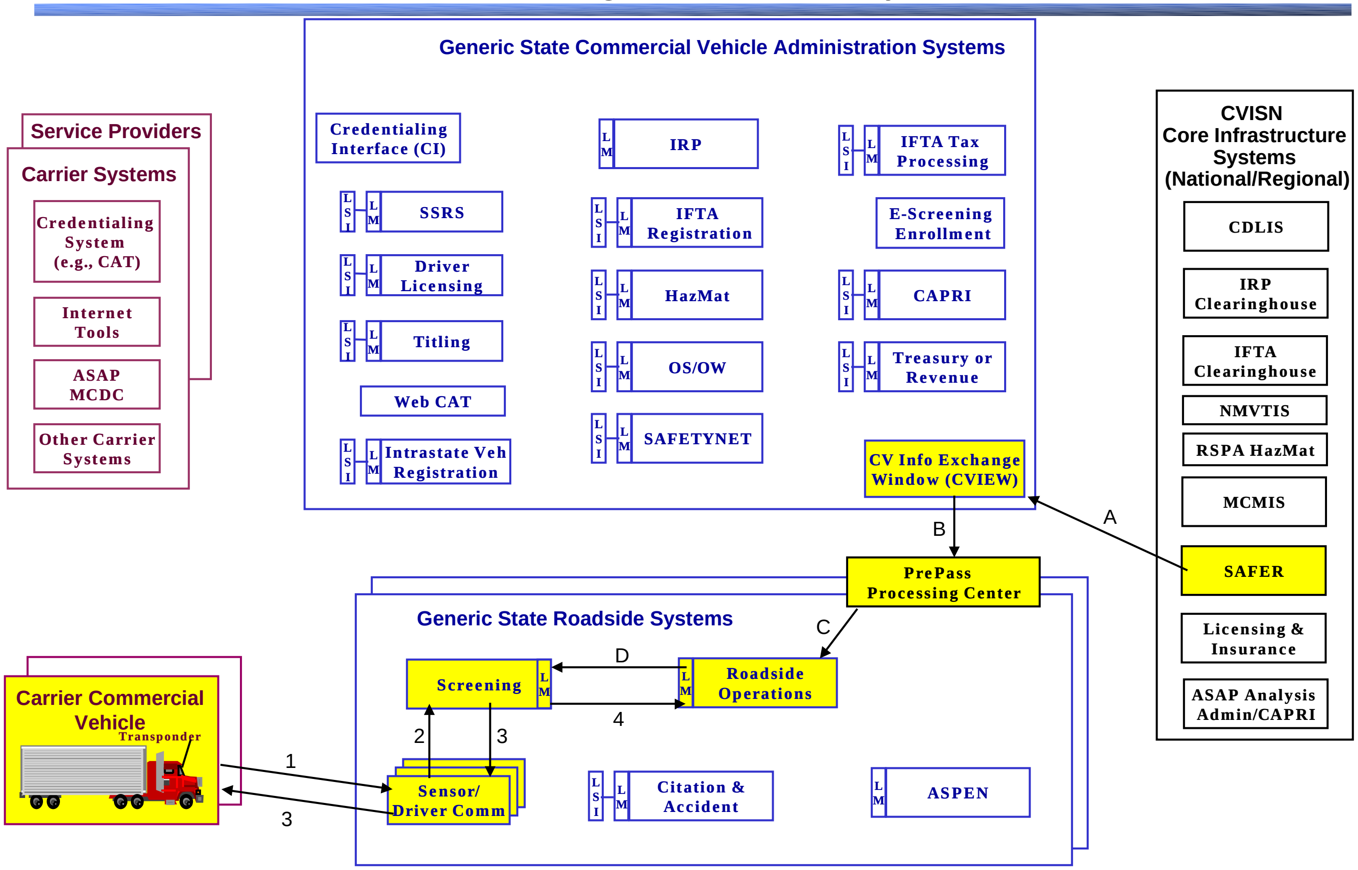
B. CVIEW distributes carrier and vehicle snapshots to the PrePass Processing Center.

C. The PrePass Processing Center distributes a Pre-clearance list to the roadside sites.

D. Enrolled vehicles are identified from the Pre-clearance list. The resulting carrier and vehicle specific screening "scores" or values are sent to the screening system. This is a local interface that is not subject to to standards.

Example 3 Functional Thread Diagram: Screen Vehicles electronically, using Snapshot data

States using the PrePass system



Example 4 Operational Scenario: Screen Vehicles electronically, using Snapshot data

States using the NorPass system

Note: The following steps (A - E) occur on a periodic basis to establish screening values for the site.

A. SAFER sends subscription updates to the state CVIEW for carrier and vehicle snapshots based on state-specified subscriptions, via EDI X12 TS 285.

B. The Credentialing Interface (CI) updates CVIEW with snapshot data for Intrastate carriers and vehicles, via EDI X12 TS 285.

C. CVIEW distributes carrier and vehicle snapshots to the Enrolled Vehicle List (EVL) Builder/Editor, via EDI X12 TS 285.

D. The EVL Builder/Editor generates an EVL from the CVIEW snapshot data and downloads the EVL to the roadside.

E. Enrolled vehicles are identified from the EVL. The resulting carrier and vehicle specific screening "scores" or values are sent to the screening system. This is a local interface that is not subject to standards.

Example 4 Operational Scenario: Screen Vehicles electronically, using Snapshot data

States using the NorPass system

Note: The following steps (1 - 4) occur in real time for each vehicle.

1. Transponder ID is transmitted from the Dedicated Short Range Communications (DSRC) transponder on board the Commercial Vehicle to the Sensor/Driver Communications interface using ASTM version 6.
2. A screening decision is made.
3. The screening decision is communicated back to the driver, again using the ASTM version 6 standards.
4. Screening information is communicated back to Roadside Operations for use by site staff. This may be a non-standard interface.

Example 4 Functional Thread Diagram: Screen Vehicles electronically, using Snapshot data

States using the NorPass system