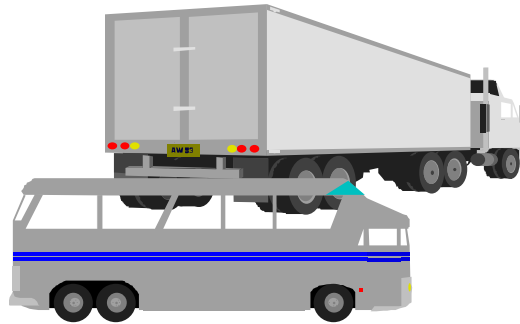


New Entrant Safety Research

Final Report

April 1998



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PREFACE

This report documents a study of the safety performance and compliance of motor carriers entering interstate service, i.e., new entrants, and the possible need for a new entrant prequalification and monitoring program. The study 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 Federal Highway Administration's (FHWA) Office of Motor Carriers (OMC). The concept of a new entrant program originated from a larger research project at the Volpe Center, the goal of which was to define an improved process for motor carrier safety fitness determination and assurance for the OMC. A new entrant program was as identified as one of the potential components of the proposed improved process.¹

This study also updates and expands earlier research conducted by Dr. Thomas Corsi of the University of Maryland Business School. As part of a study of the impacts of motor carrier deregulation in the 1980's, Dr. Corsi analyzed the safety performance and compliance of authorized for-hire carriers, comparing new entrants to experienced carriers. The Volpe study updated Dr. Corsi's research using the latest available data, and expanded the population under study to include all classifications of motor carriers, not just authorized for-hire carriers. The Volpe study also incorporated additional methodologies and included a study of the accuracy of some of the underlying data. The results of the investigation were assessed and used to make recommendations regarding the need for a new entrant program, the form such a program would have, and related issues.

At the OMC, the project was managed by Dale Sienicki of the Office of Motor Carrier Information Analysis. The Volpe Center technical project manager was Donald Wright of the Economic Analysis Division in the Office of System and Economic Assessment. The analysis was performed at the Volpe Center by Jon Ohman, with assistance from Dr. Corsi, under contract to the Volpe Center.

¹ "Motor Carrier Safety Fitness Determination - Proposals for an Improved Process," July 1997.

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EXECUTIVE SUMMARY

Background

Deregulation of the motor carrier industry combined with a period of sustained economic growth have resulted in sizable increases in the number of new motor carriers entering into interstate operation (i.e., new entrants). The results of previous academic research have raised safety concerns about this rapid influx of new carriers.

For example, Professors Corsi (of the University of Maryland Business School) and Fanara (of the Howard University School of Business and Public Administration) analyzed data from compliance and safety reviews of carriers regulated by the Interstate Commerce Commission (ICC) that were conducted between September 1986 and April 1988. They found that new entrants with approximately three or fewer years of experience had significantly higher crash rates and lower rates of complying with (or having safety programs in place to comply with) the Federal Motor Carrier Safety Regulations (FMCSRs) than did more experienced carriers. The authors identified the existence of what they described as a safety learning curve for new entrants. That is, new carriers exhibit higher compliance rates and improved performance (i.e., lower crash rates) as they accumulate experience with safety management policies and procedures.

This report presents the results of research conducted by Donald Wright and Jon Ohman at the Research and Special Programs Administration's (RSPA) John A. Volpe National Transportation Systems Center (the Volpe Center), under a program plan agreement with the Federal Highway Administration's (FHWA) Office of Motor Carriers (OMC). The purpose of this investigation is to review the safety performance and regulatory compliance experience of the growing number of new entrant motor carriers. If the results of earlier investigations of the safety of new entrants can be confirmed, then there may be a need to review public policies in this area. Certainly, if new entrants have significantly higher regulatory non-compliance in the safety area and significantly higher crash rates, then there is reason to develop ways to mitigate this situation through education, monitoring, and enforcement programs. Furthermore, if the safety learning curve phenomenon can be substantiated, then there is reason to explore ways to shorten, reduce, or eliminate this learning curve.

Definition of a New Entrant

For the purposes of this study, a new entrant is an operator of large commercial vehicles initiating interstate operations or intrastate hazardous material or passenger operations, becoming subject to the FMCSRs, and registering with the United States Department of Transportation (USDOT). A new entrant can be either:

- 1) a recently formed carrier initiating interstate operations (or intrastate hazardous material or passenger operations), or

- 2) a previously operating carrier initiating interstate operations (or intrastate hazardous material or passenger operations) for the first time.

Overview of the Research

This research was designed to update the earlier Corsi-Fanara Study results using the latest and most complete data available, and expand the coverage to include all carriers, not just the ICC-regulated (for-hire) carriers included in the original study. Two analyses were performed to confirm the existence of a safety performance (i.e., crash rate) learning curve, while one study was performed to confirm the existence of a safety regulation compliance learning curve. In all three analyses, the age of the carrier was calculated from the date that the carrier's DOT registration Form MCS-150 information was entered into the Motor Carrier Management Information System (MCMIS) Census File. A supplementary study was performed that examined the validity of that date as the true start date of operations. Finally, there was also a survey of new entrant education programs being conducted by the states.

Crash Rate Analyses

Two studies were performed to confirm the existence of a safety performance (i.e., crash rate) learning curve: the Compliance Review Crash Rate Analysis and the State-Reported NGA Crash Rate Analysis.

The Compliance Review Crash Rate Analysis used data from compliance reviews that were conducted between April 1993 (when the USDOT definition of a crash changed) and June 1997 (the latest data available at the time this study was conducted). The data were broken out according to the age of the carrier at the time of the review. Weighted mean, or overall, crash rates (recordable crashes per million vehicle miles traveled (VMT) weighted by VMT) were calculated for each age group. This calculation is equivalent to calculating the aggregate crash rate in each group, i.e., dividing the total crashes in the group by the total VMT in the group and multiplying by 1 million.

The State-Reported NGA Crash Rate Analysis used calendar year 1996 NGA crash data from the MCMIS Crash File and power unit data from the MCMIS Census File to calculate crash rates by age of carrier. The analysis included only carriers with non-zero power unit values that had received compliance or safety reviews since April 1, 1993 (when the USDOT crash definition changed), so that power unit information that was more current than the original Form MCS-150 information would be available.

The data were broken out into groups, based on the year the carrier registered with the USDOT, i.e., the year the carrier's Form MCS-150 information was entered into the MCMIS Census File. Weighted mean, or overall, crash rates (NGA crashes per power unit weighted by power units) were calculated for all age groups. This calculation is equivalent to calculating the aggregate crash rate in each group, i.e., dividing the total number of NGA crashes in the group by the total number power units in the group.

Each analysis was first performed using data for all carriers. The analyses were then repeated using data only for authorized for-hire carriers, as in the Corsi-Fanara Study, to determine if the learning curve effect holds only for that carrier classification.

Although the most experienced carriers usually had the lowest overall crash rate, the results of the analyses do not indicate the presence of a safety learning curve. The declines in crash rates from the least experienced carriers to the most experienced carriers exhibited patterns of variability, rather than the steady progressions that are characteristic of learning curves.

Compliance Analysis Using Acute/Critical Regulation Violations

To examine the existence of a safety regulation compliance learning curve, a study was performed using data on violations of acute and critical regulations from compliance reviews. The study used data from compliance reviews that were conducted between October 1994 (when acute/critical regulations were first used to evaluate the five regulatory factors in a compliance review) and June 1997 (the latest data available at the time this study was conducted).

The data were broken out according to the age of the carrier at the time of the review. The data were also broken out by SafeStat Safety Evaluation Area (SEA), either Driver or Safety Management. For each SEA/age group combination, the average number of violations of acute regulations per thousand interstate drivers and the average number of patterns of violations of critical regulations per thousand interstate drivers were calculated.

The results indicate a substantial age-related pattern of compliance, i.e., the numbers of violations of acute regulations and patterns of violations of critical regulations in both SEAs were substantially higher for new entrants than for more experienced carriers. Furthermore, the rates declined in steady progression across age groups, showing clear evidence of a safety regulation compliance learning curve.

Start Date Study

A supplementary study was performed that addressed the issue of the accuracy of the determination of carrier age used in the above studies. An underlying assumption of these studies, necessarily, was that the date a carrier's information is entered into the MCMIS Census File as a result of its filing Form MCS-150 is equivalent to its date of entry into interstate operations. This necessary assumption resulted from the absence of alternative data on which to base an age calculation. There was a concern, however, that there was a difference between the date a carrier entered interstate service and the date it was added to the MCMIS Census File. As a result, using the date of entering the MCMIS Census File as the date of entry into interstate operations may have classified some carriers as new entrants that, in fact, were not new entrants, but experienced carriers that had only recently been added to the MCMIS Census File. These carriers may have been operating intrastate or been unaware of the USDOT interstate registration requirement.

Furthermore, there was a concern that this alleged discrepancy varied by industry segment—i.e., it was thought that the discrepancy was greater for private and exempt for-hire operators than it was for authorized for-hire carriers. Therefore, it was theorized that experienced private and exempt for-hire carriers were more likely to have been misclassified as new entrants in the studies than were experienced authorized for-hire carriers.

To investigate these issues, the Volpe Center conducted a sample survey of new entrants (i.e., carriers whose submitted USDOT registration forms (Form MCS-150) were entered into the MCMIS Census File between May and August 1996) in the Census File. Each respondent was asked to verify information from its submitted Form MCS-150 and indicate when it began 1) any motor carrier service and 2) interstate service.

The results of the study indicate that private carriers² were significantly more likely to delay registering with the USDOT after initiating any or interstate service than were authorized for-hire or exempt for-hire carriers. In addition, the mean time differences between the initiation of any and interstate service and the addition to the MCMIS Census File for private carriers were much greater than the comparable time differences for authorized for-hire carriers or exempt for-hire carriers.

Another finding of the Start Date Study is that some respondents did not understand the meanings of terms used by the OMC such as, motor carrier, power unit, interstate/intrastate, and hazmat. Many carriers were confused by the operation classifications, i.e., authorized for-hire, exempt, for-hire, private, etc. Many carriers answered the classification questions on their survey questionnaires differently than on their registration forms.

Many of the carriers that did not understand these terms were private carriers. In fact, many of the private carriers contacted for the study said that, while they recognized that they operated large commercial vehicles, they did not consider themselves to be motor carriers, but rather they identified themselves by their primary businesses (e.g., contractors, manufacturers, retailers, etc.) instead.

Assess State Education Programs

As part of this investigation, the OMC regional offices were asked to provide information about any state new entrant education programs in their regions. The objectives were to both learn from those experiences and develop a federal program that is complementary and not duplicative. Although the information resulting from this effort was limited, some summary findings are:

- 1) Only a few states have specific safety education programs for new entrants. These programs range from mandatory seminars to educational material being mailed to new entrants.

² In this study, “private” carriers included the classifications private, private passenger (business), and private passenger (non-business).

- 2) Many other states conduct educational seminars which are open to, but not limited to, new entrants. These seminars may include non-safety-related information such as licensing regulations and requirements of state and federal agencies.
- 3) Many states will provide assistance regarding safety regulations and requirements to individual carriers (including, but not exclusively for, new entrants) upon request.

Recommendations

Education and Monitoring Program

In view of the safety regulation compliance learning curve found in the investigation, it is recommended that a consistent federal program for new entrants be considered that focuses on education and monitoring. Carriers appear to “learn” about regulatory compliance through experience. The rates of noncompliance decrease in a steady progression as carrier age increases. There is good reason to believe, therefore, that interventions with effective education and training programs at the time of interstate service initiation can shorten the compliance learning curve and increase the speed at which new carriers come into compliance with the FMCSRs. The program would also collect necessary information on new carriers and monitor their safety performance and compliance more intensely than under current OMC procedures. This additional surveillance would provide additional insight into the safety status of new entrants, because of the increased amount of safety data obtained.

Modifications to Form MCS-150

The inconclusive results of the crash rate studies may have been caused, in part, by the inability to accurately determine what carriers were actually new entrants. The problem impacts the analysis of new carriers, since it mixes some experienced carriers in with the new entrant pool. To address this issue, it is recommended that two questions be added to Form MCS-150:

- 1) Date of initiation of any motor carrier operations
- 2) Date of initiation of interstate operations

It is also recommended that Form MCS-150 also be revised to make it more understandable to all affected operators of large commercial vehicles. These revisions should include printing definitions in boldface to make them more noticeable and using the term “large commercial vehicle operator” in lieu of “motor carrier” (which implies the carriage of goods for hire). This term would better indicate that for-hire carriers are not the only commercial vehicle operators that have to register with the USDOT.

Update Form MCS-150 Information

In the State-Reported NGA Crash Rate Analysis, crash rates were calculated using power unit data from the MCMIS Census File. This power unit information comes from a carrier’s original Form MCS-150, and is usually only updated if and when the carrier undergoes a compliance review. Due to the volatile nature of the industry, and the infrequent updating of basic carrier information (e.g., number of power units), the power unit data in the Census File for many

carriers may not be accurate. Therefore, crash rates calculated using these data may also be inaccurate.

Therefore, it is recommended that procedures be established for carriers to regularly and consistently update their Form MCS-150 information (perhaps in conjunction with state vehicle registration), so that accurate carrier power unit data will be available for use in crash rate studies.

1. BACKGROUND

1.1. INTRODUCTION

The Federal Highway Administration's (FHWA) Office of Motor Carriers (OMC) has devoted considerable resources toward reducing the frequency and severity of truck crashes. Their approach has been multidimensional, involving a combination of roadside inspections, on-site carrier reviews, and directed enforcement cases against individual carriers. This combined approach has been needed to deal with an expansion in the number of motor carriers due both to the nation's fast-paced economic growth and the enhanced competitive environment for transportation services as a result of deregulation.

The increasing number of new motor carriers focuses attention on a problem discovered in previous academic research. Previous academic studies found that the safety performance and regulatory compliance of motor carriers just starting in business were significantly worse than were the performance and compliance of more experienced carriers. In fact, the authors identified the existence of what they described as a safety learning curve for new entrants. That is, new carriers exhibit higher compliance rates and improved performance (i.e., lower crash rates) as they accumulate experience with safety management policies and procedures. The authors recommended that some type of special attention be given to new entrants so as to expedite the learning process and minimize the number of crashes in the learning period.

This report presents the results of research conducted at the Research and Special Programs Administration's (RSPA) John A. Volpe National Transportation Systems Center (the Volpe Center), under a program plan agreement with the Office of Motor Carriers (OMC). The purpose of this investigation is to review the safety performance and regulatory compliance experience of the growing number of new entrant motor carriers in an era of deregulation and sustained economic growth. There are legitimate questions about the experiences of new entrant carriers. If the results of earlier investigations can be confirmed, then there may be definite public policy concerns with respect to new entrants. Certainly, if new entrants have significantly higher regulatory non-compliance in the safety area and significantly higher crash rates, then there is reason to develop ways to mitigate this situation through education, monitoring and enforcement programs. This research would explore ways to shorten, reduce, or eliminate this learning curve. This investigation examines both the need for and the possible elements of a program to improve the safety performance and regulatory compliance of new entrants.

1.2. DEFINITION OF A NEW ENTRANT

Any discussion of new entrants and/or new entrant programs requires a definition of a new entrant in order to avoid any misunderstanding or confusion. As a result, within the context of this investigation, a new entrant is a motor carrier:

- 1) initiating interstate operations or intrastate hazardous material or passenger operations, and
- 2) becoming subject to the Federal Motor Carrier Safety Regulations (FMCSRs), in particular, Part 385 - Safety Fitness Procedures, and the Hazardous Materials Regulations (HMRs), and
- 3) registering with the United States Department of Transportation (USDOT) using Form MCS-150, Motor Carrier Identification Report.

Within this context, then, a new entrant can be either:

- 1) a recently formed carrier initiating interstate operations (or intrastate hazardous material or passenger operations), or
- 2) a previously operating carrier initiating interstate operations (or intrastate hazardous material or passenger operations) for the first time.

Carriers fitting this definition are the basis of this current investigation. It is the experience of these carriers, initiating expanded interstate operations, or, alternatively, intrastate hazardous material or passenger operations, that are this study's focal point.

1.3. PREVIOUS RESEARCH - CORSI-FANARA STUDY

The Corsi-Fanara Study¹ used data from OMC compliance and safety reviews of carriers regulated by the Interstate Commerce Commission (ICC) (which, by definition, were authorized for-hire carriers) as a basis for examining the safety performance of new entrants. These reviews were conducted between September 1986 and April 1988. The authors split their data into three groups, based on a carrier's date of initial ICC certification:

- 1) Carriers certified on or after January 1, 1985, i.e., carriers with approximately 3 or fewer years of experience,
- 2) Carriers certified between July 1, 1980 and December 31, 1984, i.e., carriers with

¹ Thomas M. Corsi and Philip Fanara, Jr., "Deregulation, New Entrants, and the Safety Learning Curve," *Journal of the Transportation Research Forum*, Vol. XXIX, No. 1, 1988, pp. 3-8.

approximately 3 to 6 years of experience,

- 3) Carriers certified before July 1, 1980 (the date of passage of the Motor Carrier Act of 1980), i.e., carriers with approximately more than 6 years of experience.

The safety performance and regulatory compliance of each group were analyzed to determine whether significant differences existed among the three groups of carriers and, as a result, whether there was any evidence of a new entrant safety performance and/or compliance problem. Figures 1-1 and 1-2 show some of the results of this analysis. In each graph, the newest entrants are shown on the left-hand side. The data for these graphs are shown in Appendix 1.

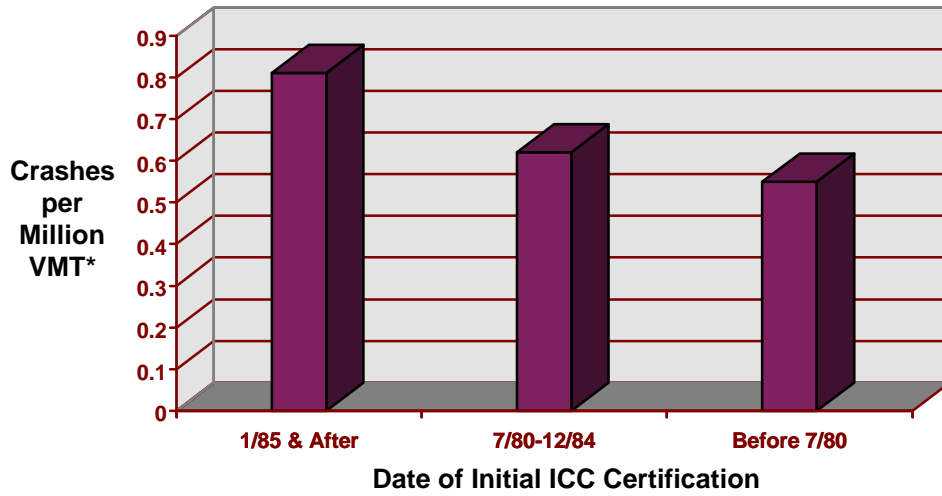
Figure 1-1 shows the mean reportable crash rate (crashes per million vehicle miles traveled (VMT)) for each group. Figure 1-2 displays the percentage of each group that had a system to effectively control hours of service, the percentage of each group that was complying with vehicle inspection procedures, and the percentage in each group that had a driver safety training program. In each case, the newest entrants, i.e., those certified on or after January 1, 1985, exhibited significantly poorer safety performance or regulatory compliance than did the carriers that had been certified earlier (i.e., had been operating longer). In other words, the newest entrants were more likely to be involved in crashes and less likely to comply with (or to have systems in place to comply with) the FMCSRs than were the more experienced carriers.

Based on these findings, Professors Corsi and Fanara identified the existence of what they described as a safety learning curve. That is, new entrants exhibited higher compliance levels and improved safety performance (i.e., lower crash rates) as they accumulated experience with safety management policies and procedures. The authors recommended that special attention be given to new entrants so as to expedite the learning process and minimize the number of crashes in the learning period, i.e., shorten the safety learning curve. They specifically recommended that the ICC, at that time responsible for new entrant certification, require as part of its certification process for new entrants that a carrier demonstrate the existence of a comprehensive risk management program prior to its certification.

1.4. OVERVIEW OF CURRENT RESEARCH

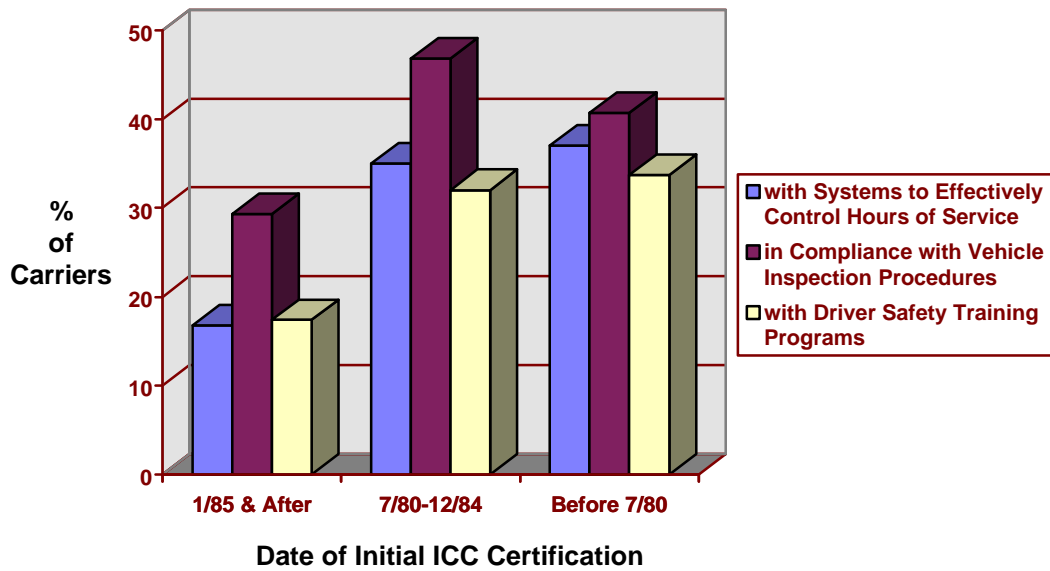
The Corsi-Fanara Study was intended to assess the impact of economic deregulation on safety and was restricted to an analysis of a selected group of ICC-regulated carriers. The research described in this report updates and expands the Corsi-Fanara Study to determine whether or not the safety performance and regulatory compliance of a wider group of carriers display evidence of safety learning curves. It uses the latest and most complete data available, and focuses specifically on regulatory compliance and crash rates as they relate to a motor carrier's time in interstate operations.

**Figure 1-1 -
Mean Crash Rate
by Date of Initial ICC Certification**



* - Reportable Crashes per Million Vehicle Miles Traveled (VMT)

**Figure 1-2 -
Compliance Rates
by Date of Initial ICC Certification**



The research is presented in Sections 2, 3, and 4 as follows:

2. Confirm Findings of Previous Studies
 - 2.1. Update and Expand Earlier Studies
 - 2.1.1. Compliance Review Crash Rate Analysis
 - 2.1.2. State-Reported NGA Crash Rate Analysis
 - 2.1.3. Compliance Analysis Using Acute/Critical Regulation Violations
 - 2.2. Conduct Start Date Study
3. Determine Need for New Entrant Program
 - 3.1. Assess Results of Studies
 - 3.2. Review State Education Programs
4. Recommendations
 - 4.1. Education and Monitoring Program
 - 4.2. Modifications to Form MCS-150
 - 4.3. Update Form MCS-150 Information

Two studies were performed to confirm the existence of the safety performance learning curve found in the Corsi-Fanara Study. One study used recordable crash data collected during compliance reviews, as did the Corsi-Fanara Study, while the other study used reportable crash data reported to the OMC by the states according to the NGA (National Governors' Association) standard.

To confirm the existence of the regulatory compliance learning curve found in the Corsi-Fanara Study, a study was performed using data on violations of acute and critical regulations from compliance reviews.

A supplementary study, the Start Date Study, was performed to examine the issue of the accuracy of calculating carrier age in the above studies.

The results of the above studies as well as the results of a review of current state new entrant education programs were assessed to determine the need for a new entrant program.

2. CONFIRM FINDINGS OF PREVIOUS STUDIES

2.1. UPDATE AND EXPAND PREVIOUS STUDIES

The Volpe Center, with assistance from Professor Thomas Corsi, a co-author of the Corsi-Fanara Study, conducted research to update and expand the Corsi-Fanara Study. This research was designed to 1) update the Corsi-Fanara Study using the latest and most complete data available, and 2) expand the research to include all carriers, not just the ICC-regulated carriers included in the original study. By definition, ICC-regulated carriers were authorized for-hire carriers.

To confirm the existence of a safety performance (i.e., crash rate) learning curve, two studies were performed. One study used recordable crash data collected during compliance reviews, as did the Corsi-Fanara Study, while the other study used reportable crash data reported to the OMC by the states according to the NGA (National Governors' Association) standard.

To confirm the existence of a safety regulation compliance learning curve, a study was performed using data on violations of acute and critical regulations from compliance reviews.

2.1.1. Compliance Review Crash Rate Analysis

To confirm the existence of the safety performance learning curve found in the Corsi-Fanara Study, two studies were performed as part of the current investigation. The first study, the Compliance Review Crash Rate Analysis, used data from 23,575 compliance reviews that were conducted between April 1, 1993 (when the USDOT definition of a crash changed¹) and June 2, 1997 (the latest data available at the time this study was conducted). The data were broken out according to the age of the carrier at the time of the review. The age of the carrier was calculated from the date that the carrier's Form MCS-150 information was entered into the Motor Carrier Management Information System (MCMIS) Census File. (Carriers are required to file Form MCS-150 within 90 days of beginning interstate operations.) This date was used as the best available approximation of the date that the carrier began interstate operations. The only time that a discrepancy would exist would result from a carrier's delay in filing Form MCS-150.

¹ Effective March 4, 1993, 49 CFR Part 394 of the FMCSRs was removed. The term "reportable accident" that was in Part 394 was replaced by a definition of the term "accident," which appears in Section 390.5, Definitions, as follows: (A recordable accident) is "an occurrence involving a commercial motor vehicle operating on a public road which results in a fatality; bodily injury to a person who, as a result of the injury, immediately receives medical treatment away from the scene of the accident; or one or more motor vehicles incurring disabling damage as a result of the accident, requiring the vehicle to be transported away from the scene by a tow truck or other vehicle."

The data were broken out into ten groups based on the age of the carrier at the time of the review:

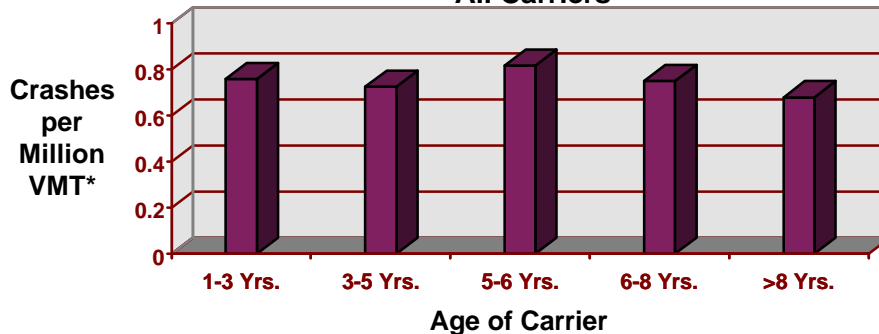
X = Age of carrier at review	
$1 < X \leq 2$	Greater than 1 year and less than or equal to 2 years
$2 < X \leq 3$	Greater than 2 years and less than or equal to 3 years
...	
$9 < X \leq 10$	Greater than 9 years and less than or equal to 10 years
$10 < X$	Greater than 10 years

Weighted mean, or overall, crash rates (recordable crashes per million vehicle miles traveled (VMT) weighted by VMT) were calculated for each age group. This calculation is equivalent to calculating the aggregate crash rate in each group, i.e., dividing the total crashes in the group by the total VMT in the group and multiplying by 1 million.

A crash rate was not calculated for carriers of age 1 year or less. When a carrier less than 1 year old receives a compliance review, it provides an estimate of its annual vehicle miles traveled (VMT), but only the actual number of crashes that have occurred up to the time of the review. Thus, the crash rate for that carrier is calculated using a full year of VMT data, but only a partial year of crash data. Therefore, the crash rate for this age group would have been artificially low. For this reason, the 0-1 year group was not included in the analysis.

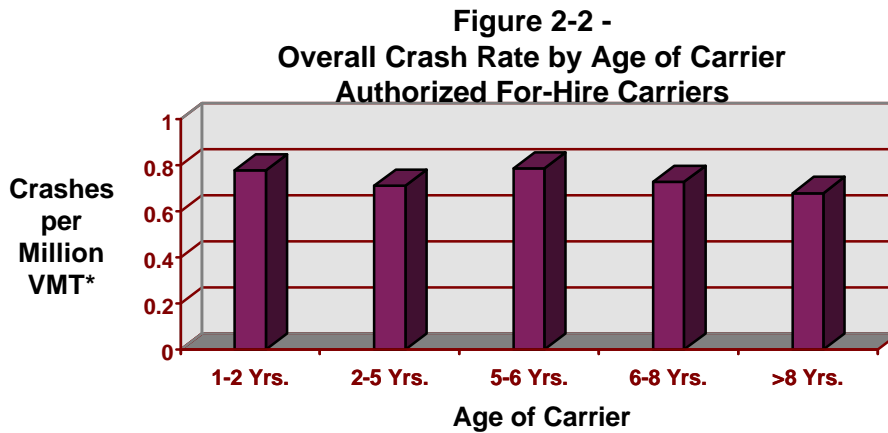
After rates were calculated for each of the ten groups, adjacent groups with comparable rates were combined. The results, as shown in Figure 2-1, do not indicate the presence of a safety learning curve, although the most experienced (>8 years) carriers did have the lowest crash rate. The decline in crash rates from the least experienced (1-3 years) carriers to the most experienced (>8 years) carriers exhibits a pattern of variability, rather than the steady progression that is characteristic of a learning curve. In fact, the least experienced (1-3 years) carriers did not have the highest crash rate. A table showing the results for each age group can be found in Appendix 2.

**Figure 2-1 -
Overall Crash Rate by Age of Carrier
All Carriers**



* - Recordable Crashes per Million Vehicle Miles Traveled (VMT) Weighted by Vehicle Miles Traveled (VMT)

This analysis used data on all carriers, while the Corsi-Fanara Study used data on only ICC-regulated carriers, which by definition were authorized for-hire carriers. To determine if the learning curve effect holds for only authorized for-hire carriers, the analysis was repeated using data for only authorized for-hire carriers. The results, as shown in Figure 2-2, are similar to the results for all carriers. Although the most experienced (>8 years) carriers had the lowest crash rate, the least experienced (1-2 years) carriers did not have the highest crash rate. Furthermore, the decline in crash rates does not exhibit the steady progression of a learning curve. A table showing the results for each age group can be found in Appendix 2.



* - Recordable Crashes per Million Vehicle Miles Traveled (VMT) Weighted by Vehicle Miles Traveled (VMT)

Therefore, the results of the Compliance Review (Recordable) Crash Rate Analysis do not confirm the finding of the Corsi-Fanara Study that a safety performance learning curve exists. The results, however, do suggest that new entrants, in the initial years of interstate operations, have higher crash rates than do the most experienced carriers.

2.1.2. State-Reported NGA Crash Rate Analysis

The second study performed as part of the current investigation to confirm the existence of the safety performance learning curve found in the Corsi-Fanara Study was the State-Reported NGA Crash Rate Analysis. In this study, calendar year 1996 NGA crash data from the MCMIS Crash File and power unit data from the MCMIS Census File were used to calculate crash rates by age of carrier.

The analysis included only carriers with non-zero power unit values that had received compliance or safety reviews since April 1, 1993 (when the USDOT crash definition changed), so that power unit information that was more current than the original Form MCS-150 information would be

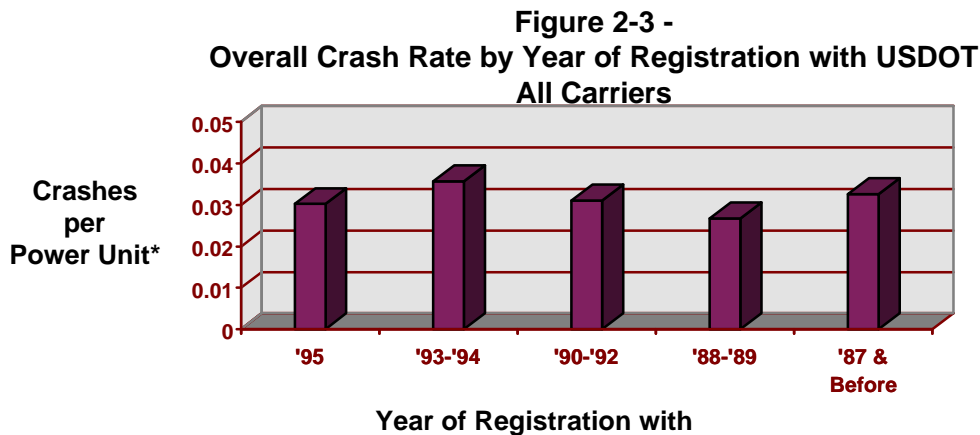
available. It should be noted that power unit information is routinely updated as part of the review process. However, the longer the passage of time between the filing of Form MCS-150 and the review, the more unreliable the original power unit information is likely to be.

The data were broken out into ten groups, based on the year the carrier registered with the USDOT, i.e., the year the carrier's Form MCS-150 information was entered into the MCMIS Census File:

1995, 1994, 1993, ..., 1987, and 1986 and earlier.

Weighted mean, or overall, crash rates (NGA crashes per power unit weighted by power units) were calculated for all age groups. This calculation is equivalent to calculating the aggregate crash rate in each group, i.e., dividing the total number of NGA crashes in the group by the total number of power units in the group.

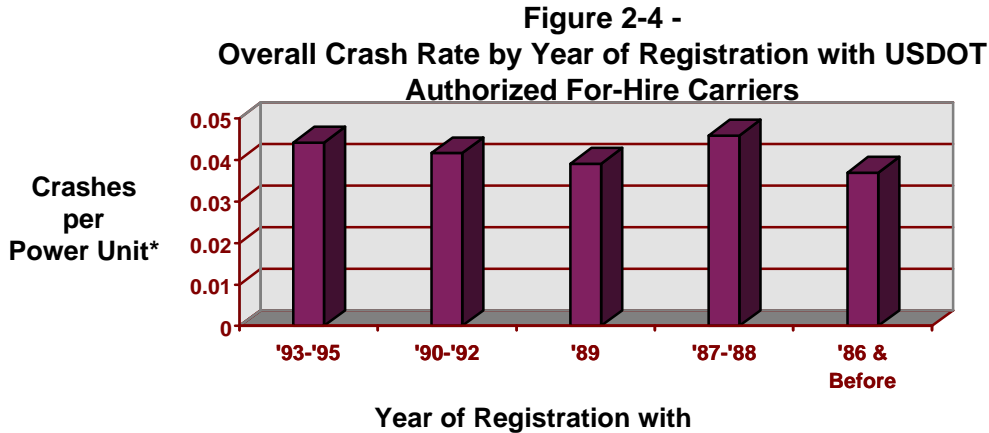
After rates were calculated for each of the ten groups, adjacent groups with comparable rates were combined. As shown in Figure 2-3, no age-related pattern was found. The least experienced (registered in 1995) carriers did not have the highest crash rate, nor did the most experienced (registered in 1987 or before) carriers have the lowest crash rate. In fact, the most experienced carriers had a higher crash rate than the least experienced carriers. The graph represents data from 28,507 carriers. A table showing the results for each age group can be found in Appendix 3.



* - Recordable Crashes per Power Unit Weighted by Power Units

As in the Compliance Review Crash Rate Analysis, this analysis was repeated using data for only authorized for-hire carriers to see if an age/crash rate pattern existed only for this classification of carriers. As shown in Figure 2-4, with the exception of the carriers registered in 1987-1988, crash rates declined with carrier age. The least experienced (registered in 1993-1995) carriers had the highest crash rate (except for the carriers registered in 1987-1988), while the most

experienced (registered in 1986 or before) carriers had the lowest crash rate. The graph represents data from 12,620 (authorized for-hire) carriers. A table showing the results for each age group can be found in Appendix 3.



* - Recordable Crashes per Power Unit Weighted by Power Units

In general, therefore, the results of the State-Reported NGA Crash Rate Analysis suggest, in the case of authorized for-hire carriers, that there may be a safety performance learning curve and that carriers that recently began interstate operations have higher crash rates than do more experienced carriers. However, the age/crash rate patterns are not consistent or pronounced, and these results alone are not a compelling argument for a new entrant safety program. Furthermore, these results may be compromised by inaccurate carrier age estimates. This was shown by the results of the Start Date Study, which assessed the accuracy of the age of the carrier based on the filing date (registration) of Form MCS-150 by interstate carriers (See Section 2.2.).

2.1.3. Compliance Analysis Using Acute/Critical Regulation Violations

To examine the existence of a safety regulation compliance learning curve, a study was performed using data on violations of acute and critical regulations from compliance reviews. The study used data from 23,016 compliance reviews that were conducted between October 1, 1994 (when acute/critical regulations were first used to evaluate the five regulatory factors in a compliance review²) and June 2, 1997 (the latest data available at the time this study was conducted). The

² Effective October 1, 1994, the OMC modified its Safety Fitness Rating Methodology, used to measure the safety fitness of motor carriers against the safety standard, by initiating the use of violations of the safety regulations designated as “acute” or “critical” to rate each of the five regulatory factors evaluated when performing a compliance review at a carrier’s place of business. Acute regulations are those where noncompliance is so severe (and avoidable by the attentive motor carrier) that its occurrence is itself demonstrable of the absence of effective safety management controls. There is zero tolerance for violations of these regulations. An example of an acute

data were broken out according to the age of the carrier at the time of the review. The age of the carrier was calculated from the date that the carrier's Form MCS-150 information was entered into the MCMIS Census File. This date was used as the best available approximation of the date that the carrier began interstate operations.

The data were broken out into eleven groups, based on the age of the carrier at the time of the review:

X = Age of carrier at review	
$0 < X \leq 1$	Less than or equal to 1 year
$1 < X \leq 2$	Greater than 1 year and less than or equal to 2 years
...	
$9 < X \leq 10$	Greater than 9 years and less than or equal to 10 years
$10 < X$	Greater than 10 years

The data were also broken out by SafeStat Safety Evaluation Area (SEA), either Driver or Safety Management.³

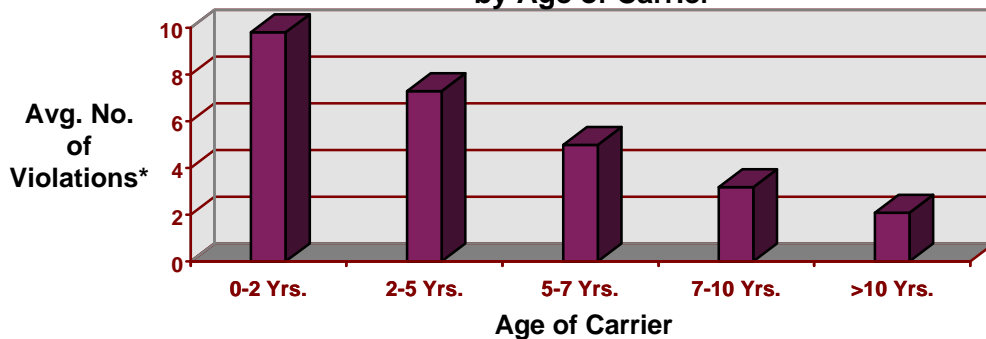
For each SEA/age group combination, the average number of violations of acute regulations per thousand interstate drivers and the average number of patterns of violations of critical regulations per thousand interstate drivers were calculated. The results for the Driver SEA are shown in Figures 2-5 and 2-6. The results for the Safety Management SEA are shown in Figures 2-7 and 2-8. Tables showing the results for every age group in each SEA can be found in Appendix 4.

The results show a substantial age-related pattern of compliance, i.e., the numbers of violations of acute regulations and patterns of violations of critical regulations in both SEAs were substantially higher for new entrants than for more experienced carriers. Furthermore, the rates declined in steady progression across age groups, showing clear evidence of a safety regulation compliance learning curve.

regulation is 382.211, using a driver who has refused to submit to an alcohol or controlled substances test required under Part 382. "Critical" regulations are violated when there is a pattern of noncompliance. An example of a critical violation is 395.3(a)(1), requiring or permitting a driver to drive more than 10 hours. A "pattern" is defined as a number of violations (more than one) constituting 10 percent or more of the occasions where like violations could have occurred.

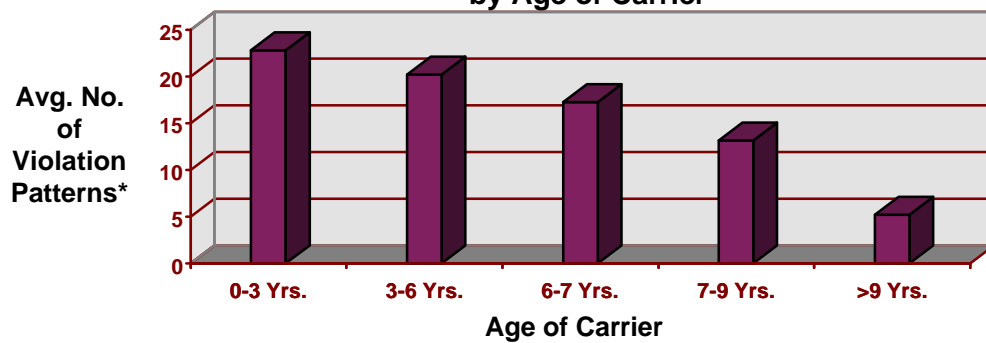
³ "SafeStat Motor Carrier Safety Status Measurement System, Methodology: Version 4," July 1997.

**Figure 2-5 -
Number of Violations of
Acute Driver Regulations
per 1,000 Drivers
by Age of Carrier**



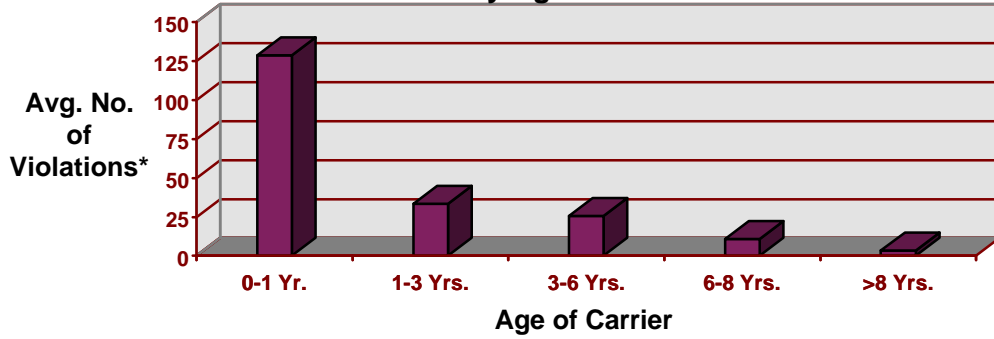
* - Violations per 1,000 Interstate Drivers Weighted by Interstate Drivers

**Figure 2-6 -
Number of Patterns of Violations of
Critical Driver Regulations
per 1,000 Drivers
by Age of Carrier**



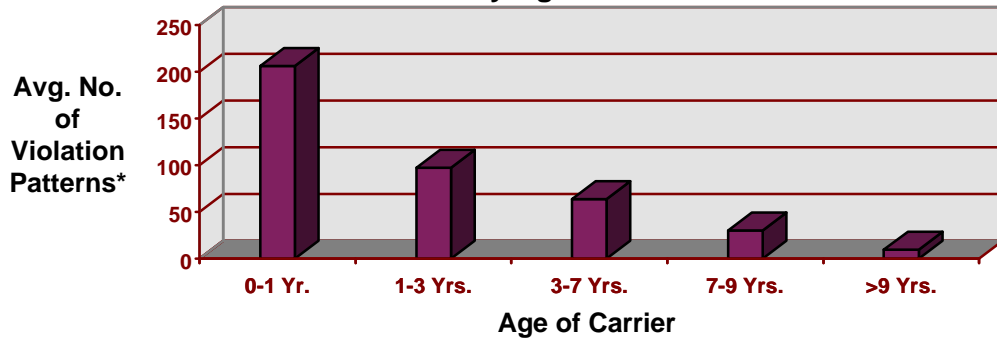
* - Patterns per 1,000 Interstate Drivers Weighted by Interstate Drivers

**Figure 2-7 -
Number of Violations of
Acute Safety Management Regulations
per 1,000 Drivers
by Age of Carrier**



* - Violations per 1,000 Interstate Drivers Weighted by Interstate Drivers

**Figure 2-8 -
Number of Patterns of Violations of
Critical Safety Management Regulations
per 1,000 Drivers
by Age of Carrier**



* - Patterns per 1,000 Interstate Drivers Weighted by Interstate Drivers

2.2. CONDUCT START DATE STUDY

A supplementary study was performed that addressed the issue of the accuracy of the determination of carrier age used in the above studies. An underlying assumption of these studies, necessarily, was that the date a carrier's information is entered into the MCMIS Census File as a result of its filing Form MCS-150 is equivalent to its date of entry into interstate operations. This necessary assumption resulted from the absence of alternative data on which to base an age calculation. There was a concern, however, that there was a difference between the date a carrier entered interstate service and the date it was added to the MCMIS Census File. As a result, using the date of entering the MCMIS Census File as the date of entry into interstate operations may have classified some carriers as new entrants that, in fact, were not new entrants, but experienced carriers that had only recently been added to the MCMIS Census File. These carriers may have been operating intrastate or been unaware of the USDOT interstate registration requirement.

Furthermore, there was a concern that this alleged discrepancy varied by industry segment—i.e., it was thought that the discrepancy was greater for private and exempt for-hire operators than it was for authorized for-hire carriers. This concern was based on the hypothesis that authorized for-hire carriers have more direct contact with government agencies and are more aware of the various regulations and registrations required. As a result, authorized for-hire carriers are more likely to fill out Form MCS-150 closer to the time at which they begin interstate operations, as required by law, than are private and exempt for-hire carriers. Therefore, it was theorized that experienced private and exempt for-hire carriers were more likely to have been misclassified as new entrants in the studies than were experienced authorized for-hire carriers.

To test this hypothesis, the Volpe Center, with assistance from Professor Corsi, performed a study to determine whether a discrepancy existed between the date of addition to the MCMIS Census File (after the submission of Form MCS-150) and the dates at which 1) any service and 2) interstate service began. A second objective was to determine whether the observed discrepancy differed among the individual industry segments—i.e., authorized for-hire, exempt for-hire, private, and other.

To investigate these issues, the Volpe Center conducted a sample survey of new entrants (i.e., carriers whose submitted USDOT registration forms (Form MCS-150) were entered into the MCMIS Census File between May 6 and August 2, 1996) in the Census File. First, the carriers were stratified by classification and size, i.e., number of power units, as entered on Form MCS-150.

Four classification groups were created from the operation classifications listed on Form MCS-150:

<u>Classification Group</u>	<u>Operation Classifications Included</u>
Authorized	authorized for-hire
Exempt	exempt for-hire
Private	private, private passenger (business), and private passenger (non-business)
Other	migrant, U.S. Mail, government (federal, state, or local), Indian tribe, and other

After it was determined that 500 completed questionnaires would be needed for the analysis, a sample of 1,036 carriers was drawn. Since 31 carriers were selected in more than one stratum (because they circled more than one classification on Form MCS-150), the actual number of carriers in the sample was 1,003. Completed questionnaires were received from 571 carriers. Because some carriers were selected and summarized in more than one stratum, the responses from the 571 carriers resulted in 593 questionnaires being summarized.

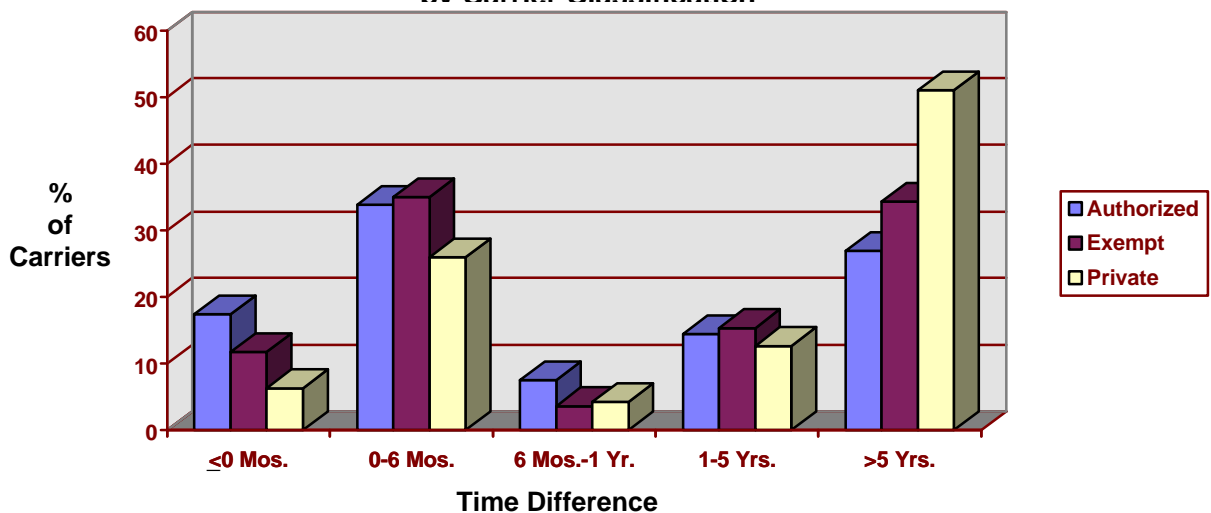
Principal Findings

Study results are shown in Figures 2-9 and 2-10 and Tables 2-1 and 2-2. Figure 2-9 shows the percentage distributions by carrier classification of the differences between the dates that carriers were added to the MCMIS Census File and the dates they initiated any (intra or interstate) motor carrier service. Figure 2-10 provides comparable distributions of the differences between the dates that carriers were added to the MCMIS Census File and the dates of their initiations of interstate service. The data for these graphs can be found in Appendix 5.

In both Figures 2-9 and 2-10, significantly more of the private carriers are in the “>5 Yrs.” category than are the authorized or exempt carriers. This category represents the largest time differences between registration with the USDOT and the initiation of service. Over half (51.0%) of the private carriers operated some type of motor carrier service for more than five years before registering with the USDOT, compared to 26.9 percent of the authorized carriers and 34.3 percent of the exempt carriers. Similarly, 22.8 percent of the private carriers waited over five years after initiating interstate service before registering with the USDOT, compared to 12.2 percent of the authorized carriers and 13.0 percent of the exempt carriers.

On the other hand, significantly fewer of the private carriers are in the smaller time difference categories than are the authorized or exempt carriers. For example, 32.2 percent of the private carriers registered with the USDOT no later than six months after initiating some kind of motor carrier service, compared to 51.2 percent of the authorized carriers and 46.7 percent of the exempt carriers. Similarly, 55.7 percent of the private carriers registered with the USDOT no

**Figure 2-9 -
Percentage Distributions of Differences Between
Date of Initiation of Any Service and
Addition to MCMIS Census File
by Carrier Classification**



**Figure 2-10 -
Percentage Distributions of Differences Between
Date of Initiation of Interstate Service and
Addition to MCMIS Census File
by Carrier Classification**

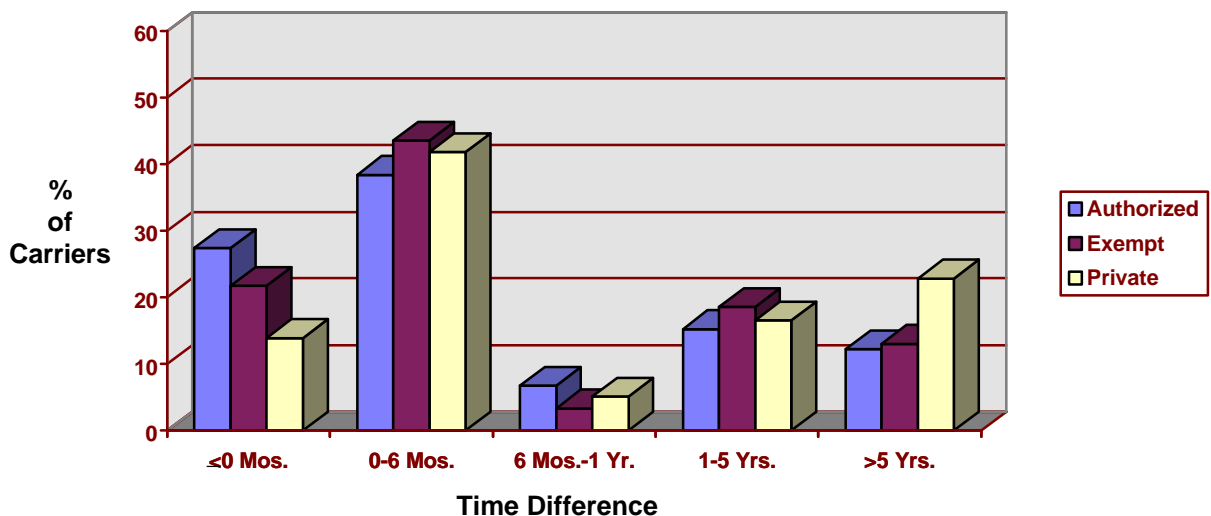


TABLE 2-1 -
Mean Time Differences
Between Initiation of Any/Interstate Service and Addition to MCMIS Census File
by Carrier Classification

Classification	Type of Service	No. of Carriers	Mean Time Difference (Years)
Authorized	Any Service	201	5.83
	Interstate Service	164	2.37
Exempt	Any Service	137	7.31
	Interstate Service	92	2.70
Private	Any Service	239	11.93
	Interstate Service	158	3.96
Other	Any Service	16	7.98
	Interstate Service	10	2.47

TABLE 2-2 -
Mean Time Differences
Between Initiation of Any/Interstate Service and Addition to MCMIS Census File

Type of Service	Number of Carriers	Weighted Mean Time Difference (Years)
Any Service	593	8.87
Interstate Service	424	3.14

later than six months after initiating interstate service, compared to 65.9 percent of the authorized carriers and 65.2 percent of the exempt carriers.

Table 2-1 shows the mean differences (in years) between addition to the MCMIS Census File and initiation of any/interstate service for each carrier classification. These results also confirm the hypothesis that the difference between start of operations and inclusion in the MCMIS Census File was greater for private carriers than it was for authorized for-hire carriers. The results do not, however, support the hypothesis that exempt for-hire carriers would also exhibit larger time differences than authorized for-hire carriers. The mean time differences between the initiation of any and interstate service and the addition to the MCMIS Census File for private carriers were 11.93 and 3.96 years, respectively. In contrast, the comparable time differences for authorized for-hire carriers were 5.83 and 2.37 years, while the comparable time differences for exempt for-

hire carriers were 7.31 and 2.70 years.

As Table 2-2 indicates, for the entire sample, the weighted mean difference between the start of any motor carrier service and addition to the MCMIS Census File was 8.87 years, while the weighted mean difference between the start of interstate motor carrier service and addition to the MCMIS Census File was 3.14 years. These means were calculated by weighting the means of the four carrier classifications by the numbers of carriers in those classifications in the new entrant population (from which the sample was selected).

It should be noted that of the 593 carriers in the sample, 424 indicated that they were engaged in interstate operations.

Conclusions

Overall, these results confirm the belief that there is a discrepancy between time of initiation of operations and addition to the MCMIS Census File and that this discrepancy is most pronounced for private carriers. These results are not surprising. A private carrier differs from authorized for-hire and exempt for-hire carriers in that its primary business is other than transportation. As such, private carriers have less focus on many of the detailed administrative requirements of complying with USDOT regulations.

While these results confirm there is 1) often a difference between the initiation of motor carrier service and entry into the MCMIS Census File and 2) variability among the carrier classification groups in these disparities, the question is how they impact efforts to assess the safety performance differences of new entrants. Ideally, a carrier's date of entry into the MCMIS Census File should be adjusted to reflect its actual initiation of interstate motor carrier service. While the survey data allow these adjustments to be made in the aggregate—i.e., an average number of years difference between initiation of interstate service and entry into the MCMIS Census File for each of the different carrier classifications—the data provide no basis for making these adjustments on a case by case basis. While, in general, the results inform us that a higher percentage of private carriers than authorized for-hire carriers delay registering with the USDOT, there is no way to know whether any individual carrier has delayed submitting Form MCS-150. Thus, if any systematic adjustment were made in carrier age, e.g., adding X.X years to each private carrier's age based on average delay time, some private carriers would have time added to their age, when they, in fact, started interstate operations at the same time they entered the MCMIS Census File. Indeed, 55.7 percent of the private carriers had six or fewer months delay between the start of interstate operations and entry into the MCMIS Census File.

One solution to this problem, and the only way to ensure the accuracy of future new entrant investigations, would be to require each carrier to indicate on its Form MCS-150 registration the date on which any large commercial vehicle operations and, specifically, interstate operations were initiated. This additional information would allow researchers to have actual operation initiation dates to use as a screening device for examining the performance of carriers based on their age.

If this change is not made, then studies of new entrant performance must include cautionary references to the fact that private carrier new entrant performance may be impacted by the greater discrepancy between the start of interstate operations and the filing of Form MCS-150 information for these carriers than for carriers in the other operation classifications—i.e., authorized for-hire, exempt for-hire, and other. Thus, researchers should separately report information on safety performance of carriers by age of firm for each category of carriers—i.e., authorized for-hire, exempt for-hire, private, and other. This technique should be employed unless and until the change is made to Form MCS-150.

Other Findings

In addition to the principal findings described above, other information was learned from the survey.

One finding is that respondents did not understand the meanings of terms used by the OMC such as:

- motor carrier
- power unit
- interstate/intrastate
- hazmat
- authorized, exempt, and private

Many carriers were confused by the operation classifications, i.e., authorized for-hire, exempt, for-hire, private, etc. Many carriers answered the classification question on their survey questionnaires differently than on their Forms MCS-150.

Many of the carriers that did not understand these terms were private carriers. In fact, many of the private carriers contacted for the study said that, while they recognized that they operated large commercial vehicles, they did not consider themselves to be motor carriers, but rather their primary businesses (e.g., contractors, manufacturers, retailers, etc.) instead.

Some carriers were not aware they were registered with the USDOT, despite the fact that they had USDOT Numbers. These carriers had not registered themselves with the USDOT, but had registered their vehicles with their states, which then forwarded the information to the USDOT.

3. DETERMINE NEED FOR NEW ENTRANT PROGRAM

3.1. ASSESS RESULTS OF STUDIES

The Corsi-Fanara Study found (with empirical data covering the mid-1980s) that among ICC-regulated, authorized for-hire carriers, new entrants had crash rates that were significantly higher than the rates for more experienced carriers. In fact, the crash rates for these carriers declined in a stepped progression as carrier age increased. The authors labeled the phenomenon a “safety learning curve,” suggesting that as carriers become more experienced with safety management procedures and practices, their crash rates lessen.

In addition to a “new entrant” problem concerning crash rates, the authors identified a “new entrant” problem with respect to compliance. The authors used the same empirical database of ICC-regulated carriers to demonstrate that new entrant carriers had lower regulatory compliance rates than did more experienced carriers. Furthermore, these compliance rates improved in a stepped progression as carrier age increased. Once again, the authors pointed to a “safety learning curve,” covering regulatory compliance as well as crash rates.

This current investigation began with the objective of examining the “safety learning curve” hypothesis, covering both crash and compliance rates, with a broader and more current database. The objective was to increase the sample size of carriers included in the investigation by a significant factor over the sample used in the previous studies. Furthermore, the goal was to broaden the coverage of carriers, i.e., to go beyond the set of ICC-regulated, authorized for-hire carriers included in the Corsi-Fanara Study, and to examine a more recent time period. Indeed, the results presented in Section 2 substantiate that these objectives were all achieved. The range of carriers examined in the analysis was broader, and more carriers were included in the analysis. Furthermore, the study time period covered the most currently available data.

Crash Rate Analyses

Both the compliance review crash rates and the state reported NGA crash rates failed to establish the clear presence of a safety learning curve effect with respect to new entrants. Although, among authorized for-hire carriers, the newest carriers had higher crash rates than did the most experienced carriers, the differences were not great and the age/crash rate patterns were weak. In any event, the crash rate analyses cannot be considered conclusive due to suspect start date data.

Compliance Analysis Using Acute/Critical Regulation Violations

The Compliance Analysis Using Acute/Critical Regulation Violations did substantiate that new entrants had higher rates of acute violations and patterns of critical violations covering both the driver and overall safety management than did more experienced carriers. In fact, the rate of decline in noncompliance showed a steady progression across age groups. This pattern of a stepped decline in noncompliance substantiates the earlier Corsi-Fanara finding of a safety learning curve covering compliance with safety regulations. Therefore, it appears that new entrants experience a learning curve

with respect to safety regulations, in particular, with respect to driver regulations and overall safety management issues. Over time, carriers probably develop an understanding of these regulations and incorporate this knowledge into their operating procedures.

3.2. ASSESS STATE EDUCATION PROGRAMS

In determining the elements of a federal program designed to mitigate or shorten the compliance safety learning curve, it is instructive to also examine existing state education programs to assess their relevance, their specific program elements, and their impact on safety regulation compliance, and, in the final analysis, on motor carrier safety. The objectives are to both learn from those experiences and develop a federal program that is complementary and not duplicative.

As part of this investigation, the OMC regional offices were asked to provide information about any state new entrant programs in their regions. Specifically, the OMC state program managers were asked to briefly describe any state programs in place to assist new entrants in acquiring knowledge about safety regulations and safety management practices. Unfortunately, the information resulting from this effort was superficial and limited, and provides only a broad outline of program elements. Clearly, a more thorough examination of these state programs would be required, prior to passing judgment on their applicability on a broader level. Despite these caveats and limitations, some summary assessments are possible.

The state of Oregon has a mandatory eight-hour safety/regulatory training program for new carriers. Effective January 1, 1998, the state of Iowa will be requiring all new intrastate for-hire motor carriers of liquid commodities or passengers to complete a safety education seminar provided by or approved by the Iowa DOT. This seminar must be completed within six months of the permit or certificate issuance. In Georgia, when a new carrier registers with the Public Service Commission, a safety education and training packet is mailed to the carrier. In Missouri, the OMC division office identifies new entrants by their USDOT Numbers, and mails them education and training packets as well as seminar announcements.

Many other states (e.g., Illinois and Minnesota) conduct education seminars at locations throughout the states. While these seminars attract new carriers, they are not limited to new entrants and may not be directed entirely at developing a carrier's basic understanding of safety regulations and safety management practices. They may include non-safety related material such as licensing regulations and fee requirements of state and federal agencies. In some cases, seminars are conducted, upon request, for groups of carriers, including motor carrier organizations.

In addition, many states will provide assistance regarding safety regulations and requirements to individual carriers upon request. Like the seminars discussed above, these requests are not restricted to new entrants. Any carrier can make such a request.

This review of state programs for motor carriers shows that 1) only a few states have specific safety education programs for new entrants, and 2) those programs are limited in duration and content.

4. RECOMMENDATIONS

4.1. EDUCATION AND MONITORING PROGRAM

In view of the safety regulation compliance learning curve found in the investigation, it is recommended that a consistent federal program for new entrants be considered that focuses on education and monitoring. Carriers appear to “learn” about regulatory compliance through experience. The rates of noncompliance decrease in a steady progression as carrier age increases. There is good reason to believe, therefore, that interventions with effective education and training programs at the time of interstate service initiation can shorten the compliance learning curve and increase the speed at which new carriers come into compliance with the FMCSRs. In a comprehensive federal program, new entrants would learn the FMCSRs as well as effective safety management policies and procedures. The program would collect necessary information on new carriers and would also monitor the safety performance and compliance of new entrants more intensely than under current OMC procedures. For example, new entrants would be at higher priority to receive roadside inspections than more experienced carriers. This additional surveillance would provide additional insight into the safety status of new entrants, because of the increased amount of safety data obtained.

4.2. MODIFICATIONS TO FORM MCS-150

Include Start Dates

The inconclusive results of the crash rate studies may have been caused, in part, by the inability to accurately determine what carriers were actually new entrants. This investigation also included the Start Date Study, an analysis of the discrepancies arising from the dates carriers actually initiated interstate service and the dates they filed Form MCS-150. At present, the date a carrier files Form MCS-150 is taken as the date it initiates interstate service. In fact, some carriers, in particular, according to the results of this study, private carriers, delay filing Form MCS-150. As a result, these delaying carriers are classified as new entrants when, in fact, they are actually experienced carriers. The problem impacts the analysis of new carriers, since it mixes some experienced carriers in with the new entrant pool. The only way to address this issue is to ask each carrier to indicate on its Form MCS-150 the exact dates on which it initiated 1) any operations and 2) interstate operations. Unless and until this change is made, it will not be possible to obtain more definitive results from studies of carrier safety performance and compliance as functions of carrier age.

Therefore, it is recommended that two questions be added to Form MCS-150:

1. Date of initiation of any motor carrier operations
2. Date of initiation of interstate operations

Revise Terminology

This investigation also revealed that many carriers did not understand meanings of some commonly used terms on Form MCS-150, such as “motor carrier” and “private carrier.” Many of the carriers that were confused by these terms were private carriers. In fact, many private carriers identified themselves as their primary businesses (e.g., farmer or contractor), rather than as motor carriers. In fact, “large commercial vehicle operator” is a more accurate term than “motor carrier,” which implies the carriage of goods for hire.

One measure that would address this problem would be to further modify Form MCS-150. The definitions of certain terms, such as carrier classifications (i.e., authorized for-hire, exempt for-hire, private, other, etc.), could be printed in boldface to make them more noticeable. In addition, since many private carriers are confused by the term “motor carrier,” an alternative term such as “large commercial vehicle operator” could be used on the form in lieu of or addition to “motor carrier.” This term would better indicate that for-hire carriers are not the only commercial vehicle operators that have to register with the USDOT.

Therefore, it is recommended that Form MCS-150 also be revised to make it more understandable to all affected operators of large commercial vehicles. These revisions should include printing definitions in boldface to make them more noticeable and using the term “large commercial vehicle operator” in lieu of “motor carrier.”

If the recommended changes to Form MCS-150 are implemented, the start date questions will provide analysts with more reliable data to study carrier safety performance and compliance over time. The studies in this investigation could then be repeated to better assess the safety performance of new entrants.

4.3. UPDATE FORM MCS-150 INFORMATION

In the State-Reported NGA Crash Rate Analysis, crash rates were calculated using power unit data from the MCMIS Census File. This power unit information comes from a carrier’s original Form MCS-150, and is usually only updated when the carrier undergoes a compliance review. Due to the volatile nature of the industry, and the infrequent updating of basic carrier information (e.g., number of power units), the power unit data in the Census File for many carriers may not be accurate. Therefore, crash rates calculated using these data may also be inaccurate.

One way to obtain current/accurate power unit data would be to require carriers to update their Form MCS-150 information on a regular basis using procedures that are consistent across all states. For example, a carrier could update its Form MCS-150 information when registering its vehicles. If such procedures were implemented, then complete, current power unit data would be available for use in the calculation of crash rates.

Therefore, it is recommended that procedures be established for carriers to regularly and consistently update their Form MCS-150 information (perhaps in conjunction with state vehicle registration), so that accurate carrier power unit data will be available for use in crash rate studies.

APPENDIX 1
CORSI-FANARA STUDY (1988) - TABLE

TABLE A1-1 - CORSI-FANARA STUDY (1988)*

	Date of Initial ICC Certification		
	<u>Jan. 1985 & After</u>	<u>July 1980 - Dec. 1984</u>	<u>Before July 1980</u>
Mean Crash Rate**	.81	.62	.55
Does carrier have a system to effectively control hours of service? (%)	16.8	35.0	37.0
Is carrier complying with vehicle inspection procedures? (%)	29.3	46.8	40.7
Does carrier have a driver safety training program? (%)	17.4	32.0	33.7

* - Data from compliance and safety reviews conducted between September 1986 and April 1988

** - Reportable crashes per million vehicle miles traveled (VMT)

**APPENDIX 2
COMPLIANCE REVIEW CRASH RATE ANALYSIS - TABLES**

TABLE A2-1 - ALL CARRIERS

<u>X=</u> <u>AGE OF</u> <u>CARRIER</u> <u>(YEARS)</u>	<u>NO. OF</u> <u>COMPL.</u> <u>REVIEWS</u>	<u>NO. OF</u> <u>CRASHES</u>	<u>MILL.</u> <u>OF</u> <u>VMT</u>	<u>CRASHES/</u> <u>MILL. VMT</u>
1<X≤2	4,174	781	1,034	.756
2<X≤3	2,837	901	1,185	.761
3<X≤4	2,353	991	1,348	.735
4<X≤5	1,910	785	1,101	.713
5<X≤6	1,492	920	1,124	.818
6<X≤7	1,278	946	1,279	.740
7<X≤8	996	1,052	1,387	.758
8<X≤9	759	906	1,284	.706
9<X≤10	634	933	1,448	.644
10<X	7,142	20,970	30,827	.680
TOTAL	23,575			

Data from compliance reviews conducted between April 1, 1993 and June 2, 1997

TABLE A2-2 - AUTHORIZED FOR-HIRE CARRIERS

<u>X=</u> <u>AGE OF</u> <u>CARRIER</u> <u>(YEARS)</u>	<u>NO. OF</u> <u>COMPL.</u> <u>REVIEWS</u>	<u>NO. OF</u> <u>CRASHES</u>	<u>MILL.</u> <u>OF</u> <u>VMT</u>	<u>CRASHES/</u> <u>MILL. VMT</u>
1<X≤2	1,502	568	731	.777
2<X≤3	1,115	672	922	.729
3<X≤4	913	773	1,086	.712
4<X≤5	665	591	849	.696
5<X≤6	613	625	794	.787
6<X≤7	596	606	877	.691
7<X≤8	522	769	1,012	.760
8<X≤9	479	750	1,068	.702
9<X≤10	418	834	1,331	.627
10<X	4,205	18,854	27,665	.682
TOTAL	11,028			

Data from compliance reviews conducted between April 1, 1993 and June 2, 1997

APPENDIX 3
STATE-REPORTED NGA CRASH RATE ANALYSIS - TABLES

TABLE A3-1 - ALL CARRIERS

<u>YEAR OF REGIS.*</u>	<u>NO. OF CARRIERS</u>	<u>NO. OF CRASHES**</u>	<u>NO. OF POWER UNITS</u>	<u>CRASHES/ POWER UNIT</u>
1995	1,405	266	8,821	.0302
1994	2,296	453	12,599	.0360
1993	4,096	931	26,131	.0356
1992	3,729	853	27,630	.0309
1991	2,380	658	22,541	.0292
1990	2,202	781	23,448	.0333
1989	1,865	732	30,078	.0243
1988	1,412	811	27,456	.0295
1987	1,000	894	24,128	.0371
1986 & earlier	8,122	16,281	503,253	.0324
TOTAL	28,507			

* - Year of registration, i.e., year that that a carrier's Form MCS-150 information was entered into the MCMIS Census File

** - Recordable NGA crashes occurring in calendar year 1996

TABLE A3-2 - AUTHORIZED FOR-HIRE CARRIERS

<u>YEAR OF REGIS.*</u>	<u>NO. OF CARRIERS</u>	<u>NO. OF CRASHES**</u>	<u>NO. OF POWER UNITS</u>	<u>CRASHES/ POWER UNIT</u>
1995	547	214	5,001	.0428
1994	933	363	7,743	.0469
1993	1,836	793	18,254	.0434
1992	1,258	653	17,196	.0380
1991	799	479	11,366	.0421
1990	694	582	12,591	.0462
1989	619	481	12,321	.0390
1988	565	582	13,188	.0441
1987	603	745	15,809	.0471
1986 & earlier	4,766	14,793	400,586	.0369
TOTAL	12,620			

* - Year of registration, i.e., year that a carrier's Form MCS-150 information was entered into the MCMIS Census File

** - Recordable NGA crashes occurring in calendar year 1996

APPENDIX 4
COMPLIANCE ANALYSIS USING ACUTE/CRITICAL REGULATION VIOLATIONS
- TABLES

TABLE A4-1 - DRIVER SEA REGULATION VIOLATIONS

X= AGE OF CARRIER (YEARS)	NO. OF COMPLIANCE REVIEWS	NO. OF INTERSTATE DRIVERS	NO. OF ACUTE REGULATION VIOLATIONS	NO. OF PATTERNS OF CRITICAL REGULATION VIOLATIONS	NO. OF ACUTE REG. VIOLATIONS PER 1,000 DRIVERS	NO. OF PTRNS. OF CRITICAL REG. VLTNS. PER 1,000 DRIVERS
X≤1	3,576	14,560	152	337	10.4	23.1
1<X≤2	2,269	17,572	162	403	9.2	22.9
2<X≤3	1,872	21,869	164	491	7.5	22.5
3<X≤4	1,663	22,524	131	466	5.8	20.7
4<X≤5	1,337	18,033	159	345	8.8	19.1
5<X≤6	1,244	17,257	99	355	5.7	20.6
6<X≤7	1,269	21,965	97	380	4.4	17.3
7<X≤8	1,053	28,434	98	346	3.4	12.2
8<X≤9	841	21,038	73	305	3.5	14.5
9<X≤10	703	33,908	99	263	2.9	7.8
10<X	7,189	504,277	1,052	2,547	2.1	5.1
Total	23,016					

TABLE A4-2 - SAFETY MANAGEMENT SEA REGULATION VIOLATIONS

X= AGE OF CARRIER (YEARS)	NO. OF COMPLIANCE REVIEWS	NO. OF INTERSTATE DRIVERS	NO. OF ACUTE REGULATION VIOLATIONS	NO. OF PATTERNS OF CRITICAL REGULATION VIOLATIONS	NO. OF ACUTE REG. VIOLATIONS PER 1,000 DRIVERS	NO. OF PTRNS. OF CRITICAL REG. VLTNS. PER 1,000 DRIVERS
X≤1	3,576	14,560	1,875	3,003	128.8	206.3
1<X≤2	2,269	17,572	599	1,964	34.1	111.8
2<X≤3	1,872	21,869	720	1,882	32.9	86.1
3<X≤4	1,663	22,524	605	1,563	26.9	69.4
4<X≤5	1,337	18,033	334	1,221	18.5	67.7
5<X≤6	1,244	17,257	550	1,187	31.9	68.8
6<X≤7	1,269	21,965	267	1,124	12.2	51.2
7<X≤8	1,053	28,434	285	880	10.0	30.9
8<X≤9	841	21,038	119	637	5.7	30.3
9<X≤10	703	33,908	98	528	2.9	15.6
10<X	7,189	504,277	1,649	4,878	3.3	9.7
Total	23,016					

Data from 23,016 compliance reviews conducted between October 1, 1994 and June 2, 1997

**APPENDIX 5
START DATE STUDY - TABLES**

TABLE A5-1 -
Percentage Distributions of Time Differences
Between Initiation of Any Service and Addition to MCMIS Census File
by Carrier Classification

Classification	X = [Initiation of Any Service – Addition to MCMIS Census File]						Total
	X ≤ 0 Mos.	0 < X ≤ 6 Mos.	6 < X ≤ 12 Mos.	1 < X ≤ 5 Yrs.	5 < X ≤ 10 Yrs.	X > 10 Yrs.	
Authorized % of Row	17.4	33.8	7.5	14.4	10.0	16.9	100.0
Exempt % of Row	11.7	35.0	3.6	15.3	10.2	24.1	100.0
Private % of Row	6.3	25.9	4.2	12.6	7.5	43.5	100.0
Other % of Row	12.5	37.5	6.2	18.8	6.2	18.8	100.0
Total % of Row	11.5	31.0	5.2	14.0	8.9	29.3	100.0

TABLE A5-2 -
Percentage Distributions of Time Differences
Between Initiation of Interstate Service and Addition to MCMIS Census File
by Carrier Classification

Classification	X = [Initiation of Interstate Service - Addition to MCMIS Census File]						Total
	X ≤ 0 Mos.	0 < X ≤ 6 Mos.	6 < X ≤ 12 Mos.	1 < X ≤ 5 Yrs.	5 < X ≤ 10 Yrs.	X > 10 Yrs.	
Authorized % of Row	27.4	38.4	6.7	15.2	6.7	5.5	100.0
Exempt % of Row	21.7	43.5	3.3	18.5	3.3	9.8	100.0
Private % of Row	13.9	41.8	5.1	16.5	8.2	14.6	100.0
Other % of Row	20.0	50.0	0.0	20.0	0.0	10.0	100.0
Total % of Row	21.0	41.0	5.2	16.5	6.4	9.9	100.0