THE CRESCENT PROJECT: An Evaluation Of An Element Of The HELP Program

Executive Summary

by

The Crescent Evaluation Team

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The Crescent Evaluation

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LIST OF EXHIBITS

APPENDICES

LIST OF ACRONYMS

ADOT	Arizona Department of Transportation
AVC	Automatic Vehicle Classification
AVI	Automatic Vehicle Identification
AWACS	Automatic Weight and Classification System
Caltrans	California Department of Transportation
CDO	Crescent Demonstration Office
CVO	Commercial Vehicle Operations
FHWA	Federal Highway Administration
HELP	Heavy Vehicle Electronic License Plate Program
IVHS	Intelligent Vehicle-Highway Systems
LISC	Lockheed Integrated Solutions Company
OBC	Onboard Computer
ODOT	Oregon Department of Transportation
SEB	State Entry Beacon
WIM	Weigh-in-Motion

Forward

The Crescent Project element of the HELP Program is a bi-national multi-jurisdictional cooperative research and demonstration initiative involving the public and private sectors in an application of advanced technologies for the creation of an integrated heavy vehicle management system. This initiative is a leading example of the commercial vehicle operations (CVO) aspect of the Intelligent Vehicle Highway Systems (IVHS) concept. Some of the advanced technologies demonstrated in this project include: (1) automatic vehicle identification (AVI); (2) weigh-in-motion (WIM); (3) automatic vehicle classification (AVC); and (4) data communications networks and systems integration.

The HELP program, initiated in the early 1980s, consisted of three phases which included assessing the feasibility of the concept, technical studies involving laboratory and field tests, and lastly, a demonstration phase. Perhaps the most significant activity of this project centered on the subject of institutional arrangements, associated with the integration of emerging technologies with current operational policies and practices, within both government and industry sectors.

The demonstration element of the program, referred to as the Crescent Demonstration Project, began in 1991 and involved six U.S. states and one Canadian province. This project was phased into full scale operation over a three year period.

This document is one of several cited below which comprise the evaluation of the Crescent Project. The complete evaluation is reported in the following list of documents:

The Crescent Project: An Evaluation of an Element of the HELP Program: Executive Summary

Appendices:

A. ***On-Site Analysis of HELP Technologies and Operations Evaluation Report***

B. ***State Case Study Evaluation Report***

C. ***Motor Carrier Case Study Evaluation Report***

D. ***Crescent Computer System Components Evaluation Report***

E. ***Crescent Demonstration Office Evaluation Report***

F. ***State Line Beacon Project User Case Studies***

The Evaluation team consisted of the following groups:

WHM Transportation Engineering Consultants, Inc. (lead group)
Castle Rock Consultants
Western Highway Institute, ATA Foundation

In addition, the evaluation team was supported in this effort by:

Lockheed Information Management Systems
Booz-Allen & Hamilton Inc.

The team members wish to acknowledge the. participation and support of the many individuals and organizations who provided guidance, assistance and encouragement during the evaluation process. While the team members are solely responsible for the content accuracy of these evaluation documents, the process would have been greatly impaired without the recognition of the importance of this effort by all who contributed and their desire to promote efficiency and productivity in future freight systems. To all we are greatly appreciative and indebted.

C. Michael Walton

Chairman, Evaluation Team

1. BACKGROUND, OBJECTIVES, AND APPROACH

The Heavy Vehicle Electronic License Plate (HELP) program was formally concluded on September 30, 1993. Conceived in 1983, HELP was the nation's leading intelligent vehicle-highway system (IVHS) initiative in the commercial vehicle operations (CVO) field. The HELP program evolved through several phases including concept explanation, feasibility, concept development, technical study. The Crescent project, the final phase of the HELP program, was intended to implement and to demonstrate the integrated technologies and CVO services. Rather than a test of preconceived and hypothesized benefits of potential CVO services and technology applications, the program helped state, motor carrier industry, and IVHS system and service provider participants to envision the benefits and obstacles of HELP services through real-world experience. The HELP/Crescent program evolved over time, incorporating more services than conceived at its inception.

This report presents the evaluation team's conclusions regarding the services and technologies that were demonstrated. The purpose of the report is to assist HELP Inc. and other IVHS operational test partnerships in the continued enhancement of CVO services and technologies. The conclusions presented in this report are intended to identify the important features of the HELP/Crescent program which:

- Supported the CVO services and should be continued in other projects and wider deployment of the services,

  or

- Were barriers to effective provision of the CVO services and should be the focus of resolution efforts by HELP Inc and IVHS operational tests.

The evaluation team's conclusions reflect findings that may be affected by factors inherent to the locations in which the HELP/Crescent services were observed and which may be different at other locations in the country. For example, specific institutional issues may be different in states other than the participating states.

1.1 BACKGROUND OF THE HELP/CRESCENT PROJECT

Heavy vehicle data are required for a wide variety of purposes. Federal, state, and local governments are involved in disparate programs to support highway planning and design activities, as well as size and weight enforcement and tax administration. For private industry, information is required to monitor industry activity levels and to support financial planning. Private carriers must also monitor vehicles and loads to ensure effective operational management

Many of these data collection activities entail substantial efforts. Yet the data produced have inconsistencies among states, between sources, and over years, or have important elements missing, such that much of the data are not directly useful. Moreover, some data sources remain proprietary and unavailable for general use.

The HELP concept was envisioned as a means of developing integrated technical solutions to many of these problems. A HELP system could automatically weigh, classify and identify heavy vehicles at strategic locations. The resultant data could then be stored, processed and retrieved in such a way as to provide both government and the trucking industry with useful, consistent information for many purposes.

The basic notion of an integrated HELP system was first discussed by the Arizona and Oregon Departments of Transportation in 1983, leading to the production of two concept papers. Soon it become apparent that there was support for the system concept from various other states and from the Federal Highway Administration (FHWA). The FHWA provided grants to the Arizona Department of Transportation (ADOT) to undertake a feasibility study and to the Oregon Department of Transportation (ODOT) to perform a proof of concept demonstration.

The initial feasibility study was concluded in December 1984 and gave encouraging results. These were confirmed by the Oregon concept demonstration. Basic system concepts were found to be technically feasible, potentially offering benefits to states and truckers alike. A multi-state development and testing program was outlined which would bring this promising concept closer to reality.

During those early stages, considerable interest was generated in state agencies, federal government and trucking concerns across the U.S. A group of states came together to form the nucleus and the driving force behind the HELP program. At the conclusion of the program these partners comprised the states of Arizona, California, Colorado, Idaho, Iowa, Minnesota, Nevada, New Mexico, Oregon, Pennsylvania, Utah, Virginia and Washington, as well as the FHWA, Transport Canada and the Province of British Columbia

The HELP program subsequently moved into a series of technical studies that included:

- Development of an automatic weight and classification system (AWACS)
- A systems design study
- Preparation of a weigh-in-motion (WIM) performance specification
- Examination of a satellite reference system design
- A trucking industry workshop
- A HELP site selection study
- Examination of the role of onboard computers (OBCs) in the HELP program
- Development of the HELP automatic vehicle identification (AVI) system specification
- Development of a state entry beacon (SEB) system

Beyond research, the HELP program focused on the implementation and evaluation of the Crescent project. AVI and WIM/AVC equipment was installed at multiple sites in the western states of Washington, Oregon, California, Arizona, New Mexico and Texas, and a computerized communications system to link these sites was developed. The Crescent provided an international perspective through the active participation of Transport Canada and a parallel demonstration in the Province of British Columbia

In summary the HELP concept transitioned from applied research and testing into an arena in which to develop and evaluate functional applications of the basic technologies

and their supporting hardware and software systems. The Crescent project provided an opportunity to assess the feasibility of both the HELP technologies and the services.

1.2 GOALS AND OBJECTIVES

The overall HELP Program's goals were formally adopted in 1988 and progress toward the goals was intended to be the basis for determining the feasibility of the Program. The goals were to:

- Improve institutional arrangements
- Assess the viability of the technology in the highway environment
- Measure efficiency and productivity changes
- Identify additional applications for technology.

The first two goals were considered to be the highest priority.

The Crescent Demonstration and Evaluation (The Crescent Project) represents the culmination of the HELP program's multi-year research and development efforts. It was intended to advance the utility of the HELP program by evaluating the HELP CVO services and technologies under real-world operating conditions and with significant numbers of participating vehicles and motor carriers. Implicitly, the objectives of the Crescent Demonstration and Evaluation were to understand:

- Which HELP CVO services provide benefits and should be deployed
- What obstacles need to be overcome to deploy CVO services.

1.3 APPROACH

The Crescent Project evaluation process is summarized in Exhibit l-l. The evaluation encompasses several dimensions that need to be defined to understand how they fit together:

- CVO Services Evaluated
- HELP Technologies Applied
- Measures Of Effectiveness
- Evaluation Areas.

1.3.1 CVO SERVICES EVALUATED

The HELP technologies are not an ends in themselves, but are intended to provide services that benefit motor carriers and state governments. The services as postulated and evaluated can be grouped into the six categories described below:

- **Roadside Dimension And Weight Compliance Clearance —** Allows state authorities to check the size and weight of commercial vehicles without stopping them. Benefits include reduced trip time for compliant trucks and more effective enforcement (capture) of non-compliant trucks by the states.

- **Pre-Clearance Of Vehicles With Proper Documents —** Electronic checking of vehicle documents, by storing the data in a transponder in the vehicle or in state databases that can be quickly checked when the vehicle's identity is automatically determined,

could reduce unnecessary vehicle stops, improve enforcement, and reduce trip time for compliant trucks.

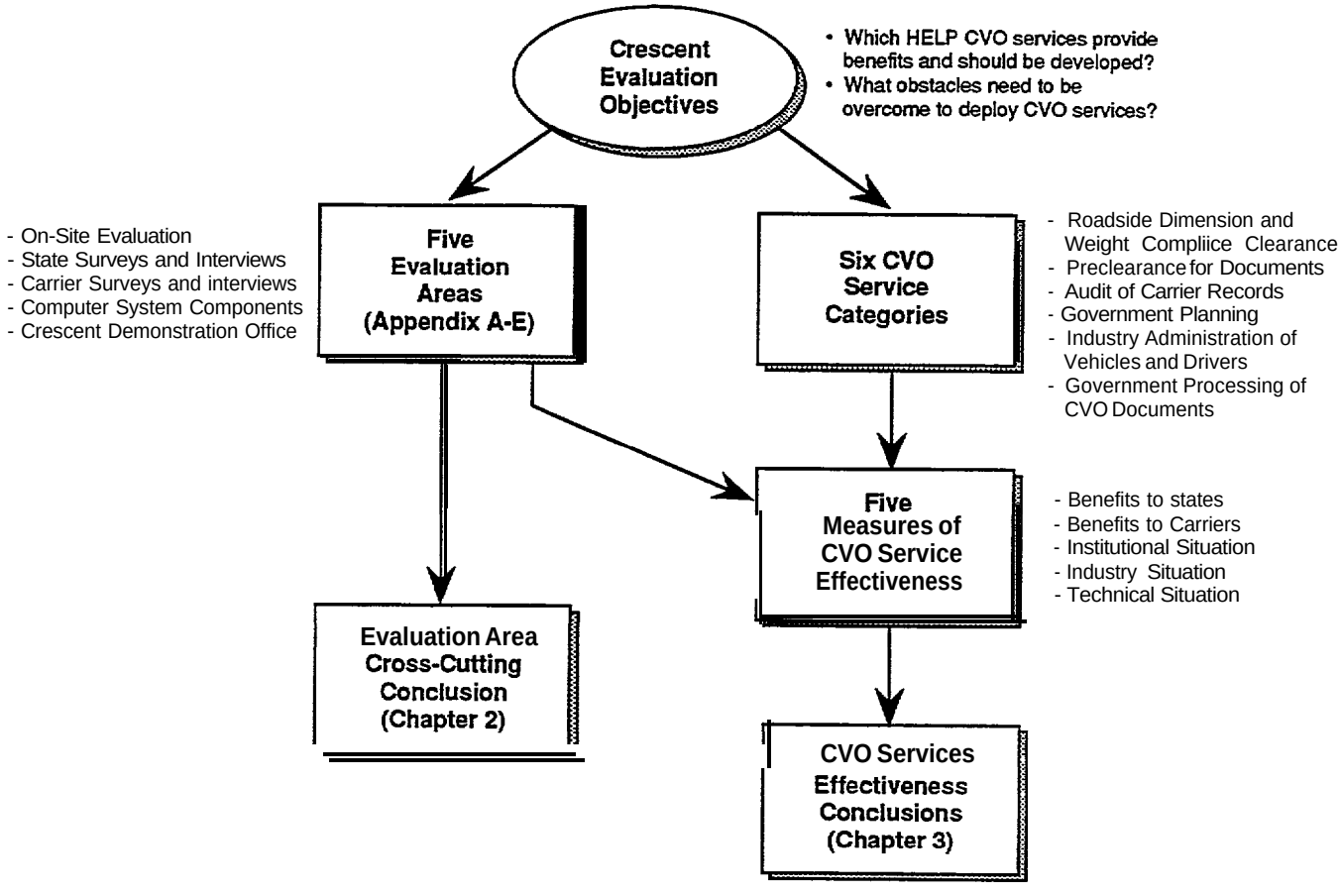
- **Government Audit Of Carrier Records —** Electronic monitoring of vehicles could improve the accuracy and reduce the costs of state audits of: carrier mileage records, number and location of vehicles, fuel tax payments, and certification of fleet maintenance inspections.

- **Government Processing Of Commercial Vehicle Operator Documents —** Electronic administration of documents is both required for other services to be effective (for example, pre-clearance of vehicles with proper documents may require that the documents be electronically filed) and could reduce the time and paperwork currently involved in issuing/acquiring/certifying permits, credentials, and inspections("one-stop-shopping").

- **Government Planning —** HELP/Crescent government planning services could provide better and more timely road use data to state planners.

- **Industry Administration Of Vehicles And Drivers —** Motor carriers could benefit from HELP/Crescent services in better managing their fleet vehicles and drivers. Driver monitoring could provide more carrier control of errant drivers (for example, routing and log book verification) and could lead to better drivers in the long run. Private use of the technology could tell the carrier when trucks need to be brought in for regular maintenance service and improve scheduling of routes. The improved vehicle and driver management could, in turn, result in safer roads.

EXHIBIT 1-1
The Crescent Project Evaluation Process



1.3.2 HELP TECHNOLOGIES APPLIED

Four principal technologies formed the basis of the HELP system. These are AVI, WIM, AVC, and an integrated communication system and database. In the Crescent project, roadside stations equipped with AVI, WIM, and AVC were linked to Crescent state and regional computers.

- **Automatic Vehicle Identification —** AVI is the term used for techniques that uniquely identify vehicles, as they pass specific points on the highway, without requiring any action by the driver or an observer. There are a number of approaches to AVI which have been developed since the first investigations were carried out in the 1960s. Recent advances in vehicle detection and data processing techniques have made the application of AVI systems both technically and economically feasible.

  AVI systems typically consist of three subsystems: a vehicle-mounted transponder; a roadside reader unit, with associated antennas; and a system for the transmission, analysis and storage of data= AVI is a "dependent" surveillance technology - it depends on vehicles to be equipped with transponders to enable AVI to work. The broad technological options originally considered for the HELP system were:

  Optical and infrared systems
  Inductive loop systems
  Radio frequency and microwave systems.

  The multi-user nature of the HELP system means that the needs and requirements from the ultimate system will be many and varied. One of the aims of the HELP program was therefore to develop a standard specification for an AVI system which would serve the purposes of all the end users, including the trucking industry as well as state and federal government agencies. In order to produce this AVI specification, a technology testing and appraisal program was conducted.

- **Weigh-in-Motion —** WIM is now an established technology in the United States and throughout the world. With WIM systems, the axle and gross weights of vehicles can be obtained while they are traveling along the highway using in-pavement sensors. There is a wide variety of systems available, from slow-speed WlM through a range of full highway speed systems, each with a different level of capability and cost.

  Unlike AVI systems, which need to be standardized in order to permit compatibility between different states and manufacturers, uniformity of approach to WIM system design was not considered essential within the HELP context. Each state can choose its own system, or might even decide to use several systems to achieve a range of objectives. For this reason, the aims of the HELP program were somewhat different in the consideration of WIM systems than with vehicle identification. With WIM, the task of the HELP program was to set out the alternatives and develop a minimum

performance specification based on user needs. States could then assess the relative merits of all WIM systems which meet the minimum performance standards, in deciding which particular systems to deploy for their HELP system applications.

Possible alternatives for WIM within the HELP system include:

Bending plate systems
Shallow weighscale systems
Deep pit weighscales
Bridge systems
Piezo-electric systems
Capacitive systems.

- **Automatic Vehicle Classification —** AVC forms the third key technology used at Crescent project sites. Classified traffic data provide basic information widely used in the design, maintenance and management of the highway network. AVC systems within HELP offer the possibility for collecting these data reliably, continuously and at low cost.

AVC systems comprise the following subsystems:

Sensors, which provide data on the presence or passage of the vehicle to be classified

Detectors, which receive signals from the sensors, and condition them, before passing them on to a processor

The processor, which performs the basic calculation of component wheel base, number of axles, etc., from which vehicle class is determined

The recorder, which stores the data and manipulates it into the presentation format.

General requirements for sensors are that they be low cost, easy to install, and above all be reliable. Several technologies are available which meet these requirements in specific applications.

As for the WIM systems, with which they are often physically combined, the approach adopted toward AVC was to develop a minimum performance specification, which any HELP AVC system must meet.

- **Integrated Communications System And Database — The** Crescent computer system is the platform that enables data from the other technologies to be integrated and analyzed, and to reach the various state and motor carrier users to provide the CVO services.

To enable “one-stop-shopping”, the database includes motor carrier credential and permit information, allowing alI agencies and states to share the information rather than

require motor carriers to acquire documents in each state and agencies to re-enter data.

Weighstations can check credential and permit data from the database for each truck identified by the AVI equipment for pre-clearance of vehicles with proper documents.

AVI and WIM/AVC data are captured by the database and can be accessed by states and motor carriers, by terminal or hard copy:

- State taxation agencies can use the data to audit carrier records.
- State planning agencies can use traffic volume and weight data for road planning.
- Motor carriers can use AVI data for vehicle and driver administration (location, estimated time-of-arrival, time on duty, average speed).

Appendix D, Chapter 1 provides further discussion of the objectives of the Crescent computer system and database.

1.3.3 MEASURES OF EFFECTIVENESS

Each of the CVO Services evaluated were rated according to measures of potential effectiveness that can be grouped as follows:

- **Benefits To The States —** The measures of benefits to the states are both quantitative and qualitative (from state surveys) and include increased revenue, productivity, and safety.
- **Benefits To Motor Carriers —** The measures of benefits to motor carriers include lower costs from reduced trip time, more efficient fleet records acquisition and administration, and better vehicle utilization.
- **Institutional Situation —** Barriers or freedom from barriers to HELP/Crescent services as a result of current policies, openness, and "turf" protection of state agencies.
- **Industry Situation —** Barriers or freedom from barriers to HELP/Crescent services as a result of current motor carrier practices and concerns (for example, concerns about how data collected about them will be used and shared}.
- **Technical Situation —** Includes measures of the equipment and system performance (for example, WIM accuracy and availability), operations adequacy (for example, site layout), and adequacy of the technologies applied in terms of developmental needs.

The specific measures used vary depending on what service is being evaluated.

1.3.4 EVALUATION AREAS

The actual conduct of the evaluation (that is, rating services in each measure of effectiveness) was organized to make the evaluation process most efficient. The ***Crescent Evaluation Plan: Phase B*** describes how the evaluation was conducted. In summary, there were five evaluation areas:

- **On-Site Evaluation Of HELP Technologies And Operations —** Primary source for data on the performance of individual system components and the performance of integrated systems in providing the desired CVO services.

- **Surveys And Interviews With Key State Agencies —** Primary source for data on institutional issues affecting implementation and performance of the CVO services.

- **Surveys And Interviews With Participating Motor Carriers —** Primary source for data on industry acceptance issues affecting implementation and performance of the CVO services.

- **Review Of The Crescent Computer System Components —** Primary source of information on the computer platform that integrates the other technologies into systems that provide CVO services.

- **Review Of The Crescent Demonstration Office — Source** of information on the operations of the central "service provider" responsible for data input, processing, and distribution for most of the HELP applications tested.

The findings from work in each evaluation area led to cross-cutting conclusions that affect many or all the CVO services and conclusions relevant to particular CVO services.

1.4 ORGANIZATION OF THIS EVALUATION REPORT

The evaluation team's conclusions are presented in two chapters. Chapter 2 presents conclusions, from each ***area of evaluation,*** which are cross-cutting and apply to many or all of the CVO services. For example, the state case study area of evaluation found that their was agreement by most state representatives that clear benefit/cost analysis for their agencies was lacking and needed to be done before serious consideration to investment or change in policies could be considered. That finding, and the conclusion that credible benefit/cost analyses tailored to each state and agency should be conducted to help overcome institutional barriers, applies to all the CVO services. As a result, future operational tests should include the development of economic feasibility analyses from the view point of each state and each agency.

Chapter 3 presents integrated conclusions on HELP applications to CVO services. That is, the conclusions from each of the evaluation areas that are relevant to a particular CVO service are integrated to present a complete evaluation of the service. For example, it appears that automated roadside dimension and weight screening is a high leverage service based on the measures of effectiveness (see above). The categories of motor carriers that will benefit from automated roadside dimension and weight screening may be limited, however.

2. SUMMARY CONCLUSIONS FROM AREAS OF EVALUATION

The actual conduct of the evaluation (that is, rating services in each measure of effectiveness) was organized to make the evaluation process most efficient. The ***Crescent Evaluation Plan: Phase B*** describes how the evaluation was conducted. In summary, there were five evaluation areas:

- **On-Site Evaluation Of HELP Technologies And Operations —** Primary source for data on the performance of individual system components and the performance of integrated systems in providing the desired CVO services.

- **Surveys And Interviews With Key State Agencies —** Primary source for data on institutional issues affecting implementation and performance of the CVO services.

- **Surveys And Interviews With Participating Motor Carriers —** Primary source for data on industry acceptance issues affecting implementation and performance of the CVO services.

- **Review Of The Crescent Computer System Components —** Primary source of information on the computer platform that integrates the other technologies into systems that provide CVO services.

- **Review Of The Crescent Demonstration Office —** Source of information on the operations of the central "service provider" responsible for data input, processing, and distribution for most of **the** HELP applications tested.

The research in each evaluation area led to cross-cutting conclusions, summarized in Exhibit 2-1 and discussed in this chapter, which affect many or all of the CVO services. In addition, findings from the research in the evaluation areas were integrated to draw conclusions about particular CVO services (conclusions regarding each CVO service are presented in Chapter 3).

The many conclusions presented below can be consolidated into several statements that summarize what appear to be the most important results:

- With some exceptions, the HELP technologies and procedures can perform adequately and are not a barrier to deployment

- Institutional issues present the greatest obstacles to the effectiveness, and even feasibility, of CVO services, particularly in the following areas:

  Policies that prevent common data collection standards and electronic data sharing among agencies and states.

  Lack of commitment by senior state government management to implement, use, and communicate the importance of the HELP systems to affected state employees.

  Lack of training of state employees who operate the system and the required allocation of adequate resources to them so they can operate

the new systems at the same time that they carry out their current duties (transition costs).

State agency and user needs must be re-addressed, else the system may be "doing the wrong things very well". The following should be determined:

Information content, format, and frequency needs
Database search and analytical capabilities
User interface needs.

Benefits of the CVO services to each agency in each state and to motor carriers must be clearly demonstrated before tide scale user investment can be expected. Benefit/cost analyses need to be:

Targeted to each user's perspective
Detailed
Credible in terms of key assumptions.

EXHIBIT 2-1
Summary Of Evaluation Area (Cross-Cutting) Conclusions
(page 1 of 2)

Evaluation Area	Summary Conclusions
On-Site Evaluation Of HELP Technologies, And Operations, And Benefits And Costs (Appendix A)	. Overall, Help System Technologies Are Adequate And Are Not A Barrier To The Implementation Of HELP CVO Services • WIM And AVC Accuracy Needs To Be Improved • State Maintenance And Calibration Of HELP Equipment Needs To Be improved • Improved Operating Logistics Preparation Is Needed • Site Configuration Is A Key Factor In The Effectiveness Of CVO Services And Net Benefits Derived
Surveys And Interviews With Key State Agencies (Appendix B)	• Institutional Policies And "Turf" Issues Are A Major Barrier To Successful Application Of HELP Systems To CVO services · Technical Standards Are Needed To Protect State Investment In Roadside Equipment · Database Standards And Protocol Need To Be Established To Facilitate Data Sharing And To Reduce Duplication Of Data Entry · Benefits Of CVO Services To States Need To Be Demonstrated With A Detailed Benefit/Cost Analysis Before States Will Invest In HELP Systems
Surveys And Interviews With Participating Motor Carriers (Appendix C)	• Benefits Of CVO Services To Motor Carriers Need To Be Conclusively Demonstrated Before Wide-Scale Voluntary Participation Can Be Expected · Motor Carriers Perceive That By-Passing (For Roadside Dimension And Weight Compliance And Document Pre-clearance) Services Are The Only Ones That Could Provide Them Significant Benefits · Motor Carriers' Views On HELP Systems' Utility Appears To Be Strongly Related To Their Operations · Most Motor Carriers Perceive Some Potential Fleet Management Benefits From Access To AVI and WIM data · The Crescent Database Does Not Currently Provide Useful Data To Most Carriers

EXHIBIT 2-1
Summary Of Evaluation Area (Cross-Cutting) Conclusions
(page 2 of 2)

Evaluation Area	Summary Conclusions
Review Of The Crescent Computer System Components (Appendix D)	• Overall, Computer System Component Technologies Are Adequate And Not A Barrier To Deployment Of HELP CVO services • Re-engineering, Rather Than Enhancement Of The Crescent Components, Should Be Considered - User Needs Analysis Should Be Conducted - Appropriate Degree Of Database Centralization Should Be Reevaluated - Upgrading System Hardware And Software To Current Technologies Should Be Considered - "Best Practices" Weigh Station Layout Design Standards Should Be Developed - Communications Strategy Should Be Reevaluated Considering Current Technology • System Documentation Should Be Undated
Review Of The Crescent Demonstration Office (Appendix E)	• Procedures For Enrolling Motor Carriers And Distributing Transponders Are Adequate • Analysis Of User Requirements Is Needed To Develop Database Content, Search And Analytical Capabilities, User Interfaces, And Screen Layouts • Procedures For Entry Of Credential Data Need To Be Improved To Ensure Database Is Current • The Validity Of Credentials Downloaded To Weigh Stations Cannot Be Determined • The Accessibility And Utility Of The Crescent Database By The Sites Cannot Be Conclusively Determine& Their Are Indications That Data Screens Currently In Place Could Be Useful • Significant Screen, Accuracy, And Utility Enhancements Are Needed To Make The Crescent Database Useful To Motor Carriers • Screen Display Available To States Are Navigable But Content Needs To Be Improved To Make The Database Useful To States • Current Database Reports Are Not Useful; They Need To Be Redesigned Based On User Needs • Current Data Security Mechanisms Appear To Operate correctly

2.1 ON-SITE EVALUATION OF HELP TECHNOLOGIES, OPERATIONS, AND BENEFITS AND COSTS

On-site evaluation of HELP technologies and operations was the primary source for data on the performance of individual system components and the performance of integrated systems in providing the desired CVO services. Included were observations, interviews, and collection of data to:

- Analyze equipment performance and factors (such as site characteristics) affecting performance
- Assess operations with and without the equipment (for benefit/cost analysis)
- Assess Crescent Demonstration Office performance from site operators' point of view (accessibility, usefulness, user-friendliness, accuracy, reports, data security).

The evaluation team's conclusions regarding technology, operations, and resulting benefits and costs of CVO services are:

- Technologies

  Overall, HELP system technologies are adequate and are not a barrier to the implementation of HELP CVO services.

  WIM and AVC accuracy needs to be improved.

- Operations

  State maintenance and calibration of HELP equipment needs to be improved.

  Improved operating logistics preparation is needed in:

  - Training
  - Building operator confidence in the systems
  - Raising operators' perceived importance of the systems.

- Resulting benefits and costs

  Site configuration is a key factor in the effectiveness of CVO services and net benefits derived.

The following sections discuss the conclusions.

2.1.1 OVERALL, HELP SYSTEM TECHNOLOGIES ARE ADEQUATE AND ARE NOT A BARRIER TO THE IMPLEMENTATION OF HELP CVO SERVICES

Three major on-site vehicle monitoring technologies were tested at weighstations and mainline sites. The technologies did not meet the HELP specifications in their entirety, however the evaluation team concluded that enhancing the technologies to satisfy the specifications would not be a significant obstacle.

AVI Equipment Met The HELP Specification — The operational test was not conducted as originally planned because a large proportion of the participating trucks did not have the Crescent decal affixed to their windshield. However, equipment tests were conducted in 1991 at two test locations using an AVI equipped automobile. The test results indicate that the AVI equipment performed satisfactorily under a range of placement, vehicle speed, external electrical interference, and environmental conditions (refer to Appendix A, Chapter 6).

- **WIM Equipment Had Mixed Results With Respect To The HELP Specifications —** Four measures of WIM equipment accuracy (versus static scale weight) were evaluated — mean percentage difference from static weight, standard deviation of the percentage difference, mean absolute, difference, and standard deviation of the absolute difference. Although more than half of the WIM systems assessed have weighing accuracies outside those indicated by the HELP WIM specification for one or more measures, it appears that resolving the accuracy problem does not require a new technology approach for the following reasons:

  The technology was adequate to meet the specifications for all measurements for 3 (treating the Santa Nella high and low speed WlM/AVCs as 2 installations) of 8 sites where tests were conducted; and for 1, 2, or 3 measurements at the other sites.

  Where accuracy specifications were not met, the measurements were frequently close enough to the specification to indicate that refinement, rather then a new technology approach, could close the gap.

It should be noted, and is discussed in Appendix A, Chapters 5 and 8, that due to the nature of the WIM tests, the results are not conclusive.

- **AVC Equipment Had Mixed Results With Respect To The HELP Specifications —** Axle spacing and vehicle classification accuracy were measured. Appendix A, Chapters 5 details the AVC tests.

  - Only four sites were examined for axle spacing accuracy due to technical problems not related to the AVC equipment and to weighmaster concerns that data collection would create a traffic hazard. Three of the sites examined were within the acceptable limits for axle spacing measurement,

    After adjustments to reflect what were believed to be explainable differences between manual and AVC results, vehicle classification using AVC met HELP specifications at one of four sites. A second site was "close" to the specifications. One of the sites' results was extremely poor and the evaluation team hypothesizes the cause to be poor lane discipline or a defective installation.

2.1.2 WIM And AVC Accuracy Needs To Be Improved

WIM and AVC accuracy affects the ability to provide several Crescent CVO services including roadside dimension and weight compliance clearance, electronic tax collection/audit, and electronic data collection for planning.

As discussed above, more than half of the WIM systems assessed have weighing accuracies outside those indicated by the HELP WIM specification. Additionally, all the WIM systems failed to meet at least one criterion of the manufacturers' accuracy specifications. Further, vehicle classification using AVC does not meet specifications in most analysis. However, it appears that the technologies being used would be adequate with relatively minor enhancements and improved installation, training of operators, calibration, and maintenance of the equipment

2.1.3 State Maintenance And Calibration Of HELP Equipment Needs To Be Improved

Maintenance staff are not adequately trained to keep HELP equipment operating properly and maintenance guidelines and schedules do not exist. Regular schedules for maintenance and calibration of Crescent equipment is likely to increase the accuracy and reliability of data collected.

2.1.4 Improved Operating Logisitics Preparation Is Needed

Most weighstation personnel interviewed thought that fully operational and accurate systems would provide benefits. The evaluation team believes that, in addition to equipment enhancements, the following preparation is needed to make the equipment operational and accurate:

More active senior state government management commitment to, and promotion of, the use of the Crescent system to raise the system's importance to weighstation staff

Establishment of a training program for weighstation personnel covering technical and operational issues to raise their confidence in the system

Recognition that additional resources (to help weighstation staff) are required during transition from current operations to the Crescent system, until staff are experienced with operating and maintaining the new systems.

2.1.5 Site Configuration Is A Key Factor In The Effectiveness Of CVO Services And Net Benefits Derived

A benefit/cost analysis was conducted for each of the 11 Crescent site configurations. The configurations are defined by:

Location (mainline or weighstation)

Equipment (WIM/AVC, AVI, both)

Extent of lane coverage (full or partial) of mainline sites

By-pass lane (present or not) at weighstation sites and location of equipment with respect to the by-pass lane.

Exhibit 2-2 shows what is included in state and motor carrier benefit/cost calculations. Appendix A, Chapter 7 describes the configuration types and benefit/cost analysis in detail.

Exhibit 2-3 summarizes the-characteristics and benefits of the various configurations of sites in the Crescent Project. Most of the sites are configuration Type III, which would theoretically provide a significant benefit/cost ratio to both states and motor carriers. Note that the results require many assumptions and cannot be considered conclusive. The assumptions and calculations supporting the exhibit are in Appendix A, Chapter 7.

As evidenced by on-site observation and benefit-cost estimates, development of guidelines for configurations of new weighstations and mainline installations of Crescent equipment would raise the overall effectiveness and benefits of the system. Also, greater standardization of weighstation configuration and operation would likely provide a safer environment for drivers.

Exhibit 2-2
Categories of Benefits and Costs Calculated

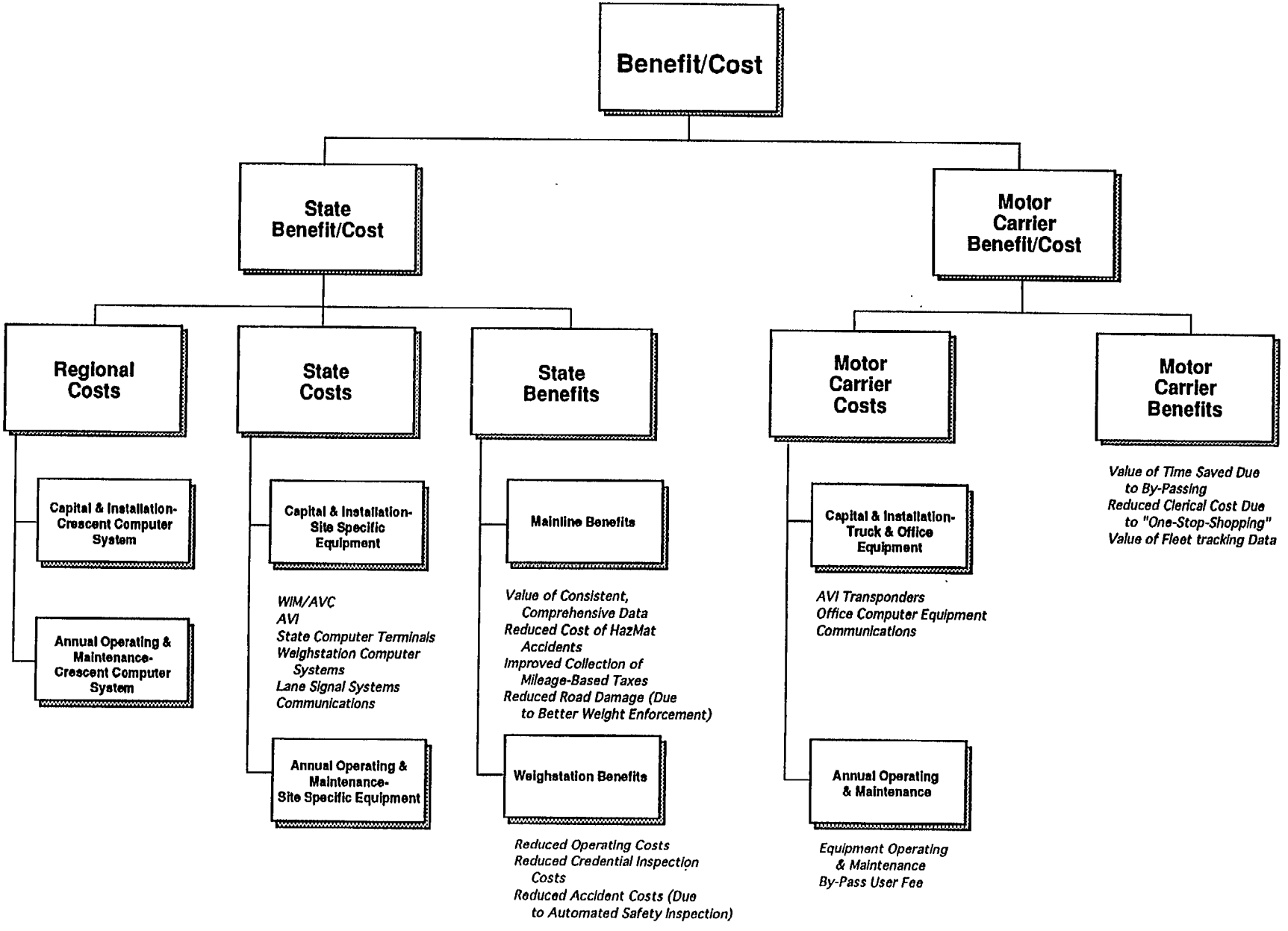


EXHIBIT 2-3
Characteristics And Benefits Of Crescent Site Configuration Types

Site	Characteristics			Benefits										No.	20 Year B/C Ratio	
				State							Motor Carrier					
				Mainline				Weighstation								
	Equipment	Equipment Location	By-Pass Lane	Consistent Data	Reduce HazMat Accidents	Increase Tax Collection	Reduce Road Damage	Reduce Operating Cost	Reduce Credential Inspection Cost	Reduce Safety Inspection Related Accidents	Save Time — By-Passing	Reduce Costs — "One-Stop-Shopping"	Value Of Fleet Tracking Data		State	Carrier
I	AVI	Mainline	N/A		√	√							√	2	1.8	24
II	AVI	Mainline	N/A											3	¬	¬
III	WIM, AVI	Mainline	N/A	√	√	√	√						√	15	2.6	24
IV	WIM, AVI	Mainline	N/A	√										1	1	—
V	AVI	Weighstation	No		√	√			√	√		√	√	1	13	27
VI	AVI	Weighstation	Yes		√	√			√	√		√	√	2	13	27
VII	WIM, AVI	Weighstation	Yes		√	√		√	√	√	√	√	√	1	4.8	88
VIII	WIM, AVI	Weighstation	Yes		√	√		√	√	√	√	√	√	3	4.8	88
IX	WIM, AVI	Weighstation	Yes		√	√		√		√		√	√	1	2.8	27
X	WIM, AVI	Weighstation	Yes		√	√			√	√		√	√	1	3.2	27
XI	WIM	Mainline	N/A	√	√	√		√	√	√	√	√	√	2	5.2	3.3

Equipment — AVC is present when WIM indicated
By-Pass Lane — N/A = Not applicable (weighstation only)
No. — Number of Crescent demonstration sites of this type
20 Year B/C Ratio — ¬= No benefits

2.2 SURVEYS AND INTERVIEWS WITH KEY STATE AGENCIES

One of the highest priority goals of the HELP Program was to improve institutional arrangements. The implicit objective to support the goal was to understand how effective existing institutional arrangements are and what institutional barriers exist to the deployment of CVO services. Effectiveness was measured and barriers identified through a series of interviews with and surveys of state government personnel from a cross section of agencies involved in each state. It should be noted that an incidental but important benefit of the HELP Program was to improve interstate cooperation (and state and motor carrier cooperation), just by the process of the participants trying to implement the program. This benefit was not measured quantitatively, however the evaluation team and many state participants believe that routine communications and meetings among participants helped breakdown some barriers.

Survey responses were aggregated and analyzed by state and by type of agency. Exhibit 2-4 shows the distribution of responses by state and by agency type.

Exhibit 2-5 summarizes the key issues and opportunities of all the respondents in aggregate (strongest average agreement or disagreement with survey statement). In summary, state representative feel strongly that:

- A high degree of inter-jurisdictional cooperation is required to implement the HELP/Crescent CVO services.
- Implementation of HELP/Crescent services could help motor carriers enhance their productivity.
- Pre-clearance services, using AVI, would significantly assist their agencies' operations.
- Control and privacy of motor carrier data is important

The following sections present the evaluation team's conclusions regarding how effective existing institutional arrangements are and what institutional barriers exist to the deployment of CVO services. The conclusions are:

- Institutional Policies And "Turf" Issues Are A Major Barrier To Successful Application Of HELP Systems To CVO Services.
- Technical Standards Are Needed To Protect State Investment In Roadside Equipment.
- Database Standards And Protocol Need To Be Established To Facilitate Data Sharing And To Reduce Duplication Of Data Entry.
- Benefits Of CVO Services To States Need To Be Demonstrated With A Detailed Benefit/Cost Analysis Before States Will Invest In HELP Systems.

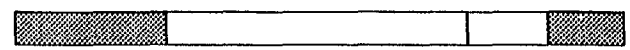
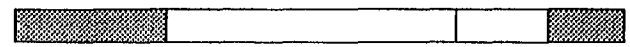
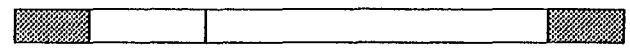
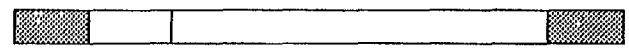
Detailed survey results and information for each state are in Appendix B.

EXHIBIT 2-4
Distribution of State Survey Responses

	State					
Agency Type	Arizona	California	New Mexico	Oregon	Texas	Washington
Operating Authority		Public Utilities Commission	State Corporation Commission	Oregon Public Utility Commission	Railroad Commission of Texas	Washington Utilities and Transportation Commission
Vehicle Registration	Arizona Department of Transportation	Department of Motor Vehicles	Taxation and Revenue Department	Department of Transportation/ Public Utility Commission	Texas Department of Transportation	Department of Licensing
Driver Licensing	Arizona Department of Transportation	Department of Motor Vehicles	Taxation and Revenue Department	Oregon Department of Transportation	Department of Public Safety	Department of Licensing
Taxation	Arizona Department of Transportation	State Board of Equalization	Taxation and Revenue Department	Department of Transportation/ Public Utility Commission	Comptroller of Public Accounts	Department of Licensing
Enforcement	Arizona Department of Public Safety	California Highway Patrol	Taxation and Revenue Department	Oregon State Police	Department of Public Safety	Washington State Patrol
Transportation Planning	Arizona Department of Transportation	California Department of Transportation	Highways and Transportation Department	Oregon Department of Transportation	Texas Department of Transportation	Washington State Department of Transportation
Environmental		Environmental Protection Agency		Oregon Public Utility Commission		

EXHIBIT 2-5
Key Issues And Opportunities Of Aggregated State Survey Respondents

ALL AGENCIES
SUMMARY OF KEY ISSUES AND OPPORTUNITIES

	ISSUES	Number of Responses	Results	Min.	Avg.	Max.
			Strongly Disagree 1 2 3 Neutral 4 5 6 7 Strongly Agree			
1	A high degree of inter-jurisdictional cooperation will be required for Crescent implementation.	42		2	5.9	7
2	Implementation of the HELP Technology provides significant opportunities for motor carrier productivity and efficiency enhancement.	37		2	5.8	7
3	Pre-clearance for safety inspections, permits, etc. using AVI would significantly assist my agency's operations.	32		4	5.8	7
4	Privacy of data is not a concern in implementing HELP Technology.	40		1	2.5	7
5	Control of data is not a concern in implementing HELP Technology.	39		1	2.1	7

2.2.1 Institutional Policies and "Turf" Issues Are A Major Barrier To Successful Application Of HELP Systems To CVO Services

The HELP program has greatly improved cooperation among the state staff who are participating in the program, however significant changes are needed at the policy level of state governments and agencies affected by the CVO services. The State Case Study (Appendix B) indicated strong agreement that inter-jurisdictional cooperation is essential. Content, control, and sharing of data among states and agencies within states appears to be the greatest concern to the states. Different agencies and states have different requirements for data. For CVO services, for example "one-stop-shopping", data collected by any entity that is processing a carrier's application must be adequate for each state's data requirements. Some agencies, which "want" much more and/or proprietary data than others (Planning agencies for example), may have to lower their expectations. Some agencies consider their data proprietary (operating authorities, taxation agencies, enforcement agencies) and are concerned about relinquishing control of their data.

2.2.2 Technical Standards Are Needed To Protect State Investment In Roadside Equipment

States are concerned that any investment they make in equipment to provide CVO services may be obsolete very quickly given the current lack of industry technical standards. Further, there is concern by the states that because of the uncertainty in equipment compatibility, motor carriers may be reluctant to invest in the onboard equipment necessary for CVO services requiring automatic vehicle identification (particularly automated pre-clearance of vehicles with proper documents); or they may invest in equipment (transponders) compatible with another CVO system's equipment, but not with their own. Enforcement agencies are concerned with the integrity and reliability of the data, both of which are affected by the standards set for equipment.

2.2.3 Database Standards And Protocol Need To Be Established To Facilitate Data Sharing And To Reduce Duplication Of Data Entry

The content, control, and sharing of data was identified above as an important concern to state agencies. In addition to those data issues are the need for database standards and protocols to allow, ***technically,*** data to be shared. Using "one-stop-shopping" as an example again, agencies in each state must be able to access the data that is entered by the originating entity or carrier and to put the data in the format they need. Without database standards and protocols to ensure electronic transfer of data, document processing will be as laborious or more so than today as each agency reenters the data originally captured.

2.2.4 Benefits Of CVO Services To States Need To Be Demonstrated With A Detailed Benefit/Cost Analysis Before States Will Invest In HELP Systems

At the time the state surveys and interviews were conducted, no benefit/cost analyses had been conducted. The need to demonstrate financiaI benefit of the CVO services is required before states will make large scale investments. The financial analyses need to be detailed and to address the benefits and costs (investment and recurring operating and maintenance costs) accrued by each agency. The states

need to be consulted to determine the content, detail, and results of benefit/cost analyses that would satisfy their legal and financial risk concerns. The benefit/cost calculations discussed in Section 2.1 above and in Appendix A, Chapter 7 were completed after the state case studies; the data available for the calculations, constrained as discussed in Appendix A, are probably not of adequate detail or high enough confidence to resolve the states needs for detailed benefit/cost analysis.

2.3 SURVEYS AND INTERVIEWS WITH PARTICIPATING MOTOR CARRIERS

Overall results of motor carrier surveys and interviews indicate that none of the HELP CVO services are highly regarded by the industry as a whole. However, there are several reasons for the industry's views that either can be resolved or should be evaluated further in other tests:

- Many of the services for which motor carrier input was requested were "hypothetical" rather than real-world tests. The process of debugging the systems, trying to keep sites operating, and other implementation problems did not allow carriers much real experience. As a result, respondents had the difficult job of trying to envision the service and benefits to them.

- The benefits perceived by motor carriers of the various CVO services are very dependent on the characteristics of each carrier's operation. So, for example, while AVI data was deemed to have no use by motor carriers accounting for 41% of all the trucks in the sample, 89% of the trucks in temperature controlled, bulk, and heavy haul commodity fleets could make use of AVI data (Appendix C, Chapter 3).

- Motor carrier feedback on some of the services, for example use of the Crescent data base, focused on problems rather than benefits. The problems can be corrected and the carriers re-interviewed.

- In order to allow time for demonstration and evaluation efforts, system development and implementation took place with little input from motor carriers. As a result, it is to be expected that enhancements and possibly major changes may be required, after their evaluation feedback, for motor carriers to envision and to derive benefits.

The following sections present the evaluation team's conclusions regarding motor carrier acceptance of HELP CVO services. The conclusions are:

- Benefits Of CVO Services To Motor Carriers Need To Be Conclusively Demonstrated Before Wide-Scale Voluntary Participation Can Be Expected.

- Motor Carriers' Views On HELP Systems' Utility Is Strongly Related To Their Operations.

- Motor Carriers Perceive That By-Passing (For Roadside Dimension And Weight Compliance And Document Pre-clearance) Services Are The Only Ones That Could Provide Them Significant Benefits.

- Most Motor Carriers Perceive Some Fleet Management Benefits From Access To AVI and WIM data

- The Crescent Data Base Does Not Currently Provide Useful Data To Most Carriers.

Detailed survey results are in Appendix C.

2.3.1 Benefits Of CVO Services To Motor Carriers Need To Be Conclusively Demonstrated Before Wide-Scale Voluntary Participation Can Be Expected

As with state participants, motor carrier participants indicated that net benefits to them would have to be clearly demonstrated before they would participate wide-scale in CVO services. At the time the surveys and interviews were conducted, no benefit/cost analyses had been conducted. Due to a range of test difficulties ranging from inconsistent operation of HELP equipment at the weighstations to motor carrier and driver awareness (see Appendix A), motor carriers probably view the CVO services as too much of a vision/not enough reality for them to believe any real benefits currently exist. In view of the price competitiveness of their business, it is unlikely that investments of funds or time will take place without very high confidence of near-term returns on the motor carriers' investments.

2.3.2 Motor Carriers Perceive That By-Passing (For Roadside Dimension And Weight Compliance And Document Pre-clearance) Services Are The Only Ones That Could Provide Them Significant Benefits

Exhibit 2-6 shows that the CVO services rated by the motor carriers to have the greatest ***overall*** value (weighted by number of trucks benefiting as opposed to number of motor carriers) are the services that allow trucks to by-pass weighstations (see Appendix C, Chapter 8). Forty of the fifty-two motor carriers surveyed responded to the question of whether they would be willing to pay to by-pass weighstations; 72.5%, representing 54% of the trucks, indicated they would pay $1 or more for each by-pass (see Appendix C, Chapter 6). There is a significant difference in perceived value between by-passing and the next highest rated service, "one-stop-shopping".

EXHIBIT 2-6
Motor Carrier Ranking Of Potential HELP/Crescent CVO Services

CVO Service (Motor Carrier Related)	Fleet Weighted Score Relative	Out Of 100
By-Passing	1	80.1
One-Stop-Shopping	2	58.4
Driver Management	3	51.2
Fleet Management	4	48.7
Safety Management	5	47.5
Reporting/Auditing	6	43.7
Private Use Of AVI	7	32.6
Theft Prevention	8	32.1
Clheck On Loading	9	19.2

2.3.3 MOTOR CARRIERS' VIEWS ON HELP SYSTEMS' UTILITY APPEARS TO BE STRONGLY RELATED TO THEIR OPERATIONS

The 52 participating motor carriers had fleets with operating characteristics that varied along several dimensions:

- Class of carriage (for hire; private)
- Commodity carried (general freight, LTL; general freight, TL; general freight, LTL & TL; temperature controlled; liquid [tank], bulk [hopper, dump]; heavy haul)
- Jurisdiction (intrastate, interstate, international)
- Length of haul (primarily short, primarily long, mixture)
- Nature of routes (primarily regular, primarily irregular, mixture)
- Current use of advanced management technologies (on-board computers, electronic engines, satellite tracking/communications, other monitoring devices, electronic logs, driver communications).

The motor carriers' perceived value of CVO services ***appears*** to be dependent on their operating characteristics as defined by one or more of the above dimensions. Note that the characteristics of motor carriers that indicated a relatively high potential value from a CVO service, as shown in Exhibit 2-7, are not conclusive or statistically significant because the sample size for any particular set of characteristics is small. Also, some of the motor carriers' value ratings are based on perceptions of a particular service rather than actual demonstration experience. Refer to Appendix C, Chapter 5 for more details.

This conclusion affects which type of motor carriers various CVO services should be designed to serve, which types should be consulted in further development of needs, and which types to consider when extrapolating potential benefits beyond test samples.

EXHIBIT 2-7
Characteristics Of Motor Carriers That Perceive Potential Value From CVO Services

CVO Service (Motor Carrier Related)	Class of Carriage		Commodity Carried			Jurisdiction		Length of Haul		Route		Technology		
	For Hire	Private	Gen'l Freight LTL	Gen'l Freight TL	Special Com-modity	Intra State	Inter State	Short	Long	Reg-ular	Ir-reg-ular	No Satel-lite	No Driver Comm.	No On-Board Comp.
By-Passing		√			√	√		√						
One-Stop-Shopping				√			√				√			
Driver/Safety Management	√		√			√						√	√	
Fleet Management	√		√						√			√	√	√
Reporting/Auditing		√										√	√	
Private Use Of AVI				√			√		√		√			
Theft Prevention	√					√			√					
Check On Loading			√					√		√				

2.3.4 Most Motor Carriers Perceive Some Fleet Management Benefits From Access To AVI And WIM Data

Seventy-one percent of the participating carriers, accounting for seventy-one percent of the fleet, indicated some interest in using AVI and WIM data. General freight LTL and heavy haul carriers have the most interest in axle load data — LTL carriers because they do not typically scale their trucks before a trip and heavy haul carriers because of the effect of load placement on axle loading. LTL and TL general freight carriers that do not scale their trucks are interested in gross weight information.

Carriers without satellite tracking, electronic engine monitoring, or other technologies to monitor speed were interested in obtaining speed from WIM scales (truck speed must be measured to compute weight). It is possible that WIM equipment will not provide unbiased speed information — drivers can adjust their speed when approaching WIM, thereby providing misleading speed information about the rest of the trip. Intrastate and LTL general freight carriers expressed the most interest in WIM speed data.

2.3.5 The Crescent Database Does Not Currently Provide Useful Data To Most Carriers

Most motor carriers that were exposed to Crescent data accessed it through hard copy reports generated by the Crescent Demonstration Office. The reports were not useful to the carriers for reasons including the following:

- The motor carriers were not included in the original development of Crescent database report contents, formats, or other attributes.
- The data was not perceived to be accurate (no tests of actual accuracy were conducted).
- The data reported was frequently inconsistent for multiple site observations.

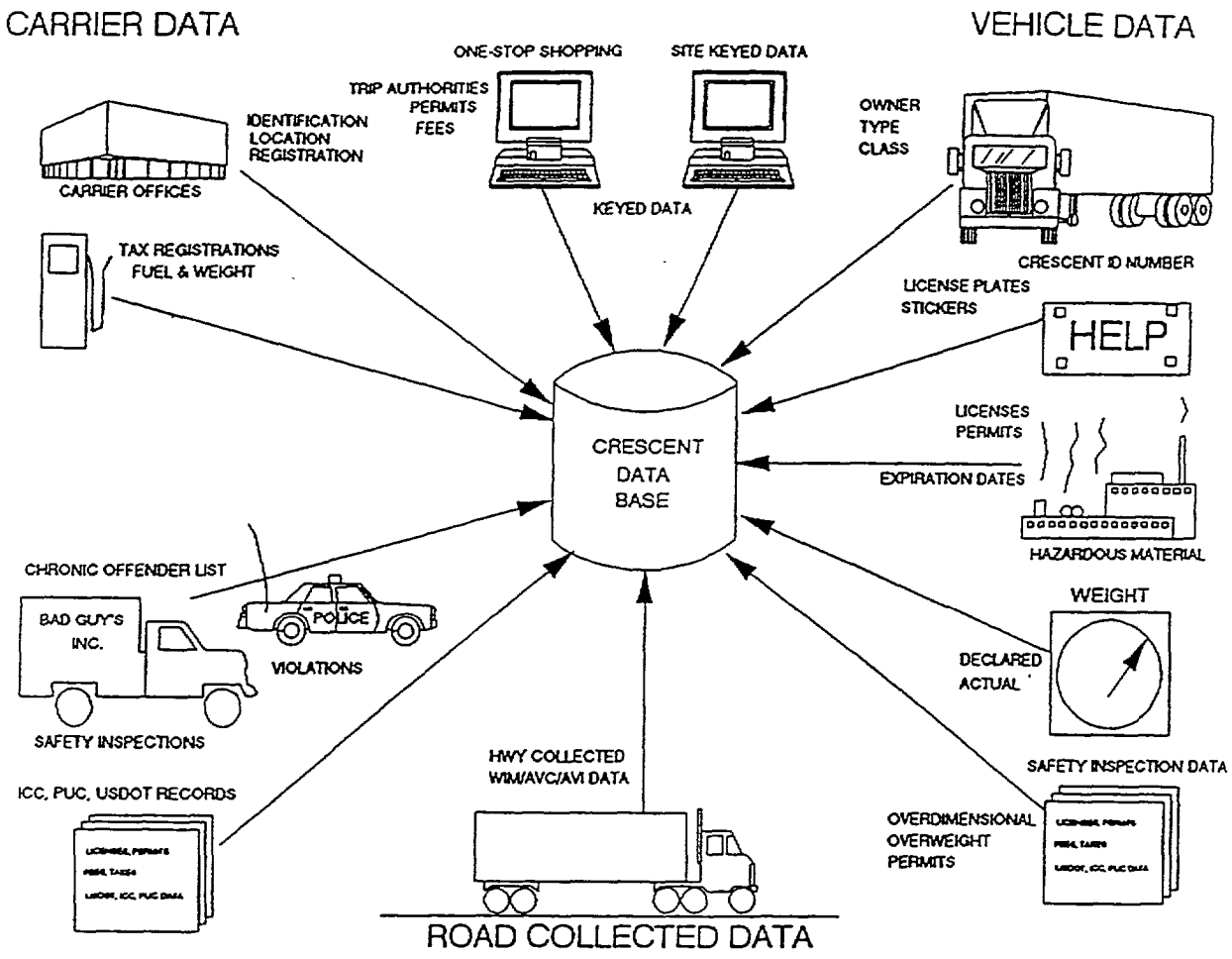
The review of the Crescent Demonstration Office below and in Appendix E discuss motor carrier use of the Crescent database further.

2.4 Review Of The Crescent Computer System Components

The Crescent computer system can be viewed as the enabling platform through which data must flow for any of the HELP CVO services to work. Exhibit 2-8 illustrates the system components from which data is integrated in the Crescent database. The evaluation of the Crescent computer system and its components included six areas:

- Systems Architecture
- Systems Communication
- Applications Software
- Crescent Database
- Site Availability
- Data Reconciliation.

EXHIBIT 2-8
Crescent System Components



The following sections present the evaluation team's conclusions regarding the Crescent computer system components. The conclusions are:

- Overall, Computer System Component Technologies Are Adequate And Not A Barrier To Deployment Of HELP CVO Services.

- Re-engineering, Rather Than Enhancement Of The Crescent Components, Should Be Considered

  User Needs Analysis
  Degree Of Database Centralization
  System Hardware And Software Upgrades
  Weigh Station Layout Design Standards
  Communications Strategy.

- System Documentation Should Be Updated.

Detailed survey results are in Appendix D.

2.4.1 Overall, Computer System Component Technologies Are Adequate And Not A Barrier To Deployment Of HELP CVO Services

The system has demonstrated that it can successfully support three of four of its original objectives:

- Data collection for highway planning, using data from WIM, AVC, and AVI equipment, was collected and stored in a central database.

- Data for dimension and weight enforcement was collected from WIM and AVC, used to calculate bridge formulas, and the results displayed for weighstation staff. Data for enforcement of motor carrier documents was not used primarily because the data was not provided to the Crescent Demonstration Office on a timely basis.

- Data for roadside dimension and weight compliance clearance was collected from WIM and AVC and used to allow by-passing. of compliant trucks. The system was capable of pre-clearing vehicles with proper documents using AVI data however, as explained above, carrier document data in the database was not current enough to allow this service to be used.

- The system demonstrated that it could perform some of the administration functions required for "one-stop-shopping", however key elements of the overall infrastructure needed were not in place to allow this service to be provided — institutional issues need to be resolved to allow regional processing of commercial vehicle operator documents. The evaluation team believes that the Crescent system is adequate to support "one-stop-shopping" when the other issues are resolved, but operational testing is not now possible.

Refer to Appendix D, Chapter 2 for details on the Crescent System Component evaluation.

2.4.2 RE-ENGINEERING, RATHER THAN ENHANCEMENT OF THE CRESCENT COMPONENTS, SHOULD BE CONSIDERED

Although the Crescent components evaluated were adequate for their original objectives, the evaluation team believes that are-engineering effort is now appropriate (Appendix D, Chapter 3):

- Significant advancements in hardware and software have been made and new technologies have emerged since the current system was assembled. Incorporating these advancements in a re-engineered system may be appropriate considering:

  Future requirements and objectives of HELP and Crescent

  Compatibility of state and motor carrier equipment with other regional CVO systems

  The potential logistical difficulties in supporting an older, one-of-a-kind system.

- User requirements need to be to be analyzed to develop effective database contents, search and analytical capabilities, user interfaces, and screen layouts.

  As indicated earlier, motor carriers did not use the Crescent database for several reasons including that they could not easily access it and could not get useful information — not surprising since system outputs were developed with little input from them. This approach was necessary to begin the research and development efforts.

  State representatives indicated that information needs to be better tailored to their requirements and they would like the Federal Highways Administration involved in qualifying the use of the data.

- The degree of database centralization, distribute processing, and, alternate communications options should be reviewed in light of the user requirements analysis, recommended above.

2.4.3 SYSTEM DOCUMENTATION SHOULD BE UPDATED

The current system has evolved over many years of research and development modifications. Considering any actions taken about the above section, the specifications for the system currently in-place need to be updated to reflect the "as-built" condition. This will facilitate future enhancements and maintenance.

2.5 REVIEW OF THE CRESCENT DEMONSTRATION OFFICE

The Crescent Demonstration Office review included inputs from the users (states and motor carriers) and the office operator (Lockheed) on the operations of the central "service provider" responsible for data input, processing, and distribution for most of the HELP applications tested. The evaluation team concluded that:

- Procedures For Enrolling Motor Carriers And Distributing Transponders Are Adequate.
- Analysis Of User Requirements Is Needed To Develop Database Content, Search And Analytical Capabilities, User Interfaces, And Screen Layouts.
- Procedures For Entry Of Credential Data Need To Be Improved To Ensure Database Is Current.
- The Validity Of Credentials Downloaded To Weigh Stations Cannot Be Determined.
- The Accessibility And Utility Of The Crescent Database By The Sites Cannot Be Conclusively Determined; There Are Indications That Data Screens Currently In Place Could Be Useful.
- Significant Screen, Accuracy, And Utility Enhancements Are Needed To Make The Crescent Database Useful To Motor Carriers.
- Screen Display Available To States Are Navigable But Content Needs To Be Improved To Make The Database Useful To States.
- Current Database Reports Are Not Useful, They Need To Be Redesigned Based On User Needs.
- Current Data Security Mechanisms Appear To Operate Correctly.

The conclusions are discussed briefly below and in more detail in Appendix E.

2.5.1 PROCEDURES FOR ENROLLING MOTOR CARRIERS AND DISTRIBUTING TRANSPONDERS ARE ADEQUATE

The functions involved in carrier enrollment, shown in flow charts in Appendix E, are:

- Recruiting carriers
- Processing enrollment applications
- Processing fleet vehicle data
- Distributing, replacing, and accounting for transponders
- Processing change of information requests from carriers
- Processing carrier license information
- Processing permit information
- Verifying data with state authorities.

The evaluation team concluded that the procedures in place, to carry out the above functions, are adequate for demonstration purposes but would likely require considerable enhancement for systems utility.

2.5.2 Analysis Of User Requirements Is Needed To Develop Database Content, Search And Analytical Capabilities, User Interfaces, And Screen Layouts

As discussed in Section 2.4.2 above, a re-engineering of the system, including an assessment of state and motor carrier needs, is warranted. Unless needs are addressed there will continue to be little incentive by users to provide inputs, to maintain, and to operate the systems.

2.5.3 Procedures For Entry Of Credential Data Need To Be Improved To Ensure The Database Is Current

Although procedures are documented and in place, the data in the system is often not current or complete. Motor carriers are responsible for initiating much of the data (registrations and permits), however there was little incentive for the motor carriers to provide the data in terms of return benefits. As a result, CVO services requiring AVI to match a vehicle to current registration and permit data could not be provided.

As an alternative, if institutional issues are resolved, electronic interfaces among agency computers within and among states could ensure timely and complete information availability. Further, electronic interfaces are essential for some of the most valuable CVO services (for example, “one-stop-shopping”).

2.5.4 The Validity Of Credentials Downloaded To Weigh Stations Cannot Be Determined

None of the weighstations used HELP AVI equipment to verify credentials of transponder equipped trucks during the on-site evaluations. As a result, the validity of electronic credential download could not be determined Three principal reasons were given by weighstation personnel for not using the equipment:

- The equipment did not work or did not work accurately.
- Too few trucks were equipped with transponders to warrant a separate procedure to validate those trucks' credentials.
- They had not been trained for three years and could not remember what they had been taught

2.5.5 The Accessibility And Utility Of The Crescent Database By The Sites Cannot Be Conclusively Determined; There Are Indications That Data Screens Currently In Place Could Be Useful

Two sites used data screens on a regular basis. Santa Nella, CA and Woodburn, OR used screens for WIM weight information. In addition, Woodburn used screens to display vehicle credentials, however the source of the credential data was the Oregon PUC database, not the Crescent database. Nonetheless, weighstation personnel indicated that all the iuformation they would need to verify truck weights and documents is displayed on a single screen and the Santa NeIla personnel indicated that the system would greatly benefit document verification if the system were more reliable and more trucks were transponder-equipped.

2.5.6 Significant Screen, Accuracy, And Utility Enhancements Are Needed To Make The Crescent Database Useful To Motor Carriers

Five of the motor carriers appeared to be regular users of the Crescent database and therefore able to comment on screens. The fact that more carriers did not regularly use the database probably suggests that a more friendly interface is needed and that, for a number of reasons unrelated to the screens available for review, there was not much utility to be gained by accessing the database. The comments received from carriers with experience accessing the data indicate improvements are required in the following areas:

- Terminology needs to be consistent from screen to screen.
- Additional data is desired (for example, direction of travel, speed, truck number [rather than transponder number]).
- Data that is obviously incorrect should be flagged or filtered out of the report
- Additional calculations and data filtering capabilities are desired.
- Carriers need to be able to download data to their computer or to print reports at their site.

This conclusion supports earlier conclusions that indicated the need for re-engineering and consulting with the system users when refining system capabilities and the user interface.

In addition to Appendix E, Appendix C, Chapter 7 provides detailed information about carrier use of the Crescent database.

2.5.7 Screen Display Available To States Are Navigable But Content Needs To Be Improved To Make The Database Useful To States

As with motor carriers, only a limited number of state participants used the Crescent database (nine used it once, to answer the survey questions about the database system; four used it more than three times). As a result, the responses indicate what further work needs to be done but are not conclusive.

The participants who accessed the database indicated that the on-line display was easy to read; that it was easy to query for specific information; and that it was easy to move among menus. They also indicated that changes were needed to make the database useful:

- The underlying theme of state participant responses was that more information is needed about each truck and more trucks need to be captured in the database (more trucks need to have transponders).

  While easy to read, the screens do not provide the right information. Information needs are very specific to the agency using the data and the information available did not appear to be sufficient for any of the respondents.

- Crescent data accuracy was questioned and the desirability of the FHWA to "bless" the data was indicated. Note that the implication is that it may be appropriate to include the FHWA with the list of users when determining user needs.

- User interface enhancements, for example quicker response time, more conventional use of key strokes, on-line help, and function keys, are desired.

2.5.8 CURRENT DATABASE REPORTS ARE NOT USEFUL; THEY NEED TO BE REDESIGNED BASED ON USER NEEDS

Findings regarding database ***reports*** were similar to those for screens in terms of content and accuracy, State participants did not think that the format of the reports was satisfactory nor, with some exceptions, that the reports were useful — the reports need to be tailored for each agency. Weighstation personnel do not need most Crescent reports.

Motor carrier responses depended to some extent on the characteristics of their operations (see Section 2.3 above). Their responses reflect the database more than the reports themselves:

- Large carriers use or are leaning toward satellite systems to provide their data needs and therefore see little use for the data that Crescent could provide. (Note that satellite systems offer the advantage of being able to track/communicate with trucks anywhere the trucks are, not just when/if the trucks pass an AVI installation. However, use of a satellite system alone does not allow the motor carrier to use document pre-clearance services).

- Some small carriers and carriers with regular routes find that satellite systems are too expensive for their needs and indicated that the Crescent database may be an inexpensive way to get the limited information they need.

- Large carriers that do not typically scale their trucks indicated that the Crescent database may be useful for monitoring weight data, for example patterns of axle overloading and checking shipper claims of shipment weights.

- Most carriers thought the database was inaccurate.

- Many carriers were not interested in the information available because they have other means of getting the data, the data is not timely, and the number and location of AVI sites was inadequate considering the routes of their trucks.

2.5.9 CURRENT DATA SECURITY MECHANISMS APPEAR TO OPERATE CORRECTLY

Software mechanisms to restrict access to data, to those who input the data or those who "need to know", are in place and there have been no known security violations. Other security issues, which have not been pressing to date, need to be addressed for future deployment:

- System redundancy
- Data backup and recovery procedures
- Disaster recovery plans.

3. INTEGRATED CONCLUSIONS ON HELP APPLICATIONS TO CVO' SERVICES

The prior chapter presented broad conclusions that affect several CVO services. This chapter presents conclusions, analyses, and lessons learned specific to each CVO service. CVO services are intended to benefit motor carriers, the states, or both by increasing productivity or providing capabilities not currently available. Benefits and costs and the affect of institutional issues, industry issues, and system performance associated with each CVO service are the basis for conclusions. The potential CVO services evaluated can be grouped in six categories:

- **Roadside Dimension And Weight Compliance Clearance —** Allows state authorities to check the size and weight of commercial vehicles without stopping them. Benefits include reduced trip time for compliant trucks and more effective enforcement (capture) of non-compliant trucks by the states.

- **Pre-Clearance Of Vehicles With Proper Documents —** Electronic checking of vehicle documents, by storing the document data in a transponder in the vehicle or in state databases that can be quickly checked when the vehicle's identity is automatically determined, could reduce unnecessary vehicle stops, improve enforcement, and reduce trip time for compliant trucks.

- **Government Audit Of Carrier Records —** Electronic monitoring of vehicles could improve the accuracy and reduce the costs of state audits of carrier mileage records, number and location of vehicles, fuel tax payments, and certification of fleet maintenance inspections.

- **Government Processing Of Commercial Vehicle Operator Documents —** Electronic administration of documents is both required for other services to be effective (for example, pre-clearance of vehicles with proper documents may require that the documents be electronically filed) and could reduce the time and paperwork currently involved in issuing/acquiring/certifying ("one-stop-shopping") permits, credentials, and inspections.

- **Government Planning —** HELP/Crescent government planning services could provide better and more timely road use data to state planners.

- **Industry Administration Of Vehicles And Drivers —** Motor carriers could benefit from HELP/Crescent services in better managing their fleet vehicles and drivers. Driver monitoring could provide more carrier control of errant drivers (for example, routing and log book verification) and could lead to better drivers in the long run. Private use of the technology could tell the carrier when trucks need to be brought in for regular maintenance service and improve scheduling of routes. The improved vehicle and driver management could, in turn, result in safer roads.

The findings from each of the evaluation areas (identified in Chapter 2) were integrated, to develop conclusions about each of the above CVO services, by using five measures of effectiveness — benefit of the service to the states, benefit of the service to motor carriers, the institutional situation, the industry situation, and the technical situation — described in section 1.3. The evaluation team rated each CVO service in each of the measures of effectiveness on a scale of 1 - 7 as described in Exhibit 3-l. The results of the ratings are presented in the "radar" chart format shown in Exhibit 3-2. The actual rating of services will be found in exhibits 3-5 through 3-10.

Exhibit 3-3 illustrates the relative leverage of each of the service areas from the industry perspective (top box in the exhibit) and from the state perspective (bottom box in the exhibit). The circles represent the CVO services. The higher the service is plotted in each box, the greater benefit the service is perceived to provide. The further to the right the service is plotted, the stronger and fewer barriers it has. Services plotted in the top right area of a box have relatively high leverage from the perspective of the industry or the states. Services plotted in the top right area in both parts of the exhibit have the greatest leverage overall and may be considered a priority for refinement and/or deployment. Overall, roadside dimension and weight compliance clearance, government planning, and pre-clearance of vehicles with proper documents appear to be the highest leverage CVO services as shown in Exhibit 3-3 and described below:

- They would provide significant benefits to both states and motor carriers (in the case of roadside dimension and weight compliance), or would provide significant benefit to one without disbenefit to the other.

- They are strongly supported and/or are not faced with high barriers to implementation by the states or motor carriers.

- The HELP technologies demonstrated appear to be adequate (not shown in Exhibit 3-3).

EXHIBIT 3-1
Rating Scheme For CVO Service Measures Of Effectiveness

Measure of Effectiveness	Rating 1 ⟷ 4 ⟷ 7
Benefit Of The Service To The States	Dis-benefit ⟷ None ⟷ Significant Benefit
Benefit Of The Service To Motor Carriers	Dis-benefit ⟷ None ⟷ Significant Benefit
Institutional Situation	Opposition; High Barriers ⟷ Neutral ⟷ Strong Support; Low Barriers
Industry Situation	Opposition; High Barriers ⟷ Neutral ⟷ Strong Support; Low Barriers
Technical Situation	Different Technology Needed ⟷ Further Development & Test Needed ⟷ Works Satisfactorily

EXHIBIT 3-2
Rating Chart Format

HELP Application to CVO Functions
Example Rating Plot

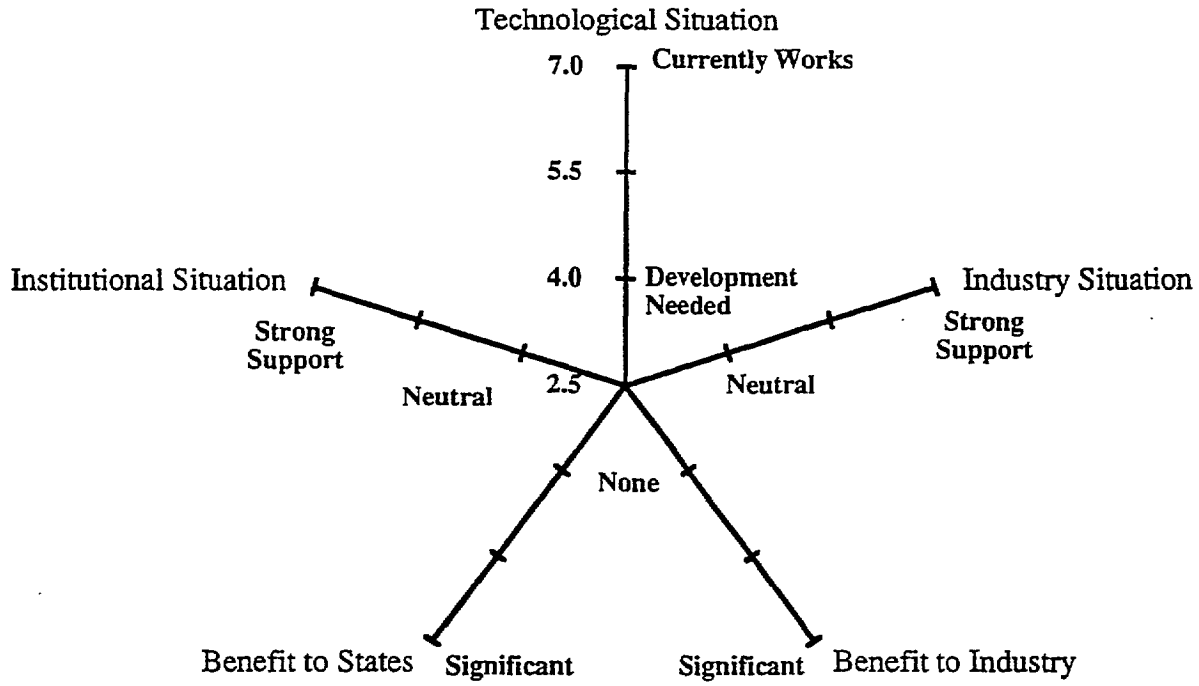
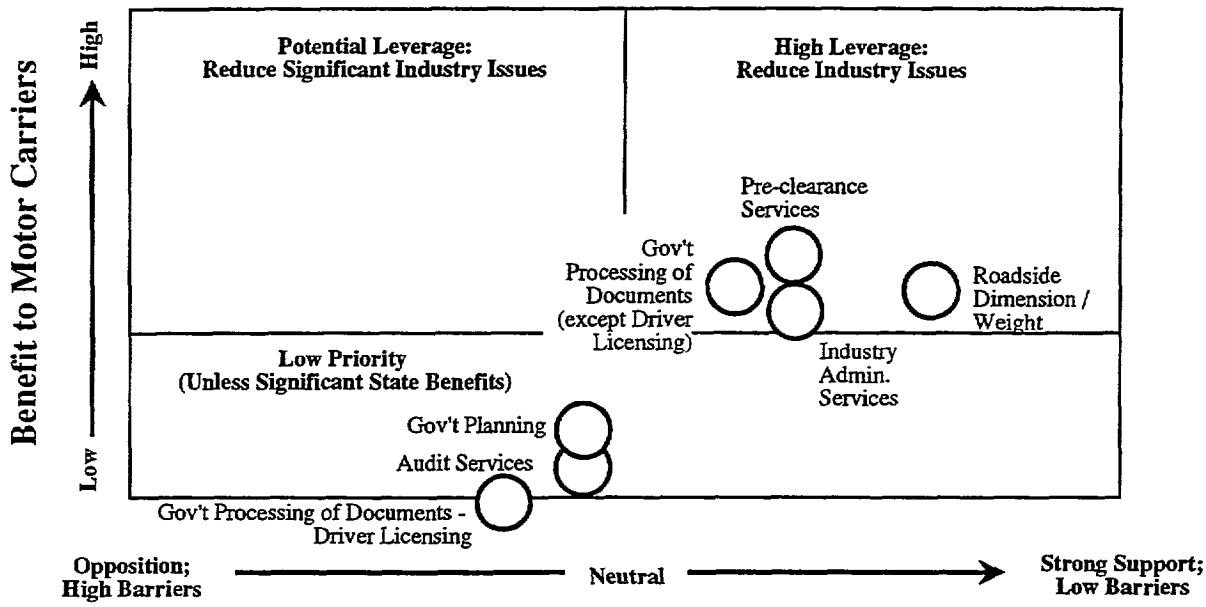


EXHIBIT 3-3
Relative Leverage Of HELP CVO Services

Industry Issues



State Issues

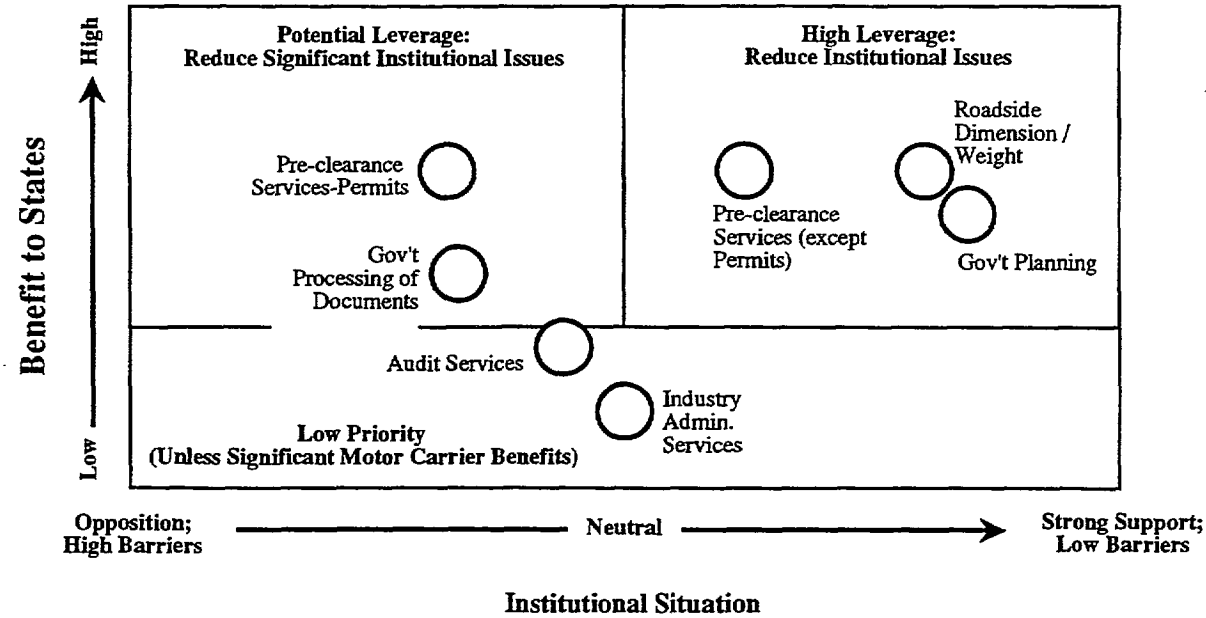


Exhibit 3-4 summarizes, and the following sections present, the evaluation team's conclusions about each service.

3.1 ROADSIDE DIMENSION AND WEIGHT COMPLIANCE CLEARANCE

Roadside dimension and weight compliance clearance uses WTM and AVC technologies, integrated with weighstations' on-site computers, to determine whether each truck is within acceptable dimension and weight without the truck having to stop. The truck can be signaled to stop if it does not comply with dimension and weight maxima. This HELP/Crescent service would allow virtually all trucks to be checked automatically because the service does not depend on motor carriers equipping their trucks (in contrast to HELP CVO services that use AVI and require trucks to be equipped with transponders). Benefits include reduced trip time for compliant trucks, more effective enforcement (capture) of non-compliant trucks by the states, and ultimately fewer violations of dimension and weight laws.

As indicated earlier; roadside dimension and weight compliance clearance is a high leverage CVO service and nearest to ready for deployment of all the services.

EXHIBIT 3-4
Summary Of CVO Services Conclusions (page 1 of 3)

Potential CVO Services	Summary Conclusions
Roadside Dimension And Weight Compliance Clearance Allows state authorities to check the size and weight of commercial vehicles without stopping them. Benefits include reduced trip time for compliant trucks and more effective enforcement (capture) of non-compliant trucks by the states.	• Of All HELP CVO Services, Automated Roadside Dimension And Weight Screening Is Closest To Ready For Deployment: - Benefits States Through Improved Road Safety, Greater Revenues From Enforcement, And Reduced Emissions - Benefits Compliant Motor Carriers Through Reduced Weighstation Stops - Low Institutional Barriers, However Commitment By Weighstation Operating Staff (And State Hierarchy) Is Needed - Low Industry Barriers - Technically, improvements are needed but are not a significant barrier
Pre-Clearance Of Vehicles With Proper Documents • Credentials (Vehicle Registration, Operating Authority) • Permits (Overdimension/ Overweight, Single Trip, Temporary) • Safety Inspection • HazMat Electronic checking of vehicle documents, by storing the data in a transponder in the vehicle or in state databases that can be quickly checked when the vehicle's identity is automatically determined, could reduce unnecessary vehicle stops, improve enforcement, and reduce trip time for compliant trucks	• Automated Pre-Clearance Of Trucks For Credential, Safety Inspection, And HazMat Compliance: - Provides High Benefits To States And Industry - Requires Proof Of Performance To Encourage Carrier Participation - Can Be Accomplished With Available Technologies • Automated PreClearance Of Trucks For Proper Permits Faces Greater Institutional Barriers Than Other Pre-Clearance Services

EXHIBIT 3-4
Summary Of CVO Services Conclusions (page 2 of 3)

Potential CVO Services	Summary Conclusions
Government Audit Of Carrier Records • Mileage Records • Vehicle Home Base Taxes • Fuel Taxes • Fleet Maintenance And Safety Inspections Electronic monitoring of vehicles could improve the accuracy and reduce the costs of state audits of carrier mileage records number and location of vehicles, fuel tax payments, and certification of fleet maintenance inspections.	• Automated Support Of Government Mileage, Operating Authority, And Fuel Tax Audits Has The Least Leverage Of The Services Examined - The Most Value From Automating Audit Functions Would Be Derived By The States - Significant Institutional And Industry Barriers Exist - Technical Aspects Are Not Expected To Be A Barrier • Automated Support Of Safety Inspection Audits Should Be Considered Before Other Audit Areas - Both States And Motor Carriers Perceive Value From Enhancing Safety Audits - Institutional And Industry Barriers For Safety Audits Are Less Significant Than For Other Audits - Technical Aspects Are Not Expected To Be A Barrier
Government Processing Of Commercial Vehicle Operator Documents - Operating Authority - Vehicle Licensing And Registration - Permits (Including HazMat) - Insurance Verification - Temp Registrations And Authorities Electronic processing and sharing of documents among agencies is both required for other services to be effective (for example, pre-clearance of vehicles with proper documents may require that the documents be electronically filed) and could reduce the time and paperwork currently involved in issuing/acquiring/clarifying ("one-stop-shopping") permits, credentials, and inspections.	• Automating Hazardous Material Permits Appears To Have Few Barriers But Also Few Perceived Benefits • Automated Government Processing Of Driver Licensing Does Not Appear To Be A High Leverage Service In The Near Term • Automated Processing Of Other Commercial Vehicle Operator Documents Could Provide Significant Benefits But Has Significant Institutional Barriers - Potential To Significantly Reduce Duplication Of Efforts By Agencies Within A State And Among States - Potential To Reduce Motor Carrier Credential Acquisition Costs And To Increase Vehicle Utilization - Getting Agencies To Coordinate The Document Acquisition Process Is A Major Barrier To Overcome - Industry Supports Automated Document Processing Services - Technical Implementation Would Be A Major Systems Development Task

EXHIBIT 3-4
Summary Of CVO Services Conclusions (page 3 of 3)

Potential CVO Services	Summary Conclusions
Government Planning - Road Use Data . Reports To FHWA HELP/Crescent government planning services could provide better and more timely road use data to state planners.	• Automated Data Collection And Reporting Appears Worthwhile If Automated Roadside Dimension And Weight Pre-Clearance Screening Is In Place - Provides States Better And More Timely Data For Small Additional (To Automated Roadside Dimension And Weight Pre-Clearance Screening) cost - State Planning Agency Representatives Support This Service; Would Like Data On Non-Commercial Vehicles Too - No Industry Barriers To This Service
Industry Administration Of Vehicles And Drivers - Fleet Management - Driver Management Motor carriers could benefit from HELP/Crescent services in better managing their fleet vehicles and drivers. Driver monitoring could provide more carrier control of errant drivers (for example, route and log book verification) and could lead to better drivers in the long run. Private use of the technology could tell the carrier when trucks need to be brought in for regular maintenance service and improve scheduling of routes. The improved vehicle and driver management could, in turn, result in safer roads.	• The Value Of HELP Provided Automated Services To Support Vehicle And Driver Administration Depends On Carrier Size And Alternative Private Sector Systems That Are Available

3.1.1 Of All HELP CVO Services, Automated Roadside Dimension And Weight Screening Is Closest To Ready For Deployment

As shown in Exhibit 3-5, roadside dimension and weight compliance clearance rates relatively high on all measures of effectiveness. As discussed below:

- Benefits states through improved road safety, greater revenues from enforcement, and reduced emissions. A benefit/cost analysis targeted to specific state agencies will be required for the states to justify investment, however the state participants perceive significant benefits would accrue. If AVI were combined with the WIM/AVC equipment, additional benefits would accrue (improved collection of mileage-bases taxes, better data for planning). Appendix A, Chapter 7 identifies benefits and costs for a range of site configurations that provide multiple CVO services. Although the benefit/cost ratio for a specific service cannot be extracted, it appears that roadside dimension and weight compliance clearance services provide a benefit to states in excess of their costs.

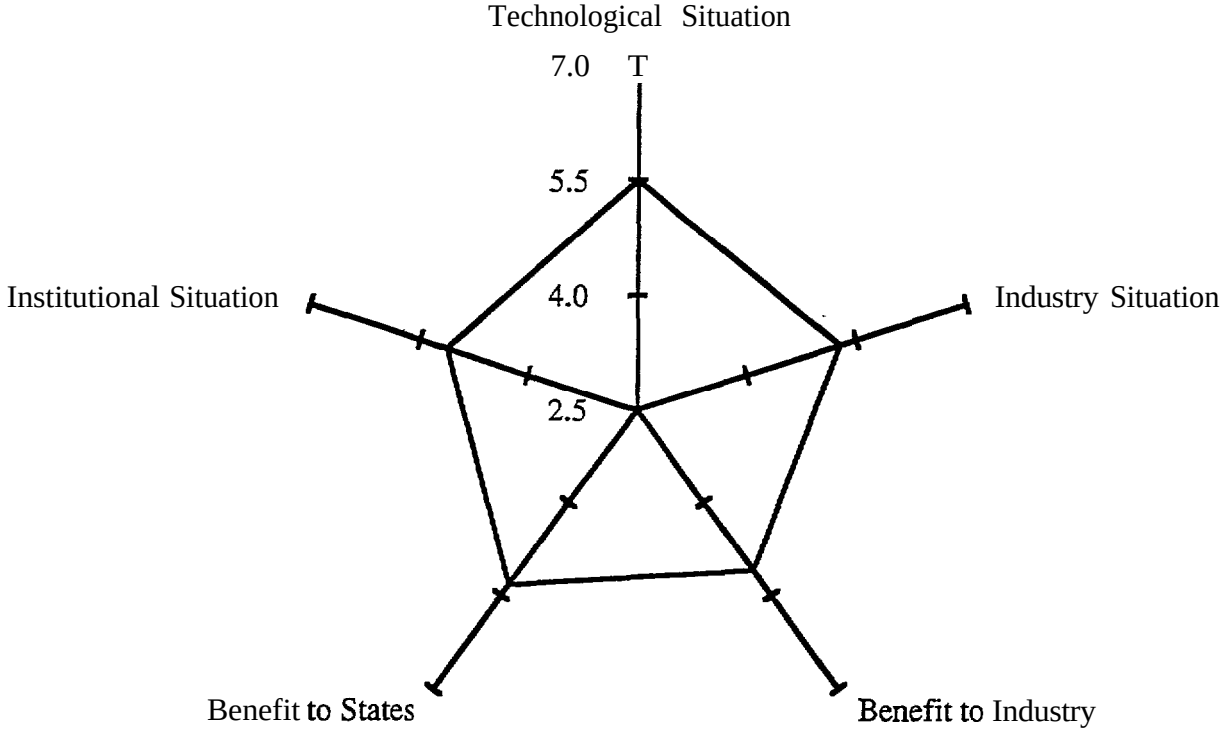
- Benefits compliant motor carriers through reduced weighstation stops. The aggregate potential time savings for all trucks passing a weighstation appears large, however the perceived benefit to an individual motor carrier may appear to be small. In any case, the evaluation team concluded that there would not be a disbenefit to motor carriers. Further, motor carriers willingness to pay to by-pass a weighstation (refer to Section 2.3.2) indicates that the industry perceives a benefit to exist.

- Low institutional barriers, however commitment by weighstation operating staff (and state hierarchy) is needed. Roadside dimension and weight compliance clearance does not require inter-jurisdictional cooperation because typically only one agency is involved at each weighstation. Senior state government management need to convey the system's importance to weighstation personnel and to commit the resources needed to transition to WlM/AVC equipment or else it will not be used.

- Low industry barriers. Roadside dimension and weight compliance clearance is the highest rated CVO service in terms of industry support Conceivably, the service can be provided with no up front investment on the part of motor carriers and, although there would be a greater likelihood of receiving a citation if a truck is not compliant, the industry does not appear to feel threatened by this service.

- Technical improvements are needed but are not a significant barrier. HELP systems/equipment are adequate but availability and accuracy need to be improved. Realistic tolerances and standards need to be established. Site layout and training need to be improved.

EXHIBIT 3-5
Ratings Of Services That Provide
Roadside Dimension And Weight Compliance Clearance



3.2 PRE-CLEARANCE OF VEHICLES WITH PROPER DOCUMENTS

Pre-clearance of vehicles with proper documents includes a group of CVO services that allow a commercial vehicle's permits and credentials to be checked electronically, without stopping, instead of maintaining numerous paper documents and stickers on the vehicle and checking them manually at weighstations or other checkpoints. Using AVI, transponder equipped trucks identify themselves to the Crescent computer system which in turn checks the Crescent database for record of the trucks documents. Alternatively, but not used in the HELP program, the data could be stored electronically in the truck (on-board computer, smart card) and downloaded to weighstations in advance of the truck passing the weighstation. The types of documents that can be automated include:

- Credentials (vehicle registration, operating authority)
- General Permits (overdimension/overweight, single trip, temporary permit)
- Safety Inspection (CVSA stickers)
- Hazardous Material Permits (HazMat placards).

3.2.1 AUTOMATED PRE-CLEARANCE OF TRUCKS FOR CREDENTIAL, SAFETY INSPECTION, AND HAZMAT COMPLIANCE IS A HIGH LEVERAGE APPLICATION OF HELP SYSTEMS TO CVO SERVICES

Exhibit 3-6 illustrates the composite ratings for automated document pre-clearance services for all four of the document types identified above. If the rating for general permits were not included in the composite, the institutional situation dimension would be more favorable but industry interest would degenerate. Automated pre-clearance of vehicles with proper credential, safety inspections, and hazardous material permits:

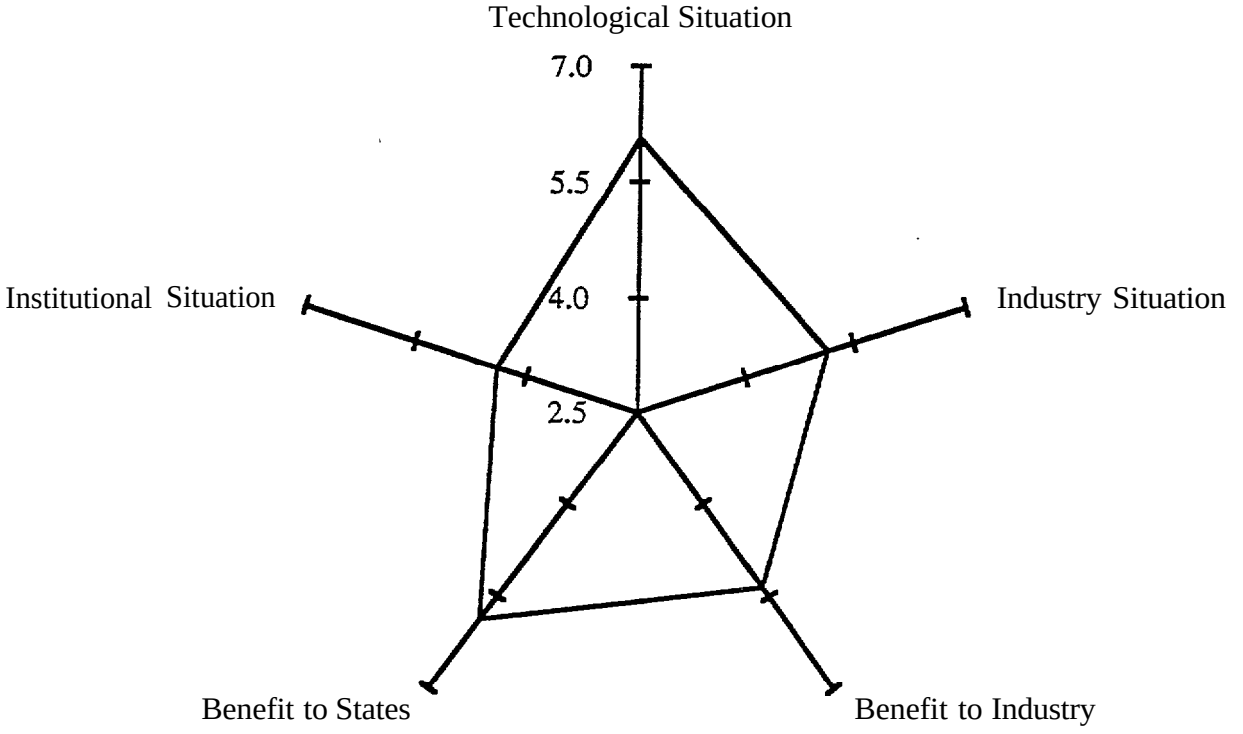
- Provides high benefits to states and industry. Motor carriers gave the highest rating to services that allow them to by-pass weighstations and indicated willingness to pay for each by-pass (see Section 2.3) As with roadside dimension and weight compliance clearance, benefits to states and motor carriers appear to exceed their costs for these services, however benefits and costs for individual services cannot be extracted. Electronic document checking can also increase the safety of the general public given the fact that more non-compliant vehicles can be pulled over and inspected. Benefit/cost analyses targeted to each agency and to motor carriers are needed.

- Has strong conceptual support by states but significant inter-jurisdictional barriers. In order for these services to work, the Crescent database must contain each truck's documents for each state. This requires a willingness/policies to share data among states and the ability to electronically transfer document data from state computers to the Crescent system (see Section 2.2).

- Requires proof of performance to encourage carrier participation. The industry appears somewhat supportive of these services. Net benefits will need to be demonstrated to the industry to convince them to buy transponders, properly install them (in the correct trucks), and maintain them.

- Can be accomplished with available technologies. Equipment installation testing indicate that the HELP AVI systems/equipment are adequate, though "operational" tests were not conducted (see Section 2.1)

EXHIBIT 3-6
Ratings Of Services That Provide
Pre-Clearance Of Vehicles With Proper Documents



3.2.2 AUTOMATED PRE-CLEARANCE OF TRUCKS FOR PROPER PERMITS HAS SOMEWHAT LOWER LEVERAGE THAN OTHER PRE-CLEARANCE SERVICES

The rating of automated pre-clearance of trucks for proper permits was similar to the ratings for other documents except in terms of institutional situation. It was concluded that "permits" face greater institutional barriers than other document pre-clearance services because more agencies are typically involved in issuing permits and enforcing compliance.

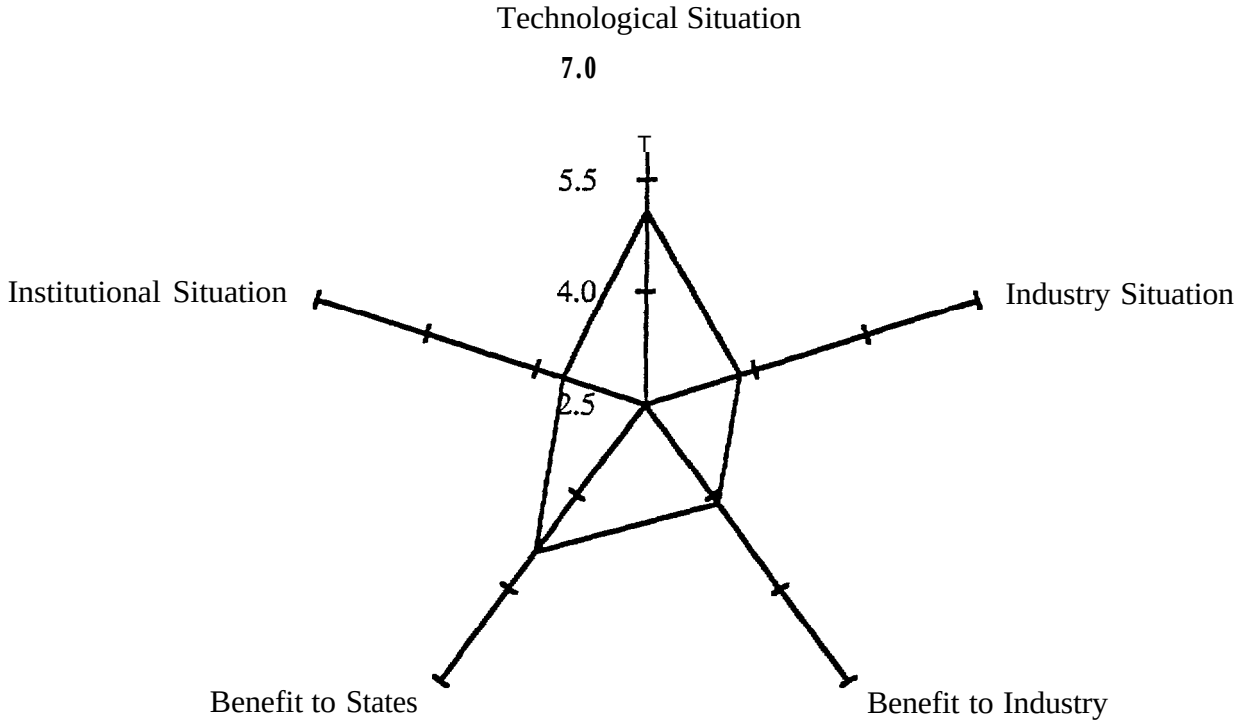
3.3 GOVERNMENT AUDIT OF CARRIER RECORDS

There are many different types of audit functions that various state agencies perform regarding motor carrier activities. These include verifying the authenticity of mileage records that carriers submit, and on which prorated taxes are calculated. In addition, intrastate carriers need to be regulated as a company within that state and therefore must pay appropriate taxes and fees based on how many vehicles and what types of vehicles they base in the state. Another major source of mileage dependent revenue for the states are the fuel taxes that are charged per vehicle. Finally, the state needs to schedule fleet

maintenance inspections at regular intervals during the year for large carriers. HELP/Crescent CVO services are envisioned to support government audits, primarily by speeding up the verification process and improving accuracy through electronic monitoring of vehicles. The enforcement of the audits is similarly enhanced.

Automated support of state government audit activities was not demonstrated under the HELP program, however it was a subject of the state and motor carrier interviews and surveys. Overall, automated government audit of carrier records ratings place it as the lowest priority of CVO services. Exhibit 3-7

EXHIBIT 3-7
Ratings Of Services That Provide
Automated Government Audit Of Motor Carrier Records



3.3.1 AUTOMATED SUPPORT OF GOVERNMENT MILEAGE, OPERATING AUTHORITY, AND FUEL TAX AUDITS HAS THE LEAST LEVERAGE OF THE SERVICES EXAMINED

The ratings for these services are even lower than suggested by Exhibit 3-7 above, due to the inclusion of safety audits which is perceived to have greater value than the other audits.

- The most value from automating audit functions would be derived by the states. Theoretically, enforcement effectiveness (and

therefore revenue) would improve and the recurring cost per audit could decrease. Carriers perceive no compliance benefit to the industry and expect that they may end up paying more taxes than they do now.

Significant institutional and industry barriers exist. The states indicate moderate support of automated audit capabilities however the hurdles of existing policies and the need to be able to share data are present. The industry is opposed to automated government audit services because they see it as the first step to imposing a weight/mileage tax burden on them.

- Technical aspects are not expected to be a barrier. These services were not tested in the program, however the technology requirements are not expected to be an issue.

3.3.2 Automated Support Of Safety Inspection Audits Should Be Considered Before Other Audit Areas

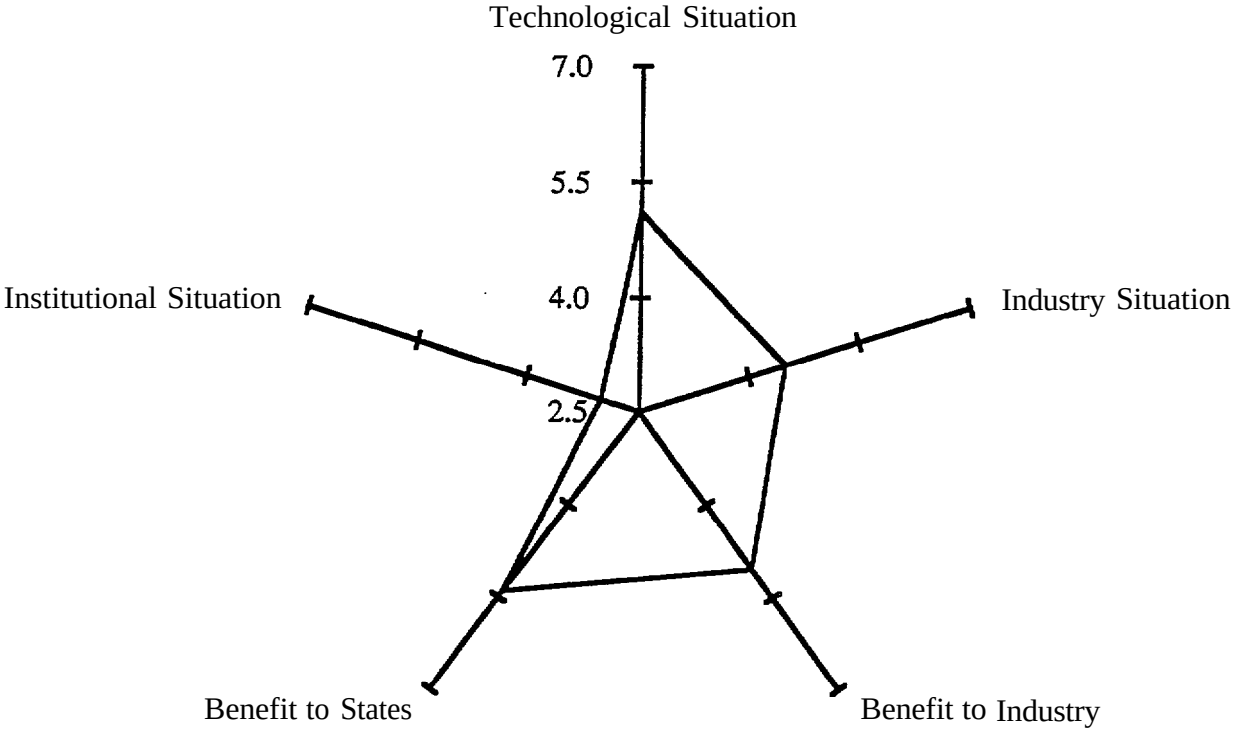
Automation of safety inspection audits was better received than automating other auditing services. Both states and motor carriers perceive value from enhancing safety audits. Institutional and industry barriers appear to be less significant for safety audits and, as with other audits, technical aspects are not expected to be a barrier.

3.4 GOVERNMENT PROCESSING OF COMMERCIAL VEHICLE OPERATOR DOCUMENTS

These services deal with many of the same items mentioned in the pre-clearance services section. However, the activities that occur here are different and are handled by administrative personnel in multiple agencies in multiple states rather than by enforcement and compliance personnel. Stated simply, these services are the initial processing (acquisition form the carriers' point of view) of carrier, vehicle, and driver applications for such things as operating authority, vehicle licensing, vehicle registration, driver licensing, hazardous material carrier permitting, and temporary registrations and authorizations for carriers or vehicles. Normally, these services require the largest amounts of paperwork to be filled out by both the state and the carrier, and long lead times to acquire documents by motor carriers are the norm. The Crescent system could provide electronic entry and transfer of documents among agencies within a state, among states, and between agencies and carriers, allowing "one-stop-shopping" for motor carriers and reducing much of the paperwork and time currently required. Motor carriers would be able to acquire permits more quickly and have that information immediately available to their trucks, allowing better utilization of motor carrier fleets. In addition, the recent requirement that carriers show proof of various types of insurance before being able to operate legally could be implemented on an integrated computer database.

Automated processing of commercial vehicle operator documents was not demonstrated under the HELP program, however it was a subject of the state and motor carrier interviews and surveys. Exhibit 3-8 presents the rating for these services. Technically, the large database management requirements can be accomplished with existing technologies, however implementation of such systems would be an enormous task. The overriding obstacle to implementing these services is institutional — primarily the ability to share data among agencies and states.

EXHIBIT 3-8
Ratings Of Services That Provide
Government Processing Of Commercial Vehicle Operator Documents



3.4.1 AUTOMATING HAZARDOUS MATERIAL PERMITS APPEARS TO HAVE FEW BARRIERS BUT ALSO FEW PERCEIVED BENEFITS

Of all the documents processed, hazardous material permits appear to be the best supported for automating. It is perceived by states as helping to meet Federal requirements and to be responsive to environmental groups, however it is not perceived as providing significant benefits overall by either states or motor carriers.

3.4.2 AUTOMATED GOVERNMENT PROCESSING OF DRIVER LICENSING DOES NOT APPEAR TO BE A HIGH LEVERAGE SERVICE IN THE NEAR TERM

The industry perceives that automating driver license processing through the Crescent system offers no advantage but would result in extra costs to them.

3.4.3 Automated Processing Of Other Commercial Vehicle Operator Documents Could Provide Significant Benefits But Has Significant Institutional Barriers

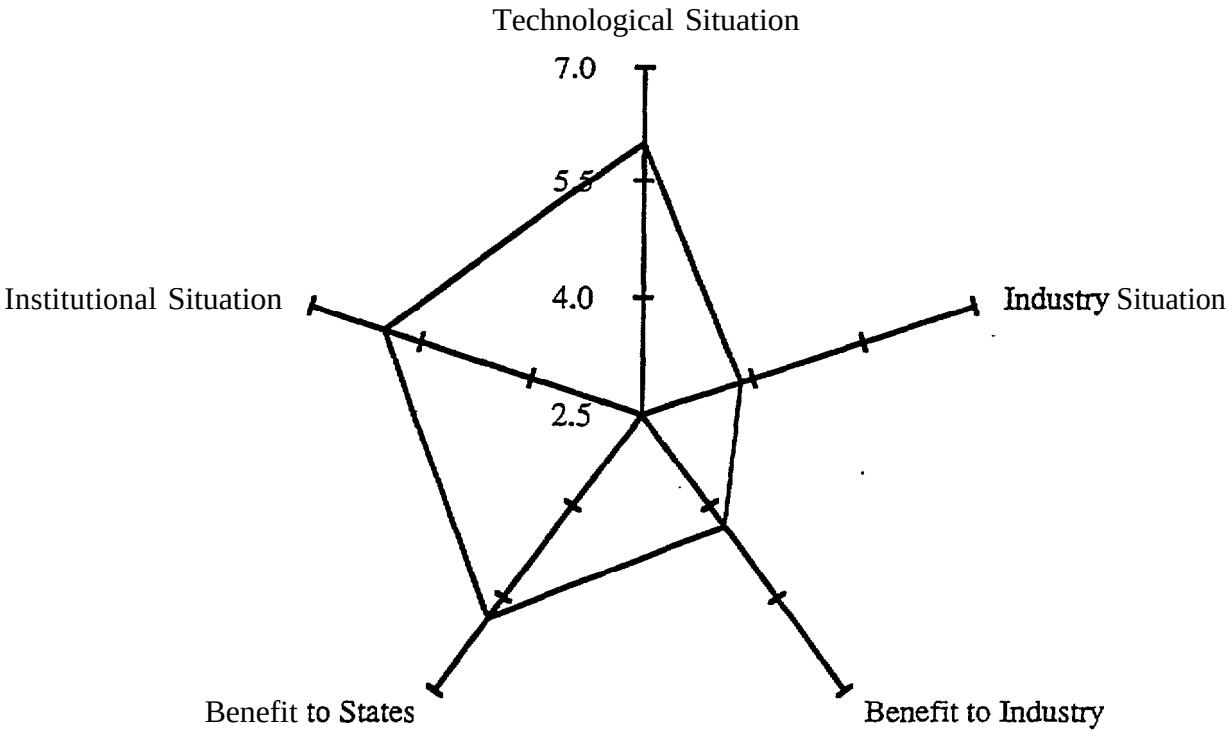
Automated processing of vehicle trip permits, licensing/registration, and operating authorities could provide significant benefits to both states and motor carriers. "One-stop-shopping", as this service is referred to, was the second highest rated CVO service by motor carriers. It has the potential to reduce duplication of data entry efforts among states and among agencies within each state when carriers apply for documents. Similarly, it could reduce motor carrier administrative costs involved in acquiring documents and could enhance their fleet utilization by allowing trucks, regardless of where they are, immediate access to their newly acquired documents. Industry support for automated processing of these documents is greater than for driver licenses and hazardous material permits.

3.5: GOVERNMENT PLANNING

Government Planning functions are performed by the state highway planning divisions (usually these divisions are part of state departments of transportation) and consist of the collection of many kinds of road use data. Included are estimated single axle load equivalent data, vehicle count data, truck weight and count by classification data, and other data that would be useful in planning and designing highway roads and bridges. Much of this data is already being collected. However, HELP/Crescent services could improve the process by collecting more data, more timely data, and more accurate data (for example, improved origin-destination data). In addition, since the planning divisions need to produce a number of reports for the Federal Highways Administration, HELP/Crescent could improve the reports' accuracy and timeliness.

Exhibit 3-9 shows that the states derive the benefits and support these services. The industry derives no benefit and is relatively neutral to these services being provided.

EXHIBIT 3-9
Ratings Of Services That Support Government Planning Activities



3.5.1 The Benefits Of Automated Planning Data Collection And Reporting Need To Be Better Understood

Automated data collection and reporting appears worthwhile if automated roadside dimension and weight compliance clearance (using WIM/AVC) and/or pre-clearance of vehicles with proper documents services are in place. In this way, automated data collection and reporting provides states better and more timely data for relatively small additional cost.

State planning agency representatives support this service and would like data on non-commercial vehicles too. While no industry barriers to this service appear to exist, there is some motor carrier concern that proprietary data (for example, origin and destination information) will be accessible by their competitors.

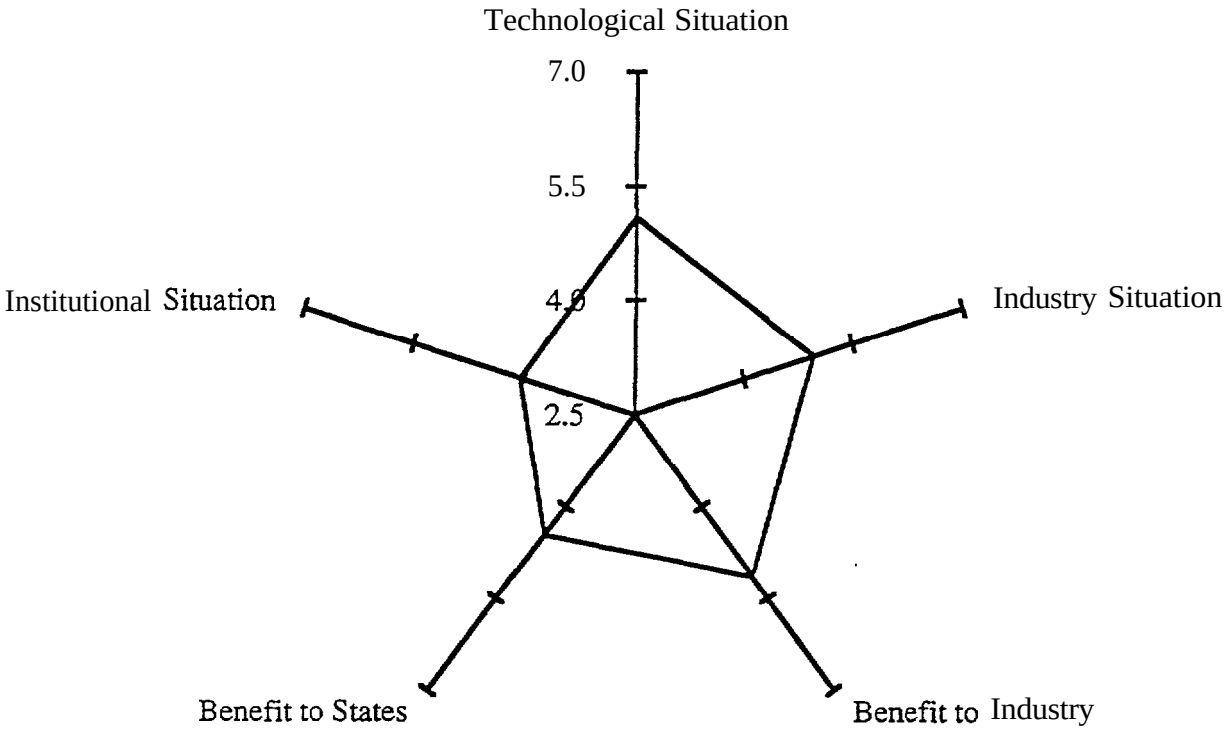
3.6 INDUSTRY ADMINISTRATION OF VEHICLES AND DRIVERS

Access to the Crescent database by motor carriers could theoretically help them in better managing their fleet vehicles and drivers. Driver monitoring could provide more carrier control of errant drivers and could lead to better drivers in the long run. Private use of technology can tell the carrier when the trucks need to be brought in for regular

maintenance service and it also allows for improved scheduling of routes. The improved vehicle and driver management could, in turn, result in safer roads.

Exhibit 3-10 shows that these services tend to benefit and be supported somewhat more by the industry than by states.

EXHIBIT 3-10
Ratings Of Services That Support Industry Administration Of Vehicles And Drivers



3.6.1 The Value Of HELP Provided Automated Services To Support Vehicle And Driver Administration Depends On Carrier Size And Alternative Private Sector Systems That Are Available

As discussed in Sections 2.3 and 2.5, some of the motor carrier industry, particularly large carriers, use or are leaning toward satellite systems to provide data for fleet and driver management. However, it appears that several segments could find the Crescent data valuable a study of potential user needs is warranted to properly design the service (see Section 2.5). The technology is adequate to provide these services to carriers.