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Driver education and safety climate in an emergency services fleet
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KEYWORDS
VEHICLE FLEET SAFETY
FLEET SAFETY CLIMATE
DRIVER EDUCATION
DRIVER TRAINING
EMERGENCY

SERVICES
The ongoing social and financial costs of work-related motor vehicle accidents are substantial. This study investigated the relationship between the frequently used intervention of driver education and motor vehicle fleet safety climate. The findings of the study suggest that, within the context of an Australian emergency services fleet, driver education is related to employees’ perceptions of fleet safety climate. More specifically, the provision of driver education is associated with improved perceptions of organisational commitment to safety management, appropriate work demands, and trusting relationships and good communication. The findings also indicate that the fleet safety climate scale may be a useful measure for OHS personnel who are interested in identifying where safety enhancements are required or for benchmarking employees’ safety perceptions.

Introduction
Research into vehicle fleet safety has important applications for OHS. Haworth has reported that road crashes are the most commonly identified reason for work-related deaths in Australia.1 Despite this, there has been little research into this important area of workplace safety. There is an immediate need for, and value in, identifying and understanding the factors that may influence fleet safety outcomes.

In many organisations, the most common approach to reducing exposure to vehicle fleet safety risk is the provision of behind-the-wheel driver training. Although the terms “driver training” and “driver education” are often used interchangeably in both the community and the scientific literature, it is important to distinguish the difference in terminology and to identify the scope of this review. Driver education aims to improve driver knowledge, attitudes and behaviour. The term is used broadly to cover a range of instruction and learning procedures that emphasise the cognitive processes and underlying values relating to safe driving behaviour. Within this broad definition, driver education includes driver training. Driver training, in comparison, is typically a specific instructional program. This term usually relates to practical learning that is designed to improve driving skills and competencies.2 This study investigated the broader dimension of driver education.

Research investigating the effectiveness of driver education in the general community has found mixed results. This is not surprising, considering the wide range of driver education programs that were reviewed. Despite mixed empirical evidence for the relationship between driver education and driver behaviour, the relationship is often assumed by many practitioners in the OHS field. Consequently, driver education often forms the basis for vehicle fleet safety intervention programs. As little workplace research has been conducted in this area, the current study focused on the frequently used intervention of driver education in the workplace.

Workplace safety climate is one of the recognised areas that assists in our understanding of workplace behaviour in the OHS context.3,4 Safety climate refers to shared perceptions held by employees regarding their organisation’s commitment to safety management. These perceptions may be based on employee interpretations of events, features and processes in the work environment that impact on their safety.5 This study contributes to this growing area by exploring the relationship between vehicle fleet safety climate and driver education.

Safety climate
Safety climate is one measure which is believed to have the ability to provide insight into potential workplace safety hazards and how to address them.3 Stemming from research into organisational culture and climate, Zohar pioneered a path of more specialised research into safety climate.7 Measuring an organisation’s safety climate can assist in three key areas: (1) identifying where safety requires improvement; (2) determining
trends in safety performance; and (3) providing data benchmarks that may be compared across different departments or organisations.\textsuperscript{8}

In recent years, numerous surveys have been developed to measure safety climate and to investigate the relationship between safety climate and safety outcomes across a range of occupations, geographical locations and cultures. A number of general dimensions that may impact safety climate have been identified, including: policies and practices (for example, relating to training); work facilities (for example, personal protective equipment); safety-related conditions (for example, work stress); and the attitudes and actions of other employees (for example, management).\textsuperscript{5} Furthermore, many studies have found a relationship between safety climate and safety outcomes, suggesting that issues relating to safety climate may have important applications for OHS. Studies have observed that safety climate factors can predict accident and injury rates, frequency of workers compensation claims, and self-reported employee accident frequency.\textsuperscript{7,9-13}

Recently, Wills has extended the research into workplace safety climate to specifically include work vehicle usage.\textsuperscript{14-15} The development of this research (called “fleet safety climate”) increases our understanding of the antecedents of driving behaviour in the workplace. Given the suggested link between safety climate and safety outcomes, there is value in investigating the relationship between fleet safety climate and interventions that are intended to deliver safety outcomes. This study investigated the relationship between fleet safety climate and exposure to safety training, in the form of driver education.

**Safety training**

Previous studies have recommended safety training as a way to decrease OHS risks for drivers.\textsuperscript{16} Many studies have found that safety training, in general, is associated with safety outcomes. A positive relationship has been found between safety training and safety knowledge, safety attitudes, perceived personal work injury risk, safety concerns and safety climate.\textsuperscript{10,16,17} Additionally, a negative relationship has been found between safety training and employees’ willingness to accept prevailing OHS risks and exposure to workplace safety incidents.\textsuperscript{18}

Within the general domain of road safety, some research has been conducted to evaluate the effectiveness of driver education as an example of safety training. Measures of driver education effectiveness have typically focused on post-training accident rates. While some research has found driver education to be associated with lower accident risk,\textsuperscript{19-20} many studies have failed to find significant risk reductions.\textsuperscript{21-23} It has been suggested that accident rates provide a poor measure of training effectiveness, and only provide retrospective data which are often derived from unreliable records. Furthermore, in studies where the number of accidents is low, accident rates may not be sufficiently sensitive to identify relationships.\textsuperscript{24}

A broader review (that included research that evaluated the effectiveness of driver education using measures other than accident rates) identified that driver education may influence safety outcomes. A positive relationship has been found between driver education and caution when approaching and overtaking a hazard, adherence to traffic signals and signs, and visual monitoring of the driving environment.\textsuperscript{25-27} Furthermore, drivers who have had driver education have fewer traffic violations/infringements.\textsuperscript{28}

The research into driver education is inconclusive, and there is very little research to show that driver education in a fleet setting may have the intended and desired results. This study allows us to examine the relationship between the frequently used intervention
of driver education and perceived fleet safety climate within the context of an Australian emergency services fleet.

**Present study**
The present study had three aims. The first aim was to further investigate the dimensions of fleet safety climate (Wills identified six fleet safety climate factors: communication and support, work pressure, relationships, safety rules, management commitment, and safety training).\(^{29}\) Drawing from a different sample of drivers, the present study applied the fleet safety climate scale to investigate whether the fleet safety climate factors identified by Wills were replicated in another fleet setting.

The second aim was to explore the relationship between driver education and fleet safety climate. It was hypothesised that employees who participated in driver education would have greater perceptions of fleet safety climate than employees who did not participate in driver education.

Finally, assuming that driver education is related to fleet safety climate, this study investigated which aspects of fleet safety climate are related to driver education. It was hypothesised that driver education would be related to fleet safety climate factors in different ways. More specifically, employees who participated in driver education would have greater perceptions of management commitment to fleet safety and of communication and support. Perceptions in relation to other factors (including work pressure, relationships, safety rules and safety commitment) would vary, depending on the content of the education material provided. For example, if the driver education outlined strategies for handling demanding situations (such as controlling emergency vehicles when operating at high speeds), personnel who participated may perceive their work as less demanding.

**Method**
Employees in a large emergency services organisation were given the opportunity to participate (voluntarily) in an organisation-wide driving questionnaire. Of the 2,319 staff that were sent the questionnaire, 351 participated, yielding a response rate of approximately 15%. For operational reasons, the questionnaire was distributed to all current operational clinical drivers. While this excluded clerical staff and other fleet drivers, it did include some office-based, clinically-accredited personnel for whom the questionnaire was not relevant. Therefore, a low response rate was anticipated.

Respondents ranged in age from 22 to 64 years, with the average age being 40 years. The majority of respondents were male (82%). Length of service in the organisation varied from one year or less to 21 years or more. The study population included the full range of ages, years of driving, and clinical training levels from within the organisation and from all regional locations in the jurisdiction. A majority of respondents reported having held their open licence for a minimum of eight years (96%), and the amount of work-related driving undertaken by respondents ranged from five hours or less per week to 31 hours or more.

To ensure confidentiality, participants were required to return completed questionnaires directly to Queensland University of Technology. The questionnaire included three sections (measures of demographics, training participation and safety climate). To determine the level of exposure to driver education, respondents were asked to estimate the average number of days that they had spent in driver education each year for the past three years. Driver education in this study was defined as any formal training in the control of emergency vehicles, including study modules, classroom presentations by designated instructors, peer mentoring, and in-vehicle instruction (both on-road and off-road). To determine the perceived fleet safety climate, a 35-item scale was formulated
based on the Safety Climate Questionnaire – Modified for Drivers developed by Wills and the Safety Climate Questionnaire developed by Glendon and Litherland.5,15,29

Results
The results of this study were analysed using the Statistical Package for the Social Sciences.30 First, a factor analysis was performed in order to explore drivers’ responses to the fleet safety scale. To determine the number of factors, the 35 fleet safety climate items were submitted to a principal components analysis, followed by a varimax rotation. Principal axis analysis revealed a four-factor solution with eigenvalues of greater than one. The four factors were management commitment, trusting relationships and communication, appropriateness of work demands, and appropriateness of education and rules. Table 1 presents the percentage of variance (explained by each factor) and the variable loadings. Cumulatively, these factors accounted for 57% of the variance. Reliability analyses revealed that the fleet safety climate scale had a high internal reliability of .96. Each of the extracted factors had a similarly high internal reliability. The following coefficient alpha values were obtained: factor one (management commitment) — .94; factor two (trusting relationships and communication) — .92; factor three (appropriateness of work demands) — .87; and factor four (appropriateness of education and rules) — .77.

***INSERT TABLE 1 APPROXIMATELY HERE***

Second, a one-way analysis of variance (ANOVA) was conducted in order to evaluate the relationship between exposure to education programs and fleet safety climate. To aid in this analysis, each respondent’s exposure level to driver education programs was categorised into four levels of exposure: no training; one day or less; two to four days; and five days or more. Each respondent’s total item score on the fleet safety scale was used as the dependent variable. The ANOVA was significant (f (3, 246) = 3.33, p = .02), with a positive relationship between perceived fleet safety climate and the number of training participation days. Specifically, employees who participated in no training had significantly lower safety climate perceptions (M = 3.12, SD = .66) than employees who participated in training for one day or less (M = 3.23, SD = .57), between two and four days (M = 3.41, SD = .67), and for five or more days (M = 3.55, SD = .48).

Third, a one-way ANOVA was performed on each of the four fleet safety climate factors in order to assess which aspects of fleet safety climate are related to driver education. The relationship between driver education and management commitment was significant (f (3, 274) = 2.84, p = .04). It was observed that employees who participated in no driver education had lower perceptions of management commitment than employees who were exposed to driver education programs. Similarly, the relationship between driver education program exposure and respondents’ perceptions of appropriateness of work demands was significant (f (3, 295) = 3.52, p = .02), that is, those who were exposed to driver education programs had higher levels of perceived appropriateness of work demands than employees who were not exposed to driver education programs. The relationship between exposure to driver education and trusting relationships and communication was also significant (f (3, 285) = 4.38, p = .01), that is, employees who participated in no driver education had lower perceptions of trusting relationships and communication in the workplace compared with employees who were exposed to driver education programs. In contrast, the relationship between exposure to driver education programs and perceived appropriateness of education and rules in the workplace was found to be not significant (f (3, 302) = 1.87, p = .14). The means and standard deviations for each of the fleet safety climate factors are presented in Table 2.

***INSERT TABLE 2 APPROXIMATELY HERE***
Discussion
Fleet safety climate factors
This study investigated the dimensions of fleet safety climate. Four factors emerged in the current analysis of the fleet safety scale. Items loading onto factor one related primarily to management commitment. For example, items with high loadings on this factor included “management is committed to driver safety” and “safety is an important part of fleet management”. This pattern is consistent with previous research using the Safety Climate Questionnaire – Modified for Drivers and the general safety climate literature.5,29

Items loading onto factor two related primarily to trusting relationships and communication at work. For example, items with high loadings on this factor included “good relationships exist” and “employees trust management”. In previous fleet safety climate research and general safety climate research, the themes of communication and relationships have emerged, although the item loadings suggested two separate factors.5,29 A potential explanation for this variation in loading could be that emergency services personnel felt that trusting and supportive relationships were a necessary basis to allow effective communication in relation to fleet safety issues. For example, because high-risk driving (including exceeding the speed limit and disobeying traffic signals) is a job component for some emergency services employees, they may consider both the quality of their relationships and the level of communication with management when deciding whether to express their safety concerns. Such perceptions may have influenced responses to items, including “safety problems are openly discussed”.

Factor three items related primarily to appropriate work demands. For example, items with high loadings on this factor included “sufficient thinking time” and “time schedules are realistic”. Work demands has emerged as a factor in previous fleet safety climate research.29 Similarly, the theme of work demands has appeared in safety climate research (including factors such as work pressure and workload).5,31

Items loading onto factor four related primarily to appropriateness of education and rules. For example, items with high loadings on this factor included “risks identified in driver education” and “rules are always practical”. The emergence of this factor in the present study is similar to other research. Rules and procedures have been identified as one of the most frequently occurring themes in safety climate research.32 Additionally, previous fleet safety climate research has identified the theme of education and rules, although the item loadings suggested two separate factors, specifically, driver training and safety rules.29 A potential explanation for this variation in loading could be that the emergency services personnel felt that there was a substantial overlap between the appropriateness of education and rules in relation to their work. In responding to emergency situations, personnel in the emergency services may be faced with unique and critical decisions that may challenge the appropriateness of both the training that they have received and the rules that they must adhere to.

The similarities between the present research findings and previous research suggest that some fleet safety climate factors, for example, management commitment, may be stable across different samples. Given the emergence of several factors, additional research is required to assess the generalisability of the fleet safety climate scale with regard to other samples. This scale may provide a generic questionnaire that is suitable for measuring factors that are relevant to many organisations (such as management’s commitment to fleet safety). Such measures may be used to identify potential fleet safety issues and to benchmark employees’ safety perceptions longitudinally or across organisations.
Relationship between exposure to driver education and fleet safety climate
As hypothesised, employees who participated in driver education programs had greater perceptions of fleet safety climate than employees who did not participate. This finding is consistent with research that was conducted on workers from another country who were employed in a different industry. The present study findings suggest that participation in driver education is positively related to fleet safety climate perceptions.

Relationship between training participation and fleet safety climate
Consistent with hypothesis three, driver education related to fleet safety climate factors in different ways. As hypothesised, employees who participated in driver education programs had greater perceptions of management’s commitment to fleet safety. It is suggested that this finding may reflect the fact that the provision of driver education could be perceived by employees as a sign of management’s commitment to fleet safety.

Perceptions of trusting relationships and communication were also greater for employees who participated in driver education programs. This finding may suggest that education sessions provided opportunities for greater fleet safety communication and trusting/supportive relationships to be developed.

Employees who participated in driver education programs had greater perceptions of the appropriateness of work demands compared with employees who did not participate. It is suggested that this finding may have been influenced by the content of the education material. In this study, the driver education provided to employees related primarily to controlling emergency vehicles. Therefore, when responding to work demand items such as “workload changes are handled without affecting safety”, employees who participated in the education program may have been better able to manage work demands if the education covered strategies such as controlling emergency vehicles when operating at high speeds.

Participation in driver education did not appear to be related to employees’ perceptions of the appropriateness of education and rules. It is suggested that this finding may also have been influenced by the fact that the content of the education material related primarily to controlling emergency vehicles. Employee perceptions regarding the appropriateness of education and rules remained relatively consistent across the education participation levels. It is anticipated that driver education may be related to employees’ perceptions of the appropriateness of education and rules in situations where the content of the education material outlines strategies for managing difficult situations. For example, education sessions could discuss how to manage an emergency situation where following these rules would conflict with standard practice.

Interpreting the relationships
When considering these findings, it is important to note that correlations merely indicate a statistical relationship and do not indicate cause and effect. Therefore, although it was observed that driver education was related to fleet safety climate, it is unclear whether participation in driver education programs influenced employees’ perceptions of fleet safety climate, or whether the current fleet safety climate influenced participation in driver education programs. This consideration also applies to interpretations of the relationship between driver education and the different fleet safety climate factors. Further research investigating the direction of these relationships is recommended.

In the present study, it was observed that the provision of annual driver education was associated with enhanced fleet safety climate. Furthermore, driver education appeared to be related in different ways to the different fleet safety climate factors. This has implications for accident prevention and education interventions. For example, the present findings suggest that driver education relating primarily to controlling vehicles...
may improve employees’ perceptions of management’s commitment to fleet safety, but
may not be related to changes in the perceived appropriateness of education and rules.

When reviewing these findings, it is important to note that drivers were exposed to broad
and multifaceted driver education programs. A limitation of studies of multifaceted driver
education programs is the inability to identify the successful components of the programs.
In this study, assumptions regarding the relationship of driver education and fleet safety
climate factors cannot be directly generalised to any specific type of intervention (such as
behind-the-wheel driver training or peer mentoring). A further limitation of this study was
the low response rate. Although a low response rate was anticipated (due to the
questionnaire distribution process) and the sample encompassed the full range of ages,
years of driving, work locations and clinical training levels from within the organisation,
caution should be taken when interpreting the results as it is unclear if the sample of
drivers who responded to the questionnaire differed from the non-responding drivers in
any meaningful way.

**Conclusion**

Given the substantial ongoing social and financial costs of work-related motor vehicle
accidents, there is a need to develop and refine measures that can be used as indicators
of potential fleet safety risks. The findings from the present study indicate that the fleet
safety climate scale can be a useful organisational measure. This measure may be used
to identify where safety enhancements are required and to benchmark safety
perceptions. As the factors identified in this study are similar, but not identical, to factors
which have emerged in previous research using this scale, additional research is
recommended to assess the generalisability of the scale.

Finally, the findings of the present study suggest that, within the context of an Australian
emergency services fleet, driver education is related to fleet safety climate and the driver
education programs appear to be related in different ways to fleet safety climate factors.
The findings also suggest that the provision of annual fleet driver education was
associated with enhanced fleet safety climate. More specifically, the provision of driver
education programs may increase employees’ perceptions in relation to management’s
commitment to fleet safety, work relationships, and control over work pressures. Further
research investigating the direction of these relationships is recommended to inform the
development of OHS interventions.
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### TABLE 1
**Percentage of variance and factor loadings**

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management’s commitment to driver safety</td>
<td></td>
<td>.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective documentation of management system</td>
<td></td>
<td>.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety is important part of fleet management</td>
<td></td>
<td>.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety is central to management’s values</td>
<td></td>
<td>.69</td>
<td></td>
<td></td>
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<tr>
<td>Safety procedures are comprehensive</td>
<td></td>
<td></td>
<td>.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management is committed to safety</td>
<td></td>
<td>.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety policies are communicated</td>
<td></td>
<td>.64</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Employees are informed of changes</td>
<td></td>
<td>.56</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Co-worker support is encouraged</td>
<td></td>
<td>.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedures match practice</td>
<td></td>
<td>.53</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Relevant procedure for each job</td>
<td></td>
<td>.47</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Confident about future with organisation</td>
<td></td>
<td></td>
<td>.75</td>
<td></td>
<td></td>
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<tr>
<td>Good relationships exist</td>
<td></td>
<td></td>
<td></td>
<td>.75</td>
<td></td>
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<tr>
<td>Employees trust management</td>
<td></td>
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<td></td>
<td>.73</td>
</tr>
<tr>
<td>Management trusts employees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.73</td>
</tr>
<tr>
<td>Good morale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.66</td>
</tr>
<tr>
<td>Safety problems are openly discussed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.60</td>
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<tr>
<td>Consulted when changes are made</td>
<td></td>
<td>.40</td>
<td>.55</td>
<td></td>
<td></td>
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<tr>
<td>Discuss safety policy issues</td>
<td></td>
<td>.45</td>
<td>.54</td>
<td></td>
<td></td>
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<tr>
<td>Changes in procedures are communicated</td>
<td></td>
<td>.49</td>
<td>.54</td>
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<tr>
<td>Consulted for suggested improvements</td>
<td></td>
<td>.42</td>
<td>.51</td>
<td></td>
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<tr>
<td>Express safety views to management</td>
<td></td>
<td>.45</td>
<td>.50</td>
<td></td>
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<tr>
<td>Sufficient “thinking time”</td>
<td></td>
<td></td>
<td></td>
<td>.78</td>
<td></td>
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<tr>
<td>Time schedules are realistic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.76</td>
</tr>
<tr>
<td>Enough time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.65</td>
</tr>
<tr>
<td>Balanced work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.65</td>
</tr>
<tr>
<td>Enough employees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.64</td>
</tr>
<tr>
<td>Workload changes are handled without affecting safety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.62</td>
</tr>
<tr>
<td>Problems are handled without affecting safety</td>
<td></td>
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<td></td>
<td>.61</td>
</tr>
<tr>
<td>Risks are identified in driver training</td>
<td></td>
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<td>.71</td>
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<tr>
<td>Training is carried out by people with experience</td>
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<td>.68</td>
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<tr>
<td>Rules are followed when conflict with practice</td>
<td></td>
<td>.41</td>
<td>.59</td>
<td></td>
<td></td>
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<tr>
<td>Rules are always practical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.57</td>
</tr>
<tr>
<td>Work vehicle-specific training is provided</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.51</td>
</tr>
<tr>
<td>Rules are followed when rushed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.50</td>
</tr>
</tbody>
</table>

*Note: items with factor loading correlations of less than .4 are suppressed.*
<table>
<thead>
<tr>
<th>Safety Climate Factor</th>
<th>No training</th>
<th>&gt; 1 day</th>
<th>2–4 days</th>
<th>&gt; 5 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management commitment</td>
<td>3.03</td>
<td>3.18</td>
<td>3.36</td>
<td>3.45</td>
</tr>
<tr>
<td>(SD = .78)</td>
<td>(SD = .65)</td>
<td>(SD = .79)</td>
<td>(SD = .50)</td>
<td></td>
</tr>
<tr>
<td>Trusting relationships and communication</td>
<td>2.49</td>
<td>2.66</td>
<td>2.78</td>
<td>3.14</td>
</tr>
<tr>
<td>(SD = .73)</td>
<td>(SD = .67)</td>
<td>(SD = .81)</td>
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