Fostering a Safety Culture in Small Motor Carriers

Initial Findings
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PREFACE

Congress recognized a safety problem with new motor carriers. The MCSIA of 1999 mandated a new entrant program. FMCSA's research demonstration project, "Fostering a Safety Culture in Motor Carriers," focuses on evaluating the effectiveness of fostering development of a safety culture in new entrant motor carriers. Most of them are too small to have a safety department.

FMCSA sponsors the Transportation Research Board (TRB) Commercial Truck and Bus Safety synthesis program. Synthesis Report 14, titled "The Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes", reported that the existence of a safety culture is very important to safe operations of motor carriers. The report concludes that the literature does not provide any information on how to promote adoption of a safety culture in motor carriers too small to have a safety department.

During 2005 – 2006, under a contract with the State of Montana, supported by an FMCSA new entrant grant to Montana, proactive training was provided to new entrant motor carriers prior to receiving their Safety Audit (SA) by the State of Montana. Many lessons were learned from that training. In 2009 FMCSA issued a cooperative agreement to perform a carefully constructed research demonstration building on lessons learned from the 2005-6 effort, and information available from TRB and FMCSA. Specific goals of this effort include:

- To foster development of a safety culture in new entrant carriers, that dominantly are too small to have their own safety function,
- To improve safety performance measures,
- To reduce crashes,
- To reduce the number of carriers that fail their Safety Audit under the new criteria of the new entrant final rule, and
- To help new entrants succeed economically so the above safety goals are achieved.

As a part of this research effort, it is necessary to measure the effectiveness of the training. This measurement includes:

- Analyzing effectiveness of the training provided to new entrant carriers in the 2005 – 2006 timeframe, and
- Analyzing the effectiveness of the new training being developed that will be provided, in the 2010 – 2011 timeframe, including comparing it with the effectiveness of the training offered in the 2005-6 timeframe.

This paper addresses the first point, namely it reports on initial analysis of results from training provided to new entrant carriers in the 2005 – 2006 timeframe. It includes:

- Additional background into the Problem Definition,
- Background on the New Entrant Training provided to Montana New Entrant Carriers in the 2005 – 2006 timeframe.

- An overview of the initial data analysis plan,
- A description of changes to the data analysis plan discovered by analysis of the actual data,
- A summary of the results of the data analysis, and
- Conclusions

This document also includes appendices that provide additional detail about the methods used and the actual analysis performed.

Problem Definition

Importance of a Safety Culture

As noted above, TRB's Commercial Truck and Bus Safety synthesis Report 14, The Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes, found that the existence of a safety culture is very important to safe operations of motor carriers. Further, they recommended procedures, or best practices, by which the safety departments of motor carriers can foster the development of a safety culture within their companies.

That report concludes with a fundamental question they could not answer. "Can a safety culture be developed among employees of a small carrier, particularly those carriers not large enough to have a safety department or safety professionals on staff?" This paper provides information on this issue of whether a safety culture can effectively be fostered in motor carriers too small to have its own safety department or safety professionals.

New Entrant Program

Congress created the *New Entrant Motor Carrier Program* in the Motor Carrier Safety Improvement Act (MCSIA) of 1999. The program was initially implemented via an interim final rule issued May 2002. Shortly after issuance of the interim rule, internal discussions began on what the final rule should look like.

One key issue, which was included in the final rule issued December 2008, is that failure of a new entrant to have certain safety program components in place will result in failure of the required Safety Audit (SA). New entrants that fail the SA must file a corrective action plan that requires follow-up by FMCSA Field employees, including verification of the plan and that the new entrant has come into compliance with FMCSA's regulatory requirements.

The 2005-6 contract was created because the previous Division Administrator in Montana wanted to find a way to reduce staff resources for the projected substantial additional workload of determining whether new entrants that failed the SA had come into compliance. The results of that effort are analyzed and reported in this paper.

Why Focus on New Entrants for Safety Culture?

FMCSA's New Entrant Motor Carrier program is a good laboratory for testing whether a safety culture can be effectively fostered in small motor carriers without a safety department, and what impact fostering a safety culture has on their safety behavior? This is because most new entrants are very small motor carriers. Dominantly they are single truck operations that are more of a family undertaking. To the extent that these companies expand, they tend to expand organically, with the owner hiring siblings, in-laws, neighbors, etc. As shown in Table 4 and Table 5 in Appendix C below, 99% of the control group carriers, and 100% of the Montana Trained Carriers reported less than 15 power units on their initial MCS-150. In both groups, 94% of the carriers reported 4 or fewer power units. Such small new entrant motor carriers are highly unlikely to have safety departments.

The hypothesis of the original and follow-on research demonstration is that a properly constructed, proactive, early training effort with new entrants will have a significant impact on their long-term safety culture. Data from the 2005-6 effort enables an analysis of the validity of this hypothesis. This paper presents the initial results from that analysis.

Relevance to Future of the New Entrant Program

Since 2006, numerous parties are on record that FMCSA should consider revisions in its approach to new entrants in order to better achieve the intent of Congress for a new entrant motor carrier program. FMCSA developed an analysis of the new entrant program as practiced under the interim final rule.[1] That analysis found the current program was not having any discernable impact on the crash rate of new entrant motor carriers. A final rule was published in December 2008 establishing 16 mandatory requirements, which constitute an automatic failure of the SA if the new entrant is not in compliance with each of them.[2]

The Advocates for Highway and Auto Safety (AHAS) petitioned for reconsideration of that final rule, including that FMCSA should require a proficiency examination prior to granting new entrants operating authority, as authorized in the enabling legislation.[3] FMCSA issued an Advanced Notice of Proposed Rule Making (ANPRM) on the possibility of a proficiency examination in August 2009.[4]

In the summer of 2009, FMCSA assigned a task to the Motor Carrier Safety Advisory Committee (MCSAC) asking for their recommendations on what a new entrant program should look like. The MCSAC's September 2, 2009 report to the Acting Deputy Administrator recommends a number of changes.[5]

Almost any changes in the new entrant program being advocated by these parties will require one or more regulatory changes to the new entrant program requirements. Any such rulemakings require consideration of costs and benefits. Analysis of existing data, plus research demonstrations are an excellent means of getting such data.

New Entrant Training in 2005 – 2006

Using new entrant grant funds, the Montana FMCSA Division office worked with the State of Montana on an effort that proactively provided training to new entrant motor carriers prior to receiving their SA by the State of Montana. The State of Montana awarded a competitive contract in June of 2005 to The SAGE Corporation. Goals of that training included improving the safety performance of the new entrant carriers and reducing the number of new entrants who would fail the SA under the then forthcoming final rule.

The following year in 2006, FMCSA made a determination that new entrant grant funds could only be used to conduct the SA, and not to support training new entrants. Thus, due to unavailability of new entrant grant funds to support the Montana training contract for the next contracted year, it was terminated at the end of the fiscal year, September 30, 2006 for the convenience of the Government.

New entrants are dominantly very small motor carriers; many are single truck operations. They are starting a new business, and many have no knowledge of the extensive regulatory requirements of FMCSA. The 2005-6 training effort found most were overwhelmed with the extent of FMCSA's regulatory requirements. The trainers encountered the classic "deer in the headlights" phenomenon that took up some of the very limited one-on-one training time of the single visit.

Additionally, most had little or no knowledge of how to run a business. That lack of business knowledge is another of the lessons learned from the 2005-6 training. FMCSA has data showing a correlation between business success and safety performance.[6] Thus, lack of business knowledge appeared to be contributing to poorer safety performance.

The training was restricted to non-hazmat, freight motor carriers. However, because carrying even small, unplacardable amounts of hazardous materials requires registering as a hazmat motor carrier, there is some data from MCSAP inspections regarding hazmat violations for those carriers.

Because of the early termination of the 2005-6 contract, no analysis of data associated with that training was conducted. This paper reports the initial analysis of impacts from that training.

Initial Data Analysis Plan

Background

The short duration, proactive new entrant training conducted in Montana during 2005-6 provides safety performance data from one attempt at training. This data is germane to the multiple interests being advocated for possible changes to the new entrant program. Therefore, we analyzed the impact that training had on safety performance of new entrants as a surrogate for measuring the effectiveness of influencing their long-term safety culture.

The goals of analyzing the safety performance data from that training intervention are to determine:

1. If the education and outreach training interventions conducted by the 2005-6 training resulted in a statistically significant difference in these carriers' safety performance, and
2. What are the cost-benefit implications of such training in light of current new entrant grant program costs and results.

All new entrants in Montana were offered training during the period June 2005 through August of 2006. Based on FMCSA's data for the number of Montana new entrants in 2005 and 2006, virtually all who were in the pipeline at the time this training was occurring accepted the training.

Detailed Analysis Plan

The plan includes using data from the Motor Carrier Management Information System (MCMIS), Driver License Records, and data from several other sources. The SAGE Corporation provided records identifying each new entrant motor carrier they trained.

Data is available for both direct and indirect measures. The direct measure is crash data. The indirect measures include inspection results, and citations. This report presents the initial analysis of the data, which includes data from several tables in MCMIS. Driver traffic conviction data has also been used in past studies as an indirect measure. We hope to analyze such data for drivers in this study at a later time.

Direct Measures

MCMIS crash data is available for carriers included in this analysis. This includes identification of the driver and the carrier for each crash. Two ways were proposed to identify the exposure, in order to develop crash rates.

- Carrier Crash Rate per Power Unit. This measure of crashes divides by the number of crashes assigned to the carrier by the number of power units reported by the motor carrier.
- Carrier Crash Rate per Carriers' Drivers. This measure uses the number of crashes divided by the number of drivers (or driver years) associated with the carrier. Further explanation of this measure is included in Appendix D below.

Indirect Measures

There were a number of indirect measures of carrier safety performance. These included:

- Percent of carriers' inspections that result in violations.
- Percent of carriers' inspections that result in specific types of violations. The measured violation types are grouped into:
    - Driver Violations and
    - Vehicle Violations.
- Percent of carriers' inspections that result in out-of-service orders. The measured out-of-service order types were:
    - Driver Out-of-Service Orders and
    - Vehicle Out-of-Service Orders.
- Carriers' Drivers' Traffic Conviction Measure,

- Carriers' Drivers Inspection Violation Measure,
- Rate at which the carriers' drivers are detected as being suspended at the time of encounters with law enforcement.
- Carriers' New Entrant Safety Audit Results, and
- Carrier Performance in Compliance Reviews

This paper presents results of these measures that could be calculated with available MCMIS data. Other of these measures may be added to later reports if funding is available, and if other data, particularly CDLIS driver record data, becomes available.

Control Group

For each of the above referenced analyses, statistical significance is determined by comparing results of the trained carriers to a control group. There were two major considerations in the selection of a control group.

- It has often been observed that motor carrier safety data patterns change from year to year. For example, there is reason to believe that the increased number of crashes is associated with improved reporting. In order to avoid any issues associated with timeframe, the control group was selected from new entrants that had an MCS-150 "Add Date" in the same timeframe as the MCS -150 "Add Dates" of the study group.

- It is clear to the casual observer that, in a number of ways, Montana is not a 'typical' State. Thus the control group was created from States that are from the geographical region around Montana, and have relatively similar population densities.

Changes to the Original Plan

Initial analysis led to the following three minor modifications to the original plan.

Homework

The training provided was one-on-one with the new entrant. The training was less than a full day, and only addressed FMCSA regulations. In addition, there was recommended follow-up homework the new entrant could send to The SAGE Corporation for review and comment. The new entrant carriers had access to phone technical support from SAGE during the homework period following the onsite instruction. Approximately half of the new entrants made the time investment to complete the suggested follow-up reinforcing "homework" to assist the new entrants become more familiar with the regulatory requirements. While it was not specifically tracked, SAGE also reports that the carriers that completed the 'homework' generally were also the carriers that took advantage of the telephone support.

That choice of performing the homework and sending for review and comment, or not, separated the Montana new entrants into two groups. These groups are identified as "Homework Carriers" and "No-homework Carriers" in this paper. The safety performance of each of the two groups is analyzed separately.

Carrier Size Issue

The original study plan was to use new entrant motor carriers as a proxy for carriers that are not large enough to have a safety department or safety professionals on staff. However, a review of the control group of new entrants identified some of these carriers were associated with large corporate structures that likely had a safety department, or at least had safety professionals on staff.

In order to enhance the likelihood that carriers we analyzed fit the profile, namely being too small to have a safety department, we imposed an additional filtering criteria to include only new entrants which are small motor carriers, identified number of reported power units. In the control group, there were a few new entrants that reported substantial numbers of power units, thus implying that they may be large enough to have a safety department. To increase the likelihood we are analyzing motor carriers without safety departments, we restricted our analysis to new entrants that reported 15 or fewer power units on their MCS-150 when they applied for their USDOT number from FMCSA.

Rate Adjustment for Average Inspection Result Differences

An initial review of the results of the inspection measures found that the Montana Trained Carriers did far better than the control group carriers in all inspection related measures. It was further observed that there are large differences in some of the measures between the national measure for all inspections as compared to the Montana measure for all inspections. For example, for inspections with an inspection date of 2006 and later, 69% of all inspections nationally resulted in a violation. For inspections in Montana, only 52% of inspections resulted in a violation.

The study group (trained) carriers had approximately 42% of their inspections in Montana. The control group had approximately 2% of their inspections in Montana. To equalize the calculation, the expected value from the control group carriers was adjusted by 40% of the difference (in this case 7%). This adjustment process is explained more fully in Appendix B below. The actual adjustment calculations are presented in Table 10 in Appendix E below.

Other Possible Adjustments

In making any adjustments, the primary consideration is that, in general, it is better not to modify the original statistical analysis plan. However, as shown above, specific anomalies in the data must be accounted for. Two other adjustments to the control group carriers were considered, but not acted upon.

- First, there was some consideration given to removing carriers with a high ratio of inspections to power units, as reported on the initial MCS 150. However, a review of the data showed that the overwhelming majority of these carriers had subsequent MCS-150 filings, that the number of inspections was in line with the number of power units reported on the subsequently filed MCS-150(s), and that these carriers remained relatively small (less than 15 power units.) Consequently, these carriers were not excluded from the control group.

- The second filter considered was eliminating carriers that reported more than 5 drivers per power unit. However, a detailed review of the data suggested that the carriers with a seemingly high number of drivers per power unit likely had mis-reported the number of drivers. All other statistics point to those new entrants being small carriers, within the definition of this study. These carriers were not excluded from the control group. (There was no analysis performed on the number of reported drivers in this study.)

Results Summary

This section provides an overview of the results of the analyses performed. Additional detail on these results is available in the appendices to this paper.

Note. The data available for Montana trained carriers is a relatively small group, 222 trained motor carriers. Further, that group is roughly divided in half by self-selection. One consequence of this small number of carriers (or events) is that a substantial difference in performance between the intervention study group and the control group is required to result in a statistically significant difference at the 95% or better level.

Inspection Results

Table 1 below provides a summary of key inspection results.

Measure	All Inspec-tions	Montana Inspec-tions	Adjustment Factor from Appendix B	Control Group Inspections	Expected Value	Montana Homework Carriers	"No home-work" Carriers' Inspections
Percent of Inspections with Driver Out-of-Service Orders	6.31%	8.89%	-1.03%	10.55%	**11.58%**	***7.63%***	***8.09%***

Measure	All Inspec-tions	Montana Inspec-tions	Adjustment Factor from Appendix B	Control Group Inspections	Expected Value	Montana Homework Carriers	"No home-work" Carriers' Inspections
Percent of Inspections with Vehicle Out-of-Service Orders	16.16%	9.52%	2.66%	22.03%	**19.37%**	***11.49%***	18.47%

Table 1 - Inspection Related Measures for Montana Homework Carriers

Red indicates significant at the 99.9% level, ***Blue*** indicates significant at the 95% level

Table 1 above shows the results of several key inspection measures comparing study group carriers with the control group. This data is for inspections from 2006 to the date of the data extract in late summer 2009. Overall, there were 1,140 inspections on the Montana Homework carriers, 665 inspections on the Montana No-homework carriers, and 58,406 inspections on the control group carriers.

For all of the measures the performance difference between the Montana Homework carriers and the expected value (control group carrier statistic minus adjustment) was significant at the 99.9% confidence level. For the Montana No-homework carriers and the performance of the control group carriers, the difference was significant at the 95% confidence level for Percent of Inspections with Driver Out-of-Service Orders.

Additional data on all of the identified measures is presented in Appendix F below.

Impact on Crashes

Crashes per Power Unit

Overall, the calculated crash rate for all Montana trained carriers, over the period 2006 to the end of the data collection timeframe, is 5.44 crashes per 100 reported power units. The calculated crash rate for the control group carriers (with less than 16 reported power units) is 5.98 crashes per 100 power units. This is not a significant difference at the 95% level. See Appendix C below for the more complete analysis and discussion of crashes per power unit and the data quality problems that may have contributed to the lack to significance.

Crashes per Carriers' Driver

The second crash rate measure is crashes per carriers' driver. See Appendix D below for a detailed discussion of how this is derived.

Measure	Control Group Carriers	Montana Homework Carriers	Montana No-homework Carriers
Total number of drivers	22,439	279	153
Total number of drivers in crashes	2,889	24	19
Total number of crashes for Carriers' Drivers	3,233	24	19
Average Number of Crashes per Driver	.144	***.086***	.124

Table 2 - Summary of Crashes per Carriers' Drivers

Overall, the calculated crash rate for drivers associated with Montana Homework carriers, over the period 2006 to the end of the data collection timeframe, is .086. The calculated crash rate for the control group carriers is .144 crashes per driver. This is a significant difference at the 98% level.

Projected SA Results

One of the reasons for FMCSA undertaking a more fully developed research demonstration project to evaluate providing early, proactive training to new entrants is as a possible way to lower the number of new entrants that are forecast as likely to fail the new Safety Audit requirements of the final rule. Table 3 provides an analysis of the control group and the two groups of trained Montana new entrant carriers. It strongly demonstrates that some of the training provided in 2005-6 was highly successful in improving what would have

been the pass rate under the new final rule for the Homework carriers. It also clearly indicates not all training is equally effective. The No-homework carriers who did not have reinforcing education did not do significantly better.

New Entrant Group	Total Safety Audits	Number of Carriers that would fail with New Criteria	Percent of Carriers that would fail with New Criteria
Montana Homework Carriers	96	29	***30%***
Montana No-Homework Carriers	87	46	53%
Control Group Carriers	5,303	2,993	56%

Table 3 - Impact of Training on Failure Rate of Safety Audit

This demonstrates it is possible for such early proactive training to reduce significantly the number of new entrants that would fail. Such a properly structured undertaking applied nationally likely could significantly lower the number of new entrants that would fail the SA. Reducing the number of failed audits would provide benefits to both the carriers and to the government. When a carrier fails a safety audit:

- The carrier will be required to provide a Correction Action Plan to FMCSA for resolving the problem.
- The plan must be reviewed and approved by FMCSA staff.
- The carrier must implement the plan.
- FMCSA staff must monitor and verify compliance.
- If the carrier does not comply, FMCSA must rescind the carriers' registration.

Reducing the SA failure rate will eliminate these costs for the carriers that pass the SA, but would have failed the SA, but for the benefit of the training. This includes both the cost to the carrier and the cost to FMCSA.

Further, based on lesson learned from analysis of the specific SA requirements that need improved training (see Appendix G below), SAGE anticipates training in the research demonstration could reduce the failure rate of trained new entrants substantially below the forecast 30% rate associated with the 2005-06 training. For those who do fail, the training should enable them to quickly submit a safety correction plan and come into compliance.

Conclusions

The Montana new entrant motor carriers that completed the recommended reinforcing homework, had substantially and significantly better safety performance on almost every identified measure, including both the direct measures of crash performance and a wide range of indirect measures of safety performance.

In contrast, those Montana new entrants that did not do the suggested reinforcing homework have safety performance measures that are only slightly better than the new entrants in the control States. In many cases, while the difference in safety performance is clear from the data, we cannot assert that it is significantly different from the performance of the control group. This suggests a hypothesis. While any training helps, a structured, integrated program that includes both training and reinforcing homework has a much greater impact than just 'scatter-shot' training. This could have implications for the possible effectiveness of distance training FMCSA is planning to make available to new entrants too small to have a safety department.

The existence of a correlation does not, necessarily imply causality. It is not possible to determine how much of the adoption of a safety culture by the Montana Homework new entrants who achieved reinforcement of their limited one-on-one training might be because of self selection, and how much is a result of training. It appears reasonable that training improves performance, and that homework reinforcing training improves performance more than training without reinforcing homework.

In other words, it is impossible to differentiate:

- How much the existing carriers' basic safety culture both led them to complete the recommended homework and led to better safety performance, as compared to;

- How much the base training plus the homework reinforcement led to a modification of their safety culture, and thus to better safety performance.

The research demonstration just getting started will help answer this question via its training structure, which is designed to reduce the potential impact of self-selection, by incentivizing virtually all the new entrants to complete the reinforcing homework.

This analysis identifies that the performance difference of the trained Homework carriers, as compared to the control group carriers is quite dramatic;

- The safety performance of the trained Homework carriers, across a wide range of measures, is substantially and significantly better than the safety performance of the untrained, control group new entrant carriers.

- The Safety Audit performance of the trained Homework carriers, as compared to the untrained, control group carriers, is also substantially and significantly better. If implemented on a national level, this approach could mean both a lesser cost to the carrier in complying with the additional requirements associated with a failed Safety Audit, and a lesser cost to the government in monitoring that compliance.

Appendix A Logic for Selecting the Control Group

Time Period

Prior studies have demonstrated that a wide range of statistical indicators can change across time. For example, FMCSA's New Entrant Program Effectiveness Study ran into difficulty comparing crash rates in different time intervals. FMCSA has an ongoing program to improve the data quality of crash reporting and is improving the reporting quality over time. Because of changes in crash data reporting it is not reasonable to compare crash rates for groups in different time periods.

This study addresses that problem by choosing a control group of new entrant carriers that had entry dates during the same time window as for the Montana trained carriers.

Affinity

Two other effects have been identified that can result in differences in safety performance statistics;

- There are cultural differences (e.g. Western vs. Eastern, urban vs. rural) in both carrier practices and in the nature of the dominant motor carrier businesses in those States. For example, there are probably relatively few hog haulers in New York City.

- There are differences in enforcement patterns among States. (See Appendix B below for further discussion.)

For these reasons, only new entrant carriers from States that are geographically and culturally similar to Montana were selected to be included in the baseline. Selection of the States for inclusion in the control group is guided by the key differences between Montana and other States, which we believe can be dominantly represented as:

- Regional similarities (and differences), and
- State population densities.

To avoid unanticipated bias from regional differences with new entrants included in the control group, we are using new entrant, non-hazmat, interstate freight carriers from States in the same region of the U.S. Additionally, we only included States in the control group with population densities that are not radically higher (or lower).

There are four States neighboring Montana; Idaho, Wyoming, North Dakota, and South Dakota. Each of these States has a population density similar to Montana's, and are included in the control group.

There are eight states adjacent to the states that are adjacent to Montana. These states, listed in increasing order of population density are: Nevada; Nebraska; Utah; Oregon; Colorado; Iowa; Minnesota; and Washington.

- The two most distant States are Iowa and Minnesota, which could contribute to larger regional differences. Additionally, those States also have the second and third highest population densities on the list. So, those two states are excluded from the control group.

- Unlike Iowa and Minnesota, Washington State is fairly close to Montana. At the closest point it is approximately 100 miles distant. However, there is a substantial difference in population density. Washington has almost 15 times the population density of Montana. Therefore, because of the large population density difference, Washington is also excluded from the control group.

As a result, the following nine states satisfy the criteria of being located in the same regional area and having roughly compatible population densities. Thus, subject to the filtering out of carriers with 16 or more power units all new entrant motor carriers from these nine States are included in the control group. The States in the control group are Colorado, Idaho, Nebraska, Nevada, North Dakota, Oregon, South Dakota, Utah, Wyoming.

Appendix B Adjustment for Differences in State Enforcement Patterns

As noted in Appendix A, titled "Logic for Selecting the Control Group" there can be differences between enforcement patterns among states. For example, data for inspections from January 1, 2006 through the end of the data extract in late summer, 2009 shows:

- Nationally, 69.32% of all inspections resulted in vehicle violations, while only 52.26% of Montana inspections resulted in vehicle violations.

- Nationally, 16.16% of all inspections resulted in vehicle out-of-service orders, while in Montana only 9.52% of inspections resulted in vehicle out-of-service orders.

- On the other hand, nationally only 6.31% of inspections resulted in driver out-of-service orders, while in Montana 8.89% of inspections resulted in driver out-of-service orders.

In this time period, the control group carriers had 12,853 of their 16,137 inspections (76.64%) result in vehicle violations. There were 1,140 inspections on Montana Homework carriers in this timeframe. Without any adjustment to the expected results, based on the percent of inspections to control group carriers that resulted in violations, we would statistically expect 76.64%, or 874 of the inspections on Montana Homework carriers to have resulted in violations.

Because of these differences in patterns of inspection results in Montana, the first pass at looking at inspection statistics showed that, in areas such as percent of inspections resulting in violations, percent of inspections resulting in vehicle violations, and percent of inspections resulting in vehicle out-of-service orders, both the Montana Homework and No-homework groups of Trained Carriers appeared to do much better than the control group carriers.

Montana Trained Carriers had 42% of their inspections in Montana, while the control group carriers had 2% of their inspections in Montana. Because of the apparent substantial differences in results from an inspection in Montana, in order to make the comparison of inspection results more accurate, this analysis includes an adjustment factor to calculate the expected value consistent with the prevailing difference in inspection results.

The adjustment is calculated as follows:

- The difference in Montana inspections resulting in violations, as compared to inspections nationwide resulting in violations is 17.06%. This is derived as the national average of 69.32% less the Montana rate

of 52.26 %.

- Montana Homework carriers had 42% of their inspections in Montana, as compared 2% of the control group, so the expected percent of inspections that would result in vehicle violations is calculated as 40% of the difference. Therefore, the comparative rate of control group inspections resulting in violation is reduced by 40% of 17.06%, or 6.83%.

- Using this adjustment of 6.83%, the expected percent of Montana inspections resulting in violations would be 69.82 (76.64% observed violation in control States less 6.83% adjustment factor. Excel performs the complete calculations, resulting in the apparent error of .01.) This statistically projects that, for a sample of carriers randomly drawn from the control group, an expected number of Montana inspections with violations to be 796 inspections (not 874 inspections.)

In fact, 680 of the 1,140 inspections to homework carriers, or 59.65% of inspections, resulted in violations. This is a statistically significant difference.

Appendix C Crashes Per Power Unit

There are known significant data problems with the reported number of power units and number of drivers per carrier contained in the MCMIS census data for new entrants during that time period. That is because during the time period these new entrants were getting their USDOT number, FMCSA had recently implemented a web capability for carriers to submit their data electronically, rather than the older paper-based approach, and receive their USDOT number.

The first analysis of crashes per power unit showed that the control group carriers appeared to have far fewer crashes per power unit than either the Montana Homework or No-homework trained carrier groups. A strong contribution to this was from there being a surprisingly large number of power units reported in the control group. A review of the power unit data for the control group carriers identified several unusual MCS-150 reports, including 7 carriers which had, among them 76,752 power units, 12 drivers, 5 inspections, and no crashes. Data for these seven carriers was removed for any analysis that used power units.

A quick review of the other records suggested, based on comparing the number of power units reported to the number of drivers, the number of inspections, and the number of crashes, and the presence (or absence) of SEA scores, that a number of other control group carriers also appear to have over-reported their number of power units. However, developing a more complex algorithm to eliminate carriers that had over reported power units from the analysis of crashes per power unit was beyond the scope of this study.

The following analysis looked at crashes stratified by count of power units, for new entrant control group carriers (not including data for the 7 carriers identified above for exclusion.) Table 4 shows the analysis of crashes per power unit for all Montana Trained Carriers. This table is based on all crashes for the carriers from their time of original entry to the data cutoff in late summer 2009, i.e., this is not crashes per year.

Group	Number of Carriers	Reported Power Units	Crashes	Crashes Per hundred Power Unit	Cumulative crashes per hundred power units
No Reported Power Units	2	2	0	0	0
One Reported Power Unit	158	158	20	12.66	12.50
2 - 4 Reported Power Units	47	115	5	4.35	9.09
5 - 9 power units	11	67	1	1.49	7.60
10 – 14 power units	3	41	0	0.00	6.79

Table 4 - Crashes per Power Unit for Montana Trained Carriers

For each carrier, the number of power units used was the number of power units identified on the initial MCS-150. Further, it is assumed that no active carrier actually has no

power units. For analysis purposes, one power unit was assigned to each carrier that reported no power units. Because of the limited results found using the crashes per power unit measure, for this analysis it did not seem worthwhile to analyze this at the more disaggregated level of Montana Homework and No-homework groups.

Group	Carriers in the Control Group	Reported Power Units	Crashes	Crashes Per hundred Power Unit	Cumulative crashes per hundred power units
No Reported Power Units	2,163	2,163	123	5.69	5.69
One Reported Power Unit	10,423	10,423	914	8.77	8.24
2 - 4 Reported Power Units	3,942	9,965	464	4.66	6.66
5 - 9 power units	713	4,355	147	3.38	6.13
10 - 14 power units	150	1,717	65	3.79	5.98

Table 5 - Crashes per Power Unit for Control Group Carriers

Table 5 shows a similar analysis for the control group carriers. Overall, the crash rate per power unit for the Montana trained carriers was 6.79.

The crash rate per power unit for the control group carriers is 5.98 crashes per hundred power units. This is not a significant difference at the 95% level.

Appendix D Crashes Per Carriers' Driver

A second measure of crash rate has been used is some previous studies for FMCSA. This rate is crashes per carriers' drivers. This alternative approach is documented in at least two studies done for FMCSA that used a measure of the number of drivers obtained from inspection and crash reports as the denominator to calculate a rate.[7,8]

FMCSA has data available from its methods that routinely gathers motor carrier safety performance information. That data identifies drivers and what motor carrier they are driving for at the time of the contact. This safety performance data is available for analysis from MCMIS. Most connections are based on roadside inspections. However, additional connections can also be made based on MCSAP traffic enforcement activities and crashes.

The goal is to link driver safety performance data for as many drivers as possible with the new entrant motor carriers the driver is associated with in either Montana or the control States. Safety performance data from MCMIS for crashes and inspection reports also contain both driver and motor carrier identification information.

This study used all such MCMIS data from August 2006 forward to late summer of 2009 to determine if a driver was ever associated with a new entrant in either Montana or one of the control States contained in this analysis.

While this process does not identify all drivers associated with each new entrant, the FMCSA safety performance data from MCMIS represents measures of performance from a consistent process of exposure for identifying a representative metric of safety performance. Because the process is consistent, other studies have found this metric useful. Although the number of drivers determined for a particular carrier may not be exact, because the process is consistent, the ratios are representative.

It has also been very useful in identifying functionally larger carriers that have artificially subdivided themselves into multiple motor carriers to spread their safety performance data. It successfully associates the same base of drivers with all the artificially created motor carriers, thus identifying them as if they were not artificially separated.

The analysis approach used is that if any inspection shows a driver is associated with one of the new entrants, the driver is connected to that carrier. In this analysis, the data from all other events (in this case, inspections and crashes) for that driver are then attributed to that new entrant's USDOT number.

In summary, we take all crashes for each driver to calculate that driver's total crashes, regardless of what carrier the driver was working for at the time of the crash. Then we determine if that driver is associated with a new entrant carrier in one of the target groups we are analyzing, using driver and carrier identification information from

inspections. Then we calculate the crash rate for the new entrant carriers in each of the target groups as the number of crashes associated with all drivers associated divided by the number of all drivers associated with them. Table 6 shows the data for carriers' drivers, established using inspection data.

Measure	Control Group Carriers	Montana Homework Carriers	Montana No-homework Carriers
Total number of drivers	20,088	278	153
Total number of drivers in crashes	2,750	29	19
Total number of crashes for Carriers' Drivers	3,311	***32***	21
Total Crashes for target group*	983	13	5
Average Number of Crashes per Driver*	0.165	0.115	0.137
Average Number of Crashes per driver when driving for the target group	0.049	0.047	0.033
Percent of Crashes for Target Group	30%	41%	24%

Table 6- Carriers' Drivers' Crash Rates

There were 20,088 drivers in inspections for control group carriers who had correctly formatted Driver's License Numbers. (In order to provide accurate counting and matching, only events where the drivers had correctly formatted US driver's licenses were used. This is necessary for accurate identification and matching.) Of these drivers, 2,750 drivers had 3,311 crashes. This is an average of .165 crashes per driver, using all collected data.

By comparison, there were 278 drivers associated with Montana Homework carriers by inspection. These drivers had a total of 32 crashes; an average of .115 crashes per driver, using crash data from all available years, 2006-2009. The difference between 0.165 crashes per driver and 0.115 crashes per driver is a significant difference (at the 98% confidence level.) The drivers associated with Montana Homework Carriers had significantly better overall crash rates than drivers associated with Control Group carriers. In other words, overall, the Homework Carriers' Drivers had an overall crash rate significantly lower than the crash rate for the Control Group Carriers' Drivers.

There were 153 drivers associated with Montana No-homework Carriers. Overall, these drivers had a total of 21 crashes, or .137 crashes per driver. While this is a visibly better performance than the 0.165 for control group drivers, the difference is not statistically significant at the 95% level.

Looking at only the crashes that the drivers had that were charged to the associated carriers, there is little difference in the driver's crash performance. However, the key difference is the percent of the drivers' crashes that they had while working for the identified carrier. The drivers for the Homework Carriers had a far larger percentage of their crashes while working for those carriers, as opposed to while working for any other carrier.

* The term 'target group' refers to Control Group Carries, Montana Homework Carriers, or Montana No-Homework Carriers. This calculation shows the number of crashes that were assigned to the carriers in the control groups for the identified drives. For example, there were 20,088 drivers associated with the control group carriers via inspection had 983 (of their 3,311) crashes associated with the control group. If we divide the number of crashes for drivers associated with the control group by the number of drivers associated with the control group, the calculation is 983/20,088, or .049 crashes per driver.

Additional Comparative Statistics

Measure	**Montana Trained Carriers**	**Control Group Carriers**
Drivers with 7 crashes	0	1
Drivers with 5 crashes	0	1
Drivers with 4 crashes	0	10
Drivers with 3 crashes	0	58
Drivers with 2 crashes	4	405

Drivers who had 3 crashes for one carrier	0	10
Drivers who had 2 crashes for one carrier	0	151
Drivers who had 3 crashes for a target group carrier	0	1
Drivers who had 2 crashes for a target group	0	41
Montana Driver Count as a Percent of Control Group Driver Count	2.15%	

Table 7 - Additional Comparative Statistics

Table 7 provides additional comparison statistics on crash rates between the drivers associated with control group Carriers, as compared to the drivers associated with Montana combined Trained Carriers.

While these statistics do not rise to the level of statistical significance, due to the small number of incidences, this data supports the suggestion that the drivers associated with Montana trained carriers had better overall crash performance than the drivers associated with control group carriers.

Use of Only Inspection Connections

The key to the effectiveness of any carriers' drivers' measure is to be able to connect drivers to carriers. The original plan was to use every connection possible. Specifically, the plan included both connections of drivers to carriers through inspections and connections of drivers to carriers through crashes.

However,

- For drivers connected to carriers through crashes, the crash rate will be at least one crash per driver.
- For drivers connected to carriers through inspections, the crash rate is substantially less than one crash per driver.

As Table 8 below shows, there were, percentage wise, more connections of drivers to control group carriers only through crashes than there were to Montana trained carriers only through crashes.

Measure	Montana Trained Carriers	Control Group Carriers
Inspected Drivers	434	20,088
Drivers in Crashes with Valid DLNs	52	1,698
Drivers in Crashes with No Inspections	3	720
Total Carriers' Drivers	437	23,159
Percent of Carriers' Drivers with Crashes and No Inspection	0.06%	3.11%

Table 8 - Sources of Connections of Drivers to Carriers

This was unexpected; it is not clear what the underlying business explanation might be. Essentially, it means crash data was reported to MCMIS, but there is no associated inspection data, either for the event or for other inspections associating the driver with the carrier. In order to avoid any concern with biasing the results, for this analysis the identification of driver's crashes and their association with new entrant motor carriers was made using only inspections.

Conceptual Overview of Carriers' Drivers

The concept of Carriers' Drivers (Safety Event) Rate was used in analysis over a number of years. In the past, this analysis was used for both Violation and Conviction Rates. In this project, Carriers' Drivers' Crash Rate is used in this appendix, and Carriers' Driver's Inspection Rate is addressed in Appendix F.

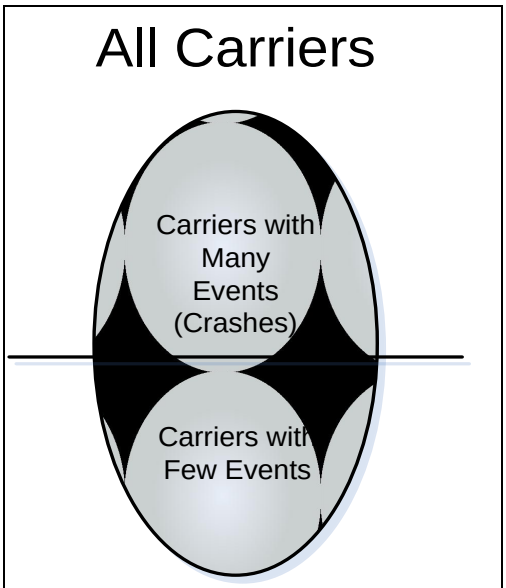

Figure 1 - The analysis can only be carriers, or groups of carriers, that have a significant number of events.

The following offers a simple explanation of how the concept was derived.

The first element of the analysis is, originally, that we are not all that interested in carriers that have no or very few events. Because this analysis is related to many small carriers, the actual analysis is being made for groups of carriers. But, the underlying concept is still the same.

For any carrier, or group of carriers, if there are no events, or very few events, there is nothing to be gained from the analysis. Given that there is an interest only in a population with a number of events, the question then is, what would it mean for a carrier (or a group of carriers) to have a relatively large number of events.
If we look at a carrier that has many events for relatively few drivers (e.g. a lot of crashes per driver), then we can be relatively certain that the carrier is a problem carrier.

However, if we look at a carrier with many events, we can not tell much about the carrier. It could be that it is a large carrier, with many events, and many drivers. The classic example is UPS. UPS has more crashes nationally than almost any other carrier. Nonetheless, UPS is known to be one of the safest carriers.

On the other hand, some carriers hire drivers for short periods of time, sometimes for a period as short as a single trip. The question then is how to identify these problem carriers. Specifically, these will be carriers that have many different drivers, over short terms, and which has management practices that do not encourage, or that actively discourage safe driving, i.e., a surrogate for the safety culture of the motor carrier.

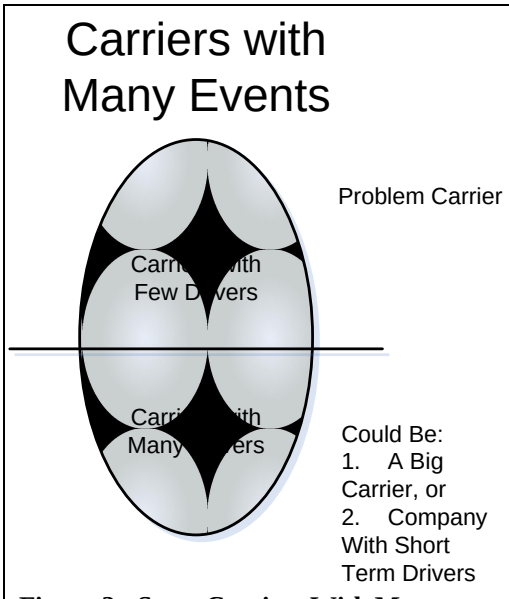

Figure 2 - Some Carriers With Many Events are Very Safe Carriers, Some are NOT

The concept is that every driver is a reflection of the carrier for whom he or she is working. Whether or not the event in question occurs when the driver is working for the carrier, each event that the driver has is associated with the carrier. If the analysis is being performed over the period of a year, the measure of exposure is a driver year. (For this analysis, the period of analysis is actually January 2006 through the middle of 2009, or about 3½ driver years per carrier for every driver associated with the carrier.) As a result, the carrier associated with the driver 'inherits' both the full performance of the driver in the time period, and the full measure of exposure for the time.

Consider, for example, two companies.

- Quality Carrier has 1,000 drivers associated (through inspections) with the carrier. These drivers have a total of 30 crashes in a year. All of these crashes are assigned to Quality Carrier. Viewing only Quality Carrier and its drivers, Quality Carrier has a crash rate of .03 crashes per driver per year.

- Fly-by-Night Carrier also has 1,000 drivers associated (through inspections) with the carrier. Fly-by-Night only has 20 crashes in the year, or a crash rate of .02 crashes per driver per year. However, these same drivers have a total of 80 crashes in the year. (These drivers had 60 crashes while working for other carriers.)

Table 9 - Comparative Analysis of Carrier's Drivers' Crash Rates for Example Case.

Measure	Quality Carrier	Fly-by-Night Carrier
Total number of drivers	1,000	1,000
Total number of drivers in crashes	30	80
Total number of crashes for Carrier's Drivers	30	80
Total Crashes for target group	30	20
Average Number of Crashes per Driver	.03	.08
Average Number of Crashes per driver for target group	.03	.02
Percent of Crashes for Target Group	100%	25%

In this case, looking just at the crash rate for the drivers while working for the carrier clearly does not tell the whole story. The drivers associated with Quality Carrier had a crash rate of .03 crashes per driver. In other words, the Carrier's Drivers' Crash Rate for Quality Carrier was .03 crashes per driver. The drivers associated with Fly-by-Night carrier had a Carrier's Drivers' crash rate of .08 crashes per driver.

Appendix E Inspection Results

Table 10 below shows the results of the various inspection measures comparing Montana Homework and No-homework carriers with the control group of carriers for inspections from 2006 to the date of the end of the data extract in late summer 2009. Overall, there were 1,140 inspections on the Montana Homework carriers, 665 inspections on the Montana No-homework carriers, and 58,406 inspections on the control group carriers.

Measure	All Inspec-tions Since 2005	Montana Inspec-tions Since 2005	Adjust-ment Factor (See Appendix B)	Control group (less largest carriers) Inspec-tions Since 2005	Expected Value	Montana Homework Carriers Since 2005	"No-home-work Carriers' Inspec-tions Since 2005
Percent of Inspections with Violations	69.32%	52.26%	6.83%	76.64%	**69.82%**	**59.65%**	70.38%
Percent of Inspections with Out-of-Service Orders	21.02%	17.32%	1.48%	29.71%	**28.23%**	**18.33%**	24.89%
Percent of Inspections with Driver Violations	34.94%	32.52%	0.97%	43.81%	**42.84%**	**36.14%**	41.07%
Percent of Inspections with Driver Out-of-Service Orders	6.31%	8.89%	-1.03%	10.55%	**11.58%**	**7.63%**	**8.09%**
Percent of Inspections with Vehicle Violations	50.84%	29.00%	8.74%	54.56%	**45.82%**	**35.00%**	45.50%
Percent of Inspections with Vehicle Out-of-Service Orders	16.16%	9.52%	2.66%	22.03%	**19.37%**	**11.49%**	18.47%

Table 10 - Inspection Related Measures for Montana Homework Carriers

For all measures of safety performance, the difference between the Montana Homework carriers and the (calculated) expected value (control group carrier statistic minus adjustment) was significant at the 99.9% confidence level. For the Montana No-homework carriers and the performance of the control group carriers, the difference was significant at the 95% confidence level only for Percent of Inspections with Driver Out-of-Service Orders.

For most of the calculated statistics, the differences between the Montana No-homework carriers and the expected values were quite small. However, for the percent of inspections resulting in driver out-of-service orders, the performance of the No-homework carriers was significantly better than the adjusted control group performance.

Appendix F Carriers' Drivers' Inspection Violation Measure

The purpose of evaluating the carriers' drivers' Inspection Violation rate is two fold;

- First, it agrees with the other inspection results. Table 10 above reviewed the percent of inspections resulting in violations and in out-of-service orders. Looking at the rate of violations per inspection, it agrees with this finding. Larger numbers of violations per inspection are often associated with out-of-service orders. Even without out-of-service orders, a large number of violations may be taken as an indicator that the inspector was concerned with the safety fitness of the truck and/ or driver.

- Second, this analysis provides a view of how the carriers' drivers perform overall, in comparison to their performance for the three target groups of new entrant carriers being studied.

Table 11 presents the results of this analysis.

Table 11 - Driver and Carriers' Drivers' Inspection Measures - All data from 2006 to Late Summer 2009

Measure	Control Group	Montana Homework Carriers	No-homework Carriers
Drivers with validly formatted DLNs	23,155	280	158
Inspections for target carriers	53,103	923	439
Total Violations in Inspections for Target	136,257	1,377	974
Inspections with Violations for Target	39,753	552	307
Total Inspections for All Carriers	86,906	1,314	653
Total Violations in all Inspections	210,731	2,083	1,259
Inspections with Violations for all inspections	64,159	806	438
Target Group Pct of Inspections with VIOS	75%	60%	70%
Target Group Violations per Inspection	2.57	1.49	2.22
Overall Pct of Inspections with Violations (Carriers' Drivers Inspections with Violations Rate)	74%	61%	67%
Overall Violations Per Inspection (Carriers' Drivers' Violations Per Inspection Rate)	2.42	1.59	1.93
Percent of Inspections for Target Group *	61%	70%	67%

* This row presents the percentage of drivers' inspections that occurred when the driver was driving for the target group. For example, of inspections for drivers associated with the control group, 61% of the inspections were associated with control group carriers, meaning 39% of their inspections occurred when the driver was working for other than control group carriers. Of the inspections for drivers associated with Homework Carriers, 70% of the inspections were associated with the Montana Homework carriers, meaning 30% of the inspections were associated with working for other carriers. Of the inspections associated with drivers associated with Montana No-homework carriers, 67% of the inspections were for the No-homework carriers, meaning 33% of the inspections occurred when the driver was working for another carrier.

This table offers some interesting revelations

- The rankings in this measure are the same as the rankings in most every other measure. The Montana Homework Carriers had the best results, the control group Carriers had the worst results, and the Montana No-homework carriers came in somewhere in the middle.

- Overall, the drivers for control group carriers had slightly better overall inspection performance when working for either of the Montana trained target groups of new entrant carriers.

- Similarly, the drivers for the Montana no-homework carriers had slightly better overall performance in inspections when working for Montana Homework new entrant carriers than in their performance when working for the No-homework carriers.

- The reverse is also true. Namely, the drivers for the Montana Homework Carriers had slightly worse overall inspection performance when working for other than the Montana Homework Carriers.

This pattern very strongly suggests it is possible to foster a safety culture, and that the safety culture of the Montana trained carriers had a clear impact on the driver's safety performance, not only when the driver was working for the carrier, but also when the carriers' drivers were working for other carriers. Further, the amount of impact is greatest for drivers who worked for carriers that received the training reinforcement by completing the homework.

Appendix G Safety Audits – Projected Difference in Failure Rates with New Failure Criteria in Final New Entrant Rule

There are 16 questions from the Safety Audit that have been identified as automatic failure criteria, based on the final rule in the Federal Motor Carrier Safety Regulations.

Summary Results

Table 12 presents information about the safety audits that were performed on each of the three target groups for this analysis. It shows;

- The total number of carriers that received safety audits within each group;
- The total number of carriers within each group that would have failed, based on the 16 automatic failure criteria contained in the new entrant final rule, and
- The percent of carriers within each group that would have failed the Safety Audit.

Table 12 - Projected Failure Rate

New Entrant Group	Total Safety Audits	Number of Carriers that would fail with New Criteria	Percent of Carriers that would fail with New Criteria
Montana Homework Carriers	96	29	***30%***
Montana No-Homework Carriers	87	46	53%
Control Group Carriers	5,303	2,993	56%

Comparing the number of carriers between the target groups that would have failed, based on the final rule new criteria, the number of carriers among Montana Homework Carriers that would have failed is **Dramatically** (and significant at the 99.9 % level) lower than would have been expected, had the Montana Homework group been picked randomly from the Control Group carriers.

The number of Montana No-Homework carriers that would have failed is only slightly less than would have been expected, had the Montana no-homework carriers been selected randomly from the Control Group carriers. That difference is not statistically significant at the 95% level.

Detailed Results

Table 13 shows each of the questions identified as SA failure criteria, and the number of carriers in each target group that would have failed the safety audit, based on the final rule new criteria, by question. The total number in each column is more than the total number of carriers that would have failed the safety audit. This is because some of the carriers would have failed the safety audit on more than one question.

Figure 3- The analysis can be performed only on carriers, or

FMCSR Citation	Safety Audit Question	Safety Audit Quest-ion Number	Count of Control Group Carriers that Would have Failed on the Question	Count of Montana Homework Carriers that Would have Failed on the Question	Count of Montana No-Homework Carriers that Would have Failed on the Question
387.7(a), 387.31(a)	Does the carrier have required minimum levels of financial responsibility?	1	20		
391.11(b)(4)	Is the carrier using physically qualified drivers?	8			
391.15(a)	Is the carrier using any disqualified drivers?	10			
382.115(a), 382.115(b)	Has the carrier implemented an alcohol and/or controlled substances testing program?	12	1,415	12	6
382.215	Has the carrier used a driver who has tested positive for a controlled substance?	14			
382.201	Has the carrier used a driver with an alcohol concentration >= 0.04?	15			
382.305	Has the carrier implemented random testing program?	19			
382.211	Has the carrier used a driver who has refused a BAT/CST?	25			
383.23(a)	Has a driver operated a commercial motor vehicle without a current operating license, or a license, which hasn't been properly classed and endorsed? Note, this question has been replaced by question 89.	27/ 89	8 23		
383.37(a)	Do drivers with suspended/revoked/canceled CDLs drive?	28	2		
383.51(a)	Has the carrier allowed a disqualified driver to drive?	29	1		
396.17(a)	Can the carrier produce evidence of periodic inspections?	31	1,841	28	23
396.11(c)	Does the carrier ensure OOS defects on the DVIRs are corrected?	33	5		
396.9(c)(2)	Does the carrier ensure vehicles declared OOS have repairs made?	34	5		
395.8(a)	Does the carrier require drivers to make a record of duty status? (This has been replaced by question 90)	37 90	159 891	1 9	1 6

Table 13 - Safety Audit Questions that Will Result in Failure, with New Regulations

This analysis provides another valuable lesson learned. The forecast failures under the final rule new requirements are dominantly for only a few questions. SAGE believes these questions are straightforward to address in the research demonstration training project. Based on FMCSA implementation policies, this would be addressed either via training the new entrant on how not to fail those questions on the SA, or preparing the new entrant to quickly provide the required correction action plan and verify compliance. Thus, performance of Montana trained new entrants should be significantly better than would have been the case from the 2005-6 training.

[1] FMCSA Analysis Division, *New Entrant Program Effectiveness Study*, September 5, 2008

[2] New Entrant Safety Assurance Process; Final Rule;

http://www.fmcsa.dot.gov/rules-regulations/administration/rulemakings/final/E8-29253-New-Entrant-Safety-Assurance-Process-Final-Rule-12-16-08.pdf

[3] Advocates for Highway and Auto Safety, Petition for Reconsideration: New Entrant Motor Carrier Safety Assurance Process, December 16, 2008, http://www.regulations.gov/search/Regs/home.html#documentDetail?R=090000648082b34a

[4] New Entrant Safety Assurance Process: Implementation of Section 210(b) of the Motor Carrier Safety Improvement Act of 1999, ANPRN, http://www.fmcsa.dot.gov/rules-regulations/administration/rulemakings/proposed/New-Entrant-Safety-Assurance-Process.htm

[5] Motor Carrier Safety Advisory Committee (MCSAC): Improving the Existing Processes, Procedure and Requirements for New Entrant Carriers, September 2, 2009. The report is posted on the FMCSA website for all information pertaining to the MCSAC, http://mcsac.fmcsa.dot.gov/documents/Final%20Report%2009-03.pdf

[6] Thomas M. Corsi, Linkages Between Financial and Safety Performance Among Carriers in Major Industry Segments-2003, November 2004

[7] An Analysis of Commercial Vehicle Driver Traffic Convictions Data to Identify Higher Safety Risk Motor Carriers, North Dakota State University and Federal Motor Carrier Safety Administration, March 22, 2004, http://www.regulations.gov/search/Regs/home.html#documentDetail?R=0900006480317f24

[8] Driver/Carrier Data Relationship Project, Keane Federal Systems, July 1997