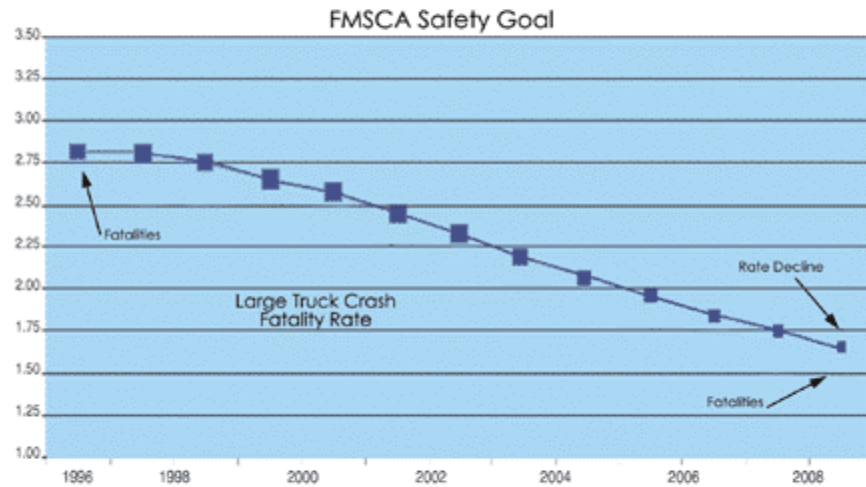


# U.S. Department of Transportation Federal Motor Carrier Safety Administration

## Measuring the FMCSA's Safety Objectives from Year 2000 to 2002

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## Preface

The *DOT Strategic Plan 2003-2008* document states the Department of Transportation's safety strategic objective as "Enhance public health and safety by working towards the elimination of transportation-related deaths and injuries." As such, the Secretary has established a goal to reduce the *highway fatality rate* to not more than 1.0 per 100 million vehicle miles traveled by 2008. This is a 41% reduction from a 1996 baseline of 1.7 per 100 million vehicle miles traveled. Consistent with the Departmental goal, the Federal Motor Carrier Safety Administration (FMCSA) has set its goal of reducing the *large truck fatality rate* by 41% from 1996 to 2008. In support of this effort, FMCSA has established specific objectives focusing on individual areas of improvement as outlined in the *2010 Strategy: Saving Lives through Safety, Innovation and Performance* document. These objectives, if met, will collectively lead toward FMCSA reaching its goal of 41% reduction in truck fatal crash rate and support the Department's overall goal of a 41% reduction in the highway fatality rate.

This report documents the progress of FMCSA toward meeting its specific safety objectives. Work on the selection of metrics for tracking FMCSA progress towards the safety objectives was initiated by a series of studies that tested the utility of various SafeStat measures and other industry metrics. The metrics selected as the most appropriate depiction of the achievement of the safety objectives were then calculated based on semiannual SafeStat runs between March 2000 and March 2002. A trend analysis was conducted to document progress over time. This report will be updated semiannually with more recent results from succeeding SafeStat runs.

The research for this report was conducted by the Research and Special Programs Administration's (RSPA) John A. Volpe National Transportation Systems Center (the Volpe Center) in Cambridge, MA under a project plan agreement with the FMCSA. The two sponsoring divisions at the FMCSA are the Analysis Division (MC-RIA), managed by Dale Sienicki and the Strategic Planning and Program Evaluation Division (MC-PRS), managed by Sue Halladay. The Volpe Center project manager is Donald Wright, Chief of the Motor Carrier Safety Assessment Division in the Office of System and Economic Assessment. The analysis was performed at the Volpe Center by Donald Wright, David Madsen, and Julie Nixon of the Volpe Center, and Walter Zak and Leon Parkin of EG&G Services and Anusha Seetharaman of Cambridge Systematics Inc. under contract to the Volpe Center.

## Table of Contents

Executive Summary .....	viii
1 Overview.....	1-1
1.1 Background.....	1-1
1.2 FMCSA Safety Objectives.....	1-1
1.3 Project Design.....	1-2
1.3.1 Scope.....	1-2
1.3.2 Approach.....	1-3
1.3.3 Carrier Populations .....	1-5
1.3.4 Data Sources .....	1-5
1.3.5 Metrics to Measure Progress.....	1-6
1.4 Organization of this Report.....	1-9
2 General Safety Objective: Reduction in Commercial Motor Vehicle Crashes.....	2-1
2.1 Accident Involvement Measure (AIM).....	2-1
2.2 Recordable Accident Rate (RAR).....	2-3
2.3 State-Reported Crash Rate (SRCR).....	2-5
2.4 Summary .....	2-6
3 Safety Objective: All Commercial Motor Vehicle Drivers are Fully Qualified, Safe, Alert, and Healthy .....	3-1
3.1 Driver Inspection Measure (DIM) .....	3-1
3.2 Moving Violation Measure (MVM) .....	3-3
3.3 Driver Out-of-Service (DOOS) Rate .....	3-5
3.4 Hours-of-Service (HOS) Violation Rate.....	3-6
3.5 Commercial Drivers License (CDL) Violation Rate .....	3-6
3.6 Post-Crash Inspection DOOS Rate .....	3-6
3.7 Summary .....	3-7
4 Safety Objective: Improving the Safety and Performance of Non-Commercial Drivers with Respect to Trucks.....	4-1
4.1 Number of Single Passenger Vehicle/Single Large Truck Fatal Crashes and Number with Passenger Vehicle Driver Factors.....	4-1
4.2 Summary .....	4-1
5 Safety Objective: Improve the Overall Safety Performance of the Motor Carrier Industry Through Refined and Enhanced Management Systems .....	5-1
5.1 Driver Review Measure (DRM) .....	5-1
5.2 Safety Management Review Measure (SMRM).....	5-2
5.3 Percent of Compliance Reviews (CRs) with No Acute or Critical Violations .....	5-2
5.4 Summary .....	5-3
6 Safety Objective: Increase the Safety Performance of the Worst Offenders to Meet the Norm .....	6-1
6.1 Comparative Analysis Results – SafeStat Category A and B Carriers.....	6-1
6.2 Longitudinal Analysis Results – SafeStat Category A and B Carriers.....	6-2
6.3 Longitudinal Analysis Results - ISS Inspect Carriers.....	6-3
6.4 Summary .....	6-6
7 Safety Objective: Commercial Motor Vehicles have Optimum Safety Performance .....	7-1
7.1 Vehicle Inspection Measure (VIM) .....	7-1

7.2	Vehicle Out-of-Service (VOOS) Rate .....	7-3
7.3	Post-Crash Inspection VOOS Rate .....	7-4
7.4	Summary .....	7-4
8	Summary of the Results to Date and Plans for Updates .....	8-1
8.1	Summary of Results.....	8-1
8.2	Plans for Updates .....	8-2

## List of Illustrations

Table 1-1: Large Truck Crash Fatality Rates 1996-2008 .....	1-1
Table 1-2: Safety Objectives, Metrics, and Analyses .....	1-3
Table 2-1: Metrics and Analyses to Measure Progress Towards Reduction in Commercial Motor Vehicle Crashes .....	2-1
Figure 2-1: AIM Cumulative Mean- All Carriers.....	2-2
Figure 2-2: AIM Peer Group Analysis- 50 <sup>th</sup> Percentile .....	2-2
Figure 2-3: AIM Peer Group Analysis- 75 <sup>th</sup> Percentile .....	2-3
Figure 2-4: RAR Cumulative Mean- All Carriers .....	2-4
Figure 2-5: RAR Peer Group Analysis- 50 <sup>th</sup> Percentile.....	2-4
Figure 2-6: RAR Peer Group Analysis- 75 <sup>th</sup> Percentile.....	2-5
Figure 2-7: SRCR Cumulative Mean- All Carriers .....	2-5
Table 2-2: Summary of Progress Towards Reduction in CMV Crashes .....	2-6
Table 3-1: Metrics and Analyses to Measure Progress Towards All CMV Drivers being fully Qualified, Safe, Alert, and Healthy .....	3-1
Figure 3-1: DIM Cumulative Mean- All Carriers.....	3-2
Figure 3-2: DIM Peer Group Analysis- 50 <sup>th</sup> Percentile .....	3-2
Figure 3-3: DIM Peer Group Analysis- 75 <sup>th</sup> Percentile .....	3-3
Figure 3-4: MVM Cumulative Mean- All Carriers.....	3-4
Figure 3-5: MVM Peer Group Analysis- 50 <sup>th</sup> Percentile.....	3-4
Figure 3-6: MVM Peer Group Analysis- 75 <sup>th</sup> Percentile.....	3-5
Figure 3-7: DOOS Cumulative Mean- All Carriers.....	3-5
Table 3-2: CDL Violation Rate.....	3-6
Table 3-3: Post-Crash Inspection DOOS Rate.....	3-6
Table 3-4: Summary of Progress Towards All CMV Drivers Being Qualified, Safe, Alert, and Healthy .....	3-7
Table 4-1: Metrics and Analyses to Measure Progress Towards Improving Non-Commercial Driver Safety Performance.....	4-1
Table 4-2: Large Truck / Passenger Vehicle Fatal Crash Data.....	4-1
Table 5-1: Metrics and Analyses to Measure Progress Towards Improving the Overall Safety Performance of the Motor Carrier Industry Through Refined and Enhanced Management Systems.....	5-1
Figure 5-1: DRM Cumulative Mean – All Carriers.....	5-1
Figure 5-2: SMRM Cumulative Mean- All Carriers.....	5-2
Table 5-2: Compliance Review Violation Data.....	5-2
Table 6-1: Metrics and Analyses to Measure Progress Towards Increasing the Safety Performance of the Worst Offenders to Meet the Norm.....	6-1
Table 6-2: Comparative Analysis Results for SafeStat Category A and B Carriers.....	6-2
Table 6-3: Longitudinal Analysis Results for SafeStat Category A and B Carriers.....	6-3
Table 6-4: Longitudinal Analysis of Cumulative Means for ISS Inspect Carriers.....	6-4
Figure 6-1: Longitudinal Analysis of SRCR Cumulative Means for ISS Inspect Carriers .....	6-5
Figure 6-2: Longitudinal Analysis of DOOS Cumulative Means for ISS Inspect Carriers.....	6-5
Figure 6-3: Longitudinal Analysis of VOOS Cumulative Means for ISS Inspect Carriers.....	6-6
Table 7-1: Metrics and Analyses to Measure Progress Towards CMVs having Optimum Safety performance.....	7-1
Figure 7-1: VIM Cumulative Mean- All Carriers.....	7-2

Figure 7-2: VIM Peer Group Analysis- 50<sup>th</sup> Percentile ..... 7-2  
Figure 7-3: VIM Peer Group Analysis- 75<sup>th</sup> Percentile ..... 7-3  
Figure 7-4: Vehicle Out-Of-Service Rate ..... 7-3  
Table 7-2: Post-Crash Inspection VOOS Rate..... 7-4  
Table 7-3: Summary of Progress Towards CMVs having Optimum Safety Performance..... 7-4

## Glossary

AIM	Accident Involvement Measure
CDL	Commercial Driver's License
CMV	Commercial Motor Vehicle
CR	Compliance Review
CVMT	Commercial vehicle miles traveled
DIM	Driver Inspections Measure
DOOS	Driver Out-of-Service
DOT	Department of Transportation
DRM	Driver Review Measure
FARS	Fatality Analysis Reporting System
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulations
HMR	Hazardous Materials Regulations
HOS	Hours-of-Service
ISS	Inspection Selection System
MCMIS	Motor Carrier Management Information System
MVM	Moving Violations Measure
NHTSA	National Highway Traffic Safety Administration
OOS	Out-of- Service
RAR	Recordable Accident Rate
RSPA	Research and Special Programs Administration
SafeStat	Motor Carrier Safety Status Measurement System
SEA	Safety Evaluation Area
SMRM	Safety Management Review Measure
SRCR	State-Reported Crash Rate
TVMT	Truck Vehicle Miles Traveled
VIM	Vehicle Inspection Measure
VOOS	Vehicle Out-of-Service

## Executive Summary

### Background

The Federal Motor Carrier Safety Administration (FMCSA) document, *2010 Strategy: Saving Lives Through Safety, Innovation and Performance*, establishes the agency mission of saving lives and reducing injuries in truck and bus crashes. In 2002, the introduction of the *DOT Strategic Plan 2003-2008*, FMCSA has aligned its goal with Department of Transportation's overall rate-based safety goal. The *DOT Strategic Plan 2003-2008* states the Department's strategic safety objective is to "Enhance public health and safety by working towards the elimination of transportation-related deaths and injuries." As such, the Secretary has established a goal to reduce the *highway fatality rate* to not more than 1.0 per 100 million vehicle miles traveled by 2008. This amounts to a 41% reduction from a 1996 baseline of 1.7 per 100 million vehicle miles traveled. Consistent with the Departmental goal, the FMCSA has set its goal of reducing the *large truck fatality rate* by 41% from 1996 to 2008. This reduction translates to a 2008 rate of 1.65 fatalities per 100 million truck vehicle miles traveled. Assuming a yearly increase of 3.4% in truck miles traveled, that rate would result in an estimated total of 4,330 truck-related crash deaths in 2008. This total compares to an estimated 7,376 deaths in truck-related crashes in 2008, if the fatality rate remained at the 1996 rate of 2.81 fatalities per 100 million truck vehicle miles traveled.

In order to meet an overall fatality reduction goal, FMCSA formulated a set of eight safety objectives, which were documented in *2010 Strategy: Saving Lives Through Safety, Innovation and Performance Report*. FMCSA addressed the underlying safety issues identified within each of these safety objectives by creating an environment of improved safety through better motor carrier compliance with Federal safety regulations, public education, and other strategies and safety programs. These objectives are the envisioned end-state that, when reached, will contribute to the meeting of the fatality reduction goal. To determine if, and/or to what extent, FMCSA is moving toward meeting these objectives, relevant metrics need to be established, calculated, and periodically updated.

### Approach

The Volpe Center was requested by FMCSA to establish metrics and benchmarks against which to assess progress in attaining the FMCSA safety objectives. This was to be done objectively, emphasizing the use of SafeStat information. SafeStat (short for Motor Carrier Safety Status Measurement System) is a data-driven analysis system that utilizes a comprehensive variety of safety data to determine the relative safety fitness of *individual* motor carriers on a periodic basis. Additionally, however, SafeStat results can collectively be applied to assess the safety performance and status of the entire motor carrier industry or specific segments, such as high-risk carriers.

The Volpe Center was requested to conduct studies and research different approaches to utilizing SafeStat-based and other relevant measures that would quantify FMCSA's progress towards achieving its specific safety objectives. During this review, specific metrics were formulated for



five of the eight safety objectives along with the general objective of reducing commercial motor vehicle crashes. In order to further refine and confirm the analysis, the metrics were calculated on comparative, longitudinal, or peer group bases. This resulted in a set of fifty different analyses and metrics that tracked safety improvement comparisons for various segments of the industry. Separately, the fifty analyses/metrics were each associated with a FMCSA safety objective. Collectively, the results provide a complete view of FMCSA's progress in achieving its safety objectives. This approach allows the FMCSA to monitor trends to determine changes in safety, and measure the extent of those changes.

### Summary of the Results

This report contains the results for five SafeStat runs from March 2000 to March 2002. All metrics were benchmarked to the March 2000 SafeStat run results and updated on a semiannual basis. Overwhelmingly, the analyses/metrics in this report show that FMCSA is moving in a positive direction with respect to meeting its stated safety objectives. In nearly all cases, the trends of the metrics demonstrate an improvement from the baseline period of March 2000 to the most current period measured (March 2002). A summary of the results by FMCSA safety objective follows:

#### *General Objective: Reduction in Commercial Motor Vehicle Crashes*

- All three crash metrics showed significant reductions in commercial motor vehicle crash involvement from the baseline ranging from 10% to 24%.
- The SafeStat peer-group analysis showed a reduction ranging from 6% to 24% in crash rates for all peer groups.

#### *Safety Objective: Commercial Motor Vehicle Drivers are Fully Qualified, Safe, Alert, and Healthy*

- All of the metrics revealed decreases in driver-related violations over the study period.
- Most of the metrics showed strong downward trends of driver-related violations with reductions of violation rates of about 10% from March 2000 to March 2002.

#### *Safety Objective: Improve the Safety and Performance of Non-commercial Drivers with Respect to Trucks*

- There was a reduction in single passenger/single large truck crashes of 5.0% from 2000 to 2001, and
- A reduction of 5.4% in the number of such crashes where the passenger vehicle driver factors were recorded from 2000 to 2001.

#### *Safety Objective: Improve the Overall Safety Performance of the Motor Carrier Industry through Refined and Enhanced Management Systems*

- All three metrics reveal decreases in the number and extent of serious violations discovered during compliance reviews (CRs).
- The SafeStat-based measures show decreases of about 11% to 32% in violations of acute/critical regulations discovered.

*Safety Objective: Increase the Safety Performance of the Worst Offenders to Meet the Norm*

- Since the development and national employment of SafeStat, FMCSA has been able to target its resources on ‘high-risk’ or ‘worst offender’ carriers. The “worst offender” carriers that were targeted for FMCSA’s Compliance Review (CR) program (i.e., SafeStat identified Category A/B carriers) demonstrated dramatic improvement in crash rate performance (reductions of 22% to 47%), in roadside inspection performance (violation rate reductions of 11% to 26%), and in safety compliance (CR-based violation rate reductions of 69% to 79%) within one-and-a-half years.
- The “worst offender” carriers that were targeted for the roadside inspection program (i.e., Inspection Selection System’s recommended “Inspect” carriers) also showed dramatic improvement in crash rate performance (reductions of 29%) and in roadside inspection performance (violation rate reductions of 9% to 15%) within one-and-a-half years.
- The worst offenders of the most recent period (the Category A/B carriers identified in March 2002 SafeStat run) had lower crash rates (15% to 22% lower), lower inspection violations rates (12% to 20% lower), and lower CR violation rates (5% to 15% lower) than the Category A/B carriers identified in the baseline March 2000 run.

*Safety Objective: Commercial Motor Vehicles have Optimum Safety Performance*

- All of the metrics revealed decreases in vehicle-related violations over the study period.
- Industry-wide metrics based on vehicle out-of-service inspections showed a decrease in vehicle out-of-service rates of about 7% to 9% from the baseline period of March 2000 to March 2002.
- The SafeStat peer-group analysis showed a reduction in vehicle violation rates of about 9% from March 2000 to March 2002

Plans for Updates

While the results in this report show that the FMCSA is making strides toward meeting its safety objectives to ultimately achieve its goal of a 41% reduction in the large truck fatality rate by 2008, it is important to continue to monitor progress. This monitoring allows FMCSA to (1) adjust its safety programs based on where the most improvement is needed, and (2) observe the results of its efforts. Most of the analyses/metrics presented in this report are based on safety data used in semiannual SafeStat runs done in March and September. The results in this report are current through March 2002. Revisions of this document are planned that will contain updates of the results and further analysis of progress in attaining FMCSA’s safety objectives.

# 1 Overview

The Volpe National Transportation Systems Center (Volpe Center) is supporting the Federal Motor Carrier Safety Administration (FMCSA) in establishing and calculating metrics for tracking the agency’s progress in meeting motor carrier safety objectives.

## 1.1 Background

The *DOT Strategic Plan 2003-2008* states the Department of Transportation’s strategic safety objective is to “Enhance public health and safety by working towards the elimination of transportation-related deaths and injuries.” As such, the Secretary has established a goal to reduce the *highway fatality rate* to not more than 1.0 per 100 million vehicle miles traveled by 2008. This amounts to a 41% reduction from a 1996 baseline of 1.7 per 100 million vehicle miles traveled. FMCSA set a comparable goal of reducing the *large truck fatality rate* by 41% from 1996 to 2008. This reduction translates to a 2008 rate of 1.65 fatalities per 100 million truck vehicle miles traveled. Assuming a yearly increase of 3.4% in truck miles traveled, that rate would result in an estimated total of 4,330 truck-related crash deaths in 2008. This total compares to an estimated 7,376 deaths in truck-related crashes in 2008, if the fatality rate remained at the 1996 rate of 2.81 fatalities per 100 million truck vehicle miles traveled. By revising the goal to reflect a reduction in the fatality rate, FMCSA estimates that an additional 14,232 lives will be saved between 2002 and 2008.

To measure progress against this goal, FMCSA has developed yearly targets. The table below shows the actual fatality rate per 100 million truck miles traveled for 1996-2001, along with the target values for 2002-2008. These target values represent a reduction in the fatality rate of approximately 5% per year.

**Table 1-1: Large Truck Crash Fatality Rates 1996-2008**

Year	Fatality Rate/ 100 Million TVMT
1996	2.81
1997	2.82
1998	2.75
1999	2.65
2000	2.57
2001	2.45
2002	2.32
2003	2.19
2004	2.07
2005	1.96
2006	1.85
2007	1.75
2008	1.65

## 1.2 FMCSA Safety Objectives

The following series of eight objectives are outlined in FMCSA’s *2010 Strategy: Saving Lives Through Safety, Innovation and Performance Report*:

1. All commercial motor vehicle drivers are fully qualified, safe, alert, and healthy.
2. Improve the safety and performance of non-commercial drivers with respect to trucks.
3. Commercial motor vehicles have optimum safety performance.
4. Roadway systems are optimized for commercial motor vehicle safety.
5. Increase the safety performance of the worst offenders to meet the norm.
6. Facilitate improvement in the overall safety performance of the motor carrier industry through refined and enhanced safety management systems.
7. High quality, complete, and timely safety performance data are available.
8. A dynamic and focused motor carrier research and technology program exists.

FMCSA addresses the underlying safety issues identified within each of these safety objectives by creating an environment of improved safety through better motor carrier compliance with Federal safety regulations, public education, and other strategies and safety programs. These objectives are the envisioned end-state that, when reached, will contribute to the meeting of the fatality reduction goal. To determine if, and/or to what extent, FMCSA is moving toward meeting these objectives, relevant metrics are being established, calculated, and periodically updated.

### **1.3 Project Design**

#### **1.3.1 Scope**

The Volpe Center was requested by FMCSA to establish metrics and benchmarks against which to assess progress in attaining the FMCSA safety objectives. This was to be done objectively, emphasizing the use of SafeStat information. SafeStat (short for Motor Carrier Safety Status Measurement System) is a data-driven analysis system that utilizes a comprehensive variety of safety data to determine the relative safety fitness of *individual* motor carriers on a periodic basis. Additionally, however, SafeStat results can collectively be applied to assess the safety performance and status of the entire motor carrier industry or specific segments, such as high-risk carriers.

The Volpe Center conducted studies and researched different approaches to utilizing SafeStat-based and other relevant measures that would quantify FMCSA's progress towards achieving its specific safety objectives. During this review, specific metrics were formulated for five of the eight safety objectives along with the general objective of reducing commercial motor vehicle crashes. In order to further refine and confirm the analysis, the metrics were calculated on comparative, longitudinal, or peer group bases. This resulted in a set of fifty different analyses and metrics that tracked safety improvement comparisons for various segments of the industry. Separately, the fifty analyses/metrics were each associated with a FMCSA safety objective. Collectively, the results provide a complete view of FMCSA's progress in achieving these safety objectives. This approach allows the FMCSA to monitor trends to determine changes in safety, and measure the extent of those changes. Table 1-2 provides the metrics for each safety objective, along with the carrier population and approach used for computing the metrics (i.e., comparative, longitudinal, or peer group).

**Table 1-2: Safety Objectives, Metrics, and Analyses**

Safety Objective	Carrier Population	Metrics to Measure Progress	Approach		
			Comparative	Longitudinal	Peer Group
A reduction in commercial motor vehicle crashes	All Carriers	Accident Involvement Measure (AIM)	X		X
		Recordable Accident Rate (RAR)	X		X
		State-Reported Crash Rate (SRCR)	X		
All commercial motor vehicle drivers are fully qualified, safe, alert, and healthy.	All Carriers	Moving Violation Measure (MVM)	X		
		Driver Out-of-Service (DOOS)	X		
		Driver Inspection Measure (DIM)	X		X
		Hours of Service Violation Rate	X		
		CDL Violation Rate	X		
		Post-Crash Inspection DOOS	By Year		
Improve the safety and performance of non-commercial drivers with respect to trucks.	Fatal Truck/Passenger Vehicle Crashes	Number of Crashes	By Year		
		Crashes w/ Passenger Vehicle Driver Factors	By Year		
Improve the overall safety performance of the motor carrier industry through refined and enhanced management systems.	All Carriers	Driver Review Measure (DRM)	X		
		Safety Management Review Measure (SMRM)	X		
		% of CRs with no acute/ critical violations	X		
Increase the safety performance of the worst offenders to meet the norm.	High Risk Carriers (SafeStat Category A/B)	Accident Inspection Measure (AIM)	X	X	X
		Driver Review Measure (DRM)	X	X	
		Recordable Accident Rate (RAR)	X	X	X
		Moving Violation Measure (MVM)	X	X	X
		Driver Inspection Measure (DIM)	X	X	X
		Vehicle Inspection Measure (VIM)	X	X	X
		Safety Management Review Measure (SMRM)	X	X	
		Driver Out-of-Service (DOOS)	X	X	
		Vehicle Out-of-Service (VOOS)	X	X	
		State-Reported Crash Rate (SRCR)	X	X	
	Safety Evaluation Area (SEA) Values		X		
	Inspection Selection System (ISS) "Inspect" Carriers	Driver Out-of-Service (DOOS)		X	
		Vehicle Out-of-Service (VOOS)		X	
State-Reported Crash Rate (SRCR)			X		
Commercial motor vehicles have optimum safety performance.	All Carriers	Vehicle Inspection Measure (VIM)	X		X
		Vehicle Out-of-Service (VOOS)	X		
		Post-Crash Inspection VOOS	By Year		

**1.3.2 Approach**

All metrics are calculated on a periodic basis. This allows the FMCSA to establish benchmarks, monitor trends to determine changes in safety and measure the extent of

those changes. To analyze the results of the metrics, the Volpe Center used semiannual SafeStat runs and the corresponding MCMIS data available for those SafeStat runs. The following SafeStat data runs are included in this report:

- March 25, 2000 (baseline)
- September 23, 2000
- March 24, 2001
- September 22, 2001
- March 23, 2002

The Fatality Analysis Reporting System (FARS) data were also used to calculate fatal crash-related metrics on an annual basis.

Several analytical techniques were employed in calculating the results of the metrics of a series of SafeStat runs. The following approaches were used:

- *Comparative Analysis:* comparing metrics for carrier populations over each SafeStat run. Each population is treated separately across SafeStat runs when the selected metrics are calculated. The results for the selected population are then compared to the results for the ‘like’ populations of other SafeStat runs. The approach uses the cumulative mean to calculate each metric. The cumulative mean is calculated by summing the safety event data (such as the number of crashes of all carriers in the population) and dividing by the sum of the normalizing data (such as the collective number of power units operated by the carriers in the population).
- *Longitudinal Analysis:* tracking a selected high-risk carrier population over a number of SafeStat runs. A baseline carrier population is selected for a SafeStat run and the metrics for that specific population are tracked over following SafeStat runs. This technique shows how the *same* carriers perform over time. The cumulative mean is also used with this approach.
- *Peer Group Analysis:* All SafeStat measures based on crash and inspection data are grouped into “peer groups.” The peer groups are defined such that carriers with comparable amounts of safety events are grouped together. This analysis examines the 50<sup>th</sup> (median) and 75<sup>th</sup> percentile (highest quartile) measures associated with each peer group. This approach provides insight into how different segments of the carrier population, such as carriers with few crashes or carriers with many crashes, are performing over time.

In cases where a carrier is missing a piece of information essential to calculating a metric, the carrier’s data are excluded from computation of that particular metric. For example, a carrier with no power unit value will be excluded from the calculation of a crash rate normalized by the number of power units.

### 1.3.3 Carrier Populations

Each safety objective and metric has a carrier population associated with it. The carrier populations used in this report are as follows:

- *All Carriers.* Associated metrics are calculated using all carriers that had data available at the time of the SafeStat run.
- *High Risk Carriers – SafeStat Category A and B.* FMCSA identifies carriers as being high safety risks based on their SafeStat results. The group of carriers with the worst performance and compliance according to the SafeStat results are known as “Category A and B” carriers. FMCSA subsequently targets these high-risk carriers for safety interventions, such as CRs, to encourage the carriers to improve their safety fitness.
- *Inspection Selection System (ISS) “Inspect” Carriers.* The ISS provides a recommendation to aid roadside inspectors based on the safety status of the responsible carrier. The main goal of ISS is to prioritize and target carriers with poor safety performance. Carriers with the highest priority are given a recommendation of “inspect” based on poor SafeStat results.
- *Other Non-Carrier Population: Fatal Truck/Passenger Vehicle Crashes.* Associated metrics are based on data from fatal crashes involving a single large truck and a single passenger vehicle.

### 1.3.4 Data Sources

The results calculated for this report are based on data from the Motor Carrier Management Information System (MCMIS), and the Fatality Analysis Reporting System (FARS).

- *MCMIS* maintains a comprehensive record of the safety performance of interstate carriers and hazardous materials shippers subject to the Federal Motor Carrier Safety Regulations (FMCSR) or Hazardous Materials Regulations (HMR), and of intrastate companies subject to federal and state motor carrier safety regulation. It supports the FMCSA mandate to monitor the safety of motor carriers engaged in interstate commerce in the United States and is maintained by FMCSA. MCMIS is also the source of data used for the semiannual SafeStat results. Many of the metrics used in this report are based on “snapshots” of the MCMIS database at the time of SafeStat runs.
- The Fatality Analysis Reporting System (FARS) contains data on a census of fatal traffic crashes within the 50 States, the District of Columbia, and Puerto Rico. To be included in FARS, a crash must involve a motor vehicle traveling on a traffic way customarily open to the public and result in the death of a person (occupant of a vehicle or a non-occupant) within 30 days of the crash. The National Highway Traffic Safety Administration (NHTSA) maintains the FARS database.

### 1.3.5 Metrics to Measure Progress

As previously mentioned, many of the metrics used in this report are SafeStat-based measures. The list below briefly describes the SafeStat measures. A more detailed description can be found in the latest SafeStat Methodology document (<http://ai.volpe.dot.gov/SafeStat/safestat.asp?file=method.pdf>).

#### *SafeStat Measures*

The Accident Involvement Measure (AIM) is computed in SafeStat using the state-reported crashes that have occurred over the past 30 months normalized by the number of power units. Each state-reported crash is severity weighted (e.g., a crash involving a fatality or injury is given more weight than a crash only involving a vehicle being towed from the scene) and is time weighted (a crash that occurred more recently is given more weight than a crash that occurred further in the past). In SafeStat, the AIM is calculated for every carrier that has 2 or more crashes. SafeStat also places carriers into “peer groups” based on the number of state-reported crashes, so that carriers with similar amounts of crash experience have their AIMs compared with one another. For the calculation of the “cumulative mean AIM,” the entire carrier population’s number of state-reported crashes over the past 30 months was normalized by the entire carrier population’s number of power units.

The Recordable Accident Rate (RAR) is computed in SafeStat using the number of recordable crashes and commercial vehicle miles traveled (CVMT) information collected from compliance reviews (CRs). The RAR is measured in the number of recordable crashes per million CVMT. Only carriers that have received a CR over the past 12 months have a RAR calculated. SafeStat also places carriers into “peer groups” based on the number of recordable crashes so that carriers with similar amounts of crash experience have their RARs compared with one another. For the calculation of “cumulative mean RAR,” the number of recordable crashes of the carrier population with a CR within the past 12 months was normalized by the population’s total number of CVMT.

The Driver Inspection Measure (DIM) is computed in SafeStat using driver roadside inspection data from inspections performed within the last 30 months. SafeStat calculates the DIM for carriers that have had a minimum of three driver inspections. To compute a DIM, SafeStat weights each inspection by its age and the number of driver OOS violations found, and then normalizes the weighted driver OOS results by the number of driver inspections to obtain a weighted driver OOS rate. The DIM is adjusted upward in instances where the driver was found “jumping,” or violating, OOS orders. SafeStat also places carriers into “peer groups” based on the number of driver inspections, so that carriers with similar amounts of inspections can have their DIMs compared with one another. To calculate the “cumulative mean DIM,” the driver inspections and resulting DOOS violations from all carriers with three or more driver inspections over the past 30 months were used.



The Vehicle Inspection Measure (VIM) is computed in SafeStat using vehicle roadside inspection data from inspections performed within the last 30 months. SafeStat calculates the VIM for carriers that have had a minimum of three vehicle inspections. To compute a VIM, SafeStat weights each inspection by its age and the number of vehicle OOS violations found, and then normalizes the weighted vehicle OOS results by the number of vehicle inspections to obtain a weighted vehicle OOS rate. SafeStat also places carriers into “peer groups” based on the number of vehicle inspections so that carriers with similar amounts of inspections can have their VIMs compared with one another. To calculate the “cumulative mean VIM,” the vehicle inspections and resulting VOOS violations from all carriers with three or more vehicle inspections over the past 30 months were used.

The Moving Violations Measure (MVM) is calculated in SafeStat using serious moving violations recorded during roadside inspections that have occurred over the past 30 months. SafeStat weights each moving violation by its age for carriers with a minimum of three moving violations, and then normalizes the weighted violations by the number of drivers to obtain the Moving Violations Measure (MVM). SafeStat also places carriers into “peer groups” based on the number of moving violations so that carriers with similar amounts of violations can have their MVMs compared with one another. For the calculation of the “cumulative mean MVM,” the entire carrier population with three or more serious moving violations over the past 30 months was used to compute number of moving violations normalized by the entire carrier population’s number of drivers.

The Driver Review Measure (DRM) is calculated in SafeStat using the results from compliance reviews performed within the last 18 months. SafeStat quantifies the number and severity of violations of driver-related acute/critical regulations cited at a carrier’s most recent compliance review into the DRM.

The Safety Management Review Measure (SMRM) is calculated in SafeStat using the results from compliance reviews performed within the last 18 months. SafeStat quantifies the number and severity of violations of safety management-related acute/critical regulations cited at a carrier’s most recent compliance review into the SMRM.

The Safety Evaluation Areas (SEAs) Values are calculated in four areas, Accident, Driver, Vehicle, and Safety Management. For each of the SEAs, values ranging from 0-100 are determined for all carriers with sufficient safety data related to that SEA. Each SEA value approximates the carrier’s percentile rank to all other carriers with sufficient data. The higher a carrier's SEA value, the worse its safety status. Therefore, an Accident SEA Value of 80 indicates that approximately 80% of the carrier population had better safety performance than that carrier with respect to accidents and 20% had worse.

*Other metrics used in this report are as follows:*

The State-Reported Crash Rate (SRCR) is the number of state-reported crashes for the entire carrier population over the past 30 months divided by the number of power units. It is similar to the “cumulative mean AIM,” but without the time and severity weighting.

The Vehicle Out-of-Service (VOOS) Rate is the number of vehicle OOS inspections normalized by the number of vehicle inspections over the past 30 months for the entire carrier population. It is similar to the “cumulative mean VIM,” but the VOOS rate is not time weighted nor does it account for multiple VOOS violations from a single inspection.

The Driver Out-of-Service (DOOS) Rate is the number of driver OOS inspections normalized by the number of driver inspections over the past 30 months for the entire carrier population. It is similar to the “cumulative mean DIM,” but the DOOS rate is not time weighted nor does it account for multiple DOOS violations from a single inspection.

Hours of Service (HOS) Violations Rate is the number of hours of service out-of-service violations found in driver roadside inspections over the past 30 months normalized by the number of driver inspections for the entire carrier population. HOS refers to the number of hours that a commercial motor vehicle (CMV) driver may drive, and the number of hours a CMV driver may be on duty, before rest is required, as well as the minimum amount of time that must be reserved for rest. Refer to 49 CFR 395 for further information. The data for this metric only became available in March 2001.

Commercial Driver’s License (CDL) Violations Rate is the number of CDL out-of-service violations found in driver roadside inspections over the past 30 months normalized by the number of driver inspections for the entire carrier population. The data for this metric only became available in March 2001.

Percent of Compliance Reviews with No Acute or Critical Violations is measured by the percentage of compliance reviews in which no violations of acute or critical regulations were discovered.

Post-Crash Inspection DOOS and VOOS Rates are based on the results of the subset of inspections conducted on the drivers and vehicles after being involved in a reportable crash. The DOOS and VOOS rates are the fraction of post-crash inspections with DOOS violations and VOOS violations, respectively.

Number of Fatal Truck/Passenger Vehicle Crashes and the Percentage with Passenger Vehicle Driver Factors are both calculated using the FARS data for fatal crashes involving crashes between large trucks and passenger vehicles. Passenger vehicle driver factors are noted by the officer at the scene based on the officer’s judgment. Such factors describe the condition and judgment of the passenger driver that could have contributed toward the crash.

## **1.4 Organization of this Report**

The remainder of this report is organized by the safety objectives and the associated results of the metrics, namely:

Section 2: General Objective: Reduction in Commercial Motor Vehicle Crashes

Section 3: All Commercial Motor Vehicle Drivers are Fully Qualified, Safe, Alert, and Healthy

Section 4: Improve the Safety and Performance of Non-commercial Drivers with Respect to Trucks

Section 5: Improve the Overall Safety Performance of the Motor Carrier Industry through Refined and Enhanced Management Systems

Section 6: Increase the Safety Performance of the Worst Offenders to Meet the Norm

Section 7: Commercial Motor Vehicles have Optimum Safety Performance

Section 8: Summary of the Results to Date and Plans for Updates

## 2 General Safety Objective: Reduction in Commercial Motor Vehicle Crashes

A comparative analysis on three accident-related metrics was conducted to track FMCSA’s progress in meeting the general objective of reducing commercial motor vehicle crashes. The comparative analysis examined the cumulative means of the Accident Involvement Measure (AIM), Recordable Accident Rate (RAR) and State-Reported Crash Rate (SRCR) over five SafeStat runs. The carrier population analyzed included all carriers with sufficient data present. A peer group analysis of 50<sup>th</sup> and 75<sup>th</sup> percentile values for AIM and RAR measures was also carried out. Refer to Table 2-1 for a summary of the metrics selected and the analysis conducted.

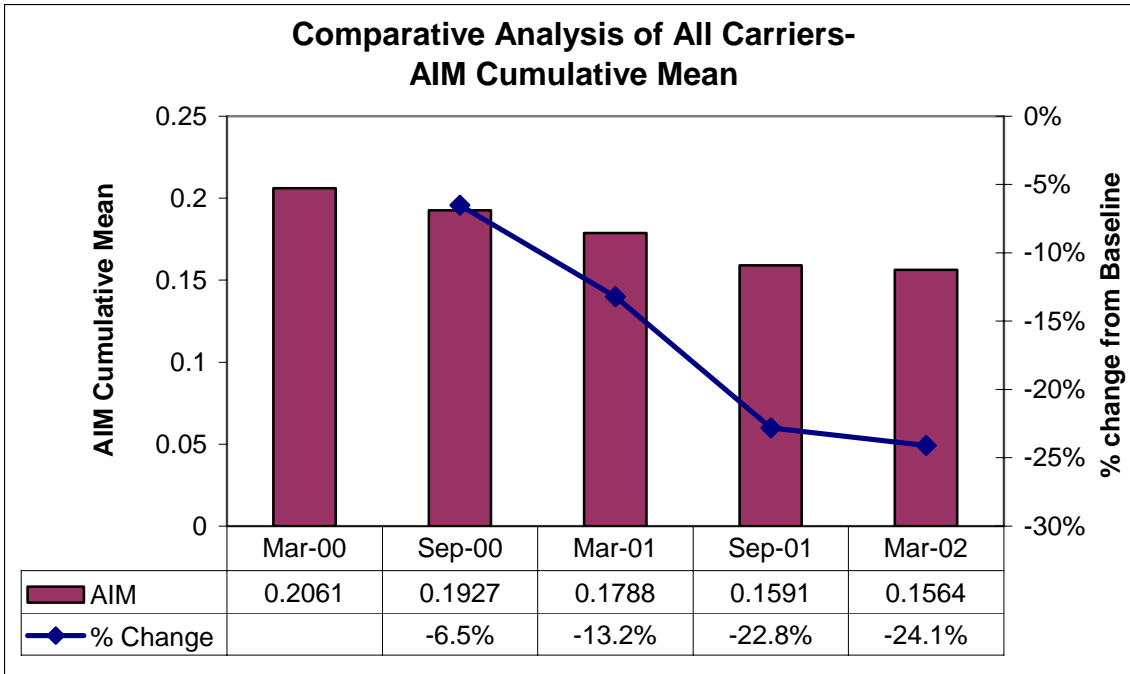
**Table 2-1: Metrics and Analyses to Measure Progress Towards Reduction in Commercial Motor Vehicle Crashes**

Safety Goal	Carrier Population	Metrics to Measure Progress	Comparative Analysis	Peer Group Analysis
A reduction in commercial motor vehicle crashes.	All Carriers	AIM	X	X
		RAR	X	X
		SRCR	X	

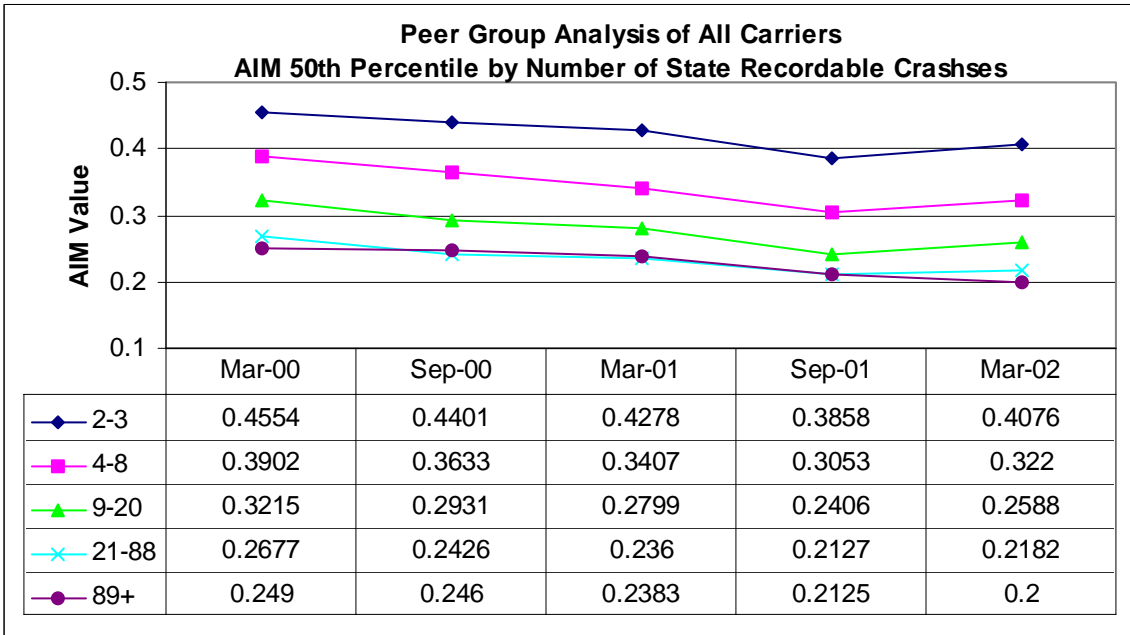
### 2.1 Accident Involvement Measure (AIM)

The AIM is computed in SafeStat using the state-reported crashes that have occurred over the past 30 months normalized by the number of power units. The state-reported crashes are weighted by time and crash severity. A comparative and peer group analysis was performed on the AIM to look for trends over time. Both analyses used SafeStat semiannual runs between March 2000 and March 2002. The AIM cumulative mean of the entire carrier population shows a decreasing trend through the course of the five runs, as shown in Figure 2-1. Since the March 2000 baseline run, the AIM Cumulative Mean has decreased by almost 25%.

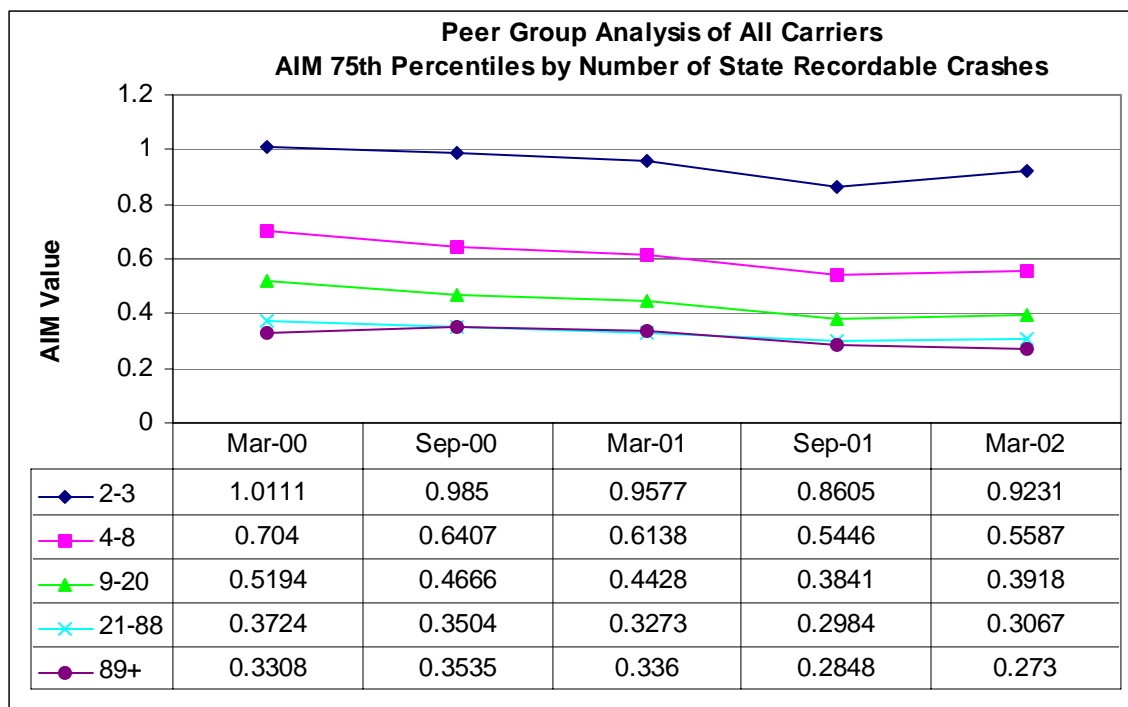
The peer group analysis for the AIM was conducted by grouping carriers with similar numbers of reportable crashes using the peer grouping in used SafeStat (i.e., carriers with 2-3, 3-8, 9-20, 21-88, 89+ crashes). Figures 2-2 and 2-3 show that, in both the 50<sup>th</sup> and 75<sup>th</sup> percentile studies, the AIM value decreases over time. In March 2002, however, instead of a slight decrease from September 2001, as shown in the cumulative mean, there is a slight increase. This is true of all peer groups, with the exception of the 89+ recordable crash group, which shows a decrease of approximately 5%. This trend shows that there is an improvement in the performance of carriers that have been involved in the largest number of crashes.



**Figure 2-1: AIM Cumulative Mean- All Carriers**



**Figure 2-2: AIM Peer Group Analysis- 50<sup>th</sup> Percentile**

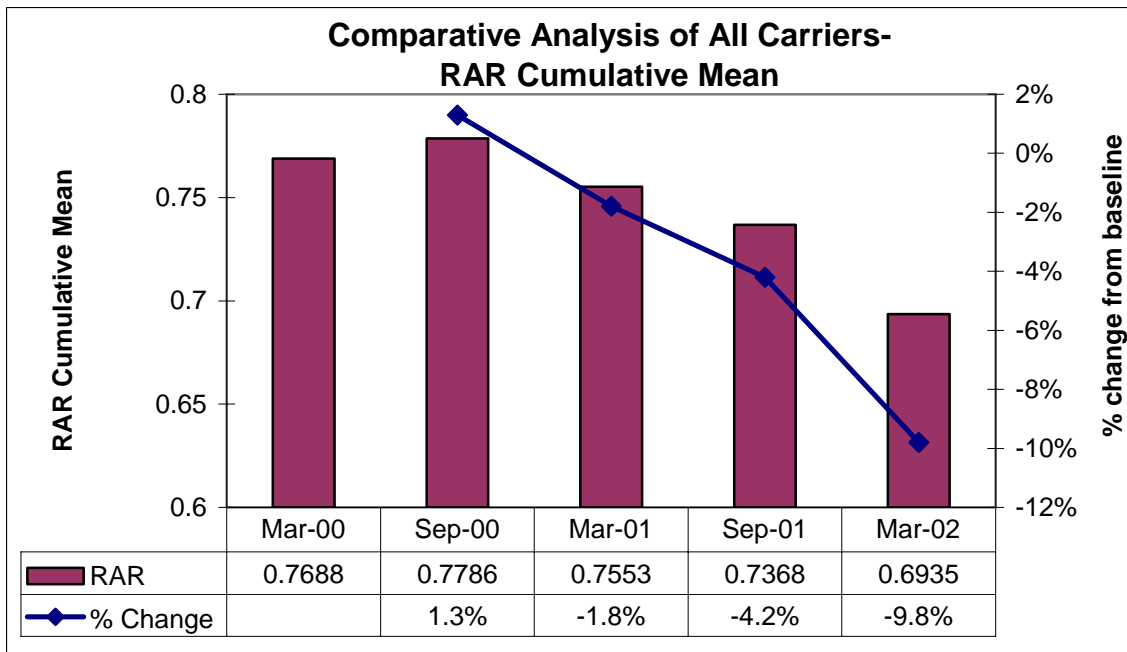


**Figure 2-3: AIM Peer Group Analysis- 75<sup>th</sup> Percentile**

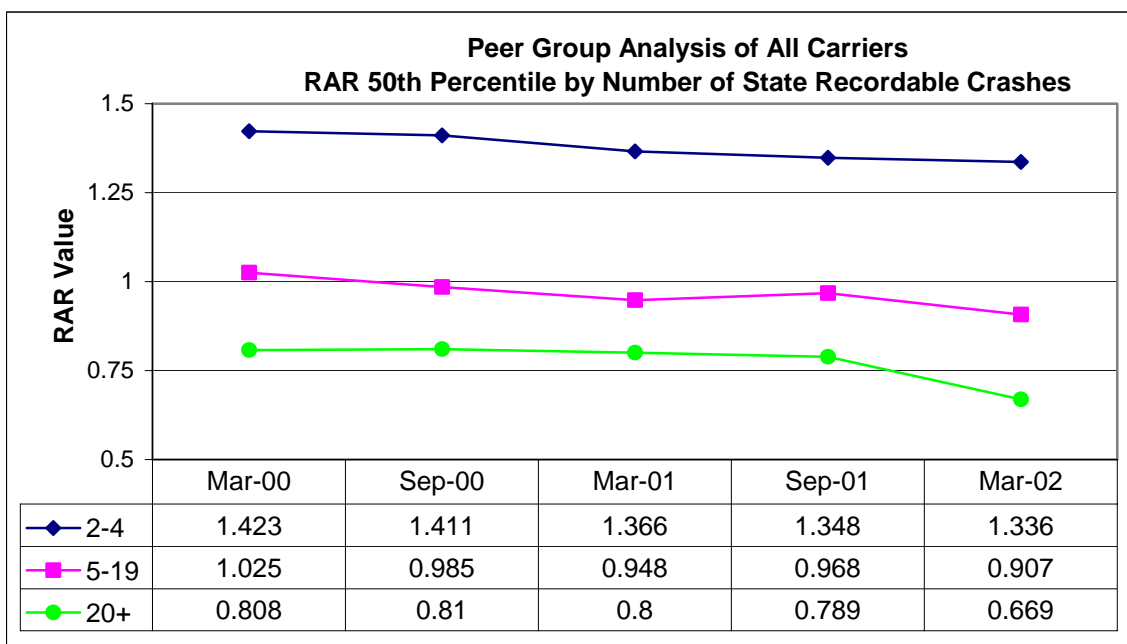
## **2.2 Recordable Accident Rate (RAR)**

The RAR is computed in SafeStat using the number of recordable crashes and commercial vehicle miles traveled (CVMT) information collected from compliance reviews (CRs). It is measured in recordable crashes per million CVMT over the prior 12 months from when the CR was conducted. Comparative and peer group analyses were performed on the Recordable Accident Rate (RAR). Both studies used SafeStat semiannual runs between March 2000 and March 2002. The RAR cumulative mean of all carriers with a CR in the past 12 months shows a slight increase of 1.3% between the March 2000 SafeStat run and the September 2000 run, followed by a decreasing trend for subsequent runs. There is an overall decrease of 9.8% between March 2000 and March 2002 (see Figure 2-4).

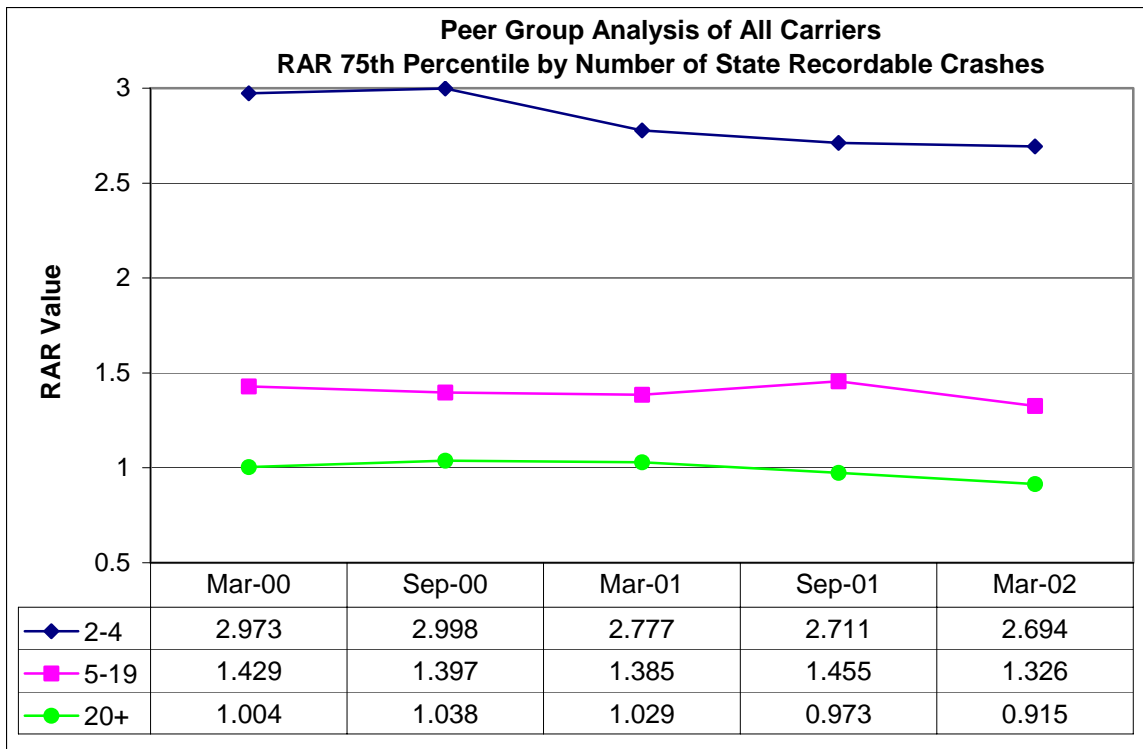
The peer group analysis for the RAR was conducted by grouping carriers with similar numbers of recordable crashes using the peer grouping used in SafeStat (i.e., carriers with 2-4, 5-19, and 20+ crashes). Figures 2-5 and 2-6 illustrate that all peer groups' RAR for both the 50<sup>th</sup> and 75<sup>th</sup> percentiles improved between the March 2000 baseline and the March 2002. However, there are some fluctuations in the value over the runs. The 20+ recordable crash peer group has an initial increase in the 75<sup>th</sup> percentile value of 3% before decreasing for the remainder of the runs. The 5-19 recordable crashes peer group, for both the 50<sup>th</sup> and 75<sup>th</sup> percentile, shows increases in September 2001 when compared to the previous period of 2% and 5%, respectively.



**Figure 2-4: RAR Cumulative Mean- All Carriers**



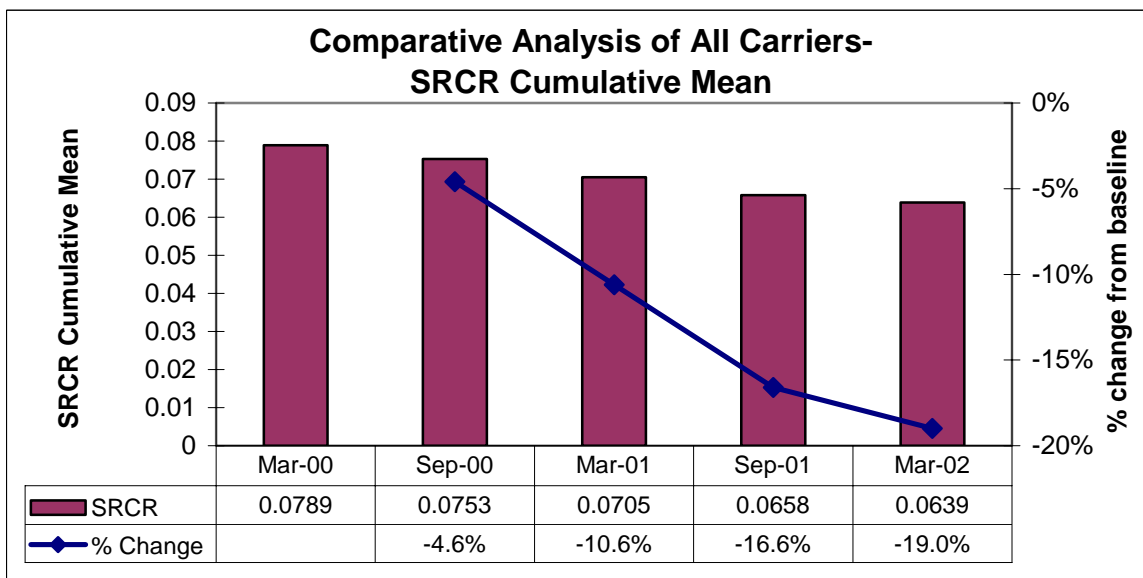
**Figure 2-5: RAR Peer Group Analysis- 50<sup>th</sup> Percentile**



**Figure 2-6: RAR Peer Group Analysis- 75<sup>th</sup> Percentile**

### 2.3 State-Reported Crash Rate (SRCR)

The SRCR is the number of state-reported crashes for the entire carrier population over the past 30 months divided by the number of power units. The cumulative mean of the SRCR was computed and shows a consistently decreasing trend of 19% since the baseline run of March 2000, as shown in Figure 2-7.



**Figure 2-7: SRCR Cumulative Mean- All Carriers**



## 2.4 Summary

All three metrics showed significant reductions in commercial motor vehicle crash involvement since March 2000. The AIM, the RAR, and the SRCR cumulative means showed reductions in crash rates over the baseline of 24.1%, 9.8% and 19.0%, respectively. In addition, the RAR values for both the 50<sup>th</sup> and 75<sup>th</sup> percentiles have decreased for a minimum of one period, and show a minimum improvement of 6.1% over the baseline value and a maximum improvement of 17.2%. Most of the trends show a continuous reduction in crash rate over the five SafeStat runs. There was a minor exception to this trend that showed the AIM 50<sup>th</sup> and 75<sup>th</sup> percentiles values within some of the peer groups having a slight increase between the last two periods (September 2001 to March 2002). Overall, assuming that the reporting of crash data is relatively constant over the course of the SafeStat runs, the results indicate that the FMCSA is moving in the right direction toward meeting its objective of reducing commercial motor vehicle crashes.

**Table 2-2: Summary of Progress Towards Reduction in CMV Crashes**

Metrics to Measure Progress	Study Type	Peer Grouping	# Of Consecutive Periods with Improving Trend	% Change from baseline
AIM	Comparative Analysis		4	-24.1%
	Peer Grouping by number of state-reported crashes 50 <sup>th</sup> Percentile	2-3	0	-10.5%
		4-8	0	-17.5%
		9-20	0	-19.5%
		21-88	0	-18.5%
		89+	1	-19.7%
	Peer Grouping by number of state-reported crashes 75 <sup>th</sup> Percentile	2-3	0	-8.7%
		4-8	0	-20.6%
		9-20	0	-24.6%
		21-88	0	-17.6%
89+		1	-17.5%	
RAR	Comparative Analysis		3	-9.8%
	Peer Grouping by recordable crashes 50 <sup>th</sup> Percentile	2-4	4	-6.1%
		5-19	1	-11.5%
		20+	3	-17.2%
	Peer Grouping by recordable crashes 75 <sup>th</sup> Percentile	2-4	3	-9.4%
		5-19	1	-7.2%
20+		3	-8.9%	
SRCR	Comparative Analysis		4	-19.0%

### 3 Safety Objective: All Commercial Motor Vehicle Drivers are Fully Qualified, Safe, Alert, and Healthy

A comparative analysis of driver violation-based metrics was used to track FMCSA’s progress in meeting the objective that all commercial motor vehicle drivers are fully qualified, safe, alert, and healthy. The following metrics were calculated over the various SafeStat runs: Driver Inspection Measure (DIM) and Moving Violations Measure (MVM) as well as the Driver Out-of-Service (DOOS) rate, the Hours-of-Service (HOS) violation rate, and the Commercial Driver License (CDL) violation rate. A peer-group analysis of 50<sup>th</sup> and 75<sup>th</sup> percentile values for the DIM and MVM was also carried out. Additionally, the DOOS rate from inspections performed on large trucks following involvement in a crash were calculated on an annual basis. Refer to Table 3-1 for a summary of the metrics selected and the analysis conducted.

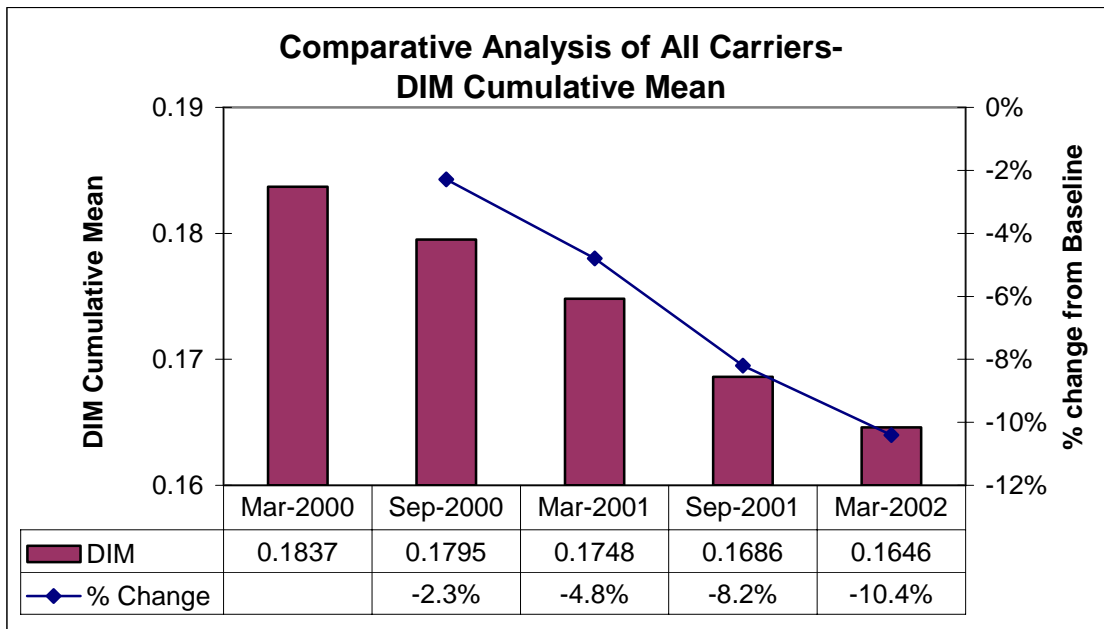
**Table 3-1: Metrics and Analyses to Measure Progress Towards All CMV Drivers being fully Qualified, Safe, Alert, and Healthy**

Safety Objective	Carrier Population	Metrics to Measure Progress	Comparative Analysis	Peer Group Analysis
All commercial motor vehicle drivers are fully qualified, safe, alert, and healthy	All Carriers	DIM	X	X
		MVM	X	X
		DOOS	X	
		HOS Violation Rate	X	
		CDL Violation Rate	X	
		Post-Crash Inspection DOOS Rate	By Year	

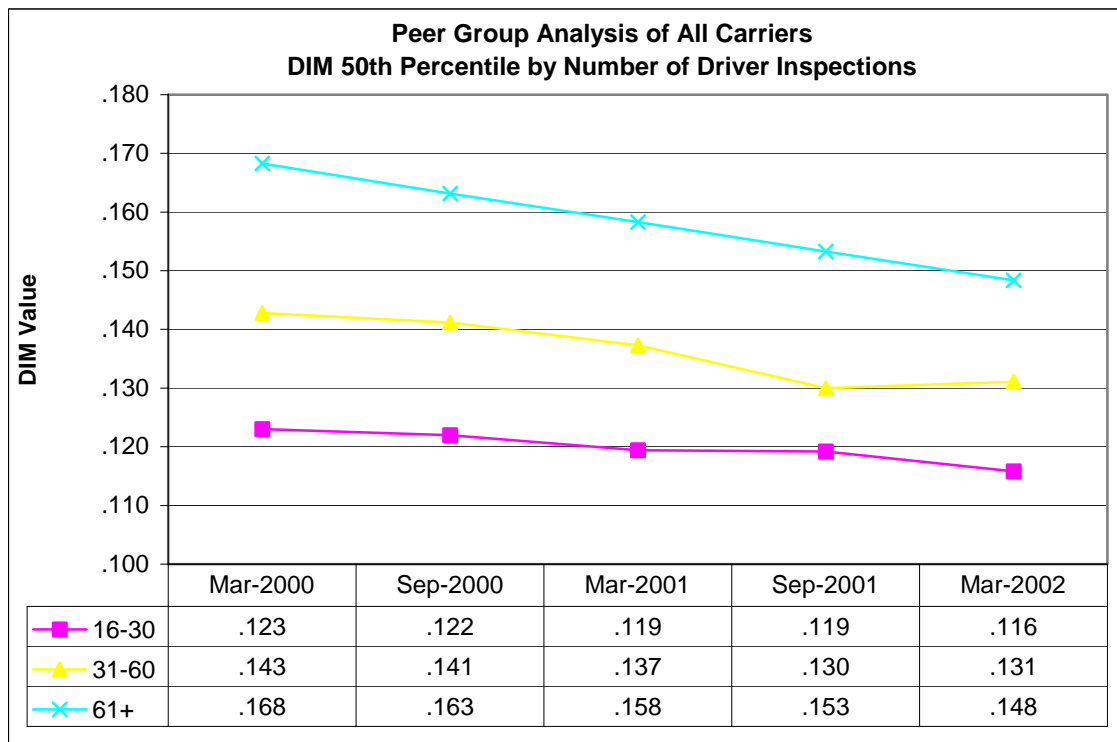
#### 3.1 Driver Inspection Measure (DIM)

The DIM is computed in SafeStat using driver roadside inspection data from inspections performed within the last 30 months. SafeStat calculates the DIM for carriers that have had a minimum of three driver inspections. To compute a DIM, SafeStat weights each inspection by its age and the number of driver OOS violations found, and then normalizes this result by the number of driver inspections to obtain a weighted driver OOS rate. Comparative and peer group analyses were performed on the DIM. Both studies used SafeStat semiannual runs between March 2000 and March 2002. Figure 3-1 shows the DIM cumulative mean of all carriers with three or more driver inspections has been steadily decreasing between each of the SafeStat runs. The DIM shows a net decrease over the examined time period of 10.4%.

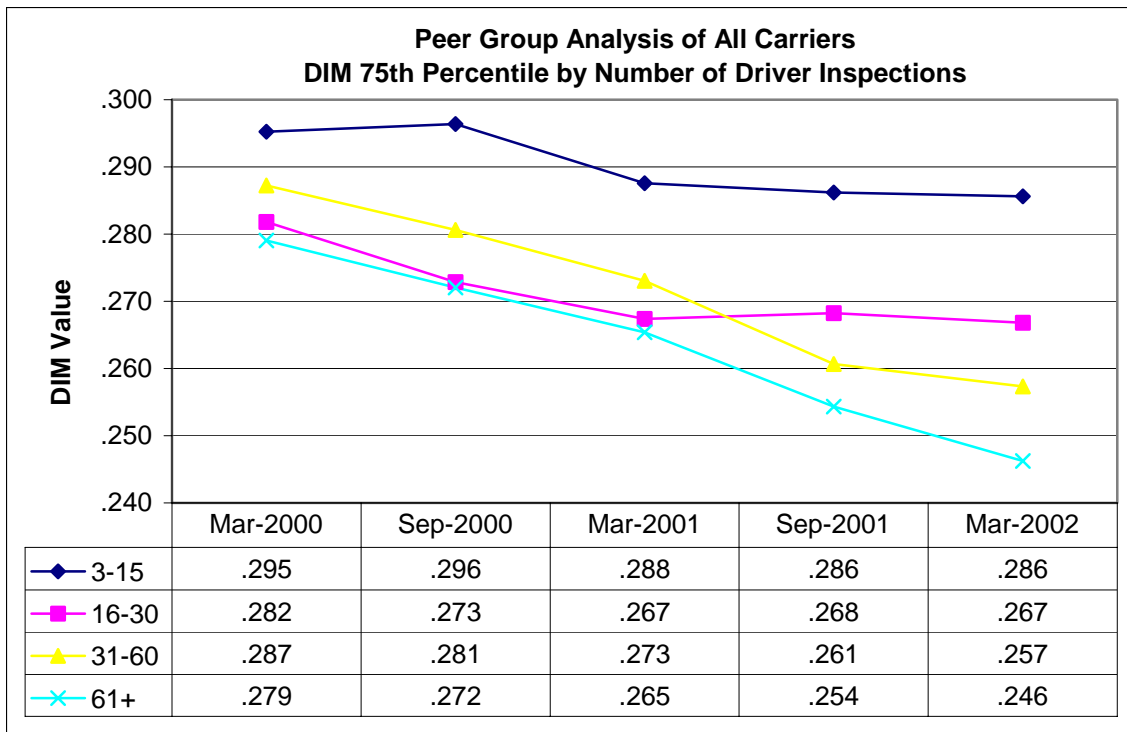
The peer group analysis for the DIM was conducted by grouping carriers with similar amounts of inspections using the peer grouping used in SafeStat (i.e., carriers with 3-15, 16-30, 31-60, and 61+ driver inspections). The peer group comparisons show a decreasing trend. In Figure 3-2, 50<sup>th</sup> percentile values have decreased in the range of 6% to 12% since the March 2000 SafeStat run. The DIM 75<sup>th</sup> percentile values in Figure 3-3 shows a similar trend. The higher the number of inspections, the higher the decrease in values; for example, carriers in the 61+ inspection group, for the 75<sup>th</sup> percentile, had a decrease of about 12% compared to around 5% for the 3-15 inspection group. Both the 50<sup>th</sup> and 75<sup>th</sup> percentile values show that the carriers with a greater number of inspections demonstrated a higher level of improvement.



**Figure 3-1: DIM Cumulative Mean- All Carriers**



**Figure 3-2: DIM Peer Group Analysis- 50<sup>th</sup> Percentile**

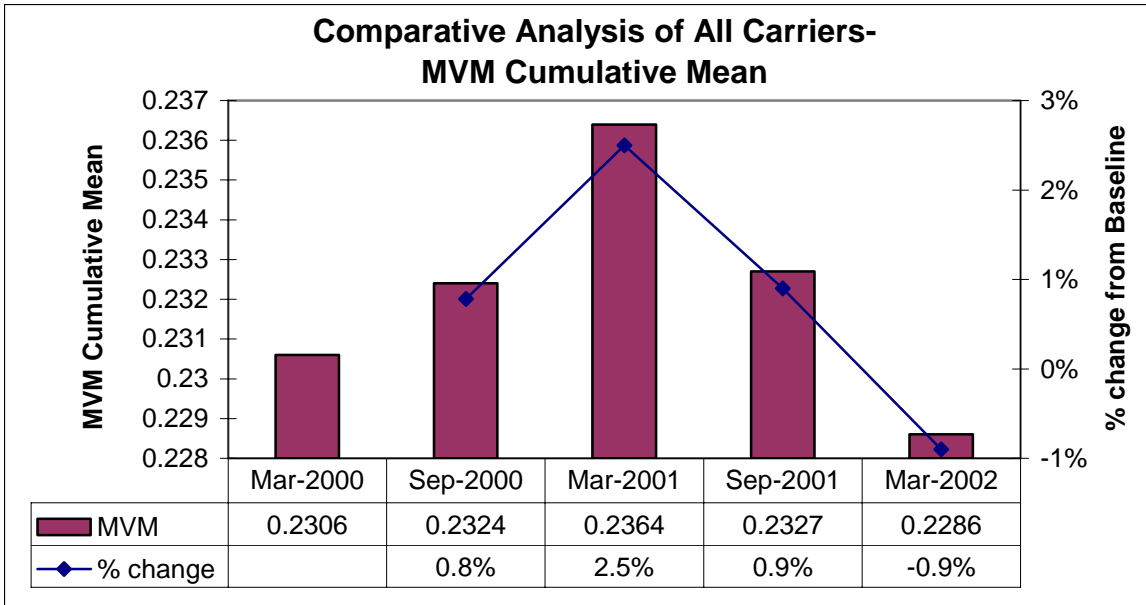


**Figure 3-3: DIM Peer Group Analysis- 75<sup>th</sup> Percentile**

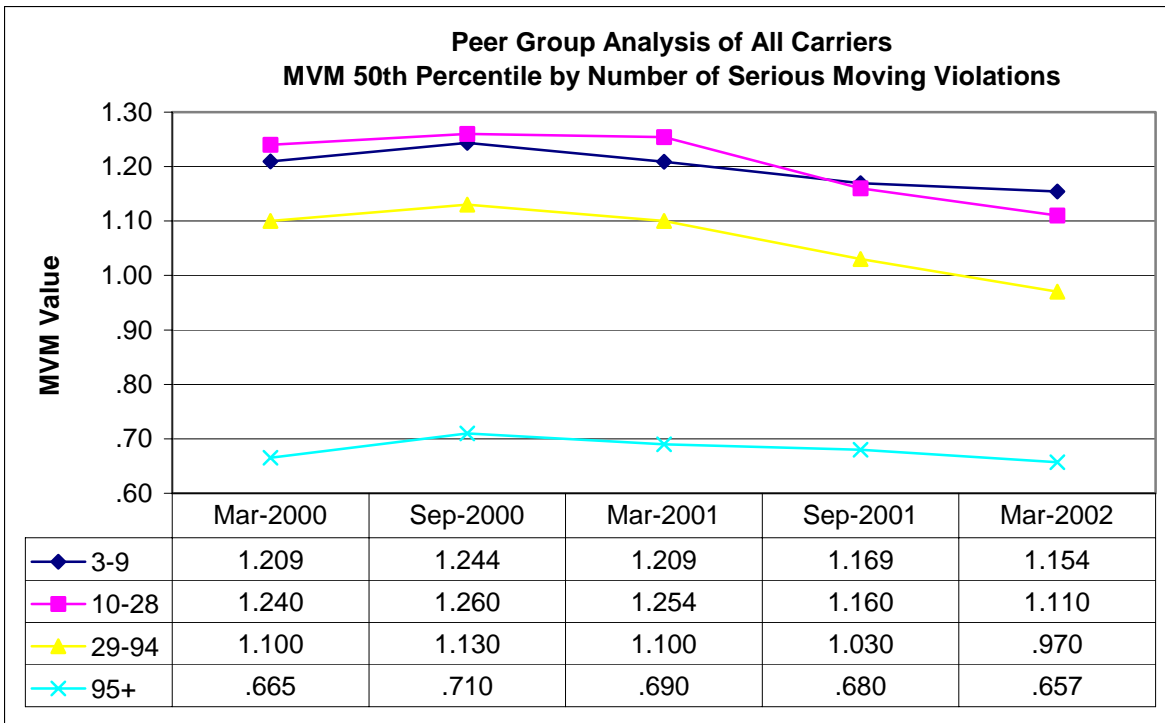
### **3.2 Moving Violation Measure (MVM)**

The MVM is calculated in SafeStat using moving violations recorded from roadside inspections that have occurred over the past 30 months. SafeStat weights each moving violation by its age for carriers with a minimum of three moving violations, and then normalizes the weighted violations by the number of drivers to obtain the MVM. The MVM Cumulative Mean shows an increasing trend over the first three SafeStat runs followed by a decrease over the next two runs. Comparative and peer group analyses were performed on the MVM. Both studies used SafeStat semiannual runs between March 2000 and March 2002. Figure 3-4 shows the MVM cumulative mean of all carriers with three or more serious moving violations increasing slightly from March 2000 to March 2001 and decreasing slightly from March 2001 to March 2002. The overall decrease in MVM over the entire period was approximately 1%.

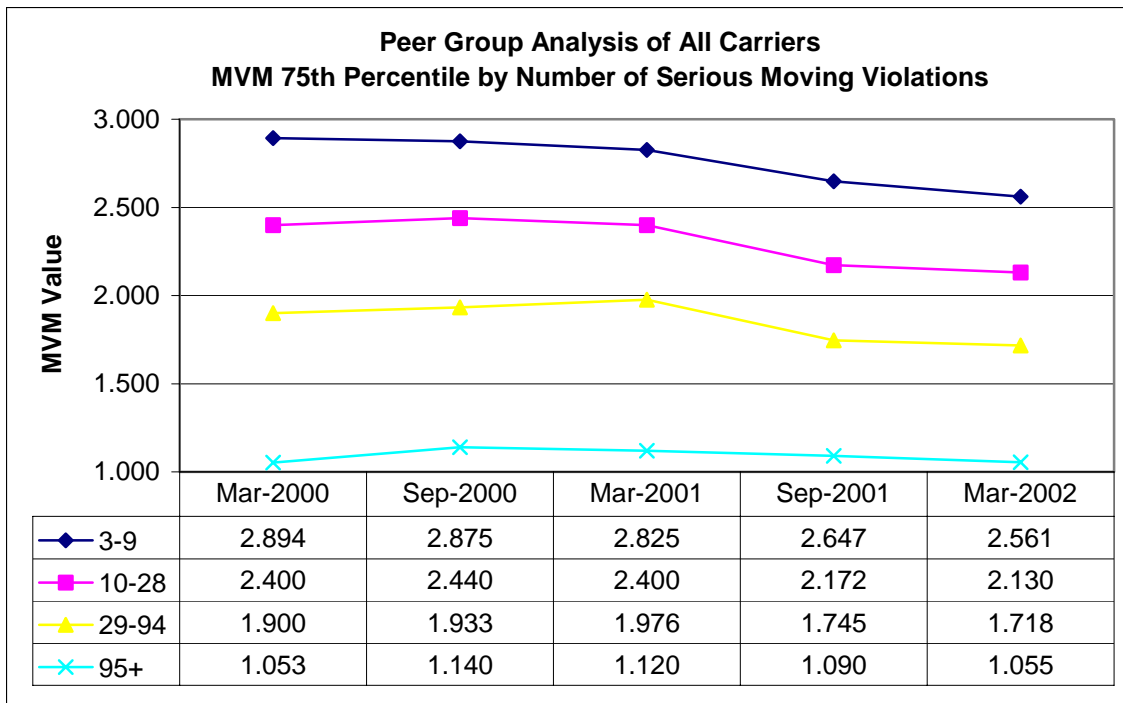
The peer group analysis for the DIM was conducted by grouping carriers with similar amounts of inspections using the peer grouping used in SafeStat (i.e., carriers with 3-9, 10-28, 29-94, and 95+ serious moving violations). The peer group analysis also shows a decrease in percentile values for the first three peer groups of 3-9, 10-28 and 29-94 serious moving violations. See Figures 3-5 and 3-6. These groups lowered their 50<sup>th</sup> and 75<sup>th</sup> percentile MVMs by 4.6% to 11.8% when comparing the baseline value in March 2000 to the March 2002 value, while the 95+ moving violation peer group MVM remained steady.



**Figure 3-4: MVM Cumulative Mean- All Carriers**



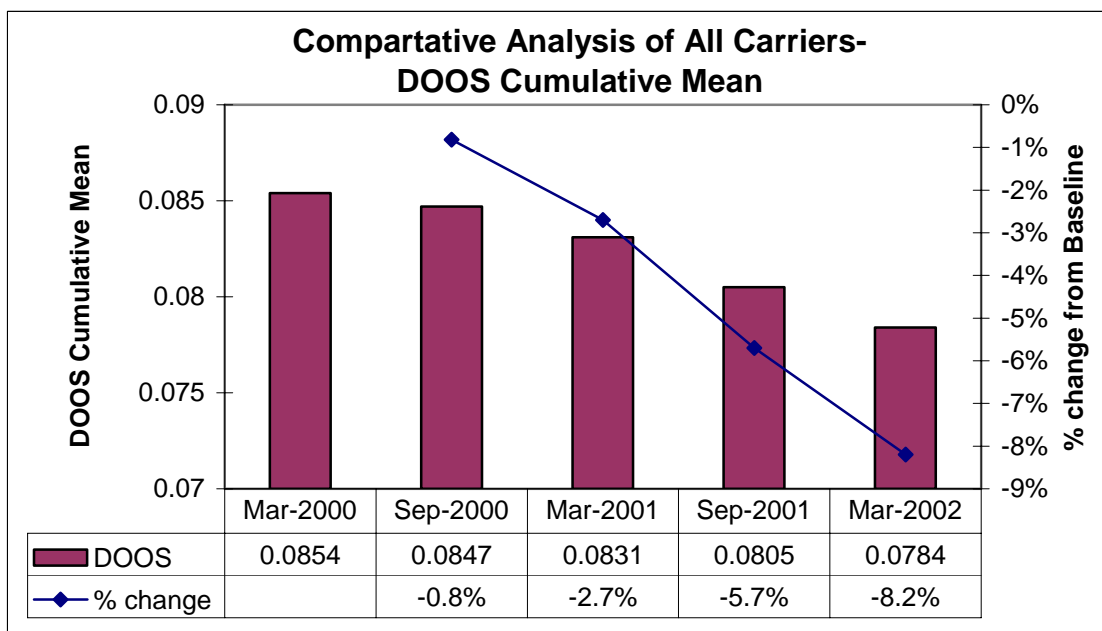
**Figure 3-5: MVM Peer Group Analysis- 50<sup>th</sup> Percentile**



**Figure 3-6: MVM Peer Group Analysis- 75<sup>th</sup> Percentile**

### 3.3 Driver Out-of-Service (DOOS) Rate

The DOOS rate is the number of driver OOS inspections normalized by the number of driver inspections over the past 30 months for the entire carrier population. It is similar to the “cumulative mean DIM,” but the DOOS rate is not time weighted nor does it account for multiple DOOS violations from a single inspection. The following figure shows that the DOOS rate has been steadily decreasing. The total decrease in the DOOS rate between the baseline date of March 2000 and March 2002 was 8.2%.



**Figure 3-7: DOOS Cumulative Mean- All Carriers**

### **3.4 Hours-of-Service (HOS) Violation Rate**

The HOS violation rate is the number of hours of service out-of-service violations found in driver roadside inspections over the past 30 months normalized by the number of driver inspections for the entire carrier population. HOS refers to the number of hours that a commercial motor vehicle (CMV) driver may drive, and the number of hours a CMV driver may be on duty, before rest is required, as well as the minimum amount of time that must be reserved for rest. Refer to 49 CFR 395 for further information. The data for this metric only became available in March 2001. This metric has remained at approximately 72 HOS out-of-service violations per thousand driver inspections for the March 2001, September 2001 and March 2002 SafeStat runs.

### **3.5 Commercial Drivers License (CDL) Violation Rate**

The CDL violation rate is the number of CDL out-of-service violations found in driver roadside inspections over the past 30 months normalized by the number of driver inspections for the entire carrier population. The data for this metric only became available in March 2001. Overall, the CDL violation rate has dropped by 24.7% from the March 2001 run to the March 2002 run.

**Table 3-2: CDL Violation Rate**

<b>Date</b>	<b>Number of CDL OOS Violations per Thousand Driver Inspection</b>
March 2001	81
September 2001	57
March 2002	61

### **3.6 Post-Crash Inspection DOOS Rate**

Post-Crash Inspection DOOS is based on the results of the subset of inspections conducted on the drivers after being involved in a reportable crash. The DOOS is the fraction of post-crash inspections with DOOS violations. The analysis of driver violations during post-crash inspections is based on the MCMIS snapshot from the March 2002 SafeStat run and is calculated on an annual basis. The 2002 results may change in subsequent releases of this report since data were available only through March 2002. The post-crash driver OOS rate has dropped by 8.6% while the percentage of post-crash inspections with any driver violations has remained fairly constant at approximately 42% for the three years examined.

**Table 3-3: Post-Crash Inspection DOOS Rate**

<b>Year</b>	<b>% Of Post-Crash Inspections with Driver OOS Violations</b>	<b>% With any Driver Violations</b>
2000	10.97	42.80
2001	10.35	41.98
2002	10.01	42.91

### 3.7 Summary

All metrics used to measure progress of the safety objective “All Commercial Motor Vehicle Drivers are Fully Qualified, Safe, Alert, and Healthy” show a decrease from the March 2000 baseline value to the March 2002 (see Table 3-4). Most of the metrics also show a strong positive trend of lower driver violation rates. This denotes a positive trend for this safety objective. Assuming fewer driver violations are being discovered due to improved industry compliance with the FMCSRs, these results indicate that FMCSA is moving toward its objective of all CMV drivers being qualified, safe, alert, and healthy.

**Table 3-4: Summary of Progress Towards All CMV Drivers Being Qualified, Safe, Alert, and Healthy**

Metrics to Measure Progress	Study Type	Peer Grouping	# Of Consecutive Periods with Improving Trend	% Change from baseline
DIM	Comparative Analysis		4	-10.4%
	Peer Grouping by number of inspections 50 <sup>th</sup> Percentile	3-15	N/A	N/A
		16-30	4	-5.8%
		31-60	0	-8.2%
		61+	4	-11.8%
	Peer Group by number of inspections 75 <sup>th</sup> Percentile	3-15	3	-3.3%
		16-30	1	-5.3%
		31-60	4	-10.4%
		61+	4	-11.8%
	MVM	Comparative Analysis		2
Peer Group by number of moving violations 50 <sup>th</sup> Percentile		3-9	3	-4.6%
		10-28	3	-10.5%
		29-94	3	-11.8%
		95+	3	-1.3%
Peer Group by number of moving violations 75 <sup>th</sup> Percentile		3-9	4	-11.5%
		10-28	3	-11.3%
		29-94	2	-9.6%
	95+	3	-2%	
DOOS	Comparative Analysis		4	-8.2%
HOS Viol. Rate	Comparative Analysis		Flat from period to period	
CDL Viol. Rate	Comparative Analysis		0	-24.7%
Post-Crash Inspection DOOS	Comparative Analysis		2	-8.6%



## 4 Safety Objective: Improving the Safety and Performance of Non-Commercial Drivers with Respect to Trucks

A comparative analysis of fatal crash metrics was used to track FMCSA’s progress in meeting the objective of improving the safety and performance of non-commercial drivers with respect to trucks. FARS data was used to measure the number of fatal crashes involving a single large truck and a single passenger vehicle, and the number of those fatal crashes where the passenger vehicle driver is noted as a factor in the crash.

**Table 4-1: Metrics and Analyses to Measure Progress Towards Improving Non-Commercial Driver Safety Performance**

Safety Objective	Carrier Population	Metrics to Measure Progress	Comparative Analysis
Improve the safety and performance of non-commercial drivers with respect to trucks.	Carriers involved in fatal Large Truck/Passenger Vehicle Crashes	Number of Crashes	By Year
		Crashes w/ Passenger Vehicle Driver Factors	By Year

### 4.1 Number of Single Passenger Vehicle/Single Large Truck Fatal Crashes and Number with Passenger Vehicle Driver Factors

The number of single passenger vehicle/single large truck fatal crashes was calculated on an annual basis for calendar years 2000 and 2001. Table 4-2 shows that the number of single passenger vehicle/single large truck fatal crashes decreased by 5.0% from 2,710 to 2,574. Also, the number of such crashes with passenger vehicle driver factors was calculated. Passenger vehicle driver factors are noted by the officer at the scene based on the officer’s judgment. Such factors describe the condition and judgment of the passenger driver that *could have* contributed toward the crash. On an absolute basis, the number of crashes with the passenger vehicle driver-related factors recorded dropped from 2,230 to 2,109 between 2000 and 2001, an improvement of 5.4%.

**Table 4-2: Large Truck / Passenger Vehicle Fatal Crash Data**

Fatal Crashes	2000	2001
Total Single Passenger Vehicles/Single Large Truck Crashes	2,710	2,574
Passenger Vehicle Driver-Related Factors Recorded	2,230	2,109
% With Driver Factors Recorded For Passenger Vehicle Driver	82.3%	81.9%

### 4.2 Summary

There was a 5.0% reduction in single passenger/single large truck fatal crashes and a 5.4% reduction in the number of such crashes where the passenger vehicle driver factors were recorded from 2000 to 2001. This indicates that FMCSA is moving in a positive direction in meeting its objective of improving the safety and performance of non-commercial drivers with respect to trucks.

## 5 Safety Objective: Improve the Overall Safety Performance of the Motor Carrier Industry Through Refined and Enhanced Management Systems

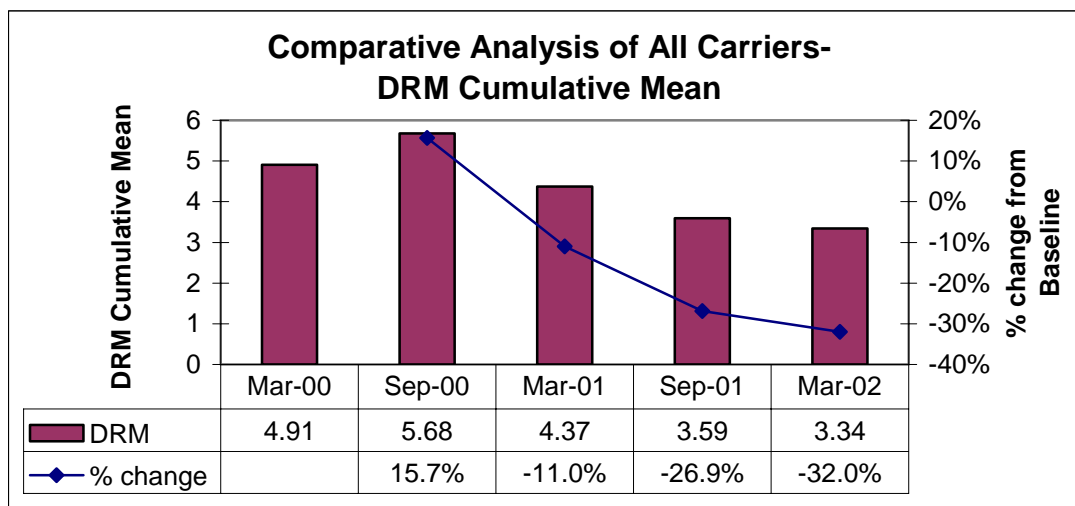
A comparative analysis of compliance review (CR) based metrics was undertaken to track FMCSA’s progress in meeting the objective of improving safety performance through refined and enhanced management systems. The comparative analysis examined the cumulative mean of the Driver Review Measure (DRM) and Safety Management Review Measure (SMRM) and the percentage of CRs with no violations of acute or critical regulations.

**Table 5-1: Metrics and Analyses to Measure Progress Towards Improving the Overall Safety Performance of the Motor Carrier Industry Through Refined and Enhanced Management Systems**

Safety Objective	Carrier Population	Metrics to Measure Progress	Comparative Analysis
Improve the overall safety performance of the motor carrier industry through refined and enhanced management systems.	All Carriers	DRM	X
		SMRM	X
		% CRs with no acute critical violations	X

### 5.1 Driver Review Measure (DRM)

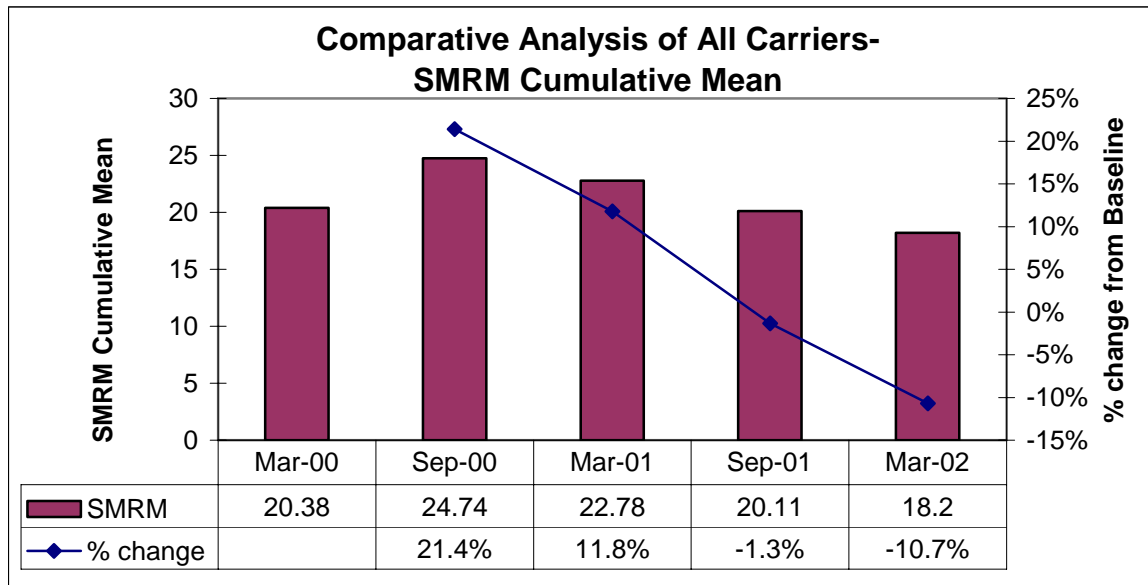
The DRM is calculated in SafeStat using the results from CRs performed within the last 18 months. SafeStat quantifies the number and severity of violations of driver-related acute/critical regulations cited at a carrier’s most recent compliance review into the DRM. A comparative analysis of the cumulative mean DRM was conducted using SafeStat semiannual runs from the March 2000 (baseline) to March 2002 for the population of carriers with a CR. The results show an initial increase in the DRM mean of 15% from March 2000 to September 2000. After September 2000 the DRM showed a steady decrease. The net decrease from the baseline to March 2002 in the cumulative mean was 32%.



**Figure 5-1: DRM Cumulative Mean – All Carriers**

## 5.2 Safety Management Review Measure (SMRM)

The SMRM is calculated in SafeStat using the results from CRs performed within the last 18 months. SafeStat quantifies the number and severity of violations of safety management-related acute/critical regulations cited at a carrier's most recent compliance review into the SMRM. A comparative analysis of the cumulative mean SMRM was conducted using the SafeStat semiannual runs from the March 2000 (baseline) to March 2002 for the population of carriers with CRs. The results show a similar trend to the DRM results with an initial increase in the SMRM mean from March 2000 to September 2000. After September 2000 the SMRM showed a steady decrease. The net decrease from the baseline to March 2002 in the cumulative mean was 10.7%.



**Figure 5-2: SMRM Cumulative Mean- All Carriers**

## 5.3 Percent of Compliance Reviews (CRs) with No Acute or Critical Violations

The percent of CRs without any violations of acute or critical regulations was measured on an annual basis. Table 5-2 shows that the percentage of CRs with no acute or critical violations has increased between 2000 and 2002 from 43.2% to 48.4%. The result of CRs in 2002 is only partial for that year because the analysis is based on CR data available as of March 2002.

**Table 5-2: Compliance Review Violation Data**

	2000	2001	2002
Number of Compliance Reviews	13,437	11,429	2,215
Number with Acute/Critical Violations	7,638	5,999	1,142
Number without Acute/Critical Violations	5,799	5,430	1,073
% without Acute/Critical Violations	43.2%	47.5%	48.4%

## **5.4 Summary**

All three metrics used to measure progress of the safety objective “Improving the Overall Safety Performance of the Motor Carrier Industry Through Refined and Enhanced Management Systems” show a decrease from the March 2000 baseline value to March 2002. Assuming that the thoroughness of the CRs conducted and the selection criteria for carriers with CRs are consistent over the analysis, the results indicate that FMCSA is making positive progress in meeting this safety objective.

## 6 Safety Objective: Increase the Safety Performance of the Worst Offenders to Meet the Norm

FMCSA identifies carriers as high safety risks based on their SafeStat results. The group of carriers with the worst performance and compliance according to the SafeStat results are known as “Category A and B” carriers. FMCSA subsequently targets these high-risk carriers for its safety initiatives, such as CRs, to encourage the carriers to improve their safety fitness. Comparative and longitudinal analyses of various safety metrics were conducted to examine the safety performance of the Category A and B carriers to determine FMCSA’s progress in meeting its objective of increasing the safety performance of the worst offenders to meet the norm. In addition to these analyses, another longitudinal analysis was performed on the Inspection Selection System (ISS) “inspect” carriers. Table 6-1 summarizes the metrics used and the analyses performed.

**Table 6-1: Metrics and Analyses to Measure Progress Towards Increasing the Safety Performance of the Worst Offenders to Meet the Norm**

Safety Goal	Carrier Population	Metrics to Measure Progress	Comparative Analysis	Longitudinal Analysis
Increase the safety performance of the worst offenders to meet the norm.	AB Carriers	AIM	X	X
		RAR	X	X
		MVM	X	X
		DIM	X	X
		VIM	X	X
		DRM	X	X
		SMRM	X	X
		DOOS	X	X
		VOOS	X	X
		SRCR	X	X
	SEA Values		X	
	ISS Inspect Carriers	SRCR		X
		DOOS		X
VOOS			X	

### 6.1 Comparative Analysis Results – SafeStat Category A and B Carriers

A comparative analysis was conducted on SafeStat Category A and B carriers. First the Category A and B carriers were identified for each of the semiannual SafeStat runs from March 2000 to March 2002, and then metrics were calculated for each set of Category A and B carriers. Table 6-2 summarizes the comparative analysis of cumulative means for each metric. Percentage changes shown in the table are computed from the March 2000 baseline. When comparing the March 2002 values to the baseline, all metrics decreased. These decreases ranged from 4.5% to 21.5%. This shows that the worst offenders as defined by SafeStat in the more recent runs are relatively safer than the worst offenders in the past.

**Table 6-2: Comparative Analysis Results for SafeStat Category A and B Carriers**

Metric	Mar 2000	Sep 2000	% Change	Mar 2001	% Change	Sep 2001	% Change	Mar 2002	% Change
AIM	0.4317	0.4496	4.1	0.4287	-0.7	0.3703	-14.2	0.3391	-21.5
RAR	1.0641	1.0183	-4.3	1.0127	-4.8	0.9331	-12.3	0.8769	-17.6
MVM	0.5678	0.5835	2.8	0.5752	1.3	0.5018	-11.6	0.4564	-19.6
DIM	0.3556	0.3553	-0.1	0.3483	-2.1	0.3133	-11.9	0.3042	-14.5
VIM	0.8167	0.8009	-1.9	0.8029	-1.7	0.7598	-7.0	0.7034	-13.9
DRM	12.83	16.06	25.2	13.64	6.3	12.29	-4.2	12.25	-4.5
SMRM	36.69	45.06	22.8	41.06	11.9	35.51	-3.2	31.21	-14.9
DOOS	0.1601	0.1618	1.1	0.1585	-1.0	0.1436	-10.3	0.1386	-13.4
VOOS	0.3022	0.2968	-1.8	0.2955	-2.2	0.2784	-7.9	0.2654	-12.2
SRCR	0.1572	0.1681	6.9	0.1597	1.6	0.1465	-6.8	0.1329	-15.5

## **6.2 Longitudinal Analysis Results – SafeStat Category A and B Carriers**

A longitudinal analysis was conducted on SafeStat Category A and B carriers. This analysis tracks the performance of the selected carrier population (namely the Category A and B carriers of a specific SafeStat run). A baseline carrier population of Category A and B carriers is selected for a SafeStat run and the cumulative mean of the metrics for that specific population are tracked over following SafeStat runs. This technique shows how the same carriers perform over time. In addition to the metrics used in the comparative analysis, SafeStat’s four Safety Evaluation Area (SEA) values for Accident, Driver, Vehicle, and Safety Management were also used in this longitudinal analysis. For each of the SEAs, values ranging from 0-100 are determined for all carriers with sufficient safety data related to that SEA. Each SEA value approximates the carrier’s percentile rank to all other carriers with sufficient data. The higher a carrier's SEA value, the worse its safety status.

Three baseline groups of Category A and B carriers were identified from the SafeStat runs of March 2000 (baseline 1), September 2000 (baseline 2), and March 2001 (baseline 3). Each baseline group was then tracked over the next six months, year, and year-and-a-half. Table 6-3 shows that all metrics had a significant decrease after the year and year-and-a-half marks when compared to the baseline. This analysis demonstrates that the worst offenders, according to past SafeStat runs, improve their safety over time.

**Table 6-3: Longitudinal Analysis Results for SafeStat Category A and B Carriers**

Metric	Baseline	Base value	After 6 months	After 1 year	% Change	After 1.5 years	% Change
AIM	1	0.4317	0.3258	0.2901	-32.8%	0.236	-45.3%
	2	0.4496	0.3359	0.2845	-36.7%	0.2391	-46.8%
	3	0.4287	0.332	0.287	-33.1%		
RAR	1	1.0641	0.9433	0.8395	-21.1%	0.8321	-21.8%
	2	1.0183	0.8736	0.7911	-22.3%	0.7366	-27.7%
	3	1.0127	0.932	0.7953	-21.5%		
MVM	1	0.5678	0.5103	0.4696	-17.3%	0.5026	-11.5%
	2	0.5835	0.4741	0.4977	-14.7%	0.4661	-20.1%
	3	0.5752	0.5524	0.5298	-7.9%		
DIM	1	0.3556	0.3227	0.2976	-16.3%	0.269	-24.4%
	2	0.3553	0.3243	0.2928	-17.6%	0.2645	-25.6%
	3	0.3483	0.3133	0.2854	-18.1%		
VIM	1	0.8167	0.7769	0.7366	-9.8%	0.7204	-11.8%
	2	0.8009	0.7581	0.7446	-7.0%	0.6671	-16.7%
	3	0.8029	0.7848	0.7121	-11.3%		
DRM	1	12.83	8.96	5.37	-58.1%	3.44	-73.2%
	2	16.06	8.4	4.54	-71.7%	3.34	-79.2%
	3	13.64	6.78	4.72	-65.4%		
SMRM	1	36.69	28.27	18.03	-50.9%	11.45	-68.8%
	2	45.06	27.82	15.07	-66.6%	11.04	-75.5%
	3	41.06	22.53	15.49	-62.3%		
DOOS	1	0.1601	0.1515	0.1421	-11.2%	0.1305	-18.5%
	2	0.1618	0.1531	0.1414	-12.6%	0.1281	-20.8%
	3	0.1585	0.1483	0.137	-13.6%		
VOOS	1	0.3022	0.2942	0.2844	-5.9%	0.2767	-8.4%
	2	0.2968	0.2883	0.2825	-4.8%	0.2635	-11.2%
	3	0.2955	0.2903	0.274	-7.3%		
SRCR	1	0.1572	0.1278	0.1179	-25.0%	0.1037	-34.0%
	2	0.1681	0.1333	0.1223	-27.2%	0.1033	-38.5%
	3	0.1597	0.1374	0.1218	-23.7%		
Accident SEA	1	43.43	30.64	28.17	-35.1%	25.35	-41.6%
	2	41	28.96	25.67	-37.4%	25.05	-38.9%
	3	39.97	26.91	26.63	-33.4%		
Driver SEA	1	85.32	80.46	76.3	-10.6%	70.97	-16.8%
	2	85.8	79.87	74.58	-13.1%	68.96	-19.6%
	3	85.66	79.81	75.18	-12.2%		
Vehicle SEA	1	74.35	72.13	69.87	-6.0%	67.27	-9.5%
	2	73.12	70.83	68.97	-5.7%	65.87	-9.9%
	3	73.2	71.23	69.09	-5.6%		
Safety Mgmt. SEA	1	86.99	79.28	74.8	-14.0%	72.16	-17.0%
	2	85.31	78.93	74.55	-12.6%	72.13	-15.4%
	3	83.84	78.09	75.09	-10.4%		

Baseline 1 is March 25, 2000 SafeStat run  
 Baseline 2 is September 23, 2000 SafeStat run  
 Baseline 3 is March 24, 2001 SafeStat run

### 6.3 Longitudinal Analysis Results - ISS Inspect Carriers

The ISS provides a recommendation to aid roadside inspectors based on the safety status of the carrier. The main goal of ISS is to prioritize and target carriers with poor safety performance. Carriers with the highest priority are given a recommendation of “inspect” based on poor SafeStat results. The ISS recommendations are updated with each SafeStat run. A longitudinal analysis was conducted on ISS “inspect” carriers to track the

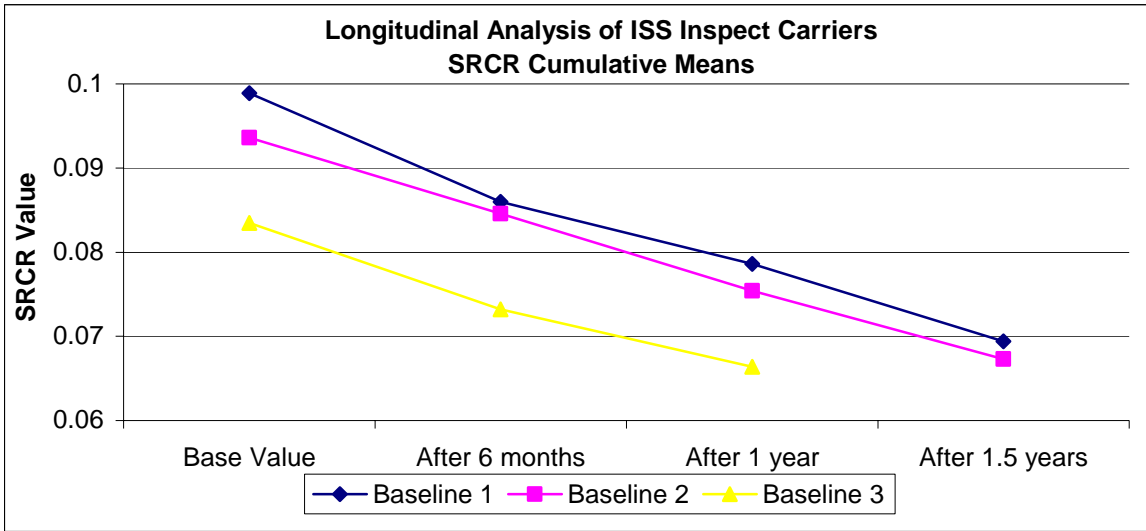
performance of this group of carriers over time. A baseline carrier population of ISS inspect carriers was selected for a SafeStat run and the cumulative mean of the metrics for that specific population was tracked over following SafeStat runs. This technique shows how the same carriers perform over time. The inspection metrics, DOOS rate and VOOS rate, and crash rate metric, SRCR, were used to measure performance.

Three baseline groups of ISS inspect carriers were identified from the SafeStat runs of March 2000 (baseline 1), September 2000 (baseline 2), and March 2001 (baseline 3). Each baseline group was then tracked over the next six months, year, and year-and-a-half. Table 6-4 shows that all metrics had significant decreases after the year and year-and-a-half marks when compared to the baseline. The SRCR shows that ISS inspect carriers improved over time with approximately 20% reduction in SRCR after one year and almost a 30% reduction after 1.5 years. Figures 6-1, 6-2, and 6-3 show declining trends in the SRCR, DOOS and VOOS rates, respectively, over time for the three baselines. This analysis demonstrates that the worst offenders, according to past ISS recommendations, improve their safety over time.

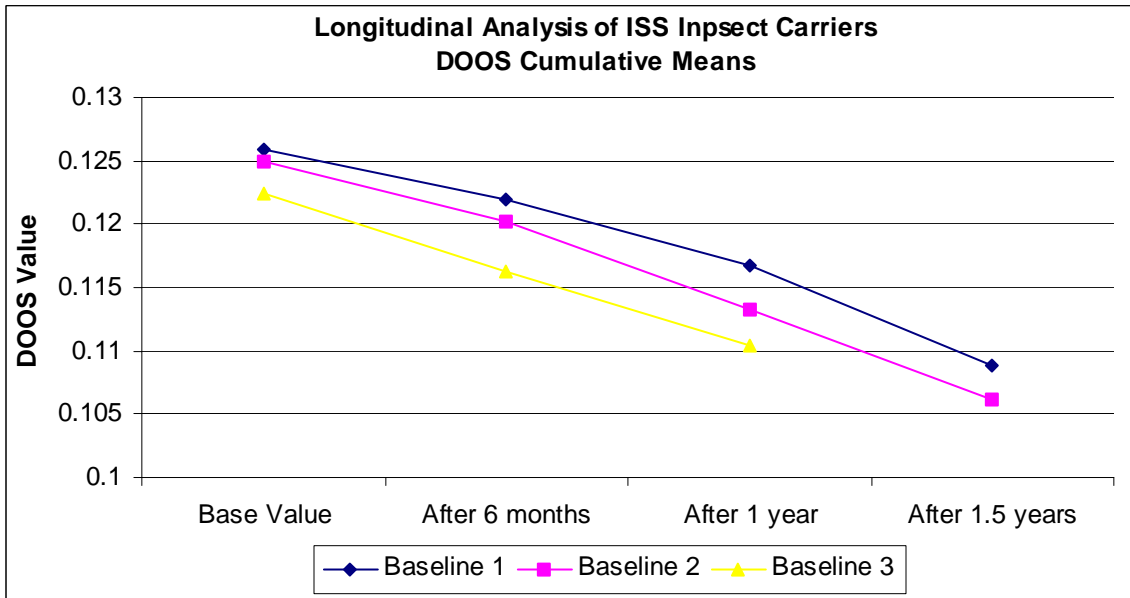
**Table 6-4: Longitudinal Analysis of Cumulative Means for ISS Inspect Carriers**

	Baseline	Base Value	After 6 months	After 1 year	% Change	After 1.5 years	% Change
<b>SRCR</b>	1	.0989	.0860	.0786	-20.5%	.0694	-29.8%
	2	.0936	.0846	.0754	-19.4%	.0673	-28.1%
	3	.0835	.0732	.0664	-20.5%		
<b>DOOS</b>	1	.1259	.1219	.1167	-7.4%	.1088	-13.6%
	2	.1250	.1202	.1133	-9.4%	.1061	-15.1%
	3	.1225	.1163	.1105	-9.8%		
<b>VOOS</b>	1	.3007	.2919	.2814	-6.4%	.2734	-9.1%
	2	.2969	.2868	.2809	-5.4%	.2640	-11.1%
	3	.2899	.2853	.2709	-6.6%		
Baseline 1 is March 25 2000 SafeStat run Baseline 2 is September 23, 2000 SafeStat run Baseline 3 is March 24, 2001 SafeStat run							

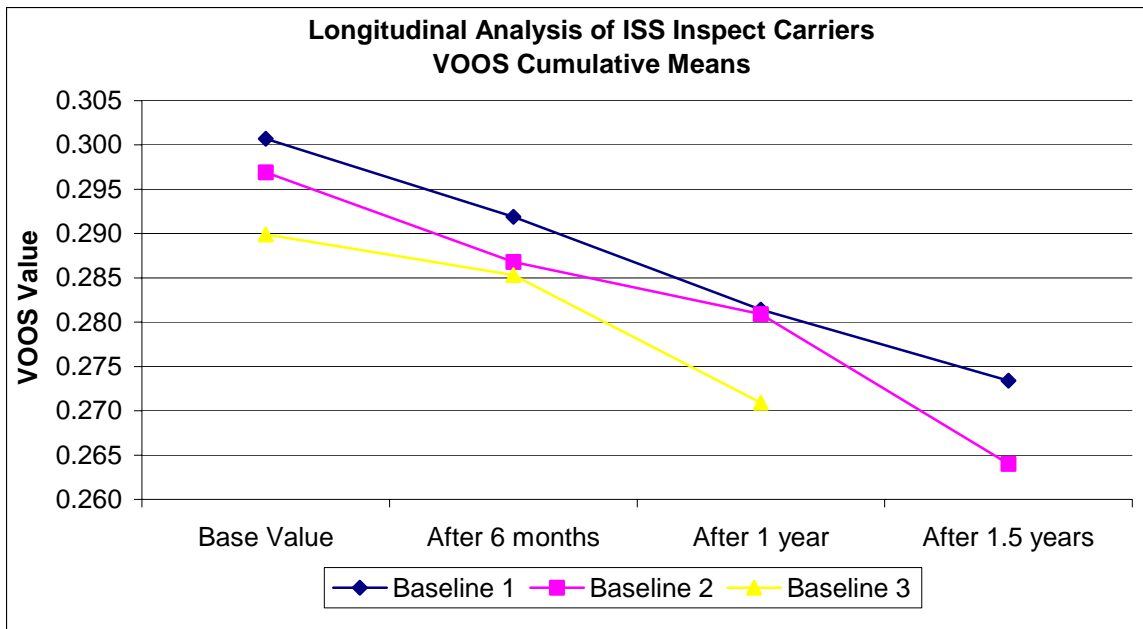




**Figure 6-1: Longitudinal Analysis of SRCR Cumulative Means for ISS Inspect Carriers**



**Figure 6-2: Longitudinal Analysis of DOOS Cumulative Means for ISS Inspect Carriers**



**Figure 6-3: Longitudinal Analysis of VOOS Cumulative Means for ISS Inspect Carriers**

#### **6.4 Summary**

The comparative analysis of Category A and B carriers shows that the worst offenders, as defined by SafeStat, in the more recent runs are relatively safer than the worst offenders in the past. The longitudinal analyses of Category A and B carriers and ISS inspect carriers demonstrates that the worst offenders identified in the past improve their safety over time. The results of all three of these analyses indicate that FMCSA is moving toward its objective of increasing the safety performance of the worst offenders to meet the norm.

## 7 Safety Objective: Commercial Motor Vehicles have Optimum Safety Performance

A comparative analysis of vehicle violation-based metrics was used to track FMCSA’s progress in meeting the objective that all commercial motor vehicles have optimum safety performance. The following metrics were calculated over the various SafeStat runs: Vehicle Inspection Measure (VIM) and the Vehicle Out-of-Service (VOOS) rate. A peer-group analysis of 50<sup>th</sup> and 75<sup>th</sup> percentile values for the VIM was also carried out. Additionally, the VOOS rate from inspections performed on large trucks following involvement in a crash was calculated on an annual basis. Refer to Table 7-1 for a summary of the metrics selected and the analysis conducted.

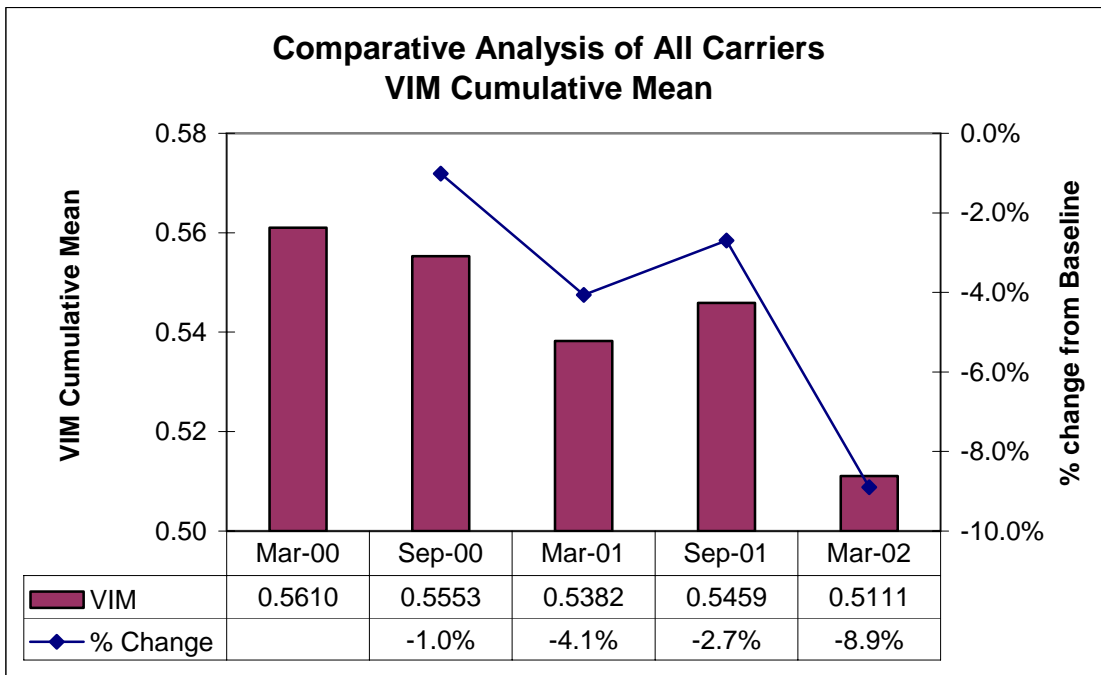
**Table 7-1: Metrics and Analyses to Measure Progress Towards CMVs having Optimum Safety performance**

Safety Goal	Carrier Population	Metrics to Measure Progress	Comparative Analysis	Peer Group Analysis
Commercial motor vehicles have optimum safety performance.	All Carriers	VIM	X	X
		Vehicle Out-of-Service (VOOS) rate	X	
		Post-Crash Inspection VOOS	By Year	

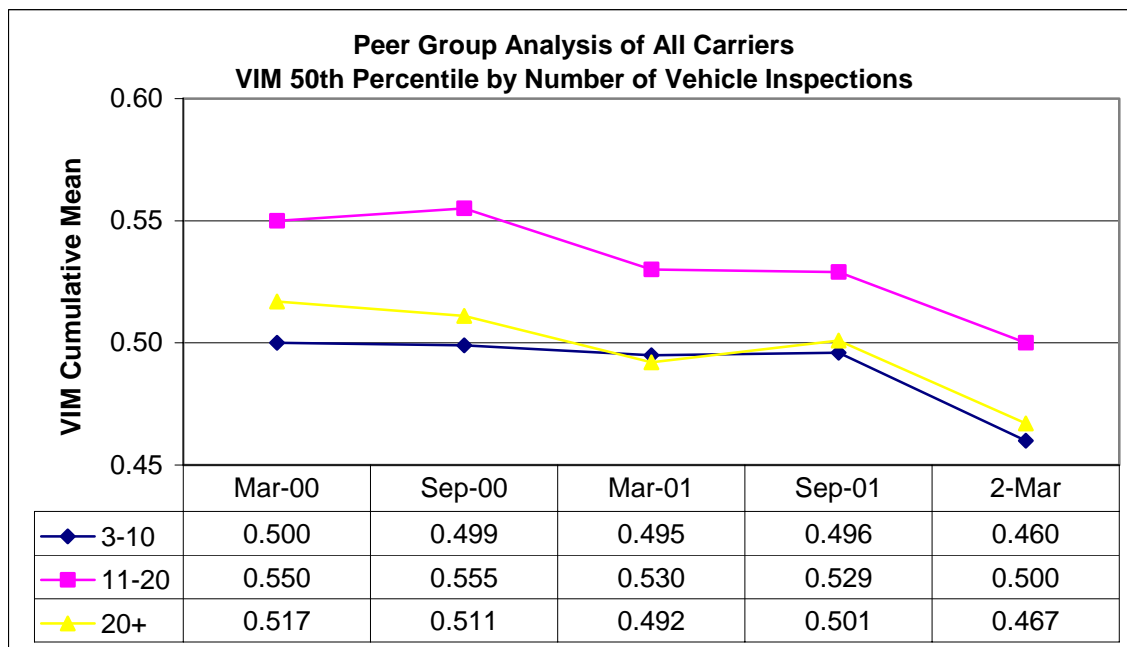
### 7.1 Vehicle Inspection Measure (VIM)

The VIM is computed in SafeStat using vehicle roadside inspection data from inspections performed within the last 30 months. SafeStat calculates the VIM for carriers that have had a minimum of three vehicle inspections. To compute a VIM, SafeStat weights each inspection by its age and the number of vehicle OOS violations found, and then normalizes this result by the number of vehicle inspections to obtain a weighted vehicle OOS rate. Comparative and peer group analyses were performed on the VIM. Both studies used SafeStat semiannual runs between March 2000 and March 2002. Figure 7-1 shows the VIM cumulative mean of all carriers with three or more driver inspections has decreased over the examined time period by 8.9%.

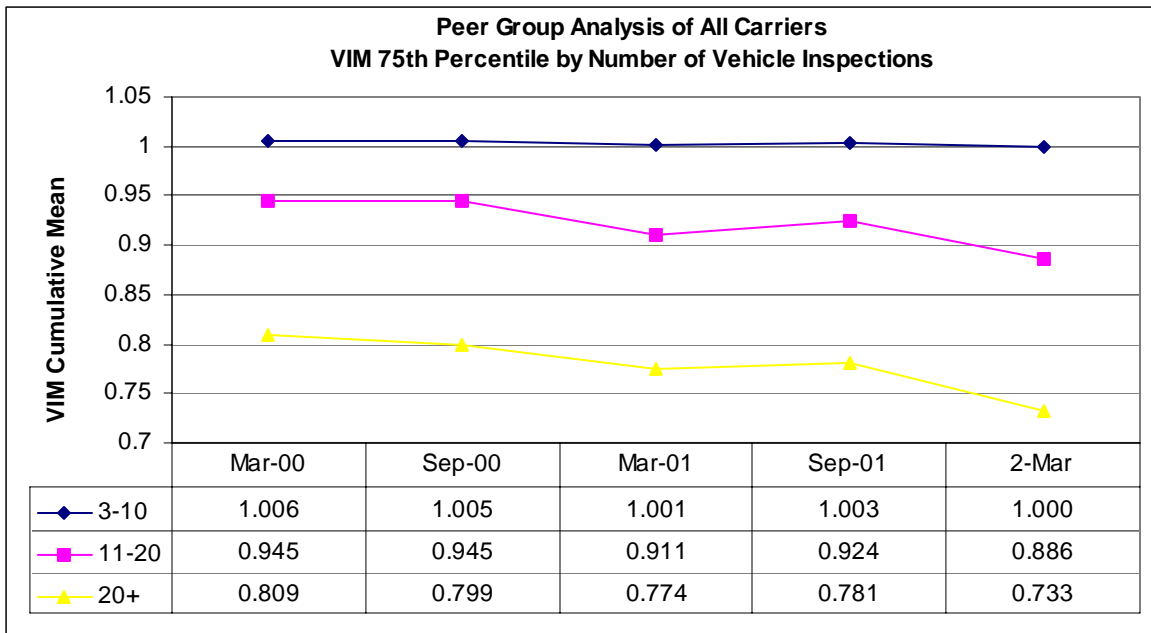
The peer group analysis for the VIM was conducted by grouping carriers with similar amounts of inspections using the peer grouping used in SafeStat (i.e., carriers with 3-10, 11-20, and 21+ vehicle inspections). Figures 7-2 and 7-3 show decreasing trends in VIM percentile values. All of the inspection peer groups show steady decreasing trends for both 50<sup>th</sup> and 75<sup>th</sup> percentiles, overall demonstrating a decrease in the range of 6.2% to 9.7% since the March 2000 SafeStat run. The only exception is the 75<sup>th</sup> percentile values of the 3-10 inspection peer group showing little change over the analysis time period.



**Figure 7-1: VIM Cumulative Mean- All Carriers**



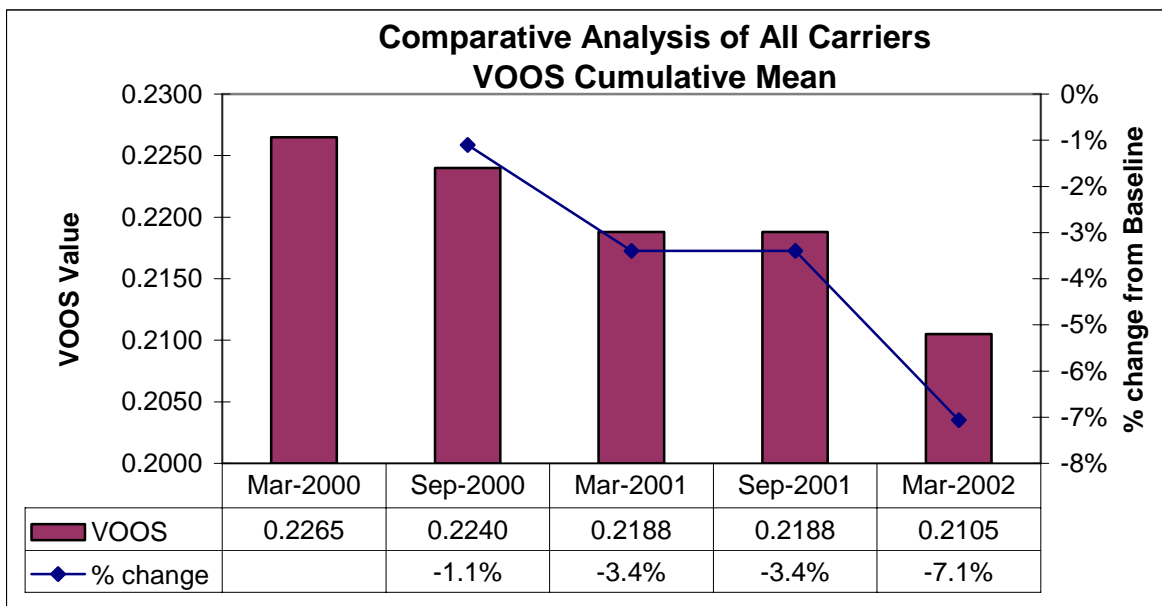
**Figure 7-2: VIM Peer Group Analysis- 50<sup>th</sup> Percentile**



**Figure 7-3: VIM Peer Group Analysis- 75<sup>th</sup> Percentile**

## 7.2 Vehicle Out-of-Service (VOOS) Rate

The VOOS rate is the number of vehicle OOS inspections normalized by the number of vehicle inspections over the past 30 months for the entire carrier population. It is similar to the “cumulative mean VIM” but the VOOS rate is not time weighted nor does it account for multiple VOOS violations from a single inspection. The following figure shows that the VOOS rate has been steadily decreasing. The total decrease in the VOOS rate between the baseline date of March 2000 and March 2002 is 7.1%.



**Figure 7-4: Vehicle Out-Of-Service Rate**

### 7.3 Post-Crash Inspection VOOS Rate

The Post-Crash Inspection VOOS rate is based on the results of the subset of inspections conducted on the vehicles after being involved in a reportable crash. The VOOS is the fraction of post-crash inspections with VOOS violations. The analysis of vehicle violations during post-crash inspections is based on the MCMIS cut from the March 2002 SafeStat run and is calculated on an annual basis. The 2002 results may change in subsequent releases of this report, since data were available only through March 2002. The post-crash vehicle OOS rate has decreased by 16.2% while the percentage of post-crash inspections with any vehicle violations decreased by 3.5% for the three years examined.

**Table 7-2: Post-Crash Inspection VOOS Rate**

Year	% of Post-Crash Inspections with Vehicle OOS Violations	% With any Vehicle Violations
2000	33.38	61.80
2001	32.87	62.96
2002	27.95	59.61

### 7.4 Summary

All metrics used to measure progress of the safety objective “Commercial Motor Vehicles have Optimum Safety Performance” show decreases from the March 2000 baseline values to March 2002 (see Table 7-3). This denotes a positive trend for this safety objective. Assuming fewer vehicle violations are being discovered due to improved industry compliance with the FMCSRs, these results indicate that FMCSA is moving toward its objective of all CMVs having optimum safety performance.

**Table 7-3: Summary of Progress Towards CMVs having Optimum Safety Performance**

Metrics to Measure Progress	Study Type	Peer Grouping	# Of Consecutive Periods with Improving Trend	% Change from baseline
VIM	Comparative Analysis		1	-8.9%
	Peer Grouping by number of inspections 50 <sup>th</sup> Percentile	3-10	1	-8.0%
		11-20	3	-9.1%
		20+	1	-9.7%
	Peer Group by number of inspections 75 <sup>th</sup> Percentile	3-10	1	-0.6%
		11-20	1	-6.2%
		20+	1	-9.4%
VOOS	Comparative Analysis		4	-7.1%
Post-Crash Inspection VOOS	Comparative Analysis		2	-16.2%

## 8 Summary of the Results to Date and Plans for Updates

### 8.1 Summary of Results

This report contains the results for five SafeStat runs from March 2000 to March 2002. All metrics were benchmarked to the March 2000 SafeStat run results and updated on a semiannual basis. Overwhelmingly, the analyses/metrics in this report show that FMCSA is moving in a positive direction with respect to meeting its stated safety objectives, and ultimately, is on target to achieve its safety goal. In nearly all cases, the trends of the metrics demonstrate an improvement from the baseline period of March 2000 to the most current period measured (March 2002). A summary of the results by FMCSA safety objective follows:

#### *General Objective: Reduction in Commercial Motor Vehicle Crashes*

- All three crash metrics showed significant reductions in commercial motor vehicle crash involvement from the baseline ranging from 10% to 24%.
- The SafeStat peer-group analysis showed a reduction ranging from 6% to 24% in crash rates for all peer groups.

#### *Safety Objective: Commercial Motor Vehicle Drivers are Fully Qualified, Safe, Alert, and Healthy*

- All of the metrics revealed decreases in driver-related violations over the study period.
- Most of the metrics showed strong downward trends of driver-related violations with reductions of violation rates of about 10% from March 2000 to March 2002.

#### *Safety Objective: Improve the Safety and Performance of Non-commercial Drivers with Respect to Trucks*

- There was a reduction in single passenger/single large truck fatal crashes of 5.0% from 2000 to 2001, and
- A reduction of 5.4% in the number of such crashes where the passenger vehicle driver factors were recorded from 2000 to 2001.

#### *Safety Objective: Improve the Overall Safety Performance of the Motor Carrier Industry through Refined and Enhanced Management Systems*

- All three metrics reveal decreases in the number and extent of serious violations discovered during compliance reviews (CRs).
- The SafeStat-based measures show decreases of about 11% to 32% in violations of acute/critical regulations discovered.

#### *Safety Objective: Increase the Safety Performance of the Worst Offenders to Meet the Norm*

- Since the development and national employment of SafeStat, FMCSA has been able to target its resources on ‘high-risk’ or ‘worst offender’ carriers. The ‘worst offender’ carriers that were targeted for FMCSA’s CR program (i.e., SafeStat identified Category A/B carriers) demonstrated dramatic improvement in crash rate performance (reductions of 22% to 47%), in roadside inspection performance

- (violation rate reductions of 11% to 26%), and in safety compliance (CR-based violation rate reductions of 69% to 79%) within one-and-a-half years.
- The “worst offender” carriers that were targeted for the roadside inspection program (i.e., Inspection Selection System’s recommended “Inspect” carriers) also showed dramatic improvement in crash rate performance (reductions of 29%) and in roadside inspection performance (violation rate reductions of 9% to 15%) within one-and-a-half years.
  - The worst offenders of the most recent period (the Category A/B carriers identified in March 2002 SafeStat run) had lower crash rates (15% to 22% lower), lower inspection violations rates (12% to 20% lower), and lower CR violation rates (5% to 15% lower) than the Category A/B carriers identified in the baseline March 2000 run.

*Safety Objective: Commercial Motor Vehicles have Optimum Safety Performance*

- All of the metrics revealed decreases in vehicle-related violations over the study period.
- Industry-wide metrics based on vehicle out-of-service inspections showed a decrease in vehicle out-of service rates of about 7% to 9% from the baseline period of March 2000 to March 2002.
- The SafeStat peer-group analysis showed a reduction in vehicle violation rates of about 9% from March 2000 to March 2002

## **8.2 Plans for Updates**

While the results in this report show that the FMCSA is making strides toward meeting its safety objectives to ultimately achieve its goal of a 41% reduction in the large truck fatality rate by 2008, it is important to continue to monitor progress. This monitoring allows FMCSA to (1) adjust its safety programs based on where the most improvement is needed, and (2) observe the results of its efforts. Most of the analyses/metrics presented in this report are based on safety data used in semiannual SafeStat runs done in March and September. The results in this report are current through March 2002. Revisions of this document are planned that will contain updates of the results and further analysis of progress in attaining FMCSA’s safety objectives.