Dakotas' ITS-CVO Institutional Issues Study

Ayman Smadi
Julene Rodriguez

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Table of Contents

List of Tables

List of Figures

Abbreviations

AHS	Automated Highway System
APTS	Advanced Public Transportation Systems
ARTS	Advanced Rural Transportation Systems
ATA	American Trucking Association
ATIS	Advanced Traveler Information Systems
ATMS	Advanced Traffic Management Systems
AVI	Automatic Vehicle Identification
AVL	Automatic Vehicle Location
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial Vehicle Operations
DOT	Department of Transportation
EDI	Electronic Data Interchange
ETC	Electronic Toll Collection
GPS	Global Positioning System
FHWA	Federal Highway Administration
IFTA	International Fuel Tax Agreement
IRP	International Registration Plan
ITS	Intelligent Transportation System (replaced Intelligent Vehicle Highway System, IVHS)
ITS-America	Intelligent Transportation Society of America
NAFTA	North American Free Trade Agreement
SHP	State Highway Patrol
SSRS	Single State Registration System
WIM	Weigh-in-Motion

Chapter 1. — INTRODUCTION

This report documents the findings from a study on institutional issues related to implementing Intelligent Transportation Systems in Commercial Vehicle Operations (ITS-CVO) in the Dakotas. The study was funded by the Federal Highway Administration (FHWA) through a contract with the North Dakota and South Dakota Departments of Transportation. The FHWA provided funding for each state to examine institutional issues that could act as barriers to implementing new technologies (referred to prior to 1994 as Intelligent Vehicle Highway Systems, IVHS). In many instances, these studies were conducted for a group of states at the same time to examine the administrative structure and institutional arrangements related to interstate motor carrier operations.

One of the most promising elements of the ITS program is in the area of commercial vehicle operations (CVO). ITS-CVO technologies and programs offer substantial improvements in the operational efficiency of shippers, motor carriers, and public agencies that interact with them. Further, the technology required to implementing these programs is commercially available (off-the-shelf). In the absence of technical barriers, there remains substantial non-technical barriers to effective implementation of ITS-CVO programs. This study will focus on identifying institutional barriers to implementing ITS-CVO in North Dakota and South Dakota. The study provides information to the two states about appropriate technology, potential barriers, and alternatives for resolving barriers.

1.1. Background

The development and maintenance of the highway transportation system has long been the jurisdiction of public entities represented in federal, state, and local governments. Along with this authority came some fundamental responsibilities, that include: 1) collecting user fees to finance the development, operation, and maintenance of the system, and 2) regulating the use of the system to ensure the safety of all users and to prevent excessive damage to the system due to illegal use, i.e., oversize or overweight vehicles. As a result, states have developed laws, policies, and procedures that govern motor carrier commerce. Most of these laws were developed after the substantial increase of truck traffic in the late 1920s and early 1930s. Much of the increase in truck traffic was not in local and intrastate traffic, but interstate bridge traffic, i.e. traffic which originated and terminated outside the borders of the state responsible for the highway infrastructure.

Each state developed a different set of laws, procedures, and regulations that apply to motor carrier operations within that state. Although these regulations

were to some extent based on federal regulations, the variations in state laws can sometimes be quite dramatic. For interstate carriers, the differences in state laws resulted in operating conditions that differ from one state to another. Further, the responsibility of enforcing and administering motor carrier laws within a single state is shared by many agencies. At the federal level, these agencies include a multitude of agencies within the US Department of Transportation, the Interstate Commerce Commission (ICC),[1] and the Internal Revenue Service (IRS). A typical list of state agencies which deal with motor carriers for example would include the Department of Transportation, the State Highway Patrol, the Department of Tax or Revenue, the Public Service Commission, and the Department of Health. These agencies often have distinct differences in their main mission, goals and objectives, primary customers, and agency procedures which consequently impact how they do business with motor carriers.

The differences in state laws affecting motor carrier commerce cause inefficiencies and frustrate drivers and companies attempting to operate legally[1]. Operating inefficiencies due to the increased compliance burden consequently increase trucking costs. The increase in costs to carriers and shippers is ultimately transferred to consumers and could reduce the competitiveness of US firms in a national and global economy. These increased costs are not trivial. Although it would be difficult to identify specific costs, total expenditures on commercial truck transportation services grew from $277 billion in 1991[2] to more than $311 billion by 1993. It is obvious how even small percentage increases in efficiency could result in substantial savings.

1.2. Problem Definition

ITS-CVO technologies provide a means of masking, mitigating, or eliminating the differences in state laws which interfere with interstate motor carrier traffic and commerce. These technologies can expedite and facilitate both enforcement and administrative procedures. They may also improve compliance with existing laws because they make compliance easier and less costly. They also hold the potential to reduce costs for both the governing jurisdictions and the motor carriers, as well as reduce accidents and congestion on the roadways.

Since the completion of the first institutional issues studies, many new issues have developed and new information has been gained, from nationwide operational tests and research efforts. It remains true that ITS-CVO technologies are considered to be one of the most promising ITS concepts. These technologies offer substantial improvements in the operational efficiency of motor carriers and

[1] The role of ICC has diminished since the sweeping regulatory reform of the interstate and intrastate trucking. The ICC itself is expected to be dissolved due to recent Congress resolutions.

public agencies. Some of the benefits of improved commercial vehicle operations include reducing compliance costs for motor carriers, reducing unnecessary delays of vehicles and drivers, improving motor carrier safety, and reducing regulatory and enforcement costs for state agencies.

However, there may be a number of barriers to implementing these technologies. These barriers can be categorized into technical (technological), financial, and institutional issues. A combination of all or some of these issues could hinder implementing ITS depending on the type of systems and their locations. Technological issues may be the least constrictive barriers in the area of ITS-CVO, which uses off-the-shelf technologies that have been well developed. Advanced communication systems, weigh-in-motion equipment, and transponders, the basic components of ITS-CVO systems, are readily available. However, as will be discussed in later sections, these technologies lack established standards, which may become a barrier to wide user acceptance. Financial barriers may arise because of the level and type of investments required for implementing ITS technologies. Funding ITS technologies requires substantial up-front investments (high fixed costs) to develop the basic infrastructure, before these systems can be operational. Also unclear is the cost sharing of providers and users of these systems. User fees are envisioned to support the operations of ITS elements once they have been developed and are operational.

Institutional issues can encompass technical and financial issues (funding shares, procurement procedures, access to equipment and data, etc.), and also can include agency policies, laws, and procedures. These issues may act as serious barriers to implementing ITS-CVO technologies due to the nature of commercial vehicle operations. These operations involve many players which include state and federal agencies and private carriers who have conflicting goals. The partnerships being formed between private and public entities also pose some institutional issues that must be resolved, such as the ownership of the system, proprietary data, and profit making. Since commerce involves interstate activities, institutional issues must be addressed among agencies in different states. Once these issues are resolved, an envisioned national CVO program would allow trucks to travel across state lines without the need to stop, very much as automobiles can today.

1.3. Objectives of the Study

The impetus of this project was to provide an understanding of and propose solutions to the institutional barriers to implementing ITS-CVO technologies. An institutional barrier may be a state law, practice, or agency policy that could impede or restrict using one or more ITS-CVO technologies. However, other non-technical issues, such as financing, also were examined. The approach to assess potential barriers greatly relied on effective participation from the various stakeholders in the public and private sectors. With the exception of North Dakota

and South Dakota, each of the contiguous 48 states was involved in a study of this nature, either singly or as part of a multi-state effort. A positive aspect of a late start of the Dakotas' study was to fully use findings and experiences from studies in other states, especially those contiguous to North and South Dakota. Coordination with neighboring states will help in forming future regional CVO alliances that will improve the efficiency of interstate motor carrier commerce.

The objectives for this study are summarized below:

(1) Identify public and private agencies and organizations that have a role in motor carrier operations in each state and select representatives from these groups to participate in a steering committee. The purpose of the committee is to provide information and direction to the study and to lead to future implementation plans in the two states.

(2) Identify and obtain similar studies completed or taking place in other states and summarize the major issues identified by these studies that could relate to the Dakotas' study.

(3) Document state laws, regulations, and procedures impacting motor carrier operations, with particular emphasis on:

   (a) registration, taxation, and permit requirements and procedures;

   (b) filing requirements (information, forms, locations, methods);

   (c) agency/division roles and coordination.

(4) Identify, document, and prioritize problems and inefficiencies resulting from state laws and procedures influencing motor carrier operations.

(5) Identify predominant ITS-CVO technologies with the highest potential to reduce inefficiencies and problems originating from laws, regulations, and procedures.

   (a) Examine the ITS-CVO National Program Plan (ITS America) to identify current and future ITS-CVO technologies, concepts, and programs;

   (b) Describe and document current CVO technologies and concepts;

   (c) Identify how these technologies would be used in the Dakotas under alternative implementation scenarios.

(6) Identify and prioritize institutional barriers and obstacles to ITS-CVO implementation schemes developed for the Dakotas. Develop and evaluate potential solutions to barriers.

(7) Summarize and document study findings and alternative action plans in a final report that would be useful to decision makers in the two states.

1.4. Description of the Study

This section provides an overview of the Dakotas' ITS-CVO Institutional Issues Study. The following sections provide information on the research team, the agencies involved in the study, the steering committee membership and roles, and the methodology followed in the study for achieving the goals and objectives set forth in the previous section.

Research Team

The study was conducted by a research team from the Upper Great Plains Transportation Institute (UGPTI) at North Dakota State University. The team's qualification included transportation engineering, transportation economics, and motor carrier operations. The role of the research team was to facilitate the mission of this study by:

(1) Contacting relevant agencies and carriers to form steering committee;

(2) Assuring proper input from and effective coordination among the various agencies;

(3) Collecting and documenting all relevant laws, regulations, and administrative procedures;

(4) Conducting a literature review on prevailing CVO technologies, their typical system setup, and costs;

(5) Examining and documenting other states' experiences by contacting appropriate agencies and reviewing completed ITS-CVO studies.

(6) Working with the steering committee to identify barriers, possible solutions to barriers, and identifying alternative strategies;

(7) Documenting study findings and disseminating information to relevant agencies, organizations, and individuals within the two states.

Steering Committee

A steering committee was formed from representatives of state agencies, motor carriers, and motor carrier associations. Two project coordinators from the North Dakota Department of Transportation (NDDOT) and South Dakota Department of Transportation (SDDOT) who participated in approving the work plan assisted in identifying contacts from state agencies which regulate, administer, tax, or interact with motor carriers. These representatives had the primary role of explaining their agency policies and assisting the UGPTI team in obtaining required data. Solicitations were sent to these agencies and to selected motor carriers from North Dakota and South Dakota. After representatives were identified, they were briefed on the mission of the study and their role in its completion. Table 1 shows the membership of the steering committee.

Table 1 Steering Committee Membership		
Agency/Organization	Address	Representative
Federal Highway Administration- Regional Office	Denver, CO	C. P. Damon
Federal Highway Administration- ND Office	Bismarck, ND	Steve Busek
FHWA-Office of Motor Carriers- ND Office	Bismarck, ND	Ron Evenson
Federal Highway Administration- SD Office	Pierre, SD	Ken Eschmier
FHWA-Office of Motor Carriers- SD Office	Pierre, SD	Greg Hall
Governor's Office	Bismarck, ND	Bob Harms
North Dakota Department of Transportation	Bismarck, ND	Dennis Jacobson
North Dakota Tax Department	Bismarck, ND	Bob Hanson Gary Anderson
North Dakota State Patrol	Bismarck, ND	Arden Johnson Dennis Erickson Ken Halldorson
South Dakota Department of Transportation	Pierre, SD	Norm Humphrey Dave Huft
South Dakota Department of Motor Vehicles	Pierre, SD	Debra Hillmer
South Dakota Highway Patrol	Pierre, SD	Myron Rau
North Dakota Motor Carrier Association	Bismarck, ND	LeRoy Ernst
South Dakota Trucking Association	Sioux Falls, SD	Barb Lindstorm
Interstate Truck License	Bismarck, ND	Melissa Dixon
B & G Transportation	Madison, SD	Gene Phillips
E/W Motor Express	Black Hawk, SD	David Stebbins
K & J Trucking	Sioux Falls, SD	Shelly Schipper
Lewis Truck Lines, Inc.	Fargo, ND	Bob Lewis, Jr.
Midwest Coast Transport	Sioux Falls, SD	Murray Smith Larry Thury

The role of the committee can be summarized as follows:

Assist study team in obtaining information about their agency and/or organization roles, policies, administrative and operational procedures, and any data relevant to the study.

(8) Learn and understand prevailing CVO technologies and share this knowledge within their agency or organization.

(9) Act as a catalyst to stimulate interest within their organization and obtain perceptions and concerns of decision makers.

(10) Provide guidance on ways to overcome barriers to and possible future implementation plans of ITS-CVO technologies and programs in the region.

Methodology

The approach in this study centered on establishing a constructive dialogue among motor carriers operating in the region and the public agencies that interact with them through regulation, taxation, and enforcement. This goal was achieved by forming a steering committee that represents the major parties involved in motor carrier operations in the two states. The committee provided input and guidance to the research team in getting the required information, identifying barriers, and formulating alternative solutions and action plans. It should be noted that carriers and public agencies in the Dakotas already enjoyed good working relationships. This was evident in objective and candid discussions during the committee meetings. However, the two sides gained more insights about each other's operations, concerns, and limitations. A successful ITS-CVO strategy must consider any conflicting roles and gradually remove unnecessary obstacles. An important part of the solution is to improve agency-carrier relationships. The process of removing institutional barriers must be based on trust and long-term goals rather than short-term gains. It must seek a balance between public interest and carrier operating efficiency.

An institutional barrier may be a state law, practice, agency policy, or attitude that could impede or restrict using one or more ITS-CVO technologies. Institutional issues are identified based on an assessment of current state practices and the ITS CVO technologies with greatest potential for applications. Plausible technologies are identified through a process of reviewing other states' experiences, and input from state agencies and motor carriers. This study may not resolve all institutional issues to implementing ITS CVO technologies, but it is hoped to be a launching pad for future efforts to increase efficiencies in motor carrier operations and

agency enforcement and administration through better coordination, elimination of duplication, and use of technology.

A major attribute to the success of the study is how well the steering committee represents agencies/individuals involved in CVO and how well it assesses actual operations, laws, and procedures. Comments and inputs from department personnel and carrier groups were actively sought out throughout the study, and during two steering committee meetings. During the first meeting, the final approach to the study was formalized and the roles of the participants in accomplishing the goals of the study were identified. After documenting state laws, regulations, and procedures, the research team conducted an extensive review of current and completed ITS-CVO projects in other states. Coordination among one state's agencies is only but part of a more extensive multi-state coordination in an anticipated national CVO network. A final steering committee meeting was held in September 1995 to present the study findings and generate discussions on future actions.

1.5. Report Organization

The remaining parts of this report are organized as follows:

(1) Chapter 2 contains a description of the national ITS program with emphasis on CVO programs. A background on the ITS program elements describes the system development and its broad deployment plans. The first two sections are devoted to describing the prevalent ITS-CVO technologies and user services. The remaining sections discuss the benefits/costs of typical CVO system configurations and provide examples of on-going demonstration projects and operational tests.

(2) Chapter 3 summarizes motor carrier regulations in the Dakotas. It provides a background on interstate regulations (IRP, IFTA), a summary for North Dakota, a summary for South Dakota, and a summary of motor carriers' perspective and third party licensing agency interviews.

(3) Chapter 4 identifies actual and perceived institutional barriers. This chapter starts with an overview of state experiences with ITS-CVO programs and discusses common institutional issues. Issues that could act as barriers to ITS-CVO implementation in the Dakotas are identified and supplemented with interviews and conversations with agency and industry representatives.

(4) Chapter 5 summarizes the findings of the study and provides recommendations for future actions in the two states.

Endnotes to Chapter 1

1. Griffin, Rodriguez, and Lantz. *Job Satisfaction of U.S. Commercial Drivers*, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, May 1993, Publication 90, p. 23.

2. Coyle, Bardi, and Langely. *The Management of Business Logistics*, West Publishing Co., St. Paul, 1992, p. 43.

Chapter 2. — ITS-CVO TECHNOLOGIES

This chapter provides a description of intelligent transportation systems and common ITS technologies with a main emphasis on CVO. The first section briefly describes the US ITS program initiative and some of its common concepts The second section describes the various applications of intelligent transportation systems in commercial vehicle operations. It also outlines the national ITS-CVO program components and plans. The third section provide some examples of ITS-CVO applications currently used in operational tests across the nation. Finally, the fourth section identifies some initial benefit and cost estimates for typical CVO system configurations.

2.1. Background

ITS refers to a number of technologies and concepts that use advanced technologies to alleviate some of the current traffic and safety problems and improve the performance of the existing transportation system. Although these systems are not all new, the formal recognition of these systems under the ITS (and earlier IVHS) banner can be traced back to the early 1990s. ITS refers to transportation systems that integrate applications of advanced surveillance, communications, and control technologies in the transportation network and the vehicle. Some of the objectives of ITS are to decrease congestion, improve safety, facilitate efficient goods movement, improve mobility, and improve the environment. These benefits are accomplished through an intermodal strategic approach to transportation that will make better use of existing infrastructure and energy resources.

The motivation for developing an advanced transportation system can be attributed to several factors. Factors related to the transportation system include increasing demand, limited capacity, scarce resources, and highway safety. As a result, excessive traffic congestion plagued most major urban areas, resulting in an estimated annual cost of $100 billion in economic losses. In addition, highway crashes caused an average of 40,000 fatalities each year, at an estimated annual cost of $30 billion. Other factors included the availability of technologies and increased restrictions on traditional solutions (road building) due to economic, social, and environmental issues. The Federal Highway Administration (FHWA) is the leading public agency for managing ITS programs under the United States DOT. The Intelligent Transportation Society of America (ITS America) is a private-public entity that provides direction and technical support for the ITS program.

ITS Concepts

ITS applications range from providing accurate and timely information to users of the transportation systems, to fully automated highway systems that will communicate with cars and control their speeds, lane changes, following distances, etc. The technological elements of these smart systems can be classified in three areas: surveillance, communications, and control. These systems stand at various development stages and it will take sometime before realizing fully operational systems for all these groups. A group of systems that include CVO are, however, targeted for deployment in the short-term (next 5-10 years). The ITS program can be categorized in terms of user services bundles, each consisting of a number of specific user services and concepts that include the following[1]:

1. Travel and Transportation Management
2. Travel Demand Management
3. Public Transportation Operations
4. Electronic Payment
5. Commercial Vehicle Operations
6. Emergency Management
7. Advanced Vehicle Control and Safety Systems

Travel and transportation management services provide information during the trip. They include traveler services information, route guidance, en-route weather/road information, traffic control, and incident management. There are several mediums for providing this information, currently traffic and weather radios are most common. Travel demand management services provide information on a pre-trip basis and include demand management, such as ridesharing information. Public transportation operations include transit services and information. Electronic payment services cover tolls, transit fares, and parking fees. Commercial vehicle operations user services include electronic clearance, automated road side safety inspection, on-board safety monitoring, administrative processes, hazardous material incident response, and freight mobility. These services will be discussed in detail starting on page 17. Emergency management services include notification and personal security and emergency vehicle management. Advanced vehicle control systems will provide for collision avoidance through automated controls and vision enhancement. These technologies are envisioned to accomplish an automated highway system (AHS).

ITS National Program

ITS programs are distinctly different from traditional, and largely publicly funded, transportation infrastructure development. The new systems involve a significant role for the private sector, the standards for these systems are still in development stages, they have open architecture creating new project development procedures, and they involve high initial investments compared for example, to the incremental costs of developing highways. As a result, there was a need for a national strategy and vision on the development of ITS. A National ITS Program Plan was issued in March 1995 as a joint effort of ITS America and the U.S. DOT. Work on the plan started in mid 1993 as directed by Congress, and incorporated a substantial number of individuals and organizations. The plan serves objectives and purposes, which include the following[2]:

1. Promote shared ITS goals by integrating cooperation and coordination among the ITS players including federal and state transportation agencies, private businesses, user groups, and academia.

2. Provide guidance for ITS investment decisions in the public and private sector by providing information on available services and market readiness for new services and products.

3. Maintain focus on deployment of ITS components by identifying the time frame and order in which user services will be deployed.

To ensure national compatibility, a National ITS Architecture and several standards were developed. The architecture describes how ITS components work individually, how they interact, and what information is exchanged among the components to achieve the goals of an operational system. The development of the architecture involves understanding the functions necessary to achieve system goals and the different operational concepts and technologies that can be used to build the system. The development of standards for system components will follow the architecture to ensure compatibility of product operations, performance, and maintenance. Developing product standards is paramount to manufacturers and users. There could be significant risks associated with investments into these products in the absence of proper standards. The need for standards is most critical for telecommunication systems, which constitute the backbone of ITS.

ITS Deployment

The early period of applying ITS technologies and concepts consisted of demonstration projects and operational tests across the nation. These efforts provided valuable information for developing a road map for the national program. One of the major issues that impact the deployment of ITS is funding.

These systems are generally high-technology oriented and, as a result, require substantial initial investments. At the start of the ITS program, public entities (federal, state, and local) were responsible for funding and administering most of the demonstration and operational tests. During this period, some estimates place public investment close to $800 million. However, this number is quite small in compared to estimated total investments of about $20 billion, mostly private moneys, in ITS in the next 20 years. There has been a noticeable increase in private sector participation in funding and developing ITS projects in the last two or three years. Market forces are expected to set the pace and direction of developing and establishing ITS services and related technologies. In addition, the early partnerships established between private and public agencies will grow in number and extent at the national, state, and local levels, and thus expedite ITS deployment.

Several ITS user services are either in use or are available for deployment. Many of these applications are related to travel and transportation management services, which have predominantly been in the largest metropolitan areas. Freeway operations top the list of ITS applications in metropolitan areas. These systems use information from traffic surveillance devices such as loop detector and roadside cameras to predict changes in road and traffic conditions and change traffic control accordingly. Traffic management centers typically collect this information and can control signal timing and ramp metering, issue traffic advisories via mass media and changeable message signs, and direct emergency response services to incident locations. Private sector companies have started marketing travel information services and equipment. Road and traffic conditions data are processed and packaged for sale to interested customers. A number of in-vehicle devices can receive travel information and provide navigational aid to drivers. Most travel guidance systems are still based on static information, but development of real-time systems is in progress.

ITS deployment in the CVO area is quite significant. Many trucking companies were investing in advanced technologies to improve their fleet operations even before the recognition of a national ITS program. The need for better equipment utilization and higher levels of customer service prompted trucking companies to use electronic data interchange (EDI) and tracking systems. In the public sector, several operational tests are testing technologies that will expedite processing of truck credential, weight, and safety inspections. A detailed discussion of CVO deployment is provided in the next section.

A widespread deployment of ITS is expected to take place within the next 10 years. The first five years will see an era of travel information and fleet management, as depicted in Figure-1. During this period, there will be more data sharing between public and private entities and the public. The focus will be on

efficient delivery of data to end users to make better, more informed travel decisions. As a requirement, a National Information Infrastructure must emerge. In the five years following year 2000, the focus will be on travel management. The enhancement of information infrastructures will allow real-time sharing of information through improved roadside-vehicle communications. This era is expected to be followed by more advances in in-vehicle systems, classified under Advanced Vehicle Control services. Although some form of these technologies have already appeared on some vehicle models, such as adaptive cruise control and blind spot warning systems, the majority of these systems are still in the research and development stages.

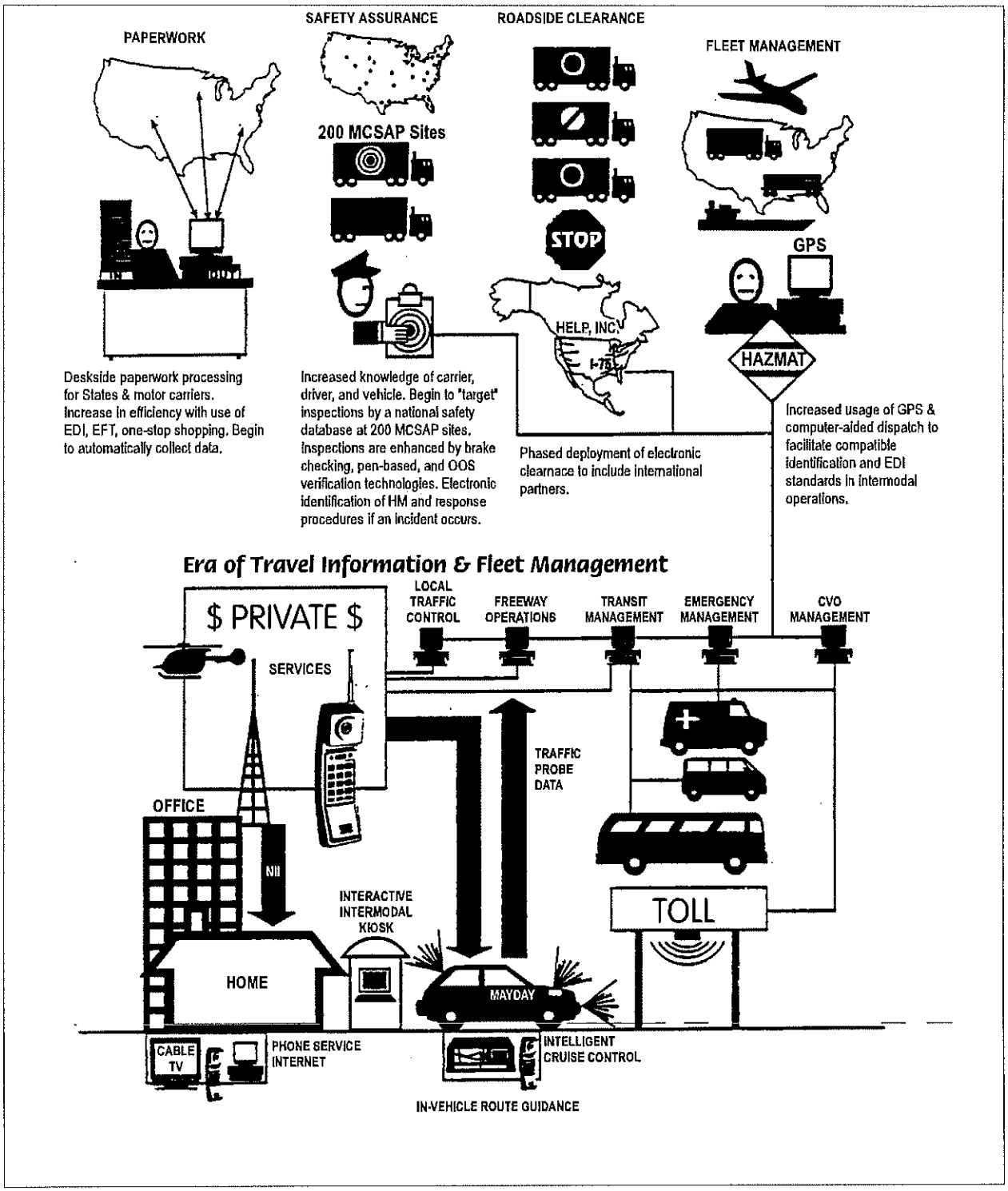

Figure 1 Short-Term ITS Deployment. Source: National ITS Program Plan

The success of future ITS deployment plans will greatly depend on how active a role the public and private entities will play in deployment. The level of involvement of the public sector can be non-assertive or fully assertive. The present non-assertive role of the Federal government does not require or fund ITS deployment by states or local governments. In contrast, in a fully assertive role, the Federal government would take a leadership role in the deployment of ITS by providing funding to states to comply with a national deployment strategy. However, in absence of federal involvement, states can still be active in ITS deployment, but the goals of a national system may not be fully achieved. The role of the Federal government in assuring standards, compatibility, and architecture is paramount to a seamless national system.

Product and service providers and users make up the private sector in ITS. The private sector is guided by market forces—providers develop and sell their services or products to satisfy demand by users. To take a proactive role in deployment the private sector must have confidence in the market potential of ITS. In absence of that confidence, the skepticism in the private sector would prohibit large investments that would be viewed with substantial risk. As a result, private sector participation could be characterized as reactive to market forces, caused largely by public sector decisions. If the private sector believes in the large potential of ITS, it will take a proactive role by investing in ITS deployment and in developing ITS markets.

A successful deployment strategy will require an assertive public sector role and a proactive private sector role. In absence of a Federal program, as is the case now, ITS projects have to compete with other traditional transportation demands. However, a dedicated public source of funding for ITS projects cannot meet all of the operations and maintenance demands. Only with effective private sector participation can those demands be met. This participation will be significant once private industries realize the potential of ITS. To demonstrate this presumption, an examination of private investments in truck transportation services, for example, shows they are substantially more than $300 billion.[3] If presented with substantial benefits from ITS, the trucking industry has the financial means to support productivity enhancing ITS-CVO services.

2.2. ITS-CVO Technologies

ITS-CVO technologies provide a means of masking, mitigating, or eliminating the differences in state laws that interfere with interstate motor carrier traffic and U.S. commerce. These technologies can expedite and facilitate both enforcement and administrative procedures. They also may improve compliance with existing laws because they make compliance easier and less costly. They also hold the potential to reduce costs for both the governing jurisdictions and the motor carriers. The

goals of CVO user services are to 1) improve highway safety by improving roadside inspections and by using on-board safety monitoring systems, 2) improve service levels to trucking companies through administrative process streamlining and to shippers through better fleet management, 3) reduce energy and environmental impacts by reducing unnecessary stops and delays, and 4) enhance productivity by reducing operating and compliance costs due to reduction in delays and streamlining administrative process and better fleet management.

Commercial vehicle operations can greatly benefit from the use of advanced technologies. The application of ITS to commercial vehicle operations has two distinct advantages over other applications. The first advantage is in the availability of technologies to support an immediate ITS-CVO implementation (off-the-shelf status). Secondly, the benefits of implementing ITS-CVO are tangible and can be realized early even with partial participation from motor carriers. These two advantages place CVO at the top of targeted ITS elements for short-term deployment. ITS-CVO is a bundle of user services that are expected to facilitate motor carrier operations by eliminating unnecessary stops, reducing delays, and streamlining the administrative process.

Before discussing the ITS-CVO user services, the technologies used to support these services are described. As stated earlier, ITS elements basically encompass one or more of four major functions that include surveillance, communication, data processing, and control. It is helpful to discuss the supporting technologies in the context of these functions. Surveillance involves detection and identification of vehicles and their location. Communication systems are necessary to transmit raw data from surveillance systems to processing centers and to convey information (processed data) back to users and other systems. Control systems are the most complicated and may use information from surveillance, vehicle monitoring systems, and supporting data bases to make recommendations or select appropriate actions. The relationships of these technologies to CVO user services are described in the following section. Some of the predominant technologies that support CVO services can be classified by function as follows[4]:

1. Vehicle identification systems

   AVI Automatic Vehicle Identification

   AVL Automatic Vehicle Location

   WIM Weigh-In-Motion

   AVC Automatic Vehicle Classification

2. Communication systems

   VRC Vehicle to Roadside Communications

   One or Two-way Mobile Communications, and Stationary Communications

3. Database processing systems

4. Navigation systems

   AVL Automatic Vehicle Location

5. Routing data processing

6. Payment systems

   AVI Automatic Vehicle Identification

   EFT Electronic Fund Transfer

7. In-vehicle sensors and devices

   OBC On-Board Computers

Automatic Vehicle Identification (AVI)

AVI is one of the basic components of the ITS-CVO technology. It provides each truck with a unique tag, which is used to identify and track an individual truck on the transportation network. The system is comprised of an in-vehicle unit (a transponder) that carries vehicle information, a roadside reader, and a roadside data processing unit. Transponders available in the market today can range from basic models that only transmit limited vehicle information, such as a vehicle identification code, to the more advanced models that can transmit and receive electronic data on truck identification, weight, shipment information, carrier and driver information, and information from last inspection point. Vehicle to Roadside Communications (VRC) equipment are necessary to receive electronic signals from vehicle transponders and transmit these signals to a processing unit. Typical configurations of these systems provide the processing unit with a connection to a central data base which include vehicle and company data.

Automatic Vehicle Location (AVL)

Automatic vehicle location systems estimate the location of a truck or trailer using a number of methods. Dead reckoning systems use a magnetic compass and wheel odometers to track distance and direction of travel from a known point. Radio determination systems use radio signals to measure the distance between a truck and two or more known points. Loran-C systems use signals from ground towers. Global Positioning Systems (GPS) use signals from a network of satellites. GPS is comprised of a network of satellites that provide latitude, longitude, and altitude data using on-vehicle transponders and a communication terminal. GPS is becoming more popular in ITS applications because of its accuracy, within 100 feet of actual location, and availability. Location data may be displayed in the cab or transmitted to the fleet office.[5] Potential uses include integration with EDI systems to provide detailed status of shipment and equipment.

Weigh-In-Motion (WIM)

Weigh-in-motion measures dynamic axle weight at highway speeds and detect axle configuration (using an AVC). The accuracy of these systems are within 15 percent for axle weights and within 8-10 percent for gross vehicle weight. These systems have been widely used for data collection for planning and pavement design purposes. These systems can be used within ITS-CVO to screen trucks approaching weight stations.[6] Truck weight data are transmitted to inspection stations while the truck is traveling at mainline speeds. The vehicle weight, axle weight, and configuration data are instantly evaluated and the truck either passes the evaluation or is flagged for further inspection. Some of the benefits of using WIM include the following: eliminating unnecessary truck weigh station stops (thus minimizing delay), improving enforcement by increasing coverage and reducing avoidance, improving safety, and reducing congestion (due to weigh station operation).

Automatic Vehicle Classification (AVC)

These systems could work in conjunction with a WIM setup to classify trucks by vehicle length, number of axles, and axle spacing. Sophisticated AVC systems can distinguish dozens of truck types. When coupled with WIM, AVC can be used to screen trucks for compliance with the bridge formula, for example.[7]

Vehicle to Roadside Communications (VRC)

VRC are required to transfer data between the vehicle and readers. There are no current standards for these systems. Existing communications systems include radio, microwave, satellite based, or infrared. These systems can be one-way, by allowing transmitting data in one direction but no reception, or two-way, which allows both data transmitting and receiving. In addition, stationary communications systems may be used to connect site processing unit to central

databases or control centers. In addition to the mentioned communications technologies, these systems also may be based on fiber optics and land lines.

Electronic Fund Transfer (EFT)

These technologies allow transfer of funds between travelers and service providers. They work in combination with AVI and smart cards. Applications in CVO include purchasing credentials and electronic toll collection.

On-Board Computers Monitoring Systems (OBC)

On-board computers use sensors to record truck (mileage, speed) and engine (speed [rpm], temperature) data. These systems can be equipped with keyboards and display screens permitting the driver to enter and recall information, such as fuel purchases, delivery instructions, etc. In addition, they can keep data on the truck's total miles, stop time, fuel consumption, and idle time. On-board computers can be coupled with other systems, such as AVI and AVL, to capture and manage data for a truck, a fleet, and payroll administration.[8]

It should be noted that CVO would benefit from services offered by other ITS applications in areas such as Travel and Transportation Management, Emergency Management, and Advanced Vehicle Control and Safety Systems.

2.3. CVO User Services

The majority of the CVO user services are related to freight mobility and streamlining of regulatory functions. The technology applications for CVO are categorized into six user services in the National Program Plan, and include the following:[9]

1. Commercial vehicle electronic clearance
2. Automated roadside safety inspection
3. On-board safety monitoring systems
4. Commercial vehicle administrative process
5. Hazardous materials incident response
6. Freight mobility

Each of these user services is supported by one or more of the technologies described in the previous section. The relationship between user services and enabling technologies is depicted in Table 2. The relationship between technologies and user services is indicated by a black dot in the appropriate cell in

Table 2. For example, the table indicates that automated roadside safety inspection requires the following technologies: two-way mobile communications, database processing, stationary communications, and in-vehicle sensors and devices.

Table 2 CVO Technologies and User Services

Applicable Technologies											
2-way Mobile Communications	Data Base Processing	Vehicle Surveillance	1-Way Mobile	Stationary Communications	Individual Traveler Interface	In-Vehicle Sensors/Devices	Variable Message Displays	Navigation	Payment Systems	Routing Data Processing	**Provides Deployment Basis For**
●	●	●	●	●	●		●				Commercial Vehicle Electronic Clearance
●	●			●		●					Automated Roadside Safety Inspection
●					●	●					On-board Safety Monitoring
●	●	●	●	●	●		●		●		Commercial Vehicle Administrative Processes
●	●	●	●			●		●			Hazardous Material Incident Response
●	●	●	●	●	●			●		●	Freight Mobility

Commercial Vehicle Electronic Clearance

Commercial trucks have to stop at points of entry and other check points for credential, weight, and safety inspection. The goal of electronic clearance is to allow commercial vehicles to operate freely, like automobile traffic, over the transportation network. This service will allow legal trucks to bypass points of entry, weigh stations, and other check points or stop them for specific items only. An electronic check is conducted using VRC while the truck is traveling at mainline speed. When a truck approaches a check point, information that identifies the truck (AVI) is transmitted to the roadside computer. The truck weight is then checked at mainline speed using WIM and AVC, and data from

that check are transmitted to the roadside computer. The enforcement personnel, after getting the truck identification and WIM data, can obtain relevant information on the truck from a central database that includes: motor carrier's safety fitness rating, vehicle inspection and maintenance data, driver inspection and citation record data, and credential data (such as registration, fuel use tax, operating authority, insurance, and special permits). Based on the truck information, the enforcement personnel can allow legal trucks to bypass the checkpoint or pull them in for inspection. A typical layout for electronic clearance is shown in Figure 2.

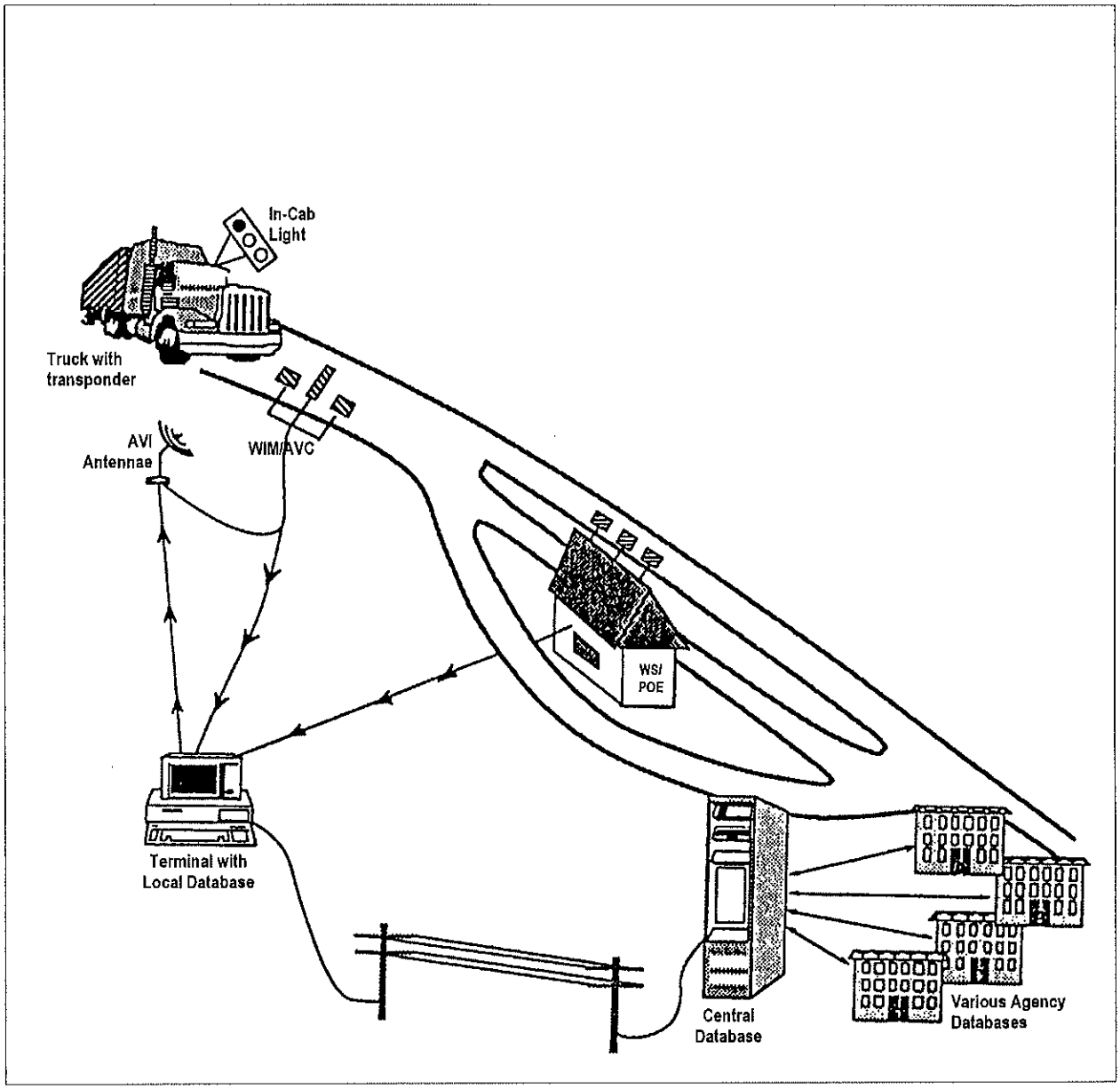

Figure 2 Typical Layout for Electronic Clearance

Automated Roadside Safety Inspection

This service will provide automated inspection capabilities to check safety requirements quickly and accurately during inspections. These systems will benefit from electronic clearance capabilities by allowing inspectors to target unsafe vehicles. Brake inspection is the big item in vehicle safety inspections. Several tests are being conducted on devices to measure brake performance, steering and suspension systems performance without the need for manual inspection. Inspectors also will be able to review driver safety data and also check for driver's alertness and fatigue. These systems will be further enhanced by integrating in-vehicle monitoring and diagnostic systems.

On-board Safety Monitoring

These systems will work with VRC, AVI, and an OBC. The required capabilities of these systems will include: 1) sensing and collecting data on critical vehicle systems (brakes and tires), 2) detecting unsafe conditions of the cargo, 3) monitoring driver's driving time, 4) monitoring driver alertness level, and 5) developing warning mechanisms to the driver, carrier, or enforcement personnel. The driver would be the first to receive such warning to allow corrective action according to the nature of the detected problem. Motor carrier fleet managers and safety personnel can tap into this information on a real-time basis or on a post-trip basis.

Commercial Vehicle Administrative Process

The vision for this CVO user service is to develop a system that will allow motor carriers to purchase credentials and pay fees and taxes electronically by the year 2000. There are two components of this service: 1) Electronic Purchase of Credentials, and 2) Automated Mileage and Fuel Reporting and Auditing. The electronic purchasing option would allow a motor carrier to order a variety of permits in advance and pay for them electronically. Under this system a trucking company could order and obtain annual credentials and special permits via computer link to individual states. A state system receives the carrier's application and checks for completeness and accuracy of the information. If the application is in order, the system would calculate and collect the required fees. The payment will be done electronically through electronic fund transfers and an established account with the state. The state system would update the carrier's record on the state database to reflect the transaction(s). Information such as types of permits purchased, the name of the motor carrier and dates of use will be entered into the state database. The state then sends (electronically, fax, or mail) a receipt acknowledging the purchase to the motor carrier at his headquarters or other location.

Automated tax reporting systems would be possible through automatic mileage and fuel reporting and auditing. Motor carriers would be able to collect and

document mileage, fuel purchases, trip and vehicle data by state, eliminating the need for vehicle log books. These systems would also calculate mileage and fuel purchased within each state allowing accurate calculations of state registration fees and fuel taxes. Motor carriers would not need to keep paper records of their mileage and fuel purchases to file quarterly reports required under the current systems. Several technologies could be used to support this service including AVL, OBC, and beacons. The use of AVL involves capturing a truck location using GPS at state lines to determine mileage. That information could then be recorded on an OBC. An alternative system would involve a network of beacon sites located at state crossings which could transmit location, date and time information. The OBC would process the data received from the beacon and integrate it with other normally acquired sensor information (e.g., odometer readings) into the record. This record if properly prepared would essentially replace the manual trip log which is typically prepared by the driver. This OBC data would then provide the means to automatically create tax reports. However, a fleet management software package would be needed to match fuel purchases with mileage and actually calculate tax liabilities and prepare tax reports. Fuel purchase data would be collected using on-board electronic logs and smart card technology.

Hazardous Materials Incident Response

This service basically involves providing accurate cargo information to emergency response teams. This information will be critical to the safety of emergency response teams and the general public at the site of the incident. Information on the truck cargo could be obtained from the vehicle or from data obtained using roadside readers. Truck shipment data could be entered on a transponder, that also would be used for electronic clearance. Incident management personnel would have readers to obtain that information from the vehicle. However, the survivability of on-vehicle devices during crashes could be an issue. Another alternative would be to access cargo data collected during electronic vehicle clearance or inspection. Emergency teams would then need communications tools to retrieve that information from remote sites.

Freight Mobility

This service of CVO relates to fleet management functions for motor carriers. The public sector will have little direct involvement in developing this service. However, private fleet owners will benefit from technologies and systems offered under other CVO user services. Information on vehicle location and equipment and driver status and the availability of efficient communications systems will enhance fleet management operations. These capabilities will enable fleet managers to use real-time data to re-route their equipment to avoid congestion or incident locations and to respond to service demands. In addition, automation in other areas such as electronic purchase of credentials and electronic record

keeping will facilitate fleet managers jobs and reduce the time they spend on report preparation.

2.4. Benefits and Costs of ITS-CVO

ITS-CVO technologies are considered to be among the early winners of the ITS program. They offer substantial efficiencies to motor carriers and public agencies. ITS-CVO services can make a significant contribution to national productivity by reducing motor carrier transportation costs and increasing the efficiency of their operations. By streamlining the motor carrier regulatory administrative process, CVO services will reduce motor carriers compliance costs. Electronic clearance systems will improve equipment utilization by reducing unnecessary stops and delays for inspections. The safety of all transportation system users will improve due to effective enforcement of safety regulations by targeting illegal carriers. Benefits from better fleet management, enhanced by timely information and automated data collection and processing, will increase efficiency and improve service reliability. Motor carriers, shippers, public agencies, and the general public will benefit from these improvements (NPP, Synopsis, p. 7). The greatest benefits will be realized from reducing motor carrier compliance costs and improving the efficiency of motor carrier operations. Two ITS-CVO services will provide these benefits: Administrative Process and Electronic Clearance.

Since many of these systems are not operational yet, there is some reluctance to place exact figures on the expected benefits of ITS-CVO services. However, there is a universal agreement on the potential of these systems, and on the range of benefits that could be achieved. Before discussing benefits and costs, there are a number of important issues that will impact the benefits and costs of CVO systems that must be pointed out, and they include:

1. The distribution of benefits among private sector and public agency. Most significant benefits will occur in the private sector, namely motor carriers who take advantage of CVO services. Other economic sectors will benefit from improved efficiency and increased productivity.

2. Cost participation of private and public entities. ITS systems, including CVO, require public-private partnerships to develop and operate these systems. At issue, is the contribution of these two groups to the cost of developing a core infrastructure and the payment of user fees to support system's operations.

3. Level of participation of motor carriers. Motor carrier participation in using CVO technologies is expected to be on a voluntary basis. The level of participation will impact the level of benefits achieved. Since there must be a core infrastructure in place regardless of the participation, as more motor carriers participate in the programs, more benefits will accrue. Also, the types

of motor carriers subscribing to CVO services will be those with operation and market characteristics (e.g., interstate) that benefits most from the potential savings (i.e., carriers' acceptance will not be universal).

4. System configuration or extent of infrastructure development (incremental vs. one-time investment). This issue will go hand in hand with carrier participation. In order to justify a system development, an adequate core infrastructure must be developed that can accommodate enough carriers' participation to achieve a positive benefit-cost ratio.

Public Sector Benefits

Broad public benefits from ITS-CVO services are primarily in increased productivity and improved safety. Government agencies also will benefit from implementing ITS-CVO services. With the restructuring of many public agencies responding to reduced budgets and increased customer services, ITS-CVO services will increase the utilization of current resources while accomplishing the goals of these agencies. Examples of agency benefits include: improved administration of programs, improved planning and design due to better data, more efficient data collection and analysis, reduced enforcement costs, increased revenues as a result of more effective enforcement, and preservation of pavements as a result of better weight enforcement. Local governments will benefit from improved incident management and response through the hazardous material incident response service. Examples of additional public benefits also include environmental improvement (air quality), improved mobility, and reduced congestion and or conflict near truck weigh stations and check points.

Industry Benefits

Commercial vehicle fleets can achieve time and cost savings through the various ITS-CVO user services. The extent of these benefits will vary by motor carrier industry segment. Interstate motor carriers with established service routes that encompass multiple jurisdictions will benefit the most from electronic clearance and automated roadside safety inspection. However, all motor carriers will benefit from improved commercial vehicle administrative process.

Time savings to motor carriers will be achieved by reducing delays and eliminating unnecessary stops. Electronic clearance will allow legal carriers to bypass points of entry and truck check points. Trucks will virtually operate under a transparent border concept, much as passenger cars do today. Automated safety inspection will expedite the inspection process and, by targeting high risk trucks, will save legal trucks from unnecessary inspections. Electronic payment will reduce delays at toll booths through automatic toll collection commercial vehicles also will benefit from information from other ITS services to avoid traffic congestion, delays due to bad weather, road construction sites, and incident

locations. When this information is combined with tracking capabilities offered through advanced communications, motor carriers will provide better trucking and parcel delivery services to shippers and receivers. These time savings will translate into reduced motor carrier operating costs, in addition to improving service reliability.

Cost savings to motor carriers will result from reduced operating costs due to reductions in delays and better fleet management, and from reduced compliance costs as a result of streamlining the administrative process. Electronic purchase of motor carrier credentials will reduce paperwork and staff resources to handle permits, registration, and record keeping. Perhaps the most significant savings will be in reducing the administrative burden of keeping and compiling records for safety compliance and tax reporting. The improved safety and reduced conflicts near truck check points also will result in reduction in accident and insurance costs.

ITS-CVO Costs

The costs of developing and implementing ITS-CVO systems can vary tremendously with the system design and scope. Substantial investments may initially be required to develop a core infrastructure for partial operations. The source of these investments will depend on public and private sector roles, but public sector shares during the infrastructure development is expected to be high. Public agency costs will include:

1. Physical modifications to existing truck inspection facilities to accommodate new operations

2. Purchasing and installing electronic systems for reading truck information and collecting necessary weight and axles data (WIM, AVC, and AVI readers)

3. Purchasing and installing communication systems to facilitate the transfer of necessary information from roadside readers to inspection sites and to central data bases.

4. Computer systems to receive, process, analyze, and transmit necessary information. These computer systems may include new hardware at the roadside and at the agency headquarter for processing information and handling electronic credential applications. In addition, these systems will require computer software to accomplish the required functions.

In addition to public sector investments, motor carriers will have to purchase and install special equipment and or devices required for CVO. This equipment will include transponders for electronic clearance and on-board computers. Many

trucking companies already use advanced computer and communication systems through the use of EDI. However, some software will be required to handle the interface with regulatory agencies for compliance and credential purchase purposes. Specific examples of benefit-costs ratios are provided in the following section.

Benefit-Cost Analysis

To justify funding CVO projects, an economic analysis must be included in the evaluation process. As with other transportation project evaluation, CVO projects must demonstrate a benefit-cost ratio greater than one to be accepted. The benefits in this case will reflect public and private cost savings resulting from reductions in operating, compliance, enforcement, and administrative costs. However, the benefits and costs must be measurable to estimate their magnitude in dollar terms. The estimation of ITS-CVO cost elements could be achieved by examining vendor prices of available electronic devices and systems required for a functional CVO system. To estimate benefits, itemized motor carrier costs must be established for major functions relating to their operations and compliance. Agency costs will predominantly be dominated by system development costs. The specific examples of benefit-cost ratios of CVO services listed in this section are obtained by the FHWA and the trucking industry to demonstrate financial viability of CVO.

According to Oregon State ITS Strategic Plan, an electronic clearance program in the state would result in a benefit-cost ratio of 3.6 : 1.0 when 60 percent of the trucks participate in the program[10]. This means, that for each dollar spent on implementing an electronic clearance system, total public and private sector savings will amount to 3.6 dollars. A study in the State of Indiana included some rough financial estimates of CVO benefits and costs based on 1990 ATA truck operating cost estimates and Advantage I-75 agency and system costs[11]. The study determined a baseline motor carrier compliance cost of $6.52 based on a $0.05 per truck per mile and a 6.05 billion truck-miles in the state. Baseline agency costs included $310,000 annual weigh station operating costs (plus employee costs of $27,000) for 14 stations and an existing budget for the Indiana Motor Carrier Tax and Authority Section of $4.37 million. A total of $8.71 million was estimated as the total motor carrier related agency cost in Indiana. The cost of implementing CVO systems in the state was estimated at about $1.33. Benefits to motor carriers were based on a Florida study, which estimated a $1.59 savings per reduced weigh station stop, $0.864 per reduced minute idling, and a rate of $0.882 per reduced minute of delay.[12] An estimated $267.8 million could be saved with mainline speed WIM bypass and 100 percent participation by motor carriers. Increased enforcement revenues due to more effective enforcement were estimated at over $22 million. Maze and Maggio referred to an earlier National Cooperative Highway Research Program Study that estimated net present benefits

of AVI for electronic clearance as $9.25 million with 15 percent participation rate and $28.75 million with 30 percent participation.[13]

The National ITS Program Plan included some benefit and cost estimates for ITS-CVO user services. For electronic clearance, the plan estimated the cost for a full installation of WIM, AVI, and AVC and related signaling equipment to be $300,000 to $500,000.[14] An additional cost of $50 was estimated for a transponder in the vehicle. A safety data base for interstate carriers was estimated to cost about $3 million for development and to exceed one million dollars for annual operations and maintenance.[15] Roadside computer hardware and software to access safety information was estimated at $5,000 per site for initial installation plus a $1,000 for annual operations and maintenance.[16] The cost for an on-board computer with the use of GPS for Automatic Vehicle Location and vehicle-to-roadside communications would be about $2,000 per power unit. There would be additional costs to the state to automate its processing of credentials and mileage reporting for fuel tax purposes.[17]

There have been more studies on benefit-cost ratios of CVO. One of the most recent ones is a study by the ATA Foundation for the FHWA to estimate motor carrier benefits and costs of ITS-CVO user services.[18] At the time of writing, a draft final report was being reviewed, but the research team obtained verbal approval from the ATA Foundation to use the results of the study in this report. The ATA Foundation study may be the first detailed study of the financial inpacts of CVO user services on motor carriers. The results of this study were based on a survey of 700 motor carriers and 170 technology vendors. Motor carriers were stratified into the following categories.[19]

1. Industry segment: Truckload, Less-than-truck-load, TL/LTL, Private fleets, and other carriers

2. Range of operations: local, regional, and national

3. Fleet size: small carriers (1 to 10 power units)

   medium (11 to 99 power units)

   large (more than 100 power units)

The study estimated motor carrier costs based on average labor wages related to the following compliance activities.[20]

- Obtaining operating authority, licenses, registrations, and permits
- Calculating and reporting mileage/fuel tax and subsequent audits
- Reviewing/auditing driver logs and trip sheets
- Reviewing driver qualifications and maintaining driver records
- Conducting annual vehicle safety inspections
- Installing operating credentials on the vehicle
- Monitoring on-road safety of driver and vehicle
- Maintaining hazardous materials emergency response
- Conducting safety and weight roadside compliance checks
- Conducting driver paperwork requirements

The cost of roadside demonstration of safety compliance estimated at $2,727 per vehicle annually was the highest among regulatory compliance costs.[21] About 94 percent of this cost (or $2,573) was in driver time spent on trip sheets and logs.[2] This is clear evidence on the significant potential savings from automating driver and truck data collection and reporting. The study also found regulatory compliance costs to be highest for small carriers, followed by medium size carriers, and finally large carriers due to economies of scale. Table 3 shows average per vehicle annual labor costs of regulatory compliance. Table 4 shows total regulatory compliance costs by fleet size.

[2] M/st drivers are paid by mile not by hour

Table 3 Average Annual Cost of Regulatory Compliance[22]	
Activity	Cost/vehicle
Administrative:	
Licenses, Registrations, Permitting	$78
Mileage/fuel tax reporting and audits	$89
Installing credentials on vehicles	$11
Total	$178
Deskside Safety Compliance:	
Audit logs, summarize, data entry	$189
Reviewing driver records, qualifications	$127
Annual safety inspection of vehicles	$15
Total	$331
Roadside Safety Compliance:	
On-Board safety monitoring	$83
Driver time at roadside checks	$71
Driver time on trip sheets and logs	$2,573
Total	$2,727
Hazardous Material Incident Response	$31

Table 4 Average Annual Compliance Per Vehicle Cost by Fleet Size[23]				
Activity	Large	Medium	Small	Average
Administrative functions	$145	$306	$918	$178
Deskside safety compliance	$265	$530	$963	$331
Roadside safety compliance	$2,670	$2,841	$3,086	$2,727
Hazardous material incident response	$20	$74	$270	$31

In assessing the potential benefits and costs of CVO services, the ATA identified the necessary equipment for each user service. Benefits were estimated based on expected savings in motor carrier compliance costs relative to the estimates in Table 3. The cost of technology applications were estimated as the incremental cost of new applications given existing computer and communications systems currently owned by trucking firms that could be used for CVO. These costs were based on prices obtained through a survey of 170 technology vendors. Benefit-cost ratios were then calculated for each CVO user service and stratified by motor carrier fleet size, range of operations, and industry segment. A summary of these ratios is shown in Table 5. The range of benefit-cost ratios will depend on implementation scenarios and motor carrier participation.

Table 5 Summary of ITS-CVO User Service Assessments[24]

CVO User Service	Range of B/C Ratio
Commercial Vehicle Administrative Process	2:1 to 19.8:1
Electronic Clearance	1.9:1 to 7.5:1
Automated Safety Inspections (Hours of Service reporting and verification)	1.1:1 to 1.6:1
On-board Safety Monitoring	0.1:1 to 0.5:1
Hazardous Material Incident Response	0.4:1 to 3.0:1
Freight Mobility	1.5:1 to 5:1

The highest benefit-cost ratios among CVO user services were for commercial vehicle administrative process and electronic clearance. Even with most conservative estimates, minimum benefit-cost ratios for these services show significant (at least two-fold) returns on investments. In fact, the study states "[B]enefits from technology applications are narrowly defined and are assumed to be conservative."[25] Estimated reductions in administrative compliance due to the use of CVO were 18 percent for medium size fleets, 15 percent for large fleets, and undetermined for small fleets. Electronic clearance benefits were based on a 50 percent to a 100 percent reduction in total stop time for roadside compliance checks. Table 6 shows a detailed description of expected motor carrier costs and benefits by applying the CVO administrative process user service. Similarly, Table 7 shows expected costs and benefits of using electronic clearance. The two tables distribute benefits and costs by carrier type, carrier size, and range of operations.

Table 6 Average Annual Benefits/Costs of Commercial Vehicle Administrative Processes

Industry Segment	Administrative Cost/PU (1)	Savings/PU (2)	Cost of Technology/PU (3)	Range of B/C Ratios (4)
Truckload	$200	$30-36	$3.82	7.6:1 to 9.4:1
Less-Than-Truckload	$97	$14 - $17	$2.15	6.9:1 to 7.9:1
Truckload/ Less-Than-Truckload	$131	$20 - $24	$6.25	3.2:1 to 3.8:1
Private Fleets	$201	$30 - $36	$5.15	5.8:1 to 7.0:1
Other Carriers	$172	$26 - $31	$5.05	5.1:1 to 6.1:1
Local Carriers	$298	$45 - $54	$22.73	2.0:1 to 2.3:1
Regional Carriers	$186	$28 - $33	$5.81	4.8:1 to 5.7:1
National Carriers	$169	$25 - $30	$2.08	12.0:1 to 14.4:1
Small Carriers (1-10 Units)	$918	N/A	$83.33	N/A
Medium Carriers (11-99 Units)	$306	$55	$13.15	4.2:1
Large Carriers (100+ Units)	$145	$22	$1.11	19.8:1

(1) Average administrative yearly cost per power unit
(2) Estimated reduction in compliance costs through the use of CVO administrative process
(3) Estimated yearly cost of technology applications to implement CVO administrative process per power unit--motor carrier only (no agency cost for infrastructure, etc.)
(4) Range of benefit-cost ratios calculated by dividing column (2) by column (3)

SOURCE: ATA Foundation

Table 7 Average Annual Benefits/Costs of CVO Electronic Clearance

Industry Segment	Compliance Cost/PU (1)	Savings/PU (2)	Cost of Type I AVI Tag Per Year/PU (3)	Range of B/C Ratios (4)
Truckload	$82	$42 to $82	$11	3.8:1 to 7.5:1
Less-Than-Truckload	$61	$31 to $61	$11	2.8:1 to 5.5:1
Truckload/ Less-Than-Truckload	$62	$31 to $62	$11	2.8:1 to 5.6:1
Private Fleets	$64	$32 to $64	$11	2.9:1 to 5.8:1
Other Carriers	$45	$23 to $45	$11	2.1:1 to 4.1:1
Local Carriers	$51	$26 to $51	$11	2.4:1 to 4.6:1
Regional Carriers	$70	$35 to $70	$11	3.2:1 to 6.4:1
National Carriers	$79	$40 to $79	$11	3.6:1 to 7.2:1
Small Carriers (1-10 Units)	$71	$36 to $71	$11	3.3:1 to 6.5:1
Medium Carriers (11-99 Units)	$81	$41 to $81	$11	3.7:1 to 7.4:1
Large Carriers (100+ Units)	442	$21 to $42	$11	1.9:1 to 3.8:1

(1) Average annual cost of driver time per power unit for roadside compliance stops at an average driver wage of $14.49 per hour
(2) Based on 50 to 100 percent reduction in total stops by using electronic clearance
(3) $11 per year is the cost of a Type I, read-only tag, capitalized over a three-year period. Based on a purchase price of $33.
(4) Range of benefit-cost ratios calculated by dividing savings in column (2) by the cost of transponder in column (3). The minimum ratio corresponds to 50 percent reduction in stop time, while the maximum ratio is based on a 100 percent reduction in total stop time.

SOURCE: ATA Foundation

Current CVO Applications

This section identifies some of the major ITS-CVO projects currently applied throughout the United States. Some of these projects started right after the completion of the first institutional issues studies. This section will briefly discuss these efforts in relation to institutional, financial, technological, and private-public partnership arrangements. The March 1995 National ITS Program Plan listed numerous CVO demonstration and operational tests activities, which can be classified into:[26]

System design and development

These activities aim at developing system design for CVO user services and supporting systems of data and communications. One of the early activities is developing system design for Safety and Fitness Electronic Records System (SAFER) to provide access to historical motor carrier safety data as a means for selecting trucks for roadside inspection. This activity was targeted for completion by October 1995. Design for a national prototype of the electronic clearance system will be developed by early 1997. The system design will be based on several scenarios and on evaluation of operational regional and local clearance systems. Plans are in place to develop a consolidated credential purchasing system design by 1996. The design for this system will be based on results from operational tests evaluation and input from states and motor carriers. The system design will identify requirements, equipment, and roles in the national prototype for an electronic administrative process.

Testing and evaluation:

The testing and evaluation through CVO operational tests will provide valuable information for system design. The evaluation in these tests covers technology performance, database access and integration, participation, benefits and costs, funding arrangements, and institutional arrangements. There are numerous CVO operational tests underway nationwide. Most of these tests involve federal and state agencies, motor carrier groups, and technology vendors. A couple of examples on these tests are discussed below.

Advantage I-75

The Advantage I-75 project is by far the premier wide-scale application of CVO technologies to facilitate electronic clearance across state lines and international borders. Advantage I-75 is partnership of public and private interests along the I-75 corridor running from Florida through Georgia, Tennessee, Kentucky, Ohio, Michigan, to Highway 401 in Ontario, Canada. In addition to the six states and the province of Ontario, project partners include FHWA, the Canadian Ministry of Transport, U.S. and Canadian trucking associations, and various trucking companies. The Kentucky Transport Cabinet is the lead agency for the project and

is supported by the Transportation Center at the University of Kentucky. JHK and Associates designed the system, which is managed by Science Applications International Corporations. The technology used for AVI is provided by Hughes Transportation Management Systems. The Iowa Transportation Center is serving as an independent project evaluator.[27] Almost 4,500 trucks will voluntarily participate in the operational test.

The goal of Advantage I-75 is to test and evaluate electronic clearance of commercial vehicles. Truck weight and credentials will be verified electronically at mainline speeds at 26 deployment sites along the I-75 corridor. Trucks will be equipped with read-write transponders that will be encoded with a vehicle identification, weight, and other relevant credential data. AVI roadside readers will scan trucks identification and weight from WIM and AVC equipment about half mile up stream from an enforcement site. The truck information is evaluated using a site database that is connected to a regional database. An in-cab device instructs the truck driver whether the truck has been cleared or if he needs to pull in the station for further inspection.

This operational test is expected to assess benefits and costs of electronic clearance, and to evaluate the performance of the deployed technology systems under real situations. Expectations from project partners for significant benefits are high because of the dense truck traffic movement on the I-75 corridor, a major trade and good movement corridor. The number of motor carriers beyond the project's target of 4,500 trucks is expected to increase to 10,000 trucks, at a cost of $75 for AVI equipment. Public sector funding (80 percent federal) is estimated at $12 million. Trucks participating in the operational test are not required to pay a participation fee, beyond the cost of the transponder. The project is expected to grow geographically, by including more states, and in motor carrier participation. Although work on this project started in early 1990, the two-year operational test did not start until October 1995. The next two years of operational test will be quite important in setting the tone for future growth of CVO deployment along that corridor and in other regions.

HELP, Inc.[28]

The first phase of HELP started in 1991 as a multi-state Heavy Vehicle Electronic License Plate Program. The goal of the first phase was to design and test an integrated heavy vehicle monitoring system that uses AVI and WIM technologies. This first phase referred to as the Crescent Project included British Columbia, Washington, Oregon, California, New Mexico, and Texas. The project included 40 sites along interstate highways I-5, I-10, and I-20 equipped with AVI, AVC, and WIM equipment. About 2,000 trucks were equipped with transponders during the test period through the end of 1993. During that phase, data collected from the automated sites were transmitted to a central database that could be accessed by

state agencies for clearance of trucks along the corridor. After the end of the first phase, the ownership of the system was transferred to a private organization known as HELP, Inc.

The second phase of the project included California, Arizona, and New Mexico to test one-stop electronic purchase of credentials. Motor carriers participating in the program will be able to purchase credentials and permits using on-line terminals, as well as calculating and paying fees. The project uses a Vehicle Information System for Tax Apportionment (VISTA) developed by Lockheed and integrates the system with the HELP electronic clearance system. The second phase started in January of 1995 and is expected to conclude in two years.

Midwest States One-Stop Electronic Purchase of Credentials[29]

The goal for this project is to test and evaluate an electronic system to enable motor carriers to request, pay for, and receive credentials electronically through a single interface. The states participating in the project include: Minnesota, Iowa, Illinois, Kansas, Missouri, Nebraska, South Dakota, and Wisconsin. The Iowa Transportation Center of Iowa State University is coordinating the project in cooperation with FHWA. The system will be designed to allow motor carriers to electronically purchase credentials from motor carrier facilities, permitting services, truck stops, and state agencies. Credentials will be issued electronically to a location specified by the carrier. The system is still in development, but was tested in July of 1996.

There are many other efforts to develop and test CVO systems for electronic clearance at international borders (U.S. - Canadian and U.S. -Mexican), one-stop electronic purchase of credentials in the Southwest, Out-of-Service verification in Idaho using video images and readable tags, and Out-of-Service verification using real-time data links and imaging technologies in Minnesota and Wisconsin.

CVO Deployment

Deployment refers to actual application of technologies and systems of some or all of the ITS-CVO user services in the real world. There are some distinct issues relevant to ITS-CVO deployment that are different from other ITS services. Some of these issues include: diversity of agencies, non-homogenous trucking industry, and interstate operations which require multi-state cooperation and coordination. Since CVO services have national implications and are interrelated there is a need for a national system design for development and deployment.

The two major CVO areas with wide scale deployment are the Commercial Vehicle Electronic Clearance and the Commercial Vehicle Administrative Process (referred to as One-Stop Shopping). There are two targeted dates for deployment in these two services[30]: 1) a congressional deadline to provide 100 roadside safety

inspection sites with access to a national carrier safety database and a driver license database, and 2) a US DOT deadline to implement a nationwide electronic clearance system by 1997.

As a result, the deployment of ITS-CVO services can be characterized by the following main features:

1. Target the electronic clearance and administrative process CVO user services for short-term deployment.

2. Participation by motor carriers will be on a voluntary basis. However, the results of testing and evaluation of CVO operational tests will provide concrete evidence on the potential benefits of these systems. As a result more carriers would join these projects.

3. National compatibility must be assured for CVO services to provide the benefits they are intended for. National standards and system designs for these services are being developed with the results from operational tests.

4. Early focus is on interstate operation to mask state differences that could result in motor carrier operating inefficiencies. As a result, deployment will start from corridor and regional level applications that will then be integrated into a national system.

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19. *Benefit/Cost Analysis of the Intelligent Transportation Systems/Commercial Vehicle Operations (ITS/CVO) User Services*, Draft Final Report, Prepared by the ATA Foundation, Inc., for the Federal Highway Administration, October 1995, p. 8.

20. *Benefit/Cost Analysis of the Intelligent Transportation Systems/Commercial vehicle Operations (ITS/CVO) User Services*, Draft Final Report, Prepared by the ATA

Foundation, Inc., for the Federal Highway Administration, October 1995, p. 7.

21. *Benefit/Cost Analysis of the Intelligent Transportation Systems/Commercial vehicle Operations (ITS/CVO) User Services*, Draft Final Report, Prepared by the ATA Foundation, Inc., for the Federal Highway Administration, October 1995, p. 10.

22. *Benefit/Cost Analysis of the Intelligent Transportation Systems/Commercial Vehicle Operations (ITS/CVO) User Services*, Draft Final Report, Prepared by the ATA Foundation, Inc., for the Federal Highway Administration, October 1995, p. 10.

23. *Benefit/Cost Analysis of the Intelligent Transportation Systems/Commercial Vehicle Operations (ITS/CVO) User Services*, Draft Final Report, Prepared by the ATA Foundation, Inc., for the Federal Highway Administration, October 1995, p. 11.

24. *Benefit/Cost Analysis of the Intelligent Transportation Systems/Commercial Vehicle Operations (ITS/CVO) User Services*, Draft Final Report, Prepared by the ATA Foundation, Inc., for the Federal Highway Administration, October 1995, p. ES8.

25. *Benefit/Cost Analysis of the Intelligent Transportation Systems/Commercial Vehicle Operations (ITS/CVO) User Services*, Draft Final Report, Prepared by the ATA Foundation, Inc., for the Federal Highway Administration, October 1995, p. ES8.

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27. *Public Roads*, Autumn 1995, pp. 16-21.

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Chapter 3. — ADMINISTRATIVE PROCESS

Barriers to the implementation of ITS-CVO may not be technical or legal, they may merely be of the "This is the way we've always done it" type. This section looks at the current processes in the Dakotas for administering the International Fuel Tax Agreement, the International Registration Plan, and oversize/weight permits and evaluates their impact on implementing ITS-CVO technologies. These programs were chosen because they represent an effort to minimize the administrative burden under the manual process. ITS-CVO would be able to take advantage of the efforts expended to get these programs where they are and would be able to add the benefits of automation and technology on top.

For many years, when a motor carrier wished to do interstate business they would have to deal individually with each state they traveled in. This meant that in each state a motor carrier would have to be concerned with fuel taxes, vehicle registration, oversize/overweight permitting (and in the past and to some extent today, operating authority), not to mention enforcement issues. Merely keeping one truck operating legally in all 48 states could get to be quite a job. Motor carriers and states began to look for ways to reduce this burden on carriers. The idea of multi-state agreements to allow carriers to deal with only one state emerged and was applied to the areas of fuel tax and vehicle registration. These programs were voluntary until mandated by Congress for participation in 1996.

This section is broken down into a description of each of these areas: International Fuel Tax Agreement, International Registration Plan, and oversize/overweight permits. There also is a concluding section containing comments on the current administrative system.

3.1. International Fuel Tax Agreement

The underlying concept that makes fuel taxes for interstate vehicles cumbersome is that the carrier should have to pay taxes on the fuel consumed in the state and not on the amount of fuel purchased in the state. This is an equitable idea given that different states charge different tax rates and carriers could simply purchase fuel in low tax states and avoid buying fuel in high tax states. The burden placed

on carriers is twofold: 1) determining the amount of fuel consumed in each state and 2) paying the taxes to each state. ITS technologies may be able to help carriers with keeping records to determine the first item. The International Fuel Tax Agreement was developed to help ease the burden of the second item. ITS technologies also may help with automated fund transfers.

The International Fuel Tax Agreement is a plan for allowing carriers to pay fuel taxes to only their base state who then distributes it to the other states in the agreement as necessary. Twenty states and one Canadian province participated in IFTA in 1993 (this doesn't include the three states[1] who are members of the Regional Fuel Tax Agreement). The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) has essentially mandated participation in IFTA (or RFTA for the existing three states) by September 1996.

Where available

Carriers in both states apply to their Department of Transportation at the state capital. North Dakota carriers apply for a fuel license in Bismarck at the Department of Transportation's Motor Vehicle Department. If they are an established carrier with an application on file additional decals can be obtained at branch offices in Fargo, Grand Forks, Minot, Dickinson, and Williston.

South Dakota carriers apply to the Department of Transportation in Pierre. Temporary IFTA decals and permits are available in Pierre. Credentials can also be faxed anywhere if the carrier has been licensed for one year and is in good standing. This can be convenient if a permit expires before a truck returns to its home state.

Information required

Carriers are asked to fill out a one-page application form that asks for company name, address, contact person, phone number, Federal ID number, IFTA account number, IRP Account Number, and number of vehicles needing decals. The application also has check boxes for carriers to indicate which IFTA states the carrier will be operating in. A question also is asked regarding the types of fuel used and where bulk storage is maintained, if applicable. Many of the items on the application are specified by the IFTA agreement and are the same in all IFTA states, but individual states do have the authority to add questions that they feel are necessary.

How to apply

New applications (first time) must be made at the state capital, Bismarck or Pierre. The application must be filled out and accompanied by cash, a money order, or a check. In North Dakota the staff subjectively determines if a background check is needed. Renewals are considered in a following section.

Credentials Issued

After receiving the application and fees, the DOT issues the company one fuel license. A copy of this license must be carried in each of the company's trucks. The company is responsible for making and distributing these copies. Not only is a copy of the company's fuel license required to be in each truck, but there also must be a decal affixed to its exterior. In North Dakota, these credentials may be issued on the spot if everything is in order. In South Dakota, they are mailed to the company.

Under the IFTA agreement, the base state collects all fees and issues a license and decals that are recognized in all IFTA states. The decal is similar in appearance for all states with the exception of a background silhouette of the state where the decal was issued. This allows enforcement officials to 1) easily distinguish an IFTA decal and 2) if necessary, identify the issuing state to verify information.

Fee Structure

The fee structure is different between the two Dakota's. The South Dakota fee applies only to the decals that cost 50 cents each. In North Dakota, there are several fees that apply. The first time a carrier applies for a fuel license there is a $5 fee. An application fee of $20 applies to new and renewing carriers. North Dakota charges $1 for each decal.

Taxes are filed quarterly. The fees due are based on the total fleet miles in each IFTA state, the fuel purchased in each IFTA state, and an estimate of the fuel consumed in each state (based on an average miles per gallon estimate for the entire fleet). If payment is due, a check, money order, or cash must accompany the return. If a substantial credit exists (>$25) the state will issue a check before the next filing period. Small amounts may be held and applied to future taxes. Some states (not North or South Dakota) do not issue refunds.

Renewals

Fuel licenses must be renewed by Jan. 1. All carriers must renew at the same time. Most states, including North and South Dakota, have the same deadline of Jan. 1. This puts quite a burden on both the carriers and on the states to meet this deadline. While officially states allow a 30-day grace period to get the decals on the trucks, many truckers will tell you that the troopers are out checking, and fining, on Jan. 1.

North and South Dakota send out renewal notices in the fall (as early as September or as late as November). South Dakota sends theirs out with the third quarter tax returns. North Dakota sends out a separate mailing. South Dakota does not process fuel license renewals until the third quarter tax returns are finished.

The information needed for the new year is based on the previous year's experience — same states, same miles, same MPG.

Miscellaneous

A carrier may be given permission to file taxes annually if approval is granted by all affected jurisdictions. This status is reviewed annually and the taxes are paid at the end of the year.

3.2. International Registration Plan

The International Registration Plan was drawn up in the early 1970s. It purpose is "to promote and encourage the fullest possible use of the highway system by authorizing apportioned registration of fleets of vehicles, and the recognition of vehicles apportioned in other jurisdictions, thus contributing to the economic and social development and growth of the jurisdictions."[2] While originally developed as a voluntary participation agreement, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) mandated participation by all states by 1996 or risk losing federal funds for highways. Even before the ISTEA mandate the IRP was a fairly popular program with 44 states and two Canadian provinces participating in 1993.

IRP is an agreement for allowing carriers to pay vehicle registration fees only to their base state, which then distributes it to the other states in the agreement as necessary. IRP does not attempt in any way to determine what each state's fees shall be, but does allow carriers to write only one check to pay for a vehicle's registration in several states. IRP prorates a state's registration fee based on the percentage of a total of the vehicle's miles that are traveled in that state. For example, if a carrier spends 10 percent of its miles in a state, then the carrier pays 10 percent of that state's vehicle registration fee.

Where available

Vehicles must be registered at the state capital, either Pierre or Bismarck. In North Dakota, replacement cards may be issued from branch offices in Fargo, Grand Forks, Minot, Dickinson, and Williston.

Information required

The International Registration Plan determines much of information requested on an application form. The usual company name, address, and account number is asked for plus information about the vehicle that is being registered. Carriers must identify the IRP states they will be traveling in. New carriers in North Dakota are asked to estimate the number of miles that will be traveled in each IRP state. South Dakota has a preset mileage schedule that new carriers use their first year. Established carriers in either state use the previous year's mileage as an estimate.

These miles are what the registration fees are based on. Carriers must show proof of payment of the Federal Heavy Vehicle Use Tax.

How to apply

Application is made to the Department of Transportation at the capital in Pierre or Bismarck. Payment of fees is required at the time of application.

Credentials

Carriers are issued a cab card, license place, and decal for each tractor. These must be placed on or in each unit.

Fee structure

Vehicle registration fees are determined by each state. IRP in no way sets these fees or limits them. The IRP allocates fees based on the amount of miles traveled in each state as percentage of total miles. The formula is

$$\frac{(miles\ traveled\ in\ \ each\ state)}{(total\ \ annual\ \ miles)} \times registration\ fee\ for\ \ each\ \ state$$

This formula is repeated for each IRP state and summed to determine the total fee that the carrier owes. It is multiplied by the total number of vehicles being registered (assuming they are all traveling in all the identified states).

Renewals

Licenses expire on Dec. 31. Both states send out renewal notices around October; South Dakota may be a couple of weeks ahead of North Dakota. The estimated miles for the year are taken from the previous year's actual mileage. Credentials are then issued to carriers who must place them in tractors by the Jan. 1 deadline.

Miscellaneous

If a new state is traveled in that was not anticipated when the application was filled out, the carrier must estimate the amount of miles that will be traveled in that state. That estimate is then divided by the original estimate of total miles. This causes the states percentages to total to more than 100 percent. The adjustment is made the following year to include the new state(s).

If a vehicle is sold or destroyed during the year, South Dakota allows the unused fees to be transferred to a new vehicle. Refunds will be issued if the plates are returned. North Dakota does not allow for refunds or transfers.

3.3. Oversize/Overweight Permits

Two of the three major functions of government agencies in the development, maintenance, and operation of the highway system are involved in the oversize/overweight permitting function. Government agencies are responsible for preventing damage to the system and collecting sufficient funds to finance the development and maintenance of the system. To protect the highway system from excessive damage, size and weight limits have been imposed on the system. If these limits cannot be met by a load, there are provisions to allow these special loads to travel the highways after obtaining the proper permits and paying the applicable fees.

These permits allow a particular load to exceed these maximums for a particular trip. If a load is capable of being divided, it **must** be divided to fit under the maximum size and weight limits. Oversize/overweight loads are ones that cannot be divided into smaller loads (a house is a good example). Special exception is granted to these loads by permit. The permit fee is put in place to compensate for the extra damage done to the highway system by this particular load. Oversize/overweight permits are load and route specific and only good for one trip.

Where available

Oversize/overweight permits are administratively different than IFTA or IRP processes. In the Dakotas, they are administered by the Highway Patrol not the Department of Transportation. In North Dakota, however, a Highway Patrol member has an office at the DOT to handle these permits and other issues relating to Commercial Vehicle Operations.

OS/OW permits are available from highway patrol officer and at inspection/weigh stations. After a carrier is established, self permits are also allowed. Self permits allow a carrier to complete the paperwork and mail it in to receive the necessary permit for a particular load.

Information required

Information specific to each load and each trip. Information about the weight or size of the load, the number of axles, the size of the tires, and the route to be traveled are required. This information is needed to estimate the amount of damage that will be done to the pavement system. If a load is particularly difficult or unusual, state engineers may be asked for their opinion about the load and its route.

How to apply

Permit application must be made to a highway patrol officer. This can be done at headquarters or on location at a roadside inspection station. The application must be complete before the trip can begin.

Credentials

A permit for one specific load/trip combination is issued. Application for permit must be made prior to the trip. Credentials, however, may be faxed to any location. The credential will specify the load and route that will be taken and any other restrictions on the movement (e.g., daylight only). No variations are allowed.

Fee structure

In South Dakota the fee is a straight $20 per permit. In North Dakota it depends upon the load, the type of vehicle and the road to be traveled. Fees start at $10. Fees can be paid in cash, or by check, money order, or by credit card. This is the only area in which fees can be paid by credit card. In both Dakotas, these fees are not applicable to publicly owned vehicles. In North Dakota, commercial haulers doing charity hauling are also exempt from these fees.

Renewals

There are no renewals required since the permits are based on a specific trip.

Miscellaneous

In both states, appl)cations made in the field must be made in person. Both states also have self-issue programs in place. In South Dakota a book of 10 permits can be purchased for $200. To use one, an authorization number must be obtained to validate each permit. The authorization numbers may be obtained by telephone. In North Dakota, self-permitting is allowed once an identification supplement is issued by Bismarck. Self-permitting accounts for 80 percent of the permits issued in North Dakota.

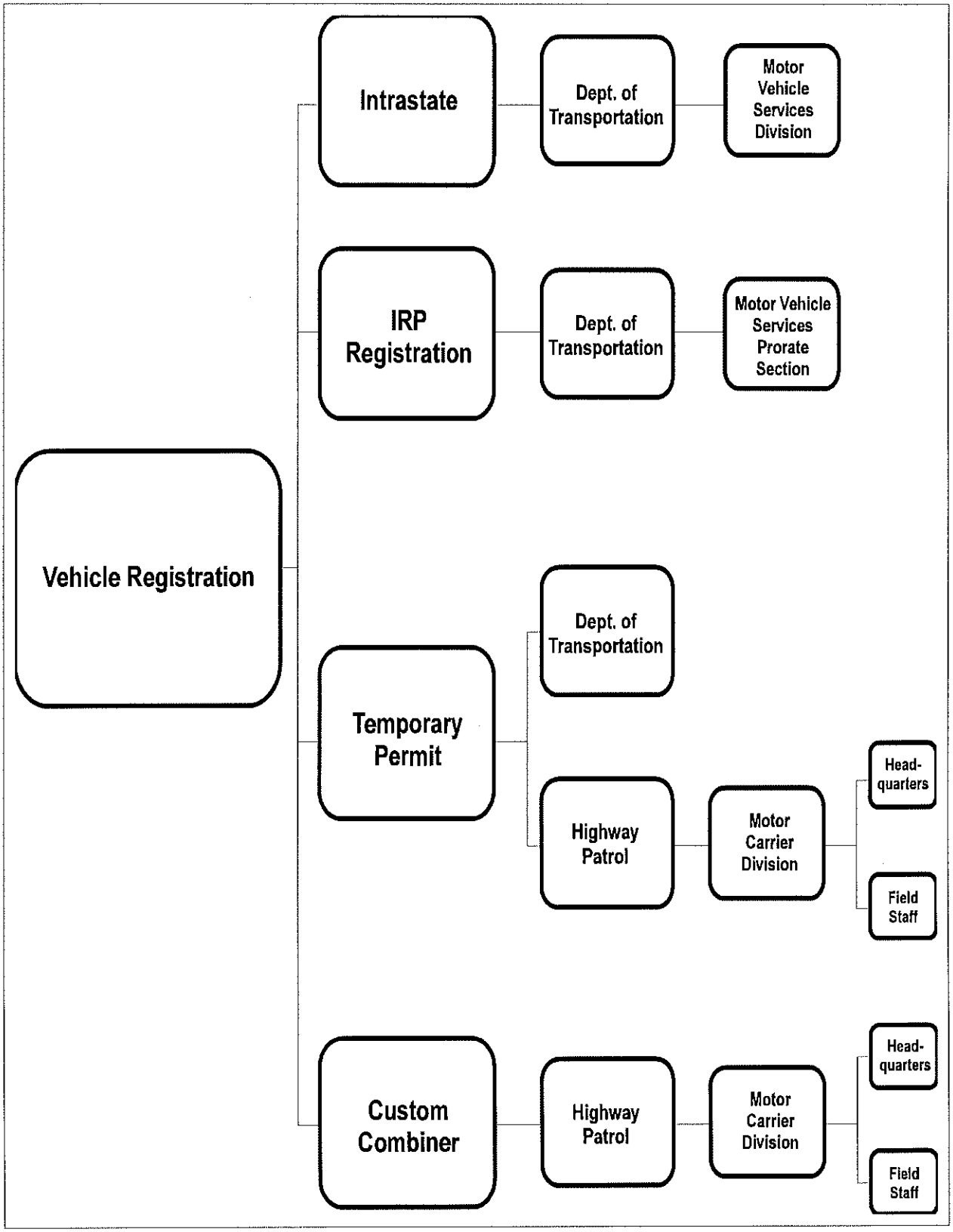

Figure 3 North Dakota's Vehicle Registration Process

3.4. Conclusions

These programs have been successful in their objective of reducing the onerous paperwork burden imposed on an interstate carrier by the accumulation of each state's requirements. They have simplified the process of applying for and renewing credentials required to operate an interstate commercial vehicle. However, they also have created their own problems.

Often getting these credentials to a unit during the necessary time frame can be a problem. The fourth quarter of the year is typically the busiest time for motor carriers (Christmas rush). This also is the time that most credentials need to be renewed. Not only is the paperwork a burden at this time, but the necessary credentials must be physically placed in or on a unit. In the time frame this is supposed to be done, it is entirely possible that a truck will not get back to the company headquarters/terminal. Companies are then forced to either mail credentials to places where trucks are hoped to be, or run empty trucks to terminals just to get credentials in place. The Jan. 1 deadline for renewals is a worst case scenario with regards to timing. This deadline also taxes the state agencies responsible for issuing the credentials. All carriers are renewing at the same time, which strains the staff to the limit. They do their best to be courteous and prompt, but with everyone renewing at once the burden can become overwhelming. This is as true of the IFTA renewals as it is of the IRP process.

Endnotes for Chapter 3

1. Maine, Vermont, and New Hampshire.

2. *International Registration Plan*, American Association of Motor Vehicle Administrators, Article 1 Section 102, March 1991.

Chapter 4. — COMMON CVO INSTITUTIONAL ISSUES

This chapter identifies some of the actual and perceived institutional barriers to implementing ITS-CVO services. This chapter starts with an overview of common issues that could act as barriers to CVO implementation and illuminates some specific examples from other states. A summary of barriers identified from national and state studies based on a review of the literature is also included. The remainder of this chapter is devoted to discussing issues that could act as barriers to ITS-CVO implementation in the Dakotas. These issues are identified from a review of laws and regulations in the two states and supplemented by interviews and conversations with agency and industry representatives throughout the study.

4.1. Common CVO Implementation Issues

The administering, regulating, and enforcement functions of commercial vehicle operations in the public sector are shared by many agencies. The responsibilities of these agencies were established historically as states initiated and implemented motor carrier laws and regulations. Further, these roles did not necessarily respond to the changing motor carrier regulatory climate. The involvement of several public agencies requires several issues to be resolved, which include coordination and communications, lead role, funding participation, and program management. These issues are further escalated at the multi-state level of partnership required for interstate operations.

Commercial vehicle operations encompass a broad range of operations distinguished by distinct segments of the trucking industry with unique services and operating characteristics. The interstate segment of the trucking industry is expected to have higher level of participation in, and in turn benefits from, the ITS-CVO programs. Nonetheless, the interstate motor carrier industry still consists of more than 275,000 carriers and 6.6 million drivers[1]. These carriers with varied operations and practices will not necessarily embrace CVO applications with the same enthusiasm.

The development and implementation of ITS systems are faced with a number of challenges. Some of the general challenges that are relevant to CVO implementation include[2]:

Lack of Market Information

The success of implementing CVO systems will be influenced by private sector participation in two areas: the development and marketing of technologies by technology vendors and the willingness of motor carriers to invest in technology to participate in CVO applications. However, there is no clear information on the benefits and costs of these systems, and as a result, the extent of potential use by the motor carriers. Developers and users who invest in technology have some risk involved in their investment decisions until the performance of the system has been proven.

Infrastructure Development

The most significant investments in ITS will be in developing an adequate information infrastructure that can handle the intended functions. The development of this infrastructure is expected to be largely financed by public money during the early stages. The uncertainty of public commitment to development of this system will impact the private sector participation.

Competition for Scarce Resources

Current public transportation funding levels are significantly lower than the demands of the system. Continuous reductions in transportation budgets and the increasing demand created a backlog of infrastructure needs that is devastating state transportation agencies and users. Since no source of dedicated ITS funding exists, ITS projects must compete with traditional transportation projects. ITS projects must demonstrate significant benefits to attract the scarce transportation dollar at the local, state, and federal levels.

Need for New Skills

ITS requires new technical skills in advanced computer and communications technologies by transportation professionals. Many public agencies do not have the required skills needed to develop and manage ITS projects. In addition, the unfamiliarity of key decision makers of ITS systems may inhibit their support for application and implementation.

Inexperience in Partnerships

ITS brings the need for forming public-private partnership on a multi-state and multi-agency level. The most pressing partnership will be in getting public and private entities to work together for developing the system. Further, the proper functioning of ITS elements will rely on the free flow of information across agency lines.

The extent of the impact of these issues on ITS-CVO implementation will vary from region to region, and from one state to another. The degree of the impact of financial issues will be more evident in states with limited resources. Institutional

issues will be most severe among larger states with complex organization structures and roles.

4.2. Completed Institutional Issues Studies

This section summarizes the institutional issues found to be barriers to CVO implementation in other states. The information in this section is based on a literature review of completed institutional issues study reports. The summary is not intended to be exhaustive of all state efforts, but to provide some helpful examples from other states with similarity to the Dakotas.

State institutional issues studies were conducted using federal funding allocated through the FHWA to each state. FHWA recognized that institutional issues could act as barriers to implementing ITS-CVO on the national and state level. Since any national system will consist of state systems, it was important to resolve institutional issues starting at the state level. Many states approached institutional issues studies by forming alliances with neighboring states. It was believed that institutional issues would be more severe on a multi-state basis. However, regardless of the approach followed in these studies, there are some common issues that will apply to other states and will be discussed in the following sections.

Iowa was among the first states to conduct an institutional issues study back in 1992. The study focused on identifying the most promising CVO technologies and any potential barriers that could inhibit their implementation. However, a clearer direction of the CVO technologies and user services has been developed in national program planning efforts. The Iowa study identified current practices by public agencies and the adversary relationship with motor carriers as major barriers[3].

A Western States institutional study encompassed seven states: Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming[4]. The study examined the regulatory and institutional structure in each individual state. In addition, the study addressed how this structure could impact a multi-state implementation of the transparent border concept. In general, the study found that the primary barriers to implementation of ITS-CVO technologies were not institutional or regulatory. Instead, significant barriers were found to be a combination of economic uncertainty and a lack of shared vision among the relevant parties. Other institutional barriers were found to be unimportant in view of more serious questions to determine[5]:

1. What is the system's intended function?

2. What is the cost of providing the system?

3. What is the cost responsibility of the different parties?

The variety of issues that could inhibit implementation of ITS-CVO technologies were classified into two groups: strategic barriers and tactical barriers. Strategic barriers include issues related to higher levels of d%cision making in each of the participating states, industry groups, and federal government. Strategic barriers included[6]:

1. lack of a mandate from upper management,
2. lack of communications between and within state agencies,
3. lack of a compelling argument to expend scarce resources on ITS-CVO projects, and
4. lack of standards for technologies and procedures for CVO.

Tactical barriers referred to day-to-day operational and planning aspects of the implementation process. Some of the tactical barriers identified in the study included[7]:

1. high cost of implementing transparent border systems of ITS-CVO,
2. imbalance of resources between or within agencies (more demand on funds than available resources),
3. regulatory and legislative limitations,
4. different perspectives and priorities between agencies and industry groups,
5. resistance to change within organizations,
6. lack of automation within organizations, and
7. physical or geographical constraints.

The major factor in economic issues is estimating anticipated savings by agencies and carriers. Carriers will vary in their perception of these savings due to differences in their operations. Carriers with time-sensitive operations will perceive higher levels of savings than carriers who have operations that are not time-sensitive. The level of anticipated savings will influence a carrier's willingness-to-pay, i.e., the level of their financial contribution to developing and

operating the system. Differences among carriers suggested that a "whole" system concept would be infeasible.

Although public agencies viewed CVO technologies positively, they too had concerns primarily related to funding. Agencies were uncertain whether their benefits could justify investments in developing an infrastructure for the system. In addition, these benefits cut across traditional agency lines, resulting in ambiguity in funding roles.

To surmount these barriers, a modular-system concept was suggested by the study team. The system would start with a partial low-cost implementation of ITS-CVO technologies. The benefits from such a system would commensurate with cost contributions After participating parties had accrued benefits they would invest more money to expand the system. Participation in the system would be voluntary for carriers. The envisioned system was primarily an electronic credential verification system that will incorporate existing IRP and IFTA structures on a national or regional basis. The proposed action plan for creating the system included:[8]

1. Create a regional (or national) electronic repository for interstate vehicle and carrier credentials. The system would include IRP and IFTA registration and interstate operating authority. The repository would receive and transmit data from participating states at least once per day.

2. Use an electronic license plate to replace existing IRP and IFTA plates and stickers, interstate operating authority, and proof of insurance. Information would be stored into electronic data base entries and a single piece of paper would be issued annually. Some type of standards must be developed for the electronic plate.

3. Create an electronic verification system that combines data from the central repository system with electronic tags.

The COVE project examined institutional issues to CVO implementation in Arizona, Arkansas, Colorado, Louisiana, New Mexico, Oklahoma, and Texas. Many of these states are currently active in some CVO applications. The COVE study concluded that major institutional barriers exist in the following areas[9]:

1. Organizational complexity: a number of agencies and organizations are involved in activities related to motor carrier operations. These agencies have overlapping responsibilities and different goals and focus.

2. Regulatory complexity: there are numerous regulations that lack conformity and require extensive and sometimes redundant information.

3. Lack of customer service orientation: government agencies have varying degrees of responsiveness to their customers (motor carriers). The goals and focus of the customer and the agency are different.

4. Inadequate understanding and/or appreciation of CVO and ITS: many agencies lack an adequate understanding of ITS-CVO concepts and technologies and how this technology would be integrated with existing practices.

5. Resource constraints: agencies lack staff and staff expertise, adequate funds, and automation and communications systems to support implementation of CVO systems.

A study of institutional issues in Indiana found that the modest technological capabilities of state agencies was a major barrier to implementing ITS-CVO systems. The lack of adequate computer systems was the most commonly identified problem.[10] The required computer systems must be able to share data among state agencies and be capable of producing audit and analysis reports. Similarly, computer software used by state agencies had limited capabilities. These computer problems were further heightened by redundant data requirements by various agencies. Motor carriers were required to provide identical information several times to different agencies (e.g., proof of insurance, tax payment, etc.)

Minnesota approached ITS-CVO implementation in a somewhat unique approach. The state completed a Business Plan to guide its CVO activities. The plan's highest priority activity was a CVO process re-engineering initiative. The perception in the state was that technology was not the sole issue in CVO implementation and that solutions for CVO must focus on producing an efficient CVO process. The plan identified the problems of current practices in five government agencies that interact with motor carriers. These agencies use separate databases, which contain redundant information on motor carriers, vehicles, and drivers. These databases were not linked nor were they accessible to the Minnesota State Patrol for enforcement.[11] An inter-agency re-engineering team is evaluating current practices in order to develop a new process architecture that will reduce the cost of doing business for agencies and motor carriers.[12]

4.3. Summary

The development of any new system will be faced with barriers to effective implementation. A review of the literature on institutional issues to CVO implementation and report documenting state studies reveal three types of fundamental issues:[13]

Technical Issues

These issues are related to having adequate knowledge of the technologies and concepts for conducting CVO services and the necessary databases required to support these services. The technology for the electronic clearance and administrative process CVO services targeted for deployment in the short-term is readily available. However, some technologies required for automated roadside safety inspection and on-board safety monitoring are still in the development process.

Resource Issues

Many state transportation agencies have scarce resources that are inadequate to meet their highway infrastructure demands. As a result, it would be difficult for these agencies to justify investing in new technologies and systems. Although the application of CVO services would provide great savings, these savings are most significant for motor carriers. Some motor carriers are reluctant to pay for CVO services and believe these services should be provided free of user fees.

Institutional Issues

There is a widespread non-uniformity among states' motor carrier regulations. Further, the agency roles and responsibilities in overseeing motor carrier compliance with these regulations have not responded to the changes in the motor carrier industry. The diversity of agencies and their corresponding focus and goals discourages cooperation to implement CVO services. These differences become more critical for multi-state CVO projects.

Other Issues

Some of the additional issues that could negatively impact implementing CVO services include uncertainty about system design and standards for systems components. This uncertainty is perceived as a high risk on investments in advanced technologies and systems that could lack national compatibility once a national system is in place.

Endnotes for Chapter 4

1. National ITS Program Plan, Volume II, First Edition, March 1995, p. 182.

2. National ITS Program Plan, Synopsis, March 1995, pp. 43-46.

3. Maze and Maggio, *Intelligent Vehicle Highway Systems, Institutional Barriers and Opportunities for IVHS in Commercial Vehicle Operations: An Iowa Case Study*, Midwest Transportation Center, Iowa State University, Ames, Iowa, 1992.

4. Mary Hallenbeck, Jodi Koehne, Robert Scxheibe, *Western States Transparent Borders Project, Institutional Barriers and Recommended Action,* Washington Draft Technical Report, Washington State Transportation Center, University of Washington, Seattle, Washington, June 1993.

5. Mary Hallenbeck, Jodi Koehne, and David Rose, *Identifying and Surmounting Barriers to Implementing IVHS Commercial Vehicle Operations Systems*, Proceedings of the IVHS America 1994 Annual Meeting, Atlanta, Georgia, April 1994, pp.

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7. Mary Hallenbeck, Jodi Koehne, and David Rose, *Identifying and Surmounting Barriers to Implementing IVHS Commercial Vehicle Operations Systems*, Proceedings of the IVHS America 1994 Annual Meeting, Atlanta, Georgia, April 1994, pp.

8. Mary Hallenbeck, Jodi Koehne, and David Rose, *Identifying and Surmounting Barriers to Implementing IVHS Commercial Vehicle Operations Systems*, Proceedings of the IVHS America 1994 Annual Meeting, Atlanta, Georgia, April 1994, pp.

9. Greg Fulton, *COVE: Overcoming Institutional Barriers for Commercial Vehicles*, Western States Association of State Highway and Transportation Officials meeting, Vail, Colorado, July 1994.

10. James Kavalaris and Kumares Sinha, *Institutional Issues Affecting the Implementation of IVHS Technologies to Commercial Vehicle Operations in the State of Indiana*, in Proceedings of the 1993 Annual Meeting of the IVHS America, Washington, D.C., April 1993, pp. 387-396.

11. Minnesota Commercial Vehicle Operations Process Re-engineering-Fixing the Process Before Automation, Minnesota Guidestar, St. Paul, Minnesota, August 1995.

12. Conversation with Scott Sannes, Minnesota Guidestar, September, 1995.

13. Michael Hancock, T.H. Maze, and Kathleen Waggoner, *Institutional Issues which Act as Barriers to Multi-state Applications of Intelligent Transportation Systems to Commercial Vehicle Operation*, 1995 Vehicle Navigation and Information Systems Conference Proceedings, Seattle, Washington, August 1995, pp. 465-471.

Chapter 5. — BARRIERS/ISSUES IN THE DAKOTAS

North Dakota and South Dakota were among the last states to conduct institutional issues studies. These states are faced with tremendous highway infrastructure demands that greatly outgrew their continuously decreasing transportation budgets. The two states have extensive transportation systems that could be characterized by low average traffic volumes and a small user fee and tax base to support these systems. Commercial traffic plays an important role in the Dakotas' transportation system. The states are traversed by several important highways that support international trade and regional agricultural commodity movements. Resource issues are evident in the Dakotas as state agencies try to meet the high demand on their limited resources for infrastructure maintenance and commercial vehicle operations needs. These agencies generally have limited staff and support systems. However, most motor carriers in the two states who participated in the study indicated a positive perception of the functions performed by these agencies.

Both the motor carriers and state agencies viewed ITS-CVO services positively. However, there are a number of issues that could act as barriers to implementing these systems. The most critical issues in the Dakotas are related to resource availability. However, other issues such as organizational structures of public agencies and motor carriers willingness to participate in funding CVO projects may also impact the implementation process.

This section summarizes the major issues that were identified throughout the study as potential barriers to CVO applications. These issues were identified based on an examination of the regulatory systems in the two states and based on input from the study steering committee. The issues are arranged in order of their priority in the two states.

5.1. Resource Issues

The most pervasive barrier to implementing ITS-CVO services in the Dakotas may be the lack of adequate resources. The necessary resources can be classified into financial, technical, and support systems.

Financial resources

The two states have modest transportation budgets that can not meet the current demands for infrastructure improvements and maintenance. Further, the socio-economic characteristics of these states result in less than adequate user fee base to support an extensive transportation system. The two states can be classified as "recipient" states who depend on federal transportation funds to support their transportation systems. The ratios of North Dakota's federal allocations to its contributions to the Highway Trust Fund is about 1.92, while South Dakota's ratio is about the same at 1.93.[1] This means, the two states receive almost two dollars from the federal government for each dollar they contribute from collecting user fees. There is a real fear that these states can not even maintain current federal funding levels if Congress changes the funding formula for states.

Table 8 shows some general trends of highway expenditures in the two states. The amount of funds allocated to enforcement and safety activities, where CVO applications could be implemented, are quite low. Any CVO implementation has to compete with pressing highway needs. In order for CVO applications to receive funding consideration, the philosophy of the transportation agency must be realigned to recognize the potential return on investments in CVO. Another alternative would be to use dedicated federal funds for CVO implementation as part of a deployment of a national system.

Human resources

The current staffing levels at state transportation and enforcement agencies that have the greatest motor carrier related roles are at an all-time low. These agencies have gone through restructuring to scale down staffing levels responding to significant budget cuts. Further, the staff experience and backgrounds are incompatible with the knowledge required for ITS activities. Even when middle and lower management staff are aware of the new technologies, this information is not shared with top decision makers.

Technical and support systems

Transportation and enforcement agencies in the two states lack adequate computer and communications systems to support automation. These agencies lack efficient computer systems to handle automatic data collection, data analysis, and data sharing. Motor carrier information is kept on several databases and updated periodically by staff. There was no coordination between data collection for similar tasks. For example, the information provided by motor carriers for IRP is

re-requested on different forms for IFTA, which is then re-entered into the system. The IRP and IFTA representatives do not cross check information provided by the same motor carrier, such as total vehicle miles or even addresses. In addition, IFTA and IRP correspondence could be sent to motor carriers in one mailing.

Another example is computer and communications equipment at truck weight stations. After a truck is weighed, the weight enforcement officer may print the information from the scale, but that information is not stored in any way. When a truck is in violation of weight limits, a citation is hand written using standard forms. These forms are sent to headquarters for manual entry into agency records. The problems with the current systems are lengthy processing, incompatible databases, and outdated information that can not support the information requirements of CVO services. It should be stated that for permitting purposes, there are a number of fax machines for processing permit requests from third party permit services. Electronic fund transfer use is limited. North Dakota was scheduled to start accepting credit card payments for some types of permits, but has not yet activated this service.

Table 8 Historical Highway Expenditures (Millions of dollars)[2]

	North Dakota			South Dakota		
Category	1990	1992	1993	1990	1992	1993
Roads and bridges	64	93	123	118	160	189
Maintenance	35	34	38	34	33	39
Safety, Enforcement	13	11	N/A	26	14	N/A

5.2. Lack of Mandate

This issue was ranked among the top of potential barriers to implementing ITS-CVO systems in the Dakotas. The issue is further complicated by the limited resources available in the two states. A mandate could be at two levels. At the state level, key decision makers could give CVO applications a higher priority within the transportation agency. This level of mandate may encourage more consideration of CVO projects, however, securing funding will still be difficult. The more critical lack of mandate is at the federal level. There is strong evidence that many states lack the motivation and/or the resources to implement ITS-CVO systems. The federal government has traditionally played a leadership role by establishing mandates for state transportation agencies and designing funding

mechanisms to support these mandates. As a result, states with limited resources seldom acted beyond satisfying federal requirements using dedicated program funds. This trend is noticeable in the Dakotas, where transportation funds depend largely on federal funds. In these states, state agency and motor carriers perceive no pressing need for implementing CVO systems in the Dakotas. However, motor carriers indicated they do face regulatory compliance problems in other states. They believe the federal government has the means to oversee CVO applications that will naturally cross state lines.

5.3. Lack of Common Vision

There are several state agencies that interact in some way with motor carriers. These agencies, however, each have a main mission that is different from other agencies. In North Dakota, the state Department of Transportation oversees the allocation of transportation funds in the states. The DOT through its Motor Vehicle Division handles most motor carrier administrative and regulatory functions. The division issues motor carrier credentials and manages the IFTA and IRP programs. The State Highway Patrol (SHP) has the primary enforcement function of motor carrier regulations. They have continuous interaction with motor carriers during weight, credential, and safety enforcement activities. These activities are highly visible within the SHP as a major part of its mission. As a result, the SHP seemed more tuned to motor carrier needs and more willing to consider CVO applications to improve their operations. However, funds for CVO applications would come from the DOT, who view motor carrier operations as one small part of its mission. This example shows how conflicting policies can result in inconsistent priorities between agencies in the same state.

5.4. Lack of Perceived Need

Representatives from motor carriers based in the two states who participated on the steering committee were satisfied with the state agency motor carrier services. Both of the state agency and motor carrier representative believed their relationship in the two states was not adversarial. They indicated that the two states have adequate channels for motor carriers and agencies to solve problems related to state regulatory processes. However, motor carriers from the Dakotas indicated they faced problems in other states due to complicated permitting and taxing procedures. Motor carriers welcomed solving these problems by means of CVO services. However, they were not sure on how they could participate in other state efforts, nor were they clear on their financial contributions to these efforts.

5.5. Carriers Reluctance

A combination of unclear benefits and lack of compelling need cause reluctance among motor carriers in the two states in accepting CVO services. In addition, these motor carriers were under the impression that CVO systems will enable state agencies to collect "new fees". They viewed a "per-use" fee for participating in CVO projects as yet another additional state tax that adds to their financial burden. These motor carriers generally believe that any implementation of CVO services should be offered to the carriers free of charge--since they have paid through existing fee and use tax structure. The benefits offered by CVO were not perceived to be significant enough to justify additional investments in infrastructure. However, most carriers agreed that once these systems were operational and national standards were established, they would invest in equipping their trucks with required technology. One motor carrier commented: "I do not want to carry five different transponders for each CVO corridor."

5.6. Conclusions

ITS-CVO services can offer motor carriers and state agencies significant benefits. However, the implementation of these systems will be faced by resource, institutional, and technical barriers. Issues related to financial barriers will be more visible in states with smaller transportation budgets, especially those who must maintain extensive transportation systems. However, this issue goes hand-in-hand with a lack of mandate to support CVO applications. This lack of mandate denies high level political support for investments in advanced technologies and for increasing interagency cooperation and coordination. The current organizational scheme inhibits interagency cooperation, especially at the operations level.

The study found resource issues and lack of mandate to be the top priority barriers to implementing ITS-CVO applications in the Dakotas. The two states have limited transportation budgets that cannot meet the current demand on the system. Further, a trend of transportation expenditures that were way short of actual highway needs has caused a backlog of needs. Since highways represent the most visible asset for a transportation agency, it will be difficult to allocate needed highway funds to CVO projects. Both states do not have adequate computer and communications systems in place. These systems would be required for most CVO applications. Building and developing new systems will greatly increase the costs of CVO projects. In addition, existing truck inspection facilities may not be able to accommodate the required CVO functions, thus adding physical improvement costs. In absence of a mandate to support CVO implementation, CVO projects would compete with other needs that according to current agency philosophies, have higher priorities.

Motor carriers were aware of the ITS-CVO technologies. However, they did not have a clear perception of the benefits and costs of CVO services. They were also concerned about having to maintain two systems, both the paper system and the electronic one. They thought this might occur because only some states would accept the electronic version while others would still require the paper variety. They were also extremely reluctant to embrace the benefits offered by CVO systems because of their fear of new fees. There was a general perception among motor carriers that the new systems will help states collect additional fees and improve the current collection process. They did not think the new systems would support a more efficient and equitable user fee system.

5.7. Recommendations

Given the substantial investments required for CVO systems and the limited financial resources in the two states it is important to realize efficiencies in the CVO process. The first step in increasing efficiency should be to eliminate overlapping authority and duplications in the CVO process. Eliminating redundant data collection and processing would, in addition to immediate savings, reduce the costs of building computerized database systems for CVO. Once these systems are developed they can support an automated motor carrier administrative process and provide timely information for electronic clearance systems. Given the financial constraints in the two states, reliable data are paramount to successful planning to properly manage anticipated resources and needs.

The implementation of ITS-CVO systems in the two states will require a "champion" to lead key agencies and gather political support for investing in advanced technologies. It is critical to provide the top management with motives to get them excited about ITS-CVO concepts. The steering committee formed for this study could be an excellent starting point for an effective forum to exchange information, ideas, and develop strategies for implementing ITS-CVO services.

The two states must cooperate with other states to benefit from economies of scale in costs and expertise. The second round of FHWA CVO studies required groups of six states or more. These studies will address CVO implementation from a multi-state level. Since the Dakotas do not individually have enough resources, they can join other states in partnerships. Participation in regional and national efforts is necessary to assure that the two states do not miss out on the benefits of CVO. Further, their participation will assure state-specific issues and concerns be addressed early on in the system development process.

Endnotes for Chapter 5

1. Transportation Data Sampler 2, *States Highway Fact Sheets*, Bureau of Transportation Statistics, Publication BTS-CD-03, Washington, D.C., January, 1994.

2. Transport Topics, October 17, 1994.