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Perception of safety culture in the trucking industry

Ana Maria Arboleda Arango
Iowa State University

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Perception of safety culture in the trucking industry

by

Ana Maria Arboleda Arango

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE

Major: Industrial Relations

Program of Study Committee:
Paula Morrow, Major Professor
Peter Orazem
Mack Shelley

Iowa State University
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2002

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Graduate College
Iowa State University

This is to certify that the master's thesis of

Ana Maria Arboleda Arango

has met the thesis requirements of Iowa State University

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# Table of Contents

**ABSTRACT** .................................................................................................................. V

**INTRODUCTION** ........................................................................................................ 1

**PURPOSE** .................................................................................................................. 3

**LITERATURE REVIEW** .............................................................................................. 4
  **DRIVER FATIGUE TRAINING** .................................................................................. 4
  **DRIVER AUTONOMY REGARDING SAFETY** .......................................................... 5
  **DRIVER OPPORTUNITIES FOR SAFETY INPUT** .................................................... 8
  **TOP MANAGEMENT COMMITMENT TO SAFETY** ................................................. 10
  **PERCEPTION OF SAFETY CULTURE** ................................................................... 12

**HYPOTHESES** ........................................................................................................... 16
  **DRIVER FATIGUE TRAINING** .............................................................................. 16
    Hypothesis 1 ........................................................................................................ 16
    Hypothesis 2 ........................................................................................................ 16
  **DRIVER AUTONOMY REGARDING SAFETY** .......................................................... 17
    Hypothesis 3 ........................................................................................................ 17
    Hypothesis 4 ........................................................................................................ 18
  **DRIVER OPPORTUNITIES FOR SAFETY INPUT** .................................................... 19
    Hypothesis 5 ........................................................................................................ 19
    Hypothesis 6 ........................................................................................................ 19
  **TOP MANAGEMENT COMMITMENT TO SAFETY** ................................................. 20
    Hypothesis 7 ........................................................................................................ 20
    Hypothesis 8 ........................................................................................................ 21

**METHOD** .................................................................................................................. 22

**SAMPLE** .................................................................................................................. 22

**MEASURES** .............................................................................................................. 25
Abstract

Safety research stresses the importance of achieving similar perceptions regarding the importance of safety to realize a strong culture while at the same time, acknowledges that employees may vary in their safety perceptions. Despite the recognition of this problem, the effect that safety issues have upon various hierarchical levels is not differentiated.

Data for this study were drawn from 116 trucking firms, stratified by three safety performance levels. The data were collected from drivers (lowest hierarchical level), dispatchers (medium hierarchical level), and safety directors (highest hierarchical level), regarding their perceptions of their corporate safety cultures. Perceptions of safety culture were analyzed through a linear regression using dummy variables to differentiate the three hierarchical groups. The resulting model allowed for examination of the specific antecedents of safety culture for each hierarchical employee group and the extent to which the hierarchical groups were in agreement with each other.

Driver fatigue training, driver opportunity for safety input, and top management commitment to safety were perceived to be integral determinants of safety culture in all three groups. Trucking firms seeking to strengthen their employees' perceptions of safety culture might logically begin by improving these three safety issues. The fourth safety practice examined, driver autonomy, was not found to be instrumental in shaping safety culture for any of the three hierarchical levels. In addition, it should be recognized that various employee groups within the firm are influenced by some practices more than others (e.g., drivers' perceptions of safety culture are more influenced by top management commitment and driver fatigue training).
Introduction

The movement of freight by trucks in the United States has increased tremendously in recent years. The number of trucks on U.S. highways increased by 25% between 1995 and 1999; fortunately, accidents involving trucks have not increased proportionately (13%) during the same period (Bureau of Transportation Statistics, 2002 #11). Still, any increase in the accident rate involving trucks is troubling. The research addressed in this study seeks to provide insights into how accidents in the trucking industry might be reduced by better safety management practices.

Safety is not only a matter of engineers, insurance companies, and employees “at risk.” It is also a matter of corporate culture. Even though accidents are unavoidable and interventions to reduce accidents are expensive, some companies seek to reduce the probability of accidents by establishing a culture that emphasizes safety. These firms believe that accidents and even disasters depend on organizational activities and can thus be minimized in frequency and severity (Roberts & Bea, 2001). For example, attitudes and behaviors that determine employees’ compliance with safety rules may decrease the frequency of accidents (Griffin & Neal, 2000; Hofmann & Morgeson, 1999; Varonen & Mattila, 2000; Zohar, 1980). Key safety culture issues that have been identified to prevent and minimize accidents are training, empowerment, team communication, and effective rewarding systems (Roberts & Bea, 2001).

The present study uses the concept of organizational culture as a concept entailing the assumptions, thoughts, and expectations taken for granted by employees. Culture is defined
and held collectively (Mearns & Flin, 1999). Accordingly, organizational safety culture refers to how organizational members’ perceptions interact to form a shared view of safety.

Research on safety culture states that there is a set of beliefs, norms, and values that are held collectively by the members of the organization (Mearns & Flin, 1999). However, there are some beliefs within the culture that are not clear but ambiguous and/or inconsistently held by different members or groups (Clarke, 1999; Martin, 1992, 2002). Safety literature indicates that there is ambiguity in members’ perception of safety culture. Differences have been observed comparing safety-related perceptions among drivers, supervisors, and managers (i.e., comparing employees from different hierarchical levels) within the railway industry. On the other hand, it is argued that similar intergroup perceptions regarding safety are essential to the development of mutual trust and understanding between levels. This basic understanding forms the basis for a positive safety culture (Clarke, 1999).

The potential for differential perceptions related to safety by hierarchical level will be explored by comparing perceptions of the extensiveness of four safety-related managerial practices: provision of safety training, employee autonomy in matters related to safety, employee participation in setting safety policies, and management commitment to safety. These practices are commonly used by organizations where safety is highly valued.
Purpose

The purpose of this study is two-fold. First, to report whether factors identified in prior research as integral to the perception of a strong safety culture are supported using three employee groups in trucking firms: drivers, safety directors, and dispatchers. The factors to be examined are (1) driver safety training, (2) driver autonomy regarding safety, (3) opportunities for safety input, and (4) top management commitment to safety. The second purpose of the research is to evaluate the extent to which there is a consensus among the three employee groups regarding the contributions of the above factors in determining perceptions of safety culture. Stated differently, the research asks the question “are drivers’, safety directors’, and dispatchers’ perceptions of safety culture shaped by the same factors?”

This study begins by providing the research background that has explored and identified safety measures predictive of safety culture. Given this framework, eight hypotheses are stated; these summarize the assumptions regarding individuals’ perceptions of safety culture in the trucking industry. Next, the design of the research and methodology are discussed. This is followed by the presentation of the results considering the mentioned hypotheses. The remainder of the study is dedicated to the discussion of the findings and the development of conclusions, limitations, and suggestions for future research.
Literature Review

**Driver Fatigue Training**

In the trucking industry, a great deal of safety training is directed toward management of driver fatigue, as it is a key element predictive of close calls (Crum, Morrow, & Daecher, 2001) and crashes (Williams & Monaco, 2001).

Fatigue is impairment in the ability to undertake the driving task and is primarily related to lack of sleep, which in turn is influenced by the operational and social constructs within which the driver participates (Baas, Charlton, & Bastin, 2000).

Because it has been observed that behaviors some drivers adopt to cope with fatigue are not always ideal (e.g., consumption of alcohol, use of stimulants, poor rest), organizations have focused on training drivers on effective ways of managing fatigue (Oron Gilad & Shinar, 2000). Results demonstrate that training employees on the prevention of substance abuse (alcohol and drugs) has been effective in getting employees to seek help for this behavior (Bennett & Lehman, 2001). Organizations typically offer additional kinds of health and safety training because of the evidence demonstrating that safety training can help prevent injuries. In addition, such training has been found to be positively related with productivity (Kaminski, 2001).

According to the Federal Highway Administration, training is one of the most fundamental elements in an effective hours-of-service compliance program (Federal Highway Administration, 1997). Individuals who have received safety-related training understand organizational safety incentive systems, have greater knowledge regarding appropriate safety behavior, and adhere to proper safety protocol more frequently; hence,
safety knowledge significantly predicts actual compliance with safety policies (Griffin & Neal, 2000). This occurs because knowledge mediates the impact of safety climate on individuals’ safety behavior, participation, and compliance with safety.

Differences among subcultures in the organization may cause training to have a different effect on modifying safety attitudes. Employees react differently to training efforts depending on how involved their position in the organization demands them or allows them to be. When employees take a greater ownership of the training program then it is more likely that they will be supportive of it and be more positive about the changes. Contrary, if employees are not involved in the development of the program then they may not be interested in encouraging the implementation of learning (Griffin & Neal, 2000), which makes it more difficult to build a safety culture.

Despite the difficulties and the different expectations individuals have from training, truck drivers are interested in being trained and being involved in training apprentice drivers as a way of having their jobs enlarged (McElroy, Rodriguez, Griffin, Morrow, & Wilson, 1993). Giving drivers the opportunity of training new employees may help them overcome negative attitudes toward the company and the job (McElroy et al., 1993). Training is more effective if it is perceived as career advancement.

**Driver Autonomy Regarding Safety**

Job autonomy is the objective control that the individual has in a specific domain of task process and accomplishment. Job autonomy is different from participation in the sense that is an individual decision (not a joint decision as participation) (Evans & Fischer, 1992). Part of an employee’s autonomy is being able to use alternative work schedules; flextime and
compressed workweeks are increasingly being adopted by organizations to satisfy the benefits expected by their employees. However, alternative work schedules can have unintended negative effects when they interfere with supplier and customer schedules (Baltes, Briggs, Huff, Wright, & Neuman, 1999) or result in drivers driving at night or in the early morning. Thus, alternative work schedules become a hazard given that a higher rate of fatigue-related accidents occur during this period (Soccomanno, Shortreed, & Yu, 1996).

The deviation from a natural 24 hours rhythm of work that favors daytime work schedules over nighttime work schedules causes what is called circadian fatigue (Soccomanno et al., 1996). On the other hand, alternative work schedules can have positive effects on driver job autonomy by allowing drivers to use their own personal and possibly unique circadian rhythms.

Parker, Axtell, and Turner (2001) defined job autonomy as the degree of discretion employees have over important decisions in their work, and they found this job characteristic to be an outcome of organizational commitment. That is, the positive effects that job autonomy has on safety culture assessments occurs primarily through the mechanism of organizational commitment (Parker, Axtell, & Turner, 2001). Stated differently, job autonomy is mediated by the identification and emotional attachment that the employee has for the organization. Therefore, the perception that the employee has about the strength of a safety culture is expected to be influenced by the perceived level of autonomy since higher levels of autonomy may give rise to higher levels of organizational commitment.

In addition, the autonomy individuals have seems to diminish the amount of perceived work overload (i.e., it provides a way to cope with stress) (Karasek et al., 1981). Low status jobs that require low levels of education tend to constrain individual autonomy;
this, of course, could apply to truck drivers. Thus, autonomy can be viewed as a determinant of safety perception via its ability to reduce stress and make drivers feel safer. A failure to appreciate this aspect of job autonomy could lead those in higher hierarchical levels to underestimate its importance in shaping perceptions of corporate safety culture.

Hours of service regulations moderate the extent to which organizations can empower the driver to manage his or her own hours of work. In spite of the regulations, drivers (and, to some extent, organizations) violate hours of driving regulations; this is mediated by years of experience, age, and drivers' economic pressure (Williams & Monaco, 2001). Younger drivers and those with more years of experience tend to violate hours of service regulations, a tendency that declines as drivers get older (Williams & Monaco, 2001).

In the trucking industry specifically, the driver's pace is determined by shippers' demands for tight delivery schedules and how dispatchers assign work schedules (Braver, Preusser, & Ulmer, 1999). Therefore, job autonomy in the trucking industry is relative not only to safety policies stated by the organization or the law, but also to dispatchers' awareness of driver's safety. Dispatchers' decisions to accept or reject loads may contribute to hours-of-service violations and driver's fatigue. On the other hand, because driving conditions are strictly regulated, drivers' duties are usually clear, as well as the relationship with dispatchers and other employees. When job activities and relationships among employees, supervisors, and management are clear-cut (i.e., the rights and responsibilities of supervisors and employees are already clearly specified), employees can make job related decisions without requiring management approval. In other words, truck drivers work presents opportunities for genuine autonomy through route selection, schedules, rest breaks, etc.
A meta-analysis of studies concerning autonomy and participation at work indicated that these constructs exhibit similar patterns of interrelation with other outcomes like job satisfaction and organizational commitment (Spector, 1986). It appears that these two constructs represent the common underlying variable of perceived control. Perceived control is especially relevant in that it is an important contributor to health outcomes for employees when workloads are heavy (Karasek, Baker, Marxer, Ahlbom, & Theorell, 1981), as may be the case of truck driving work. Because the sum of studies shows that employees who perceive comparatively high levels of control at work experience fewer physical and emotional symptoms, it is expected that these employees have a more positive perception of safety culture.

Even though the concept of job autonomy and participation may overlap constituting what is known as employees’ perceived control, in this study, these variables have unique elements that determine their separate definition and statistical treatment (Evans & Fischer, 1992).

**Driver Opportunities for Safety Input**

Employees' participation, or the opportunity for safety input, is important because it facilitates decision making, which in turn facilitates subsequent task execution. Participation includes an interpersonal dynamic (a condition that is absent in job autonomy) (Evans & Fischer, 1992). Participation is a "loose-tight" phenomenon described as one in which leaders and floor employees influence each other (Sagie, 1997). Stated differently, task execution is enhanced when a leader's direction and employee's practice are complementary rather than being contradictory. The probability of this occurring is increased when trust
among members of the organization is high, which is considered to be the basis of a positive safety culture (Clarke, 1999).

Employee participation is generally regarded as a desirable thing, but the most effective combination of management control/employee participation varies across people and jobs. Expectations for participation may vary depending on hierarchical level. Lower-level employees react favorably to participation (Beehr & Gupta, 1987), perhaps because it is less anticipated. Additionally, the opportunity for input is important in the case of truck drivers given their concern for influencing management (McElroy et al., 1993). Truck drivers may believe that their daily driving experience could be useful for management in the creation and control of safety policies.

Lavy (1984) found it useful to differentiate between direct and indirect participation. The former is associated with feelings of representation in decision-making, with acceptance of company policy, with involvement of shop-floor employees, and with the belief that participation will assist in company problem solving. The latter type of participation is associated with perceptions of delay in decisions and with the belief that supervisors are not likely to take more responsibility than is necessary (Lavy, 1984).

Examples of direct participation relevant to this study would be the creation of safety committees at the group level and creating opportunities for employees to participate in safety activities. Participation practices have been shown to decrease the severity and frequency of occupational injuries; this is true for mandatory and voluntary safety groups (O'Toole, 1999).

Griffin and Neal (2000) included participation in their definition of safety performance. Examples of participation are attending to safety meetings and encouraging the
safety of others, caring about each other's safety, giving ideas to improve safety conditions, and routinely communicating with others about safety. Through these activities, employees are engaging in organizational citizenship behaviors and demonstrating safety commitment.

Hofmann and Fredrick (1999) emphasized the importance of communication in the development of a safety environment. The perceptions that individuals have about organizational support are positively related to safety communication; in turn, communication is positively related with safety commitment and negatively related to accidents (Hofmann & Morgeson, 1999). Employees' commitment to safety may be demonstrated through their attendance to safety meetings or the extent to which they give safety suggestions. Hence, as employees participate, better communication regarding safety ensues, and safe working increases (Parker et al., 2001).

**Top Management Commitment to Safety**

There is a great deal of literature that agrees on the importance of management concern with safety and employee well being (Griffin & Neal, 2000; Hofmann & Morgeson, 1999). The perceptions that individuals have about management support for safety is considered a higher order safety climate factor because these perceptions reflect how employees believe that safety is valued in the organization (Griffin & Neal, 2000).

Safe behavior can be increased when managerial personnel demonstrate their commitment toward employees by enacting strong safety programs. Along the same lines, Simard and Marchand (1997) indicated that worker safety compliance is higher when supervisors are involved with workers in the conduct of accident prevention activities and when employees influence management decisions regarding safety. Management safety
practices are recognized as an important predictor of employees' compliance with safety measures (Hayes, Perandan, Smecko, & Trask, 1998; Simard & Marchand, 1997). Compliance with safety rules, in turn, is related to lower levels of workplace injuries and accidents (Hofmann & Morgeson, 1999; Probst & Brubaker, 2001).

Safety performance is higher when employees have a sense of commitment to the firm generated by organizational practices and general trust and respect for their job, for safety practices, and for top management involvement in safety programs (Parker et al., 2001). The perception of support that employees have from their organizations has been shown to be critical for the implementation of behavior-based safety programs (DePasquale & Geller, 1999) and in the creation and success of safety committees (O'Toole, 1999). Management support and appreciation for activities related with safety has been a condition for these to be successful (Zohar, 1980). Research in the trucking industry has observed that drivers' perception about management determines their perception of safety conditions. Drivers claimed to be less safe when they believed their employers had less regard for their safety and were less concerned about the number of hours they drive (Walton, 1999).

Previous research has also found management commitment to safety to be positively related to work group cohesiveness (Simard & Marchand, 1997). High work group cohesiveness, in turn, enhances the likelihood that all employees will perceive work-related practices similarly, including the extent to which the organization has a strong or weak safety culture. Hence, top management commitment to safety not only may affect perceptions regarding the strength of a safety culture, but through its effects on group cohesion it may also explain how employees from diverse places in the organization come to view safety culture similarly.
Perception of Safety Culture

When talking about perceptions, it must be noted that individuals tend to disassociate themselves from negative outcomes and associate themselves with positive outcomes; this is an “ego defensive” behavior called self-serving bias (Bierhoff, 1989). For example, dispatchers may not think that they are assigning tight schedules (Braver et al., 1999), drivers may underestimate their violation of work hour rules (Braver, Preusser, Preusser, Baum, Beilock., & Ulmer, 1992), or drivers may believe that other road users drive faster than they do (Walton, 1999). The self-serving bias could be especially true in the case of an injury, accident, or close call because these may be interpreted as situations that occurred due to an external cause. There are studies that emphasize how reluctant people are to admit blame for vehicle crashes (Geller, 2001).

Taking into account that perceptions could be biased, the present study does not question how drivers, dispatchers, and top management perceive safety behaviors, or specifically driver’s safety behaviors. The present study is concerned with the activities, safety practices, and value that the organization places on safety; it is concerned about hierarchical, not individual, perceptions of safety.

A factor that might influence the perception of organizational safety culture is the type of job held by the employee and how potentially dangerous or injurious that job may be. The safety-risk perception that an employee has of his or her job depends on the objectives of the job, its characteristics, and the employee's personality. Changes in the work environment (e.g., a job change or promotion) have been shown to alter the perceived effects of work on health, independent of employee’s personality (Ettner & Grzywacz, 2001).
Individuals’ thoughts about safety and their safety behaviors constitute a part of the organizational culture. However, culture is not necessarily shared and unique (Marin, 2002), thus not all individuals ought to have the same perception of safety. Perceptions that individuals have of their organizational culture can be analyzed using three different perspectives: integration, differentiation, and fragmentation. Which one is used depends upon how members are thought to view their roles and relationships (Martin, 1992, 2002).

The integration perspective assumes that members' perceptions are consistent and that there is an organizational consensus. The differentiation perspective focuses on the conflict and lack of consensus among members. Finally, the fragmentation perspective argues that the organization is in a constant state of change, and that therefore, its culture is always in the process of being reconstructed. This third perspective focuses on the ambiguity and complexity that makes it difficult to find a cultural consensus within the organization (Martin, 1992). Perspectives organizational members have about the culture of their company may be related to their hierarchical position. Head office employees tend to have a more integrated perspective of culture. Middle level employees are inclined towards the differentiation perspective and lower level employees view culture in fragmented terms (Harris & Ogbonna, 1998).

Differences attached to the importance of various safety areas are a function of organizational position (Clarke, 1999). In other words, different safety priorities were evident and contingent on hierarchical level (Clarke, 1999). The different perspectives about culture could be reflected in the employees’ perceptions regarding health and safety. But if the employees do not share a common safety culture, efforts to enhance safety attitudes and behaviors in the company may be attenuated (Harvey et al., 2001).
Hierarchal label influence the perception of safety culture and the perception of safety climate as well (that is, the perception of specific issues that are immediately interpretable, while culture is held collectively and requires a history). Perceptions of climate are hierarchically structured because individuals evaluate their environment in terms of their personal values, the significance of the events, and how specific things in their workplace affect their well-being (Griffin & Neal, 2000). Due to these features, drivers’ perceptions about a safe environment may be different from managers’ and supervisors’ perceptions.

Despite the support that is observed in the literature for why perceptions regarding safety may be disparate among organizational members, prior research examining the safety factors that are incorporated in this research did not detect any difference in the importance attached to them by different organizational levels.

Clarke (1999) argues that similar intergroup perceptions regarding safety are essential to the development of mutual trust and understanding between levels, which forms the basis for a positive safety culture. Zohar (1980) agrees with the idea of having a unified cognition about safety aspects; however, he limits this homogeneous concept to production workers. Organizations that value safety may work to establish positive safety cultures by setting up policies and engaging in practices that promote a common safety vision. The present study would argue that this common safety vision ought to be developed throughout the organization (particularly those in the trucking industry) within its different hierarchical levels.

On one hand safety literature points out at the disagreement that organizational members have regarding safety perceptions. On the other hand, this literature agrees on the importance that issues such as training, job autonomy, employee participation, and
management commitment has for the expected safety of a company without making any
distinction among individuals.

Even though individuals exhibit some individual differences in their perceptions,
there are some issues for which their perceptions may be similar, regardless of their
knowledge, status, job, or experience. For example, a room with a temperature of 32 °C (90
°F) would be perceived as hot for most healthy individuals, others would think is warm
enough to feel comfortable. But, given the whole population that experiences the event,
there may be an agreement in saying that the room is very warm. For certain issues, it is
possible to find an agreement that describes the corporate culture regardless of individual
preferences.

Assuming that training, driver autonomy, driver opportunity for safety input, and top
management commitment are essential safety issues, the present study expects to find a
similar perception about safety across employees on different hierarchical levels of the
trucking industry. If this were the case, these may be factors that should be universally taken
into account by organizations in hope of developing a consistent safety culture. This would
be significant especially within the trucking industry.
Hypotheses

For each of the safety measures accounted for, two sets of hypotheses were proposed. The first sets of hypotheses (odd numbered) were formulated as simple relationships between the dependent and independent variable. Next, the second sets of hypotheses (even numbered) were based on a multiple regression that tested if safety measures were true predictors of safety culture.

Driver Fatigue Training

Hypothesis 1
The extent to which drivers are perceived to be trained about driver fatigue issues is positively related to perceptions of a strong safety culture.

Hypothesis 1a: The more drivers believe they have been trained about driver fatigue, the more highly company safety culture is rated.

Hypothesis 1b: The more dispatchers believe drivers have been trained about driver fatigue, the more highly company safety culture is rated.

Hypothesis 1c: The more safety directors believe drivers have been trained about driver fatigue, the more highly company safety culture is rated.

Hypothesis 2
The extent to which drivers are trained about driver fatigue issues will be a significant predictor of safety culture

Hypothesis 2a: The extent to which drivers are trained about driver fatigue issues will be a significant predictor of safety culture for drivers.
Hypothesis 2b: The extent to which drivers are trained about driver fatigue issues will be a significant predictor of safety culture for dispatchers.

Hypothesis 2c: The extent to which drivers are trained about driver fatigue issues will be a significant predictor of safety culture for safety directors.

Previous research indicates that safety knowledge, which may be gained through training, is positively related with employee's perception of job security (Probst & Brubaker, 2001). Additionally, it has been noted that job training programs are a manifestation of a management’s commitment to safety (Zohar, 1980), which implies that the perception of safety requires the involvement of several (if not all) members and hierarchical levels of the organization. It is asserted that driver fatigue training should play an importance role in formulating employees’ perceptions of a strong safety culture.

Driver Autonomy Regarding Safety

Hypothesis 3
The extent to which drivers are perceived to be afforded autonomy with respect to driver fatigue issues is positively related to perceptions of a strong safety culture.

Hypothesis 3a: The more drivers believe they are afforded autonomy with respect to driver fatigue, the more highly company safety culture is rated.

Hypothesis 3b: The more dispatchers believe drivers are afforded autonomy with respect to driver fatigue, the more highly company safety culture is rated.

Hypothesis 3c: The more safety directors believe drivers are afforded autonomy with respect to driver fatigue, the more highly company safety culture is rated.
Hypothesis 4
The extent to which drivers are afforded autonomy with respect to driver fatigue issues will be a significant predictor of safety culture.

Hypothesis 4a: The extent to which drivers are afforded autonomy with respect to driver fatigue issues will be a significant predictor of safety culture for drivers.

Hypothesis 4b: The extent to which drivers are afforded autonomy with respect to driver fatigue issues will be a significant predictor of safety culture dispatchers.

Hypothesis 4c: The extent to which drivers are afforded autonomy with respect to driver fatigue issues will be a significant predictor of safety culture safety directors.

Safety research has included job autonomy as a work practice that promotes organizational safety. Job autonomy goes beyond safety rules and hours-of-service limits; it also establishes a control from within through the exercise of driver judgment. Thus, job autonomy is positively related with safe working (Parker et al., 2001).

In the trucking industry perceptions of autonomy might be reflected in truck drivers’ authority to judge their level of fatigue. Such autonomy may enhance organizational commitment, which in turn encourages drivers to seek to avoid driving when fatigued and thereby reduce accident potential. To the extent that drivers feel and act in this manner, they are likely to describe their organizations as having a strong corporate safety culture.

The role of supervisors (in this case, safety directors and dispatchers) is important in enhancing employee safety perception. Organizations that allow supervisors to grant drivers the authority to self-manage fatigue are likely to be perceived as endorsing a strong safety
culture because supportive supervision is positively related with safe working (Parker et al., 2001).

**Driver Opportunities for Safety Input**

*Hypothesis 5*
The extent to which drivers are perceived to be able to provide safety-related input is positively related to perceptions of a strong safety culture.

Hypothesis 5a: The more drivers believe they can provide safety-related input, the more highly company safety culture is rated.

Hypothesis 5b: The more dispatchers believe drivers can provide safety-related input, the more highly company safety culture is rated.

Hypothesis 5c: The more safety directors believe drivers can provide safety-related input, the more highly company safety culture is rated.

*Hypothesis 6*
The extent to which drivers can provide safety-related input will be a significant predictor of safety culture.

Hypothesis 6a: The extent to which drivers can provide safety-related input will be a significant predictor of safety culture for drivers.

Hypothesis 6b: The extent to which drivers can provide safety-related input will be a significant predictor of safety culture for dispatchers.

Hypothesis 6c: The extent to which drivers can provide safety-related input will be a significant predictor of safety culture for safety directors.
Because the concern in the trucking industry is with respect to fatigue as a prime determinant of safety, the participant role assumed by drivers is very important. Participation can have a positive impact on decision quality when the individuals involved have relevant information to offer and when they are willing to contribute to organizational decisions (Jenkins & Lawler, 1981). In turn, this participation generates more favorable work-related attitudes and perceptions among employees (Beehr & Gupta, 1987). In the case of safety, drivers have relevant information since their experience in dealing with fatigue is important for the company development of safety culture. It would seem reasonable to assert that the greater the direct participation of drivers in safety-related matters, the stronger the control over fatigue. Such participation also would enhance favorable perceptions related to the organization’s safety culture.

**Top Management Commitment to Safety**

*Hypothesis 7*  
The extent to which top management is perceived to be committed to driving safety is positively related to a strong safety culture.

Hypothesis 7a: The more drivers believe top management is committed to driving safety, the more highly company safety culture is rated.

Hypothesis 7b: The more dispatchers believe top management is committed to driving safety, the more highly company safety culture is rated.

Hypothesis 7c: The more safety directors believe top management is committed to driving safety, the more highly company safety culture is rated.
**Hypothesis 8**
The extent to which top management is perceived to be committed to driving safety will be a significant predictor of safety culture.

Hypothesis 8a: The extent to which top management is perceived to be committed to driving safety will be a significant predictor of safety culture for drivers.

Hypothesis 8b: The extent to which top management is perceived to be committed to driving safety will be a significant predictor of safety culture dispatchers.

Hypothesis 8c: The extent to which top management is perceived to be committed to driving safety will be a significant predictor of safety culture safety directors.

The perception of support that employees have from their organization and the relationship with its leaders is critical to the success of safety programs (DePasquale & Geller, 1999; Haines, Merrheim, & Roy, 2001). When employees feel they are valuable for the organization, because they feel that their contributions are important, they tend to comply and believe in organizational efforts to improve their well-being.

Supervisory and leader communication with other members is positively related to safety commitment, and this communication with leaders is negatively related to occupational accidents (Hofmann & Morgeson, 1999). Therefore, leaders’ involvement in the organization's safety programs might determine a more positive perception of safety culture. This occurs because when employees perceive management to be committed to safety they tend to follow this behavior, comply, and apply safety measures. As compliance with safety increases, the accident rate decreases; thus, the perception of having a safety culture increases.
Method

Sample

Data for this study are drawn from a larger study of motor carrier scheduling practices in U.S. trucking concerns (Crum et al., 2001). The data reported here reflect information collected from drivers, dispatchers, and safety directors regarding their perceptions of their corporate safety culture and other thoughts about safety practices in general.

Firms that were available in the federal government’s Office of Motor Carriers Census file and had been rated for safety in the Motor Carrier Safety Status Measurement System, known as SafeStat, constituted the primary population. The sampling procedure used to acquire these data is described below. SafeStat holds data for 136,745 firms. In 1999 there were 77,216 firms exclusively engaged in trucking that carried only freight; these were the firms eligible for selection. Those that transported both freight and passengers were excluded. The population then was restricted further to firms with at least four drivers, leaving 21,292 carriers. Next, these companies were grouped into three safety performance rating categories (poor, average, and top safety performers). Sample carriers were selected randomly from within each category. Of the companies that were contacted (566), 66.1% agreed to participate (374). The percentages of firms that were willing to participate and returned the surveys approximated a normal distribution, with 32 top firms, 53 average firms, and 31 poor performing firms providing usable data. This sample of 116 firms constituted the unit of analysis of the present study.
The overall response rate was 31% (116 of 374 firms). Not quite half (44.8%) were "for-hire" companies, 21.6% described themselves as private carriers (companies hauling their own products), and 4.3% described themselves as both.

Data were collected through the safety director from each firm. This representative was contacted via telephone and solicited for his or her firm's voluntary participation in the study. Carriers that chose not to participate were replaced with firms selected at random from the appropriate safety performance group. Sampling continued until the data collection time deadline was reached; by this time, 116 firms had returned surveys with usable data.

At each company, the safety director was asked to distribute the surveys, one for him/herself, two for dispatchers, and three for drivers. The safety director was instructed to select "typical" dispatchers and drivers; that is, neither the best nor the worst. At least one driver did provide usable data, and when more than one driver and/or dispatcher supplied usable data a single driver and/or dispatcher was selected randomly to be representative of the firm. Respondents were instructed to put their completed survey into the provided envelope, seal it, and return it to the safety director, who would return the entire packet to the researchers.

Most driver respondents were male (95.6%), with an average age of 43 years (ranging from 22 to 63 years), and with an average of 14.92 years of driving experience. Most drivers (87.6%) classified themselves as company drivers, while just over ten percent (10.6%) were owner-operators or independent contractors. Only 1.8% were temporary, casual, or leased drivers. On average, drivers reported they had worked for 15 companies during the last two years, with a minimum of 1 (1%) and a maximum of 41 (1%). Relatively few drivers (5.3%) were unionized. Regarding driving behavior, the estimated number of miles per week was
1,890, with a range of 20 to 3,500. With respect to accidents, 80.4% of the drivers reported that they had not had a reportable crash in the previous two years and 96.6% reported that they had not had a chargeable crash (i.e., received a citation) during the same period.

Although most dispatchers were men (67.2%), a good percentage of women (20.7%) held this position. (Gender was not reported for the other 12.1%.) Dispatchers’ average age was 41 years (ranging from 21 to 65 years). Some dispatchers previously had worked as drivers, as reflected in an average of 7.39 years of driving experience, which ranged from zero years (39.8%) up to 30 years (2.0%). The mean number of years of experience as dispatcher were 8.56, ranging from 1 (10.9%) through 26 years (1.0%). Regarding the nature of their job, 53.9% of the dispatchers performed this job for the same drivers, 32.4% dispatched not only for the same group of drivers but also for others, and 7.8% of them dispatched for a customer or region. Dispatchers reported having worked for a minimum of one (80.9%), and a maximum of eight (1.1%) commercial motor vehicle companies for the last two years, with an average of 1.34.

Because there was not much interest in safety directors’ demographic characteristics this information was not collected; however, there were some alternative data provided. There were some companies in which the safety director was also the CEO or owner of the company, which was reported in 4.5% of the cases. For most companies—76.4% of them—the safety director indeed received this title and for 13.6% of the companies his or her title was fleet manager. Given their job status, 22.7% of the safety directors held this position as a full-time job, while 77.3% not only were responsible for safety but also had other duties. Finally, with respect to safety directors’ activities, 72.5% of them reported being responsible
for driving and non-driving operations and 27.5% reported being responsible for driving operations only.

**Measures**

*Predictors of Safety: Independent Variables*

Organizational members were given statements regarding issues that were mentioned by the literature as predictors of safety. They were asked to report the extent to which they believe these statements were true using a 1 to 7 scale. "To a very little extent" (1), "To some extent" (4), and "To a very large extent" (7) was the wording of the response option framework. All independent variables were measured with the use of this scale.

Driver safety training was measured by the extent that respondents thought drivers have been trained about driver fatigue issues. Driver autonomy was measured by the extent that respondents thought drivers were the best judges of whether or not they were too tired to drive. Driver participation was measured by the extent to which respondents thought that drivers in their company had opportunities to make suggestions and voice complaints regarding safety and fatigue. Finally, top management commitment was measured by the extent to which respondents thought that top management in their company was committed to driving safety (Appendix A). These single-item measures constitute the four independent variables within each organizational level, identified by the three types of respondents (driver, dispatcher, and safety director).
Perception of Safety: Dependent Variable

Perception of company safety culture was a variable common to each of the organizational levels that was taken into account in the study.

Driver, dispatcher, and safety director perception of safety culture was measured using a four-item scale consisting of opinions about the concern organizations have regarding safety and fatigue. Respondents reported their level of agreement using a (1) strongly disagree to a (7) strongly agree response-option questionnaire. The item responses were summed to yield a theoretical range of 4 to 28 (see Appendix A); observed values had the same range. Cronbach alpha values were calculated for each organizational level. The Cronbach alpha for drivers was .91, for dispatchers was .88, and for safety directors was .88. These values indicate that culture was measured reliably in all these groups.

Data Analysis

Correlations that described the relationship between the dependent variable and each of the independent variables were calculated and interpreted (Table 1). Next, a multiple linear regression model was used to analyze the effect that safety measures had on individuals’ perception of safety culture (Table 2). Several F-tests were performed in order to evaluate more precisely differences among hierarchical levels and the contribution of each variable to the overall model (Table 3).

Collinearity problems among the variables were examined due to the close relationship that has been observed through the literature between three of the independent variables (autonomy, participation, and top management commitment). Collinearity occurs when, in a multiple regression, the explanatory variables are correlated (Golberger, 1991).
Because of this condition, problems that could arise are inflated standard errors and an outcome whereby variables that really are significant appear to be insignificant. However, if the effect of a coefficient still were significant, in spite of its inflated standard error, this would occur because its true value is so large.

**Model**

The dependent variable examined here, perception of safety culture, was differentiated across the three organizational groups with the use of three dummy variables. The three dummy variables allowed modeling in one regression (Bowerman & O'Connell, 1990) the effect of the independent variables on the perception of safety culture of the three different groups (drivers, dispatchers, and safety directors). If the dummy variables were not used, three independent regressions would have been needed; comparisons between groups would not have been as simple as in the model that was chosen.

The resulting model allowed identification of the safety issues (independent variables) that predicted safety culture for each level of the organization. For \(i = 1, 2, 3, ..., 315\), (33 observations were excluded due to missing data) the following model was estimated,

\[
SP_i = \beta_0 + \beta_1 d_{2i} + \beta_2 d_{3i} + \\
\beta_3 d_{1i} T_i + \beta_4 d_{2i} T_i + \beta_5 d_{3i} T_i + \\
\beta_6 d_{1i} A_i + \beta_7 d_{2i} A_i + \beta_8 d_{3i} A_i + \\
\beta_9 d_{1i} P_i + \beta_{10} d_{2i} P_i + \beta_{11} d_{3i} P_i + \\
\beta_{12} d_{1i} M_i + \beta_{13} d_{2i} M_i + \beta_{14} d_{3i} M_i + \epsilon_i
\]
where $SP_i$ represents the safety perception of the $i$-th individual, $d_{1i}$ takes the value of one if the individual is a driver and zero otherwise, $d_{2i}$ takes the value of one if the individual is a dispatcher and zero otherwise, $d_{3i}$ takes the value of one if the individual is a safety director and zero otherwise, $T_i$ is the perception of individual $i$ regarding driver's fatigue training, $A_i$ is the perception of individual $i$ about divers' autonomy, $P_i$ is the perception of individual $i$ about drivers' opportunity for safety input, $M_i$ is the perception of individual $i$ about top management commitment to safety, and $\epsilon_i$ is the random error term. The individuals belong to three different categories: driver, dispatcher, and safety director.

Note that when the safety perception of a driver is estimated, then $d_{1i} = 1$, $d_{2i} = 0$, and $d_{3i} = 0$, so that the regression equation becomes

$$SP_i = \beta_0 + \beta_1 d_{1i} T_i + \beta_2 d_{1i} A_i + \beta_3 d_{1i} P_i + \beta_{12} d_{1i} M_i + \epsilon_i$$

Likewise, when the safety perception of a dispatcher is estimated, then $d_{1i} = 0$, $d_{2i} = 1$, and $d_{3i} = 0$; so that the regression equation becomes

$$SP_i = \beta_1 d_{2i} T_i + \beta_2 d_{2i} A_i + \beta_3 d_{2i} P_i + \beta_{13} d_{2i} M_i + \epsilon_i$$

Similarly, when the safety perception of a safety director is estimated, then $d_{1i} = 0$, $d_{2i} = 0$, and $d_{3i} = 1$; so that the regression equation becomes

$$SP_i = \beta_2 d_{3i} T_i + \beta_3 d_{3i} A_i + \beta_4 d_{3i} P_i + \beta_{14} d_{3i} M_i + \epsilon_i$$
Results

The model designed to explain the perception of safety culture in the trucking industry was found to be plausible. An F-test for the null hypothesis that all the coefficients jointly equal zero was not rejected, giving evidence of the goodness of fit of the model (F(223,77) = 1.50, p < 0.02). This also was supported by a high R-squared value of 0.66 (the adjusted R-squared value was 0.64; see Table 2). Note that the R-squared value in this case should not be interpreted as it is done in the classical way because the model as it is estimated implies the estimation of three different linear models, one for each group. Therefore, the model is useful to predict the safety perceptions for a particular group and not to predict safety perceptions in general. The model is also useful to make comparisons among the groups.

Before explaining the results for each of the independent variables, notice that in the model that was formulated in this study the intercept and the differences between the intercept and each of the dummies (Table 2) provided interesting results.

The intercept for the driver shows that when no independent variable was introduced, that is when no safety issues were taken into consideration, the impact of the dependent variable was not significantly different from zero. In other words, without any intervention in safety measures (through training, driver autonomy, driver opportunity for safety input, or top management commitment), drivers' perception of safety was not a statistically significant predictor of perception of safety culture.

However, this was not the case for dispatchers and safety directors. When no safety measures were accounted for, dispatchers and safety directors perceived that there was some
nonzero level of safety. The difference in the intercept of drivers and dispatchers was statistically significant \((t = 1.96, p = 0.05)\); and so was the difference in the intercept of drivers and safety directors \((t = 3.55, p < 0.001)\).

The difference in the intercept of drivers and dispatchers could also be understood just as dispatchers' intercept; and the difference in the intercept of drivers and safety directors could be understood just as safety directors' intercept. This direct interpretation of dispatchers' and safety directors' intercept is possible because drivers' intercept was not statistically significant.

However, an omnibus F-test showed no significant difference among the coefficients of the three intercepts (Table 3, A.2.); the null hypothesis of no difference among the intercepts for the drivers, dispatchers, and safety directors was not rejected. In other words, the differences among the drivers', dispatchers', and safety directors' intercepts were not large enough to be statistically significant. Additionally, because jointly these intercepts were statistically different from zero \((F(3, 300) = 18.24, p < 0.001)\) (Table 3, A.1.), it is possible to say that when no safety measures are accounted for, individuals in the organization may still perceive that there is a safety culture.

**Driver Fatigue Training**

The relationship between drivers' fatigue training and the perception of a strong safety culture was evaluated. The perception that the three organizational members have about driver fatigue training was tested as a predictor of safety culture.

Given the significance of the Pearson correlations (Table 1), the following conclusions were drawn. Support was found for hypotheses 1a, 1b, and 1c. The three
relationships were positive and significant at the .05 level. These hypotheses stated that the more that drivers, dispatchers, and safety directors believe that drivers have been trained about driver fatigue, the more highly each group would rate the company’s safety culture. The strongest of the three correlations was the one for drivers ($r = 0.52, p < 0.01$). The correlations for dispatchers ($r = 0.39, p < 0.01$) and safety directors ($r = 0.36, p < 0.01$) also were significant.

Next, this basic information was further explored through a multiple regression equation (Table 2). The estimated mean change in safety culture perception that drivers, dispatchers, and safety directors had when drivers’ level of training increases by one unit was statistically significant ($t = 6.25, p < 0.001$; $t = 2.88$, and $p = 0.004$, and $t = 2.13$, $p = 0.034$, respectively). This means that when driver fatigue training was introduced into the model, drivers, dispatchers, and safety directors perceived a stronger safety culture to be present. This result was stronger for drivers; a change in one unit of training would mean a change as low as 0.17 or as high as 0.33 in their safety perception. For dispatchers, a change in one unit of training would change their perception of safety somewhat, between 0.05 and 0.25. Driver training will change safety directors’ perception of a safety culture between .001 and 0.23. (These statements are based on the 95% confidence interval for B.)

The value of partial Eta squared confirmed the importance that “driver fatigue training” had for the model. The effect size of drivers’ opinion regarding their own training was one of the largest contributors to the model, with Eta squared = 0.12. Dispatchers’ and safety directors’ opinion about driver’s fatigue training had a smaller contribution to the model, with partial Eta squared values of 0.03 and 0.02 (respectively).
An F-test that tested the null hypothesis of no difference among drivers, dispatchers, and safety directors failed to be rejected (Table 3, B.2.). Pairwise comparisons confirmed that there was no significant difference between driver and dispatcher opinion on drivers’ training or between dispatcher and safety director opinion of drivers’ training as a predictor of safety culture (Table 3, B.3. and B.5.). However, the comparison between drivers and safety directors showed that the effect that driver fatigue training had on these two groups was statistically different ($F(1,300) = 3.98 \ p < 0.05$) (Table 3, B.4.).

In other words, even though drivers and safety directors did not have the same opinion about driver fatigue training, this issue seems to predict perception of safety culture for both individuals. Moreover, the bulk of the evidence supports that all three constituent groups (i.e., drivers, dispatchers, and safety directors) are equally influenced by driver fatigue training.

An F-test for the null hypothesis that all coefficients accounted for drivers’ fatigue training are simultaneously equal to zero was not rejected ($F(3,300)=17.31, \ p < 0.001$) (Table 3, B.1.). Thus, hypothesis 2, which stated individuals’ perception about driver fatigue training could be a predictor of safety culture, was supported. This means that, even though driver fatigue training might not have the same level of importance for all individuals, driver fatigue training is an important factor for the overall perception of safety culture.

**Driver Autonomy Regarding Safety**

Hypothesis 3, the extent to which drivers are perceived to be afforded autonomy with respect to fatigue issues and its relationship to a strong safety culture, was evaluated. The corresponding hypotheses 3a and 3c were not supported; that is, for drivers and safety
directors the extent to which drivers are afforded autonomy did not influence their perception of safety culture. On the other hand, drivers' autonomy seemed to be positively correlated with dispatchers' perception of safety culture. Hypothesis 3b—the more dispatchers believe drivers are afforded autonomy with respect to driver fatigue, the more highly company safety culture is rated—was supported ($r = 0.21, p < 0.05$; Table 1).

Hypothesis 4, the extent to which drivers are afforded autonomy with respect to driver fatigue issues is a significant predictor of safety culture, was tested through a multiple regression equation (Table 2). The estimated mean change in safety perception that drivers, dispatchers, and safety directors had when there was a change of one unit in driver autonomy was not statistically significant. Drivers' perceived level of autonomy did not have an effect on any of their perception of safety culture. This was confirmed through an F test that accounted for all coefficients related to driver autonomy, hypothesis 4, which stated that "driver autonomy" did not have any significant contribution to the model, was not supported (Table 3, C.1.).

The statistical significance of drivers', dispatchers', and safety directors' level of agreement regarding the difficulty of considering driver autonomy as a predictor of safety culture also was confirmed through an F-test for the relevant null hypothesis. This test showed no significant difference among the three coefficients (Table 3, C.2.). Thus the evidence supports the conclusion that all three constituent groups (i.e., drivers, dispatchers, and safety directors) agree that driver autonomy does not play an integral role in shaping safety culture.
**Driver Opportunities for Safety Input**

Hypothesis 5, the extent to which drivers are perceived to be able to provide safety-related input and how this is related to perceptions of a strong safety culture, was evaluated.

The opportunities that individuals perceived drivers had for safety input had a positive and strong correlation with their perception of safety culture. The correlation for drivers was \( r = 0.45 \), \( r = 0.62 \) for dispatchers, and \( r = 0.69 \) for safety directors. Thus, hypotheses 5a, 5b, and 5c were supported with a 99% level of confidence.

It was not possible to reject null hypothesis 6a, which stated that there was no change in drivers' safety perception given a change of one unit in the opportunity they have to participate by providing safety input. However, null hypotheses 6b and 6c were rejected (Table 2). The mean change in dispatchers' perception of safety was statistically significant given the change of one unit in driver participation \( (t = 2.06, p < 0.04) \). Given the confidence interval of the unstandardized coefficient, a change in one unit in driver participation may have a small change of 0.01 on dispatchers' perception of safety culture, or it could change it as much as 0.31 (with a 95% level of confidence).

The relationship between driver participation and perception of safety culture was also important, and even stronger, for safety directors \( (t = 2.95, p < 0.003) \). Notice that the 95% confidence interval for this group ranged from 0.08 to 0.38, which confirms the concern that safety directors had for drivers' participation as a predictor of a safety culture.

Even though driver participation seems to be a stronger predictor of safety culture for safety directors than for dispatchers, an F-test showed no significant difference among these coefficients (Table 3, D.5.). Furthermore, an F-test for the difference between drivers', dispatchers', and safety directors' perceptions of driver opportunity for safety input was not
significantly significant (Table 3, D.2.). Stated differently, there was no statistical difference among hierarchical levels on the effect that opportunity for safety input had in their perception of safety culture.

Next, the null hypothesis of driver's dispatcher's and safety director's opinion about driver opportunity for safety input being equal to zero was rejected (F (3, 300) = 4.94, p < 0.002). This indicated that agreement among the three hierarchical levels was in favor of drivers' opportunity for safety input as a predictor of safety culture (i.e., drivers, dispatchers, and safety directors attributed similar levels of importance to driver safety input as an antecedent of safety culture). In other words, taking into account the three coefficients jointly, driver opportunity for safety input was found to be an important predictor of safety culture; hypothesis 6 was thus supported (Table 3, D.1).

**Top Management Commitment to Safety**

The relationship between individuals' perceptions of top management commitment to safety and their perception of safety culture was found to be positively and statistically significant for the three categories of respondents.

Hypothesis 7 and its following subset of hypotheses (7a, 7b, and 7c) were strongly supported. The correlation was $r = 0.78$ ($p < 0.01$) in the case of drivers' perception; $r = 0.72$ ($p < 0.01$) for dispatchers; and $r = 0.70$ ($p < 0.01$) for safety directors.

Hypothesis 8 and its subsidiary three hypotheses stating that top management commitment was a significant predictor of the perception a safety culture for the three groups of employees also were confirmed. The effect that a change in top management commitment to safety had on safety perception of drivers, dispatchers, and safety directors was
statistically significant ($t = 11.91$, $t = 5.25$, and $t = 3.47$, respectively; $p < 0.001$ in each case).

Stated differently, top management commitment was found to be a predictor of drivers' perception of safety culture (hypothesis 8a), dispatchers' perception of safety culture (hypothesis 8b), and safety directors' perception of safety culture (hypothesis 8c).

An omnibus F-test showed that there was a significant difference ($F (2, 300) = 9.03$, $p < 0.001$) between drivers, dispatchers, and safety directors in how their perception of safety changed given a change of one unit in the commitment top management had to safety (Table 3, E.2.). Pairwise comparisons complemented this finding, and allowed determining which pairs of respondents were different from each other.

Given individuals' perceptions of top management commitment as a predictor of safety culture, the difference between drivers' and dispatchers' coefficients was statistically significant ($F (1, 300) = 7.46$, $p = 0.007$); and so was the difference between drivers' and safety directors' coefficients ($F (1, 300) = 15.86$, $p < 0.001$) (Table 3, E.3. and E.4.). The difference between dispatchers' and safety directors' coefficients was not statistically significant.

Despite differences in the effect that top management commitment had on different groups' perceptions of safety culture, this variable did have a significant contribution to the model. Drivers' perception of top management commitment to safety had the largest contribution to the model; the estimated effect size was 0.32. The effect sizes of top management commitment to safety for dispatchers and safety directors indicated that these effects also were relevant (0.8 and 0.4 respectively).

Additionally, an F-test for the null hypothesis that all coefficients related to top management commitment were simultaneously equal to zero, was not rejected ($F (3, 300) =$
60.50, \( p < 0.001 \)), providing support for hypothesis 8 (Table 3, E.1.). Top management commitment to safety is a predictor of safety culture for the overall model (regardless of the different effect it has over perceptions of safety culture among various hierarchical levels). However, drivers and dispatchers, along with drivers and safety directors, did exhibit differences in the importance they accorded top management commitment to safety in determining safety culture, with drivers valuing this factor more strongly.

**Company Performance Safety Rating**

Companies were grouped into three safety performance rating categories (poor, average, and top safety performers). The sample of 116 companies had a normal distribution among these categories (31 poor, 53 average, and 32 top performing companies).

Companies’ safety performance rating was correlated with individual perception of safety culture to determine the accuracy of their perception. The relationship between dispatchers’ perception of safety culture and companies’ safety performance rating was not significantly different from zero. The same finding was reported for safety directors’ perception of safety culture. Both dispatchers and safety directors had a relatively high average perception of how safe is their corporate culture (means = 5.90 and 5.51, respectively); in fact, there was a positive and significant relationship between their perceptions of safety \( (r = 0.32, p < 0.01) \) (Table 4).

The relationship between drivers’ perception of safety culture and companies’ safety performance rating was negative and significantly different from zero \( (r = 0.22, p < 0.05) \); in other words, the poorest the rating of companies’ safety performance the higher drivers’ perception of safety culture (Table 4). The relationship between drivers’
and dispatchers' perception of safety culture was significantly different from zero and positive \((r = 0.28, p < 0.01)\). Note that drivers also had a relatively high average perception of safety culture about their company (mean = 5.21).

**Test for Collinearity**

In the regression model it was observed that there were high levels of collinearity among the independent variables. Some of the variance inflation factor (VIF) coefficients were fairly large (> 10). Additionally, the levels of tolerance reported were also indicators of high collinearity; some tolerance values were close to 0.00, which indicates a high degree of similarity among the independent variables and hence great difficulty in determining which independent variables were meaningful predictors. However, Goldberger (1991) suggests that researchers should not be so concerned about collinearity, but instead with whether the variances of the coefficient estimates are too large to provide useful estimates of the regression coefficients. In this case the standard errors were fairly small relative to the unstandardized coefficients.

Additionally, the possible impact of collinearity was addressed by examining the effect size (eta-squared) of each independent variable, which reveals its real contribution to the model.

In sum, even though collinearity was influencing the regression model, given that the standard errors were relatively small and that the use of dummy variables made it possible to make the kind of interpretations that were desired, collinearity was a bearable and minor issue.
Discussion

As in previous research (Clarke, 1999; Griffin, 2000; Martin, 1992, 2002), this study also found that there is a different perception of safety culture depending on individuals' hierarchical level. However, most safety measures that were accounted for seem to be important for individuals regardless of their hierarchical level.

Individuals who are not directly affected by safety issues seem to have a different perception of safety culture from those who deal with safety matters daily and directly. Those who are not directly affected by safety policies, such as dispatchers and safety directors, might believe that there is a strong safety culture even when no safety practices were implemented. However, the driver, who is directly affected by safety practices, to some extent might also believe that there is a strong safety culture when no safety practices are taken into account.

In the case of dispatchers and safety directors, one may think that those who are not directly affected by the risk related with driving seem to dissociate themselves from probably negative outcomes; this finding is congruent with the concept of self-serving bias (Bierhoff, 1989). Dispatchers and safety directors could overestimate the safety culture in the organization, because to some extent they are responsible for drivers' safety (e.g., helping them loading and unloading the truck, supporting the creation and use of safety policies) and might want to assume that safety is being insured.

Regarding drivers' perception of safety, it is possible that because the risk of driving is something that drivers routinely have to deal with and they may believe it is mostly under their control, they protect themselves by becoming optimistic about this risk. In other words,
truck drivers, as many other drivers, seem to underestimate their susceptibility, because persons are unrealistic about their vulnerability to hazards perceived to be controllable (Weinstein, 1984).

**Driver Fatigue Training**

An early evaluation of the relationship between training and safety culture showed that there is a positive correlation among these issues for drivers, dispatchers, and safety directors. Next, by estimating the slope of driver fatigue training for driver, dispatcher, and safety director, it was confirmed that this variable was a significant predictor of safety culture for individuals on all three hierarchical levels. Subsequently, a more in-depth analysis stated that drivers' and safety directors' opinions about training had a different effect on each group's perception of safety culture.

As observed in previous research (Zohar, 1980), employees who are directly involved with the activity that requires safety indicated that training is a prerequisite for a safety environment and a successful performance. However, it was found that by training drivers about fatigue a safety culture was perceived not only by drivers but also by dispatchers and safety directors.

Drivers and dispatchers showed a similar opinion regarding the importance of drivers' fatigue training as a predictor of safety. Consensus could be reached if common beliefs are shared; this could happen because of the characteristics of their jobs (frequently interact with each other) or probably because of the job-related experience (have driven a truck). It is possible that dispatchers may be involved in drivers' training and know how this may be helpful to prevent accidents. There ought to be a consensus (implicit or explicit) regarding
the usefulness of training for individuals to have a similar appreciation of it. Finding things in common among organizational groups is a powerful means of unity in the workplace. Consensus is what makes it possible to find links across groups (Martin, 1992).

It should be noted that training was one of the major contributors to the overall prediction of safety culture, particularly because of the relatively large effect size of drivers’ opinion of their own fatigue training. Because of the importance that the estimate of drivers’ fatigue training had for the overall prediction of a safety culture, this ought to be a safety issue accounted for in the development of a safety program (even though its significance was not equal for all members).

If further research determines that there is consensus among the different levels of the organization, driver fatigue training should be considered by organizations as an issue through which its members could find agreement about safety culture.

**Driver Autonomy Regarding Safety**

It was surprising that hardly any support was found for drivers’ autonomy. Driver autonomy was positively correlated with dispatchers’ perception of safety culture. But the correlation between driver autonomy and either dispatchers’ or safety directors’ perception of safety culture was found to be significant. Nor was it found to be a predictor of safety culture for any individual. The extent to which employees are afforded autonomy is an issue that in many industries is taken as a fundamental requirement for safety culture.

Given the most advanced statistical analysis carried out in this study (multiple regression followed by F-test), individuals’ opinions about the autonomy that drivers are afforded provided an insignificant predictor of safety culture (Tables 2 and 3). Drivers,
dispatchers, and safety directors appear to agree on not considering drivers' judgment about tiredness (autonomy) as an issue that predicts company's safety culture (i.e., the results failed to reject the null hypothesis that stated that the autonomy drivers are afforded was not a predictor of safety culture).

However, this is not a negative finding. This finding supports the use of strong safety regulations regarding hours of work in the trucking industry. In the trucking industry, employees' autonomy may not have all the positive implications that the literature describes for other industries (Karasek et al., 1981; Parker et al., 2001). For example, reducing driver autonomy by requiring drivers to drive the same hours each day and following prescribed routes could enhance safety as these practices diminish fatigue (Soccomanno et al., 1996). In other words, alternative work schedules and flexible work hours have been identified as hazards in the trucking industry (Baltes et al., 1999; Soccomanno et al., 1996). Moreover, in an industry in which hours of work are not well regulated and non-driving work is often not compensated, there is an incentive for drivers to exercise their job autonomy and drive longer (i.e., work longer hours) to increase their compensation based on mileage reimbursement (Williams & Monaco, 2001). Under these circumstances, affording drivers with even more autonomy might enhance hours of service violations, especially since truck drivers are not a good judge of how fatigued they are (Wylie, Shultz, Miller, Mitler, & Mackie, 1996).

It may well be that affording drivers more autonomy could be detrimental for the actual highway safety, and by extension, for the company. The effectiveness of autonomy as a predictor of safety culture may depend on how employees are being paid and the incentives for completing the job on time or given a specific level of quality. In the trucking industry, drivers (and sometimes dispatchers) are paid by making a delivery on time and by the
amount of time/miles drivers drive. These conditions create economic incentives to continue
driving when fatigued. To offset these conditions and promote safety (i.e., adhering to hours
of service regulations, driving the speed limit), strong safety policies need to be implemented
and less driver autonomy may be appropriate.

Driver Opportunities for Safety Input

Driver opportunity for safety input, which has been explained through the literature
using the term "participation," was identified as an important predictor of safety culture.
This was true for the three hierarchical levels that were taken into account in this study (after
testing the null hypothesis of no difference between the individuals jointly and pairwise
comparisons of no difference between the individuals – Table 3, D.2. and D.3.-5.).

But, why was not participation an indicator of safety culture for drivers in the
regression model as it is for dispatchers and safety directors? This model, as explained
before, is a conservative statistical model in which items that could be significant are not. To
overcome this difficulty, F-tests for the difference among individuals were conducted (Table
3).

Having found the implications that driver opportunity for safety input had for the
different organizational members on their perception of safety culture, the idea of stating
driver participation as a comprehensive safety measure in the trucking industry may be
supported. Stated differently, driver opportunity for safety input should be universally taken
into account by organizations as an issue through which its members find agreement about
safety culture. That is, driver participation allows developing consensus and consistency
within the corporate culture.
In integration views of culture, people at all levels of an organizational hierarchy are said to agree about potentially divisive issues (Martin, 1992). In the trucking industry, driver opportunity for safety input seems to be an issue through which individuals find consensus and agreement.

In the trucking industry, drivers' participation is particularly important to predict the overall perception of safety culture because these are the employees who are regularly dealing with driving related risks. Moreover, given drivers' hierarchical level, their participation is particularly important in the prediction safety culture because participation is a favored policy among lower-level employees (Beehr & Gupta, 1987).

**Top Management Commitment to Safety**

As found by previous research (Griffin & Neal, 2000; Hofmann & Morgeson, 1999; Zohar, 1980), management commitment to safety has an important effect on individuals' perceptions of safety. The three hierarchical levels accounted for found "top management commitment to safety" to be a significant predictor of safety culture.

Even though top management commitment was found to be a significant predictor of safety culture for the three categories of respondents, the effect that this variable had over all the hierarchical levels observed was not the same. Specifically, the effect that this variable had on drivers' perception of safety culture was statistically different from the effect it had on dispatchers' and safety directors' perception of safety. On the other hand, it was not possible to conclude that top management commitment had a different effect over dispatchers' and safety directors' perceptions of safety culture. That is, individuals in higher hierarchical levels have a similar appreciation of head office employees' commitment to
safety, whereas lower-level employees have a significantly different perception of this issue; yet this issue is important for all of them.

Inconsistency occurs when one manifestation is interpreted in different ways (Martin, 1992). It is possible that drivers may have a different interpretation of management commitment to safety, compared to the meaning management actually gives to this issue. Additionally, compared to drivers, it is also possible to find more similarities among dispatchers and safety directors regarding their opinion about management commitment. Differences among organizational levels may create subcultures, which in turn, may cause differences in the effect that management commitment has (Harvey et al., 2001) on the perception of safety culture.

Because top management commitment to safety demonstrated such strong effects on the perception of safety in this study, it would be important to find agreement within each group regarding the meaning and the importance of this issue. Particularly, it would be valuable to know how and why drivers’ perceptions of management commitment differed from the perception of others.

**Company Performance Safety Rating**

Individuals’ perception of safety culture did not match the actual safety measures implemented and promoted by trucking companies. Drivers, dispatchers, and safety directors seem to overestimate their corporate safety culture.

This bias was particularly significant for drivers who seem to perceive a stronger safety culture when indeed the safety ratings of the company are lower. This finding may be related to the self-serving bias that prevents individuals from taking into account facts that
are contrary to their beliefs and expectations (Bierhoff, 1989). It is also congruent with drivers' tendency to overestimate driving safety conditions (Weinstein, 1984).

The inaccurate perception of the actual safety performance of the company is a finding that supports the nonsignificant effects of drivers' autonomy on individuals' perception of safety culture. Given drivers' biased perception of safety, affording them with more autonomy would lead to an increase in unsafe behaviors. Because individuals' perceptions of safety tend to be incongruent with the actual safety performance of the company, strong safety policies that protect the company and the community in general (i.e., other drivers) should be enforced.

Conclusions

Driver fatigue training, driver opportunity for safety input, and top management commitment to safety are safety measures that trucking firms should implement to strengthen the perception of safety culture. These issues were perceived by the three hierarchical levels accounted for as predictive of a safety culture.

Perceptions among individuals about issues that determine a safety culture in the organization may be different. However, with respect to safety in the trucking industry, there are clue issues upon which the different hierarchical levels agree. In this particular case, three different hierarchical levels of organizations in the trucking industry are influenced in their perceptions of safety culture by drivers' opportunity for safety input training drivers about fatigue, and top management commitment to safety. Additionally, individuals coincide on not supporting driver autonomy as a predictor of safety culture. This fact is important
because it shows that different employees in trucking firms seem to be aware of drivers’ tendency to overestimate personal and environmental driving safety conditions.

Because head office employees tend to have a more integrated perspective and may expect to reach consensus on the implementation of safety measures, it is useful for them to emphasize on safety measures that are not only effective but also equally important for most individuals (such as driver participation and driver fatigue training). Furthermore, as Clarke (1999) suggests, consensus among members of the organization is the basis of a positive safety culture.

However, in this case one variable, top management commitment to safety, did not have the same effect on individuals’ perception of safety culture. Different priorities and values associated with hierarchical divisions (Clarke, 1999) may explain this result.

Notice that drivers’ opinions of management commitment to safety had the largest contribution (effect size) to the model. It is important that management and head office employees become aware of the expectations held by lower level employees (i.e., lower level employees believe that higher hierarchical levels should be working for a stronger safety culture). Management can respond to drivers’ expectations by providing training about fatigue and by being open to drivers’ input about safety. Also, given the nonsupportive findings associated with driver autonomy, management should be cautious in relying on drivers’ judgments as to whether or not they are too tired to drive. Restricting this aspect of autonomy could reduce hours of driving violations, close calls, and accidents.

Although organizational culture may not be all about agreement and stability nor all about conflict and confusion, in this case different members of the organization seem to be influenced by the four safety factors examined; although not all the factors had the same
effect over the various hierarchical levels. If the company knows some of the issues that have the same influence on most or all hierarchical levels perception of safety culture, it would be possible to take advantage of these issues and use them to strengthen and integrate individuals in the organization. For example, if the firm wants to develop a stronger safety culture, driver participation, driver fatigue training, and to some extent, top management commitment to safety, would be primary issues that may allow the development of a safety program that is perceived by most individuals to be effective.

**Limitations and Suggestions**

A multiple regression model that included three dummy variables allowed determining the predictors of a safety culture for each respondent group. The model also was used to compare groups and to draw predictors of a safety culture given the overall model. However, interactions among the variables accounted for in the model caused some collinearity problems. Because of this, predictors that could have been significant were not found to be significant.

Given the safety measures that were not found to be commonly important for individuals’ perception of safety culture, further research should test each of these individually. It is important to determine if the issues proposed by the literature as predictors for a safety culture apply in the trucking industry, and specifically, to which groups (positions) in the organization.

The only variable that was found to be significant in the literature that was not confirmed here as a significant factor having an effect on safety culture was driver autonomy. Further research should suggest a different measure of drivers’ autonomy and compare it
with how this has been measured in the present study. It should be determined if the extent
to which drivers are afforded autonomy regarding safety is truly opposite to what is expected
from other employees.

It is also important to differentiate which individuals are affected directly by
companies' safety measures and which are responsible for the use of these measures.
Because of the self-serving bias, individuals who are responsible for safety may overestimate
a company's safety culture to protect themselves from negative outcomes. When safety
programs are implemented or safety polices are evaluated, the self-serving bias should be
taken into account as a mechanism that may hinder the effectiveness of safety.
References


*Perceptual and Motor Skills, 59*(1), 215-218.


Appendix A

Measures
Opinions about Truck Driving

The following questions are related to your personal opinions. Please indicate the extent to which you think the statement is true, by circling the number which best corresponds to your opinion, using a scale of 1 to 7, with 1 = To a Very Little Extent and 7 = To a Very Large Extent. (Circle one number for each statement).

To what extent do you think...

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Drivers have been trained about driver fatigue issues?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td><strong>2.</strong> Drivers are the best judges of whether or not they are too tired to drive?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td><strong>3.</strong> Drivers in your company have opportunities to make suggestions and voice complaints regarding safety and fatigue?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td><strong>4.</strong> Top management at your company is committed to driving safety?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
**Perceptions About Organizational Safety Culture**

Listed below are statements that represent opinions people have about driving fatigue and safety. Please indicate the extent to which you agree or disagree with each statement by circling the number which best corresponds to your opinion, using a scale of 1 to 7, with 1 = Strongly Disagree and 7 = Strongly Agree. (Circle one number for each statement.)

<table>
<thead>
<tr>
<th>Statement about driving fatigue and safety</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>Strongly agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Our company makes driving safety a top priority.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2. Driving safety is an important concern at this company.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>3. I am satisfied with the amount of emphasis this company places on driving safety.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>4. Drivers and management openly discuss issues related to driver fatigue.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
Appendix B

Tables
Table 1

Descriptive Statistics and Correlations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Driver</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Safety culture</td>
<td>5.21</td>
<td>1.55</td>
<td>(.91)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Driver fatigue training</td>
<td>4.50</td>
<td>1.93</td>
<td>0.52**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Driver autonomy</td>
<td>6.27</td>
<td>1.33</td>
<td>-0.03</td>
<td>0.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Driver safety input</td>
<td>5.23</td>
<td>1.83</td>
<td>0.45**</td>
<td>0.25**</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>5. Top management commitment</td>
<td>5.65</td>
<td>1.57</td>
<td>0.78**</td>
<td>0.28**</td>
<td>-0.01</td>
<td>0.49**</td>
</tr>
<tr>
<td><strong>Dispatcher</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Safety culture</td>
<td>5.90</td>
<td>1.10</td>
<td>(.88)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Driver fatigue training</td>
<td>4.57</td>
<td>1.60</td>
<td>0.39**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Driver autonomy</td>
<td>5.42</td>
<td>1.66</td>
<td>0.21*</td>
<td>0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Driver safety input</td>
<td>5.76</td>
<td>1.38</td>
<td>0.62**</td>
<td>0.27**</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>5. Top management commitment</td>
<td>6.01</td>
<td>1.37</td>
<td>0.72**</td>
<td>0.21*</td>
<td>0.17</td>
<td>0.67**</td>
</tr>
</tbody>
</table>
Descriptive Statistics and Correlations continued

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety director</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Safety culture</td>
<td>5.51</td>
<td>1.15</td>
<td>(.88)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Driver fatigue training</td>
<td>4.17</td>
<td>1.48</td>
<td>0.36**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Driver autonomy</td>
<td>4.82</td>
<td>1.62</td>
<td>0.13</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Driver safety input</td>
<td>4.88</td>
<td>1.65</td>
<td>0.69**</td>
<td>0.27**</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>5. Top management commitment</td>
<td>5.33</td>
<td>1.58</td>
<td>0.70**</td>
<td>0.30**</td>
<td>0.12</td>
<td>0.78**</td>
</tr>
</tbody>
</table>

Drivers N = 113, Dispatchers N = 98, Safety Directors N = 109.

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).
Table 2

Multiple linear regression for the perception of safety culture

<table>
<thead>
<tr>
<th>Parameter Estimates</th>
<th>$\beta$</th>
<th>$t$</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.27</td>
<td>0.59</td>
<td>0.00</td>
</tr>
<tr>
<td>Dummy2</td>
<td>1.27</td>
<td>1.96*</td>
<td>0.01</td>
</tr>
<tr>
<td>Dummy3</td>
<td>2.09</td>
<td>3.55***</td>
<td>0.04</td>
</tr>
<tr>
<td>Driver fatigue training*Dummy1</td>
<td>0.25</td>
<td>6.25***</td>
<td>0.12</td>
</tr>
<tr>
<td>Driver fatigue training*Dummy2</td>
<td>0.15</td>
<td>2.88*</td>
<td>0.03</td>
</tr>
<tr>
<td>Driver fatigue training*Dummy3</td>
<td>0.12</td>
<td>2.13*</td>
<td>0.02</td>
</tr>
<tr>
<td>Driver autonomy*Dummy1</td>
<td>-0.05</td>
<td>-1.08</td>
<td>0.00</td>
</tr>
<tr>
<td>Driver autonomy*Dummy2</td>
<td>0.03</td>
<td>1.08</td>
<td>0.00</td>
</tr>
<tr>
<td>Driver autonomy*Dummy3</td>
<td>0.00</td>
<td>0.20</td>
<td>0.00</td>
</tr>
<tr>
<td>Driver safety input*Dummy1</td>
<td>0.06</td>
<td>1.38</td>
<td>0.01</td>
</tr>
<tr>
<td>Driver safety input*Dummy2</td>
<td>0.15</td>
<td>2.06**</td>
<td>0.01</td>
</tr>
<tr>
<td>Driver safety input*Dummy3</td>
<td>0.21</td>
<td>2.95**</td>
<td>0.03</td>
</tr>
<tr>
<td>Top management commitment*Dummy1</td>
<td>0.67</td>
<td>11.91***</td>
<td>0.32</td>
</tr>
<tr>
<td>Top management commitment*Dummy2</td>
<td>0.41</td>
<td>5.25***</td>
<td>0.08</td>
</tr>
<tr>
<td>Top management commitment*Dummy3</td>
<td>0.28</td>
<td>3.47***</td>
<td>0.04</td>
</tr>
</tbody>
</table>

N = 315 (33 observations were excluded).

Dummy1 = Driver, Dummy2 = Dispatcher, Dummy3 = Safety director

$F = 41.59 \quad R^2 = 0.66 \quad$ Adjusted $R^2 = 0.64$

*p < .05. **p < .01. ***p < .001. (2-tailed)
### Table 3

**F-tests**

<table>
<thead>
<tr>
<th>Comparisons (Null hypothesis)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D (Driver safety input)</th>
<th>E (Top management commitment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver, Dispatcher, Safety director = 0</td>
<td>18.24***</td>
<td>17.31***</td>
<td>0.79</td>
<td>4.94**</td>
<td>60.50***</td>
</tr>
<tr>
<td>Driver = Dispatcher = Safety director</td>
<td>2.19</td>
<td>2.44</td>
<td>1.17</td>
<td>1.75</td>
<td>9.03***</td>
</tr>
<tr>
<td>Driver = Dispatcher</td>
<td>0.94</td>
<td>2.59</td>
<td>2.33</td>
<td>1.05</td>
<td>7.46**</td>
</tr>
<tr>
<td>Driver = Safety director</td>
<td>3.33</td>
<td>3.98*</td>
<td>0.92</td>
<td>3.19</td>
<td>15.86***</td>
</tr>
<tr>
<td>Dispatcher = Safety director</td>
<td>2.00</td>
<td>0.17</td>
<td>0.41</td>
<td>0.40</td>
<td>1.33</td>
</tr>
</tbody>
</table>

*p < .05.  **p < .01.  ***p < .001
Table 4

Company Performance Safety Rating and Perception of Safety Culture

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Company Performance rating</td>
<td>2.01</td>
<td>0.74</td>
<td>116</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Driver perception of safety culture</td>
<td>5.21</td>
<td>1.55</td>
<td>115</td>
<td>-0.22*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Dispatcher perception of safety culture</td>
<td>5.9</td>
<td>1.10</td>
<td>102</td>
<td>0.087</td>
<td>0.28**</td>
<td></td>
</tr>
<tr>
<td>4. Safety director perception of safety culture</td>
<td>5.51</td>
<td>1.15</td>
<td>110</td>
<td>0.127</td>
<td>0.173</td>
<td>0.28**</td>
</tr>
</tbody>
</table>

*p < .05.  **p < .01.