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MARYLAND MOTOR CARRIER PROGRAM
SAFETY PROFILE OF COMMERCIAL MOTOR CARRIERS TRAVELING IN MARYLAND AT THE PERRYVILLE SCALE HOUSE UNDER THE JURISDICTION OF THE MARYLAND TRANSPORTATION AUTHORITY POLICE (MdTAP)

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16. Abstract

The Commercial Vehicle Information Systems and Networks (CVISN) program envisions the development, design, and deployment of various technical devices and systems to benefit interstate and intrastate commercial motor carriers and the state and federal governments. CVISN is an integration of information systems and networks designed to improve the performance of commercial vehicle operations and add strategic value to the transportation industry.

The major objective of this project is to collect, analyze, and document the safety profile of commercial motor vehicles traveling in Maryland. Safety profile information includes ISS (Inspection Selection System) scores that are based on prior safety history of commercial motor carriers, average number of total violations and total out-of-service violations per inspection. The distribution of safety ratings of commercial motor carriers traveling on I-95 at Perryville truck and weigh inspection station, under the jurisdiction of Maryland Transportation Authority Police, is provided. This project also determines the effectiveness of using the ISS algorithm for the selection process of commercial vehicles for safety inspection. This report, based on the detailed analysis of the data collected, will enable policymakers and commercial vehicle administrators to assess objectively the outcomes of the CVISN implementations.

This study may also help in evaluating the utility of safety algorithms like ISS and SafeStat and may promote fine-tuning of these algorithms for improved performance and effectiveness. Use of safety ratings for screening of commercial motor carriers will result in enhanced safety for drivers and commercial motor vehicles and all vehicles in general. Additionally, there will be improved operating efficiencies and thus considerable savings in terms of time and money for both government agencies and commercial motor carriers. As a result, both the public and private sector participants will benefit from enhanced safety and will realize savings in time, resources, and the cost of doing business.

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ABSTRACT

The Commercial Vehicle Information Systems and Networks (CVISN) program envisions the development, design, and deployment of various technical devices and systems to benefit interstate and intrastate commercial motor carriers and the state and federal governments. CVISN is an integration of information systems and networks designed to improve the performance of commercial vehicle operations and add strategic value to the transportation industry. CVISN includes information systems owned and operated by state and federal governments, commercial motor carriers, and other stakeholders. CVISN system deployments are expected to necessitate, and otherwise facilitate, changes in the operational processes of the participants. The State of Maryland is implementing the CVISN architecture to enhance and support administrative processes for commercial vehicle operations, improve roadside safety inspection operations, and implement electronic screening for commercial vehicles.

The major objective of this project is to collect, analyze, and document the safety profile of commercial motor vehicles traveling in Maryland. Safety profile information includes ISS (Inspection Selection System) scores that are based on prior safety history of commercial motor carriers, average number of total violations and total out-of-service violations per inspection. The distribution of safety ratings of commercial motor carriers traveling on I-95 at Perryville truck and weigh inspection station, under the jurisdiction of Maryland Transportation Authority Police, is provided. This project also determines the effectiveness of using the ISS algorithm for the selection process of commercial vehicles for safety inspection. This report, based on the detailed analysis of the data collected, will enable policymakers and commercial vehicle administrators to assess objectively the outcomes of the CVISN implementations.

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1.0 INTRODUCTION

The goal of this project is to establish a baseline for determining the effectiveness of the Commercial Vehicle Information Systems and Networks (CVISN) with respect to the selection of commercial vehicles for inspection. The major objective of this project is to collect, analyze, and document the safety profile of commercial motor vehicles traveling on I-95 at Perryville in Maryland. Safety profile information includes ISS (Inspection Selection System) scores that are based on prior safety history of commercial motor carriers, average number of total violations and total out-of-service (OOS) violations per inspection. The distribution of safety ratings of commercial motor carriers traveling on I-95 at Perryville in Maryland is provided. This project also determines the effectiveness of using the ISS algorithm for the selection process of commercial vehicles for safety inspection.

The results of this study will help in evaluating CVISN in terms of increased safety due to the identification of unsafe and non-compliant carriers, and increased efficiencies in terms of time and cost savings to safe and compliant carriers. This report, based on the detailed analysis of the data collected, will enable policymakers and commercial vehicle administrators to objectively assess the outcomes of the safety components of CVISN. This study will also assist the architects of the CVISN to design and benchmark the system based on the needs of all the stakeholders.

The work that has been underway for several years to apply Intelligent Transportation Systems (ITS) to Commercial Vehicle Operations (CVO) has taken a major step forward, primarily through two major initiatives sponsored by the Federal Highway Administration (FHWA). The first is the establishment of the mainstream program that is concerned with the organization and the management of ITS/CVO deployment. The second major initiative is the model development and prototype deployment of ITS technologies under the CVISN program. Through these two initiatives, the FHWA is investing in the technical and organizational infrastructure that is necessary to support widespread ITS/CVO technology deployment.

The CVISN program envisions the development, design, and deployment of various technical devices and systems to benefit interstate and intrastate commercial motor carriers and the state and federal governments. CVISN system deployments are expected to necessitate, and otherwise facilitate, changes in the operational processes of the participants.

1.1 THE NATIONAL ITS/CVO PROGRAM

ITS involves the application of advanced and emerging technologies in fields such as information processing, communications, control, and electronics to surface transportation needs. ITS is being applied to CVO to streamline the administration of motor carrier regulations, focus safety enforcement on high-risk carriers, reduce congestion costs for motor carriers and other vehicles, and reduce environmental damage. ITS/CVO products and services involve automating existing processes and operations, networking existing information systems, and changing the way that states and motor carriers do business.

The national ITS/CVO program comprises numerous initiatives covering multiple functions. These initiatives represent the efforts of the federal government, individual states, consortia of states, individual carriers, and industry associations. The program is developing capabilities mainly in four broad areas:

- **Safety assurance**: Programs and services designed to ensure the roadside safety of commercial drivers, vehicles, and cargo. These include manual and automated roadside safety inspections, carrier, vehicle, and driver safety reviews, safety information exchange systems, and onboard safety monitoring.

- **Credentials administration**: Programs and services designed to improve and automate the desk-side procedures and systems for managing motor carrier registrations, fuel taxes, and other credentials. These include electronic application processing, automated purchasing, and issuance of credentials, as well as automated reporting and filing of appropriate taxes.

- **Electronic screening**: Programs and services designed to facilitate the automated verification of size, weight, and credentials information. These include automated vehicle screening at weigh/inspection facilities and international borders. For example, electronic screening of vehicles would allow the identification of unsafe carriers, thus making highways safer.

- **Carrier operations**: Programs and services designed to reduce congestion and manage the flow of commercial vehicle traffic. The public sector role in this area is focusing on hazardous materials incident response services and travel advisory services. The private sector is leading the deployment of fleet and vehicle management technologies that improve motor carrier safety and productivity. For example, the use of onboard safety monitoring system and transponders would allow some vehicles and drivers to bypass weigh and inspection facilities at mainline speeds. This would result in improved highway safety and the efficient movement of commercial vehicles.

The ITS/CVO program already has made great progress. Key technologies such as weigh-in-motion, electronic data interchange, and mobile communications have been successfully developed, deployed, and tested. States and carriers are participating in operational tests and deployments using these and other technologies to screen vehicles at weigh stations and international border crossings, to enforce out-of-service orders issued as a result of driver or vehicle safety inspections, and to create statewide electronic *one-stop shopping* systems. Working with the states, the FHWA has deployed portable computers and inspection software at several roadside inspection sites. In addition, all states have joined the national agreements to administer interstate vehicle registration and fuel tax collections.

The CVISN program is one of the ITS initiatives that will enhance and facilitate CVO by automating and simplifying the user services. CVISN is an integration of information systems and networks designed to improve the performance of CVO and add strategic value to the industry. CVISN includes information systems owned and operated by state and federal governments, commercial motor carriers, and other stakeholders. Maryland and Virginia are the CVISN prototype states. Eight pilot states are also implementing the CVISN program. The purpose of the prototype/pilot program is to demonstrate the operational feasibility, efficiency, and effectiveness of CVISN concepts and systems.

1.2 BACKGROUND

The Maryland Department of Transportation (MDOT) and FHWA are currently deploying, testing, and evaluating ITS technologies to enhance the safety and efficiency of interstate and intrastate CVO. One of the major goals of CVISN is to create *transparent* borders for interstate and intrastate commercial vehicles and improve the safety and efficiency of CVO. To achieve this objective, one of the primary requirements is to establish a national CVO system that can perform numerous user services, including automated roadside safety inspections, electronic roadside screening and clearance, onboard safety monitoring, and electronic credential and tax administrative procedures.

Essentially, CVISN is an attempt to link the disparate ITS technologies already affecting the CVO under a single operating umbrella. Without such a link or network, these ITS computer systems would continue to operate in a stand-alone capacity and would be unable to communicate with each other in a meaningful manner.

Maryland, one of the two CVISN prototype states, is implementing the CVISN architecture to enhance and support administrative processes for CVO, improve roadside safety inspection operations, and implement electronic screening for commercial vehicles. It is anticipated that the deployment of CVISN will achieve measurable improvements in efficiency and effectiveness for commercial motor carriers, drivers, governments, and other CVO stakeholders. Some of the major advantages of CVISN are:

- The CVISN architecture will enable electronic information exchange among authorized stakeholders via open standards;

- Roadside operations will focus on eliminating unsafe and illegal operations by commercial motor carriers, vehicles, and drivers without hindrance to the productivity and efficiency of safe, legal, and compliant commercial motor carriers, vehicles, and drivers;

- CVISN information technology will support and improve the practices and procedures for obtaining CVO permits, credentials, and the payment of fees and taxes.

1.3 GOALS AND OBJECTIVES

The goal of this study is to establish a baseline for determining the effectiveness of CVISN with respect to the selection of commercial vehicles for inspection, on I-95 at the Perryville truck and weigh inspection station (TWIS). The proposed study documents the safety profile of commercial motor vehicles and carriers traveling at this TWIS. The effectiveness of using ISS scores for the selection of commercial vehicles for safety inspection is also reported. During this study, safety data is collected and analyzed to document the safety profile of commercial motor carriers. The two major objectives of the project are:

- Gather safety profile information on commercial motor carriers traveling at the Perryville TWIS in Maryland on the static scale.

- Determine the effectiveness of selection capabilities of the ISS safety algorithm versus the current procedures for selecting commercial motor vehicles for roadside inspections.

The above objectives will establish a baseline for determining the effectiveness of CVISN with respect to the selection of commercial vehicles for inspection at the Perryville TWIS. The results of this study will help in evaluating CVISN in terms of increased safety due to the identification of unsafe and non-compliant carriers, and increased efficiencies in terms of time and cost savings to safe and compliant carriers. Additionally, this study will help policymakers determine the value of implementing the safety component of CVISN. The architects of the CVISN system will get additional insights on the utility, design, and benchmarking of safety algorithms like ISS and SafeStat. To meet these objectives, the following tasks are carried out:

1) Measure the safety ratings distribution of commercial motor vehicles entering the static scale of the TWIS.

   The USDOT (United States Department of Transportation) or ICC (Interstate Commerce Commission) numbers, tag numbers, and the carrier name are recorded on a voice recorder and transcribed to an electronic file that is used to obtain available safety ratings data from the ISS system.

   The safety ratings distribution of vehicles entering the scale lane at the TWIS is assumed to be representative of the safety ratings distribution of vehicles bypassing the scale using the bypass lane and of vehicles bypassing the TWIS at mainline speeds. This assumption is based on the fact that the selection of vehicles entering the scale lane is determined by the queue length and available resources and hence is random. The distribution of vehicles entering the scale lane is not determined by selection criteria based on safety ratings. The static scale lane is chosen as the appropriate lane for measurement purposes because it is feasible to obtain complete data (USDOT/ICC numbers, tag numbers, and the carrier name) for all vehicles entering this lane.

2) Measure the safety ratings distribution of commercial motor vehicles entering the static scale of the TWIS that are not subjected to an inspection.

3) Measure the safety ratings distribution of commercial motor vehicles entering the static scale of the TWIS that are subjected to an inspection, but are not cited for violations.

4) Measure the safety ratings distribution of commercial motor vehicles entering the static scale of the TWIS that are subjected to an inspection and are cited for violations.

5) Measure the distribution of commercial vehicles traveling in the scale lane according to the carrier's base registration jurisdiction.

Additionally, based on the preliminary analysis of the data, and the potential value of the results to the stakeholders, the following tasks are also carried out:

6) Measure the distribution of commercial vehicles that have no visible USDOT/ICC number according to the carrier's base registration jurisdiction.

7) Obtain the average number of total (driver and/or vehicle) violations per inspection of commercial vehicle with and without a USDOT/ICC number. Similarly, obtain the average number of total OOS driver and vehicle violations per inspection of commercial vehicles with and without a USDOT/ICC number.

1.4 SAFETY BENEFITS OF CVISN

Implementation of CVISN and the use of safety ratings for screening of commercial motor carriers will result in enhanced safety for drivers, commercial motor vehicles and all vehicles in general. Additionally, there will be improved operating efficiencies and thus considerable savings in terms of time and money for both government agencies and commercial motor carriers. As a result, both the public and private sector participants will benefit from enhanced safety and will realize savings in time, resources, and the cost of doing business. The benefits due to increased safety, efficiency, and savings are identified as follows:

1.4.1 Safety

- Reduced congestion at weigh stations will result in shorter lines of trucks waiting for clearance;
- Law enforcement will be able to concentrate its efforts on high-risk and new carriers and operators;
- Fewer trucks pulling in and out of weigh stations reduce accident risk for motor carriers and passenger vehicles.

1.4.2 Efficiencies

- Simplified, automated screening and targeting of high-risk carriers and operators will improve enforcement efficiency;
- Standardized data exchange protocols will result in a simpler and more efficient workday for motor carriers, drivers, and regulators alike;
- Low-risk carriers and drivers will face fewer, simpler, and more efficient roadside inspections;
- Commercial motor carriers will be able to file applications efficiently from their offices;

- Commercial motor carriers will be able to get better and necessary information quickly from regulatory and enforcement agencies.

1.4.3 Savings

- Existing highway infrastructure and facilities can be used more effectively;
- In an era of shrinking budgets, electronic screening technologies will enable state and federal government agencies to shift personnel and resources from processing paperwork to more important tasks;
- Electronic screening will eliminate the need for safe, legal, and compliant commercial motor vehicles and drivers to stop for unnecessary weight and safety inspection;
- Automated reporting and record keeping will reduce costly paperwork for government and commercial motor carriers;
- Commercial motor carriers will not have to go in person to file applications at each of the applicable state and federal government agencies that regulate their business;
- State and federal credentials processing government agencies will be able to process license and certificate applications more quickly and accurately;
- Electronic screening will reduce the number of stops and starts commercial vehicles must make, thus reducing fuel consumption and time idling in lines at weigh stations;
- As vehicles keep moving, the flow of goods from manufacturer to distributor to consumer will be streamlined, and on-time deliveries will increase;
- States will be able to collect taxes and other revenues more effectively.

In the following sections, we describe in detail the safety-related components of CVISN systems and processes.

1.5 SAFETY INFORMATION EXCHANGE

Safety Information Exchange (SIE) is a process in which safety information related to carriers (credentials, safety ratings, and other historical information), vehicles, and drivers (for both, inspection and citation records and other historical information) are collected, stored, and exchanged. The major objectives of SIE are as follows:

- Improving safety performance on roads and highways;
- Using government resources more efficiently and effectively by assisting the enforcement agencies to focus on high-risk carriers, vehicles, and drivers;
- Providing motor carriers access to better and more timely information to facilitate improved management of their safety programs;
- Providing improved and online access to commercial motor carrier, vehicle, and driver credentials and safety information to all the stakeholders.
- Providing facility to proactively update commercial motor carrier, vehicle, and driver credentials and safety information.

1.5.1 SAFER

Safety and Fitness Electronic Record (SAFER) is an online, nationwide system developed by the Johns Hopkins University Applied Physics Laboratory, under contract to the FHWA. The primary objective of SAFER is to facilitate the exchange of carrier, vehicle, and driver safety and credential information among different jurisdictions nationwide. SAFER provides authorized users access to only interstate carrier, vehicle, and driver safety and credential information. Authorized users input inspection data at fixed and roving sites and other state and federal credential processing agencies. All stakeholders can access the inspection data. Based on the information provided by SAFER, the roadside inspectors will be able to perform their tasks in a more effective and efficient manner. For example, roadside inspectors will be able to screen and select vehicles and/or drivers for inspection based on the number and results of prior carrier inspections, as well as historical information about the carrier, vehicle, and driver safety and credential records. In addition to the advantages for law enforcement agencies, SAFER also benefits the motor carriers by eliminating duplicate inspections in multiple jurisdictions. Hence, by being able to identify non-compliant and unsafe drivers, the enforcement agencies will be able to concentrate their efforts and resources on these operators, thus improving highway safety and rewarding safe, legal, and compliant commercial motor carriers whose vehicles and drivers will be subject to fewer inspections.

SAFER provides two types of standardized carrier, vehicle, and driver data sets: snapshots and reports. Snapshots contain limited but critical information such as identification, status flags, and key data items (for example, census data, compliance review summary, inspection and accident data summary, and OOS history). Reports contain more detailed information than snapshots and are based on criteria that are pre-defined by the user. Snapshots are primarily designed to support electronic roadside clearance and are used when time is a critical factor for obtaining information. In contrast, reports are used when snapshots do not provide all the information and the timeliness of responses to queries is less critical. Snapshot data are stored in the system to facilitate quick response, while data used in reports are not stored permanently. SAFER provides snapshots and reports to users based on user-defined subscription criteria. EDI X12 transaction set 285 is used to carry snapshot information, whereas EDI X12 transaction set 284 is used to carry safety report information.

SAFER also provides access to information concerning a motor carrier's safety fitness rating, roadside inspection history, and accident record via the Internet at www.safersys.org. In addition to the safety rating score obtained using the Inspection Selection System (ISS), SAFER also provides out of service (OOS) inspection. All the information displayed using the Internet query is public information and has been available under the Freedom of Information Act at no cost. The system allows motor carriers information that was formerly obtained via telephone requests and hard copy paper reports to be transferred electronically. A major benefit of such an approach is the ability to access that information using several different methods. The ability to query interstate carriers is available through the SAFER web site. Queries can be made on the SAFER database using the carrier's DOT number, ICC number, or name. Additionally, the SAFER homepage provides links to other related sites, including FHWA's home page and the SAFER Deployment Coordinator.

SAFER is heavily subsidized by FHWA, and information on SAFER is currently provided at no cost. SAFER will continue to provide information at no cost to certain types of users, including enforcement agencies and other state and federal agencies that provide it with credential and safety information. However, other users will be required to pay a nominal fee ($9 per profile request) for their data exchange activities. These fees will be used to offset the cost of maintaining the SAFER database. SAFER costs are mainly of three types: infrastructure costs that include cost of hardware, facilities, personnel, and supplies; data costs paid to Motor Carrier Management Information System (MCMIS) for providing SAFER with motor carrier credential and safety information; and telecommunications costs for sending information to its users.

An inspection report consists of all the census and safety information collected at the roadside during a vehicle and/or driver inspection. These inspection reports are formatted according to the input definition defined in the *SAFER and CVIEW Application Programming Interface (SCAPI) Inspection Report Field Definitions Document*, published by the Johns Hopkins University Applied Physics Laboratory, and are uploaded and stored in the SAFER system for 45 days. Inspectors from all jurisdictions have access to these inspection reports during the 45-day retention period, after which they are purged from the system. SAFER sends these reports to the requester in the same format as defined in the *SCAPI Inspection Report Field Definitions Document.*

As an interstate system, SAFER, has certain limitations. For example, it cannot provide safety information regarding intrastate carriers, vehicles, and drivers. As a result, the CVISN architecture has proposed the implementation of a new system called Commercial Vehicle Information Exchange Window (CVIEW) as a key element of each state's CVISN design.

1.5.2 MCMIS

Before the design and implementation of CVISN, Motor Carrier Management Information System (MCMIS) served as the primary repository for credentials and safety-related data on interstate commercial motor carriers, vehicles, and drivers. MCMIS was established by FHWA's Office of Motor Carriers (OMC) to store, track, and analyze census information about interstate commercial motor carriers and hazardous material shippers. MCMIS receives credential and safety information on all interstate motor carriers, vehicles, and drivers from Safetynet systems of different states. This information is then uploaded on a regular basis to the SAFER system for distribution to all jurisdictions in all states. In the past, those who requested motor carrier safety information contained in MCMIS had to pay a service fee of about $25 per request. This was used by FHWA to cover the cost of preparing the Carrier Profile Report and mailing it or transmitting it to the requester by facsimile. However, because SAFER will provide electronic access to this information, there will be a significant reduction in cost per request (currently information is provided at no cost). Additionally, the requester will be able to receive this information in a much-improved and timely fashion.

1.5.3 CVIEW

Commercial Vehicle Information Exchange Window (CVIEW) is a system administered by each state to manage *segments* of snapshots for interstate carriers, vehicles, and drivers based in that state and to manage *whole* snapshots and reports for all intrastate carriers, vehicles, and drivers in that state. In other words, CVIEW is a derivative of the SAFER system and can be viewed as a state-owned and -operated version of the nationwide SAFER system. It is designed to handle information on both interstate and intrastate carriers, vehicles, and drivers who operate in the state. The key motivation for developing CVIEW as a separate entity from SAFER is to provide states with a single point-of-access to its intrastate safety and credential information and to provide SAFER with a single source of information about the interstate carriers, vehicles, and drivers in the state. With this design, SAFER is relieved of the burden of having to establish a custom interface to each state's legacy systems. Hence, each state will be able to exchange interstate information via the SAFER system. CVIEW will have the ability to distinguish between intrastate and interstate operators. Data, snapshots, and reports of interstate carriers, vehicles, and drivers operating in the state are forwarded to SAFER to provide access to other jurisdictions in other states, while information regarding intrastate carriers, vehicles, and drivers is stored locally. SAFER then sends updated snapshots to all subscribers, i.e. to the state's CVIEW. CVIEW in turn forwards the updated snapshots to all roadside sites and Aspen host computers that subscribe to it within the state. The Roadside Operations System that receives the updated snapshot will forward the snapshot to all Roadside Operations Computer (ROC) systems for use by inspectors to screen commercial motor vehicles and drivers.

1.5.4 Safetynet

Before the implementation of CVISN, all manual and electronic inspection reports were uploaded to the state's Safetynet system. The Avalanche software converts the data obtained from inspection reports created with Aspen software to the appropriate format for upload to Safetynet. Safetynet will then store the inspection reports of intrastate commercial motor carriers, vehicles, and drivers locally, while transmitting the data on interstate operators and vehicles to FHWA's MCMIS for distribution to all jurisdictions. As mentioned earlier, MCMIS also makes this information available to all other stakeholders by providing carrier profile reports to all other stakeholders for a fee. Safetynet also has the capability to obtain information on interstate commercial motor carriers, vehicles, and drivers operating in other states from SAFER.

1.5.5 ROC

Roadside Operations Computer (ROC) systems are located at weigh/inspection facilities and assist the enforcement agency in performing efficient and effective inspections of vehicles. ROC systems have the ability to download credential and safety snapshots of commercial motor carriers, vehicles, and drivers from CVIEW and SAFER. These snapshots would also include the *safety index* (based on ISS) of the carrier. Using the ROC system, a user would be able to send criteria for screening a vehicle. The system would in turn read data from the vehicle's transponder unit and the weigh-in-motion (WIM) scales and forward them to the ROC user. Based on the screening results, the ROC user would signal the vehicle to bypass the weigh/inspection facility or come in for additional inspection.

Additionally, ROC has the capability to upload inspection data directly to CVIEW, which would then forward the results of inspections on interstate commercial carriers, vehicles, and drivers to SAFER for distribution to other jurisdictions and locally store the information on intrastate operators and vehicles.

1.5.6 Aspen

Aspen, a Windows-based software selected by most of the states, was developed by the FHWA's Office of Motor Carrier (OMC) and is provided by the FHWA to different states. It has the ability to provide more timely and accurate data as compared to the method used by the states in which the state employees are required to re-enter handwritten inspection reports into the Safetynet system days, weeks, or even months after the inspection. Aspen also has the ability to assist the inspector in selecting the commercial vehicle for inspection based on the ISS score and other information already available in the system. It also has an interface for distributing citations and compliance review reports electronically to the state's CVIEW and FHWA's SAFER.

The departments responsible for collecting and disseminating inspection data in the state of Maryland are the Maryland State Police Commercial Vehicle Enforcement Division (MSP-C.V.E.D.), and Maryland Transportation Authority Police (MdTAP). Upon completing an inspection (Aspen-based or manually filled inspection reports) at either roadside weigh and inspection facility, the inspection reports are forwarded to the C.V.E.D. office for uploading to Safetynet and the state's CVIEW. The electronic roadside inspection process using laptop or desktop computers using Aspen software in the state of Maryland is as follows:

- The inspection reports are entered at roadside inspection facilities using laptop or desktop computers using the Aspen software;
- When completed, inspection reports are uploaded to Maryland's mailbox on the SAFER system;
- The Avalanche software at C.V.E.D. Headquarters downloads the information from the SAFER mailbox and makes it available to the Safetynet software for uploading to MCMIS.

Aspen also has the ability to download snapshots from CVIEW and SAFER. The snapshots could be used at both fixed inspection stations and with roving enforcement vehicles equipped with laptop computers. Future versions of Aspen software are anticipated to support direct links to CVIEW. In this case, Blizzard 32 will replace the Avalanche Bulletin Board System in Safetynet for transforming Aspen database tables into Safetynet required database tables. Before CVISN, inspection reports of interstate carriers from state Safetynet systems were uploaded to FHWA's MCMIS. Under the CVISN program, snapshots are also uploaded from MCMIS and CVIEW to SAFER.

The Aspen software also includes a program called Past Information Queries (PIQ) that assists an inspector to query the SAFER database using the carriers' DOT number, ICC number, or state ID. The inspector will then have access to detailed reports on all of the inspections performed on that vehicle and/or driver in the preceding 45 days. Based on the information provided in these reports, the inspector will be able to make a determination if a particular vehicle is operating safely and legally. Considering the costs of communications and the advantages of providing information on inspections as quickly as possible, most enforcement agencies recommend that inspection reports be uploaded to SAFER twice a day. The goal is to ensure that a given inspection report is, at the most, four hours old before it is available through the SAFER system. However, there is an exception to this rule when a vehicle is put on OOS status. In this case, it is recommended that the OOS report be posted in the SAFER database immediately and be available to other officers and jurisdictions for OOS violation enforcement activities. The aim is to have an OOS inspection report available for enforcement activities within 10 minutes of the completion of an OOS inspection.

To further accelerate the safety data exchange process, road inspection data are transmitted from Aspen to the SAFER data mailbox, which helps in distributing safety data to be used in other states.

2.0 SAFETY ALGORITHMS AND EFFECTIVENESS

The major goal of this study is to establish a baseline for determining the effectiveness of CVISN when it is operational. It is anticipated that CVISN would use the latest version of the Inspection Selection System (ISS) algorithm to select vehicles and drivers for inspections. The commonly used safety algorithms are ISS, SafeStat, and ISS-2. Maryland agencies currently have access to the ISS algorithm and hence this algorithm is used to obtain the safety profile of commercial vehicles that travel in Maryland. This safety profile serves as the baseline to evaluate the impact of CVISN when it is operational. The details on the criteria and steps used by this algorithm to obtain an ISS score are provided in Section 2.1. This section also provides a brief overview of the SafeStat algorithm and SAFER scores. The ISS-2 algorithm, an enhancement of the ISS algorithm, assigns an ISS-2 score based on a combination of the ISS score and the SafeStat score. Section 2.2 discusses past research on the effectiveness of the ISS and the SafeStat algorithms. Moreover, details on prior study on the effectiveness of CVISN pertaining to safety scores is described in this section.

2.1 DESCRIPTION OF THE ISS SAFETY ALGORITHM

The Inspection Selection System (ISS) algorithm was developed and designed at the Upper Great Plains Transportation Institute, North Dakota State University and is a joint effort of the Federal Motor Carrier Safety Administration (FMSCA), FMSCA's Field Systems Group, and representatives from several states involved in the Roadside Technology Technical Working Group. The major objective of the ISS algorithm is to identify, recommend, and prioritize vehicles and drivers of commercial motor carriers with poor prior safety records and those with few or no history of inspections. The ISS algorithm assigns an "inspection value" based on the analysis of the data about the motor carrier's past safety performance record. Based on this inspection value, the ISS algorithm provides a three-tiered recommendation as shown in Table 1.

Table 1: Inspection Recommendation Based on ISS Score

ISS Score	Recommendation
90-100	Inspect (inspection warranted)
80-89	Optional (may be worth a look)
50-79	Pass (no inspection required)

The ISS uses prior safety data to help guide the selection of commercial motor vehicles and drivers for roadside inspections. Prior safety data includes results of past inspections of both drivers and vehicles belonging to the carrier, crash history, accident data, past compliance review data, and safety management experience. The ISS algorithm is also bolstered by data in the Performance and Registration Information Systems Management (PRISM) program.

The main objective of PRISM is to identify carriers with poor safety performance relative to other carriers and encourage them to improve their safety performance or risk having their registration privileges revoked. PRISM assigns a SafeStat (Safety Status Measurement System) score using data obtained from past roadside inspections, compliance reviews, accidents, and others (Lantz et al, 1997). Both the ISS and the SafeStat algorithms use similar data to rate commercial motor carriers. However, while SafeStat is designed to prioritize carriers for monitoring and compliance reviews, the ISS is designed to prioritize carriers for roadside inspections.

Beginning in October 1986, motor carriers were assigned a Safety and Fitness Electronic Record (SAFER) rating based on a Safety Review or a Compliance Review. A Safety Review is an overview of a motor carrier's knowledge of the Federal Motor Carrier Safety Regulations (FMCSR). This covers all major areas of the Safety Regulations. Much of the rating is based on an interview with management. The main purpose is to educate a carrier about the FMCSR. A

Compliance Review is a statistical sampling or audit of required records to determine a motor carrier's compliance with the FMCSR. An in-depth review of the motor carrier's records is made to check different categories of drivers, vehicles and trips. This review may be limited to specific problems and may include a detailed investigation of a problem area. The compliance status determination is based on FMCSR violations discovered during the review. A commercial motor carrier may be assigned any of the following three SAFER ratings:

Table 2: SAFER Rating Interpretation

SAFER Rating	Interpretation
Satisfactory	Records indicate no evidence of substantial non-compliance with safety requirements.
Conditional	Records indicate that the carrier was out of compliance with one or more safety requirements.
Unsatisfactory	Records indicate evidence of substantial noncompliance with safety requirements.

In the case of insufficient information on a carrier, ISS determines the inspection value by weighing the carrier size and the number of past inspections. In summary, the ISS algorithm would recommend roadside inspections for those commercial vehicles and drivers with one or both of the following:

- Poor prior safety performance as evidenced by an unsatisfactory safety compliance fitness rating and/or higher than average vehicle/driver out-of-service rates.
- None or few roadside inspections in the prior two years relative to the carriers size.

It is expected that the inspector at a roadside inspection facility will use the roadside inspection computer (ROC) to obtain the ISS score for the commercial motor carrier by entering the DOT/ICC number of the carrier found on the power unit of the commercial vehicle. In addition to the ISS score, the computer will also display the carrier's name, address, a recommendation, and the record of the carrier's past history of safety compliance. ISS gives a recommendation based on the inspection score using the classification shown in Table 1. However, the final decision of selecting a vehicle or driver for inspection is left to the discretion of the inspector. Furthermore a vehicle or driver can also be selected for inspection if an obvious or visible defect and/or problem is detected or suspected. It is anticipated that, in the future, transponder-equipped vehicles will be screened at mainline speeds using the ISS. This will result in considerable time and cost-savings for commercial motor carriers with transponders and good prior safety performance.

The ISS algorithm consists of the following steps:

Step 1. The ISS algorithm searches its database using the DOT/ICC number of the commercial motor carrier. If no match can be made, ISS does not provide any output. A successful carrier match warrants the ISS to check if the carrier is currently in the PRISM program and has a recent (assigned within the previous five years) safety compliance rating. If they are in the PRISM monitoring process and have an unsatisfactory rating, they are assigned a compliance rating (CR) value of 100. If they have a conditional rating, they are assigned a CR value of 90. If they are not on PRISM, nothing is calculated.

Step 2. If the carrier has more than two vehicle and/or driver inspections in the past two years, the ISS determines Vehicle and Driver OOS values for the carrier as follows. If the carrier has a 100% vehicle out of service rate (i.e. every vehicle inspected for the carriers in the past two years resulted in a vehicle being placed OOS), they are assigned a Vehicle OOS value of 100. Or, carriers with vehicles OOS lower than 100% receive lower Vehicle OOS values based on the nationwide distribution of vehicle out-of-service rates. More specifically, for every five-percentile points below 100%, they receive a two-point deduction from 100. The driver OOS-value is derived in a similar fashion. Finally, the overall OOS average value is obtained by taking the average of driver and vehicle OOS values.

Step 3. The Safety Fitness average-value is then calculated as the higher of the overall OOS average-value or the CR-value (if applicable).

Step 4. The ISS next determines an Inspection value per power unit and per driver based on the inspection rates. The lower the inspection rates, the higher inspection values carriers receive. The Inspection value per power unit is calculated as follows: The value starts at zero when the carrier is at or above the 50th percentile (median) for their size group, and then two points are added to this value for each five percentile points carriers fall below the median. The Inspection value per driver is determined by dividing the number of Level I, II, and III inspections the carrier has had in the previous two years by the number of drivers they indicate. Finally, these two values are averaged to calculate the Inspection average-value.

Step 5. The final ISS inspection value is calculated and displayed by adding the Inspection Average-value and the Safety Fitness Average-value with a maximum value of 100.

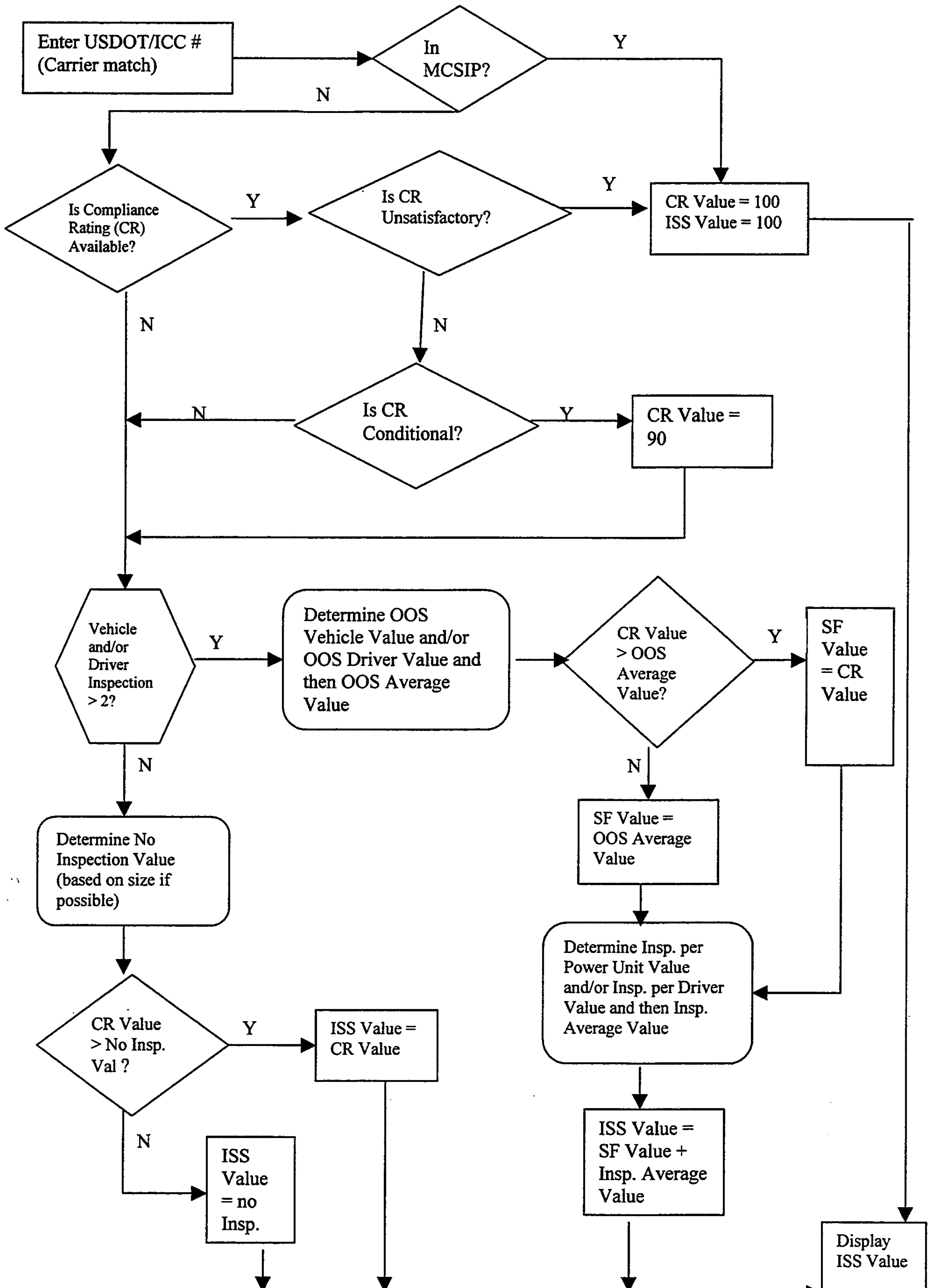
Step 6. If the carrier has not had at least three roadside inspections in the last two years (and no CR), they are assigned a value based solely on their size. The largest carriers are assigned values of 100. Two points are subtracted for each of the six smaller size groups in which they might be categorized. These categories, shown in Table 3, are based on the number of power units and the number of drivers a carrier has. This number is displayed with an explanation that there is insufficient data available about this carrier.

Table 3: Commercial Motor Carrier Size Categories

Number of Power Units	Number of Drivers
1001+	1001+
201-1000	201-1000
64-200	72-200
16-63	16-71
7-15	6-15
2-6	2-5
1	1

The following Figure 1 shows the flow chart for the ISS algorithm given in the preceding paragraphs.

Figure 1: Flowchart of the ISS Algorithm



2.2 SURVEY OF PRIOR STUDIES

Several studies have focused on the effectiveness of safety algorithms and the safety profile of carriers traveling on highways. Lantz et al. (1997) examined the effectiveness of the ISS algorithm whereas Madsen and Wright (1999) examined the effectiveness of the SafeStat algorithm. Kinateder (1999) measures the safety profile of carriers traveling in Connecticut. Relevant details of these studies are given next.

2.2.1 ISS

Lantz et al. studied the effectiveness of the ISS algorithm in terms of identifying carriers and drivers likely to be placed out-of-service. The analysis is based on carrier-specific data and inspection-specific data. The inspection-per-power-unit and inspection-per-driver-rate is also used as a basis for evaluating carriers.

They found a significant difference in the driver and vehicle OOS rates of carriers that were stopped and recommended for inspection versus those that were stopped but not recommended for inspections. Carriers recommended for inspections had an 11 (34) percent driver (vehicle) OOS rate, whereas carriers not recommended for inspections had a 7 (15) percent driver (vehicle) OOS. They found a significant difference in the inspection-per-power-unit and inspection-per-driver rates between carriers recommended for inspections and those that were not.

A total of approximately 40,000 inspections, carried out on portable laptop computers using the Aspen software, were used to determine the inspection specific effectiveness. The ISS algorithm recommended an inspection for approximately half of these observations. Of these, approximately 8.2% were recommended for an inspection because none or very few inspections were done on the carrier. These carriers typically have few power units and thus have not been inspected during the previous two-year period. The driver and vehicle OOS service rates were greater when compared to those that were not recommended for inspections for these carriers. For all inspections done on Aspen, the driver (vehicle) OOS rates were 9.9 (20) percent when an inspection was not recommended versus driver (vehicle) OOS rates of 13.5 (33.7) percent when an inspection was recommended. Table 4 shows the results obtained by them.

Table 4: OOS Rates for ISS Inspection Recommendation

	Inspection	
	Not Recommended (%)	**Recommended (%)**
Driver OOS rate	9.9	13.5
Vehicle OOS rate	20.0	33.7
Total OOS rate	24.8	38.3

2.2.2 SafeStat

SafeStat evaluates the safety status of a carrier relative to other carriers on four Safety Evaluation Areas (SEA) categories: accident, driver, vehicle, and safety management. These SEA values are determined only if sufficient data is present. A carrier is designated "at-risk" if it is unacceptable in three or more of the five SEA values (Accident, Driver, Vehicle, and Safety) with the unacceptable Accident SEA being counted twice. A carrier is designated as having a "poor" safety status if it has two unacceptable SEAs without an unacceptable accident SEA.

Madsen and Wright defined safety risk as the likelihood of having crashes in the near future. They categorized carriers in three groups: "at-risk", "poor", and those that had relevant SEA scores but were not identified as having "poor" or "at-risk" safety ratings. Table 5 summarizes the results of the analysis based on the post-selection crash rates.

These results indicate that carriers that were designated at-risk had a crash rate that was 169 percent higher than those not identified. Even the carriers that were identified as poor performers had an 85 percent higher crash rate than those that were not identified.

Table 5: Effectiveness of the SafeStat Algorithm

Carrier Group	Number of Carriers	% Higher than Not Identified Carriers
All identified	4,276	85%
At-Risk (with Worst SafeStat Scores)	1,450	169%
Poor (with poor SafeStat Scores)	2,826	41%
Not Identified	69,797	Baseline

2.2.3 Connecticut CVISN Effectiveness Study

Kinateder (1999) reports on the effectiveness of CVISN to improve targeting of high-risk vehicles. The research study was conducted in four sites in Connecticut: Danbury, Greenwich, Middletown, and Union. Of these four sites, Union was the most advanced in terms of deployment of systems with screening done on a Weigh-in-Motion (WIM) ramp and screening at static scales being done by using ISS/ISS-2 algorithms. They categorize carrier risk as High-risk, Medium-risk, and Low-risk using the ISS-2 algorithm. Table 6 lists risk categories of commercial vehicles on the ramp lane, static lane, and those that are inspected at the Union TWIS.

Table 6: Percentage of Vehicles in High, Medium and Low Risk Categories at Union TWIS, Connecticut

Risk Category	Ramp Lane		Static Lane		Inspected	
High-Risk	5%	(236)	5%	(21)	8%	(9)
Medium-Risk	28%	(1319)	29%	(121)	24%	(26)
Low-Risk	52%	(2450)	46%	(192)	41%	(44)
Insufficient Data	15%	(707)	20%	(83)	27%	(29)
Total Observations	100%	(4712)	100%	(417)	100%	(108)

As observed from Table 6, a larger percentage of high-risk vehicles in the population are inspected when using the ISS/ISS-2 algorithms. Moreover, a lower percentage of low-risk vehicles in the population are inspected. Thus, these results confirm the benefit of using the ISS/ISS-2 algorithms.

3.0 METHODOLOGY

Based on the goals and objectives of the study, data are collected using several methodologies and different sources. These data are collected at the Perryville TWIS located on I-95 south in Maryland. This TWIS is under the jurisdiction of MdTAP. Figure 2 shows the location of this TWIS. The three major data collection activities relate to:

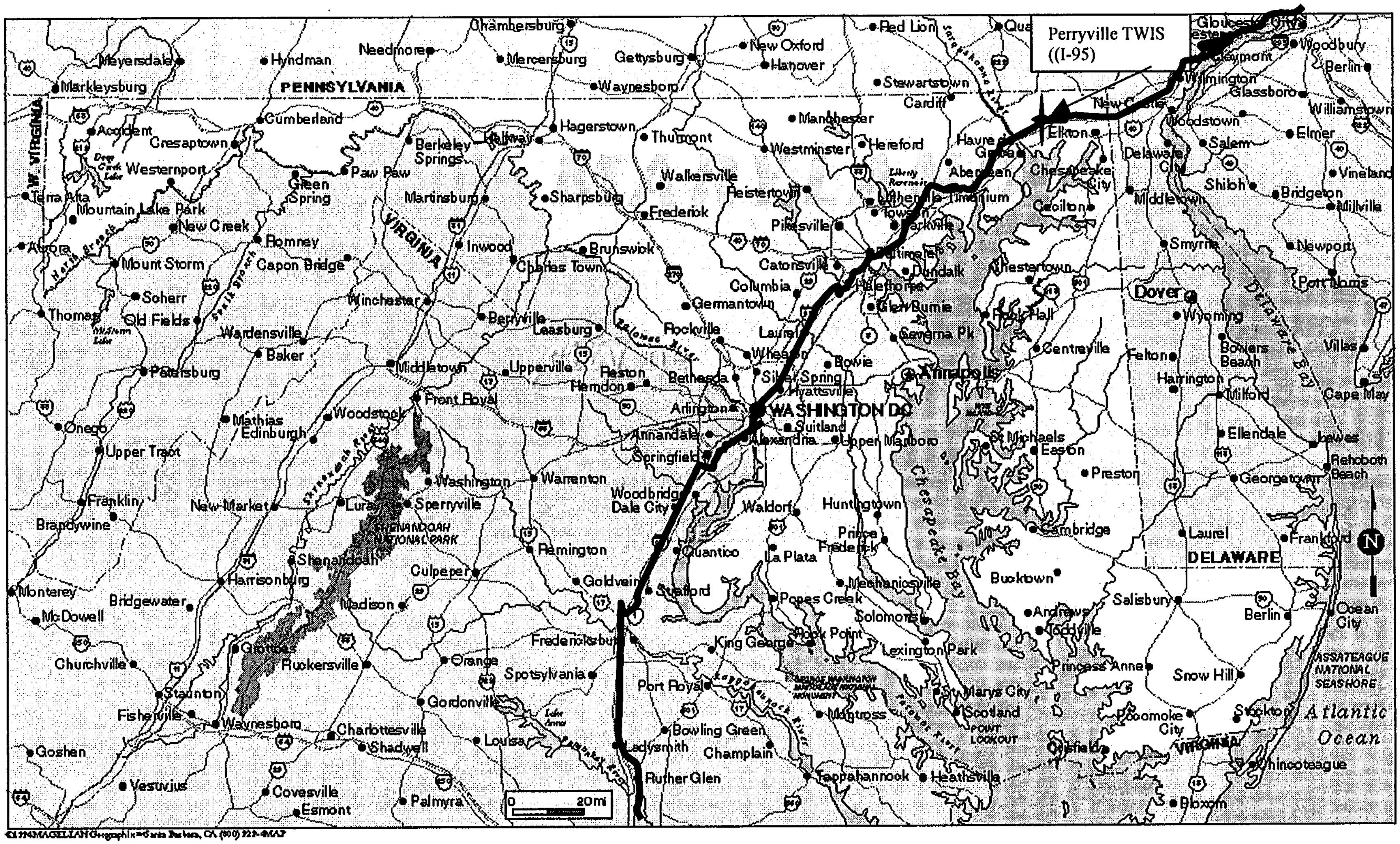
a) carrier and vehicle information for those vehicles going through the scale lanes during several different time intervals for a one-week period;
b) inspection records of carriers inspected at the TWIS for the period from January 1 through July 14, 2000;
c) ISS scores of carriers that went through the scale lanes, as well as those that were inspected during the period from June 7 through July 14, 2000.

3.1 CARRIER AND VEHICLE INFORMATION

During the 24-hour, seven-day period, data are collected for time periods that include peak volume traffic and distinctive traffic patterns (nights and/or weekends) subject to resource availability at the TWIS. This task is comprised of several subtasks: the layout of each site is studied, logistics for data collection is determined, data collection techniques are tested, and finally data are collected and transcribed to an electronic format. This task involves on-site visits to collect data.

The following data are collected for all commercial vehicles that travel in the static scale lanes of the TWIS: USDOT number, ICC number, tag number, tag state, and carrier name. These data are dictated into a tape recording device and then transcribed into an electronic format for further analysis.

Figure 2: Map of Maryland with the Location of Perryville Truck Weigh and Inspection Station on I-95



These data are verified by using the SAFER site (http://www.safersys.org/) in the following manner. The transcribed USDOT number or the ICC number is manually entered into the site, and the name of the carrier returned by the site is matched with the transcribed name. Similar verification of the transcribed data is also carried out by using the Inspection Selection System (ISS).

3.2 INSPECTION RECORDS

Inspection analysis is based on data collected from Maryland's Safetynet. Database files are obtained from the MSP-C.V.E.D. office. For this analysis, data for all inspections conducted in Maryland for the period from January 1 through July 14, 2000 are used. During this period, data for a total of 53,031 inspections were obtained from the database. Of these inspections, 5,225, inspections were conducted at the Perryville TWIS.

3.3 ISS SCORES

ISS Scores were obtained using version 1.52 of the ISS software that computes the ISS score based on the data stored in the SAFER database. The SAFER database was obtained on July 17, 2000 from the MSP-C.V.E.D. office. For the purpose of obtaining the safety profile of carriers traveling at this TWIS, ISS scores are obtained for all commercial vehicles that travel on the scale lanes. For the purpose of obtaining the safety profile of carriers inspected at this TWIS, ISS scores are obtained for inspections recorded in the database for the period from June 7 through July 14, 2000.

The USDOT or the ICC number is manually entered in the ISS software to obtain the corresponding ISS score for the carrier. The ISS score is then transcribed into an electronic format for that commercial motor carrier. If the USDOT/ICC number does not result in a carrier name match, then the SAFER site is searched to glean more information on the carrier. If necessary, carriers are contacted by telephone to identify mismatches in name.

3.4 INSPECTION PROCESS

This section describes the inspection process at the Perryville TWIS located on I-95 in Maryland that is the focus of this study. The main function of the scale house is to weigh and inspect vehicles over 10,000 pounds.

Drivers of vehicles over 10,000 pounds are notified by a road sign to pull into the weigh facility to have their vehicles weighed and inspected. Upon entrance, there are three lanes in which a vehicle can travel. For safety considerations, during periods of heavy traffic volume, commercial vehicles are signaled to bypass this TWIS by using the bypass lane. If a vehicle is signaled to go through the bypass lane, it is not weighed and the driver is allowed to continue toward his or her destination. Vehicles that are not signaled to bypass must enter one of the two scale lanes.

When a vehicle enters the scale lane, it is weighed and visually inspected. At that point, there are several variables that determine whether a driver will be requested to pull into the inspection area to receive a possible Level I, II, III, or IV inspection, or (if applicable) to receive a traffic citation for a weight violation. These variables fall into one of three categories:

- Overweight violations
- Visual violations
- Random selection

A vehicle can fall into the overweight violation category if the gross weight of the vehicle exceeds allowable limits. If a vehicle violates any of these specifications, it is subject to a traffic citation and a fine.

Visual violations are identified at the point when a vehicle is on the scale being weighed. Inspectors follow established guidelines as defined in both federal and state regulations that pertain to the weighing and measurement of vehicles. In most cases, the inspector relies on visual observations of the vehicle. Violations that are noted include missing IFTA (International Fuel Tax Agreement) decals, damaged/bald tires, cracked windshields, obvious equipment violations, improperly secured cargo, and various other violations. These visible violations are grounds for a vehicle to undergo closer inspection, which can be a Level I, II, III, or IV inspection.

The final category that can cause a vehicle to be subject to a Level I, II, III, or IV inspection is random selection. In this instance, there are no definite criteria that are used in the selection process. Selection is purely random.

The inspection process can be conducted either manually or electronically through the Aspen system. The roadside inspection processes for manual and electronic inspections are as follows.

Manual inspections are conducted using Form MSP-24-32, which is filled out by the inspector. After the inspector completes the inspection report, it is manually checked before the reports are sent to MSP-C.V.E.D. for processing in Safetynet.

The electronic inspection reports are entered at roadside workstations or laptops using the Aspen software. Inspectors use the Aspen software to enter the USDOT number or the ICC number. This information is used by the ISS to retrieve the carrier information. The carrier information provides a fitness value of the carrier along with demographic data for the carrier. Next, the "Driver" tab and the "Vehicle" tab details are filled in. Violations, if any, are checked. The "State" tab details are then completed. Finally, the inspections may be sent to SAFER or saved. A printed copy of the inspection report is given to the driver. The software does not allow the inspection process to be completed unless all mandatory fields are entered. The inspectors are recommended to post inspections that result in out-of-service (OOS) status immediately to SAFER.

During the inspection process, the inspector may find it valuable to use the ISS system in greater detail. The ISS system provides a comprehensive history of the carrier and other details, such as the vehicle OOS rate, driver OOS rate, safety fitness rating, inspections per power unit, inspections per driver, and total number of inspections. This information is updated weekly. Additional details on violations can also be accessed using ISS. The software highlights all potential problems with the carrier, making the inspection process easier for the inspector. If up-to-date information is required, the inspector can request an individual update through the SAFER system. The inspector may also use the Past Inspection Query (PIQ) to obtain detailed vehicle inspection information during the previous 45 days.

At the end of the day/next day, the inspection reports are uploaded to SAFER. The data entry supervisor at the C.V.E.D. office retrieves the inspection reports from SAFER via the Avalanche Blizzard router, which polls SAFER on an hourly basis.

4.0 ANALYSIS

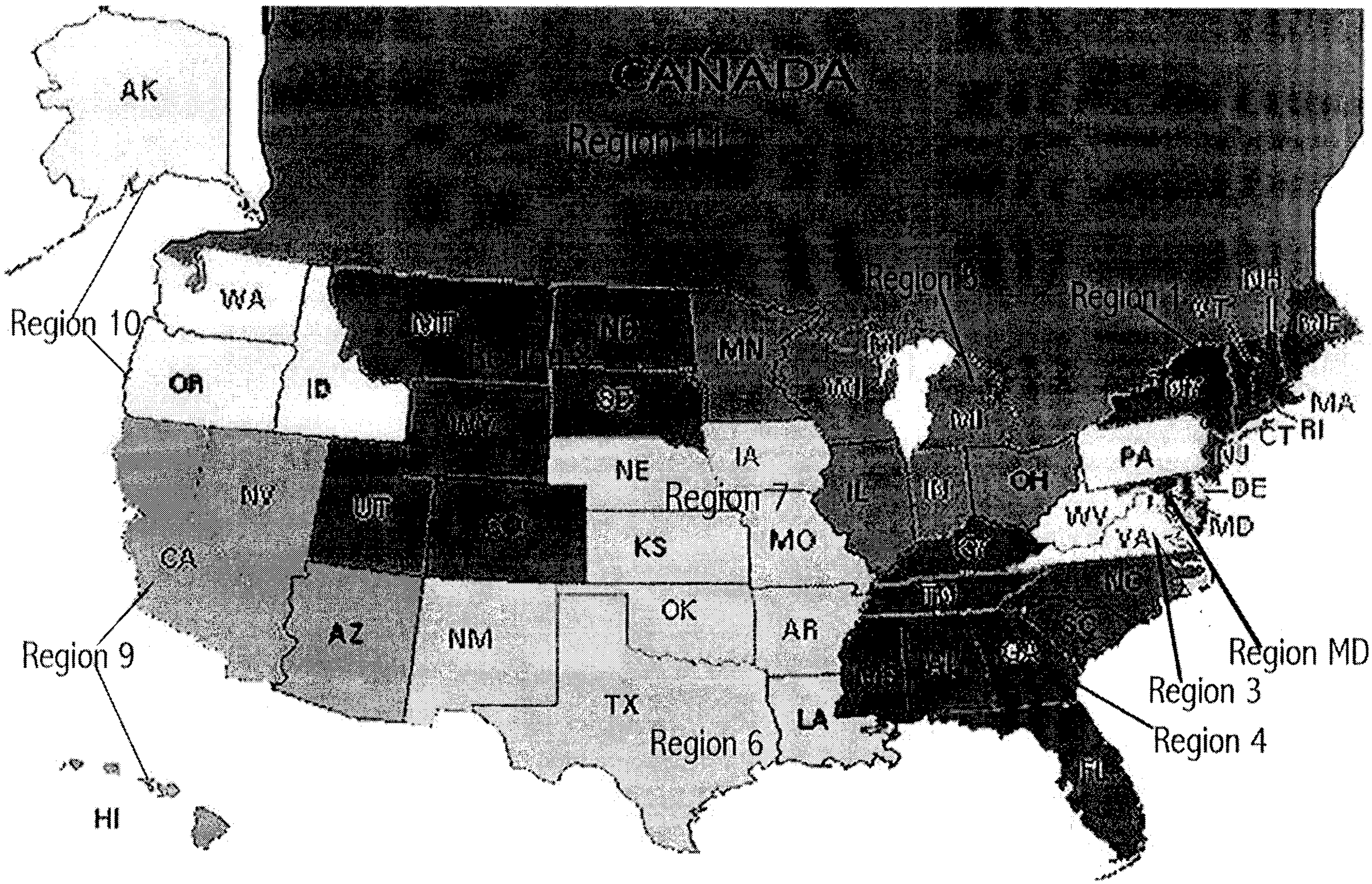
This section presents a detailed analysis and the safety profile for commercial vehicles traveling on I-95 southbound at the Perryville TWIS.

Analysis on the following is presented:

- distribution of commercial vehicles traveling in the scale lanes according to the carrier's base registration jurisdiction; furthermore, a similar distribution is presented for vehicles that do not have a USDOT/ICC number
- safety profile (distribution of ISS scores) for commercial vehicles and commercial carriers traveling on the scale lanes
- safety profile (distribution of ISS scores) for commercial vehicles that are inspected
- comparison of safety profile (ISS score distribution) of commercial vehicles for all inspections based on total violations and total OOS violations
- comparison of the average number of total violations and total OOS violations per inspection of commercial vehicles with and without a USDOT/ICC number

The carrier's base registration jurisdiction is determined by the state that appears on the tag plate on the tractor unit of a commercial vehicle. The analysis is based on the region numbers as defined by FHWA 49 CFR 301. However, because of the large volume of Maryland-based tag plates, Region 3 is separated into a region named "Region MD" (Maryland) and "Region 3 excluding MD." Figure 3 shows a pictorial mapping of these regions for the USA and Canada.

Figure 3: Mapping of FHWA Region Numbers (as Defined by 49 CFR 301) for USA and Canada



In certain instances, the USDOT or the ICC number for an observation is unavailable due to several factors. One possible factor could be that the USDOT/ICC number is not displayed on the power unit of the vehicle. It could also be possible that the number is displayed, but was not visible or that the data collector could not locate the USDOT/ICC number on the power unit. In all of these instances, an attempt is made to obtain the missing USDOT/ICC number from the following online sources: SAFER (http://www.safersys.org) and SafeStat (http://ai.volpe.dot.gov/SafeStat/SafeStatMain.asp?PageN=results). When a match of the carrier name, carrier city, and carrier state is found, the USDOT and/or ICC number returned by the data source is used for this analysis.

One of the factors that influences safety of a highway is the safety distribution of commercial vehicles traveling on that highway. Thus, it is important to study the ISS score distribution of vehicles traveling on a highway. However, ISS scores are based on the carrier history and safety performance, and the carrier is assigned an ISS score. Therefore, all vehicles belonging to a specific USDOT number will have the same ISS score. Hence, it is interesting to study the ISS score distribution of carriers traveling on a highway. It should be noted that the total number of commercial vehicles is equal to or greater than the number of commercial motor carriers traveling on a highway. This is because a carrier may have more than one vehicle passing on the scale lanes of the TWIS, or the same vehicle may travel more than once during the period of taking observations on those lanes. The ISS score distribution of a carrier is aggregated over the entire week, during which data are collected for the TWIS.

To study the effectiveness of the safety algorithm used to calculate the ISS score, a comparison of the ISS score distribution of vehicles that are subjected to an inspection is shown. This comparison is based on inspections that result in at least one violation (driver and/or vehicle) and inspections that do not result in any violation. A similar comparison is made for inspections that result in at least one

OOS violation (driver and/or vehicle) and inspections that do not result in any OOS violation.

To study the inspection results of commercial vehicles without USDOT/ICC numbers, the average number of total (driver and/or vehicle) violations and total OOS violations per inspection is obtained for the period from January 1 through July 14, 2000. These results are compared with similar results for inspections of vehicles with USDOT/ICC numbers.

4.1 PERRYVILLE

4.1.1 Schematic

Figure 4 shows the logical schematic of the Perryville TWIS located on southbound I-95 in Cecil County, Maryland. The main functions of the scale house are to weigh and inspect commercial vehicles over 10,000 pounds. This station has two lanes: both the lanes are equipped with a scale. Commercial vehicles that travel in the scale lanes are candidates for inspections. For safety considerations, commercial vehicles are allowed to travel in the mainline during periods of high traffic volume.

Figure 5 shows the total number of observations collected during the week of July 6-12, 2000. Section 3.1 describes the type of data collected for all commercial vehicles that travel on the scale lanes. Figures A.1 through A.6 in Appendix A provide detailed information on the number of observations collected in hourly time slots for the period of July 6-12, 2000. Appendix B gives the detailed schedule and comments for data collection activities.

Figure 4: Schematic Layout (Logical) of Perryville (I-95) Scale House

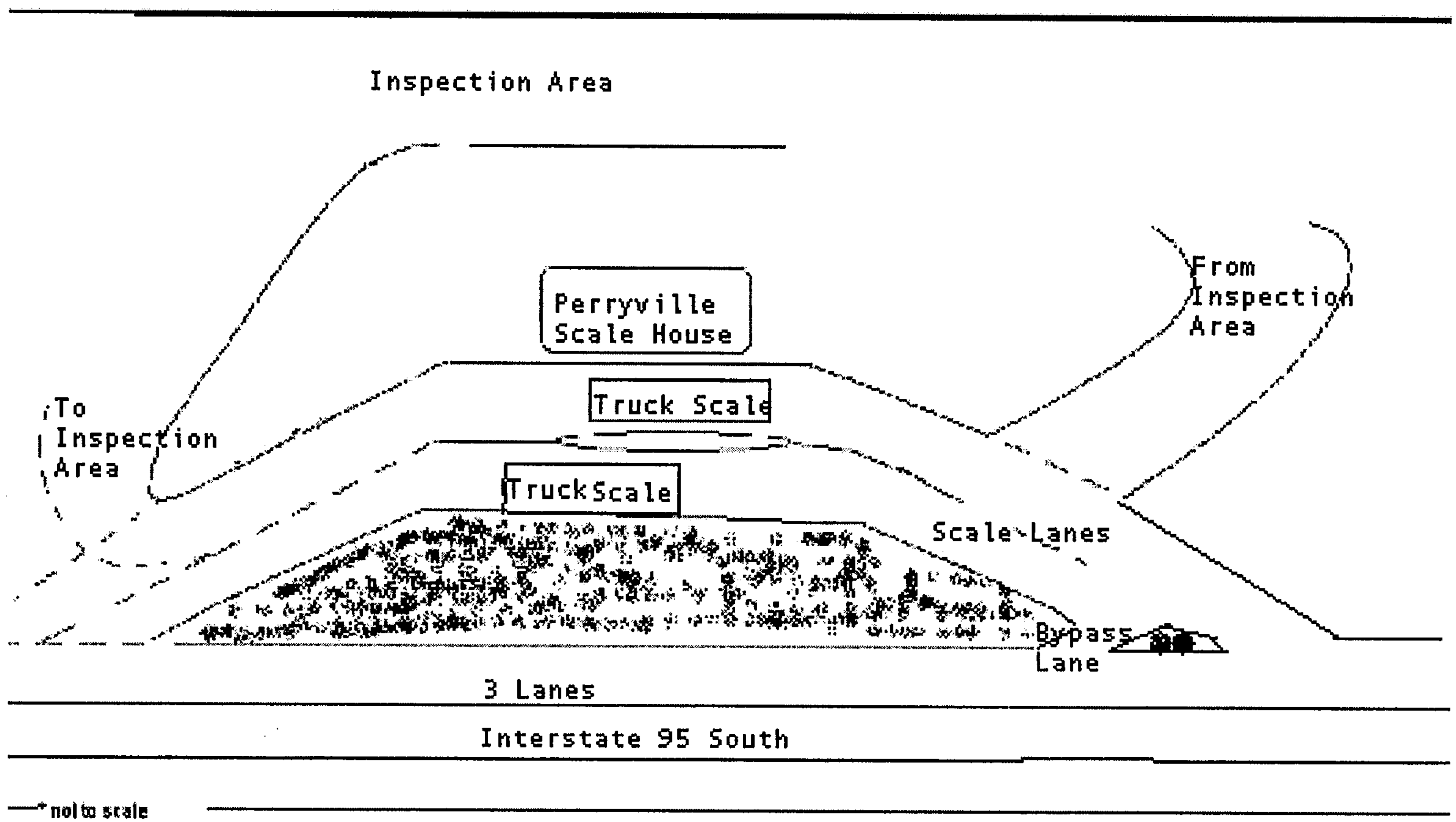
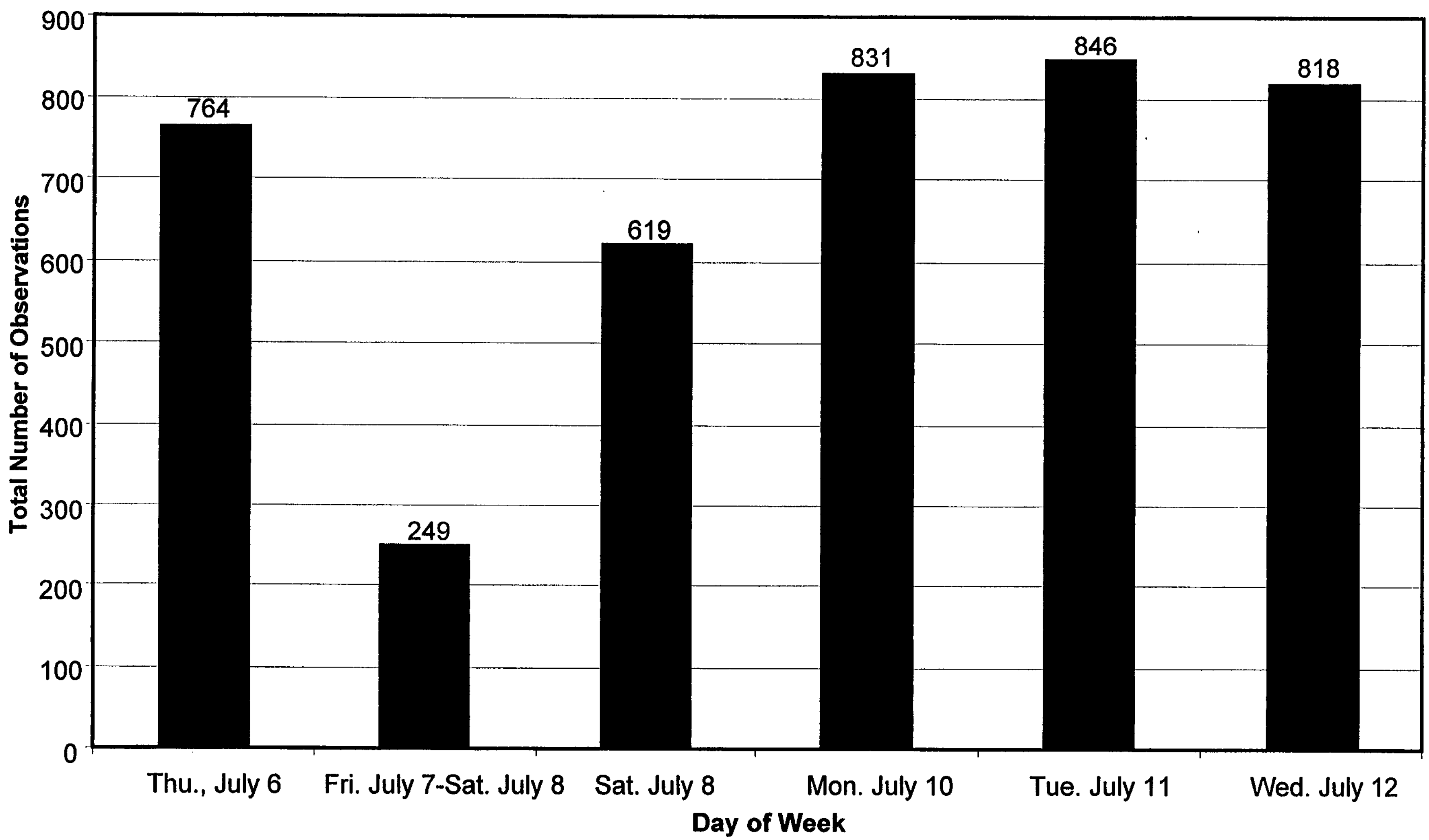


Figure 5: Number of Observations Collected at Perryville Scale House for the Period July 6 - July 12, 2000



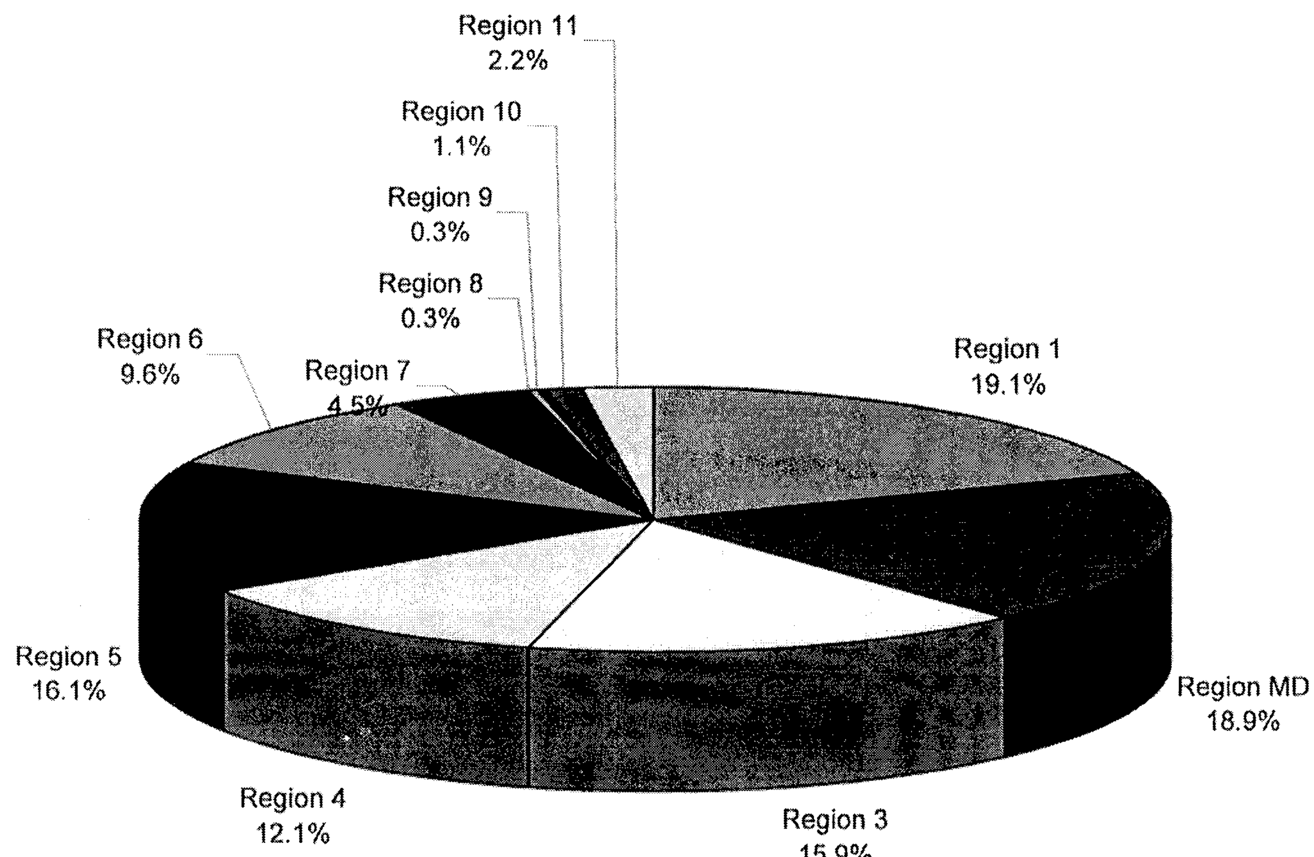
4.1.2 Carrier Base Jurisdiction Demographics

Figure 6 shows the distribution of commercial vehicles traveling on southbound I-95 during the period from July 6 through July 12, 2000, according to the carrier's base registration jurisdiction as defined in Section 4.0. The Perryville scale house is located in the I-95 southbound lane. I-95 runs from Florida to Maine. In Maryland, I-95 runs north-south through the following counties: Cecil, Harford, Baltimore, Baltimore City, Howard and Prince Georges. After leaving Maryland, I-95 south passes through Virginia, North Carolina, South Carolina, Georgia, and Florida. The northbound lane of I-95 passes through Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine. It is expected that the distribution of commercial vehicle traffic traveling through I-95 southbound at Perryville TWIS would be weighed more heavily toward regions that I-95 traverses. For the period of July 6-12, 2000, approximately 19% of the commercial vehicles traveling in the I-95 southbound lane are Maryland-based, whereas the surrounding states (Region 3, excluding Maryland) account for 16%. Northeastern states (Region 1) account for another 19% of the commercial vehicle traffic.

Figures 7, 8 and 9 show samples of the distribution of commercial vehicles according to the base registration jurisdiction of the carrier on a representative weekday, weeknight and weekend, respectively. Figures A.7 through A.12 show similar graphs for the period of July 6-12, 2000. The representative weekdays for this study are Thursday - July 6, Monday - July 10, Tuesday - July 11, and Wednesday - July 12, wherein the number of observations taken span a large part of the day. On the weeknight and weekend of this study, the percent of Maryland-based carriers traveling in the I-95 southbound lane at Perryville TWIS is lower than on representative weekdays.

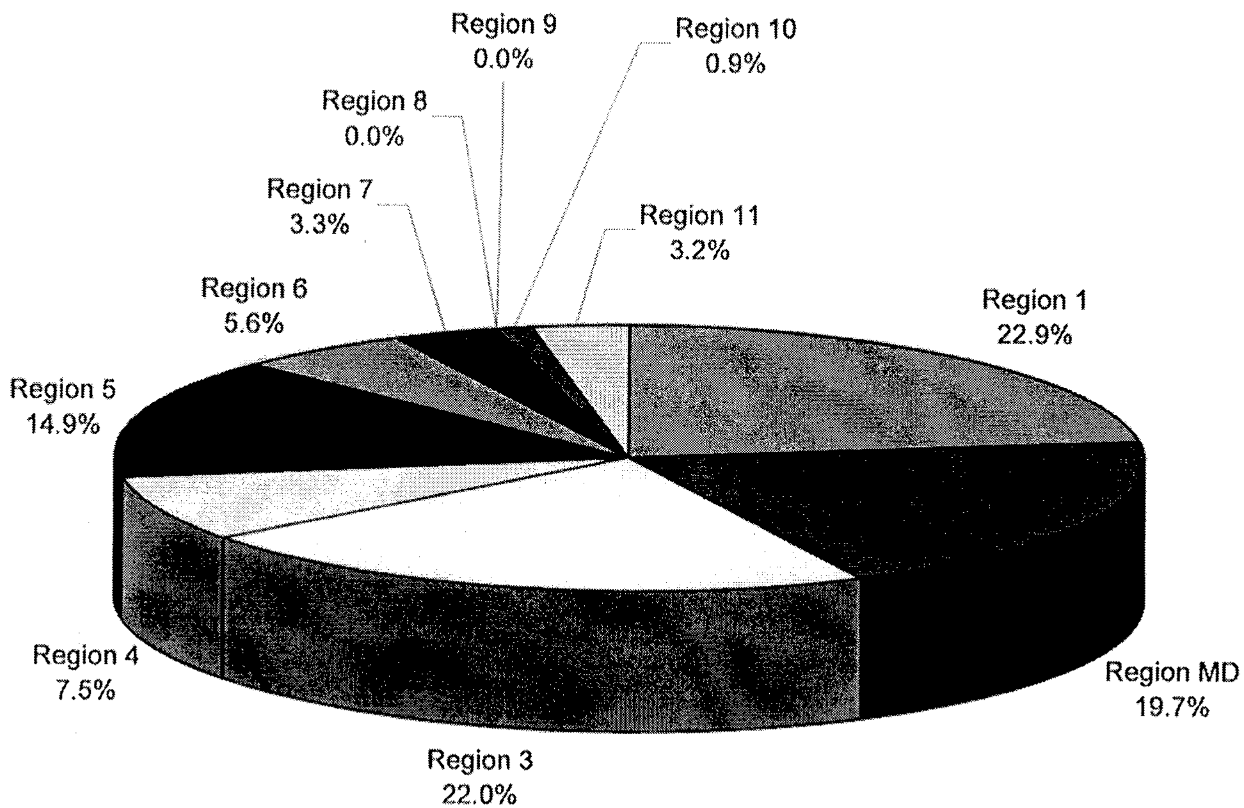
Figure 10 shows the distribution of commercial vehicles according to the base registration jurisdiction, as displayed on the tag for those vehicles where neither the USDOT nor the ICC number is available. Section 4.0 describes several reasons for the unavailability of these numbers. Approximately 27% of these vehicles are registered in the state of Maryland. One possible reason for a large percentage of Maryland-registered carriers may be that intrastate carriers are not required to obtain a USDOT/ICC number. However, it is beyond the scope of this study to distinguish between Maryland-based intrastate and interstate carriers. Another 28% of the vehicles without a USDOT/ICC number have tag plates from Region 1 (northeastern states). The neighboring states (Region 3, excluding Maryland) account for an additional 11% of such vehicles. Regions 5, 6, 4, and 7 account for another 11%, 11%, 4%, and 4% of commercial vehicles, respectively, where no USDOT/ICC number is available. It may be that these vehicles do not display the USDOT/ICC number on the power unit of the commercial vehicle, even though they may have a valid USDOT/ICC number. In all instances, an effort is made to obtain the USDOT/ICC number by searching appropriate databases using the carrier name, carrier city, and carrier state, as discussed in Section 4.0. When a match of the carrier name, carrier city, and carrier state is found, the USDOT and/or ICC number returned by the data source is used for this analysis.

Figure 6: Distribution of Commercial *Vehicles* According to the Carrier's Base Registration Region at Perryville Scale House from July 6 - 12, 2000



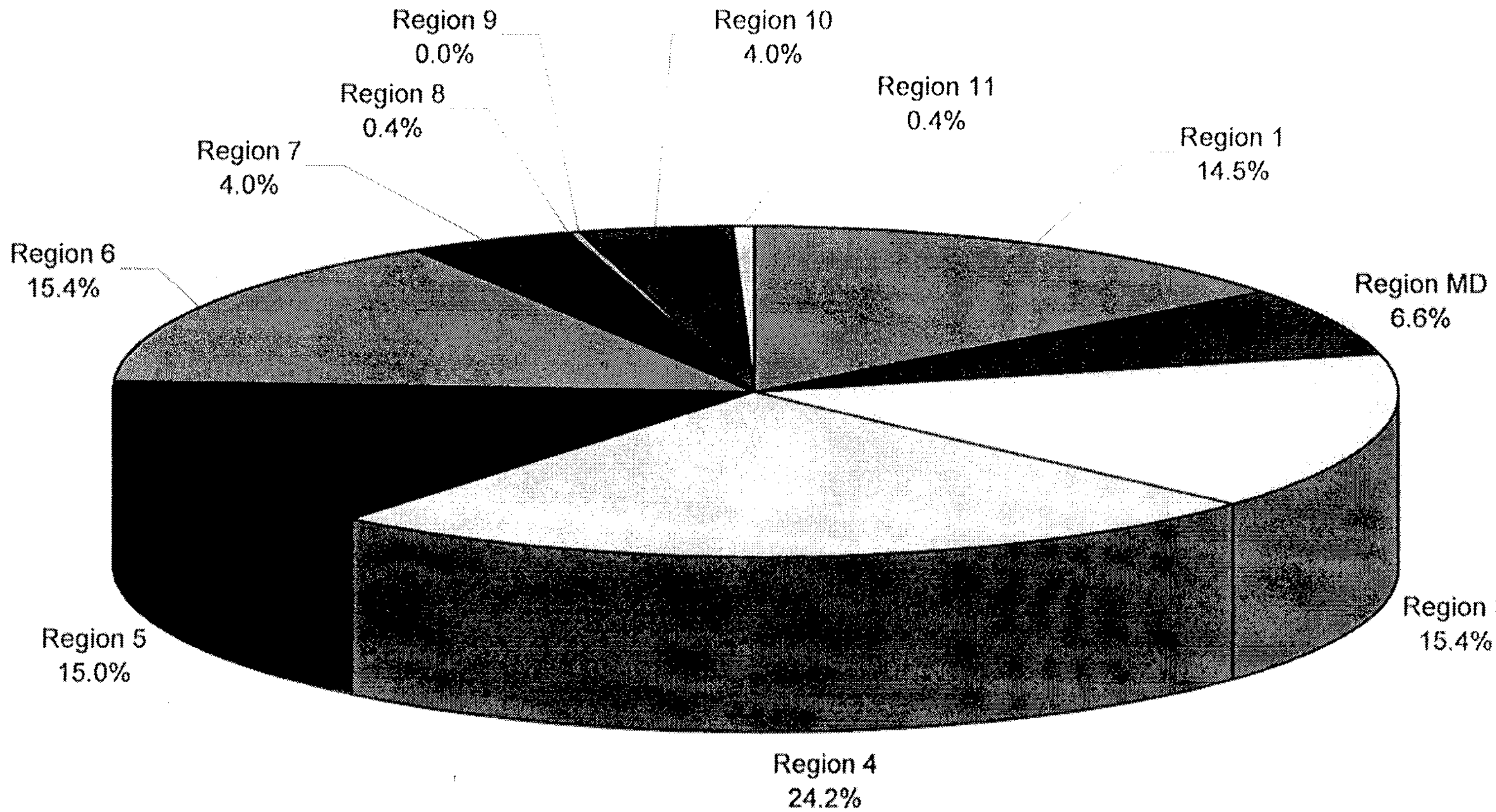
REGION 1 (CT, ME, MA, NH, NY, NJ, RI, VT, PR)
REGION MD (MD)
REGION 3 (DE, DC, PA, VA, WV) excluding MD
REGION 4 (AL, GA, FL, MS, NC, SC, TN, KY)
REGION 5 (IL, IN, MI, OH, MN, WI)
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

Figure 7: Distribution of Carriers According to Carrier's Base Registration Region at Perryville Scale House on Monday July 10, 2000



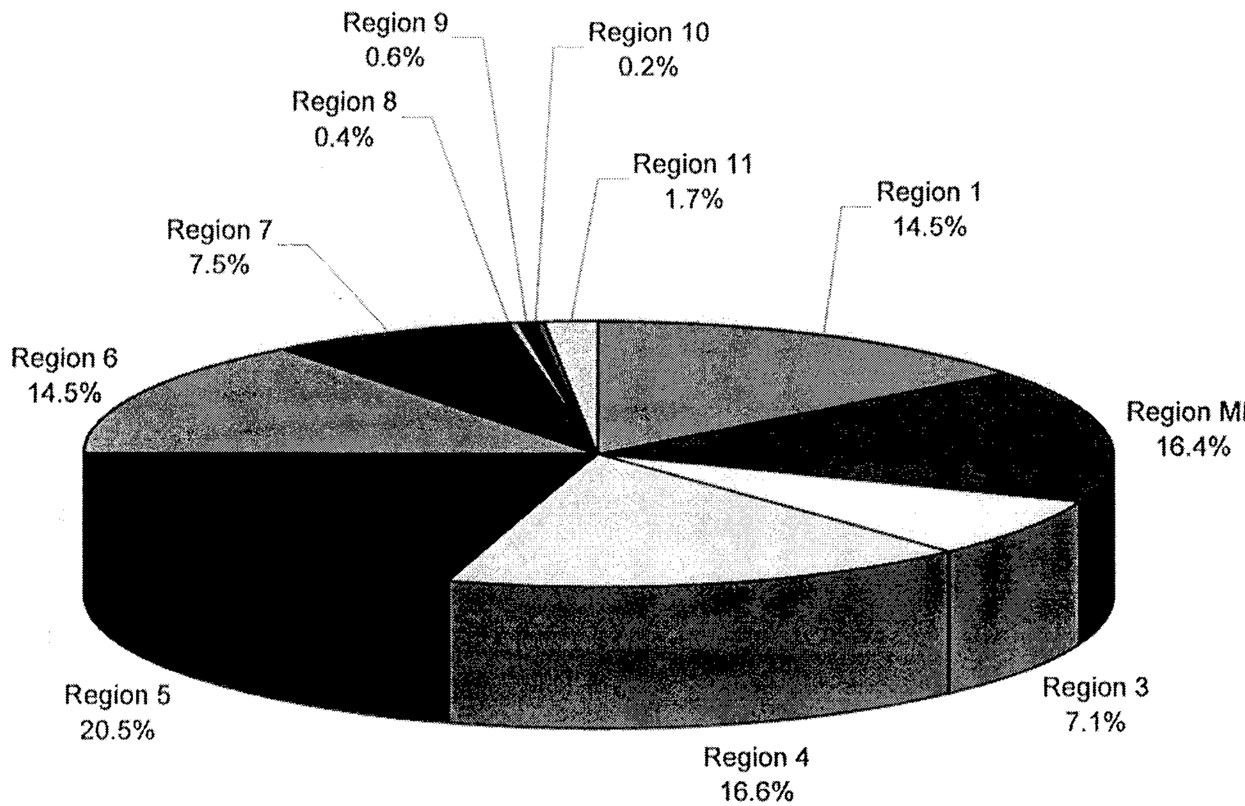
REGION 1 (CT, ME, MA, NH, NY, NJ, RI, VT, PR)
REGION MD (MD)
REGION 3 (DE, DC, PA, VA, WV) excluding MD
REGION 4 (AL, GA, FL, MS, NC, SC, TN, KY)
REGION 5 (IL, IN, MI, OH, MN, WI)
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

Figure 8: Distribution of Commercial Motor Vehicles According to the Carrier's Base Registration Region at Perryville Scale House on Fri. July 7 Night through Sat. July 8, 2000



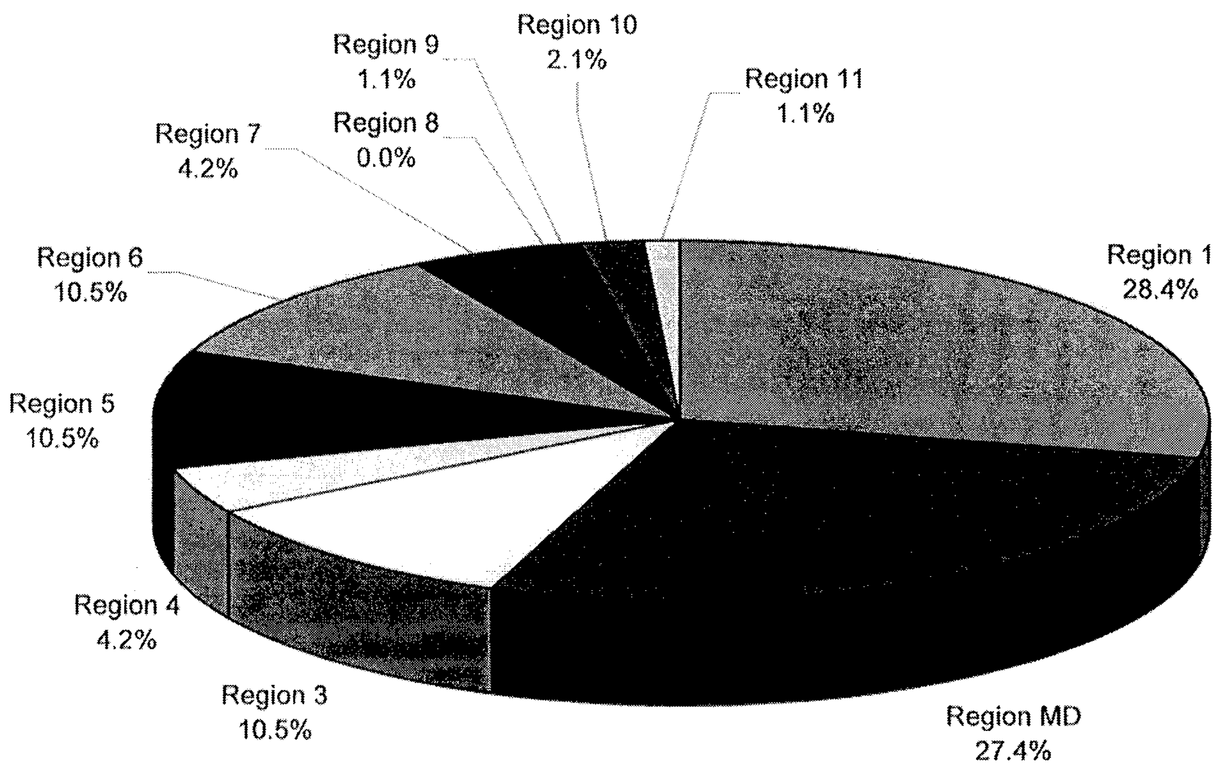
REGION 1 (CT, ME, MA, NH, NY, NJ, RI, VT, PR)
REGION MD (MD)
REGION 3 (DE, DC, PA, VA, WV) excluding MD
REGION 4 (AL, GA, FL, MS, NC, SC, TN, KY)
REGION 5 (IL, IN, MI, OH, MN, WI)
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

Figure 9: Distribution of Carriers According to Carrier's Base Registration Region at Perryville Scale House on Saturday July 8, 2000



REGION 1 (CT, ME, MA, NH, NY, NJ, RI, VT, PR)
REGION MD (MD)
REGION 3 (DE, DC, PA, VA, WV) excluding MD
REGION 4 (AL, GA, FL, MS, NC, SC, TN, KY)
REGION 5 (IL, IN, MI, OH, MN, WI)
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

Figure 10: Distribution of Commercial *Vehicles* with no USDOT/ICC Number Based on Regions at Perryville Scale House from July 6 - 12, 2000



REGION 1 (CT, ME, MA, NH, NY, NJ, RI, VT, PR)
REGION MD (MD)
REGION 3 (DE, DC, PA, VA, WV) excluding MD
REGION 4 (AL, GA, FL, MS, NC, SC, TN, KY)
REGION 5 (IL, IN, MI, OH, MN, WI)
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

4.1.3 Safety Profile of Commercial Vehicles and Carriers

Figure 11 shows the distribution of ISS scores of commercial vehicles traveling on I-95 southbound during the period from July 6 through July 12, 2000. Section 2.1 describes the ISS algorithm and interpretation of the ISS scores. Section 3.3 describes the methodology for obtaining the ISS scores. For the period of July 6-12, 2000, approximately 64% of the vehicles traveling in the I-95 southbound lane are recommended a "Pass" rating by the ISS algorithm. The ISS algorithm assigns an "Optional" rating to 20% of the vehicles, whereas 13% of the vehicles are recommended for inspection. Approximately 3% of the vehicles do not have a safety rating because the DOT/ICC number is unavailable. Section 4.0 describes several reasons for the unavailability of these numbers.

Figures 12, 13 and 14 show samples of the ISS score distribution of commercial vehicles on a representative weekday, weeknight, and a weekend respectively. Figures A.13 through A.18 show similar graphs for the period of July 6-12, 2000. The representative weekdays for this study are Thursday - July 6, Monday - July 10, Tuesday - July 11, and Wednesday- July 12, wherein the number of observations taken span a large part of the day. On the weeknight and weekend of this study, a higher percent of vehicles have a "Pass" rating, compared with representative weekdays, whereas a higher percent of vehicles have an "Inspect" rating on the weeknight. As shown in Figures 7 and 8, a higher volume of interstate traffic travels on weeknights when compared with weekdays. It is expected that interstate carriers are larger carriers and therefore have a better safety rating (results of previous studies are described in Section 2.2.1).

Figure 15 shows the distribution of ISS scores for commercial motor carriers traveling on I-95 southbound during the period from July 6 through July 12, 2000. Sections 4.0 and 3.3 describe the rationale and methodology for obtaining this data. For the period of July 6-12, 2000, approximately 51% of the carriers traveling in the I-95 southbound lane are recommended a "Pass" rating by the ISS algorithm. The ISS algorithm assigns an "Optional" rating to 23% of the carriers, whereas 17% of the carriers are recommended for inspection. Approximately 9% of the carriers did not have a safety rating because the DOT/ICC number is unavailable. In comparison with the ISS score distribution for vehicles (Figure 11) and carriers (Figure 15), a lower percent of the carriers, compared with vehicles, are assigned a "Pass" rating by the ISS algorithm. This is because, on average, larger carriers have a better safety profile (results of previous studies are described in Section 2.2.1). A higher percent of carriers have an "Inspect" rating, compared with vehicles. Carriers with no safety inspection history are assigned an "Inspect" rating by the algorithm.

Figure 11: Distribution of ISS Scores of Commercial *Vehicles* at Perryville Scale House from July 6 - 12, 2000

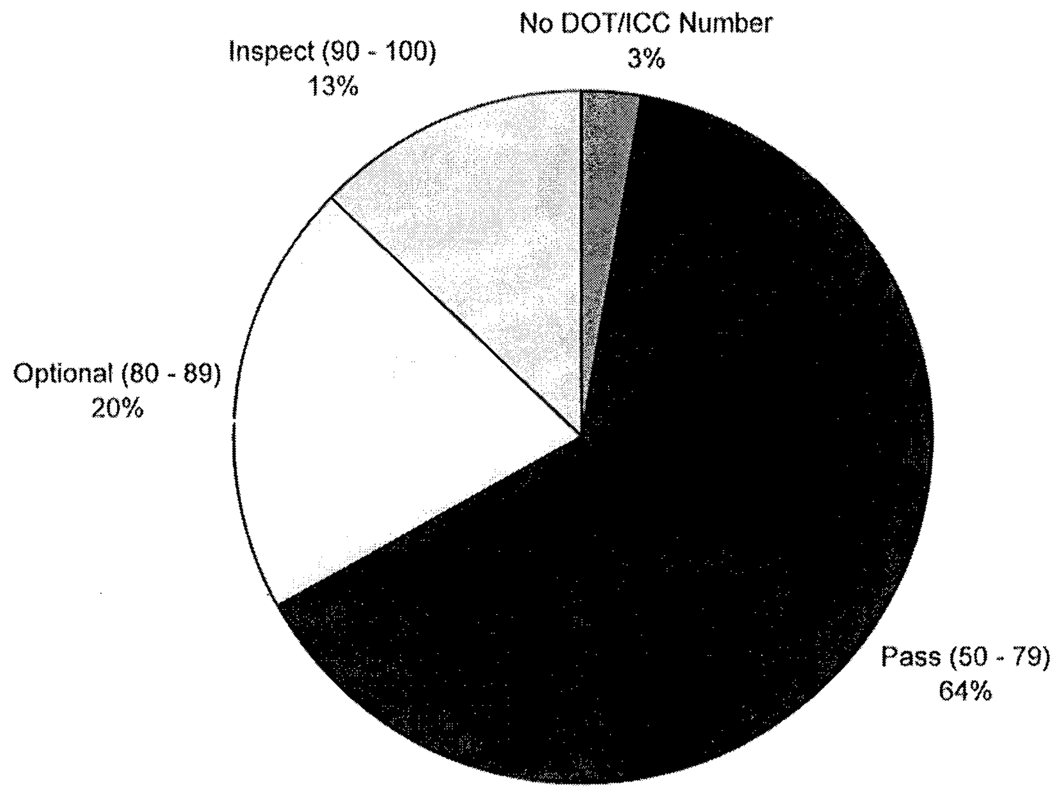


Figure 12: Distribution of ISS Scores of Commercial Vehicles at Perryville Scale House on Monday July 10, 2000

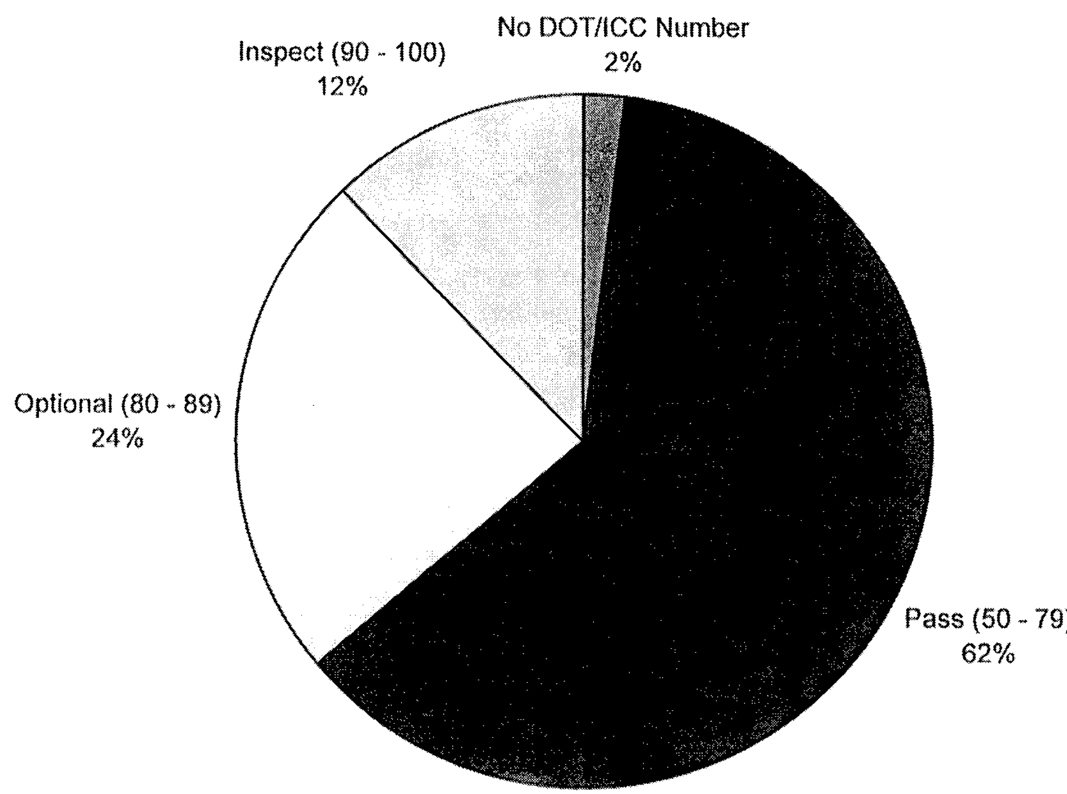


Figure 13: Distribution of ISS Scores of Commercial Vehicles at Perryville Scale House on Friday July 7 Night through Saturday July 8, 2000

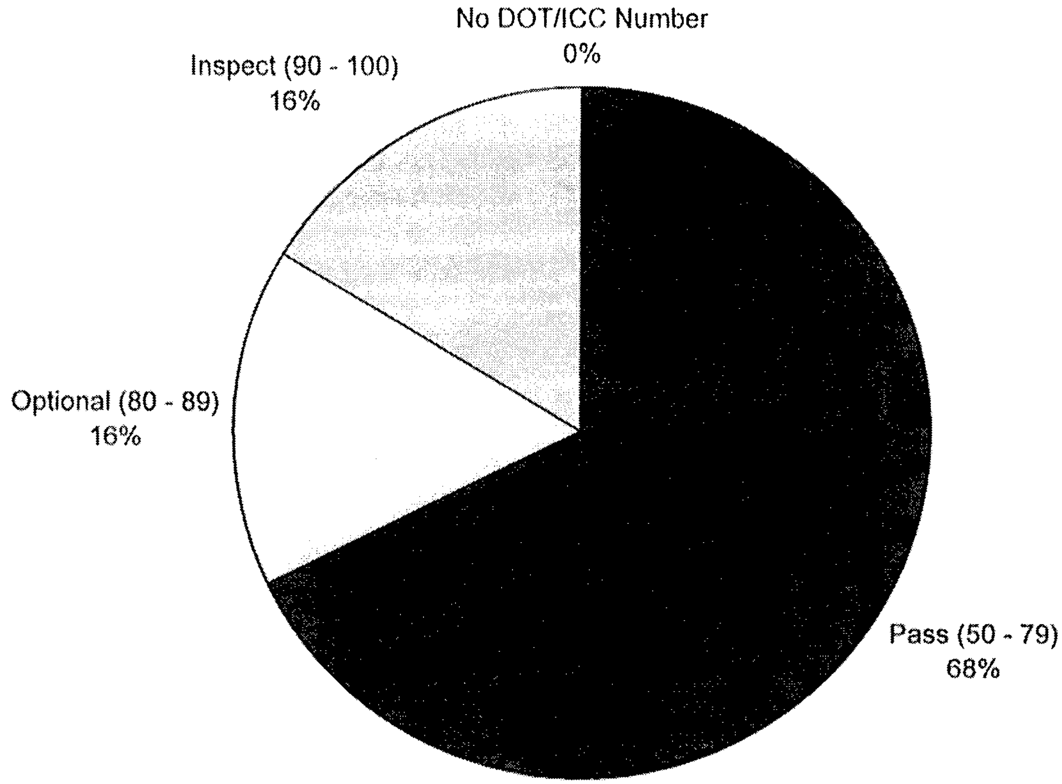


Figure 14: Distribution of ISS Scores of Commercial Vehicles at Perryville Scale House on Saturday July 8, 2000

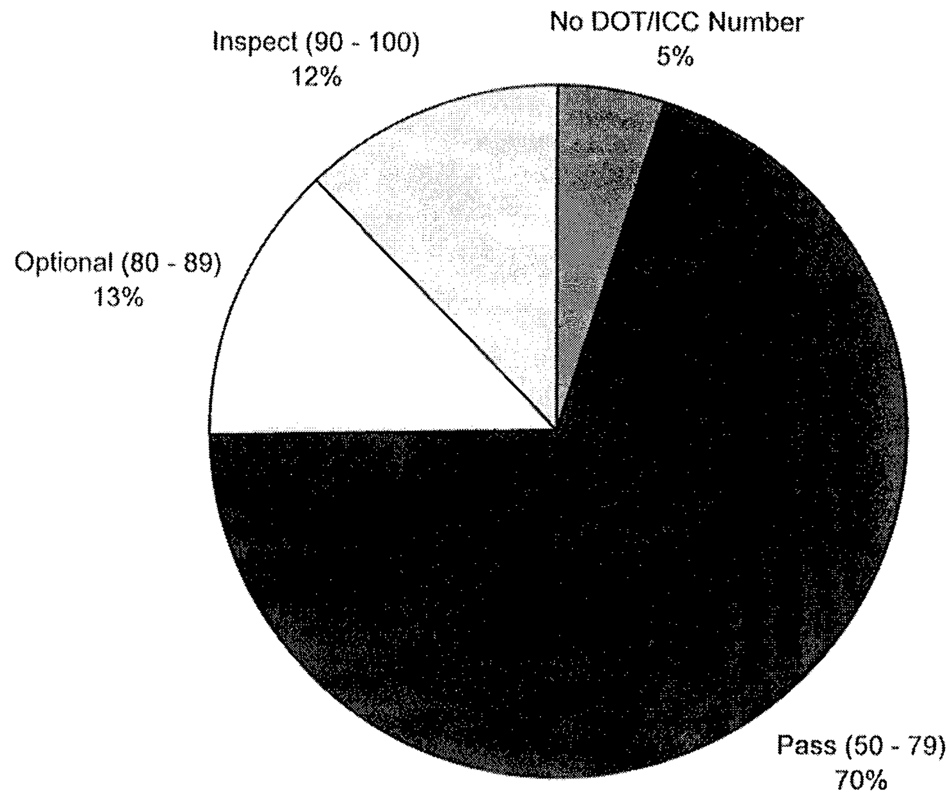
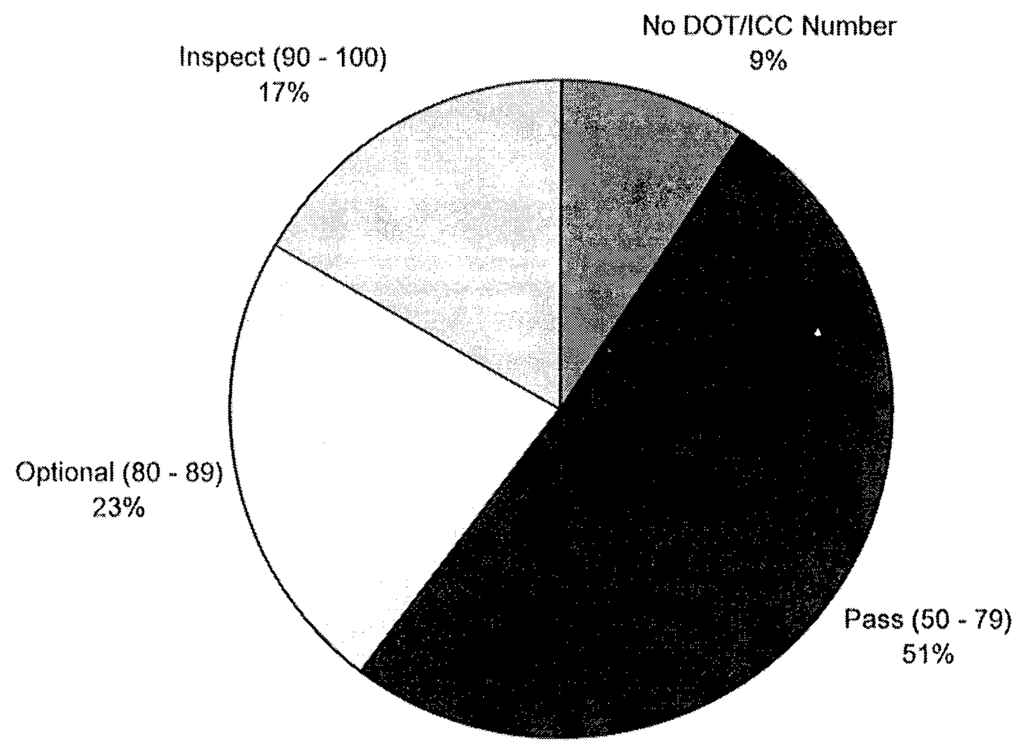


Figure 15: Distribution of ISS Scores for Commercial *Motor Carriers* at Perryville Scale House from July 6 - 12, 2000 (Total Vehicles: 4,134 Total Carriers: 2,208)

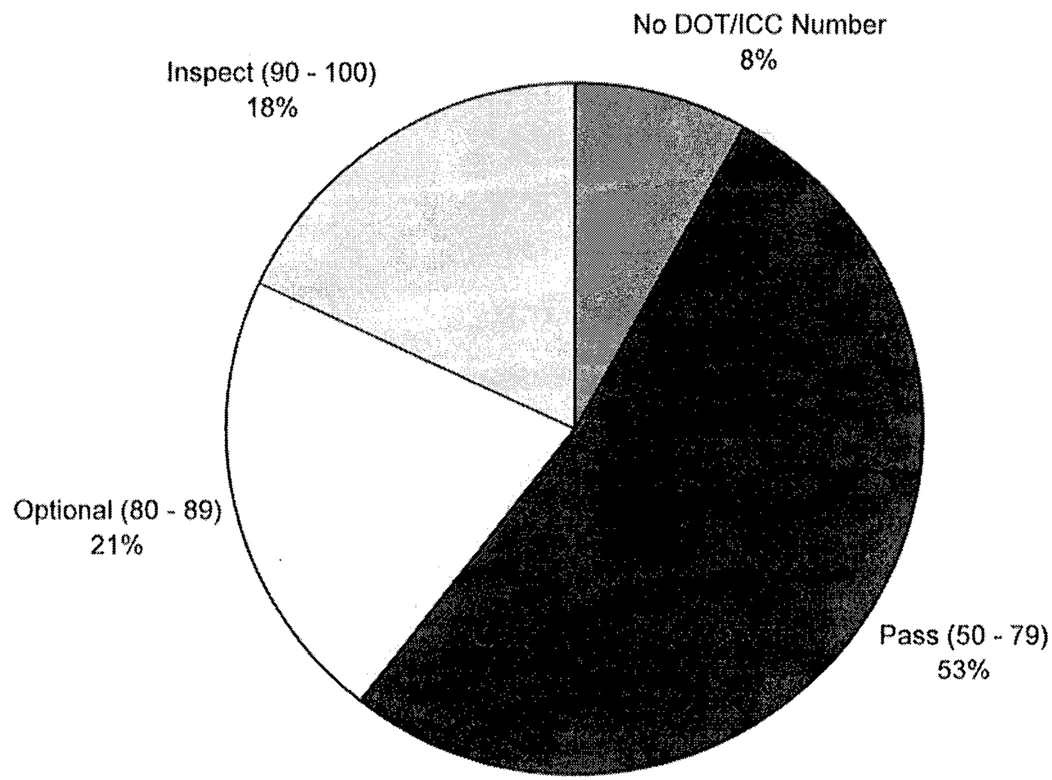


4.1.4 Safety Profile of Commercial Vehicles That Are Inspected

Figure 16 shows the distribution of ISS scores of commercial vehicles that are subjected to an inspection at the Perryville TWIS during the period from June 7 through July 14, 2000. Section 2.1 describes the ISS algorithm and interpretation of the ISS scores, whereas Section 3.3 describes the methodology for obtaining ISS scores. Section 3.2 gives the methodology of obtaining the inspection records of commercial vehicles inspected during the period from June 7 through July 14, 2000. For this period, approximately 53% of the vehicles inspected are recommended a "Pass" rating by the ISS algorithm. The ISS algorithm assigns an "Optional" rating to 21% of the vehicles, whereas 18% of the vehicles are recommended for inspection. Approximately 8% of the vehicles did not have a safety rating because the USDOT/ICC number is unavailable. Section 4.0 describes several reasons for the unavailability of these numbers.

The safety rating distribution of vehicles inspected during the period from June 7 through July 14, 2000 is not similar to the safety rating distribution of commercial vehicles traveling on I-95 southbound at Perryville during the period of July 6-12, 2000 (Figure 11). This may imply that vehicles are not selected at random for inspections at Perryville.

Figure 16: Distribution of ISS Scores for Inspections of Commercial *Vehicles* at Perryville Scale House Between June 7- July 14, 2000



4.1.5 Effectiveness of ISS Scores

To study the effectiveness of the safety algorithm used to calculate the ISS score, a comparison of the ISS score distribution of vehicles that are subjected to an inspection is shown. This comparison is based on inspections that result in at least one violation (driver and/or vehicle) and inspections that do not result in any violation. A similar comparison is made for inspections that result in at least one OOS violation (driver and/or vehicle) and inspections that do not result in any OOS violation.

Figure 17 shows the comparison of the ISS scores distribution for inspections of commercial vehicles based on violations between June 7 through July 14, 2000. Of the total of 603 vehicles that are inspected, 469 (78%) of the inspections resulted in the vehicle/driver being cited for one or more violations. The figure indicates that when an inspection is conducted and an "Inspect" rating is recommended by the ISS algorithm, a higher percentage of these inspections result in the vehicle/driver being cited for one or more violations. A chi-square test of independence indicates that there is less than a 6% probability that the ISS scores are independent of the inspection resulting in no violations or violation(s). This implies that our tests are inconclusive at the 5% significance level about the effectiveness of the ISS algorithm at the Perryville scale house in terms of identifying vehicle/drivers who are likely to be cited for one or more violations.

Figure 18 shows the comparison of the ISS scores distribution for inspections of commercial vehicles based on OOS violations between June 7 through July 14, 2000. Of a total of 603 vehicles that are inspected, only 197 (33%) of the inspections resulted in the vehicle/driver being placed OOS. This figure indicates that, when an inspection is conducted and the ISS algorithm recommends an "Inspect" rating, a higher percentage of these inspections result in the vehicle/driver being cited for one or more OOS violations. A chi-square test of independence indicates that there is less than a 1% probability that the ISS scores are independent of the inspection, thus resulting in no OOS violations or OOS violation(s). This implies that the ISS score is effective in terms of identifying vehicles/drivers that are more likely to be cited for one or more OOS violations.

Figure 17: Comparison of ISS Score Distribution for Inspections of Commercial *Vehicles* Based on Violations at Perryville Scale House Between June 7- July 14, 2000

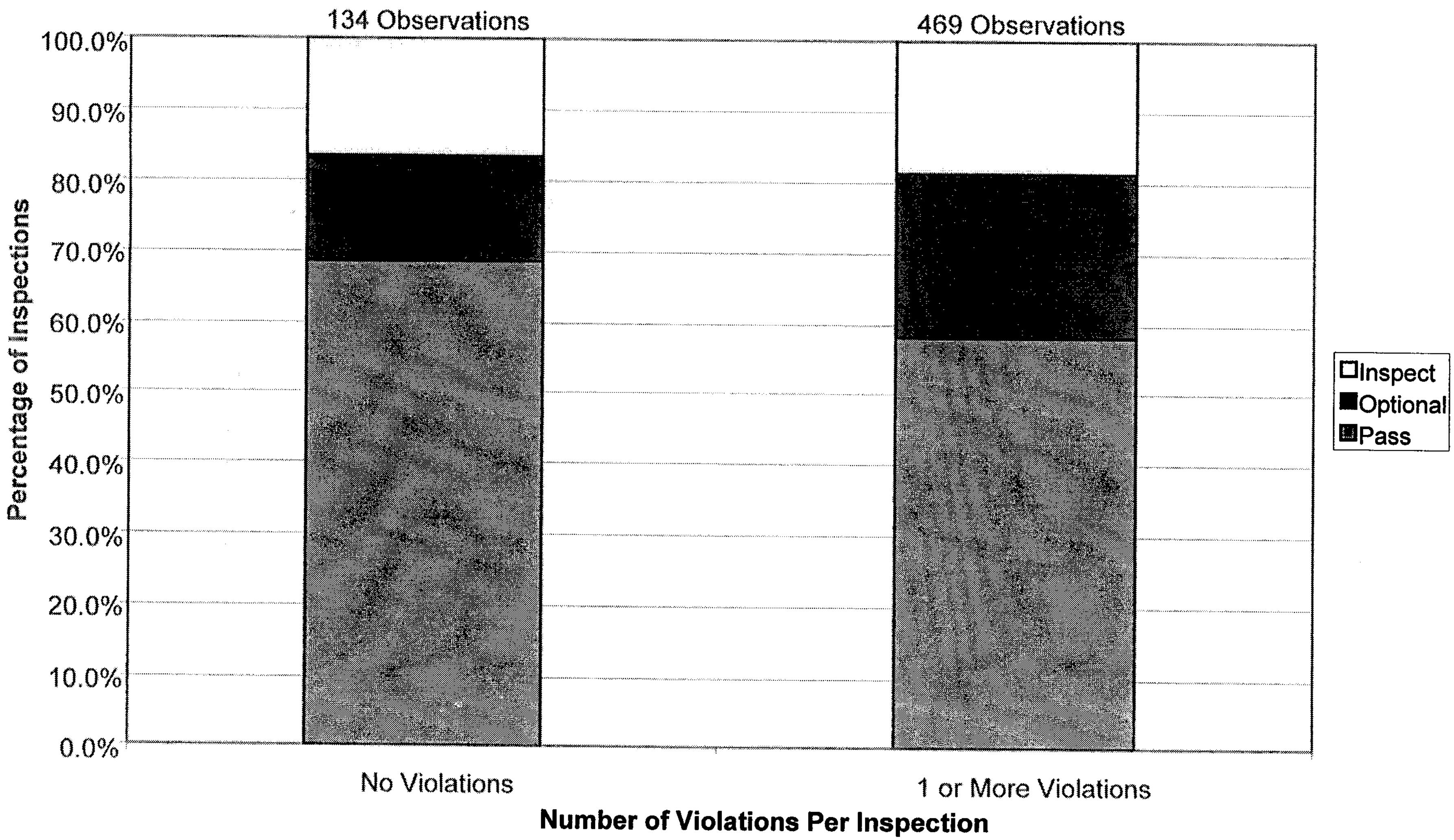
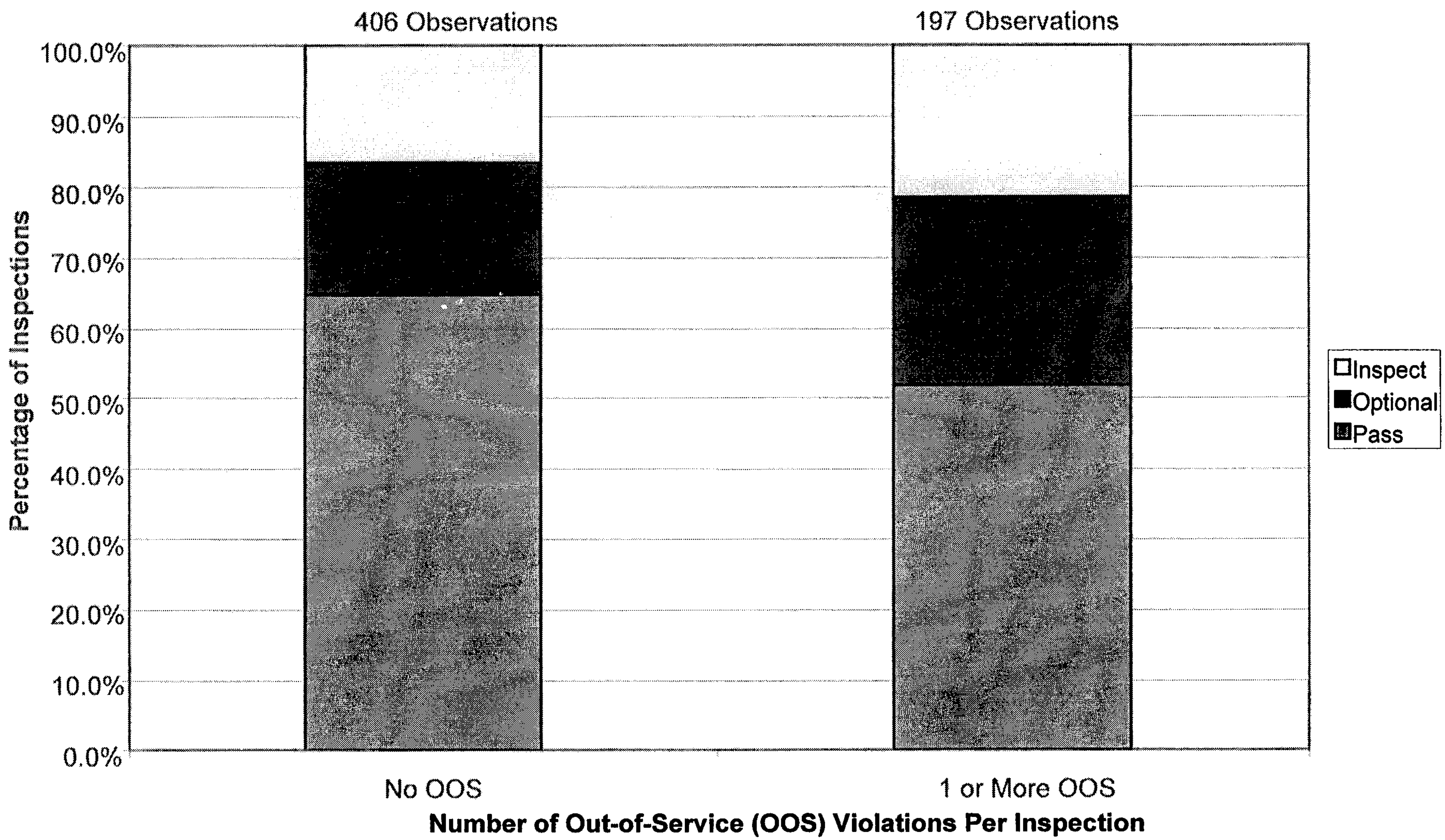


Figure 18: Comparison of ISS Score Distribution for Inspections of Commercial *Vehicles* Based on Out-of-Service (OOS) Violations at Perryville Scale House Between June 7 - July 14, 2000



4.1.6 Violations for Carriers with No USDOT/ICC Number (Perryville)

To study the inspection results of commercial vehicles without USDOT and/or ICC numbers, the average number of total (driver and/or vehicle) violations and total OOS violations per inspection is obtained for the period from January 1 through July 14, 2000. These results are compared with similar results for inspections of vehicles with USDOT/ICC numbers.

Figures 19 and 20 show a comparison of the average number of total violations and total OOS violations per inspection, respectively, of commercial vehicles with and without USDOT/ICC numbers. During the period from January 1 through July 14, 2000, data on a total of 5,225 inspections are obtained. Of these, 9% of the vehicles do not have a USDOT/ICC number.

As shown in Figure 19, on average, vehicles with no USDOT/ICC number (9% of all inspections) are cited for 2.8 violations, compared with 2.4 violations for vehicles with USDOT and/or ICC number (91% of all inspections). In other words, on average, vehicles without a USDOT/ICC number are cited more total violations, compared with vehicles with USDOT and/or ICC numbers.

A similar comparison for OOS violations is shown in Figure 20. On average, vehicles with no USDOT/ICC number are cited for 0.64 OOS violations, compared with 0.53 OOS violations for vehicles with USDOT and/or ICC numbers. On average, vehicles without a USDOT/ICC number are cited more times the total OOS violations, compared with vehicles with USDOT and/or ICC numbers.

Figure 19: Comparison of the Average Number of Violations per Inspection of Commercial *Vehicles* With and Without USDOT/ICC Numbers at Perryville Scale House Between January 1- July 14, 2000

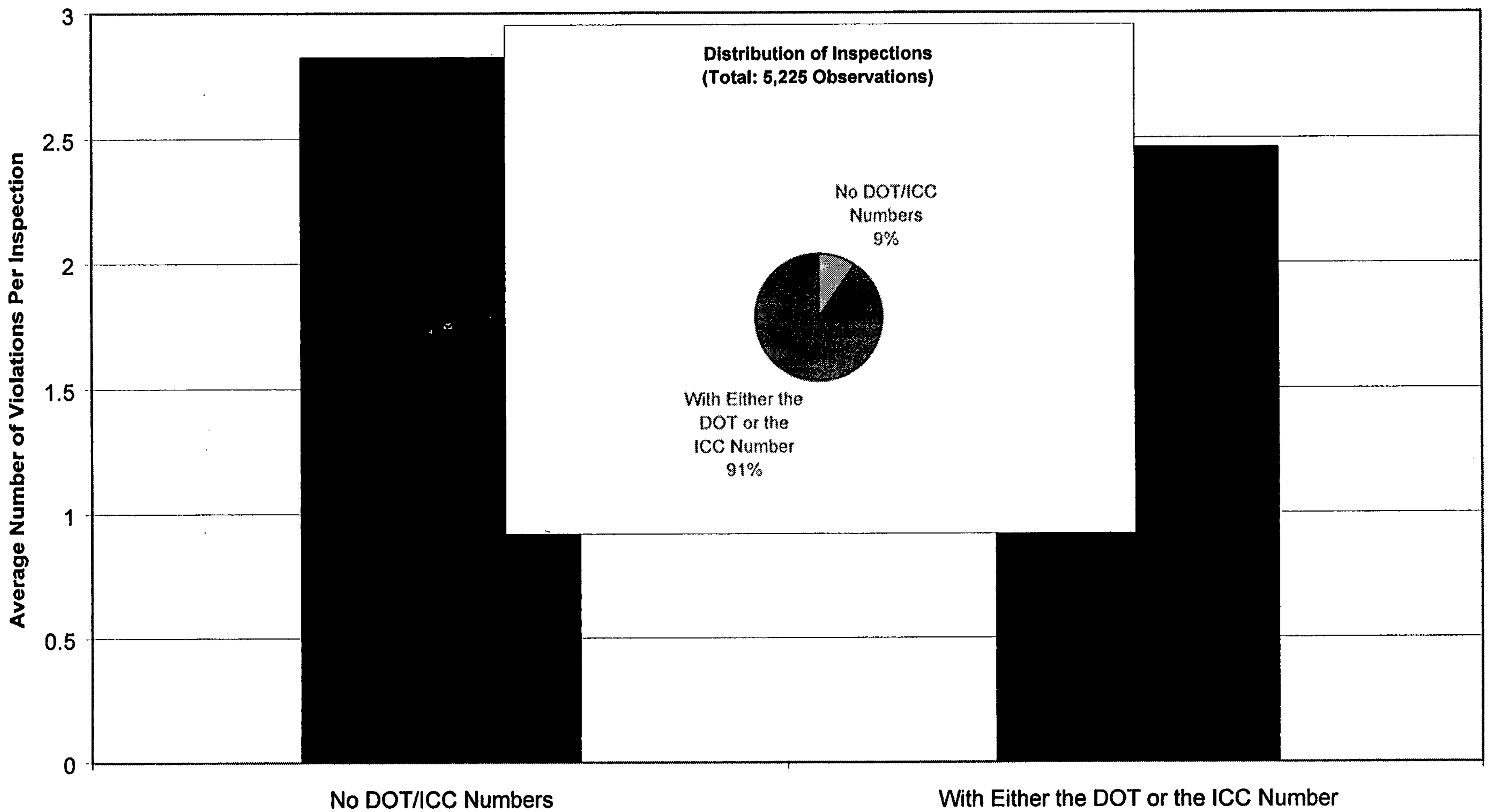
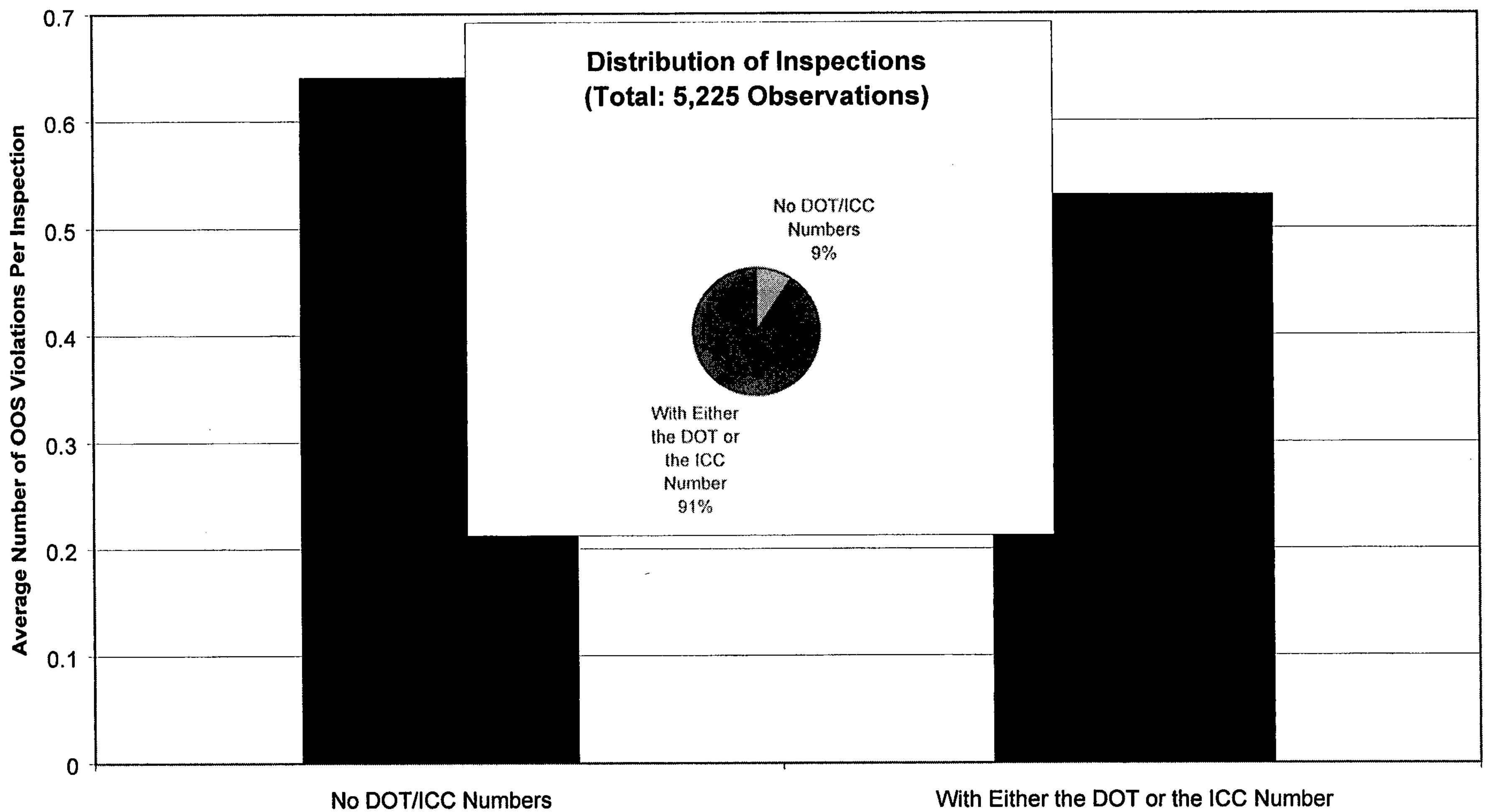


Figure 20: Comparison of the Average Number of Out-of-Service (OOS) Violations per Inspection of Commercial *Vehicles* With and Without USDOT/ICC Numbers at Perryville Scale House Between January 1- July 14, 2000



4.1.7 Violations for Carriers with No USDOT/ICC Number (Maryland)

Figures 21 and 22 show a comparison of the average number of total violations and total OOS violations per inspection, respectively, of commercial vehicles without and with USDOT/ICC number for all inspection facilities in Maryland. During the period from January 1 through July 14, 2000, data on a total of 53,031 inspections are obtained. Of these, 8% of the vehicles do not have a USDOT/ICC number.

As shown in Figure 21, on average, vehicles with no USDOT/ICC number (8% of all inspections) are cited for 2.9 violations, compared with 1.6 violations for vehicles with USDOT and/or ICC number (92% of all inspections). Therefore, on average, vehicles without a USDOT/ICC number are cited approximately two times the total violations, compared with vehicles with USDOT and/or ICC number.

A similar comparison for OOS violations is shown in Figure 22. On average, vehicles with no USDOT/ICC number are cited for 0.53 OOS violations, compared with 0.28 OOS violations for vehicles with USDOT/ICC number(s). In other words, on average, vehicles without a USDOT/ICC number are cited approximately two times the total OOS violations, compared with vehicles with USDOT and/or ICC numbers.

Figure 21: Comparison of the Average Number of Violations per Inspection of Commercial *Vehicles* With and Without USDOT/ICC Numbers for All Inspections in Maryland Between January 1- July 14, 2000

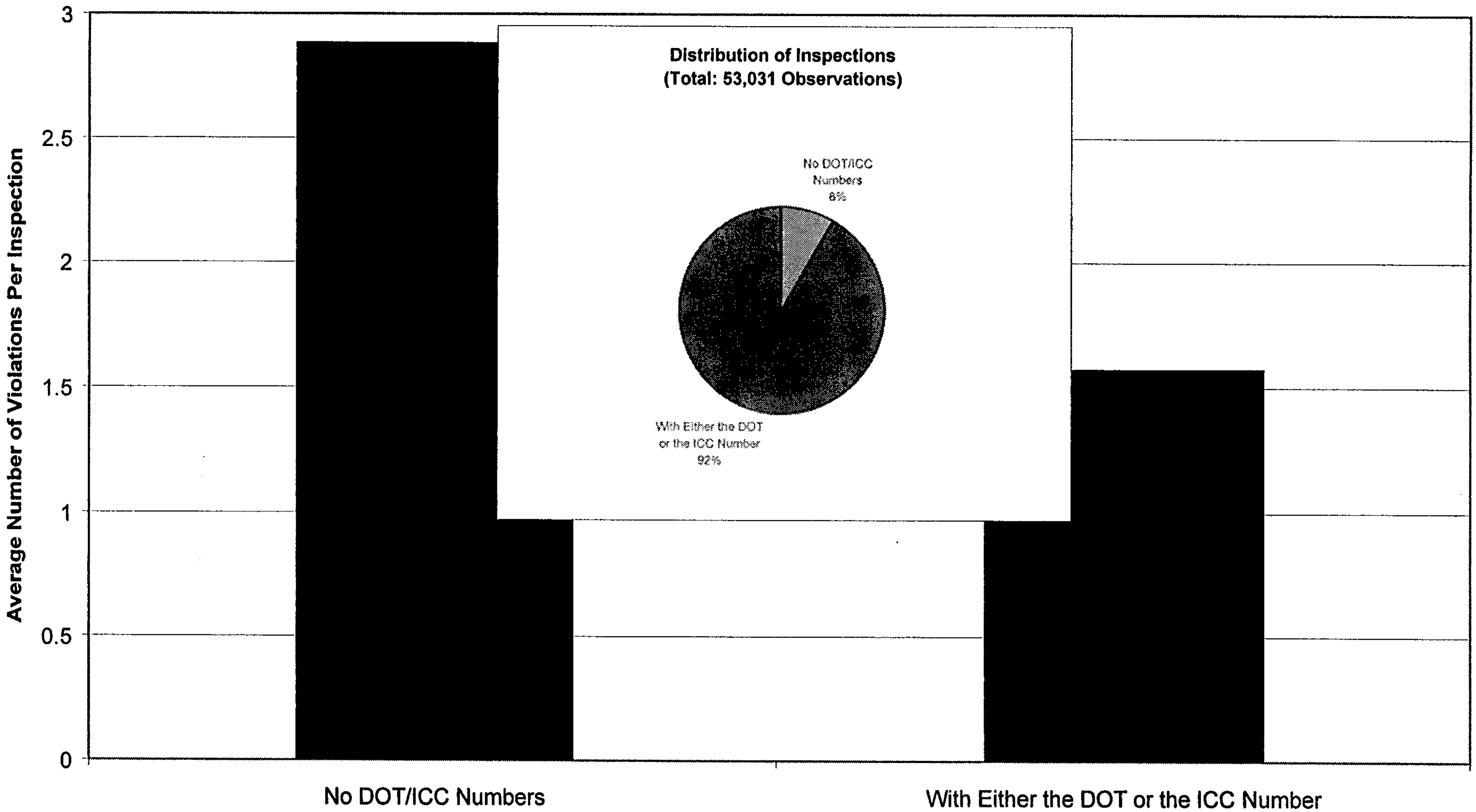
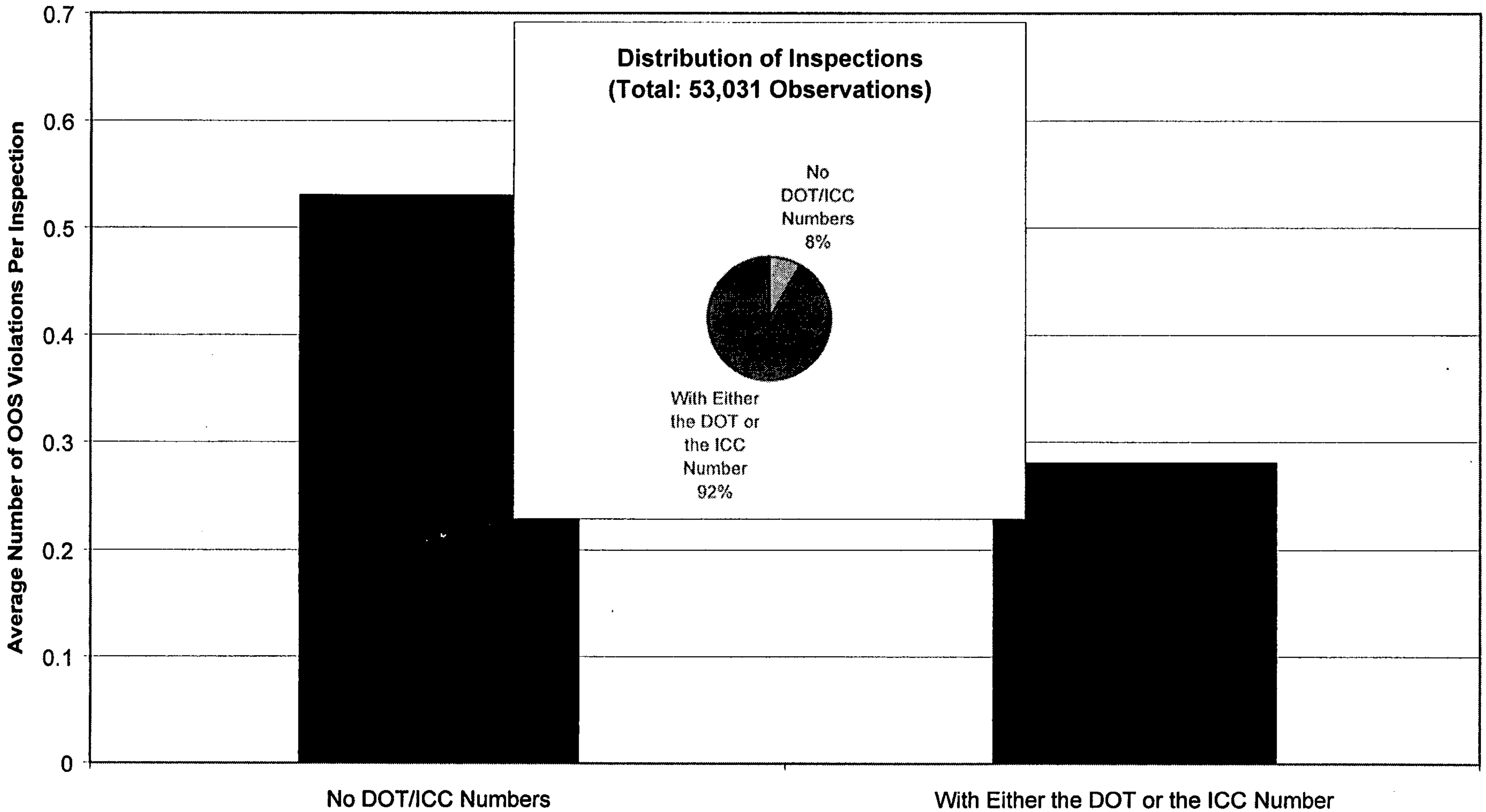


Figure 22: Comparison of the Average Number of Out-of-Service (OOS) Violations per Inspection of Commercial *Vehicles* With and Without USDOT/ICC Numbers for All Inspections in Maryland Between January 1- July 14, 2000



5.0 CONCLUSION

This study establishes the baseline for determining the effectiveness of CVISN with respect to the selection of commercial vehicles for inspection. To establish the baseline, readings and observation were taken at the Perryville scale house on I-95 in Maryland under the jurisdiction of Maryland Transportation Authority Police.

The distribution of ISS scores of commercial vehicles at the scale houses is shown in Figure 11. Currently, approximately 64% of the vehicles traveling at these scale houses are recommended a "Pass" rating by the ISS algorithm. The ISS algorithm assigns an "Optional" rating to 20% of the vehicles, whereas 13% of the vehicles are recommended for inspection. Approximately 3% of the vehicles do not have a safety rating because the DOT/ICC number is unavailable. This study has shown that the ISS algorithm is effective in identifying vehicles/drivers that are more likely to be placed out-of-service. However, the results of this study are inconclusive in determining the effectiveness of the ISS algorithm in identifying vehicles/drivers that are more likely to be cited for violations. Section 2.1 gives the interpretation of these safety ratings assigned by the ISS algorithm.

This study has shown that the ISS algorithm is partially effective in identifying vehicles/drivers that are more likely to be cited for violations and/or are more likely to be placed out-of-service. The ISS algorithm also provides the history of past inspections of the carriers vehicles, and drivers. Currently, a majority of the scale houses have access to the ISS recommendations. Hence, whenever possible, it is recommended that inspectors use systems that provide the ISS ratings rather than randomly selecting vehicles for inspections.

The current safety algorithms like ISS and SafeStat evaluate the safety ratings of a vehicle/driver combination based on the aggregate safety rating of the carrier. However, in reality, carriers with good safety ratings may have a few unsafe vehicles and/or drivers. These vehicles and drivers may be allowed to bypass at mainline speeds thus endangering the safety on highways. During the developmental stages of the ISS and the SafeStat algorithm, it was feasible to visually identify a vehicle and/or driver only through the USDOT/ICC number. However, current technologies enable the identification of individual vehicles and/or drivers. Research needs to be directed toward developing safety algorithms that incorporate the safety ratings based on individual vehicles and drivers rather than the aggregate ratings of vehicles and drivers affiliated to a carrier.

Future research on the safety component of CVISN should be directed toward discerning patterns between types of violations and the safety profile of carriers based on vehicle/driver combination. A study on the frequency of various violations would help in identifying specific violations that may be correlated with the safety ratings and/or accident frequency of a carrier. This would help fine tune the selection criteria for identifying unsafe vehicles/drivers.

Once CVISN is operational and the highways are equipped with WIMs, it is expected that transponder equipped vehicles will be screened at mainline speeds by the ISS/ISS-2 algorithm. The carriers that have good past safety performance will generally be allowed to bypass the scale houses at mainline speeds. These carriers will accrue cost savings and travel time benefits. However, as a deterrent, vehicles of carriers with good ratings will be randomly selected to enter the scale house. Based on the availability of resources, vehicles of carriers with marginal safety ratings may be required to enter the scale house. Vehicles of carriers with poor safety ratings and vehicles that are not equipped with transponders will be required to enter the scale house.

This implies that not all vehicles will be required to enter the scale house thereby facilitating efficient and effective use of limited inspection personnel and resources. It is expected that the safety profile of vehicles that will enter the scale house, once CVISN is operational, will be different compared to the safety profile of the population of vehicles reported in this study. It is hypothesized that when CVISN is operational, a larger percentage of vehicles with marginal and poor ratings will enter the scale house. Hence, it may be necessary to increase the availability of resources during the initial operational stages of CVISN. This increase of resources may serve to motivate commercial motor carriers with marginal or poor safety ratings to improve their safety performance.

This study has shown that commercial vehicles with no USDOT and ICC numbers are more likely to be cited for violations or to be placed out-of-service. Hence, it is recommended that inspectors closely examine vehicles that have neither the USDOT nor the ICC number.

The total volume of commercial vehicle traffic and the volume of vehicles bypassing the scale houses will aid in the optimal use of available personnel. The state agencies will need to install appropriate counting devices on major highways to periodically collect this type of data. These data will assist policymakers to reallocate and/or increase the inspection personnel and resources.

Demographic information on the base registration jurisdiction of the vehicles traveling on a highway is found to be consistent with the location and the time and day of the week. More out-of-state carriers traveled on I-95 at the Perryville TWIS during the night and weekends. Demographic information on the base registration jurisdiction of the vehicles with no visible USDOT and ICC number is also provided. At this TWIS, which is close to the Maryland border, the majority of these vehicles are from other states. As noted earlier, commercial vehicles with no USDOT and ICC numbers are significantly more likely to be cited for violations or to be placed out-of-service. Hence, it is strongly recommended that inspectors closely examine out-of-state vehicles that have neither the USDOT nor the ICC number, specifically at Maryland scale houses located on highways bordering neighboring states.

Data on inspections and safety profiles of commercial vehicles that are collected by the CVISN system can be used to report, evaluate, and make policy decisions. For example, to improve effectiveness, law enforcement agencies can study the changes in traffic volume patterns and safety profiles of commercial vehicles to reallocate resources. These tasks can be automated and a decision support system can be incorporated in the overall architecture and design of the CVISN system. It is recommended that these types of reports be available to other stakeholders also. For example, commercial motor carriers can improve their efficiencies by scheduling their travel on specific highways based on the traffic volume patterns.

Another use of the decision support system could be to dynamically change the safety algorithms for the selection of motor carriers. Although, the current safety rating algorithms are partially effective, changes in the safety characteristics and behavior of carriers may change in response to the implementation of CVISN. This will necessitate fine tuning of the safety algorithms for them to be more effective in identifying unsafe and illegal carriers. The decision support system should be equipped with reporting capabilities that would alert the appropriate regulatory agencies on changes in the safety profile of commercial motor carriers.

In conclusion, the results of this study will help in evaluating CVISN in terms of increased safety due to the identification of unsafe and non-compliant carriers, and increased efficiencies in terms of time and cost savings to safe and compliant carriers. This report, based on the detailed analysis of the data collected, will enable policymakers and commercial vehicle administrators to objectively assess the outcomes of the safety components of CVISN. This study will also assist architects of the CVISN to design and benchmark the system to satisfy the needs of all stakeholders.

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ACRONYMS

C	
CR	Compliance Rating
CVED	Commercial Vehicle Enforcement Division
CVIEW	Commercial Vehicle Information Exchange Window
CVISN	Commercial Vehicle Information System and Network
CVO	Commercial Vehicle Operation
E	
EDI	Electronic Data Interchange
F	
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulations
I	
ICC	Interstate Commerce Commission
IFTA	International Fuel Tax Agreement
ISS	Inspection Selection System
ITS	Intelligent Transportation Systems
ITS/CVO	Intelligent Transportation System/Commercial Vehicle Operations
M	
MCMIS	Motor Carrier Management Information Systems
MCSIP	Motor Carrier Safety Improvement Process
MDOT	Maryland Department of Transportation
MdTAP	Maryland Transportation Authority Police
MSP	Maryland State Police
MSP-C.V.E.D	Maryland State Police-Commercial Vehicle Enforcement Division
O	
OMC	Office of Motor Carrier
OOS	Out-of-Service
P	
PIQ	Past Inspection Query
PRISM	Performance and Registration Information Systems Management
R	
ROC	Roadside Operations Computer

S

SAFER	Safety and Fitness Electronic Record System
SafeStat	Safety Status Measurement System
SCAPI	Safer and CVIEW Application Programming Interface
SEA	Safety Evaluation Areas
SF	Safety Fitness
SIE	Safety Information Exchange

T

TWIS	Truck Weigh and Inspection Station

U

USDOT	United States Department of Transportation

W

WIM	Weigh-in-Motion

APPENDIX A

FIGURES FOR PERRYVILLE

Figure A.1: Number of Commercial *Vehicles* Weighed on the Scale Lane at Perryville Scale House on Thursday July 6, 2000

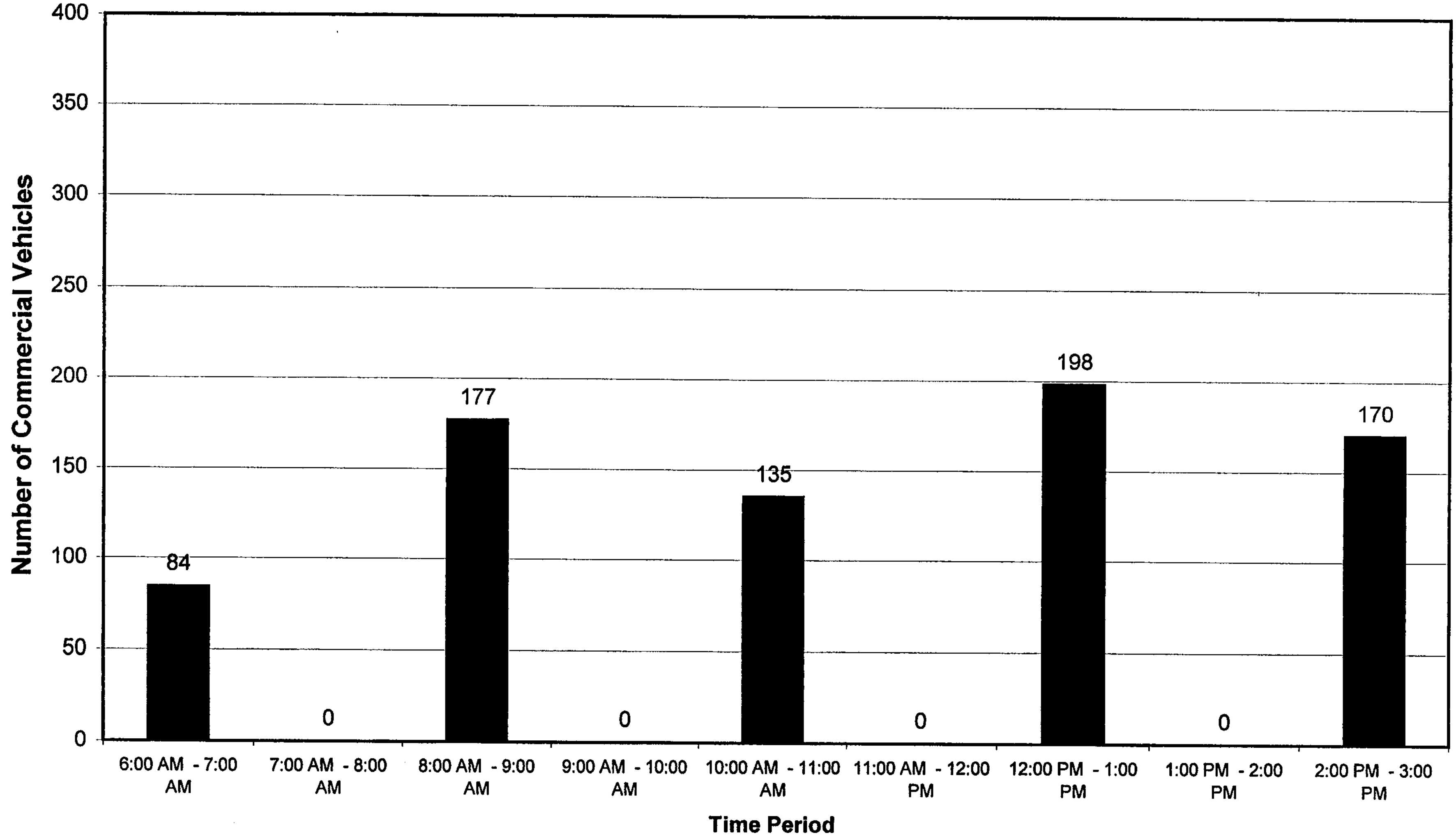


Figure A.2: Number of Commercial *Vehicles* Weighed on the Scale Lane at Perryville Scale House on Friday July 7 Night through Saturday July 8, 2000

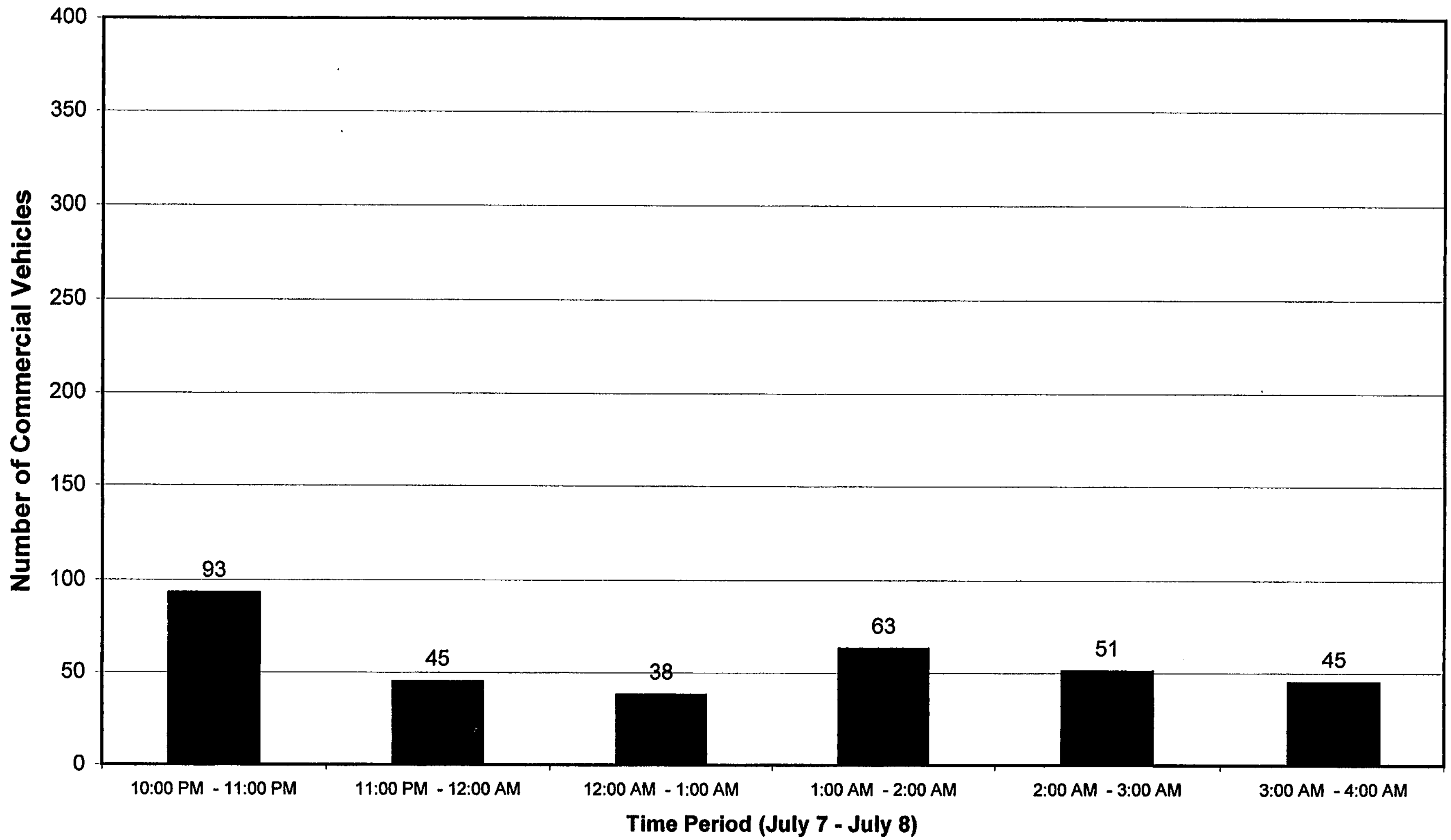


Figure A.3: Number of Commercial Vehicles Weighed on the Scale Lane at Perryville Scale House on Saturday July 8, 2000

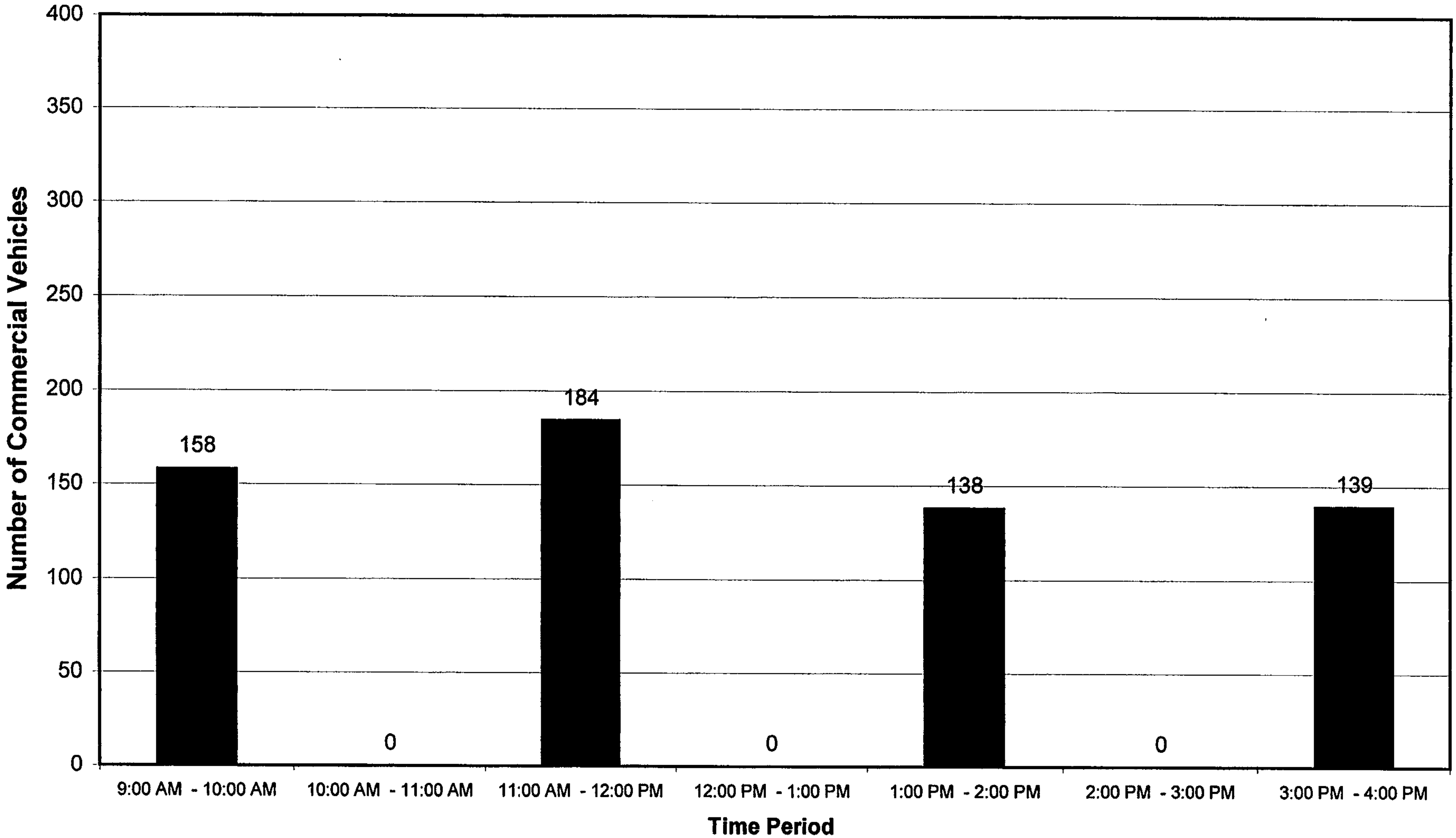


Figure A.4: Number of Commercial Vehicles Weighed on the Scale Lane at Perryville Scale House on Monday July 10, 2000

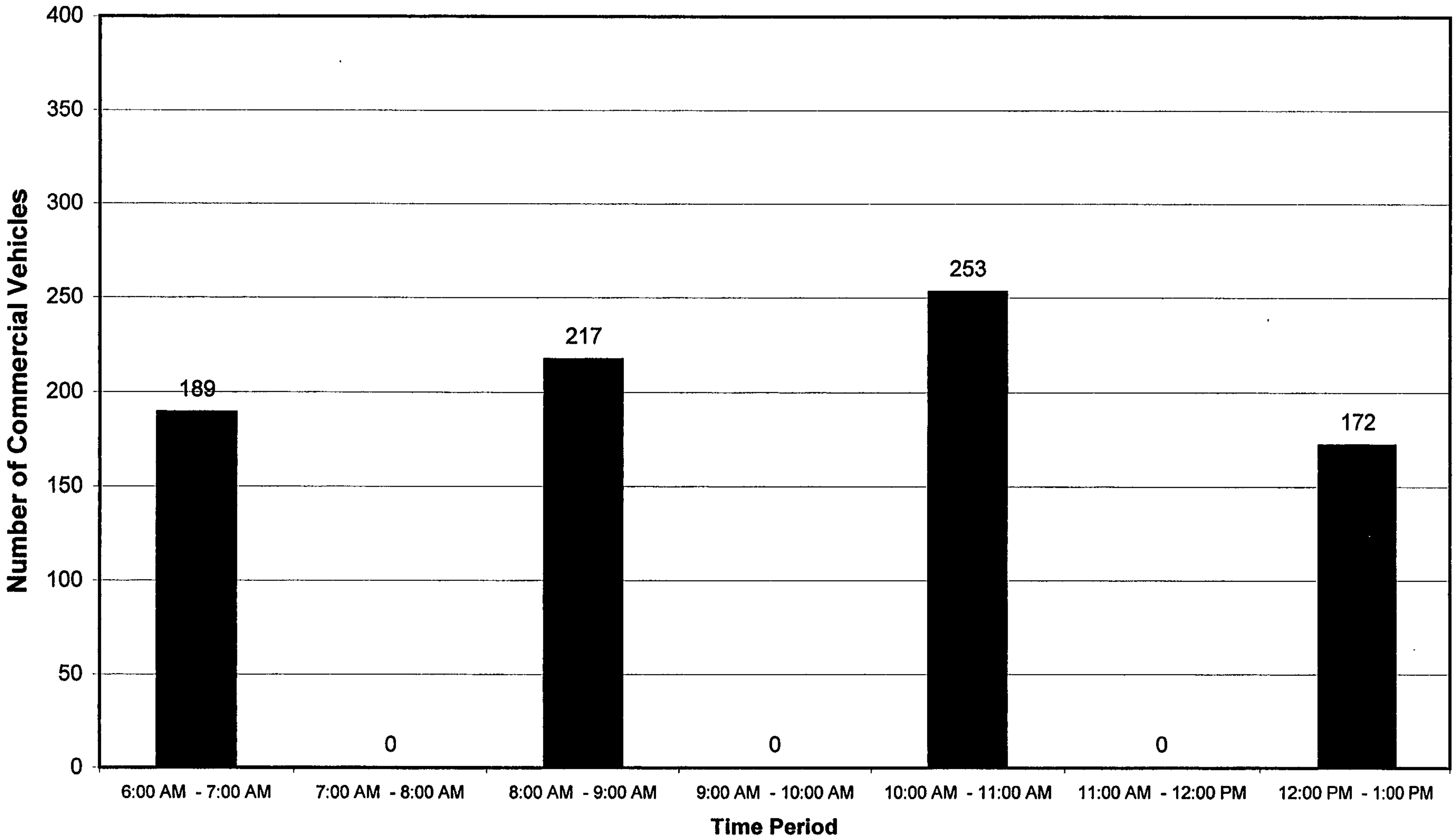


Figure A.5: Number of Commercial Vehicles Weighed on the Scale Lane at Perryville Scale House on Tuesday July 11, 2000

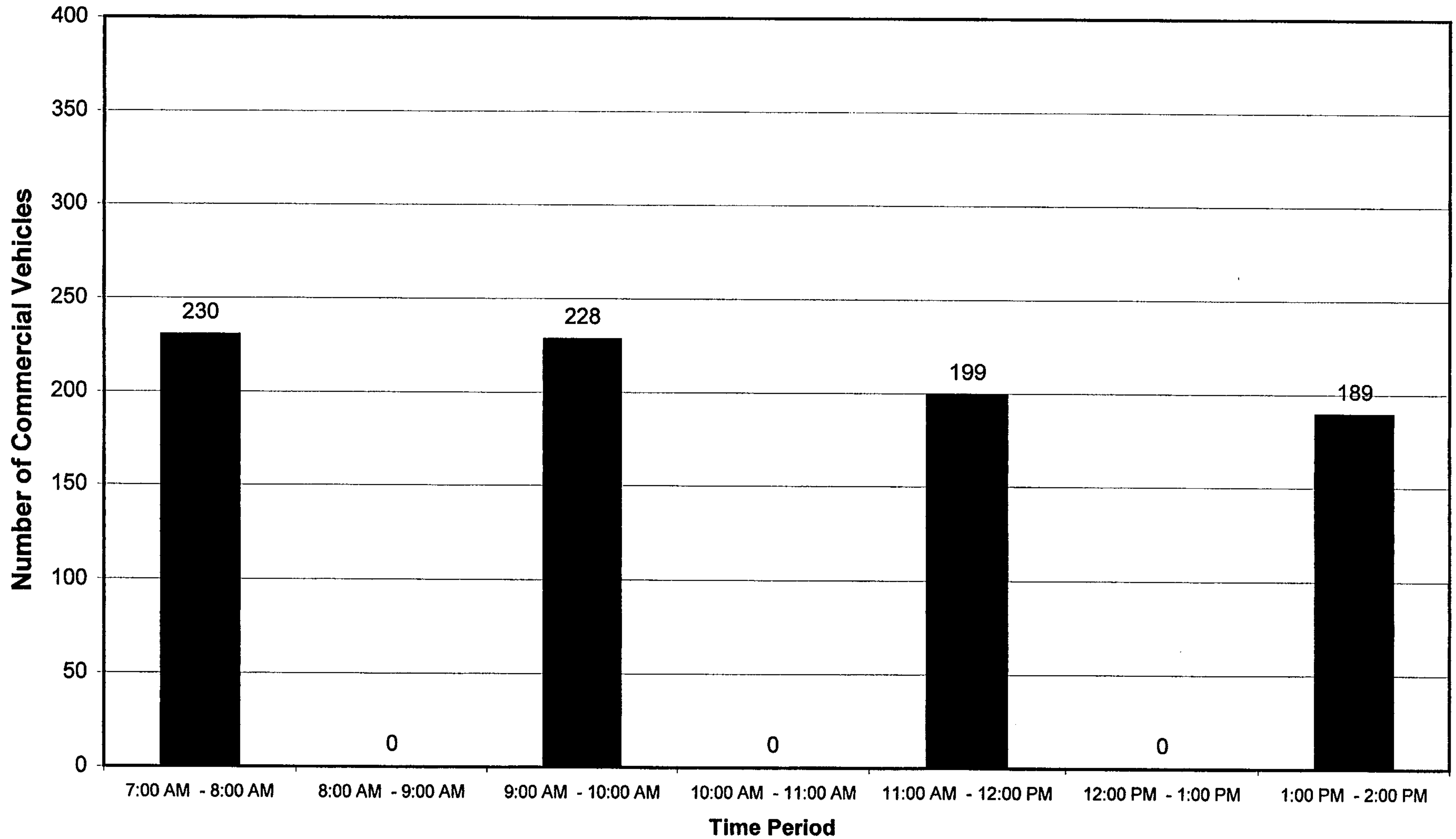


Figure A.6: Number of Commercial Vehicles Weighed on the Scale Lane at Perryville Scale House on Wednesday July 12, 2000

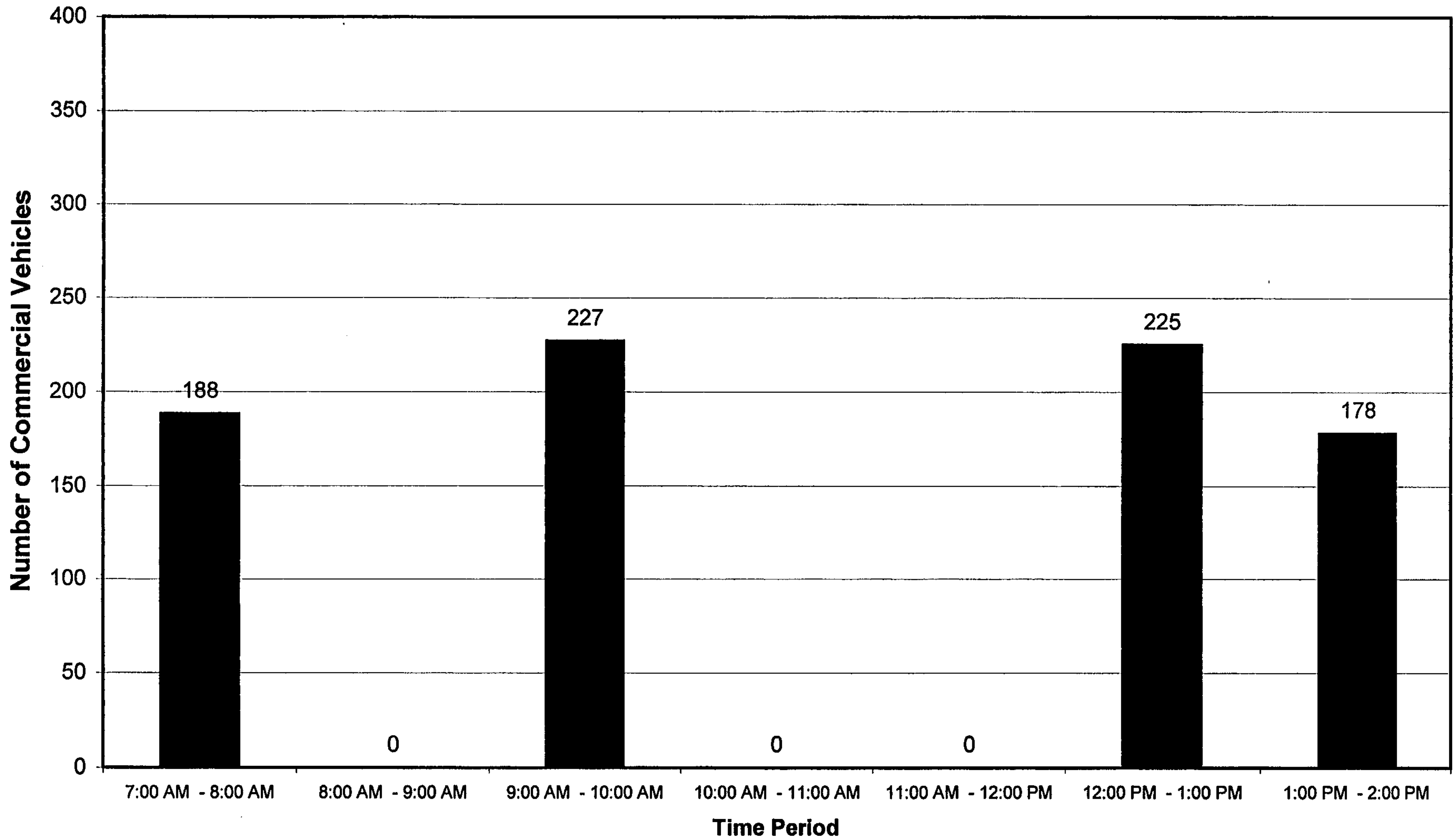
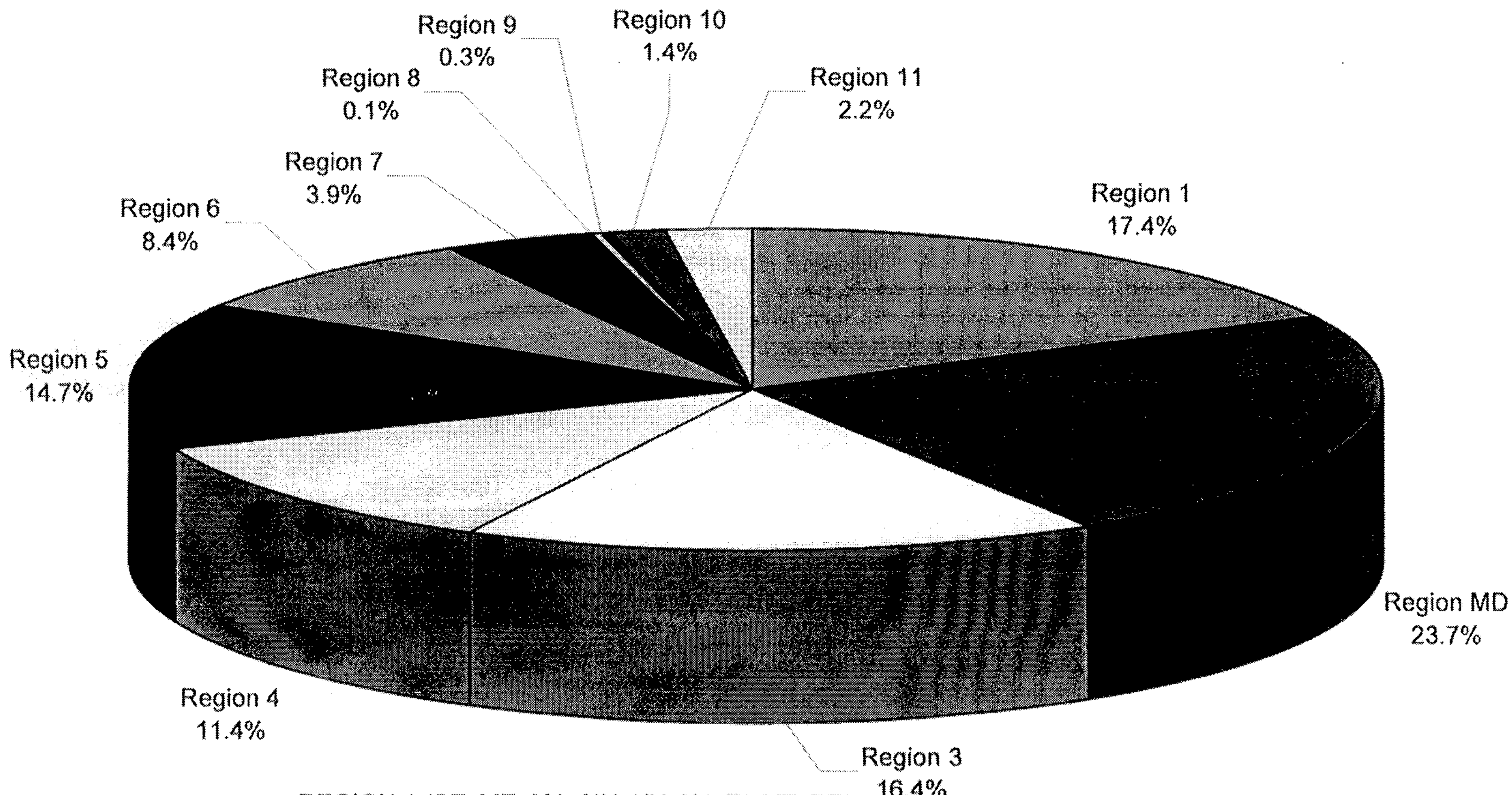
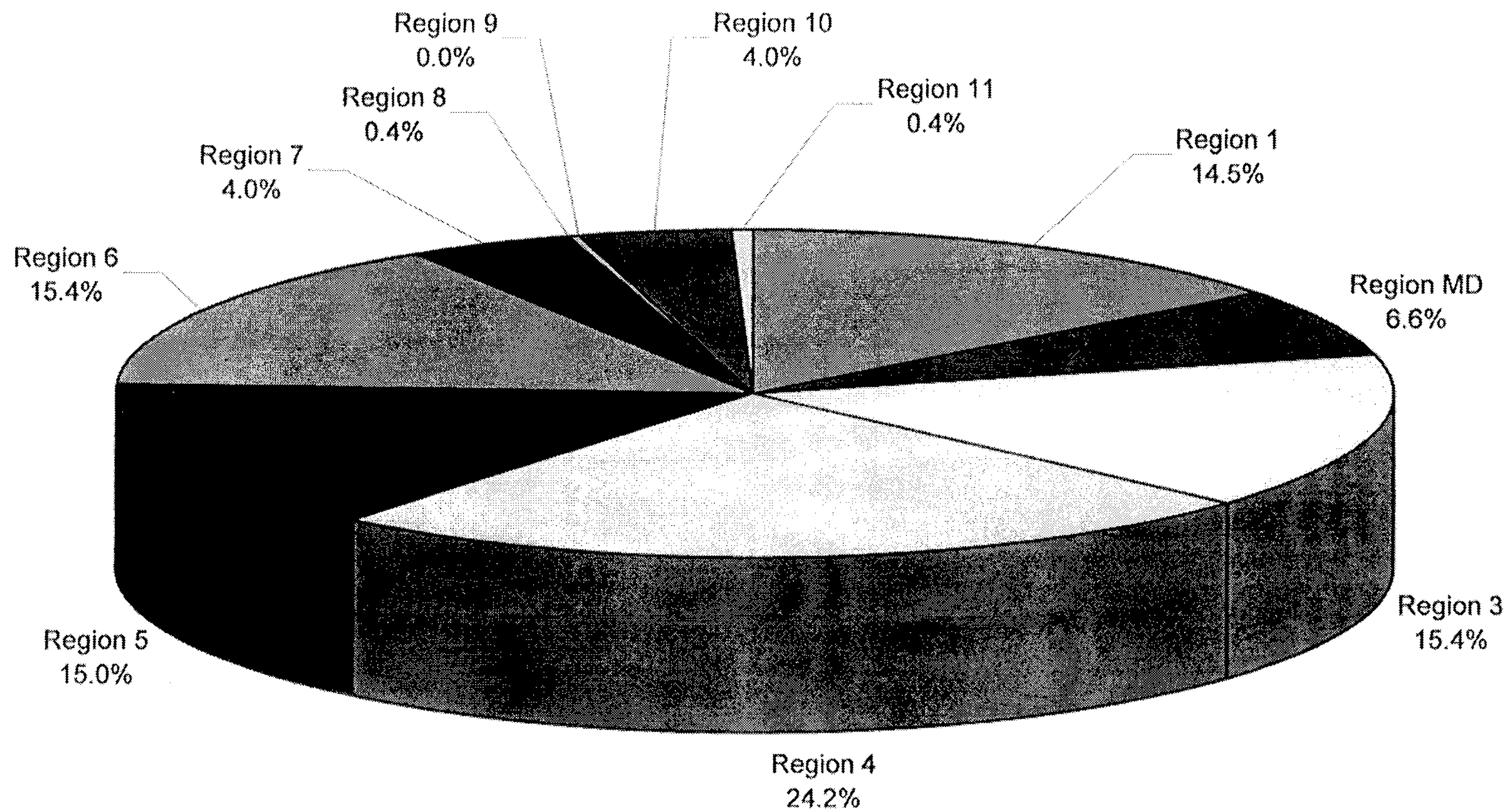


Figure A.7: Distribution of Commercial *Vehicles* According to the Carrier's Base Registration Region at Perryville Scale House on Thursday July 6, 2000



REGION 1 (CT, ME, MA, NH, NY, NJ, RI, VT, PR)
REGION MD (MD)
REGION 3 (DE, DC, PA, VA, WV) excluding MD
REGION 4 (AL, GA, FL, MS, NC, SC, TN, KY)
REGION 5 (IL, IN, MI, OH, MN, WI)
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

Figure A.8: Distribution of Commercial Motor Vehicles According to the Carrier's Base Registration Region at Perryville Scale House on Fri. July 7 Night through Sat. July 8, 2000



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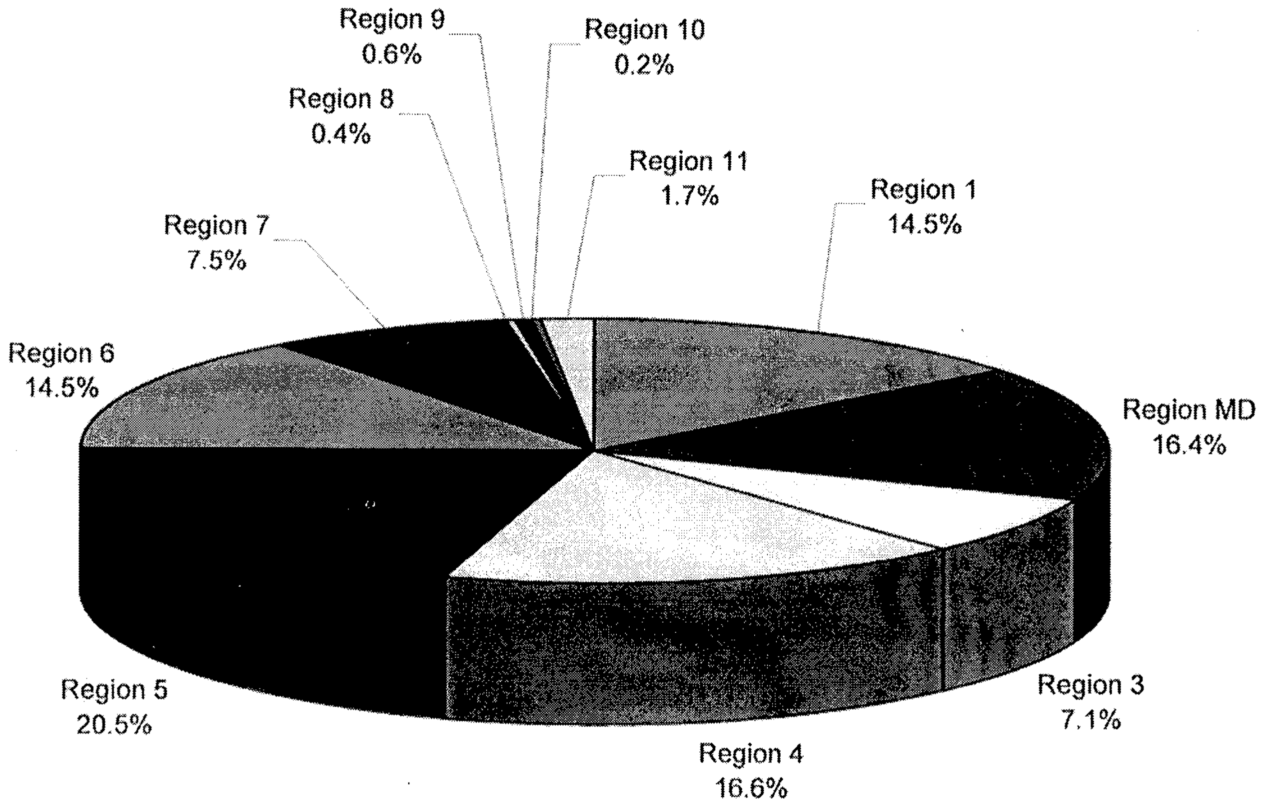
REGION 5 (IL, IN, MI, OH, MN, WI)
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

Figure A.9: Distribution of Carriers According to Carrier's Base Registration Region at Perryville Scale House on Saturday July 8, 2000



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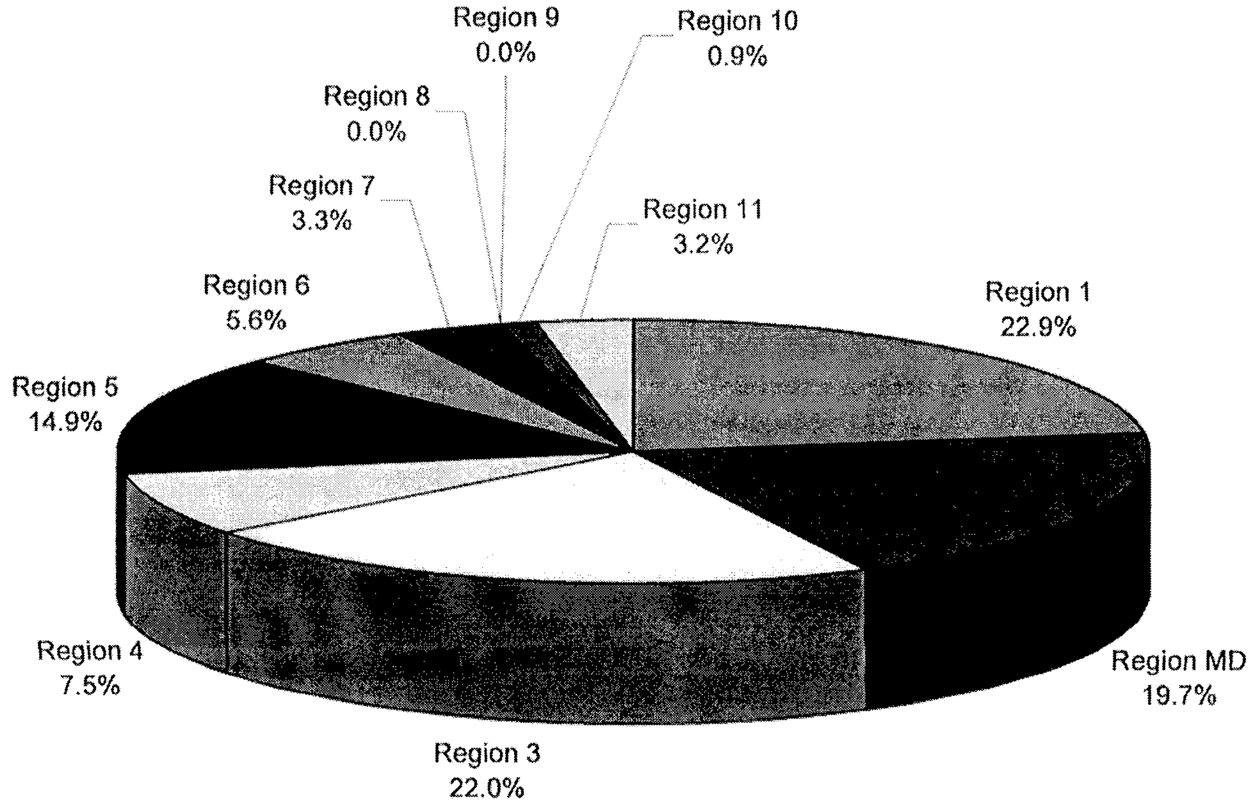
REGION 5 (IL, IN, MI, OH, MN, WI)
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

Figure A.10: Distribution of Carriers According to Carrier's Base Registration Region at Perryville Scale House on Monday July 10, 2000



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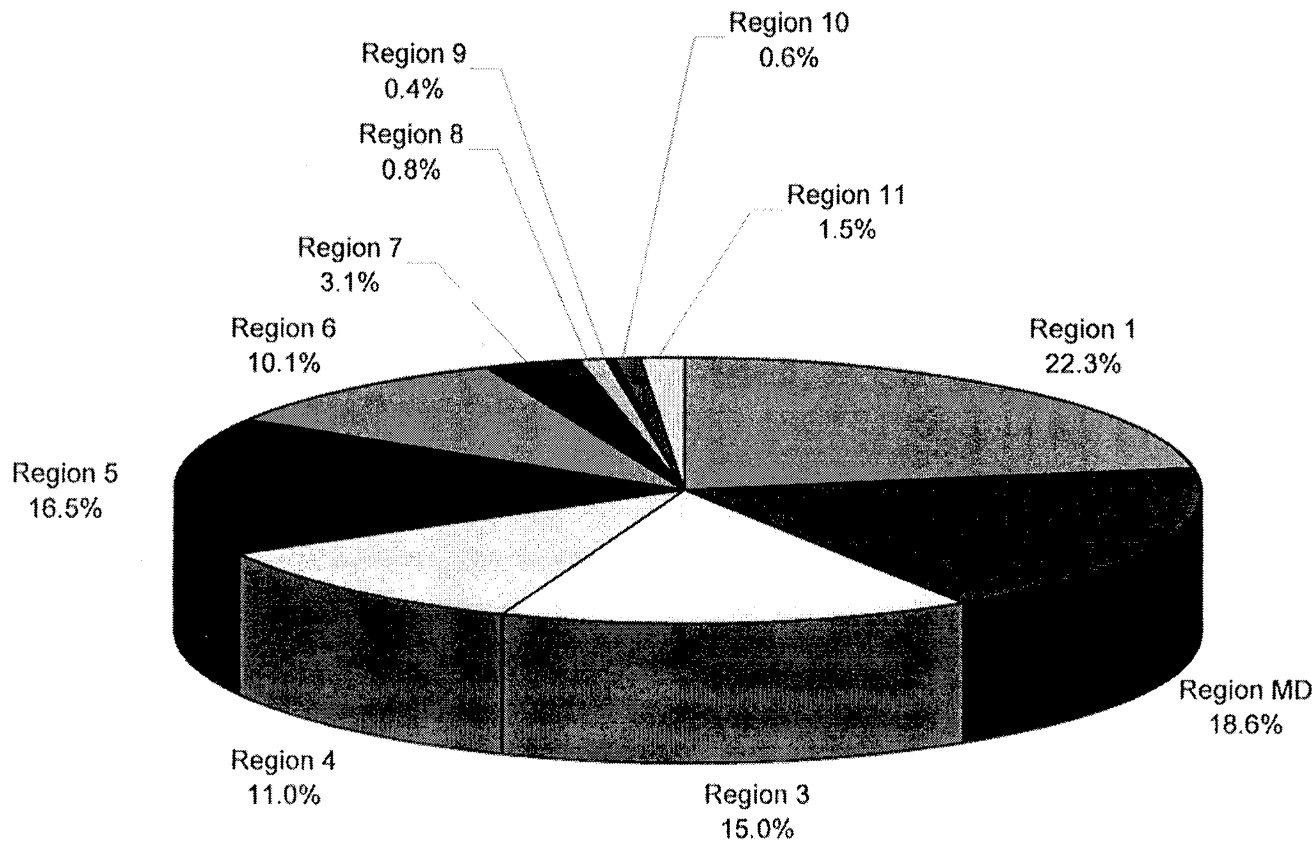
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

Figure A.11: Distribution of Carriers According to Carrier's Base Registration Region at Perryville Scale House on Tuesday July 11, 2000



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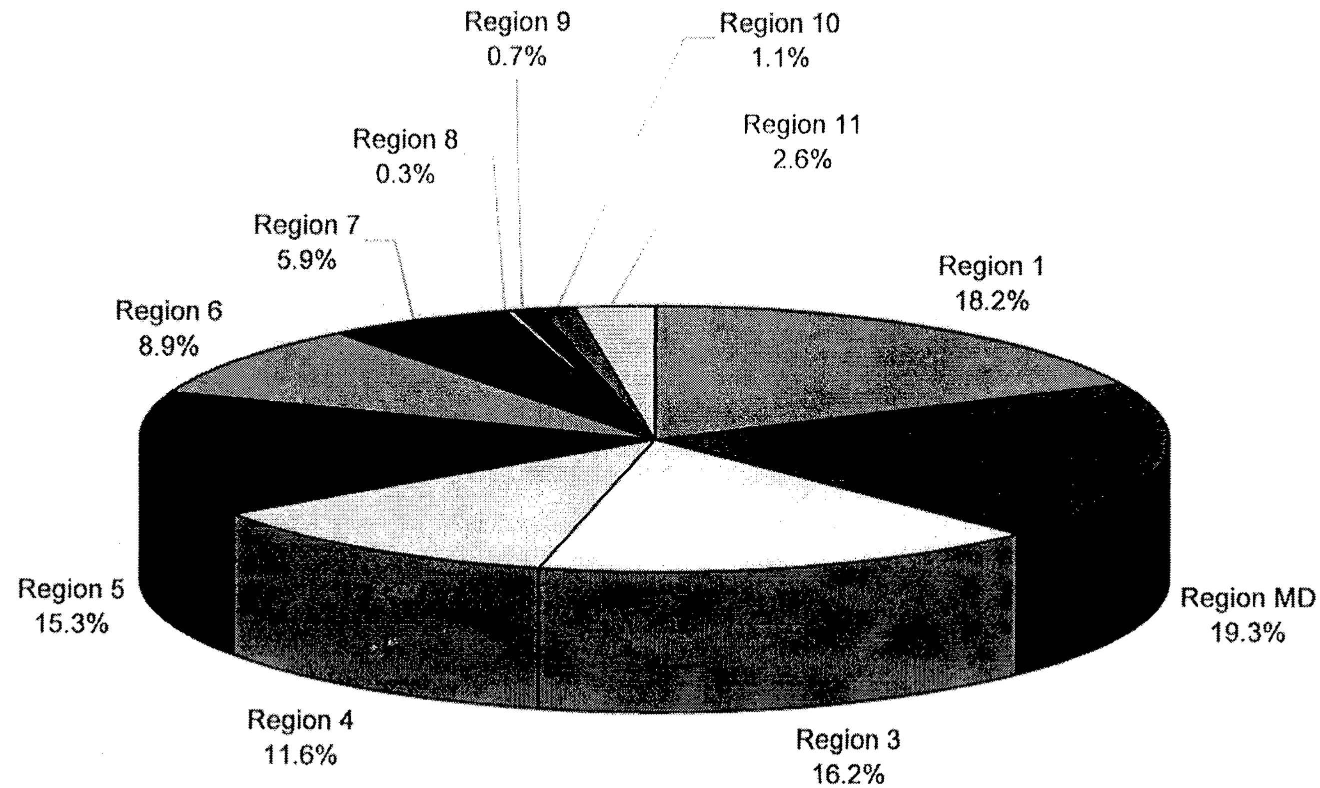
REGION 5 (IL, IN, MI, OH, MN, WI)
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

Figure A.12: Distribution of Carriers According to Carrier's Base Registration Region at Perryville Scale House on Wednesday July 12, 2000



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REGION 4 (AL, GA, FL, MS, NC, SC, TN, KY)
REGION 5 (IL, IN, MI, OH, MN, WI)
REGION 6 (AR, LA, NM, OK, TX)
REGION 7 (IA, KS, MO, NE)
REGION 8 (CO, MT, ND, SD, UT, WY)
REGION 9 (AZ, CA, NV, HI)
REGION 10 (AK, ID, OR, WA)
REGION 11 (CANADA)

Figure A.13: Distribution of ISS Scores of Commercial Vehicles at Perryville Scale House on Thursday July 6, 2000

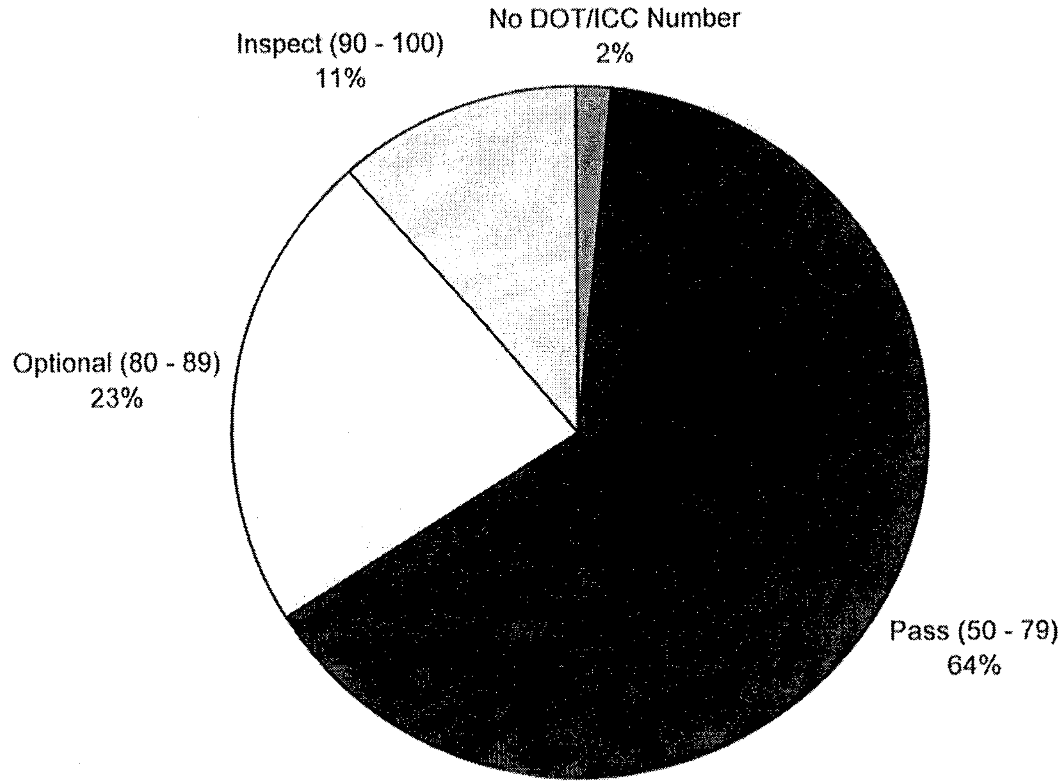


Figure A.14: Distribution of ISS Scores of Commercial Vehicles at Perryville Scale House on Friday July 7 Night through Saturday July 8, 2000

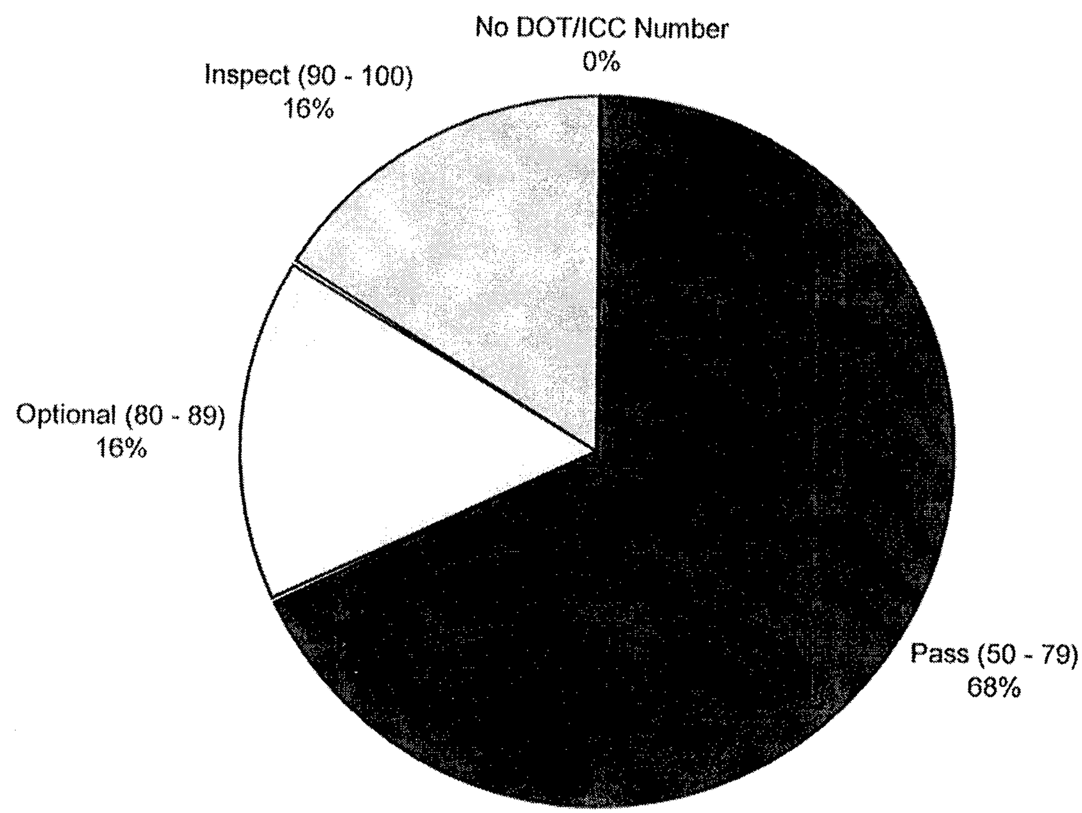


Figure A.15: Distribution of ISS Scores of Commercial Vehicles at Perryville Scale House on Saturday July 8, 2000

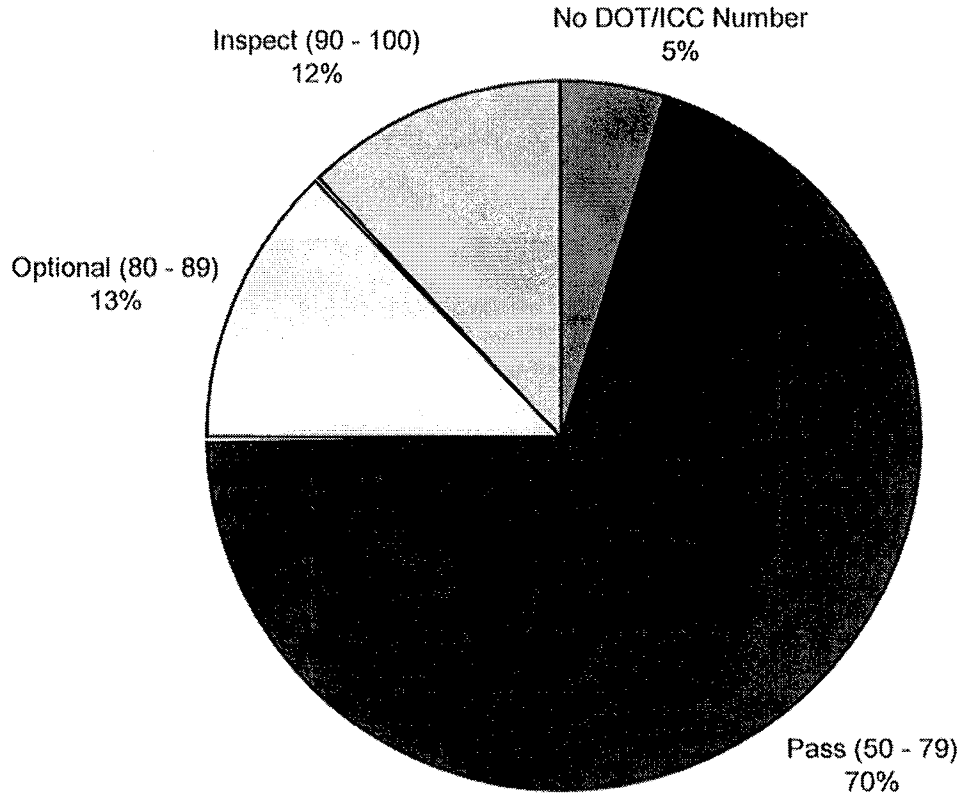


Figure A.16: Distribution of ISS Scores of Commercial Vehicles at Perryville Scale House on Monday July 10, 2000

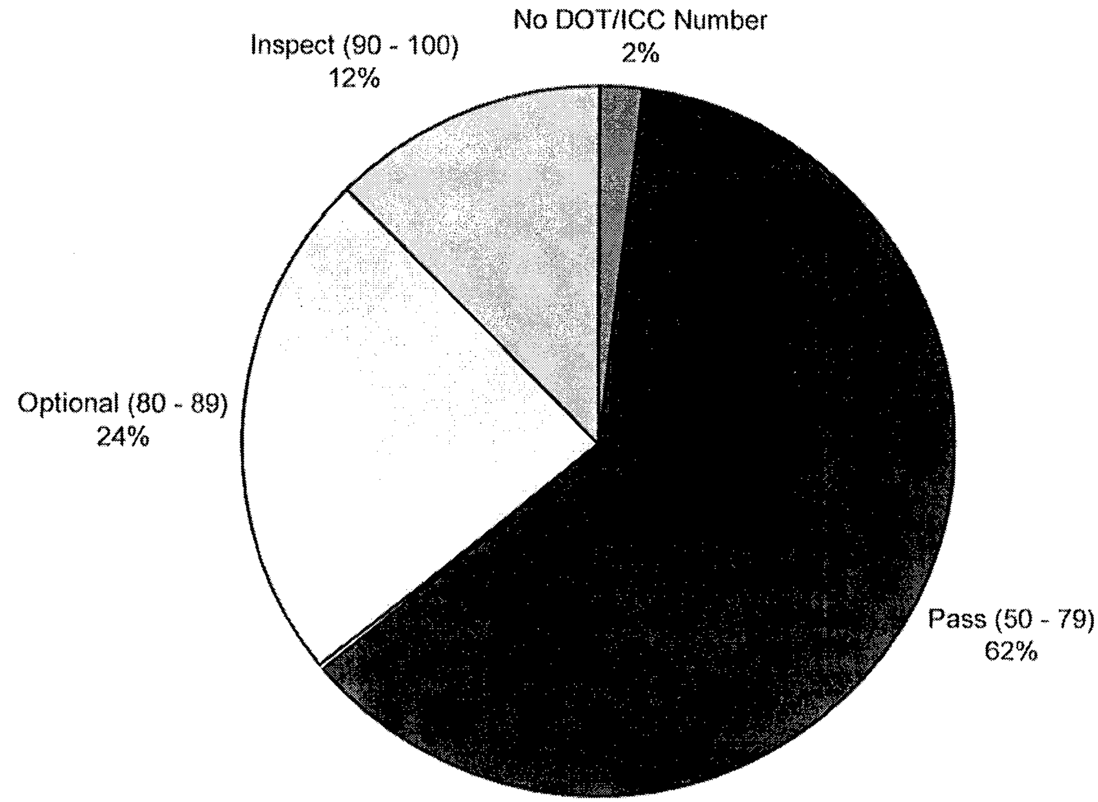


Figure A.17: Distribution of ISS Scores of Commercial Vehicles at Perryville Scale House on Tuesday July 11, 2000

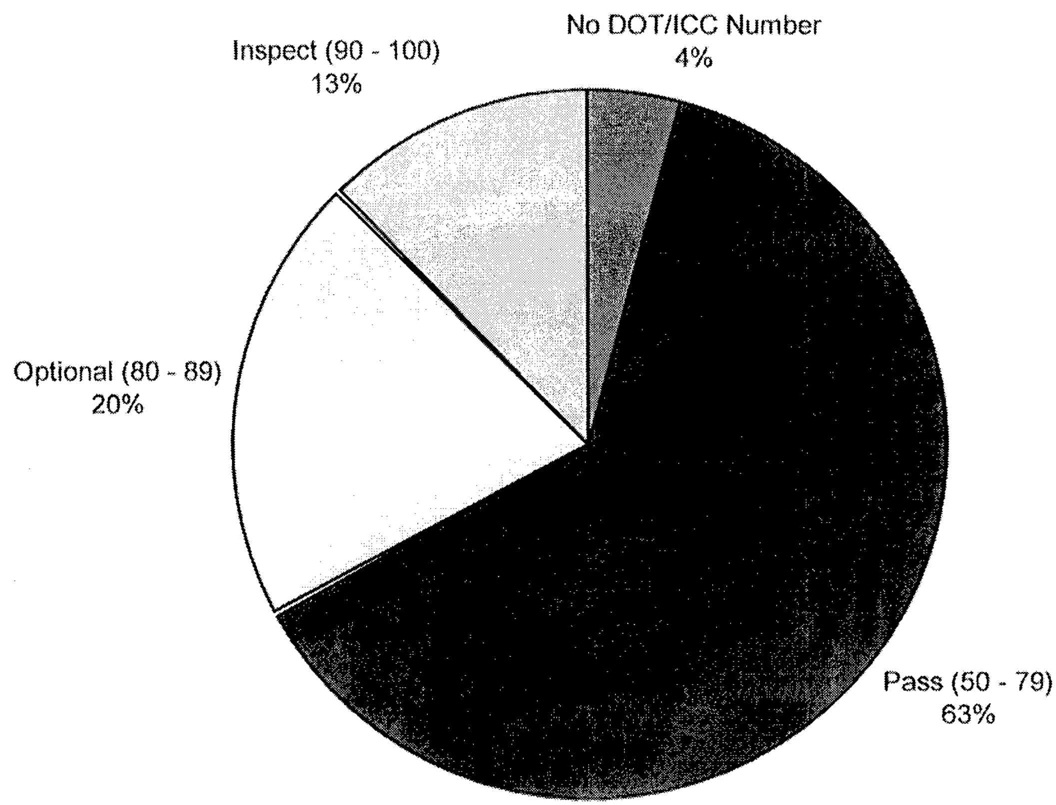
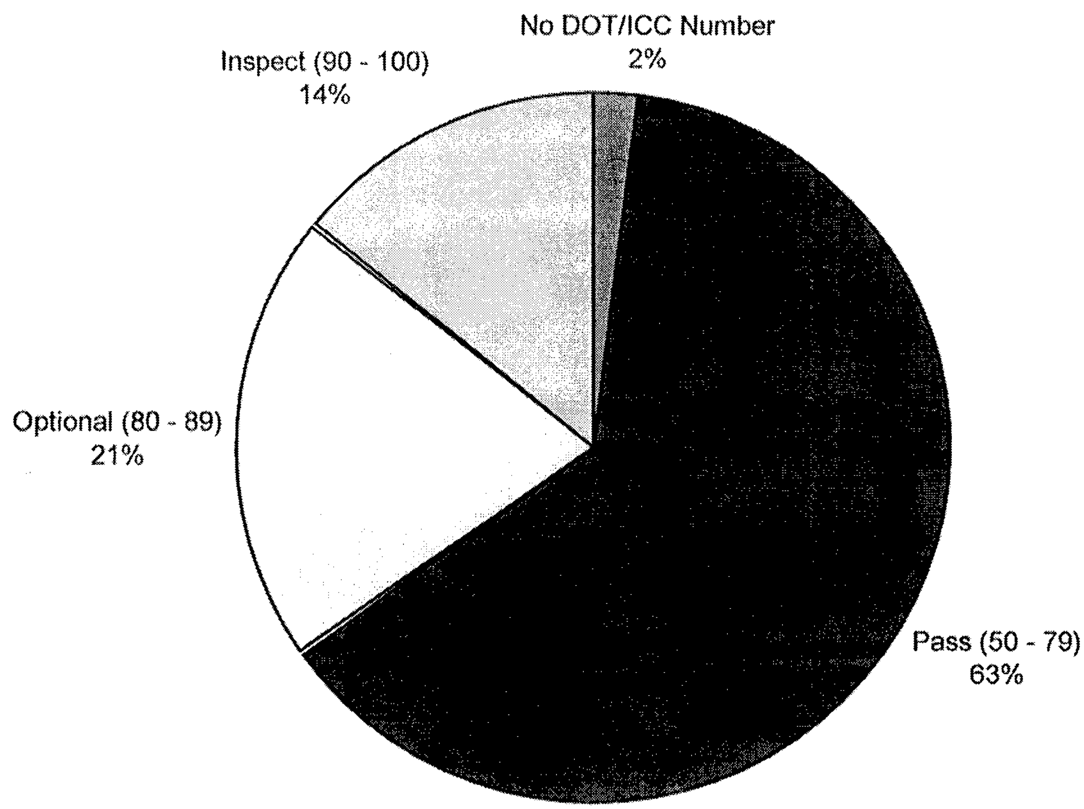


Figure A.18: Distribution of ISS Scores of Commercial Vehicles at Perryville Scale House on Wednesday July 12, 2000



APPENDIX B

SCHEDULE AND COMMENTS FOR DATA COLLECTION ACTIVITIES

Appendix B: Schedule and Comments for Data Collection Activities

Two research assistants were assigned the tasks of observations and the collection of data during the following time periods at the Perryville Truck Weigh and Inspection Station (TWIS) on I-95. As shown in Figure 4, the Perryville TWIS has two scale lanes and one bypass lane prior to the scale lanes. For safety considerations, commercial vehicles are allowed to travel in the bypass lane during periods of high traffic volume. For each alternate hour of the scheduled time periods, each of the two research assistants is assigned to collect observations and data for each of the two scale lanes respectively. The following hour is then spent in preparing equipment of the next hourly reading. Hence, observations and data at the Perryville TWIS are collected at alternate hours during the scheduled time periods. The following gives the schedule for data collection activities at the Perryville TWIS and describes the unusual circumstances encountered during the data collection activities.

Data collection activities were scheduled for the following days and times:

Day	Date	Time
Thursday	July 6, 2000	6:00 a.m. – 2:00 p.m.
Friday - Saturday	July 6 & 7, 2000	10:00 p.m. - 6:00 a.m.
Saturday	July 8, 2000	9:00 a.m. – 6:00 p.m.
Monday	July 10, 2000	7:00 a.m. – 3:00 p.m.
Tuesday	July 11, 2000	7:00 a.m. – 3:00 p.m.
Wednesday	July 12, 2000	6:00 a.m. – 2:00 p.m.

The following describes the unusual circumstances encountered during the data collection activities:

- Thursday July 6, 2000: Observations and data collection activities were scheduled for 6:00 a.m. – 2:00 p.m. However, one of the research assistants arrived late. Consequently, data for only one scale lane was collected for the time period 6:00 a.m. – 7:00 a.m.

- Friday July 7- Saturday July 8, 2000: Observations and data collection activities were scheduled for one scale lane of the TWIS between the hours 10:00 p.m. – 6:00 a.m. A single research assistant was scheduled to collect the data. However, both lanes were open compromising the quantity of data during this time period.
- Saturday July 8, 2000: Observations and data collection activities were scheduled for the time period 9:00 a.m. – 6:00 p.m. However, the TWIS was closed early by the TWIS personnel. Hence, data could not be collected after 4:00 p.m.
- Tuesday July 11, 2000: Observations and data collection activities were scheduled for the time period 7:00 a.m. – 3:00 p.m. However, data collected from 12:00 p.m. – 2:00 p.m. was not time-stamped. This compromised the hourly count of commercial vehicles.