MEMBERSHIP COUNTS: ASSOCIATIONS WITH SAFETY

August 2023

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ACRONYM LIST

ANOVA	Analysis of Variance
ATA	American Trucking Associations
ATRI	American Transportation Research Institute
CMV	Commercial Motor Vehicle
CVSA	Commercial Vehicle Safety Alliance
FHWA	Federal Highway Administration
FIRST	Fatality and Injury Reporting System Tool
FMCSA	Federal Motor Carrier Safety Administration
HSD	Honestly Significant Difference
IQR	Interquartile Range
IRS	Internal Revenue Services
MCMIS	Motor Carrier Management Information System
NHTSA	National Highway Traffic Safety Administration
OOS	Out-of-Service
RAC	Research Advisory Committee
SAFER	Safety and Fitness Electronic Records
SMS	Safety Measurement System
STA	State Trucking Association
TAEC	Trucking Association Executives Council
U.S. DOT	United States Department of Transportation

INTRODUCTION

Membership associations are ubiquitous across the United States and represent both public- and private-sector interests. Almost by definition, the missions and agendas differ across associations, but their organizational models are quite similar, as their creation and management are primarily controlled by state and/or federal laws and regulations.

To support their members, associations provide myriad resources including training and education, research, products, advocacy, as well as numerous other services including networking. Ostensibly, an association is successful when their members succeed; membership success can be defined in many ways, but economic and safety performance measures are leading indicators.

While associations strive to improve the functionality of their members' operations, safety and financial health, there is little empirical data or documentation that supports this premise. Furthermore, the anecdotal information favoring the benefits of association value does not answer the critical question of, "Do associations make firms safer or do safe firms (a priori) join associations?" This question is particularly critical in light of recent increases in both car and truck crashes.[1]

In the trucking industry, state and national associations provide the same supporting resources described above.

These ongoing questions related to the relationship between association membership and motor carrier safety have been discussed for several decades. The key questions circulated around:

1) Is there a correlation between association membership and safety? If so,
2) Do associations make motor carriers safer, or do safe, proactive carriers join associations?
3) Does a methodology exist to: a) develop a statistical correlation between membership and safety; or b) statistically confirm that association membership itself creates (any) safety benefits?

The American Transportation Research Institute (ATRI) Research Advisory Committee (RAC) raised the concept of researching the relationship between trucking association membership and safety in 2022.[2] While not identified as a top five research priority by the RAC, several trucking association executives on the RAC advocated for the association-focused research.

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[1] Insurance Institute for Highway Safety, "Fatality Facts 2021 Large Trucks" (accessed on August 7, 2023), https://www.iihs.org/topics/fatality-statistics/detail/large-trucks.; Journal Record, "Data reflects alarming rise in road deaths, staggering costs" (June 22, 2023), https://journalrecord.com/2023/06/22/data-reflects-alarming-rise-in-road-deaths-staggering-costs/.

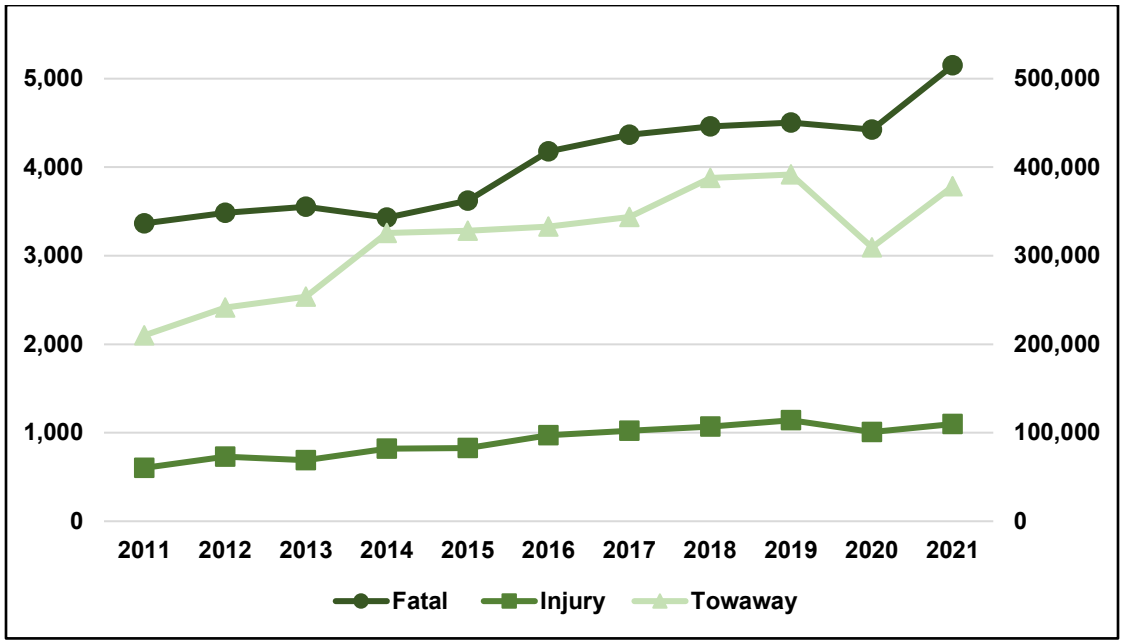
[2] ATRI's Research Advisory Committee RAC is comprised of industry stakeholders representing motor carriers, trucking industry suppliers, government agencies, professional truck drivers, law enforcement, and academia. The RAC is charged with annually recommending a research agenda for the Institute.

ATRI staff determined that the association / safety research could proceed using state association contributions to ATRI that are dedicated to state association support activities.

Background: Safety Data Trends in Trucking

Prior to the COVID-19 pandemic shutdown in 2020, towaway, injury and fatal crashes involving large trucks were on a steady incline. Over a decade ago, in 2011, the National Highway Traffic Safety Administration (NHTSA) reported a total of 273,733 truck-involved crashes (towaway, injury and fatal crashes); this data was pulled from the Fatality and Injury Reporting System Tool (FIRST).[3] By 2019, this rose to 510,299 total truck-involved crashes, an increase of 86.4 percent. Figure 1 below displays the growth of fatal, injury and towaway truck-involved crashes in recent years. To no surprise, there was a decline in the number of truck-involved crashes across all three crash types in 2020. The most severe crashes – fatal crashes – only dropped 1.8 percent while injury crashes decreased by 11.6 percent and towaway crashes by 21.0 percent.

Figure 1: Fatal, Injury and Towaway Crashes Involving Large Trucks 2011 – 2021



The total count of traffic crashes for all motor vehicles since 2011 has not grown at the same rate as crashes in the trucking industry. In 2011, there were 5,337,829 crashes nationwide. This number grew by 26.6 percent to 6,756,084 total crashes in 2019 with a majority of that growth coming from injury and towaway crashes; fatal crashes grew 12.1 percent. There was a sharp decrease in personal and business travel during the COVID-19 pandemic starting in 2020.[4] Essential businesses made up a majority of individuals commuting as e-commerce and

[3] National Highway Transportation Safety Administration, "Fatality and Injury Reporting System Tool" (June 29, 2023), https://cdan.dot.gov/query.

[4] Bureau of Transportation Statistics, "Daily Vehicle Travel During the COVID-19 Public Health Emergency" (accessed on July 1, 2023), https://www.bts.gov/covid-19/daily-vehicle-travel.

telecommuting work environments became a new lifestyle option for many in the U.S. and across the world.

The Federal Highway Administration (FHWA) releases monthly traffic volume trends based on the flow of traffic in each state throughout the U.S.[5] Comparing April 2019 to April 2020, there was a 39.3 percent decrease in vehicle miles traveled across the nation going from 279.2 billion miles traveled to 169.6 billion miles traveled. The Northeast experienced the largest decrease (45.7%). From April 2020 to April 2021, there was a near return to 256.5 billion miles traveled, a growth of 51.2 percent. This change in total vehicle miles traveled between 2019 and 2021 helps to explain the decrease in crashes.

In addition to crash data, violation and inspection data will be analyzed throughout this report. Between December 30, 2020 and October 31, 2022, there were 5,534,765 total inspections entered into the Federal Motor Carrier Safety Administration (FMCSA) Motor Carrier Management Information System (MCMIS). Of these inspections, 29.5 percent were Level I inspections, also referred to as the North American Standard Inspection.[6] Of all inspections conducted, 2,922,546 (52.8%) resulted in no basic violations and 4,514,210 (81.6%) resulted in no Out-Of-Service (OOS) violations. Unfortunately, there are minimal historical data available for violations and inspections, but FMCSA regularly provides updates to their MCMIS data used for this research.

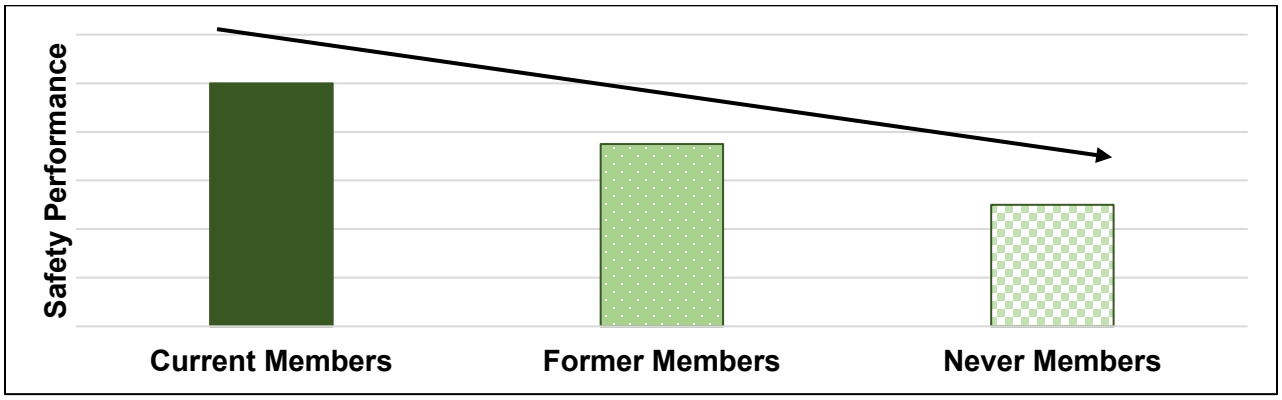
[5] Federal Highway Administration, Policy and Governmental Affairs, "Traffic Monitoring, Traffic Volume Trends" (accessed on June 29, 2023), https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm.

[6] Commercial Vehicle Safety Alliance, "All Inspection Levels" (accessed on June 29, 2023), https://www.cvsa.org/inspections/all-inspection-levels/.

METHODOLOGY

This association membership research methodology attempts to move beyond correlations between association membership and safety by focusing on a causation-oriented hypothesis. Figure 2 illustrates this hypothesis, whereby Current members have the best safety data metrics within the three cohorts, followed by Former members, and Never members have the worst safety metrics among the cohorts.

Figure 2: Hypothesis that Association Membership Leads to Safety Performance

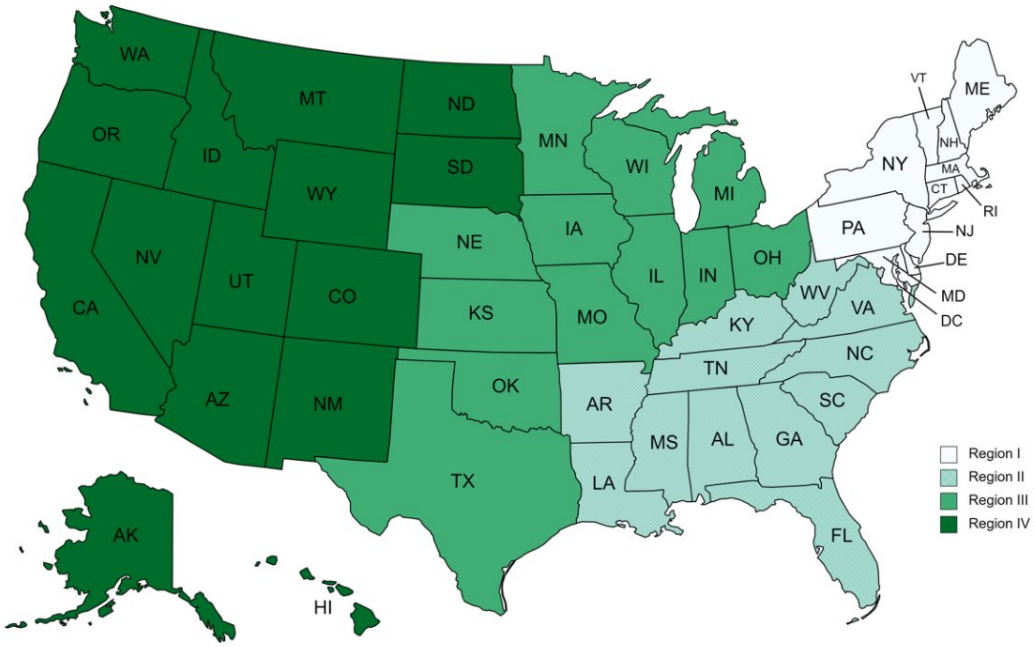


Identifying Association Data Sources

To undertake research on the above hypothesis, complete lists of Current members and an extensive list of Former members were solicited from State Trucking Associations (STAs) and the American Trucking Associations (ATA). Among the 50 STAs, there are innumerable differences in membership structure, composition and geography. In an attempt to generate a geographically representative sample of STAs, two STAs were selected from each of the Trucking Association Executives Council (TAEC) regions identified below in Figure 3.

In terms of representative memberships, association membership size was considered using data from ATRI's annual STA benchmarking survey. The research team has chosen to maintain the anonymity of the eight STAs included in this analysis.

Figure 3: TAEC Regions



The eight STAs each provided their respective Current membership lists along with extensive lists of Former members. All associations provided data on Former members from the past ten years, and several STAs provided data on motor carriers who left their associations spanning decades. ATA provided Current membership data for 900+ motor carrier members, as well as a requisite list of former members. Table 1 outlines the sources of the membership status data that were analyzed in this research. Given the complete lists of Current and Former members provided by the STAs and ATA, the ATRI research team was able to match the association membership data with a motor carrier census file within MCMIS. This was an important step in the research, as it created the opportunity to compare three different member statuses to determine whether a chronological relationship exists.

Table 1: Association Membership Status – Sources and Parameters

Membership Status	Source	Membership Parameters
Current Members	Trucking Associations	Any motor carrier that joined the respective associations on or before March 1, 2023.
Former Members	Trucking Associations	Any motor carrier that left the respective associations on or before March 1, 2023.
Never Members	A random sample of motor carriers from the MCMIS census data file.	Any motor carrier that was not listed as a Current or Former member. All associations provided a list of Former members who left in the last 10 years, with some STAs providing several decades of Former member data.

Membership Data Separated by Association Type

ATA accepts members from any sector and geographic location, but their national focus tends to draw larger, interstate carrier members. While STAs do the same, members of STAs are typically based in the same state as the association and tend to be smaller in size and/or regionally focused. Due to these differences, ATRI researchers ran separate analyses of state and national membership data.

Identifying the "Never Member" Carrier Cohort

The member data provided by the STAs and ATA was merged with a publicly available MCMIS census data file. The MCMIS census data is regularly released by FMCSA, and the data used for this analysis was from December 30, 2022. After merging the census file with the member data, the research team was able to code motor carriers as Current, Former and Never members. This was done twice, once for the STAs and another time for ATA. A brief description of the MCMIS data follows.

Association Membership Data Cleansing

The eight state associations maintain membership data using association management software. While the ATRI research team requested the same type of data from all nine state and national associations, some of the data needed cleansing. Some associations provided an extensive list of Current and Former members; five of the eight STAs provided detailed data in terms of join and cancel dates, while three associations provided somewhat less detailed data.

The first major step in data cleansing was removing any motor carriers with invalid membership join or cancel dates.

Obtaining Missing U.S. DOT Numbers

In instances where associations did not provide U.S. DOT numbers, ATRI staff located the missing numbers.

Ultimately, some motor carriers were no longer active and did not show up in the FMCSA data. As many Former members have gone out of business, the Current members eventually took up a larger portion of the data. However, going out of business is not the only reason a motor carrier may leave an association. Other factors may include the expense, the sense that they no longer need the services provided by the association or the business is relocating for some other reason.

After merging the association membership and MCMIS census data, each motor carrier had several key variables attached to them. These included U.S. DOT number, membership status, annual mileage, year of reported mileage, number of drivers, number of power units and fleet base state. Any motor carrier that was a part of multiple STAs was only entered once. If a motor carrier was a member of both an STA and ATA, both memberships were included as these analyses were conducted independently.

Applying Filters to Eliminate Outliers

As part of the data cleansing process, several filters were applied to the merged membership and census data file. ATRI annually releases its *Operational Costs of Trucking* research, documenting motor carrier operational costs and equipment benchmarks across a number of key metrics.[7] The Operational Costs report data collection form asks for average annual mileage per truck and in the 2022 report, the average mileage per unit in 2021 was 79,808. The research team removed any motor carrier with a mileage per unit or mileage per driver less than 39,904 miles – half of the 2021 average mileage per unit. With hours-of-service (HOS) regulations prohibiting commercial motor vehicle (CMV) drivers from driving more than 60 hours in a 7-day time frame, multiplied by 52 weeks and a maximum of 70 miles per hour, any motor carrier with a driver or unit that exceeded 218,400 miles in a 12-month period was removed. The minimum mileage per unit and driver of 39,904 and a maximum of 218,400 miles were set to remove any motor carriers with inaccurate mileage, driver, or power unit data that would skew the safety analysis results. Several motor carriers with different operations were tested to ensure the filters only removed motor carriers with outliers that would skew the data. Lastly, any motor carrier with mileage reported prior to 2019 or after 2022 was removed from the analysis as only motor carriers with recent mileage should be merged with 2021 crash and inspection data.

Table 2 outlines the Current and Former member data counts throughout the data cleansing process. The most dramatic drop in viable carrier data occurred when merging the membership and census data and then applying the mileage filters. The totals in the table are a combination of the STA and ATA membership data. It is worth noting that the difference between the total

[7] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: A 2022 Update,* American Transportation Research Institute (August 2022), https://truckingresearch.org/2022/08/an-analysis-of-the-operational-costs-of-trucking-2022-update/.

count of Current and Former STA members is much larger than the difference in the total count of Current and Former ATA members.

Table 2: State/National Membership Data Counts Through Data Cleansing

	Data from Associations	After Confirming U.S. DOT Numbers	After Matching Membership Data with MCMIS Census Data	After Applying Filters (Final Data)
Current Members				
ATA	933	914	896	444
STAs	3,300	2,997	2,977	678
Total	4,233	3,911	3,873	1,122
Former Members				
ATA	860	845	833	280
STAs	5,019	2,055	1,700	224
Total	5,879	2,900	2,533	504

Developing Random Samples for Never Members

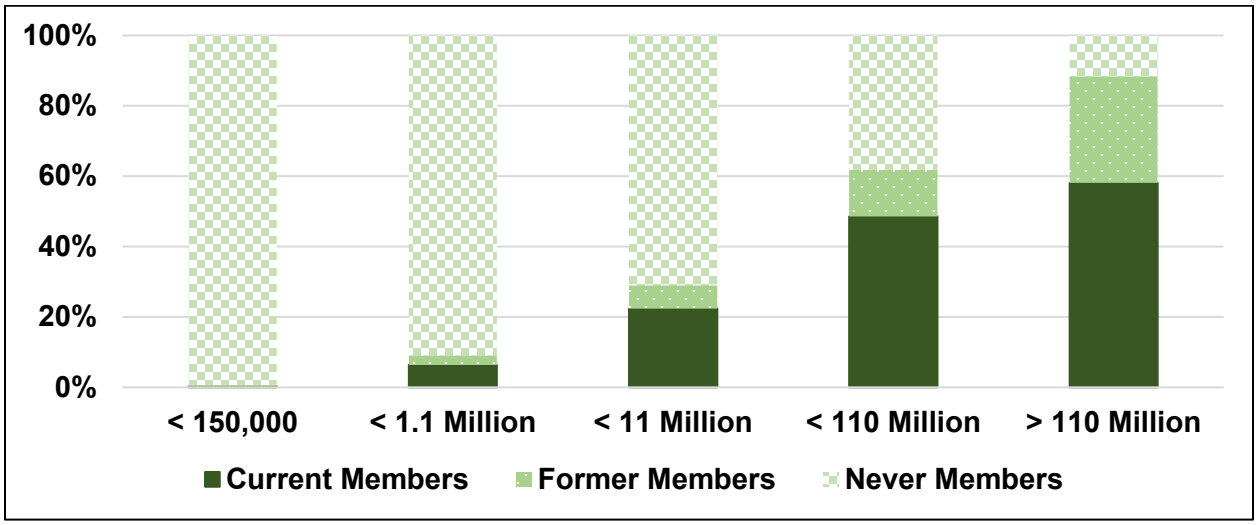
To gather a random sample of Never members from the Never member population, the fleet sizes of Current and Former members needed to be represented in a normal distribution of motor carrier mileage, with a majority of the members in the middle bin.

There were 678 Current STA members, 224 Former STA members and a population of 3,868 motor carriers to select from as Never STA members. When cleansing and filtering the data for the STA analysis, only Never member motor carriers in the eight states where association membership data came from were included. The STA membership was separated into five separate mileage bins. The middle bin, made up of motor carriers with annual mileage between 1.1 million miles and 11 million miles represented 54.0 percent of the STA members.

Since Current and Never members were not being compared in this analysis, the fleet size distribution of the Never population was mapped to the distribution of the Former membership population.

Figure 4 demonstrates the percentage makeup of the membership population bins in the analysis. The far-left bar is comprised of motor carriers with fewer than 150,000 annual miles and averaging 1.4 units and 1.3 drivers. Over 99 percent of this bin was comprised of the Never member population. On the right side of Figure 4, 58.1 percent of these motor carriers with more than 110 million annual miles were Current members. As the mileage increases, the percentage of Current and Former members increases and the percentage of Never members decreases.

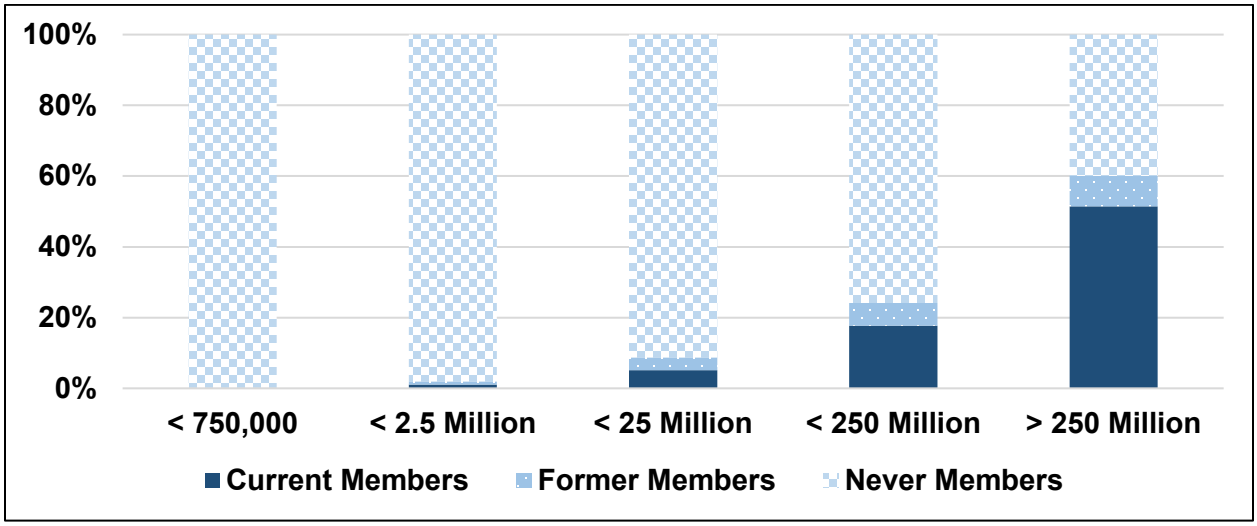
Figure 4: STA Current / Former / Never Member Mileage Bin Percentages



After cleansing the ATA membership data, 444 Current ATA members, 280 Former ATA members and 24,593 ATA Never members remained. ATA is a national organization, therefore all eligible motor carriers in the U.S. were included in this random sample of Never members.

The middle bin, carriers with average annual mileage between 2.5 million and 25 million, contains 59.9 percent of the Current members (Figure 5). Similar to Figure 4, as the mileage increases, the percentage of Current and Former members increases and the Never member percentage decreases. The most significant difference between Figure 4 and Figure 5 is the mileage axis along the bottom. The mileage ranges for the STAs are approximately half of what the ranges are for ATA in order to better represent the larger number of very large carriers at the national level.

Figure 5: ATA Current / Former / Never Member Mileage Bin Percentages



Identifying Appropriate Safety Metrics

In advance of the statistical analysis, the concept of safety needed to be defined, and meaningful empirical safety metrics needed to be identified.

A commonly used safety metric is the ratio of crashes to mileage. A second common metric is the number of violations to inspections. In 2005, ATRI released its first iteration of *Predicting Truck Crash Involvement*, frequently referred to as the crash predictor analysis.[8] Since 2005, three updates have been released in 2011, 2018 and 2022. All four iterations of the crash predictor analysis examine drivers who did and did not receive certain violations, and whether they were involved in a crash the following year. Each report confirmed that certain violations statistically increase the probability of future crashes. Due to the statistical relationship of certain violations to future crashes, this metric was used, along with truck-involved crash data.

MCMIS Safety Data

Census, inspection violations and crash data can be found in MCMIS.[9] The various data files available are updated monthly with roadside inspection data, including both driver and vehicle violations. In addition to these data, FMCSA has implemented a crash reporting system based on the crash reports completed by police officers that is electronically transmitted from the states to FMCSA. The data are collected in a system called SAFETYNET at a state level, then the crash data is uploaded to MCMIS.[10] These data files are outlined in Table 3.

[8] Dan Murray, Brenda Lantz and Stephen Keppler, *Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior-Based Model and Recommend Countermeasures*, American Transportation Research Institute (October 2005), https://truckingresearch.org/2005/10/predicting-truck-crash-involvement-2005-report-request/.
[9] A Notice by the Federal Motor Carrier Safety Administration, "Revised Carrier Safety Measurement System," *Federal Register 88 FR 9954* (February 15, 2023): 9954-9960, https://www.federalregister.gov/documents/2023/02/15/2023-02947/revised-carrier-safety-measurement-system.
[10] Federal Motor Carrier Safety Administration, "MCMIS Catalog and Documentation, Crash File Documentation – Overview)" (accessed June 29th, 2023), https://ask.fmcsa.dot.gov/app/mcmiscatalog/d_crash1.

Table 3: MCMIS Data Sources

Data File	Time Frame	Relevant Information
Census File	All motor carriers in MCMIS as of December 30, 2022.	While used to gather a sample of motor carriers who have not been an association member, the MCMIS census file was also valuable when developing certain safety metrics for the analysis. FMCSA requires all entities under their jurisdiction to update this information biennially. The list is comprised of both interstate and intrastate motor carriers. Each motor carrier is represented in a single row.
Inspection File	All operators inspected between December 30, 2020 – October 31, 2022.	Each row represents a single CMV inspection. Each inspection has its own unique identifier but is linked to the correct motor carrier by U.S. DOT number.
2021 Crash File	January 1, 2021 – December 31, 2021	Each DOT reportable crash for each CMV from 2021 is represented as a single row in the data as reported by each state. Some crashes have multiple entries as there may have been several CMVs involved in a crash.

The MCMIS inspection file is comprised of all inspection data from approximately two years; for this analysis, all inspections occurred between December 30, 2020 and October 31, 2022.[11] Each row in the data provides a count of basic violations, Out-of-Service (OOS) violations, driver OOS violations and vehicle OOS violations. The latter two are subsets of OOS violations.

The final data set utilized for the analysis was the MCMIS Crash File, released annually with crash records from the prior year.[12] The crash records in this data file represent all crashes that were U.S. DOT-reportable during that specific year. As outlined in 49 CFR § 390.5T, a DOT-reportable crash is one where either a vehicle was towed from the scene, a fatality occurred, or a person was injured and required immediate medical treatment away from the crash scene.[13]

[11] Federal Motor Carrier Safety Administration, "Safety Measurement System Downloads," (accessed January 6, 2023), https://ai.fmcsa.dot.gov/SMS/Tools/Downloads.aspx.
[12] Federal Motor Carrier Safety Administration, "MCMIS Catalog and Documentation, Crash File Documentation – Overview)" (accessed June 29th, 2023), https://ask.fmcsa.dot.gov/app/mcmiscatalog/d_crash1.
[13] Federal Motor Carrier Safety Administration, "The Motor Carrier Safety Planner 4.4.1 What is a Crash? (390.5T)" (accessed on June 30, 2023), https://csa.fmcsa.dot.gov/safetyplanner/MyFiles/SubSections.aspx?ch=21&sec=62&sub=126.

Crash Data Cleansing

ATRI obtained a MCMIS crash data file from FMCSA containing 245,196 crash records for 2021.[14] After removing 1,102 duplicate crash entries, there were 7,786 crashes involving at least one fatality, 86,547 crashes involving at least one injury, and 234,627 involving at least one vehicle being towed away from the crash scene. Several safety metrics were produced for each motor carrier involving these crash types:

- Crashes per 100 million miles;
- Fatal Crashes per 100 million miles;
- Injury Crashes per 100 million miles; and
- Towaway Crashes per 100 million miles.

Inspection Violations Data Cleansing

The MCMIS violation and inspection data utilized violation and inspection data from December 30, 2020 to October 31, 2022. There were 5,534,765 inspections that took place during those 670 days. As part of the data cleansing process, several filters were applied to create the final analyzed data set. To ensure the data consisted of adequate inspection sample sizes, the research team removed motor carriers with fewer than three inspections.

The denominator within the inspection violations analysis was the number of inspections. There were four different safety metrics tested in this analysis:

- Violations per Inspection;
- Out-of-Service Violations per Inspection;
- Driver Out-of-Service Violations per Driver Inspection; and
- Vehicle Out-of-Service Violations per Vehicle Inspection.

Generally, each of the eight Commercial Vehicle Safety Alliance (CVSA) inspection levels have a different focus. Levels I and II involve an inspection of both the driver and the vehicle; the only difference between these two inspection levels is that a Level I inspection requires the inspector to physically get under the commercial vehicle. A Level III inspection only involves the driver, and a Level V inspection only inspects the vehicle. There are two other types that were included in the census file: a Level IV inspection involving a one-time examination of a particular item and a Level VI inspection focused on select radiological shipments.[15] Drivers are inspected during Level I, II, III and VI inspections. Vehicles are inspected during Level I, II, V and VI inspections so only these inspection levels were included in the total number of inspections for the driver and vehicle OOS violation rates. There were 611,866 total driver inspections and 534,584 total vehicle inspections. The driver and vehicle OOS violations are both subsets of the OOS Violations per Inspection rate.

[14] Federal Motor Carrier Safety Administration, "MCMIS Catalog and Documentation, Crash File Documentation – Overview)" (accessed on June 29, 2023), https://ask.fmcsa.dot.gov/app/mcmiscatalog/d_crash1.
[15] Commercial Vehicle Safety Alliance, "All Inspection Levels" (accessed on June 30, 2023), https://www.cvsa.org/inspections/all-inspection-levels/.

Prioritized Safety Metrics

While all eight safety metrics could produce valuable results, the prioritized output for this analysis were:

- Crashes per 100 million miles;
- Violations per inspection; and
- OOS violations per inspection.

The other five safety metrics, while important, are subsets of the overall crash and violation data. Fatal and injury crashes are relatively rare from a rate perspective; from a statistical analysis standpoint, small datasets make it difficult or nearly impossible to identify statistically significant findings.

Statistical Analysis of Membership and Safety Data

The overall objective of this research was to determine if trucking associations causally generate safety benefits for their members. If this hypothesis is correct, the results will show that Former members are not as safe as Current members but are safer than those that have never been members.

If there were not a significant difference between Current and Former members, but a significant difference still existed between Current and Never members; there would still be a *correlation* between safer carriers and association members. However, there would not be enough evidence to conclude that the associations *causally* make their members safer. If found, this causal effect could generate from areas where associations provide skills, knowledge and resources that become institutionalized within member motor carriers. For example, motor carriers may learn better practices through the networking, events and education provided by associations. While they may no longer be a member of an association, the carrier may have implemented safety practices based on those experiences from when they were an association member. This is dependent on the specific motor carrier but could be a justification for why there would not be a significant difference between those that are Current members and those who were at one point in the last ten years.

Another possible outcome would be a significant difference between Current and Former members, but not between Former and Never members. In this scenario, an additional comparison between Current and Never members was included. If Current members are also safer than Never members, this could mean that motor carriers receive relevant information and resources while a member but as soon as that membership ends, they are no longer receiving the relevant information, resulting in a not significant difference between Former and Never members. A possible explanation could be that associations provide member-only content to improve safety practices but when that content is no longer accessible, the carriers' safety performance reverts back to pre-membership status. If the additional comparison between Current and Never members is not significant, then the variances of the data being tested are likely very inconsistent with one another.

A third possible outcome between the two tests would be no significant p-values. In this situation, there is not enough evidence to conclude that there was a statistical difference in safety between those who are, were or have never been members of the associations tested.

Welch's Two-Sample T-Test

The primary statistical test used for this research was Welch's two-sample t-test, which is used to test the significance between two populations. In order to do this, three assumptions must be checked. First, the two populations must be independent of one another, meaning that motor carriers are not included in multiple membership categories. To corroborate that the associations *cause* their members to be safer, the hypothesis requires that the membership categories are based on discrete membership status (Current, Former and Never members). Second, outliers should be removed. Finally, the data should be distributed normally on a bell curve. Based on the distribution of Current and Former members' mileage, a random sample of Never members was drawn following the normal distribution parameters of the Current and Former members.

The Welch's two-sample t-test formula requires the two means, standard deviations and sample sizes to compute the test statistic, more specifically the t-value. Using the t-value and a t-table, the p-value can be identified. A p-value indicates that, depending on the level of confidence, two means are significantly different from one another. A p-value of 0.10 is used with 90 percent confidence intervals, a p-value of 0.05 is used with 95 percent confidence intervals and a p-value of 0.01 is used with 99 percent confidence intervals. This research uses all three p-values but annotates which level of significance the p-values hold.

The p-value indicates the state of the hypothesis being tested. For this research, the *alternative* hypothesis is simple: associations uniquely make their members safer. The *null* hypothesis is that there is no difference in safety between the association membership types tested. To test whether a certain membership type is safer than another, various rates involving crashes and violations have been identified. The safer membership type will have a smaller rate for all eight safety metrics. The smaller the p-value, the more confidence in the conclusion. In other words, as the p-value grows closer to zero, the null hypothesis can be rejected with greater confidence.

Additional Statistical Tests

An analysis of variance (ANOVA) is similar to Welch's two-sample t-test, but instead of testing the means of two independent variables, the ANOVA tested the difference between three or more means. Each of the crash and violation rates for the STAs and ATA include the ANOVA output. Typically, a second test, Tukey's Honestly Significant Difference (Tukey's HSD) test, is applied in conjunction with the ANOVA test. However, the Tukey's HSD test requires equal sample sizes which is not the case for the Current members as they have more data than the Former members and sample Never members for both the STA and ATA analyses.

Several other statistical tests were considered. The Mann-Whitney-Wilcoxon test was computed for the association membership statuses and safety metrics. While some outputs from the Mann-Whitney-Wilcoxon test supported the outputs of the Welch's two-sample t-test, it

is not considered an ideal test for this type of data analysis, since the Mann-Whitney-Wilcoxon test relies on the median values, while the Welch's two-sample t-test relies on mean values.

Box and Whisker Plots

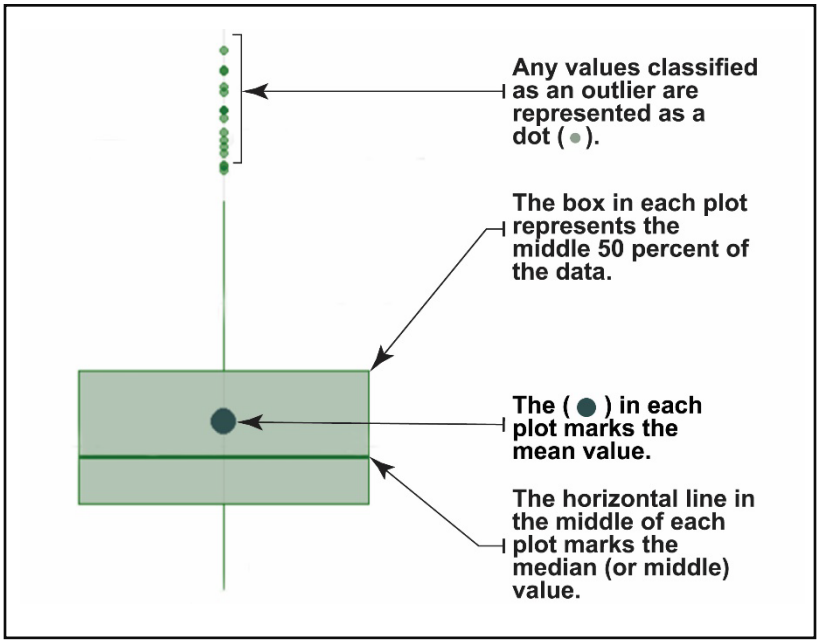
Box and Whisker plots, also known as box plots, are graphical representations used to visualize the distribution and summary statistics of a set of data. They provide a concise and informative way to display the spread, central tendency, and potential outliers within a dataset. Box plots are particularly useful when comparing multiple datasets or identifying patterns and differences in a single dataset.

Box plots are utilized in the STA and ATA findings sections of this research comparing the violations per inspection and OOS violations per inspection across the three membership statuses. There are five key components:

- Minimum (Lower Whisker): The smallest value in the dataset, excluding any outliers. It represents the lower boundary of the data.
- First Quartile (Q1): Also known as the lower quartile, this marks the 25th percentile of the data, meaning 25 percent of the data points are below this value.
- Median (Q2): The middle value of the dataset when sorted in ascending order. It represents the 50th percentile, dividing the data into equal halves.
- Third Quartile (Q3): Also known as the upper quartile, this marks the 75th percentile of the data, meaning 75 percent of the data points are below this value.
- Maximum (Upper Whisker): The largest value in the dataset, excluding any outliers. It represents the upper boundary of the data.

Occasionally a dataset will contain outliers, which are data points falling beyond the whiskers of the box plot. These outliers are values that are greater than 1.5 times the Interquartile Range (IQR) beyond the box, or Q1 and Q3. The IQR is the distance between Q3 and Q1, or Q3 minus Q1. Figure 6 identifies these features in a box plot example.

Figure 6: Box Plot Features



STATE TRUCKING ASSOCIATIONS FINDINGS

As previously noted, the eight STAs provided membership data for their Current members along with motor carriers who have left the respective associations within at least the last ten years. While the STAs provided extensive membership data, data cleansing was conducted to ensure that data across states and membership categories was comparable. The membership data was analyzed based on eight different safety metrics involving mileage and the various crash types along with inspections and various violation types associated with them. The eight safety metrics include:

- Crashes per 100 million miles;
  - Fatal Crashes per 100 million miles;
  - Injury Crashes per 100 million miles;
  - Towaway Crashes per 100 million miles;
- Violations per Inspection;
  - OOS Violations per Inspection;
    - Driver OOS Violations per Driver Inspection; and
    - Vehicle OOS Violations per Vehicle Inspection.

The resulting statistics corroborate that STA membership itself makes carrier members safer. Based on statistically significant results from key safety metrics, it can be concluded that Current members are safer than Former members, and that Former members are safer than those that are described as Never members. This particular sequential relationship between membership status and safety allowed the research team to draw the causal relationship that associations make their members safer (vs safer carriers join an association).

Several metrics did not have a statistically significant difference between Current and Former members, but did yield a statistically significant difference between Former and Never members. In many instances the lack of statistical significance is associated with the rarity of certain safety events including truck-involved fatal crashes. The research team believes that additional research may make these comparisons possible in the near future.

STA Member Crash Findings

The ANOVA test results shown in Table 4 compare whether a statistically significant difference exists between the means of the three membership statuses. Again, because of the dearth of data among all carriers, the p-values returned for fatal and injury crashes were not significant in either direction. However, when comparing the three means for all crashes and towaway crashes, there is enough statistical significance to conclude that the three means are different. The ANOVA test does not indicate the direction that these results lean, therefore the Welch's two-sample t-test was used to compare the means.

Table 4: ANOVA Significance Results for STA Member Crashes per 100 Million Miles

Crash Type	All Crashes	Fatal Crashes	Injury Crashes	Towaway Crashes
Significance	< 0.01	NS	NS	< 0.01

The results of the Welch's two-sample t-test confirm that STAs make their members safer in terms of all crashes and towaway crashes, as shown in Table 5. There is a larger statistically significant difference between Current and Former members resulting in a p-value below 0.05 whereas the Former member and Never member t-test only met a p-value threshold of 0.10. However, in terms of statistics, both p-values are deemed as significant and in turn allow the research team to conclude that associations make their members safer in preventing the two most common crash bins: truck-involved towaway crashes and all truck-involved crashes.

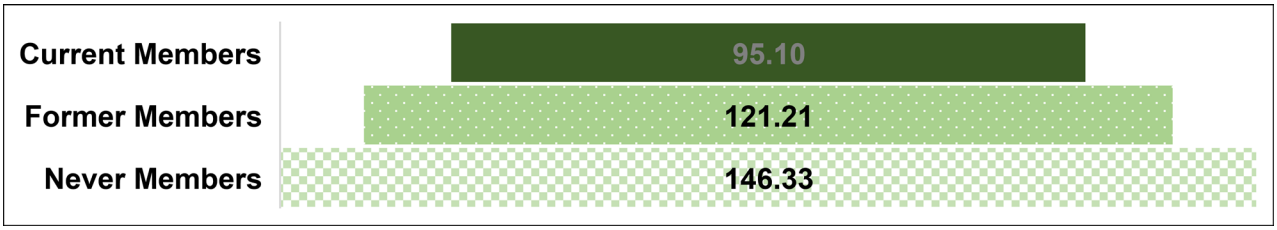
As previously noted, the p-values for fatal and injury crashes within Welch's two-sample t-test were not significant in either direction, due to the rarity of these crash events, resulting in heavily skewed data (e.g. if a small company traveling less than 250,000 miles in a single year were to get in a single fatal crash rate, their fatal crash rate per every 100 million miles would be 400 fatal crashes per 100 million miles.) Companies are much more likely to experience towaway crashes; therefore, there was adequate data to support a significant p-value. For perspective, 95.7 percent of crashes involved one vehicle being towed away from the crash scene while only 3.2 percent of truck-involved crashes involved at least one fatality. For a comprehensive breakdown of Welch's two-sample t-test, see Appendix A.

Table 5: Welch's T-Test Significance Results for the STA Member Crashes per 100 Million Miles

Crash Type	All Crashes	Fatal Crashes	Injury Crashes	Towaway Crashes
Current and Former Member Significance	< 0.05	NS	NS	< 0.05
Former and Never Member Significance	< 0.10	NS	NS	< 0.10

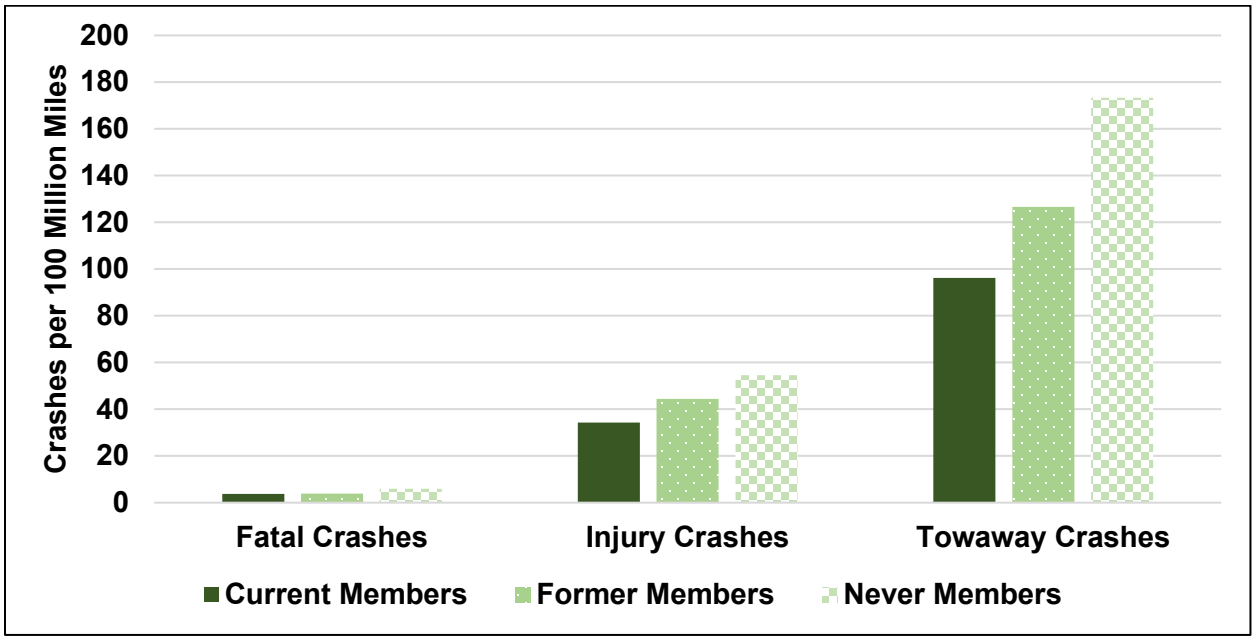
As can be seen in both the findings for the ANOVA test (Table 4) and the Welch's two-sample t-test (Table 5), the crashes per 100 million miles rate (combines fatal, injury and towaway crashes) is significantly different between STA Current, Former and Never members. Current members average 95.10 crashes every 100 million miles, Former members average 121.21 crashes every 100 million miles, and Never members average 146.33 crashes every 100 million miles. Figure 7 demonstrates that as motor carriers chronologically move away from STA membership, their crash count per 100 million miles increases.

Figure 7: Crashes per 100 Million Miles by STA Membership Status



However, Figure 8 visualizes the relationship between the different STA membership statuses by crash type. While the fatal and injury trends fall short of statistical significance for Current, Former and Never members, the data trends indicate that the Current STA members have a lower average injury and fatal crash rate than Former members along with Former members having lower average rates than Never members. The higher the rate, the more crashes a membership status experiences every 100 million miles.

Figure 8: Crashes per 100 Million Miles by Crash Type and STA Membership Status



STA Member Violation Findings

This same methodology was applied to the inspection-related violation data to analyze the relationship between Current, Former and Never STA members who underwent three or more inspections. The output from the inspection violations assessment corroborates that STAs make their members safer at even higher confidence levels.

Violations result from a driver doing something they were not supposed to, whether behavioral or mechanical, accidental or intentional. The ANOVA output for the inspection violations was significant for all four violation categories:

- Violations per Inspection;
- OOS Violations per Inspection;
- Driver OOS Violations per Driver Inspection; and
- Vehicle OOS Violations per Vehicle Inspection.

Table 6 shows the ANOVA output, displaying whether a significant difference exists between the three means, although it does not identify the direction of the trends. All four violation categories have strong evidence that the means are statistically different between Current, Former and Never member types as they have smaller p-values than the strongest statistical threshold of 0.01. A p-value less than 0.01 indicates that there is greater than a 99 percent probability that the Current and Former members are safer than the Former and Never members, respectively.

Table 6: ANOVA P-Value Results for STA Member Violations per Inspection

Violations	All Violations	All OOS Violations	Driver OOS Violations	Vehicle OOS Violations
Significance	< 0.01	< 0.01	< 0.01	< 0.01

As was done with the Crashes per 100 million miles safety metrics, the Welch's two-sample t-test was run to determine the direction of the inspection violations trends (Table 7). All four of the ANOVA tests on STA violations were very significant, with a p-value less than 0.01. Taking the analysis a step further, six of the eight means within the Welch's two-sample t-test are highly significant, with p-values of less than 0.01.

The two p-values with less significance, for the driver OOS and vehicle OOS t-tests, are lower than 0.10. Among CMV driver OOS violations, there is greater than a 90 percent likelihood that Current members are safer than Former members. Additionally, there is a 90 percent likelihood that Former members are safer than Never members in terms of vehicle OOS violations. While the results are still significant, the strength of a p-value that meets the 0.10 threshold is not as prominent.

The strength of the driver OOS p-value between Current and Former members could be explained by the many safety resources provided by trucking associations, including safety training and education. STAs typically provide direct exposure to safety products and services. Finally, it is likely that the formal and informal peer exchanges created at STA events are influential. The critical role of peer exchange and peer influence was documented in motor carrier research that assessed the role of safety culture in trucking.[16] Similarly, the slightly less strong 0.10 p-value threshold for vehicle OOS violations between Former and Never members appears to document a residual value from STA interactions that Former members retain for some certain time period. It is presently undetermined how long this residual effect remains.

Table 7: Welch's T-Test Significance Results for the STA Member Violations per Inspection

Violations	All Violations	All OOS Violations	Driver OOS Violations	Vehicle OOS Violations
Current and Former Member Significance	< 0.01	< 0.01	< 0.10	< 0.01
Former and Never Member Significance	< 0.01	< 0.01	< 0.01	< 0.10

Violations reflect direct and indirect actions of both CMV drivers and motor carriers. FMCSA's Federal Motor Carrier Safety Regulations and the OOS criteria established by CVSA are enforced to minimize harmful safety behaviors or events on roadways. Figures 9 and 10 display

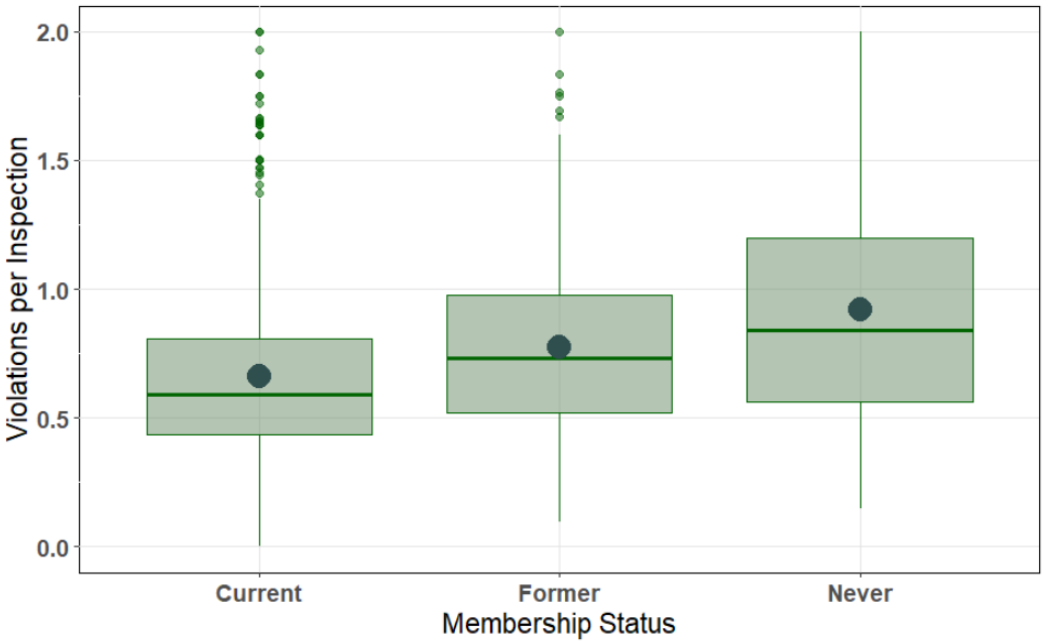
[16] Jeffery Short et al., "The Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes," *Commercial Truck and Bus Safety* Synthesis 14, (2007), https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Commercial_Truck_and_Bus_Safety-The_Role_of_Safety_Culture.pdf.

two boxplots that provide additional information on the distribution of the safety data. The different features of a boxplot are introduced in Figure 6 in the Methodology section.

These box plots display the higher violation per inspection rates for Former and Never members, as well as a breakdown of the distribution across the data. There is more clarity in the interpretation when the boxplots for membership status are compared across multiple safety metrics. While there are outliers for the three membership statuses, the outliers that exceed 2.0 and 0.8 in Figures 9 and 10, respectively, have been removed. When including the outliers beyond these boundaries, it can be difficult to compare the three boxplots with a much larger Y-axis. The shape, or the distribution of the data is another aspect of this visualization worth highlighting. The skewness is a result of having a few larger values that influence the mean and extend the upper whisker of the box plot. The right skew (i.e., outliers) of the distribution helps explain why the mean is consistently higher than the median; as the data gets closer to a normal distribution (a more symmetrical shape), the mean will gravitate towards the median.

The medians in Figure 9 represent violation rates by membership status, with 0.60 violations per inspection for Current members, 0.76 violations per inspection for Former members and 0.95 violations per inspection for Never members. Mean violations per inspection were slightly higher among all membership statuses.

Figure 9: Violations per Inspection by STA Membership Status



The medians for the OOS data presented in Figure 10 for the three membership statuses are much lower than the values displayed in Figure 9. Non-OOS violations are issued far more frequently and are less severe. Current members receive 0.12 OOS violations per inspection, Former members receive 0.16 OOS violations per inspection and Never members receive 0.19 OOS violations per inspection. Another way to interpret these median OOS violations per inspection is that, on average a Current member receives an OOS violation every 8.33

inspections, a Former member every 6.30 inspections and a Never member every 5.25 inspections.

Figure 10: OOS Violations per Inspection by STA Membership Status

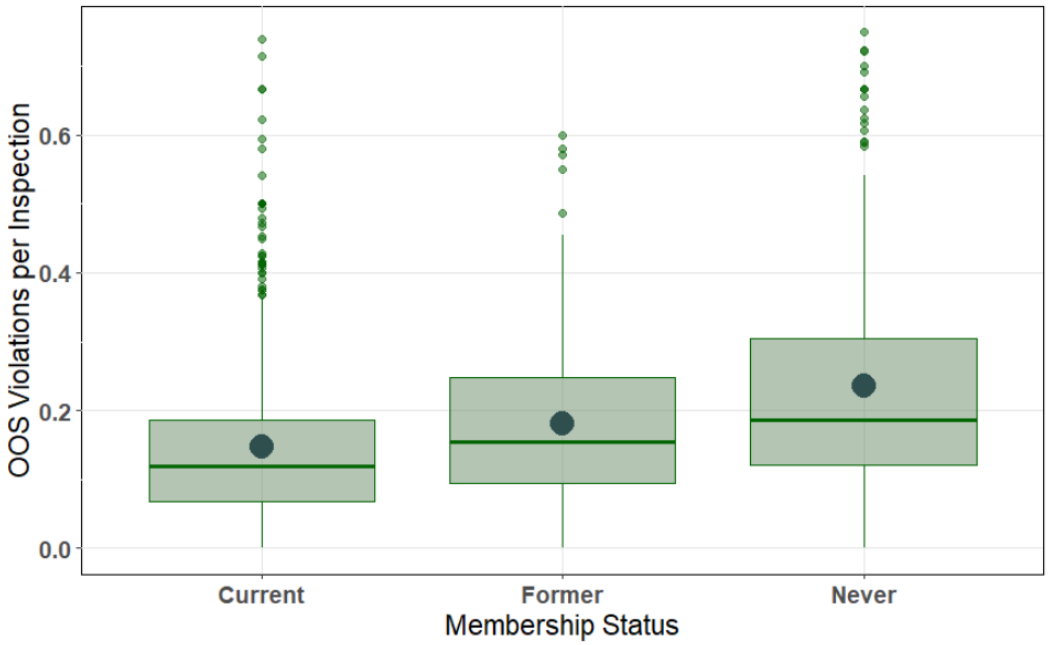
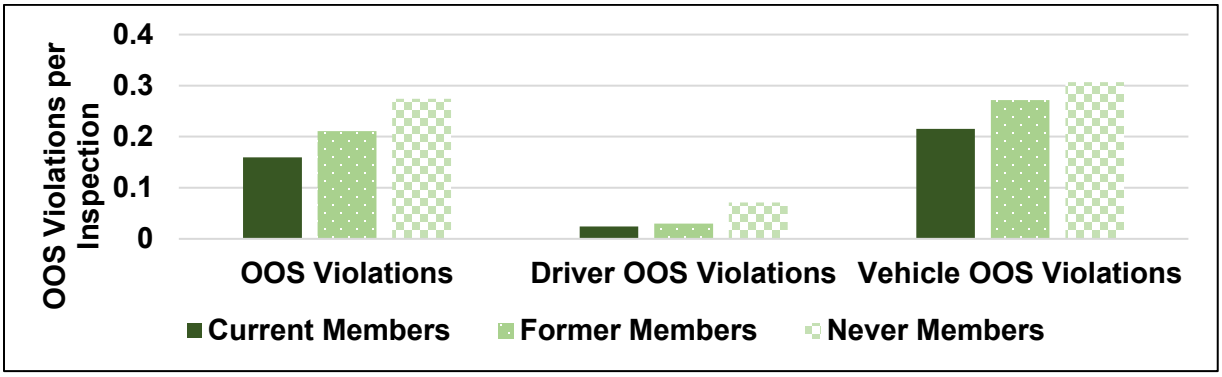


Figure 11 illustrates the p-values identified in Table 7 for all OOS violations, driver OOS violations and vehicle OOS violations. These results indicate that as motor carrier engagement in STAs moves from active to former to never, safety performance declines vis a vis inspection-related violation numbers. Consequently, by using the denominator of inspections, the research team calculated a percentage or rate of violations to inspections based on membership status.

As evident in Figure 11, driver OOS violations are not as frequent as vehicle OOS violations. For all three membership statuses, less than 10 percent of all driver inspections resulted in a driver OOS violation while over 20 percent of vehicle inspections resulted in a vehicle OOS violation.

Figure 11: OOS Violations per Inspection by Type and STA Membership Status



STA Member Conclusions

Six of the eight tested safety metrics demonstrated with statistical significance that associations make their members safer. Two of the four crash rates and all of the inspection violation rates support the chronological relationship that as motor carriers further distance themselves from STA membership, their safety performance declines. The primary confounding variables in the research are:

1) Carrier levels of participation or engagement with association activities was not known or included in the analysis;
2) Every state has unique activities, products and services so it is difficult to discern what aspect of STA membership is most influential.

Based exclusively on the STA data collected from eight STAs, this analysis statistically identifies safer operations based on safety metrics for STA members. That said, STAs share best practices, lessons learned and positive / negative experiences with different safety training and experience. Further, most STAs manage and rely on state Safety Councils – which may be one of the more influential commonalities.

AMERICAN TRUCKING ASSOCIATIONS FINDINGS

Similar to the STA structure, the ATA, headquartered in Washington D.C., provides myriad industry products, services and carrier engagement opportunities – including creating and managing several different safety-related councils and committees.[17]

The different ATA programs, events and activities are designed to improve the financial, safety and performance measures associated with managing a sound business. However, as with the STA situation, previous findings on the efficacy of active membership in producing safer carriers were anecdotal at best.

With safety as a leading objective within STAs and ATA, this analysis again focused on the relationship between ATA membership and safety performance. Using an identical methodology as the STA analysis, this assessment analyzed the crash and inspection violation records of Current, Former and Never members to identify the relationship between ATA membership and safety.

ATA Member Crash Findings

Again, the ANOVA test examines whether a statistical difference exists between two or more means. The statistical means tested in Table 8 relate to Current, Former and Never ATA members. As was the case with STAs, the fatal and injury crashes show no difference between means for the three membership statuses, however, the all crashes and towaway crashes resulted in a significant p-value of less than 0.05. These results allow the research team to

[17] American Trucking Associations, "Join American Trucking Associations," (accessed on July 2, 2023), https://www.trucking.org/join-american-trucking-associations.; American Trucking Associations, "Share the Road" (accessed on July 2, 2023), https://www.trucking.org/share-road.

conclude there may be some difference in safety between the membership statuses, but not the direction of the safety trend.

Table 8: ANOVA Significance Results for ATA Member Crashes per 100 Million Miles

Crash Type	All Crashes	Fatal Crashes	Injury Crashes	Towaway Crashes
Significance	< 0.05	NS	NS	< 0.05

Table 8 demonstrates that there is a statistically significant difference in crash involvement by Current, Former and Never ATA members. To identify the significance levels and direction of trends, Welch's two-sample t-test was applied to each of the crash types for each membership status. All crashes and towaway crashes follow a chronological sequence, whereby the further a motor carrier is separated from Current membership, the greater the decline in safety performance. Current members and Former members were compared, followed by a statistical test evaluating whether a significant difference exists between Former and Never members along with the strength of the significance.

Comparing Current and Former ATA Members

The Welch's two-sample t-test was utilized to compare the crash rates among Current and Former ATA members. These comparisons are presented in Table 9. Current ATA members are involved in fewer injury and towaway crashes, as well as all crashes combined. All three statistically significant results contain p-values of less than 0.05. Based on these statistical results, Current members are involved in fewer crashes, injury crashes and towaway crashes per 100 million miles, more than 95 percent of the time.

Comparing Former and Never ATA Members

The Welch's two-sample t-test was also utilized to compare the crash rates among Former and Never ATA members. Former members are statistically safer because they are involved in fewer towaway crashes at least 90 percent of the time, based on a p-value of less than 0.10.

Comparing Current and Never ATA Members

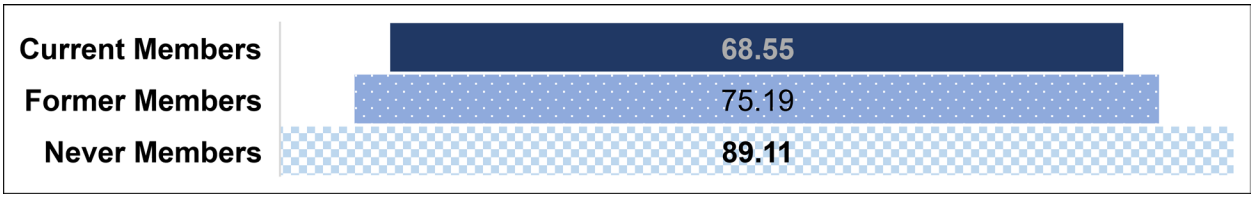
When there was a statistical difference between Current and Former members, but not between Former and Never members, an additional test was necessary to determine whether Current members were truly safer than all groups. There were two instances where Current members were safer than Former, but Former were not safer than Never members. For all crashes, Welch's two-sample t-test returned a p-value of less than 0.05, making Current members safer than all other motor carriers. For injury crashes, the p-value was greater than 0.10, meaning there is only a statistical difference between Current and Former. When running this statistical test, the variance, or the deviation from the averages, had great influence in the significance. In this situation, the Never members had a very large variance, resulting in no statistical significance when comparing Current and Former members to Never members.

Table 9: Welch's T-Test Significance Results for the ATA Member Crashes per 100 Million Miles

Crash Type	All Crashes	Fatal Crashes	Injury Crashes	Towaway Crashes
Current and Former Member Significance	< 0.05	NS	< 0.05	< 0.05
Former and Never Member Significance	NS	NS	NS	< 0.10

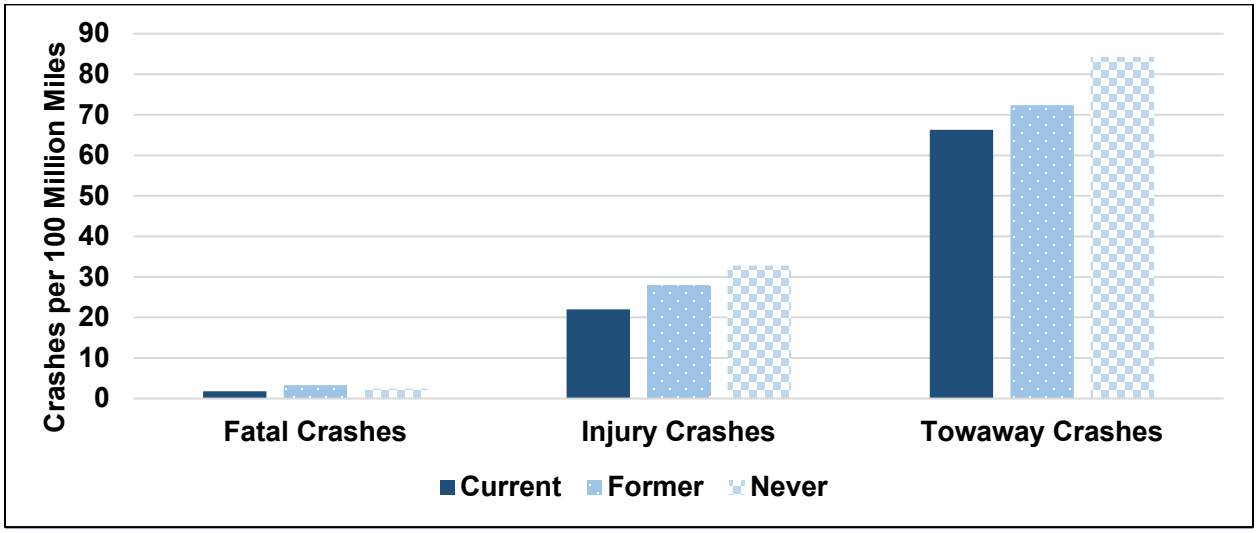
Figure 12 depicts the trend between the membership status and crashes per 100 million miles. As identified in Table 9, Current members are safer than both Former and Never ATA members. Current ATA members had 68.55 crashes per 100 million miles (representing all crash types). Former ATA members had 75.19 crashes per 100 million miles and Never ATA members had 89.11 crashes per 100 million miles.

Figure 12: Crashes per 100 Million Miles by ATA Membership Status



The previous Table 9 outlines the p-value significance results between the membership status for the three different types of crashes. Figure 13 helps illustrate these relationships. While both injury and towaway crashes demonstrate a chronological relationship, where Current members are safest and Never members are the least safe, towaway crashes was the only crash type to display a chronologically statistically significant relationship.

Figure 13: Crashes per 100 Million Miles by Crash Type and ATA Membership Status



ATA Member Violation Findings

An ANOVA test was run on four different violation categories for motor carriers with three or more inspections:

- Violations per Inspection;
- OOS Violations per Inspection;
- Driver OOS Violations per Inspection; and
- Vehicle OOS Violations per Inspection.

Each of these rates were computed using the specific inspections associated with each violation type (e.g. only inspections involving a CMV driver being inspected was used as the denominator for driver OOS violations.)

The ANOVA results in Table 10 reveal that the inspection violation means vary between the membership statuses as all four inspection violation rates have a p-value of less than 0.01.

Table 10: ANOVA P-Value Results for ATA Member Violations per Inspection

Violations	All Violations	All OOS Violations	Driver OOS Violations	Vehicle OOS Violations
Significance	< 0.01	< 0.01	< 0.01	< 0.01

All four violation rates have significant output, as shown in Table 11. There are only two p-values with confidence levels below 99 percent – the driver OOS violation rate for Current and Former members, and the vehicle OOS violation rate for Former and Never members.

There is strong evidence to conclude that ATA membership makes carriers safer from a driver and vehicle violation standpoint. As noted with STAs, ATA's provision of safety training (through its Safety Management Council), technology and vehicle maintenance education (through its Technology & Maintenance Council) likely explains the much lower driver and vehicle violation rates experienced by ATA members when compared to Former and Never members.

Table 11: Welch's T-Test Significance Results for the ATA Member Violations per Inspection

Violations	All Violations	All OOS Violations	Driver OOS Violations	Vehicle OOS Violations
Current and Former Member Significance	< 0.01	< 0.01	< 0.05	< 0.01
Former and Never Member Significance	< 0.01	< 0.01	< 0.01	< 0.10

Box plots can aid in understanding the distribution of a data subset. Figure 14 and Figure 15 present two separate datasets, violations per inspection and OOS violations per inspection respectively. These metrics include ATA membership status with Current, Former and Never members. To visually corroborate the relationship between membership and safety, the box plot should shift upward from left to right. For an explanation of how to interpret a box plot, reference Figure 6.

As previously outlined in Table 11, there is a statistically significant relationship between ATA membership and safety – meaning that Current members receive significantly fewer violations than Former members and Former members receive significantly fewer violations than Never members. Figure 14 shows the distribution of the violations per inspection for all three membership statuses. For all violations per inspection, Current members averaged 0.52 violations per inspection, Former members averaged 0.57 violations per inspection and Never members averaged 0.69 violations per inspection.

Figure 14: Violations per Inspection by ATA Membership Status

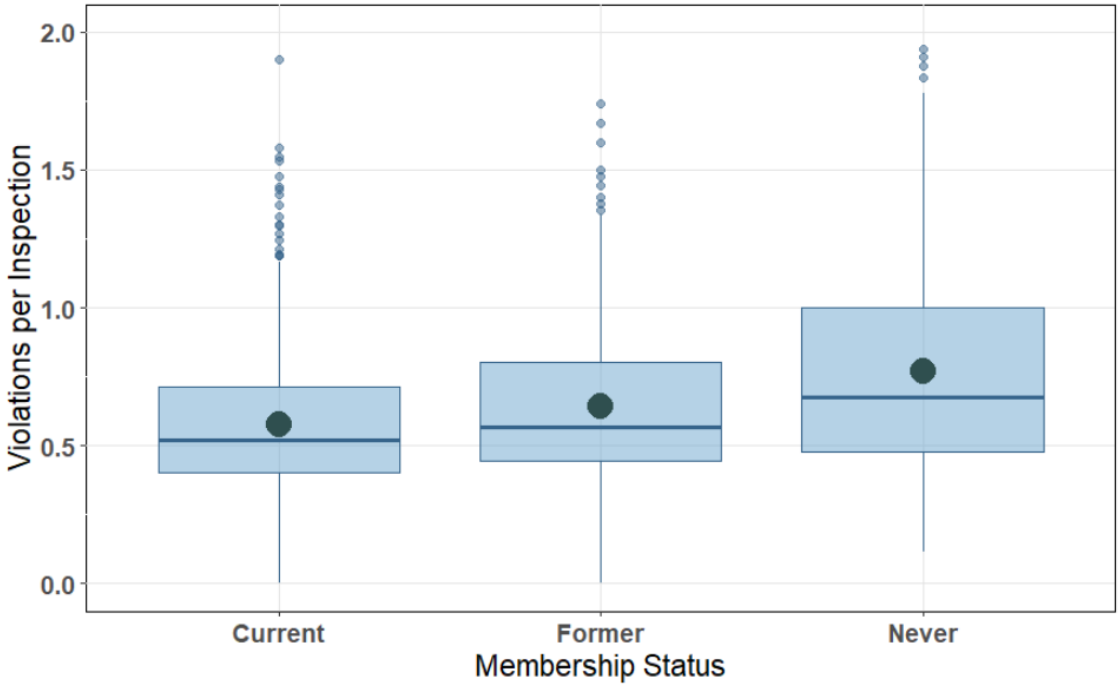
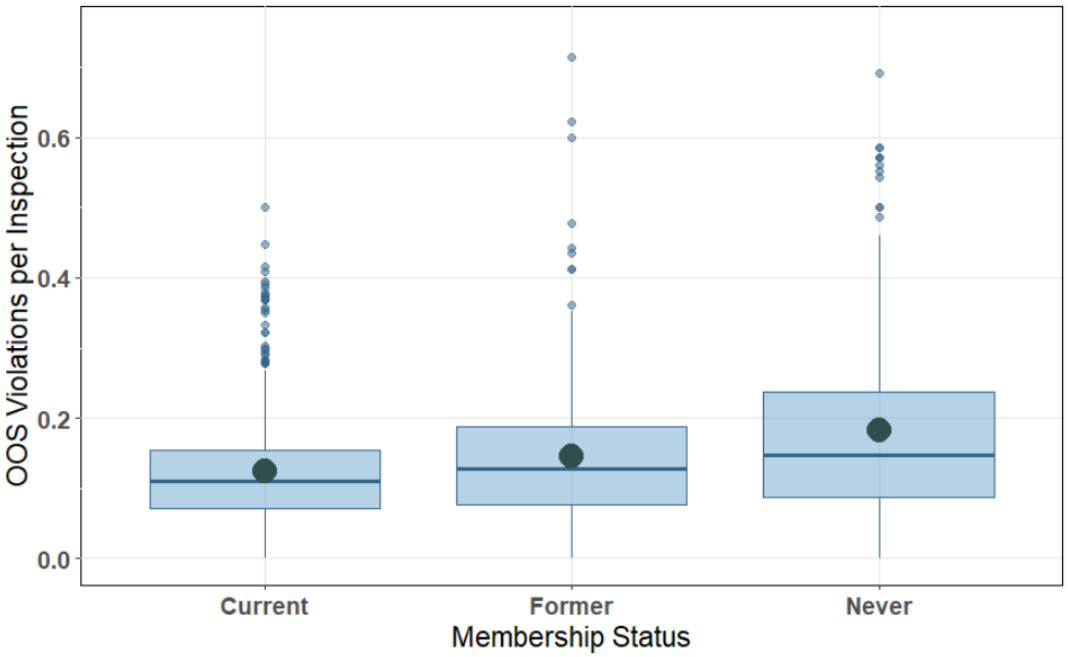


Figure 15 similarly displays the distribution of the OOS violations per inspection data. The combination of the driver and vehicle OOS violations make up the total OOS violations per inspection rate. Current members averaged 0.11 OOS violations per inspection, Former members averaged 0.13 OOS violations per inspection and Never members averaged 0.15 OOS violations per inspection.

Figure 15: OOS Violations per Inspection by ATA Membership Status

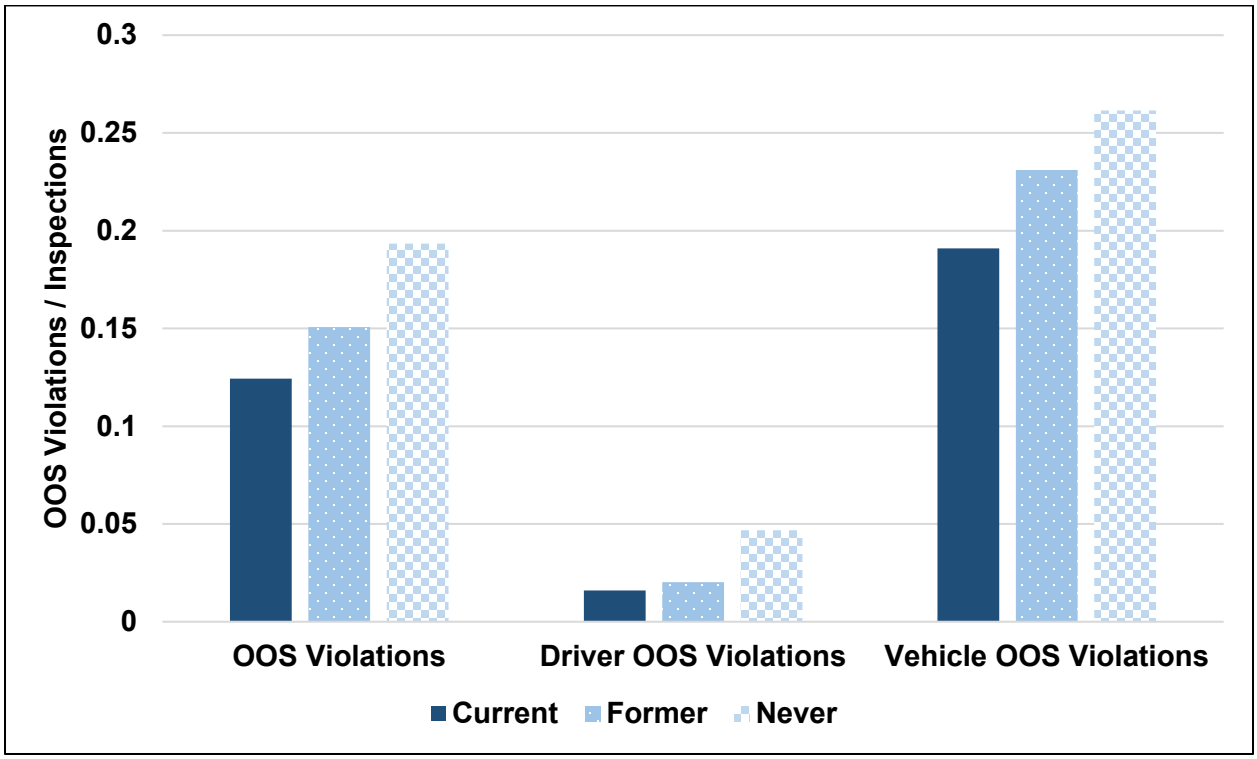


All three OOS violation series of bar plots below demonstrate that as motor carriers move further away from ATA membership, their OOS violations increase.

Breaking down the OOS violations by both the OOS violation type and membership status, there is a chronologically linear relationship between ATA membership and safety as shown in Figure 16. The largest inspection rate resulting in an OOS violation is the vehicle OOS violations. There are multiple maintenance and component issues that can affect vehicle out of service rates.[18] For example, in 2022, the CVSA International Road Check placed 4,592 vehicles out of service due to brake system issues, 3,374 for tire-related violations, and 2,219 due to light issues.[19]

[18] Federal Motor Carrier Safety Administration Compliance, Safety and Accountability, " Common Violations," (accessed on July 2, 2023), https://csa.fmcsa.dot.gov/safetyplanner/documents/Forms/Common%20Violations_508.pdf.
[19] Commercial Vehicle Safety Alliance, "CVSA releases 2022 International Road check Results," (accessed July 2, 2023), https://www.cvsa.org/news/2022-roadcheck-results/.

Figure 16: OOS Violations per Inspection by OOS Violation Type and ATA Membership Status



ATA Member Conclusions

A key tenet of ATA's mission is to promote safety on America's roadways. To support this, the association works to establish strong relations between their staff and members through events, resources and initiatives.

The analysis conducted on the ATA data confirms, as it does with STA data, that Current ATA members have the best safety performance data, on average, when compared to Former and Never members. The safety metrics used derive from crashes and inspection violations; by capturing the number of crashes a carrier was involved in during 2021 over the mileage they traveled, a rate was returned. The lower the rate, the safer the motor carrier. Similarly, every motor carrier that underwent at least three inspections received a violations-per-inspection rate – which examined all violations and OOS violations.

While the specific components of ATA safety products, services, training and peer exchanges were not individually analyzed, it is likely that a suite of these safety resources would be the underlying basis for the statistically significant findings.

RESEARCH IMPLICATIONS

The research findings herein could be leveraged by multiple stakeholders within industry and government. For example, there could be some credence for regulatory and enforcement agencies to consider association membership in their safety targeting and weighting algorithms. While this may seem somewhat controversial, limited enforcement resources, along with the statistical validity of this research, would help rationalize that marginal carriers should be prioritized over safer carriers.

Finally, the insurance industry should consider active association membership in their actuarial formulas and premium settings.

APPENDIX A: STA Welch's Two-Sample T-Test Output

Safety Metric	Membership Status 1	Membership Status 2	P-Value	Confidence Interval
Crashes per 100 Million Miles	Current	Former	< 0.05	95 % CI
	Former	Never	< 0.10	90 % CI
Fatal Crashes per 100 Million Miles	Current	Former	Not Significant	
	Former	Never	Not Significant	
Injury Crashes per 100 Million Miles	Current	Former	Not Significant	
	Former	Never	Not Significant	
Towaway Crashes per 100 Million Miles	Current	Former	< 0.05	95 % CI
	Former	Never	< 0.10	90 % CI
Violations per Inspection	Current	Former	**< 0.01**	**99 % CI**
	Former	Never	**< 0.01**	**99 % CI**
OOS Violations per Inspection	Current	Former	**< 0.01**	**99 % CI**
	Former	Never	**< 0.01**	**99 % CI**
Driver OOS Violations per Inspection	Current	Former	< 0.10	90 % CI
	Former	Never	**< 0.01**	**99 % CI**
Vehicle OOS Violations per Inspection	Current	Former	**< 0.01**	**99 % CI**
	Former	Never	< 0.10	90 % CI

APPENDIX B: ATA Welch's Two Sample T-Test Output

Safety Metric	Membership Status 1	Membership Status 2	P-Value	Confidence Interval
Crashes per 100 Million Miles	Current	Former	< 0.05	95 % CI
	Former	Never	Not Significant	
Fatal Crashes per 100 Million Miles	Current	Former	Not Significant	
	Former	Never	Not Significant	
Injury Crashes per 100 Million Miles	Current	Former	< 0.05	95 % CI
	Former	Never	Not Significant	
Towaway Crashes per 100 Million Miles	Current	Former	< 0.05	95 % CI
	Former	Never	< 0.10	90 % CI
Violations per Inspection	Current	Former	**< 0.01**	**99 % CI**
	Former	Never	**< 0.01**	**99 % CI**
OOS Violations per Inspection	Current	Former	**< 0.01**	**99 % CI**
	Former	Never	**< 0.01**	**99 % CI**
Driver OOS Violations per Inspection	Current	Former	< 0.05	95 % CI
	Former	Never	**< 0.01**	**99 % CI**
Vehicle OOS Violations per Inspection	Current	Former	**< 0.01**	**99 % CI**
	Former	Never	< 0.10	90 % CI