
Violations Severity Assessment Study

Final Report

September 14, 2007

Prepared For:

Federal Motor Carrier Safety Administration
Office of Research and Analysis
Analysis Division (MC-RRA)
400 7th Street, SW
Washington, DC 20590

Prepared By:

John A. Volpe National Transportation
Systems Center
Motor Carrier Safety Division (RTV-3E)
55 Broadway
Cambridge, MA 0214

Table of Contents

Chapter 1:	Executive Summary	1-4
1.1	Project Background.....	1-4
1.2	Methodology Description	1-4
1.3	Synthesis of Results	1-5
1.4	Report Structure	1-9
Chapter 2:	Background	2-10
2.1	Introduction.....	2-10
2.2	Risk and Safety	2-10
2.3	Current Violation Risk Categorization	2-14
2.4	Assigning Relative Values of Risk: The Cycla Study	2-16
2.5	Analysis and Targeting	2-17
2.6	Applications in Safety Rating: SafeStat and the Intervention Model	2-21
2.7	Conclusions.....	2-22
Chapter 3:	Regulations and Data	3-23
3.1	Overview	3-23
3.2	FMCSA Regulatory Authority.....	3-23
3.3	Commercial Motor Vehicle (CMV) Safety Regulations	3-24
3.4	Motor Carrier Safety Regulations Cited within MCMIS.....	3-25
3.5	Overview of Roadside Inspection Data in Analysis	3-29
3.6	Compliance Review Regulations.....	3-42
Chapter 4:	Methodology	4-44
4.1	Overview	4-44
4.2	Roadside Inspection Violation Methodology	4-45
4.3	Compliance Review Violation Methodology	4-54
Chapter 5:	Violation Risk Results	5-58
5.1	Overview.....	5-58
5.2	Roadside Violation Risk Results	5-58
5.3	Compliance Review Violation Results	5-78
5.4	Comparison of Roadside and Compliance Review Results.....	5-88
5.5	Conclusion	5-91
Chapter 6:	Limitations, Enhancements & Applications	6-92
6.1	Methodology and Data Limitations	6-92
6.2	Enhancements	6-94
6.3	Applications	6-95
Chapter 7:	Bibliography	7-98
Chapter 8:	Appendix of Acute and Critical Regulations.....	8-102
Chapter 9:	Appendix of Analysis of Valid Regulations in MCMIS.....	9-108
Chapter 10:	Appendix of Post-Crash Inspections.....	10-117
Chapter 11:	Appendix of Traffic Enforcement Violations	11-124
Chapter 12:	Appendix of Speeding Rate Methodology.....	12-126
Chapter 13:	Roadside Violation Risk Results	13-130
Chapter 14:	Compliance Review Risk Results.....	14-175

DRAFT

Chapter 1: Executive Summary

1.1 Project Background

The Federal Motor Carrier Safety Administration (FMCSA) creates and enforces safety regulations of commercial driver, vehicle and carrier operations. FMCSA also funds its state partners through grant programs to improve motor carrier safety through the enforcement of the Federal regulations and local laws. FMCSA has developed several safety programs to enforce these safety regulations and laws. These programs include on site safety audits of motor carriers at their principle place of business, compliance reviews (CRs), roadside inspections of commercial drivers and vehicles, and traffic enforcement of commercial drivers and vehicles. When violations of the Federal Motor Carrier Safety Regulations (FMCSRs) and/or Hazardous Materials Regulations (HMRs) are found, FMCSA may initiate enforcement cases leading to fines and other penalties.

Realizing that all regulatory violations are not equal in terms of their relationship to safety, FMCSA and its state partners have established weighting schemes to designate the severity of violations for each of these programs. The intent of these weighting schemes is to place emphasis on enforcing those regulations that are most related to safety. For example, as part of the CR program, violations of a particular subset of the FMCSRs are classified as being either acute or critical violations. Violations of these regulations are used in determining the safety fitness rating of the motor carrier. Violations that are not classified as acute or critical are essentially not considered in the safety rating of a motor carrier. There is an additional set of severe violations of certain regulations that can warrant enforcement case action, yet are not used as part of the CR safety rating. Further, there is a different set of severity criteria applied to violations found during roadside inspections to determine if a driver or vehicle will be placed out of service (OOS). OOS violations must be rectified before the vehicle and driver can resume operations. Finally, there is a subset of traffic moving violations that are designated as serious.

Rather than the current environment of different weighting schemes and designations, FMCSA recognizes the need for a consistent severity-weighting scheme for violations related to crash risk. Such a consistent approach will assist FMCSA in focusing on the most pertinent safety problems across all of their programs. Such a weighting scheme can be applied to all measures that quantify a motor carrier's or driver's safety posture. The weighting scheme may also be the basis for a more consistent and comprehensive safety fitness determination process. The Violation Severity Assessment Study (VSAS) develops a statistical analysis of the risk associated with particular violations of regulations by motor carriers in roadside inspections and compliance reviews.

1.2 Methodology Description

Risk is traditionally defined as the product of the probability of the event and the severity of the event. Separating the incidence of the event from the consequences of the event allows for a comparison of a low severity, but frequently occurring event to a high severity, but infrequent one. Following the convention in risk analysis, the roadside risk is decomposed into the risk associated with crash incidence and crash severity.

Combining these two risk components produces the total roadside violation risk. The roadside violation risk is based on the association of the violation with crash occurrence and crash severity. As a consequence, there is no causal inference that can be made based on the data and methodologies used in this analysis.

The crash incidence analysis compares the roadside inspection violation rate to the post-crash inspection violation rate. A difference in proportions test is conducted to test whether the post-crash inspection violation rate is significantly higher than the roadside inspection violation rate. If the post-crash violation rate is significantly higher than the roadside inspection rate, then the ratio of these two violation rates is applied to the underlying crash rate to determine the increased crash occurrence per 100 million vehicle miles due to the presence of the violation. The data used to calculate the risk for each violation were normalized to account for the tendency for post-crash inspections to over sample more severe crashes. The crash severity analysis compares the severity distribution of the crashes with post-crash inspections to the overall crash severity distribution for crashes reported in the Motor Carrier Management Information System (MCMIS). Figures on the average cost per crash by severity were used as severity weights so that the final severity factor is the additional dollar value of the increase in crash severity associated with the violation. Combining the crash incidence factor and the crash severity factor produces the total violation risk.

The approach to quantifying the risk associated with violations cited during compliance reviews relies upon an association between the compliance review violation and increased roadside violations. Based on the difficulty in prior research of directly linking compliance reviews to crashes and the absence of an analogous post-crash compliance review, an indirect method for calculating compliance review risk was applied to compliance review violations. The theory behind this approach is that the underlying carrier behavior detected in compliance review violations is manifested through increased on-the-road violations. The association between the compliance review violation and a set of related roadside violations, taken with the roadside violation risk for each of those roadside regulations produces the compliance review violation risk. The association between the compliance review violation and each of the related roadside violations is determined using the phi correlation coefficient with a chi-square test for significance.

Risk is expressed as the cost associated with the violation. The roadside violation risk can be interpreted as the value of the risk due to the presence of the violation for 100 million vehicle miles. The compliance review risk is similarly interpreted; however the compliance review violation is a single occurrence that leads to an increase in the associated roadside violations for 100 million vehicle miles. Thus, the compliance review risk is per compliance review violation, but is spread over 100 million vehicle miles exhibiting the increase in roadside violations.

1.3 Synthesis of Results

Roadside Inspection Results

At the aggregate level, the results of this study are consistent with prior efforts to quantify the risk associated with violation of the FMCSRs. Regulations can be separated into three

separate categories: administrative, driver, and vehicle. Recent studies conducted by ATRI and FMCSA both conclude that driver behavior and violations of the driver regulations play a significant role in crashes. The ATRI study,¹ found statistically significant driving behaviors and events that increased the likelihood of crashes from 18% to 325%. The Large Truck Crash Causation Study (LTCCS)² also found that driver-related critical reasons were cited in 87% of the crashes (where the critical reason was assigned to the truck), while vehicle-related critical reasons were cited in 10% of those crashes. As shown in Table 1-1: Violation Risk by Regulation Type, driver violations on average were found to have a positive correlation with crashes more frequently than either vehicle or administrative violations. Furthermore, driver violations on average posed 7 times the risk of vehicle violations and 8 times the risk of administrative violations.

Table 1-1: Violation Risk by Regulation Type

Regulation Type	Number with Positive Risk	Total Number	Percentage with Positive Risk	Average Risk / Regulation
Driver	39	131	30%	\$80,670,638.77
Vehicle	168	747	22%	\$11,784,130.74
Administrative	7	39	18%	\$9,841,356.18

Again, these results are also in agreement with a recent publication based on the LTCCS, which assigns relative crash risk to violation categories.³ This study found that on average driver violations were far riskier than vehicle violations. For example, driver violations such as traveling too fast for conditions posed 3 times the risk as that of tire and break violations, which are the most common vehicle violations in the study.

Alternatively, the results of this study can be analyzed using a second classification of violations: roadside, hazardous materials, traffic enforcement, and passenger carrier violations. The study “Risk-based Evaluation of Commercial Motor Vehicle Roadside Violations” employed a synthesis of expert knowledge and judgment regarding the risks associated with different roadside violations in order to categorize them into one of five categories that corresponded to the likelihood of a crash occurring due to the presence of the violation.⁴ Partially based on this work, traffic enforcement violations (also known as moving violations) were thought to pose significantly more risk than general roadside violations. Furthermore, in the SafeStat methodology, the Moving Violation Indicator (MVI), which is based on moving violations recorded during roadside inspections, is the

¹ American Transportation Research Institute (ATRI). 2005. *Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior-Based Model and Recommended Countermeasures*. Page 2.

² Federal Motor Carrier Safety Administration, Large Truck Crash Causation Study, (Publication #: FMCSA-RRA-07-017), Department of Transportation, Washington D.C., July 2007.

³ Ibid

⁴ Cyclca Corporation, Risk-based Evaluation of Commercial Motor Vehicle Roadside Violations: Process and Results, prepared for Office of Motor Carriers, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C.,1998.

second most effective indicator for identifying high risk carriers, trailing only the Accident Involvement Indicator (AII).⁵

Overall, these results are consistent with those presented in this study and shown in Table 1-2: Violation Risk by Inspection Type. Traffic enforcement violations had a noticeably larger percentage of violations with a positive risk value and those violations on average had a significantly larger crash risk than general roadside violations. Also consistent with expert opinion are the results for hazardous materials and passenger carrier violations, which pose less risk on average than either traffic enforcement or roadside violations.

Table 1-2: Violation Risk by Inspection Type

Inspection Violation Type	Number with Positive Risk	Total Number	Percentage with Positive Risk	Average Risk / Regulation
Traffic Enforcement	15	27	56%	\$369,978,133.02
Roadside (General)	192	433	44%	\$21,990,680.91
Passenger Carrier	1	43	2%	\$1,702,046.98
Hazardous Materials	6	414	1%	\$410,265.19

At the violation level, traffic enforcement regulations dominate the list of the highest incremental total violation risk results in the roadside analysis. Six of the top ten regulations are traffic enforcement and the remaining traffic enforcement regulations also rank quite high. It should be noted that the traffic enforcement regulations required a slightly different methodology, described in Chapter 4: Methodology, to address a bias in the number of traffic enforcement inspections. The riskiest traffic enforcement regulations (with the incremental violation risk in parentheses) are:

- failure to exercise caution in hazardous road conditions (\$3,014 million);
- reckless driving (\$2,750 million);
- ill or fatigued operator (\$1,576 million);
- improper turns (\$658 million); and
- failure to yield right of way (\$507 million).

These results are again consistent with the LTCCS findings, which found illness/fatigue, illegal maneuver, and traveling too fast for conditions all as having statistically significant associations with the assignment of the critical reason for the crash.

While traffic enforcement violations constitute a large number of the high risk violations, there is one group of general roadside violations that also pose a significant risk,

⁵ Volpe National Transportation Systems Center, Motor Carrier Safety Assessment Division, SafeStat—Motor Carrier Safety Status Measurement System Methodology: Version 8.6, prepared for the Federal Motor Carrier Safety Administration, U.S. Department of Transportation, Washington, D.C. 2004.

securement of cargo. For example, regulations 393.122B and 393.122, which cover securement of paper roles have incremental violation risk of \$556 million and \$454 million respectively and regulation 393.100 which covers prevention against shifting of load is at \$374 million. Again, the LTCCS found a similar result in its analysis. The shifting of cargo while in transit was found to be the most risky vehicle or driver violation. While the VSAS found traffic enforcement violations with higher risk, it is encouraging that both studies found violations of the cargo securement regulations posed a significant risk.

Other common vehicle violations such as brake and tire defects showed positive results; however, were much less risky than the previously mentioned violations. Brake violations were found to have little to no correlation with crash incidence, but very significant correlation with crash severity. This somewhat unconventional result is discussed further in Chapter 5: Violation Risk Results.

Compliance Review Results

The risk associated with compliance review violations tended to be lower in magnitude than the risk associated with roadside violations. The ten highest risk compliance review regulations fall into two broad categories: driver hours-of-service regulations and regulations covering the inspection, repair, and maintenance of vehicles. A few of the highest violation risk compliance review regulations are:

- no carrier shall require or permit a driver to be on duty and possess or be under the influence of amphetamines, narcotics, drugs, etc. (\$6.4 million),
- limit on-duty hours to 70 in eight consecutive days (\$6.3 million), and
- a general failure to complete driver record of duty status, a failure to preserve those records, or a false report (\$6.1 million).

Of the compliance review regulations currently designated as critical or acute violations four of the top ten compliance review incremental violation risk factors are critical violations and one of the top ten highest incremental risks is an acute regulation. Many of the critical regulations with high calculated risk concern proper record keeping of vehicle inspections, for instance

- Inspection, repair and maintenance (396.3B) at \$15.8 million,
- Driver vehicle inspection report(s) (396.11A) \$13.7 million, and
- Driver hours of service regulations 395.3B2 and 395.8E at \$23.9 million and \$6.1 million respectively.

The acute regulations with the highest risk are drug and substance violations, regulations 392.4B and 382.115A (\$6.4 million and \$5.3 million) and operation of an out-of-service vehicle, 396.9C2 (\$3.9 million). While a large percentage of acute and critical regulations (84% and 87% respectively) showed positive risk results, overall these results indicate that the designation of regulations as critical and acute does not correspond to carrying an additional weight in safety assessment. In fact, there are other regulations not designated as critical or acute which appear to have a greater risk in terms of crash risk.

Conclusion

All in all, the results generated for compliance review and roadside inspection violations seem reasonable and consistent with prior work in the area, including the LTCCS, ATRI, and SafeStat. While there are some exceptions in the results of this effort, those exceptions should be examined closely to determine the cause. This information will prove valuable to further projects whose goals include the development of quantitative risks. Finally, this effort is not expected to be the definitive answer with regard to establishing violation risks; however, it is an important contribution to the drive for a quantitative assessment of the risk associated with regulatory non-compliance.

1.4 Report Structure

The remainder of this report further details the methodology used in this effort. The organization of this report is as follows:

- Chapter 2: Background provides overview of the current state of research in the area of violation risk.
- Chapter 3: Regulations and Data describes the MCMIS inspection and crash data used in the violation risk analysis.
- Chapter 4: Methodology lays out the full methodology for the roadside violation risk analysis and the compliance review violation risk analysis. The statistical tests, formulas, and data thresholds used to determine the final risk results are presented in this chapter.
- Chapter 5: Violation Risk Results presents an analysis of the overall results for each of the methodologies, including the regulations with the highest risk for the roadside and compliance review methods.
- Chapter 6: Limitations, Enhancements & Applications is the last section of the report, and it discusses the limitations, applications and next steps for the violation risk analysis.
- Chapter 7 contains the necessary bibliographical information for the report.
- Chapters 8 – 14 are appendices which support the body of the report.

Chapter 2: Background

2.1 Introduction

More than eight million large trucks and buses operate over 200 billion miles⁶ each year on the nation's roadways. To ensure the public safety, federal regulations⁷ define organizational and operational requirements for the nearly 700,000⁸ interstate truck and bus companies, as well as all commercial large vehicles and drivers. Motor carrier safety regulation is the responsibility of the Federal Motor Carrier Safety Administration and enforcement of these regulations is conducted by federal and state professionals. Each year, there are nearly 150,000⁹ commercial motor vehicle crashes with total cost of crashes exceeding \$32 billion.¹⁰

In the context of reducing the number and severity of commercial motor vehicle crashes, what are the areas of regulatory non-compliance (i.e. violations of the FMCSRs) that generate the greatest risk? This is the fundamental question of the Violation Severity Assessment Study (VSAS); the answer of to which has broad implications for many analytical and enforcement efforts of the FMCSA.

After addressing the basic questions “what is risk?” and “what is the risk from commercial motor vehicle operations?” the background section details the current methods for ranking risk related to violations, recent efforts to quantify violation risk, and the applications of safety rankings in SafeStat and in the Volpe Center's Intervention Model (an economic computer model that estimates the benefits from conducting roadside inspections, in terms of crashes avoided and lives saved, by calendar year.)

Existing regulation categorizations represent de facto weights (for example, where a regulation is deemed “acute,” it is believed to represent greater risk than a regulation labeled as critical) and direct weights assigned to regulations in determining fitness for duty. The research methodology of the VSAS is not dependent on any of the existing categorizations or existing weighting of regulations assigned; rather it is designed to quantify the statistical association between violations and crash incidence and crash severity.

2.2 Risk and Safety

2.2.1 Defining and Measuring Risk

What is risk? In general, “gauging risk is a matter of probabilities.”¹¹ “Most expressions of risk are compound measures describing both the *probability* of harm and its

⁶ 2003. Federal Motor Carrier Safety Administration (FMCSA).

⁷ Federal Motor Carrier Safety Regulations (FMCSR) and Hazardous Materials Regulations (HMR) (Title 49 of CFR), and Title 23 Part 658 (Size and Weight).

⁸ 2004. FMCSA.

⁹ 2005. FMCSA, MCMIS.

¹⁰ Calculated from FMCSA data (see table 1 below)

¹¹ Lowrance, William W. 1976. Of Acceptable Risk: Science and the Determination of Safety, page 10.

severity.”¹² While not every truck crashes, risk is present in every action performed by trucks, drivers, and carriers operating on the nation’s roadways. Lowrance also indicated that “risks often need to be expressed in relation to exposure, so that different risks can be compared.”¹³ A general risk function is:

$$[1] \quad \frac{\text{Negative Event/Exposure} * \text{Exposure/Time Period} * \text{“Value” of Negative Event}}{\text{Total Value of Negative Events/Time Period}}$$

In the context of commercial motor vehicle operations on the roadways, the safety risk function is:

$$[2] \quad \frac{\text{Number of Crashes/Exposure} * \text{Exposure/Year} * \text{Cost of Each Crash}}{\text{Total Cost of Crashes/Year}}$$

When observing any random driver, truck or truck trip, the ex ante (before the fact) risk value is the expected value of a crash measured by the number of crashes normalized¹⁴ for the number of drivers, trucks or miles traveled. For example during a period of time, the probability of a truck crash can be estimated by the number of crashes divided by the number of trucks. Risk is then defined as the likelihood of having crash and the expected severity (cost) of the crash.¹⁵

Ex post (after the fact) risk is observable as the combination of actual number of crashes and the total cost of crashes. Zaloshnja and Miller, and others¹⁶ define crash costs in terms of total economic costs that include medical costs and expenses related to emergency service and property damage as well as lost productivity and monetized quality-of-life years.

For 2005, the total costs for large truck crashes is estimated to be \$31.7 billion;¹⁷ as depicted in Table 2-1 total costs are calculated by applying the average total economic cost for each type of crash based on severity (tow-away, non-fatal injury and fatal injury crashes) to the number of crashes in each severity category.

¹² Ibid. page 70.

¹³ Ibid. page 70.

¹⁴ Exposure is defined by the number of drivers, power units, vehicle-miles traveled, truck trips, etc. The use of these different exposure measures generate measures with different meanings and are sometime not possible due to data availability.

¹⁵ *SafeStat—Motor Carrier Safety Status Measurement System Methodology: Version 8.6*. Prepared by the John A. Volpe National Transportation Systems Center, Motor Carrier Safety Assessment Division. Prepared for the Federal Motor Carrier Safety Administration. 2004. Page 7-1.

¹⁶ Miller, Ted R. 1993. “Costs and Functional Consequences of U.S. Roadway Crashes.” *Accident Analysis and Prevention* 25(5): 593-607 and Zaloshnja, Eduard and Ted R. Miller. 2004. “Costs of Large Truck-involved Crashes in the United States.” *Accident Analysis and Prevention* 36(1): 801-808.

¹⁷ *Comparative Risks of Hazardous Materials and Non-Hazardous Materials Truck Shipment Accident/Incidents*. Prepared by the Battelle Memorial Institute. Prepared for Federal Motor Carrier Safety Administration. 2001. Page ES-4.

Table 2-1: Large Truck Crashes and Costs

Crash Type	Number— 2005 ¹⁸	2005\$/Crash Cost ¹⁹	Total Cost (Number *\$/Crash)	Percent of Total Cost
Tow-away	79,138	\$15,114	\$830,702,480	3.77%
Injury	60,672	\$195,258	\$11,846,693,376	37.28%
Fatal	5,198	\$3,604,518	\$18,781,443,812	58.95%
Total	145,008	\$216,533	\$31,781,443,812	100.00%
Source: Volpe Center; FMCSA, Zaloshnja and Miller.				

Risk assessment can be described as a logical process of collecting, organizing and analyzing information to inform a risk decision, or as a “science-based decision-making.” The risk assessment approach is also a forecasting process for the prevention of future adverse events, outcomes or impacts. It is an iterative process that includes progressive screening to initially identify high risk items and to conduct more detailed analysis, as required. The goal of risk assessment is to perform the minimal analysis required to provide the decision-maker with adequate information to make a sound decision.

The process generally comprises the following steps:

1. Hazard identification – to categorize and group hazards with similar characteristics
2. Consequence assessment – to determine the likelihood of exposure to the hazard and the severity of the consequences of exposure
3. Exposure assessment – to identify the source of the hazard
4. Risk estimation – to rank risks by combining the consequence score and the exposure score (or probability x severity)

A risk matrix (also known as a risk severity matrix) graphically combines probability and severity of an event to systematically classify and prioritize risk potential, and to identify appropriate intervention strategies to prevent or mitigate future adverse events. Figure 2-1 represents a general depiction of a risk matrix.

¹⁸ FMCSA: http://www.ai.volpe.dot.gov/CrashProfile/n_overview.asp;

¹⁹ Zaloshnja, Eduard and Ted Miller. 2007. “Unit Costs of Medium/Heavy Truck Crashes.” FMCSA;

		Probability / Likelihood				
		Frequent	Likely / Probable	Occasional	Seldom / Remote	Unlikely / Improbable
Severity / Impact	Catastrophic	Extremely High Risk				
	Major					
	Moderate					
	Minor					
	No Impact					Very Low Risk

Figure 2-1: Risk Matrix

Several different types of risk analysis can be used to populate the risk matrix: these include qualitative (high, medium, low), semi-quantitative (hazard ranking) or quantitative and involve Monte Carlo, uncertainty or sensitivity analysis. The risk assessment and risk matrix approach is widely used, and provides a flexible, repeatable methodology to identify and rank risk potential.

The predominant methods of risk assessment involve developing and populating a risk matrix, which combines the probability or frequency of occurrence of an adverse event, outcome or impact, and the severity or magnitude of that adverse event, in an effort to rank risk and prioritize mitigation measures. This method involves probabilistic risk/safety assessment and is also called “quantitative risk assessment.”

2.2.2 Safety Goals

“The primary mission of the Federal Motor Carrier Safety Administration (FMCSA) is to reduce crashes, injuries and fatalities involving large trucks and buses.²⁰” Furthermore, the FMCSA policy has set a goal of reducing the fatal crash rate “by 41% from 1996 to 2008. This reduction translates into a rate of 1.65 fatalities in truck crashes per 100 million miles of truck travel.²¹”

“Determining safety, then, involves two extremely different kinds of activities:

- *Measuring risk*—measuring the probability and severity of harm—is an empirical, scientific activity;

²⁰ FMCSA web-site. Captured August 15, 2006.
<http://www.fmcsa.dot.gov/about/what-we-do/mission/mission.htm>

²¹ FMCSA web-site. Captured August 15, 2006.
<http://www.fmcsa.dot.gov/safety-security/safety-initiatives/other/saftprogs.htm>

- *Judging safety*—judging the acceptability of risks—is a normative, political activity.”²²

The study of violation risk does not explicitly consider the socially optimum level of safety; however, the objective of this research is to measure risk, which supports FMCSA enforcement and regulatory efforts of achieving safety goals.

2.2.3 Ranking Violation Risk

In the context of large-truck crash risk, the risk associated with a violation of the FMCSRs comprises several different, but related measures. The values of these quantitative measures characterize the relative risk from violating the regulation, and when these measures are ordered from highest to lowest, produce a ranking based on risk.

Measures of the different components of risk that can be used for ranking violations of regulations include:

1. Increase in the probability of crashes
2. Increase in crash severity
3. Severity-weighted probability (combination of increase in probability and severity)
4. Cost of crashes
5. Cost attributed to the severity-weighted probability

Further, the objective of the VSAS, and risk assessment in general, is to focus on conditional probability: given the presence of a violation, what is the increased probability or severity of a crash?

2.3 Current Violation Risk Categorization

Citation of violations is used, along with other information, such as accident experience, to assess the safety performance of drivers and motor carriers. The weighting of violations currently used by FMCSA was determined by expert opinion. The weighting process has two levels: categorization of regulations and assigning weights for violations. Certain regulations have been deemed to have greater safety risk (acute, critical, out-of-service, and severe). Weights are applied to estimate risk and/or determine safety fitness for regulations in these risk categories.

2.3.1 Acute and Critical Regulations

For FMCSA compliance reviews, specific regulations are categorized as acute and critical, with violations of these regulations carrying an additional weight in safety assessment. Acute and critical are defined in Appendix B of 49 CFR 385 as part of the determination of carriers' safety fitness.

²² Zaloshnja, Eduard and Ted Miller. 2007. "Unit Costs of Medium/Heavy Truck Crashes." page 76.

Regulations are categorized based on the belief that they have a greater potential or actual impact on operational safety. “Noncompliance with acute regulations and patterns of non-compliance with critical regulations are quantitatively linked to inadequate safety management controls and usually higher than average accident rates.” (49 CFR 385 Appendix B II(e)) Observations of non-compliance with these regulations are the “regulatory statistics” that comprise the calculation of CFR safety fitness determination (other regulatory violations and roadside inspection data are not considered).

Acute regulations are identified as those where non-compliance is so severe as to require immediate corrective actions by motor carrier regardless of the overall safety posture of the motor carrier. Thirty-nine regulations are defined as acute (see Chapter 8: for a complete listing.) Critical regulations are identified as those where noncompliance relates to management and/or operational control. These are indicative of breakdowns in a carrier’s management controls. Sixty-five regulations are defined as critical (see Chapter 8: for a complete listing.)

2.3.2 Out-of-Service

Out-of-service violations apply to roadside activities where a violation is deemed severe enough to not allow the driver and/or vehicle to continue in service until compliance is restored. Placing a driver or vehicle “out-of-service” is an enforcement action that represents a clear statement of the expected severity of non-compliance with a regulation; accordingly assigning an “out-of-service” designation to a violation represents a relative severity weight (those designated represent greater risk than those not designated).

The driver out-of-service conditions fall into one of three main categories: licensing; physical condition of the driver and use of drugs/alcohol; and hours of operation and keeping of accurate duty logs. There are thirteen vehicle categories covered by the Commercial Vehicle Safety Alliance (CVSA) vehicle out-of-service criteria; they are the following: brake system; coupling devices; exhaust system; frame; fuel systems; lights; safe loading; steering; suspension; tires; wheels, rims, and hubs; and windshield wipers.

2.3.3 Severe

“Severe” is a regulation category for significant violations of hazardous materials regulations within the Federal Motor Carrier Safety Regulations (FMCSRs.) This category of violations is distinct from the set of acute and critical regulations. However for the purposes of safety fitness determination,²³ each of the hazardous materials-related severe violations are viewed as being similar to either a critical and acute violation.

The following example will help illustrate the difference between a hazardous materials-related severe violation considered as a critical violation and one that is treated as an acute violation. While “offering a charged/filled cylinder for which required markings have not been properly maintained (173.34(c))” is viewed considered a critical violation, “offering a cylinder that is not free of leaks, bulges, defective valves or safety devices, or

²³ For the purposes of SafeStat, a carrier’s hazardous materials review measure is combined with its safety management review measure in determining the carrier’s safety management SEA.

bears evidence of physical abuse (173.34(a))” is viewed as an acute violation. Clearly, the former violation is more of a paperwork issue, while the latter definitely has greater consequences if violated.

2.4 Assigning Relative Values of Risk: The Cycla Study

The objective of the 1998 Cycla study (“Risk-Based Evaluation of Commercial Motor Vehicle Roadside Violations: Process and Results”) was to categorize commercial motor vehicle (CMV) roadside violations according to potential risk posed by the violation. The study was conducted to support “the use of risk management and risk-based decision making to enhance agency efforts to promote the safe operation of commercial motor vehicles.”²⁴

Risk was defined as the likelihood that a violation will contribute to a significant, immediate risk of a crash, or a release of or exposure to a hazardous material. Five categories of risk were identified and assigned a numerical weighting of commercial motor vehicle roadside violations in carrier evaluation systems.²⁵ Table 2-2 depicts the categories of risk and their measure. Similar weighting system was prepared for hazardous materials regulations.

Table 2-2: Assignment of Relative Numerical Weights to Driver and Vehicle Violation Risk Categories

Risk Category	Weighting
Potential single, immediate factor leading to crash or injury/fatalities	1,000
Potential single, eventual factor leading to crash or injury/fatalities	100
Potential contributing factor in crash or injury/fatalities	10
Unlikely potential contributing factor leading to crash or injury/fatalities	1
Little or no connection crashes or prevention of injury/fatalities	0.1

The risk categorization was devised through synthesis of expert knowledge and judgment in a Delphic approach. Two groups of representatives were assembled to provide their group consensus. These groups included: (1) industry; enforcement; insurance; and, (2) research; insurance; and, public safety advocacy. “The evaluation groups performed the risk-based categorization of violations based on consideration of the worst possible risk imposed by the violation.”²⁶

The analysis considered regulations at a broad-level²⁷ and it was noted that more granular consideration would be more accurate. Further, the report indicates that the results overstate risk: the highest relevant risk factor is assigned to violations with multiple

²⁴ *Risk-based Evaluation of Commercial Motor Vehicle Roadside Violations: Process and Results*. Prepared by Cycla Corporation for FHWA/OMC. July 3, 1998. Page 1.

²⁵ Ibid, Page E-1.

²⁶ Ibid, Page E-2.

²⁷ The “regulatory entity” (also referred to as “part-section”) level of the Code of Federal Regulation was the primary level of analysis for the Cycla study.

regulatory areas. The study categorized the 564 violations represented in the database of violations used in the ASPEN driver/vehicle inspection software: 231 driver and vehicle violations and 333 hazardous materials violations. The regulations were listed in each risk category; and violations resulting in a vehicle or driver being placed out-of-service were also indicated.

2.5 Analysis and Targeting

Assigning risk to different violations in order to weight and rank the violations for use in targeting regulatory and enforcement activities is also an empirical exercise. Those violations that generate the greatest increase in the probability of crashes, the greatest increase in the severity of crashes, or a combination of the two will be used to best allocate regulatory and enforcement resources and support the stated safety goals. In a general consideration of risk, Starr and Whipple indicated “targeting” resources is effective in reducing risk.²⁸ Specifically to commercial motor vehicles, the targeted efforts of “compliance reviews” have been demonstrated to reduce crashes.²⁹

Several statistical analyses have focused on different portions of the research questions of the VSAS. The following details key findings from these studies.

2.5.1 Compliance Review Working Group

Research conducted by the Volpe Center for the Compliance Review Working Group (CRWG)³⁰ considered the association between violations (cited during compliance reviews and roadside inspections, and captured from post-crash inspections) and crashes. This research laid a robust foundation for statistical analysis (using regression and other parametric and non-parametric statistical techniques) with datasets assembled from the Motor Carrier Management Information System (MCMIS).

Several statistically significant associations between regulatory non-compliance (observed at compliance reviews) and crashes were found particularly for regulations in regulatory Parts 382, 391 and 395. For roadside inspections, the results were mixed: positive statistically significant associations were found for regulatory Parts 393 and 395.

In addition, violations observed in post-crash inspections were compared to violations observed during roadside inspections. Unlike the regression models and high/low analyses used for compliance reviews and roadside inspection results, the analysis for post-crash inspections was a simple comparison of violation rates. It was assumed that “instances where violations are found at a higher rate in post-crash inspections may

²⁸ Starr, Chauncy and Chris Whipple. 1980. “Risks of Risk Decisions.” *Science* 208(4448):1114-1119.

²⁹ Moses, Leon N. and Ian Savage. 1997. “A Cost-Benefit Analysis of US Motor Carrier Safety Programmes.” *Journal of Transport Economics and Policy*. 31(1):51-67

³⁰ Compliance Review Work Group Phase II Final Report: Proposed Operational Model for FMCSA Compliance and Safety Programs. Prepared by the John A. Volpe National Transportation Systems Center, Motor Carrier Safety Assessment Division. Prepared for the Federal Motor Carrier Safety Administration. 2004.

indicate that these particular violations are associated with crash involvement.”³¹ For both post-crash and other roadside inspections, the violation rate is the cumulative sum of violations per regulatory area divided by the cumulative sum of relevant inspections (according to regulatory part as related to driver, vehicle and/or hazmat).

The analysis found few “dramatic” differences in the violation rates for crashes and non-crash vehicles. Drug and alcohol, and traffic enforcement (392) violation rates were far greater in crash than in non-crash inspections; the rates were deemed “not comparable” because of the fact that drug and alcohol tests are conducted after a crash, but not during other roadside inspections, and also of the inconsistency of traffic enforcement activities between different states. Regulatory areas that demonstrated significantly higher rates in post-crash than in non-post crash inspections are the following: CDL standards (383), financial responsibility (387), brakes (393), cargo loading (393), and inspection, repair and maintenance (396).

2.5.2 American Transportation Research Institute and Others

The American Transportation Research Institute (ATRI)³² study and related analyses by Brenda Lantz³³ of the Upper Great Plain Transportation Institute focused on the relationship between driver violations and crashes. These analyses utilized a unique dataset combining violation and crash data from MCMIS with driver conviction and other records from MCMIS.

In “Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior-Based Model and Recommended Countermeasures,” ATRI assembled “driver-specific data sets”³⁴ in order to develop an “overall truck driver performance-based model for predicting future crash involvement based on prior driving history.”³⁵ “Violations discovered during roadside inspections, driver traffic conviction information and past crash involvement”³⁶ were used in order to link driving violations and crashes. The study found “statistically significant driving behaviors and events”³⁷ that increased the likelihood of crashes from 18% to 325%. The focus of the study is on-road driver behavior.

³¹ Compliance Review Work Group Phase II Final Report: Proposed Operational Model for FMCSA Compliance and Safety Programs, p. G-77.

³² Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior-Based Model and Recommended Countermeasures. American Transportation Research Institute (ATRI). 2005.

³³ Lantz, Brenda M. and Michael W. Blevins. 2001. “An Analysis of Commercial Vehicle Driver Traffic Conviction Data to Identify High Safety Risk Motor Carriers.” The Upper Great Plains Transportation Institute. <http://www.ugpti.org/research/carrier/>

³⁴ American Transportation Research Institute (ATRI). 2005. *Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior-Based Model and Recommended Countermeasures*. Page 2.

³⁵ Ibid. Page 2.

³⁶ Ibid. Page 2.

³⁷ Ibid. Page 2.

Other studies focusing on driver behavior echo the results of the ATRI effort and indicate a positive relationship between violation of regulations and crashes. Hickman³⁸ finds that 15% of drivers cause 50% of crash risk; hence, a program to identify and screen out the high-risk drivers would be useful. Lantz and Blevin³⁹ find driver convictions provide an indicator of risk.

2.5.3 Large Truck Crash Causation Study and National Truck Fleet and Bus Fleet Safety Surveys

The Large Truck Crash Causation Study (LTCCS)⁴⁰ and the recently-released National Truck Fleet and Bus Fleet Safety Surveys⁴¹ (NTFBFSS) provide important context for this analysis. The in-depth analysis of large truck crashes in the LTCCS and the conclusions drawn about causation provide unique insight to the severity of crashes.

The LTCCS⁴² found several broad driver behaviors that were considered the “critical reason” for a crash. These behaviors include: physical driver factor (12% of crashes), driver recognition factors (29%), driver decision factors (38%), and driver performance factors (6%). Relating behavioral factors (as represented in regulatory non-compliance) will in turn lead to a better and more accurate determination of drivers and carriers safety fitness.

The LTCCS was based on a nationally representative sample of large-truck fatal and injury crashes. 1,000 elements related to 967 crashes were collected for crashes that occurred during 2001 to 2003. These data elements help attribute crashes to such causes as commercial vehicle drivers operating their vehicle at excessive speed or operating with faulty brakes. Determining the critical reasons associated with crashes is important in determining the role of regulatory noncompliance in crashes. The quote below from Blower and Campbell⁴³ describes the statistical method used in determining crash causation.

“In the “statistical method,” causation is not determined by researchers at the data collection stage, regardless of their expertise. In fact, the “causes” of specific crashes are not determined or assigned at any point. Instead, crash cause is defined in terms of changes in risk. Researchers attempt to collect objective data describing the crash, the environment in which the crash occurred, and the vehicles and drivers involved. Analysts then search for associations between

³⁸ Hickman, Jeffrey S. 2005. “High-Risk Commercial Vehicle Drivers and Differential Crash Rates.” *Future Truck and Bus Research Opportunities: Conference Proceedings 38*. Transportation Research Board.

³⁹ Lantz, Brenda M. and Michael W. Blevins. 2001. “An Analysis of Commercial Vehicle Driver Traffic Conviction Data to Identify High Safety Risk Motor Carriers.” The Upper Great Plains Transportation Institute. <http://www.ugpti.org/research/carrier/>

⁴⁰ FMCSA. 2006. Report to Congress on the Large Truck Crash Causation Study. (MC-R/MC-RRA).

⁴¹ FMCSA. 2006. 2003 National Truck Fleet and Bus Fleet Safety Surveys: Final Report. (FMCSA-RI-06-044).

⁴² FMCSA. 2006. Report to Congress on the Large Truck Crash Causation Study. (MC-R/MC-RRA).

⁴³ Blower, Daniel and Kenneth L. Campbell. 2005. “Methodology of the Large Truck Crash Causation Study.” (FHWA-RI-05-035)

factors of interest and changes in the risk of crash involvement. In this approach, a "cause" is defined either explicitly or implicitly as a factor that increases the risk of a crash. "Risk" in the statistical method can be measured in either absolute or relative terms. Sometimes appropriate measures of exposure are available, and the absolute risks of a crash can be calculated. For example, if travel estimates for tractor-semitrailers and tractors pulling two trailers are available, the absolute rates can be calculated, and the crash risks per mile traveled for the two combinations can be compared. In other cases, exposure information is not available, and the crash data are analyzed to provide estimates of conditional or relative risks."

The NTFBFSS were conducted by the Federal Motor Carrier Safety Administration during the summer and fall of 2003. In the two studies, non-targeted (random) inspections were used to estimate driver and vehicle out-of-service (OOS) rates for both buses and large trucks regulated by FMCSA, based on Level 1 (i.e., full driver and vehicle) inspections. According to the 2003 NTFBFSS, the OOS violation rate from MCMIS, relative to the weighted randomly selected vehicle out-of-service violation rate from the NTFBFSS, does not demonstrate a significant bias. Brake-related violations were the most common type of OOS violation found, constituting roughly 40% of all OOS violations (both vehicle and driver). The most common driver OOS violations found were "No Record of Duty Status" and "Failure to Retain Logs for 7 Days," which together constituted 48% of all driver OOS violations.

2.5.4 Other Studies

Caird and Kline⁴⁴ put forth an analytical approach to consider both the impacts of organization and individual behaviors in commercial motor vehicle crashes. Within the context of a multi-year study of one large motor carrier, the analysis addresses the role of organizational support, planning, driver errors, fatigue, speed, and other related factors in crashes. The findings detail driver behaviors that predict crashes, supporting recommendations for adequate training, appropriate work schedules, and a safety culture in order to reduce crashes.

Research at the University of North Carolina Highway Safety Research Center (UNC-HSRC) has addressed the relationship between regulatory violations and crashes. Two studies conducted to address truck crash risk and efforts to target enforcement efforts for remedial actions of note are Hughes (2001), and Hughes, Gray and Evan (2002).⁴⁵

⁴⁴ Caird, J.K. and T.J. Kline. 2004. "The Relationships Between Organizational and Individual Variables to On-the-job Driver Accidents and Accident-free Kilometers." *Ergonomics*. 47(15):1598-1613. Page 1161.

⁴⁵ Hughes, Ronald G. 2001. "The Effectiveness of Commercial Motor Vehicle (CMV) Enforcement in reducing Truck-Involved Crashes." And Hughes, Ronald G, George E. Gray, Anna Beth Evan. 2002. "Quantifying the Crash Reduction Benefits of 'Targeted' Commercial Vehicle Enforcement Efforts." <http://www.hsrc.unc.edu/research/truck.htm>

Several other academic articles provide useful underpinnings for establishing the appropriate indicators and measures of large truck crash risk notably, Hakkert and Braimler⁴⁶, Hauer et al⁴⁷, and Lyman and Braver⁴⁸.

2.6 Applications in Safety Rating: SafeStat and the Intervention Model

In the SafeStat methodology, the severity weight of three is used for acute violations, a weight of two is used for operational critical violations, and a weight of one is used for paperwork critical violations: Table 2-3 depicts these severity weights. Severity weights for 188 acute, critical, and severe violations are considered in the computation of driver, vehicle, safety management, and hazardous material review measures. Other weights applied in the safety rating algorithms include time-weighting (recent violations receive more weight than older ones) and out-of-service violation rate weighting (driver and vehicle out-of-service violations receive more weight than equivalent non- out-of-service violations).

Table 2-3: SafeStat Critical and Acute Violations Severity Weightings

Severity Weight	Criterion
1	Violations of critical regulations that are compliance or paperwork oriented
1	Violations of hazardous material-related severe regulations
2	Violations of critical regulations that are performance oriented
3	Violations of all ratable acute regulations

“Use of Critical and Acute Violations in SafeStat and in Safety Fitness Determination,”⁴⁹ by Tom Corsi, defines the weighting system that is currently used to include critical and acute violations in the SafeStat algorithm. The paper was prepared to: (1) demonstrate how individual critical and acute violations are incorporated into SafeStat; (2) illustrate the difference between “critical and acute violations” across review areas; (3) detail how these violations are incorporated into overall carrier safety fitness determination as component of Compliance Review process; and (4) detail how violations of hazardous materials regulations are incorporated.

The Volpe Center’s Intervention Model, which measures the benefits derived from conducting roadside inspections in a given year, in terms of crashes avoided and lives saved, relates violations found through the Roadside Inspection (RI) and Traffic Enforcement (TE) programs to both the direct and indirect avoidance of crashes, and the

⁴⁶ Hakkert, A.S. and L. Braimster. 2002. “The Uses of Exposure and Risk in Road Safety Studies.” SWOV Institute for Road Safety Research.

⁴⁷ Hauer, Ezra, D.W. Harwood, F.M. Council, M.S. Griffith. 2002. “The Empirical Bayes Method for Estimating Safety: A Tutorial.” Pages 126-131 in *Transportation Research Record 1784*. Transportation Research Board.

⁴⁸ Lyman, S and E.R. Braver. 2003. “Occupant deaths in large truck crashes in the United States: 25 years of experience.” *Accident Analysis and Prevention* 35(5): 731-739.

⁴⁹ Appendix B in “Background Research and Literature Review,” June 30, 2006.

resulting fatalities and injuries. As a key part of the model, individual violations are converted into crash risk probabilities that are in turn categorized into one of five “Risk Categories.” This weighting scheme—where violations under Risk Category 1 contribute the most risk towards a crash occurring whereas those under Risk Category 5 provide the least risk—is based on the methodology of the Cyclia study, discussed in Section 2.4. The Intervention Model carefully considers violation weight by also separately calculating crash risk probabilities for violations found by Traffic Enforcement and Roadside Inspection Programs.

The Intervention Model uses risk categories and observed deficiencies (out-of-service and non-out-of-service violations) to derive crash risk probabilities. This method is based on the assumption that detected defects represent varying degrees of mechanical and judgmental faults, and further, that some are more likely than others to play a contributory role in crashes. The assumption is that these deficiencies can be noted and ranked into discrete risk categories, each of which possesses a probability that reflects the crash risk that it poses.

2.7 Conclusions

The genesis for VSAS is found in the need to improve the current ranking of risk related to regulatory non-compliance of commercial motor vehicles. While qualitative and quantitative analyses to date have established relative measures (such as critical, acute, and out-of-service, as well as a categorization scale), defined risk, and laid an analytical foundation, the data available in MCMIS can now support the comprehensive statistical analysis of VSAS. The following section describes in detail the regulations and the data in MCMIS used in the VSAS analysis.

Chapter 3: Regulations and Data

3.1 Overview

The unit of analysis in the VSAS is the individual regulation. The Federal Motor Carrier Safety Administration has three main enforcement tools: roadside inspections, traffic enforcements and compliance reviews, to evaluate regulatory compliance. During these interventions violations of regulations are detected and recorded. The FMCSA regulates a wide variety of large trucks and buses resulting in regulations specific to different types of vehicles and carriers, notably hazardous materials and passenger carriers.

Safety regulations for commercial motor vehicles (CMVs) are comprised of a set of specific operational requirements or prohibited activities. As the congressional-designated executive-branch regulatory agency, the FMCSA defines and enforces these regulations. This section introduces the FMCSA's role and safety regulations. It then defines the universe of regulations as well as those regulations for which violations have been observed. The universe of regulations is defined by this study through the creation of the "Volpe Center Regulations Master File." From the universe of regulations, the list for analysis has been narrowed based on relevance and data availability.

Data are collected as part of several separate activities by state and federal safety inspectors. The quality of the data is a function of how the data are collected and classified. Crash data are critical to the analysis: the risk associated with the violation of a particular regulation is calculated from observations of violations in normal roadside inspections and violations in post-crash inspections. The observed data are drawn from the Motor Carrier Management Information System (MCMIS).

3.2 FMCSA Regulatory Authority

Formed by federal legislation⁵⁰ in 1999, the FMCSA has broad powers to develop and enforce regulations, and set and implement policy. As with most federal agencies, the FMCSA is part of the executive branch and responsive to federal legislation⁵¹, executive orders and directives from the Secretary of the Department of Transportation, and is subject to both Congressional and Executive agency oversight⁵². Further, the FMCSA's activities in rulemaking and applying rules to motor carriers are subject to appeal to the United States Court of Appeal for the District of Columbia.

⁵⁰ Motor Carrier Safety Improvement Act of 1999, Public Law 106-159—December 9, 1999

⁵¹ As a regulatory agency, the FMCSA must also follow the rulemaking process set out in the Administrative Procedure Act (Title 5, CFC §5 511-599).

⁵² In addition to their committee and subcommittee oversight activities, Congress relies on the Congressional Budget Office to conduct research and policy analysis; Executive branch oversight is provided within the Department of Transportation by the Inspector General, and also by the Office of Management and Budget.

3.3 Commercial Motor Vehicle (CMV) Safety Regulations

3.3.1 What are regulations?

Regulations are legal restrictions promulgated by government administrative agencies through rulemaking supported by a threat of sanction or a fine. Regulations are mandated to produce outcomes which might not otherwise occur (decrease crash risk); and/or produce or prevent outcomes in different places to what might otherwise occur (decreased crash risk). Safety regulations are designed “to prohibit certain undesirable byproducts of the production process.”⁵³

3.3.2 FMCSRs and HMRs

The universe of regulations is found in the Federal Motor Carrier Safety Regulations (FMCSRs) and Hazardous Materials Regulations (HMRs) (Title 49 of the Code of Federal Regulations (CFR)), and Title 23 Part 658 (size and weight). A master list of all regulations nearly 27,500 separate clauses relevant to motor carrier operations has been assembled by the Volpe Center. Table 9-1 in Chapter 9:Appendix of Analysis of Valid Regulations in MCMIS illustrates the high level regulatory areas, 54 CFR parts, from the federal code. The lion’s share of the regulations is represented in the FMCSR⁵⁴ and HMRs⁵⁵.

Businesses and individuals who operate CMVs (large trucks or passenger-carrying vehicles) in interstate commerce must comply with FMCSRs and HMRs. Specifically, the FMCSRs and HMRs apply to:

- Operators of motor vehicles with a gross vehicle weight rating (GVWR), gross combination weight rating (GCWR), gross vehicle weight (GVW), or gross combination weight (GCW) of 4,536 kilograms (10,001 lbs) or more in interstate commerce
- Operators of motor vehicles designed or used to transport more than 15 passengers (including the driver) in interstate commerce
- Operators of motor vehicles designed or used to transport between 9 and 15 passengers (including the driver), for direct compensation, beyond 75 air miles from the driver's normal work-reporting location, in interstate commerce
- Transporters of hazardous materials, in a quantity requiring placards, in interstate commerce
- For-Hire and Private carriers

⁵³ Gramlich, Edward M. 1990. A Guide to Benefit-Cost Analysis. Upper Saddle River, NJ: Prentice Hall. Page 198.

⁵⁴ http://www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/fmcsrguide.asp?section_type=A

⁵⁵ Title 49, Subchapter C, Parts 107, 130, 171, 172, 173, 177, 178, 179 and 180: <http://www.myregs.com/dotrspa/>

Adherence to these Federal Regulations is the primary indicator of the safety posture of a motor carrier. These regulations focus on the operational activities of motor carriers, drivers and vehicles and comprehensively define a minimum standard of acceptable behavior. Regulations are created to discourage and force correction of unacceptable behaviors that are believed to be related to crashes.

3.3.3 Regulating Commercial Motor Vehicle Operations

The operational behavior of commercial motor vehicle drivers and operators, as well as the configuration and operational condition of the vehicle itself are regulated by the FMCSRs and HMRs. The list of driver-related regulations is extensive, beginning with licensing standards, operational behaviors and hours-of-service. The corresponding regulations for drivers are defined at the broad part-level (for example, “Commercial Driver’s License Standards, Requirements, and Penalties” Part 383) and extends to the more granular part, section-part level (for example, “Number of Drivers Licenses” 383.21 “No person who operates a commercial motor vehicle shall at any time have more than one driver’s license.”)

Specific and general requirements are placed on motor carriers, ranging from operating authority, drug-testing program requirements to record keeping. As with driver-related regulations, carrier regulations are defined at the broad part-level (for example, “Safety Fitness Procedures” Part 385) and extends to the more granular part, section-part level (for example, “What happens after a new entrant has been notified under 385.319C to take corrective action to remedy its safety management practices?” 385.325 “...(c) The new entrant may not operate in interstate commerce on or after the effective date of the out-of-service order.”)

Requirements for the configuration and operational condition of the vehicle and its load are detailed in the regulations. The corresponding regulations for vehicles are also defined at the broad part-level. An example is Part 393 “Parts and Accessories Necessary for Safe Operation.” A section-specific part level under Part 393 is 393.75A2 “No motor vehicle shall be operated on any tire that has any tread or sidewall separation.”

3.3.4 Volpe Center Regulations Master File

The “Volpe Center Regulations Master File” was assembled as part of the VSAS to describe the universe of regulations, reconcile inconsistencies in data captured during inspections and the regulations, and support regulation groupings for VSAS. A comprehensive list of all regulations listed by part and part section according to the published regulations was created. While the comprehensive listing of all relevant regulations was useful in framing the following discussion and organizing the regulations for analysis, the availability of MCMIS inspection data has driven the violation risk analysis.

3.4 Motor Carrier Safety Regulations Cited within MCMIS

MCMIS contains data that help determine the safety fitness of commercial motor carriers and hazardous material (HM) shippers that are subject to the FMCSRs and HMRs. The database is a compilation of information, including state-reported crashes, compliance

reviews and roadside inspection results, enforcement data and motor carrier census data. Analysis for VSAS has concentrated on violations cited in compliance reviews, roadside and traffic enforcement inspections and violations cited in post-crash inspections. In addition, the crash table provides the necessary details about crashes in the post-crash inspections.

Within MCMIS, there are 36 CFR parts that have at least one violation of a regulation between 2003 and 2006. In total, there are more than 2,500 unique regulations that have been cited in any type of inspection during the analysis period⁵⁶. The FMCSA, whose mission is to reduce crashes, injuries and fatalities involving large trucks and buses, administers these regulations. The 36 regulatory parts under which at least one violation of has been cited are listed Table 3-1 with the number of regulations with violations in parentheses.

Table 3-1: Title 49 CFR Parts

Part 40 – Procedures for Transportation Workplace Drug and Alcohol Testing Programs (141)	Part 376 – Lease and Interchange of Vehicles (17)
Part 107 - Hazardous Materials Program Procedures (27)	Part 379 – Preservation of Records (2)
Part 130 - Oil Spill Prevention And Response Plans (3)	Part 380 – Special Training Requirements (23)
Part 171 - General Information, Regulations, And Definitions (38)	Part 381 - Waivers, Exemptions, And Pilot Programs (1)
Part 172 - Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, And Training Requirements (264)	Part 382 – Controlled Substances and Alcohol Use and Testing (188)
Part 173 - Shippers--General Requirements For Shipments And Packagings (270)	Part 383 – Commercial Driver's License Standards; Requirements and Penalties (51)
Part 177 - Carriage By Public Highway (92)	Part 385 – Safety Fitness Procedures (28)
Part 178 - Specifications For Packagings (149)	Part 386 - Rules of Practice for Motor Carrier, Broker, Freight Forwarder, and Hazardous Materials Proceedings (13)
Part 179 - Specifications For Tank Cars (1)	Part 387 – Minimum Levels of Financial Responsibility for Motor Carriers (31)
Part 180 - Continuing Qualification And Maintenance Of Packagings (166)	Part 390 – Federal Motor Carrier Safety Regulations; General (50)
Part 365 – Rules Governing Applications for Operating Authority (1)	Part 391 – Qualifications of Drivers and Longer Combination Vehicle (LCV) Driver Instructions (161)

⁵⁶ Several other “regulations” are included in MCMIS, yet are considered “invalid” for a variety of reasons. Chapter 9: further details the criteria used to screen the “invalid” regulations contained in the MCMIS database.

Part 366 – Designation of Process Agents by Motor Carriers and Brokers (4)	Part 392 – Driving of Motor Vehicles (80)
Part 367 – Standards for Registration with States (1)	Part 393 – Parts and Accessories Necessary for Safe Operation (326)
Part 370 – Principles and Practices for the Investigation and Voluntary Disposition of Loss and Damage Claims and Processing Salvage (11)	Part 395 – Hours of Service of Drivers (138)
Part 371 – Brokers of Property (14)	Part 396 – Inspection, Repair and Maintenance (93)
Part 373 – Receipts and Bills (3)	Part 397 – Transportation of Hazardous Materials; Driving and Parking Rules (37)
Part 374 – Passenger Carrier Regulations (13)	Part 398 – Transportation of Migrant Workers (6)
Part 375 – Transportation of Household Goods in Interstate Commerce; Consumer Protection Regulations (124)	Part 399 – Employee Safety and Health Standards (2)

3.4.1 Inspection and Compliance Review Data Collection Tools

MCMIS data are collected by state and federal inspectors using data-capture tools (Aspen and CAPRI) and funneled into MCMIS via a common protocol (SAFETYNET).

SAFETYNET is a database management system designed to support federal and state motor carrier safety programs. It allows entry, access, analysis, and reporting of data from driver/vehicle inspections, crashes and complaints. Further, SAFETYNET allows the field staff to import and export driver/vehicle inspections, crashes, compliance reviews and safety audits, complaints and carrier census data. SAFETYNET is operated at state safety agencies and federal divisions and interfaces with Aspen, CAPRI, Safety and Fitness Electronic Records (SAFER⁵⁷), MCMIS, and state systems. Within SAFETYNET there is a pick list that contains 754⁵⁸ FMCSRs and HMRs which can be selected as a violation during a roadside inspection.

Aspen is the software application that is utilized to capture driver and vehicle inspection data and transfer it to the SAFER and/or SAFETYNET systems. From there, the data are uploaded into the MCMIS database. The ASPEN's pick list includes 748⁵⁹ regulations.

CAPRI is used to capture FMCSA reviews, including: compliance reviews, safety audits, specialized cargo tank facility reviews, and HM shipper reviews. It also creates the

⁵⁷ The FMCSA Safety and Fitness Electronic Records (SAFER) System offers company safety data and related services to industry and the public over the Internet. Users can search FMCSA databases, register for a USDOT number, pay fines online, order company safety profiles, challenge FMCSA data using the DataQs system, access the Hazardous Material Route registry, obtain National Crash and Out of Service rates for Hazmat Permit Registration, get printable registration forms and find information about other FMCSA Information Systems.

⁵⁸ SAFETYNET pick list as of February 2007.

⁵⁹ Aspen pick list as of February 2007.

preliminary carrier safety fitness rating and various reports for motor carriers. It electronically transfers data to SAFETYNET and/or MCMIS. The CAPRI database pick list contains significantly more, 966⁶⁰ regulations, which can be selected by an inspector during compliance review.

FMCSA developed the MCMIS crash file which contains state-reported data from police crash reports involving drivers and vehicles of all motor carriers (interstate and intrastate) operating in the U.S. It includes a standard set of data elements that the states are required to collect for all trucks and buses involved in crashes that meet a specific severity threshold. The MCMIS crash file also includes several other data elements that are derived by linking the state supplied data to other files.

3.4.2 Behavior Analysis and Safety Improvement Categories (BASICS)

As part of the CSA 2010 Initiative, FMCSA regulations have been categorized into six Behavior Area Safety Improvement Categories (BASICS). These categories were used in this study to identify regulations pertaining to the driver and vehicle.

The BASICS are as follows:

- Unsafe Driving — Dangerous or careless operation of commercial motor vehicles. Example violations: speeding, reckless driving, improper lane change, and inattention.
- Fatigued Driving — Driving commercial motor vehicles when fatigued. Instances related to the Fatigued Driving BASIC be distinguished from incidents where unconsciousness or an inability to react is brought about by the use of alcohol, drugs, or other controlled substances. Example violations: hours-of-service, logbook and operating a Commercial Motor Vehicle (CMV) while ill or fatigued.
- Driver Fitness — Operation of commercial motor vehicles (CMVs) by drivers who are unfit to operate a CMV due to lack of training, experience or medical qualifications. Example violations: Failure to have a valid and appropriate commercial driver's license and failure to have proper medical documentation.
- Controlled Substance/Alcohol — Operation of a CMV while impaired due to alcohol, illegal drugs, and misuse of prescription or over-the-counter medications. Example violations: uses or possession of controlled substances or alcohol.
- Vehicle Maintenance — CMV failure due to improper or inadequate maintenance. Example violations: brakes, lights, and other mechanical defects, and failure to make required repairs.
- Improper Loading/Cargo Securement — Shifting loads, spilled or dropped cargo, and unsafe handling of hazardous materials. Example violations: improper load securement, cargo retention, and hazardous material handling.

⁶⁰ CAPRI pick list as of February 2007.

- Administrative/Accountability – Not safety related regulations that deal with administrative actions or accountability, e.g. insurance.

The classification of cited regulations into BASICs was used as a grouping in the analysis for grouping and defining drivers and vehicle violations and mapping compliance review (carrier audits) violations to the road safety performance.

3.5 Overview of Roadside Inspection Data in Analysis

The MCMIS data was used to conduct all analysis for four calendar years, 2003-2006⁶¹. Three inspection and/or enforcement areas were used in analysis: roadside inspections, traffic enforcements and compliance reviews. Within these intervention areas some of the regulations are only applicable to specific operation types which are taken into account. The methodology involved comparing regulations cited in non-post-crash inspections to those cited in post-crash inspections.

The MCMIS data used is the inspection, crash and compliance review tables. The regulations were partitioned in various ways to account for exposure.

Roadside Inspection Regulations

Roadside Inspections (RI) are federal and state fixed and remote inspection activities that include several inspection levels. Roadside Inspection (RI) regulations are considered to be those to which a carrier, driver or vehicle would be exposed during the course of a roadside inspection at a fixed or remote location. Any regulation that is cited at both roadside inspections and compliance review is considered a roadside inspection regulation and is evaluated as such. For example, “No driver’s record of duty status” 395.8A, is found in both roadside inspections and compliance reviews and had 42,526 roadside inspection violations and 3,454 compliance review violations in 2005.

Traffic Enforcement Regulations

Traffic Enforcement (TE) activities are focused on citing moving violations and subsequently conducting additional safety inspections. Regulations concerning moving violations are those violations observed during traffic enforcement activities; these include many regulations addressing Unsafe Driving as defined by the current CSA 2010 initiative, and regulations that are classified by the MCSAP Traffic Enforcement Program as ‘Traffic Enforcement.’⁶² Regulations concerning moving violations are assessed separately from the roadside violation results, because the exposure of these specific violations is different than those commonly found in roadside inspections. The Traffic Enforcement Program inspections have two parts: a traffic stop due to a moving violation and a subsequent roadside inspection.

⁶¹ In order to obtain 4 years of inspection data it was necessary to concatenate two MCMIS snapshots since the MCMIS snapshot only contains 3-4 years of inspections; March 2007 and March 2006 snapshots were used in the analysis.

⁶² The MCSAP program identifies a list of moving violations that can be found: <http://ai.fmcsa.dot.gov/Help/Help.asp#tel>, as of October 2006 the list of moving violations has changed and both lists were considered in this analysis .

Hazardous Materials Regulations

Hazardous Materials (HM) inspections are federal and state fixed and mobile inspection activities applied to hazardous materials shipments. The methodology for analyzing hazardous materials violations directly mirrors that of RI calculations. For violations of hazardous material regulations and crashes, only CMVs carrying hazardous materials are included; these data are recognized using hazardous materials identifiers.

Passenger Carrier Regulations

Passenger carrier (PC) specific regulations are regulations applicable only for passenger carriers. Passenger carrier specific regulations need to be treated separately because only a portion of the population (buses, vans, motorcoaches, etc.) is subject to these certain regulations. The violations of these regulations must be compared to only the relevant sub-set of all passenger carriers.

FMCSA defines passenger carriers as vehicles engaged in the transport of 15 or more passengers⁶³, including vans, buses (including school buses), limos, and motor coaches.⁶⁴ A motorcoach (also called an over-the-road bus) can typically transport 40 to 50 passengers. School buses vary in size and seating capacity, but can typically transport 10 to 80 passengers. A mini-bus is designed to transport 16 or more passengers, and is typically built on a small truck chassis. A minibus has a smaller seating capacity than a motorcoach. A passenger van can typically transport 15 or fewer passengers. Limousines and airport shuttles can typically transport 15 or fewer passengers, but vary in size and seating capacity.⁶⁵

There are several parts of the FMCSRs directed uniquely toward passenger carriers. These regulations are focused in three broad areas: 1) federal rules related to ensuring adequacy of service and non-discrimination (Part 374) and insurance requirements (Part 387); 2) driver related requirements focused on CDL endorsements and required knowledge to operate a bus (Parts 383, 391, 392.62-392.63, 398.4G5) and hours of service exceptions (Parts 395.1 and 395.5); and, 3) vehicle related (Part 393).

3.5.1 Driver/Vehicle Roadside Inspections and Regulations

Roadside inspections found in MCMIS are the basis for the analysis on the roadside inspection regulations, traffic enforcement regulations, hazardous material regulations and passenger carrier regulations. As previously stated the inspections have a driver aspect, vehicle aspect, or both driver and vehicle aspect; this can be determined by the level of inspection. There are six different levels of inspections⁶⁶ including:

⁶³ Passenger carriers transporting 8 to 14 passengers interstate are subject to FMCSRs under certain circumstances (when operating beyond 75 air miles radius around normal work-reporting location); <http://www.fmcsa.dot.gov/rules-regulations/bus/company/smallvanbackinfo.htm>

⁶⁴ The following are the corresponding vehicle type identification codes: Bus (1), Limousine (4), Motorcoach (5), School Bus (8), and Van (12).

⁶⁵ <http://www.ai.fmcsa.dot.gov/Passenger/guide.asp>

⁶⁶ <http://www.fmcsa.dot.gov/safety-security/safety-initiatives/mcsap/insplevels.htm>

- LEVEL I North American Standard Inspection - An inspection that includes examination of driver's license, medical examiner's certificate and waiver, if applicable, alcohol and drugs, driver's record of duty status as required, hours of service, seat belt, vehicle inspection report, brake system, coupling devices, exhaust system, frame, fuel system, turn signals, brake lamps, tail lamps, head lamps, lamps on projecting loads, safe loading, steering mechanism, suspension, tires, van and open-top trailer bodies, wheels and rims, windshield wipers, emergency exits on buses and HM requirements, as applicable.
- LEVEL II Walk-Around Driver/Vehicle Inspection - An examination that includes each of the items specified under the North American Standard Inspection. As a minimum, Level II inspections must include examination of: driver's license, medical examinees certificate and waiver, if applicable, alcohol and drugs, driver's record of duty status as required, hours of service, seat belt, vehicle inspection report, brake system, coupling devices, exhaust system, frame, fuel system, turn signals, brake lamps, tail lamps, head lamps, lamps on projecting loads, safe loading, steering mechanism, suspension, tires, van and open-top trailer bodies, wheels and rims, windshield wipers, emergency exits on buses, and HM requirements, as applicable. It is contemplated that the walk-around driver/vehicle inspection will include only those items which can be inspected without physically getting under the vehicle.
- LEVEL III Driver-Only Inspection - A roadside examination of the driver's license, medical certification and waiver, if applicable, driver's record of duty status as required, hours of service, seat belt, vehicle inspection report, and HM requirements, as applicable.
- LEVEL IV Special Inspections - Inspections under this heading typically include a one-time examination of a particular item. These examinations are normally made in support of a study or to verify or refute a suspected trend.
- LEVEL V Vehicle-Only Inspection - An inspection that includes each of the vehicle inspection items specified under the North American Standard Inspection (Level I), without a driver present, conducted at any location.
- LEVEL VI Enhanced NAS Inspection for Radioactive Shipments⁶⁷ - An inspection for select radiological shipments, which include inspection procedures, enhancements to the Level I inspection, radiological requirements, and the enhanced out-of-service criteria.

Inspection levels I, II and VI are considered to have both a driver and vehicle aspect. Inspection level III only has a driver component, while a level V inspection only covers the vehicle. The level IV inspections are rarely used therefore it is hard to know exactly what these inspections cover.

⁶⁷ Level VI inspections are coded in MCMIS as Level I inspections.

The regulations, as with the inspections, are usually either driver or vehicle specific. The BASICs that a given regulation is assigned, determine if the regulation would be found in a driver or vehicle inspection. For example, Unsafe Driving, Fatigued Driving, Driver Fitness and Controlled Substance/Alcohol regulations would be found in a driver inspection, while Vehicle Maintenance and Improper Loading/Cargo Related would be found in a vehicle inspection. The Administrative/Accountability regulations are neither driver nor vehicle specific so it is assumed they can be found in any inspection type. Table 3-2 describes the different regulation type as they are applicable to inspections.

Table 3-2: Regulation Types as Applicable to Inspection Types

Regulation Type	Inspection Type			Total
	Administrative	Driver	Vehicle	
General Roadside	30	74	329	433
Hazardous Materials	5	21	388	414
Traffic Enforcement	0	24	3	27
Passenger Carrier	4	12	27	43
Total	39	131	747	917

3.5.2 Post-Crash Inspections

The violation risk methodology revolves around comparing violations found in post-crash inspections with those violations that are found in non-post-crash inspections. Data limitations exist in MCMIS due to the lack of a common link between the post-crash inspections and the crash records. Further, the inconsistency found among reporting states and the percentage of crashes that receive a post-crash inspection hinder the quality of these records. Table 10-1 details the number of crashes and number of post-crash inspections found by report state.

Overall, only approximately 14% of the crashes nationwide between 2003 and 2006 had a post-crash inspection performed. The difference among states becomes clear when comparisons are made between the states of California where 0.14% of crashes have a post-crash inspection and Vermont where 99.55% of crashes have a post-crash inspection.

There were 81,385 post-crash inspections between 2003 and 2006, displays the number of post-crash inspections, but this number is further reduced when we try to link these records to the corresponding crash record to obtain the crash severity. As previously mentioned there is no link, or identification field, between the crash records and post-crash inspection so other fields are used a substitute including: date, report state, driver information (last name, license number and license state) or vehicle information (plate number and state or vehicle identification number (VIN)). Less than half of the post-crash inspections were matched with their crash record (38,307 out of 81,385), 47.07%, limiting the information on crash severity.

3.5.3 Roadside Inspection Regulations

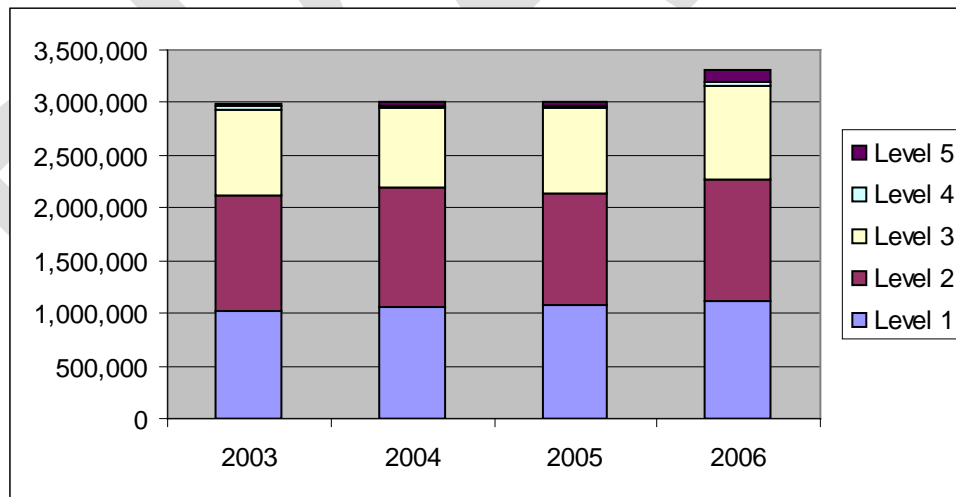
Roadside inspection regulations are found in the roadside inspections of all levels. Between the years of 2003 and 2006 there were a 12.3 million inspections performed of which 8.9 million inspections had at least one violation (72.6%). The distribution of RI is detailed by Table 3-3 where the majority of inspections are of level I, II or III.

Table 3-3: Roadside Inspections by Inspection Level, Calendar Years 2003-2006

Inspection Level	2003	2004	2005	2006
Level I - North American Standard Inspection	1,014,044	1,062,309	1,078,307	1,113,680
Level II - Walk-Around Driver/Vehicle Inspection	1,103,741	1,138,358	1,068,151	1,162,250
Level III - Driver-Only Inspection	823,539	742,132	796,852	890,046
Level IV - Special Inspections	22,145	20,997	23,827	25,045
Level V - Vehicle-Only Inspection	33,416	35,608	37,226	116,235
Total	2,996,885	2,999,404	3,004,363	3,307,256

A graphical illustration of the inspections is detailed in Figure 3-1.

Figure 3-1: Roadside Inspections by Level, Calendar Years 2003-2006

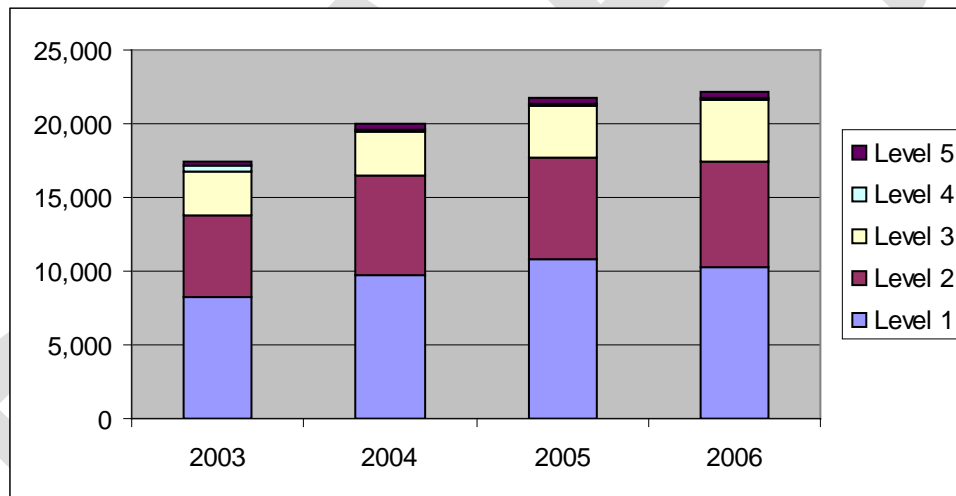


The violations found in the roadside inspections are compared to violations found in post-crash inspections. Table 3-4 displays the distribution of post-crash inspections by level and year, where it is shown that level I inspections are cited the most frequently.

Table 3-4: Post-Crash Inspections by Level, Calendar Years 2003-2006

Inspection Level	2003	2004	2005	2006
Level I - North American Standard Inspection	8,181	9,780	10,818	10,334
Level II - Walk-Around Driver/Vehicle Inspection	5,601	6,704	6,837	7,128
Level III - Driver - Only Inspection	3,019	2,938	3,523	4,141
Level IV - Special Inspections	335	214	176	167
Level V - Vehicle-Only Inspection	341	369	363	416
Total	17,477	20,005	21,717	22,186

A graphical illustration of the inspections is detailed in Figure 3-2.

Figure 3-2: Post-crash Inspections by Level, Calendar Years 2003 - 2006

To obtain the severity of the post-crash inspections the violations are linked to crashes. The distribution of crash severity is displayed in Table 3-5. Over the four years, 3.4% of the crashes resulted in fatality, 43.7% resulted in an injury and 52.8% were tow-away crashes.

Table 3-5: Crashes by Severity, Calendar Years 2003 - 2006

Crash Severity	2003	2004	2005	2006	Total
Fatal Crashes	4,669	5,070	5,461	4,788	19,988
Injury Crashes	63,680	66,098	66,703	59,504	255,985
Tow-Away Crashes	68,031	77,442	83,872	79,827	309,172
Total	136,380	148,610	156,036	144,119	585,145

3.5.4 Traffic Enforcement (TE) Regulations

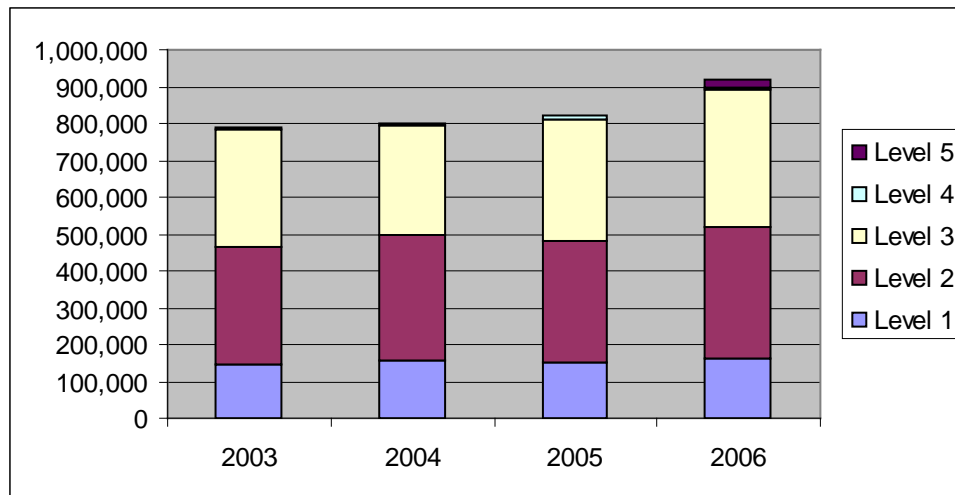
The Traffic Enforcement Program is composed of two activities: issuing a citation for the moving violation resulting in a traffic stop and the subsequent inspection. The subsequent inspection is treated as a normal roadside inspection where the roadside inspection regulations may be found. The initiating moving violation does not have the same exposure as violations found in the roadside inspection since the CMV must be moving at the time of the violation. These inspections are treated separately and the distribution of the inspections by level and year is detailed in Table 3-6. The distribution of inspection level seems to be more heavily geared towards level II and III inspections; intuitively this makes sense since the investigators are not performing the inspections at fixed locations, instead they are most likely performing the inspection on the side of the road so crawling under the truck to perform level I inspection may not be the safest choice. Level III inspections, which are cited the most frequently of any level inspection in 2006, might be favored because most traffic enforcement stops are initiated because of the driver's behavior making other aspects of driver behavior the most relevant.

Table 3-6: TE Inspections by Level, Calendar Years 2003-2006

Inspection Level	2003	2004	2005	2006
Level I - North American Standard Inspection	143,930	154,191	152,558	164,217
Level II - Walk-Around Driver/Vehicle Inspection	320,429	345,622	331,131	356,352
Level III - Driver - Only Inspection	318,372	294,694	328,685	372,456
Level IV - Special Inspections	2,551	1,638	6,658	6,658
Level V - Vehicle-Only Inspection	2,073	1,831	2,069	19,157
Total	787,355	797,976	821,101	918,840

A graphical illustration of the inspections is detailed in Figure 3-3.

Figure 3-3: TE Inspections by Level, Calendar Years 2003-2006



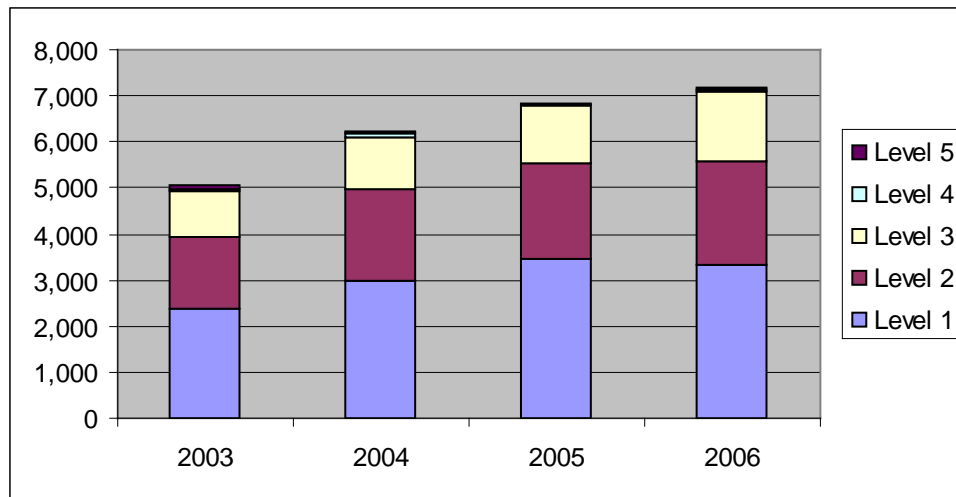
The post-crash inspections where a traffic enforcement violation is cited seem to follow the trend of roadside inspection post-crash inspections. The most common inspection level is I and is detailed in Table 3-7.

Table 3-7: TE Post-Crash Inspections by Level, Calendar Years 2003-2006

Inspection Level	2003	2004	2005	2006
Level I - North American Standard Inspection	2,369	2,965	3,438	3,348
Level II - Walk-Around Driver/Vehicle Inspection	1,554	2,014	2,092	2,236
Level III - Driver - Only Inspection	989	1,137	1,243	1,502
Level IV - Special Inspections	79	52	39	44
Level V - Vehicle-Only Inspection	48	54	41	50
Total	5,039	6,222	6,853	7,180

A graphical illustration of the inspections is detailed in Figure 3-4.

Figure 3-4: TE Post-crash Inspections by Level, Calendar Years 2003-2006



The distribution of crash severity for traffic enforcements is the same as roadside inspections and is detailed in Table 3-5.

3.5.5 Hazardous Material (HM) Regulations

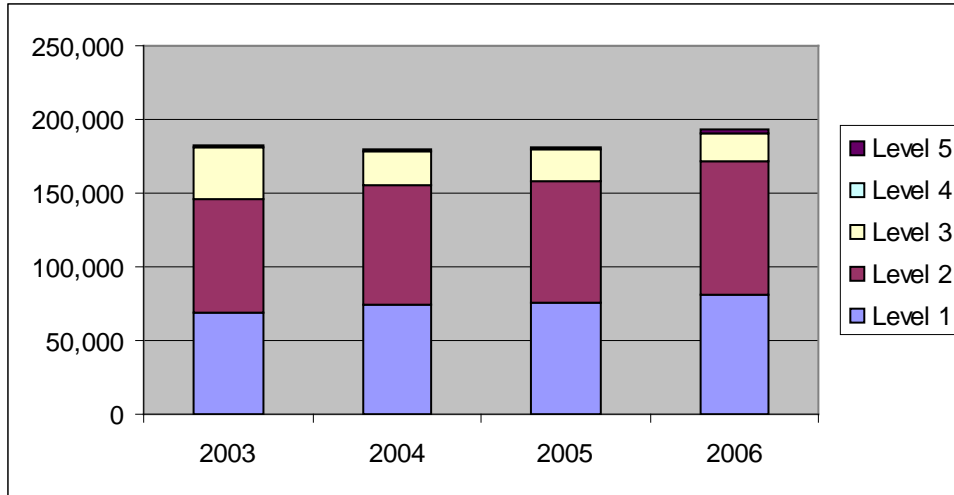
Violations of HM regulations are found in those inspections where the vehicle in questions is hauling HM. To account for this special subset of regulation only the roadside inspections, post-crash inspections and crashes where the vehicle is carrying HM are considered. The distribution of HM inspections by level indicates that levels I and II are most frequently conducted on these types of vehicles. Table 3-8 shows this distribution.

Table 3-8: HM Inspections by Level, Calendar Years 2003-2006

Inspection Level	2003	2004	2005	2006
Level I - North American Standard Inspection	68,767	73,897	75,730	81,281
Level II - Walk-Around Driver/Vehicle Inspection	77,089	81,779	81,779	89,799
Level III - Driver - Only Inspection	34,891	22,577	22,444	19,312
Level IV - Special Inspections	745	739	718	734
Level V - Vehicle-Only Inspection	836	902	998	1,732
Total	182,328	179,894	181,669	192,858

A graphical illustration of the inspections is detailed in Figure 3-5.

Figure 3-5: HM Inspections by Level, Calendar Years 2003-2006



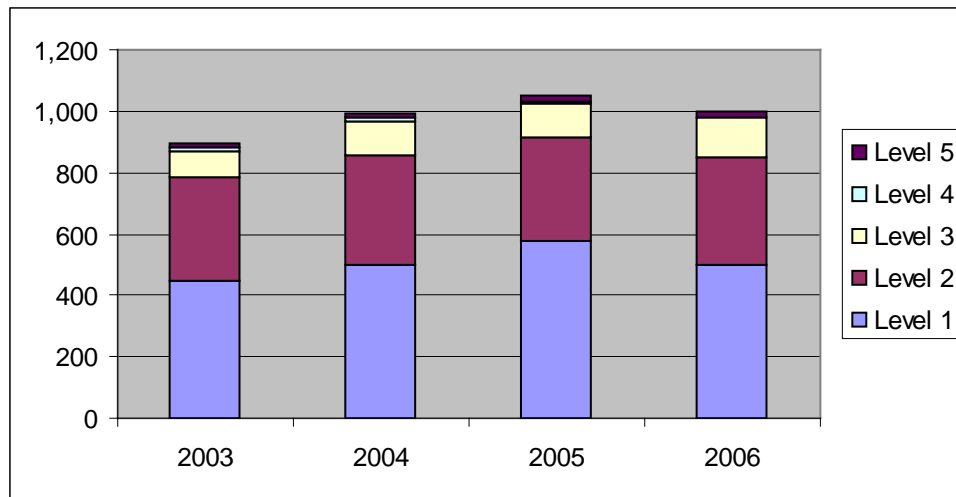
Following the trend of other post-crash inspections, level I inspections are conducted most frequently. Table 3-9 details the inspections by level and year.

Table 3-9: HM Post-Crash Inspections by Level, Calendar Years 2003-2006

Inspection Level	2003	2004	2005	2006
Level I - North American Standard Inspection	450	501	578	497
Level II - Walk-Around Driver/Vehicle Inspection	332	355	336	355
Level III - Driver - Only Inspection	85	113	111	125
Level IV - Special Inspections	17	9	9	4
Level V - Vehicle-Only Inspection	14	14	19	20
Total	898	992	1,053	1,001

A graphical illustration of the inspections is detailed in Figure 3-6.

Figure 3-6: HM Post-crash Inspections by Level, Calendar Years 2003-2006



To be consistent with the analysis only crashes where the CMV was hauling HM were considered. Over the four years of analysis, 4.5% of HM crashes were fatal, 44.5% resulted in a fatality and 51% were tow-away only crashes. Comparing these crash severity shares with all crashes, these percentages are slightly higher and may be due to the load. The crash severities by year for HM crashes are detailed in Table 3-10.

Table 3-10: HM Crashes by Severity, Calendar Years 2003-2006

Crash Type	2003	2004	2005	2006	Total
Fatal Crashes	121	129	136	14	400
Injury Crashes	1,194	1,307	1,299	132	3,932
Tow-Away Crashes	1,305	1,559	1,484	166	4,514
Total	2,620	2,995	2,919	312	8,846

3.5.6 Passenger Carrier (PC) Regulations

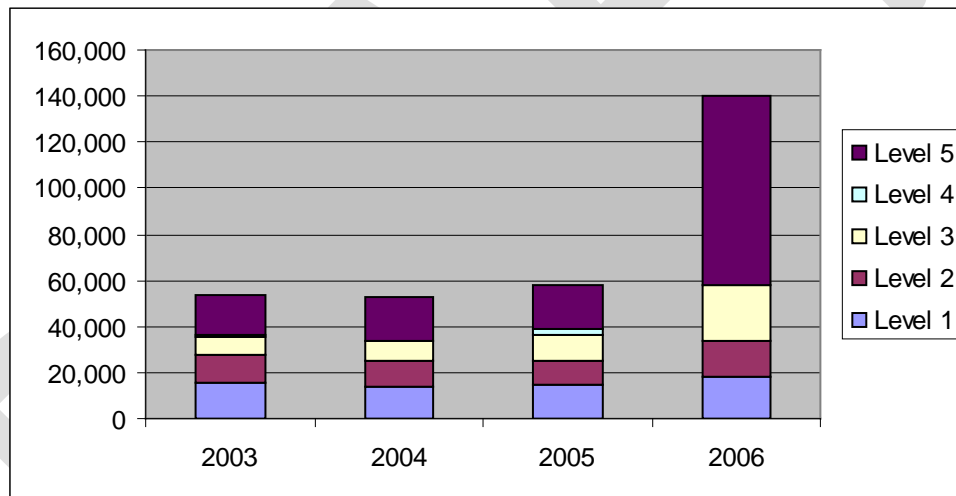
The passenger carrier regulations, similar to the HM regulations, are only going to be found in those inspections conducted on passenger carrier vehicles, buses, etc. The regulations specific nature requires the regulations to only be looked at in the context of inspections occurring on passenger carrier vehicles. The distribution of these inspections by level indicates that level V inspections are most often occurring on these vehicles. The level V inspections are used because the passenger carrier vehicles are not required to stop in roadside inspection stations. The distribution of inspections on passenger carriers is detailed in Table 3-11.

Table 3-11: PC Inspections by Level, Calendar Years 2003-2006

Inspection Level	2003	2004	2005	2006
Level I - North American Standard Inspection	15,919	13,834	15,035	18,204
Level II - Walk-Around Driver/Vehicle Inspection	11,375	11,028	10,174	15,462
Level III - Driver - Only Inspection	8,453	8,883	10,993	24,196
Level IV - Special Inspections	245	286	2,478	319
Level V - Vehicle-Only Inspection	17,557	18,634	19,011	81,703
Total	53,549	52,665	57,691	139,884

A graphical illustration of the inspections is detailed in Figure 3-7.

Figure 3-7: PC Inspections by Level, Calendar Years 2003-2006



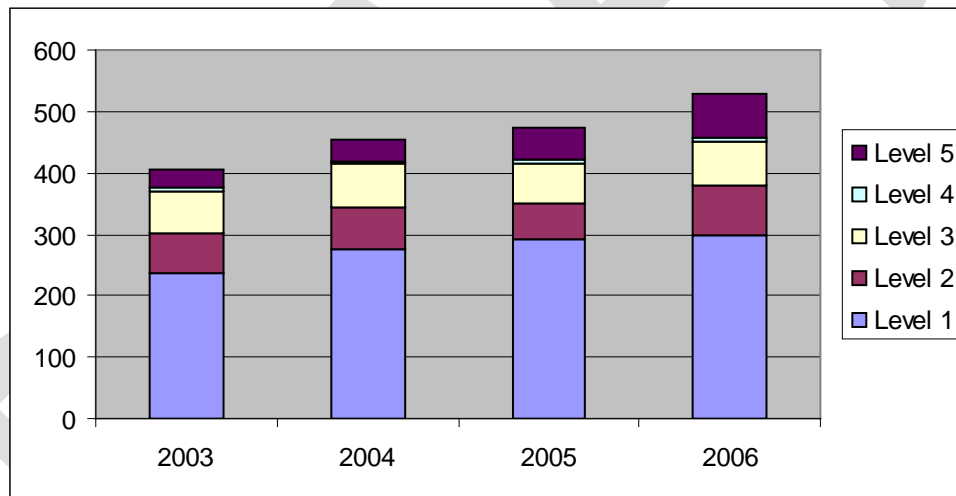
Following the trend of other post-crash inspections, level I inspections are conducted most frequently on passenger carriers. Table 3-12 details the inspections by level and year.

Table 3-12: PC Post-crash Inspections by Level, Calendar Years 2003-2006

Inspection Level	2003	2004	2005	2006
Level I - North American Standard Inspection	238	275	292	297
Level II - Walk-Around Driver/Vehicle Inspection	65	68	59	83
Level III - Driver - Only Inspection	66	71	63	71
Level IV - Special Inspections	7	4	8	5
Level V - Vehicle-Only Inspection	31	37	51	73
Total	407	455	473	529

A graphical illustration of the inspections is detailed in Figure 3-8.

Figure 3-8: PC Post-crash Inspections by Level, Calendar Years 2003-2006



To be consistent with the analysis only crashes where the vehicle was able to carry passengers were considered. Over the four years of analysis, 2.2% of PC crashes were fatal, 56.2% resulted in a fatality and 41.6% were tow-away only crashes. Comparing these crash severity shares with all crashes, the fatal share is much lower but the injury share is much higher. The crash severities by year for PC crashes are detailed in Table 3-13.

Table 3-13: PC Crashes by Severity, Calendar Years 2003-2006

Crash Type	2003	2004	2005	2006	Total
Fatal Crashes	187	210	246	203	846
Injury Crashes	5,039	5,228	5,856	5,290	21,413
Tow-Away Crashes	3,241	3,681	4,586	4,334	15,842
Total	8,467	9,119	10,688	9,827	38,101

3.6 Compliance Review Regulations

Compliance Reviews are federal and state inspections of carrier operations. These are regulations directed at the carrier and generally these regulations are only cited in compliance reviews and not in roadside inspections or traffic enforcements. The violation risk methodology treats CR regulations differently than the roadside, moving violations, and hazmat regulations. CR regulations are associated with the carrier's on-the-road performance by linking violations cited in a CR to violations cited in a RI or TE when the roadside violation is found in the same BASIC as the CR violation. A CR regulation may be linked to multiple RI or TE regulations, thereby deriving its risk from that of the RI and TE regulations risk.

CR regulations are associated with the carrier's on-the-road performance by linking violations cited in a CR to violations cited in roadside inspections. Roadside violations are only linked to CR violations if they occurred within a one year period prior to the CR and if the roadside violation is found in the same BASIC as the CR violation. Furthermore, if the carrier had multiple CRs performed in a year, then only violations that occurred prior to a particular CR were mapped to that CR. For example, if a carrier has a CR on January 10th and another on July 1st the violations that occurred between January 11th and July 1st are mapped to the July 1st CR. Additionally, follow up CRs were not included in the analysis; these were identified by a field in the MCMIS database that indicates a follow up CR or if the CR occurred within 120 days of another CR the 2nd CR was not included in the analysis. A CR violation may be linked to multiple roadside violations, so a weighted average of the roadside violations risk severity is used to determine the risk severity of the CR regulation.

“During a CR, the safety investigator reviews historical motor carrier records to determine compliance with the Federal Motor Carrier Safety Regulations (FMCSRs), Hazardous Materials Regulations (HMRs), and certain Federal Motor Carrier Commercial Regulations (FMCSRs). These regulations are divided by regulatory parts into five “factors” for determining compliance (e.g., Factor 1= Parts 387 and 390) and categorized as either “critical” or “acute” (Part 385). The sixth factor is the carrier's recordable crash rate.”⁶⁸

⁶⁸ CRWG Phase II, page 3 The complete list of factors addressed in CRs are:
(1) General (CFR Parts 387, 390)

FMCSA reviews in this analysis focus on the compliance reviews. The distribution of reviews is detailed in Table 3-14.

Table 3-14: FMCSA Reviews by Type⁶⁹, Calendar Years 2003-2006

Review Type	2003	2004	2005	2006
C - Compliance Review	11,356	11,019	12,423	14,071
G - Compliance Review and CTR	3	26	14	12
J - Compliance Review and Security Contract Review	0	0	153	1,515
Total	11,359	11,045	12,590	15,598

There are more individual regulations cited in CRs than in inspections; 1,119 unique violations are cited as part of a CR in the four year period. Currently, the CR regulation severity is determined by whether the violation is acute, critical or other. The breakdown of violations cited in CRs over the four years of analysis is detailed in Table 3-15.

Table 3-15: CR Violations by Type, Calendar Years 2003-2006

Violation Type	2003	2004	2005	2006	Total
Acute	2,394	2,194	2,666	3,261	10,515
Critical	11,031	10,710	10,674	12,662	45,077
Other (Non-Acute/Non-Critical)	75,256	73,990	81,759	102,379	333,384
Total	88,681	86,894	95,099	118,302	388,976

These regulations are different in nature than the on-the-road performance capture in the RI; the CR regulations are more paperwork related. To determine the severity of these regulations these regulations were mapped to the on-the-road performance at a carrier level by matching the CR violations to inspection violations within the same BASIC in a given timeframe. The approach is detailed in Chapter 4: Methodology.

-
- (2) Driver Qualification (CFR Parts 382, 383, 391)
 - (3) Operational/Driving (CFR Parts 392, 395)
 - (4) Vehicle/Maintenance (CFR Parts 393, 396 Performance Data (OOS%))
 - (5) Hazardous Material (CFR Parts 397, 171, 172, 173, 177, 180)
 - (6) Accident (Reportable Accident Rate per million vehicle miles traveled (VMT) >1.5 is unsatisfactory).

⁶⁹ These only capture applicable types used by the Compliance Review Effectiveness Model.

Chapter 4: Methodology

4.1 Overview

The goal of the Violations Severity Assessment Study (VSAS) is to determine the risk associated with violations of the FMCSRs and HMRs based upon an empirical analysis. The increased risk associated with the violation of each regulation is measured by the combined effect of the violation on two factors: crash incidence and crash severity. The VSAS methodology separately estimates the increase in crash incidence and crash severity associated with the violation of each regulation for which data in MCMIS will support such estimates. The approach assumes that a violation has an independent effect on (or association with) the probability that a crash will occur and on the expected severity of the crash. These two dimensions of risk are combined to produce an overall risk factor, which can be used to rank violations by risk or to categorize regulations by importance.⁷⁰

FMCSA supports two major programs that are responsible for identifying violations of the FMCSRs and HMRs:

- Roadside Inspection Program – This program consists of roadside inspections performed by qualified safety inspectors following the guidelines of the North American Standard, which was developed by the Commercial Vehicle Safety Alliance in cooperation with the FMCSA. Roadside inspections can be performed at a fixed location (such as a weigh station) or as a result of a traffic stop on the roadside.
- Compliance Review Program – This program consists of an on-site examination of a motor carrier's records and operations to determine whether the carrier meets the FMCSA safety fitness standard.

While the Roadside Inspection and Compliance Review Programs can cite the same violations (with the exception of traffic enforcement violations), the Compliance Review Program reviews the carrier's overall operations searching for systemic violations of the regulations, whereas the Roadside Inspection Program is both a mechanism to collect data regarding a carrier's compliance with the regulations and a tool to enforce violations of the regulations while in operation.

As a result of these different approaches to violation identification, this study has developed different methodologies for assessing the risk associated with the violations cited in each program. Furthermore, the Roadside Inspection Program includes roadside inspection violations and traffic enforcement violations, which are also separated in this section.

⁷⁰ The methodology has been developed by the Volpe Center with Dr. Thomas M. Corsi of the University of Maryland.

4.2 Roadside Inspection Violation Methodology

This section describes the methodology used to assess the risk associated with the violation of regulations cited during roadside inspections. Roadside inspection violations include all violations with the exception of the FMCSA sanctioned traffic enforcement violations. To calculate the crash incidence factor the population violation rate, estimated by the roadside inspection violation rate, is then compared to the post-crash inspection violation rate. A difference in proportions test is used to determine if the two rates are significantly different from one another. When the post-crash violation rate is found to be higher than the population violation rate, the violation is associated with crash involvement. The crash severity factor is calculated by comparing the severity distribution of all MCMIS reported crashes to the post-crash inspections where the violation was cited. The combination of the crash incidence factor and crash severity factor produce the total roadside violation risk factor.

Some roadside regulations apply only to a subset of the roadside inspections/vehicle miles. As a consequence, the entire set of roadside inspections, were disaggregated, in order to compute the regulation violation rates for these regulation subsets. This analysis considers two subsets of roadside regulations in addition to traffic enforcement regulations: hazardous materials regulations and passenger carrier regulations. Since only those carriers, drivers, and vehicles involved in the transportation of hazardous materials would be exposed to the hazardous materials specific regulations, only the hazardous materials' carrier inspection records are used in the hazardous materials regulation violation rate analysis. Similarly for passenger carrier regulations, only data from inspections on the subset of carriers subject to passenger carrier specific regulations are used to calculate regulation violation rates of passenger regulations.

Furthermore, within each of the categories of roadside violations (general, hazardous materials, and passenger) it is necessary to differentiate the between driver violations and vehicle violations. The reason for this additional level of analysis is due to the levels of roadside inspections that can be performed by an FMCSA safety inspector, Levels I – V as described in Section 3.5.1.

The regulation's Behavior Area Safety Improvement Category (BASIC) is used to determine whether the regulation is driver related (inspections of Level 1, 2, and 3 are used), a vehicle related (Level 1, 2, 5), or administrative, regulations that can be identified and cited at all inspection levels. Regulations of BASIC 1 through 4 are driver-related, BASIC 5 through 8 are vehicle-related, and BASIC 9 regulations are administrative violations. The methodology described in the subsequent section for crash incidence is applied to each of the categories of regulations:

- General Roadside Violations – Administrative / Driver / Vehicle.
- Hazardous Materials – Administrative / Driver / Vehicle
- Passenger Carrier – Administrative / Driver / Vehicle

The crash severity analysis does not require controlling for the number of times when the violation may be cited, therefore violations found in inspections of all levels are used.

4.2.1 Roadside Violation Crash Incidence Risk

Assigning crash incidence risk factors for violations of the individual regulations requires a comparison of each regulation's violation rate in the carrier population with the regulation's violation rate in post-crash inspections. The regulation violation rate in non-crash roadside inspections approximates the population regulation violation rate based on the assumption that the set of roadside inspections is representative of all truck vehicle miles. This assumption is based on the fact that the out-of-service violation rate within MCMIS (for all roadside inspections) is consistent with the estimated population regulation violation rate as observed in National Fleet Safety Survey⁷¹.

The violation rate across the set of roadside inspections is calculated in [3] as:

$$[3] \quad VR(j) = \frac{InspViol(j)}{Insp(j)} \quad \text{where :}$$

$VR(j)$ = Violation rate for violation j
 $InspViol(j)$ = Number of inspections where violation j was cited
 $Insp(j)$ = Number of inspections where violation j was checked for compliance

For each regulation, the calculation of its violation rate, more specifically the $Insp(j)$ term, is based on the set of roadside inspections for in which that violation could be checked for compliance.

Once the population violation rate is established for each regulation, the corresponding post-crash violation rate is similarly computed using the post-crash inspection data.

$$[4] \quad PCVR(j) = \frac{PCInspViol(j)}{PCInsp(j)} \quad \text{where :}$$

$PCVR(j)$ = post - crash violation rate for violation j
 $PCInspViol(j)$ = Number of post - crash inspections where violation j was cited
 $PCInsp(j)$ = Number of post - crash inspections where violation j was checked for compliance

Difference in Proportions Test

A difference in proportions test determines whether the population and post-crash violation rates are statistically different for each regulation violation. If the post-crash violation rate is greater than the population violation rate, then the violation of the regulation is found in a higher proportion of post-crash inspections than it is in the population (as represented by the universe of roadside inspections).

$$[5] \quad \begin{aligned} H_o : VR(j) &= PCVR(j) \\ H_a : VR(j) &< PCVR(j) \end{aligned}$$

⁷¹ The National Truck Fleet and Bus Safety Surveys are designed as a random sample of truck vehicle miles across the nation's highways in a defined time period. See section 2.5.3.

$$[6] \quad Z_{score} = \frac{PCVR(j) - VR(j)}{\sqrt{\frac{PCVR(j) * (1 - PCVR(j))}{PCInsp(j)} + \frac{VR(j) * (1 - VR(j))}{Insp(j)}}}$$

Statistical significance is defined at the 95 percent confidence level for the purpose of this analysis, which implies $Z_{score} \geq 1.64$.

Crash Incidence Factor

The ratio of the post-crash and roadside violation rates determines the likelihood of observing the violation in a crash compared to observing it in the general population of commercial motor vehicles. If the ratio is greater than one, then the violation is found in greater proportion in post-crash inspections than it is in the general population, and we conclude that the violation is associated with crash involvement.

$$[7] \quad VRatio(j) = \frac{PCVR(j)}{VR(j)}$$

Multiplying the ratio of the two violation rates shown in [7] by the overall crash rate results in the expected crash rate for vehicle miles where the violation is present. The overall crash rate is defined as the number of crashes per 100 million vehicle miles traveled (VMT). For this analysis, we use the FMCSA calculated crash rate of 189.3 crashes per 100 million VMT, since this is a consistent, accepted crash rate.⁷²

$$[8] \quad \begin{aligned} CIF(j) &= \frac{PCVR(j)}{VR(j)} * \overline{CR} = \frac{PCVR(j)}{VR(j)} * \frac{Crashes}{MVMT} = \frac{Crashes(j)}{MVMT(j)} \text{ where :} \\ CIF(j) &= \text{Crash Incidence Factor for violation } j \\ \overline{CR} &= \frac{Crashes}{MVMT} = \text{Crashes per 100 Million Vehicle Miles Traveled} \\ Crashes(j) &= \text{Crashes where violation } j \text{ is present.} \\ MVMT(j) &= \text{Million Vehicle Miles Traveled where violation } j \text{ is present.} \end{aligned}$$

The Crash Incidence Factor for regulation j is labeled as $CIF(j)$ and is interpreted as the crash probability for vehicle miles with the presence of the violation of regulation j . This interpretation can be seen in [8] as the equation is reduced to the number of crashes where violation j is present divided by the number of vehicle miles traveled where violation j is present.

Incremental Crash Incidence Factor

The incremental crash incidence factor, which measures the increase in crash occurrence associated with the presence of violation j is the difference between the crash probability

⁷² FMCSA, Large Truck Crash Facts 2005.
<http://ai.fmcsa.dot.gov/CarrierResearchResults/PDFs/LargeTruckCrashFacts2005.pdf>.

with violation j and the overall crash probability without the presence of violation j , is represented in [9] as $ICIF(j)$.⁷³

$$[9] \quad ICIF(j) = CIF(j) - \overline{CR} \text{ where :}$$

$ICIF(j)$ = Incremental Crash Incidence Factor for violation j

It should be noted that equations [8] and [9] are only applicable in the case where $CIF(j) > \overline{CR}$. If this condition is not satisfied, then $CIF(j)$ is set equal to \overline{CR} . Violations should not be associated with a reduction in the incidence of a crash and as such are treated as if there is no association with the incidence of a crash.

Not all of the crashes estimated by [8] are a result of the violation's presence. Some of these crashes result from factors other than the violation, so they need to be removed to arrive at the increased crash rate (above the baseline) as a result of violation j . The incremental crash probability factor is the key component in measuring the impact of violating a particular regulation on crash incidence—one of the two components of overall risk.

In equations [8] and [9], we use the average crash rate per 100 million vehicle miles traveled rather than using the number of crashes per truck trips, which was proposed in earlier project deliverables. Substituting an overall crash rate measure rather than calculating the number of truck crashes divided by the number of truck trips has a number of distinct advantages for this analysis. First, the estimation of total number of truck trips is imprecise at best. It requires estimates of truck miles traveled and average trip distances. Unfortunately, national statistics exist in Highway Statistics for the annual truck miles traveled on the nation's highways. However, these miles are not disaggregated into a private and for-hire truck segment. Yet, based on data in the Commodity Flow Survey there are substantial difference in the average trip length between the for-hire and the private carriers. Thus, any attempt to estimate the number of truck trips on an annual basis is subject to significant error. There are, however, accepted estimates from FMCSA on crash rates expressed as crashes per hundred million vehicle miles traveled. As a consequence, henceforth, we will use crash rates in terms of crashes per hundred million truck vehicle miles traveled as the conventional unit of analysis.

Crash Incidence Data Threshold

In addition to the criteria mentioned above, a minimum data threshold was used to ensure that all study results are based on adequate sample sizes. To meet this threshold, a regulation must have been violated in at least 10 roadside inspections and 10 post-crash inspections in order to be considered in this analysis. Regulations failing to meet the data threshold are considered to have insufficient data for calculation of a crash incidence factor and an incremental crash incidence factor.

⁷³ Conceptually, the crash rate should be the probability of crash without the presence of violation j . However, when applying the roadside methodology, regulation specific crash rates could not be calculated due to the biases in the post-crash violation data. Section 5.2.4 Assessment of Roadside Violation Risk Methodology-Crash Rate and Severity Weight Parameters addresses this issue.

4.2.2 Roadside Violation Crash Severity Risk

Total risk also includes the effect of the associated increase in the severity of a crash due to the presence of a violation, whether or not that particular violation was a causal factor in the crash. This perspective of the crash severity component for the total risk measure seeks to isolate the severity component from the crash incidence, recognizing that some regulations were created to address crash severity, but not necessarily crash incidence. Like the crash incidence methodology, the following methods for crash severity do not control for other crash severity factors present at the time of the crash.

The severity risk analysis determines the weighted average cost of crashes in which the violation of a particular regulation was present and compare that weighted average cost with the weighted average cost of all crashes reported in MCMIS. The weighted average cost of crashes with a given violation present is calculated by determining the percentage of such crashes that fall into each of the following crash severity categories: fatal, injury, and towaway. This methodology provides the dollar cost associated with crashes involving the violation of a particular regulation.

Crash Severity in MCMIS

The severity analysis considers violations found in three crash severity types: fatal, non-fatal injury, and towaway crashes. All crash records in MCMIS meet the following reporting threshold:

- Fatal Crash – A crash where one or more persons dies within 30 days of the crash. The fatality does not have to occur at the scene of the crash. It includes any person involved in the crash, including pedestrians and bicyclists, as well as occupants of the passenger cars and trucks.
- Injury Crash – A crash where one or more persons has non-fatal injuries requiring transportation by a vehicle for the purpose of obtaining immediate medical attention.
- Towaway Crash – A crash where one or more of the vehicles were towed away from the scene due to "disabling damage." The towed vehicle need not be the truck or bus involved in the crash.

The severity analysis uses post-crash inspection records that can be matched to their corresponding crash record. The post-crash inspection record, containing the violation information and the MCMIS crash record, which contains the crash severity information, are entered as separate records into MCMIS with no common identifier to match the two records. Without a common identifier, match criteria such as the DOT number, the date, and state are used to match the post-crash inspection record to the crash record. Less than half of the post-crash inspections can be positively matched to their corresponding crash record. Since the objective of the severity analysis is to determine whether the violation is associated with more severe crashes, post-crash inspection records that cannot be matched to severity information are not used in the analysis. See Section 2 for a full discussion of this data.

Standardizing Post-crash Inspections for Crash Severity Distribution in MCMIS

The severity distribution of post-crash inspections differs from the distribution of all crashes reported in MCMIS. The tendency of post-crash inspections to be performed on more severe crashes causes fatal and injury crashes to be overrepresented in the post-crash inspection data. Thus, standardization weights are applied to the post-crash inspections so that the distribution of post-crash inspections does not contain the inspection bias. The standardization weights are calculated as the ratio of the share of crashes in MCMIS divided by the post-crash inspection share.

Table 4-1: MCMIS Crash Distribution Standardization Weights

Crash Severity	Post-Crash Inspections (2003-2006)	Post-Crash Inspection Severity Shares	MCMIS Crash Counts (2003-2006)	MCMIS Crash Severity Shares	Weight
Fatal	5,616	14.7%	19,998	3.4%	0.23
Injury	17,299	45.2%	255,985	43.7%	0.97
Towaway	15,392	40.2%	309,172	52.8%	1.31
Total	38,307	100%	585,145	100%	

The crash severity standardization weights are applied to the post-crash counts to produce standardized violation crash counts.

$$APCInsp_i(j) = PCInsp_i(j) * PCSW_i \text{ where :}$$

$$i = \{\text{Fatal, Injury, or Towaway}\}$$

[10] $APCInsp_i(j)$ = Adjusted number of post - crash inspections of severity i where violation j was cited

$PCInsp_i(j)$ = Raw number of post - crash inspections of severity i where violation j was cited

$PCSW_i$ = Post - crash standardization weight for severity i

Crash Severity Share

The post-crash inspections are converted into shares of the total number of post-crash inspections matched to severity for each violation. Since the standardization weights have been applied, the analysis effectively attributes any deviation between the MCMIS crash severity distribution and the post-crash inspections to the presence of the violation.

$$[11] \quad SR_i(j) = \frac{APCInsp_i(j)}{\sum_i APCInsp_i(j)} \text{ where :}$$

$SR_i(j)$ = Severity ratio for violation j and crash severity i

Crash Severity Weights (Crash Cost)

Each of the severity shares are assigned a weight in order to differentiate each of the crash severity types in the contribution to overall severity risk. Crash cost estimates are used as the crash severity weights. Using cost per crash as the severity weight results in a violation severity factor measured in dollars.

Table 4-2: Cost per Crash and Average Crash Cost

Severity	Crash Severity Weight ⁷⁴ (Cost per Crash)	Share of Crashes Reported in MCMIS	MCMIS Crash Share Cost
Fatal	\$ 3,604,518	3.42 %	\$ 123,127
Injury	\$ 195,258	43.75 %	\$ 85,420
Towaway	\$15,114	52.84 %	\$ 7,986
Average Crash Severity (\overline{SC})			\$ 216,533

Violation Crash Severity and Incremental Crash Severity Factor

Applying the crash costs to the standardized crash severity shares results in the expected severity of a crash for violation j :

$$CSF(j) = \sum_i (Cost_i * SR_i(j))$$

[12] $CSF(j)$ = Crash severity factor for violation j
 $Cost_i$ = Cost of a crash of severity i

The incremental crash severity factor for violation j , $ICSF(j)$ is calculated as the total crash severity expected in crashes when the violation is cited minus the average crash severity of crashes reported in MCMIS.

$$ICSF(j) = CSF(j) - \overline{SC} \quad \text{where :}$$

$$\overline{SC} = \sum_i (Cost_i * Share_i) = \text{Average cost of a crash}$$

[13] $ICSF(j)$ = Incremental Crash Severity Factor

It should be noted that equations [12] and [13] are only applicable in the case where $CSF(j) > \overline{SC}$. If this condition is not satisfied, then $CSF(j)$ is set equal to \overline{SC} . The reasoning behind this approach is that violations should not be associated with a reduction in the severity of a crash and as such are treated as if there is no association with an increase in the severity of a crash.

Crash Severity Data Threshold

In addition to the criteria mentioned above, the regulation must have been violated in at least 10 post-crash inspections, where the post-crash inspection was positively matched to the crash record containing crash severity information to meet the minimum data threshold for the crash severity factor. Regulations failing to meet the data threshold are

⁷⁴ Zaloshnja, Eduard and Ted Miller. 2007. "Unit Costs of Medium/Heavy Truck Crashes."

considered to have insufficient data for calculation of a crash severity factor and an incremental crash severity factor.

4.2.3 Roadside Violation Total Crash Risk

With the violation crash incidence factor and the violation crash severity factor both calculated, the final step in the roadside regulation violation risk calculation is to combine these two measures into a single total violation risk measure. The total risk associated with violation j is the crash incidence factor for violation j multiplied by the crash severity factor for violation j :

$$[14] \quad \begin{aligned} TVR(j) &= CIF(j) * CSF(j) \text{ where :} \\ TVR(j) &= \text{Total risk associated with violation } j \end{aligned}$$

Since it is possible that the incremental crash incidence or incremental crash severity factors are zero, the total incremental risk cannot be calculated as the product of the two incremental measures. Instead the total incremental risk is the total violation risk less the average expected risk, where the average expected risk is the product of the crash rate per 100 million vehicle miles and the average cost of a large truck crash.

$$[15] \quad \begin{aligned} IVR(j) &= TVR(j) - \overline{CR} * \overline{SC} \text{ where :} \\ IVR(j) &= \text{Incremental risk associated with violation } j \\ \overline{CR} &= \text{Crashes per 100 million vehicle miles} \\ \overline{SC} &= \text{Average cost of a crash} \end{aligned}$$

4.2.4 Traffic Enforcement Violation Methodology

The Traffic Enforcement Program targets a group of driver-specific, moving violations, which are classified by FMCSA as MCSAP traffic enforcement violations (see Chapter 11: Appendix of Traffic Enforcement Violations for a complete list). The Traffic Enforcement Program does not stop with the enforcement of the traffic violations; instead all qualifying traffic enforcements are accompanied by an appropriate level roadside inspection. This section describes the methodology used to assess the risk of the set of traffic enforcement violations.

Traffic Enforcement Violation Crash Incidence Risk

For the most part, the methodology used to assess the crash incidence risk of roadside inspection violations can be applied to traffic enforcement violations. The necessary adaptation to the roadside inspection methodology for traffic enforcement violations is in the determination of the number of random inspections necessary to calculate the roadside violation rate. The calculation of this violation rate depends on the determination of the exposure ($Insp(j)$) or the number of times that a regulation was observed for compliance. The recorded number of traffic enforcement inspections cannot be used in the methodology because traffic enforcements are only recorded in MCMIS when there is at least one traffic enforcement violation. Unlike roadside inspections, which are recorded even when no violations are found, there is no traffic enforcement data available in MCMIS regarding the number of times that vehicles are observed for

compliance with the traffic enforcement regulations (i.e. exposure). The inability to calculate an unbiased measure of exposure necessitates the use of a data source other than MCMIS to estimate the exposure of traffic enforcement violations.

Random Sample of Population Speeding Violation Rate

The most common traffic enforcement violation is 392.2S or more commonly known as a speeding violation, which was cited 833,394 times from 2002 through 2006. Again, the MCMIS data provides the number of times where 392.2S was cited; however, the number of times this violation was checked for compliance is unknown, which means the random violation rate, which approximates the prevalence of this violation in the population, cannot be calculated.

To resolve this issue, vehicle speeding data were obtained from the Washington State Department of Transportation (WSDOT). WSDOT provided one year of observations (2006) from thirty-eight Weigh-in-Motion (WIM) stations distributed throughout the State of Washington. Each WIM station records data from all vehicles passing through the station, including the vehicle speed and vehicle type. The data from these stations were validated and analyzed to determine a truck and bus speeding rate⁷⁵ for each station. The truck and bus speeding rates for each station were aggregated by functional class of highway and weighted by VMT on the functional class, which resulted in the calculation of an overall speeding rate of 4.38% in the general CMV population. See Chapter 12: Appendix of Speeding Rate Methodology for a full discussion of the methodology used to determine the average speeding rate.

Traffic Enforcement Exposure

The truck and bus speeding rate of 4.38% from the Washing State data is assumed to be a reasonable approximation for the population violation rate of regulation 392.2S, otherwise known as speeding.

$$[16] \quad VR(392.2S) = \frac{InspViol(392.2S)}{Insp(392.2S)} = 4.38\%$$

Subsequently, the violation rate along with the number of violations of regulation 392.2S can be used to determine the number of times this regulation would need to be checked (based on a random sample of moving trucks) in order to produce a violation rate of 4.38%.

$$[17] \quad Insp(392.2S) = \frac{InspViol(392.2S)}{VR(392.2S)} = \frac{833,394}{0.0438} = 19,027,260$$

As shown in equation [17], regulation 392.2S would need to be checked for compliance 19,027,260 times over the four-year study period. Furthermore, the exposure value for regulation 392.2S is a reasonable approximation for the exposure of the remaining traffic

⁷⁵ Speeding is defined as traveling at 10 mph or over the posted speed limit at the station.

enforcement regulations. This is based on the assumption that enforcement personnel are equally monitoring driver compliance with all other traffic enforcement regulations while checking drivers' compliance with the speeding regulation.

Crash Incidence Factor Calculation

With the estimation of the exposure completed, the calculation of the crash incidence factors for all traffic enforcement violations follows the same methodology as the roadside violations. Equations [3] through [9] are applied to the traffic enforcement violations with the estimated exposure, $Insp(j)$, of 19,027,260 being substituted for the total number of roadside inspections where the violation was checked for compliance.

Traffic Enforcement Crash Severity Risk

The calculation of the crash severity factors for traffic enforcement violations follows the same methodology as the roadside violations, see Section 4.2.2 Roadside Violation Crash Severity Risk for a full discussion of the methodology.

Traffic Enforcement Total Crash Risk

The calculation of the total crash risk for traffic enforcement violations follows the same methodology as the roadside violations, see Section 4.2.3 Roadside Violation Total Crash Risk for a full discussion of the methodology.

4.3 Compliance Review Violation Methodology

This section describes the methodology used to assess the risk associated with violations cited during compliance reviews. The approach uses compliance review violation data and roadside inspection data from carriers who had at least one compliance review during the analysis period. Carrier compliance review inspections are merged with the carrier's driver and vehicle roadside inspections so that all of the roadside violations are matched to each of the violations cited in the carrier's compliance review. Risk related to compliance review violations is derived from the statistical association between the compliance review violation and the corresponding roadside violations. The compliance review regulation is assigned a risk factor equal to the sum of the roadside risk factors, weighted by the association between the compliance review violation and each of the roadside inspection violations. Thus, the compliance review risk factor is based on the strength of association between the compliance review violation and the roadside inspection violations, and the risk assigned to each of those roadside inspection violations.

Underlying this approach is the belief that a compliance review violation reflects behaviors recorded at the roadside in terms of one or more driver or vehicle inspection violations. In effect, a carrier's violation of a compliance review regulation is assumed to be associated with higher violation rates for certain roadside violations.

The analysis limits the potential association between compliance review and roadside inspection regulations to regulations of same Behavioral Analysis and Safety Improvement Category (BASIC), in order to reduce the possibility of any spurious associations between the compliance review and roadside inspection regulations.

Additionally, the analysis only considers the roadside inspection records prior to the carrier's compliance review and follow-up compliance reviews are not included in the analysis.⁷⁶

4.3.1 Association Between Compliance Review Violation and Roadside Inspection Violations

The compliance review methodology focuses on whether there is a statistical association between violation of a compliance review regulation and a roadside violation. Carriers can violate or comply with the compliance review regulations, and similarly can either violate or comply with the roadside inspection regulations. This “two choose two” scenario produces four possible outcomes and can be depicted in a contingency table.

Table 4-3: Roadside Inspection (matched to Carrier Compliance Review) Outcome Matrix

		CRViol(k) Present?		
		No	Yes	
RSViol(j) Present?	No	A	B	$r_1=A+B$
	Yes	C	D	$r_2=C+D$
		$c_1=A+C$	$c_2=B+D$	N

where

A = Roadside regulation j not violated and compliance review regulation k not violated

B = Roadside regulation j not violated and compliance review regulation k violated

C = Roadside regulation j violated and compliance review regulation k not violated

D = Roadside regulation j violated and compliance review regulation k violated

The dichotomous nature of the violation data necessitates the use of a special version of the usual Pearson product-moment correlation coefficient, which is adapted for use with binary data. In this situation, the two analysis groups are defined as follows: one group consists of carriers found to be in violation of a specific regulation assessed as part of a compliance review, while the second group consists of carriers found to be in compliance with that same regulation. The special product moment correlation coefficient adapted for use with binary data is sometimes called the Phi correlation coefficient. The Phi coefficient seems to offer all of the desired properties for the analysis in that it directly measures the strength of association between a compliance review violation and each roadside violation. It is independent of the absolute values of the violation rates for roadside inspection regulation j among the two carrier groups, and like any other correlation coefficient ranges in absolute value between 0 and 1.0.

The association between the compliance review violation, $CRViol(k)$, and the roadside inspection violation j , $InspViol(j)$, is measured by the Phi correlation coefficient, which is denoted $\rho(k,j)$ and is calculated as:

⁷⁶ Follow-up compliance reviews are identified as compliance review inspections occurring within 120 days from the prior compliance review inspection

$$[18] \quad \rho(k,j) = \frac{AD - BC}{\sqrt{r_1 r_2 c_1 c_2}}$$

The association measure is calculated for all for all roadside violations that are found for carriers violating compliance review violation k . The use of $\rho(k,j)$ to weight the corresponding roadside risk factor $TVR(k)$ only applies if $\rho(k,j)$ is non-negative. If $\rho(k,j)$ is negative the roadside risk is not applied to the compliance review violation; instead the compliance review violation/roadside violation pair are treated as though no association exists.

The significance of the association between the compliance review violation and the roadside inspection violation is tested using a chi-square test.

$$[19] \quad \chi^2 = \rho(k,j) \cdot N$$

4.3.2 Assigning Roadside Risk to Compliance Reviews Using Association of Violations

The correlation coefficient $\rho(k,j)$ is used to approximate the portion of the risk assigned to the roadside inspection violation that can be traced to the compliance review violation. The correlation coefficient $\rho(k,j)$ is applied to the previously computed roadside risk for roadside violation j , $TVR(j)$. The association between the compliance review violation and the roadside inspection violation becomes the weighting factor for summing the total and incremental risk associated with the compliance review violation via (indirectly) the roadside violation. The sum of the weighted risk factors for each roadside violation j produces the total compliance review violation risk factor $TVR(k)$.

In cases where the compliance review violation is also cited in roadside inspections, the violation is given the full roadside risk, not the risk factor computed from the compliance review method. Alternatively, some compliance review regulations are associated with multiple roadside inspection regulations. In these cases, the risk assigned to the compliance review regulation is a sum of the portion of each roadside inspection regulation's risk correlated with the specific compliance review regulation.

$$[20] \quad TVR(k) = \sum_j \rho(k,j) * TVR(j) \text{ where :}$$

$TVR(k)$ = Total risk associated with compliance review violation k
 $\rho(k,j)$ = Correlation between the compliance review violation k and roadside violation j
 $TVR(j)$ = Total risk associated with roadside violation j

Since the roadside incremental violation risk can be expressed as the difference between the total violation risk, $TVR(j)$ less the average expected risk, the compliance review incremental violation risk, $IVR(k)$ can also be expressed as the weighted difference in the roadside violation risk. Alternatively the incremental compliance review violation risk, $IVR(k)$ can be computed as the sum of the weighted roadside incremental risk.

$$IVR(k) = \sum_j \rho(k, j) (TVR(j) - \overline{CR} * \overline{SC}) = \sum_j \rho(k, j) * IVR(j) \text{ where:}$$

[21] $IVR(k)$ = Incremental risk associated with compliance review violation k
 $\rho(k, j)$ = Correlation between the compliance review violation k and roadside violation j
 $IVR(j)$ = Incremental risk associated with roadside violation j
 \overline{CR} = Crashes per 100 million vehicle miles
 \overline{SC} = Average cost of a crash

Compliance Review Data Thresholds

In addition to a positive and statistically significant association for the Phi correlation coefficient, the compliance review regulations must meet the data thresholds for the compliance review analysis to have a positive risk result calculated. The compliance review data threshold requires that the compliance review regulation was violated in a minimum of 10 compliance reviews and that the compliance review regulation is matched to a minimum of 100 roadside inspections for each roadside violation considered.

Chapter 5: Violation Risk Results

5.1 Overview

This section presents the risk results for the roadside inspection and compliance review violations. The intermediate roadside violation results for the incremental crash incidence factor and incremental crash severity factor are presented separately in the roadside violation risk section. Following the roadside and compliance review results is an assessment of each methodology based on the results. Lastly, the roadside and compliance review results are compared, including a comparison of the incremental violation risk for regulations cited in both compliance reviews and roadside inspections.

5.2 Roadside Violation Risk Results

Roadside inspection and post-crash inspection violation data are used to calculate crash incidence and crash severity factors. These two components of risk are combined to produce the total incremental violation risk. This section presents a summary of the data and results for the roadside violation risk. Following the total incremental results is an assessment of the roadside methodology based on a review of the final results.

From 2003 through 2006, there were a total of 917 regulations with at least one valid roadside or post-crash violation recorded in MCMIS. Each of these 917 regulations was categorized as a general roadside regulation, hazardous materials regulation, passenger carrier regulation or a traffic enforcement regulation. Additionally, using the BASIC classification scheme (see section 3.4.2), each regulation was classified as being found primarily in driver, vehicle, or all (administrative) inspection types.

Table 5-1: Number of Regulations Violated in Roadside and Traffic Enforcement Inspections

Regulation Type	Inspection Type			Total
	Administrative	Driver	Vehicle	
General Roadside	30	74	329	433
Hazardous Materials	5	21	388	414
Traffic Enforcement	-	24	3	27
Passenger Carrier	4	12	27	43
All Types	39	131	747	917

Due to the inclusion of the regulations found in the Code of Federal Regulations (CFR) Parts 171 through 180, nearly half of the 917 regulations are hazardous materials regulations. Indeed, the majority of the regulations found in the data were classified as either general roadside or hazardous materials regulations. The majority of regulations are also classified as vehicle related regulations, meaning that they are primarily inspected for and cited during Level I, II, and V inspections. While the hazardous

materials regulations are quite numerous, most of these regulations were cited only a handful of times over the four-year analysis period.

5.2.1 Roadside Violation Crash Incidence Risk Results

Assigning crash incidence risk factors to violations of individual regulations requires a comparison of the violation rate in the carrier population with the post-crash violation rate. The regulation must have been cited a minimum of ten times in roadside inspections and a minimum of ten times in post-crash inspections to meet the crash incidence data threshold. More than half of the general roadside and traffic enforcement regulations meet the data thresholds. *Only 4% of hazmat regulations meet the crash incidence data threshold and none of the passenger carrier regulations are cited enough times to be included in the crash incidence analysis.*

Table 5-2: Regulations Meeting the Crash Incidence Data Threshold

Regulation Type	Regulations Meeting the Crash Incidence Data Threshold	Percent of Cited Regulations Meeting Crash Incidence Threshold	Cited Regulations
General Roadside	251	58%	433
Hazardous Materials	17	4%	414
Traffic Enforcement	18	67%	27
Passenger Carrier	-	0%	43
All Types	286	31%	917

Table 5-3 shows that of the 286 regulations meeting the crash incidence threshold, 153 of the regulations have a positive incremental crash risk. That is, 153 regulations have a higher violation rate in post-crash inspections when compared with their violation rate in roadside inspections. *Of the 153 regulations with a positive incremental crash risk factor, 122 have positive crash risk factors that are statistically significant at the 95% significance level(i.e., statistically different from zero).*

Table 5-3: Number of Regulations with Positive Incremental Crash Risk and Significant Crash Incidence

Regulation Type	Crash Incidence Threshold Met	Incremental Crash Incidence Factor Positive	Incremental Crash Incidence Factor Positive and Significant
General Roadside	251	133	106
Hazardous Materials	17	5	2
Traffic Enforcement	18	15	14
Passenger Carrier	0	0	0
All Types	286	153	122

Table 5-4 lists the ten violations with the highest incremental crash factors. The incremental crash incidence factor is interpreted as the expected number of additional crashes per 100 million vehicle miles given the presence of the violation for 100 million vehicle miles traveled. Table 5-4 also shows the roadside violation rate, the post-crash violation rate, the z-score for the test of whether these two rates are significantly different (from the difference in proportions test) and the incremental crash incidence factor. Since these are the regulations with the highest incremental crash incidence factors, all of the post-crash violation rates are greater than the roadside violation rates.

Many of the highest incremental crash incidence factors are for traffic enforcement regulations. The failure to exercise extreme caution in the presence of hazardous conditions (e.g. snow, ice, sleet, fog, etc.) is the violation with the highest incremental crash incidence factor. Ordinary driving experiences lend credence to this finding. Hazardous conditions are typically associated with higher crash rates even when caution is exercised, let alone when caution is not exercised.

Two of the ten highest incremental crash incidence factors concern securing paper rolls, and another regulation is directed at preventing shifting of the load/preventing lateral movement. All four of these regulations fall into Part 393 – “Parts and Accessories Necessary for Safe Vehicle Operation.”

Table 5-4: Top Ten Incremental Crash Incidence Factor Results

Part and Sec No	Regulation Type	Violation Description	Roadside Violation Rate	Post-Crash Violation Rate	Violation Rate Z-Score	Incremental Crash Incidence Factor
392.14	Traffic Enforcement	Failure to use caution for hazardous conditions in operating a commercial motor vehicle	0.00002	0.00122	9.67	13,923
392.2R	Traffic Enforcement	Reckless driving when operating a commercial motor vehicle	0.00013	0.00916	26.63	12,705
392.3	Traffic Enforcement	Operating commercial motor vehicle with ill or fatigued driver	0.00021	0.00810	24.75	7,280
392.2T	Traffic Enforcement	Improper turns when operating a commercial motor vehicle	0.00024	0.00404	16.84	3,037
393.122B	General Roadside	Failure to properly secure paper rolls (eyes vertical)	0.00002	0.00027	3.95	2,571
392.2Y	Traffic Enforcement	Improper lane change when operating a commercial motor vehicle	0.00038	0.00505	18.52	2,339
393.122	General	Failure to properly secure paper rolls	0.00003	0.00031	4.19	2,056
393.100C	General	Failure to prevent cargo shifting (such that the vehicle's stability or maneuverability is adversely affected)	0.00050	0.00501	16.53	1,730
392.2LC	Traffic Enforcement	Improper lane change when operating a commercial motor vehicle	0.00175	0.01713	33.30	1,666
393.71H	General	Failure to properly use tow-bar in driveaway/towaway operations	0.00003	0.00024	3.55	1,494

5.2.2 Roadside Violation Crash Severity Risk Results

The total risk resulting from a violation includes the risk from an increase in the association with crash incidence and the risk of an increase in the severity of a crash, whether or not that particular violation was a causal factor in the crash. In determining the incremental severity associated with violating a particular roadside regulation, the methodology compared the severity of crashes with the violation present against the overall average severity of all crashes combined with appropriate weighting for the distribution of all crashes by severity. If crashes with the violation present had a weighted average severity that exceeded the weighted average severity of all crashes, the roadside violation was assessed as having a positive incremental severity risk.

A minimum of ten post-crash inspections matched to the crash severity was required for the severity analysis. Table 5-5 reveals that of the 917 total roadside inspection regulations, 251 had sufficient data (27%) to proceed with the analysis. Over half of the general roadside and traffic enforcement violations met the severity data threshold. The number of regulations with positive incremental crash severity factors is also listed in Table 5-5. Unlike the crash incidence factor, there is no statistical significance test for the severity factor, so all of the 139 regulations with positive incremental crash severity factors are used in the final analysis.

Table 5-5: Regulations Meeting Crash Severity Data Threshold

Regulation Type	Positive Incremental Crash Severity Factor	Severity Data Threshold Met	Percent of Regulations Meeting Severity Data Threshold	All Regulations
General Roadside	130	218	50%	433
Hazardous Materials	5	15	4%	414
Traffic Enforcement	3	17	63%	27
Passenger Carrier	1	1	2%	43
All Types	139	251	27%	917

Table 5-6 lists the regulations with the highest incremental crash severity factors. The number of post-crash violations by crash severity (fatal, injury, and towaway) is presented for each regulation followed by the calculated incremental crash severity factor. The incremental crash severity factor should be interpreted as the additional cost per crash due to an increased crash severity associated with the presence of the violation at the time of the crash.

As shown in Table 5-6, the regulation with the highest incremental crash severity factor involves violation of requirement that carriers do not permit drivers of passenger vehicles to be on duty beyond 60 hours in any 7 consecutive days; or 70 hours in any 8 consecutive days. The regulations with the highest incremental crash severity factors are not the same regulations with the highest incremental crash incidence factors, which are listed in Table 5-6, since each of these factors are determined independently.

It is notable that traffic enforcement regulations are not present in the top ten regulations with the highest incremental severity factors, despite the strong crash incidence results for traffic enforcement regulations. The highest severity result is for a passenger carrier violation the only passenger carrier with any positive incremental risk result. The remaining regulations in the top ten crash severity factor results are all general roadside regulations, again with the exception of the highest result, which is for a passenger carrier violation.

DRAFT

Table 5-6: Regulations with Highest Incremental Crash Severity Factors (Top Ten)

Part No	Violation Description	Fatal Crash Violations	Injury Crash Violations	Towaway Crash Violations	Incremental Crash Severity Factor
395.5B	Failure to comply with total on-duty time (60/70 hours) during seven/eight day period (passenger carrier)	5	3	3	\$385,545
393.47B	Failure to match the size of brake chambers	4	4	3	\$260,581
393.110 C	Failure to meet the minimum tie down requirement with cargo positioned or blocked	4	2	5	\$189,751
393.55E	Failure to meet appropriate anti-lock braking system requirements for vehicles in tow	3	6	2	\$187,588
393.61A	Operating commercial motor vehicle with inadequate or missing truck side windows	5	11	3	\$185,570
393.13 D1	Failure to properly locate reflex reflectors on trailer siders	7	6	8	\$182,776
383.95A	Violating airbrake restriction	3	4	3	\$175,044
393.13 C3	Failure to properly locate retroreflective sheeting on trailer upper rear area	9	11	10	\$163,274
393.25E	Failure of lamp to burn steady	10	27	6	\$158,027
393.13 C1	Failure to properly locate retroreflective sheeting on trailer sides	12	25	10	\$157,079

5.2.3 Roadside Violation Total Risk Results

With the crash incidence and crash severity factors calculated, the next step of the analysis is to combine these two components of risk to produce the total violation crash risk. For a positive incremental total violation risk to be calculated at least one of the crash incidence or crash severity data thresholds must be met, and at least one of the incremental factors must be positive.

The first summary statistics of the total roadside crash risk results are the number of unique individual regulations meeting the data thresholds. The crash incidence data threshold requires a minimum of 10 violations cited in post-crash inspections. The crash severity threshold requires that a minimum of 10 violations cited in post-crash inspections be matched to their crash severity. Though it would seem that any regulation meeting the crash severity threshold would also meet the crash incidence threshold, this is not the case. Since the crash incidence analysis used violations from the inspection levels indicated for either driver, vehicle or all inspections, but the severity analysis uses all post-crash inspections matched to severity, it is possible for the severity data threshold to be met, while the crash incidence data threshold is not.

Table 5-7: Regulations Meeting Crash Incidence and/or Crash Severity Data Thresholds

Regulation Group	Thresholds Met			Total
	One	Both	At Least One	
General Roadside	33	218	251	433
Hazardous Materials	8	12	20	414
Traffic Enforcement	1	17	18	27
Passenger Carrier	1	0	1	43
All Types	43	247	290	917

The regulatory violations with positive incremental risk include regulations with total risk from the crash incidence factor, regulations with total risk from the crash severity factor, and regulations with a total risk from both a positive incremental crash incidence factor and positive incremental crash severity factor. Of the regulations meeting the data thresholds, a positive incremental total risk can has been calculated for 214 regulations as shown in Table 5-8. Seventy-five of the regulations with positive incremental total risk are based solely on the incremental crash incidence risk; another 81 of the regulations with positive total incremental risk are based only on the crash severity component, and 58 violations have a positive incremental total risk calculated from both a positive incremental crash incidence and incremental crash severity component.

Table 5-8: Number of Regulations with Positive Incremental Total Risk by Regulation Type

Regulation Type	Only Incremental Crash Incidence Factor Positive	Only Incremental Crash Severity Factor Positive	Both Incremental Crash Incidence and Crash Severity Factors Positive	Regulations with Positive Incremental Total Risk IVR(k)	Number of Regulations
General Roadside	62	76	54	192	433
Hazardous Materials	1	3	2	6	414
Traffic Enforcement	12	1	2	15	27
Passenger Carrier	0	1	0	1	43
All Types	75	81	58	214	917

The majority of the regulations cited in the four year period are in BASIC 6 - Improper Loading/Cargo Related Issues, however the majority of the regulations with positive incremental total risk are in BASIC 5 - Vehicle Maintenance, which also has a large share of the cited regulations.

Table 5-9: Number of Regulations with Positive Incremental Total Risk by BASIC

BASIC	Only Incremental Crash Incidence Factor Positive	Only Incremental Crash Severity Factor Positive	Both Incremental Crash Incidence and Severity Factors Positive	Number of Regulations with Positive Incremental Risk	Number of Regulations
1 – Unsafe Driving	7	0	3	10	41
2 - Fatigued Driving	1	5	3	9	28
3 - Driver Fitness	10	4	4	18	43
4 - Controlled Substance/Alcohol	2	0	0	2	5
5 - Vehicle Maintenance	28	60	34	122	242
6 - Improper Loading Cargo Related Issues	22	10	14	46	505
9 - Administrative	5	2	0	7	39
No BASIC Assigned	0	0	0	0	14
All BASICs	75	81	58	214	917

Broken down by Part Number, the majority of the regulations with positive total risk are from Part 393-‘Parts and Accessories Necessary for Safe Operation. There were 185 regulations from Parts 78, 107, 171, 178, 179, 375, 385, 386, 397, 398 and 399 that failed to meet the data thresholds and did not have a positive incremental risk factor. In particular, there were 109 unique regulations under Part 178-‘Specifications for Packaging’ which were cited during the analysis period, but failed to produce positive incremental crash risk factors.

Table 5-10: Number of Regulations with Positive Incremental Total Risk by Part Number

Part Number	Only Incremental Crash Incidence Factor Positive	Only Incremental Crash Severity Factor Positive	Both Incremental Crash Incidence and Crash Severity Factors Positive	Regulations with Positive Incremental Total Risk IVR(k)	Number of Cited Regulations
139	1	0	0	1	6
172	0	2	0	2	146
173	0	0	1	1	61
177	0	1	0	1	37
180	0	0	1	1	14
383	5	1	1	7	13
387	1	0	0	1	11
390	2	2	0	4	6
391	5	3	3	11	20
392	17	2	4	23	58
393	39	56	44	139	312
395	0	5	3	8	35
396	5	9	1	15	23
Other Part Numbers	0	0	0	0	185
All Part Numbers	75	81	58	214	917

Table 5-11 (on page 71) presents the regulations with the highest incremental total violation risk. The incremental crash incidence factor and incremental severity factor are both listed along with the incremental total violation risk. Incremental total violation risk should be interpreted as the total value of the increase in risk caused by the presence of the violation for 100 million vehicle miles. The incremental total violation risk results are discussed by regulation type, beginning with the traffic enforcement violation results since a majority of the top ten results are traffic enforcement regulations.

Traffic Enforcement Violation Results

There were a total of 27 regulations on the MCSAP traffic enforcement list cited during the analysis period. Of these 27 regulations, 18 regulations met at least one of the data thresholds and positive incremental risk was calculated for 15 of the regulations. These 15 traffic enforcement regulations rank among the regulations with the highest incremental total risk when

compared to the other roadside violation risk results, 6 of which are in the top ten of the overall roadside results.

The regulations with the highest incremental total violation risk, shown in Table 5-11, find that many of the regulations with the highest incremental violation risk are traffic enforcement regulations. The five highest traffic enforcement regulations (with their incremental violation risk in parentheses) are: failure to exercise caution in hazardous road conditions (\$3,014 million); reckless driving (\$2,750 million); ill or fatigued operator (\$1,576 million); improper turns (\$658 million); and failure to yield right of way (\$507 million). For each of these five traffic enforcement violations, the incremental violation risk results entirely from an incremental crash incidence factor. Indeed, violation of each of these regulations results in a crash incidence rate with the violation present that significantly exceeds the overall crash incidence rate. The violation crash incidence rate for failing to exercise caution in hazardous road conditions exceeds the overall crash incidence rate by factor of 74. The following lists each of the other five top violation risk traffic enforcement regulations and (in parentheses) the factor by which its violation crash incidence rate exceeds the overall crash incidence rate: reckless driving (68); ill or fatigued operator (39); improper turns (17); failure to yield right of way (13).

Four additional traffic enforcement regulations are included in the list of the top fifty regulations with the highest incremental violation risk. These traffic enforcement regulations (with their incremental violation risk in parentheses) are: improper lane change (\$361 million); possession, use, or under the influence of alcohol- 4 hrs prior to violation (\$315 million); driver uses or is in possession of drugs (\$282 million); and following too closely (\$220 million). In each of these four cases, the incremental violation risk results from an incremental crash incidence factor as opposed to an incremental crash severity factor.

General Roadside Results

While traffic enforcement violations constitute a large number of the high risk violations, there is one group of general roadside violations that also pose a significant risk, securement of cargo. For example, regulations 393.122B and 393.122, which cover securement of paper rolls have incremental violation risk of \$556 million and \$454 million respectively and regulation 393.100 which covers prevention against shifting of load is at \$374 million. Again, the LTCCS found a similar result in its analysis. The shifting of cargo while in transit was found to be the most risky vehicle or driver violation. While the VSAS found traffic enforcement violations with higher risk, it is encouraging that both studies found violations of the cargo securement regulations to pose a significant risk.

Beyond the top ten results and generalizing to the top fifty violation results, the general roadside regulations include a number of regulations dealing with cargo loading/load securement regulations. These include such regulations as: no/improper securement of paper rolls (393.122); improper safety chain attachment (393.70D8); improper coupling driveaway/towaway operations (393.71), improper restraint/securement of heavy vehicles, equipment or machinery with crawler tracks or wheels (393.130C). The incremental risk associated with no/improper securement of paper rolls stems primarily from an incremental crash incidence factor and a small incremental crash severity factor. The improper safety chain attachment regulation has an incremental violation risk resulting from both an incremental crash incidence factor as well as an incremental crash severity factor. The improper coupling driveaway/towaway operations regulation has an

incremental violation risk stemming from an incremental crash incidence factor. The improper restrain of heavy vehicles has both an incremental incidence and an incremental severity factor contributing to its overall risk.

There are some very important general roadside inspection regulations in the top fifty list that do not fall into the category of cargo loading/load securement regulations. The first regulation falling into this category is no or defective rear vision mirrors (393.80). The incremental violation risk associated with this regulation is \$169 million, all resulting from the crash incidence factor. The second regulation concerns cargo or any other object obscuring the driver's view (392.9A3). This regulation has an incremental violation risk factor of \$122 million. Violations of this regulation are associated with an increased crash incidence factor and an increased crash severity factor. The third regulation in this group involves steering wheel not secured/broken (393.209A). This regulation has an incremental violation risk factor of \$107 million. The incremental violation risk stems from an incremental crash incidence factor and an incremental crash severity factor. Regulation four in this group involves stud/bolt holes elongated (i.e. out of round) on wheels (393.205B). This violation, with an estimated incremental violation risk of \$104 million, results solely from an increased crash incidence factor. The fifth regulation in this group is mis-matched brake chambers on the same axle (393.47B). This regulation has an incremental violation risk of \$76 million as a consequence of both an incremental crash incidence factor and an incremental crash severity factor.

Other important regulation areas are included beyond the top fifty regulations with the highest incremental violation risk. One such area involves driver qualification issues. For example, driving a CMV while disqualified (391.15A) has an incremental violation risk factor of \$73.3 million; operating a CMV with more than one driver's license has an incremental violation risk factor of \$67 million, not having a valid medical waiver in the driver's possession has an incremental violation risk factor of \$43.4 million, and driving a CMV while disqualified has an incremental violation risk factor of \$32.6 million. Additional areas involve vehicle maintenance issues: e.g. tires, wheels, and brakes. There is one regulation violation covering no brakes as required (393.42) with an incremental violation risk of \$50.1 million from both crash incidence and crash severity factors. A second regulation in this category is a wheel/rim cracked or broken. This regulation has an incremental violation risk of \$47.2 million as a consequence of both an incremental incidence and an incremental severity factor. A third regulation in this category is operating on a tire that has body ply or belt material exposed or is flat or has an audible leak (393.75A) with an incremental violation risk of \$45.8 million as a result of an incremental crash incidence factor. A fourth regulation involves insufficient brake linings with an incremental violation risk of \$17.9 million, solely as a consequence of an incremental crash severity factor.

Table 5-11: Roadside Regulations with Highest Incremental Violation Risk (Top Ten)

Part and Sec No	Regulation Type	Violation Description	Incremental Crash Incidence Factor	Incremental Violation Crash Severity Factor	Incremental Violation Risk (IVR)
392.14	Traffic Enforcement	Failure to use caution for hazardous conditions in operating a commercial motor vehicle	13,923	\$0	\$ 3,014,706,261
392.2R	Traffic Enforcement	Reckless driving when operating a commercial motor vehicle	12,705	\$0	\$ 2,750,978,412
392.3	Traffic Enforcement	Operating commercial motor vehicle with ill or fatigued driver	7,280	\$0	\$ 1,576,387,069
392.2T	Traffic Enforcement	Improper turns when operating a commercial motor vehicle	3,037	\$0	\$ 657,558,756
393.122B	General Roadside	Failure to properly secure paper rolls (eyes vertical)	2,571	\$0	\$ 556,680,624
392.2Y	Traffic Enforcement	Improper lane change when operating a commercial motor vehicle	2,339	\$0	\$ 506,507,093
393.122	General Roadside	Failure to properly secure paper rolls	2,056	\$4,269	\$ 454,790,057
393.61	General Roadside	Operating commercial motor vehicle with inadequate or missing truck side windows	979	\$185,570	\$ 428,898,107
393.100C	General Roadside	Failure to meet the minimum tie down requirement with cargo positioned or blocked	1,730	\$0	\$ 374,649,424
392.2LC	Traffic Enforcement	Improper lane change when operating a commercial motor vehicle	1,666	\$0	\$ 360,746,589

Passenger Carrier Violation Results

The passenger carrier specific regulations comprise a very small proportion of cited regulations and only a small subset of carriers is subject to these regulations. Only one passenger carrier specific regulation met the data threshold and had a positive incremental total risk. The passenger carrier driver hours of service violation (395.5B) actually has the highest incremental crash severity factor out of all roadside violations. This regulation is the first regulation listed in Table 5-6 (on page 64).

Hazardous Materials Violation Results

While the hazardous materials regulations in the Code of Federal Regulations (CFR) are numerous, the citation of these regulations is quite infrequent in roadside and post-crash inspections. A consequence of the low citation rates is that, only 20 of the 414 cited hazardous materials regulations met at least one of the roadside data thresholds.

There were 414 unique hazmat regulations cited in roadside or post-crash inspections during the analysis period. Of the regulations meeting the data thresholds, six regulations had a positive incremental crash risk factor—two regulations with a positive incremental crash incidence factor, five regulations with a positive incremental crash severity factor, and one with both a positive incremental crash incidence and positive incremental crash severity factor. Table 5-12 displays the hazardous materials regulations with their incremental crash incidence, incremental crash severity factor and total incremental violation risk.

Release of HM from package has the highest incremental risk of the HM regulations. It is unclear whether this result is due to an actual association with crash incidence or is the result of miscoding in the data. The violations used in the analysis were limited to only violations present before the crash (not violations that occurred as a result of the crash).

Table 5-12: Hazardous Materials Regulations with Positive Incremental Violation Risk

Part No	Sec No	Violation Description	Incremental Crash Incidence Factor	Incremental Crash Severity Factor	Incremental Violation Risk (IVR)
173	24B1	Failure to comply with general packaging requirements	343	\$ 41,299	\$ 96,324,154
383	93B4	Transporting hazardous materials without proper endorsements	268	\$ 0	\$ 57,979,552
180	415B	Failure to mark cargo tank with test type and date	0	\$ 34,294	\$ 6,510,048
172	502A 1	Displaying prohibited placarding	0	\$ 22,170	\$ 4,208,497
172	516C 6	Placard damaged, deteriorated, or obscured	0	\$ 14,485	\$ 2,749,755
177	817E	Failure to ensure that shipping papers are accessible during inspection or accident	0	\$ 10,945	\$ 2,077,783

5.2.4 Assessment of Roadside Violation Risk Methodology

At the aggregate level, the results of this study are consistent with prior efforts to quantify the risk associated with violation of the FMCSRs. Regulations can be separated into three separate categories: administrative, driver, and vehicle. Recent studies conducted by ATRI and FMCSA both conclude that driver behavior and violations of the driver regulations play a significant role in crashes. The ATRI study,⁷⁷ found statistically significant driving behaviors and events that increased the likelihood of crashes from 18% to 325%. The Large Truck Crash Causation Study⁷⁸ also found that driver-related critical reasons were cited in 87% of the crashes (where the critical reason for the crash was assigned to the truck), while vehicle-related critical reasons were cited in 10% of those crashes. As shown in Table 5-13: Violation Risk by Regulation Type, driver violations on average were found to have a positive correlation with crashes more frequently than either vehicle or administrative violations. Furthermore, driver violations on average posed 7 times the risk of vehicle violations and 8 times the risk of administrative violations.

Table 5-13: Violation Risk by Regulation Type

Regulation Type	Number with Positive Risk	Total Number	Percentage with Positive Risk	Average Risk / Regulation
Driver	39	131	30%	\$80,670,638.77
Vehicle	168	747	22%	\$11,784,130.74
Administrative	7	39	18%	\$9,841,356.18

Again, these results are also in agreement with a recent publication based on the LTCCS, which assigns relative crash risk to violation categories.⁷⁹ This study found that on average driver violations were far riskier than vehicle violations. For example, driver violations such as traveling too fast for conditions posed 3 times the risk as that of tire and break violations, which are the most common vehicle violations in the study.

Aggregate results are shown in Table 5-14: Violation Risk by Inspection Type. Traffic enforcement violations had a noticeably larger percentage of violations with a positive risk value and those violations on average had a much large crash risk than general roadside violations. Also consistent with expert opinion are the results for hazardous materials and passenger carrier violations, which pose less risk on average than either traffic enforcement or roadside violations.

⁷⁷ American Transportation Research Institute (ATRI). 2005. *Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior-Based Model and Recommended Countermeasures*. Page 2.

⁷⁸ Federal Motor Carrier Safety Administration, Large Truck Crash Causation Study, (Publication #: FMCSA-RRA-07-017), Department of Transportation, Washington D.C., July 2007.

⁷⁹ Ibid

Table 5-14: Violation Risk by Inspection Type

Inspection Violation Type	Number with Positive Risk	Total Number	Percentage with Positive Risk	Average Risk / Regulation
Traffic Enforcement	15	27	56%	\$369,978,133.02
Roadside (General)	192	433	44%	\$21,990,680.91
Passenger Carrier	1	43	2%	\$1,702,046.98
Hazardous Materials	6	414	1%	\$410,265.19

In spite of the positive results at the aggregate level, there are a large number of regulations with an insufficient number of violations for inclusion in the analysis which is a major limitation of a statistical analysis of violation risk. Another inherent limitation of a statistical analysis is that the quality of the results is limited by the quality of the data—whether that means the ability of the data to meet the data thresholds, or biases in the citation and recording of the violations.

Data Limitations

Insufficient roadside violation data can be attributed to either the absence or highly infrequent nature of the violation, or to the fact that the inspection does not routinely include inspecting for the particular regulation. If the regulation is never violated it may be that the regulation has such a high risk that drivers and carriers are always in compliance. On the other hand, if a violation is never cited for a regulation (in the data) it could also be that of the thousands of possible regulations there only a certain number of violations which can be detected and recorded in the course of a routine inspection.

Post-crash violation data limitations have additional causes. The first reason for limited post-crash violation data is that there are fewer post-crash inspections conducted than roadside inspections. The number of post-crash inspections is not only limited by the total number of crashes, but also by the low proportion of post-crash inspections conducted out of all crashes. In addition, given the already limited number of post-crash inspections, the post-crash inspection violations used in the severity analysis are further limited by the relatively low proportion of post-crash inspections that can be matched to their crash record (crash record contains crash severity information).

The post-crash violation data can also be limited or biased in the violations actually recorded due to the post-crash nature of the inspection. Firstly, it may be physically impossible to determine if a particular regulation was present at time of the crash. The damage to the vehicle involved may make it impossible to ascertain the existence of selected violations at the time of the crash. The post-crash vehicle may simply be in such a condition that some of the violations that existed at the time of the crash are not determinable. It seems inherently more difficult to identify all of the conditions existing at the moment of a crash when inspecting a vehicle that has been damaged during a crash. Clearly, some items inspected in a non-crash vehicle simply cannot be evaluated in a post-crash inspection of a damaged vehicle. Additionally, it is possible that a violation occurs as the result of a crash, however the violation is recorded as if the violation was present prior to, or at the time of crash. There are some violations, especially traffic

enforcement regulations which cannot be observed after the crash and there may not be any indication that the violation was present at the time of the crash.

Post-crash inspections may also employ a higher degree of scrutiny during the inspection given that a crash has occurred. The inspector may also focus on particular area of inspection if there seems to be some obvious violations which may have been related to the crash occurrence. In these cases, violations may be cited more frequently in the post-crash inspection data, but it is unclear if the higher violation rate is due to a true association with crashes, or the increased inspection scrutiny.

Despite setting data thresholds, the results may still be sensitive to the number of violations recorded for each regulation. The data thresholds were set by a rule-of-thumb that an analysis should at least have a small sample size of 10 observations. The regulations with the highest incremental crash severity factors tend to be regulations with relatively few post-crash inspections matched to severity. The top four severity regulations all have only 11 post-crash inspection violations, one more than the data threshold.

Brake violations are typically thought of as playing a significant factor in crash occurrence.⁸⁰ The results however do not show any appreciable increase in crash occurrence (crash incidence factor) associated with brake violations. While the incremental crash incidence factors are zero, all of the brake violations that meet the data thresholds have positive incremental crash severity factors. The crash incidence results for the brake violations may reflect some of the biases in the detection and recording of violations in roadside and post-crash inspections discussed above.

The inability to determine the presence of a violation at the time of the crash in the post-crash inspection might lead to a post-crash violation rate that is lower than it would be if all the violations at the time of the crash could have been recorded. The finding that speeding violations have a zero crash incidence factor may be example of such a downward bias in the post-crash violation rate.

It is a commonly held belief that speeding contributes toward crash occurrence, implying that this regulation should have a positive incremental crash incidence (overall) risk. Speeding is a traffic enforcement regulation which is subject to a source of uncertainty in determining the proper exposure measure. In addition, it may be difficult for post-crash inspectors to determine if the truck was speeding prior to the crash. Therefore, the post-crash speeding violation rate may be lower than it would be if speeding could be easily detected in the post-crash inspection.

Traffic Enforcement Exposure Correction

One of the major findings in this study is that traffic enforcement regulations have very high risk results compared to other types of general roadside regulations. The traffic enforcement regulation roadside methodology differed from the other roadside violation

⁸⁰ Federal Motor Carrier Safety Administration, Large Truck Crash Causation Study, (Publication #: FMCSA-RRA-07-017), Department of Transportation, Washington D.C., July 2007.

methodologies in one aspect, the use of an inferred exposure risk as opposed to the use of the actual count of the number of traffic enforcement inspections. Chapter 11: Appendix of Traffic Enforcement Violations contains the full discussion of the need for this method and the data employed to approximate the traffic enforcement exposure measure.

Uncertainty surrounding the proper exposure measure may be a reason for the higher risk results for traffic enforcement violations. However, it may also be the case that these traffic enforcement violations are a source of higher risk, which has significant implications for enforcement. It should, however, be emphasized that due to the inability to properly capture the exposure measure in the count of violations there is a level of uncertainty in these results and though efforts were taken in the methodology to make the traffic enforcement results comparable to the general roadside inspection regulation results, caution should be exercised when comparing the results from these different regulation categories.

Crash Rate and Severity Weight Parameters

The use of such a large severity weight for fatal crashes was a source of concern developing the methodology. It was feared that such a large severity weight would bias total risk toward regulations with higher severity factor, reducing the relative importance of the crash incidence factor. Despite the initial concern, the majority of the top fifty results are actually driven by the incremental crash incidence factor. Counter to the initial concerns, it may be that the choice of the crash rate used in the calculation of the incremental crash incidence factor may bias the crash incidence factor upwards—the crash rate may cause the crash incidence factor to be higher than it would be if a lower crash rate were used.

The crash rate chosen for use in the crash incidence methodology affects the magnitude of the incremental crash incidence risk and the total incremental risk. Similarly, the severity weights determine the magnitude of the severity factor. If the crash rate is changed, the magnitude of the total risk and the incremental violation risk will change, but the order of the risk ranking is preserved. When the crash severity weights are changed, the magnitude of the severity score is changed and the ranking may also change. For example, if the severity weights are changed to place more emphasis on injury crashes, the severity results will be reordered with regulations with violations found in a disproportionate number of injury crashes ranked higher than they were using the previous severity weights.

Conceptually in the methodology, the crash rate used in calculating the crash incidence factor should be the probability of a vehicle getting into a crash when the particular violation is not present. Since at least one violation was cited in the majority of the post-crash violations the crash rate (without violations) could not be imputed from the fraction of post-crash inspections without violations. The overall total crash rate was used in the analysis since an alternative and accepted crash rate could not be determined. It is likely that the probability of crash unrelated to violations is approximated by the proportion of crashes where the motor carrier was found not at fault.

5.3 Compliance Review Violation Results

This section presents the results of the compliance review violation risk analysis. The methodology used to assess the risk of violations cited during compliance reviews uses compliance review violation data and roadside inspection data from carriers who had at least one compliance review during the analysis period. Risk related to compliance review violations is derived from the statistical association between the compliance review violation and the corresponding roadside violations.

There were 1,119 unique regulations cited during compliance reviews from 2003 through 2006. The analysis relies upon the records from 49,188 compliance reviews, which were matched to 2,099,460 roadside inspection records. The 1,119 regulations violated in compliance reviews were matched to 714 unique roadside violations producing a total of 22,330 compliance review violation-roadside violation pairs. The phi correlation coefficient was calculated for each of these pairs.

An association between the compliance review violation and the roadside violation was assumed when the phi correlation coefficient was positive with a significant chi-square statistic. Roadside regulations must have met the roadside data thresholds in order for a positive incremental roadside risk to be weighted. In addition to the roadside regulation meeting the roadside data threshold, two compliance review data thresholds were also applied.

The first compliance review data threshold is on the number of times the compliance review regulation was cited and the second data threshold is on the minimum total number of roadside inspections matched to the violation of the compliance review regulation. The thresholds are that the compliance review regulation must be cited in a minimum of 10 compliance reviews, and a minimum of 100 roadside violations ($c_2=100$) must be matched to the compliance review violation. The total number of compliance review regulations meeting these requirements is 463.⁸¹

The results of this matching process can be summarized as follows:

- Of the 22,330 compliance review violation-roadside violation pairs, 16,193 pairs met the data threshold criterion for the compliance review risk analysis.
- Of the compliance review-roadside violation pairs meeting the data threshold, 11,460 had a positive association and 6,813 pairs had a positive association with a statistically significant chi-square statistic.
- Out of the 1,119 unique compliance review regulations, 463 met the data threshold, and 346 had a positive incremental total risk calculated.

⁸¹ There were 305 compliance review regulations that a higher data threshold with the number of roadside inspections equal to or greater than 1,000 ($c_2 \geq 1,000$) and number of compliance review regulations violations greater than or equal to 15. Of the 305 meeting the stricter thresholds, 213 compliance review cited regulations have a positive compliance review incremental risk.

5.3.1 Compliance Review Results

The calculated phi correlation coefficients for the compliance review violation to roadside violation pairs are quite small in magnitude, often in the range of 0.005 and lower. The phi correlation coefficient measures the association between the compliance review violation and the roadside violation. A correlation coefficient of one indicates perfect linear correlation and a coefficient of zero indicates no association. Though the phi coefficients are quite small, the chi-square statistics are quite large, demonstrating statistical significance for an overwhelming majoring of the positive correlations, meaning that these associations are in fact not zero, though very small. The low values for the phi correlation coefficient seem to be countered by the fact that most compliance review regulations are associated with multiple roadside inspection regulations. In these cases, the risk assigned to the compliance review regulation is a sum of the portion of each roadside inspection regulation's risk correlated with the specific compliance review regulation.

Table 5-15 provides a list of the ten compliance review regulations with the highest incremental violation risk based on the explained methodology. These ten compliance review regulations fall into two broad categories: driver/hours-of-service regulations and regulations covering the inspection, repair, and maintenance of vehicles.

Driver violations with the highest incremental risk fall into three broad categories: those dealing with drug use/possession; those dealing with on duty status reporting/hours of service, and those dealing with use of radar detectors. According to regulation 392.4B, no carrier shall require or permit a driver to be on duty and possess or be under the influence of amphetamines, narcotics, drugs, etc. Violation of this regulation has an estimated incremental risk of \$6.4 million.

There are two specific compliance review regulations dealing with duty status reporting/hours of service compliance. Regulation 395.3B2 limits on-duty hours to 70 in eight consecutive days. Violations of this regulation have an incremental risk, based on model results, of \$6.3 million. Regulation 395.8E is a general failure to complete driver record of duty status, a failure to preserve those records, or a false report is a top ten violation risk result with an estimated incremental risk of \$6.1 million.

A final driver regulation category in the top ten list covers violations of the prohibition against use of radar detectors in a commercial motor vehicle. Violation of this regulation (392.71A) is associated with an incremental risk of \$7.0 million. One could argue that the use of such radar detectors only encourages drivers to drive recklessly. The discussion of reckless driving as having a significant incremental risk was presented in the full presentation of the roadside results.

The second broad category covered in the top ten compliance review regulations with the highest incremental risk involves regulations covering the inspection, repair, and maintenance of vehicles. One such regulation forbids carriers to employ any person as a brake inspector unless evidence of the inspector's qualification is maintained at the carrier's principal place of business (396.25E). Violation of this regulation is associated with an incremental risk of \$7.35 million. The likelihood of vehicles operating over-the-

road with brake defects, it can be argued, is increased, if the motor carrier hires unqualified inspectors.

Also, there is a series of regulations regarding the maintenance of inspection records on vehicles in a carrier's fleet. First, carriers are required to have maintenance records for each vehicle (396.3B). Second, these records must identify the vehicle make, serial number, and tire size on the vehicle (396.3B1). Third, the records must indicate the nature and due date of various inspections and maintenance operations to be performed on the vehicle in the future (396.3B2). Fourth, the records must indicate past repairs and maintenance conducted on the vehicle (396.3B3). The incremental risks associated with these regulations are as follows: 396.3B (\$15.8 million); 396.3B1 (\$16.5 million); 396.3B2 (\$23.9 million); 396.3B3 (\$7.6 million). Interestingly, the highest incremental risk is associated with violating the regulation requiring the carrier to indicate on its inspection report the due dates for required future inspections and maintenance operations. Clearly, carriers who are not organized about performing these activities will be the carriers who do not insure that they are carried out. Failure to carry these activities out, indeed, enhances the risk factor. Thus, the connection might very well be that violating the regulation leads to omission of required inspections, which leads, in turn, to operation of vehicles with defects and a resulting increased risk.

Lastly, there is a requirement for the drivers to complete an inspection report in writing at the end of each day's work. The inspection report covers major mechanical systems on the truck. Failing to comply with this regulation produces an incremental risk of \$7.4 million (396.11A). Failure to complete inspection reports on a daily basis increase the likelihood that vehicle defects, noticed by the driver, will not be addressed prior to the dispatch of the vehicle on a subsequent workday.

Table 5-15: Top Ten Compliance Review Incremental Violation Risk Results

Part and Sec No	Acute or Critical	Violation Description	CR Incremental Risk IVR(k)
396.3B2		Failure to maintain a means to indicate the nature and due date of the various inspection and maintenance operations to be performed	\$ 23,964,456
396.3B1		Failure to maintain a record of vehicle information including company number, make, serial number, year, and tire size	\$ 16,517,422
396.3B	Critical	Failure to maintain required records	\$ 15,834,653
396.11A	Critical	Failure to maintain daily driver vehicle inspection records	\$ 13,377,602
396.3B3		Failure to maintain a record inspection, repairs and maintenance indicating their date and nature	\$ 7,583,599
396.25E		Employing a person as a brake inspector without maintaining the required evidence of the inspector's qualifications at the motor carrier's principal place of business or at the location at which the brake inspector is employed	\$ 7,354,991
392.71A		Operating commercial motor vehicle with radar detector in use or installed	\$ 7,004,760
392.4B	Acute	Requiring or permitting a driver to be on duty while possessing, or being under the influence of, prohibited drugs or other substances	\$ 6,369,971
395.3B2	Critical	Failure to comply with total on-duty time of 60/70 hours during seven/eight day period	\$ 6,304,242
395.8E	Critical	Failure to accurately record driver duty status	\$ 6,148,759

The compliance review regulations ranked 11 through 25 can be divided into three major categories: driver (hours of service; drug testing; alcohol use/possession); inspection, repair, and maintenance of vehicles, and hazardous materials.

Regarding the driver, allowing drivers to go beyond the 14 duty hour after coming on duty following 10 consecutive off-duty hours (395.3A2) is a violation that the methodology estimates as a \$4.4 million increased risk. The second regulation in this group specifies that it is unlawful for a driver to be on duty or operate a commercial motor vehicle where the driver possesses alcohol. Violations of this regulation (392.5A3) have an estimated incremental risk of \$3.7 million. The final two regulations in this group deal with meeting random testing for controlled substances and alcohol use requirements (382.305) and implementing such a program on the date operations begin (382.115A). Violations of the former regulation produce an estimated increase in risk of \$5.3 million, while violations of the latter have an estimated incremental risk of \$3.3 million. Alternatively, the lack of these programs will increase the likelihood that the carrier will be dispatching drivers who might be operating equipment under the influence of drugs/alcohol.

Nine of the fifteen regulations ranked 11 through 25 pertain to inspection, repair, and maintenance regulations. One important regulation in the group indicates that a motor carrier shall not operate a CMV in such a condition as to likely cause an accident or breakdown (396.7A). Violations of this regulation carry an estimated incremental risk of \$5.2 million. A second regulation in this group states that no carrier shall require or permit any person to operate any motor vehicle declared out-of-service until the out-of-service condition has been eliminated as a result of repairs. Violations of this regulation result in an estimated incremental risk factor of \$3.9 million. A related compliance review regulation requires every motor carrier to certify on the driver inspection report listing any defects or deficiencies that the defect or deficiency has been taken care of before the vehicle can be operated (396.11C1). Violations of this regulation in compliance reviews have an incremental risk factor of \$3.8 million. There are two specific regulations in this group that require the motor carrier to ensure that brake inspectors have qualifications and training to do their jobs (396.25D). In addition to brake inspector training, the carrier is required to maintain evidence that general motor carrier inspectors performing annual inspections have necessary training. It should be noted that the nine regulations in this group include several that relate to paperwork only. While clearly violating these paperwork regulations does not enhance risk directly, they may be manifestations of underlying behavior that, indeed, has an incremental risk impact. For example, regulation 396.21B requires carriers to keep a copy of inspection reports for 14 months after inspection is conducted. Carriers violating this regulation may be in fact the carriers who are, in general, careless about keeping records of vehicle maintenance, repairs, and inspections. As a result, they may be more frequently dispatching vehicles without the required services and leading to increased risk as a consequence.

The final group of regulations among the regulations ranked 11 through 25 in terms of incremental risk deals with transportation of hazardous materials. Regulation 172.200A indicates that each person who offers a hazardous material for transportation shall describe the hazardous material on the shipping paper in the manner required by the regulation and carries a risk of \$5.3 million. A second regulation, 171.2B says that each

person who offers a hazardous material for transportation must comply with all applicable requirements. This hazardous materials regulation carries an incremental compliance review risk of \$4.9 million. Again, violating these regulations in compliance reviews may be a symptom of underlying behavior, which leads to an incremental risk as suggested by the methodology.

5.3.2 Assessment of Compliance Review Methodology

The compliance review results presented and discussed are quite satisfactory. Clearly, the process of estimating the risk associated with each compliance review violation is a challenging one, made all the more difficult by the difficulty to establish any direct correlation between compliance review violations and increased crash risk. As a result, the study team focused on the connection between compliance review violations and associated roadside inspection violations and the differences in violation patterns between carriers who violated the particular compliance review regulation and those who did not.

Overall, the values of the phi correlation coefficient were quite small, with most values of phi less than 0.001. The magnitude of the calculated values for phi was likely impacted by the unbalanced nature of the samples. Attenuation, a lower value, of the phi correlation coefficient is a strong possibility due to the unbalanced sample and the tendency for violation rates to be very low. Despite the low values of the phi coefficients, there were a number of statistically significant values. In fact, chi-square results show that of the 22,330 CR-RS pairs, 16,394 had positive phi association and 9,940 of these positive phi coefficients had a significant chi-square statistic.

The low phi coefficient values meant that the compliance review violations received only a small portion of the risk assigned to each associated roadside violation. Although some compliance review violations had a large number of associated roadside violations, the total summed risk for a compliance review violations, in most cases, were small in magnitude. To the extent that the methodology and use of the phi coefficient underestimates the true association between the compliance review violation and the related roadside violation, the methodology underestimates the risk associated with each compliance review violation. It may also be that there were strong associations between the compliance review violation and certain roadside violations, but that the roadside violations failed to meet the data thresholds or have a positive incremental risk.

Furthermore, in the case of calculating the crash risk for a specific compliance review violation, only looking for associations between that violation and those roadside violations belonging to the same BASIC category may have produced a downward bias on the CR violation's crash risk estimate. The purpose of this approach is to limit the number of possible pairing where there is clearly no relationship between the CR violation and the roadside violation. For example, driver violations of the drug and alcohol policy have no meaningful relationship to poor maintenance programs by carriers. The only downside to this approach is some valid pairs of violations may have been excluded from the analysis merely due to their BASIC classification.

Many of the results presented above are strong and consistent with expectations. There may, however, be some concern regarding violations which are paperwork related, yet have very large compliance review risk factors. It is important, however, to emphasize

that these violations may produce the high risk factor because they are directly related to behaviors that, in fact, are directly responsible for the incremental risk. For example, violating the prohibition against radar detectors is a violation with a high risk factor. It is clear that violating this regulation indicates that the carrier allows drivers to have radar detectors. It can be argued that drivers with radar detectors may drive more recklessly than drivers without detectors. The roadside results established reckless driving as a violation with a high risk factor. Thus, violating the prohibition against radar detectors may indirectly result in increased speeding probability, which, in itself, has a high incremental risk. Other regulations with the highest incremental risk related to paperwork violations have the same type of indirect impact as well. Thus, the list of regulations with the highest incremental risk includes a set of both direct and indirect impacts (primarily paper work violations). If we examine the paper work violations at a more detailed level and account for the behaviors that are associated with the paper work violations, the list of regulations with the highest incremental risk meets expectations. These regulations seem to be capturing more systemic carrier behavior which is then captured in a variety of roadside violations.

5.3.3 Compliance Review Results: Analysis of Risk for Critical and Acute Regulations

There are 103 regulations on the acute and critical list—a total of 39 acute regulations and 64 critical regulations. Table 5-16 shows the number of acute and critical regulations with positive incremental risk results, the number of regulations meeting the data thresholds, the number of regulations cited and matched to roadside violations, and the total number of acute and critical regulations. Of the regulations meeting the data threshold, 89% of the acute regulations had a positive incremental risk, and 84% of the critical regulations had a positive calculated incremental risk.

Table 5-16: Number of Acute and Critical Regulations with Positive Incremental Risk

Regulation Type	Positive Incremental CR Risk	Meet Thresholds	Cited and Matched to Roadside Violations	Number of Regulations
Acute	17	19	24	39
Critical	42	51	57	64
Total	59	70	81	103

There are 39 regulations listed as acute in the list of critical and acute regulations. In Part 385- “Explanation of the Safety Rating Process” an acute regulation is defined as the following:

Acute regulations are those identified as such where noncompliance is so severe as to require immediate corrective actions by a motor carrier regardless of the overall safety posture of the motor carrier. An example of an acute regulation is 383.37b, allowing, requiring, permitting, or authorizing an employee with more than one Commercial Driver's License

(CDL) to operate a commercial motor vehicle. Noncompliance with 383.37b is usually discovered when the motor carrier's driver qualification file reflects that the motor carrier had knowledge of a driver with more than one CDL, and still permitted the driver to operate a commercial motor vehicle. If the motor carrier did not have such knowledge or could not reasonably be expected to have such knowledge, then a violation would not be cited.⁸²

The highest risk ranked acute regulations are:

- 392.4B – “Motor carrier violation of the Driver Drug and Other Substances regulation”;
- 382.115A – “Controlled Substances and Alcohol Use and Testing-Testing starting date”; and
- 396.9C2 – “Motor carrier allows operation of out-of-service vehicle.”

The lowest calculated incremental risk factor for an acute regulation was \$27,069, ranking 308th out of all compliance review violations, for 387.31A – “No motor carrier shall operate a motor vehicle transporting passengers until the motor carrier has obtained and has in effect the minimum levels of financial responsibility as set forth in 387.33 of this subpart.”

There are 64 regulations listed as critical in the list of critical and acute regulations. Part 385- “Explanation of the Safety Rating Process” defines a critical regulation as:

Critical regulations are those identified as such where noncompliance relates to management and/or operational controls. These are indicative of breakdowns in a carrier's management controls. An example of a critical regulation is 395.3a1, requiring or permitting a property-carrying commercial motor vehicle driver to drive more than 11 hours.⁸³

Four of the top ten compliance review regulation incremental risk factors are for critical regulations. The critical regulations with the highest incremental risk are:

- 396.3B – “required records for vehicle inspections” (\$15.8 million);
- 396.11A– “driver vehicle inspection report required” (\$13.4 million);
- 395.3B2 – “on duty 70 hours in a period of 8 consecutive days” (\$6.3 million); and
- 395.8E – “failure to complete record of duty activities” (\$6.1 million).

Acute and Critical regulations with incremental total risk in the top ten of all compliance review regulations are listed in Table 5-15 (page 5-81). The next ten

⁸² <http://www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/385appnb.htm>

⁸³ <http://www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/385appnb.htm>

acute and critical regulations with the highest incremental risk are listed in Table 5-17.

While a large percentage of acute and critical regulations (84% and 87% respectively) showed positive risk results, overall these results indicate that the designation of regulations as critical and acute does not correspond to carrying an additional weight in safety assessment. In fact, there are other regulations not designated as critical or acute which appear to have a greater risk in terms of crash risk.

DRAFT

Table 5-17: Compliance Review Incremental Risk for Acute and Critical Regulations (Top Results beyond Top Ten)

Part and Sec No	Acute or Critical	Violation Description	CR Incremental Risk IVR(k)	CR Risk Rank
382.115A	Acute	Failure to implement a controlled substance and alcohol use and testing program	\$ 5,284,143	13
396.17A	Critical	Failure to be inspected as required	\$ 4,896,982	17
395.3A2	Critical	Failure to comply with maximum driving time/total on-duty time (14-hours) rule	\$ 4,399,515	18
396.9C2	Acute	Operating commercial motor vehicle declared and marked "out-of-service"	\$ 3,893,172	20
382.305	Acute	Failure to comply with random controlled substance and alcohol use testing requirements	\$ 3,268,007	25
382.301A	Critical	Failure to conduct testing for controlled substances prior to the first time a driver performs safety-sensitive functions for an employer	\$ 3,093,309	26
391.51A	Critical	Failure to maintain a driver qualification file for each driver	\$ 3,072,763	27
392.5B1	Acute	Failure to maintain required alcohol prohibition	\$ 2,874,724	28
180.407A	Critical	Failure to comply with requirements to test and inspect specific cargo tanks	\$ 2,285,677	36
392.2	Critical	Failure to comply with operating requirements	\$ 2,170,712	38

5.4 Comparison of Roadside and Compliance Review Results

5.4.1 Regulations Cited in both Roadside and Compliance Reviews

This section compares the results for the set of violations, which were cited in both roadside inspections and compliance reviews. In such cases, the risk associated with the violation may have been calculated twice, once using the compliance review methodology and once using the roadside violations methodology. The risks from these two methodologies differ in their conceptualization and basic construction, according to the available violations data recorded for the regulation. In the case of a violation cited in a roadside inspection, the risk is directly calculated as that particular violation being found in a higher proportion in post-crash inspections. On the other hand, the compliance review method relies upon an indirect mechanism through which the risk from the violation is calculated. The compliance review violation is associated with other roadside violations, which have their own direct (roadside method) risk factor. It is not necessarily the case that a violation from a compliance review is associated with that same violation found in roadside inspection. The compliance review violation may be associated with several other violations and not necessarily with itself.

Three of the top ten compliance review results were also cited in roadside inspections (392.71A, 395.8E, and 396.11A). Table 5-18 compares the roadside and compliance review calculated risk for all 218 regulations that were cited in either a compliance review or at the roadside. Eighty of these regulations had a calculated risk of zero for both methods, 52 regulations had a higher compliance review violation risk and 86 regulations had a higher roadside violation risk.

Table 5-18: Summary of Roadside and Compliance Review Violation Risk Results for Regulations Cited in Compliance Reviews and Roadside Inspections

Result	Number of Regulations
Both Roadside and Compliance Review Violation Risk is Zero	80
Compliance Review Violation Risk Greater than Roadside Violation Risk	52
Compliance Review Violation Risk Less than Roadside Violation Risk	86
Total number of Regulations	218

Table 5-19 compares the calculated incremental risk from the two methods for regulations cited in both compliance reviews and roadside inspections. Each of the compliance review violations is also cited as a roadside inspection violation as well. Of the thirteen compliance review violations, also cited directly in a roadside inspection, with the highest incremental risk calculated from the compliance review methodology, five did not have an incremental risk calculated using the roadside methodology. The failure to calculate a roadside incremental risk stems from either a lack of times the regulation was cited during a post-crash inspection (data insufficiency) or a failure to

establish a higher violation rate of this regulation in the post crash inspection versus the violation rate among all inspections. For two of the compliance review violations, the incremental risk using the compliance review methodology resulted in a higher value than did the incremental risk using the roadside inspection methodology. However, in six cases, the incremental risk assessment was substantially higher using the roadside methodology as opposed to the compliance review methodology.

DRAFT

Table 5-19: Ten Highest Compliance Review Risk for Regulations Cited in Compliance Reviews and Roadside Inspections

Part and Sec No	Acute or Critical	Violation Description	CR Incremental Risk IVR(k)	CR Risk Rank	Roadside Calculated Incremental Risk IVR(j)
396.11A	Critical	Failure to maintain daily driver vehicle inspection records	\$ 13,377,602	4	0
392.71A		Operating commercial motor vehicle with radar detector in use or installed	\$ 7,004,760	7	\$ 25,284,720
395.8E	Critical	Failure to accurately record driver duty status	\$ 6,148,759	10	\$ 38,059,642
172.200A		Failure to provide shipping paper with hazardous materials description	\$ 5,288,308	12	0
171.2B		Failure to comply with the requirements for hazardous materials transportation (including labeling and handling)	\$ 4,917,034	16	0
395.3A2	Critical	Failure to comply with maximum driving time/total on-duty time (14-hours) rule	\$ 4,399,515	18	\$ 3,802,612
396.9C2	Acute	Operating commercial motor vehicle declared and marked "out-of-service"	\$ 3,893,172	20	\$ 33,986,361
396.9D3		Failure to properly document that "out-of-service" violations corrected	\$ 2,678,921	30	0
396.3A1		Operating commercial motor vehicle without proper inspection, repair and maintenance	\$ 2,480,741	33	\$ 4,914,776
392.7		Failure to inspect and use prescribed equipment	\$ 2,468,502	34	\$ 33,308,684

5.4.2 Comparing the Roadside and Compliance Review Risk

Violations found in compliance reviews are not necessarily the same in nature as when they are cited in roadside inspections. A violation found in a compliance review indicates a systematic and more pervasive type of behavior and may apply to all of the carrier's drivers, whereas the roadside inspection is a single occurrence or single driver observed violating the regulations.

The main conclusion from a comparison of the roadside and compliance review violation risk results is that the roadside methodology for calculating incremental violation risk produces much larger risk factors than the compliance review approach and the risk factors have a much greater standard deviation. Since two different methodologies to determine risk in these two different settings were applied, equivalent risk results were not expected. However, it does seem that the compliance review method, whether due to the low correlation coefficients, or the low number of violation association by design produces a lower risk result. In the development of the methodology there was concern that the correlation between the compliance review violation and multiple roadside violations would produce risk results many times the roadside risk. Limiting the compliance review violation to roadside violation pairs to be within the same BASIC and the choice of the phi correlation coefficient were measures taken to prevent unreasonably large compliance review violation risk results. These two measures, however, also decreased the risks derived for the compliance review violations.

Table 5-20: Comparison of Roadside and Compliance Review Calculated Risk

Result Methodology	Number of Regulations	Regulations with positive incremental violation Risk (IVR)	Minimum Incremental Risk	Maximum Calculated Incremental Risk	Average Incremental Risk
Roadside	917	214	\$ 251,893	\$ 3,014,706,261	\$ 92,310,338
Compliance Review	1,119	346	\$ 2,056	\$ 23,964,456	\$ 1,030,010

5.5 Conclusion

Overall the results seem to demonstrate that the methodologies employed are effective in producing a relative risk ranking for the regulations. The results seem reasonable given the data, particularly when the data thresholds are used to require a minimum number of violations to produce valid results. Most of the risk factors assigned to regulations look reasonable, and in many cases the results conform to generally held beliefs on the relative risk of the various types of regulations. However, certain regulations have very unexpected results—the cause attributed largely to potential data problems or insufficient observations. In addition to specific instances where the methodology does not produce results consistent with common expectations, the methodology has its own inherent global limitations discussed in the next section of this report.

Chapter 6: Limitations, Enhancements & Applications

6.1 Methodology and Data Limitations

There were significant data and methodological challenges in estimating the incremental risk associated with the set of violations for roadside and compliance review regulations. It should be emphasized, however, that despite the limitations, the selected methodological approach more than satisfactorily achieves project objectives. To this time, FMCSA has relied upon professional judgments, and past experiences in order to compare and contrast regulations according to their individual risk. There has been no systematic evaluation of which regulations have more impact on risk than do others. Such a systematic, comparative assessment of each regulation is critical to FMCSA's overall mission. Such an assessment is needed to prioritize enforcement actions and to determine which regulation violations have the greatest potential risk associated with them.

The discussion of study limitations covers a number of important issues. The purpose of this section is to introduce and acknowledge the global limitations of the study approach, not necessarily the specific limitations discussed in the risk results. The specific limitations identified in the results have already been described in the assessment of each of the methodologies in the Results section. These limitations will again be listed and briefly discussed as limitations of the violation risk study.

6.1.1 Data Insufficiency

In compiling four years worth of data for this analysis, it became clear that many FMCSA regulations in the CFR were not being cited during roadside inspections and/or post-crash inspections at all or at a sufficient rate to meet the study's data sufficiency requirements. It may be that these regulations are never violated or it may also be that inspectors do not routinely inspect for the violation of the specific regulation. In either case violation risk results were only calculated for a fraction of all regulations that are listed in the CFR. The question remains whether regulations that have not been cited in the past four years is purely a "small numbers" or infrequent event problem, or is it the case that some regulations are not violated or inspected for.

In the inspection records, we know that a violation positively indicates that the violation was present (by definition). However, we cannot always say that a violation was not present in an inspection, if that regulation were not checked as being violated. The study team is treating the data as if they are collected as Violated/Not Violated in every instance, but this may not be the case.

The large number of regulations with no or infrequent citations is clearly an important matter for FMCSA to address. Clearly, these regulations must be examined more carefully to determine why they are not being cited or are cited so infrequently. Indeed, a number of these regulations may need to be eliminated or combined with other existing regulations, cited on a more regular basis.

6.1.2 Data Limitations

Data limitations in the detection and citation of violations in roadside and post-crash inspections were addressed in the Assessment of the Roadside Risk Methodology. Similar data problems may also occur in recording and detection of violations during compliance reviews. A statistical approach to quantifying risk is subject to the biases and recording errors in the data. While some methodological adaptations may be able to correct for data biases, the methodologies can never overcome the fundamental problems in the data.

6.1.3 Lack of Causality

The study team made no attempt to link the violation of regulations to crash causation. Post-crash inspection violations indicate the presence of a violation, however they do not indicate the extent to which a violation “caused” or even contributed to the crash itself. The lack crash causation information is a limitation of the analysis and a reality of the available data. Some of the violations included in the analysis may not have contributed directly to the crash itself. To the extent that our analysis included these violations, our analysis overestimates the violation rate of these regulations at the time of the crash. Data sources analyzing crash causation often link the factors or reasons leading to the crash, however these causal factors are not listed as specific regulatory violations.

In the compliance review analysis, a methodological challenge emerged from the conclusion, based on the set of pre-existing studies, that there was *no direct relationship* between compliance review violations and crash incidence or severity. The study team concluded that the relationship between compliance review violations and incremental risk could be evaluated, however, by focusing on the association between compliance review violations and a related set of roadside violations. Thus, the risks associated with compliance review violations relied the portion of risk assigned to roadside violations that could be associated (through a statistical correlation) with each particular related roadside regulation. However, the compliance review methodology of risk through association with roadside violations does not infer crash causation or measure the direct risk of a compliance review violation. Additionally, since the compliance review risk results are predicated on the underlying roadside risk results, all of the study limitations affecting the roadside results indirectly affect the compliance review results as well.

6.1.4 No Control for Multiple Crash Factors or Combined Effects

This statistical analysis of violation risk does not control for the presence of other violations, factors or other crash characteristics in the methodologies. Each violation is associated with a crash independently of other violations also present in the post-crash inspection in the roadside methodology. Similarly, each compliance review violation is associated with all possible roadside violations regardless of the presence of other violations in the compliance review. The methodology attributes the entire crash to an individual violation even when many other violations are present in the post-crash inspection. Furthermore, there was no effort to establish whether environmental factors (at the time of the crash) contributed to the crash in a more substantial way than did any specific regulatory violation. The methodology did not evaluate the contribution of each specific violation to the crash cause nor did it assess the existence of multiple violations

occurring in the same crash. No multivariate technique was employed to single out the contribution of the individual violation to the crash occurrence or crash severity.

In the methodology employed, each regulation was evaluated separately from the presence of other violations. While it was recognized that it is often the combination of multiple factors that leads to a crash or contributes to the crash severity, these multiplicative or interactions were not analyzed in this study. It may indeed be the case that the presence of two violations has a combined risk greater than the sum of the two individual violation risk factors. For example, bad brakes in combination with reckless driving may produce a combined risk that is greater than the sum of their individually calculated risk factors.

6.1.5 Properly Calculate Enforcement Exposure

Under the topic of correct calculation of the enforcement exposure rate, the calculation of the traffic enforcement exposure rate received the most attention. Corrections were also made to account for the subset of carriers subject to hazardous materials and passenger carrier regulations. However, there are many regulations which only apply to an even more specific subset of carriers or under specific circumstances. Carriers of radioactive materials are an example of a very specific subset of carriers and failure of stop at railroad crossing is an example of a regulation which can only be violated under certain conditions.

6.1.6 Choice of Analysis Parameters

Any uncertainty in the choice of the crash rate and severity weights, or the inability to calculate the true value for these parameters is a limitation in the calculation of the roadside violation risk factors. Clearly, the choice of the parameters will affect the overall magnitude of the risk results and can even affect the relative risk ranking of the regulations. The challenges in accurately calculating the crash rate for vehicles without violations is a limitation of the crash incidence and total violation crash risk.

6.1.7 Low Values for Compliance Review Violation to Roadside Violation Association

The study team selected the phi correlation coefficient to measure the association between a compliance review violation and the associated set of roadside violations. However, it is a phenomena that phi may have low values when—as in the data we are using—the categories are uneven, violating the assumptions of normality and homogeneity.

6.2 Enhancements

While the methodology used by the VSAS is more robust than any prior empirical effort determining the risk associated with specific regulatory violations, this section identifies a few enhancements that could have significant effects on the results.

Development of Aggregate Risk

The current methodology used by the VSAS heavily focused on obtaining quantitative results for all violations with sufficient data available. This effort did not include grouping of violations in to categories and applying the methodology to the category. The idea behind this approach is some applications of these results will use data at the most detailed level available. Other applications prefer use of aggregate results. In general, it is easier to aggregate lower level results than disaggregate higher level results.

As a result of this design decision, one potential enhancement is to review all of the violations cited and develop a middle level of aggregation lower than the part and section numbers but higher than the individual violation. To successfully accomplish this would require significant input from the FMCSA field staff. Using only the violation description provided by the FMCSRs is not enough information to categorize violations. It is vital that enforcement practices when citing those violations are also taken into consideration for the categorization.

Violations with Insufficient Data

As stated in the previous section, the VSAS methodology was only able to develop a risk index for the regulations with sufficient violation data. Another potential enhancement is to review the regulations with insufficient data and assess their individual place in the overall risk index. Any review of these regulations should include input from the FMCSA field staff. Again, the enforcement practices may have significant implications on the risk index of particular regulations.

6.3 Applications

Several major analytical projects, concurrent with the CSA 2010 effort—including the Intervention Model, a Driver Safety Measurement System and Motor Carrier Safety Measurement System—are currently under development, with the goal of assisting FMCSA to assess the safety performance of motor carriers, commercial motor vehicles, and commercial vehicle drivers. All these projects utilize roadside inspection violation data as well as a customized violation risk index to produce their output. The results of the VSAS will support each of these projects by serving as an additional input to the development of their custom violation risk index. It is not realistic to expect each project to use the VSAS results “as is” at the conclusion of this report. Instead, the VSAS results will project an additional piece of data to use in developing the necessary violation risk index for each project.

Intervention Model

The Intervention Model employs innovative techniques to relate violations found through the Roadside Inspection (RI) and Traffic Enforcement (TE) programs to both the direct and indirect avoidance of CMV crashes, fatalities, and injuries. As a key part of the model, individual violations are converted into crash risk probabilities that are in turn categorized into one of five “Risk Categories”. This risk index – where violations under Risk Category 1 contribute the most risk towards a crash occurring whereas those under Risk Category 5 provide the least risk – was developed through an outside study by the Cyclac Corporation. The Intervention Model carefully considers violation weight by also

separately calculating crash risk probabilities for violations found under Traffic Enforcement vs. Roadside Inspection, as well as for those that are OOS vs. non-OOS.

The results of the Violation Severity Assessment Study (VSAS) could be particularly valuable to the Intervention Model as violation severity would be assessed at a finer level of detail than by the 5-category system used in the Intervention Model. This could significantly improve the precision of the crash risk probabilities used by the model and therefore the accuracy of calculated crashes avoided, lives saved, and injuries avoided by conducting interventions.

Motor Carrier Safety Measurement System

The Comprehensive Safety Analysis 2010 project (CSA 2010) is a new, holistic business plan that will effectively encompass all of FMCSA's compliance, enforcement, and safety programs. The effort will create a new operational model that will necessitate the integration of current FMCSA information systems, and dictate a higher level of data quality. This system integration will be facilitated by IT programs such as COMPASS, but will also be guided by existing projects, new rulemakings, legal proceedings, and future research. At a fundamental level, CSA 2010's revised approach to improving motor carrier safety will be largely shaped by the defined Behavior Analysis and Safety Improvement Categories (BASICS) described earlier in this report.

A key component of the operational model will be a new Motor Carrier Safety Measurement System (CSMS). This measurement component for CSA 2010 will be partly modeled after SafeStat, but will differ from SafeStat as follows, it will 1.) consider a broader range of safety and compliance data, 2.) directly support the selection of interventions by BASIC as will be defined by CSA 2010 and 3.) directly support safety fitness determinations. The violation severity weighting scheme produced by the VSAS will be another input into its violation risk index. Furthermore, the VSAS results will be more granular than required by the CSMS; however, with the guidance of field experts, the VSAS results can be aggregated up to logical categories just below the BASIC level and tailored to the context of carrier safety.

Driver Safety Measurement System

The CSMS, the Driver Safety Measurement System (DSMS), also currently under development to support CSA 2010, will focus on the identification of high-risk CMV drivers. It has become widely held by FMCSA and its stakeholders, and demonstrated by the Volpe Center's Pilot Driver Study (2004)⁸⁴ that driver-related factors significantly contribute to the occurrence of a large percentage of commercial vehicle crashes. Measuring the safety status of drivers will also help assess the safety status of the carriers that employ them. Conversely, as CMV drivers increasingly move from carrier to carrier, a measurement system that will evaluate the workforce on an individual driver basis rather than a carrier-only basis makes much sense. The DSMS methodology is in early development; various approaches will be examined for measuring, ranking, prioritizing, and scoring individual drivers as opposed to carriers. As an integral part of CSA 2010,

⁸⁴ Volpe Center. Pilot Driver Study, 2004.

DSMS will be organized by the BASICS. The Volpe Center is currently finalizing a mapping classification scheme for all cited driver violations within each BASIC to support the DSMS methodology.

DRAFT

Chapter 7: Bibliography

- American Transportation Research Institute (ATRI), **Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior-Based Model and Recommended Countermeasures**, Arlington, VA, 2005.
- Battelle memorial Institute, **Comparative Risks of Hazardous Materials and Non-Hazardous Materials Truck Shipment Accident/Incidents**, prepared for Federal Motor Carrier Safety Administration, U.S. Department of Transportation, Washington, D.C., 2001
- Blower, Daniel and Campbell, Kenneth L. **Methodology of the Large Truck Crash Causation Study**, Federal Motor Carrier Safety Administration and Federal Highway Administration, Department of Transportation, (FHWA-RI-05-035), Washington, D.C. 2005.
- Caird, J.K. and Kline, T.J., “The Relationships Between Organizational and Individual Variables to On-the-job Driver Accidents and Accident-free Kilometers,” **Ergonomics**. Vol. 47, No. 15, 2004, pp.1598-1613.
- Cycla Corporation, **Risk-based Evaluation of Commercial Motor Vehicle Roadside Violations: Process and Results**, prepared for Office of Motor Carriers, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C., 1998.
- Federal Highway Administration, Department of Transportation, **Truck Size and Weight Regulations (23 CFR 658)**, Washington, D.C., April 1, 2007.
- Federal Motor Carrier Safety Administration, **2003 National Truck Fleet and Bus Fleet Safety Surveys: Final Report**, (FMCSA-RI-06-044), Department of Transportation, Washington D.C., 2006.
- Federal Motor Carrier Safety Administration, **Crash Profiles**, http://www.ai.volpe.dot.gov/CrashProfile/n_overview.asp, Department of Transportation, Washington, DC, March 2007 data snapshot. Data sources for the Crash Profiles: Fatality Analysis Reporting System (FARS), General Estimate System (GES), and Motor Carrier Management Information System (MCMIS).
- Federal Motor Carrier Safety Administration, Department of Transportation, **Safety Regulations (49 CFR 300-399)**, Washington, D.C., October 1, 2006.
- Federal Motor Carrier Safety Administration, Department of Transportation, **Motor Carrier Census File, Motor Carrier Management Information System**, Washington, D.C., continuously updated.
- Federal Motor Carrier Safety Administration, Department of Transportation, **Mission Statement**, <http://www.fmcsa.dot.gov/about/what-we-do/mission/mission.htm>,

Washington, D.C., August 2007.

Federal Motor Carrier Safety Administration, Department of Transportation, **Motor Carrier Safety Programs**, <http://www.fmcsa.dot.gov/safety-security/safety-initiatives/other/saftprogs.htm>, Washington, D.C., August 2007.

Federal Motor Carrier Safety Administration, Department of Transportation, **Safety Fitness Electronic Records (SAFER) System**, Washington, D.C., ongoing online database, <http://safer.fmcsa.dot.gov/>

Federal Motor Carrier Safety Administration, Department of Transportation, **North American Standard Driver/Vehicle Inspection Levels**, Washington, D.C., <http://www.fmcsa.dot.gov/safety-security/safety-initiatives/mcsap/insplevels.htm>

Federal Motor Carrier Safety Administration, Department of Transportation, **Field Operations Training Manual: Acute and Critical Regulations**, Washington, D.C., <http://www.fmcsa.dot.gov/documents/foia/chapter11.pdf>

Federal Motor Carrier Safety Administration, Department of Transportation, **Large Truck Crash Facts: 2005, Washington, D.C., February 2007**, <http://ai.fmcsa.dot.gov/CarrierResearchResults/PDFs/LargeTruckCrashFacts2005.pdf>

Federal Motor Carrier Safety Administration, Department of Transportation, **Appendix B To Part 385—Explanation of Safety Rating Process**, Washington, D.C., <http://www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/385appnb.htm>

Federal Motor Carrier Safety Administration, **Report to Congress on the Large Truck Crash Causation Study**, (MC-R/MC-RRA), Department of Transportation, Washington D.C., 2006.

Federal Motor Carrier Safety Administration, **Large Truck Crash Causation Study**, (Publication #: FMCSA-RRA-07-017), Department of Transportation, Washington D.C., July 2007.

Gramlich, Edward M., **A Guide to Benefit-Cost Analysis**, Waveland Press, 2nd Edition, 1997, pp. 246.

Hakkert, A.S. and Braimster, L., “The Uses of Exposure and Risk in Road Safety Studies.” SWOV Institute for Road Safety Research, The Netherlands, 2002, pp. 53, <http://www.swov.nl/rapport/R-2002-12.PDF>

Hauer, Ezra, Harwood, D.W., Council, F.M., and Griffith, M.S., “The Empirical Bayes Method for Estimating Safety: A Tutorial,” **Transportation Research Record**, 1784. Transportation Research Board, Washington, D.C., 2002, pp. 126-131.

Hickman, Jeffrey S., “High-Risk Commercial Vehicle Drivers and Differential Crash

Rates.” **Future Truck and Bus Research Opportunities: Conference Proceedings 38**, Transportation Research Board., Washington, D.C., 2006.

Hughes, Ronald G., “The Effectiveness of Commercial Motor Vehicle (CMV) Enforcement in reducing Truck-Involved Crashes,” Highway Safety Research Center, University of North Carolina at Chapel Hill, 2001,
http://www.hsrc.unc.edu/pdf/hfactors/pdf/risk_mov_violation.pdf

Hughes, Ronald G., Gray, George E, and Evan, Anna Beth, “Quantifying the Crash Reduction Benefits of ‘Targeted’ Commercial Vehicle Enforcement Efforts.” Highway Safety Research Center, University of North Carolina at Chapel Hill, 2002,
http://www.hsrc.unc.edu/pdf/hfactors/pdf/quant_crash_benefits.pdf.

Interstate Commerce Commission Termination Act of 1995, Public Law 104-88, 109 Stat. 803, January 1, 1996.

Kolstad, Charles D., Ulen, T., and Johnson, G., “Ex Post Liability for Harm vs. Ex Ante Safety Regulation: Substitutes or Complements?” **American Economic Review**, Vol. 80, 1990, pp. 888-901.

Lantz, Brenda M. and Blevins, Michael W., **An Analysis of Commercial Vehicle Driver Traffic Conviction Data to Identify High Safety Risk Motor Carriers**, The Upper Great Plains Transportation Institute.,
<http://www.ugpti.org/research/carrier/>, North Dakota State University, Fargo, North Dakota, 2001.

Lowrance, William, **Of Acceptable Risk: Science and Determination of Safety**, William Kaufmann Publisher, May 1976, 180 pages.

Lyman, S and Braver, E.R., “Occupant Deaths in Large Truck Crashes in the United States: 25 Years of Experience,” **Accident Analysis and Prevention**, Vol. 35, No. 5, 2003, pp. 731-739.

Miller, Ted R., “Costs and Functional Consequences of U.S. Roadway Crashes.” **Accident Analysis and Prevention**, Vol. 25, No. 5, 1993, pp.: 593-607.

Moses, Leon N. and Savage, Ian, “A Cost-Benefit Analysis of US Motor Carrier Safety Programmes,” **Journal of Transport Economics and Policy**, Vol. 31, No.1, 1997, pp. 51-67.

Motor Carrier Act of 1980, Public Law 96-296, July 1, 1980, 94 Stat. 793.

Motor Carrier Safety Improvement Act of 1999, Public Law 106-159, December 9, 1999, 113 Stat 1748.

Pipeline and Hazardous Materials Safety Administration, Department of Transportation, **Carriage by Public Highways (49 CFR 177)**, Washington, D.C.

October 1, 2006.

Posner, Richard A. 1986. **Economic Analysis of Law**. Third Edition. Boston: Little, Brown and Company

Shavell, Steven M. "A Model of the Optimal Use of Liability and Safety Regulation," **RAND Journal of Economics**, Vol. 15, Summer 1984, pp. 271-280.

Shavell, Steven M. "Liability for Harm versus Regulation of Safety," **Journal of Legal Studies**, Vol. 13, June 1984, pp. 357-374.

Starr, Chauncy and Chris Whipple, "Risks of Risk Decisions," **Science**, Vol. 208 (4448), 1980, pp.1114-1119.

Volpe National Transportation Systems Center, Motor Carrier Safety Assessment Division, **SafeStat—Motor Carrier Safety Status Measurement System Methodology: Version 8.6**, prepared for the Federal Motor Carrier Safety Administration, U.S. Department of Transportation, Washington, D.C. 2004.

Volpe National Transportation Systems Center, Motor Carrier Safety Assessment Division, **Compliance Review Work Group Phase II Final Report: Proposed Operational Model for FMCSA Compliance and Safety Programs**, prepared for the Federal Motor Carrier Safety Administration, Department of Transportation, Washington, DC 2004.

Zaloshnja, Eduard and Miller, Ted R., "Costs of Large Truck-involved Crashes in the United States," **Accident Analysis and Prevention**, Vol. 36, No.1, 2004, pp. 801-808.

Zaloshnja, Eduard and Miller, Ted, **Unit Costs of Medium and Heavy Truck Crashes**, Final Report prepared for Federal Motor Carrier Safety Administration, Washington, DC, December 2006, 9 pages.

Zaloshnja, Eduard., Miller, Ted., and Spicer, R. **Costs of Large Truck and Bus-Involved Crashes**, Federal Motor Carrier Safety Administration, Department of Transportation, Washington, DC, March 2001.

Chapter 8: Appendix of Acute and Critical Regulations

Table 8-1: Acute Violations

Part & Section Number	Violation Description
172.313(a)	Accepting for transportation or transporting a package containing a poisonous-by-inhalation material that is not marked with the words "Inhalation Hazard"
173.24(b)(1)	Accepting for transportation or transporting a package that has an identifiable release of a hazardous material to the environment
173.431(a)	Accepting for transportation or transporting in a Type A packaging a greater quantity of Class 7 (radioactive) material than authorized
173.431(b)	Accepting for transportation or transporting in a Type B packaging a greater quantity of Class 7 (radioactive) material than authorized
173.441(a)	Accepting for transportation or transporting a package containing Class 7 (radioactive) material with external radiation exceeding allowable limits
173.442(b)	Accepting for transportation or transporting a package containing Class 7 (radioactive) material when the temperature of the accessible external surface of the loaded package exceeds 50° C (122° F) in other than an exclusive use shipment, or 85° C (185° F) in an exclusive use shipment
173.443(a)	Accepting for transportation or transporting a package containing Class 7 (radioactive) material with removable contamination on the external surfaces of the package in excess of permissible limits
177.801	Accepting for transportation or transporting a forbidden material
177.835(a)	Loading or unloading a Class 1 (explosive) material with the engine running
177.835(c)	Accepting for transportation or transporting Division 1.1, 1.2, or 1.3 (explosive) materials in a motor vehicle or combination of vehicles that is not permitted
177.835(j)	Transferring Division 1.1, 1.2, or 1.3 (explosive) materials between containers or motor vehicles when not permitted
177.841(e)	Transporting a package bearing a poison label in the same transport vehicle with material marked or known to be foodstuff, feed, or any edible material intended for consumption by humans or animals unless an exception in §177.841(e)(i) or (ii) is met
382.115(a)	Failing to implement an alcohol and/or controlled substance testing program
382.201	Using a driver known to have an alcohol concentration of 0.04 or greater
382.211	Using a driver who has refused to submit to an alcohol or controlled substances test required under part 382
382.213(b)	Using a driver known to have used a controlled substance
382.215	Using a driver known to have tested positive for a controlled substance

382.305	Failing to implement a random controlled substances and/or an alcohol testing program
382.309(a)	Using a driver who has not undergone a return-to-duty alcohol test with a result indicating an alcohol concentration of less than 0.02
382.309(b)	Using a driver who has not undergone a return-to-duty controlled substances test with a result indicating a verified negative result for controlled substances
382.505(a)	Using a driver within 24 hours after being found to have an alcohol concentration of 0.02 or greater but less than 0.04
382.605(c)(1)	Using a driver who has not undergone a return-to-duty alcohol test with a result indicating an alcohol concentration of less than 0.02 or with verified negative test result, after engaging in conduct prohibited by Part 382 Subpart B
383.37(a)	Knowingly allowing, requiring, permitting, or authorizing an employee with a commercial driver's license which is suspended, revoked, or canceled by a state or who is disqualified to operate a commercial motor vehicle
383.37(b)	Knowingly allowing, requiring, permitting, or authorizing an employee with more than one commercial driver's license to operate a commercial motor vehicle
383.51(a)	Knowingly allowing, requiring, permitting, or authorizing a driver to drive who is disqualified to drive a commercial motor vehicle
387.7(a)	Operating a motor vehicle without having in effect the required minimum levels of financial responsibility coverage
387.31(a)	Operating a passenger carrying vehicle without having in effect the required minimum levels of financial responsibility
390.35	Making, or causing to make fraudulent or intentionally false statements or records and/or reproducing fraudulent records
391.11(b)(4)	Using a physically unqualified driver
391.15(a)	Using a disqualified driver
392.4(b)	Requiring or permitting a driver to drive while under the influence of or in possession of a narcotic drug, amphetamine or any other substance capable of rendering the driver incapable of safely operating a motor vehicle
392.5(b)(1)	Requiring or permitting a driver to drive a motor vehicle while under the influence of in possession of an intoxicating beverage
392.5(b)(2)	Requiring or permitting a driver who shows evidence of having consumed an intoxicating beverage within 4 hours to operate a motor vehicle
396.9(c)(2)	Requiring or permitting the operation of a motor vehicle declared "out-of-service" before repairs were made
396.11c	Failing to correct Out-of-Service defects listed by driver in a driver vehicle inspection report before the vehicle is operated again
396.17(g)	Failing to promptly repair parts and accessories not meeting minimum periodic inspection standards
397.5(a)	Failing to ensure a motor vehicle containing Division 1.1, 1.2, or 1.3 (explosive) material is attended at all times by its driver or a qualified representative

Table 8-2: Critical Violations—65 Regulations

382.301(a)	Using a driver before the motor carrier has received a negative pre-employment controlled substance test result
382.303(a)	Failing to conduct post accident testing on a driver for alcohol and/or controlled substances
382.305(b)(1)	Failing to conduct random alcohol testing at an annual rate of not less than the applicable annual rate of the average number of driver positions
382.305(b)(2)	Failing to conduct random controlled substances testing at an annual rate of not less than the applicable annual rate of the average number of driver positions
382.503	Allowing a driver to perform safety sensitive function, after engaging in conduct prohibited by subpart B, without being evaluated by substance abuse professional, as required by 382.605
382.605(c)(2)(ii)	Failing to subject a driver who has been identified as needing assistance to at least six unannounced follow-up alcohol and/or controlled substance tests in the first 12 months following the driver's return to duty
383.23(a)	Operating a commercial motor vehicle without a valid commercial driver's license
387.7(d)	Failing to maintain at principle place of business required proof of financial responsibility
387.31(d)	Failing to maintain at principle place of business required proof of financial responsibility for passenger carrying vehicles
390.15(b)(2)	Failing to maintain copies of all accident reports required by State or other governmental entities or insurers
391.45(a)	Using a driver not medically examined and certified
391.45(b)(1)	Using a driver not medically examined and certified during the preceding 24 months
391.51(a)	Failing to maintain driver qualification file on each driver employed
391.51(b)(2)	Failing to maintain inquiries into driver's driving record in driver's qualification file
391.51(b)(7)	Failing to maintain medical examiner's certificate in driver's qualification file
392.6	Scheduling a run which would necessitate the vehicle being operated at speeds in excess of those prescribed
392.9(a)(1)	Requiring or permitting a driver to drive without the vehicle's cargo being properly distributed and adequately secured
395.1(h)(1)(i)	Requiring or permitting a property-carrying commercial motor vehicle driver to drive more than 15 hours (Driving in Alaska)
395.1(h)(1)(ii)	Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty 20 hours (Driving in Alaska)
395.1(h)(1)(iii)	Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty more than 70 hours in 7 consecutive days

	(Driving in Alaska)
395.1(h)(1)(iv)	Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty more than 80 hours in 8 consecutive days (Driving in Alaska)
395(h)(2)(i)	Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive more than 15 hours (Driving in Alaska)
395.1(h)(2)(ii)	Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty 20 hours (Driving in Alaska)
395.1(h)(2)(iii)	Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty more than 70 hours in 7 consecutive days (Driving in Alaska)
395.1(h)(2)(iv)	Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty more than 80 hours in 8 consecutive days (Driving in Alaska)
395.1(o)	Requiring or permitting a short-haul property-carrying commercial motor vehicle driver to drive after having been on duty 16 consecutive hours
395.3(a)(1)	Requiring or permitting a property-carrying commercial motor vehicle driver to drive more than 11 hours
395.3(a)(2)	Requiring or permitting a property-carrying commercial motor vehicle driver to drive after the end of the 14th hour after coming on duty
395.3(b)(1)	Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty more than 60 hours in 7 consecutive days
395.3(b)(2)	Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty more than 70 hours in 8 consecutive days
395.3(c)(1)	Requiring or permitting a property-carrying commercial motor vehicle driver to restart a period of 7 consecutive days without taking an off-duty period of 34 or more consecutive hours
395.3(c)(2)	Requiring or permitting a property-carrying commercial motor vehicle driver to restart a period of 8 consecutive days without taking an off-duty period of 34 or more consecutive hours
395.5(a)(1)	Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive more than 10 hours
395.5(a)(2)	Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty 15 hours
395.5(b)(1)	Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty more than 60 hours in 7 consecutive days
395.5(b)(2)	Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty more than 70 hours in 8 consecutive days
395.8(a)	Failing to require driver to make a record of duty status
395.8(e)	False reports of records of duty status

395.8(i)	Failing to require driver to forward within 13 days of completion, the original of the record of duty status
395.8(k)(1)	Failing to preserve driver's record of duty status for 6 months
395.8(k)(1)	Failing to preserve driver's records of duty status supporting documents for 6 months
396.3(b)	Failing to keep minimum records of inspection and vehicle maintenance
396.11(a)	Failing to require driver to prepare driver vehicle inspection report
396.17(a)	Using a commercial motor vehicle not periodically inspected
397.7(a)(1)	Parking a motor vehicle containing Division 1.1, 1.2, or 1.3 materials within 5 feet of traveled portion of highway or street
397.7(b)	Parking a motor vehicle containing hazardous material(s) other than Division 1.1, 1.2, or 1.3 materials within 5 feet of traveled portion of highway or street
397.13(a)	Permitting a person to smoke or carry a lighted cigarette, cigar or pipe within 25 feet of a motor vehicle containing Class 1 materials, Class 5 materials, or flammable materials classified as Division 2.1, Class 3, Divisions 4.1 and 4.2
397.19(a)	Failing to furnish driver of motor vehicle transporting Division 1.1, 1.2, or 1.3 (explosive) materials with a copy of the rules of part 397 and/or emergency response instructions
397.67(d)	Requiring or permitting the operation of a motor vehicle containing explosives in Class 1, Divisions 1.1, 1.2, or 1.3 that is not accompanied by a written route plan
397.101(d)	Requiring or permitting the operation of a motor vehicle containing highway route-controlled quantity, as defined in §173.403, of radioactive materials that is not accompanied by a written route plan.
171.15	Carrier failing to give immediate telephone notice of an incident involving hazardous materials
171.16	Carrier failing to make a written report of an incident involving hazardous materials
172.704(a)(4)	Failing to provide security awareness training
172.704(a)(5)	Failing to provide in-depth security awareness training
172.802(b)	Failure to make copies of security plan available to hazmat employees
173.800c	Failing to instruct a category of employees in hazardous materials regulations
177.817(a)	Transporting a shipment of hazardous materials not accompanied by a properly prepared shipping paper
177.817(e)	Failing to maintain proper accessibility of shipping papers
177.823(a)	Moving a transport vehicle containing hazardous material that is not properly marked or placarded
180.407(a)	Transporting a shipment of hazardous material in cargo tank that has not been inspected or retested in accordance with §180.407

180.407(c)	Failing to periodically test and inspect a cargo tank
180.415	Failing to mark a cargo tank which passed an inspection or test required by §180.407
180.417(a)(1)	Failing to retain cargo tank manufacturer's data report certificate and related papers, as required
180.417(a)(2)	Failing to retain copies of cargo tank manufacturer's certificate and elated papers (or alternative report) as required
392.2	Operating a motor vehicle not in accordance with the laws, ordinances and regulations of the jurisdiction in which it is being operated

Chapter 9: Appendix of Analysis of Valid Regulations in MCMIS

This appendix outlines the number of valid regulations found in the MCMIS database by CFR part number. Regulations were deemed invalid for any of the following reasons:

- The regulation doesn't exist on the FMCSA website, there is no violation description given by the MCMIS part_section table, and the violation has not been cited in the past 3 years (2003-2005) in inspections, compliance reviews or enforcements.
- The regulation doesn't exist on the FMCSA website and the violation has not been cited in the past 3 years (2003-2005) in inspections, compliance reviews or enforcements.
- The violation refers to a regulation heading and has not been cited in the past 3 years (2003-2005) in inspections, compliance reviews or enforcements.
- The violation refers to a regulation definition and has not been cited in the past 3 years (2003-2005) in inspections, compliance reviews or enforcements.
- The regulation refers to an entity other than Driver, Carrier, or Shipper (e.g. Manufacturer or Government) and the violation has not been cited in the past 3 years (2003-2005) in inspections, compliance reviews or enforcements.
- The regulation has been discontinued, given by the MCMIS part_section table, and the citations of the violation only occur in the early years.
- The violation refers to another regulation and it has not been cited in the past 3 years (2003-2005) in inspections, compliance reviews or enforcements.
- Invalid - Other.
- The regulation doesn't exist on the FMCSA website, there is no entry in the MCMIS part_section table, but there have been citations of the violations. This relates to it being in CAPRI or SAFETYNET.

Table 9-1: Valid Regulations in MCMIS by CFR Part

Regulation Type (FMCSR, HMR, etc.)	CFR Title	CFR Subchapter	CFR Part	Regulation	Number Valid Regulations That Appear in MCMIS
FMCSR (FHWA)	23	Subchapter G - Engineering and Traffic Operations	658	Truck Size and Weight, Route Designations — Length, Width and Weight Limitations	0
FMCSR (OST)	49	- none -	40	Procedures for Transportation Workplace Drug Testing Programs	141
FMCSR	49	Subchapter A - General Regulations	325	Compliance with Interstate Motor Carrier Noise Emission Standards	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	350	Commercial Motor Carrier Safety Assistance Program	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	355	Compatibility of State Laws and Regulations Affecting Interstate Motor Carrier Operations	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	356	Interpretations and Routing Regulations	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	360	Fees for Motor Carrier Registration and Insurance	0

Regulation Type (FMCSR, HMR, etc.)	CFR Title	CFR Subchapter	CFR Part	Regulation	Number Valid Regulations That Appear in MCMIS
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	365	Rules Governing Applications for Operating Authority	1
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	366	Designation of Process Agents by Motor Carriers and Brokers	4
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	367	Standards for Registration with States	1
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	368	Applications for Certificates of Registration by Foreign Motor Carriers and Foreign Motor Private Carriers	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	370	Principles and Practices for the Investigation and Voluntary Disposition of Loss and Damage Claims and Processing Salvage	11
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	371	Brokers of Property	14
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	372	Exemptions, Commercial Zones, and Terminal Areas	0

Regulation Type (FMCSR, HMR, etc.)	CFR Title	CFR Subchapter	CFR Part	Regulation	Number Valid Regulations That Appear in MCMIS
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	373	Receipts and Bills	3
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	374	Passenger Carrier Regulations	13
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	375	Transportation of Household Goods in Interstate Commerce; Consumer Protection Regulations	124
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	376	Lease and Interchange of Vehicles	17
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	377	Payment of Transportation Charges	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	378	Procedures Governing the Processing, Investigation, and Disposition of Over-Charge, Duplicate Payment, or Overcollection Claims	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	379	Preservation of Records	2

Regulation Type (FMCSR, HMR, etc.)	CFR Title	CFR Subchapter	CFR Part	Regulation	Number Valid Regulations That Appear in MCMIS
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	380	Special Training Requirements	23
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	381	Waivers, Exemptions, And Pilot Programs	1
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	382	Controlled Substances and Alcohol Use and Testing	188
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	383	Commercial Driver's License Standards; Requirements and Penalties	51
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	384	State Compliance with Commercial Driver's License Program	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	385	Safety Fitness Procedures	28
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	386	Rules of Practice for Motor Carrier, Broker, Freight Forwarder, and Hazardous Materials Proceedings	13

Regulation Type (FMCSR, HMR, etc.)	CFR Title	CFR Subchapter	CFR Part	Regulation	Number Valid Regulations That Appear in MCMIS
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	387	Minimum Levels of Financial Responsibility for Motor Carriers	31
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	388	Cooperative Agreements with States	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	389	Rulemaking Procedures — Federal Motor Carrier Safety Regulations	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	390	General	50
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	391	Qualifications of Drivers and Longer Combination Vehicle (LCV) Driver Instructors	161
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	392	Driving of Motor Vehicles	80
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	393	Parts and Accessories Necessary for Safe Operation	326

Regulation Type (FMCSR, HMR, etc.)	CFR Title	CFR Subchapter	CFR Part	Regulation	Number Valid Regulations That Appear in MCMIS
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	395	Hours of Service of Drivers	138
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	396	Inspection, Repair, and Maintenance	93
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	397	Transportation of Hazardous Materials; Driving and Parking Rules	37
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	398	Transportation of Migrant Workers	6
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	399	Employee Safety and Health Standards	2
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	Appendix B to Subchapter B	Special Agents	0
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	Appendix F to Subchapter B	Commercial Zones	0

Regulation Type (FMCSR, HMR, etc.)	CFR Title	CFR Subchapter	CFR Part	Regulation	Number Valid Regulations That Appear in MCMIS
FMCSR	49	Subchapter B - Federal Motor Carrier Safety Regulations	Appendix G to Subchapter B	Minimum Periodic Inspection Standards	0
FMCSR (NHTSA)	49	- none -	565	Vehicle Identification Number Requirements	0
FMCSR (NHTSA)	49	- none -	571	Federal Motor Vehicle Safety Standards	0
HMR	49	Subchapter A - Hazardous Materials and Oil Transportation	107	Hazardous Materials Program Procedures	27
HMR	49	Subchapter B - Oil Transportation	130	Oil Spill Prevention And Response Plans	3
HMR	49	Subchapter C - Hazardous Materials Regulations	171	General Information, Regulations, And Definitions	38
HMR	49	Subchapter C - Hazardous Materials Regulations	172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, And Training Requirements	264

Regulation Type (FMCSR, HMR, etc.)	CFR Title	CFR Subchapter	CFR Part	Regulation	Number Valid Regulations That Appear in MCMIS
HMR	49	Subchapter C - Hazardous Materials Regulations	173	Shippers--General Requirements For Shipments And Packagings	270
HMR	49	Subchapter C - Hazardous Materials Regulations	177	Carriage By Public Highway	92
HMR	49	Subchapter C - Hazardous Materials Regulations	178	Specifications For Packagings	149
HMR	49	Subchapter C - Hazardous Materials Regulations	179	Specifications For Tank Cars	1
HMR	49	Subchapter C - Hazardous Materials Regulations	180	Continuing Qualification And Maintenance Of Packagings	166

Chapter 10: Appendix of Post-Crash Inspections

Who Conducts Post-Crash Inspections- Some Examples:

- Minnesota - The State Patrol/Police is the only police agency authorized to make post-crash inspections involving CMVs. A peace officer responding to an accident involving a CMV must immediately notify the State Patrol if the accident results in a fatality, injury, or property damage greater than \$4000.00.
- Florida - A CMV Post-Crash Inspection Program has been created whereby the DOT works jointly with the Highway Patrol to collect enhanced truck and driver information on fatal crashes involving CMVs and buses for the USDOT. A Motor Carrier Compliance Office (MCCO) law enforcement officer is assigned to the program if he/she has received a Certificate of Proficiency from the Commercial Vehicle Safety Alliance (CVSA) including Basic Hazardous Materials Inspection and Cargo Tank Inspection and has completed MCCO's "Post-Crash Inspection" course. A post-crash inspection report is prepared, which is a comprehensive report detailing an enhanced North American Level V Inspection (See Attached North American Standard Inspection Procedure).⁸⁵ The information supplements the crash investigator's homicide report and is used in court proceedings.
- New Jersey - A Special Operations Section/Transportation Safety Bureau - Motor Coach/Compliance Review Unit of the State Police has been created to act as a liaison between the State Department of Transportation, Division of Motor Vehicles, Division of Highway Traffic Safety and the Federal Highway Administration (FHWA) and to respond to and assist with post-crash inspections. The same unit is also responsible for roadside inspections of motor coaches, buses and commercial vehicles.
- Harris County, Texas - A Traffic Enforcement Division/Commercial Vehicle Enforcement Unit of the County Sheriff's Office has been created to conduct post-crash inspections of CMVs to determine pre-crash conditions that may have been contributing factors for a crash.
- Maine - A Reconstruction Unit comprised of State Police, Municipal and County Law Enforcement personnel has been created within the State Police to conduct in-depth investigations and analyses of major traffic collisions throughout the State.
- Maryland - A Commercial Vehicle Safety Unit comprised of uniformed Transportation Authority Police Officers, civilian motor carrier inspectors and Police Cadets has been created to conduct post-crash inspections and enforcement activities at all facilities under the Authority's jurisdiction.

⁸⁵ The North American Standard is the process developed by CVSA to assist in dealing with crashes caused by CMVs. The Standard is based upon mechanical defects identified as the cause or contributing factoring for those crashes. Driver qualifications and hours of service are included due to the critical relationship between the driver and the highway crashes.

Inspections are made in compliance with CVSA regulations and state regulations. The FHWA Transportation Institute certifies the division staff.

Case Study- Pennsylvania Department of Transportation (PennDOT)

Pennsylvania enacted legislation in 2001 requiring that all trucks involved in fatal accidents undergo a Motor Carrier Safety Assistance Program (MCSAP) inspection. The measure specified that “a qualified Commonwealth employee, as designated by the DOT” must perform inspections of all large trucks and transit vehicles involved in fatal crashes as well as their drivers, before the vehicle or driver is allowed to continue operations.

Who performs the inspection is determined by which agency responds to the crash (i.e., state or local police). If a State Trooper responds, the trooper assigned to the station certified to do inspections is notified. If this person is not available, the State Police notify PennDOT motor carrier enforcement. Local police follows analogous procedures. In actuality, personnel from many organizations may be called upon to perform the inspections. This includes the Pennsylvania State Police, the Public Utility Commission, PennDOT, and selected local police departments. Individuals performing the inspections must be trained and certified.

Information Collected:

Program personnel are notified by local enforcement whenever a fatal truck crash occurs and crash investigators (existing state motor carrier enforcement personnel) are rushed to the crash scene, usually arriving within an hour of notification. Interviews of surviving drivers and others, and in-depth investigation of the crash are conducted. Extensive data on the truck are compiled, including detailed information on the tractor, the trailer, and the cargo. Information on the truck driver includes physical condition, training and experience, recent sleep history, use of drugs and medications, hours of service, company policies trip origin and destination, restraint use, and motor carrier characteristics. Additional data are compiled on the crash itself, including detailed information on truck condition and damage. Data are also collected on the other driver(s) and vehicle(s) in the crash, and finally on the events leading up to the crash. A North American Level I Inspection is conducted.

The officer or other official conducting the inspection completes an inspection report using the standard MCSAP roadside inspection report form. This report is then forwarded to the PennDOT Motor Carrier Division for inclusion in the SAFETYNET database. The report is designated as a post-fatal-crash inspection.

This program has resulted in approximately 1,100 vehicle inspections to date. The police routinely request inspections following fatal crashes but may also request them for significant non-fatal crashes. Although the Pennsylvania post-fatal-crash inspection program is still fairly new, it has resulted in reliable, standardized inspections of commercial vehicles involved in fatal (and some non-fatal) crashes, including vehicle mechanics, equipment, load securement, driver credentials and duty status, and other mandatory safety documentation. Planned future data analyses are expected to provide information on the prevalence of violations for crash-involved vehicles and drivers, and will be compared to the violation database as a whole.

Model Minimum Uniform Crash Criteria

The National Highway Traffic Safety Administration (NHTSA), FMCSA, FHWA and the Governor's Highway Safety Association (GHSA formerly NAGHSR) have developed the Model Minimum Uniform Crash Criteria (MMUCC). The purpose of the MMUCC is to provide a minimum, standardized dataset for describing crashes of motor vehicles that will generate the information necessary to improve highway safety within each state and nationally. They are a voluntary set of guidelines designed to assist states in collecting accurate, consistent and reliable crash data that can effectively facilitate data-driven decision-making. In addition, they can be utilized to identify traffic safety problems, establish goals and performance measures, and monitor the progress of highway safety programs.

MMUCC were originally developed in response to requests by states that were interested in improving and standardizing their crash data. Although the majority of states collected a uniform core set of highway safety data elements and definitions, the lack of consistent and complete reporting limited the usefulness of intrastate and interstate comparisons, skewed analytical results, and made sharing of crash data difficult. Different database elements and definitions resulted in incomplete data and misleading results. Different reporting thresholds made it difficult to determine accurately whether the differences between states were caused by the data or the highway safety countermeasures (safety belts, helmets, etc.) that had been implemented.

At the national level, comparable state data could expand NHTSA and FHWA analytical capabilities. The collection and coding of information in Federal systems, most of which are used by state and local agencies, would improve and possibly lead to further revisions and economies in how the data are collected.

Data Reporting

The MMUCC data represents a core set of data elements, most of which were already being collected by the states before the first edition of the MMUCC Guideline was published. The 113 data elements contained in the MMUCC Guideline, 1st Edition (1998) were revised in response to emerging issues and other highway safety needs. The second edition of the MMUCC Guideline, published in 2003, contains 111 data elements.

MMUCC recommends voluntary implementation of a minimum set of standardized data elements to promote comparability of data within the highway safety community. It was intended to serve as a foundation for state crash data collection and reporting systems. To reduce the data collection burden, MMUCC recommends that law enforcement at the scene collect 77 of the 111 data elements. From crash scene information, 10 data elements can be derived while the remaining 24 data elements, related to the person and roadway involved, should be obtained after linkage to driver history, injury and roadway inventory data.

The current edition of the guidelines recommends that states incorporate the following reporting threshold to generate the cases needed to improve highway safety:

- All crashes statewide involving a fatality, injury or property damage in the amount of \$1000.00 or greater
- Crash data should be reported for all persons involved, including the injured and non-injured
- States should adopt a reporting threshold that is uniform and consistently implemented statewide

Traffic and Criminal Software

In 1994, the Iowa Department of Transportation (IDOT), working in partnership with the Iowa Department of Public Safety and several local law enforcement agencies, initiated a program to create a PC-based incident (accident and traffic ticketing) reporting system to expedite data capture for police crash reports. The capability was subsequently expanded to include traffic citations and CMV inspections in 1995. Over time, the Iowa crash reporting program evolved into Traffic and Criminal Software (TraCS), an integrated system used by state and local law enforcement agencies.

TraCS is based on the MMUCC and is a data collection and reporting software application that, with minor modifications, is transferable and customized for use by law enforcement and motor vehicle agencies nationwide. It was conceived to provide state agencies and organizations with an information management tool to streamline and automate the capture, transfer and sharing of crash data in the field. The goal of the TraCS system is to improve the accuracy, completeness, and timeliness of crash data and to reduce administrative duties and paperwork.

Data Reporting

TraCS utilizes laptops and PDAs to record and retrieve crash data when and where it occurs. To allow different states to use TraCS, a Software Development Kit (SDK) is included in the TraCS Software Suite. The SDK contains a set of tools that allows states and agencies to design their own database, including local or state forms, reporting formats and data analyses for transfer to other databases. TraCS also allows retrieval of data from other sources to populate the crash report forms (e.g., databases of driver license and vehicle information) and the capability to import data into the TraCS database (e.g., citation dispositions). TraCS provides the ability to:

- Capture the crash data where it originates thereby improving the accuracy, completeness, and timeliness
- Eliminate the need for duplicate entry into local and state databases
- Provide quantifiable benefits in the reduced need for data entry resources and administrative duties
- Provide faster access to better data for improved problem identification and decision-making. Provide local law enforcement administrators with nearly immediate information Expedite the receipt of data in a central processing system and provide linkage to federal systems

The following are examples of state application of the TraCS model to facilitate crash reporting⁸⁶:

- Delaware has adopted the electronic MMUCC-based crash report format designed by IDOT in its implementation approach
- New York is working to upgrade the TraCS database from Microsoft Access to Oracle and is developing an ASPEN-to-TraCS interface to allow the user to perform a vehicle inspection in ASPEN and import the driver, vehicle and traffic violation information into TraCS
- Tennessee is utilizing the TraCS approach, which allows the use of E-Crash and E-Citation report forms

Table 10-1: Post-crash Inspections vs. Crashes by Report State in 2003-2006

Report State	Number of Crashes	Number of Post-Crash Inspections	Percent of Crashes with Post-Crash Inspection
Alabama	14,738	754	5.12%
Alaska	119	111	93.28%
American Samoa	52	11	21.15%
Arizona	12,638	999	7.90%
Arkansas	8,591	423	4.92%
California	51,453	72	0.14%
Colorado	8,995	5,204	57.85%
Connecticut	4,339	359	8.27%
Delaware	1,362	110	8.08%
District of Columbia	34	33	97.06%
Federal Inspections	0	29	undefined
Florida	20,699	1,208	5.84%
Georgia	26,904	1,908	7.09%
Hawaii	866	15	1.73%
Idaho	3,283	933	28.42%
Illinois	27,250	4,989	18.31%
Indiana	20,052	2,279	11.37%
Iowa	7,148	0	0.00%
Kansas	6,421	2,061	32.10%

⁸⁶ TraCS is currently licensed in 18 States: Alaska, Arizona, Arkansas, Colorado, Delaware, Florida, Georgia, Iowa, Nebraska, New Mexico, New York, North Carolina, North Dakota, Oklahoma, South Dakota, Tennessee, Texas and Wisconsin.

Report State	Number of Crashes	Number of Post-Crash Inspections	Percent of Crashes with Post-Crash Inspection
Kentucky	10,407	3,467	33.31%
Louisiana	10,405	116	1.11%
Maine	4,105	768	18.71%
Maryland	6,957	555	7.98%
Massachusetts	4,078	1,516	37.18%
Michigan	21,671	1,572	7.25%
Minnesota	11,190	6,126	54.75%
Mississippi	5,338	328	6.14%
Missouri	19,484	1,345	6.90%
Montana	2,455	2,084	84.89%
Nebraska	4,503	373	8.28%
Nevada	2,573	623	24.21%
New Hampshire	2,022	304	15.03%
New Jersey	33,062	845	2.56%
New Mexico	1,015	2,650	261.08%
New York	14,626	2,616	17.89%
North Carolina	17,620	3,757	21.32%
North Dakota	1,296	968	74.69%
Northern Marianas	0	4	undefined
Ohio	19,264	4,515	23.44%
Oklahoma	6,812	1,122	16.47%
Oregon	5,482	2,536	46.26%
Pennsylvania	29,537	2,531	8.57%
Puerto Rico	1	1	100.00%
Rhode Island	1,647	277	16.82%
South Carolina	12,074	1,311	10.86%
South Dakota	1,228	313	25.49%
Tennessee	16,572	2,910	17.56%
Texas	62,950	5,385	8.55%
Utah	4,480	2,071	46.23%
Vermont	670	667	99.55%
Virginia	10,301	1,006	9.77%

Report State	Number of Crashes	Number of Post-Crash Inspections	Percent of Crashes with Post-Crash Inspection
Washington	5,953	2,096	35.21%
West Virginia	4,375	1,222	27.93%
Wisconsin	12,494	815	6.52%
Wyoming	3,554	1,092	30.73%
Total	585,145	81,385	13.91%

DRAFT

Chapter 11: Appendix of Traffic Enforcement Violations

This section lists the specific violations that were evaluated using the traffic enforcement violation methodology. The violations included in this listing are taken directly from two policy memorandums provided by FMCSA, which identified the set of traffic enforcement violations available for reimbursement under MCSAP. The first memorandum was active from the beginning of the study period (January 1, 2002) until October 31, 2006, while the second memorandum was active from November 1, 2006 through the end of the study period (December 31, 2006). The final listing of traffic enforcement violations is any violation classified as a traffic enforcement violation by either policy memorandum.

Table 11-1: Traffic Enforcement Violations

Part	Section	Description	MCSAP Traffic Enforcement Violation	
			Prior to October 31, 2006	After October 31, 2006
392	2	General / unspecified traffic violation	Y	Y
392	2OT	Other moving violations	Y	N
392	2FC	Following too close	Y	Y
392	2LC	Improper lane changing	Y	Y
392	2C	Failure to obey traffic control device	Y	Y
392	2P	Improper passing	Y	Y
392	2R	Reckless driving	Y	Y
392	2S	Speeding	Y	Y
392	2T	Improper turns	Y	Y
392	2W	Size and weight	Y	N
392	2Y	Failure to yield right of way	Y	Y
392	3	Operating a CMV while ill or fatigued	N	Y
392	4	Driver uses or is in possession of drugs	Y	Y
392	4A	Driver uses or is in possession of drugs	Y	Y
392	5	Driver uses or is in possession of alcohol	Y	Y
392	5A	Driver uses or is in possession of alcohol	Y	Y
392	10A1	Railroad grade crossings; stopping required; bus transporting passengers	N	Y
392	10A2	Railroad grade crossings; stopping required; commercial motor vehicle transporting Division 2.3 chlorine	N	Y

392	10A3	Railroad grade crossings stopping required; commercial motor vehicle transporting hazardous materials designated under 49 Part 392.10(a)(3)	N	Y
392	10A4	Railroad grade crossings stopping required; every cargo tank motor vehicle used in transporting hazardous materials defined under 49 Part 107 through 180.	N	Y
392	14	Hazardous conditions; extreme caution	N	Y
392	16	Failing to use seat belt while operating CMV	N	Y
392	20	Failing to properly secure parked vehicle	Y	N
392	21	Stopped vehicle interfering with traffic	Y	N
392	22A	Failing to use hazard warning flashers	Y	N
392	22B	Failing / improper placement of warning devices	Y	N
392	71A	Use of radar detector in a commercial motor vehicle, or operate a commercial motor vehicle that is equipped with or contains any radar detector.	N	Y

Chapter 12: Appendix of Speeding Rate Methodology

This appendix describes how data obtained from the Washington State Department of Transportation (WSDOT) was used in the determination of the average speeding rate of trucks and buses.

Data

WSDOT provided one year of observations (2006) from thirty-eight Weigh-in-Motion (WIM) stations distributed throughout the State of Washington. Each WIM station records data from all vehicles passing the station, including the vehicle speed and vehicle type.

Validation

The first step in determining the speeding rates was to validate the data. The primary source of invalid data is a malfunctioning traffic recorder at a station, which renders an entire day or month of data to be invalid. Reports of malfunctioning traffic recorders are provided by WSDOT. These reports include the WIM station along with day(s) during which the recorder was malfunctioning. Subsequently, any speed data recorded from those invalid dates are excluded from the population of data.

Speeding Calculation

For each station, the following data is computed for all validated time periods:

- Total number of validated days
- Total number of buses observed (vehicle type = 4) for validated days
- Total number of trucks observed (vehicle type > 4) for validated days
- Bus speeding rate
- Truck speeding rate

The number of speeding vehicles at each station was determined by counting the number of vehicles traveling at 10 mph or more over the posted speed limit at the station.

$$SR_{VC}(w) = \frac{S_{VC}(w)}{Vol_{VC}(w)} \text{ where :}$$

$SR_{VC}(w)$ = Speeding rate at WIM station w by vehicle class

[22] $S_{VC}(w)$ = Total number of vehicles speeding at WIM station w by vehicle class

$Vol_{VC}(w)$ = Total number of vehicles observed at WIM station w by vehicle class

VC = Vehicle class = $[Truck, Bus]$

Functional Class Speeding Rates

The ultimate goal of this analysis is to develop a single speeding rate across all stations and vehicle classes to approximate the national population speeding rate. The first step is to aggregate the individual station speeding rates into speeding rates by vehicle class and

functional class. Each station is also assigned to one of the following roadway functional classes:

- Interstate Rural
- Interstate Urban
- Other Arterial Rural
- Other Rural
- Other Urban

Because the data from each station represent a different number of validated and different traffic volumes, it is necessary to normalize the data so that under-represented (validated days) and high volume stations are assigned a proper weight in the aggregation. First, a normalized volume for each station is calculated in Equation 2 by extrapolating the measured volume to get a yearly volume:

$$VPY_{VC}(w) = \frac{Vol_{VC}(w)}{Days(w)} * 365 \text{ where :}$$

[23] $VPY_{VC}(w)$ = Estimated vehicles per year observed by WIM station w by vehicle class
 $Days(w)$ = Validated days at WIM station w

Next, the volume of vehicles per year is converted into shares of the total yearly volume of vehicles in the functional class to which the station is assigned.

$$SW_{VC}(w) = \frac{VPY_{VC}(w)}{\sum_i VPY_{VC}(i)} \text{ where :}$$

[24] $SW_{VC}(w)$ = Share of the total yearly volume for WIM station w
 i = The set of all stations belonging to functional class of WIM station w

Finally, by multiplying the station's share of the total year volume by the station's speeding rate provides an estimate of the share of the speeding rate that this station will contribute to the station's functional class. The results of this calculation are shown in Table 12-1.

$$FCSR_{VC}(j) = \sum_i SR_{VC}(i) * SW_{VC}(i) \text{ where :}$$

[25] $FCSR_{VC}(j)$ = Aggregate speeding rate for functional class j by vehicle class
 i = The set of all stations assigned to functional class j

Table 12-1: Speeding Rates by Functional Class and Vehicle Class

Functional Class	Bus Speeding Rate	Truck Speeding Rate
Interstate Rural	5.39%	11.82%
Interstate Urban	0.38%	1.97%
Other Arterial Rural	3.01%	2.20%
Other Rural	0.88%	1.95%
Other Urban	0.36%	2.58%

Vehicle Class Speeding Rate

The next step in the process of creating a composite speeding rate is to aggregate the functional class and vehicle class speeding rates in two vehicle class speeding rates.

Table 12-2: 2005 VMT by Functional Class

Functional Class	BUS VMT	Bus VMT Share	Truck VMT	Truck VMT Share
Interstate Rural	971	14.60%	51,708	23.20%
Interstate Urban	964	14.50%	40,064	17.98%
Other Arterial Rural	961	14.46%	40,123	18.01%
Other Rural	1,658	24.95%	28,852	12.95%
Other Urban	2,093	31.49%	62,089	27.86%
Totals	6,647	100%	222,836	100%

Vehicle miles traveled by vehicle class are published annually by the Federal Highway Administration in their Highway Statistics report (shown in Table 12-2: 2005 VMT by Functional Class). These values are used to determine what share each functional class' VMT contributes to the total VMT across all functional classes for each vehicle class.

$$VMTShare_{VC}(j) = \frac{VMT_{VC}(j)}{\sum VMT_{VC}} \text{ where :}$$

[26] $VMTShare_{VC}(j)$ = Share of the total VMT represented by functional class j by vehicle class

$VMT_{VC}(j)$ = Total VMT represented by functional class j by vehicle class

Next, the normalized speeding rate of a vehicle type can be determined by applying the VMT share of each functional class to the speeding rate and summing across all functional classes.

$$[27] \quad FCSR_{VC} = \sum_j FCSR_{VC}(j) * VMTShare_{VC}(j) \text{ where :}$$

$FCSR_{VC}$ = Functional class speeding rate by vehicle class

Table 12-3: Speeding Rates by Vehicle Class

Vehicle Type	Speeding Rate	VMT Share
Bus	1.61%	2.9%
Truck	4.46%	97.1%

Composite Speed Rate

The final step in the process of determining a composite speeding rate is the aggregation of the distinct vehicle class speeding rates. In order to calculate a single speeding rate for all vehicles, the VMT share is applied to the speeding rates of each vehicle class and summed. This results in a composite speeding rate of 4.38%.

$$[28] \quad CSR = \sum_{FC} VMT_{VC} * VCSR_{VC}$$

Chapter 13: Roadside Violation Risk Results

The roadside violation risk results for regulations with a positive total incremental list are presented in Table 13-1. The following items are included in the table:

- **Part Number (Part No):** The regulation Part Number under the Code of Federal Regulations 49.
- **Section Number (Sec No):** The regulation section number under the specific Part Number.
- **Regulation Type (Reg Type):** The type of regulation, either roadside (RS), hazardous materials (HM), passenger carrier (PC), or traffic enforcement (TE).
- **Violation Description:** Short description or title of the regulation/violation.
- **Violation Rate Z-Score:** The z-score calculated from the difference in proportions test conducted on the roadside violation rate and the post-crash violation rate. If the incremental crash incidence factor was zero, the z-score is listed as not applicable (NA).
- **Violation Crash Incidence Factor:** The violation crash incidence factor (CIF) as calculated using equation [8].
- **Incremental Crash Incidence Factor:** The incremental crash incidence factor (ICIF) as calculated using equation [9].
- **Violation Crash Severity Factor:** The violation crash severity factor (CSF) as calculated in equation [12].
- **Incremental Crash Severity Factor:** The incremental crash severity factor (ICSF) as calculated in equation [13].
- **Violation Total Risk:** The total violation risk (TVR) as calculated in equation [14].
- **Incremental Violation Risk:** The incremental violation risk (TVR) as calculated in equation [15].

Table 13-1: Roadside Violation Total Risk Results

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
392	14	TE	Failure to use caution for hazardous conditions in operating a commercial motor vehicle	9.67	14112	13923	\$216,533	\$0	\$3,055,810,671	\$3,014,706,261
392	2R	TE	Reckless driving when operating a commercial motor vehicle	26.63	12895	12705	\$216,533	\$0	\$2,792,082,822	\$2,750,978,412
392	3	TE	Operating commercial motor vehicle with ill or fatigued driver	24.75	7470	7280	\$216,533	\$0	\$1,617,491,479	\$1,576,387,069
392	2T	TE	Improper turns when operating a commercial motor vehicle	16.84	3227	3037	\$216,533	\$0	\$698,663,166	\$657,558,756
393	122B	RS	Failure to properly secure paper rolls (eyes vertical)	3.95	2761	2571	\$216,533	\$0	\$597,785,034	\$556,680,624

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
392	2Y	TE	Improper lane change when operating a commercial motor vehicle	18.52	2529	2339	\$216,533	\$0	\$547,611,503	\$506,507,093
393	122	RS	Failure to properly secure paper rolls	4.19	2246	2056	\$220,802	\$4,269	\$495,894,467	\$454,790,057
393	61A	RS	Operating commercial motor vehicle with inadequate or missing truck side windows	5.36	1169	979	\$402,103	\$185,570	\$470,002,517	\$428,898,107
393	100C	RS	Failure to prevent cargo shifting (such that the vehicle's stability or maneuverability is adversely affected)	16.53	1920	1730	\$216,533	\$0	\$415,753,835	\$374,649,424
392	2LC	TE	Improper lane change when operating a commercial motor vehicle	33.30	1856	1666	\$216,533	\$0	\$401,850,999	\$360,746,589

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	71H	RS	Failure to properly use tow-bar in driveway/towaway operations	3.55	1684	1494	\$216,533	\$0	\$364,606,475	\$323,502,065
392	5A	TE	Driver on duty or operating commercial motor vehicle within four hours of using alcohol or while under the influence of alcohol	19.59	1643	1454	\$216,533	\$0	\$355,847,232	\$314,742,822
393	102A3	RS	Failure to maintain tie down assembly capable of withstanding prescribed acceleration in a lateral direction	5.91	1590	1400	\$216,533	\$0	\$344,260,131	\$303,155,721
392	4A	TE	Driver on duty while possessing, using or under the influence of drugs	12.60	1490	1300	\$216,533	\$0	\$322,642,916	\$281,538,506

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
390	35	RS	Making fraudulent records (falsification, reproduction or alteration of certificates, reports or records)	3.24	1411	1221	\$216,533	\$0	\$305,499,222	\$264,394,812
393	203E	RS	Operating commercial motor vehicle with front bumper missing, unsecured or protruding	12.77	861	671	\$309,437	\$92,904	\$266,271,280	\$225,166,869
392	2FC	TE	Following too close when operating a commercial motor vehicle	25.44	1206	1016	\$216,533	\$0	\$261,032,422	\$219,928,012
393	70B2	RS	Operating commercial motor vehicle with improper fifth wheel locking mechanism	9.52	1196	1006	\$216,533	\$0	\$259,030,769	\$217,926,359

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	106D	RS	Failure to maintain minimum strength of tie down	6.48	1038	848	\$247,329	\$30,797	\$256,691,753	\$215,587,343
393	120	RS	Failure to properly secure metal coils	4.67	1014	824	\$216,533	\$0	\$219,528,200	\$178,423,790
393	102C	RS	Exceeding working load limit for tie down assembly	4.60	955	765	\$226,712	\$10,179	\$216,406,753	\$175,302,343
393	102A1	RS	Failure to maintain tie down assembly capable of withstanding prescribed deceleration in the forward direction	4.25	972	782	\$216,533	\$0	\$210,448,299	\$169,343,889
393	116	RS	Failure to adequately secure logs	5.00	651	461	\$322,940	\$106,407	\$210,315,935	\$169,211,525
393	80	RS	Failure to comply with rear-vision mirror requirements	13.79	971	781	\$216,533	\$0	\$210,189,039	\$169,084,629

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
396	13C	RS	Failure of driver to review and sign daily vehicle inspection report	6.04	952	763	\$216,533	\$0	\$206,245,935	\$165,141,524
393	100B	RS	Failure to prevent loss of load (leaking/spilling/blowing/falling cargo)	14.74	880	690	\$216,533	\$0	\$190,574,040	\$149,469,630
393	203	RS	Failure to comply with cab and body parts requirements	18.24	751	561	\$238,274	\$21,741	\$178,958,299	\$137,853,889
393	71	RS	Failure to properly couple vehicles in driveway/towaway operations	4.51	799	609	\$216,533	\$0	\$172,946,266	\$131,841,856
396	7	RS	Operating commercial motor vehicle in such a condition as to likely cause an accident or a breakdown of the vehicle	14.01	756	566	\$216,533	\$0	\$163,691,702	\$122,587,291

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	106C2	RS	Failure to properly secure cargo (articles beside each other secured with tie down must not shift)	3.17	755	565	\$216,533	\$0	\$163,377,690	\$122,273,279
392	22B	TE	Failure to place warning devices when necessary	7.25	709	519	\$216,533	\$0	\$153,456,039	\$112,351,629
393	114	RS	Failure to comply with front end structure requirements (used for cargo securement)	2.27	484	294	\$308,139	\$91,607	\$149,216,814	\$108,112,404
392	9A3	RS	Operating commercial motor vehicle with view obscured or driver movement restricted by cargo	3.62	688	498	\$216,533	\$20,324	\$148,961,268	\$107,856,858

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	209A	RS	Operating commercial motor vehicle with not secured or broken steering wheel	4.93	400	211	\$369,648	\$153,115	\$148,019,850	\$106,915,440
393	203A	RS	Operating commercial motor vehicle with cab door missing or broken	8.31	530	340	\$276,616	\$60,084	\$146,595,230	\$105,490,820
393	205B	RS	Operating commercial motor vehicle with stud or bolt holes on the wheels elongated (out-of-round)	6.29	672	482	\$216,533	\$0	\$145,577,100	\$104,472,690
393	203C	RS	Operating commercial motor vehicle with hood not securely fastened	11.06	529	340	\$268,005	\$51,472	\$141,890,671	\$100,786,260
393	132	RS	Failure to properly secure crushed vehicle	3.60	649	459	\$216,533	\$0	\$140,463,150	\$99,358,740

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
392	60A	RS	Operating commercial motor vehicle with unauthorized passenger on board	10.08	505	315	\$273,770	\$57,237	\$138,220,162	\$97,115,752
173	24B1	HM	Failure to comply with general packaging requirements for the transportation of hazardous materials	3.82	533	343	\$257,832	\$41,299	\$137,428,564	\$96,324,154
393	106C1	RS	Failure to restrain cargo from rolling (with chocks, wedges, a cradle or equivalent means)	2.88	630	440	\$216,533	\$0	\$136,386,036	\$95,281,626
393	86A1	RS	Failure to comply with rear impact guard requirements for trailers and semitrailers	6.01	400	210	\$338,756	\$122,224	\$135,578,465	\$94,474,055

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	104C	RS	Use of damaged vehicle structures and anchor points for cargo securement	4.25	612	422	\$216,533	\$0	\$132,570,677	\$91,466,267
393	130C	RS	Failure to properly secure vehicle with crawler tracks or wheels	2.84	361	172	\$364,629	\$148,096	\$131,766,664	\$90,662,254
393	70D8	RS	Failure to properly attach safety chains	2.74	606	417	\$216,533	\$138,667	\$131,314,209	\$90,209,799
393	104D	RS	Use of damaged material for dunnage, chocks, cradles, shoring bars, blocking and bracing (adversely effecting performance for cargo securement)	2.16	600	410	\$216,533	\$15,679	\$129,822,002	\$88,717,592
393	70C	RS	Failure to operate full trailer with required coupling devices	9.54	543	354	\$216,533	\$0	\$117,650,672	\$76,546,261

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	130B	RS	Failure to properly prepare heavy vehicle, equipment or machinery for transport	4.24	491	301	\$234,014	\$17,482	\$114,912,197	\$73,807,787
391	15A	RS	Operating commercial motor vehicle with disqualified driver	11.79	528	339	\$216,533	\$0	\$114,418,693	\$73,314,283
395	5B	PC	Failure to comply with total on-duty time (60/70 hours) during seven/eight day period (passenger carrier)	0.98	190	12148	\$602,078	\$385,545	\$114,292,430	\$73,188,020
392	2P	TE	Improper passing when operating a commercial motor vehicle	6.83	511	322	\$216,533	\$0	\$110,756,356	\$69,651,946
392	2	TE	Failure to comply with applicable operating rules	72.23	499	309	\$216,533	\$0	\$108,023,325	\$66,918,914

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
383	23C	RS	Operating commercial motor vehicle with a driver's permit while not meeting minimum requirements	2.38	494	304	\$216,533	\$0	\$106,888,290	\$65,783,880
393	102A2	RS	Failure to maintain tie down assembly capable of withstanding prescribed acceleration in the rearward direction	3.25	481	291	\$216,533	\$0	\$104,140,533	\$63,036,123
383	93B4	HM	Transporting hazardous materials without proper endorsements	2.49	458	268	\$216,533	\$0	\$99,083,962	\$57,979,552
393	207D	RS	Operating commercial motor vehicle with defective or missing leaf spring assembly	2.23	430	240	\$216,533	\$0	\$93,133,176	\$52,028,766

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	76	RS	Failure to comply with sleeper berth requirements	1.88	285	95	\$323,765	\$107,232	\$92,127,240	\$51,022,830
393	42	RS	Failure to meet the requirement for brakes on all wheels	5.99	318	128	\$287,199	\$70,667	\$91,402,728	\$50,298,318
393	106B	RS	Failure to immobilize or secure cargo	5.52	419	229	\$216,533	\$0	\$90,791,785	\$49,687,375
393	47B	RS	Failure to match the size of brake chambers	1.14	190	56	\$477,114	\$260,581	\$90,570,532	\$49,466,122
139	0	RS		4.51	413	223	\$216,533	\$0	\$89,347,354	\$48,242,944
393	205A	RS	Operating commercial motor vehicle with cracked or broken wheels or rims	13.44	384	194	\$230,020	\$13,488	\$88,320,977	\$47,216,567
393	112	RS	Failure of tie down to be adjustable by driver	2.61	407	217	\$216,533	\$0	\$88,105,421	\$47,001,011
393	65	RS	Failure to comply with fuel system requirements	9.01	405	216	\$216,533	\$0	\$87,793,230	\$46,688,820

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	104A	RS	Failure to use proper cargo devices and systems	7.88	402	213	\$216,533	\$0	\$87,144,040	\$46,039,630
393	75A	RS	Operating commercial motor vehicle with flat tire, separated tread or exposed ply/belt	23.13	401	212	\$216,533	\$0	\$86,913,449	\$45,809,039
393	203B	RS	Operating commercial motor vehicle with cab or body improperly secured to the frame	5.78	334	144	\$259,964	\$43,431	\$86,776,045	\$45,671,635
396	11	RS	Failure to prepare daily vehicle inspection report	10.09	392	202	\$216,533	\$0	\$84,818,831	\$43,714,421
391	49J	RS	Failure to possess driver medical waiver (skill performance evaluation certificate)	2.65	341	151	\$247,866	\$31,333	\$84,470,077	\$43,365,667

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
383	21A	RS	Operating commercial motor vehicle with more than one driver's license	2.60	388	198	\$216,533	\$62,392	\$84,046,827	\$42,942,417
393	209B	RS	Operating commercial motor vehicle with excessive steering wheel lash	2.22	259	69	\$321,869	\$105,336	\$83,426,344	\$42,321,933
393	26	RS	Failure to comply with requirements for reflectors	3.69	269	80	\$303,460	\$86,927	\$81,761,259	\$40,656,849
395	8E	RS	Failure to accurately record driver duty status (incomplete or false records)	13.94	305	115	\$259,618	\$43,085	\$79,164,052	\$38,059,642
392	9A1	RS	Operating commercial motor vehicle without inspecting and properly distributing and securing cargo	7.76	360	170	\$216,533	\$0	\$77,893,201	\$36,788,791

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	75F1	RS	Operating commercial motor vehicle with tire-load weight greater than rating	1.91	249	59	\$311,850	\$95,318	\$77,602,517	\$36,498,107
393	110C	RS	Failure to meet the minimum tie down requirement with cargo positioned or blocked	0.69	190	35	\$406,283	\$189,751	\$77,124,771	\$36,020,361
387	301A	RS	Operating commercial motor vehicle without prescribed financial security	5.99	356	166	\$216,533	\$0	\$77,064,162	\$35,959,751
393	55E	RS	Failure to meet appropriate anti-lock braking system requirements for vehicles in tow	NA	190	0	\$404,121	\$187,588	\$76,714,330	\$35,609,920
396	1	RS	Failure to retain driver duty status records for seven days	4.70	351	162	\$216,533	\$0	\$76,075,298	\$34,970,888

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	13D1	RS	Failure to properly locate reflex reflectors on trailer sides	NA	190	0	\$399,309	\$182,776	\$75,800,777	\$34,696,367
383	91A	RS	Operating commercial motor vehicle without proper endorsements	2.09	282	93	\$265,927	\$49,395	\$75,115,859	\$34,011,449
396	9C2	RS	Operating commercial motor vehicle declared and marked "out-of-service"	1.97	347	157	\$216,533	\$34,294	\$75,090,771	\$33,986,361
392	7	RS	Failure to inspect and use prescribed equipment	8.58	344	154	\$216,533	\$0	\$74,413,094	\$33,308,684
383	95A	RS	Violating airbrake restriction	NA	190	0	\$391,576	\$175,044	\$74,332,947	\$33,228,537
393	203D	RS	Operating commercial motor vehicle with cab seats not securely mounted	1.98	341	151	\$216,533	\$65,944	\$73,800,622	\$32,696,211

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
383	51A	RS	Operating commercial motor vehicle while disqualified	6.66	341	151	\$216,533	\$0	\$73,758,131	\$32,653,721
393	65C	RS	Failure to properly secure fuel tank	4.04	280	90	\$262,925	\$46,392	\$73,515,056	\$32,410,646
393	104F5	RS	Failure to use edge protection on tied owns (where tie down subject to abrasion or cutting)	3.39	336	146	\$216,533	\$0	\$72,753,811	\$31,649,401
393	11RT	RS	Retro reflect not affixed as req Trl.mfg> (Retro reflect not affixed as req Trl.mfg>)	2.49	283	94	\$255,110	\$38,577	\$72,286,587	\$31,182,177
393	13C3	RS	Failure to properly locate retroreflective sheeting on trailer upper rear area	NA	190	0	\$379,807	\$163,274	\$72,098,786	\$30,994,376

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	86B1	RS	Failure to comply with rear impact guard requirements for vehicles with vertical distance (ground to rear body edge of body) greater than 30"	2.11	248	58	\$290,310	\$73,777	\$71,907,289	\$30,802,878
393	100A	RS	Failure to protect against shifting and falling cargo	12.60	328	139	\$216,533	\$0	\$71,104,827	\$30,000,417
393	25E	RS	Failure of lamp to burn steady	NA	190	0	\$374,560	\$158,027	\$71,102,723	\$29,998,312
393	13C1	RS	Failure to properly locate retroreflective sheeting on trailer sides	NA	190	0	\$373,611	\$157,079	\$70,922,644	\$29,818,234
383	23A2	RS	Operating commercial motor vehicle without a Commercial Drivers License	10.51	322	132	\$216,533	\$0	\$69,704,377	\$28,599,967

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
392	16	TE	Failure to use seat belt while operating a commercial motor vehicle	3.82	216	27	\$311,156	\$94,624	\$67,348,046	\$26,243,636
393	70	RS	Failure to operate with required coupling devices and towing methods	6.52	308	119	\$216,533	\$0	\$66,794,517	\$25,690,106
393	209D	RS	Operating commercial motor vehicle with defective steering system (components worn, faulty or repaired by welding; loose steering gear box; loose pitman arm)	4.70	228	39	\$290,758	\$74,225	\$66,431,183	\$25,326,773
392	71A	TE	Operating commercial motor vehicle with radar detector in use or installed	2.22	223	33	\$297,270	\$80,738	\$66,389,130	\$25,284,720

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	71H10	RS	Failure to properly use safety devices with tow-bar in driveaway/towaway operations	2.39	306	116	\$216,533	\$0	\$66,164,109	\$25,059,699
395	8K2	RS	Failure to retain driver duty status records for seven days	12.05	276	86	\$238,354	\$21,821	\$65,834,963	\$24,730,553
393	50C	RS	Failure to safeguard air and vacuum brake pressure with operable check valves	NA	190	0	\$339,198	\$122,665	\$64,389,904	\$23,285,493
392	9AA	RS	Operating commercial motor vehicle without operating authority	3.56	296	106	\$216,533	\$0	\$64,045,854	\$22,941,444
393	134B3	RS	Failure to properly secure rear of containers	2.11	294	104	\$216,533	\$0	\$63,573,182	\$22,468,772

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
392	33	RS	Operating commercial motor vehicle with obscured lamps or reflectors	NA	190	14	\$331,339	\$114,807	\$62,898,157	\$21,793,747
393	55C2	RS	Failure to meet appropriate automatic brake adjustment system requirements	NA	190	0	\$330,197	\$113,664	\$62,681,320	\$21,576,910
393	70D	RS	Failure to operate full trailer with required safety chains and cables	4.01	288	98	\$216,533	\$0	\$62,361,873	\$21,257,463
391	43H	RS	Operating commercial motor vehicle with improper driver medical qualification certificate	1.95	288	98	\$216,533	\$0	\$62,315,873	\$21,211,463
393	83H	RS	Failure to securely fasten exhaust system to vehicle	0.88	190	15	\$327,873	\$111,340	\$62,240,108	\$21,135,698

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	75F	RS	Operating commercial motor vehicle with tire-load weight greater than rating	NA	190	0	\$327,337	\$110,804	\$62,138,296	\$21,033,886
393	70B	RS	Operating commercial motor vehicle with improper fifth wheel assembly	4.01	286	97	\$216,533	\$0	\$62,031,804	\$20,927,394
393	70A	RS	Operating combination vehicle with coupling devices that does not track as required	2.00	281	91	\$216,533	\$0	\$60,881,373	\$19,776,963
393	209C	RS	Operating commercial motor vehicle with loose steering column	2.14	265	76	\$229,276	\$12,743	\$60,839,096	\$19,734,686
393	50A	RS	Failure to meet the applicable reservoir requirement for air-braked power units or trailers	1.47	190	82	\$320,415	\$103,882	\$60,824,289	\$19,719,879

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	13C2	RS	Failure to properly locate retroreflective sheeting on trailer lower rear area	NA	190	0	\$319,702	\$103,169	\$60,689,050	\$19,584,639
393	17	RS	Failure to properly equip combinations in driveway-towaway with operative lamps and reflectors	2.06	279	89	\$216,533	\$0	\$60,319,576	\$19,215,166
392	9A	RS	Failure to secure cargo	6.46	277	87	\$216,533	\$0	\$59,917,847	\$18,813,437
393	75A3	RS	Operating commercial motor vehicle with a flat tire or tire with audible leak	6.36	255	65	\$234,060	\$17,527	\$59,745,365	\$18,640,955
393	50	RS	Failure to meet the applicable reservoir requirement for air-braked power units or trailers	NA	190	0	\$310,788	\$94,256	\$58,996,938	\$17,892,528

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	104B	RS	Use of damaged cargo securement devices or systems (adversely effecting performance including reducing the working load limit, and must not have any cracks or cuts)	1.70	214	24	\$274,560	\$58,027	\$58,657,081	\$17,552,671
393	79	RS	Operating commercial motor vehicle with inoperative or defective windshield defrosting and defogging system	NA	190	0	\$308,139	\$91,607	\$58,494,082	\$17,389,672
393	13D2	RS	Failure to properly locate reflex reflectors on trailer lower rear area	NA	190	0	\$304,144	\$87,611	\$57,735,612	\$16,631,202

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	43A	RS	Operating commercial motor vehicle in towing without proper tractor protection valve	NA	190	0	\$304,086	\$87,554	\$57,724,719	\$16,620,309
393	209E	RS	Operating commercial motor vehicle without operational power steering	NA	190	0	\$301,985	\$85,452	\$57,325,747	\$16,221,337
396	17C	RS	Failure to conduct and document periodic vehicle inspections	6.72	213	23	\$269,151	\$52,618	\$57,238,529	\$16,134,119
395	8A	RS	Failure to record driver duty status	8.67	250	61	\$225,514	\$8,981	\$56,475,124	\$15,370,714
393	33	RS	[Reserved] (Improper wiring installations)	NA	190	0	\$297,118	\$80,585	\$56,401,862	\$15,297,452
393	11S	RS	Side retro reflect sht/reflx reflect mfg> (Side retro reflect sht/reflx reflect mfg>)	NA	190	0	\$294,176	\$77,643	\$55,843,380	\$14,738,970

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	207F	RS	Operating commercial motor vehicle with air suspension pressure loss	NA	190	0	\$292,948	\$76,416	\$55,610,370	\$14,505,960
393	100	RS	Failure to protect against shifting and falling cargo	NA	190	0	\$292,094	\$75,561	\$55,448,146	\$14,343,736
393	83A	RS	Operating commercial motor vehicle with improperly located exhaust system	NA	190	0	\$290,840	\$74,308	\$55,210,244	\$14,105,834
393	46B	RS	Failure to ensure all braking systems are free of leaks, constrictions or other conditions adversely affecting the performance of the brake system	NA	190	0	\$289,504	\$72,972	\$54,956,602	\$13,852,192

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
391	45B	RS	Failure to have driver medically examined and certified as qualified to operate a commercial motor vehicle	4.28	220	30	\$249,925	\$33,392	\$54,888,936	\$13,784,526
393	13A	RS	Failure to properly equip trailer with reflective material	NA	190	0	\$288,910	\$72,378	\$54,843,841	\$13,739,431
393	41	RS	Failure to meet minimum requirements for service brake system	3.03	253	63	\$216,533	\$0	\$54,824,283	\$13,719,872
393	65F	RS	Failure to properly protect fuel line	NA	190	0	\$288,702	\$72,170	\$54,804,372	\$13,699,962
393	104F4	RS	Failure to locate tiedowns inside rib rails (on trailers as appropriate)	NA	190	0	\$288,509	\$71,976	\$54,767,631	\$13,663,221

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	53B	RS	Failure to meet appropriate automatic brake adjustment system requirements	1.89	252	62	\$216,533	\$0	\$54,470,770	\$13,366,360
393	67	RS	Failure to comply with fuel tank requirements	3.90	236	46	\$229,048	\$12,515	\$53,954,078	\$12,849,668
393	207A	RS	Operating commercial motor vehicle with improper axle positioning parts (cracked, broken, loose or missing)	3.15	204	14	\$263,706	\$47,173	\$53,855,643	\$12,751,233
393	47D	RS	Failure to meet the applicable requirement for the width of brake linings	1.34	190	20	\$281,753	\$65,220	\$53,485,162	\$12,380,752
391	43G	RS	Operating commercial motor vehicle without driver medical qualification certificate	NA	190	0	\$280,856	\$64,323	\$53,314,866	\$12,210,456

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
391	11B5	RS	Operating commercial motor vehicle with driver not properly licensed	2.39	215	26	\$247,051	\$30,518	\$53,232,785	\$12,128,375
393	47E	RS	Failure to keep clamp and roto-chamber brakes within specified adjustment	NA	190	0	\$280,289	\$63,756	\$53,207,278	\$12,102,867
396	3A1BA	RS	Brake-out of adjustment (Brake-out of adjustment)	NA	190	0	\$279,195	\$62,662	\$52,999,507	\$11,895,097
393	207C	RS	Operating commercial motor vehicle with defective or missing leaf spring assembly	4.93	224	34	\$235,543	\$19,011	\$52,709,864	\$11,605,454
396	5B	RS	Failure to operate commercial motor vehicle without oil leaks	NA	190	0	\$277,095	\$60,563	\$52,601,017	\$11,496,607

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
392	9A2	RS	Operating commercial motor vehicle without inspecting and securing vehicle equipment	NA	190	0	\$273,790	\$57,257	\$51,973,491	\$10,869,081
391	11B7	RS	Operating commercial motor vehicle with disqualified driver	2.36	239	49	\$216,533	\$0	\$51,786,044	\$10,681,634
393	130	RS	Failure to properly secure heavy vehicle, equipment or machinery	2.01	235	46	\$216,533	\$0	\$50,956,978	\$9,852,567
393	11	RS	Failure to met requirements for lamps, reflective devices and associated equipment	NA	190	0	\$267,731	\$51,198	\$50,823,412	\$9,719,002

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	47	RS	Failure to construct, install and maintain brake components that reliably stop the commercial motor vehicle and that do not excessively fade or grab	NA	190	0	\$266,435	\$49,902	\$50,577,351	\$9,472,940
393	45B2	RS	Failure to secure hose and tubing from chaffing or kinking	NA	190	0	\$265,654	\$49,121	\$50,429,077	\$9,324,667
391	11	RS	Operating commercial motor vehicle without minimum driver qualifications	NA	190	0	\$262,134	\$45,602	\$49,760,950	\$8,656,540
393	45A4	RS	Operating commercial motor vehicle with brake hose or tubing chaffed or kinked	NA	190	0	\$261,059	\$44,526	\$49,556,757	\$8,452,347

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	9H	RS	Operating commercial motor vehicle with inoperable head lamps	5.62	220	30	\$224,805	\$8,272	\$49,424,787	\$8,320,377
393	45D	RS	Failure to ensure all braking systems are free of leaks, constrictions or other conditions adversely affecting the performance of the brake system	NA	190	0	\$259,416	\$42,883	\$49,244,966	\$8,140,556
393	48A	RS	Failure to keep brakes operative at all times	3.96	204	14	\$239,325	\$22,792	\$48,789,367	\$7,684,956
390	21C	RS	Failure to mark commercial motor vehicle with proper markings (size, shape, location and color)	NA	190	0	\$255,920	\$39,387	\$48,581,275	\$7,476,864

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	205C	RS	Operating commercial motor vehicle with loose or missing wheel fasteners	3.10	210	20	\$230,628	\$14,095	\$48,389,427	\$7,285,017
393	75F2	RS	Operating commercial motor vehicle with under-inflated tires	NA	190	0	\$253,775	\$37,242	\$48,174,033	\$7,069,623
393	201B	RS	Operating commercial motor vehicle without secured cab or body (broken, loose or missing bolts)	NA	190	0	\$253,262	\$36,729	\$48,076,684	\$6,972,274
393	83F	RS	Operating commercial motor vehicle with exhaust system temporarily repaired with wrap or patches	NA	190	0	\$253,262	\$36,729	\$48,076,684	\$6,972,274
393	83E	RS	Failure to discharge exhaust system at the rear of the cab	2.57	221	32	\$216,533	\$0	\$47,940,224	\$6,835,814

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
391	11B2	RS	Operating commercial motor vehicle with driver not meeting English language requirements	2.22	221	31	\$216,533	\$0	\$47,890,362	\$6,785,952
393	46	RS	Operating commercial motor vehicle with improper brake hose/tube connection	NA	190	0	\$251,947	\$35,414	\$47,827,044	\$6,722,634
180	415B	HM	Failure to mark cargo tank with test type and date	NA	190	2	\$250,827	\$34,294	\$47,614,458	\$6,510,048
393	17B	RS	Failure to properly equip rearmost vehicle in driveaway-towaway combination with operative lamps and reflectors	NA	190	0	\$248,740	\$32,207	\$47,218,263	\$6,113,853
393	24B	RS	Failure to comply with auxiliary headlamp requirements	NA	190	0	\$247,967	\$31,434	\$47,071,548	\$5,967,137

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	25B	RS	Failure to meet lamp visibility requirements	0.96	190	15	\$247,876	\$31,343	\$47,054,338	\$5,949,928
392	2W	TE	Improper size and weight when operating a commercial motor vehicle	NA	190	0	\$247,430	\$30,897	\$46,969,638	\$5,865,228
396	3A1BC	RS	Brake-air compressor violation (Brake-air compressor violation)	NA	190	0	\$246,878	\$30,345	\$46,864,841	\$5,760,431
393	11N	RS	No retro reflect sheet/reflex mfg > 12/93 (No retro reflect sheet/reflex mfg > 12/93)	NA	190	0	\$246,523	\$29,990	\$46,797,411	\$5,693,001
393	51	RS	Operating commercial motor vehicle without operable service brake failure notification signal	NA	190	0	\$245,873	\$29,340	\$46,674,084	\$5,569,674

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	110B	RS	Failure to meet the minimum tie down requirement without cargo positioned or blocked	NA	190	0	\$243,394	\$26,861	\$46,203,419	\$5,099,009
396	3A1B	RS	Brakes (general) (Brakes (general))	NA	190	0	\$243,276	\$26,743	\$46,181,009	\$5,076,599
393	45	RS	Failure to comply with requirements for brake systems (tubing and hoses, assemblies, and end fittings)	NA	190	0	\$242,958	\$26,425	\$46,120,756	\$5,016,346
396	3A1T	RS	Tires (general) (Tires (general))	NA	190	0	\$242,581	\$26,048	\$46,049,165	\$4,944,755
396	3A1	RS	Operating commercial motor vehicle without proper inspection, repair and maintenance	NA	190	0	\$242,423	\$25,890	\$46,019,186	\$4,914,776

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	30	RS	Failure to properly install battery as required	NA	190	0	\$242,317	\$25,785	\$45,999,104	\$4,894,693
393	75A2	RS	Operating commercial motor vehicle with proper tire tread-groove pattern	NA	190	0	\$242,260	\$25,727	\$45,988,135	\$4,883,725
393	28	RS	Failure to properly protect wiring as required	NA	190	0	\$242,101	\$25,569	\$45,958,085	\$4,853,675
393	75C	RS	Operating commercial motor vehicle with tire (other than front) tread depth less than 2/32 inches	4.81	204	14	\$224,823	\$8,290	\$45,903,151	\$4,798,741
396	3A1BD	RS	Brake-defective brake drum (Brake-defective brake drum)	NA	190	0	\$239,892	\$23,359	\$45,538,702	\$4,434,291
393	95A	RS	Failure to comply with fire extinguisher requirements	NA	190	0	\$239,045	\$22,512	\$45,377,921	\$4,273,511

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	9	RS	Operating commercial motor vehicle with inoperable or obstructed lights or reflectors	NA	190	0	\$238,946	\$22,414	\$45,359,168	\$4,254,758
172	502A1	HM	Displaying of prohibited placarding in the transportation of hazardous materials	NA	190	0	\$238,703	\$22,170	\$45,312,907	\$4,208,497
396	5	RS	Failure to operate commercial motor vehicle fully lubricated or without oil leaks	NA	190	0	\$238,093	\$21,561	\$45,197,248	\$4,092,838
391	41A	RS	Failure to possess driver medical qualification certificate	5.21	209	19	\$216,533	\$0	\$45,195,351	\$4,090,941
395	3A2	RS	Failure to comply with maximum driving time/total on-duty time (14-hours) rule	NA	190	0	\$236,564	\$20,032	\$44,907,022	\$3,802,612

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
393	13B	RS	Failure to retrofit trailer with retroreflective sheeting or reflex reflectors	NA	190	0	\$236,319	\$19,786	\$44,860,353	\$3,755,943
393	19	RS	Failure of hazard warning signals to operate properly	NA	190	0	\$235,786	\$19,254	\$44,759,342	\$3,654,932
393	93B	RS	Failure to comply with seat belt requirements	NA	190	0	\$234,183	\$17,650	\$44,454,883	\$3,350,473
390	21B	RS	Failure to mark commercial motor vehicle with carrier name and information	2.41	205	15	\$216,533	\$0	\$44,451,154	\$3,346,744
393	60B	RS	Operating commercial motor vehicle without windshield	NA	190	0	\$232,458	\$15,925	\$44,127,545	\$3,023,135
393	67C7	RS	Operating commercial motor vehicle without fill pipe cap	NA	190	0	\$232,295	\$15,762	\$44,096,506	\$2,992,096

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
395	8	RS	Failure to comply with driver record of duty status requirements	NA	190	0	\$232,150	\$15,617	\$44,068,972	\$2,964,562
395	3A1	RS	Failure to comply with maximum driving time (10-hours) rule	NA	190	0	\$231,995	\$15,462	\$44,039,558	\$2,935,148
395	8F1	RS	Failure to record current driver duty status	NA	190	0	\$231,991	\$15,459	\$44,038,939	\$2,934,529
393	207E	RS	Operating commercial motor vehicle with cracked or broken torsion bar or torsion bar suspension	NA	190	0	\$231,516	\$14,983	\$43,948,596	\$2,844,186
393	75A1	RS	Operating commercial motor vehicle with exposed ply/belt	NA	190	0	\$231,046	\$14,513	\$43,859,375	\$2,754,964

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
172	516C6	HM	Use of damaged, deteriorated, or obscured placard for the transportation of hazardous materials	NA	190	0	\$231,018	\$14,485	\$43,854,165	\$2,749,755
393	83G	RS	Operating commercial motor vehicle with exhaust system discharge below or forward of driver or sleeper compartment	NA	190	0	\$230,481	\$13,949	\$43,752,293	\$2,647,883
393	9A	RS	Operating commercial motor vehicle with inoperable lamps	NA	190	0	\$229,417	\$12,884	\$43,550,179	\$2,445,769
177	817E	HM	Failure to ensure that shipping papers are accessible during inspection or accident	NA	190	0	\$227,478	\$10,945	\$43,182,194	\$2,077,783

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
396	3A1BL	RS	Brake-reserve system pressure loss (Brake-reserve system pressure loss)	NA	190	0	\$225,224	\$8,691	\$42,754,260	\$1,649,850
390	21A	RS	Failure to mark commercial motor vehicle in accordance with general regulations	NA	190	0	\$224,173	\$7,640	\$42,554,742	\$1,450,331
393	25F	RS	Failure to comply with stop lamp requirements	NA	190	0	\$223,205	\$6,672	\$42,371,046	\$1,266,636
393	106A	RS	Failure to comply with the general requirements to prevent cargo from shifting or falling	NA	190	2	\$222,592	\$6,059	\$42,254,579	\$1,150,169
393	20	RS	Failure to properly mount clearance lamps	NA	190	0	\$222,162	\$5,630	\$42,173,063	\$1,068,653

Regulation Description and Categorizing Fields				Crash Incidence Factor			Crash Severity Factor		Violation Total Risk	
Part No	Sec No	Reg Type	Violation Description	Violation Rate Z-Score	Violation Crash Incidence Factor	Incremental Crash Incidence Factor	Violation Crash Severity Factor	Incremental Crash Severity Factor	Total Violation Risk	Incremental Violation Risk
391	11B4	RS	Operating commercial motor vehicle with driver not physically qualified	NA	190	0	\$222,059	\$5,526	\$42,153,378	\$1,048,968
393	60C	RS	Operating commercial motor vehicle with damaged or discolored windshield	NA	190	0	\$221,944	\$5,411	\$42,131,588	\$1,027,178
393	134	RS	Failure to properly secure roll-on/roll-off or hook lift containers	1.57	190	64	\$220,911	\$4,379	\$41,935,626	\$831,216
393	201A	RS	Operating commercial motor vehicle with damaged frame or chassis (cracked, loose, sagging or broken)	NA	190	0	\$217,860	\$1,327	\$41,356,303	\$251,893

Chapter 14: Compliance Review Risk Results

The compliance review risk results for compliance review regulations with a positive incremental risk are presented in Table 14-1.

- Part and Section Number (Part and Sec No) The regulation part number under the Code of Federal Regulations 49 and the regulation section number under the specific part number.
- Incremental Violation Risk The incremental violation risk (IVR) as calculated using equation [21].
- Number of Compliance Review Violations The number of times the regulation was violated during the analysis period.
- Number of Roadside Inspections for Carriers that Violated the CR regulation The total number of roadside inspections for carriers that violated the compliance review regulation. This number is labeled 'C₂' in Table 4-3.
- Number of Roadside Regulations Used to calculate the CR Risk
- Acute/Critical Identifies whether the regulation is currently designated as an acute or critical regulation.

Table 14-1 Compliance Review Incremental Risk Results

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
396.3B2	Maintenance of required records-For each vehicle, records with a means to indicate the nature and due date of the various inspection and maintenance operations to be performed.	\$ 23,964,456	6,400	127,696	113	
396.3B1	Maintenance of required records-For each vehicle, identification of the vehicle including company number, if so marked make, serial number, year, and tire size.	\$ 16,517,422	8,300	164,337	98	
396.3B	Maintenance of required records-For vehicles controlled for 30 consecutive days or more, except for a private motor carrier of passengers (non-business), the motor carriers shall maintain, or cause to be maintained vehicle maintenance records.	\$ 15,834,653	3,625	77,220	104	Critical
396.11A	Failing to require driver to prepare driver vehicle inspection report.	\$ 13,377,602	13,547	405,776	90	Critical
396.3B3	Maintenance of required records-For each vehicle, a record of inspection, repairs and maintenance indicating their date and nature.	\$ 7,583,599	2,761	90,348	81	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
396.25E	Failing to retain evidence of brake inspector's qualifications. No motor carrier shall employ any person as a brake inspector unless the evidence of the inspector's qualifications, required under this section is maintained by the motor carrier.	\$ 7,354,991	1,593	45,223	75	
392.71A	Operating a commercial motor vehicle while using a radar detector, or operating a commercial motor vehicle that is equipped with or contains a radar detector in the driver's compartment.	\$ 7,004,760	49	3,648	4	
392.4B	Requiring or permitting a driver to drive while under the influence of, or in possession of, a narcotic drug, amphetamine, or other any other substance capable of rendering the driver incapable of safely operating a motor vehicle.	\$ 6,369,971	34	545	1	Acute
395.3B2	Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty more than 70 hours in 8 consecutive days.	\$ 6,304,242	10,070	1,077,189	7	Critical
395.8E	Failing to require driver to make a record of duty status.	\$ 6,148,759	14,534	1,324,127	6	Critical

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
396.19B	Inspector Qualifications-Evidence of that individual's qualifications under this section shall be retained by the motor carrier for the period during which that individual is performing annual motor vehicle inspections for the motor carrier.	\$ 5,828,091	2,894	61,334	58	
172.200A	Description of hazardous materials required. Except as otherwise provided in this subpart, each person who offers a hazardous material for transportation shall describe the hazardous material on the shipping paper in the manner required by this subpart.	\$ 5,288,308	148	2,294	17	0
382.115A	Starting date for drug testing program-Carrier must implement required drug testing program on the date the employer begins commercial motor vehicle operations.	\$ 5,284,143	4,966	37,251	2	Acute
396.7A	A motor vehicle shall not be operated in such a condition as to likely cause an accident or a breakdown of the vehicle.	\$ 5,211,152	243	10,271	42	
396.25D	Failing to ensure that each brake inspector meets the minimum qualification requirements.	\$ 5,161,764	202	7,964	51	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
171.2B	Transporting/handling HM not in compliance w/DOT exemption special permit. Each person who offers a hazardous material for transportation in commerce must comply with all applicable requirements of this subchapter, or an exemption or special permit.	\$ 4,917,034	441	6,586	15	
396.17A	Using a commercial motor vehicle not periodically inspected. Every commercial motor vehicle shall be inspected as required by this section. The inspection shall include, at a minimum, the parts and accessories set forth in Appendix G of this subchapter.	\$ 4,896,982	6,430	155,736	63	Critical
395.3A2	Requiring or permitting a property-carrying commercial motor vehicle driver to drive after the end of the 14th hour after coming on duty.	\$ 4,399,515	13,443	1,242,013	7	Critical
396.21B	Failing to retain periodic inspection report for 14 months from date of inspection. Inspection record keeping requirements. Motor carrier must maintain original copy of inspection record and make available on request.	\$ 4,177,694	2,273	70,309	60	
396.9C2	No motor carrier shall require or permit any person to operate nor shall any person operate any motor vehicle declared and marked "out of service" until all repairs required by the "out of service notice" have been satisfactorily completed.	\$ 3,893,172	130	13,489	37	Acute

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
396.11C1	Failing to certify that repairs were made or were not necessary.	\$ 3,823,397	1,527	76,346	36	
392.5A3	Driver operating a motor vehicle while in possession of an intoxicating beverage that is not manifested and part of cargo being transported.	\$ 3,731,849	37	1,861	2	
396.3A2	Push out windows, emergency doors, and emergency door marking lights in buses shall be inspected at least every 90 days.	\$ 3,698,428	204	4,814	24	
396.3B4	Passenger carrier required records-A record of tests conducted on push out windows, emergency doors, and emergency door marking lights on buses.	\$ 3,333,555	270	3,249	18	
382.305	Random testing requirements-Every employer and every driver must submit to requirements of random testing for controlled substances.	\$ 3,268,007	3,405	45,515	2	Acute
382.301A	Prior to the first time a driver performs safety-sensitive functions for an employer, the driver shall undergo testing for controlled substances as a condition prior to being used, unless the driver/employer meets exceptions of paragraph (b) of this section	\$ 3,093,309	10,263	239,511	2	Critical
391.51A	Failing to maintain driver qualification file on each driver employed.	\$ 3,072,763	5,870	119,823	16	Critical

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
392.5B1	Requiring or permitting a driver to drive a motor vehicle while under the influence of, or in possession of, an intoxicating beverage.	\$ 2,874,724	11	203	2	Acute
396.25C	Requiring or permitting an employee who does not meet minimum brake inspector qualifications to be responsible for the inspection, maintenance, service, or repairs of any brakes on it's commercial motor vehicles.	\$ 2,697,964	95	3,190	34	
396.9D3	Within 15 days following the date of the inspection, the motor carrier shall certify violations have been corrected and roadside inspection form has been completed and submitted to issuing agency.	\$ 2,678,921	7,156	264,050	32	
395.8F41	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated	\$ 2,668,003	48	2,785	1	
392.5A1	Driver consuming an intoxicating beverage within 4 hours before operating a motor vehicle.	\$ 2,570,877	24	2,234	1	
396.3A1	Operating a motor vehicle with brake drums or discs cracked.	\$ 2,480,741	434	16,738	30	
392.7	Equipment, inspection and use. No commercial motor vehicle shall be driven unless the driver is satisfied that the following parts and accessories specified in this section are in good working order, nor shall any driver fail to use or make use of such pa	\$ 2,468,502	39	462	43	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
396.11C2	Failing to retain vehicle inspection report for at least 3 months.	\$ 2,442,297	1,630	54,247	40	
180.407A	Transporting a hazardous material in a DOT specification cargo tank for which a test or inspection specified in this section has become due in accordance with 180.407(c).	\$ 2,285,677	160	4,001	6	Critical
396.5A	Failing to ensure that vehicle is properly lubricated.	\$ 2,257,460	16	179	23	
392.2	Operating a motor vehicle not in accordance with the laws, ordinances, and regulations of the jurisdiction in which it is being operated.	\$ 2,170,712	886	42,826	7	Critical
391.45A	Using a driver not medically examined and certified.	\$ 2,064,852	1,095	8,751	14	Critical
396.3C	Failing to retain records of inspection and maintenance for 1 year or for 6 months after a vehicle is no longer controlled.	\$ 2,057,484	345	11,743	47	
382.601B	Failing to provide to employees a written policy on misuse of alcohol and controlled substances.	\$ 2,044,618	5,675	115,539	2	
180.417A1	Failing to retain a cargo tank manufacturer's data report, certificate and related papers, as required.	\$ 1,967,561	212	4,712	5	Critical
391.51B2	Driver Qualification file must contain a copy of the response by each State agency concerning a driver's driving record pursuant to §391.23(a)(1);	\$ 1,948,334	8,187	257,284	18	Critical
180.417B2	Test or inspection report does not include the specific information as appropriate for each individual type of test or inspection	\$ 1,893,086	31	165	5	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
396.9D32	Failing to maintain completed inspection form for 12 months from the date of inspection at the carrier's principal place of business. Multiple items missing.	\$ 1,888,206	30	626	12	
173.33A1	Offering or accepting for transportation a hazardous material in an unauthorized cargo tank motor vehicle.	\$ 1,869,534	15	190	10	
180.407C	Failing to periodically test and inspect a cargo tank.	\$ 1,861,011	85	2,794	5	Critical
383.23A	Operating a commercial motor vehicle without a valid commercial driver's license.	\$ 1,856,314	1,540	70,368	13	Critical
180.417B	Test or inspection report does not include the specific information as appropriate for each individual type of test or inspection	\$ 1,851,213	36	1,488	6	
130.31	Response plans	\$ 1,793,621	15	393	5	
171.2D	No person may offer or accept a hazardous material for transportation in commerce or transport a hazardous material in commerce unless that person is registered in conformance with subpart G of part 107 of this chapter, if applicable.	\$ 1,791,323	67	1,481	12	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
172.201E	Retention and Recordkeeping. Each person who provides a shipping paper must retain a copy of the shipping paper required by §172.200(a), or an electronic image thereof, that is accessible at or through its principal place of business	\$ 1,764,991	137	2,676	15	
172.202A5	The total quantity of hazardous materials covered by the description must be indicated (by mass or volume, or by activity for Class 7 materials) and must include an indication of the applicable unit of measurement.	\$ 1,741,287	81	1,298	8	
396.25A	Failing to ensure all inspections, maintenance, repairs, or service to the brakes of a commercial motor vehicle are performed in compliance with minimum standards.	\$ 1,731,345	25	1,264	17	
391.15A	Using a disqualified driver.	\$ 1,718,848	265	9,001	12	Acute
172.604A3	Failing to provide an emergency response telephone number on a shipping paper in the manner required.	\$ 1,661,611	31	865	5	
392.9A1	The commercial motor vehicle's cargo is properly distributed and adequately secured as specified in §§ 393.100 through 393.142 of this subchapter.	\$ 1,652,808	26	841	12	Critical
391.45A1	Using a driver not medically examined and certified.	\$ 1,643,035	1,056	26,476	15	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.23A	Except as provided in subpart G of this part, each motor carrier shall make the following investigations and inquiries with respect to each driver it employs, other than a person who has been a regularly employed driver of the motor carrier for a continuous period of time.	\$ 1,592,048	5,923	205,352	17	
396.19A	It shall be the motor carrier's responsibility to ensure that the individual(s) performing an annual inspection under §396.17(d) or (e) is qualified.	\$ 1,575,326	89	2,147	29	
382.601A	Failing to provide educational materials explaining requirements of part 382 and employer's policies.	\$ 1,523,540	4,881	78,644	2	
391.51B7	Failing to maintain medical examiner's certificate in driver's qualification file.	\$ 1,520,294	3,718	148,574	15	Critical
391.51B	Failing to maintain driver qualification file in accordance with 391.51(b).	\$ 1,492,959	1,183	8,887	13	
177.817F	Retention of shipping papers. Each person receiving a shipping paper required by this section must retain a copy or an electronic image thereof, that is accessible at or through its principal place of business and must make the shipping paper available, u	\$ 1,492,263	167	8,503	11	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
177.817A	General requirements. A person may not accept a hazardous material for transportation or transport a hazardous material by highway unless that person has received a shipping paper prepared in accordance with part 172 of this subchapter or the material is	\$ 1,491,690	683	114,986	2	Critical
393.9	Operating a motor vehicle with lamps inoperable, obstructions of lamps and reflectors.	\$ 1,483,379	17	119	15	
172.201A3	Unless it is specifically authorized or required in this subchapter, the required shipping description may not contain any code or abbreviation.	\$ 1,483,000	12	266	6	
391.51C	Except as provided in paragraph (d) of this section, each driver's qualification file shall be retained for as long as a driver is employed by that motor carrier and for three years thereafter.	\$ 1,450,495	752	19,039	13	
172.202A5I	For Class 1 materials, the quantity must be the net explosive mass. For an explosive that is an article, such as Cartridges, small arms, the net explosive mass may be expressed in terms of the net mass of either the article or the explosive materials cont	\$ 1,436,077	14	131	4	
180.407H	Failing to perform leakage test as prescribed.	\$ 1,418,759	10	202	8	0

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
402.5B1	Failing to request information from previous DOT regulated employers of driver applicant for the two years prior to the date of application or transfer. Drug testing history.	\$ 1,418,700	1,150	29,719	2	
172.504A	General. Except as otherwise provided in this subchapter, each bulk packaging, freight container, unit load device, transport vehicle or rail car containing any quantity of a hazardous material must be placarded on each side and each end with the type of	\$ 1,417,777	36	751	8	
172.516A	Each placard on a motor vehicle and each placard on a rail car must be clearly visible from the direction it faces, except from the direction of another transport vehicle or rail car to which the motor vehicle or rail car is coupled. This requirement may	\$ 1,411,847	23	245	9	
172.202A1	The proper shipping name prescribed for the material in Column 2 of the § 172.101 Table;	\$ 1,372,978	30	888	8	
391.11B5	Using a driver without a currently valid motor vehicle operator's license or permit.	\$ 1,346,572	319	7,542	11	
180.415	Failing to mark a cargo tank which passed an inspection or test required by section 180.407.	\$ 1,321,669	21	740	6	Critical

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
177.801	Unacceptable hazardous materials shipments. No person may accept for transportation or transport by motor vehicle a forbidden material or hazardous material that is not prepared in accordance with the requirements of this subchapter.	\$ 1,320,142	24	6,531	4	Acute
382.215	Controlled substances testing. No driver shall report for duty, remain on duty or perform a safety-sensitive function, if the driver tests positive or has adulterated or substituted a test specimen for controlled substances. No employer having actual know	\$ 1,279,384	469	20,014	2	Acute
395.3A1	Requiring or permitting a property-carrying commercial motor vehicle driver to drive more than 11 hours.	\$ 1,277,337	13,412	1,229,340	6	Critical
382.603	Failing to ensure persons designated to determine that drivers undergo reasonable suspicion testing receive 60 minutes training for alcohol and/or 60 minutes of training for controlled substances.	\$ 1,276,491	9,463	173,282	1	
172.604A	Failing to provide an emergency response telephone number.	\$ 1,276,356	47	633	7	
171.2A	Each person who performs a function covered by this subchapter must perform that function in accordance with this subchapter.	\$ 1,235,904	115	1,822	11	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
396.17G	It shall be the responsibility of the motor carrier to ensure that all parts and accessories not meeting the minimum standards set forth in Appendix G to this subchapter are repaired promptly.	\$ 1,184,436	20	1,034	26	Acute
172.604A1	Failing to provide an emergency response telephone number which is monitored at all times that a hazardous material is in transit or in storage incidental to transportation.	\$ 1,143,529	22	487	11	
173.33A31	Filling and offering for transportation a specification cargo tank for which the prescribed periodic retest or reinspection is past due.	\$ 1,141,179	18	893	6	
180.417A2	Failing to retain a cargo tank manufacturer's data report, certificate and related papers, as required.	\$ 1,134,930	112	4,512	6	Critical
180.417B1	Test or inspection report does not include the specific information as appropriate for each individual type of test or inspection	\$ 1,134,112	78	6,027	6	
402.93B2	You must make a recommendation for education and/or treatment that will, to the greatest extent possible, protect public safety in the event that the employee returns to the performance of safety-sensitive functions.	\$ 1,086,375	65	1,862	1	
395.8K1	Failing to preserve driver's records of duty status supporting documents for 6 months.	\$ 1,074,924	5,534	404,783	7	Critical

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
172.202A3	The identification number prescribed for the material as shown in Column (4) of the §172.101 table;	\$ 1,049,445	12	190	4	
180.417B31	Failing to retain a copy of test and inspection reports as required.	\$ 1,043,069	77	2,708	6	
391.21A	Using a driver who has not completed and furnished an employment application.	\$ 992,672	11,598	477,639	12	
391.51B1	Failing to maintain driver's employment application in driver's qualification file.	\$ 987,153	6,899	283,629	15	
171.2C	Each person who performs a function covered by or having an effect on a specification or activity prescribed in part 178, 179, or 180 of this subchapter, an approval issued under this subchapter, or an exemption or special permit issued under subchapter A	\$ 976,409	13	208	4	
391.51B6	Failing to maintain a list or certificate relating to violations of motor vehicle laws and ordinances required by 391.27.	\$ 947,133	8,716	315,925	14	
177.823A	A carrier may not move a transport vehicle containing a hazardous material unless the vehicle is marked and placarded in accordance with part 172 or as authorized in § 171.12a of this subchapter, or unless, in an emergency:	\$ 941,131	46	7,357	5	Critical
391.11B11	Using a driver less than 21 years old.	\$ 933,190	147	4,911	11	
382.305I1	Failing to use a scientifically valid method to select drivers for random testing.	\$ 907,163	1,511	37,542	1	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
396.17C	Using a commercial motor vehicle not periodically inspected in accordance with minimum standards. A motor carrier shall not use a commercial motor vehicle unless each component identified in Appendix G has passed an inspection in accordance with the terms	\$ 896,273	885	24,961	17	
396.9D3II	Failing to maintain completed inspection form for 12 months from the date of inspection at the carrier's principal place of business.	\$ 888,009	49	634	27	
172.203K	Unless otherwise excepted, if a material is described on a shipping paper by one of the proper shipping names identified by the letter ?G? in column (1) of the §172.101 Table, the technical name of the hazardous material must be entered in parentheses in	\$ 885,975	29	694	7	
383.37A	Knowingly allowing, requiring, permitting, or authorizing an employee with a Commercial Driver's License which is suspended, revoked, or canceled by a state or who is disqualified to operate a commercial motor vehicle.	\$ 881,348	761	65,520	3	Acute
402.5B	Failing to request information from previous DOT regulated employers of driver applicant for the two years prior to the date of application or transfer.	\$ 878,938	6,126	154,552	1	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.11B81	Using a driver who has not taken a road test or who has not been issued a certificate of driver's road test or presented an operators license, or certificate of road test which the motor carrier accepted as equivalent.	\$ 836,251	483	10,665	11	
172.202A4	Failing to enter the proper packing group of a hazardous material on a shipping paper.	\$ 807,205	13	362	6	
392.9A	General. A driver may not operate a commercial motor vehicle and a motor carrier may not require or permit a driver to operate a commercial motor vehicle unless cargo properly distributed and secured.	\$ 795,878	229	3,839	7	
172.604B	Failing to provide the emergency response telephone number of the person offering the HM for transportation, or of an organization capable of and taking responsibility for providing the information required.	\$ 785,145	59	642	7	
180.416D5	Failing to keep a complete record of monthly discharge control system inspections and tests.	\$ 778,577	63	882	5	
391.63A	Failing to maintain driver qualification file in accordance with 391.63(a).	\$ 774,374	271	5,507	9	
396.11C	Failing to correct Out-of-Service defects listed by driver in a driver vehicle inspection report before the vehicle is operated again.	\$ 774,166	504	36,888	11	Acute

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.51B3	The certificate of driver's road test issued to the driver pursuant to §391.31(e), or a copy of the license or certificate which the motor carrier accepted as equivalent to the driver's road test pursuant to §391.33;	\$ 770,834	1,792	54,206	10	
172.604A2	Failing to provide the 24-hour emergency response telephone number of a person who is knowledgeable of the hazards and characteristics of the hazardous materials being shipped, and has comprehensive emergency response and incident mitigation formation or	\$ 748,836	27	376	9	
180.407D	Failing to perform an external visual inspection as prescribed.	\$ 739,385	20	2,287	7	0
391.51B5	Failing to maintain a note relating to the annual review of the driver's driving record as required by 391.25(c)(2).	\$ 722,884	6,675	231,292	12	
382.503	Allowing a driver to perform safety sensitive function, after engaging in conduct prohibited by subpart B, without being evaluated by a substance abuse professional, as required by 382.605.	\$ 720,037	292	13,981	1	Critical
391.25A	Failing to make an inquiry into the driving record of each driver to the appropriate State agencies in which the driver held a commercial motor vehicle operator's license at least once every 12 months.	\$ 705,613	4,884	154,587	11	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
383.51A	Knowingly allowing, requiring, permitting, or authorizing a driver to drive who is disqualified to drive a commercial motor vehicle.	\$ 678,643	166	17,554	2	Acute
382.60111D	0	\$ 667,764	11	294	1	
171.16	Record requirement-Detailed hazardous materials incident reports.	\$ 662,454	35	9,912	5	Critical
391.11B8	Has successfully completed a driver's road test and has been issued a certificate of driver's road test in accordance with §391.31, or has presented an operator's license or a certificate of road test which the motor carrier that employs him/her has acceptable.	\$ 656,853	495	5,628	9	
383.93	Operating a commercial motor vehicle without having the proper endorsements on commercial driver's license.	\$ 649,047	74	1,919	8	
391.11B6	Has prepared and furnished the motor carrier that employs him/her with the list of violations or the certificate as required by §391.27;	\$ 644,381	4,251	147,140	11	
382.305B1	Except as provided in paragraphs (c) through (e) of this section, the minimum annual percentage rate for random alcohol testing shall be 10 percent of the average number of driver positions.	\$ 628,802	4,581	116,665	1	Critical

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
177.817B	Shipper certification. An initial carrier may not accept a hazardous material offered for transportation unless the shipping paper describing the material includes a shipper's certification which meets the requirements in § 172.204 of this subchapter.	\$ 614,691	32	1,962	7	
404.5A	Failing to use a Federal Drug Testing Custody and Control Form to perform a DOT controlled substance test when required.	\$ 600,738	201	6,648	1	
391.25B	Failing to review the driving record of each driver to determine whether that driver meets minimum requirements for safe driving or is disqualified to drive.	\$ 597,368	3,163	111,645	11	
177.817E	Shipping paper accessibility-accident or inspection. A driver of a motor vehicle containing hazardous material, and each carrier using such a vehicle, shall ensure that the shipping paper required by this section is readily available to, and recognizable	\$ 594,083	12	902	5	Critical
172.201A4	A shipping paper may contain additional information concerning the material provided the information is not inconsistent with the required description. Unless otherwise permitted or required by this subpart, additional information must be placed after the	\$ 589,407	12	535	5	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
172.202A	The shipping description of a hazardous material on the shipping paper must include:	\$ 571,868	277	10,541	6	0
171.16A	General. Each person in physical possession of a hazardous material at the time that any of the following incidents occurs during transportation (including loading, unloading, and temporary storage) must submit a Hazardous Materials Incident Report on DO	\$ 559,047	11	10,118	6	
401.3B	Failing to conduct required DOT testing before a non-DOT test is conducted.	\$ 558,504	20	693	1	
171.15	Immediate notice of certain hazardous materials incidents.	\$ 557,894	15	1,577	5	Critical
396.5B	free of oil and grease leaks.	\$ 556,598	17	375	10	
172.201D	Emergency response telephone number. Except as provided in §172.604(c), a shipping paper must contain an emergency response telephone number, as prescribed in subpart G of this part.	\$ 550,863	125	4,579	7	
396.9D2	Failure to correct violations or defects listed on a motor vehicle roadside inspection report.	\$ 546,832	147	27,204	6	
395.8F	Driver's record of duty status-The driver's activities shall be recorded.	\$ 536,288	6,106	179,747	6	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
382.103B	An employer who employs himself/herself as a driver must comply with both the requirements in this part that apply to employers and the requirements in this part that apply to drivers.	\$ 524,083	230	1,148	1	
172.704A	Failing to train hazardous materials employees as required.	\$ 521,272	721	27,498	4	0
382.213B	No employer having actual knowledge that a driver has used a controlled substance shall permit the driver to perform or continue to perform a safety-sensitive function.	\$ 505,041	34	1,194	1	Acute
391.11B4	Using a physically unqualified driver.	\$ 500,916	113	3,352	2	Acute
383.37C	Allowing, requiring, permitting, or authorizing a driver to drive a commercial motor vehicle during a period in which the driver was subject to an out-of-service order.	\$ 498,195	16	357	7	
391.23A1	Except as provided in subpart G of this part, each motor carrier shall make the following investigations and inquiries with respect to each driver it employs, other than a person who has been a regularly employed driver of the motor carrier for a continue	\$ 495,309	63	3,895	7	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
180.3A	No person may represent, mark, certify, sell, or offer a packaging or container as meeting the requirements of this part, or a special permit pertaining to this part issued under subchapter A of this chapter, whether or not the packaging or container is i	\$ 491,890	10	148	4	
391.11B2	Using a driver unable to read and/or speak the English language.	\$ 486,730	29	4,220	6	
172.502A1II	The placard represents a hazard of the hazardous material being offered or transported; and	\$ 478,021	10	635	3	
385.403	Transporting a type and quantity of hazardous material requiring a hazardous materials safety permit in commerce when the motor carrier does not hold a safety permit, as required.	\$ 474,392	69	8,697	6	
391.45B1	Using a driver not medically examined and certified during the preceding 24 months.	\$ 469,463	4,155	214,587	7	Critical
392.60	Requiring or permitting a driver to transport an unauthorized passenger.	\$ 456,457	34	2,995	4	
392.9AA	Operating a motor vehicle providing transportation requiring operating authority without the required operating authority.	\$ 454,096	516	10,160	5	0
172.602C2	Failing to have emergency response information immediately available.	\$ 454,052	15	307	4	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
392.71B	Requiring or permitting a driver to operate a commercial motor vehicle while using or possessing a radar detector.	\$ 448,618	62	5,917	2	
383.35B	Failing to request employment history information for the 10 years preceding the date of the application for employment.	\$ 436,420	877	33,285	8	
177.8400	Daily test of off-truck remote shut-off activation device. For a cargo tank motor vehicle equipped with an off-truck remote means to close the internal self-closing stop valve and shut off all motive and auxiliary power equipment, an operator must success	\$ 427,857	11	605	4	
180.416D1	Failing to conduct a monthly inspection on a delivery hose assembly used on a non-specification cargo tank motor vehicle authorized under 173.315(k), an MC 331 cargo tank, and an MC 330 cargo tank.	\$ 417,860	13	166	5	
395.8I	Failing to require driver to forward within 13 days of completion, the original of the record of duty status.	\$ 414,649	4,102	447,552	4	Critical
180.407G	Failing to perform a pressure retest as prescribed.	\$ 405,622	22	1,608	6	0
385.415C1	Transporting a hazardous material requiring a safety permit and failing to follow the communications plan as required.	\$ 405,455	54	2,222	4	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.23A21	Except as provided in subpart G of this part, each motor carrier shall make the following investigations and inquiries with respect to each driver it employs, other than a person who has been a regularly employed driver of the motor carrier for a continuous period of time.	\$ 396,439	127	9,372	6	
387.7D	Failing to maintain at principal place of business required proof of financial responsibility.	\$ 375,933	1,513	24,971	6	Critical
177.816B	Specialized requirements for cargo tanks and portable tanks. In addition to the training requirement of paragraph (a) of this section, each person who operates a cargo tank or a vehicle with a portable tank with a capacity of 1,000 gallons or more must re	\$ 371,726	23	223	5	
391.27A1	0	\$ 363,946	155	6,042	5	
391.25C1	Failing to maintain a copy of the response from each State agency in the driver qualification file.	\$ 363,366	2,106	91,578	8	
395.13C1	Requiring or permitting a driver declared out of service to operate a motor vehicle before prescribed off duty (or sleeper berth) time has been accumulated.	\$ 349,111	94	29,675	4	
390.21B	Failing to mark a commercial motor vehicle with the legal name or a single trade name and/or the USDOT identification number.	\$ 336,064	459	4,222	4	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
395.8F1	Failure to keep driver's record of duty status entries current. Drivers shall keep their record of duty status current to the time shown for the last change of duty status.	\$ 330,595	9,850	861,459	5	
391.63B	Failing to maintain driver's name, social security number and issuing state of driver's commercial motor vehicle license.	\$ 330,354	101	1,895	7	
387.7A	Operating a motor vehicle without having in effect the required minimum levels of financial responsibility coverage.	\$ 310,116	513	11,753	6	Acute
395.8F1112	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated	\$ 296,144	20	1,328	4	
387.31D	Failing to maintain at principal place of business required proof of financial responsibility for passenger vehicles.	\$ 292,459	90	1,395	4	Critical
391.27A	Except as provided in Subpart G of this part, each motor carrier shall, at least once every 12 months, require each driver it employs to prepare and furnish it with a list of all violations of motor vehicle traffic laws and ordinances.	\$ 285,201	102	1,863	7	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.11A	A person shall not drive a commercial motor vehicle unless he/she is qualified to drive a commercial motor vehicle. Except as provided in §391.63, a motor carrier shall not require or permit a person to drive a commercial motor vehicle unless that person	\$ 279,093	12	213	6	
375.405D	You must retain a copy of the non-binding estimate for each move you perform for at least one year from the date you made the estimate and keep it as an attachment to be made an integral part of the bill of lading contract.	\$ 277,132	13	261	5	
177.800C1	Failing to train hazardous material employee as required by Subpart H of Part 172.	\$ 274,683	573	50,331	1	
391.45	Persons who must be medically examined and certified.	\$ 257,088	127	6,562	5	
139.1	Conducting unauthorized motor carrier operations in the United States. (Foreign and Domestic)	\$ 255,722	306	3,983	3	
396.11B	Failing to ensure driver vehicle inspection report is complete and accurate.	\$ 249,615	2,740	144,151	5	
391.11B41	Using a physically unqualified driver.	\$ 246,977	155	14,136	2	
375.505B	Failing to prepare a receipt or bill of lading in the form and manner prescribed.	\$ 240,943	68	994	3	
177.816D	Training required by paragraph (b) of this section must conform to the requirements of § 172.704 of this subchapter with respect to frequency and recordkeeping.	\$ 239,918	96	8,408	1	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
395.8J2	Failing to obtain from driver used for the first time or intermittently, a signed statement giving the total time on duty during the preceding 7 days and time at which last relieved from duty.	\$ 238,831	1,652	58,627	4	
173.22A2	Offering a hazardous material in an unauthorized package.	\$ 234,907	21	329	4	
386.72B2	Failing to comply with an operations out-of-service order.	\$ 231,989	20	325	5	
383.35A	Failing to provide the required employment history information to prospective employer for the 10 years preceding the date the application is submitted.	\$ 229,773	365	13,785	5	
391.21B6	The nature and extent of the applicant's experience in the operation of motor vehicles, including the type of equipment (such as buses, trucks, truck tractors, semi trailers, full trailers, and pole trailers) which he/she has operated;	\$ 225,430	16	416	3	
390.15B	Failing to maintain, for a period of three years after an accident occurs, an accident register.	\$ 219,879	3,731	145,861	5	
375.501G	Failing to retain a copy of the order for service for each move performed for one year as an integral part of the bill of lading.	\$ 217,692	17	296	5	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
177.800C	Responsibility for training. A carrier may not transport a hazardous material by motor vehicle unless each of its hazmat employees involved in that transportation is trained as required by this part and subpart H of part 172 of this subchapter.	\$ 215,743	277	7,049	3	Critical
172.302A	Identification numbers. Except as otherwise provided in this subpart, no person may offer for transportation or transport a hazardous material in a bulk packaging unless the packaging is marked as required by § 172.332 with the identification number	\$ 211,542	13	483	3	
387.301B	Failing to file evidence of cargo insurance with the Federal Motor Carrier Safety Administration.	\$ 210,519	57	1,007	5	
395.8A	Failing to require driver to make a record of duty status.	\$ 208,680	12,901	456,683	1	Critical
390.21B1	Failing to mark a commercial motor vehicle with the legal name or a single trade name.	\$ 205,858	95	2,483	3	
366.2	Form of designation. Designations shall be made on Form BOC?3, Designation of Agent for Service of Process. Only one completed current form may be on file. It must include all States for which agent designations are required. One copy must be retained by	\$ 202,436	78	3,184	1	
172.704A1	Failing to train hazardous material employee in general awareness and familiarization training as required.	\$ 198,266	129	4,019	1	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.51D	Failing to keep required records in driver's qualification file for 3 years after date of execution.	\$ 195,965	597	25,912	4	
172.704A4	Failing to provide security awareness training.	\$ 189,531	396	33,775	1	Critical
390.19A1	Failing to file a Motor Carrier Identification Report, Form MCS-150 before beginning operations.	\$ 184,171	155	911	4	
375.505B9	The company or carrier identification number of the vehicle(s) upon which you load the individual shipper's shipment.	\$ 176,008	10	174	3	
375.519C	Failing to retain the original copy of the weight tickets for each shipment weighed as part of the file.	\$ 168,877	17	331	3	
391.31A	Except as provided in subpart G, a person shall not drive a commercial motor vehicle unless he/she has first successfully completed a road test and has been issued a certificate of driver's road test in accordance with this section.	\$ 167,551	12	263	3	
375.207B	Failing to include and/or not requiring agents to include in all advertisements for all services (including accessorial services incidental to or part of interstate household goods transportation) required information.	\$ 161,716	51	686	3	
386.84A1	Conducting operations in interstate commerce during a period when its registration as a [broker] [freight forwarder] [for-hire carrier] was suspended for failure to pay a civil penalty.	\$ 160,870	15	503	3	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
380.509A	Each employer must ensure each entry-level driver who first began operating a CMV requiring a CDL in interstate commerce after July 20, 2003, receives training required by § 380.503.	\$ 158,773	69	3,642	6	
391.230	Whether, within the previous three years, the driver had violated the alcohol and controlled substances prohibitions under subpart B of part 382 of this chapter, or 49 CFR part 40.	\$ 156,554	64	5,068	2	
172.600C1	Failing to provide emergency response information.	\$ 150,736	38	812	5	
392.8	Requiring or permitting a driver to drive without having assured him/herself that the required emergency equipment is in place and ready for use.	\$ 149,660	14	503	3	
375.211A	Failing to participate in an arbitration program.	\$ 146,245	60	508	3	
375.503A	Failing to prepare a written inventory in the form and manner prescribed.	\$ 146,037	73	713	3	
390.30	Every employer shall be knowledgeable of and comply with all regulations contained in this subchapter which are applicable to that motor carrier's operations.	\$ 143,743	385	6,351	4	
380.509B	Each employer must place a copy of the driver's training certificate in the driver's personnel or qualification file.	\$ 143,714	36	4,027	3	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
385.325C	Operating a commercial motor vehicle in interstate commerce on or after the effective date of an out-of-service order.	\$ 143,182	32	291	4	
391.45C	Using a driver not medically examined and certified after physical injury or impairment.	\$ 143,054	28	633	4	
396.13C	Failing to require driver to sign vehicle inspection report when defects or deficiencies were noted.	\$ 141,885	472	36,501	3	
139.2	Conducting unauthorized motor carrier operations in the United States.	\$ 141,170	112	1,933	3	
177.816A	In addition to the training requirements of § 177.800 , no carrier may transport, or cause to be transported, a hazardous material unless each hazmat employee who will operate a motor vehicle has been trained in the applicable requirements of 49 CFR parts	\$ 139,650	136	4,549	3	
375.401F	You and the individual shipper must sign the estimate of charges. You must provide a dated copy of the estimate of charges to the individual shipper at the time you sign the estimate.	\$ 139,224	19	365	4	
386.83A1	Operating a commercial motor vehicle in interstate commerce during a period when the [owner] [operator] has been prohibited from operating for failure to pay a civil penalty.	\$ 139,051	51	772	3	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
375.401B	You must specify the form of payment you and your agent will honor at delivery. Payment forms may include, but are not limited to, cash, a certified check, a money order, a cashier s check, a specific charge card.	\$ 138,219	12	135	3	
391.11B61	Failing to require driver to furnish list of motor vehicle traffic violations each 12 months.	\$ 135,733	72	1,983	4	
375.519A	Failing to obtain a separate weight ticket for each weighing, if not in accordance with Part 375.519(b).	\$ 135,349	20	306	4	
172.704A5	Failing to provide in-depth security awareness training.	\$ 134,902	340	38,280	1	Critical
397.19A	Failing to furnish driver of motor vehicle transporting Division 1.1, 1.2, or 1.3 explosive material with a copy of the rules of Part 397 and/or emergency response instructions.	\$ 134,632	21	137	3	Critical
375.501A	Failing to prepare a written order for service for each move performed	\$ 133,807	99	1,289	3	
375.215	How must I collect charges? You must issue an honest, truthful freight or expense bill in accordance with subpart A of part 373 of this chapter.	\$ 129,342	46	522	3	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
139.02C4B	Conducting unauthorized motor carrier operations in the United States.	\$ 128,977	51	307	3	
391.11B1	Is at least 21 years old;	\$ 124,849	49	916	4	
172.702D	A hazmat employer shall ensure that each of its hazmat employees is tested by appropriate means on the training subjects covered in § 172.704	\$ 124,158	20	923	4	
395.8F12	Failing to prepare records of duty service in form and manner prescribed-Record fails to contain the shipping document number(s), or name of shipper and commodity shall be shown on the driver's record of duty status.	\$ 123,839	365	12,400	3	
395.8F122	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated	\$ 122,696	46	1,948	3	
385.13A2	Operating a commercial motor vehicle after the effective date of an "unsatisfactory" rating.	\$ 122,117	27	390	4	
375.503E	Failing to retain a copy of an inventory for each move performed for one year as an integral part of the bill of lading.	\$ 122,084	17	347	3	
395.13D	Operating a commercial motor vehicle after having been declared out-of-service before the prescribed off-duty time has been accumulated.	\$ 121,936	42	5,245	4	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
395.3C2	Requiring or permitting a property-carrying commercial motor vehicle driver to restart a period of 8 consecutive days without taking an off-duty period of 34 or more consecutive hours.	\$ 121,568	19	2,285	4	Critical
391.43H	The medical examiner's certificate shall be substantially in accordance with the following form. Existing forms may be used until current printed supplies are depleted or until November 6, 2001, whichever occurs first.	\$ 120,447	46	1,479	1	
391.21B8	A list of all violations of motor vehicle laws or ordinances (other than violations involving only parking) of which the applicant was convicted or forfeited bond or collateral during the 3 years preceding the date the application is submitted;	\$ 120,097	21	218	7	
391.45B11	Using a driver not medically examined and certified during the preceding 24 months.	\$ 118,916	198	7,750	4	
391.21D	Before an application is submitted, the motor carrier must inform the applicant that the information he/she provides in accordance with paragraph (b)(10) of this section may be used, and the applicant's previous employers will be contacted	\$ 115,980	38	2,367	1	
172.704D1	Failing to retain a record of training provided to a hazardous material employee, including any requirement not met in 172.704(d).	\$ 115,217	505	53,890	1	
139.13904	Unauthorized broker operations in US	\$ 114,393	14	549	3	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
383.23A2	Except as provided in paragraph (b) of this section, no person may legally operate a CMV unless such person possesses a CDL which meets the standards contained in subpart J of this part, issued by his/ her State or jurisdiction of domicile.	\$ 112,946	15	564	2	
390.15B2	Failing to maintain copies of all accident reports required by State or other governmental entities or insurers.	\$ 112,615	943	55,200	2	Critical
391.21B1	The application for employment shall be made on a form furnished by the motor carrier. Each application form must be completed by the applicant, must be signed by him/her, and must contain the following information: The name and address of the employing	\$ 111,989	59	1,971	4	
391.271	0	\$ 111,014	70	4,825	3	
375.213A1	Before you execute an order for service for a shipment of household goods, you must furnish to your prospective individual shipper, all five of the following documents: 1) "The contents of appendix A of this part, "Your Rights and Responsibilities When You Move.	\$ 109,500	35	197	3	
375.207B2	Your U.S. DOT number, assigned by us authorizing you to operate as a for-hire motor carrier transporting household goods.	\$ 108,285	17	208	3	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
375.405B	If you provide a non-binding estimate to an individual shipper, you must provide your reasonably accurate estimate of the approximate costs the individual shipper should expect to pay for the transportation and services of the shipment.	\$ 107,406	36	669	3	
172.704A2	Failing to train hazardous material employee in function specific training as required.	\$ 107,251	212	8,691	1	
396.21A	Failing to ensure all inspections, maintenance, repairs, or service to the brakes of a commercial motor vehicle are performed in compliance with minimum standards.	\$ 103,536	242	14,869	2	
391.23C	Replies to the investigations of the driver's safety performance history required by paragraph (a)(2) of this section, or documentation of good faith efforts to obtain the investigation data, must be placed in the driver investigation history file, after	\$ 103,511	2,773	156,783	2	0
177.840L	Operating procedure. Each operator of a cargo tank motor vehicle that is subject to the emergency discharge control requirements in § 173.315(n) of this subchapter must carry on or within the cargo tank motor vehicle written emergency discharge control pr	\$ 103,240	19	1,170	4	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
395.1H1III	Requiring or permitting a property-carrying commercial motor vehicle driver to drive after having been on duty more than 70 hours in 7 consecutive days (Driving in Alaska)	\$ 101,762	18	1,009	5	Critical
395.8K2	Driver failing to have in possession copies of records of duty status for the previous seven consecutive days while on duty.	\$ 101,575	44	728	3	
172.704D	Recordkeeping. A record of current training, inclusive of the preceding three years, in accordance with this section shall be created and retained by each hazmat employer for as long as that employee is employed by that employer as a hazmat employee.	\$ 101,535	189	6,550	1	
395.8F41112	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated	\$ 100,569	14	411	2	
391.23I	The prospective employer must expressly notify drivers with Department of Transportation regulated employment during the preceding three years--via the application form or other written document prior to any hiring decision--that he or she has the follow	\$ 98,848	20	485	2	
391.23D2	The data elements as specified in §390.15(b)(1) of this chapter for accidents involving the driver that occurred in the three-year period preceding the date of the employment application.	\$ 98,269	40	3,345	1	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
380.503	Motor Carrier entry-level driver training requirements.	\$ 95,793	21	1,151	3	
375.213B	To comply with paragraph (a)(1) of this section, you must produce and distribute a document with the text and general order of appendix A to this part as it appears. The following three items also apply: (b) To comply with paragraph (a)(1) of this sec	\$ 95,437	31	295	3	
391.23D1	General driver identification and employment verification information.	\$ 95,215	24	2,537	1	
172.704C2	Failing to retrain hazardous material employees every three years.	\$ 92,202	234	16,258	1	
395.8C1	Driver's record of duty status-For each change of duty status (e.g., the place of reporting for work, starting to drive, on-duty not driving and where released from work), the name of the city, town, or village, with State abbreviation, shall be recorded.	\$ 90,935	17	1,164	4	
395.8C	Driver's record of duty status-For each change of duty status (e.g., the place of reporting for work, starting to drive, on duty not driving and where released from work), the name of the city, town or village, with State abbreviation, shall be recorded.	\$ 89,143	65	1,365	3	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
370.5B	The carrier shall at the time each claim is received create a separate file and assign thereto a successive claim file number and note that number on all documents filed in support of the claim and all records and correspondence with respect to the claim,	\$ 87,010	35	717	3	
391.21B	The application for employment shall be made on a form furnished by the motor carrier. Each application form must be completed by the applicant, must be signed by him/her, and must contain the following information:	\$ 85,879	21	587	3	
395.8H5	Failing to record the name of the city, town, or village, with State abbreviation where each change of duty status occurs	\$ 79,798	25	839	1	
380.113A1	No motor carrier shall allow, require, permit or authorize an individual to operate an LCV unless he/she meets the requirements in §§ 380.203 or 380.205 and has been issued the LCV driver-training certificate described in § 380.401.	\$ 79,092	18	377	1	
172.301A1	Except as otherwise provided by this subchapter, each person who offers a hazardous material for transportation in a non-bulk packaging must mark the package with the proper shipping name and identification number (preceded by "UN" or "NA," as appropriate	\$ 78,127	30	488	4	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
390.21B2	Failing to mark a commercial motor vehicle with the USDOT identification number.	\$ 77,147	228	2,137	2	
172.202B	Except as provided in this subpart, the basic description specified in paragraphs (a)(1), (2), (3) and (4) of this section must be shown in sequence with no additional information interspersed.	\$ 76,578	68	3,238	4	
395.8F61	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated	\$ 75,902	11	560	2	
390.35	No motor carrier shall falsify, reproduce, or alter certificates, reports, and records:	\$ 75,450	197	12,949	1	Acute
391.51B4	The response of each State agency to the annual driver record inquiry required by §391.25(a);	\$ 75,230	2,668	177,717	2	
391.23B2	Copy of driver's records. If no driving record exists from the State or States, the motor carrier must document a good faith effort to obtain such information, and certify that no record exists for that driver in that State. The inquiry to the State drive	\$ 74,097	51	3,992	2	
395.8F123	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated	\$ 73,697	48	1,893	4	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.25C2	Failing to maintain record of annual review in driver's qualification file.	\$ 73,123	2,989	157,640	4	
390.19A2	Failing to file a Motor Carrier Identification Report, Form MCS-150 every 24 months in accordance with the specified schedule.	\$ 72,474	817	22,936	3	
375.211B	Failing to produce a concise easy to read, accurate summary of your arbitration program.	\$ 71,469	42	672	3	
380.500B	Each employer must ensure that each entry-level driver who first began operating a CMV in interstate commerce requiring a CDL between July 20, 2003, and October 18, 2004, has had the required training no later than October 18, 2004.	\$ 70,146	18	1,594	1	
107.620A	Each person subject to the requirements of this subpart, or its agent designated under § 107.608(e) , must maintain at its principal place of business for a period of three years from the date of issuance of each Certificate of Registration:	\$ 69,100	14	374	1	
383.71B1	Provide to the new State of domicile the certifications contained in §383.71(a) (1) and (6);	\$ 68,770	31	1,266	3	
387.301A	Failing to file evidence of public liability insurance with the Federal Motor Carrier Safety Administration.	\$ 67,665	92	3,045	1	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
107.502B	No person may engage in the manufacture, assembly, certification, inspection or repair of a cargo tank or cargo tank motor vehicle manufactured under the terms of a DOT specification under subchapter C of this chapter or a special permit issued under this	\$ 66,743	14	393	1	
387.15	Forms. Endorsements for policies of insurance (Illustration I) and surety bonds (Illustration II) must be in the form prescribed by the FMCSA and approved by the OMB. Endorsements to policies of insurance and surety bonds shall specify that coverage there	\$ 63,240	189	7,416	2	
172.400A	Except as specified in § 172.400a , each person who offers for transportation or transports a hazardous material in any of the following packages or containment devices, shall label the package or containment device with labels specified for the material	\$ 63,036	25	409	2	
391.53	Failing to keep required records--Driver Investigation History File.	\$ 60,636	42	1,746	2	
395.100000	Scope of rules--Short-haul operations--(1) 100 air-mile radius driver. (v) The motor carrier that employs the driver maintains and retains for a period of 6 months accurate and true time records.	\$ 59,939	14	133	1	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.51B52	Failing to maintain a note relating to the annual review of the driver's driving record as required by 391.25(c)(2) and Driver Qualification file must contain a copy of the response by each State agency concerning a driver's driving record pursuant to §39	\$ 59,066	14	234	4	
172.201A1	When a hazardous material and a material not subject to the requirements of this subchapter are described on the same shipping paper, the hazardous material description entries required by §172.202 and those additional entries that may be required by §172	\$ 58,366	165	13,633	3	
391.23B	A copy of the driver record(s) obtained in response to the inquiry or inquiries to each State driver record agency required by paragraph (a)(1) of this section must be placed in the driver qualification file within 30 days of the date the driver's employment.	\$ 57,768	139	4,357	2	
395.8F111	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated.	\$ 55,738	63	3,095	3	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.51B62	Failing to maintain a list or certificate relating to violations of motor vehicle laws and ordinances required by 391.27. and Driver Qualification file must contain a copy of the response by each State agency concerning a driver's driving record pursuant	\$ 54,409	13	225	4	
395.8F4	Failing to prepare records of duty service in form and manner prescribed-Record fails to contain the total miles driving today. Total mileage driven during the 24 hour period shall be recorded on the form containing the driver's duty status record.	\$ 54,217	132	7,573	3	
376.121	Written lease requirements. Except as provided in the exemptions set forth in subpart C of this part, the written lease required under Sec. 376.11(a) shall contain the following provisions. The required lease provisions shall be adhered to and performed	\$ 53,769	18	872	1	
391.21	Application for employment.	\$ 52,181	11	1,276	2	
391.43F	The medical examination shall be performed, and its results shall be recorded, substantially in accordance with the following instructions and examination form. Existing forms may be used until current printed supplies are depleted or until September 30,	\$ 52,030	74	2,400	1	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
395.8D11	Driver's record of duty status-The shipping document number(s), or name of shipper and commodity must be included on the form in addition to the grid.	\$ 50,735	45	1,310	4	
395.8F11	Failing to prepare records of duty service in form and manner prescribed-Record fails to contain the total hours. The total hours in each duty status: off duty other than in a sleeper berth; off duty in a sleeper berth; driving, and on duty not driving, s	\$ 43,462	121	6,930	2	
395.8F21	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated	\$ 40,242	12	411	4	
395.8F5	Failing to prepare records of duty service in form and manner prescribed-Record fails to contain the commercial motor vehicle identification. The driver shall show the number assigned by the motor carrier or the license number and licensing State of each	\$ 39,919	14	287	1	
395.8D2	Driver's record of duty status-The Total miles driving today must be included on the form in addition to the grid.	\$ 38,127	12	180	3	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.23E	In addition to the investigations required by paragraph (d) of this section, the prospective motor carrier employers must investigate the information listed below in this paragraph from all previous DOT regulated employers that employed the driver within	\$ 37,694	145	13,388	2	
172.202A2	The hazard class or division number prescribed for the material, as shown in Column (3) of the §172.101 table. Except for combustible liquids, the subsidiary hazard class(es) or subsidiary division number(s) must be entered in parentheses.	\$ 37,265	11	167	2	
391.51B8	Failing to keep driver qualification file for at least 3 years after termination of driver's employment.	\$ 35,983	23	1,174	3	
383.71B	License transfer. When applying to transfer a CDL from one State of domicile to a new State domicile, an applicant shall apply for a CDL from the new State of domicile within no more than 30 days after establishing his/her new domicile.	\$ 34,394	37	1,409	1	
395.8F412	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated	\$ 32,720	33	1,094	2	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.51D4	Failing to keep required records in driver's qualification file for 3 years after date of execution. The medical examiner's certificate of the driver's physical qualification to drive a commercial motor vehicle or the photographic copy of the certificate	\$ 31,066	33	1,699	1	
395.8F121	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated	\$ 29,738	236	11,142	3	
395.5A2	Requiring or permitting a passenger-carrying commercial motor vehicle driver to drive after having been on duty 15 hours.	\$ 27,146	216	3,431	1	Critical
387.31A	Operating a passenger carrying vehicle without having in effect the required minimum levels of financial responsibility.	\$ 27,069	54	185	2	Acute
391.51B21	Failing to maintain inquiries into driver's driving record in driver's qualification file.	\$ 26,635	11	1,275	1	
390.19A22	Unknown? No "A22" there is "A2"	\$ 24,018	18	150	3	
172.203C2	The letters "RQ" shall be entered on the shipping paper either before or after, the basic description required by §172.202 for each hazardous substance (see definition in §171.8 of this subchapter).	\$ 23,826	22	4,360	3	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
390.21B3	If the name of any person other than the operating carrier appears on the CMV, the name of the operating carrier must be followed by the information required by paragraphs (b)(1), and (2) of this section, and be preceded by the words "operated by."	\$ 23,259	13	1,802	3	
375.403A	You may provide a guaranteed binding estimate of the total shipment charges to the individual shipper, so long as it is provided for in your tariff. The individual shipper must pay the amount for the services included in your estimate. You must comply with	\$ 23,089	17	227	2	
139.2C4B	Conducting unauthorized motor carrier operations in the United States.	\$ 19,384	35	362	2	
380.500	Compliance date for training requirements for entry-level drivers.	\$ 19,138	13	1,241	1	
376.11A	Lease-There shall be a written lease granting the use of the equipment and meeting the requirements contained in §376.12.	\$ 18,916	11	104	1	
375.2A		\$ 18,700	16	109	2	
375.213A	Before you execute an order for service for a shipment of household goods, you must furnish to your prospective individual shipper, all five of the following documents: (1) The contents of appendix A of this part, "Your Rights and Responsibilities When Y	\$ 18,122	35	509	2	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.43H1	Medical Examiner's Certificate	\$ 17,327	12	1,848	1	
375.221A	You may provide in your tariff for the acceptance of charge or credit cards for the payment of freight charges. Accepting charge or credit card payments is different than extending credit to shippers in §§ 375.219 and 375.807. Once you provide an estimate	\$ 17,020	20	256	2	
380.107	General requirements for LCV driver-training requirements.	\$ 16,983	11	857	1	
375.209A	Failing to have a complaint & inquiry-handling program.	\$ 16,218	42	549	2	
375.503C	Failing to ensure a company representative and/or shipper sign an inventory.	\$ 15,722	17	253	2	
387.39	Failing to have complete information on required endorsement and surety of bonds for a passenger carrying vehicle.	\$ 13,778	13	374	2	
107.608B	No person required to file a registration statement may transport a hazardous material or cause a hazardous material to be transported or shipped, unless such person has on file, in accordance with § 107.620 , a current Certificate of Registration.	\$ 13,119	66	682	2	
375.205B	If you have agents, you must have written agreements between you and your prime agents. You and your retained prime agent must sign the agreements.	\$ 12,107	13	167	2	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.23C2	The investigation may consist of personal interviews, telephone interviews, letters, or any other method for investigating that the carrier deems appropriate. Each motor carrier must make a written record with respect to each previous employer contacted,	\$ 9,628	13	886	1	
366.	Designation of Process Agent-Part Title	\$ 9,036	15	410	1	
395.8D10	Driver's record of duty status-The total hours must be included on the form in addition to the grid (far right edge of grid).	\$ 8,145	35	679	1	
395.8F2	Failing to prepare records of duty service in form and manner prescribed-Entries made by driver only. All entries relating to driver's duty status must be legible and in the driver's own handwriting.	\$ 7,440	23	2,133	1	
375.209B	Producing a summary of your complaint & inquiry-handling program that does not meet the requirements of Section 375.209(b)(1-4)	\$ 7,437	11	171	1	
376.11	General leasing requirements. Other than through the interchange of equipment as set forth in §376.31, and under the exemptions set forth in Subpart C of these regulations, the authorized carrier may perform authorized transportation in equipment it does n	\$ 7,370	10	254	1	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
391.53A	After October 29, 2004, each motor carrier must maintain records relating to the investigation into the safety performance history of a new or prospective driver pursuant to paragraphs (d) and (e) of §391.23.	\$ 7,260	54	3,579	1	
395.8D	Driver's record of duty status-The following information must be included on the form in addition to the grid:	\$ 7,243	19	458	1	
395.8K	Fraudulent or intentional alteration of a supporting document/failing to preserve a record or document required to be maintained in its original form.	\$ 7,048	43	10,568	1	0
390.21A	General. Every self-propelled CMV, as defined in §390.5, subject to subchapter B of this chapter must be marked as specified in paragraphs (b), (c), and (d) of this section.	\$ 6,708	25	457	1	
395.8D111	Driver's record of duty status-Failure to provide multiple items of information.	\$ 6,365	40	2,190	1	
395.8F124	Failing to prepare records of duty service in form and manner prescribed-Multiple sections violated	\$ 5,776	33	1,709	1	
391.251	Driver qualification records.	\$ 5,404	30	1,806	2	

Part and Sec No	Violation Description	Incremental Violation Risk IVR(k)	Number of Compliance Reviews Where the Violation Was Cited	Number of Roadside Inspections for Carriers that Violated the CR Regulation (c2)	Number of Roadside Violations Used to Calculate CR Risk	Acute / Critical
395.8F7	Failing to prepare records of duty service in form and manner prescribed-Record missing signature/certification. The driver shall certify to the correctness of all entries by signing the form containing the driver's duty status record with his/her legal n	\$ 4,770	34	2,170	1	
375.403C	You must retain a copy of the binding estimate for each move you perform for at least one year from the date you made the estimate and keep it as an attachment to be made an integral part of the bill of lading contract.	\$ 4,490	10	154	1	
375.213A5	A concise, easy to read, accurate summary of your customer complaint and inquiry handling procedures. Included in this description must be both of the following two items:	\$ 4,286	15	163	1	
375.213A4	A concise, easy-to-read, accurate summary of the your arbitration program.	\$ 3,178	11	146	1	
375.505A	Failing to prepare a bill of lading for each move performed.	\$ 2,530	12	100	1	
375.5A		\$ 2,465	15	234	1	
375.505D	Failing to retain a copy of a bill of lading for each move performed for one year from the date it's created prescribed.	\$ 2,056	10	169	1	