LESSON 1: INTRODUCTION TO ITS/CVO

Course objectives

After completing this course, students should be able to:

- Discuss ITS applications to Commercial Vehicle Operations
- Explain the four broad program areas of the national ITS/CVO Program
    - Safety assurance
    - Credentials administration
    - Electronic screening
    - Carrier operations
- Describe the CVISN initiative
- Relate the CVISN deployment process

Objectives of ITS/CVO

CVO is an area in which public agencies interact closely with motor carriers to accomplish a wide range of activities including vehicle registration, fuel tax collection, driver and vehicle inspections, and hazardous materials routing. The idea behind the ITS/CVO program is to use ITS technologies to accomplish three broad objectives:

1. **Streamline** administrative procedures
2. **Improve** highway safety
3. **Increase** the productivity of the trucking and bus industries

CVO Issues and ITS Opportunities

In ITS we are not using technology just for the sake of technology. What we are really trying to do is to see how technology can help us solve our current **problems**, or help us enhance the **productivity** and **safety** of our system. So what problems are we trying to solve here?

Well, the ITS/CVO program addresses three broad problems:

- Difficulties in enforcement of safety and regulatory compliance
- Complexity of motor-carrier regulatory processes
- Increase in pressure to reduce costs while satisfying customers

We will start discussing these issues on the following screens.

Difficulties in enforcement of safety and regulatory compliance

Our current enforcement activities, unfortunately, cannot completely assure the compliance of motor carriers with safety, size and weight, and credentials regulations, or the safety of the nation's highways.

1

Current safety assurance activities are conducted in a random fashion -- in other words, they do not consistently target those carriers that pose the highest risk to the public. This is because roadside officials often lack timely access to information on a carrier's safety performance record.

2

2

Non-compliant carriers often evade the weigh stations and other fixed sites where the majority of inspections occur.

next

How can ITS help?

Building of information systems containing carrier safety data and provide enforcement officials with access to these data. We could also build decision-making tools to enable them to target high-risk carriers.

Use of portable inspection systems and vehicle identification technologies to make mobile enforcement more productive.

Use of automated vehicle screening technologies to enable safe and legal carriers to travel across multiple states with no more than one stop.

Complexity of motor-carrier regulatory processes; How can ITS Help?

- *One-stop shopping systems to simplify compliance requirements*
- *Streamlined regulatory operations through the increased use of computers and information systems*
- *Multistate clearinghouses to facilitate data and funds exchange*

Reduce costs while satisfying customers

The global economy of today is demanding changes in the ways we do business. Transporation providers are currently facing pressures to reduce costs and to pay increased attention to delivery time and customer satisfaction.

How can ITS help?

Vehicle tracking technologies and computer-aided dispatch and scheduling systems can help motor carriers reduce the cost and improve the reliability of long-distance freight transportation.

Onboard monitoring and roadside safety inspection technologies (we will discuss these later) can enhance the safety of drivers, vehicles and cargo.

Traffic management systems can reduce congestion delays for motor carriers, thereby reducing the costs of delivering goods and improving on-time performance.

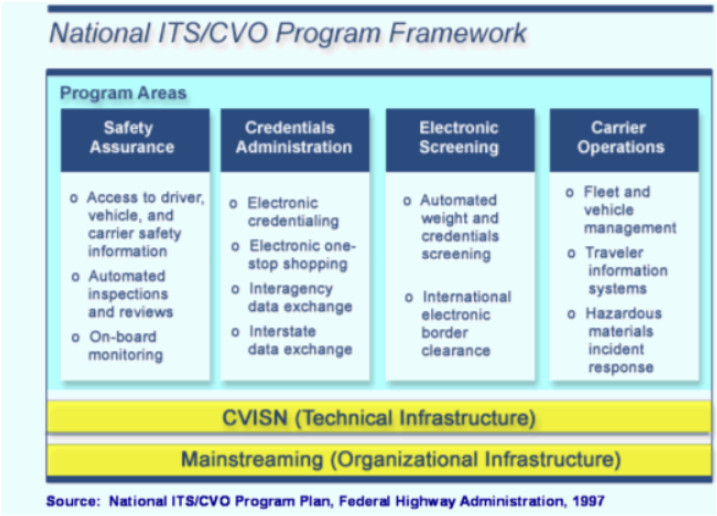
Efforts to streamline regulatory processes can reduce compliance costs for motor carriers.

The National ITS/CVO Program

The national ITS/CVO program was defined in order to achieve the three objectives described earlier, which have been grouped within four broad program areas:

1. Safety assurance
2. Credentials administration
3. Electronic screening
4. Carrier operations

The four program areas included in the National ITS/CVO program are illustrated below. These areas are supported by two initiatives, represented by the two yellow boxes at the bottom, and described on the next page.



The two ITS/CVO Program initiatives are:

Mouse over the name of the initiative to see a description.

CVISN Initiative

CVISN provides the technical architecture needed to link these projects and information systems. CVISN includes the development of common standards for electronic communications among the different agencies and carriers to ensure "interoperability."

Mainstreaming Initiative

The mainstreaming initiative, on the other hand, provides the organizational and institutional infrastructure needed to support the ITS/CVO. This initiative attempts to bring the different CVO stake-holders to the table and enable discussion and resolution of issues relating to the deployment of ITS/CVO systems and technologies.

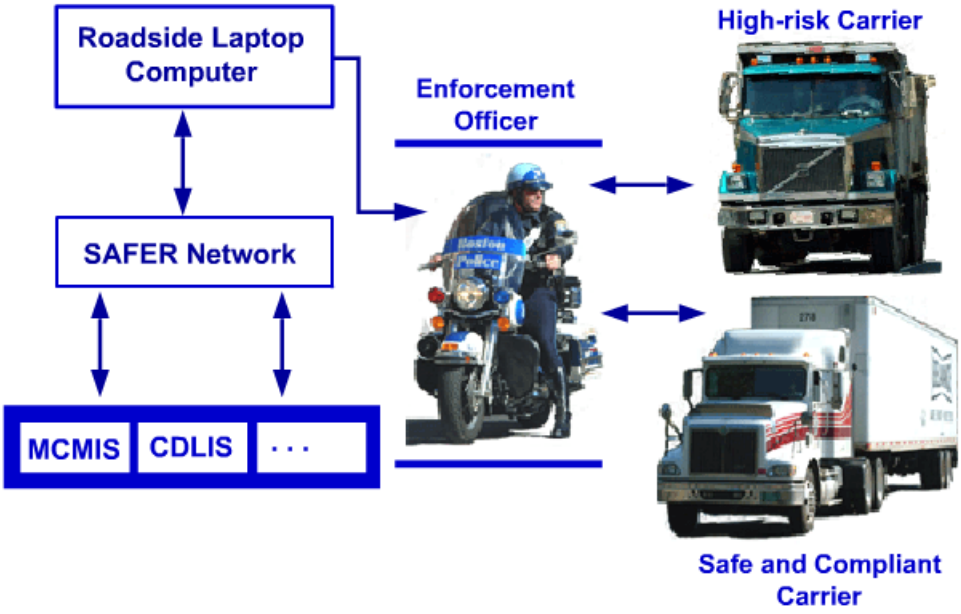
Let us now focus our attention on each of the four program areas and what they are trying to achieve.

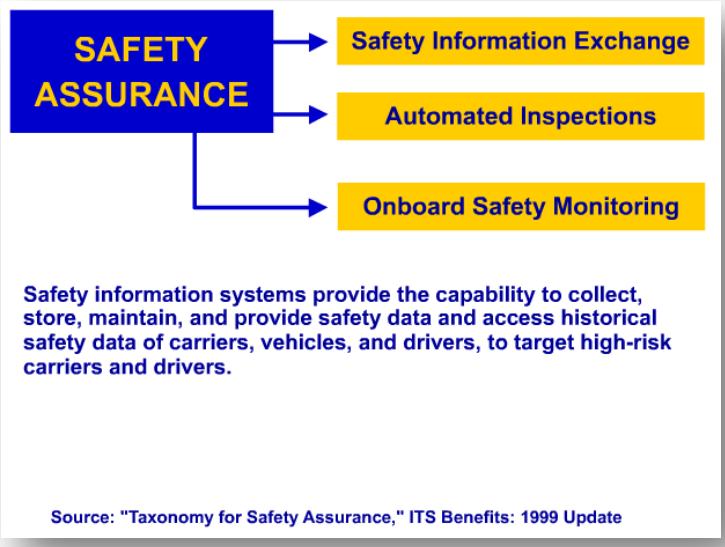
LESSON 2: SAFETY ASSURANCE

Safety Assurance

The first program area we will address is that of Safety Assurance. As its name indicates, this area revolves around programs and services designed to assure the safety of commercial drivers, vehicles and cargo. The graphic below illustrates the general operational concept of this area. We will learn about these elements on the following pages.

The objective of safety assurance projects is to improve highway safety.





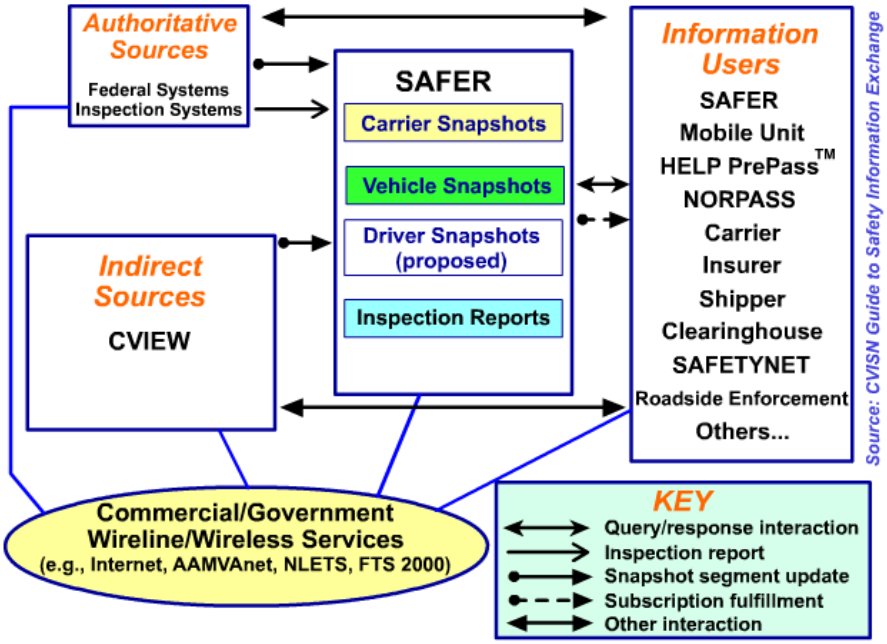
Safety Information Exchange (SAFER)

At the core of safety information exchange, as well as the overall Safety Assurance area, is a system called the Safety and Fitness Electronic Records (SAFER). This system provides access, from both fixed and mobile inspection stations, to the data residing within Federal and State motor-carrier safety information systems.

Using laptop computers, for example, enforcement officials could access this data, as well as enter inspection results. Decision-support tools that screen carriers for inspection based upon the SAFER data (i.e. to decide whether a particular vehicle should be inspected or not) have been developed.

SAFER is a Federal system that provides standardized carrier, vehicle, and driver (future) datasets containing safety and credentials information to authorized users via timely, electronic access. It provides users with summary reports ("snapshots") or detailed inspection reports. SAFER supports online query and response for snapshot and report information.

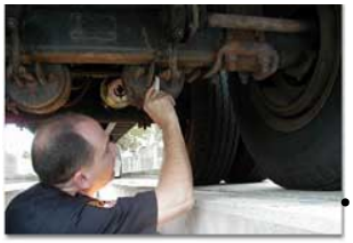
One of SAFER's primary objectives is to increase the efficiency and effectiveness of the inspection process at the roadside. The SAFER system provides carrier, vehicle, and driver safety and credentials information to fixed and mobile roadside inspection stations. This allows roadside inspectors to focus their efforts on high-risk operators, that is, selecting carriers and/or vehicles for inspection based on prior inspections and safety and credentials history.



Automated Roadside Safety Inspection

This service will enable the **automated** collection of roadside safety inspection data. This will allow inspectors to reduce the time needed to record results, and will enable results to be recorded more **accurately** and more **quickly** during a safety inspection performed **when a vehicle has pulled off** the highway at a fixed or mobile inspection station.

The results of the inspection can then be transmitted to the national safety data bases electronically. These capabilities will allow better and more accurate data about safety to be submitted to the SAFER system.



In turn, access to more accurate and timely information should allow safety inspectors to check **more** vehicles that are likely to have safety violations, thereby increasing safety compliance and reducing the number of accidents caused by poor commercial vehicle safety.

States have been testing and evaluating innovative devices for assessing vehicle safety performance, including brake testing technology in two categories:

- Infrared detectors detect wheel bearing temperature when brakes are not applied to detect worn wheel bearings; detect wheel drum temperature consistency when brakes are applied to detect proper brake application. Infrared brake detection permits faster screening of more vehicles, and the sensors see things the inspector might miss.
- Performance-based equipment quantitatively measures actual braking capability, whereas previous test methods measured physical characteristics and assumed resulting capabilities. Performance-based brake testing technologies include rolling dynamometers, flat plate testers, and breakaway torque testers.

Some technologies will also allow for checking steering and vehicle suspension systems performance without having to inspect the system manually. Moreover, the Sandia National Lab is experimenting with technologies that can be used to measure system performance rather than relying on manual measurements.

On-Board Safety Monitoring

The Safety Assurance area also includes the development and availability of advanced onboard safety monitoring systems to help drivers operate commercial vehicles more safely and effectively. The goal is to reduce crashes by helping drivers avoid errors such as following too close, unintended lane departures, and driving too fast in turns.

Examples of onboard safety monitoring systems include:

1. In-cab safety advisory system using a satellite-based location system and a map database to warn the truck driver when they are approaching a location with a high incidence of commercial vehicle crashes or other safety hazards.
2. Rollover prevention technology which is an in-cab device that indicates to the truck driver if there is a rollover risk for the vehicle and its load and provides feedback to the driver that will allow them to adjust their driving to a safer level.

These and other technologies are currently being used by motor carriers and evaluated. These technologies are shown on the following page.

Technology Truck

Sensing Systems

Onboard safety monitoring systems also include systems for sensing and collecting data on the condition of critical vehicle components such as brakes, tires, and lights, as well as the ability to determine thresholds for warning and countermeasures; for sensing shifts or unsafe conditions related to the cargo as the vehicle is moving; and for monitoring driving time and time-on-tasks. Some sensors already exist for monitoring vehicle systems, cargo temperature, and driver alertness.

Approaches to on-board driver identification and monitoring still need to be established. One approach involves monitoring steering movements to detect "drift-and-jerk" movements, which are indicative of driver's fatigue. Another approach involves the use of machine vision technologies to monitor driver/vehicle lateral position in relation to normal lane edge markings, and the processing of the data captured to detect excessive weaving or other aberrant patterns.

There are also efforts aiming at developing low-cost, unobtrusive psychological and physiological monitoring devices, including eye activity monitoring. These devices are based on the fact that excessive eye closure is an a priori indication of unsafe driving and driver's non-alertness.

Roadside Communication

After collecting information on the safety status of the vehicle, cargo and driver, the information will have to be compiled and transformed into a comprehensive output. This can easily be

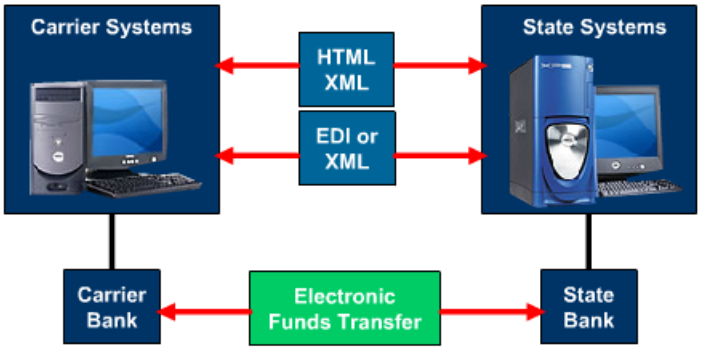
accomplished using an on-board microprocessor. The output can then be communicated to roadside enforcement officers with vehicle-to-roadside communication (VRC) technologies, as a part of an electronic screening system.

LESSON 3: CREDENTIAL ADMINISTRATION

Credential Administration

We now turn to the second program area of the ITS/CVO program, Credentials Administration. The objective of credentials administration projects is to streamline credentials and tax procedures. Their primary benefits are as follows:

- **A reduction in operating costs and administrative effort for both agencies and carriers**
- **An improvement in regulatory compliance by carriers**
- **The ability to get vehicles on the road faster**



Electronic credentialing

The electronic purchase of credentials component will allow carriers to file applications electronically for credentials such as registration, fuel use taxes, trip permits, oversize/overweight permits or hazardous materials permits.

The credentials will be approved in a much shorter time than is possible with the current paper system. This component will also allow for electronic data interchange and electronic funds transfer capabilities for the movement of data and funds between agencies and carriers. Systems will be developed to allow "one-stop shopping", whereby carriers can obtain permits for multiple states through a single source.

The electronic purchase of credentials will require the development of software including screen formats for each license and permit. Communication software must also be developed to carry data from the carrier to the states, and information/credentials from the states back to the carrier. Many states are currently looking to develop this capability using the Internet and web-based solutions.

Electronic Credentialing is an operational process that uses software under the applicant□s control to send credentials applications and fuel tax returns to a government agency, and to receive electronic notification of credentials status in return. When feasible, the credential itself

is returned electronically, and it may be printed as needed by the customer. Electronic payment is normally associated with electronic credentialing.

Most credentials are issued by state agencies, sometimes acting on behalf of the Federal Government. CVO credentials include:

- International Registration Plan (IRP)
- International Fuel Tax Agreement (IFTA)
- Intrastate Registration
- Carrier Registration
- Oversize/Overweight Permits
- Hazardous Materials (Hazmat) Permits
- Vehicle Titling
- Commercial Driver License (CDL)

Electronic credentialing approaches fall into two basic categories:

Person-to-computer solution. State provides a web site that the carrier accesses using a commercial browser and HTML or XML web standards (note that HTML and XML were shown in the previous diagram).

Computer-to-computer solution. This involves Carrier Automated Transaction (CAT) software stored locally that exchanges credentialing information with state credentialing systems using Electronic Data Interchange (EDI) credentialing standards (also shown on the previous diagram). EDI will be discussed in more detail in Lesson 6.

Electronic credentialing differs significantly from the traditional paper-based process. The next page illustrates the steps in processing paper forms.

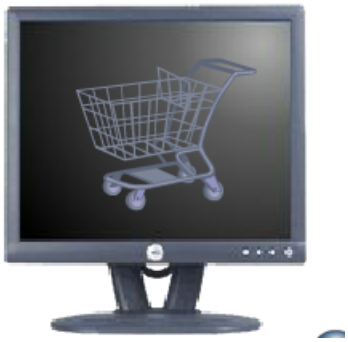
- **The carrier prepares the application electronically.**
- **The automated credentialing system reviews the application for completeness and conformity with state requirements, and submits it.**
- **The automated system then calculates the fee and immediately notifies the carrier of the amount due.**
- **The carrier receives the credential in minutes rather than weeks.**

One Stop Shopping

One-stop shopping can be physical or electronic (online):

- Physical one-stop shopping enables a carrier to obtain their credentials by visiting one location or office. Many states have established one-stop shop centers that consolidate credential functions in one place.
- Online one-stop shopping provides the most benefits by allowing carriers to apply for and receive various credentials online through one "window" or portal. States in increasing numbers are developing this functionality.

  Benefits of online one-stop shopping include:
  - Improved processing of credential requests, i.e., shorter turnaround time for issuance
  - Elimination of redundant data entry
  - Improved accuracy of information
  - Reduction of paperwork



LESSON 4: ELECTRONIC SCREENING

Objective

To improve the verification of size, weight, safety, and credentials information by roadside enforcement operations.

Benefits

- Reduced delays and congestion costs for motor carriers
- Improved traffic flow
- Focused inspections on high-risk operators

Transponder-equipped vehicles

Electronic screening is based on **vehicle-to-roadside communication** (VRC), using a device known as a transponder. As a vehicle approaches a checkpoint, an electronic reader at the roadside reads the transponder; vehicle identification and data about credentials, vehicle weight, and safety status can then be electronically checked by the authorities. Enforcement personnel can then select potentially unsafe vehicles for inspection and allow safe and legal vehicles to bypass the checkpoint.

The transponder carries a vehicle unique identification code, and is capable of communicating with a roadside device (commonly called a reader). By communicating, we mean that the device is capable of sending and receiving information to and from the roadside readers.

Electronic screening is dependent upon two basic technologies: Automatic Vehicle Identification (AVI), and Weigh-In-Motion (WIM). We first learned about transponders and vehicle-to-roadside communication (VRC), which are a form of AVI, earlier in this lesson.

Automatic Vehicle Identification (AVI) is the term used for techniques that uniquely identify vehicles as they pass specific points on the highway, without requiring any action by the driver or an observer. It typically consists of three components:

1. A vehicle-mounted transponder
2. A roadside reader unit, with associated antenna
3. A system for the transmission, analysis and storage of data

Two broad systems might be considered:

- Optical and infrared systems
- Radio frequency and microwave systems

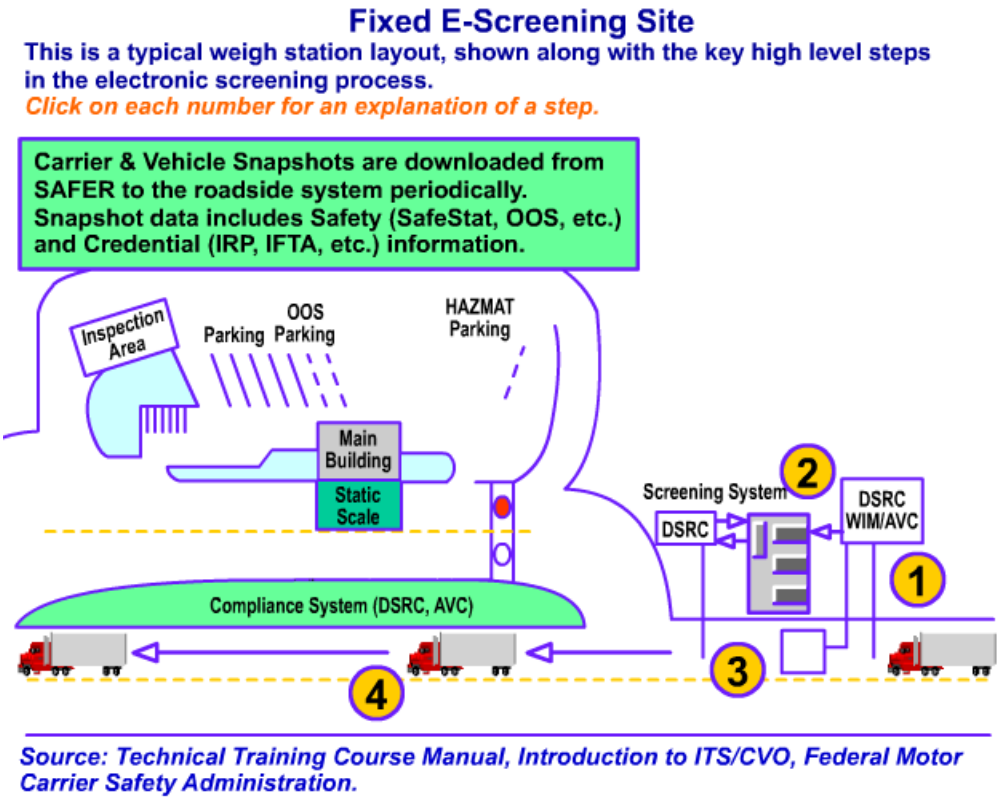
An exit AVI reader in Laurel County, Ky., identifies trucks as they leave the weigh station and records weight data on their transponders.

Source: "Advantage I-75 Prepares to Cut Ribbon on Electronic Clearance" by Joe Crabtree. Public Roads v59:2

Weigh-In-Motion, or WIM, is now an established technology in the U.S. and throughout the world (you might want to visit these informative European WIM and U.S. WIM sites). With WIM systems, the axle and gross weights of vehicles are obtained, while the vehicles are traveling along the highway or a sorter ramp at a commercial vehicle monitoring station. This is accomplished through the use of in-pavement sensors.

A wide variety of systems are available, from slow-speed WIM through a range of full highway speed systems, each with a different level of capability and cost. Unlike AVI systems which need standardization, WIM standardization is not considered essential.

Read the discussion of electronic screening and its various design recommendations in Roadside Electronic Screening, hosted on the CVISN web site.

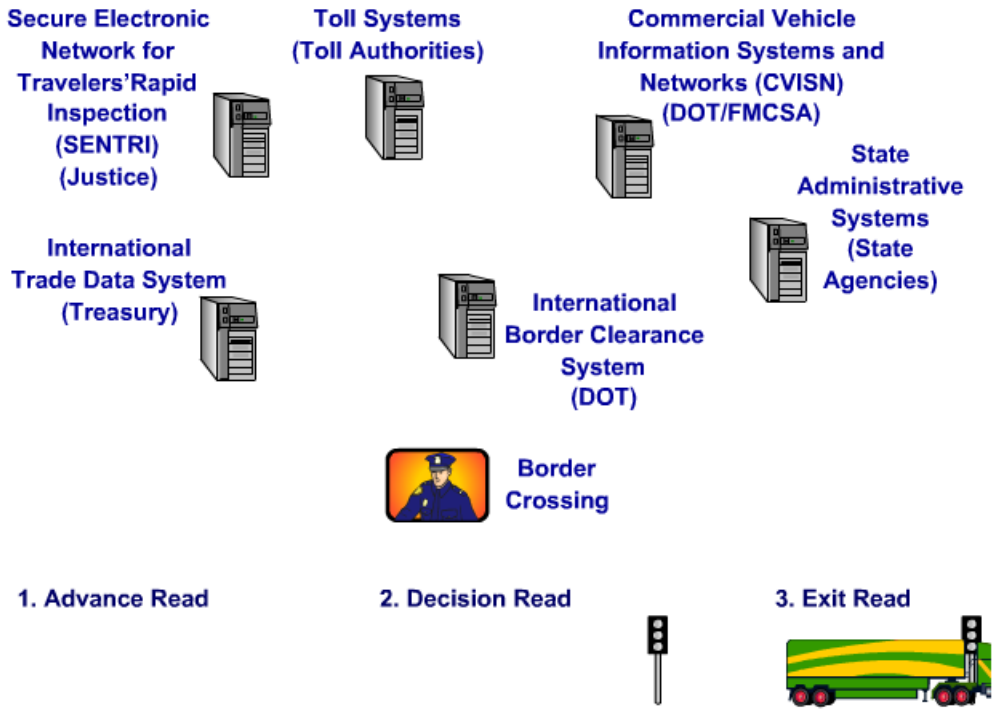


International Boarder Clearance

The electronic screening program area also includes International Electronic Border Clearance. The program, IBC for short, provides for electronic safety and credentials screening at the border with Canada and with Mexico for all carriers, vehicles, and drivers that want to cross the border for international trade. The objective of IBC is to provide for efficient, safe international trade transportation, into and out of the U.S.

AVI and information exchange systems have been installed and tested at a number of northern and southern border locations. At these sites, CVO operations are integrated with many other Federal and International processes. The border crossing systems allow selected vehicles to cross the border without stopping or with expedited inspections. The systems address customs, immigration, administrative, and safety requirements.

The process is demonstrated below.



LESSON 5. CARRIER OPERATIONS

Fleet Management Systems

These systems provide real-time communications for vehicle location, dispatching, and tracking, between commercial vehicle drivers, dispatchers and intermodal transportation providers. The availability of real-time information on vehicle location would help dispatchers optimize their fleet operations and improve customer service. The basic components needed for implementing such systems are:

1. Vehicle tracking devices (e.g. GPS)
2. Wireless communications between the vehicle and dispatcher
3. Optimization algorithms for real-time routing and dispatching

Traffic Management and Traveler Info Systems

The idea here is to collect, package, and disseminate information on highway travel conditions to motor carrier dispatchers and drivers. The objective is to enhance motor carrier safety and operating efficiency through better routing and dispatching based on accurate and timely information on highway construction, incidents, congestion and weather.

The I-95 Corridor Coalition's **Fleet Forward Project** is a good example of such applications. Fleet Forward is being developed jointly by the motor carrier industry, and the states as a value-

added repackager of traffic information. The system will collect information on highway traffic conditions, construction activity, traffic accidents, and incidents from state transportation agencies as well as other sources. It will then repackage, market, and deliver the information to motor carrier dispatchers and drivers to help them make timely and cost-effective routing and dispatching decisions.

Hazardous Materials Incident Response

The main objective of this service is to develop a system that would provide a description of the hazardous materials carried on a vehicle after an incident has occurred. The focus is on identifying the materials involved so that they can be handled appropriately.

The required information could reside in infrastructure-based systems such as existing carrier databases or States information systems, or it could be stored in vehicle-based systems such as the transponders used for electronic clearance. In the former case, emergency responders would have to have remote access to the databases, while in the latter case, they would have to be provided with readers capable of communicating with the transponder.

LESSON 6. COMMERCIAL VEHICLE INFORMATION SYSTEMS AND NETWORKS (CVISN)

The CVISN initiative aims at providing the technical architecture needed to support the three broad functional areas of Safety Information Exchange, Credentials Administration, and Electronic Screening. These roughly are three of the ITS/CVO program areas that we learned about in earlier lessons. A key, defining element of CVISN is the partnership of Federal, State, and Industry.

The term CVISN (pronounced "see-vision") denotes the collection of information systems and communications networks that support CVO. These include systems owned and operated by governments, motor carriers and other stakeholders.

The CVISN program provides a framework or "architecture" that will enable government agencies, the motor carrier industry, and other stakeholders exchange information and conduct business transactions electronically using national standards governing communications protocols.

In other words, the CVISN Architecture is the CVO part of the National ITS Architecture (discussed in detail in CITE's *Introduction to the National ITS Architecture* course).

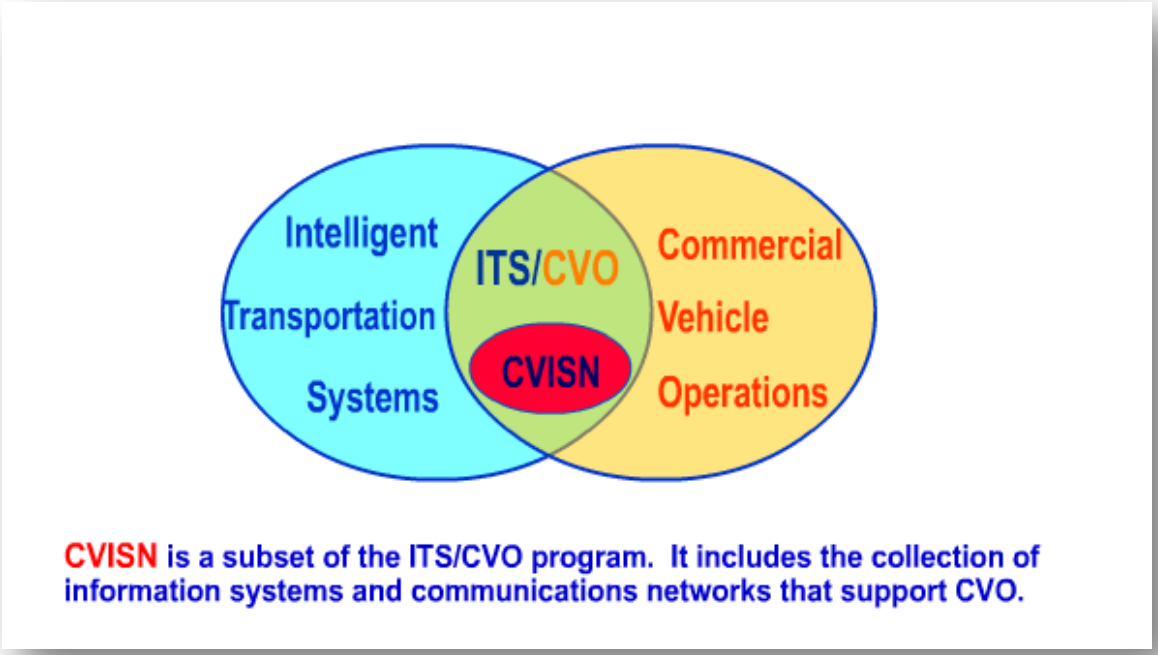
CVISN involves three types of activities:

Automating existing processes
- Laptop computers at the roadside
- Electronic application for credentials and permits
- Weigh-in-motion scales

Networking information systems
- SAFER
- Consolidated state CVO databases

Changing the way that states and carriers do business
- One-stop shopping
- Performance-based regulations

There has always been a lot of confusion about terminology used in the ITS/CVO arena. Here is an illustration of the difference between ITS, CVO, ITS/CVO and CVISN.



CVISN is a subset of the ITS/CVO program. It includes the collection of information systems and communications networks that support CVO.

CVISN Core Capabilities

The Federal Government has established "CVISN Core Capabilities" (formerly known as CVISN Level 1) as the benchmark or baseline for states deploying CVISN. This consists of a specific set of capabilities that can be implemented incrementally by a state and its motor carriers. The capabilities fall within these three areas:

- **Safety Information Exchange**
- **Credentials Administration**
- **Electronic Screening**

A state will develop or otherwise acquire new systems and modify some existing systems to implement CVISN Core Capabilities. There are many ways to do this and still conform to the National ITS Architecture and standards.

CVISN is based on open architecture and standards, so that these capabilities may be deployed in a manner that is interoperable from state-to-state. The architecture will also allow the addition of advanced capabilities in the future (Expanded CVISN). These expanded future capabilities will improve the safety and productivity of commercial vehicle operations beyond the CVISN Core Capabilities and enhance transportation security.

For more information on CVISN Core Capabilities, refer to the CVISN web site.

The figure shown on the next screen presents an overview of CVISN. As the title indicates, CVISN is really about Safety, Simplicity, and Savings.