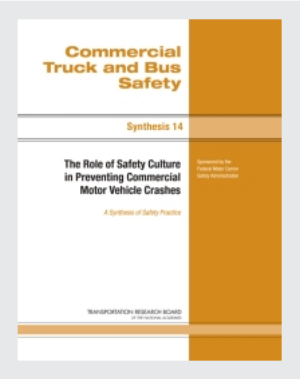


# The Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes

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**AUTHORS**

COMMERCIAL TRUCK AND BUS SAFETY SYNTHESIS PROGRAM

CTBSSP SYNTHESIS 14

# The Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes

**Jeffrey Short**
American Transportation Research Institute
Atlanta, GA

**Linda Boyle**
University of Iowa
Iowa City, IA

**Sandra Shackelford**
American Transportation Research Institute
St. Paul, MN

**Bob Inderbitzen**
REI Safety Services, LLC
Vonore, TN

**Gene Bergoffen**
MaineWay Services
Fryeburg, ME

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## COMMERCIAL TRUCK AND BUS SAFETY SYNTHESIS PROGRAM

Safety is a principal focus of government agencies and private-sector organizations concerned with transportation. The Federal Motor Carrier Safety Administration (FMCSA) was established within the Department of Transportation on January 1, 2000, pursuant to the Motor Carrier Safety Improvement Act of 1999. Formerly a part of the Federal Highway Administration, the FMCSA's primary mission is to prevent commercial motor vehicle-related fatalities and injuries. Administration activities contribute to ensuring safety in motor carrier operations through strong enforcement of safety regulations, targeting high-risk carriers and commercial motor vehicle drivers; improving safety information systems and commercial motor vehicle technologies; strengthening commercial motor vehicle equipment and operating standards; and increasing safety awareness. To accomplish these activities, the Administration works with federal, state, and local enforcement agencies, the motor carrier industry, labor, safety interest groups, and others. In addition to safety, security-related issues are also receiving significant attention in light of the terrorist events of September 11, 2001.

Administrators, commercial truck and bus carriers, government regulators, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and underevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information available on nearly every subject of concern to commercial truck and bus safety. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the commercial truck and bus industry, the Commercial Truck and Bus Safety Synthesis Program (CTBSSP) was established by the FMCSA to undertake a series of studies to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern. Reports from this endeavor constitute the CTBSSP Synthesis series, which collects and assembles the various forms of information into single concise documents pertaining to specific commercial truck and bus safety problems or sets of closely related problems

The CTBSSP, administered by the Transportation Research Board, began in early 2002 in support of the FMCSA's safety research programs. The program initiates three to four synthesis studies annually that address concerns in the area of commercial truck and bus safety. A synthesis report is a document that summarizes existing practice in a specific technical area based typically on a literature search and a survey of relevant organizations (e.g., state DOTs, enforcement agencies, commercial truck and bus companies, or other organizations appropriate for the specific topic). The primary users of the syntheses are practitioners who work on issues or problems using diverse approaches in their individual settings. The program is modeled after the successful synthesis programs currently operated as part of the National Cooperative Highway Research Program (NCHRP) and the Transit Cooperative Research Program (TCRP).

This synthesis series reports on various practices, making recommendations where appropriate. Each document is a compendium of the best knowledge available on measures found to be successful in resolving specific problems. To develop these syntheses in a comprehensive manner and to ensure inclusion of significant knowledge, available information assembled from numerous sources, including a large number of relevant organizations, is analyzed.

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Each year, potential synthesis topics are solicited through a broad industry-wide process. Based on the topics received, the Program Oversight Panel selects new synthesis topics based on the level of funding provided by the FMCSA. In late 2002, the Program Oversight Panel selected two task-order contractor teams through a competitive process to conduct syntheses for Fiscal Years 2003 through 2005.

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# FOREWORD

By Christopher W. Jenks
Director, Cooperative Research Programs
Transportation Research Board

This synthesis will be useful to federal and state agencies, commercial truck and bus operators, and others interested in improving commercial vehicle safety. The synthesis provides information on practices that offer the greatest influence on developing and enhancing a culture of safety among commercial motor vehicle drivers. The synthesis is based on a comprehensive review of (a) literature and research pertaining to safety culture as it relates to motor carrier industries, (b) surveys and interviews of motor carrier safety managers and commercial motor vehicle drivers, and (c) case study data collected from motor carriers.

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Administrators, commercial truck and bus carriers, government regulators, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and underevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

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This synthesis series reports on various practices; each document is a compendium of the best knowledge available on measures found to be successful in resolving specific problems.

To develop these syntheses in a comprehensive manner and to ensure inclusion of significant knowledge, available information assembled from numerous sources is analyzed.

For each topic, the project objectives are (1) to locate and assemble documented information; (2) to learn what practices have been used for solving or alleviating problems; (3) to identify relevant, ongoing research; (4) to learn what problems remain largely unsolved; and (5) to organize, evaluate, and document the useful information that is acquired. Each synthesis is an immediately useful document that records practices that were acceptable within the limitations of the knowledge available at the time of its preparation.

# CONTENTS

SUMMARY

# The Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes

**Approach.** While improvement of "safety culture" is sought by organizations that face safety risks, the specifics of the term itself and the methods by which safety culture is fostered are relatively ambiguous. A key reason for this is the general lack of standardization of the highly qualitative term "safety culture," even within the trucking and motorcoach industries.

Understanding this ambiguity, the CTBSSP 14 research team synthesized the current available research and literature pertaining to safety culture, finding specific ties between the available body of knowledge and the motor carrier industries. The effort also included a data collection component, consisting of convenience sample surveys and interviews of motor carrier safety managers and commercial motor vehicle (CMV) drivers, as well as case study data collect onsite, directly from motor carriers. This report contains an outline of suggested steps for increasing safety culture through a series of best practices. The report concludes with a discussion of findings and final research needs.

**Literature Review.** The research team's approach includes an extensive review of the literature on organizational culture, safety, and the concept of "safety culture." This review includes, but is not limited to, research conducted in the field of transportation, with a specific focus on the transport of goods and people in the following sectors: trucking, motorcoach, aviation, and maritime. Safety culture-related research of the high risk chemical and energy production industries and similar types of operations were also included.

The literature review identified the following key concepts:

- Culture and safety have a clear connection.
- Safety culture is best defined and indexed by an organization's norms, attitudes, values, and beliefs regarding safety.
- Effective top to bottom safety communication and interactions enhance safety culture.
- Terms such as "accident" and "mishap" are often replaced with the terms "crash," "wreck," and other more appropriate, straightforward terms in many safe cultures.
- In many instances, organizations, organizational subgroups, and professions may each have identifiable safety culture.
- Recognition and certain rewards systems for safe behavior are an effective component of safety culture.
- Driver experience enhances a safety culture, especially if that experience is with one carrier. Driver retention problems, however, have the potential for degrading a safety culture.
- Many levels of communicating safety culture are necessary in "remote workforce" industries such as truck and bus operations.
- Policies, procedures, employee safety responsibilities, and safety messages must be clear and simple.

- Hiring practices, safety training and education, company orientation, and safety management are all key components of a safety culture.
- Measuring safety performance of drivers and the organization as a whole are key components of a safety culture.

**Safety Culture Survey, Interview, and Case Study Results.** Through the safety manager survey and interview process, it was found that safety managers look positively on top to bottom communications, as well as internal cooperation within an organization, effective and simple communications, safety training and education, full organizational participation in safety programs (not just safety departments and drivers), and a good balance between positive and negative motivations. Safety managers indicated that a culture of fear is not positive or effective, nor are generic, indirect safety program methods.

Drivers indicated that the independence found in the profession is a positive aspect, which in many ways contradicts the basic foundations of an organizational culture and a safety culture, even if a personal "safety ethic" exists. All drivers indicated that safety was a priority professionally and was also a priority for their employer. All drivers realized that the heaviest level of safety responsibility rested with them. Eighty percent of those interviewed indicated that their company had a rewards/recognition program for safe behavior, and there was an indication that drivers tend to communicate with peers within their own organization more often than those outside of their organization.

Finally, three trucking companies participated in onsite safety culture discussions that acted as comprehensive case studies, detailing the company safety culture examples, and methods for producing and maintaining a safety culture.

**Safety Culture Relationship Framework.** The safety culture relationship framework section suggests a list of practices that will aid in the development of a positive culture of safety within a motor carrier. Such actions include the following:

- Develop or redevelop internal definitions of culture and safety
- Conduct "Swiss cheese" analyses
- Identify and dispel myths
- Conduct institutional safety knowledge development
- Define or redefine employee safety roles from top to bottom
- Assess the effectiveness of safety communication and reengineer systems of safety communication
- Create or enhance a system of safety record data collection and analysis
- Develop or redevelop motivational tools
- Improve driver retention

The safety culture itself, as has been shown through the literature and data collection, requires a multilevel, comprehensive series of safety program steps and procedures that act as a baseline for safety management efforts. When such programs are implemented, there is a tendency to seek to mitigate bad behavior by isolating such behavior and their relationships to future crashes. This leads to greater levels of safety, thus linking safety culture and safety performance.

**Best Practices Guidelines.** The best practices guidelines chapter takes key findings from the literature review, data collection efforts, and discussion of the safety culture to develop practical questions and actions for motor carrier safety managers to use when developing their organization's safety culture. It is organized in four stages:

Stage 1: Assess Safety Culture
Stage 2: Identify Safety Culture Improvement Areas
Stage 3: Develop Solutions to Improve Safety Culture
Stage 4: Implement Safety Culture Improvement Plan and Reassess

**Findings and Summary of Major R&D Needs.** Based on this analysis, it is recommended that future research be conducted on (1) the connection between driver retention and safety, (2) the influence of driver peers on safety, and (3) the safety culture limitations faced by smaller carriers. Additionally, a test of the effectiveness of the Best Practices Guidelines on increasing motor carrier safety culture should be conducted in an effort to formalize the process of increasing safety culture. Final conclusions and findings are also offered in this section.

CHAPTER 1

# Introduction

## Background

The American Transportation Research Institute (ATRI) recently released the results of a CMV "crash predictor model" study (Murray et al. 2005), which provides quantitative, statistical documentation of future crash probability based on several CDL driver risk behaviors. Research such as this backs the premise that en route risk behaviors are initiated by drivers.

There also exists support for the idea that some carriers have become havens for, and even attract, unsafe drivers (Knipling et al. 2003). Both empirical and anecdotal evidence, however, support that "safe" carriers—as defined by numerous metrics including SafeStat scores, safety awards, and industry safety statistics—produce, attract, and retain safe drivers.

While all major components that make up the safety culture of a motor carrier have not been adequately studied in past research, specific safety factors and correlations that contribute to safety culture do exist. These include compensation schema (ATA); non-financial reward programs (Transanalytics, ATRI); and ISO 9000 certification's nexus to safety (Naveh et al. 2003). It is also clear that other industry sectors that contain safety-sensitive positions such as aviation, mining and heavy equipment manufacturing have researched the tangible and intangible mechanisms that contribute to a positive safety environment.

The following research identifies and analyzes significant safety and non-safety programs and initiatives across relevant sectors that create and support, or could create and support, a positive safety culture within the trucking and motorcoach industries. These programs and initiatives were synthesized and analyzed, resulting in a documented best practices outline of the factors and attributes that offers the greatest influence on developing and enhancing a culture of safety. The team also identified non-programmatic factors that help cultivate or improve an overall culture of safety, such as leadership roles (within management and among CMV drivers).

Finally, in conjunction with *CTBSSP Synthesis 12* data collection, the research team hopes to add to the overall CMV safety culture literature by identifying and demonstrating qualitative and quantitative relationships between positive safety cultures and safety outcomes as defined by the research, literature review, and industry members.

## Scope

The objective of this synthesis was to provide information to assist the commercial vehicle safety management community (especially safety program managers) in understanding how and what company safety practices and philosophies favor and nurture safety in the workplace. Specifically, this synthesis investigated the following aspects of motor carriers and bus operators that define the concept known as safety culture:

- Attitudes, values, norms, and beliefs with respect to risk and safety within bus and truck organizations and
- Visible practices and procedures and the requisite behaviors they target which characterize a "safe" commercial operator.

This synthesis undertook three major research tasks to reach this objective:

1. The documentation and analysis of major factors, programs, and attitudes that create a positive safety culture within trucking and motorcoach operations,
2. Discussion of the relationships between positive safety cultures and operational safety as defined by accepted safety metrics, and
3. The development of a high-level best practices guide for incorporating the significant programs and attributes into the safety programs of trucking and motorcoach operations.

This last objective provides the practical transfer of research synthesis findings to industry safety stakeholders.

## Data Collection Approach

### Review of Literature

The research team first investigated the full range of literature pertaining to organizational culture and safety, with a focus on research conducted on industrial and transportation organizations. The literature review defined safety culture based on past research, and laid the foundation of safety culture in the motor carrier industries through an outline of the pieces that make up a culture of safety within a motor carrier. More specifically, sources included academic journals, texts, and trade publications, including past research garnered from the following sources:

- Transportation Research Information System (TRIS).
- FMCSA research publications.
- ATA Foundation, ATRI, and other industry research publications.
- Transportation safety research literature.
- Industrial safety management literature (e.g., *Journal of Safety Research; Journal of Organizational Behavior Management; Professional Safety;* and *Occupational Health & Safety*).
- Published studies and articles relating to certification and self-evaluation programs in trucking safety and other related industrial activities.

### Surveys and Interviews

Information was gathered through a broad truck and bus industry survey and one-on-one interviews to gain insight on overall industry understanding of safety culture, as well as experiences with and efforts to develop a safety culture within a commercial motor vehicle operation.

The research team first surveyed a convenience sample of fleet safety managers to gain a better understanding of attitudes and other factors related to the understanding and development of a safety culture within a motor carrier.

The research team also conducted in-depth, one-on-one interviews with members of motor carrier safety management divisions. This research task provided more candid information regarding motor carrier safety culture, as well as details on subjects/aspects of safety culture that fell outside the current body of literature.

The research team also gained insight on safety culture by conducting one-on-one interviews with randomly selected CMV drivers and through the use of a survey guide.

Finally, the research team conducted a series of three case studies to outline specific trucking company's safety culture.

CHAPTER 2

# Literature Review

## Overview

This discussion of literature focuses on the following concepts:

- Organizational culture,
- Safety in industrial and transportation settings,
- Definition of safety culture, and
- Relationship between the safety culture and the trucking and motorcoach industries.

Within the motor carrier discussion is an analysis of how individual parts of such organizations, including leadership, safety managers, and drivers, create and interact with an organization's safety culture.

## Defining Organizational Culture

Throughout the literature, organizational culture is generally defined as the norms, attitudes, values, and beliefs held by members of an organization. There are, however, many variations and slight additions to this definition.

Manuele (1997) includes other concepts in the definition, such as "legends, rituals, mission, goals, performance measures, and [a] sense of responsibility to employees, customers, and community, all of which are translated into a system of expected behavior," adding that all these (including the previously mentioned four qualities) are translated into something that describes the culture of an organization.

Cameron and Quinn (1999) refer to organizational culture as something that

> *. . . reflects the prevailing ideology that people carry inside their heads. It conveys a sense of identity to employees, provides unwritten and, often, unspoken guidelines for how to get along in the organization, and enhances the stability of the social system that they experience . . . It is simply undetectable most of the time.*

Thus, a collection of individually held norms, attitudes, values, and beliefs, when organized "under one roof," creates an overriding culture that is defined by those norms, attitudes, values, and beliefs that prevail.

Beyond what is typically thought of as an organization, which is often in the form of a corporation, institution, or government agency, it is suggested in the literature that organizational practices are heavily influenced by outside cultures, such as nationality (Hofstede 1983) and occupation (Helmreich in press). In basic terms, it is thought by this research that nationality and occupation itself can act as an organization.

### Leadership and Management

A key set of culture-defining positions within an organization are those involving leadership and management. Employees in such roles attempt to guide the organization and the behavior of its members through the use of tools, including official policies, rewards and remediation, planning and decision making. The tasks of those in this position rely heavily on communications. In many large organizations, for instance, top leadership must develop an organization's culture not solely through one-on-one discourse, but through mass communications such as email, memos, official policies, and large-scale speaking engagements and teleconferences.

While many authors cite leadership as having a key role in organizational culture, it is noted that a large emphasis has been placed on enhancement of leadership methods rather than on enhancement of organizational culture through leadership (Roughton and Mercurio 2002; Schein 2004).

## Safety, Risk, and Loss

### Defining Safety

The term "safety" describes a condition where adverse events and hazards are avoided, and barriers are erected to prevent future occurrences or interactions with such events or hazards. In the workplace, safety can describe the act of avoiding being the victim of or the cause of "*accidents.*"

Using the term "accident," however, is thought by some to be inappropriate when describing failures in safety. Such a term places the responsibility for safety, risk, and loss on someone or something other than those employees and other persons directly involved in unsafe behavior (Van Fleet 2000). Using the term "accident," and similar terms, is accordingly deemed a language myth, which may undermine safety culture within an organization.

Van Fleet defines three key categories of "accident myths" that are part of an organization's culture and that allow for individuals and groups to avoid accountability for safety failures. The first myth, termed the "force of nature accident myth" is one that applies directly to motor vehicle incidents and places responsibility in the hands of weather rather than in human behavior.

The "non-accident accident myth" removes individuals from responsibility for injuries or losses by placing blame on something, where something is anything but the individual who is responsible. This might relate to motor carriers in a situation where a driver makes the choice to speed to meet a delivery window. If that driver speeds, creating an unsafe environment and reaches the destination without incident, the unsafe environment is not referred to by the driver as an accident. When the unintended consequences of such activities occur (i.e., the speeding driver crashes), however, the driver may respond by stating it was an accident. This has the effect of, first, convincing the myth user that the accident (crash) could not have been prevented and, second, it removes accountability, and subsequently, undermines accident evaluation and the safety improvement process.

The final accident myth defined by Van Fleet is the "common accident myth," which contains four components: chance accidents, unplanned accidents, unforeseen accidents, and unavoidable accidents. All four components within this myth, as is the case with the first two myths, suggest that accidents cannot be prevented or avoided.

Organizations that are not safe may accept such myths, but in industries that have high risks and potential for loss regarding safety such as the motor carrier industries, improper use of terms may undermine or prevent the development of a safe culture. Therefore, clear definitions of what a culture of safety is attempting to achieve are necessary.

In discussing such language myths and their use among motor carriers, Reagle (1997) criticizes use of the word accident. He states "continued use of the word 'accident' implies that these events are outside human influence or control. In reality, they are predictable results of specific actions." He continues that more appropriate terms include crash, collision, and injury, stating that the regulatory arm of the motor carrier industry would no longer use the term accident.

Just as safety goals must be defined, it is also crucial to define the causes of a crash or other loss. One attempt at this is the Swiss cheese model, which outlines the cause of a crash through descriptions of breached safety barriers (Reason 1998). The concept defines safety barriers, which are depicted as slices or layers of Swiss cheese, as measures that typically prevent crashes. The barriers, however, have holes or weaknesses. If the holes in a series of slices/barriers come into alignment, according to the theory, a crash can occur.

A simple example of Reason's model for the motor carrier industries might involve three barriers such as (1) CMV driver training, (2) CMV maintenance, and (3) highway safety practices of the general public (see Figure 1). If a situation arises where deficiencies or "holes" in driver training, the quality of maintenance, and a non-commercial user's ability to safely interact with commercial vehicles come in alignment, a crash will occur. Building on this theory, a solution may be for those employees that are at risk to "learn" safety or safe behavior to close the holes in Reason's Swiss cheese barriers.

The research of Gherardi et al. (1998) offers that "people in organizations do not learn 'safety' [but] learn safe working practices." The authors state

> *Practical knowledge of what is safe and . . . dangerous is . . . a stock of knowledge—both tacit and explicit—which is stored and transmitted within the community of practice and constitutes its power base vis-à-vis other communities that depend on it in the production cycle. It is principally participation in [a community of practice] which provides access to this practical knowledge and makes its competent use possible.*

This discussion reveals that safety in the motor carrier operator environment may belong, in part, to communities and not entirely to the organization itself. Following the community theory, a motor carrier has communities within organizations and outside organizations, such as the community known as "drivers" and the community known as "safety managers."

Following Gherardi's logic, there is also an importance placed on practicing an occupation over a significant period of time, such as practicing the occupation of truck driver to learn and build on what behaviors are safe and what behaviors are not safe. Safety training does have a place, of course, but experience is critical according to this analysis.

Determining why loss occurs and how to predict future loss is also discussed in the literature. Mearns et al. (2001) find that the best predictor of loss and near loss is nothing beyond simple "unsafe behavior." The Murray et al. research likewise shows the predictive qualities of past "unsafe behavior" by connecting historic CMV moving violations with the likelihood of future crashes.

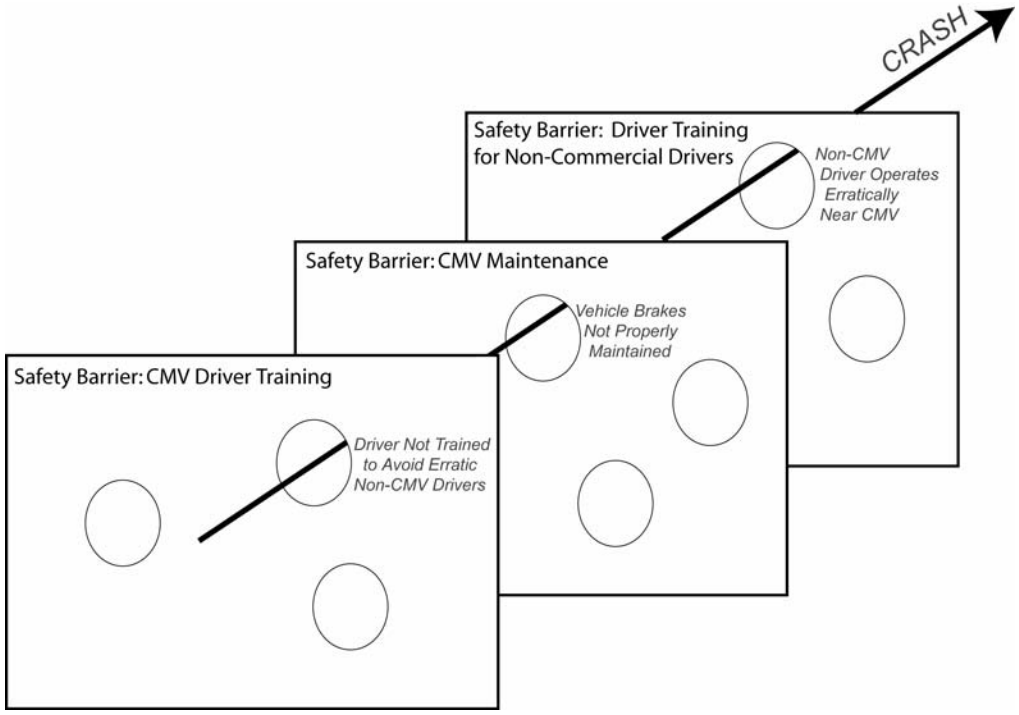



***Figure 1. Example of Reason's Swiss cheese model applied to CMV safety.***

It should also be noted that the Mearns research suggests that the reason behind unsafe behavior is "perceptions of pressure for production." Thus, the goals of production and profit do not align with those of safety.

## Safety and Scale of Loss

The literature on safety and loss tends to focus on single industrial disasters of great magnitude, such as Bhopal (Union Carbide chemical disaster) and Chernobyl (nuclear power plant disaster). The term safety culture was actually derived through the investigation of the causes of Chernobyl. The trucking and motorcoach industries are not typically directly involved or at risk for involvement within such widescale disasters. While it is true that tens of thousands of individuals are killed and injured each year in automobile and truck crashes, the overall national and international impact derived from each crash instance is minimal and does not receive the degree of national or worldwide attention that a major failure such as an industrial accident that kills thousands receives (Dwyer 1991). Crashes are also commonplace; the consequences of crashes (injuries and fatalities) may desensitize the public.

While it may be the case that a widescale loss typically gains greater public attention, truck and bus crashes are a major concern among highway safety professionals, those outside of industry who are directly involved in such accidents, and the motor carriers themselves. The U.S. DOT statistics show that the rate of fatal crashes per 100 million vehicle miles traveled (VMT) has decreased from a peak of 5.21 in the late 1970s to 1.99 in 2003 as shown in Figure 2.[1] However, large truck travel has continued to increase and the actual number of fatalities that result from crashes involving large trucks has not declined as significantly. In the last 5 years, trucks involved in fatal crashes numbered nearly 5,000 annually, while the number of buses involved in fatal crashes remained close to 300 annually. It should be noted, however, that VMT traveled by trucks annually is far greater than that traveled by buses.[2]

## Safety Culture: Definitions and Applications to the Motor Carrier Industries

The norms, attitudes, values, and beliefs of organizations define the culture of an organization and are manifested in the behaviors of its agents. For many organizations, safety and loss prevention are of the highest concern. This is especially true for organizations that operate in and/or create hazardous environments as part of typical business operations. Such

[1] Large Truck Crash Facts 2003, FMCSA, Publication Number FMCSA-RI-04-033, 2003.

[2] National Summary of Large Trucks and Buses Involved in Crashes, 2001–2005, Volpe National Transportation Systems Center, U.S. Department of Transportation, 2006. Available online: http://ai.volpe.gov/CrashProfile/n_overview.asp

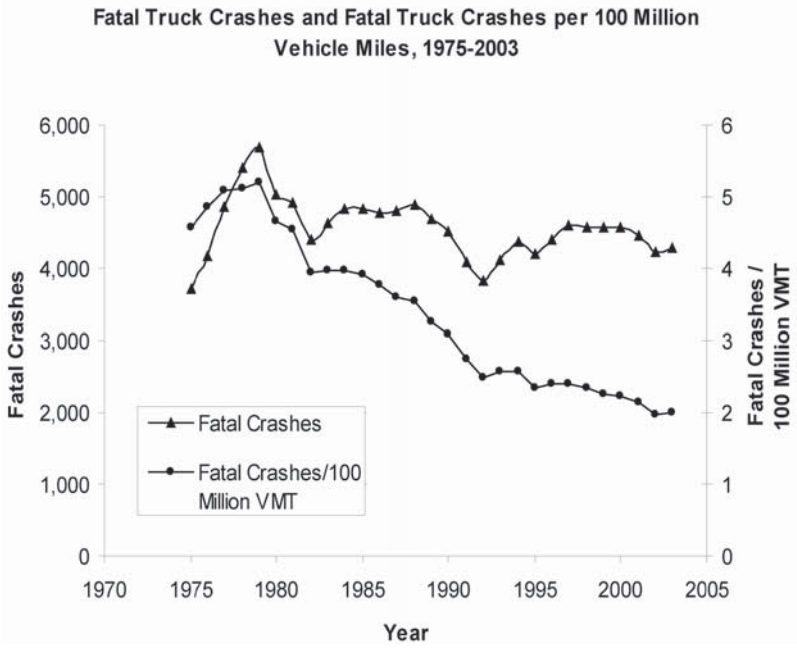



***Figure 2. Fatal truck crashes and fatal truck crashes per 100 million vehicle miles traveled.***

hazardous environments exist internally (e.g., chemical plant) and externally (e.g., transportation-related industries).

Within an organization, culture will influence individuals and individuals will define the culture. The following review of safety culture-related literature attempts to clarify this connection across several industries, with an emphasis on trucking and motorcoach operations.

## Definition of Safety Culture

Uttal (1983) defines organizational culture and, intuitively, its relationship to safety as follows:

> *Shared values (what is important) and beliefs (how things work) that interact with an organization's structures and control systems to produce behavioral norms (the way we do things around here).*

Thus, when analyzing an organization's culture of safety under these criteria (and using a definition that existed prior to the term safety culture itself), three main questions might emerge for any organization concerned with safety:

- Who develops, defines, and communicates shared values regarding safety in a work environment?
- What are the internal policies and procedures (i.e., beliefs) that create a culture of safety?
- How do the values and beliefs regarding safety interact with other organizational values and beliefs, and how do they become standard practice throughout?

Such questions were likely not asked by operators of a Ukrainian nuclear power plant prior to the 1986 Chernobyl nuclear disaster. This event is credited with defining the term safety culture as well as exemplifying a working environment that lacked a culture of safety. Several onsite events led to the meltdown of the Chernobyl reactor, but longer term issues were central to the disaster itself. Investigators determined that there existed a lack of an overall "safety culture": inadequate and unsafe reactor construction created a dangerous operating environment, standard operating procedures were not followed, and systems of communicating safety-related information were ineffective (Nuclear Energy Agency 2002).

Ostrom et al. (1993) notes that even prior to the Chernobyl disaster catalyst, researchers were well aware of the relationship between safety and culture and understood that, within an organization, "safety performance is affected by [a given group's] socially transmitted beliefs and attitudes towards safety." Such beliefs were said to be manifested in an organization's actions, policies, and procedures.

But as the post-Chernobyl investigation took on an international scale, some standardization of the connections between safety and culture began to manifest. Sorensen (2002) cites the full course of development of the term "safety culture" through a synthesis of several years of International Nuclear Safety Advisory Group (INSAG 1991) investigations into the Chernobyl disaster. The INSAG-4 report defines safety culture as

> *That assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, . . . safety issues receive the attention warranted by their significance.* (INSAG 1991)

The INSAG-4 continues its definition of the term, stating that safety culture flows from top to bottom, with senior management being essential to an organization's safety culture, and official policies and objectives regarding safety being a critical indicator of an organization's safety culture.

The report also offers an outline of how one should determine if a safety culture exists in the operation of nuclear power plants, with the criteria for judgment relating to the following (all of which can be related to and used by motor carriers):

- Environment created by management
- Attitudes of personnel at all levels
- Safety record of the organization

Harvey (2002) takes the criteria a step further, concluding that "safety culture is viewed as involving perceptions and attitudes, as well as the behavior of individuals, within an organization." This is a reference to the perceptions of risk in the operating environment, attitudes held among members of the organization at all levels, and the behaviors of those operating on behalf of an organization. Thus, it can be concluded that individuals are responsible for their own safety results, while still maintaining an important role in the safety of others through their influence on other members of an organization.

Harvey also finds a link between work and non-work environments, which might be exemplified by those who bring safety values from home to the environment at work. Regarding the motor carrier environment, Bergoffen et al. (2005) indicate such behavior among truck drivers that use safety belts at work and when driving their personal cars. It was found that among those drivers that used safety belts, top reasons for doing so were not related to work. The reasons included being in or seeing a bad accident (while not driving a truck) and the driver was being influenced directly or indirectly by his children and other members of his family.

Swartz et al. (2000) differentiates the idea of organizational culture from the unique quality of "safety culture" in the following manner:

> *Every organization has a culture—a set of written and unwritten rules and assumptions that determine how things are done. However, not every culture is a safety culture dedicated to the health and safety of all employees.*

Safety culture becomes a quality that an organization does or does not possess. Swartz offers the National Safety Council's *14 Elements of a Successful Safety and Health Program* (National Safety Council 1998) as a tool to build a safety culture within an organization. These include organizational actions and functions that

- Recognize, evaluate, and control hazards;
- Design and engineer safe workplaces;
- Manage safety performance;
- Manage regulatory compliance;
- Address occupational health;
- Collect safety-related information;
- Incorporate and involve employees at all levels;
- Motivate employees and positively modify their behavior and attitudes;
- Train employees and orient them with new procedures and equipment;
- Communicate safety-related information;
- Manage and control external exposures;
- Manage external environments;
- Integrate safety into hiring and placement processes; and
- Measure the performance of safety-related activities.

Some sources define transportation safety as it pertains to motor carriers through their relationship to three factors: those pertaining to carrier behavior (which are actions taken on behalf of carrier operations), societal norms (which are reflected in government regulation) and situational factors (which are the "uncontrollable factors" that exist in the transportation system) (Mejza et al. 2003). Accordingly, a carrier safety culture may in part address factors that include the behaviors of those operating on behalf of the carrier, adherence to government regulations on the carrier, and preparation for and avoidance of factors that cannot be greatly controlled.

Von Thaden et al. (2003) define five global components of safety culture based on a synthesis of previous research. It includes the following:

- Organizational Commitment: This commitment to safety is defined by upper level management and is manifested in use of safety as a core value in the long term.
- Management Involvement: This is contingent on management's physical approach to safety. Are upper and middle management, for instance, directly involved in safety meetings or in safety oversight?
- Reward System: This addresses how safety-related behavior is evaluated and rewarded or corrected.
- Employee Empowerment: This pertains to the responsibility placed on employees by upper management and the degree to which that responsibility empowers or motivates employees to have safe behavior.
- Reporting System: Such systems evaluate and intend to improve safety.

Finally, Gherardi finds the contrary. His research suggests that a safety culture is defined/embodied in a profession's collective expertise and knowledge and is expressed through "beliefs, norms, expectations, and tacit coordination with other safety practices" within an organization. Accordingly, a specific type of task may have its own safety culture.

Relevant examples of such tasks may involve those who operate hazmat tank truck versus those who haul general freight. Likewise, those who drive trucks as a profession may have a different safety culture than those who manage truck drivers.

## Groups That Define a Motor Carrier's Safety Culture

Research finds that there is a tendency to have a variation in safety culture within organizations at different physical locations as well as within subgroups of organizations (e.g., managers/drivers) (Harvey 2002). Building on this thought, leadership and management groups have been separated from drivers in the following motor carrier specific safety culture review of existing literature and research.

### *Top Leadership, Safety Professionals, and Safety Departments*

Reason states that "a safety culture depends critically upon first negotiating where the line should be drawn between unacceptable behavior and blameless unsafe acts" (GAIN 2004). This line should, of course, not be drawn by each individual but should instead be set through policy by top leadership. Such "line drawing" is the essence of the role of leadership in creating a safety culture.

What leaders decide is "acceptable for the prevention and control of hazards is a reflection of [an organization's] culture" (Manuele 1997). Therefore, what is considered "tolerable" is determined at the highest levels of an organization. However, a key difficulty faced by motor carrier leadership and management in preventing crashes and controlling hazards is that they are not physically present during normal core operations. Delivery of goods or people from Point A to Point B, where the distance between the two points is an external environment, is a difficult risk environment to control and standard techniques often do not apply.

While such difficulties may exist, it has been determined that safety management practices have a bearing on safety outcomes, with findings indicating that "close calls," crashes, and driver fatigue can be reduced by management practices, even while management and drivers are normally out of direct contact with one another (Morrow and Crum 2004).

The researchers also find that dispatchers work against the efforts of safety professionals (and their efforts to establish a culture of safety), citing their tendency to pressure drivers to operate when tired and more susceptible to crashes and "close calls." It is stated that more research is needed regarding the dispatcher/driver relationship with regard to safety. Nonetheless, a key lesson from this research is that different divisions of management must coordinate when an organization wishes to develop its safety culture and that, according to Simon (2000), the safety function within this collaboration must move beyond basic technical expertise and act as a change agent.

### *Drivers*

Truck driver culture is anecdotally tied to images of "the open road" and "independence." This independence is exemplified by those in the long-haul trucking profession. Drivers have a great level of responsibility: they are "responsible for safety, on-time delivery, customer relations, equipment breakdowns, and . . . insurance rates, all of which have bottom-line consequences for motor carriers" (McElroy et al. 1993). Safety is listed first in the quote, but many factors lead to the actual prioritization of safety among a driver's other responsibilities.

## Safety Beliefs and Attitudes of Drivers

There is a clear linkage between attitude and general behavior in the literature (Harvey 2002; Sorensen 2002). However, according to Sorensen, there is a scarcity of statistical evidence to link safety culture, specifically workforce attitudes towards safety, with actual safety performance.

One example is found in McElroy et al.'s examination of truckload carrier driver attitudes and their relationship to length of driving career and typical trip duration. A sample size of nearly 3,400 employee drivers indicated a somewhat alarming relationship between career drivers and negative attitudes: the longer a driver's career was, the more negative that driver's attitudes were, especially regarding the work in general, the income, and career advancement.[3]

It is clear that such attitudes may have impacts on safety and, at the very least, have an impact on driver retention. It may be assumed that with all other variables remaining equal, when a skill such as truck driving is practiced regularly a driver will gain experience, thus making him a better driver. If, however, the attitude of a driver becomes negative as the driver gains experience (including safety experience), safety itself will likely be viewed in a negative light.

## Stability of Driver Labor Pool and Safety

Driver retention is perennially a top trucking industry issue (Beilock and Capelle 1990; ATRI 2005). With a lack of retention among the driving population comes a lack of stability, which in turn affects a company's culture. A safety culture, as stated repeatedly throughout the literature, does not occur instantly. Employees (e.g., drivers) must be, over the long term, part of an organization—both developing and

[3] Owner-Operator respondents were excluded.

learning its culture. Likewise, an organization must have a culture in place to teach new members its norms, attitudes, values, and beliefs.

If this culture-building process is not in place due to labor instability, then a driver may hold only the industrial subculture of the driving profession as he moves from carrier to carrier, which will undermine the safety culture of those carriers that are the driver's past, present, and future employers.

One key labor stability issue found in the literature is that, in comparison to other industries, there are few opportunities to advance beyond the title "truck driver" while still actively driving (McElroy et al. 1993; Beilock 2003).

One solution, which may build on the McElroy et al. research of driver attitudes, may be to involve experienced drivers in safety training. While driver attitudes were found by McElroy et al. to increase in negativity with length of career (due to a lack of advancement prospects), an experience-based safety position for drivers that demonstrates long-term satisfaction could nurture a positive attitude, allow for career advancement, and encourage safety. McElroy et al. suggests that more experienced drivers, for instance, become mentors (or safety mentors) for new recruits that can (1) take the place of professional driving schools and (2) introduce and indoctrinate drivers to a motor carrier's safety culture.

## Communicating to a Remote Workforce and the Professional Culture of the Driver

Prussia et al. (2003) identify the differences between safety cultures in "interdependent" work environments (in this case, a steel mill) where "members possess substantial experience working together" and "managers and employees . . . share general mental models about the factors that contribute to unsafe behaviors [and] workplace accidents" and those that are not as interdependent. The authors state that organizations that are not tightly connected could, in fact, use the models demonstrated by the interdependent industrial workforces to determine appropriate methods for developing a shared understanding of safety factors.

It is true that motor carriers and other transportation-related industries do not have managers and drivers that work physically closely with one another. Drivers are essentially a remote workforce, often dispersed throughout the United States or even North America. Modern communications technologies have allowed for managers and drivers to become closer, though, and promises to tighten the gap more so in the future. Anecdotally, safety managers currently have the ability to view the exact location of a driver, get an instant report when a driver has a hard braking incident, and call that driver's cell phone immediately to ask what happened. Technology may therefore be one solution to the remote workforce issue.

Issues, however, may arise when the driver workforce (1) does not identify with other professional cultures within the organization they operate in and (2) identifies strictly with the professional culture under which they operate.

Gherardi's investigation of conflicting safety perspectives within an organization offers the concept of subgroups, termed "communities of practice." These communities and the safety cultures that direct each overlap through participation in the larger organization's production cycle. Through research of managers and employees, the cause of accidents was found to be different by each. In determining accident cause, regular employees (engineers) believed that a lack of organizational control and economic/time constraints led to a lack of respect for safety, which led to human error and then to an accident. The managers (construction site managers) found that a lack of organizational control and lack of safety norms led directly to accidents, as well as a third factor—poor workforce professionalism led to management difficulties, which led to accidents. Thus, a disconnect is shown between the views of management and regular employees. In the case of remote workforces such as truck and bus drivers, this disconnect may be even greater.

Alvesson (2002) also discusses the concepts of industrial sub-cultures and isomorphism, which, in lay terms, is related to cultural norms that are developed by macro groups (e.g., truck drivers) within even larger groups (the trucking industry).

Helmreich (in press) discusses professional or occupational culture as it pertains to pilots. There are positive influences within professions (such as aviators or CMV operators) which include professional pride and may be manifested through "recognizable physical characteristics," such as equipment (e.g., airplane types and truck types), but there are negatives in aviation (and other professions) which are said by Helmreich to include a sense of invulnerability (i.e., a "macho" attitude). This may also afflict CMV driver profession, especially trucking. Many drivers simply do not feel they need to use potentially life-saving equipment, such as seat belts (Bergoffen et al.).

Driving a truck or a bus is a unique profession that requires specific training. To receive a CDL, one must go through specific training and pass certain tests, including those related to intoxicating substances. These are the norms and values that make up the profession, and if the rules that govern such licensing and testing are broken and disregarded then a CMV driver may no longer be permitted to practice his or her profession (Schein 2004).

## Developing a Culture of Safety within a Motor Carrier

Pidgeon (1997), in concluding that the cultures of organizations are often blind to emerging/new threats to safety and that there is a need to mitigate this "blindness," states that

> *While safety and culture do seem to hold an intimate relationship, the later should be invoked only as one part of a wider critique of organizational politics and performance: the only thing for certain, then, about a safety culture is that one can never assume we have a good one in every respect.*

There are not specific inputs that can be used in generating outputs that are regular or predictable. Likewise, what a good culture is and what a bad culture is are not easily defined. Schein dismisses many pervasive styles of evaluating an organization's culture stating that

> *[Many] usages of the word culture display not only a superficial and incorrect view of culture, but also a dangerous tendency to evaluate particular cultures in an absolute way and to suggest that there actually are "right" cultures for organizations . . . [but] whether or not a culture is "good" or "bad," "functionally effective" or not, depends not on the culture alone, but on the relationship of the culture to the environment in which it exists.*

While researchers, analysts, and practitioners cannot reasonably state that one carrier has a "good" safety culture and one has a "bad" safety culture, it is possible, using Schein's analysis, to evaluate the parts that make up a carrier's safety culture and determine what practices work and what practices do not. This is especially true of motor carrier safety culture as it relates to the environments mentioned by Schein. It is a carrier's core business function to move goods or people between points that are often external from the organization and that are separated by vast areas of public roadways. Thus, appropriate driver and carrier behavior in such an environment is one indicator of a good safety culture.

On the topic of specific safety culture qualities, research in the field of oil tanker piloting (Brown and Haugene 1998) concluded that several management and organizational factors (MOFs), when implemented properly, reduce the probability of grounding a tanker by 99% and therefore increase safety and develop safety culture.

The researchers identify 11 performance shaping factors (PSFs), many of which can be used by the trucking and motorcoach industries. Relevant to this research are the following:

- **Inattention** to tasks and responsibilities.
- **Lack of motivation** to perform well.
- **Poor physical condition** (resulting in fatigue and other physical problems).
- **Inadequate knowledge** of procedures, standards, and regulations.
- **Lack of awareness** of responsibilities.

The researchers also identify several critical MOFs that are defined by safety culture and that directly affect the PSFs. Of the 16 listed by Brown and Haugene, the following are most relevant to the trucking industry:

- **Workload:** Policies, procedures, and practices for assigning driver workloads.
- **Formalization:** Identification and communication of safety rules.
- **Benefits:** Levels of pay and other benefits.
- **Quality of Life:** In general, a driver's standard of living.
- **Performance Evaluation:** How is the driver's safety performance evaluated?
- **Personnel Selection:** Who is hired?
- **Personnel Turnover:** Results in drivers that have little experience with an organization.
- **Training:** The level of safety-related education.
- **Supervision:** What type of oversight exits?
- **Organizational Learning:** How well is past data used to affect future safety?
- **Communications:** How effective are informal or formal communications?

More specific to the trucking industry, Arboleda et al. (2003) state the following in discussing safety culture:

> *A homogeneous perception of safety is important for the achievement of a strong safety culture: however, employees may differ in their safety perceptions, depending on their position and/or hierarchical level within the organization.*

In U.S. interstate trucking, the external environment includes thousands of local governments, 48+ state governments, and at least one national government. In the United States, this environment also includes tens of millions of individual property owners, whose land, vehicles, and structures may be affected by unsafe motor carrier behavior. Even beyond the safety of property, personal safety is at stake as was described in the aforementioned fatality statistics.

While some of the literature (Pidgeon) begins with the premise that it is difficult to specifically define or differentiate between what is a good and what is a bad safety culture, Ostrom et al. (1993) cite criteria for a "good" safety culture. They begin by outlining two examples of safety norms: the first being a good norm where accident reporting is rewarded and the second being bad norms, found in instances where safety solutions are no longer sought. The following are cited as norms found in good safety culture qualities:

- Alert employees that seek and use safety-related information.
- Organizations that reward safe behaviors and attitudes.
- Participation in safety policy and procedure at all levels of the company.
- Ongoing data collection and analysis of safety-related events.

### *Communicating a Safety Culture*

Distinct groups within organizations, such as drivers and their managers, may have high levels of conflict with one another because communications are either not effective or non-existent (Schein, p. 10). In research of safety culture at a nuclear power plant, Carroll (in press) found that communications in both directions within the hierarchy were not effective and resulted in an organization whose employees did not entirely and consistently understand "safety."

### *Hiring Practices*

A carrier's safety culture and carrier safety in general can be greatly affected in the hiring portion of the planning function. The drivers that carriers use to represent them in the external environment (in which most operational activities occur) are a focus for many safe carriers.

This is exemplified through research of 148 carriers deemed to be among the industry's safest. Mejza determined the importance of specific hiring practices related to non-personality traits, hiring of owner-operators, and personality traits. The most important non-personality traits considered in the hiring process were (1) history of alcohol/drug-related crashes, (2) chargeable crashes, (3) violations related to speeding, (4) other moving violations, and (5) prior driving experience. Also apparent is that safe carriers who hire owner-operators and employee drivers apply the same hiring criteria to both groups. Finally, several personality traits of applicants were ranked by importance, with the following in-order rankings tested among those traits deemed "important": (1) honesty/reliability, (2) self-discipline, (3) self-motivation, and (4) patience. "Sociability," or the potential ability of applicants to interact with others was found to be less important.

Murray et al. (2005) developed and tested an analytical model for predicting crash involvement for drivers based on prior driving history. An analysis of data on more than 500,000 drivers over a 3-year time period showed reckless driving and improper turn violations as the two associated with the highest increase in likelihood of a future crash. Likewise, four driver conviction categories offered the highest likelihood of future crashes: (1) improper/erratic lane change, (2) failure to yield, (3) improper turn, and (4) failure to maintain proper lane. Results showed that a conviction in any of these four categories led to a 91 to 100% increase in the probability of a future crash.

### *Training and Driver Retention*

Dobie and Glisson (2005) hypothesize that because drivers often may not see the connection between training and professional advancement, this causes drivers to seek advancement at other carriers, thus shortening employee history with companies. The solution, according to the authors, is to retain drivers by creating a connection between training (or the skills learned through training) and career advancement.

Though retention is the central issue in Dobie and Glisson, there are several major components of their analysis that tie directly to safety culture. First, safety is a central theme in driver training, if not the core topic. Creating a connection for drivers from safety training to career advancement allows for safety training, and in theory, safety itself, to correlate directly with benefits such as schedules, route choice, compensation, and other benefits. Second, retention itself could make the investment in driver training more valuable, and could therefore augment the amount of safety training that is conducted industrywide.

### *Safety Management of Drivers*

Management of safety critical workforces must often take place at the micro level (or, as suggested in the survey portion of this synthesis, at the front-line manager level).

Mejza describes the safety-related behaviors of carriers as related in part to driver performances, but more importantly related to the management of drivers, which is defined as the "activities a carrier performs to enable its drivers to detect and avoid potentially dangerous situations." Driver management itself is placed into four categories for the purposes of this research: hiring practices, training, driver support, and driver motivation.

### *Driver Incentives for Safe Behavior*

The general concept of a safety incentive program is to reward drivers (typically monetarily) for meeting certain safety criteria over a specified period of time.

Canadian research has indicted that, for trucking companies, both increased safety and profitability can result from the implementation of a safety incentive program aimed at driver behavior, and such results can be increased to a greater level through the monitoring and reengineering of existing incentives programs (Ray Barton Associates et al. 1998). The research also suggests that benefits may include reduction in driver turnover problems. This research suggests that the following safety programs exist in close conjunction with a standard monetary-based safety incentive program:

- Management demonstration of safety commitment
- Driver awards and recognition programs
- Effective communication within a company
- Ongoing safety meetings and training

Just how prevalent such programs are is not certain. A convenience sample of 238 truck drivers indicated that only 3% had

safety rewards or incentives as part of their employment (Bergoffen). The Canadian research indicates that carriers would like research that offers a better picture of the use of incentives for safe behaviors, as well as best practices and a determination of industry norms (Ray Barton Associates et al.).

### *Safety Audits and Safety Performance Measures*

The safety performance record of drivers is clearly the most critical aspect of their influence on and adherence to a company's safety culture. Cox and Cox (1991) suggest that "constructive attitudes" among employees is the most critical performance measurement of a safety culture. Measuring such a qualitative aspect of employees may be difficult, but there are several aspects that are quantifiable and are collected and analyzed through safety audits and in the form of safety performance measures.

Swartz (2000b) offers guidelines for designing a safety audit program, first stating that the following categories should be the focus:

- Safety program administration
- Hazards control
- Training
- Industrial hygiene and health
- Recordkeeping and workers' compensation
- Communications and awards

The literature refers to many instances of data collection for the purposes of developing a safety culture. Ostrom et al. cite instances of verbal and written data collection from employees and others who interact with an organization regarding the general topic of safety. Specifically outlined is the Johnson & Johnson model (Safety Outreach System) whereby the following types of questions are asked:

- What worries you the most about your safety?
- What hazards do you see here in the work place?
- Where is the next accident going to occur?
- What can we do to prevent it?

Ostrom et al. developed and tested a survey—the EG&G Idaho Safety Norm Survey—to assess the safety culture of several Department of Energy facilities. This survey offered 84 statements (within 13 categories) and asked respondents to address each on a 5-point agree/disagree scale. Statements were categorized under Safety Awareness, Teamwork, Pride & Commitment, Excellence, Honesty, Communications, Leadership & Supervision, Innovation, Training, Customer Relations, Procedure Compliance, Safety Effectiveness, and Facilities. Many of the 13 categories are difficult to relate to the motorcoach industries, including Teamwork in a lone worker environment and Facilities, which often play a small role in a driver's work.

The von Thaden research of survey methods allowed all levels of an airline the opportunity to assess the "five global components" of safety culture (see the Definition of Safety Culture subsection). A similar, customized survey tool could potentially be used to assess the safety culture of a motor carrier by measuring perceptions of Organizational Commitment, Management Involvement, Reward Systems, Employee Empowerment, and Reporting Systems.

Mejza describes driver performance measurements (possibly through a survey) as a second aspect that measures carrier behavior in relation to safety. Research suggests, however, that a survey to outline the current state of an organization's safety culture is not a holistic enough approach and may lead to assumptions that problems currently exist within an organization's culture. Carroll (in press) offers a four-pronged methodology for determining the state of safety culture: (1) conducting an anonymous safety culture questionnaire, (2) conducting interviews with all questionnaire respondents, (3) reporting questionnaire and interview results to senior leadership/management, and (4) reporting results back to the entire organization.

It is also important, in a culture of safety, to be able to collect accurate data while at the same time having a system that prevents injury through individual responsibility. Literature on patient safety suggests that cultural change within two key components is necessary for increasing safety: openness (in reporting incidents and near incidents) and accountability (Firth-Cozens 2001). These appear to require a strong balancing act, however. If an individual will receive a large penalty as a result of reporting his/her own mistake, there is no incentive to do so. Likewise, without an accurate reporting system, improvements cannot be made. This dilemma relates to the current system of tort liability faced by the motor carrier industries; in one sense complete transparency regarding accidents can benefit the performance of the entire industry because others learn from mistakes but, on the other hand, carriers may not wish to be transparent because of additional financial losses that they might incur as a result.

CHAPTER 3

# Data Collection Results

## Survey of Motor Carriers

The first of four data collection efforts undertaken through this research represents a convenience sample of the safety departments of 25 trucking company and 5 motorcoach operators. The intent of this survey was to gain insight on motor carrier understanding and use of safety culture concepts.

The survey was distributed to industry association members, such as the American Trucking Associations (ATA), State Trucking Association members (e.g., members of Georgia Motor Trucking Association) and safety committees within such organizations. The survey was also open to the public via ATRI's website, and links were available from the front page of the ATA's website, truckline.com. The survey was also publicized by eTrucker.com,[4] bulktransporter.com[5] and Business Fleet magazine.[6]

While the survey itself was available to many non-motor carrier related individuals (i.e., it had a public presence), it can be verified that all respondents included in this analysis are actual trucking companies. Those who completed the survey were given the option to identify their company by name and to provide contact information on a confidential basis. All respondents chose to do so and therefore their status as a motor carrier could be verified.

Respondents were first asked a series of demographic questions. Table 1 shows respondent population, mean, standard deviation, median number of power units (company vehicles), total employees, and drivers (including owner-operators).

Table 2 identifies the distribution of truckload (TL), less than truckload (LTL), and specialized carriers within the trucking firms.

Of the trucking companies, 12 identified themselves as being primarily short haul (i.e., they indicated that more than 50% of their operation was short haul), 12 identified themselves as long haul, and 1 described its operation as split equally between long and short haul (see Table 3). Of the five motorcoach companies, three listed local operations as being greater than 50% and two indicated that they were more regional. Each motorcoach company did have some proportion of national operations (ranging from 2 to 20%).

### *Safety Department*

All but two organizations indicated they had a safety management department or a department that has safety responsibilities, which is consistent with what was expected of the survey population.[7] The two organizations that did not indicate the existence of any safety department were both private fleets.

Respondents who indicated that they had a safety department were next asked to prioritize the level of importance that department held within the organization, with the option of selecting from three choices:

1. Safety is the top/central priority.
2. Safety is an equal priority with other operational objectives.
3. Safety is important, but other priorities are more important.

Of those whose primary operations are short haul, seven identified their safety department as the top priority (see Table 4). Among the long-haul operations, 11 identified safety as the top priority. No organization indicated that safety was less important than other priorities in their organization.

Those that identified competing demands with safety (n = 6) noted that customer and operational concerns also needed to be equally addressed.

[4] http://www.etrucker.com/apps/news/article.asp?id=54680

[5] http://bulktransporter.com/news/safety3560/index.html

[6] http://www.fleet-central.com/bf/t_inside.cfm?action=news_pick&storyID=24573

[7] Typically, a survey respondent that does not have a safety department is less likely to complete and return a survey that is heavily focused on the action of safety departments.

**Table 1. Surveyed population.**

| Company Type | Variable | N | Mean | Std Dev | Min | Max | Median |
|---|---|---|---|---|---|---|---|
| Trucking | Power units | 25 | 1668 | 2768 | 12 | 10618 | 262 |
| | Employees | 25 | 67737 | 319482 | 10 | 1600000 | 250 |
| | Drivers | 25 | 2231 | 4241 | 16 | 17000 | 340 |
| Motorcoach | Power units | 5 | 60 | 15 | 45 | 84 | 60 |
| | Employees | 5 | 27 | 6 | 20 | 35 | 26 |
| | Drivers | 5 | 81 | 19 | 62 | 110 | 80 |

**Table 2. Trucking company types.**

| | Trucking Company Type | | | | Total |
|---|---|---|---|---|---|
| | TL | LTL | Specialized | None specified | |
| For-hire | 13 | 2 | 5 | 0 | 20 |
| Private | 2 | 0 | 0 | 3 | 5 |
| Total | 15 | 2 | 5 | 3 | 25 |

**Table 3. Primary operations of trucking firms surveyed.**

| Primary operation | N | Variable | Mean | Std Dev | Min | Max |
|---|---|---|---|---|---|---|
| Short haul | 12 | Power units | 1569 | 2790 | 12 | 7750 |
| | | Employees | 140124 | 460109 | 10 | 1600000 |
| | | Drivers | 2494 | 5123 | 16 | 17000 |
| Long haul | 12 | Power units | 1022 | 1089 | 82 | 3000 |
| | | Employees | 719 | 1310 | 15 | 4500 |
| | | Drivers | 1090 | 1186 | 84 | 3500 |
| Both short and long | 1 | Power units | 10618 | . | . | . |
| | | Employees | 3321 | . | . | . |
| | | Drivers | 12768 | . | . | . |
| Local motorcoach | 3 | Power units | 56 | 10 | 45 | 63 |
| | | Employees | 28 | 7.6 | 20 | 35 |
| | | Drivers | 76 | 12 | 62 | 85 |
| Regional motorcoach | 2 | Power units | 66 | 25 | 48 | 84 |
| | | Employees | 24 | 2 | 23 | 26 |
| | | Drivers | 88 | 31 | 66 | 110 |

**Table 4. Importance of a safety department by company type.**

| Company Type | Primary Operation | Importance Level of Safety Department | |
|---|---|---|---|
| | | Top Priority | Equal with Other Objectives |
| Trucking | Short haul | 7 | 3 |
| | Long haul | 11 | 1 |
| | Both short and long | 1 | 0 |
| Motorcoach | Local motorcoach | 2 | 1 |
| | Regional motorcoach | 1 | 1 |
| Total | | 22 | 6 |

**Table 5. Whom does the safety department report to within the company.**

| Safety Department Leader… | # of Responses |
|---|---|
| Reports directly to CEO/President | 13 |
| Reports directly to CEO and is an on-par member | 5 |
| Is an on-par member of the executive team | 4 |
| Reports to another Staff Leader (e.g., Operations/HR) | 3 |
| Reports to senior VP of Transportation | 1 |
| Reports to CEO, staff leaders, and a safety committee | 1 |

**Table 6. Areas where operational decisions are integrated into safety.**

| Safety activities that are integrated into organizations. | # of Responses |
|---|---|
| Firing | 22 |
| Company safety policies | 22 |
| Driver screening | 21 |
| Driver selection | 21 |
| Driver disciplines | 21 |
| Safety-related benefits/incentives | 20 |
| Compensation | 16 |

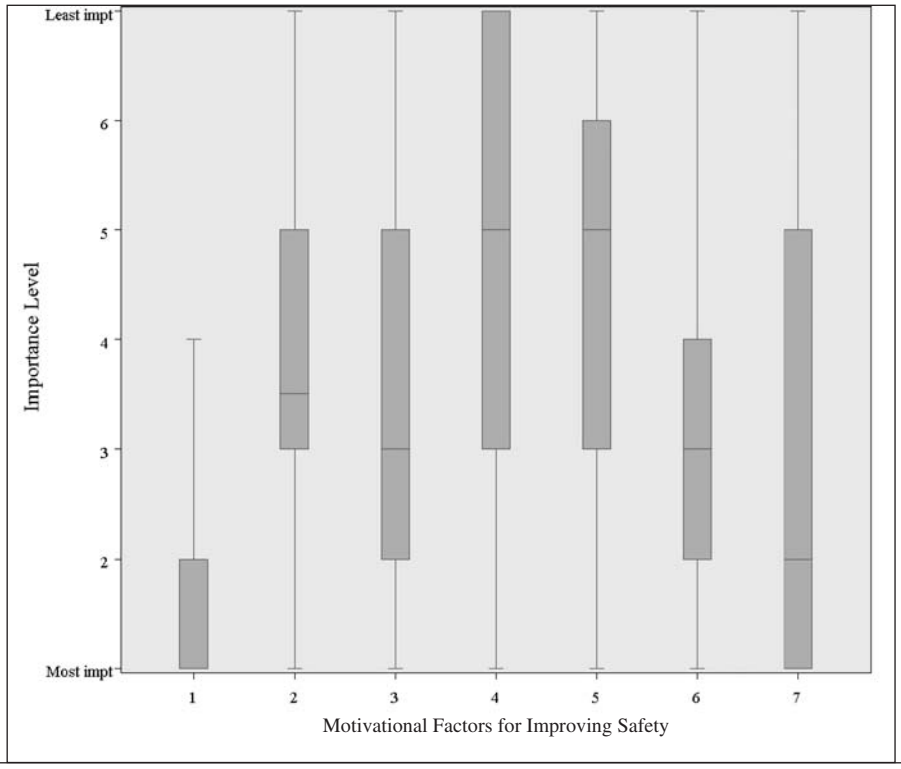
The motor carriers that indicated having a safety department indicated that the leader of this department typically reports to the CEO or president of the company (see Table 5).

There were many areas that are integrated into safety-related activities including firing, establishing safety policies, driver screening, and driver selection (see Table 6).

Respondents were asked to rank the order of seven motivations for improving company safety on a 7-point scale, with 1 the most important and 7 the least important. In terms of motivational factors for improving company safety, the most important motivation was reducing crashes, followed by setting a high industry safety standard (see Figure 3). In addition to the ones listed in the survey, another motivational factor cited included improving the public's perception.

### *Hiring, Training and Retention*

Traffic violations and convictions were the most used safety-related information by all organizations surveyed (i.e., truckload, LTL, and specialized) and for all operations




Where: 1 = Reduce crashes (median = 1 or Most important)
2= Avoid enforcement issues (median = 3.5)
3= Avoid costly lawsuits (median = 3)
4 = Attract customers (median = 5)
5 = Attract drivers (median = 5)
6 = Decrease insurance costs (median =3)
7 = Set high industry safety standard (median =2)

***Figure 3. Chart of responses for each motivational factor.***

**Table 7. Most often used information to assess safety.**

| Safety-related driver information | # of organizations using information |
|---|---|
| Traffic violations | 26 |
| Traffic convictions | 26 |
| Prior crash records | 23 |
| Prior drug and alcohol tests | 25 |
| General background check | 24 |
| Felony convictions | 23 |
| Other: The job interview | 3 |
| Other: Employment history | 2 |
| Other: General health history | 1 |

(short haul, long haul, local coach, and regional coach) (see Table 7). Those that indicated that additional information was needed (i.e., employment history as well as the job interview itself) were primarily short- or long-haul operations.

Participants were also asked to report their top three safety performance predictors. Table 8 indicates how often respondents rated a particular category as a top priority. The majority indicated that crash history was a top factor, followed by traffic violations, and employment history. There were also a variety of other safety measures used including age (too old or too young), perception of bad behavior (including aggressiveness, absenteeism), and roadside inspection compliance. A few organizations also indicated that they used crash and safety data available through the U.S. DOT including SafeStat, Safer, and Motor Carrier Management Information System (MCMIS).

Thirteen organizations out of the 30 surveyed indicated that they would hire entry-level drivers: 3 were motorcoach companies, 7 truckload, 2 LTL, and 1 specialized. Each of these organizations also indicated that they have an entry-level driving program (see Table 9).

There were 28 motor carriers that indicated some ongoing training for drivers with the majority having defensive driving, followed by accident procedure training, and compliance training (see Table 10 for frequency to all questions).

Out of the 30 surveyed, 26 indicated some type of remedial training available (see Table 11). The remedial training was typically given after a driver was involved in a crash. Some organizations offered the training immediately after the crash (n = 11). Others, however, instill the training only after a certain number of crashes (e.g., 2 preventable crashes within a 1-year period or 3 crashes within a 6-month period) while others have this as part of the orientation or even after a compliance violation.

Almost all organizations had an onsite training program (n = 29) with very few having online training (n = 5). Those who have onsite training typically conduct it around three times a year (median) with some having training as often as once a month.

Safety culture was reported to play a large role in the majority of organizations' recruiting efforts (n = 21). Some (n = 5) also indicated that applicants need to be cleared through their safety department before the employment process can be completed; however, this effect was not observed across all organizations. When asked how the company's safety culture relates to driver turnover, 23 reported that it improves retention, 5 reported no impact, and 1 had reported that it harms retention.

**Table 8. Frequency of information type to evaluate safety performance by operation type.**

| Operation Type | Crash history | Traffic violations | Employment history | Previous experience | Background check | Other safety measures |
|---|---|---|---|---|---|---|
| Short haul | 13 | 7 | 4 | 2 | 1 | 6 |
| Long haul | 7 | 8 | 4 | 1 | 1 | 15 |
| Both short and long | 1 | 1 | 1 | 0 | 0 | 0 |
| Local motorcoach | 1 | 2 | 3 | 0 | 0 | 2 |
| Regional motorcoach | 1 | 2 | 2 | 0 | 0 | 1 |
| **Total** | **23** | **20** | **14** | **3** | **2** | **24** |

**Table 9. Respondents that hire entry-level drivers by operation type.**

| **Company Type** | **Company Operations** | | | | | Total |
|---|---|---|---|---|---|---|
| | Short haul | Long haul | Short and long | Local MC | Regional MC | |
| TL | 1 | 5 | 1 | | | 7 |
| LTL | 2 | 0 | 0 | | | 2 |
| Specialized | 1 | 0 | 0 | | | 1 |
| Motorcoach | | | | 1 | 2 | 3 |
| Total | 4 | 5 | 1 | 1 | 2 | 13 |

**Represents for-hire firms only*

**Table 10. Types of defensive driving programs used in motor carrier firms.**

| Safety Training | # of carriers |
|---|---|
| Defensive driving | 27 |
| Compliance training | 25 |
| Accident procedures | 25 |
| Fatigue & wellness | 24 |
| Extreme weather driving | 24 |
| Backing | 24 |
| Security | 21 |
| Coupling/uncoupling | 13 |
| Other | 10 |

### *Bonuses and Incentives*

An overwhelming majority of motor carriers (23) indicated some form of bonus or incentive program (see Table 12). One motorcoach firm used a bonus or incentive, and it was primarily a regional operation. The other motorcoach operations indicated that there were no crashes or preventable crashes. Fifteen of those that do offer bonuses typically give drivers cash if they are accident free for a specific period of time. Some give gifts in the form of pins, jackets, belt buckles, and watches. One motor carrier indicated that drivers get to keep their job as a bonus.

### *External Environment*

In terms of the general CMV driver population (not just the respondent's company), 25 agreed or strongly agreed that the drivers operated in a culture of safety. The remaining 5 disagreed. These 5 were from for-hire firms.

Regarding the amount of influence that other drivers outside the company had on their driver's attitude toward safety, 3 believed they had a strong influence (2 were private drivers), 20 (2 private drivers) believed there was some influence, and 6 (none of which were private drivers) indicated that there was no influence at all.

Figure 4 shows there is disagreement among the companies surveyed that the motor carrier industry is viewed as safe by the general public. There is a general consensus among most of the organizations that customers value safety.

There were 24 motor carriers with an internal maintenance department. Of these, four were private companies (two were primarily short-haul, truckload firms, and the other two did not specify their operation type). All five motorcoach companies had internal maintenance departments. The majority had a close working relationship between the safety department and the maintenance department. They all appear to have a common goal of working together to improve safety.

**Table 11. Frequency of training program (annual).**

| Type of training (per year) | N | Mean | Min | Max | Median |
|---|---|---|---|---|---|
| Onsite training | 29 | 3 | 1 | 12 | 3 |
| Call-in/dispatch safety training | 11 | 36 | 1 | 200 | 12 |
| Online training | 5 | 14 | 1 | 52 | 4 |
| Behind the wheel | 15 | 29 | 0.5 | 365 | 1 |

### *Accident and Driver Convictions*

When asked to describe their process for collecting information regarding violations and convictions, 19 organizations indicated that they used Motor Vehicle Record (MVR) checks on a periodic basis. Others use SafeStat, Commercial Driver's License Information System (CDLIS), MCMIS, Commercial Vehicle Operator Registration (CVOR), and criminal checks as well.

The median values for this group of questions ranged from 2 (important) to 3 (neutral). As shown in Figure 5, there was a great variability with respect to what each motor carrier believed was the value of a crash investigation in improving overall fleet safety.

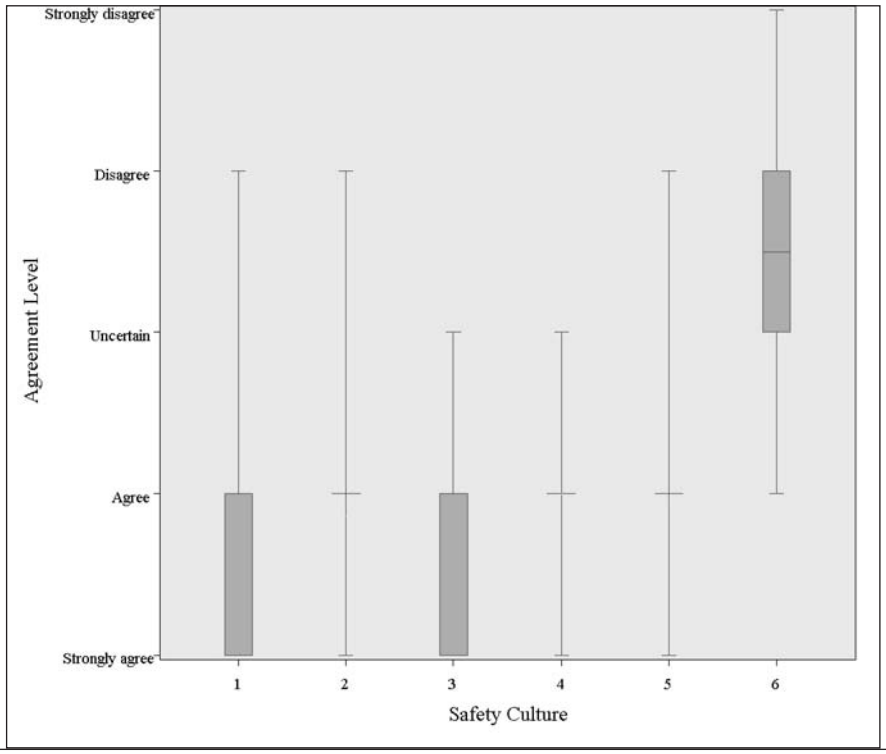
### *Technology*

The respondents used a variety of safety technology (see Table 13). Most have invested in computerized training programs, or other online safety programs and even driving simulators. In terms of technology within the vehicle, these included collision warning systems, rollover stability systems, GPS/Satellite Tracking/Communications, ABS, DriveCam, and other event recorders to observe drivers behavior.

As shown in Table 14, the most often cited reason for the use of each technology was to reduce crashes (including

**Table 12. Companies that offer bonuses and incentives by company type.**

| Company Type | For Hire | | | Private | | Regional | Total |
|---|---|---|---|---|---|---|---|
| | Short haul | Long haul | Both | Short haul | Long haul | MC | |
| TL | 3 | 8 | 1 | 2 | 0 | | 14 |
| LTL | 2 | 0 | 0 | 0 | 0 | | 2 |
| Specialized | 2 | 1 | 0 | 0 | 0 | | 3 |
| None specified | 0 | 0 | 0 | 2 | 1 | | 3 |
| Motorcoach | | | | 0 | 0 | 1 | 1 |
| Total | 7 | 9 | 1 | 4 | 1 | 1 | 23 |




Where: 1: Our customer values safety (median = 2 or agree)
2: Our insurers help make us a safer company (median = 2)
3: Enforcement sees our company as one that is safe (median = 2)
4: Drivers from other companies see our company as one that is safe (median = 2)
5: The general public sees our company as one that is safe (median = 2)
6: The general public sees our industry as one that is safe (median = 3.5)

***Figure 4. General perception of safety.***

minimizing rollovers, avoiding blind spots, and rear end collisions). Motor carriers also reported that the technology was used to improve driver performance, increase communication, and ensure that their driver was safe.

## One-on-One Interviews with Motor Carrier Safety Managers

To get a more in-depth perspective of motor carrier safety culture, six safety management team members from trucking companies participated in individual, one-on-one interview sessions. The interviews focused on eight discussion points that were followed as a general guide.

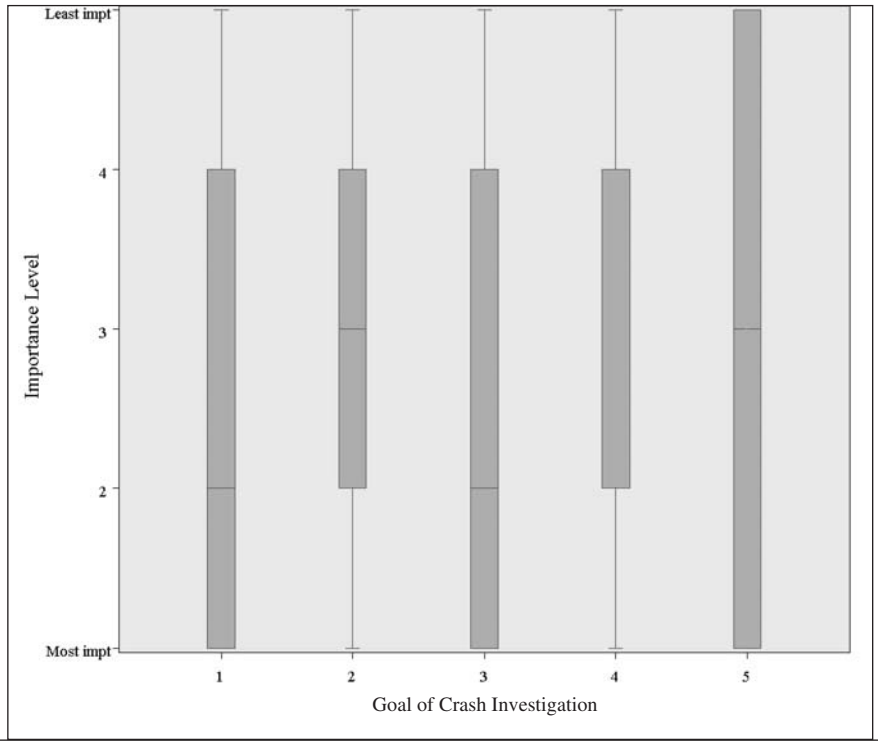
The first discussion point centered on the interviewee's perception of what safety culture is. One manager stated that it is "a uniform belief throughout all levels of a company, where everyone has the same goal and objective related to safety." A second manager stated that safety culture is "engrained in everything" the organization does, and likewise agreed that every part of the company develops the safety culture, including members of the safety management team, drivers, operations, and human resources. Other insights included safety culture perceptions as

- Something that is "lived" or is a way of life. It is part of the way people think. It is not something superficial.
- It is led by the drivers' method of safety application; the tone of these safety applications is set by management.
- It is a combination of leadership and training that creates a safety value among employees.

Key to these responses is that safety needs to be a part of everyday life for there to be a safety culture at a motor carrier, but there is some conflict regarding responsibilities of different positions within a motor carrier.

The second discussion point asked how a culture of safety is promoted at his/her particular motor carrier. The following represents a synthesized/normalized list of the answers:

- **Training:** Ample driver opportunity for training and gaining safety knowledge. Classroom time.
- **Incentives:** Bonuses, awards, prizes.
- **Non-Work Environment:** Involvement of driver's family, promotion of a safety lifestyle outside of work, safety always comes first.
- **Driver Involvement:** Drivers are involved in safety planning.
- **Safety Slogans:** Each phone conversation with a driver ends with a safety slogan.




Where: 1: To determine who was at fault (median value of importance= 2)
2: To determine appropriate response/actions toward driver (median value = 3)
3: To determine methods of accident prevention (median value = 2)
4: To protect the company from liability (median value = 2)
5: To improve overall fleet safety (median value = 3)

***Figure 5. Cited reason for an accident investigation.***

**Table 13. Type of technology investments reported by respondents.**

| Technology Investments | Frequency |
|---|---|
| Computerized training programs | 9 |
| Satellite/GPS/On-Board Communications | 8 |
| Collision warning | 5 |
| Roll stability | 5 |
| Antilock braking system (ABS) | 3 |
| Online safety program | 3 |
| Video equipment | 2 |
| DriveCam (event recorder) | 2 |
| Lane departure warning system | 2 |
| Other on-board communication systems | 2 |
| Fender mirrors | 2 |
| Log scanners | 2 |
| XATA | 1 |
| Anti collision warning system | 1 |
| Truck Simulator | 1 |
| Automatic transmission | 1 |
| Smith System | 1 |
| Air ride tractors and trailers | 1 |
| Electronic speed control | 1 |
| Side sensors | 1 |
| Other event recorders | 1 |
| Enhanced safety programs | 1 |

- **Communications:** Safety message with daily/weekly dispatch. Feedback is given to drivers and to operations regarding safety.
- **Financial Backing:** Company finances and dedicates employees to the safety function.
- **Top Leadership:** CEOs and VPs act as safety spokespersons.

The third discussion point focused on the challenge of communicating safety policy, and therefore developing a safety culture with an audience that was for the most part remote. One interviewee stated that it is difficult when drivers are not seen

**Table 14. Purpose for safety technology investment.**

| Purpose of Technology | Examples | Frequency |
|---|---|---|
| Crash reduction | Collision Warning, ABS, Roll Stability | 22 |
| | Electronic speed control | |
| | Lane departure warning systems | |
| Increase driver performance | Fender mirrors, roll stability | 8 |
| | Lane departure systems | |
| Increase communication | On-board communications | 6 |
| Reduce fatigue | Electronic logs, air ride tractors | 4 |
| Overall driver safety | Online training, On-board communications | 4 |
| Monitor driver behavior | DriveCam, video, event recorders | 4 |
| Save on fuel | Electronic speed control | 1 |

face to face regularly, and some are not in physical contact for up to 8 months. This is especially true for irregular truckload routes. A second safety manager responded that the communications difficulties that existed at the national truckload operation he worked for was, simply put, because the drivers are all over the country. Other issues included the following:

- 24/7 operations: "Nothing ever stops."
- Getting drivers to realize that a safety culture is for their benefit/their families' benefit.
- Getting managers and others to "sell" safety.

These were followed by the fourth topic, which sought to isolate the major influences on drivers regarding their safety behaviors. One manager stated that "The biggest two influences are driver-to-driver [communications] within the company and outside the company. It is hard to motivate from up the chain of command." Another manager stated that driver retention is undermined through communications with drivers from outside the company (especially in the form of wage comparisons). Finally, it was indicated that more experienced drivers that act as mentors to new drivers had a large influence. The managers that indicated other drivers (internal or external) had great influence over driver safety behavior, however, were in the minority. Most believed that top leadership and management were overwhelmingly the most important influences on driver safety behavior, including such influencers as the company CEO, division leader, managers that conduct audits, office staff, general management, and front-line supervisors. Finally, one manager stated that the spouse or other family members were the most critical influence on safety.

The fifth topic centered on the recognition and resolution of safety-related issues, which was split into two sections: those situations involving individual drivers and those that focus on companywide problems. For issues of individual drivers, auditing to determine issues coupled with follow-up training was a typical response. Such situations were typically handled by safety managers. At the companywide level, many motor carriers used or wished to use internal statistics to determine issues, and resolve them.

This was followed by a discussion of incentives that each company offered for safe behavior. All company representatives indicated that their motor carrier had a safe driver rewards program in place. Rewards included the following:

- Monetary/cash rewards and bonuses
- Jackets, rings, belt buckles, gift cards, banquet invitations
- Hometown newspaper recognition
- Corporate Hall of Fame
- Awards-based safety/driver retention program
- Driver/Manager committee appointments
- Accident free mileage bonuses
- Equipment upgrades

It should be noted that at least one company indicated that there is no penalty or removal from rewards programs if an accident is not the driver's fault.

The seventh discussion point was as follows: *In your experience, is there a connection between the level of safety training/information given to drivers and their overall safety performance?* All interviewees responded that there is a relationship, though some were more enthusiastic about this relationship than others. Some noted that "knowledge is power" and "safety does not happen by osmosis." Others were more reluctant, stating that there must be driver buy-in for safety training to work, that messages must be simple and straightforward, and that drivers that do buy-in must influence their peers.

The final topic asked for an overall assessment of what works and what does not work regarding safety culture. The following is a compilation of methods and messages that work and do not work according to the interviewees:

### What Works: Methods and Messages That Promote a Safety Culture

- Messages that come from top leadership, through department managers, through front-line managers, to drivers
- Verbal communications
- Communications in general
- Participation/buy-in from all departments, not just safety (e.g., operations)
- Internal cooperation
- Education/training
- Good balance between positive and negative motivations
- Management commitment to safety
- Careful screening during hiring
- Simple safety messages

### What Does Not Work: Methods and Messages That Do Not Promote a Safety Culture

- Fear/creating a culture of fear
- Termination threats
- "Customer is always right" attitude (because the customer is not always right regarding safety)
- "Cop and robber" instead of "coach and team" approach
- Incentives *without* recognition to back them up
- Generic poster programs
- "Dressing up a compliance program as a safety program"

## Driver Interviews

### Driver Interview Summary

The research team interviewed drivers at a commercial truck stop to gain insight into their understanding of safety at

both a personal and a corporate level. The convenience sample of 15 drivers were first asked questions to determine demographics and their level of experience. This was followed by driver opinions on safety, company safety policies, frequency of communication with the appropriate safety personnel, and overall job satisfaction.

Of the drivers interviewed, 40% were owner-operators. Two-thirds of the owner-operators had contracts with a single company. Most of the drivers responded that they were truckload carriers. One driver interviewed worked with a specialized carrier that hauled truck tractors. Three drivers responded that they worked for a private carrier, and 11 responded that they worked for a for-hire carrier. The size of the carriers ranged from operations with two trucks/three drivers to operations with 14,000 trucks and drivers.

Drivers were also asked how long they had been professional drivers and how long they had been with their current company. The number of years of experience ranged from 2 to 35 years. Two-thirds of the drivers had been with their current company for 1 year or less. Only two drivers had driven for the same company their entire driving career.

## Driver Safety Perspective

Drivers were asked to discuss their thoughts on safety. Not surprisingly, every driver indicated that safety was important. This type of overwhelmingly positive response is likely due to drivers' understanding that unsafe behavior is not something to announce to the public. One driver discussed the necessary balance between safety and operations.

As a follow-up question, drivers were asked to discuss how their companies felt about safety. Again, every driver responded that their companies were strict about safety and it was something to be taken seriously. Only one driver mentioned the balance between safety and operations at this point.

## Company Safety Perspective

Drivers were then asked to describe their company's safety department: 80% of drivers responded that their company had a safety department. Overall, drivers found this a more difficult question to answer. In general, drivers found it difficult to describe their companies' safety departments in much detail. The researchers asked specifically if the company had a VP of safety, safety director, and driver managers. Approximately 60% of the drivers responded that their company had either a VP of safety or a safety director, if not both. Three other drivers were able to describe some of the specific characteristics of their companies' safety departments. One driver mentioned the company's safety policy, another mentioned that their company used driver simulators in training, and the third driver responded that their company's safety department addressed accidents.

**Table 15. Means by which company safety policies are communicated.**

| Communications Type | % of Respondents Using Communications Type |
|---|---|
| On-board computer systems/email | 47% |
| Phone communications | 33% |
| Meetings at terminals | 27% |
| Brochures and mailings | 27% |

## Communications

Drivers working for companies with safety departments were then asked how their companies communicated safety policies with drivers (see Table 15). A total of 47% responded that their companies used on-board computer systems or internet/email to communicate with drivers. A smaller number, 27%, responded that their companies communicated with them in person through meetings or at the terminals. One-third of the drivers (33 percent) said their companies used the phone to communicate while 27% responded that their companies used brochures or mail-outs to communicate with them on occasion. Two of the drivers responded that their companies did not communicate safety policies with them.

Drivers were then asked about the frequency of their communication with their companies' safety departments (see Table 16). Daily communications were heard by 27% of driver's safety departments, while 13% communicate weekly, and another 13% communicate monthly. One driver responded that communications are quarterly during companywide meetings and another driver said that he only communicated with his company's safety department when there was a problem that needed to be addressed.

## Driver Training

Drivers then were asked about the training and education they go through with their company. The majority (80%) of the drivers responded that they had to undergo training with their current companies. Three drivers said they only had to undergo training when they were initially hired. Three drivers

**Table 16. Frequency of communications with safety departments.**

| Frequency of Communications | % of Respondents |
|---|---|
| Daily | 27% |
| Weekly | 13% |
| Monthly | 13% |

said that they only underwent training as needed, either based on prior driving experience or in response to poor driving performance. Seven of the companies have ongoing training, ranging from videos that drivers have to watch at the terminals, credit given for completing computerized training programs at the terminals, to completion of several seminars or workshops per year.

Overall, drivers responded that they feel connected to their companies' safety departments. Three of the drivers referenced consistent meetings or other communication as the reason they felt they were in touch with the company. The other drivers responded that the safety department was always very responsive when the driver needed to communicate.

### Driver Peer Communication

Drivers communicate with other drivers in their company much more frequently than drivers in other companies according to our sample. About half of the drivers (53%) responded that they communicate with drivers from their own companies daily. These drivers communicated via cell phones, over the radio, during pick-ups and drop-offs, and at truck stops. Other drivers indicated that they do not communicate with drivers from their company frequently and when they did, it was at pick-ups and drop-offs at the company terminal or at meetings. Drivers that communicated with other drivers in their company frequently were also more likely to communicate with drivers from other companies more frequently, but to a much lesser extent. Truck stops were the primary way that drivers communicated with drivers from different companies. Only one driver responded that he communicated with other drivers over the radio.

### Driver Safety

When asked if truck drivers as a population were generally safe, 47% responded that they were "generally safe." An additional 27 percent responded that some drivers were safe and some were unsafe and 20% responded that truck drivers were not generally safe. When asked if drivers at their companies were safer than truck drivers in general, one-third of the drivers responded that they were, while the remainder either refused to make a comparison or did not think that their drivers were necessarily safer than other drivers (though most of these considered their company's drivers to be as safe as drivers in general).

### Company Safety Incentives

A large majority of the drivers (80%) responded that their companies provided some sort of incentive to encourage safe driving behavior. Incentives included recognition in the company newsletter, safety bonuses based on the vehicle miles traveled safely, as well as gifts and awards. Seven of the companies (58% of those with incentive programs) gave drivers some sort of safety bonus either based on miles traveled or passing the annual DOT inspection, or a combination of these two factors.

### Driver Responsibility

Drivers were asked how much responsibility they had for safety. All of the drivers realized that the primary burden of safety fell on their shoulders. Some drivers made additional comments that suggested that it was not only their responsibility to drive safely, but to react safely to other less safe drivers on the road. One driver also recognized the importance of being in a positive mental state before getting behind the wheel of the truck.

### Driver Likes and Dislikes

Finally, drivers were asked what they liked and disliked about their job. Almost half (47%) of the drivers responded that they liked the independence of being a driver and being their own boss. This statement, in many ways, contradicts the basic concept of organizational culture as well as safety culture, and perhaps only offers a personal "safety ethic" as opposed to driver participation in a safety culture. Twenty-seven percent of drivers responded that they enjoyed traveling and 20% of the drivers responded that they liked meeting new people. About one-half (53%) of the drivers said that being away from home or being isolated was their biggest dislike of their profession. Finally, 20 percent of the drivers interviewed said their biggest dislike was traffic-related such as dealing with construction, congestion, or other drivers on the road.

Only two of the drivers interviewed were wearing a company uniform, consisting of a shirt with their name on it.

## Carrier Case Studies

Three onsite carrier case studies were conducted with trucking companies that had strong safety reputations.

### Carrier A Safety Culture

The first trucking company (*Carrier A*) that participated in a case study is a large specialized carrier with more than 1,000 employee drivers.

A top leadership decision to make safety a priority was what led to a strong safety department and a strong safety culture within Carrier A. The safety department is central within this organization: all departments interact with the safety department in some capacity, and checks and balances are

made by the safety department on the actions of other departments.

One example of this type of interaction was found in the relationship between the sales and safety departments. Specialized carriers such as Carrier A often haul loads that are irregular in shape and weight. When the sales department has a new type of load or a load from a new customer, that department will inform the safety department. Unsafe scenarios created by new customers include (1) loads that cannot be tied to a flatbed to meet company-specific safety standards and (2) customers that want to carry more items per shipment than can safely be moved (from the perspective of Carrier A). It is therefore the role of the safety department to review the needs and wants of the customer (shipper) and determine if such needs and desires are safe. If safe terms cannot be agreed upon then there is no business between the two parties.

This portion of Carrier A's safety philosophy is just one example of the interaction between the safety department and its customers. Another set of safety values is found through one of the current goals of Carrier A's safety department, which is to end business ties with current customers that work against Carrier A's safety culture. Simply put, the safety culture is so strong within Carrier A, from top to bottom, that the organization is willing to place its own stringent safety practices ahead of revenue when a customer is not willing to adhere to rules that will ensure safe movement of goods.

At the safety management level, the driving force behind the safety culture was found in the departmental leader. This member of the organization holds strong convictions regarding safety, is dedicated to the company and the drivers, and brings past experience as a driver into the management environment.

Driver and safety management interaction begins during the safety department-run company orientation. It should be noted that the high level of driver turnover that has greatly affected the industry is thought to actually help the safety department achieve goals; new drivers are said to have an easier time "joining" the company culture than those who bring past experiences with them.

Key to the success of Carrier A's safety culture is the orientation and training process. Empowerment of the driver is a central premise of Carrier A's safety culture. The following steps to empowerment are taken during orientation and training:

Before drivers are employed at Carrier A, the following empowerment concepts will be recognized:

- Expectations of the driving profession
  - Driver is choosing a difficult line of work
  - Work involves extensive time away from home
  - Home-life problems may be distracting
- Safety responsibility of the driver
  - Drivers make thousands of critical safety-related decisions each day
  - Drivers must protect themselves
  - Drivers must protect the motoring public
  - Drivers must protect the organization
- Why driver made choice to enter the profession?
  - To earn money
  - To support family
- What is the driver's role in safety?
  - Drivers are the central figure in safety
  - Drivers should drive around the motoring public as is if they were driving around their family or friends.
- Drivers understand that they have been given a great deal of trust by the carrier
- Drivers must understand that they are empowered to make decisions
  - Especially to avoid unsafe situations where the following exist:
    - Poor weather conditions
    - Driver alertness issues
    - Load type issues

Thus, the driver's position within Carrier A is critical and central to safety. The safety culture is said not to be tied to regulations or to be about company policy, but it is more importantly about the drivers themselves and their knowledge of the right thing to do. To this end, the safety training, orientation, and continuing safety department activities attempt to get to the "heart" and to the "head" of the driver. The thought behind this is that any person can be trained to drive a truck; what matters is that they continually recognize what is right and wrong, and what is safe and unsafe.

After orientation and training, drivers that are offered employment by Carrier A understand, for instance, (1) that it is not the role of state or federal regulations to let them drive for their maximum hours of service if they are too tired to drive and (2) that it is not the role of the customer to make the decision whether or not to drive in an ice storm.

Carrier A's drivers act as a force to keep the safety culture strong and effective. The "bad apples" will essentially be purged from the driver population, because the overwhelming majority of drivers have "bought-in" to the culture. It is also the experience of this carrier that if a driver is unsafe, the safety department will hear about it from safe drivers.

It is not thought by this company that drivers from outside of the culture have a negative influence on drivers from within the company. This is because communication among Carrier A drivers and their fleet managers is strong. The drivers will often move in groups along the same routes and communicate using cell phones. Camaraderie is encouraged during orientation and training, at distribution facilities, and on the

road. The trucks used by this company have distinct color and logos that set them apart from other vehicles; thus, all drivers are part of a distinguishable culture through relationships with other drivers, through their company image, and through the reputation for safety that is part of that image.

## Company B Safety Culture

The second company is a national truckload carrier with about 2,100 drivers that are mostly independent contractors.

Top leadership at Carrier B believes in creating a strong safety culture. They decide how to invest money in people, processes, and programs to support a desired safe end result. It is thought by the safety department that if it did not have top leadership supporting the safety culture building process, it would be far more difficult to achieve safe outcomes. It is believed by this carrier that safety originates from the top of the organization and filters down.

A key belief held by the safety department at Carrier B is that safety and a safety culture are created and strengthened by management. While the drivers are important, they are only a small part of developing the safety culture of the organization. It is thought additionally that focusing only on the driver is an unsafe practice.

The safety department envisions itself as a line function that must permeate the entire organization, including all office employees and drivers. Carrier B's safety philosophy stems from two concepts. The company strives for safety (1) because it is the right thing to do and (2) because it is in the best interest of the overall organization to develop a strong safety culture, which in turn keeps costs low.

The company is organized like a "three-legged stool," with the legs representing (1) the safety department, (2) the sales department, and (3) operations. All departments are equally important, and all play an integral role in the organization's safety culture. Such a method of organizing departments prevents conflicts of interests; for example, operations, as part of the safety culture, will not ask drivers to make hauls when they do not have enough hours to complete the task legally.

The safety department communicates with all other departments in the organization to ensure a company-wide understanding of safety and the role that each department plays in maintaining a safe environment. Specifically, the safety department ensures that sales and operations give drivers hauls that are safe, and that all functions of the company meet regulatory requirements, with special emphasis on the hours-of-service requirements.

The safety department certifies drivers prior to employment through several steps including

- Background checks,
- Internal road test, and
- Driver agreement to follow company safety philosophy.

If a driver does not agree with the company safety philosophy, then he or she will not work with the carrier. In addition to standard training, drivers can also request additional training; sometimes additional training is encouraged or required if drivers have certain deficiencies in their skills that need to be improved. Drivers are scheduled to undergo recertification every 8 months that includes a review of safety training and company safety philosophy.

Techniques to address potential "lone worker" issues include 800 numbers on trailers. Good calls are reported to the drivers and bad calls require drivers to meet with the safety department. Drivers that receive 3 bad calls within a 1-year period are terminated. Drivers also have many company-set guidelines that they must follow. When guidelines are not followed, they are addressed by management on a case-by-case basis.

Carrier B did not find high driver turnover to act as a negative force from a safety department point of view; this carrier commented that driver turnover can be positive if it results in the removal of bad drivers.

The management team has a philosophy of referring to authoritative sources to curb any safety-related management/driver conflicts that may occur. If a driver attempts to argue a point, the carrier will access sources such as regulations or the company attorney to avoid involvement in arbitrary arguments. In doing so, companies are able to communicate a consistent message.

Carrier B's safety department does not focus specifically on the driver, but instead on the organization as a whole. If operations and sales, for instance, are part of the safety culture, they will not ask drivers to try to make deliveries if it is not safe to do so. If conflicts arise between drivers and other departments (for example, if a driver does not believe the equipment is safe, but operations tells the driver to go anyway) the safety department will refer to an authoritative source (such as a source expert on maintenance).

To address the challenge of having a safety management presence in the truckload environment, operations has been charged by the safety department with driver recertification activities (for all drivers) every 8 months. Safety is also communicated through on-board communications technology. Such communications might include bi-weekly safety messages to drivers, as well as to departments such as operations. Memos to operations might include a reminder that more time may be needed to make deliveries in poor weather conditions.

Driver empowerment is said to be a daily function at Carrier B. Drivers are allowed to make safety judgments, and if a driver feels like he/she is unable to drive safely due even to things such as being in a bad mood, or a lack of adequate sleep, operations will support that driver's decision and reassign the load.

## Carrier C Safety Culture

The third participant in the case study effort, Carrier C, is a truckload carrier with approximately 1,500 drivers.

Carrier C is currently redeveloping existing safety programs and, in essence, the entire safety culture. This transition began after a series of challenging safety audits. The carrier recognizes the need for leadership participation, and the CEO is currently working with members of the safety team in an effort that includes such tasks as (1) modifying the company mission statement and (2) making all employees active participants in the new culture of safety.

Safety is communicated through written and voice communications, as well as videos. Carrier C's safety department currently has a goal of building a safety communications dialogue with the operations department, citing the need for all departments to have ownership in their role in safety.

Training is part of the safety department function. Company C's safety department runs the orientation and training for new hires, which also acts as an introduction to the organization's safety culture. Carrier C will employ entry-level CMV drivers, but requires an additional 6 weeks of driver training.

Difficulties with lone worker issues center around drivers who often view themselves as independent of the organization. Thus, the challenge is developing an understanding between the safety department and the driver that safety programs stem from a genuine concern for the safety and well-being of drivers. Safety can be made manifest in the cab, with reminders generated through safety technologies, LCD screens with video access for trucks, weekly voice messaging, and operations communications that support the safety message.

The safety department contact at Carrier C believes that drivers need to understand safety culture, specifically the safety culture objectives that the carrier desires to achieve. An outcome of this would be more driver buy-in. Overall, it is thought by Carrier C that drivers are very receptive to safety programs, and that the true challenges lie with integrating the safety culture with departments outside the safety department.

Drivers at Carrier C are empowered with the message that operations personnel and the company as a whole will support a driver's decision as being definitive.

## Case Study Conclusions

The Carrier A and Carrier B case studies may appear to show a strong contrast in safety cultures. The Carrier A approach places drivers at the center of the culture, strongly empowers drivers, and brings the drivers in as part of a team or "family." This is shown both through camaraderie and through its insistence on having all employees on "the same level." Finally, government safety regulations are recognized but not emphasized within this culture, and drivers follow a stricter code of safety values in place of regulations.

Carrier B, on the other hand, places leadership at the center of the safety culture, with a strong command and control approach. Drivers are just a segment of what "safety" means within this organization, and the drivers do not play the central role in the safety culture. Emphasis is placed on the regulations, and drivers must follow a set of standards or termination is a possibility.

However, this apparent contrast in these approaches may be misleading. One possibility is that these carriers are at different points in the evolution of their safety culture, whereby one is still developing the management-centric "flow-down" objectives of a safety culture, and the other is at the driver-centric implementation stage. Alternatively, in considering evidence in the literature that suggests a dislike for defining approaches to culture as "good" or "bad," it may be that the type of culture that works for a company is dependent on and customized to its environment. One carrier employs drivers and one contracts with them. That is only one of many differences between these two carriers. What is key, however, is that a safety culture exists and that it works, with safe results.

It can be suggested that Carrier C, in redeveloping its safety culture, may either migrate through the "stages" of Companies A and B or have a choice of either's discrete approach. While there is no "correct" culture for this carrier to follow, Chapter 4 and Chapter 5 offer actions and best practices for developing a safety culture that can guide the carrier in determining what methods can improve its safety culture.

CHAPTER 4

# Safety Culture Relationship

Throughout the literature, there is a clear relationship between an organization's culture as it pertains to safety and the safety performance of that organization. The following discussion represents (1) a list of practices that may contribute to the augmentation of a positive culture of safety within an organization and (2) a logical discussion of the connection between safety and culture.

## Actions to Enhance Motor Carrier Safety Culture

The following safety culture building activities have been developed from the review of literature and past research found in this report.

### Action 1: Develop or Redevelop Internal Definitions of Culture and Safety

This first activity creates a baseline of where a motor carrier is currently and determines where a motor carrier would like to be regarding safety and organizational culture.

It is first proposed that a carrier define "safety":

- What does being safe mean to the carrier?
- What are the current safety goals; what should they be?
- What are the motivations/incentives to being safe?

With regard to defining culture, it is suggested that a motor carrier first assess the fundamental qualities of its organization's culture including safety and all other aspects:

- What does the company strive to achieve; what does it value?
- What is the current knowledge base of the company; what do members believe?
- What defines a typical day in the operation; what are the norms?
- How do the organization and its members feel; what are the attitudes?

Finally, are any of these organizational culture qualities in direct conflict with the motor carrier's safety definition? If so, redevelopment may be required.

It should be noted that a good guide to defining safety is found in Cooper (2002), which uses existing research to identify the key purposes or motivations for an organization to develop its safety culture as the basis for the following motor carrier-oriented purpose list:

1. To reduce crashes, close-calls, injuries, and fatalities for employees, contracted drivers (i.e., owner-operators), and actors in the external environment.
2. To ensure that safety issues are recognized, formalized, and communicated throughout the organization.
3. To ensure that values, beliefs, attitudes, and norms regarding safety are standard at all levels of the organization.
4. To increase commitment to safety among all members of an organization.
5. To define a safety program in terms of both design and overall performance.

### Action 2: Conduct Swiss Cheese Analysis

As in the discussion of Reason's Swiss cheese model (see Figure 1), carriers might choose to determine the current barriers (slices) that are in place, determine the size of the holes or vulnerabilities in each barrier, and determine methods to decrease vulnerabilities within each barrier through (1) analysis of individual barriers and (2) analysis of how multiple, identified vulnerabilities in the company's barriers could allow for a crash.

### Action 3: Identify and Dispel Myths

What drivers, safety managers, and top leadership believe about safety is tied to behavior. If something is not seen as a threat or a risk, it will not be treated as such. Risks may in some cases be treated, illogical as it may seem, as safety measures.

For instance, a driver believes that wearing a safety belt might lead to his death (which is an actual myth held by some drivers) (Bergoffen). A typical story or legend describing the danger of seatbelts might include the following elements: a driver rolls his/her truck; a fire then begins; the driver is trapped by the safety belt; and finally, the driver is killed because of the safety belt. The moral of this story: the mythical driver would have been saved had the safety belt not kept him/her in the cab. Such myths should be gathered from drivers and should be dispelled.

Likewise, downplaying the severity of CMV crashes through language myths is just as dangerous. Crashes and fatalities must be termed exactly as they are. Those who are to blame must be held accountable using language that does not indirectly pass the blame to other factors, such as through the use of the terms *accident* or *mishap*.

## Action 4: Institutional Safety Knowledge Development

A motor carrier's knowledge of safety is a critical part of its safety culture and is embedded both in internal training practices and through the experience of the organization.

- Training: Training programs should not only be used to build the initial and continual safety knowledge base of drivers, they should "learn" and "develop." Thus, it is recommended that those in charge of safety training continually monitor the safety environment and the training programs that identify ways to enhance the program.
- Experience: Taking advantage of an organization's experiences can be a critical part of developing a safety culture. A good place to garner such information is from drivers themselves. Documenting crashes and near-crashes is key, as well as building a level of trust with experienced drivers whereby penalties are not given for truthful (and helpful) reporting of driver error.
- Mentoring: More experienced drivers could be given the opportunity to advance their careers by (1) proving themselves as safe drivers and (2) mentoring new drivers to be safe drivers. This process also has the potential to increase the retention of experienced drivers.

## Action 5: Define or Redefine Employee Safety Roles from Top to Bottom

As the definition suggests, this action involves assessment and possible change in the roles of all motor carrier employees regarding their safety role and its influence on the organization's safety culture. This task should focus on the environment that is created by top leadership and management regarding driver safety and may benefit from driver involvement in the development of a company's safety culture.

## Action 6: Assess Effectiveness of and Reengineer Approaches and Systems of Safety Communication

The flow of information is key to communicating a safety culture, especially in the motorcoach industries where top leadership and management are physically removed from their remote drivers. It is important that top leadership be able to communicate directly with drivers or through driver management to drivers. Likewise, drivers must be able to give information to top leadership and management as efficiently and effectively as possible.

## Action 7: Create or Enhance a System of Safety Record Data Collection and Analysis

It can be said that no safety data should be overlooked. While this may be quite ambitious, it is true that data can often be very telling with regard to a motor carrier's current state of safety culture. It is suggested that carriers determine (1) what data exist, (2) how data are to be analyzed, and (3) how to use analysis results to positively change safety performance.

**System of Penalty-Free Driver Reporting.** It is important to learn from past crashes or near-crashes. As shown in the medical literature, a system where mistakes are learned from by open and honest reporting that does not carry a penalty is one method to collect such data.

## Action 8: Develop or Redevelop Motivational Tools, Training, and Orientation Methods

Though it is expected that all drivers behave safely, motivational tools are an effective means to increase safe behavior. Programs to reward drivers for safety should be simple and fair. Such tools may also involve tying driver career advancement with safety. Secondly, training and orientation are an important stage in bringing new drivers into the culture. Safety departments should play a key, if not central, role in training and orientation of new drivers.

## Action 9: Driver Retention

Driver retention is a goal of nearly every motor carrier, especially in the current labor shortage environment. While it is easy to ask a motor carrier to work to retain drivers for longer periods of time, the fact remains that the trucking industry specifically has low barriers to entry that results in strong competition among carriers, as well as low profit margins.

Driver retention may play a key role in developing a safety culture only in that those who are part of the safety culture are retained. As was demonstrated through the case study

**Table 17. Crash likelihood.**

| If a driver had: | the crash likelihood increases: |
|---|---|
| a reckless driving violation | 325% |
| an improper turn violation | 105% |
| an improper or erratic lane change conviction | 100% |
| a failure to yield right of way conviction | 97% |
| an improper turn conviction | 94% |
| a failure to keep in proper lane conviction | 91% |
| a past crash | 87% |
| an improper lane change violation | 78% |
| a failure to yield right of way violation | 70% |
| a driving too fast for conditions conviction | 62% |
| a false or no log book violation | 56% |

research, many safety departments have better results training new drivers and introducing them to their safety culture. Likewise, if a driver is not part of this culture, it is not a loss to the organization when that driver is not retained.

## Safety Record Analysis: Relating Safety Performance to Safety Culture

Several research reports have shown that carriers that are safe (i.e., those carriers that have an excellent safety record) have comprehensive safety programs and, therefore, strong safety cultures.

ATAF (1999), through its publication *SafeReturns: A Compendium of Injury Reduction and Safety Management Practices of Award Winning Carriers,* finds a series of tools for successful safety programs that lower the number of crashes, the overall cost of crashes, and overall risk. Such management tools include the following:

- Integration of safety management departments into the motor carrier corporate structure
- Hiring, training, and retention programs
- Bonuses and awards
- Continuing safety education, meetings, and communications
- Crash data collection and analysis

Similarly, the ATAF (1999b) publication *Truck Driver Risk Assessment Guide and Effective Countermeasures: Recommended Management Practices*, documents best practices through an outline of appropriate recruiting and selection practices and effective methods of measuring the safety performance of drivers.

Finally, Corsi and Barnard (2003) further explore motor carrier safety practices through their work in *Best Highway Safety Practices: A Survey about Safety Management Practices among the Safest Motor Carriers.* This work investigated driver hiring practices, including safety risk assessment and the driver characteristics taken into account when reviewing candidates. The report also outlines best practices regarding safety training, encouragement and enforcement of driving behaviors that are safe, driver management/monitoring, and vehicle maintenance management.

All such programs listed in these three best practices reports include qualities that are part of and enhance a motor carrier's safety culture. Such safety programs have an especially strong focus on eliminating crashes before the crash happens, particularly through preemptive measures that target driver history and its potential to lead to future crashes.

From the Murray et al. research, Table 17 outlines the crash likelihood of drivers that had specific violations.

Taking the next logical step, safety culture, as has been shown through the literature and data collection, requires a multilevel, comprehensive series of safety programs and procedures as its safety management base. Such programs, in turn, seek to mitigate bad behavior by isolating such behavior and its relationship to future crashes through evidence such as that shown in Table 17. This in turn leads to greater levels of safety and, therefore, safety culture itself can clearly be linked with safety performance results (see Figure 6).

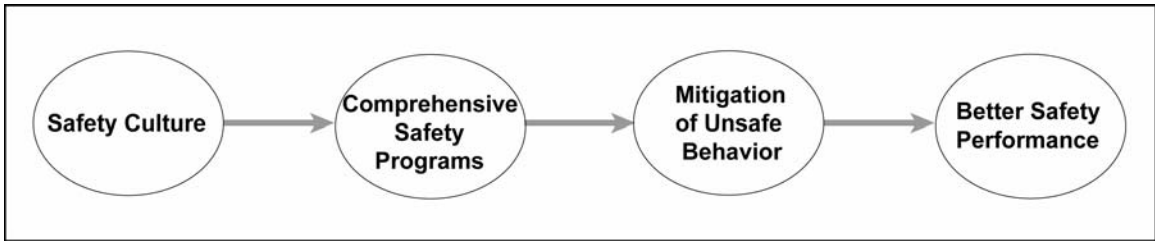



***Figure 6. Safety culture/safety performance relationship.***

CHAPTER 5

# Motor Carrier Best Practices Guidelines: A Plan to Develop and Use Safety Culture to Reduce CMV Crashes

This chapter takes key findings from the literature review, data collection, and discussion of the safety culture relationship to develop practical questions and actions for motor carrier safety managers to use when developing their organization's safety culture. Because developing a safety culture is part policy course and part program implementation, it is suggested that the four stages listed in the safety culture development and use guideline be thought of as a circular process, whereby Stage 4 leads to a new cycle of Stage 1.

## Stage 1: Assess Safety Culture

For a motor carrier that is seeking to create or enhance safety culture, an initial step is to assess the current safety culture through eight questions.

1. ***What is the current state of our corporate culture?*** Reviewing Uttal's definition of an organization's culture, carriers can first ask themselves, "how are things done around here?" How "things are done" in an organization is likely never perfect, and an initial inventory/overview of a company's state of safety culture will offer a baseline from which to work.
   **Result:** An outline of how the organization operates, with a focus on safety.
2. ***What makes up our safety culture?*** This step will create a high-level inventory of a carrier's safety culture as discussed in Action 1 and will include a determination of the pervading company safety-related attitudes, values, norms, and beliefs. More detailed parts of what makes up a safety culture are found in the remaining six questions.
   **Result:** An outline of the organization's safety culture.
3. ***What is the overall level of employee commitment to safety?*** For instance, do drivers, safety managers, or even top leadership use their safety belts when driving their personal vehicles on the weekend? A safety culture is not something that is left in the CMV driver's seat or at the distribution center; it is something that influences all parts of life in and outside the corporate setting. What currently motivates safe behavior among drivers? Is a strong safety culture in place that is responsible for such motivations?
   **Result:** An assessment of the role of specific employee groups (including drivers and operations, sales, and safety departments) in the safety culture.
4. ***Are the safety training, orientation, and recognition and rewards programs effective?*** Initial safety training and orientation programs act as a new employee's introduction to the carrier's culture. Additionally, safety rewards and recognition programs and ongoing formal safety training are effective methods to continue participation in the safety culture. To address this question, a safety manager will first assess the effects of training, orientation, and recognition and rewards programs. Pre- and post-program safety outcome data can be useful for this function.
   **Result:** Outline of driver training, orientation, rewards and recognition program.
5. ***What data are collected?*** Data drive the motor carrier objectives and allow safety managers to understand the current safety performance of their drivers and company as a whole. Data are necessary to determine what safety data are collected, what safety data could be collected, how all the data can/should be analyzed, and what the analyzed data mean as far as improving the carrier's safety culture.
   **Result:** Inventory of collected, used, and potentially useful safety data.
6. ***Is Driver Empowerment Sufficient?*** Drivers should have a central role in the safety culture. The level of empowerment that drivers have can play a role in their safety-related behaviors.
   **Result:** Outline of current driver empowerment.
7. ***What are the barriers and vulnerabilities?*** Safety departments can use Figure 1 to determine existing internal barriers to improved safety and the vulnerabilities within those barriers.
   **Result:** Model of existing safety barriers.
8. ***Are safety communications methods adequate?*** This question asks safety departments to outline their current safety communications. Essentially, this will determine what is in place and what is lacking.
   **Result:** Outline of safety communications systems.

## Stage 2: Identify Safety Culture Improvement Areas

Stage 2 is intended to act as the platform for bringing together all of the deficiencies found in Stage 1. All eight steps in Stage 2 are intended to be brainstorming exercises for safety departments and others resulting in a list of potential improvement areas.

1. Develop a list of how things "could be" or "should be" compared with how they are currently.
2. Develop a list of where high-level deficiencies exist within the safety culture, and where overall improvements will be beneficial.
3. Develop a list of safety-related deficiencies/improvement areas for each specified group within the organization.
4. Develop a list of improvement areas for training, orientation, and recognition and rewards programs.
5. Develop a list of data and data analysis needs.
6. Develop a list of driver empowerment needs.
7. List new barriers and how existing safety barriers can be improved.
8. Identify where safety communications systems are ineffective or needed.

## Stage 3: Develop Solutions to Improve Safety Culture

Stage 3 allows for a review of the compiled safety culture deficiencies for the purposes of developing individually tailored solutions for each deficiency, as well as comprehensive solutions that address multiple safety culture deficiencies.

1. Corporate culture may not need to change to improve safety culture. If "things are done quickly and carelessly" throughout an organization, however, there will be an impact on safety. While this guide does not offer methods for changing corporate culture, leadership is clearly key to changing corporate culture. If the "way things are done" is to change, the driving force for that change must come from top leaders as well as those who manage departments and fleets. Once the desired improvement(s) are determined, they must be implemented through these members of the organization.
2. The safety culture improvement tasks will likely be high-level, long-term goals, and will be derived, in part, through the last six solution exercises listed in Stage 3.
3. A plan to improve the safety commitment for specific groups within the organization will be developed. Methods to increase the departmental and driver commitment to safety will likely be delivered by the safety department and top leaders within all departments; strong leadership and buy-in across the company is key to the effectiveness of those messages.
4. The safety department should play a central role in determining appropriate methods for improving employee training, orientation, and safety recognition and rewards programs. Because of the financial aspects of a rewards system, other departments would likely participate in solution development. Solutions might include the following:
   - Safety department will run training and orientation.
   - Messages will be more safety oriented.
   - Decreased emphasis on "cash" rewards.
   - Increased emphasis on recognition.
5. Data collection and analysis solutions should be finalized before implementation.
6. Driver empowerment will stem from actions taken by the safety department in conjunction with other departments, such as sales and operations. Changes in training and orientation will likely have to take place if the empowerment of drivers is going to be increased.
7. Safety departments take the lead on developing new safety barriers and closing the gaps in existing safety barriers.
8. Communications-based solutions are exemplified in the following examples:
   - Corporate identity through logos, vehicles and trailer styles, slogans, and uniforms.
   - Technology-based solutions to convey a message or allow greater communications among drivers and between drivers and departments.

## Stage 4: Implement Safety Culture Improvement Plan and Reassess

Finally, the solutions should be implemented. Safety culture enhancing programs (or existing program enhancements) should be transparent, be open to suggestions, and include as much of the organization's staff as possible. After implementation, evaluation of effectiveness will occur as the safety culture is once again reassessed and the cycle begins once again (see Figure 7).

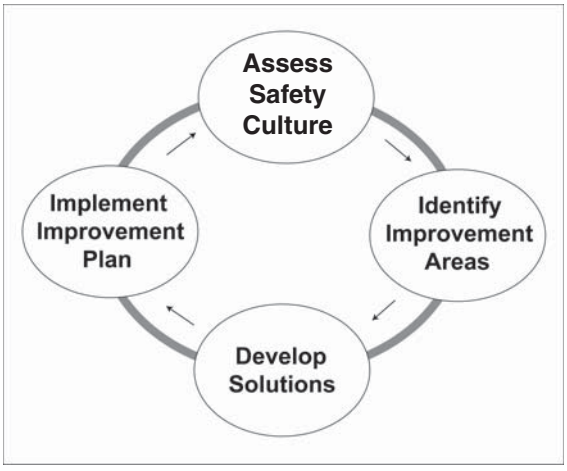



***Figure 7. Safety culture improvement cycle.***

CHAPTER 6

# Summary of Major R&D Needs and Conclusion

## Future Research

Based on the findings of this report, the following represents a list of gaps in the research that should be addressed in future efforts.

### Relationship of Labor Stability to Safety Performance and Safety Culture

The driver shortage and driver workforce stability issues should be addressed in future research. Drivers clearly are the key to operations and therefore to safety and crash prevention in both trucking and motorcoach operations. There is clear evidence, however, that experience (in years driving) and time spent working within a company's culture are key to safety and an organization's ability to develop a safety culture. Drivers who leave the profession or jump from company to company often undermine a company's safety culture. Research should identify the correlation of safety culture and performance with driver retention and labor stability.

### Relationship of Driver Peer Influence to Safety Performance and Safety Culture

It is an immutable fact that drivers are a remote workforce and that drivers have the ability to be in close contact with other drivers at stopping points and over CB radios and cell phones. Driver-to-driver communications can occur between drivers of the same company or of different companies. In such settings, attitudes, beliefs, values, and norms related to safety may be shared, leading to either positive or negative influences on the safety culture of individual organizations. Drivers may undermine driver retention efforts through peer influence, which may have a negative impact on safety culture for some organizations. Therefore, research should be conducted to determine the level of influence driver peers have on one another and how that influence relates to safety culture and safety performance.

### The Small Carrier/Safety Culture Conundrum

The majority of the 600,000+ trucking companies in the United States are very small operations that do not have the ability to maintain a safety department. While it may be true that a positive safety culture can lead to safety performance results, what are the implications of this, if any, for small carriers? Can a safety culture be developed among employees of a small carrier, particularly those carriers not large enough to have a safety department or safety professionals on staff?

## Conclusion

A strong safety culture, when properly defined by a motor carrier, is not something that is unachievable. This research hopes to offer guidelines to motor carriers, and potentially to similar industries, as to best practices regarding the assessment, development, and reassessment of safety culture. The guidelines should offer motor carriers and others a method by which to see safety culture as an evolutionary process that is adaptable to changes and offers safety managers the opportunity to commit entire organizations to a single, common goal: safety.

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APPENDIX A

# Project Statement of Work

## CTBSSP MC-14 The Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes

This work plan describes the research synthesis plan for Transportation Research Board (TRB) Commercial Truck & Bus Safety Synthesis Program (CTBSSP) project MC-14 entitled Synthesis Report on the Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes. This safety synthesis project attempts to assist the commercial vehicle safety management community, specifically safety program managers, in understanding the role that company safety practices and philosophies can play in nurturing safety in the workplace.

Major safety synthesis data sources will include research literature on industrial and transportation safety management, direct surveying of CMV carrier safety managers, drivers and other experts, and interviews with individuals who have experience and expertise in CMV safety management.

Per the requirements of the Synthesis program, this work plan provides the following:

- Proposed details of the literature review.
- Organizations (including government and industry) and individuals to be interviewed.
- A description of proposed survey processes, and the general content of survey questionnaires.
- An outline of the planned synthesis report, including chapter and subchapter titles and major content.
- Schedule for project completion.

### Background and Problem Statement

The American Transportation Research Institute (ATRI) recently released the results of a CMV "crash predictor model" study which provides statistical documentation for future crash probability based on different CDL driver risk behaviors. While research such as this continues to back the premise that en route risk behaviors are ultimately initiated by drivers, there is statistical support (Knipling; Lantz) that some carriers have essentially become havens for unsafe drivers. Alternatively, there is both empirical and anecdotal support that "safe" carriers—as defined by numerous metrics including SafeStat scores, safety awards, and industry safety statistics—produce and attract safe drivers.

While the major components that compose the overall "safety culture" of a carrier have not been dissected and studied in a holistic manner, specific safety factors and correlations that contribute to safety culture have been analyzed. These include compensation schema (ATA); non-financial reward programs (Transanalytics, ATRI); and ISO 9000 certification's nexus to safety (University of Minnesota, ATRI). It is also clear that other industry sectors that contain safety-sensitive positions such as aviation, mining and heavy equipment manufacturing have researched the tangible and intangible mechanisms that contribute to a positive safety environment.

The Safety Culture study team intends to identify and analyze significant safety and non-safety programs and initiatives across relevant sectors that create/support or could create/support a positive safety culture within the trucking and motorcoach industries. These programs and initiatives will be synthesized and analyzed, resulting in a documented best practices outline of the factors and attributes that likely offer the greatest influence on developing and enhancing a culture of safety. The team also intends to identify non-programmatic factors that help cultivate or improve an overall culture of safety, such as leadership roles (within management and among CMV drivers). Finally, and in conjunction with CTBSSP MC-13 data collection, the study team hopes to add to the overall CMV Safety Culture literature by identifying and demonstrating qualitative and quantitative relationships between positive safety cultures and safety outcomes as defined by the research, literature review, and industry members.

### Objectives and Scope

The objective of this study is to provide information that will assist the commercial vehicle safety management community (especially safety program managers) in understanding how and what company safety practices and philosophies favor and nurture safety in the workplace. Specifically, this study will investigate the following aspects of motor carriers and bus operators, which define the concept known as safety culture:

- Attitudes, values, norms, and beliefs with respect to risk and safety within bus and truck organizations; and
- Visible practices and procedures and the requisite behaviors they target which characterize a "safe" commercial operator.

The safety culture synthesis study undertook three major research tasks to reach this objective:

1. The documentation and analysis of major factors, programs, and attitudes that create a positive safety culture within trucking and motorcoach operations;
2. Calculation of the relationships between positive safety cultures and operational safety as defined by accepted safety metrics; and
3. The development of a high-level Best Practices plan for incorporating the significant programs and attributes into the safety programs of trucking and motorcoach operations.

This last objective will provide the practical transfer of research synthesis findings to industry safety stakeholders.

APPENDIX B

# Carrier Safety Manager Survey

**NOTE:** The survey for *CTBSSP Synthesis 14* was coordinated with the survey process for *CTBSSP Synthesis 12: Commercial Motor Vehicle Carrier Safety Management Certification* to minimize the impact of surveys on potential respondents and to increase the response rate. The entire survey is presented here.


### CMV Safety Culture and Certification Program Survey

The American Transportation Research Institute (ATRI) is working to gain a better understanding of the concept of safety culture and views on certification programs within CMV companies. The first of these topics will focus on overall company attitudes and practices regarding safety, while the second will inquire about experiences with safety certification programs. Your feedback will be very helpful in this study, and all information will remain confidential. If you would like a copy of the final research report and best practices, please be sure to include your contact information.

Please print/fax completed surveys to Jeff Short at (**770-432-0638**) or send electronic versions of this survey to jshort@trucking.org. Thank you for your time and assistance!

Company Name: _____

Contact Name:_____

Your Title and Department: _____

Phone Number: _____Email:_____

**Your Company Demographics**

1. How many power units does your company operate: _____
2. How many employees (excluding drivers) does your company employ:_____
3. How many drivers (employees and owner/operators) does your company employ:_____
4. Which categories best describe your company? *(Check all that apply)*

| | | | |
|---|---|---|---|
| ☐ Trucking Company | | ☐ Motor Coach | |
| ☐ Private | ☐ Truckload | ☐ Charter/Tour | ☐ Scheduled Passenger |
| ☐ LTL | ☐ Specialized | ☐ Student Transportation | |
| ☐ HazMat | | ☐ Other, please specify: | |
| ☐ Other, please specify: _____ | | _____ | |

5. Indicate what percentage of your principal operations occur in each area: (*Should equal 100%*)

| Trucking Company | Motor Coach |
|---|---|
| ____% Short haul/Local | ____ % Local |
| ____% Long haul (500 or more miles) | ____ % Regional |
| ---------- | ____ % National |
| 100% Total | ---------- |
| | 100% Total |

6. Briefly describe your safety management responsibilities: _____

**Safety Department / Organization Overview**

7. Does your company have a safety management department/safety function (i.e. a department that has safety responsibilities)? ☐ Yes ☐ No

   7a. If yes, what level of importance does this department/function hold within the organization's priorities? (*Mark only one)*
   - ☐ Safety is the top/central priority.
   - ☐ Safety is an equal priority with other operational objectives.
   - ☐ Safety is important, but other priorities are more important.

   7b. If safety is not the top/central priority, please elaborate:

_____

8. What is the reporting relationship of the Safety Department/Function to the CEO/President and/or upper management team? (*Mark all that apply*)
   - ☐ Safety Department Leader reports directly to the CEO/President
   - ☐ Safety Department has leader(s) who is/are on-par members of the executive team.
   - ☐ Safety Department leader reports to another Staff Leader (i.e. Operations or HR). *Name Other Department:* _____
   - ☐ Other (Indicate Safety Dept Reporting relationship): _____

9. Indicate the areas below where operational decisions are integrated with your organization's safety activities: (*Mark all that apply)*
   - ☐ Driver Screening
   - ☐ Driver Selection
   - ☐ Driver Discipline
   - ☐ Firing
   - ☐ Compensation
   - ☐ Company Safety Policies
   - ☐ Safety-Related Benefits/Incentives

10. Please rank order the following seven motivations for improving company safety 1 through 7, with **1 being the most important**, and **7 being the least important**. (*Please use each number only once.)*
    - _____ Reduce crashes
    - _____ Avoid enforcement issues (fines/driver violations)
    - _____ Avoid costly lawsuits
    - _____ Attract customers

_____ Attract drivers

_____ Decrease insurance costs

_____ Set a high industry safety standard

_____ Other, please specify: _____

## CMV Drivers: Hiring, Training and Retention

11. What safety-related driver history information do you collect before hiring a driver? (*Mark all that apply*)
☐ Traffic Violations ☐ Traffic Convictions ☐ Crash History
☐ Drug & Alcohol Testing History ☐ General Background Check ☐ Felony Convictions
☐ Other, please specify:_____

12. In order of importance, list your company's top three safety performance predictors:
1_____
2_____
3_____

13. List the top 3 safety-related driver history indicators that will lead you **not** to hire a driver.
1_____
2_____
3_____

14. Do you hire entry-level drivers? ☐ Yes ☐ No
14a. If **yes**, do you have an entry-level driver training program? ☐ Yes ☐ No
14a. If you do, what is the duration:_____ weeks

15. Do you have ongoing safety training for drivers? ☐ Yes ☐ No
15a. If **yes**, how frequently: _____
15b. If **yes**, please mark all safety subjects that are included in safety training
☐ Defensive Driving ☐ Fatigue and Wellness ☐ Backing
☐ Security ☐ Coupling/Uncoupling ☐ Accident Procedures
☐ Extreme Weather Driving ☐ Compliance Training
☐ Other, please specify:
_____

16. Do you have remedial safety training? ☐ Yes ☐ No
16a. If **yes**, when is it applied/used?_____

17. For the average driver, how many times per year are the following conducted?
a. On-site safety training _____/year
b. Call-in/dispatch safety training _____/year
c. Online training _____/year
d. Behind the wheel _____/year
e. Other, please specify _____ _____/year

18. What role does safety/safety culture play in your recruiting efforts?_____

19. How does your company's safety culture relate to driver turnover? (*Mark only one)*
☐ Improves Retention ☐ No Impact ☐ Harms Retention
19a. Please describe:_____

**BONUSES AND INCENTIVES**

20. Do you have a bonus or incentives program that rewards safe drivers? ☐ Yes ☐ No
20a. If **yes**, please list program details by action and reward:

| ACTION/BEHAVIOR | REWARD |
|---|---|
| | |
| | |
| | |
| | |
| | |

**EXTERNAL ENVIRONMENT**

21. In terms of the general CMV driver population (not just your company's drivers) do you agree that drivers operate in a culture of safety? (*Mark only one)*
☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree ☐ Uncertain

22. How does the overall culture among drivers within the industry impact your organization's safety efforts? (*Mark only one)*
☐ Undermines ☐ No Effect ☐ Supports

23. How much influence do other drivers outside of your company have on your drivers regarding attitudes towards safety? (*Mark only one)*
☐ Strong influence ☐ Some influence ☐ No influence

24. Indicate how much you agree or disagree with each of the following statements:

| | Strongly Agree | Agree | Disagree | Strongly Disagree | Uncertain |
|---|---|---|---|---|---|
| Our customers value safety. | ☐ | ☐ | ☐ | ☐ | ☐ |
| Our insurers help make us a safer company. | ☐ | ☐ | ☐ | ☐ | ☐ |
| Enforcement sees our company as one that is safe. | ☐ | ☐ | ☐ | ☐ | ☐ |
| Drivers from other companies see our company as one that is safe. | ☐ | ☐ | ☐ | ☐ | ☐ |
| The general public sees our | ☐ | ☐ | ☐ | ☐ | ☐ |

| | | | | | |
|---|---|---|---|---|---|
| **company** as one that is safe. | | | | | |
| The general public sees our **industry** as one that is safe. | ☐ | ☐ | ☐ | ☐ | ☐ |

**Maintenance/Equipment Specifications**

25. Do you have an internal maintenance department? ☐ Yes ☐ No
    25a. If **yes**, what is the relationship between the safety department and the maintenance department?
    _____

**ACCIDENTS AND DRIVER CONVICTIONS**

26. Please briefly describe the process for collecting information regarding violations/convictions that drivers have while employed by your company? _____
    _____
27. Please briefly describe the process for collecting accident information related to your vehicles and drivers?
    _____

28. Please rank the objectives of your accident investigations from1 through 5, with **1 being the most important** and **5 being the least important**. (*Please use each number only once.)*
    ___ To determine who was at fault.
    ___ To determine appropriate response/actions towards driver.
    ___ To determine methods of accident prevention.
    ___ To protect the company from liability.
    ___ To improve overall fleet safety.

**TECHNOLOGY INVESTMENTS**

29. What type of safety technologies has your company invested in within the past 5-10 years?
    1) _____
    2)_____
    3)_____
    4)_____
    5)_____

30. What are the objectives/goals of safety technology investments: (e.g. accident reduction; improved driver performance; accident cost reduction)

| ***Technology Type*** | ***Major Objective(s) for Use*** |
|---|---|
| | |
| | |
| | |
| | |
| | |

## FAMILIARITY/EXPERIENCE WITH EVALUATION/CERTIFICATION PROGRAMS

31. Please indicate which safety evaluation/certification programs you are familiar with and have participated in:

| Familiar with: | | Participated in: |
|---|---|---|
| ☐ | ISO 9000/9001 | ☐ |
| ☐ | NPTC's On-Line Best Practices Fleet Audit | ☐ |
| ☐ | Surface Deployment and Distribution Command (SDDC) | ☐ |
| ☐ | American Chemical Society – Responsible Care | ☐ |
| ☐ | Partners in Compliance (Alberta) | ☐ |
| ☐ | The Canadian Standards Association and other Canadian Safety Management Systems (SMS) | ☐ |
| ☐ | Insurance-related management process or program | ☐ |
| ☐ | Health, Safety, & Environment third party or self assessment program | ☐ |
| ☐ | Other, please specify: _____ | ☐ |

32. If you have participated in a safety certification program, what was the motivating factor? (*Mark all that apply*)
    - ☐ Corporate management requirement
    - ☐ Shipper requirements
    - ☐ Recognition or marketing advantage
    - ☐ Offset to regulatory requirements
    - ☐ Safety discipline or culture
    - ☐ Industry trade practices
    - ☐ Insurance rate management
    - ☐ Other, please specify: _____

33. If you have participated in a safety certification program, what measurements, if any, do you use to evaluate the effectiveness of your participation or involvement in the program? (*Mark all that apply*)
    - ☐ Accident/Injury/Incident Experience
    - ☐ Insurance rates
    - ☐ Reduced administrative burdens related to regulatory compliance
    - ☐ Other, please specify: _____

## INTEREST IN CERTIFICATION PROGRAMS

34. If you have not previously participated in a formal/external safety certification program, do you have a current interest in considering implementation of a safety evaluation or certification program? ☐ Yes ☐ No Interest

    34a. If **yes,** what was the reason(s)? (*Mark all that apply)*
    - ☐ Insurance rates
    - ☐ Management commitment to safety
    - ☐ Improve or reduce accident/injury rates
    - ☐ Marketing and recognition
    - ☐ Offset to regulatory compliance
    - ☐ Shipper/customer requirements

35. Indicate how much each of the following incentives would expand or promote your interest in an evaluation or certification program - **1 being would not expand or promote interest at all**, **7 being would expand or promote interest a great deal**):

Insurance company incentives 1…….2……..3……..4…….5……..6…….7

| | |
|---|---|
| Regulatory compliance relief | 1……..2……..3……..4……..5……..6……..7 |
| Shipper/Customer requirements | 1……..2……..3……..4……..5……..6……..7 |
| Other, please specify: _____ | 1……..2……..3……..4……..5……..6……..7 |

36. If the FMCSA waived the following compliance requirements in return for your demonstrated and auditable commitment to a self-evaluation or certification program, would this promote your interest in implementing such a program? (*Choose* ☐ Yes *or* ☐ No)

| | Yes | No |
|---|---|---|
| Roadside inspections | ❑ | ❑ |
| Driver logs | ❑ | ❑ |
| Compliance reviews | ❑ | ❑ |
| Drug and alcohol testing | ❑ | ❑ |
| Other, *please specify*: | ❑ | ❑ |

37. Indicate how much each of the following factors would deter your participation in an evaluation or certification program -- **1 being would not deter participation at all, 7 being would deter participation a great deal**):

| | |
|---|---|
| Increased amount of paper work involved in application and documentation of practices | 1……..2……..3……..4……..5……..6……..7 |
| Potential audit requirements associated with initial or on-going certification | 1……..2……..3……..4……..5……..6……..7 |
| Other, please specify: _____ | 1……..2……..3……..4……..5……..6……..7 |

38. Please provide any additional comments or views on the potential for evaluation or certification programs to offset regulatory requirements at the Federal or State level.

_____

_____

_____

APPENDIX C

# Commercial Motor Vehicle Driver One-on-One Interviews

Owner-Operator? **Yes / No**

*If O-O:* Are you contracted with one company? **Yes / No**

Size of company: **#Trucks**_____ **#Drivers**_____

*Circle One:*

**Truckload LTL Specialized:** _____

*Circle One:*
**Private For-Hire**

How long have you been a professional CMV driver?_____

How long have you been with your company -or- contracted w/ Company? _____

How do you feel about safety? _____
_____

How does your company feel about safety?_____
_____

Does your company have a safety department? **Yes / No**
If **yes,** please describe: _____
_____

How does your company let you know about their safety policies?
_____
_____

How often do you communicate w/ your company's safety department, and in what way?
_____

Does your company train or educate you in safety techniques? **Yes / No**

Explain: _____
_____

Do you feel **disconnected** or **connected** with the safety department? *(Circle one)*

Why? _____

How often do you communicate with other drivers in your company? In what ways do you communicate with drivers? (*CB radio, at truck stops, etc.)* _____

_____

How often do you communicate with drivers from other companies? In what ways do you communicate with other drivers? _____

_____

Are other truck drivers generally safe? **Yes / No** _____

_____

Truck drivers in my company are safer than truck drivers in general: **Agree / Disagree**

Does your company reward safety behavior? If so, how? (*incentive programs, raises, promotions, public recognition, etc.)* _____

_____

Overall, how much responsibility for safety do you have? _____

_____

Overall, what are your likes and dislikes about being a professional CMV driver?_____

_____

**{** *Does the Driver Have a Uniform:* **Yes / No }**

*Abbreviations and acronyms used without definitions in TRB publications:*

| | |
|---|---|
| AAAE | American Association of Airport Executives |
| AASHO | American Association of State Highway Officials |
| AASHTO | American Association of State Highway and Transportation Officials |
| ACI–NA | Airports Council International–North America |
| ACRP | Airport Cooperative Research Program |
| ADA | Americans with Disabilities Act |
| APTA | American Public Transportation Association |
| ASCE | American Society of Civil Engineers |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| ATA | Air Transport Association |
| ATA | American Trucking Associations |
| CTAA | Community Transportation Association of America |
| CTBSSP | Commercial Truck and Bus Safety Synthesis Program |
| DHS | Department of Homeland Security |
| DOE | Department of Energy |
| EPA | Environmental Protection Agency |
| FAA | Federal Aviation Administration |
| FHWA | Federal Highway Administration |
| FMCSA | Federal Motor Carrier Safety Administration |
| FRA | Federal Railroad Administration |
| FTA | Federal Transit Administration |
| IEEE | Institute of Electrical and Electronics Engineers |
| ISTEA | Intermodal Surface Transportation Efficiency Act of 1991 |
| ITE | Institute of Transportation Engineers |
| NASA | National Aeronautics and Space Administration |
| NASAO | National Association of State Aviation Officials |
| NCFRP | National Cooperative Freight Research Program |
| NCHRP | National Cooperative Highway Research Program |
| NHTSA | National Highway Traffic Safety Administration |
| NTSB | National Transportation Safety Board |
| SAE | Society of Automotive Engineers |
| SAFETEA-LU | Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005) |
| TCRP | Transit Cooperative Research Program |
| TEA-21 | Transportation Equity Act for the 21st Century (1998) |
| TRB | Transportation Research Board |
| TSA | Transportation Security Administration |
| U.S.DOT | United States Department of Transportation |