Assessing the Benefits of Alternative Compliance

January 2011

Prepared by the American Transportation Research Institute

ATRI American Transportation Research Institute

Assessing the Benefits of Alternative Compliance

January 2011

Daniel C. Murray
Vice President, Research
American Transportation Research Institute
St. Paul, MN

Steve Keppler
Executive Director
Commercial Vehicle Safety Alliance
Greenbelt, MD

Micah Lueck
Research Associate
American Transportation Research Institute
St. Paul, MN

Katie Fender
Research Analyst
American Transportation Research Institute
St. Paul, MN

950 N. Glebe Road, Suite 210
Arlington, Virginia 22203
www.atri-online.org

TABLE OF CONTENTS

FIGURES

TABLES

LIST OF ACRONYMS

AC	Alternative Compliance
ACC	Adaptive Cruise Control
APA	Administrative Procedures Act
ATA	American Trucking Associations
ATRI	American Transportation Research Institute
BASIC	Behavior Analysis and Safety Improvement Category
CFR	Code of Federal Regulations
CDL	Commercial Driver's License
CDLIS	Commercial Driver's License Information System
CMV	Commercial Motor Vehicle
CR	Compliance Review
CSA	Compliance, Safety, Accountability
CVSA	Commercial Vehicle Safety Alliance
DSRC	Dedicated Short Range Communications
ENS	Employer Notification System
EOBR	Electronic Onboard Recorder
FARS	Fatality Analysis Reporting System
FCWS	Forward Collision Warning System
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulation
HOS	Hours-of-Service
HM	Hazardous Materials
HMR	Hazardous Materials Regulation
ICC	Interstate Commerce Commission
ISS	Inspection Selection System
LDWS	Lane Departure Warning System
LTCCS	Large Truck Crash Causation Study
LTL	Less-than-Truckload
MCSAP	Motor Carrier Safety Assistance Program
MCMIS	Motor Carrier Management Information System
MVR	Motor Vehicle Report
NHTSA	National Highway Traffic Safety Administration
NPRM	Notice of Proposed Rulemaking
OOS	Out of Service
OSS	Onboard Safety Systems
PRISM	Performance and Registration Information Systems Management
RFID	Radio Frequency Identification
RI	Roadside Inspection
ROI	Return-on-Investment
RSCS	Roll Stability Control System
SA	Safety Audit
SEA	Safety Evaluation Area
SMS	Safety Measurement System
TIFA	Trucks Involved in Fatal Accidents
TL	Truckload
TPMS	Tire Pressure Monitoring Systems
TRB	Transportation Research Board
UMTRI	University of Michigan Transportation Research Institute
VMT	Vehicle Miles Traveled

EXECUTIVE SUMMARY

The past 20 years have seen a decline in the large truck fatal accident rate, with 2009 experiencing the lowest rate in the United States Department of Transportation's (U.S. DOT) recorded history. Nevertheless, the raw data indicate that total fatalities have demonstrated a fairly stable trend since 1995. These fatality statistics, while moving in a generally positive direction, indicate that there are clear opportunities for reducing truck-involved fatalities through continued enhancements to current safety performance programs.

Predicated on increasing trucking industry safety performance, a variety of safety programs and regulations are required through congressional legislation and by the Federal Motor Carrier Safety Administration (FMCSA). Furthermore, there are several critical monitoring and auditing functions that exist to assess a motor carrier's compliance with the multiple requirements promulgated in the Federal Motor Carrier Safety Regulations (FMCSRs) and the Hazardous Materials Regulations (HMRs). However, a number of stakeholders in the industry believe that current regulatory requirements, safety metrics and evaluation tools may not completely or accurately depict a carrier's true safety performance.

Both the U.S. DOT and the trucking industry have invested hundreds of millions of dollars to develop and test innovative safety research, technologies and initiatives. In a number of instances, this research has included critical cost-benefit analyses providing documented and replicable evidence that certain non-traditional safety approaches can reduce truck-involved crashes, injuries and fatalities. These "alternative" efforts – strategies that are typically voluntary relative to traditional activities – have given rise to an innovative concept known as "alternative compliance." The goal of alternative compliance is to improve upon, or in some instances supplant, certain traditional safety management and compliance practices. This research was premised on the hypothesis that, for many carriers, new approaches were needed to address what appears to be a plateau in national safety statistics. A potential application of the research would be to provide a blueprint for a pilot program that identifies and links possible alternative compliance activities with specific safety and/or crash reduction benefits.

Alternative compliance is tangentially grounded in the theory that "the best compliance is voluntary compliance." The alternative compliance concept derives from empirical data generated by analytical, objective research and "safe" carrier best practices. The ultimate objective of alternative compliance is to develop, evaluate and promote new safety strategies to appropriate carriers using discrete incentives or inducements. This study analyzes a number of potential alternative compliance activities and evaluates them in relation to existing traditional compliance activities and measures. Table ES 1 lists several existing traditional compliance activities that are analyzed in this study which correspond to potential alternative compliance activities.

Table ES 1. Traditional Compliance (TC) and Alternative Compliance (AC) Activities

Existing TC Activity	Potential Corresponding AC Activity
Driver Annual Motor Vehicle Record (MVR) Review	Employer Notification System (ENS)
Driver Logs (paper copies)	Electronic Onboard Recorders (EOBRs)
Hours-of-Service (HOS)	Fatigue Management Program (FMP)
Commercial Driver Drug Testing using Urine	Commercial Driver Drug Testing using Hair
Entry-Level Driver Training	Simulator-based Training
Driver Speed Management	Speed Limiters/Speed Governors
Highway Enforcement and Vehicle Inspections - Traditional Carrier Safety Management Practices	E-Screening Programs Forward Collision Warning System (FCWS) Lane Departure Warning System (LDWS) Roll Stability Control System (RSC) Tire Pressure Monitoring Systems (TPMS)

The research team analyzed both the efficacy of alternative compliance tools as well as options for integrating alternative compliance activities into the existing system. Three safety assessment components were evaluated in this process, which included: Motor Carrier Safety Status Measurement System (SafeStat) ratings; Compliance, Safety, Accountability (CSA) scores; and Inspection Selection System (ISS) values. Each program was described and assessed for alternative implementation techniques. High-level benefits and limitations were outlined and evaluated to determine feasibility.

A needs assessment was also conducted to determine the specific resources that may be necessary for managing and enforcing new compliance activities. Based on industry stakeholder input, the needs assessment analyzed issues and topics that included, among others, financial constraints, additional training/staffing, technology devices and enabling legislation. For each gap, one or more potential solutions were proposed.

Finally, the research team documented and rationalized potential implementation strategies that would facilitate the study objectives. These next steps would provide the necessary guidance to effectively implement the alternative compliance activities. First, the research team recommended identification of additional empirical data requirements needed to further quantify and expand the safety benefits associated with specific alternative compliance tools. Ultimately, enabling legislation may be necessary to move forward on innovative opportunities that could enhance transportation safety for all motorists.

1.0 INTRODUCTION

The past 20 years have seen a decline in the large truck fatal accident rate, with 2009 experiencing the lowest rate in recorded history.[1] Nevertheless, the raw data indicate that total fatalities have demonstrated a fairly stable trend since 1995 (Figure 1). These fatality statistics, while moving in a generally positive direction, indicate that there are clear opportunities for reducing truck-involved fatalities through continued enhancements to current safety performance programs.[2,3,4] The role of the passenger vehicle driver in these crashes creates additional challenges for the industry in its attempts to mitigate crash involvement.

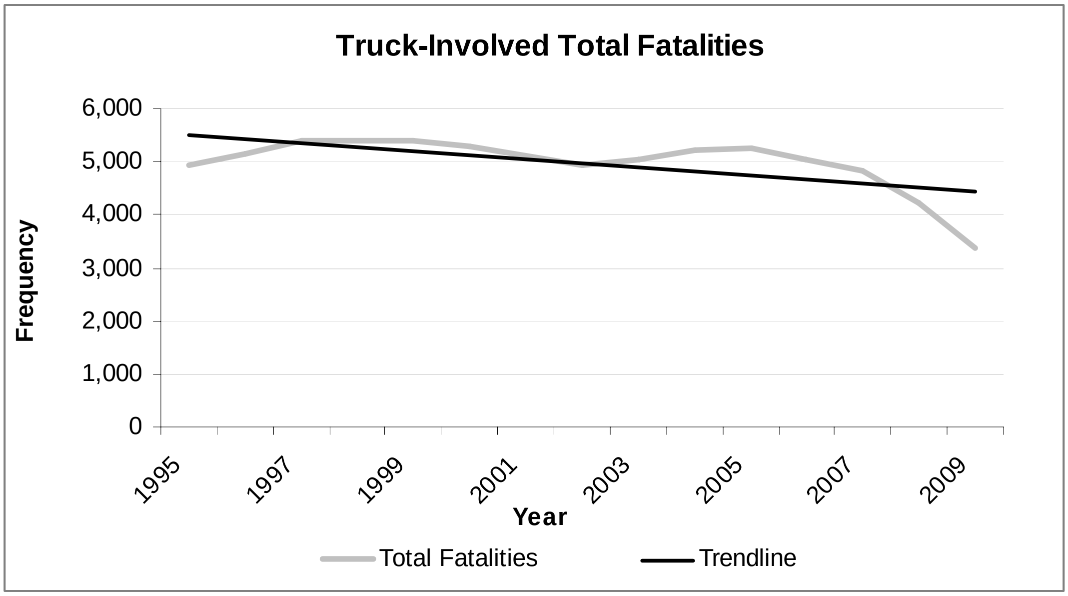

Figure 1. Truck-Involved Fatalities and Fatality Rate Trends

Predicated on increasing trucking industry safety performance, a variety of safety programs and regulations are required through congressional legislation and by the Federal Motor Carrier Safety Administration (FMCSA). Furthermore, there are several critical monitoring and auditing functions that exist to assess a motor carrier's compliance with the multiple requirements promulgated in the Federal Motor Carrier Safety Regulations (FMCSRs) and the Hazardous Materials Regulations (HMRs). However, a number of stakeholders in the industry believe that current regulatory requirements,

[1] National Highway Traffic Safety Administration. 2010. Traffic Safety Facts: Highlights of 2009 Motor Vehicle Crashes. Available Online: http://www-nrd.nhtsa.dot.gov/Pubs/811363.pdf

[2] Nabors, D.T., Khattak A.J. and Mohamedshah Y.M. 2003. An Examination of Fault, Unsafe Driving Acts, and Total Harm in Car-Truck Collisions. Federal Highway Administration. Available Online: http://www.tfhrc.gov/safety/hsis/pubs/04085/04085.pdf

[3] National Highway Traffic Safety Administration. 1999. Traffic Safety Facts, 1998. Available Online: http://www-nrd.nhtsa.dot.gov/Pubs/98largetrucks.pdf

[4] National Highway Traffic Safety Administration. 2008. Traffic Safety Facts 2006. Available Online: http://www-nrd.nhtsa.dot.gov/Pubs/810805.PDF

safety metrics and evaluation tools may not completely or accurately depict a carrier's true safety performance.

Both the United States Department of Transportation (U.S. DOT) and the trucking industry have invested hundreds of millions of dollars to develop and test innovative safety research, technologies and initiatives. In a number of instances, this research has included critical cost-benefit analyses providing documented and replicable evidence that certain non-traditional safety approaches can reduce truck-involved crashes, injuries and fatalities. These "alternative" approaches – strategies that are typically voluntary relative to traditional activities – have given rise to an innovative concept known as "Alternative Compliance" (herein after referred to as AC). The goal of AC is to improve upon, or in some instances supplant, certain traditional safety management and compliance practices. This research was premised on the hypothesis that, for many carriers, new approaches were needed to address what appears to be a plateau in national safety statistics. A potential application of the research would be to provide a blueprint for a pilot program that identifies and links possible AC activities with specific safety and/or crash reduction benefits.

New directions in carrier safety management can generate positive changes in what are otherwise relatively incremental improvements in recent truck-involved crash data, providing a compelling argument for appropriately replacing existing truck safety regulations and compliance programs with more targeted and outcome-based strategies. Several AC-oriented programs and standards have seen some adoption in the trucking industry, both in the U.S. and elsewhere.

Examples of such safety-related programs include:

- Australia's National Heavy Vehicle Accreditation Scheme (NHVAS);
- Australian Trucking Association TruckSafe Program;
- Canadian Standards Association Safety Management System;
- ISO 9000;
- Motor Carrier Safety Status Measurement System (SafeStat);
- National Private Truck Council's Best Practices Program;
- North American Transportation Management Institute's (NATMI) Certification Program;
- Partners in Compliance (PIC);
- Responsible Care Program of American Chemical Society; and
- Surface Deployment and Distribution Command (SDDC).

Currently, FMCSA is implementing a new program, Compliance, Safety, Accountability (CSA), that is designed to reduce commercial motor vehicle (CMV) crashes, fatalities and injuries.[5] Specifically, CSA is focused on increased monitoring and engagement with carriers and drivers, and improved identification and early intervention of "high risk" behaviors.

In order to take into account industry perspectives related to compliance efforts, FMCSA conducted six listening sessions across the U.S.[6] Those in attendance generally agreed that an incentive-based approach to improving carrier safety would be a more effective tool than the current penalty-based system. The top suggestions for improving safety levels included more stringent entrance requirements for carriers and improved screening and education of drivers. Carriers, however, opined that regulatory compliance alone was not a determinant of carrier safety.

In 2006, the Transportation Research Board (TRB) explored the potential for integrating certification programs with regulatory frameworks. The TRB research suggested that a pilot program could be developed to validate AC activities for certification and identification of best practices. The study concluded that AC schemes could provide significant incentives for carriers to adopt best practices.[7] However, additional research was needed to determine the level of effectiveness that an AC approach would have on safety.

The AC concept is grounded in the theory that "the best compliance is voluntary and innovative compliance." In the past, similar programs have been used to recognize "premium" carriers who go above and beyond and have exemplary safety performance. The AC concept takes this notion a step further by formalizing the link between carrier best practices and safety performance-based outcomes, while at the same time crediting those carriers through official recognition of those efforts by government regulators.

This research was premised on the safety data and analysis that indicates that opportunities exist to improve on traditional compliance. A primary objective of the study was to provide a blueprint for a pilot program by outlining possible AC activities.

1.1 Study Objectives

This study had four major research objectives:

a) analyze available research and public data to validate the application of AC in the trucking industry;

---

[5] FMCSA. Compliance, Safety, Accountability (CSA). Available Online: http://csa.fmcsa.dot.gov/default.aspx

[6] FMCSA. 2005. Comprehensive Safety Analysis 2010 Listening Sessions Final Report. March 7, 2005. Available Online: http://csa.fmcsa.dot.gov/Documents/CSA2010_Listening_Session_2005_Final_Report.pdf

[7] Bergoffen, G., Short, J., Inderbitzen, B. and Daecher, C. 2007. Commercial Truck and Bus Safety Synthesis 12: Commercial Motor Vehicle Carrier Safety Management Certification. Transportation Research Board.

b) document safety compliance programs, regulations, policies and procedures across the trucking industry that are presently utilized to assess safety levels;
c) examine government and industry research to identify various safety tool efficacies, strategies and devices used to improve truck safety; and
d) evaluate and map AC tools as surrogates for improving safety, and produce a blueprint for a potential AC pilot program.

1.2 Technical Approach

The primary research methodology utilized in this study centered on identification and mapping of comparative safety performance data associated with traditional and non-traditional safety tools, programs and strategies. ATRI then developed an exploratory framework which evaluated the merits of various AC activities that would likely enhance safety within the trucking industry. The new framework may allow carriers to select and implement a set of proven safety compliance strategies that address specific safety needs and desired outcomes.

Task 1: Literature Review

An extensive literature review was conducted consisting of historic and current compliance activities and regulations that represent “traditional” compliance and new and emerging safety tools and initiatives that reflect AC.

Truck-related safety data and trends were also analyzed during the literature review to clarify AC validity and industry applicability.

Task 2: Industry Input

In addition to the literature review, a combined panel discussion and group interview was conducted at the American Trucking Associations (ATA) Management Conference and Exhibition and included representation from trucking company CEOs, government and ATRI staff. Panel members and over 350 session participants were presented with research questions and provided with the opportunity to express opinions relating to AC and potential implementation approaches.

Task 3: Tool Box Selection

“Tool box” items were identified as a partial list of tools and implementation strategies that would populate an AC program. As safety-related research progresses, there will likely be additional AC tool box options that would provide the innovation and efficacy for inclusion.

Task 4: Carrier Demographics and Alternative Compliance

The targeting research assumed that a carrier Compliance Review (CR) was an appropriate surrogate for traditional compliance since it audits a carrier's compliance with existing regulations, policies and management tools. In that regard, large data sets were analyzed to assess the applicability of AC to the trucking industry. In particular, carrier safety data for pre- and post-CR time periods were cross-factored by fleet sizes to determine the safety impact and significance of existing versus emerging safety compliance. Significant differences by fleet size would allow for more accurate and sophisticated targeting of AC.

Carrier CR and Out-of-Service (OOS) rates were examined based on the safety rating received and carrier size to determine whether an AC program would benefit certain fleet sizes. To further substantiate the implications, previous pre- and post-CR crash rate data were examined to identify carriers most affected by traditional compliance activities.

Task 5: Integrating Alternative Compliance into Safety Management

Three safety assessment elements were used to demonstrate how an AC program could be integrated into the traditional system, including Motor Carrier Safety Status Measurement System (SafeStat) ratings, CSA scores and Inspection Selection System (ISS) values. Each program was described and assessed for alternative implementation techniques. Benefits and limitations were outlined and evaluated to determine feasibility.

Task 6: Management and Enforcement Needs

Although the research did not identify all of the resources necessary to effectively implement, manage and enforce an AC program, preliminary needs were identified. Such variables include the introduction of new low-cost technologies that could be used to easily identify carriers taking part in the AC program.

Task 7: Next Steps

Based on the literature and research, the team identified essential components and steps for developing and certifying an AC program. Among those, additional research is needed to identify and rationalize the AC solution set that carriers would implement as part of a formal AC program.

2.0 TRADITIONAL COMPLIANCE REGULATION BACKGROUND

The research literature included current safety programs, regulations, policies and procedures that have been used to assess carrier safety performance. The information provides a brief synopsis of the compliance landscape in place today and changes that have occurred in trucking industry regulations over time.

2.1 History of Traditional Compliance

Prior to the 1935 Motor Carrier Act (MCA), the Interstate Commerce Commission (ICC) primarily focused on railroad transportation.[8] However, in response to the lack of consistent and uniform motor carrier regulations, the ICC was charged with implementing the MCA to regulate the safety and economic health of for-hire motor carriers. The majority of the early ICC oversight was related to driver qualification and safety; vehicle safety was incorporated as the regulations progressed.

The MCA of 1984 revised the previous 1935 Act to include minimum safety standards for commercial motor vehicles and granted the U.S. DOT Secretary authority to execute motor carrier safety statutes and regulations.[9] The purpose of these regulations was to ensure that both drivers and vehicles were operating in the safest manner.

The Federal Highway Administration (FHWA) was originally authorized by the U.S. DOT to oversee and carry out duties relating to motor carrier safety. However, through the Motor Carrier Safety Improvement Act (MCSIA) of 1999, FMCSA was established and assigned the responsibility of motor carrier safety oversight.

FMCSA was created to enforce the Federal Motor Carrier Safety Regulations (FMCSRs) which are designed to promote carrier safety by reducing large truck and bus crashes, injuries and fatalities.[10] Specific regulatory and program responsibilities under FMCSA's purview include the following: Hazardous Materials Regulations (HMR); Motor Carrier Safety Assistance Program (MCSAP); Commercial Driver's License (CDL) program; Motor Carrier Safety Identification and Information Systems; New Entrant Safety Assurance Process; Performance and Registration Information Systems Management (PRISM); research and technology; and waivers, exemptions and pilot programs.

These FMCSR standards apply to all U.S. interstate trucking operations as well as buses and motorcoaches. Intrastate operations are regulated by state statutes and regulations; however, many jurisdictions have adopted most or all of the interstate regulations and applied them to intrastate motor carriers, buses and motorcoaches. In adopting these

[8] Transportation Research Board Truck and Bus Safety Committee. May 2007. Transportation Research Circular E-C117: The Domain of Truck and Bus Safety Research. Washington, D.C. Available Online: http://onlinepubs.trb.org/onlinepubs/circulars/ec117.pdf
[9] Ibid.
[10] FMCSA. 2009. About FMCSA. Available Online: http://www.fmcsa.dot.gov/about/aboutus.htm

regulations, it is not uncommon for states to make some changes to the regulations to address state-specific issues.

2.2 Rulemaking Process

Federal rulemaking procedures are defined under the Administrative Procedures Act (APA) of 1946. The act provides federal administrative agencies with the guidelines needed to propose, implement and enforce major legislative acts as directed by Congress. The following narrative describes the processes utilized by these agencies throughout the rulemaking process.

Prior to a federal agency initiating regulatory action, Congress must first pass a law or act that is designed to address a social or economic need. After the law is passed, an appropriate agency is selected to develop regulations required for effective implementation and enforcement of the law.[11] The regulatory agency creates those requirements according to "rules" defined by the APA. The APA defines a "rule" or "regulation" as, "[T]he whole or a part of an agency statement of general or particular applicability and future effect designed to implement, interpret or prescribe law or policy or describing the organization, procedure or practice requirements of an agency."
Under the APA, the agencies must publish all proposed regulations in the Federal Register and other specialized publications as deemed relevant, for a period of at least 30 calendar days.[12] This provides a means for interested parties to comment, offer amendments or to object to the regulation. After receiving and addressing comments on a proposed rule, the government agency publishes a Final Rule again in the Federal Register and, if no further concerns are raised, it is codified into the Code of Federal Regulations (CFR). In most cases, rules do not become effective for several months after being finalized and some rules provide several years for compliance.[13]

2.3 State-Level Management and Interstate Commerce

Each state that enacts a federal regulation is allowed to make modifications to fit individual state-level needs. This can result in variations across laws or rules applicable to interstate carriers. In the cases of those laws or rules that clearly fall under FMCSA jurisdiction, states normally will adopt the rule as outlined. However, if a state makes modifications to a federal regulation, the state regulation should remain compatible with the applicable sections of the FMCSRs.

---

[11] FSU College of Law. 2001. ABA Administrative Procedure Database. Available Online: http://www.law.fsu.edu/library/admin/1947i.html
[12] Legal Information Institute. Administrative Procedure. Cornell University Law School. Available Online: http://www.law.cornell.edu/uscode/uscode05/usc_sup_01_5_10_I_30_5.html
[13] Ibid.

In addition to rules enacted at the state level, 49 USC Section 31502 allows for the Secretary of Transportation to adopt regulations relating to motor carriers and drivers engaged in interstate commerce.[14] The provisions of the regulation ensure that:

> commercial motor vehicles are maintained, equipped, loaded and operated safely;
> the responsibilities imposed on operators of commercial motor vehicles do not impair their ability to operate the vehicles safely;
> the physical condition of commercial motor vehicle operators is adequate to enable them to operate the vehicle safely; and
> the operation of commercial vehicles does not have a deleterious effect on the physical condition of the operators.

The Secretary was given additional regulatory authority through Section 31144(a) and (b) for the purpose of using intrastate inspection records to determine a federal safety fitness rating. Under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), safety fitness is determined through carrier CRs of "the accident record (i.e. record of crashes) and safety inspection records of an owner or operator operating in interstate commerce and also the accident record and safety inspection record of such owner or operator in operations that affect interstate commerce."[15]

The program outlined in SAFETEA-LU is supported by the Commercial Vehicle Safety Alliance (CVSA), which provides a forum for the industry, safety and enforcement organizations, state DOTs and the Federal government to discuss ways to improve commercial motor vehicle safety and security.[16] CVSA is comprised of various state DOTs, Public Utility and Service Commissions, State Police, Highway Patrols and Ministries of Transport and thus has hundreds of members to assist the Alliance with its goal of reducing CMV crash rates. In order to establish uniformity in state compliance and enforcement efforts, a Memorandum of Understanding document was created to outline minimum inspection standards and OOS criteria used by participating members and, as a working agreement, states may adopt the Memorandum.

2.4 Current "Traditional Compliance" Activities

Under traditional compliance, non-compliant carriers are identified through various activities including CRs, safety audits (SAs) and roadside inspections (RI). A description of each follows.

[14] 49 USC Sec. 31502. 2010. Available Online: http://uscode.house.gov/download/pls/49C315.txt
[15] U.S. DOT. July 5, 2007. Amendments To Implement Certain Provisions of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). Available Online: http://www.thefederalregister.com/d.p/2007-07-05-E7-11717
[16] CVSA. 2008. Who We Are. Available Online: http://www.cvsa.org/about/index.aspx

Compliance Review (CR)

A CR is conducted onsite to investigate the degree to which a carrier has been fulfilling regulatory requirements. CRs are sometimes completed in response to safety-related complaints, rating changes and/or violations.[17] CRs can also be prompted by CSA scores, safety audit conversions or by carrier request, or as a follow-up to a previous CR.[18] The investigators performing the CR assess driver Hours-of-Service (HOS) compliance, driver qualifications and licensing, drug and alcohol testing procedures and vehicle maintenance and inspection procedures.[19] Several reports have been published relating to the impact of CR safety measures on large truck crash rates. For example, in a study sponsored by the Minnesota DOT, the impact of CRs on accident rates within the state was examined. It was determined that the OOS violation rate was directly related to the time elapsed since a CR. Consequently, the OOS rate was significantly reduced during the year after a CR.[20]

In a national evaluation by FMCSA, the effectiveness of CRs on carriers in reducing the number of crashes per year was also examined. The authors compared Motor Carrier Management Information System (MCMIS) census files with crash files to conclude that those companies that were reviewed had significant reductions in the number of crashes each year after the CR. Those reductions were equal across all company sizes, operation classifications, organizations and safety ratings.[21] Additional data from a cost-benefit analysis found that, when taking all cost factors into effect, the benefits of CRs outweighed the costs by four to one. This was due to the 43 percent reduction in the total number of crashes by the audited carriers and the implementation of safety initiatives by those companies that had not been audited during the study time frame.[22]

Figure 2 displays fully completed (CRs resulting in a rating) and non-rated carrier CRs by year from 1999 to 2007. Despite the attempt to reach as many carriers as possible, there are numerous carriers that have never been reviewed by a regulating authority. Part of the reason that so few carriers are reviewed (in relation to the total number of carriers) is due to the fact that a CR is very comprehensive and requires significant time and resources.

---

[17] FMCSA. 2007. Compliance Review Cost Estimation. FMCSA-RRA-07-022. October 10, 2007. Submitted by Econometrica, Inc. Bethesda, Maryland. Available Online: https://www.fmcsa.dot.gov/facts-research/research-technology/report/compliance-review-cost-estimation-oct2007.pdf
[18] FMCSA. About Compliance Reviews. Available Online: http://ai.fmcsa.dot.gov/SafetyProgram/Review.aspx
[19] FMCSA. 2009. What is a Compliance Review? Available Online: http://www.fmcsa.dot.gov/documents/training/comp_rev_mx_eng.ppt
[20] Cherkassky, V. and Pagel D. May 1997. Motor Carrier Compliance Reviews: Measuring Their Impact on Improved Safety Performance Among Interstate Freight Motor Carriers Based in Minnesota. Available Online: http://www.cts.umn.edu/Publications/ResearchReports/pdfdownload.pl?id=566
[21] Chen, G. 2007. Impact of Federal Compliance Reviews of Trucking Companies in Reducing Highway Truck Crashes. National Institute for Occupational Safety and Health.
[22] Moses, L.N. and Savage I. 1997. A Cost-Benefit Analysis of United States Motor Carrier Safety Programs. Available Online: http://faculty.wcas.northwestern.edu/~ipsavage/421.pdf

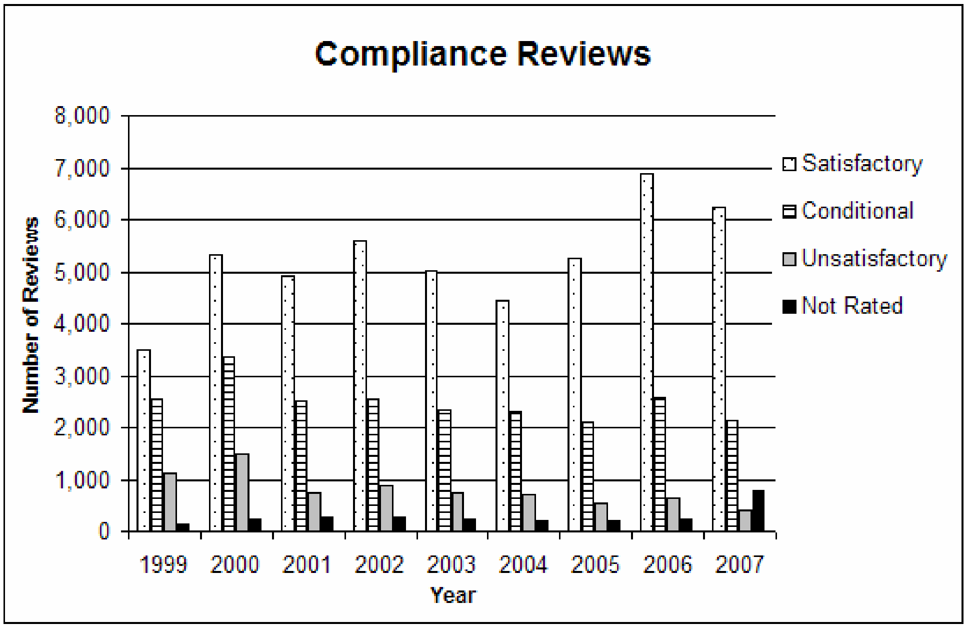

Figure 2. Total Compliance Reviews Completed from 1999-2007[23]

Safety Audit (SA)

In FMCSA's New Entrant Safety Assurance Program, all new interstate motor carriers must apply for a U.S. DOT number as a "new entrant" and will undergo a SA within the first 18 months of operations. [24] The SA typically consists of a safety program and records system review to ensure that FMCSR and/or HMR requirements are being met. Auditors are trained to identify all carrier compliance violations and provide educational guidance as needed. However, in the case that one or more violations are revealed, a carrier may be subjected to a CR in place of the SA.

Roadside Inspection (RI)

An RI is a safety inspection conducted by certified inspectors and law enforcement officials either on the highway or at a motor carrier's terminal. RIs include six levels of driver and/or vehicle inspections to ensure regulatory compliance.[25] The Motor Carrier Safety Assistance Program (MCSAP) provides state assistance to cover the majority (80%) of RI costs.[26] RI results are maintained in MCMIS, which in turn is used to

[23] FMCSA. Motor Carrier Management Information System (MCMIS), Compliance Review Activity by Safety Rating. Available Online: http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/docs/08factsfigures/table5_5hist.htm

[24] FMCSA. New Entrant Safety Assurance Program. Available Online: http://www.fmcsa.dot.gov/rules-regulations/topics/NESA/index.aspx

[25] FMCSA. 2007. Roadside Inspection Costs. October 11, 2007. Submitted by Econometrica, Inc. Bethesda, Maryland. Available Online: https://www.fmcsa.dot.gov/facts-research/research-technology/report/Roadside-inspection-costs-oct2007.pdf

[26] Ibid.

populate CSA and the ISS safety algorithms for ranking a carrier's safety performance. Chapter 5 discusses the specifics of the two programs in further detail.

Figure 3 displays RIs conducted over an eight year span. As can be seen, a substantial number of inspections are conducted each year. In fact, in 2005, the average number of RIs performed by each safety inspector was 227.[27]

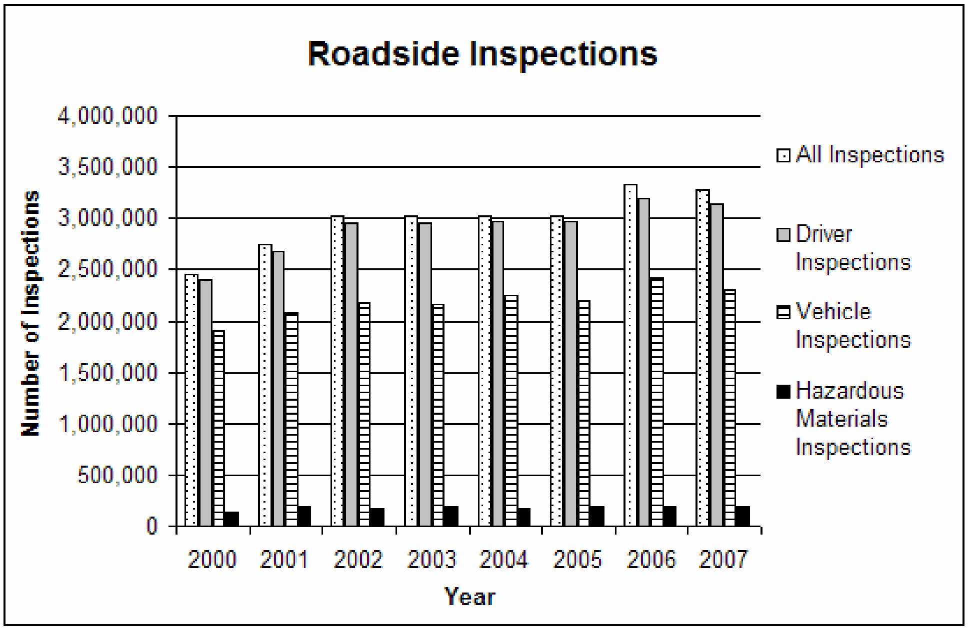

Figure 3. Total Roadside Inspections Completed from 2000-2007[28]

[27] FMCSA. 2007. Roadside Inspection Costs. October 11, 2007. Submitted by Econometrica, Inc. Bethesda, Maryland. Available Online: https://www.fmcsa.dot.gov/facts-research/research-technology/report/Roadside-inspection-costs-oct2007.pdf

[28] Source: U.S. Department of Transportation, Federal Motor Carrier Administration, Motor Carrier Management Information System (MCMIS), Roadside Inspection Activity Summary. Available Online: http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/docs/08factsfigures/table5_6hist.htm

3.0 TRENDS AND OPPORTUNITIES IN TRUCKING SAFETY

The primary objective of this chapter is to document current crash involvement and safety trends and the requisite outcomes that could be expected from AC activities.

3.1 Crash Involvement Research

Applying Motor Vehicle Crash Databases

Several motor vehicle crash databases exist, providing users with information on both passenger vehicle and motor vehicle crashes. These databases have been used in studies to assess crash causation. Using crash information, one study performed by the National Highway Traffic Safety Administration (NHTSA) analyzed how several different factors, such as fatality rates, length and weight of trucks and type of crash could be attributed to both truck drivers and passenger vehicle drivers.[29] Through an assessment of the Trucks Involved in Fatal Accidents (TIFA) and Fatality Analysis Reporting System (FARS) database, it was determined that crash probability is inversely related to the number of truck driving hours after a rest period. This means that a truck driver is more likely to be involved in a crash during the first hour of driving after a break than during any other hour. In addition, passenger vehicle drivers tend to be more at fault for truck-car crashes than truck drivers. This study found that 74 percent of all driver-related factors were attributed to the passenger vehicle driver in truck-car crashes while only 26 percent were attributed to the truck driver.[30]

In another assessment, FARS data were analyzed against collision reports with input from a panel of experts. The analysis determined that passenger vehicle drivers were cited with 67 percent of crash factors. The most common unsafe driving acts were driving in “no zones” (areas with limited commercial vehicle driver visibility), changing lanes abruptly in front of a large truck and driving inattentively.[31]

The Commercial Driver’s License Information System (CDLIS)[32] and MCMIS[33] databases provide information on large truck and bus driver and motor carrier crash records. In an assessment of these data by the John A. Volpe National Transportation Systems Center and the North Dakota State University, driver-related factors were identified as the leading

[29] Moonesinghe, R., Longthorne, A., Shankar, U., Singh, S., Subramanian, R. and Tessmer, J. June 2003. An Analysis of Fatal Large Truck Crashes. National Highway Traffic Safety Administration. National Center for Statistics and Analysis. Available Online: http://www-nrd.nhtsa.dot.gov/Pubs/809-569.PDF
[30] Ibid.
[31] Stuster, J. February 1999. The Unsafe Driving Acts of Motorists in the Vicinity of Large Trucks. FHWA. Available Online: http://www.fmcsa.dot.gov/documents/udarepo.pdf
[32] American Association of Motor Vehicle Administrators. Commercial Driver’s License Information System (CDLIS). Available Online: http://www.aamva.org/TechServices/AppServ/CDLIS/
[33] MCMIS. Motor Carrier Management Information System: Company Safety Profile – Overview. Available Online:
http://mcmiscatalog.fmcsa.dot.gov/beta/Catalogs&Documentation/documentation/csp/profile_contents.asp

causes of accidents.[34] Driver and carrier conviction scores (from a previous study linking driver conviction data from the CDLIS to the employing motor carrier) are highly indicative of OOS rates, accident rates and SafeStat Safety Evaluation Area (SEA) scores.[35] Consequently, the worse the conviction score, the higher the OOS rates.[36] In a separate study, ATRI found that the highest likelihood of future crashes included violations for reckless driving and improper turns. These violations increased the likelihood of a future crash by 325 and 105 percent, respectively.[37]

In an FHWA study, crash causation was assessed by examining multiple sources of data. The analysis determined that truck drivers were more likely at fault in backing, rear-end, turning and sideswipe collisions than passenger vehicle drivers; however, passenger vehicle drivers were more likely at fault in head-on and angle collisions.[38]

Motorist Decisions

Not surprisingly, decisions made by motorists on the road have a significant impact on crash likelihood. The University of Michigan Transportation Research Institute (UMTRI) conducted a study that compared fatal crashes involving two cars with crashes that involved one car and one truck to identify which driving actions and conditions are more likely to cause car-truck fatal accidents.[39] The research was conducted in three stages: finding explanations for the higher number of car-truck crashes caused by driver actions; deriving patterns of those driving acts; and developing methods to communicate dangerous driving decisions to motorists.

Although no percentages were provided, the study concluded that the actions of passenger vehicle drivers contributed to fatal crashes more often than truck drivers. The passenger vehicle driver actions frequently included:

- failure to keep in one's own lane or from running off the road;
- failure to yield the right of way;
- driving too fast for the road conditions or above the speed limit;

[34] Lantz, B. 2006. Development and Implementation of a Driver Safety History Indicator into the Roadside Inspection Selection System. Transportation Research Record. Available Online: http://www.ugpti.org/tssc/projects/downloads/ISS-DFinalReport.pdf
[35] Lantz, B. and Blevins, M. 2001. An Analysis of Commercial Vehicle Driver Traffic Conviction Data to Identify Highway Safety Risk Motor Carriers. Available online: http://www.ugpti.org/research/downloads/CDC09_10_01.pdf
[36] Lantz, B. 2006. Development and Implementation of a Driver Safety History Indicator into the Roadside Inspection Selection System. Transportation Research Record. Available Online: http://www.ugpti.org/tssc/projects/downloads/ISS-DFinalReport.pdf
[37] ATRI. 2005. Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior Model and Requisite Enforcement Countermeasures. Available Online: http://www.atri-online.org/research/results/One-Pager%20CMVE.pdf
[38] Nabors, D.T., Khattak A.J. and Mohamedshah Y.M. 2003. An Examination of Fault, Unsafe Driving Acts, and Total Harm in Car-Truck Collisions. Federal Highway Administration. Available Online: http://www.tfhrc.gov/safety/hsis/pubs/04085/04085.pdf
[39] Kostyniuk, L.P., Streff, F.M. and Zakrajsek J. 2002. Identifying Unsafe Driver Actions that Lead to Fatal Car-Truck Crashes. Prepared by UMTRI for the AAA Foundation for Traffic Safety.

failure to obey traffic signs;
following improperly;
obscured vision due to road conditions; and
fatigue.

Driving while intoxicated has an impact on car-truck crashes as well. In a NHTSA "Truck Safety Facts" report, an overall summary of truck-passenger vehicle crashes was provided and included statistics on truck and car drivers' previous driving records. Alcohol and previous license suspensions were found to be more critical crash factors for passenger vehicle drivers than truck drivers.[40] NHTSA also analyzed truck crash statistics by comparing the total fatal crashes per state to all truck crashes. For crashes where the driver had a blood-alcohol level above .08 percent, truck drivers represented one percent.[41]

According to a report by NHTSA, driver age may also be a predictor of crash and/or fatality rates. In the study, driver age was examined to determine if it could be a predictor of crash and/or fatality rates for drivers of passenger vehicles involved in large truck crashes. The analysis found that, although younger drivers had proportionally fewer crashes, the severity of the crashes was substantially higher than those involving older drivers. Therefore, the likelihood of being involved in a large truck crash increased with age, while crash severity decreased.[42]

For the Large Truck Crash Causation Study (LTCCS), FMCSA collected data from 963 crashes between the period of April 2001 and December 2003.[43] Though the researchers stated that more than one factor almost always contributes to a crash, passenger vehicle drivers were assigned a critical reason in 56 percent of truck-car crashes, while truck drivers were assigned a critical reason in 44 percent of such crashes.

3.2 Understanding Crash-Related Trends

To determine the culpability of passenger vehicle drivers and truck drivers, the ATRI research team synthesized available crash causation data and statistics. Though the percentages vary, every study cited found passenger vehicle drivers at fault at a higher percentage than large truck drivers in two-vehicle crashes involving a large truck and passenger vehicle. In one study conducted by UMTRI, recorded traffic violations were analyzed using a TIFA dataset to determine how different accident causations were

[40] National Highway Traffic Safety Administration. 1999. Traffic Safety Facts, 1998. Available Online: http://www-nrd.nhtsa.dot.gov/Pubs/98largetrucks.pdf
[41] National Highway Traffic Safety Administration. 2008. Traffic Safety Facts 2006. Available Online: http://www-nrd.nhtsa.dot.gov/Pubs/810805.PDF
[42] National Highway Traffic Safety Administration. 1998. Trends in Large Truck Crashes. Available Online: http://www.nhtsa.dot.gov/people/ncsa/LargeTruck.html
[43] FMCSA. March 2006. The Large Truck Crash Causation Study. Available Online: http://ai.fmcsa.dot.gov/ltccs/default.asp

reported and whether truck drivers or passenger vehicle drivers were to blame.[44] In that study, human-related factors were then compared to the type of crash (e.g. rear-end collision) to determine crash causation. It was determined that passenger vehicle drivers were at fault for 70.3 percent of crashes, while truck drivers were at fault in 16.2 percent of crashes. Table 1 displays the top three collision events between one truck and one passenger vehicle found in the TIFA dataset by severity and total number of crashes in 2007. It is important to note that the highest crash event type across all of the three categories (fatal, injury and property damage only [PDO]) were collisions with a vehicle in transport.

Table 1. Crash Severity by Total Crash Counts and Severity, 2007[45]

Crash Severity	Total Crashes
Fatal Crashes	
1. Collision with Vehicle in Transport	3,137
2. Collision with Fixed Object	370
3. Collision with Pedestrian	274
Injury Crashes	
1. Collision with Vehicle in Transport	59,000
2. Collision with Fixed Object	6,000
3. Overturn (Rollover)	5,000
Property Damage Only	
1. Collision with Vehicle in Transport	212,000
2. Collision with Parked Vehicle	52,000
3. Collision with Fixed Object	33,000

Although various estimates attempt to measure the degree to which crash-fault is attributed to large truck or passenger vehicle error, the value obtained from the LTCCS will be used in this report as a conservative estimate for analysis purposes. The LTCCS attributes 56 percent of all car-truck collisions to passenger vehicles.

Therefore, using the 2007 large truck crash data and assuming the truck fault at 44 percent, approximately 1,380 fatalities, 25,960 injuries and 93,280 PDO [truck-responsible] collisions with vehicles in transport could be conservatively prevented through some type of intervention. While the trucking industry has less influence on crash numbers associated with passenger vehicle driver fault, many of the AC tools can mitigate car-responsible crashes as well. Consequently, 44 percent or more of crashes

[44] Blower, D. 1998. The Relative Contribution of Truck Drivers and Passenger Vehicle Drivers to Truck-Passenger Vehicle Traffic Crashes. University of Michigan Transportation Research Institute. Available Online: http://www.umtri.umich.edu/content/UMTRI_1998_25.pdf
[45] FMCSA. January 2009. Large Truck and Bus Crash Facts 2007. U.S. DOT Analysis Division Federal Motor Carrier Safety Administration. Available Online: http://ai.volpe.dot.gov/CarrierResearchResults/PDFs/LargeTruckCrashFacts2007.pdf

involving another moving vehicle may be mitigated through implementation of AC activities. Additional crashes involving a single truck can be addressed through certain AC tools such as lane-departure warning and roll-stability systems.

4.0 ALTERNATIVE COMPLIANCE TOOL BOX ITEMS

This chapter focuses on new or innovative compliance activities that could be considered as an alternative method for carriers to comply with government regulations. The research team labeled these non-traditional activities “tool box” items, which were identified and selected based on documented safety benefits. Safety programs, systems and/or tools that had documented measurable effects through previous research or transparent industry data were priorities for inclusion in the AC tool box. Essentially, safety benefits related to each AC option were documented in terms of defined crash metrics (e.g. reduced crashes). Traditional and AC benefits were then compared so that tool box selection could be based on items that would potentially produce more desirable results than current regulations.

4.1 Alternative Compliance Tool Box

Under the current safety compliance system, the downward trend line for total fatalities is not extraordinary. However, there are a variety of alternative safety-related strategies being tested or used by carriers that appear promising for reducing crashes and fatalities more dramatically. ATRI researchers examined the discrete safety return-on-investment (ROI) associated with AC tools and developed a tool box of those safety-related options.

The following matrix was developed to juxtapose traditional compliance activities with proposed AC tool box items and the potential efficacy of each based on available research and analysis. While this matrix provides a relatively discrete list of alternatives, it is certainly not exhaustive when research activities and tests that are presently underway are considered.

Table 2. Traditional Compliance (TC) and Alternative Compliance (AC) Activities

TC Activity	AC Activity	AC Description	AC Impact
Driver Annual Motor Vehicle Record (MVR) Review	Employer Notification System (ENS)	Registered carriers receive near real-time notification when a driver has been issued a citation, conviction or CDL disqualification.	As a result of ENS, 6,828 crashes and 88 fatalities might be eliminated annually.[46]

[46] Smith, M., Owens, N., Stock, D., Lantz, B., Murray, D. and Sensiba, G. 2005. Driver Violation Notification Service Feasibility Study. Prepared by Science Applications International Corporation for the Federal Motor Carrier Safety Administration, USDOT.

TC Activity	AC Activity	AC Description	AC Impact
Driver Logs (paper copies)	Electronic Onboard Recorders (EOBRs)	Each truck is equipped with an EOBR that electronically records and retains changes in driver duty status.	A pilot study identified a savings of $750 a day based on a carrier with 50 drivers.[47]
Hours-of-Service (HOS)	Fatigue Management Program (FMP)	An FMP provides added flexibility to better manage individual sleep and fatigue.	A recent study examining the effects of an FMP on driver fatigue found that drivers did experience improvements in subjective sleep quality and in sleep achieved on duty days post-FMP. Drivers also reported less fatigue post-FMP and achieved a better balance in sleep efficiency between rest and duty days.[48]
Commercial Driver Drug Testing using Urine	Commercial Driver Drug Testing using Hair	Although more costly, hair testing is a highly accurate drug detection method that has lower thresholds and higher accuracy rates than urine samples for identification of long-term substance users.	An analysis of driver paired hair and urine test results (May 2006 - Mar 2008) documented that hair testing accounted for an additional 1,257 positive drug tests than urine alone.[49]
Entry-Level Driver Training	Simulator-based Training	Truck simulators can be utilized to train drivers prior to obtaining a CDL. Simulator training allows drivers to learn safe driving practices prior to driving a commercial vehicle in traffic.	In a control-test group analysis involving approximately 1,000 drivers, Schneider National found that entry-level drivers provided with add-on simulator training had 45 percent fewer DOT reportable crashes than those without the simulator training.[50]

[47] Kilcarr, S. FleetOwner: Electronic Logs Gaining Interest. November 1, 2003. Available Online: http://fleetowner.com/mag/fleet_electronic_logs_gaining/

[48] Smiley, A., Smahel, T., Boivin, D., et al. 2009. Effects of a Fatigue Management Program on Fatigue in the Commercial Motor Carrier Industry. Transportation Development Centre, Transport Canada and Federal Motor Carrier Safety Administration.

[49] Woodruff, G. FMCSA Motor Carrier Safety Advisory Committee Testimony. September 2008.

[50] Schneider National. 2009. The Impact of Simulator Training for Entry-Level Drivers.

TC Activity	AC Activity	AC Description	AC Impact
Driver Speed Management	Speed Limiters/Speed Governors	Speed limiters/governors are used to regulate and control speed or pressure in the functioning of an engine. Typically a governor will be an electric, hydraulic or mechanical device, or it may employ some combination of the three.	ATRI is currently working with FMCSA and other partners to examine the effects of speed limiter use. This two-phase initiative is examining historical research, speed limiter applications, safety benefits and crash relationships.
Highway Enforcement and Vehicle Inspections - - - - - - - Traditional Carrier Safety Management Practices	Forward Collision Warning System (FCWS)	FCWS provides a progressive series of lights and auditory alerts when the truck is within a certain following interval of the vehicle in front of it. FCWS can be integrated with adaptive cruise control (ACC) to maintain a specific following interval between the truck and the vehicle it is following by decelerating the vehicle.	A 44 percent efficacy rate would result in a reduction of 6,303 injuries and 103 fatalities annually. For each $1 spent, the ROI is estimated to be at least $1.93.[51]
	Lane Departure Warning System (LDWS)	LDWS warn drivers of a lane departure when the vehicle is traveling above a certain speed threshold and the vehicle's turn signal is not used to make an intended lane change or departure.	A 46 percent efficacy rate would result in a reduction of 1,973 injuries and 100 fatalities annually. For each $1 spent, the ROI is estimated to be at least $1.98.[52]

[51] Murray, D., S. Shackelford and A. Houser. *Analysis of Benefits and Costs of Forward Collision Warning Systems for the Trucking Industry.* Publication FMCSA-RRT-09-021. Federal Motor Carrier Safety Administration, U.S. Department of Transportation, 2009.
[52] Murray, D., S. Shackelford and A. Houser. *Analysis of Benefits and Costs of Lane Departure Warning Systems for the Trucking Industry*. Publication FMCSA-RRT-09-022. Federal Motor Carrier Safety Administration, U.S. Department of Transportation, 2009.

TC Activity	AC Activity	AC Description	AC Impact
Highway Enforcement and Vehicle Inspections - - - - - - - - - - Traditional Carrier Safety Management Practices	Roll Stability Control System (RSCS)	Currently available RSCS continuously monitor lateral forces while the vehicle is in operation. RSCS automatically reduce the throttle and apply engine and foundation brakes to counteract the tendency of a vehicle to rollover due to excessive speed in a curve.	A 51 percent efficacy rate would result in a reduction of 1,322 injuries and 73 fatalities annually. For each $1 spent, the ROI is estimated to be at least $2.33.[53]
	Tire Pressure Monitoring Systems (TPMS)	There are several different types of TPMS. Typically the systems will be equipped with a valve stem, wheel- or tire-mounted sensor, antennae, receiver and a display unit. Battery-powered sensors measure and transmit tire pressure data to the in-cab display for drivers to view.	Improper tire inflation resulted in a loss of 0.6 percent in fuel economy and costs of up to $750 annually per tractor-trailer for TL and LTL segments. ROI expected for the systems is within a one- to two-year timeframe.[54]

4.2 Tool Box Rationale

The following sections discuss each of the traditional and AC pairings in greater detail. Derived benefits of alternative activities have been offered based on the published research.

Driver Annual Motor Vehicle Report versus Employer Notification System

Under the current system, carriers are required to review each driver's record for traffic citations, convictions or Commercial Driver's License (CDL) disqualifications at least once a year.[55] An alternative option for meeting the annual requirement might include crediting a carrier for participation in a recognized Employer Notification System (ENS) program. ENS provides employers and regulatory agencies with a means of enhancing driver

[53] Murray, D., S. Shackelford and A. Houser. *Analysis of Benefits and Costs of Roll Stability Control Systems for the Trucking Industry*. Publication FMCSA-RRT-09-020. Federal Motor Carrier Safety Administration, U.S. Department of Transportation, 2009.
[54] FMCSA. July 2005. Technical Brief: Commercial Motor Vehicle Tire Pressure Sensors. U.S. Department of Transportation Federal Motor Carrier Safety Administration. Available Online: http://www.fmcsa.dot.gov/facts-research/research-technology/tech/tire-pressure-sensors.htm
[55] U.S. Department of Transportation Federal Motor Carrier Safety Administration. Part 391.25: Annual inquiry and review of driving record. Available Online: http://www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/fmcsrruletext.aspx?chunkKey=0901633480079dce

safety through continuous monitoring of driver records. Employers enrolled in the program would be assigned an identifying number, which is then added to the employee's driver's license record. When an employee's driver's license is updated to record an action or activity, a driver record is generated and mailed or sent electronically to the employer as a notification of the change.[56] Both the traditional and AC activities allow carriers to monitor driver performance as recorded in the driving records. However, ENS provides the additional benefit of immediate notification thus allowing carriers to expedite corrective action.

Each year carriers spend between $4 and $12 per individual Motor Vehicle Record (MVR). However, as part of an FMCSA-sponsored study, ATRI determined that, on average, eight out of ten annual MVR pulls resulted in no actionable items on the part of the carrier.[57] The research further suggested that tens of millions of dollars would be saved through nationwide deployment of ENS and the near real-time notification provided by ENS would have the potential to reduce crashes annually by 6,828 and fatalities by 88.

Driver Logs versus Electronic Onboard Recorders

Driver logs are traditionally maintained on paper and contain information related to driver time spent while on- and off-duty. Drivers must keep logs current from the last change of duty status and have the last eight days available upon request. Carriers retain driver paper logs and all supporting documentation (shipper bills of lading, toll, fuel and scale receipts, etc.) for 90 days. Electronic Onboard Recorders (EOBRs) capture the driver duty status information electronically, which can then be transmitted to the carrier daily or in real-time.

Both paper logs and EOBRs allow carriers to monitor driver compliance with HOS regulations. However, EOBRs allow carriers to proactively manage HOS compliance. Additionally, EOBRs have the potential to significantly reduce the administrative burden associated with managing driver logs (auditing logs, rectifying driver errors, incomplete logs, etc).

In 2005 ATRI conducted research on EOBRs to examine system functionalities and document carrier and driver usage benefits and concerns.[58] In that study, both carriers and drivers acknowledged the administrative savings afforded by EOBRs. However, carriers also recommended additional research to quantify the additional safety benefits which would result from the use of EOBRs over paper logs.

---

[56] U.S. Department of Transportation Federal Motor Carrier Safety Administration. Driver Violation Notification Service Feasibility Study. Available Online: http://www.fmcsa.dot.gov/facts-research/research-technology/report/dvn-finalreport.htm#_Toc109726942

[57] Smith, M., Owens, N., Stock, D., Lantz, B., Murray, D. and Sensiba, G. 2005. Driver Violation Notification Service Feasibility Study. Prepared by Science Applications International Corporation for the Federal Motor Carrier Safety Administration, USDOT.

[58] Shackelford, S., and Murray, D. 2006. EOBR Adoption in the Trucking Industry: Issues and Opportunities. American Transportation Research Institute.

Hours-of-Service versus Fatigue Management Program

Currently, commercial drivers must adhere to strict driving regulations which are specified in 49 CFR Part 395. These regulations limit driving time to a maximum of 11 hours with no more than 14 hours on-duty, followed by 10 consecutive hours off-duty.[59] The sleeper berth provision requires drivers to use at least eight of these ten hours in the sleeper berth, plus another two hours either off-duty or in the sleeper berth. Drivers are not allowed to drive after 60/70 hours on duty in a 7/8 consecutive day period but can restart the 7/8 day period by taking 34 or more consecutive hours off-duty.

The HOS rules prescribe set time limits for work and rest, which do not take into account the subjective nature of individual sleep needs. An alternative to prescriptive HOS rules may involve carrier participation in a Fatigue Management Program (FMP). Both compliance systems are designed to provide for well rested, alert drivers. However, an FMP allows carriers and drivers added flexibility to more effectively balance driver work and rest.

A recent study examining the effects of an FMP on driver fatigue found that drivers did experience improvements in subjective sleep quality and in sleep achieved for on-duty days post-FMP. Drivers also reported less fatigue post-FMP and achieved a better balance in sleep efficiency between rest and duty days.[60]

Drug and Alcohol Urine Testing versus Hair Testing

FMCSA requires carriers to randomly test 50 percent of their drivers for drug use and ten percent for alcohol use each year. For the drug testing rate requirement (50%) to be lowered, the nationwide commercial vehicle driver controlled substance usage rate must be less than one percent for two consecutive years in accordance with FMCSA regulations (49 CFR, Part 382).[61]

Alternative testing methods, such as the use of hair, provide a different approach for identifying long-term drug users. A 2008 analysis compared the differences between negative and positive drug tests across two methods of collection (hair vs. urine). The findings indicated that there were significant differences across the methods, with hair testing being able to identify drug users who had passed with a urine specimen.[62] The overall results are displayed in the following table.

[59] At the time of publication, FMCSA had proposed a number of changes to the HOS regulations, including reducing the maximum number of driving hours to 10 hours, allowing drivers to extend the current 14 hour "driving window" to 16 hours twice in any seven calendar days. Hours of Service of Drivers, Notice of Proposed Rulemaking available online: http://origin.www.gpo.gov/fdsys/pkg/FR-2010-12-29/pdf/2010-32251.pdf

[60] Smiley, A., Smahel, T., Boivin, D., et al. 2009. Effects of a Fatigue Management Program on Fatigue in the Commercial Motor Carrier Industry. Transportation Development Centre, Transport Canada and Federal Motor Carrier Safety Administration.

[61] FMCSA. 2002. Drug and Alcohol Testing Survey - 2001 Results. Available Online: http://www.fmcsa.dot.gov/facts-research/briefs/drugs.html

[62] Woodruff, G. FMCSA Motor Carrier Safety Advisory Committee Testimony. September 2008.

Table 3. Drug and Alcohol Testing Results for Hair and Urine[63]

Frequency	Results	Percentage
15,399	Negative on Both Tests	90.82%
228	Positive on Both Tests	1.34%
36	Positive on Urine Only	0.21%
1,293	Positive on Hair Only	7.63%

Currently, FMCSA's random drug testing requirements have been characterized as a one-size-fits-all approach. An additional AC approach to drug and alcohol testing would be a sliding scale for random testing. For instance, carriers whose drivers test positive at a lower rate than FMCSA requirements could be allowed to test employees less frequently. The alternative approach would reward carriers for exemplary records and reduce their compliance costs.

Entry-Level Driver Training versus Simulator-based Training

Although no formal training is required to obtain a CDL, truck driving schools and employers offer training programs for entry-level drivers. An entry-level driver is defined as having less than one year of experience operating a CMV with a CDL in interstate commerce (Part 380.502). Currently, basic training criteria generally include driver qualification, HOS, driver wellness and whistle blower protection requirements. However, FMCSA has issued a Notice of Proposed Rulemaking (NPRM) on minimum training requirements for entry-level property carrying CMV drivers. Simulator training may be a suitable alternative to traditional entry-level driver training, though further research is needed to determine how simulator training compares to traditional driver training.

Simulator-based training is currently used by safety professionals in the trucking industry, but is not widespread. Simulators provide a safe alternative to behind-the-wheel training, where drivers can learn the basic skills necessary to operate a vehicle and maneuver obstacles prior to on-road driving.[64]

ATRI is currently studying the effectiveness of driving simulators to reduce specific driver behaviors that have been linked to truck crashes. The research couples the findings of ATRI's "Predicting Truck Crash Involvement" study with an experimental research design that compares original simulator scenarios to customized crash behavior-oriented scenarios using a sizeable truck driver cohort.

[63] Ibid
[64] Schneider National. 2009. The Impact of Simulator Training for Entry-Level Drivers.

Current Speed Management versus Speed Limiters or Governors

Traveling in excess of the posted speed is most often monitored by enforcement officials, typically using RADAR (Radio Detection and Ranging) or LIDAR (Light Detection and Ranging) devices. However, this method of enforcement requires the presence of an officer to operate the equipment.

Use of speed limiters provides the opportunity to proactively manage driver speed. As these devices are typically controlled by a computer, integrating GPS routing with the speed limit could prevent trucks from exceeding a posted travel rate. To allow flexibility for the driver in unique instances, speed limiters can be set slightly higher than the posted speed limit.

Several different research studies are currently underway to examine the effects of speed limiter use.[65] These research initiatives will allow industry stakeholders to better understand the benefits and limitations of utilizing speed limiters.

Highway Enforcement and Carrier Practices versus Onboard Safety Systems

Traditional highway enforcement requires patrol officers to visually monitor erratic or unsafe driving behaviors. However, this labor-intensive method limits coverage and strains resources. Vehicle inspections occurring at roadside allow enforcement personnel to identify certain mechanical defects such as low tire pressure and brake issues, but this approach is also reactive as opposed to proactive. Alternatively, Electronic Screening (E-Screening) uses Dedicated Short Range Communications (DSRC) to identify a vehicle, transmit screening data and signal the driver of the pull-in decision, thereby reducing the personnel needed for highway enforcement.

Onboard Safety Systems (OSS) can also be used in conjunction with traditional carrier safety management practices such as driver training to more effectively mitigate problematic driver behaviors. Thus, OSS provides a proactive approach to identifying various vehicle and driving behavior defects, allowing for manual or automatic interdiction rather than relying on enforcement personnel.

OSS technologies include lane departure warning systems (LDWS), roll stability control systems (RSCS), forward collision warning systems (FCWS) and tire pressure monitoring systems (TPMS). In a benefit-cost analysis of OSS technologies, it was found that these systems could reduce certain crash types, including rear-end crashes, side-swipes, jack-knifes and rollovers. For example, FCWS is estimated to potentially prevent between 8,597 and 18,013 rear-end crashes[66] while RSCS may prevent between 1,422 and 2,037

[65] FMCSA. Research Division Safety Effectiveness of Speed Limiters. U.S. DOT Federal Motor Carrier Safety Administration. Available Online: http://www.fmcsa.dot.gov/facts-research/art-research-Safety-Effectiveness-of-Speed-Limiters.htm

[66] Murray, D., Shackelford, S. and Houser, A. Analysis of Benefits and Costs of Forward Collision Warning Systems for the Trucking Industry. Available Online: http://www.fmcsa.dot.gov/facts-research/research-technology/report/09-021-RP-Forward-Collistion.pdf

rollovers.[67] LDWS are effective in reducing several types of crashes resulting from lane departures, including rollovers, head-on collisions and sideswipes. It was estimated that LDWS could prevent between 3,863 and 8,103 of these types of crashes.[68]

In FMCSA's cost-benefit analysis related to large truck tire inflation levels and TPMS, costs associated with tires averaged 1.9 cents per mile or a total of $2,375 annually (for 125,000 vehicle miles traveled).[69] At that rate, tire costs were the most costly maintenance item for carriers. Improper tire inflation accounted for a loss of 0.6 percent in fuel economy and increased operating costs by $750 annually per tractor-trailer for truckload (TL) and less-than-truckload (LTL) segments.

The potential benefits of using tire pressure monitors include:

- reduction in system, maintenance and overall costs;
- fewer tire installation costs and related downtime;
- reduced costs as a result of improved safety;
- estimated annual savings of $300 for bi-weekly tire inspections; and
- cost effective devices with a ROI of one to two years for a typical fleet.

[67] Murray, D., Shackelford, S. and Houser, A. Analysis of Benefits and Costs of Roll Stability Control Systems for the Trucking Industry. Available Online: http://www.fmcsa.dot.gov/facts-research/research-technology/report/09-020-RP-Roll-Stability.pdf

[68] Murray, D., Shackelford, S. and Houser, A. Analysis of Benefits and Costs of Lane Departure Warning Systems for the Trucking Industry. Available Online: http://www.fmcsa.dot.gov/facts-research/research-technology/report/09-022-RP-Lane-Departure.pdf

[69] FMCSA. July 2005. Technical Brief: Commercial Motor Vehicle Tire Pressure Sensors. U.S. Department of Transportation Federal Motor Carrier Safety Administration. Available Online: http://www.fmcsa.dot.gov/facts-research/research-technology/tech/tire-pressure-sensors.htm

5.0 INTEGRATING TOOL BOX ACTIVITIES WITH EXISTING SYSTEM

The research team analyzed options for integrating AC activities into the existing regulatory compliance regimen and studied potential industry benefits. Two current safety assessment components (CSA and ISS) were evaluated along with one historical safety assessment component (SafeStat) that was in effect through December 2010. While CSA has replaced SafeStat, it is still useful to examine the applicability of the current report to the SafeStat regulatory environment that the general trucking community is most familiar with at the time of this publication.

5.1 Assessing Integration Opportunities

There are multiple strategies that could be used to integrate AC into the current system. However, the following approaches have been identified as likely influencing a carrier's safety rating in a positive manner, providing an incentive for carriers to participate in an AC program.

Each of the following sections first describes the safety program element and then explains how AC activities would be incorporated. Potential benefits and limitations were also addressed for each element included.

5.1.1 SafeStat

SafeStat was designed by FMCSA to assess the safety performance of motor carriers based on past and present safety data. [70] The goal of the program was to define an improved process for motor carrier safety fitness determination. The SafeStat system allowed for the monitoring of carriers and the deployment of resources to conduct on-site reviews when a carrier's safety measures were above the threshold for concern.

SEA scores were used to assess individual safety categories aside from the overall SafeStat score. The four SEA evaluation areas were accident, driver, vehicle and safety management.[71]

> Accident SEA values were based on reportable crash data. Crash indicators from the past 30 months were weighted based on crash severity and elapsed time since the accident (i.e. recent crashes received a higher weighting). This was then cross-referenced with CR information.
>
> Driver SEA values assessed driver-related safety and compliance levels for a carrier. The data used were based on RI regulation violations that occurred

[70] FMCSA. 2008. Safety Status Measurement System (SafeStat). U.S. Department of Transportation.
[71] John A. Volpe National Transportation Systems Center. January 2004. Motor Carrier Safety Status Measurement System: Methodology: Version 8.6.

within the past 30 months. The driver value was then calculated by weighting the violations based off of number received, severity and elapsed time since incident.

Vehicle SEA values measured vehicle-related violations identified during an RI or CR. The rating was calculated using the number of OOS violations received and age of the unit.

Safety Management SEA values assessed a carrier's safety management efficacy relative to other carriers. Data used to calculate this score included any violations that had occurred over the past six years and were weighted according to the elapsed time since incident. Violations in this category consisted of dispatching a driver who was knowingly under the influence of drugs or alcohol, had an invalid CDL or had been ordered out of service.

By separating the safety analysis into four categories, FMCSA was able to identify where a carrier was most deficient. The assessment used data sources, such as CR and RI findings, to populate the carrier's SEAs. The resulting number was then ranked in comparison to other carriers and a specific SEA value was computed. If a carrier had an SEA score between 75 and 100 in two of the four categories, a SafeStat score was calculated. The carrier was then ranked in categories A through C based on their overall SafeStat score range, with A being the most severe.[72] Though this system was effective in regulating carriers deemed unsafe, not all carriers received a SafeStat score since these scores were only assigned to carriers found deficient in two or more different SEAs.[73] Other common complaints by carriers included outdated, inaccurate or unreliable scores.[74] Figure 4 displays the method that was used for determining a carrier's SEA values.

[72] Source: John A. Volpe National Transportation Systems Center. January 2004. Motor Carrier Safety Status Measurement System: Methodology: Version 8.6. Available Online: http://ai.volpe.dot.gov/SafeStat/method.pdf

[73] Source: John A. Volpe National Transportation Systems Center. January 2004. Motor Carrier Safety Status Measurement System: Methodology: Version 8.6. Available Online: http://ai.volpe.dot.gov/SafeStat/method.pdf

[74] McNally, S. May 8, 2006. FMCSA Proposes to Change SafeStat Fleet Rating Formula. Transport Topics.

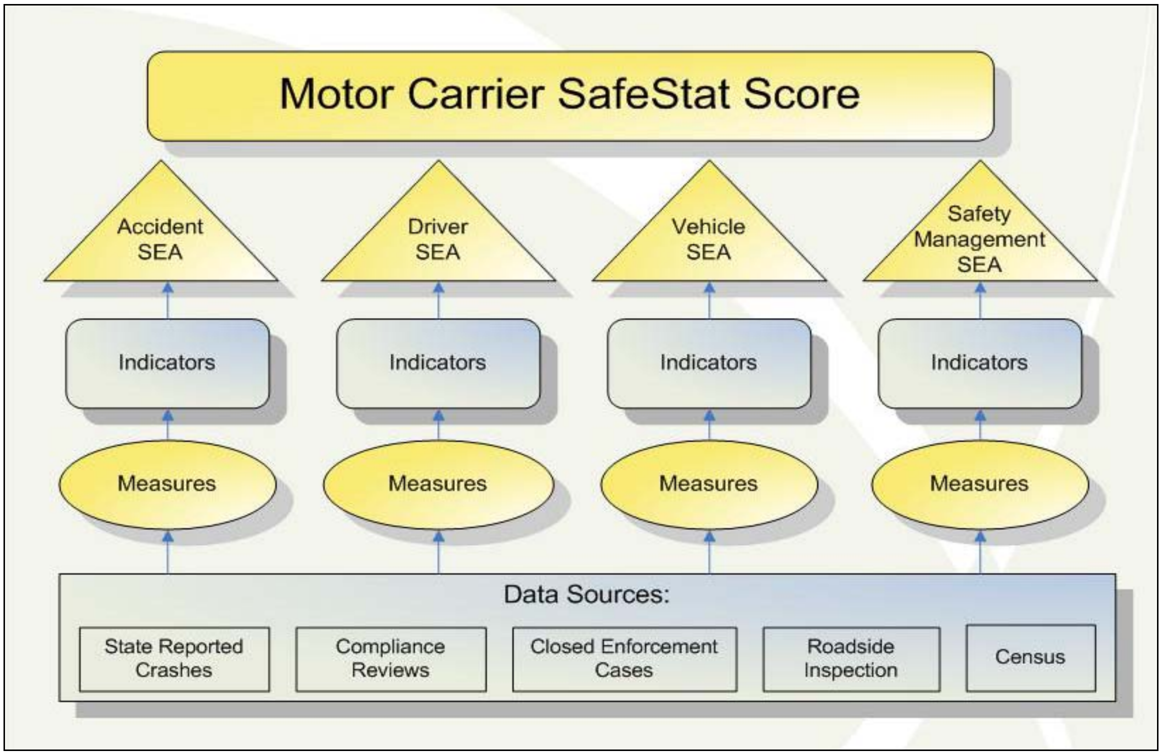

Figure 4. Organization of SafeStat Processes[75]

SafeStat and Alternative Compliance

AC could have been implemented within the SEA framework. Carriers could have potentially been required to select one tool box item for each SEA. Figure 5 describes the appropriate location of options where carriers could have implemented additional safety methods under each SEA category.

If a carrier had elected to participate, a conceptual ten point deduction in their Accident, Driver, Vehicle and Safety Management scores potentially could have been granted for a 40 point total decrease.

[75] McNally, S. May 8, 2006. FMCSA Proposes to Change SafeStat Fleet Rating Formula. Transport Topics.

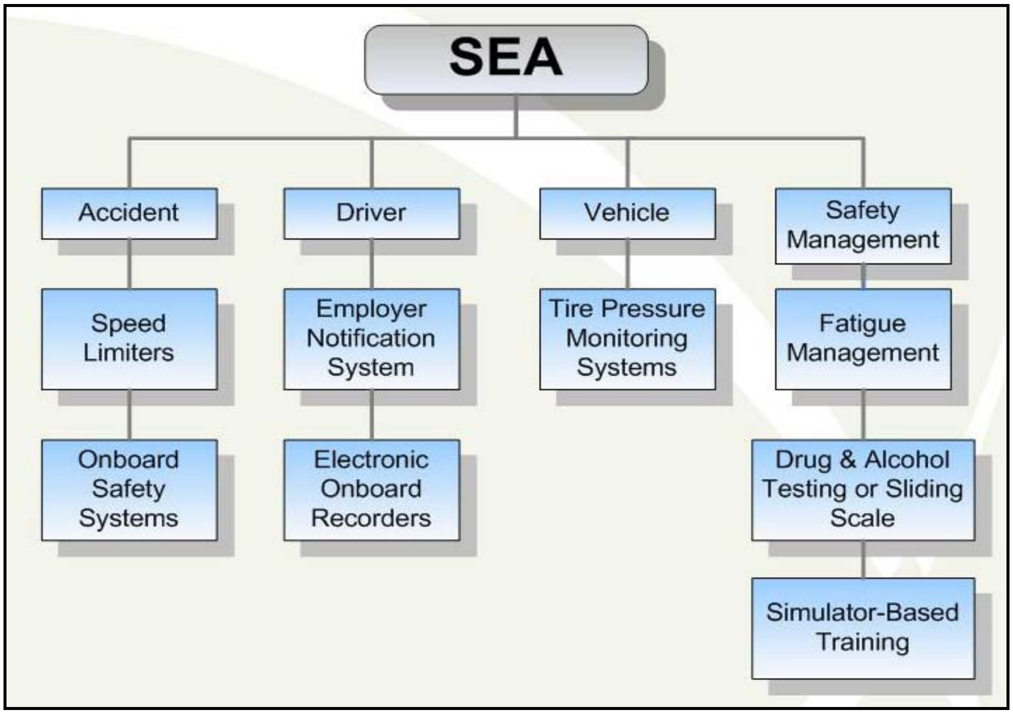

Figure 5. Safety Evaluation Area and Alternative Compliance Hierarchy

Benefits

Carriers could have experienced several benefits from participating in this type of AC program. As the deficiency level for each SEA value was between 75 and 100, a decrease of 10 points could have had a significant role in determining whether or not a carrier's safety status was high enough to warrant a SafeStat rating assessment. Carriers could have also perceived the new safety approach as an opportunity to be proactive in improving safety. Such advantages would likely have helped to ensure high participation in the program and provided a viable method for reducing overall crash involvement.

Limitations

Though there may have been several benefits to using the SEA assessment program as a method of executing an AC program, this program has been replaced by the new CSA model. The CSA program is currently being revised; it is unclear exactly how the scoring system may change. However, this general scoring template can be used for the seven Behavior Analysis and Safety Improvement Categories (BASICs) that are included in CSA.

5.1.2 Compliance, Safety, Accountability

Effective December 2010, FMCSA replaced SafeStat with an enhanced safety initiative known as CSA. This initiative focuses on reducing CMV crashes, fatalities and injuries by using more effective identification techniques and interventions than were available under SafeStat. Under CSA, both carrier and driver safety histories are monitored and measured using FMCSA's Carrier or Driver Safety Measurement System (CSMS or DSMS), respectively. In turn, carriers and drivers that do not meet safety expectations may be subject to intervention. CSA also presents new tools for intervention that were not available in SafeStat, such as focused and off-site investigations. In all instances, investigators are able to use DSMS data to identify a carrier's most problematic drivers. However, while DSMS results are limited to these situations, CSMS results are publicly available to all industry stakeholders, empowering carriers, shippers and insurers to make more targeted, safety-based business decisions.

CSA uses seven BASICs to assess driver and carrier safety. This includes an evaluation of unsafe driving, fatigued driving, driver fitness, controlled substances/alcohol use, vehicle maintenance, cargo-related and crash involvement.[76]

> Unsafe Driving BASIC values represent instances of drivers operating a CMV in a dangerous or careless manner within the previous 24 months, with more recent and severe violations carrying more weight. A comparison between similar motor carriers (or safety event groups) is derived using a utilization factor that incorporates both number of power units and VMT.
>
> Fatigued Driving (HOS) BASIC values signify instances of drivers operating a CMV while being ill, fatigued or in non-compliance with HOS regulations within the previous 24 months, with more recent and severe violations carrying more weight. A comparison between similar motor carriers (or safety event groups) is derived using the number of relevant RIs as a common denominator.
>
> Driver Fitness BASIC values represent instances in which unqualified drivers are operating CMVs without the proper training, experience or medical qualifications within the previous 24 months, with more recent and severe violations carrying more weight. A comparison between similar motor carriers (or safety event groups) is derived using the number of relevant RIs as a common denominator.
>
> Controlled Substances/Alcohol BASIC values measure violations resulting from drivers operating CMVs while impaired due to alcohol, illegal drugs and/or misuse of prescription or over-the-counter medications within the previous 24 months, with more recent and severe violations carrying more weight. A

[76] FMCSA. 2009. New Safety Measurement System vs. SafeStat. U.S. DOT Federal Motor Carrier Safety Administration. Available Online: https://csa2010.fmcsa.dot.gov/Documents/SmsCompareFlyer.pdf

comparison between similar motor carriers (or safety event groups) is derived using the number of relevant RIs as a common denominator.

Vehicle Maintenance BASIC values signify violations resulting from failing to properly maintain or repair a CMV within the previous 24 months, with more recent and severe violations carrying more weight. A comparison between similar motor carriers (or safety event groups) is derived using the number of relevant RIs as a common denominator.

Cargo-Related BASIC values represent violations for failing to properly load or secure cargo or mishandling hazardous materials on a CMV within the previous 24 months, with more recent and severe violations carrying more weight. A comparison between similar motor carriers (or safety event groups) is derived using the number of relevant RIs as a common denominator.

Crash Indicator BASIC values measure crash histories occurring within the previous 24 months, with more recent and severe violations carrying more weight. A comparison between similar motor carriers (or safety event groups) is derived using a utilization factor that incorporates both number of power units and VMT.

Similar to SafeStat, data sources such as state-reported crashes, CRs, closed enforcement cases and RIs are used to calculate BASIC scores. An important difference is that, whereas SafeStat only counted OOS violations against a carrier, CSA counts all roadside violations. Using these data, scores are then calculated independently for each BASIC and can range from 0-100, with lower values representing a safer score and better safety performance in comparison to one's safety event group.[77] Finally, thresholds are set to alert FMCSA that an investigation may be warranted with respect to one or more BASICS (65% for Unsafe Driving, Fatigued Driving and Crash Indicator BASICs; 80% for Driver Fitness, Drugs/Alcohol, Vehicle Maintenance and Cargo-Related BASICs).

Compliance, Safety, Accountability and Alternative Compliance

AC could be easily implemented into CSA. For instance, carriers might be allowed to select one or more tool box items for any BASIC to be addressed. Table 4 illustrates the AC activities that might correspond to each BASIC. If a carrier participated in this type of program, a conceptual ten point deduction could be granted for each BASIC met. For instance, a carrier may only want to focus on the driver fitness category and elect ENS as a viable AC activity. This carrier would receive a ten point reduction on their "driver fitness" BASIC score.

[77] ATA. 2010. Transport Topics Special Report: Comprehensive Safety Analysis CSA 2010.

Table 4. Compliance, Safety, Accountability BASICs and Alternative Compliance

BASICs vs. AC
Unsafe Driving ➡ Speed Limiters
Fatigued Driving ➡ Fatigue Management Program
Driver Fitness ➡ Employer Notification System
Controlled Substances ➡ Hair Testing or Sliding Scale
Vehicle Maintenance ➡ Tire Pressure Monitoring
Crash Indicator ➡ Onboard Safety Systems

Benefits

The primary benefit to using CSA as the foundation for an AC program is that all interstate motor carriers operate under FMCSA's purview; therefore, the CSA scoring rubric would be universally applied to these carriers. As it is in every carrier's best interest to have and maintain a low CSA score, the AC program would draw widespread appeal and provide all carriers with the opportunity to become involved in the program.

Since BASICs are scored individually, an AC scoring system would be easy to calculate, allowing carriers to take a more proactive role in making safety-based decisions. Given that a carrier will know which of their BASIC scores needs to be lowered to prevent an FMCSA intervention, the AC program could be strategically used to lower BASIC scores of concern, effectively reducing the likelihood that a score will pass FMCSA's "alert" threshold and trigger an investigation. Providing carriers the opportunity to resolve any safety issues prior to a CR or other FMCSA investigation would place the enforcement responsibility on the carrier first, allowing companies to become safer without FMCSA intervention, thereby reducing administrative costs and burdens. In addition, lowering BASIC scores by a set amount in exchange for participating in an AC program would potentially improve how that particular carrier is evaluated by shippers, brokers and insurance agencies.

Limitations

Although CSA provides more targeted safety evaluations, there are limitations. The most significant limitation is that the program is still being modified at the time of this research. In addition, enforcement and regulatory agencies will need time to acclimate to the new system before AC activities can be incorporated. Furthermore, carriers who have insufficient data (due to not having received enough RIs) are not given BASIC scores; this would lead to obvious complications in rewarding carriers for adopting AC systems if there is no corresponding BASIC score to provide with a 10 point reduction.

5.1.3 Inspection Selection System

The ISS utilizes information from MCMIS to identify vehicles for roadside inspections. Vehicles are assigned an inspection value based on CSMS and BASIC scores.[78] Carriers that have a BASIC score over a threshold limit have a higher likelihood of being "flagged" for inspection in the ISS. Table 5 displays the ranges used to decide if a particular vehicle should be inspected.

Table 5. Inspection Selection System Inspection Value Ranges and Recommended Action

Recommendation	ISS Inspection Value
Inspect	75-100
Optional	50-74
Pass	1-49

Although the ISS uses the same MCMIS data that are used to determine BASIC scores, ISS assigns values to all carriers. When a carrier has insufficient data for the algorithm, a specific formula is applied based on carrier size and how close they are to meeting the minimum number of inspections needed to have a true ISS value. Depending on these factors, a value between 50 and 100 is typically issued until the minimum number of inspections is reached.

Inspection Selection System and Alternative Compliance

Since ISS values are computed using the same data as BASIC scores, potential AC participation would depend on similar criteria; a carrier would be required to implement a set quantity of tool box activities. Hypothetically, inclusion in an AC program may mean that a carrier is provided with a 20 point leeway on the ISS inspection value. For example, an original ISS score of 60 would be modified by 20 points resulting in a new value of 40. Therefore, the alternative program would be used as a reward system rather than punishment for delinquent carriers.

Benefits

Providing an incentive in the form of a reduced ISS score in exchange for implementing tool box activities would likely be seen as very attractive by many carriers. Not only would it lead to fewer RIs, which would represent fewer delays and more revenue time on the road, but it would also allow roadside inspectors to devote their limited resources to carriers who are more likely in need of an inspection. Since the AC system would be based on rewarding carriers, it is likely that participation rates would be high.

[78] The inspection value was previously based on SafeStat and SEA values.

Limitations

Currently, carriers that do not have data in the CSMS database automatically receive a medium- to high-risk rating in the ISS system which recommends state enforcement agents conduct an RI. This could be a significant limitation for using the system as a foundation for AC. The ISS algorithms should be improved upon to more accurately portray carrier safety levels.

An additional caveat that merits attention is whether it is in a carrier's best interest to receive a low ISS value, as proposed in this study. Under CSA, clean inspections are worth more than no inspections in improving a carrier's BASIC scores. Limiting exposure to RIs may negatively impact the ratio of clean inspections to inspections resulting in violations and may actually harm a carrier under CSA.

5.2 Carrier Alternative Compliance Incentives

Several incentives were identified for motivating carriers to implement AC, most notably the potential reductions in CSA scores, where lower values represent a safer score. By using the strategies previously proposed to incorporate AC into CSA, carriers would be able to take a proactive role in safety management, allowing for opportunities to address safety issues prior to a follow-up CR or other investigation. Since carrier CSA scores are available to the public, carriers would have the added incentive of maintaining or improving their safety scores.

Another short-term incentive would be to offer participating carriers insurance benefits based on which tool box items the carrier chose to implement. Likewise, the government could supply participating carriers with tax credits to help offset the initial costs associated with AC investments. These types of incentives would allow carriers to recoup some or all of their expenses in a relatively brief timeframe, making it more likely that carriers, particularly small fleets, would make the most of their tool box options.

In contrast to short-term incentives, long-term incentives exist in the form of lower "operational" costs that are associated with improved safety performance, such as the savings that result from reduced crash involvement. In addition, superior safety performance resulting from AC would translate into better CSA scores, accompanied by a myriad of indirect benefits, such as improved public image and employee morale. It should be noted, however, that as positive as these long-term incentives may be, there is concern that they may not be as enticing to carriers as the aforementioned short-term incentives. The short-term incentives would likely provide a much quicker ROI, a key factor in carriers' decisions to invest in new technologies and programs.

5.3 Challenges to Consider

Uniformity in federal law, as it relates to motor carrier safety, is relatively consistent and widely accepted by states. Unfortunately, enforcement of those laws and regulations is not always uniform across states. In some cases, AC methods would increase consistency across these regulations by automating data and assisting drivers in mitigating crashes.

The initial investment costs of new technologies can significantly affect deployment rates, particularly for small carriers. Small carriers often have less capital available to invest in new technologies than do large carriers, creating unequal utilization rates across fleet sizes. Carriers of all sizes would be more likely to participate in an AC program that utilizes technology that has a small initial investment requirement and a short payback period.

6.0 ANALYZING TRADITIONAL COMPLIANCE IMPACTS

As part of the decision to move toward AC, the value of traditional compliance efforts should be examined. As is evident in the literature, there have been several analyses conducted regarding the effectiveness of CRs. These analyses revealed that both crash rates and OOS rates for carriers decreased after a CR. However, no analysis has cross-referenced safety statistics for carriers with and without compliance review ratings (satisfactory, conditional or unsatisfactory).

To address this knowledge gap, the research team undertook additional tasks to: (1) determine the constraints of traditional compliance activities through an analysis of the safety differences between non-rated and rated carriers using SafeStat scores and MVR data sources; and (2) examine crash involvement by fleet size both before and after CR activities.

6.1 Compliance Review and Crash Rate Analyses

The objective of this first analysis was to compare OOS and crash rates of carriers to their compliance review rating and fleet size. Data were queried from FMCSA in July 2008 and contained all active carriers in the FMCSA database. Carriers that had a CR in the five years prior (e.g. June 30, 2003 through June 30, 2008) were identified and used in the analysis. If a carrier had multiple reviews during this time period, the most recent CR was used. For each carrier, the total crashes and RIs that occurred within the previous 30 months were used for the analysis. In addition, the number of RIs resulting in a driver and/or vehicle OOS was examined.

Compliance Review Rate by Fleet Size

Table 6 illustrates the findings of driver OOS rates by both fleet size and the corresponding CR rating. The driver OOS rate was calculated by dividing the number of driver inspections that resulted in a driver OOS by the total number of driver inspections. Note: a carrier must have had three or more driver inspections in order to calculate this rate.

Table 6. Driver Out-of-Service Rates by Fleet Size and Rating

Number of Power Units	Satisfactory	Conditional	Unsatisfactory	Not Reviewed
1 to 49	10.2%	14.4%	19.3%	8.0%
(Number of Carriers)	18,539	4,721	495	137,298
50 to 249	6.8%	8.6%	7.7%	4.6%
(Number of Carriers)	1,664	272	7	4,327
250 to 999	5.4%	6.5%	7.7%	3.7%

Number of Power Units	Satisfactory	Conditional	Unsatisfactory	Not Reviewed
(Number of Carriers)	292	21	1	750
1,000+	5.5%	4.0%	N/A	3.7%
(Number of Carriers)	60	7	0	186
* Only includes carriers with 3 or more driver inspections in 30 months				

As expected, carriers that received an “unsatisfactory” CR rating had higher driver OOS rates than those with a “satisfactory” rating. However, the difference in OOS rates between “satisfactory” and “unsatisfactory” carriers may be moderated by fleet size, as it appears to shrink the larger a carrier gets. For instance, small (1 to 49 power unit) carriers rated “satisfactory” had roughly half the number of OOS rates as small carriers rated “unsatisfactory” (10.2% vs. 19.3%, respectively).

On the other hand, large (250 to 999 power unit) carriers rated “satisfactory” had nearly the same number of OOS rates as large carriers rated “unsatisfactory” (5.4% vs. 7.7%, respectively). This may suggest that larger carriers do not have much room for improvement within the current system and may have stabilized in “Unsatisfactory” safety rating.

In addition, carriers with a CR, regardless of the outcome rating, had higher driver OOS rates than carriers with no CR. This may be intuitive since many carriers are selected for a compliance review due to questionable safety performance data.

Table 7 illustrates the findings of vehicle OOS rates by both fleet size and the CR rating. The vehicle OOS rate was calculated by dividing the number of vehicle inspections that resulted in a vehicle OOS by the total number of vehicle inspections. Note: a carrier must have had three or more vehicle inspections in order to calculate this rate.

Table 7. Vehicle Out-of-Service Rates by Fleet Size and Rating

Number of Power Units	Satisfactory	Conditional	Unsatisfactory	Not Reviewed
1 to 49	28.7%	34.1%	40.7%	23.9%
(Number of Carriers)	17,468	4,477	462	108,541
50 to 249	20.5%	25.7%	26.8%	18.0%
(Number of Carriers)	1,670	274	7	4,281
250 to 999	18.5%	25.4%	17.8%	16.4%
(Number of Carriers)	292	21	1	749
1,000+	18.0%	9.3%	N/A	16.0%
(Number of Carriers)	61	7	0	186
* Only includes carriers with 3 or more vehicle inspections in 30 months				

Results provided in Table 8 demonstrate the same trend as Table 7, where fleet size appears to moderate the two relationships (vehicle OOS and safety ratings). However, one should use caution when interpreting both these and the prior results due to the low population sizes for the larger carrier groupings. Finally, as previously discussed, those carriers with no review generally had lower vehicle OOS rates than carriers that had been reviewed.

Crash Rate by Fleet Size and Rating

Table 8 illustrates the findings of crash rates by both fleet size and the CR rating. The rates represent the number of crashes that the carrier has been involved in per power unit. Carriers with an "Unsatisfactory" rating have higher crash rates than those with a "Satisfactory" rating, but the effect is not as great as seen with the OOS rates. Similar to the previous results, those carriers with no review had a much lower crash rate than carriers that had been reviewed.

Table 8. Crashes per Power Unit Rates by Fleet Size and Rating

Number of Power Units	Satisfactory	Conditional	Unsatisfactory	Not Reviewed
1 to 49	0.133	0.186	0.154	0.036
(Number of Carriers)	25,572	6,000	721	625,726
50 to 249	0.090	0.087	0.097	0.044
(Number of Carriers)	1,738	284	8	5,934
250 to 999	0.083	0.057	0.127	0.043
(Number of Carriers)	301	22	1	896
1,000+	0.071	0.073	N/A	0.038
(Number of Carriers)	61	7	0	247

6.2 Pre- and Post-CR Analysis

Carrier safety data for pre- and post-CR time periods were cross-factored by fleet size to determine the safety impact and significance of existing versus emerging safety programs. This type of analysis was based on previous techniques used by the John A. Volpe National Transportation Systems Center as part of the Compliance Review Effectiveness Model.[79] The analysis completed by Volpe compared carrier crash rates

[79] FMCSA. March 2008. FMCSA Safety Program Effectiveness Measurement: Compliance Review Effectiveness Model Results for Carriers with Compliance Reviews in 2004. FMCSA-RRA-08-014. Prepared by John. A. Volpe National Transportation Systems Center: Office of Surface Transportation Programs Motor Carrier Safety Division. Cambridge, MA. Available Online: http://ai.fmcsa.dot.gov/carrierresearchresults/pdfs/crem_2004_cr_final%20results_030708.pdf

for the 12 months prior to a CR to crash rates for the 12 months after a CR. Results showed that smaller carriers, those with 20 or fewer power units, had the greatest reduction in average crash rates. For carriers with 1-5 power units, the post-CR average crash rate showed a decrease of 51.3 percent from the pre-CR average crash rate and for carriers with 6-20 power units, a decrease of 34.9 percent was realized. For carriers with 21-100 power units, the post-CR average crash rate showed a decrease of 18.5 percent, and carriers with 101 or more power units had a decrease of 6.7 percent.

However, the Volpe study did not separate the data for fleet sizes larger than 101 power units. Therefore, in an effort to expand upon the previous research and evaluate the effects of CR activity on large and very large fleets, this analysis specifically examined the "percent change in average crash rate" for carriers with 101 or more power units.

Data for this analysis were queried from FMCSA in April 2009. Carriers were selected using the same method as the previous Volpe analysis, based on the following criteria:

- a CR was conducted during the 2005 calendar year and the carrier was still active 12 months after (i.e. throughout the post-CR period);
- operated as an interstate or intrastate Hazardous Materials (HM) carrier;
- was active throughout the pre-CR period (i.e. the 12 months before the CR); and
- had at least one power unit throughout the pre-CR and post-CR periods (i.e. the 12 months before and after the CR).

If the carrier had more than one CR in 2005, the most recent one was utilized for the analysis. The pre-CR average crash rate was determined using the same method as the Volpe analysis by dividing the total number of crashes recorded for a motor carrier in the 12 months before their CR by the total number of power units and then multiplying by 100.

Similarly, the post-CR average crash rate was determined by dividing the total number of crashes recorded for a motor carrier in the 12 months after receiving the CR by the total number of power units and then multiplying by 100.

As can be seen in Tables 9 through 13, there was a persistent pattern wherein the percent change in average crash rate after receiving a CR for the largest power unit group (1,001+) was quite marginal when compared with the smallest power unit group (1-5). Average crash rates tended to decrease as fleet size increased, indicating that smaller carriers were most affected by traditional compliance activities.

Table 9. 2004 Pre-CR and Post-CR Average Crash Rates

Number of Pre-CR Power Units	Number of Carriers with CRs in 2004	Pre-CR Average Crash Rate (per 100 Power Units)	Post-CR Average Crash Rate (per 100 Power Units)	Percent Change in Average Crash Rate
1-5	3,213	11.344	5.721	-49.57
6-20	2,182	7.791	5.338	-31.49
21-100	1,150	6.795	5.793	-14.75
101-250	177	4.797	4.360	-9.11
251-1,000	79	4.294	4.063	-5.38
1,001+	16	4.379	4.163	-4.93
All Carriers	6,817	8.990	5.432	-39.58

Table 10. 2005 Pre-CR and Post-CR Average Crash Rates

Number of Pre-CR Power Units	Number of Carriers with CRs in 2005	Pre-CR Average Crash Rate (per 100 Power Units)	Post-CR Average Crash Rate (per 100 Power Units)	Percent Change in Average Crash Rate
1-5	4,084	9.791	4.801	-50.97
6-20	2,611	7.072	4.839	-31.58
21-100	1,212	5.917	4.836	-18.27
101-250	194	4.530	4.141	-8.59
251-1,000	89	4.506	4.106	-8.88
1,001+	23	4.459	4.453	-0.13
All Carriers	8,213	8.125	4.871	-40.05

Table 11. 2006 Pre-CR and Post-CR Average Crash Rates

Number of Pre-CR Power Units	Number of Carriers with CRs in 2006	Pre-CR Average Crash Rate (per 100 Power Units)	Post-CR Average Crash Rate (per 100 Power Units)	Percent Change in Average Crash Rate
1-5	5,012	10.540	5.006	-52.50
6-20	3,043	7.793	5.047	-35.24
21-100	1,219	5.549	4.728	-14.80
101-250	166	4.819	4.749	-1.45
251-1,000	60	4.400	3.841	-12.70
1,001+	13	2.965	3.025	2.02
All Carriers	9,513	8.788	4.939	-43.80

Table 12. 2007 Pre-CR and Post-CR Average Crash Rates

Number of Pre-CR Power Units	Number of Carriers with CRs in 2007	Pre-CR Average Crash Rate (per 100 Power Units)	Post-CR Average Crash Rate (per 100 Power Units)	Percent Change in Average Crash Rate
1-5	5,131	9.304	5.351	-42.49
6-20	3,030	6.915	4.976	-28.04
21-100	1,252	5.544	4.938	-10.93
101-250	185	6.930	4.376	-36.85
251-1,000	71	3.705	4.250	14.71
1,001+	17	2.752	2.871	4.32
All Carriers	9,686	7.920	5.076	-35.91

Table 13. 2008 Pre-CR and Post-CR Average Crash Rates

Number of Pre-CR Power Units	Number of Carriers with CRs in 2007	Pre-CR Average Crash Rate (per 100 Power Units)	Post-CR Average Crash Rate (per 100 Power Units)	Percent Change in Average Crash Rate
1-5	5,783	10.378	4.265	-58.90
6-20	3,175	6.878	4.058	-41.00
21-100	1,298	5.673	3.618	-36.22
101-250	185	5.038	3.435	-31.82
251-1,000	50	4.539	4.162	-8.31
1,001+	15	3.526	3.101	-12.05
All Carriers	10,506	8.495	4.062	-52.18

The research team explored this fleet size relationship further by comparing the crash rate changes that occurred for the years 2004 to 2008. As can be seen in Figure 6, carriers with 1-5 power units experienced the highest reduction in crash rates for all four years (mean= 51%). Similarly, carriers with 6-20 and 21-100 power units had trends in the same direction but only had average reductions of approximately 32 and 18 percent, respectively. Larger carriers, however, seemed to benefit the least from a CR. In 2004, carriers with fleet sizes of 251-1,000 and 1,000+ had crash rate reductions of five percent, suggesting that the CRs were not highly beneficial for these particular groups. By 2007, both large carrier groups had experienced higher crash rates after receiving a CR intervention. Again, this analysis indicated that CR effectiveness decreased as fleet size increased; this can be seen in Figure 7 which shows the negative linear relationship between fleet size and the safety benefits that resulted from traditional CRs.

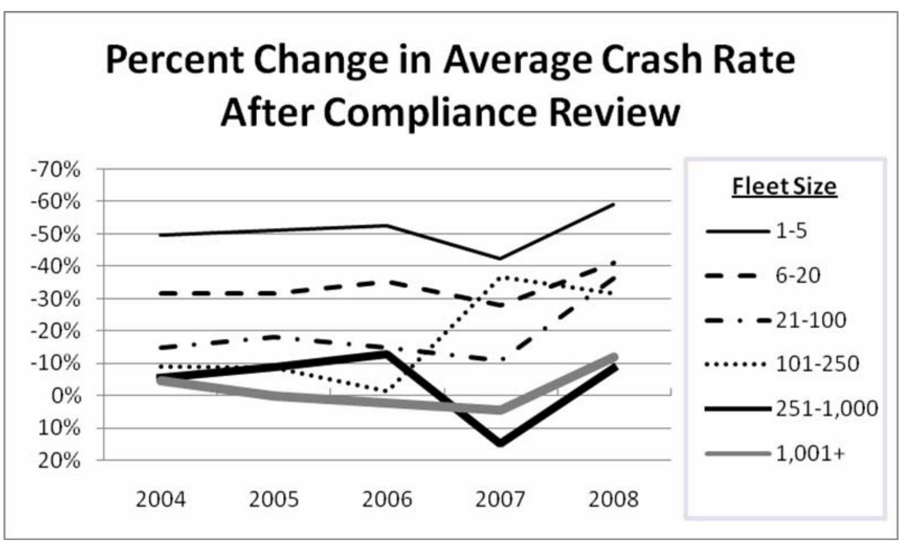

Figure 6. Crash Rate Percent Change by Fleet Size

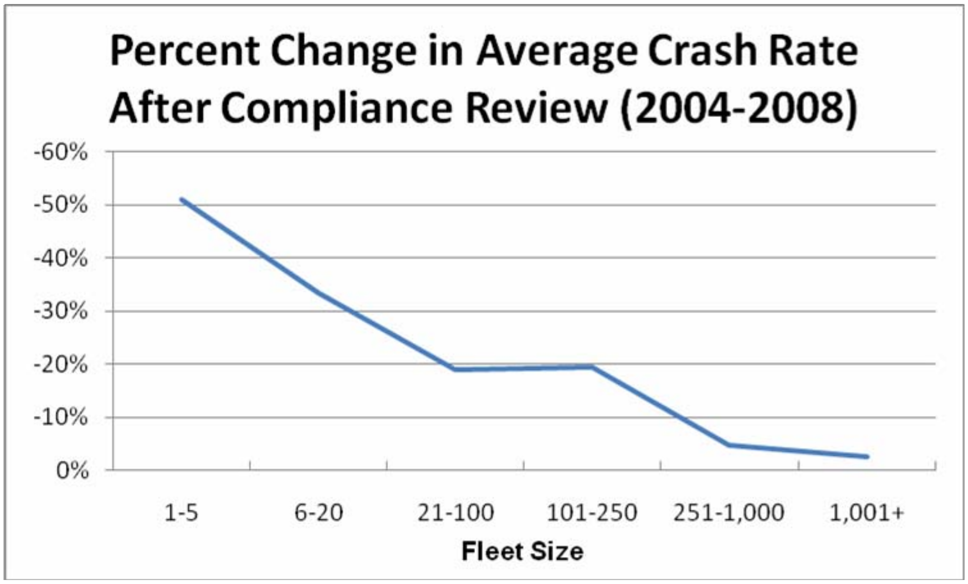

Figure 7. Percent Change in Average Crash Rate After Compliance Review (2004-2008)

6.3 Industry Involvement

Many transportation advocates are aware of the benefits associated with the use of AC, but carriers need to be provided with information that describes the opportunities and benefits that can be anticipated. Most of the initiatives envisioned in the AC program are not regulatory in nature, but rather best practices; therefore, unforeseen rewards may surface such as better insurance rates, increased operational efficiency and improved customer satisfaction. However, it is important to note that the opportunity for a carrier to participate in AC may be dependent on the program design and level of enforcement resources available.

Based on the traditional activity analysis, preliminary findings suggest that larger fleets may benefit more from AC than their smaller counterparts. Larger fleets did not have a substantial change in crash rates after receiving a CR, indicating that adherence to traditional compliance requirements has maximized its impact on large carriers (i.e. no longer effects positive changes in crash rates). Therefore, an alternative method of compliance may be needed to result in reduced crash rates for larger fleets.

In order to assess whether there are differences between crash rates across carrier sizes and the type of compliance activities received, a beta-test should be conducted that encompasses all fleet segments and both program types. FMCSA designed a pilot-test to measure the effectiveness of the new CSA initiative compared to the traditional program. A similar research design could be useful in assessing the AC program benefits as well. Pilot test results would provide some direction to indicate which carriers would likely benefit most from being involved in an AC program.

A pre- and post-test analysis could then be conducted to test the differences between crash rates under the traditional system and the AC program. Carriers selected for inclusion in the pilot test would need to have pre- and post-scores to properly analyze the results. Table 14 shows the experimental design that could be used. The "pre-test" measure would be collected at the start of the assessment and the "post-test" measure would include data after 12 and 24 months. As can be seen, the control group would continue to be measured under the traditional system and the experimental group under the AC program so that comparisons could be made across the groups simultaneously. The control group would be used in this scenario to account for any variability that extraneous variables may cause.

Table 14. Pre-Test Post-Test Research Design

Group	Pre-Test	Post-Test
Control	Traditional Compliance	Traditional Compliance
Experimental	Traditional Compliance	Alternative Compliance

Although the FMCSA's two phase field test of CSA covered 30 months, this study would assess whether or not carriers could expect an increase in safety measures after being a part of the AC program at one year and again at two years. This is believed to be a reasonable data collection period to determine which carriers would benefit most from the new program.

To ensure that a diverse sample of data is collected during the study, carriers from various geographic regions and fleet sizes should be included for each group (control vs. experiment) (Figure 8). At a minimum, carrier inclusion for an AC program could be tested with as few as 160 carriers. For example, if there were five carriers for each fleet size participating in the study across four geographic regions, that would result in a sample size of 160 (20 carriers * 4 regions * 2 groups = 160).

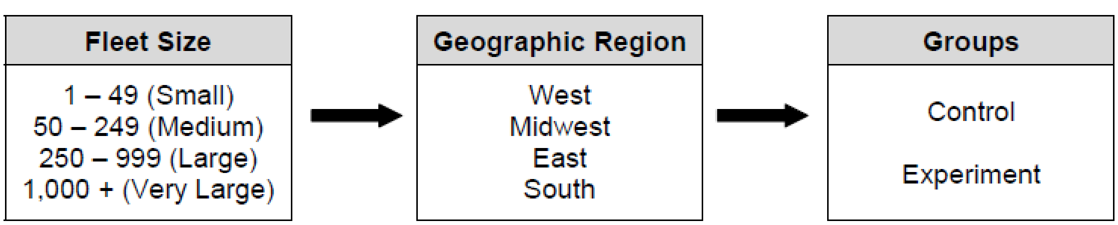

Figure 8. Carrier Sampling Distribution

7.0 MANAGING AND ENFORCING ALTERNATIVE COMPLIANCE

One of the most complicated components of this research relates to the management and enforcement of an AC program. During this portion of the research, feedback from trucking industry and enforcement representatives was sought to determine what resources would be needed to maintain and enforce new compliance activities.

7.1 Needs Assessment

A needs assessment was conducted to determine the specific resources that may be necessary for managing and enforcing new compliance activities. By using broad industry feedback from focus groups and through a review of industry publications, the gaps identified are not limited to but included the following:

- financial constraints;
- additional training/staffing;
- technology devices; and
- enabling legislation.

Each of the four gaps identified are described in greater detail in the following sections.

Financial Constraints

Although a discrete financial impact of implementing AC is unknown, there would be costs associated with program development and management. Such costs would likely include:

- training personnel to understand and operate the AC program;
- funding for oversight and monitoring of AC-participating carriers;
- creating the technology to identify program-participating trucks at weigh stations;
- developing a certification process and establishing offices to certify carriers;
- devising tools to educate carriers on the new system; and
- evaluating participating carriers.

As an example, a carrier could utilize simulator-based training for new drivers. However, carriers may not have the resources to cover the costs related to installing and implementing simulator devices. In addition, organizations assessing the carrier would need to understand the concept behind simulator-based training to determine if it is being properly applied. Financial constraints associated with this tool could potentially be mitigated through a government assistance program, where all institutions and agencies involved in the process could apply for funding to purchase or lease the new technologies. Whether an AC cost is diffused through government funding or through a different mechanism, there will be different financial issues that need to be addressed with each tool box activity.

Additional Training/Staffing

When a new program requires different or additional duties for staff, some level of training or increased staffing is required. For instance, information relating to the management of AC activities and the appropriate application of new technologies would need to be provided to the enforcement and oversight personnel. In the case of Fatigue Management Programs, this additional instruction could include alertness monitoring technologies which might be deployed. Enforcement and oversight personnel would need training to interpret the data provided by the alertness monitoring technology to properly identify drivers for intervention.

Alternatively, some of the activities may reduce the number of personnel needed to oversee safety. OSS and other AC tools could potentially decrease the number of law enforcement officials needed for identifying unsafe or inattentive driving patterns, or provide the opportunity to reallocate personnel to more targeted activities. This assumption is based on the AC premise that discrete and predictive data are known as to what role driver behavior (by action or category) and vehicle violations play in safety.

Exact numbers relating to enforcement and oversight personnel resources for implementing an AC program are not presently known. However, it is clear that either existing and future personnel would need expanded training for working with both traditional and AC carriers, or a separate group/division of personnel could be trained to focus exclusively on AC. The second option may be preferable, as personnel would then be highly specialized in the guidelines and regulations for one program.

Technology Devices

Conceptually, identification of AC carriers could be time-consuming and cumbersome for enforcement personnel. However, Radio-Frequency Identification (RFID) tags could provide an automated method for determining the carrier vehicles that are part of the new program. RFID is a system that uses radio waves to automatically identify and transport information to tags.[80] RFID tags have been used to manage inventory throughout many large retailers and can be identified from meters away. RFID tags can also be used to improve quality control or assist as an integrated component in data storage systems. As an inexpensive tool, RFID tags could be placed on appropriate trucks in a location that would be convenient for those operating weigh stations; this concept is presently being researched by the U.S. DOT under the moniker of "Universal Truck ID Sensors." For AC purposes, as participating trucks pass by, the tag could be read and relevant AC program details could be assessed. This would allow enforcement to clearly distinguish between carriers in the traditional versus AC program.

[80] University of Minnesota Intelligent Transportation Systems Institute and American Transportation Research Institute. 2005. Homeland security and the trucking industry. International Truck & Engine Corporation.

Another simple technology protocol, Bluetooth, could be used to identify and download data from AC participants. Bluetooth is a low-cost, easily implemented local area network device. The small chip is available in many portable electronic devices. Using different communications protocols and a small Bluetooth-capable device, wireless connectivity to trucks could be developed in real-time with databases throughout the country.[81]

Enabling Legislation

As the focus of AC is directly related to trucking industry safety, FMCSA is likely to be the designated regulatory agency for the new program. FMCSA could first develop program specifications and regulations that demonstrate the proper documentation techniques and procedures for managing and enforcing an AC program. This could include proposed new FMCSRs or modifications to current regulations.

7.2 Alternative Compliance Management and Enforcement Needs

To ensure the long-term efficacy of the AC program, regulatory and enforcement agencies would need to develop consensus on program oversight and management, with components that would likely include research, management, evaluation and monitoring activities. These agencies would also define parameters for carrier participation and monitor, in near-real-time, participants' safety performance in the alternative program.

The potential enforcement and oversight techniques for the AC system would ultimately depend on the certified tools and mechanisms put in place to "reward" participating carriers. Presently, enforcement agents can only verify compliance with existing rules and regulations, so many of the initiatives contemplated in AC would require different, unique enforcement approaches. It would also require more interaction between the carriers and the agencies charged with evaluating and assigning the carrier performance ratings.

The greatest resource requirement for enforcement would likely be obtaining technical equipment, and related training, for systems capable of reading, auditing and evaluating compliance with AC approaches.

7.3 Recommended Approaches

The existing public sector large truck safety program and related personnel may not be adequately designed and/or prepared to manage, enforce and evaluate AC carriers.

[81] FMCSA. July 2007. Development and Evaluation of Alternative Concepts for Wireless Roadside Truck and Bus Safety Inspections. Performed by Booz Allen Hamilton, Inc. FMCSA-RRT-07-005. Available online: http://www.fmcsa.dot.gov/facts-research/research-technology/report/wireless-inspection-report.pdf

Government resources are limited in the respect that only a certain number of carriers are currently examined, inspected and/or rated. Hence, it could be very challenging to develop and manage a new program using existing resources, at least initially. Providing carriers with alternative options for managing safety performance will likely challenge both carrier and government stakeholders since new tools, databases, certification processes, and monitoring and enforcement will all change from traditional compliance.

However, there are existing resources and/or programs available that could assist in program development. These include the research and testing already completed for OSS, ENS and Universal Truck ID. In addition, technical guidance is available for simulators, fatigue management and other proposed AC tools. Existing databases and systems that manage CDLs, MCSAP and CSA could further augment AC management.

The remaining program requirements will likely focus on the development and review of the certification process itself, and there are several certification program analogies that could be reviewed including UL certification, EPA's Smartway program and ISO 9000.

For those carriers interested in the program, the certification process and guidelines could be made readily available through both industry and government websites. Once certified, a carrier's compliance could be audited by trained third party safety compliance firms that already provide such services for traditional compliance. These third party entities could conduct reviews of carriers and provide seamless connectivity with FMCSA and enforcement agencies.

Again, start-up funding for the program may be an issue since AC costs for carriers could not reasonably be expected to exceed those of traditional compliance. This would also be an issue, at least initially, for enforcement agencies to develop and manage the certification program. However, once instituted, the overall compliance resource requirements would be expected to decrease through improvements in strategic, targeted enforcement of unsatisfactory carriers. Lastly, it is important to note that a certification program would need specific standards for developing and managing AC programs to ensure that all parties are operating under the same requirements and procedures.

8.0 NEXT STEPS

Throughout this research process, the research team has identified relevant components and approaches for addressing AC program requirements. Completion of the following "next steps" would provide critical guidance for implementing the AC activities effectively.

1. Conduct research and testing on program implementation requirements and expanded safety benefits associated with AC tools.
2. Assess regulatory and funding requirements, and develop a draft program management plan.

8.1 Additional Research

More substantive documentation and validation is still needed for several of the AC activities, as well as for the overall efficacy of AC. In addition, more granularity is needed on the components of the certification program and how it would be monitored and enforced.

Many of these assessments and requirements could be developed through a national pilot test. As previously noted in Chapter 6, additional testing could better assess personnel training requirements, crash rate differences between users and non-users, monitoring approaches and carrier costs and benefits.

Though several of the AC tools and programs described in Table 2 have foundational research describing specific cost and safety benefits associated with implementation, additional tool box items should be identified, thus requiring additional data and evaluation. Each tool should be first assessed using a benefit-cost model and then pilot-proven. Such research would further strengthen the rationale and support for an AC program.

8.2 Enabling Legislation

Beyond additional research to support the AC development process, another critical step is to assess and design any enabling legislation or modifications to current regulations that may be needed to implement an AC program, possibly formalizing a certification model and monitoring program that provides exemptions from certain traditional compliance requirements. An AC certification program would allow government agencies, carriers and other industry stakeholders to both easily identify participating carriers and make transparent the process which carriers would undergo to become certified.

Key steps related to the overall expansion of the AC concept include:

- developing specific requirements of the certification program, including carrier targets, individual AC tool benefits, training regimen, overall program objectives, and evaluation objectives and metrics;
- informing government stakeholders on the program through education and outreach efforts;
- creating public and industry awareness of AC to build support for the program; and
- presenting the results from the pilot test to document high-level findings regarding the potential impacts of AC.

These AC activities, in concert with existing safety performance initiatives, would provide trucking industry safety performance with a solid foundation on which carriers could begin to adopt meaningful alternative safety programs.

ATRI
American Transportation Research Institute

950 N. Glebe Road
Arlington, VA
(703) 838-1966
atri@trucking.org
www.atri-online.org