The Use of Performance Measures in Regional Freight Transportation Planning

by

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Submitted to the Department of Civil and Environmental Engineering on May 23, 1997 in Partial Fulfillment of the Requirements for the Degree of Master of Science in Transportation

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Abstract

This research considers how public/private collaborative planning of regional freight systems can incorporate performance measures into the strategic management process, with specific application to the state of Maryland. The time frame is the longer-term horizon for planning, from three to ten years, in which strategic choices can be made to increase the contribution that a freight transportation system can make in a region's competitiveness in the national and international economy. In suggesting a role for performance measures in freight system management, it focuses on trucking and trucking connectivity to other modes like air, marine, and rail.

The environment for deployment of Commercial Vehicle Operations (CVO) technologies involves numerous stakeholders. This research identifies the major stakeholders in Maryland's CVO program, characterizes their interests, and describes tensions a CVO program will encounter in balancing stakeholder objectives.

The nature of strategic performance measurement differs in the public and private sectors. This research extends current understanding by suggesting how performance measures can be developed to suit a program existing in a multi-stakeholder public/private environment.

Five of the leading CVO programs in the United States are reviewed, with attention to how performance measurement is being used in strategic planning and lessons that can be obtained for other CVO programs. This research concludes by recommending two alternative schemes for incorporating performance measurement into the strategic management for Maryland’s CVO program and discussing implementation issues.

Thesis Advisor: Dr. Joseph M. Sussman
Title: JR East Professor
Professor of Civil and Environmental Engineering
I wish to express my deepest appreciation for Professor Joseph M. Sussman, who patiently guided my efforts to complete this work. My regard for Professor Sussman has continued to grow from my first day at MIT, when I entered into his graduate-level class on transportation systems, through my past two years of association with him. His dedication, diligence, and vision are inspiring.

I wish to thank the staff involved with the motor carrier program in the state of Maryland, who have been patient in answering my questions. Nick Owens of the Maryland Department of Transportation and Joe Foster of the National Transportation Center at Morgan State University have demonstrated themselves to be dedicated and effective professionals.

Financial support for this research has been made by the National Transportation Center at Morgan State University, which in turn has received funding from the state of Maryland and the Federal Highway Administration (FHWA) of the U.S. Department of Transportation.
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Chapter 1
Planning for the Future of Trucking in Maryland

This research considers how public/private collaborative planning of regional freight systems can incorporate performance measures into the strategic management process, with specific application to the state of Maryland. The time frame is the longer-term horizon for planning, from three to ten years, in which strategic choices can be made to increase the contribution that a freight transportation system can make in a region's competitiveness in the national and international economy. In suggesting a role for performance measures in freight system management, we focus on trucking and trucking connectivity to other modes like air, marine, and rail.

We emphasize the use of performance measures in regional freight planning for trucking for several reasons. First, trucking is the dominant mode of freight transportation, accounting for more than half of shipments by volume and more than three-quarters of shipments by value. Especially for movements under 500 miles, trucking is by far the most competitive transportation mode. Second, many rail or marine shipments use at least one secondary movement by truck to reach their final destinations. Trucking thus plays an important role not only in line-haul (i.e., origin to destination) transportation but also in the overall connectivity of freight systems. Finally, the number and diversity of stakeholders is greater in trucking than in other freight transportation modes, because of the large number of owner/operator truckers, the dual use of highway infrastructure for passenger and freight, and the historic regulation of the industry.

This research has been supported by the state of Maryland, which in turn is receiving funding from the Federal Highway Administration (FHWA) of the

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U.S. Department of Transportation. The aim of FHWA in providing funding to Maryland is to encourage the deployment of Intelligent Transportation Systems/Commercial Vehicle Operations (ITS/CVO, or simply CVO) technology, both within Maryland and throughout the United States. More background on CVO, and more broadly on ITS, is provided in Section 1.1.

To put forth a vision for CVO deployment within the state and to guide the long-term management of the state’s motor carrier administration, Maryland’s government agencies in 1996 began working with motor carrier industry representatives to develop a strategic plan for CVO activities within the state. This research supports the development of the Maryland CVO strategic plan in a number of ways.

- It characterizes the environment for CVO deployment, both in Maryland and nationwide.
- It describes the major stakeholders in Maryland’s CVO program, their interests, and issues that could affect their program participation.
- It explains the role that performance measurement can play in strategic management of technology deployment projects occurring in a joint public/private context, which characterizes Maryland’s CVO program.
- It reviews how strategic performance measurement has been used in five current CVO deployment programs in the United States: HELP/Crescent, Advantage I-75, the I-95 Corridor Coalition CVO program, the Minnesota Guidestar CVO program, and Oregon Green Light.
- It recommends alternatives for incorporating performance measurement into Maryland’s CVO strategic plan.

Figure 1-1 provides a schematic representation of the progression of topics covered in this research. The following paragraphs provide more detail on the content of individual chapters.
Chapter 1 provides background on the environment for CVO deployment, nationwide and in Maryland. Specifically, it briefly summarizes ITS, CVO, and CVISN from a technological and programmatic perspective; gives an overview of the trucking industry; and states the need for strategic management of Maryland’s CVO program. Chapter 1 concludes by discussing the application of performance measures to strategic management.

Chapter 2 defines the stakeholders in Maryland’s freight transportation system, describes their common interests, and identifies tensions a CVO program will encounter in simultaneously achieving stakeholder goals.

Chapter 3 reviews the role of performance measurement in strategic management. It discusses what makes strategic management in the public and private sectors different. It extends current research on the use of performance
measurement in strategic management by suggesting how performance measures can be developed to suit a program existing in multi-stakeholder public/private environment.

Chapter 4 presents the results of five case studies of current CVO deployment programs, with particular attention to how performance measurement is being used in the strategic planning for these programs. It highlights lessons for Maryland’s CVO program.

Chapter 5 suggests how performance measures can be developed for Maryland’s public/private CVO program, based on the stakeholders’ interests characterized in Chapter 2, the management and performance measurement theory described in Chapter 3, and the lessons from the CVO program case studies presented in Chapter 4. It recommends two alternative schemes for incorporating performance measures into the Maryland CVO strategic plan and discusses implementation issues.

Chapter 6 presents conclusions about the development of performance measures for strategic management of public/private partnerships. Some of these conclusions concern Maryland’s program in particular, others concern current CVO programs nationwide, and others concern areas for further research.

1.1 The Application of Technology to Transportation: The ITS, CVO, and CVISN Programs

The application of advanced technology to transportation, especially to highway travel, is collectively called Intelligent Transportation Systems (ITS). Formerly known as Intelligent Vehicle-Highway Systems (IVHS), ITS provides tools that can assist the users and operators of America’s transportation system in addressing future demand by applying emerging technologies in information processing, communications, control, and electronics. ITS technologies will benefit both passenger and freight movements. Various ITS user service bundles have been developed for traveler information systems, traffic management
systems, vehicle control systems, transit operations, rural transportation, and commercial vehicle operations.

Intelligent Transportation Systems/Commercial Vehicle Operations (ITS/CVO, or simply CVO) is the application of ITS technologies to freight vehicle and passenger coach operations. (In the current research, we exclude CVO applications for passenger coach operations and focus only on freight transportation.) In the early years of ITS, the freight component of CVO dealt only with truck transportation. It now has a broader, more intermodal connotation—applying to truck-rail, truck-marine, and truck-air movements as well as movements strictly by truck.

In January, 1996, Maryland was asked by FHWA to be a CVISN pilot state. FHWA extended a similar offer to Virginia at this time. As part of the CVISN prototype initiative, Maryland and Virginia will be incorporating CVO technologies into their motor carrier programs. These technologies will enable greater coordination among the various transportation agencies within the Maryland government, but they also will require greater cooperation among state agencies and the private sector. Planning and prototype activities have already begun. In addition to Maryland and Virginia, there will be seven additional pilot areas—California, Colorado, Connecticut, Kentucky, Michigan, Minnesota, and Washington/Oregon. The two-year pilot phase will integrate and demonstrate safety inspections and electronic safety clearance, electronic registration, electronic credentials and clearance, an electronic fuel tax system, and an optional electronic oversize/overweight permitting system.

A side-by-side comparison of ITS, CVO, and CVISN, shown in Table 1-1, reveals that CVO is a much broader initiative than CVISN, with CVO itself being only one component of the ITS program. Because of the public/private nature of ITS and CVO programs, applications often transcend state jurisdictional boundaries. CVISN, on the other hand, is more clearly a publicly led program and will be well-defined within Maryland and other states.
Table 1-1
Side-by-Side Comparison of ITS, CVO, and CVISN

<table>
<thead>
<tr>
<th>Relationship of Maryland’s program to the national ITS program</th>
<th>ITS</th>
<th>CVO</th>
<th>CVISN</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ITS program exists at local and regional levels, with many applications transcending state boundaries. Applications in Maryland are inter-related to ITS applications outside the state.</td>
<td>CVO is one of six inter-related user bundles in the ITS program. Many CVO applications (e.g., automatic vehicle location) transcend state boundaries.</td>
<td>CVISN is being overlaid on the ITS and CVO programs, although in theory it could operate as a stand-alone program. In contrast to the ITS and CVO programs, CVISN is more clearly defined as a state program.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Characterization of program goals</th>
<th>ITS</th>
<th>CVO</th>
<th>CVISN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program has broad goals, including increasing mobility, level of service, and sustainability, for both passenger and freight transportation.</td>
<td>Program has broad goals, focusing on increasing economic efficiency and safety within the motor carrier industry, along with attendant regional benefits.</td>
<td>Program has narrow goals, focusing on administrative efficiency, primarily in the public sector but also in the private sector.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary funding and management lead</th>
<th>ITS</th>
<th>CVO</th>
<th>CVISN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding is public/private and consumer-driven: 80 percent of funding projected to come from private sector investments.</td>
<td>Funding is public/private and consumer-driven: most funding comes from private sector investment in CVO applications developed for the commercial market.</td>
<td>Funding is public sector, and public sector management lead, although collaboration with CVISN stakeholders is required for successful implementation.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary beneficiaries of program</th>
<th>ITS</th>
<th>CVO</th>
<th>CVISN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits extend to all users of the transportation system.</td>
<td>Motor carrier industry is the primary beneficiary, but benefits—economic efficiency, environmental quality, safety—spill over to general public</td>
<td>State governments benefit from increased efficiency inter-communicability, and enforcement capabilities. Secondary beneficiaries accrue to the motor carrier industry.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Modal orientation</th>
<th>ITS</th>
<th>CVO</th>
<th>CVISN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program is multimodal, although many applications focus on highway transportation, because of the dominance of this mode.</td>
<td>Program is multimodal, with most applications focusing on trucking. In the longer term, applications will aid growth of intermodal transportation.</td>
<td>Program is unimodal, limited to highway transportation.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Deployment strategy</th>
<th>ITS</th>
<th>CVO</th>
<th>CVISN</th>
</tr>
</thead>
<tbody>
<tr>
<td>The public sector makes substantial investments initially to lay program infrastructure. The private sector then invests in consumer-driven applications.</td>
<td>The private sector invests in high-value applications (e.g., GPS for fleet management), while the public sector invests in program infrastructure that can make additional applications attractive.</td>
<td>The public sector makes investments in information system connectivity. Deployment proceeds state-by-state, with participation being optional. Full-scale deployment is targeted for 2005.</td>
<td></td>
</tr>
</tbody>
</table>
While CVO applications have been in the process of development and deployment for over a decade, CVISN will provide much needed communication among stakeholders in the motor carrier industry. Thus, CVISN in Maryland will help establish a stronger, more effective base for CVO applications and reward the state with more efficient administrative processes and enforcement capabilities. A statewide public/private motor carrier program—Maryland’s ultimate goal—will be realized through its CVO program.

1.2 Description of CVO Applications

CVO has various functions that improve the efficiency and effectiveness of freight transportation. CVO technologies fall into three broad categories of functionality, as outlined by Joseph Sussman: safety compliance, administrative compliance, and fleet management. ²

- **Safety Compliance**: CVO technologies help the driver to operate safely and improve the ability of the public sector to enforce safety regulations.
  - **Driver/vehicle real-time safety monitoring**. Real-time safety and performance data on vehicles and drivers can be provided to a driver’s destination terminal, as well as to regulatory agencies.
  - **Hazardous material information system**. Information on hazardous materials, potential routes, and incident response capabilities can help in the tracking and routing of hazardous materials.
  - **Site-specific highway warning systems for trucks**. Specific information about highway conditions can help drivers operate more safely. Collision avoidance systems can help drivers avoid accidents with otherwise unseen vehicles.

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- **Terminal movement monitoring.** Location technologies can be used to monitor traffic into and out of terminals, thus providing more security to vehicles and cargoes.

- **Automated May-Day capabilities.** In emergency situations, May-Day facilities available through CVO could provide direct communications between drivers and police or centralized dispatchers.

- **Administrative Compliance:** CVO offers a number of applications to assist in the task of regulation on the part of the public bodies. These applications can reduce the regulatory burden for carriers by consolidating the points of interface with government regulatory functions and automating procedures.

  - **Electronic credentials.** Electronic credentials would allow drivers and truckers to obtain licenses and permits on a centralized basis, with information being passed among geographical jurisdictions electronically.

  - **Automatic credential and weight checking.** Driver and vehicle credentials could be input to a centralized system that would then permit the vehicle to flow without interruption across national and international boundaries. Information on its weight and status could be communicated electronically among jurisdictions. Similarly, information on the status of drivers' status could be pre-cleared.

  - **Electronic mileage recording and trip logs.** Information on the mileage a commercial vehicle has traveled within an individual state could permit more effective tax collection. Transmitting such information from vehicle to roadside sensors would greatly expedite the collection of this data.

- **Fleet management:** Having real-time knowledge of the position and status of all the vehicles in a fleet gives the potential for substantial
improvements in the productivity of the fleet. CVO technology offers the potential for dynamic re-routing, load consolidation, load tracking, and optimal load positioning.

1.3 The Need for Strategic Management of Maryland’s CVO Deployment Program

In both the public and private sectors, management involves long-term, medium-term, and short-term objectives. At the strategic level, managers set goals, communicate these goals to organizations involved in the CVO program, establish an overall framework for monitoring performance relative to strategic objectives, and take corrective action when necessary.

The challenge for the top management in a CVO program is to keep stakeholders cognizant of objectives on the long-term horizon while focused on the tasks at hand. Especially in a changing environment, strategic management provides a beacon by which the players orient themselves to accomplish the objectives of the program. This section reviews four factors particular to Maryland that contribute to the continually evolving environment in which the state’s freight transportation system exists. The challenges, opportunities, and threats posed by these factors underscore the need for strategic management of the Maryland CVO program.

- Maryland’s importance in the mid-Atlantic coast transportation network;
- Regional economic importance of the Port of Baltimore and Baltimore/Washington International Airport (BWI);
- Challenges faced by the freight transportation industry in Maryland; and
- Virginia’s role as a regional competitor and CVO collaborator.
1.3.1 Maryland's Importance in the Mid-Atlantic Coast Transportation Network

Two hundred years ago, the nation's capital, Washington, D.C, was sited within Maryland because of the state's location at the center of the eastern seaboard. Maryland has maintained its logistical importance through the present day, with Baltimore providing sea, rail, and air access to a hinterland along the coast and extending to the Midwest (see Section 1.3.2). Figure 1-2 illustrates the major highway arteries in the state, along with out-of-state destinations.
While Maryland has long been an important route for trade between Europe and the mid-Atlantic region, the state is emerging as an important terminus for trade with emerging markets like China, Southeast Asia, and South America as well. Strategic planning for CVO deployment in Maryland must take into account the state’s role as a transportation hub that facilitates freight service within the mid-Atlantic seaboard and to the Midwest while providing access to global destinations.
1.3.2 Regional Economic Importance of the Port Of Baltimore and BWI Airport

While highways are the predominant form of transportation within Maryland for both passengers and freight, one of their key functions is to connect to other modes in the state’s transportation network. Thus, Maryland’s CVO program should contribute to the extent possible to the regional strength of the Port of Baltimore and BWI Airport.

Business and government leaders in Maryland have continually recognized the importance of the Port of Baltimore and BWI Airport in planning for the ongoing vitality of the state. Over $1 billion has been invested in the Port of Baltimore over the last decade,\(^3\) and BWI Airport will be undergoing $250 million in expansion over the upcoming three years.\(^4\)

The state of Maryland relies on the strength of the Port of Baltimore and BWI airport for its economic well-being. Strategic planning for CVO should take into account the multi-modal nature of the freight transportation network within the state and the importance of the Port of Baltimore and BWI as nodes within this network that have significant economic importance in their own right.

The railway system within the state radiates from the Port of Baltimore, with CSX and Conrail providing links to the national rail network.\(^5\) The Port serves as a major entry point for automobiles to the mid-Atlantic area, with an average of 350,000 vehicles handled yearly.

The state’s primary passenger and freight airport, BWI, has seen sustained increases over the last decade in the number of carriers, number of flights, and

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\(^3\) Maryland Port Administration, *Strategic Plan*, July 1996.

\(^4\) Maryland Aviation Administration, *Strategic Plan*, 1996.

\(^5\) In April, 1997, CSX and Norfolk Southern announced plans for a joint acquisition of Conrail. While the final specifications of the acquisition have not yet been approved, in any case the Port of Baltimore will be served by at least one major railroad.
number of passengers. Increasing cargo volume is a major theme in the current strategic plan for the airport.

1.3.3 Challenges Faced by the Freight Transportation Industry in Maryland

In terms of volumes handled, the Port of Baltimore is the focal point of Maryland’s freight transportation network. The U.S. port industry is fiercely competitive, and the world’s container-carrying shipping lines are increasingly forming consortia that are concentrating on fewer ports of call. In its most recently released strategic plan, the Port of Baltimore acknowledges that it will not easily increase its market share in the regional transportation market, because of the length of the Chesapeake Bay and the shallowness of the Chesapeake and Delaware (C&D) Canal. In response to this structural change in the shipping business, the Port of Baltimore has set a number of goals that will depend, to some degree, on the ability of truckers to move freight from the port to its hinterland destination, and vice versa:

- To be the largest and predominant RoRo (i.e., roll-on, roll-off trailers capable of being driven away) port on the U.S. East Coast;
- To be the largest automobile importing port on the U.S. East Coast;
- To develop a diversified forest products handling capability; and
- To pursue other breakbulk (i.e., non-containerized solids) cargo opportunities.

Highway access is one of the keys that will determine the competitiveness of the Port of Baltimore, and, in turn, the future strength of the Maryland economy. Elements of this access include not only the physical roads connecting to the Port, but also the reliability of the travel times of trucks serving the Port and the ability to transmit vehicle information (particularly container identification data) across modes. CVO technologies, together with a more
cooperatively oriented motor carrier administration at the state level, can play a major role in supporting the vision expressed in the Port’s recent strategic plan.

1.3.4 Virginia’s Role as a Regional Competitor and CVO Collaborator

Virginia, like Maryland, is a CVISN pilot state and a member of the I-95 Corridor Coalition (see Section 4.3). Given the contiguous nature of the two states and their shared operation of the Capital Beltway and the Washington Metro transit system, these two states already interact on transportation issues. CVISN and, more broadly, CVO, will require more intense interaction between public agencies in Maryland and Virginia—in terms of deploying infrastructure, planning and operating information systems, and coordinating enforcement. On Maryland’s part, this will require an understanding of Virginia’s motor carrier administration and strategic plans for CVO within the state.

While Virginia exists as a collaborator in CVO deployment, it also is present as a regional economic competitor, especially with regard to freight transportation. The ports of Norfolk and Baltimore compete directly, and in recent years the trend has been for Norfolk to get an increasing share of the regional container market. Dulles Airport has extensive air freight operations, and it competes to some degree with BWI Airport.

Cooperation between the Maryland and Virginia CVO programs may run counter to traditional attitudes within both states of protecting respective regional interests. Yet, CVO offers mutual benefits; it is not a zero-sum game, one in which events to one participant’s advantage work to another’s disfavor. Both Maryland and Virginia can increase their quality of freight transportation and general economic competitiveness by striving for CVO programs that work seamlessly across states as well as within.
1.4 The Trucking Industry in Context

In this section, we review the organization of trucking industry and describe its status in Maryland. We discuss the effects of national regulatory changes beginning with the passage of the Motor Carrier Act of 1980, which began the economic deregulation of the trucking industry, and characterize the market forces currently faced by carriers.

1.4.1 The Organization of the Trucking Industry

Two-thirds (over $200 million in 1994) is accounted for by the nearly 50,000 private fleets operating in the United States. A private fleet is a set of vehicles operated by a shipper primarily for the movement of its own goods. For instance, McDonald's maintains its own fleet of trucks for transportation of products from warehouses to franchise locations.

A for-hire carrier is a company whose primary business is the transportation of goods for other companies for a fee. For-hire carriers are usually divided into three operational segments—truckload (TL), less than truckload (LTL), and package delivery—based on the range of shipment sizes they handle and technologies used:

- Truckload (TL), comprising motor carriers handling loads in excess of 10,000 pounds;
- Less than truckload (LTL), comprising motor carriers handling shipments between 150 and 10,000 pounds; and
- Package delivery, comprising motor carriers handling shipments less than 150 pounds.

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1.4.2 The Trucking Industry in Maryland

Collectively, the trucking industry is one of the largest in Maryland, providing one of twelve private sector jobs. (This figure is close to the national average.) Maryland’s trucking industry employs approximately 140,000 persons, with a payroll of $4.5 billion. More than 8,300 firms are registered with the state comptroller, operating a fleet of over 45,000 vehicles. (Vehicles weighing less than 26,000 pounds do not have to be registered with the state’s comptroller, and so the above figures are underestimates.) A typical trucker pays $4,700 worth of taxes to the state through fuel tax and registration fees. Of all of Maryland’s road user revenue in 1991, $125 million, over one-quarter came from truckers.  

1.4.3 The Effect of National Regulatory Changes

Before the Motor Carrier Act (MCA) of 1980, trucking firms were required to obtain hauling authorization both by commodity and route. The process to obtain these authorizations was both costly and time consuming. Additionally, shippers with private fleets were not allowed to haul other shippers’ freight, and for-hire carriers were restricted to being either contract or common carriers. The net effect of these rules was the protection of existing motor carriers through extensive barriers to entry.

The MCA deregulated the interstate motor carrier industry by removing many of these barriers. Specifically, the authorization process was liberalized to include only insurance coverage and safety standards; private fleets were granted authority to haul additional freight; and for-hire motor carriers were allowed to operate both as common and contract carriers.

The major effect of deregulation was to reintroduce competitive forces to an industry that had been protected for nearly 50 years. Upon enactment of the MCA, there was an almost immediate entrance into the market place of small,  

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entrepreneurial, primarily non-union carriers. Existing carriers had to compete not only with new entrants, but also with other established carriers ready to expand into other carriers' geographic markets. The general response of carriers across the board was to cut rates. While rate wars have been an apparent boon to shippers, they have lead to decreased profit margins and bankruptcies for many carriers.

The Trucking Industry Regulatory Reform Act (TIRRA), enacted in August 1994, effectively repealed the long-standing filed rate doctrine, which had required carriers to file all tariffs (i.e., rates) with the ICC at least one day before their enactment. By removing the public filing requirement, TIRRA allowed carriers to enjoy greater confidentiality for the rates they offered to different shippers.

While MCA and TIRRA deregulated interstate motor carrier transportation, intrastate transportation was still highly regulated. The Airline Improvement Act (AIA) of 1995 deregulated intrastate shipping. The main intent of the AIA was to remove the air carriers' exemption from the intrastate regulations for the ground movement portion of their networks. Because they did not move all of their freight by ground, air freight carriers had not been considered motor carriers and thus had been exempt from intrastate regulation. This allowed them to price their ground transportation services below that of the competing LTL carriers. The LTL industry successfully lobbied to remove this exemption; AIA eliminated rate, route, and service regulations for all intrastate transportation altogether.

1.4.4 Market Forces in the Trucking Industry

Private carriers compose the bulk of the motor carrier industry, capturing two-thirds of the $300 billion market in 1994. Private fleets have never been

\[\text{Common carriers could offer transportation to the general public, while contract carriers could serve only pre-arranged shippers.}\]
more efficient than for-hire carriers, even during regulated times. Since deregulation, the TL market has become more competitive and private carriers' inefficiencies have become more glaring. In light of these inefficiencies, private fleet operations have come under greater scrutiny. This scrutiny is leading to rationalization of private fleets and conversions to use of for-hire fleets, mostly in the TL segment.

Figure 1-3 illustrates the competitive environment faced by the TL segment of the trucking industry, using a scheme developed by Michael Porter. While there are many factors affecting the TL market, four are of special interest. First, buyers (i.e., shippers) are becoming much more powerful. Second, the shortage of qualified drivers, largely attributable to difficult working conditions and regulatory stringency, is leading carriers to deploy information and communications technologies that use drivers more effectively and increase the quality of the work environment. Third, while entry barriers remain low for the type of services offered by smaller TL firms, larger firms are increasingly using information and communication technologies to provide types and levels of service that are prohibitively expensive for smaller competitors. Finally, different modes serve as competitive substitutes for different segments of the TL industry: intermodalism competes with long-haul services provided by large carriers, while smaller TL firms compete with LTL firms for regional services.¹

In 1994, there were approximately 250 LTL carriers operating in the United States, earning revenues of $20 billion. The LTL segment consists of two types of carriers: nationals and regionals. National carriers are predominately long-haul and unionized, while regional carriers are largely sort-haul and non-unionized. Because of the increased competition from the regional LTL carriers, the nationals are shifting to more direct shipments, relying less on their elaborate hub-and-spoke systems, discounting heavily to increase their lane densities, and forming alliances on non-union regional carriers to parallel national unionized networks. The regional LTL carriers, in turn, are forming alliances with other regional LTLs and TL carriers to increase their coverage.

The ground package delivery segment is still dominated by the carrier which founded it, the privately held United Parcel Service (UPS). Package delivery carriers, including UPS, are expanding into the LTL market by increasing the allowable shipment size. A threat to traditional package delivery
firms is the expanded use of land transportation by air-freight firms. For instance, over half of FedEx's air freight never leaves the ground and instead travels via FedEx's growing truck fleet.

Having laid out the background of the ITS, CVO, and CVISN programs and described the context of the trucking industry, we proceed to describe the role of performance measures in the strategic management of Maryland's CVO program.

1.5 The Role of Performance Measures in Strategic Management of Maryland's CVO Program

Performance measures are quantified indicators of effectiveness. At the strategic level, they reflect the long-term health of a program, in terms of meeting primary objectives (e.g., for the public sector, profit, and for the public sector, safety) and supporting processes (e.g., employee satisfaction) that provide the basis for achieving primary objectives. Performance measures allow trends in program health to be tracked and communicated to program stakeholders. Paired with goals and objectives, performance measures provide the mechanism whereby decision makers can guide planners and engineers toward achieving desired ends and can then check, using evaluation results, that the desired strategic ends are indeed being achieved.

Maryland's CVO program involves a number of public and private sector stakeholders. These stakeholders will need to work collaboratively over an extended period of time if the program is to be a success. Obtaining and maintaining consensus among these stakeholders in an environment of shifting government priorities, intensifying freight industry competition, and continually emerging technologies will pose a tremendous challenge.

Effective deployment of CVO technologies in Maryland will require planning and management with an eye toward the long-term future as well to current tasks. By incorporating performance measures reflecting collaborative
goals into Maryland's strategic management process for CVO deployment, architects of the program will increase the likelihood that consensus among stakeholders can be maintained.

Performance-based goals serve to transmit the interests of top management without encumbering subordinate parts of an organization with a rigid plan for achieving management objectives. Once performance measures reflecting the long-term strategic objectives of stakeholders in Maryland's CVO program have been developed, they can aid in selecting projects that achieve the greatest measure of projected performance improvement per the dollars invested. In instances when project objectives change over time, pre-existing performance measures make evaluation easier by focusing analysis on the long-term objectives desired by management.

1.6 Further Remarks

Freight transportation in Maryland exists in a period of challenge and change. Deregulation, emerging technologies, and shippers' demands for a higher level of service all combine to establish an environment where collaboration among stakeholders in the freight transportation system can provide significant benefits.

To manage a collaborative public/private CVO program, participants will need to establish a strategic vision, define roles and responsibilities, and develop a business plan. This research aims to show how strategic performance measures can be incorporated into Maryland's CVO program, to enable management to satisfy stakeholders' common interests and deal with tensions that are inherent in collaboration. The following chapter defines the stakeholders in Maryland's CVO program and characterizes their interests.
Chapter 2
Incorporating Stakeholder Perspectives into CVO Strategic Management

Identifying stakeholder interests provides a basis for the development of strategic management performance measures; measuring the attainment of stakeholder interests in a balanced way will promote success and stability in Maryland’s CVO program. We identify three groupings of stakeholders in Maryland’s CVO program—active collaborators, supporting groups, and affected communities—and characterize the stakeholders and their objectives in each grouping.

2.1 Characterizing Stakeholders in Maryland’s CVO Program

The stakeholders in Maryland’s CVO program can be divided into three tiers based on their level of interest and involvement in the program:

- **Active collaborators** participate in management by identifying program goals and objectives, defining roles and responsibilities, and developing business plans.

- **Enabling supporters** facilitate the success of a program by supplying required inputs, purchasing outputs, and promoting a good operational environment.

- **Affected communities** are potentially impacted, positively or negatively, by the performance of the program; accordingly, they may want to facilitate or impede the program’s success.

Table 2-1 categorizes major stakeholders in the Maryland CVO program into these three groups, and the following sections describe the perspective of each stakeholder toward the program.
# Table 2-1

Classifying Stakeholders in Maryland’s CVO Program

<table>
<thead>
<tr>
<th>Active Collaborators</th>
<th>Enabling Supporters</th>
<th>Affected Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trucking Industry</td>
<td>Shippers</td>
<td>Other Freight-Carrying Modes</td>
</tr>
<tr>
<td>Regulatory Community</td>
<td>Maryland State Government (besides motor carrier program agencies)</td>
<td>Non-Linked ITS Programs</td>
</tr>
<tr>
<td>Enforcement Community</td>
<td>CVO Technology Developers</td>
<td>Political Interests</td>
</tr>
<tr>
<td>Academic Community</td>
<td>Financial Community</td>
<td>Passenger Vehicle Drivers</td>
</tr>
<tr>
<td></td>
<td>FHWA</td>
<td>Environmental Interests</td>
</tr>
<tr>
<td></td>
<td>Linked ITS Programs</td>
<td></td>
</tr>
</tbody>
</table>

## 2.1.1 Active Collaborators

Maryland’s CVO program revolves around the collaboration of four major parties: the trucking industry, the regulatory community, the enforcement community, and the academic community.

### 2.1.1.1 The Trucking Industry

The trucking industry comprises firms, drivers, and investors who seek profits from transporting goods at a moderate cost with a good level of service, with service defined as speed, reliability, and safety (in terms of cargo loss and damage and incident impacts). Taken as a whole, the trucking industry is likely to be supportive of CVO technologies that will allow increased efficiency and a higher level of safety, so long as these technologies are not mandated.\(^1\)

Approximately half of all the trucks in the nation already use mobile

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\(^1\) See the ITS America, CVO Technical Committee’s Statement of Guiding Principles, which were proclaimed in 1995.
communications, and about one-fifth already use computer-aided dispatch and routing systems.²

The differences among trucking firms, described in Sections 1.4.1 and 1.4.2, lead to differences in competitive pressures and operating environments. These factors make some segments of the industry more pre-disposed to adopting CVO technologies. For instance, the bigger TL firms, with their large operational scale, high driver turnover, and desire to build a base of loyal customers, are likely to employ CVO applications to enhance fleet management, enhance working conditions, and provide added value to shippers. On the other hand, owner/operators operating locally are much less likely to see the benefits of adopting CVO technologies, even if they are able to finance such an investment.

Truck drivers tend to be favorable to the CVO applications currently being tested, but they are not uniformly supportive, as the results of a recent FHWA study, shown in Table 2-2, make clear.³ The implication for the Maryland CVO program is that some services will be easier to deploy than others, at least from a driver acceptance standpoint. For example, concern about privacy (from the government and carrier managers) is an important issue in drivers' perception of commercial vehicle administrative processes and on-board safety monitoring. In contrast, drivers view hazardous materials incident response, freight mobility, and commercial vehicle electronic clearance services as easing their workload and not being too difficult to master.

³Carol Zimmerman, "How Will Commercial Drivers Adapt to CVO Services?" in *Proceedings of the 1996 ITS America Conference*, pp. 2428-2433.
Table 2-2
Favorability of Truck Drivers to CVO Services

<table>
<thead>
<tr>
<th>CVO Service</th>
<th>Index of Favorability$^a/$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous Materials Incident Response</td>
<td>7.9 to 1</td>
</tr>
<tr>
<td>Freight Mobility</td>
<td>3.1 to 1</td>
</tr>
<tr>
<td>Commercial Vehicle Electronic Clearance</td>
<td>2.0 to 1</td>
</tr>
<tr>
<td>Automated Roadside Safety Inspection</td>
<td>1.2 to 1</td>
</tr>
<tr>
<td>Commercial Vehicle Administrative Processes</td>
<td>1.0 to 1</td>
</tr>
<tr>
<td>On-Board Safety Monitoring</td>
<td>0.7 to 1</td>
</tr>
</tbody>
</table>

$^a$/Index of favorability is based on weighted responses of truck drivers rating attitude toward services in terms of “strongly in favor,” “somewhat in favor,” “somewhat opposed,” and “completely opposed.”

The FHWA study found significant variations among driver segments, with the following more likely to embrace CVO applications: less experienced drivers, union members, drivers paid by the hour, middle-aged (i.e., 45-54), lower income, and female. Drivers with the following characteristics were more likely to oppose CVO services: owner/operators or drivers working for a small fleet owner, less educated, older (i.e., older than 55), and higher income. Notably, FHWA found that drivers who had experience using CVO applications were more favorably disposed to new services, suggesting that driver receptivity may increase as CVO technologies take roots within the industry.
2.1.1.2 The Regulatory Community

An organizational chart of Maryland’s motor carrier program, showing both regulatory and enforcement components, appears in Figure 2-1. This chart shows that the four state agencies administering the Maryland’s motor carrier program—the Department of the Environment (MDE), the State Police (MSP), the Department of Transportation (MDOT), and the Comptroller—all report to the state’s governor, with no formal lines of inter-departmental communication.

Figure 2-2
Organizational Chart of Maryland’s Motor Carrier Program

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*For purposes of this research, the Maryland State Police and the Maryland Transportation Authority (MdTA) Police, part of Department of Transportation (MDOT), are assumed to constitute the enforcement community, discussed in Section 2.1.1.3; the remaining agencies involved in Maryland’s motor carrier program, described below, are assumed to constitute the “regulatory” community, though in fact these agencies have a mission to support the trucking industry as well as regulate it.*
MDOT is Maryland’s focal agency for transportation. Its mission comprises both freight and passenger operations, of all modes. The State Highway Administration (SHA) is the branch within MDOT with primary responsibility for ensuring safe operation of the state’s highways. It coordinates all motor carrier related activities throughout the state; issues oversize/overweight permits; evaluates and implements policies; and reviews regulations.

The Comptroller and the Maryland Transportation Authority receive revenues from the motor carrier industry. They depend on these revenues, and they have extensive staffs devoted to their collection. The Motor Vehicle Administration (MVA), a branch of MDOT, receives excise tax and other miscellaneous fees.

The Department of the Environment is authorized to inspect any vehicle used to transport or hold hazardous materials, and it responds to incidents involving hazardous materials. (MDOT permits haulers, drivers, and vehicles transporting hazardous substances and petroleum products.)

More detailed organization charts for motor carrier program agencies in Maryland are presented in Appendix A. These more detailed charts reveal that the cabinet-level organizations involved in Maryland’s motor carrier program have a variety of responsibilities in addition to the trucking industry. The fact that trucking-related activities are “buried” in the organizational structure makes state government-wide coordination of trucking policy difficult to achieve, much less maintain in a dynamic environment. Maryland’s government has made efforts in this direction, by obtaining an inter-agency agreement in 1996, signed by agency-level executives specifying agency trucking industry roles and responsibilities and creating a mechanism for coordination.
2.1.1.3 The Enforcement Community

The State Police have broad responsibility for maintaining safe and secure conditions in Maryland; with regard to trucking, their responsibility is enforcing truck safety and weight requirements. The Transportation Authority Police have responsibility for safety, security, and toll compliance on highways under the jurisdiction of the Toll Authority. The State Police are much more prominent on the political level and have more extensive responsibilities than the Transportation Authority Police.

Improving safety has been a continuing priority in Maryland, as it has been nationwide. In 1985, the state implemented the Maryland Commercial Vehicle Enforcement Program to help reduce the involvement of heavy trucks in accidents. As a result, the annual number of trucks involved in police-reported accidents dropped from 10,300 in 1985 to an estimated 7,500 in 1994. Deaths in these accidents fell from 121 in 1985 to 100 in 1994—about one-sixth of all accident fatalities in the state.

2.1.1.4 The Academic Community

The continuing emergence of new technologies, the prospect of greater coordination among parties in the freight transportation system, and the push to change how management works in both the public and private sectors all increase the role that the academic community can play in transportation planning. On the one hand, Maryland's technical universities will be important for educating transportation professionals who will be capable of working in the more inter-disciplinary and flexible environment of CVO deployment. On the other hand, the research capabilities of the academic community can help the

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5 I-95 from Baltimore to the Delaware line is the primary road under Maryland Toll Authority jurisdiction. Other elements under MdTA jurisdiction include the Bay Bridge, the Francis Scott Key Bridge, and the Baltimore Harbor Tunnel.

Maryland CVO program to anticipate and resolve the technical, system, and institutional difficulties that CVO programs may face.

During the drafting of ISTEA in 1991, the U.S. Congress recognized the need to expand the base for training transportation professionals. Among other actions, Congress established and provided funding for a National Transportation Center at Morgan State University. This center has been given the academic lead for assisting the Maryland state government in CVISN deployment and in the development of a strategic plan for the state’s public/private CVO program. To gain institutional knowledge regarding transportation research and education programs, Morgan State is currently partnering with the Massachusetts Institute of Technology.

A number of colleges and universities besides Morgan State provide Maryland with transportation training and research capabilities. These include Johns Hopkins University, which has been developing the national CVISN architecture for FHWA and assisting the Maryland state government with CVISN deployment in the state, and the University of Maryland, which has been developing the state government’s motor carrier home page for world wide web.

2.1.2 Enabling Supporters

Enabling supporters in a CVO program do not participate in program management but their endorsement, explicit or implicit, is required for success because they have the power to block implementation. If a CVO program is well-structured, enabling supporters provide their endorsement because the program furthers their own interests.

2.1.2.1 Shippers

While shippers traditionally have not been the focus of motor carrier programs at either the federal or Maryland state levels, their requirements drive the freight industry. Because of these service expectations, truckers (and other
freight modes) are under pressure to know and understand not only their customers (i.e., shippers) but also their customer’s customers (i.e., receivers). In the past, shippers have been conceived as entities that requested transport of goods, choosing among carriers based primarily on cost, with shipment recipients being relatively passive in the process. Increasingly, though, receivers are seen as drivers of the demand for transportation services (see Section 2.3.3). They want quick and trouble-free service; they expect to know when delivery will occur; they want information available on the status of their shipments. In many cases, both shippers and receivers are willing to pay for a higher level of service. CVO technologies can help the trucking industry to meet shippers’ and receivers’ demands in many ways:

- By strengthening communication links with drivers;
- By making routing more dynamically responsive and efficient;
- By increasing driver and shipment safety and reducing damage; and
- By increasing in-transit visibility of shipments.

2.1.2.2 Maryland State Government Besides Motor Carrier Program

Maryland’s CVO program needs the support of Maryland state government outside of the motor carrier program in two ways.

(1) The Maryland Department of Transportation operates the Port of Baltimore and BWI airport through the Maryland Port Administration and Maryland Aviation Administration, respectively. The regional importance of these entities was discussed in Section 1.3.2. Many CVO applications can help the trucking industry work more effectively with air and marine terminals, but obtaining the most satisfactory results will require inter-agency coordination.

(2) More broadly, the motor carrier program is breaking new ground in public/private partnership with its participation in the CVO program.
Whether it is perceived as a leader by other divisions in state government may, in the long term, affect the extent of executive-level support for the program.

2.1.2.3 CVO Technology Developers

The long-term potential of Maryland’s CVO program rests on current and emerging technologies being developed into meaningful applications. Companies are developing CVO applications because they see the potential for financial gains large enough to offset the risk of their investments. Already, this potential for returns has enticed over 200 companies, ranging from the nation’s largest companies in the computer and defense industries to entrepreneurial startups.7

Decisions made by CVO program managers can affect the nature of competition among CVO technology developers, both in the shorter term by choosing “winners” and in the longer term by setting the tone for competition. For instance, if Maryland’s CVO program buys from a handful of large, well-capitalized technology developers, it may support quicker consolidation of the CVO technology development industry than if it collaborates with a host of smaller, more entrepreneurial firms.

2.1.2.4 Financial Community

The financial community for CVO development involves a number of players:

- Investors in trucking companies;
- Banks, which offer credit to trucking firms and owner/operators;
- Insurers, who shield trucking firms against liability from accidents and who indemnify shipments against loss and damage of cargo;

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• Venture capital firms and other equity holders that are funding the
development and deployment of CVO applications; and

• Government agencies, which serve in many of the same capacities of private
sector financial entities but with the expectation of longer-term, broader
social benefits from investment rather than direct returns.

In the long-run, Maryland’s CVO program will require the support of
both public and private sector financial sources. Much of the public sector money
to date for CVO research and deployment has come from the FHWA. In the
future, perhaps after the completion of the authorization period under NEXTEA
(see Section 2.3.2.1), FHWA funds designated for CVO deployments will vanish,
although general assistance funds from FHWA will still be available to
Maryland. To obtain these funds, CVO program managers in Maryland will
have to convince state officials that CVO requirements compare favorably to
other public sector priorities in transportation.

Private sector funding for Maryland trucking firms will be easier to secure
if the state’s CVO program makes trucking more profitable, and funding for
development and deployment of CVO applications will be easier to obtain if the
CVO program provides opportunities for attractive returns. As a rule of thumb,
increasing levels of risk in an investment drive up the required return to make
the investment attractive, implying that stability and predictability in the
Maryland CVO program can lower the cost of private sector funding.

2.1.2.5 FHWA

FHWA has two areas of interest in Maryland’s CVO program: safety and
technology deployment. As indicated the section above, FHWA has been the
main public sector source of funding for CVO development in Maryland to date.
Because of the potential for Maryland’s CVO program to break new ground in
terms of public/private partnerships for deploying technology and advancing
trucking safety, FHWA will continue to take a funding and policy development interest in the program.

2.1.2.6 Linked ITS Programs

Maryland's CVO program is linked to other existing ITS and CVO programs, as illustrated in Figure 2-2. At the national level, there is the national ITS program and its CVO component. The I-95 Corridor Coalition, described in Section 4.3, exists at the regional level, serving to coordinate ITS and CVO activities of Atlantic coast states from Maine to Virginia along I-95 and other primary arterial highways. At the state level, the CVISN deployment program (a federal initiative) aims to establish a stronger, more effective base for CVO applications and reward the state with more efficient administrative processes and enforcement capabilities. In developing a strategic plan for CVO, program managers need to formulate goals, objectives, and business plans in view of the strategic management of ITS programs with which the Maryland CVO program is linked. Moreover, program management must be attentive to changes in the strategic management of programs that would have an impact on CVO in Maryland.
2.1.3 Affected Communities

Affected communities are not collaborating or supporting participants in a CVO program, but because they are directly or indirectly influenced by the operation of the program, they may want to facilitate or impede success, depending on the program’s impact on them. Affected communities are not likely to track the activities of a CVO program on a continuing basis. Instead, they are likely to take an active interest at certain points (e.g., in response to a major incident involving a truck). CVO program must anticipate the interests of affected communities and be prepared to respond to the influence they could exert.
2.1.3.1 Other Freight-Carrying Modes

While trucking is the dominant mode for freight transportation, it exists within an overall industry framework with competing modes, each with its own relative strengths and weaknesses. Third parties such as freight forwarders and logistics services providers also fit into the competitive framework of the freight industry (see Section 2.3.3). The market niches in terms of cost and level of service that different freight service providers currently occupy are by no means fixed. Changes in technology, regulations, factor market costs (e.g., fuel and labor), management strategies, and shipper demand will continue to shape the freight industry.

Any aspects of Maryland’s CVO program that increase the relative competitiveness of the trucking sector, or any other sector, relative to the rest of the industry are likely to be opposed by the disadvantaged sectors. Ideally, Maryland’s CVO program will maintain a “level playing field” for the entire freight industry and allow all parties to reap the benefits of new technologies and an environment of increased collaboration.

Intermodal transportation involves the use of other transportation modes in addition to trucking, usually involving the use of containers of standardized sizes. Segments of the freight industry besides trucking have an interest in the continuing growth of intermodalism, as does Maryland at large.8 While the growth of intermodal traffic has always been attributable largely to advances in technology, the sources for this technological growth may change in the future. In the past, the advent of double-stack railroad service (i.e., two containers riding piggyback on a railroad flatcar), larger container ships, and improved port facilities succeeded in achieving competitive rates for goods that previously had gone by truck. Similarly, on the air side, the creation of air freight containers and

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8 Maryland’s two key centers for intermodal transfers are the Port of Baltimore and Baltimore/Washington International Airport (BWI). See Section 1.3.2 for further description of the economic importance of these facilities.
air cargo handling facilities encouraged shippers to send higher value, more
time-sensitive goods by air. Increasingly, however, productivity growth in
intermodalism will come from the application of information technology and
greater coordination of links in the intermodal chain. CVO technology,
therefore, could play an important role in increasing the competitiveness of
intermodal service in Maryland.

2.1.3.2 Non-Linked ITS Programs

Section 2.1.2.6 discussed the role of ITS programs linked with Maryland’s
CVO program as enabling supporters. Other ITS programs, particularly CVO
programs, are part of the Maryland CVO program environment because of their
capacity to shape the market for CVO applications and the modes of
deployment.

2.1.3.3 Political Interests

In the context of Maryland’s CVO program, political pressures may be
exerted at two levels: first, political office holders, especially state legislators,
may want to influence public sector CVO program collaborators; second, public
interests may seek to promote their interests among both public and private
sector collaborators. In some cases, political pressure may seem relatively
justified (e.g., when it concerns public safety), while at other points it could seem
like the interests of the CVO program are being held hostage pending the
achievement unrelated objectives. In any case, political pressures are a reality
that the program must anticipate and handle advantageously.

Perhaps the best way to accomplish this aim is to make freight
transportation, and more specifically, CVO deployment, a priority in the public’s
eyes. This has been a difficulty for the freight industry nationwide. For example,
California’s Statewide Intermodal Goods Movement Advisory Committee
concluded in 1995 that
Too few public decision makers knew enough about the business of goods movement to have much empathy, and in fact freight transportation often was viewed negatively rather than being a requirement of healthy economies.⁹

Ideally, the general public should believe that their own interests—in terms of safety, economic benefits, and enhancements in quality of life—are being served by the development of Maryland’s CVO program.

### 2.1.3.4 Passenger Vehicle Drivers

Because of their large numbers, passenger vehicle drivers exert more political power than truck drivers. Passenger vehicles far outnumber trucks on the Maryland’s highways, and the driving public views the trucking industry skeptically, if not antagonistically. Trucks, especially longer combination vehicles, are publicly associated with safety risks because of their size and instances of unsafe operation. (See Section 2.3.5 for further discussion of the negative impacts associated with trucking.) CVO technologies hold the promise of making the trucking industry safer, and perhaps more importantly, increasing public confidence about the coexistence of trucks and passenger vehicles on public roads.

### 2.1.3.5 Environmental Interests

Environmental impacts of trucking fall into two categories: emissions of air borne pollutants and releases of hazardous materials. Because of these impacts, the environmental community sometimes advocates greater use of rail for freight transportation. CVO technologies can reduce the environmental hazards associated with trucking and, in so doing, increase the public acceptability of trucking overall.

Trucks constitute a small percentage of total traffic volume. Yet they contribute a significant portion to the mobile source emissions inventory. For example, in California, a 1987 study indicated that trucks contributed over 20 percent of total statewide emissions of nitrous oxides, 8 percent of carbon monoxide, and 4 percent of reactive organic gases.\textsuperscript{10}

Trucks are frequently used to transport hazardous materials. While trucking continues to become a safer, more environmentally friendly industry, tensions will always exist because of the tradeoff inherent between safety and competitiveness. Because trucks often carry hazardous materials, including petroleum products and chemicals, incidents can be difficult to clear and threatening to the nearby population. Incidents involving such shipments have a public impact extending well beyond other drivers on highways, and, in the past, they have led to calls for truck restrictions.

2.2 Identifying Stakeholders' Interests in Maryland's CVO Program

The long-term success and stability of Maryland's CVO program requires that stakeholders' interests be balanced. To provide the foundation for achieving this balance, in Section 2.2.1 we identify the common interests of stakeholders in Maryland's CVO program, and in Section 2.2.2 we describe tensions among stakeholders due to conflicting interests.

2.2.1 Common Interests Among Stakeholders

Despite their differences, stakeholders in Maryland's CVO program share common objectives for safety and efficiency. Stakeholders' common interest in efficiency reflects their desire to reap the possible benefits of a safe and smoothly operating trucking sector (and, more generally, the freight industry), without the efforts of any stakeholder being wasted. Some stakeholders may define efficiency in their own terms, i.e., the extent to which the CVO program is

\textsuperscript{10} Nelson, Siwek, Guensler, and Michelson, "Managing Trucks for Air Quality: Current Work in Progress,"
"making my job easier." For some stakeholders, the interest in efficiency is reflected in an overall desire for economic development and regional competitiveness in Maryland.

Beyond sharing common interests in the outcome of the Maryland CVO program, stakeholders also share common interests in its operation. All stakeholders want a system that provides a "level playing field," although their definitions of "level" may differ. Stakeholders also want a CVO program that is predictable, so that they can synchronize their efforts with the program over the longer term.

2.2.2 Tensions Among Stakeholders

While stakeholders' common and complementary interests provide incentives for them to support the CVO program, conflicts in their interests cause tensions that may threaten program stability. Recognizing the following sources of tension and balancing stakeholder interests to create a mutually favorable environment will be essential for developing a successful CVO program.

- **The need for safety and environmental protection versus the need for trucking industry efficiency and competitiveness.** The citizens and businesses of Maryland consider safety and environmental quality to be attractive features of the state. Setting high standards for the trucking industry in these areas comes with a burden of compliance, in terms of direct costs and lost business opportunities. The degree and manner in which regulations are enforced by Maryland State Police and the Maryland Toll Authority Police has an effect on the extent and cost of compliance.

- **The desire for privacy and security versus the goal of program effectiveness.** The successful operation of Maryland’s CVO program will require the transmission and storage of large amounts of data, especially

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regarding trucking firms and drivers. Firms may be cautious about the security of data they consider proprietary. Drivers may be reluctant to let the CVO program gather data they consider to be intrusive.

- **The trucking sector versus the rest of the freight industry.** Maryland’s CVO program will boost the safety and efficiency of the state’s trucking industry. Stakeholders with an interest in other transportation modes may object to the program’s giving an unfair advantage to trucking.

- **Traditional transportation versus “new” transportation.** Freight transportation administration and planning in Maryland have developed strong traditions over the past decades, including a clear delineation between the public and private sectors; a modal emphasis, with planning for trucking, rail, and other modes clearly separated; and a well-established revenue collection system. Maryland’s CVO program will threaten many of these traditions, both intentionally in its thrust for a new public/private partnership framework, and unintentionally in the design and operation of the CVO program. Individually, probably all stakeholders in Maryland’s CVO program seek continuity in Maryland’s approach to freight transportation planning. Because stakeholders view continuity significantly differently, however, some stakeholders may interpret aspects of the CVO program as unacceptably radical departures.

2.3 Using Stakeholders’ Interests as a Basis for Strategic Performance Measurement

This chapter has identified the stakeholders in Maryland’s CVO program and characterized their interests. The following chapter reviews the role of performance measurement in strategic management and describes what makes strategic performance measurement different in the public and private sectors. The following chapter concludes by suggesting how strategic performance measures can be used in collaborative public/private programs. The stakeholder
interests identified above provide the basis for the development of these strategic management performance measures. Measuring the attainment of stakeholder interests in a balanced way will promote success and stability in Maryland's CVO program.
Chapter 3
Strategic Management in the Public and Private Sectors

We review the role of strategic management in programs and explain how performance measures aid managerial functions like setting objectives, monitoring progress toward meeting objectives, and communicating program performance. Then we describe what makes strategic performance measurement different in the public and private sectors and how performance measurement has developed in recent years in both sectors. We conclude this section by suggesting how strategic performance measures can be used in collaborative public/private programs.

3.1 The Role of Performance Measures in Strategic Management

This section provides a general theoretical background on strategic performance measurement appropriate to public or private sector organizations or public/private collaborative programs. It discusses the relationship between strategic objectives and performance measures, the development of appropriate performance measures, potential errors in measuring strategic performance, and how groups of performance measures can be developed as inter-related sets.

3.1.1 The Relationship Between Strategic Objectives and Performance Measures

On a basic level, strategic management concerns vision and communication. It involves resource allocation, recruiting and training the employees required for the program’s future, and developing incentive and reward systems. While performance measurement can support strategic management, it must used in the broader context of other management
processes, which together must take into account a program’s structure, culture, and human resources, as shown in Figure 3-1.¹

Figure 3-1  
Where Performance Measurement Fits Into Strategic Management

Because a program’s success over the strategic horizon may depend on a number of stakeholders—including active collaborators, supporting stakeholders, and environmental stakeholders—performance measures must be robust enough to be suited to different users and purposes:²

- For program collaborators, so that dynamic coordination of actions and continuous improvement can occur.
- For supporting stakeholders in a program, so that a sense of belonging can be achieved and an environment of continuous improvement can be fostered.

² In discussing performance measures, we speak of a “program” as the entity of concern, for the sake of simplicity and consistency, even though the theoretical discussion applies equally well to public and private sector organizations and public/private collaborations.
• For environmental stakeholders, such as financial institutions, so that the fitness of the program can be judged.

Regardless of a stakeholder's level of participation in a program, performance is something that tends to be defined according to parochial rather than programmatic interests. The use of performance measures as a core management strategy serves to align stakeholders' conception of a program, in terms of five questions:

1. Where has a program been?
2. Where is the program now?
3. What goals should be set for the program?
4. How can the program reach the goals that have been set?
5. How can management know when the program reaches the goals that have been set for it and whether corrective actions may be necessary?

The more that a program's stakeholders concur on the answers to these five questions, the more easily they can reach a consensus about the proper management of the program. Performance measures facilitate this concurrence.

Figure 3-2 illustrates that performance measurement is an iterative process that allows management to refine its notion of a program's status and capabilities, relative to the strategic vision. A program's set of performance measures should evolve in tandem with its strategy. After collecting measurement results, managers can conduct reviews to determine not only the implications of the measured levels of performance, but also how well measures are serving their purpose, so as to increase the effectiveness of measures in the future.

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3.1.2 Developing Performance Measures for Strategic Management

Performance measures for strategic management communicate a program’s objectives and align activities to achieve them. Effective performance measures are driven by goals; give an accurate and easily understood assessment of programs and activities; minimize the burden of data collection; and are accepted and used to improve performance. For a performance measure to be accepted by managers, it must reflect a result or process over which they feel they have some control or influence.

3.1.2.1 Principles of Performance Measurement

To re-iterate, the most important step in developing performance measures is to define a program’s strategic objectives. Imprecise or ambiguous strategic objectives lead to measures that, de facto, are ineffective at helping a program achieve good strategic performance. Once the strategic goals for a
program have been defined, performance measures can be developed to indicate how effectively and efficiently a program is achieving them.

More than 50 years ago, Chester Barnard contrasted the meanings of effectiveness and efficiency: effectiveness meant accomplishing what was intended, and efficiency meant minimizing unintended consequences of achieving what was intended. Good performance measures revolve around strategic management's effectiveness and efficiency. They indicate whether a program's activities are the right thing to do, in light of its strategic goals, and whether these activities are being done well.

To determine what to measure, programs need to define their desired outcomes and understand the processes underlying the attainment of these outcomes. Figure 3-3 illustrates how performance measures can be developed once a strategic outcome and its underlying processes are recognized.

If one were to suppose that a state CVO program's objective was to make operation of trucks cheap relative to surrounding states, factors associated with this goal, in decreasing immediacy to realization of the objective, might be (a) level of mobility on state highways, (b) operating time lost to roadside inspection and monitoring, and (c) effort required to register a new firm. Measures associated with these factors, if they could be captured, would be oriented to determining the program's effectiveness in attaining its strategic objective. The first measure, concerning mobility, would be the most preferred if only one were adopted, because it has the greatest causal relationship to making truck operation in the state relatively cheap.

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5 Barnard's definition of efficiency parallels the engineering definition of efficiency, the ratio of outputs over inputs, with a perfectly efficient system being defined by its lack of waste.
Because factors, particularly those farther upstream, may not be well linked with attainment of strategic objectives, reliance on these measures should tempered by an awareness that other, possibly unidentified factors, may confound the process of determining how well an objective is being achieved. With reference to Figure 3-3, Factor C would serve poorly as the basis for a performance measure if its significance were overshadowed by other factors having a greater, but contrary, causal effect on the strategic objective, like Factors A and B.

Continuing on with the same example, but with regard to measures oriented to the efficiency with which a strategic objective is being attained, one might establish that unintended consequences, in decreasing immediacy to realization of the goal of making trucking in a state relatively cheap, were (1) a decrease in tax revenue collected from truck operation, and (2) a decrease in truck operating safety. The relative desirability of these two measures would depend on the impacts associated with them and the degree to which they were associated with the attainment of making trucking in the state relatively cheap.
3.1.2.2 Data for Performance Measurement

When developing performance measures, the following criteria related to data are useful:

- **Availability**: Are the data currently available? If not, can data be collected? Are there desirable indicators for which data are currently unavailable?

- **Accuracy**: Are the data sufficiently reliable? Are there any biases in the data? Are the data verifiable and auditable?

- **Confidentiality and security**: Does the use of the data violate the privacy of any parties or make available sensitive information concerning their practices; how can unintended uses of performance data be prevented?

- **Timeliness**: Are the data timely enough to evaluate performance? How frequently do the data need to be collected and reported?

- **Cost of data collection**: What is the cost of collecting the data? Are there sufficient resources, in terms of funding and personnel available for data collection? Is the data collection cost-effective? That is, do the benefits of data collection exceed the costs?

- **Consensus**: Do stakeholders concur that data are available, accurate, timely, and cost-effective?

If organizations address the data needed for measurement during the development and selection of their performance measures, they can minimize their long-term cost of data collection. In many cases, data collection can be incorporated as a routine component of the performance measurement process. While this may require additional time for training and experimentation initially,

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the time and resources needed will diminish as performance measurement is integrated into management processes.

3.1.3 Potential Errors in Measuring Strategic Performance

While measuring performance can bring numerous benefits to the strategic management of an organization, it can also result in serious mistakes. Section 3.1.1 indicates that performance measurement is one tool among many for achieving strategic objectives. Organizations that focus intently on measurement without scrutinizing what measures imply do not offer themselves the opportunity to evolve in step with measurement results. An over-reliance on performance measures can also lead to error if the "wrong" element is being measured. Gordon Bethune, CEO of Continental Airlines relates that when his firm's service level was being measured by the number of meals short on flights, flight attendants would often hold flights for extra meals to arrive, thereby causing a high percentage of flights to be delayed—a far more important indicator of customer satisfaction.  

Performance measures employed in strategic management should not simply be aggregates of measures collected at lower levels of an organization. Compared to measures developed specifically for top management, measures developed by aggregating performance measures from lower levels is likely to produce results that are less digestible and less reflective of the current situation. Aggregating performance measures from lower levels also increases the likelihood that embarrassing results can be hidden from senior managers.

3.1.4 Sets of Performance Measures as Interconnecting Systems

Like strategic objectives, strategic performance measures cannot exist in isolation. Even for one objective, there may be multiple measures; for multiple objectives there may be many. Programs that develop their performance

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7 Gordon Bethune, speech before MIT's Center for Transportation Studies, October, 1996.
measures as a set will find it easier to decide what they should be measuring, decide how they are going to measure it, collect the appropriate data, and establish balance in their management system.\(^8\)

Figure 3-4 shows how a set of performance measures can be examined at three different levels: (1) individual performance measures; (2) the performance measurement system as an entity; and (3) the relationship between the performance measurement system and the environment within which it operates.\(^9\) This figure indicates that performance measure systems exist within the context of a program’s internal and external environments—its stakeholders, its institutional forces, and the competitive pressure that it faces.

**Figure 3-4**
A Perspective for Performance Measurement System Design

Once a program has defined its strategic vision, it should review how its objectives interact and whether, at least theoretically, they are mutually

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achievable. Once strategic objectives have been reconciled and prioritized, the program needs to determine how individual measures would reflect on the attainment of objectives individually and as a set.

Potential sets of performance measures should be evaluated for the likely program responses they would induce. Before adopting a set of measures for evaluating strategic performance, senior management needs to communicate its intention in using the measures to program stakeholders, especially employees. The measures used at the strategic level should be developed to provide a balanced, integrated view of program performance. The set of measures should reflect a program's performance as an entity, that is, across its structure and various functions, with no one division or function "in the spotlight," so to speak, and none out of it either.

Table 3-1 reviews the attributes that a set of performance measures should have, both as a self-contained entity and in relationship to the environment in which it is deployed. One point the table includes, not made previously, is that, optimally, a performance measurement system will allow a program to compare itself with similar programs. While comparisons across programs are inherently difficult, insights as well as motivation for change can be gained from identifying similar programs that have superior performance.

\[^{10}\text{Neeley et al.}, p. 425.\]
Table 3-1
Desirable Attributes in a Performance Measurement System

<table>
<thead>
<tr>
<th>Level of Evaluation and the Program Environment</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>The performance measurement system should reinforce the program's strategies</td>
<td></td>
</tr>
<tr>
<td>The performance measurement system should match the program's culture</td>
<td></td>
</tr>
<tr>
<td>The performance measurement system should not conflict with the existing reward and incentive system</td>
<td></td>
</tr>
<tr>
<td>The performance measurement system should allow comparison of the program with similar programs</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance Measurement System</th>
<th>Performance measures should be integrated over both program functions and structure</th>
<th>The measurement system should provide a balanced picture of the program</th>
<th>The system should provide data for monitoring past and planning future performance</th>
<th>The data required for the performance measurement system should be routinely generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Measures</td>
<td>Measures should be tied to strategic objectives</td>
<td>Measures should be clearly defined and easy to understand</td>
<td>Measures should be practical; they should have an appropriate scale</td>
<td>Measures should be verifiable and auditable</td>
</tr>
</tbody>
</table>

3.2 Strategic Performance Measurement in the Private Sector

Strategic performance measurement in the private sector traditionally has emphasized accounting measures like profit, return on investment, return on assets. Belief in the efficacy of accounting measures crested during the corporate downsizing in the 1980s: downsizing was motivated by enhancing corporate book value, but the results of corporate dismemberment and staff reductions highlighted the need for senior management to account for the value of factors like employee morale and relationships with customers. In recent years,
researchers have aimed to develop frameworks for making a balanced assessment of the financial and nonfinancial aspects of a firm’s performance.

3.2.1 Traditional Management Focus on Accounting Measures

Until the 1950s, well-run American companies addressed the imperatives of industrial competition by focusing on business scale and operational speed. The traditional managerial accounting model of the firm, which focused on product-costing and defined performance as income was well-suited to measuring strategic performance and identifying alternatives for gaining market share and creating high-margin product lines.

After the 1950s, the coming of new computer-based information technologies radically altered the nature of business competition. In Relevance Lost: The Rise and Fall of Management Accounting, the authors suggest that business failed to exploit the economic opportunities offered by new information technologies but instead used emerging information technology to over-extend the uses of traditional accounting data in strategic management. The authors assert that corporate vision become myopic, narrowly defined by accounting information.

3.2.2 The Concept of the Balanced Scorecard

Robert Kaplan, one of the authors of Relevance Lost, recently collaborated with David Norton to develop a methodology that translates an organization’s mission and strategy into a comprehensive set of performance measures that provides the framework for a strategic measurement and management system. The “Balanced Scorecard” measures program performance across four perspectives: financial, customers, internal business processes, and learning and growth, as illustrated in Figure 3-5.

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Kaplan and Norton expand the traditional notion of management, namely controlling costs and quality, to creating value for its key constituencies—shareholders, customers, suppliers, and employees. The Balanced Scorecard retains an emphasis on achieving financial objectives, but also includes the performance drivers of these financial objectives—knowledgeable employees, links to customers, internal business processes, and corporate culture. Kaplan and Norton claim that the balanced scorecard enables companies to track financial results while simultaneously monitoring progress in building the capabilities and acquiring the intangible assets they need for growth.

Kaplan and Norton emphasize that financial and nonfinancial measures must be part of the information system for employees at all levels of an organization. They see this measurement system as applicable on tactical, operational, and strategic levels. They stress that front-line employees must understand the financial consequences of their decisions and actions, and that senior executives must understand the long-term drivers of success. They

Figure 3-5
Kaplan and Norton’s Balanced Scorecard
advocate the implementation of balance scorecard-oriented management, in which developing scorecard objectives, measures, targets and initiatives brings consensus among managers, clarifies strategic objectives, and identifies the critical drivers for objectives.

3.3 Strategic Performance Measurement in the Public Sector

Until recently, “strategy” as a recognized concept was a driving agent in the political sphere of the public life; in the administration of public programs, the concept of “public interest” predominated as the motivating force. In recent years, however, government administration has increasingly looked toward “strategy” as a tool for improving public satisfaction with government operations and decreasing the waste associated with government programs.

Performance measurement, with an emphasis on development of indicators of program effectiveness and efficiency, has become an important component of government administrative strategy, especially at the federal level. The feasibility of introducing systematic performance measurement of federal government programs, as envisioned under the Government Performance and Results Act of 1993 (GPRA) and Clinton administration initiatives, remains to be seen. Previous attempts at performance measurement in the public sector have been problematic.

3.3.1 The Impact of a Changing Conception of “Public Interest”

Chapter 2 discussed the importance of defining stakeholder interests in developing strategic objectives for a CVO programs. A generation ago, “public interest” consisted of administering the law based on legal and administrative precedent, and shaping relationships with key constituencies, so that the mutual betterment could be pursued on a consensual basis.13

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In recent decades, the notion that “public interest” ought to guide administrative action decreased as the difficulty of defining it grew. The “public interest” consequently disappeared from most debate about public management, in part because it became so hard to define and in part because some critics wondered if the entrepreneurial spirit might be superior as a driving force for government.

The Clinton Administration’s National Performance Review (NPR) defines “public interest” largely in terms of “customer service.” The NPR’s enthusiasm for customer service builds on the observation that citizens are unhappy with the performance of their government, and that citizens view government as too often pursuing its own internal goals instead of solving the problems of citizens. To solve that problem, the NPR pledged to provide “customer services equal to the best in business.”14 On September 11, 1993, President Clinton backed that pledge by issuing Executive Order 12862, which mandated agencies to define customer service standards.

The NPR proposed to achieve its customer service goals by changing how the public sector was managed: (1) by emphasizing inter-organizational networks of public, private, and nonprofit organizations, instead of the old approach founded on an assumption that a single agency was in charge of each program; and (2) by focusing performance evaluation on program outputs instead of inputs and on results rather than activity.15 The NPR also emphasized that, while government managers should be accountable to elected officials, they should have more flexibility in approaching their assigned tasks. It thus becomes more important for management to guide and evaluate the work of subordinate staff based on measures of performance than reflect the achievement of desired outcomes.

14 National Performance Review, From Red Tape to Results, 1993, p. 44. Emphasis in the original.
3.3.2 Performance Measurement Initiatives at the Federal Level

Recent reforms at OMB, launched in March 1994 under the banner of "OMB 2000," and the Government Performance and Results Act (GPRA), passed in 1993, seek to strengthen the role of performance measurement in the strategic management of government programs. These reforms mirror those developed in a handful of states in the late 1980s and 1990s, particularly in Oregon and Florida.16

3.3.2.1 Office of Management and Budget

OMB 2000 seeks to help the agency move from budgetary analysis constrained to annual review cycles to a longer-term perspective. In developing guidance for implementing "results-oriented" management, OMB is advocating that federal agencies use a performance management system delineating inputs, outputs, outcomes, and impacts. Figure 3-6 illustrates OMB's conception of the levels of measuring performance.17 Each project employs people, purchased resources, and some forms of technology—inputs. A project transforms these inputs into products or services, or outputs, for use by taxpayers, other government agencies, or internal agency personnel. Outcomes are the effects of the output on the customers, while impacts are the long-term effect of the outcomes. OMB's distinction between outputs and outcomes draws on Barnard's distinction between efficiency and effectiveness (see Section 3.1.2.1), with output measures recording whether "what was done was done correctly" and outcome measures assessing "whether the completed work contributed to the organization's accomplishments."

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17 U.S. General Services Administration, Performance-Based Management: Eight Steps to Develop and Use Information Technology Performance Measures Effectively, 1996, Section 2.
Guidance from OMB instructs federal managers to concentrate their efforts on measuring programs using, with decreasing preference, impact measures, outcome measures, output measures, and input measures. One of the difficulties with OMB's suggested approach is that outcomes can only be measured on completion of a project, and impacts may take substantially longer. To circumvent this problem, OMB suggests that agencies measure intermediate outcomes to provide an assessment before completion of a project.

**3.3.2.2 Government Performance and Results Act**

OMB's program was designed to support the GPRA. The GPRA is part of a far wider movement, in both the United States and abroad, to focus managers' attention on accountability for results. The GPRA defines performance as the critical touchstone of the government's programs. It also defines linkages among the government's activities and provides incentives (mostly in term of increased flexibility) for government managers to focus on results. Under the act, each federal agency will prepare a number of top-level management materials for the public record by the end of the ten-year phase-in period:

- A five-year strategic plan, to be updated every three years;
- A comprehensive mission statement that links the agency’s current operations with its long-term goals;
• An identification of the goals and objectives, along with the resources, systems, and processes required to achieve the goals;

• A description of the most important external factors that could affect the agency’s success in achieving the goals; and

• Annual program evaluations to help agency officials assess their success, explain why goals might not have been met, and revise the goals if necessary.

While there are currently no specified formats for strategic plans and annual program evaluations, they are likely to be developed by OMB in the coming years, based on the pilot projects currently being undertaken in selected federal agencies. A sample federal agency performance report developed by OMB is shown in Table 3-2.

Table 3-2
Sample Federal Agency Performance Report Suggested by OMB

<table>
<thead>
<tr>
<th>Performance Report</th>
<th>Objective</th>
<th>Performance Indicators</th>
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<tbody>
<tr>
<td></td>
<td>Type of Measure</td>
<td>Performance Measures</td>
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<tr>
<td></td>
<td>Target</td>
<td>Actual</td>
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<tr>
<td>Input</td>
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<tr>
<td>Output</td>
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<tr>
<td>Outcome</td>
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<tr>
<td>Impact</td>
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<tr>
<td>Mitigating Factors</td>
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Both the U.S. Department of Transportation and FHWA are subject to the requirements of the GPRA. To support FHWA’s development of performance
measures with which CVO program can be managed more effectively (including CVISN), the FHWA/Office of Motor Carriers currently is collecting data on deployment programs. This data collection effort, which will be completed during the summer of 1997, will be reflected in the performance goals that FHWA includes in its strategic plan, due to be submitted September 30, 1997.18

Skeptics of the GPRA note that successful implementation depends on technology that does not now exist—budgetary system, performance measures, and a career track within the government for performance analysts.19 These skeptics contend that there are few incentives for public sector managers to take a long-range perspective, and only a passing audience among elected officials, citizens, and the media for the results. They note that the federal government's failed experiences with management reform, including the planning-programming-budgeting initiative inspired by Robert McNamara's Pentagon and the zero-based budgeting attempted during President's Carter's tenure, suggests caution in pressing ahead without building the institutional, systems, and technological basis for the GPRA.

3.3.3 Increasing Performance Demands on Information Technology Projects

Management specialists both inside and outside of government assert that better use of information technology will aid government in managing its resources and delivering greater value to its stakeholders—employees, other government organizations, and the general public. The government's shortcomings to date in the use of information technology have not been due to lack of investment. From 1980 to 1992, over $200 billion was spent on information management systems at the federal level alone. Critics question whether the public has benefited from this investment, with a recent U.S. General Accounting Office report stating that

18 Personal communication with Jeff Loftus, FHWA/Office of Motor Carriers, April 18, 1997.
critical information assets are frequently inaccurate, inaccessible, or nonexistent. Efforts across the government to improve mission performance and reduce costs are still too often limited by the lack of information or the poor use of information technology.\textsuperscript{20}

The Clinger-Cohen Act, also known as the Information Technology Management Reform Act (ITMRA) of 1996, requires federal executive agencies to measure the performance of their information technology investments and link their information technology investment to agency accomplishments. The act also requires agencies to explore business process reengineering before making a significant investment in information technology, under the assumption that the benefits of a successful business process reengineering effort will be dramatically greater than an investment in information technology without reengineering.

3.4 Performance Measurement in Collaborative Public/Private Programs

Chapter 2 described how the Maryland CVO program will be an initiative of a number of stakeholders in the public and private sectors. The active collaborators in Maryland's program will be the trucking industry, the regulatory community, the enforcement community, and the academic community. For these stakeholders to develop and use strategic performance measures successfully, they must understand how their interests and processes for strategic management differ.

3.4.1 What Makes Performance Measurement Different in the Public and Private Sectors

Sections 3.4.2 and 3.4.3 indicate that the practice of performance measurement in the private and public sectors has begun to converge, especially in the last decade. While the private sector has moved from emphasizing accounting-based measures to using a "balanced scorecard" of measures

\textsuperscript{19} Kettl, \textit{Reinventing Government}, p. 43.
reflecting benefits for key constituencies—shareholders, customers, suppliers, and employees—the public sector has moved to a definition of “public interest” as “customer service”, with policies for government programs to define their impacts in this regard.

Despite the increasing similarity with which the private and public sectors approach performance measurement, fundamental differences remain that make the adoption of a either a wholly private or public sector approach to strategic performance measurement in a CVO program problematic:

- Unlike the private sector, the public sector is not oriented toward earning profits. While public sector programs can use accounting-based measures for indicating performance, these measures carry a significantly different meaning and weight than they do in the private sector, where bankruptcy and loss of capital are continual threats.

- Public programs typically have broader mandates (e.g., program equity) than private sector entities, and they benefit stakeholders in many different ways and to different degrees. Because public sector agencies provide services that do not lend themselves to clear-cut measurement, performance measurement may not be straightforward, and the criteria for evaluation may differ from private sector enterprise.

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• The budgeting process is normally more involved in the public sector and subject to greater political pressures. The public system of checks and balances, along with the relatively free access to agency activities by the press, subjects public agencies to constant public scrutiny. The threat of drawing adverse attention to a program may affect how public programs use strategic performance measures.

3.4.2 Development of Performance Measure in a Multi-Stakeholder Environment

Partners, employees, customers, and even society at large may have points of view critical to the success of a program, whether in the public or private sector. As shown in Chapter 2, Maryland's stakeholders have varying interests, and so they define success differently.

In Cooperate to Compete, a recent book explaining the necessity of stakeholder cooperation for business success,21 the authors emphasize that the managers of any enterprise, and especially those that are based on collaboration of potential adversaries, must continually offer sufficient benefits to stakeholders to assure their continued collaboration or support. The authors state that the top managers in a collaborative program must determine the points of view of each stakeholder and understand why any one point of view is or is not critical, and the contexts in which criticality may occur. In this way, they state, managers can enrich a collaborative program as a whole by balancing the value provided to each stakeholder. Over the course of time, the authors note, various points of view will rise and fall in priority and importance of program success.

CVO programs have three tiers of stakeholders, as described in Chapter 2—active collaborators, supporting groups, and affected communities. The active collaborators in a CVO program must first identify their own interests

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and the benefits collaboration can provide. Because their continued partnership in a CVO program is required for its operation, they must agree that the potential benefits of collaboration will always be sufficient for their participation. After active collaborators concur on this point, they can consider the interests of the program’s enabling supporters. The influence of enabling supporter stakeholders is important for a CVO program’s success, but because they do not actively collaborate, the program can continue to operate so long as none of these stakeholders raise opposition. Therefore, the active collaborators must consider what benefits a CVO program can provide enabling supporters and what would cause these stakeholders to interfere with program operation. Finally, the active collaborators must consider the points of view of the stakeholders in the affected communities group. These stakeholders are not likely to track the activities of the CVO program on a continuing basis. The active collaborators must assess what benefits a CVO program can provide to the affected communities. They also need to determine what events would cause these stakeholders to take an active interest in the CVO program and the extent to which they could influence program operation.

The traditionally approach to dealing with stakeholders not holding managerial responsibilities has been reactive. That is, their points of view were considered as an afterthought, or evaluated only when they were pressed to the forefront. In a CVO program, only some of the active collaborators would have a managerial role, while enabling supporters and affected communities would be outside the management structure. In many cases, CVO program managers would represent only part of a stakeholder group. For example, not all truckers would feel adequately represented by the Maryland Motor Truck Association. Balancing points of view proactively and methodically makes collaborative programs more likely to succeed in the long run. The authors of Cooperate to Compete recommend a number of steps to achieve this balance:
• Identify explicitly all of the points of view that are important in determining the success of the program in the coming years;
• For each point of view, determine a vision of success and the measures to be used in evaluating success;
• Identify obstacles that must be overcome to achieve the vision and get good measurement results;
• Identify a method by which conflicts in visions can be overcome;
• Develop a unifying point of view and vision of success, paying careful attention to preserving the vision in core measures;
• Convert all of the above to time lines, with a clear link to how stakeholders will realize the unifying vision; and
• Identify critical factors for success required on the time line to achieve vision measures.

Figure 3-7 illustrates the conceptual relationship of performance measures among stakeholders in the multi-stakeholder environment of a CVO program. This figure recalls Figure 3-4, which presented a conceptual framework for developing sets of performance measures for a single stakeholder. In Figure 3-7, the four stakeholders identified in Chapter 2 in the active collaborator tier—trucking industry, the regulatory community, the enforcement community, and the academic community—are shown having separate performance measurement systems, with all measurement systems linked to the core measurement set that reflects the unified vision for the CVO program. Stakeholders in the enabling supporter and affected communities tiers identified in Chapter 2 also can be conceived as having their own measurement systems tied to the core system for the program overall.
Because the core performance measurement system and, indeed, the unifying vision, are premised on clear strategic objectives, the active collaborator stakeholders must agree, either through negotiation or shared understanding, what their participation in the program is meant to accomplish, in the long-term as well as more immediately. Shared understanding from the stakeholders in the enabling supporter tier is important, though to a lesser degree. Section 2.2.1 indicated that the common interests of CVO program stakeholders are safety, efficiency, and program equity. These interests would need to be reflected in the core performance measurement system developed for the program.

Once this basic level agreement has been reached, performance measurement of the program can be used as a tool for maintaining the focus of stakeholders on the collaborative vision. The chronic tensions described in
Section 2.2.2 are a basic fact of CVO programs. Other, more episodic, tensions will inevitably arise in collaborations. The active collaborators in a program must anticipate these tensions. In many cases, performance measures in a CVO program can act as barometers to indicate how competing interests are being balanced. Depending on how fundamental sets of competing interests are in the nature of a CVO program, relevant performance measures should be incorporated either into the core set for the program overall or into the measurement sets of the concerned stakeholders.

Maryland's CVO program needs to take into account both the theory of strategic performance measurement and any relevant lessons that can be learned from existing CVO programs. The next chapter, which presents five case studies on strategic performance measurement in existing CVO programs, provides insights and possible extensions to the theory that has been presented above. Based on the theory that has been presented in Chapter 3 and the lessons from the case studies in Chapter 4, specific performance measurement schemes for the Maryland CVO program can be developed. Chapter 5 will present two alternative schemes, after examining impediments faced in the recent development of performance measures in public sector freight transportation programs and how traditional and CVO programs differ.

3.5 Further Remarks

This section has considered the theory of strategic performance measurement in the public and private sectors, as well as in collaborative public/private programs. In general, the theory of multi-stakeholder strategic performance measurement has begun to be developed recently. The most important text on the subject published thus far, Kaplan and Norton's Balanced Scorecard, discussed in Section 3.2, was completed only in 1996. Other research includes Atkinson, Waterhouse, and Wells article in the most recent copy of Sloan Management Review, "A Stakeholder Approach to Strategic Performance
Chapter 4

Case Studies of Performance Measurement in Recent CVO Deployment Programs

In this chapter, we review five ongoing CVO deployments—HELP, Advantage I-75, the I-95 Corridor Coalition, Minnesota Guidestar, and Oregon Green Light. We describe the organization and objectives of these programs, the extent to which they incorporated performance measures in their strategic management, and the lessons they hold for performance measurement in CVO program management. We conclude this chapter by summarizing the impediments faced by existing programs, their responses to these impediments, and the overall insights they offer regarding strategic performance measurement.

4.1 The HELP Program

The Heavy Vehicle License Plate (HELP) program was conceived as a multi-state, multi-national research effort to design and implement an integrated heavy vehicle monitoring system using automated vehicle identification (AVI), automated vehicle classification (AVC), and weigh-in-motion (WIM) technologies. The operational field test phase of the HELP program, completed in 1995, was known as the Crescent Project. Its goal was to demonstrate the various technologies that would compose a system whereby a truck entering in British Columbia could drive the entire crescent-shaped network, from British Columbia to Texas, without having to stop at other weigh stations or ports-of-entry.

Currently, HELP, Inc. operates as a Phoenix, Arizona-based non-profit public/private partnership, and its AVI-AVC-WIM services are marketed under the name of the PrePass system. In early 1997, HELP released its first non-weigh station bypass-related product: GatePass. This product uses transponders
installed for weigh station bypasses as the basis for electronic terminal control systems to track inventory and truck movements, with resulting improvements in operating efficiency and security.

4.1.1 Objectives of HELP

As originally conceived, the goals of HELP/Crescent were to (a) improve institutional arrangements involving the public and private sectors, (b) assess the viability of the identified technology in the highway environment, (c) measure efficiency and productivity changes, and (d) identify additional applications for technology.¹

4.1.2 Program Organization of HELP/Crescent and HELP, Inc.

There were three primary partners in the HELP/Crescent project: the Federal Highway Administration (FHWA), members representing state governments, and members representing the trucking industry. The participants in HELP, Inc.'s PrePass program are essentially the same, although several additional states have joined, bringing the current number to 11.

Initially, HELP/Crescent was managed by a Policy Committee and an Executive Committee, with a number of subcommittees formed to study system technologies, components, and other areas of interest. The Crescent Implementation Group was formed to manage the test deployment phase of the program, from 1988 to 1993. The organizational structure of HELP/Crescent during this test phase is reflected in Figure 4-1. The Policy Committee's role was to develop the program's budget, approve the overall work program, and appoint the Executive Committee. The Policy Committee had the following voting membership:

• The Chief Administrative Officers or their designees from all contributing states or transportation authorities in the program;

• A representative from the motor carrier industry in each of the participating states and in Canada;

• A representative from the FHWA; and

• A representative from Transport Canada.

**Figure 4-1**

Organizational Chart of the HELP/Crescent Project During the Operation Field Test (1989-1993)

The Executive Committee’s original purpose was to approve requests for proposals and consultant selection, approve technical consultant contracting products, update the project’s budget and work program, and make recommendations to the Policy Committee.

With the end of the field test phase, HELP, Inc. has assumed management of the program. Its board has an analogous composition and role to that of
HELP/Crescent's Policy Committee, except that the Crescent Implementation Group and FHWA no longer play roles in program management.

In late October, 1996, the Oregon Department of Transportation (ODOT), the Oregon Trucking Association (OTA), and the Washington Trucking Association (WTA) resigned from the governing board of the HELP program. The Washington Department of Transportation (WSDOT) shortly thereafter expressed strong reservations about their current participation in HELP. The most prominent reason for dissatisfaction among these former program supporters was HELP's arrangement for financing, in which the program charges trucks a transaction fee ranging from 90 cents to $2.50 for each station bypass.

At the time this fee was first proposed by HELP, in early 1995, United Parcel Service signaled its unwillingness to participate because of the precedence that would be established in using bypass fees as a revenue collection mechanism for states. The present dissatisfaction that ODOT, WSDOT, OTA, and WTA have with HELP reflects similar concerns. OTA and WTA state that their constituents are unwilling to pay to bypass weight stations.

4.1.3 Performance Evaluation in HELP

While evaluation was an integral part of the HELP/Crescent operational test, which ran from 1988 to 1993, the performance of the project was not evaluated using measures that were conceived at the outset of the project. Instead, evaluation occurred only as part of the operational test. An FHWA stipulation for funding HELP/Crescent, that the project be evaluated independently, contributed to the lack of integration of performance evaluation and HELP/Crescent management.

Figure 4-2 illustrates the process used to evaluate HELP/Crescent. Data from five sources was collected:
(1) On-site evaluation of HELP technologies and operations—used to evaluate individual systems and performance of integrated systems;

(2) Surveys and interviews with state agencies—used to evaluate institutional issues affecting implementation and performance of CVO services;

(3) Surveys and interviews with participating motor carriers—used to evaluate implementation issues and industry acceptance of CVO services;

(4) Review of the HELP/Crescent computer system components—used to evaluate system platform for service integration; and

(5) Review of HELP/Crescent demonstration office—used to evaluate operations of central service provider.

**Figure 4-2**
The HELP/Crescent Project Evaluation Process

Source: WHM Transportation Consultants, *The Crescent Project (Executive Summary)*, 1994
The evaluation of the HELP/Crescent operational test focused on how the project facilitated six broadly defined services: roadside dimension and weight compliance clearance, pre-clearance of vehicles with proper documents, government audits of carrier records, government processing of commercial vehicle operator documents, government planning, and industry administration of vehicles and drivers. Using data collected from the five evaluation areas, the evaluators plotted results on a "radar" graph with five axes, as shown in Figure 4-3, with one axis for each of the broadly defined measures of effectiveness, for each of the six broadly defined services. The resulting pentagons were intended to show in one figure how well the project performed from a variety of perspectives. Large, regular (i.e., having equal angles) pentagons showed that the project performed a service well according to all five perspectives considered, while irregular pentagons showing a disparity in perspectives and small pentagons showing poor performance overall.
The evaluation of the HELP/Crescent project required a substantial effort (over $300,000) and was not fully available until six months after the operational test completion. According to Richard Landis, current CEO of HELP Inc., the evaluation provided valuable information for the long-term planning of the current non-profit partnership, but did not establish any evaluation or measurement mechanisms that were practical, in terms of cost and timeliness, for the current venture. The primary current measure of long-term program health for HELP, Inc. is the number of enrolled trucks, which currently (i.e., May, 1997) stands at 43,000, with projections of over 60,000 by the end of 1997. Secondary measures are the number of participating states, which currently stands at 11,
and the number of operational by-pass stations, currently 14.² Landis stated that new HELP services are being evaluated in terms of their potential value to HELP program participants.

4.1.4 HELP: Lessons for Performance Measurement in Strategic Planning

One of the primary difficulties that HELP/Crescent experienced was a lack of consistent management. According to the Volpe Center analysis, HELP/Crescent experienced lapses that may have been avoided if government agencies and the motor carrier industry in participating states had been more involved in strategic management. Furthermore, various organizational levels of FHWA had different expectations of the program, as perceived by HELP management. These difficulties potentially could have been reduced if the strategic objectives identified at the operational test outset (see Section 4.1.1) had been more defined and if they had been tied to a set of performance measures. Such a set of performance measures would have reduced ambiguity about management objectives to states, truckers, and the FHWA.

Carriers in the HELP/Crescent program tended to be skeptical of government-sponsored deployment of technology, especially regarding the issues of a weight/distance tax and data security. Again, the ambiguity of the strategic goals of HELP/Crescent and the lack of indication of how various program sponsors were evaluating the program encouraged such doubts.

Staff inexperience and institutional lines of authority hampered acceptance and effectiveness of CVO technologies in the public sector. Many of the trucking firms participating already used vendor-supplied and supported technologies; they were be skeptical of the ability of state agencies to operate new technologies reliably. Because the evolution of CVO technologies will be a continuing aspect of the program environment for HELP, Inc. and other CVO

² Personal communication with Richard Landis, April 29, 1997.
programs, some measure of employee productivity, familiarity with CVO technologies, or training would be valuable as a strategic management tool.

The use of number of enrolled participants as a measure of strategic success is serving HELP, Inc. well, although two factors—(1) the withdrawal of high profile participants like UPS and the state of Oregon, and (2) the lack of a priori objectives besides financial gain for new HELP, Inc. services to achieve—suggest that a broader set of measures may be useful in reducing the inherent instability and lack of innovation in collaborative projects.

4.2 The Advantage I-75 Project

Advantage I-75 was established as an international public/private partnership to provide a testbed for deploying electronic clearance technologies along I-75 and Canadian Highway 401. The aim is to allow trucks equipped with transponders and proper documentation to travel any segment along the 2,200-mile length of I-75 from Ontario to Florida at mainline speeds with no more than one stop at an enforcement station. Preclearance decisions at downstream weigh stations are based on size and weight measurements taken upstream and computerized checking of operating credentials in each state. Under Advantage I-75, each state retains its authority relative to motor carriers and their operations.

4.2.1 Objectives of Advantage I-75

To achieve its goal of testing technologies for seamless CVO between states, the project adopted the following objectives:

- Work within the existing institutional framework to the maximum feasible extent;
- Use off-the-shelf technologies meeting the most appropriate “open” standards at the time of procurement;
- Work towards immediate implementation;
- Require no changes in state statutes: and
- Share funding among the participants.

4.2.2 Program Organization of Advantage I-75

The Advantage I-75 program involves partners from government, industry, and the academic community. For the present, principal partners include the six I-75 states (Michigan, Ohio, Kentucky, Tennessee, Georgia, and Florida), the Province of Ontario, FHWA, various trucking associations, and several motor carriers who frequent the I-75 corridor. Principal consultants on the project have included JHK & Associates, Science Applications International Corporation (SAIC), and Hughes Transportation Management Systems.

The organizational structure of the Advantage I-75 project is illustrated in Figure 4-4. The Advantage I-75 Policy Committee provides overall guidance. Its membership of 22 includes state, province, and national officials as well as motor carriers and trucking association representatives. Committees and task forces are formed as necessary to deal with specific elements of the program. Staff support is being provided by the Kentucky Transportation Center at the University of Kentucky, under the auspices of the Kentucky Transportation Cabinet. The Transportation Center at Iowa State University serves as the independent evaluation manager.
The idea of applying ITS technologies to motor carrier operations in the I-75 corridor germinated in March 1990 as a result of discussion among representatives of the FHWA, the Kentucky Transportation Cabinet, and the Kentucky Transportation Center at the University of Kentucky. Refinements were made to the concept, management plan, and activities timetable until the first meeting involving government agencies and motor carrier representatives from the corridor states and Ontario was held in May, 1990. Plans were then made for a conference to gauge the level of the interest of potential partners as well as the concept’s feasibility.

Using the conference task force reports as a basis, the Kentucky Transportation Center drafted a project proposal in the summer of 1990. The proposal was submitted to the FHWA in late 1990 and was approved for ITS
operational test funding as a CVO project by FHWA in 1991. Advantage I-75 has progressed rapidly through subsequent developmental stages until the present.

- **Concept refinement and organization** took from mid-1990 to the end of 1991.


- **Motor carrier recruitment and procurement** took from mid-1993 to mid-1995.

- **Installation and pre-testing** took from the end of 1993 to mid-1995.

- **Evaluation and enhancements** occurred from mid-1993 to the end of 1995.

- A two-year **operational test** began in February 1996.

For the duration of the operational test, the Advantage I-75 Operations Center is supporting day-to-day systems operations, providing system evaluation, and acting as a clearinghouse for project-related information. Advantage I-75 management has not made clear what direction it will take following completion of the operational test phase in 1998.

### 4.2.3 Performance Measurement in the Advantage I-75 Program

Like the HELP/Crescent project, Advantage I-75 is being financed primarily by FHWA with funds dedicated to the operational testing of ITS technologies. One of the stipulations of funding is that an independent evaluation be conducted following completion of the operational test phase of Advantage I-75. While the evaluation team was selected by FHWA in 1994 based on a specified scope of evaluation, a formal evaluation methodology has not been publicized, and Advantage I-75 management is not privy to interim findings. To date, Advantage I-75 management has not articulated specific performance measures that it is currently using for strategic management nor how the program will be managed after the operational test has concluded.
4.2.4 Advantage I-75: Lessons for Performance Measurement in Strategic Planning

Even more than HELP, Advantage I-75 reveals how unstable multi-state CVO collaborations can be. From the outset of the program, a large amount of rigidity was built into program management, by including as program objectives "no required changes in state statutes" and "working within the existing institutional framework to the maximum feasible extent." While these objectives are legitimate concerns for states, they are not helpful for the simple reason that they encourage no positive outcomes and could most easily be achieved if states were not to cooperate at all. Furthermore, these objectives are of no practical interest to truckers and other CVO stakeholders, who actually may stand to benefit if states were less rigid.

The objectives of Advantage I-75 make the positions of states clear, but the interests—presumably increased efficiency and safety—of states (and those of other stakeholders) are not evident. In Fisher and Ury’s negotiation text, Getting to Yes, the authors point out the inefficiencies of negotiating based on positions rather than on interests.3 It would have been much more pragmatic for Advantage I-75 to identify objectives that would benefit all program stakeholders and to quantify progress toward these objectives with measures that were satisfactory and verifiable by all of the major collaborators. The rigidity of current program objectives and the subjectivity of determining whether they are achieved will make the transition from operational test to full deployment difficult for Advantage I-75.

Trucker participation in a CVO program requires obvious benefits and the perception that trucking concerns have been adequately taken into account. In the early stages of planning for Advantage I-75, trucking representatives like the American Trucking Association (ATA) feared that they would have little

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3 Fisher and Ury, Getting to Yes, 2ed. New York: Penguin Books,
influence in the program, and were apprehensive about potential requests for proprietary information. Initial objective setting took place in absence of trucking industry participation. Trucking groups were concerned about the use of weight-distance taxes being made more feasible by CVO technology. While the Advantage I-75 Operations Center is providing selected carriers with a limited number of transponders free of charge, this modest step seems far less likely to lead to long-term program success than involving the trucking industry in program management from the beginning. Developing strategic program objectives and supporting performance measures by consensus in the initial stages of program development would lay the most effective basis for long-term collaboration.

4.3 The I-95 Corridor Coalition/CVO Component

To coordinate the delivery of transportation services across jurisdictions, and in response to federal designation in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), major operating transportation organizations from Maine to Virginia allied themselves in 1992 to form the I-95 Corridor Coalition. The Coalition is concerned with I-95, as well as other primary arterial highways in the region. Membership in the Coalition spans both the public and private sectors and various transportation modes to include twelve states’ and two cities’ (New York and Washington, D.C) departments of transportation, twelve toll authorities, federal transportation agencies, and numerous private trade and industry organizations. The I-95 Corridor Coalition has over 20 major activities in its current business plan, of which the CVO program is one.

4.3.1 Objectives of the I-95 Corridor Coalition/CVO Component

In general, the Coalition’s mission is to work cooperatively to improve the mobility, safety, environmental quality, and efficiency of interregional travel in the northeast through real-time communication and operational management of
the transportation system. In doing so, the Coalition seeks to establish an economically beneficial, multimodal framework for early implementation of appropriate ITS technology.

In the spring of 1993, the Coalition adopted its five-year business plan. The activities in the business plan range in size, scope, and implementation pace. While funding for all activities cannot be decomposed to those related to the CVO program, perhaps 10 percent of all funding supports CVO-related activities. The CVO program planned by the I-95 Corridor Coalition includes four major components.

- The I-95 CVO Forum, meant to help coordinate motor carrier policies and programs among the coalition states. The Forum will bring together task forces representing the entire corridor plus its two major regions, north and south, which have distinct needs. By doing so, it will provide an institutional basis for integrating the recommendations of studies commissioned by the Coalition and studies completed for other CVO corridor programs, including Advantage I-75 and the HELP/Crescent Project.

- The CVO Credentials and Administration Program. This will include projects dedicated to electronic registration, electronic fuel tax, uniform carrier identification and oversize/overweight permitting.

- The Carrier Operations Program. This will develop a public/private corporation to provide information on highway conditions to truck drivers and dispatchers.

- The CVO Safety Program. This includes projects devoted to roadside safety assurance, automated preclearance, and coordinated enforcement.
4.3.2 I-95 Corridor Coalition: Program Organization

The organizational structure of the I-95 Corridor Coalition centers around four primary working groups, guided by a steering committee of senior professionals, overseen in turn by an Executive Board of Chief Administrative Officers. A schematic diagram of the organization of the I-95 Corridor Coalition is included in Figure 6-5. The four working groups are focused on (1) operations and incident management, (2) technology and functional requirements, (3) public/private partnership requirements, and (4) budget and policy issues.

**Figure 4-5**
Organizational Chart of I-95 Corridor Coalition Program

The I-95 Corridor Coalition Executive Board is composed of high-level executives of the principal member organizations (12 state DOTs, 12 toll authorities, Washington, D.C., and New York City) and the U.S. Department of Transportation. The public sector composition of the Board reflects its responsibilities for making decisions on raising and spending public funds and
formulating public policy. The diversity of the Coalition is best reflected at the Steering Committee level, which includes not only the public agencies but also such organizations as Amtrak, the American Trucking Foundation, the AAA Traffic Safety Foundation, and the American Bus Association.

Members of the Coalition have been clear about avoiding over-centralization, and consequently the organization remains relatively simple, small, and flexible. Initial staffing for the Coalition was furnished by I-95 Northeast Consultants (NEC), a collaboration of JHK and Parsons Brinckerhoff. As the implementation of the business plan reached a faster pace and the need for a full-time staff became evident, the Board approved a plan for key staff to serve the coalition on a full-time basis.

4.3.3 Performance Measurement in the I-95 Corridor Coalition/CVO Component

At the strategic level, the program managers of the I-95 Corridor Coalition have developed well-defined goals for their CVO program, but they have not identified any measures by which to guide their strategy. (This statement applies equally to overall Coalition management, outside of the CVO program.) The Coalition is emphasizing performance-based evaluation of the field operational tests that it is currently conducting, but no measures or methodologies are specified in the request for proposals that was released in December, 1996.4

4.3.4 I-95 Corridor Coalition/CVO Component: Lessons for Performance Measurement in Strategic Planning

Unlike HELP and Advantage I-75, the CVO component of the I-95 Corridor has not yet progressed to the operational test stage. For this reason, perhaps, it has a better opportunity to integrate a performance measurement
system into the strategic development of the CVO program. Establishing a core set of measures that all participating jurisdictions and truckers could agree to would establish a stronger institutional basis from which to launch any CVO initiatives.

CVO is one of many elements of the I-95 Corridor Coalition ITS program. In the long term, all elements of the program should work together smoothly, or else inefficient and cumbersome operations will result. Therefore, from the outset, planners for the CVO element have a responsibility to take into account the future shape of the ITS program overall. As the I-95 Corridor Coalition evolves, CVO management must keep participants informed about their inter-relationship with the larger ITS program. One of the best ways to achieve this would be to have performance measures for the Coalition program overall, which reflected in some way success in the CVO program.

The lack of mandate for change among all stakeholders has caused difficulties for the I-95 CVO program. Commonly perceived shortcomings in trucking operations and state motor carrier administration, like inefficiency in weigh station operations, have not been interpreted uniformly as a mandate for change, much less a mandate for consensus. Developing objectives in terms of strategic performance measures can suggest potential benefits of collaboration to stakeholders and help build consensus. Even if consensus appears strong in the preliminary stages of a CVO program when objectives are straightforward and federal funding is being provided, tougher issues like equitable allocation of resources, equitable distribution of benefit and burdens, competing priorities and objectives, differences in capability, and differences in commitment may threaten long-term program effectiveness. If strategic performance measures have been established early in a program and have been used by managers to monitor and communicate program benefits, they can serve as a tool for maintaining direction

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*I-95 Corridor Coalition, Request for Letters of Interest from I-95 Corridor Coalition States to Participate in Field Operational Tests under the I-95 Commercial Vehicle Operations Program, 1996.*

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through the many stressful periods that a collaborative CVO program is likely to experience.

The I-95 Corridor Coalition CVO program lacks representation of trucking interests at its highest level—the Executive Board. There may pragmatic reasons for this exclusion, but it nonetheless leaves truckers doubting the capability and intention of the program to deal most effectively with their interests. Even if trucking interests remain excluded from the Executive Board, the existence of collaboratively developed performance measures that the Executive Board was manifestly using for its decision making would increase the incentive for trucking industry participation in the CVO program.

4.4 Minnesota Guidestar/CVO Component

Minnesota Guidestar, Minnesota’s statewide ITS program, incorporates existing and developing technologies into the statewide transportation system and seeks to modify the organizational relationships, processes, and approaches traditionally used by government, the private sector, and academia. It has three general aims:

- Increase transportation system accessibility and productivity;
- Reduce environmental impacts; and
- Broaden private sector investments.

Program participants include the Minnesota Department of Transportation (Mn/DOT) and the Minnesota Department of Public Safety (Mn/DPS), the University of Minnesota, numerous local and regional governmental agencies, the FHWA, and the private sector.

Minnesota Guidestar was conceived in 1989 from ongoing activities and discussions among Mn/DOT, CTS, and FHWA. Representatives from these organizations envisioned public, private and academic sector participants working together to plan, promote, coordinate and deploy ITS in Minnesota. A
CVO Project Section was subsequently formed to deal specifically with the application of ITS to Minnesota’s motor carrier program. Using input from state agencies and the motor carrier industry, Minnesota Guidestar completed a CVO Business Plan in April, 1995.

### 4.4.1 Objectives of the Minnesota Guidestar/CVO Component

The business plan identifies “CVO Process Re-engineering” as its highest priority activity. Most non-CVO Guidestar initiatives apply advanced technologies to address transportation problems like traffic congestion and transit efficiency, but the CVO community involved in drafting the business plan emphasized that solutions for CVO must initially focus on institutional barriers to the efficient movement of goods in Minnesota and throughout the country. The business plan’s authors concluded that CVO technologies should not be implemented to support outdated and inefficient regulatory processes and instead that process re-engineering should occur concurrently with technological change.

The Minnesota Guidestar CVO Business Plan sets forth three general objectives that will enhance the state’s economic development and competitiveness by creating a more efficient and cost-effective goods movement industry: (1) improve the safety of motor carrier operations; (2) optimize the collection of revenue due to the state through its regulation of CVO and ensure that all carriers pay their fair share; and (3) reduce the time and cost associated with the regulation of CVO for both the state and the motor carrier industry.

Minnesota Guidestar’s growth has paralleled that of the national ITS program. Guidestar’s budget has grown from $1 million in 1991 to $40 million in 1996. Roughly two-thirds of funding is provided by FHWA. Mn/DOT contributes about 15 percent, with the private sector, local government, and the University of Minnesota supplying the remainder.
4.4.2 Program Organization of Minnesota Guidestar

The Minnesota Guidestar CVO program involves the private sector, state and local government, the transportation research community, and the FHWA. State regulation of CVO falls largely to two agencies, Mn/DOT and the Mn/DPS. The organizational chart in Figure 4-6 gives further detail.

**Figure 4-6**
Organizational Chart of the Minnesota Guidestar Program

Transportation research within Minnesota is centered around the Center for Transportation Studies (CTS) at the University of Minnesota. Affiliates of CTS conduct research that complements the strategic direction of both the Minnesota Guidestar program and the national ITS program. In addition, they evaluate field demonstrations of ITS technologies.

The FHWA, which funds two-thirds of Minnesota Guidestar and has responsibility for the national ITS program, has a strong interest in Guidestar's aggressive effort to develop a CVO program. Minnesota is involved with a
number of interstate CVO projects, including HELP and CVSIN, and thus has an interest in CVO programs inter-related with Guidestar.

### 4.4.3 Performance Measurement in the Minnesota Guidestar/CVO Component

The authors of the Minnesota Guidestar’s CVO business plan developed the following set of project evaluation principles, identified during the participation process, to promote progress toward the objectives described in Section 4.4.1.

- Projects should reduce the costs associated with the administrative processes of state agencies and motor carriers;
- Projects should lead to quantifiable improvements in public safety and revenue collection; and
- Short-term needs should be addressed in a manner consistent with the resolution of long-term problems.

Specific measures of strategic program performance have not been identified, nor any guidelines for incorporating the evaluation principles identified above into program decision making or monitoring.

### 4.4.4 Minnesota Guidestar/CVO Component: Lessons Performance Measurement in Strategic Planning

Many public sector stakeholders in the Guidestar CVO component have expressed at least some resistance to the program, including “traditional highway engineers” and the enforcement community. To overcome resistance, CVO programs require a mandate for change. This requires top-level support of a general vision and specific objectives from the major program collaborators. Obtaining top-level support for specific performance measures linked to CVO program objectives would allow government agencies and enterprises in the
private sector to work in support of the overall program without requiring continual coordination.

Transportation agencies must plan for the future skills that CVO technologies will require of their staffs, possibly using training, recruitment, and more attractive compensation. Using performance measures to capture the development of human resources, especially within the public sector, would provide a continuing focus on a crucial element of the Guidestar program.

The long-term success of the Minnesota CVO program is contingent on reliable funding after federal support for pilot deployment has ended. Financial contributions from truckers will require tangible benefits that will reliably exceed costs. For motor carriers, productivity benefits and cost savings of some technologies may not exceed capital and maintenance costs for particular types of operations. Carriers with small fleets may have especially limited resources for investments in technology. Any performance measures developed for the Minnesota program to reflect benefits to carriers ideally would reflect benefits not only to the trucking industry as a whole but also to different segments of the industry.

4.5 The Oregon Green Light Project

Since the mid-1980s, the Oregon Department of Transportation (ODOT) and the Oregon Public Utility Commission (OPUC) have been testing ITS/CVO technologies like satellite tracking, two-way communications, on-board computers, weigh-in-motion systems, and automatic vehicle identification. In late 1992, in an effort to develop an ITS/CVO strategic and business plan, ODOT and OPUC held a series of meetings involving public agencies and the motor carrier industry. These meetings helped to produce a consensus on the appropriate strategic vision and mission of Oregon's CVO program, and they led to the publication of a Strategic Plan for IVHS/CVO in Oregon in July 1993. The Oregon government developed the Green Light project as an implementation
program for the strategic plan. Perhaps because of its leadership in CVO
development, the Oregon state government was selected as one of the nine
CVISN model deployment state in addition to Maryland.

4.5.1 Objectives of the Oregon Green Light Project

The mission of the Green Light program is to develop and deploy
advanced technology to improve CVO efficiency, to increase the performance of
the highway system and to protect public investment in that system. This
mission includes three goals:

- Benefit the motor carrier industry through increased productivity for legal
  commercial vehicles, by reducing travel delay and administrative burden,
  providing new information services, and providing a consistent and
  equitable regulatory environment.

- Benefit government agencies through increased efficiency and
  effectiveness, by making enforcement activities more effective, improving
  regulatory compliance, reducing administrative and operational costs,
  improving government cooperation and coordination, and protecting the
  financial and physical integrity of the public infrastructure.

- Benefit the public by improving highway safety and operations, reducing
  the number and severity of highway incidents, reducing the impact of
  highway incidents on traffic operations, and improving the operational
  efficiency of the public infrastructure.

The Green Light project has eight components: mainline preclearance,
safety enhancements, vision technology, hardware/software upgrades, database
management and development, electronic data interchange, transponder
acquisition, and independent evaluation. These eight components will be
developed in three phases:
Phase I started in July 1995 and will end in December 1996. This phase will concern development of high priority ITS/CVO infrastructure.

Phase II will started in July 1996 and will end in December 1997. During this phase, development of ITS/CVO infrastructure will continue, with continuation of funding for some high priority infrastructure items and inception of funding for lower priority items.

Phase III started in July 1997 and will end in December 1999. The goal for Phase III is to complete the infrastructure development and required for implementation of the system envisioned in the strategic plan.

The total cost of implementing Oregon's CVO strategic plan is $30.5 million (in 1996 dollars), including 20 percent in matching funds from the state. In addition to direct funding, Oregon will be contributing approximately $560,000 in payments in-kind for salaries, services, and travel. No direct funding will be supplied by the motor carrier industry; in fact, 5,000 transponders will be supplied by the state to truckers to establish a base of users of state-promoted CVO technologies.

The Oregon Department of Transportation (ODOT) and the Oregon Trucking Association were both charter members of the HELP program, described in section 4.1. In late October, 1996, however, both resigned from the governing board of HELP. The prominent reasons for dissatisfaction among these former program supporters are HELP’s arrangement for financing, concerns over data confidentiality, and the value of investments in the HELP program.

4.5.2 Program Organization of Oregon Green Light

Participants in the Green Light Project include the commercial trucking industry and federal, state, and local governments. At the state level, the commercial trucking industry is represented by the Oregon Trucking
Association, which interacts on a regional basis with the Western Trucking Association Executive Council. Four agencies within the State of Oregon have CVO-related regulatory functions: the Oregon Department of Transportation (ODOT), the Oregon Public Utility Commission (OPUC), the Oregon State Police (OSP), and the Oregon Department of Environmental Quality (ODEQ). Figure 4-7 shows an organizational chart of motor carrier administration in Oregon.

**Figure 4-7**
Organizational Chart of Oregon Green Light Program

Source: Based on information in Western States Transparent Borders Project: Description of Current State Practices, Oregon.

ODOT has three primary branches that are concerned with motor carrier administration: Information Systems, Transportation Development, and Driver and Motor Vehicle (DMV) Services. The DMV Services branch is further split into two groups, Motor Carrier Services (permits and weight monitoring) and License Control Services (driver licensing and vehicle titles). Also, the ODOT Fuels Tax Branch has some involvement with commercial vehicle owners.

OPUC has four branches concerned with CVO. The Economic Regulation branch handles certificate authority for intrastate common and contract carriers.
The Transportation Safety branch has a Motor Carrier Safety group that is responsible for safety inspection and enforcement; the Motor Carrier Services group handles vehicle registration (full fee and apportioned), permit authority, and weight/distance tax collection and audit. The Information Systems group handles computer and management information services. OSP is primarily responsible for public safety and traffic law enforcement. ODEQ is concerned with vehicle emissions and the transportation of hazardous materials and waste.

The steering group for the Green Light project consists of the managers of ODOT's Motor Carrier Services, Future Technology Research, Information Systems, and Traffic Engineering branches; OPUC's Motor Carrier Services branch; and one member chosen to represent the motor carrier industry.

4.5.3 Performance Measurement in Oregon Green Light

Before the establishment of the Green Light program, the Oregon Department of Transportation conducted an Oregon CVO cost-benefit analysis, focusing on weigh station bypass. This analysis was used to justify staffing and funding for the Green Light program.

No performance measures are specified in the Strategic Plan IVHS/CVO in Oregon, though the plan lays out a number of objectives that lend themselves to measurement.

- Reduce travel times;
- Reduce administrative burden;
- Make enforcement activities more effective;
- Improve compliance with regulations;
- Reduce administrative and operational costs;
- Reduce the number and severity of highway incidents; and
- Reduce the impact of highway incidents on traffic operations; and
- Improve the operational efficiency of the public infrastructure.

The Strategic Plan indicates that "appropriate milestones and performance measures to assure the timely and effective implementation of [the] business plan" will be undertaken by the Green Light steering group, with periodic progress reports available for review by all interested parties. To date, none of these reports have been released and no definite performance measures for evaluating the Green Light program have been established.

4.5.4 Oregon Green Light: Lessons for Performance Measurement in Strategic Planning

In many ways, the Oregon Green Light strategic plan and the process that developed it can serve as a model for Maryland's CVO program. The plan articulates a well-defined vision and tangible goals that support the attainment of this vision. Input from both the public and private sectors was solicited for the plan, and objectives reflect the interests of both government and truckers. Strategic issues, opportunities, and threats are concisely and insightfully captured. The intention to develop "appropriate milestones and performance measures to assure the timely and effective implementation of [the] business plan," with periodic progress reports available for review by all interested parties should provide a basis for communicating program direction and soliciting input among program stakeholders.

The shortcomings of the Strategic Plan IVHS/CVO in Oregon should be as illuminating to the Maryland CVO program as the plan's strengths. By stopping short of specifying the measures of effectiveness that would be used in evaluating and monitoring Green Light, or even how these measures would be developed, the plan missed opportunities for building consensus among stakeholders, communicating management priorities, and conveying a sense of the stability and continuity in the future evaluation of the program. Because performance measures will be developed by the Green Light Steering
Committee, on which the trucking industry has one representative compared to five for the state government, non-government stakeholders have adequate reason to doubt that future development of the Green Light program will be reflect equitable consideration of all stakeholders’ interests.

The current refusal of ODOT and the Oregon Trucking Association to participate in the HELP program causes some concern about the long-term integration of the HELP and Green Light programs. Considering linked CVO programs as CVO stakeholders, as suggested in Section 2.1.2.6, during the development of strategic objectives and associated strategic performance measures, could reduce difficulties that Maryland may have in this regard.

4.6 Lessons from Existing CVO Programs for Maryland’s CVO Program

This section summarizes the impediments faced in existing CVO programs, as well as program responses, with an aim of providing collaborators for CVO in Maryland an overview of the environment for the strategic management of their own program. This section concludes by highlighting the lack of strategic performance measurement in existing CVO programs, with the implication that the Maryland program could be a leader in this regard and, in the process, build itself a strong and robust basis for future program success.

4.6.1 Summary of Impediments and Responses in Existing CVO Programs

Tables 4-1 and 4-2 present summaries of common impediments that have been encountered in existing CVO programs, as well as management responses to these impediments. Close analysis of these existing CVO programs highlights a number of lessons for the Maryland CVO program. These lessons can be viewed in three groups: (1) institutional issues, (2) system issues, and (3) technical issues.
Institutional Issues

- To establish the momentum necessary for a CVO program requires top-level support of a general vision and specific objectives. To obtain this top-level support, the CVO program in Maryland needs to be able to convey its objectives and benefits, while recognizing the program costs (monetary and otherwise) perceived by different agencies and the private sector.

- Strategic planning works best when all significant stakeholders in a program provide input. By soliciting input at an early stage and involving major stakeholders (including representatives of the motor carrier industry) in the top management, Maryland will increase the likelihood of forging a program acceptable to all parties.

- The responsibilities and contributions of participant representatives on a planning committee should be clear. The mere presence of state agency and industry representatives is not an indicator of sufficient participation. The Maryland CVO program should make clear what roles individuals within a strategic planning group are expected to play, and it needs to ensure that these individuals are adequately representing their constituencies.
Table 4-1
Program Impediments In Existing CVO Programs

<table>
<thead>
<tr>
<th>Program Impediments</th>
<th>HELP/Crescent</th>
<th>Advantage I-75</th>
<th>I-95 Corridor Coalition/CVO Component</th>
<th>Minnesota Guidestar/CVO Component</th>
<th>Oregon Green Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient support from top management at program inception</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Differences in goals and priorities among participants</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Low initial motor carrier support</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Overlapping responsibilities of agencies involved in CVO</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Imbalance of resources dedicated by states and agencies</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stresses in communications with FHWA at HQ, Regional, and Division levels</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concerns about data privacy and control</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concerns about use of technology for enforcement/revenue enhancement</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skepticism over operational standards from enforcement community</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Uncertainty about standards for carrier participation</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competition between CVO and other ITS program elements</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Concern over integration with other CVO programs</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Lack of technical expertise among current staff</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Concern over program funding after completion of test phase</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Note: All assessments are based on the professional judgments of the author, given stated difficulties in available program evaluations.
### Table 4-2
Responses To Impediments In Existing CVO Programs

<table>
<thead>
<tr>
<th>Lessons &amp; Recommendations</th>
<th>HELP/Crescent</th>
<th>Advantage I-75</th>
<th>1-95 Corridor Coalition/CVO Component</th>
<th>Minnesota Guidestar/CVO Component</th>
<th>Oregon Green Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-engineer motor carrier administration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Involve carriers at onset of program</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Include carrier representatives at highest level of program management</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distribute transponders for free to jump start trucker participation</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Assign system integration to a third party contractor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Assess costs and benefits of user services</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Work within participants' existing statutory and regulatory frameworks</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scan technologies to be deployed in other CVO programs</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Aim for component modularity to ensure system adaptability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Evaluate funding options for full deployment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Train personnel in ITS/CVO technologies</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Note: All assessments are based on the professional judgments of the author, given stated difficulties in available program evaluations.
Motor carriers are the primary “customers” of the CVO programs, and they are reluctant to commit financial and staff resources to programs that do not offer immediate and clear benefits. The Maryland CVO program should be able to demonstrate how and how much its programs will benefit the motor carrier industry. It should anticipate how its technologies will be accepted by large and small firms, and experienced and novice drivers.

Enforcement officials view their primary job as ensuring the safety of the highways. Unless they are convinced that CVO technologies will maintain the current level of safety, they will not support a program. The Maryland CVO program needs both to design a CVO system promising more effective enforcement and to communicate to officials how this system will work.

Program management should understand the intentions and roles of different parts within FHWA that have an interest in the program, including the divisional, regional, and headquarters levels.

**System Issues**

- Maryland has an extensive flow of freight across state boundaries. An effective CVO program will require integration with other CVO programs not only at the federal and regional levels, but also at the state level.

- CVO is only one component of ITS deployment within Maryland. Effective long-term deployment will require an awareness of the inter-relationship of ITS programs within the state, as well as within the I-95 Corridor and the nation as a whole.

- The effective and efficient transition from an operation test phase of a program to full deployment requires a strategic vision from program
inception, in terms of changes in program administration, operation, and funding.

**Technical Issues**

- CVO technologies are emerging rapidly. To maintain integration with other CVO programs, Maryland needs to be aware of what technologies are being deployed and considered for deployment in other programs.

- New technologies may not use the same hardware or software platforms as existing technologies. To avoid future difficulties in implementing system improvements, Maryland should strive to create an open, modular, and adaptable CVO program. In addition, Maryland should keep in mind the implications of new technologies for inter-communicability.

4.6.2 Lack of Strategic Performance Measurement in Existing CVO Programs

The development and use of strategic performance measurement in existing CVO programs has been extremely limited. To the extent that performance has been measured or projected to date, cost/benefit analysis has been emphasized. Even this has occurred in a somewhat politicized context, because it has been undertaken partially to provide justification of continued government funding of CVO programs. Many of the impediments identified in Table 4-3, like “Differences in Goals and Priorities Among Participants,” suggest the role that strategic performance measures could play. In neglecting to develop strategic performance measures, the programs have missed an opportunity to involve collaborators and orient the program toward achievement of long-term goals.

Except for Oregon Green Light, the five CVO programs considered have defined their strategic objectives in a way that does not encourage measurement
of how well these objectives are being achieved. Table 4-1 summarizes the objectives stated for each program. HELP and Advantage I-75 defined objectives vaguely, particularly with regard to improving institutional relationships, for which they specify neither the stakeholder interests nor potential benefits of program participation. The I-95 Corridor Coalition and Minnesota Guidestar programs define objectives broadly in terms of “improvements” in safety, efficiency, and mobility. Only the Oregon program has specific objectives that could be easily linked to strategic performance measures.
Table 4-3
Comparison of Strategic Objectives of Existing CVO Programs

| HELP | • Improve institutional arrangements involving the public and private sectors.  
• Assess the viability of the identified technology in the highway environment.  
• Measure efficiency and productivity changes.  
• Identify additional applications for technology. |
| Advantage I-75 | • Work within the existing institutional framework to the maximum feasible extent.  
• Use off-the-shelf technologies meeting the most appropriate "open" at the time of procurement.  
• Work towards immediate implementation.  
• Require no changes in state statutes.  
• Share funding among the participants. |
| I-95 Corridor Coalition/ CVO Component | • Improve the mobility, safety, environmental quality, and efficiency of interregional truck movement in the northeast through real-time communication and operational management of the transportation system.  
• Establish an economically beneficial, multimodal framework for early implementation of appropriate CVO technology. |
| Minnesota Guidestar/ CVO Component | • Improve the safety of motor carrier operations.  
• Optimize the collection of revenue due to the state through its regulation of CVO and ensure that all carriers pay their fair share.  
• Reduce the time and cost associated with the regulation of CVO for both the state and the motor carrier industry. |
| Oregon Green Light | • Reduce travel times.  
• Reduce administrative burden.  
• Make enforcement activities more effective.  
• Improve compliance with regulations.  
• Reduce administrative and operational costs.  
• Reduce the number and severity of highway incidents.  
• Reduce the impact of highway incidents on traffic operations.  
• Improve the operational efficiency of the public infrastructure. |
In developing objectives, programs have conceived of stakeholders narrowly, generally encompassing no more than the state regulatory and enforcement community and the trucking community. Shippers, the academic community, and CVO application developers, and the other stakeholder groups identified in Chapter 2 have not been explicitly considered. Ignoring these stakeholders imperils the long-term success of a program, in which these less obvious stakeholder will play a more important role. It also limits the impact of a program. Because supporting stakeholders like CVO developers and shippers enable the degree of a program's success by supplying required inputs, purchasing outputs, and promoting a good operational environment, their interests need to be evaluated and taken into consideration. Ideally, the interests of all stakeholders should be reflected in the vision, strategic objectives, and strategic performance measures that a CVO program adopts.

In all programs, the enforcement community stressed the importance of being able to provide input during the operational test, receiving adequate training, and fully understanding the system before implementation. Enforcement concerns carry substantial political weight; in a recent I-95 Corridor Coalition/CVO breakout meeting, a law enforcement officer exclaimed, correctly in the view of the author, that deployment would not go forward without the support of enforcement officers. Reflecting the interests of the enforcement community is a necessity for any set of strategic performance measures developed for a CVO program.

Staff inexperience can impair the effectiveness of CVO technologies, and because the public sector is perceived to lag behind the private sector in adoption of technologies, public sector unfamiliarity with CVO technologies can imperil public/private collaboration. Capturing the level of training in the public sector especially, and in the process focusing management attention on the issue, is an important role strategic performance measures can play.
The CVO programs discussed in this chapter provide useful lessons for the use of performance measures in the Maryland CVO program. The following chapter combines these lessons with the characterization of stakeholders given in Chapter 2 and the performance measurement theory in Chapter 3 to suggest how strategic management for the Maryland program can incorporate performance measurement.
Chapter 5
Developing Performance Measures for CVO Programs

Previous sections have reviewed stakeholders in Maryland’s CVO program and their interests, the theory and recent application of performance measurement in the private and public sectors, and lessons from the CVO program case studies. In this section, we suggest how performance measures can be developed for Maryland’s public/private CVO program. We review limitations in the development of performance measures in public sector freight transportation programs and identify how CVO programs differ from “traditional” freight management programs. We recommend two alternative schemes for incorporating performance measures into the Maryland CVO strategic plan and discuss implementation issues.

5.1 Limitations in the Development of Performance Measures in Public Sector Freight Transportation Programs

In 1995, Richard Pratt and Timothy Lomax summarized the present condition of performance measures in public sector management by noting “it is perhaps an exaggeration, but not much, to say that transportation performance measurement is in a state of upheaval. . . . Change is coming because performance measures are being put to broader uses. The goals and objectives with which they are being paired have been augmented or changed.”

This section summarizes several recent public sector efforts to extend the application of strategic performance measures in public sector freight transportation programs. The ambitious nature of these efforts in seeking to

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capture the systematic impacts of freight transportation in states and the difficulty that they faced in terms of obtaining sufficient data suggest that they might better be pursued in the framework of a collaborative public/private CVO program. Section 5.1.1 describes the information and decision management systems mandated for statewide planning under the Intermodal Surface Transportation Efficiency Act (ISTEA), Section 5.1.2 describes performance measure development for freight intermodalism in California, and Section 5.1.3 describes the performance-oriented management initiative in the state of Oregon, launched in 1989.

5.1.1 ISTEA-Mandated Management Systems

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) mandated that states develop performance-oriented management systems—intermodal (IMS), congestion (CMS), public transit (PTMS), pavement (PMS), bridges (BMS), and safety (SMS)—plus a seventh ancillary traffic monitoring system (TMS) to provide information and serve as a decision-support tool for devising cost-effective investment strategies. The legislation required that state systems be certified annually by the federal government. The CMS and IMS relate directly to freight transportation. Congress intended that the management systems integrate operation and preservation of the existing transportation system—both public and private sector components—with long-term development and performance. Figure 5-1 presents FHWA’s schematic diagram of the relationship between the management systems, the planning process, and implementation.²

²See the Federal Register, December 1, 1993, pp. 63442-63485.
Most states found the development and implementation of the management system mandated by ISTEA problematic, and subsequently another act, the National Highway System Designation Act of 1995, made all systems but the BMS and CMS "highly encouraged" rather than mandatory. Among the chief concerns raised by states was the amount of data required to operate the systems. (The management system rulemaking had specified some elements deemed essential for operation of "basic" management systems and had suggested additional elements.) FHWA maintained that much of the data required was available and that the rule provided sufficient flexibility for states and local agencies to establish data bases that were not "excessively cumbersome." It stressed that proprietary information was not required, though it encouraged state agencies to build on the relationship between public and private sector transportation providers, although it provided no substantive guidance on this in the rulemaking or in subsequent guidance.
States also raised other concerns. They complained that FHWA did not provide clear guidance on the role of management systems in decision making, especially decisions regarding private sector activities, to which the federal agency responded that the rule provided flexibility for state and local agencies to identify their transportation issues and determine the type and level of data necessary to support this role. States also complained that some of the implementation issues associated with the management systems were beyond their control, such as inclusion in the system databases of facilities not under states' control and the required coordination between adjacent states' IMS. (The procedures for establishing an IMS consisted of identification of intermodal facilities and performance measurers, data collection and system monitoring, performance evaluation, and identification of strategies and actions.)

5.1.2 Performance Measure Development for Freight Intermodalism in California

In response to the ISTEA requirement for an IMS, California defined its freight program objectives and potential performance measures, as shown in Table 5-1. A review of Table 5-1 suggests that California has sought to capture aspects of freight system performance of interest to a range of stakeholders: mobility, cost, environmental sustainability, economic benefits, safety improvements, and quality of life enhancements. The ambitious breadth of California's potential measures raise several questions. First, some of the potential measures shown in Table 5-1 track aspects of performance over which the state planners have little control. Unless the state government mandated freight system stakeholders to enact policy that it developed, an infeasible scenario, use of the IMS would be limited largely to monitoring rather than planning the freight system. Second, California will face difficulties in obtaining the data necessary to support many of the potential measures shown in the table.
A recent research paper on development of performance measures for the regional freight transportation planning in California proposes that a staged process may be the most practical way to proceed, with measures with “reasonably available data” instituted first, followed by additional measures as the data to support them are obtained.⁴

Table 5-1
Potential Measures Developed for California’s Intermodal Management System

<table>
<thead>
<tr>
<th>Program Objectives</th>
<th>Measures</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility</td>
<td>Mobility Index</td>
<td>• ton-miles traveled/vehicle miles traveled * average speed</td>
</tr>
<tr>
<td></td>
<td>Lost Time</td>
<td>• (actual travel time - theoretical travel time)</td>
</tr>
<tr>
<td>Financial Health</td>
<td>V/C Ratio</td>
<td>• demand/capacity</td>
</tr>
<tr>
<td></td>
<td>Cost to Service Provider</td>
<td>• AEC/ton-miles</td>
</tr>
<tr>
<td></td>
<td>User Costs</td>
<td>• average cost/ton miles</td>
</tr>
<tr>
<td>Environmental Sustainability</td>
<td>Pollution</td>
<td>• pollution/ton mile</td>
</tr>
<tr>
<td></td>
<td>Fuel Use</td>
<td>• fuel/ton-mile</td>
</tr>
<tr>
<td></td>
<td>Greenhouse Emissions</td>
<td>• CO₂/ton-mile</td>
</tr>
<tr>
<td>Economic Benefit</td>
<td>Average Jobs Supported/Year</td>
<td>• capital costs/useful life * capital employment multiplier + annual operating costs * operating employment multiplier</td>
</tr>
<tr>
<td></td>
<td>Gross State Product Impact</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Cost of Pollution, Accidents, Facilities, and Lost Time per Ton Mile</td>
<td>—</td>
</tr>
<tr>
<td>Safety Improvements</td>
<td>Accidents</td>
<td>• accidents per ton-mile</td>
</tr>
<tr>
<td>Quality of Life Enhancement</td>
<td>Availability</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Schedule Frequency</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Weight, Width, Clearance Restrictions</td>
<td>—</td>
</tr>
</tbody>
</table>

5.1.3 Freight System Performance Management in Oregon

Working together with the Port of Portland, ODOT conducted a system inventory of the state’s freight transportation system, assessed gaps in data, and identified five elements for observation of performance: cost, time, accessibility and availability, reliability, and safety. To date, Oregon has identified potential freight-based performances measures for these five elements (shown in Table 5-2); it is currently evaluating them in terms of data availability and relevance of use. Coogan, National Cooperative Highway Research Program Synthesis of Highway Practice 230, Freight Transportation Planning Practices in the Public Sector, 1996, p. 18.
counterpart in California, will face difficulty implementing any decisions that it arrives at based on its performance measurement system. Many of the components in the state's freight system are not under government control, and obtaining their cooperation and coordinating their responses to government planning directives would be problematic.
Table 5-2

Freight-Based Performances Measures Under Consideration in Oregon

<table>
<thead>
<tr>
<th>Key Element</th>
<th>Key Result Area</th>
<th>Potential Performance Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Total shipping cost (producer to user)</td>
<td>• Cost per trip&lt;br&gt;• Average travel time per trip</td>
</tr>
<tr>
<td>Time</td>
<td>Total time in transit (producer to user)</td>
<td>• Capacity restrictions&lt;br&gt;• Average transfer time between modes</td>
</tr>
<tr>
<td>Accessibility/Availability</td>
<td>Negative deviations of time and cost</td>
<td>• Perceived deficiencies and services&lt;br&gt;• Availability (origin of goods to destination and alternative modes to ship)</td>
</tr>
<tr>
<td>Reliability</td>
<td>System disruption</td>
<td>• Delay per vehicle miles traveled</td>
</tr>
<tr>
<td>Safety</td>
<td>Injury, death, and property loss (product, equipment, and infrastructure)</td>
<td>• Level of service for intermodal facilities (demonstrates transfer convenience)&lt;br&gt;• Average accident-caused delay per trip&lt;br&gt;• Average accident cost (property damage, injuries) per trip&lt;br&gt;• Number of accidents (per trip, per year)&lt;br&gt;• Number of accidents per vehicle miles traveled&lt;br&gt;• Some measure of personal safety at terminals</td>
</tr>
</tbody>
</table>

5.2 The Difference Between Management for “Traditional” Freight Programs and for CVO

Management theorist Peter Drucker argues that organizing principle for work in the past two hundred years has derived from two underlying technical revolutions. Drucker asserts that during the industrial era, business competed by exploiting energy sources—water, coal, and oil, successively—with

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progressively greater scale and efficiency. The information era, he notes, was heralded by the invention of the first mainframe computer in 1946. Subsequently, the imperative in business has been the use of increasing quantities of information: to refine product design, to improve business processes, to develop a keener understanding of the market, and to communicate to business stakeholders.

Drucker’s dichotomy between the industrial and information eras aptly fits the ongoing transformation in the trucking industry and the government’s regulation of it, with the modification that the industrial era for transportation industries ended with the first oil crises in 1973. In the eight years following this oil crises, energy prices increased by over 75 percent, as shown in Figure 5-2. While transportation prices had tracked energy price levels until 1973, they show poor correlation between 1973 and 1985. It was during this point, with fluctuating energy prices and deregulation (which in itself was partially driven by the energy shocks of the 1970s) that the industry began a transformation that continues through to this day. This essence of this transformation is a shift in the “organizing principle of production” (Drucker’s terminology) from labor and energy to information. Whereas trucking service in the pre-1970 era consisted of moving a product from Location A to Location B (under highly regulated terms, as described in Section 1.3.3), now service increasingly entails becoming part of a customer’s supply chain (as described in Section 3.3). The sustained level of transportation prices following 1981 indicates how the industry in general, notwithstanding intense competition in the freight sector, has de-coupled market prices from the cost of energy inputs in the service that it provides.
The emergence of CVO technologies can be seen in context of the continuing competitive evolution of the trucking industry (and the freight industry in general) toward increasing the importance of information in the provision of service. To continue to support the trucking industry effectively, in terms of nurturing productivity gains and increasingly safe operations as well, government motor carrier programs should take advantage of the changes occurring in the industry. One of the important aspects of CVO systems and, more generally, of ITS programs, is the tremendous opportunity they offer to generate and process data on transportation system status and usage.

Existing government motor carrier programs took their current form in the era when energy and labor inputs dominated the provision of transportation services (Drucker’s industrial era). Their structure served the public interest well at that time, but now that information is increasingly becoming the driving force of competition and service, not just to customers but to all stakeholders, motor carrier programs are less well suited to the current environment. In many ways
the transformation required of motor carrier programs parallels the change forced on large industrial firms since 1980. The highly developed divisions in these firms had to be collapsed, connected, and re-oriented to delivery of service.

In the process of transformation, motor carrier programs at both the federal and state levels face the challenge of changing the nature of their programs and their technologies simultaneously. Figure 5-3 illustrates the desired nature of this change. Government programs need to shift from traditional, low-technology programs concentrating on trucking regulatory compliance to collaborative CVO programs that harness information-era technologies (i.e., a movement from Quadrant I to Quadrant III in the figure). Governments should avoid creating traditional freight programs with information-era technology (Quadrant II in the figure). Such programs would cost more but nonetheless provide service increasingly less suited to their users. (See Section 3.3.3 for a discussion of past unproductive investments in government information technology and the increasing accountability required of government investments in information technology.)
5.3 Differences in Stakeholder Perspectives Toward Deployment of CVO Technologies

The stakeholders identified in Chapter 2 have different perspectives on the deployment of CVO technologies. These perspectives determine how they will measure the performance of Maryland’s CVO program and how the performance measurement scheme adopted for the program should be constructed. Tables 5-3 through 5-5 identify stakeholder interests and example performance measures for the three tiers of stakeholders—active collaborators, supporting groups, and affected communities—in Maryland’s CVO program, based on the description of their interests presented in Chapter 2 and the lessons learned from existing CVO programs in Chapter 4.
Table 5-3
Interests and Example Performance Measures for Active Collaborators in Maryland's CVO Program

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Primary Interests</th>
<th>Example Performance Measures</th>
</tr>
</thead>
</table>
| Trucking Industry            | • Profitability                      • Mobility                                • Regulatory efficiency • Good working environment • Safety | - Trucking fleet productivity  
- Average operating cost per revenue mile  
- Cost/benefit of CVO services  
- Return on investment in CVO services  
- Total cost of administrative and safety compliance  
- Quality of driving environment  
- Damages due to truck-involved incidents |
| Regulatory Community         | • Economic development                • Safety                               • Revenue collection • Environmental protection | - Total cost of administrative and safety compliance  
- Jobs supported by CVO deployment  
- Yield on revenue collection  
- No. of truck-involved incidents  
- No. of incidents involving hazardous materials release  
- Impact of truck-involved incidents |
| Enforcement Community        | • Safety                             • Crime prevention                      | - Percentage of trucks out of compliance  
- No. of truck-involved incidents  
- No. of CVO-related crimes |
| Academic Community           | • Training                           • CVO research                          | - Person-hours of CVO training  
- CVO research and education funding |

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Table 5-4

Interests and Example Performance Measures for Enabling Supporters of Maryland’s CVO Program

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Primary Interests</th>
<th>Example Performance Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shippers</td>
<td>• Level of service • Cost</td>
<td>• Delay per vehicle-miles traveled • Average cost per shipment • Loss and damage impacts</td>
</tr>
<tr>
<td>Maryland State Government <em>(besides motor carrier program agencies)</em></td>
<td>• Economic development</td>
<td>• Intermodal shipment growth rate at Port of Baltimore and BWI • No. of participating firms in CVO program</td>
</tr>
<tr>
<td>CVO Technology Developers</td>
<td>• Return on investment • Market penetration</td>
<td>• Return on investment in CVO services • No. of installed CVO units</td>
</tr>
<tr>
<td>Financial Community</td>
<td>• Return on investment</td>
<td>• Return on investment in CVO services • Trucking firm bankruptcies</td>
</tr>
<tr>
<td>FHWA</td>
<td>• CVO program growth and sustainability • CVO and ITS program inter-operability</td>
<td>• Total assets of Maryland CVO program • No. of participating firms (i.e., carriers and CVO applications developers) in Maryland program • No. of installed CVO units (e.g., transponders) • Level of Maryland CVO program investments in applications with vendor-based standards</td>
</tr>
<tr>
<td>Linked ITS Programs</td>
<td>• Inter-operability • Program sustainability</td>
<td>• Total assets of CVO program • State government ITS staff spent in cross-program details and workshops</td>
</tr>
<tr>
<td>Stakeholder</td>
<td>Primary Interests</td>
<td>Example Performance Measures</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------------------------------------------------</td>
<td>--------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Freight Industry (*besides trucking*) | • CVO program equity  
• Intermodalism development | • State funding for freight transportation, by mode  
• Modal market shares  
• Level of intermodal service at Port of Baltimore and BWI |
| Non-Linked ITS Programs         | • Inter-operability  
• Program sustainability | • Total assets of Maryland CVO program  
• Level of Maryland CVO program investments in applications with vendor-based standards |
| Political Interests             | • Economic development  
• Quality of life | • Jobs supported by CVO deployment  
• Truck industry growth rate  
• Intermodal shipment growth rate at Port of Baltimore and BWI |
| Passenger Vehicle Drivers       | • Safety  
• Congestion reduction | • No. of truck-involved incidents  
• Congestion impacts of trucking |
| Environmental Interests         | • Energy conservation  
• Emissions reductions  
• Hazardous material control | • No. of incidents involving hazardous materials release  
• Aggregate idling time for trucks  
• Intermodal shipment growth rate at Port of Baltimore and BWI |
5.4 Potential Strategic Performance Measurement Schemes for Maryland’s CVO Program

In this section, we propose two alternative schemes the Maryland’s CVO program could use for performance measurement. Both of these alternatives are developed based on the discussion in Section 3.4. This discussion indicated that active collaborators in a CVO program must agree what their participation in the program is meant to accomplish and that the core set of performance measures for the program should be based on this unifying vision. Figure 3-7 illustrated the overlapping arrangement between stakeholder performance measurement systems and the core performance measurement system for the CVO program. A simplified version of the four-leaf clover figure in Figure 3-7 is reproduced in Figure 5-4, which shows how the arrangement among stakeholder performance measurement systems can be adopted in two alternative schemes for Maryland’s program. (Note that while the clover figure has four “leaves”, the schemes described below can be extended to include more stakeholders.) We have named the first alternative, which is described in Section 5.4.1, “The Intuitive Measures Scheme” because its core performance measurement system includes measures with intuitive meaning, like the number of truck-involved incidents. We have named the second alternative, which is described in Section 5.4.2, “The Weighted Matrices Scheme” because the performance measurement system for each stakeholder is summarized in one number that is then weighted in the overall score for the program to reflect the pre-determined weight for the stakeholder.
Alternative Schemes for Performance Measurement in Maryland's CVO Program

Alternative 1

Intuitive Measures Scheme
- Limited number of performance measures are used for management of CVO program.
- Measures have intuitive meaning (e.g., no. of truck-involved incidents).
- Measures for stakeholders are inter-related with measures for program overall.
- Weighting of stakeholder interests is implicit and, to some degree, ambiguous.

Alternative 2

Weighted Matrices Scheme
- Performance measure results for each stakeholder are combined into one number (e.g., trucker evaluation of program for Spring, 1997, is 110, compared to 105 for previous period). Score for CVO program overall is weighted average of stakeholder scores.
- Weighting of stakeholder interests is explicit.
- Measurement systems for stakeholders are less linked to evaluation of system overall.

These two schemes and the specific performance measures described below are suggested as models for developing the actual performance measurement systems to be used in the Maryland CVO program. As Section 3.4 indicated, the participation of stakeholders, especially active collaborators, in the development of a program's strategic objectives and corresponding set of performance measures is fundamental to the long-term program stability and success.
The two schemes proposed differ in several important regards:

- As the name of the first alternative implies, its “core” comprises performance measures that have intuitive meaning to program stakeholders. These may be more intelligible and insightful to management and stakeholders outside the structure of program management than the score that constitutes the core measure of the Weighted Matrices scheme.

- In the Intuitive Measures scheme, the weighting of stakeholder interests is implicit and, to some extent, ambiguous. In contrast, the Weighted Matrices scheme incorporates explicit weights for each stakeholder. (Section 5.4.2 will show how individual stakeholders’ performance measurement schemes themselves incorporate explicit weighting of interests.) The advantage of implicit weights is that they focus collaborators on the interests of stakeholders rather than on their relative importance in program management. On the other hand, explicit weights increase the transparency in program management. The use of explicit weight allows for more flexibility, as stakeholders’ interests could be re-balanced or stakeholders added by changing weights.

5.4.1 Alternative 1: Intuitive Measures Scheme

In a recent Sloan Management Review article, Venkatraman presents a framework for the measurement of corporate information technology resources, with the aim of allowing businesses to differentiate the management approaches needed to realize the value of these resources. Venkatraman considers the value of information technologies for a business; the current research extends the application to development of measures for a CVO program.

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The Venkatraman framework includes four independent management positions regarding information technologies that together constitute the total value of technology deployment for a CVO program as shown in Figure 5-5:

- The central diamond represent the overall value of technology deployment for the business.
- The cost position has an operational focus that minimizes risks with an emphasis on operational efficiency.
- The service position, while still minimizing risk, aims to create new business capabilities enabled by information technology to support current strategies.
- The investment position has a long-term focus and aims to create new business capabilities.
- The profit position delivers information technology services to the external market place for attractive returns on capital.

The cost and service centers seek to minimize risk by focusing on current business strategies, while the investment and profit centers focus on maximizing opportunities from information technology resources and shaping business strategies. Figure 5-6 suggests what the initial positions of certain stakeholders in the Maryland CVO may be. These positions may be split and may change over time.
Figure 5-5
Venkatraman Framework for Managing Information Technology Resources, As Applied to Maryland’s CVO Program

Purpose

- Develop Business Capability
- Increase Operational Efficiency

Value of Information Technology in CVO Program

- Service Position
- Investment Position
- Cost Position
- Profit Position

Minimize Risk
Maximize Opportunity

Risk Propensity
Figure 5-6
Initial Stakeholder “Positions” in Maryland’s CVO Program

The Venkatraman framework can be used to show how the different stakeholders in a CVO program, identified in Chapter 2, occupy complementary positions regarding purpose and propensity toward risk regarding the deployment of technology. The natures of the four respective positions in the framework, described in the bullets above, can be used as guides in developing performance measures, as shown in Table 5-6.
Table 5-6

Summary of the Venkatraman Framework
With Application to Maryland’s CVO Program

<table>
<thead>
<tr>
<th>Position</th>
<th>Overall (Diamond)</th>
<th>Cost</th>
<th>Service</th>
<th>Investment</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Measures</td>
<td>Safety: No. of truck-involved accidents</td>
<td>Efficiency: Unit cost per safety inspection</td>
<td>Economic Impacts: Jobs supported by CVO deployment</td>
<td>Efficiency: Fleet utilization percentage</td>
<td>Market Penetration: No. of installed units</td>
</tr>
<tr>
<td></td>
<td>Percentage of trucks operating out of compliance</td>
<td>Quality of Life Enhancement: Cost avoided of reduced fuel use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Efficiency: Total cost of administrative and safety compliance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: All measures are presented for illustrative purposes only.

- The enforcement community is tasked with maintaining a set level of scrutiny of the trucking industry, in terms of number of the number of inspections it is expected to conduct. The advantage of CVO technology for the enforcement community is that it can reduce the cost associated with inspections, and consequently the enforcement community can be thought to occupy the cost position in the Venkatraman framework.

- The regulatory community in Maryland’s CVO program is tasked with using new technologies to increase the level of service it can provide, both intra-departmentally and externally to the trucking industry. The academic community is tasked with conducting CVO research supporting deployment and training professionals capable of managing, planning, and operating a CVO transportation system. Both the regulatory and academic communities therefore can be thought to occupy the service position in the Venkatraman framework.
- Truckers and shippers focus on CVO technologies as a way to create new business capabilities, like dynamic re-routing and load tracking. They can be thought to occupy the investment position in the Venkatraman framework.

- CVO technology developers invest in technologies so that they can gain returns from their sale and operation. They can be thought to occupy the profit position in the Venkatraman framework.

The remaining stakeholders identified in Chapter 2 that are not specified above can be fit into the Venkatraman framework as well, either into one or more of the four positions or into the central, “diamond,” position indicating an overall interest in the program.

5.3.2 Alternative 2: Weighted Matrices Scheme

A performance measurement scheme developed by the Oregon Department of Transportation (ODOT) to quantify measures of efficiency and effectiveness at various levels within the department can serve as the basis for a weighted matrix scheme for the Maryland CVO program. In such a scheme, the collaborators in the Maryland program would need to determine weights accorded to the performance matrix developed by each program stakeholder, as shown in the example in Figure 5-7.

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Sample Weighting Stakeholder Interests in a Matrix Measurement Scheme

The process of implementing performance measurement at ODOT began with a steering committee consisting of all senior managers, including the agency head, the chief budget officer, the information services manager, and the personnel manager. ODOT used an established matrix format for reporting performance results. A sample matrix that could be used for the trucking industry in Maryland’s program is presented in Table 5-7.
<table>
<thead>
<tr>
<th>Measures of Performance</th>
<th>Return on Investments in CVO Services</th>
<th>Cost of Administrative Compliance</th>
<th>Cost of Roadside Compliance</th>
<th>Fatalities Due to Truck-Involved Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Results</td>
<td>Percent</td>
<td>$/Quarter</td>
<td>$/Quarter</td>
<td>Lives/Quarter</td>
</tr>
<tr>
<td>Actual Results</td>
<td>20%</td>
<td>$104 million</td>
<td>$19 million</td>
<td>90</td>
</tr>
<tr>
<td>Potential</td>
<td>25%</td>
<td>$80 million</td>
<td>$10 million</td>
<td>80</td>
</tr>
<tr>
<td>Potential</td>
<td>24%</td>
<td>$82 million</td>
<td>$11 million</td>
<td>82</td>
</tr>
<tr>
<td>Potential</td>
<td>23%</td>
<td>$84 million</td>
<td>$12 million</td>
<td>84</td>
</tr>
<tr>
<td>Potential</td>
<td>22%</td>
<td>$86 million</td>
<td>$13 million</td>
<td>86</td>
</tr>
<tr>
<td>Potential</td>
<td>21%</td>
<td>$88 million</td>
<td>$14 million</td>
<td>88</td>
</tr>
<tr>
<td>Potential</td>
<td>20%</td>
<td>$90 million</td>
<td>$15 million</td>
<td>90</td>
</tr>
<tr>
<td>Potential</td>
<td>19%</td>
<td>$92 million</td>
<td>$16 million</td>
<td>92</td>
</tr>
<tr>
<td>Potential</td>
<td>18%</td>
<td>$94 million</td>
<td>$17 million</td>
<td>94</td>
</tr>
<tr>
<td>Potential</td>
<td>17%</td>
<td>$96 million</td>
<td>$18 million</td>
<td>96</td>
</tr>
<tr>
<td>Potential</td>
<td>16%</td>
<td>$98 million</td>
<td>$19 million</td>
<td>98</td>
</tr>
<tr>
<td>Baseline</td>
<td>15%</td>
<td>$100 million</td>
<td>$20 million</td>
<td>100</td>
</tr>
<tr>
<td>Baseline</td>
<td>14%</td>
<td>$102 million</td>
<td>$21 million</td>
<td>102</td>
</tr>
<tr>
<td>Baseline</td>
<td>13%</td>
<td>$104 million</td>
<td>$22 million</td>
<td>104</td>
</tr>
<tr>
<td>Baseline</td>
<td>12%</td>
<td>$106 million</td>
<td>$23 million</td>
<td>106</td>
</tr>
<tr>
<td>Baseline</td>
<td>11%</td>
<td>$108 million</td>
<td>$24 million</td>
<td>108</td>
</tr>
<tr>
<td>Baseline</td>
<td>10%</td>
<td>$110 million</td>
<td>$25 million</td>
<td>110</td>
</tr>
<tr>
<td>Level Achieved</td>
<td>5</td>
<td>-2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Relative Weight</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Earned Value</td>
<td>125</td>
<td>-50</td>
<td>25</td>
<td>125</td>
</tr>
</tbody>
</table>

Note: All measures and values are presented for illustrative purposes only.
By viewing this matrix, similar copies to which ODOT believes can be initially comprehended in less than 30 minutes, employees at any level can determine how the agency is performing in key areas. The matrix includes columns with measures like level of safety and cost per unit of service provided. All measures are given weights that, collectively, sum to 100, based on priorities indicated by performance measure developers. Rows in the matrix contain actual results, targets for “potential” results, and “baseline” results developed from historical averages. A summary row underneath these results converts the actual result to a score between -5 and 10, relative to a baseline of zero. Cross multiplying the scores in the summary row by the weights assigned to each measure produces an overall performance index for the matrix, which, because weights sum to 100, will range between -500 and 1000. The overall score for the CVO program would be a weighted average of the scores the individual matrices. For example, because if the interests of the trucking industry were weighted at 25 percent of the total program interests, its contribution to the overall performance score would be 225 times 0.25, or 56.25.

5.4 Implementation Issues Associated with Performance Measurement in Maryland’s CVO Program

Regardless of which kind of performance measurement scheme Maryland’s CVO program adopts, it needs to consider a variety of implementation issues.

(1) An automated reporting process must be in place before agency-wide implementation begins. Without automation, data gathering can become extremely labor-intensive, making it difficult to produce timely reports.

(2) Data needs to be obtained with the cooperation of collaborating stakeholders; potential sources include government data and trade association surveys. Stakeholders, especially collaborators need to be assured that their privacy and security concerns are being addressed.
(3) Collaborating stakeholders must be involved at every step of measurement system development and implementation, especially in the identification of measures and the weighting of stakeholder performance indices.

(4) A communication and decision-making process must precede program-wide implementation of performance measures.

(5) All levels of management must be actively involved in the performance measurement process and must be kept informed. In addition, senior managers must understand, support, champion, and promote the program.

5.6 Further Remarks

This section has recommended two alternative schemes for incorporating performance measures into the Maryland CVO strategic plan, and it has raised implementation issues. The concluding section of this report summarizes the lessons learned from the current research and identifies the needs for further study in the area of strategic performance measure development for collaborative public/private CVO programs.
Chapter 6
Concluding Remarks

This chapter presents conclusions and suggests further research topics related to strategic performance measures for CVO programs. Some of these conclusions and suggested research topics concern strategic performance measurement in the public/private partnership environment, others concern current CVO programs nationwide, and still others concern Maryland’s program in particular.

6.1 Review of Contributions of Current Research

The current research has advanced existing knowledge on multi-stakeholder collaboration and performance measurement by more fully describing the set of stakeholders in CVO programs and extending management theory on performance measurement in multi-stakeholder environments to public/private collaborative programs. The current research also has reviewed the leading existing state and multi-state CVO programs, noted common impediments, and assessed how strategic performance measurement could be used in these programs.

Previous research on CVO programs generally have focused on only two stakeholders: government and the trucking industry. The existence of multiple government entities having different roles, responsibilities, cultures, and funding sources has been overlooked in research relating to public sector administration of freight programs. The current research has identified three tiers of stakeholders having different levels of participation in CVO programs—active collaborators, enabling supporters, and affected communities—and has described how the interests and objectives of 14 different stakeholder groups within these three tiers vary.
The current research has extended recent developments in management theory regarding performance measurement in multi-stakeholder environments, like Kaplan and Norton’s \textit{Balanced Scorecard} and Atkinson, Waterhouse, and Wells’ “Stakeholder Approach to Strategic Performance Measurement” by considering how strategic performance measurement can be used in public/private collaborative programs. Recent government performance measurement initiatives have considered only the development of performance measures \textit{within} government programs. While some private sector performance measure research has considered the relationships between firms and their suppliers, customers, and employees, only limited attention has been focused on facilitating cooperation among potential antagonists. Brandenburger and Nalebuff’s \textit{Co-opetition} presents a framework useful in this regard, but it does not present mechanisms for balancing stakeholder interests.

6.2 Limitations in Strategic Performance Measurement in Existing CVO Programs

Chapter 4 indicated that the development and use of strategic performance measurement in existing CVO programs has been limited. In neglecting to develop strategic performance measures, the programs have missed an opportunity to involve collaborators and orient their programs toward the achievement of long-term goals. Of the five programs studied, only Oregon Green Light set strategic objectives in a way that encouraged measurement of the achievement of objectives.

Except for HELP, existing CVO programs seem to be taking an unnecessarily short-term view of public/private collaboration. In doing so, they have avoided contention over long-term funding and balancing stakeholder interests, but they have weakened the incentive of stakeholders to support programs.
Perhaps because public sector staff have seen government agency "buy-in" as a necessary precursor to the public/private collaboration, they have delayed reaching out to private sector organizations until after the initial stages of CVO program development. The impediments faced by existing CVO programs indicate that involving the trucking community from the onset of program development is essential for obtaining the requisite level of industry support for public/private collaboration. Forming the vision and strategic objectives for a CVO program requires input from all active collaborators; optimally it would involve other stakeholders as well. The development of strategic performance measures requires similarly widespread involvement. To the extent that input from all stakeholders is obtained, it increases the likelihood that all CVO program strengths, weakness, opportunities, and threats are reflected in the performance measurement scheme adopted.

6.3 Opportunities for Strategic Performance Measurement in Maryland's CVO Program

The Maryland CVO program presents a special opportunity to public and private organizations that participate. The advent of new information and communication technologies gives an opportunity to re-invent surface transportation, in general, and CVO in particular. The inclusion of performance measures in the strategic plan being developed for the Maryland CVO program will serve to advance both program goals and the state of the art in public/private collaboration and performance measurement in multi-stakeholder environments.

6.4 Areas for Further Study

The current research has identified a number of topics that would benefit from further study. The most important of these are (1) the development, processing, and administration of data that will be required for ongoing performance measurement; (2) the use of strategic performance measures in
collaborative decision making and project identification; and (3) the integration of public/private CVO program planning with management of other components of state freight transportation systems.

**Data for performance measurement.** This research has not considered the availability of data for the development of performance measures, although Section 3.1.2.2 noted several important criteria related to the availability of data. Because CVO programs involve assets and managerial input from both the public and private sectors, basing performance measures on data from only public sector sources would be limiting. Ideally, CVO collaboration can expose program decision makers to data of which they previously did not have knowledge and allow more effective integration of data from disparate sources. Yet, the acquisition, storage, and use of private sector data involves a number of questions like the costs and benefits of specific types of data, the allocation of resources to gather data, data security, and data confidentiality. CVO systems and, more generally, ITS programs, offer a tremendous opportunity to generate and process data on transportation system status and usage.

**Use of performance measures in CVO program decision making.** Performance measures that reflect the interests of the range of stakeholders in a program can provide tools for more transparent and balanced decision making in a collaborative environment. Most CVO programs, including Maryland’s are in the planning and initial deployment stage. They are still in the process of building consensus among potential active collaborators required for their programs to go forward. In the longer term, the task of CVO program management will be to monitor performance relative to strategic objectives and take corrective action when necessary. These tasks will require continual decisions relating to project identification and evaluation, budgeting, marketing, and human resources. These decisions have the potential to alter the strength or nature of the relationship among stakeholders. Using performance measures as
a basis for decisions will increase the likelihood that program management is able to sustain stakeholder support over the longer term.

Integration of performance measurement for CVO programs with management of regional freight transportation system. This research has focused on the use of performance measures in public/private CVO programs. Other modes of transportation and intermodalism play an important role in regional freight transportation systems. The Intermodal Management Systems (IMSs) mandated by ISTEA, discussed in Section 5.1.1, were conceived with the hope of integrating data and managerial decisions regarding all assets in a state's freight transportation system. The research presented in this paper could be broadened to apply to regional freight transportation planning as a whole.
Appendix A

Organizational Charts of Motor Carrier Administration
Agencies in the Maryland State Government

(current as of January 23, 1997)
Organization Chart
Maryland State Highway Administration (SHA)
Organization Chart
Maryland COMP - Motor Fuel Tax Unit (MFTU)

Richard Carey
Administrator

Barbara Nickel
Revenue Administrator
PC Coordinator/LAN Administrator

Gerri Smith
Administrative Aide

Robert Crawford
Assistant Administrator
(Licensing/Registration)

Donald Paswater
Assistant Administrator
Motor Carrier Services/
Internal Audit/Error Resolution

Steve Taylor
Revenue Administrator
Special Projects/Motor Carrier Services
and Application Error Resolution

Tim Faulkner
Revenue Administrator
Internal Audit/Return En x Resolution

Kathi Beverly
Revenue Administrator

Karen Hapburn
Fiscal Clerk III

Joyce Hubbard
Fiscal Clerk III

Tom Prendki
Revenue Administrator

Margaret Swift
Fiscal Associate I

Helen Needle
Administrative Aide

Kristina Phares
Fiscal Clerk II

Robin Hupff
Revenue Specialist

Robert Hasley
Revenue Examiner I

Sharon Robinson
Fiscal Clerk III

Louise Herget
Fiscal Clerk III

Kathy Presley
Fiscal Clerk II
Organization Chart
Maryland Motor Vehicle Administration (MVA)
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