

## All Aboard: Gender Diversity and Safety Culture on the Track

Julia Leone<sup>1</sup> , Samantha Lacey<sup>2</sup> , and Janet Barnes-Farrell<sup>2</sup> 

Transportation Research Record  
1–11

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DOI: 10.1177/03611981231176809

journals.sagepub.com/home/trr



### Abstract

Women have been historically underrepresented in both craft and management positions in the U.S. rail industry. Identified as one of the industry's top workforce challenges, the present study provides a more detailed view of gender diversity in rail transportation, and how factors such as gender and management status interact to affect perceptions of safety culture in a sample of U.S. short line and regional railroads ( $N_{\text{railroads}} = 23$ ,  $N_{\text{railroaders}} = 1,239$ ). The results suggested that women tended to be older than men, have more education, and were more likely to be employed at larger organizations. Despite being employed in the railroad industry for fewer years than men, women in our sample were also more likely to be managers. With regard to safety culture, managers had more positive perceptions than craft employees, and female craft employees had more positive perceptions than male craft employees. Implications for the industry and avenues for future research and implementation are discussed.

### Keywords

rail, train, sustainability and resilience, transportation and society, women's issues in transportation, gender and women

The U.S. railroad industry faces a variety of workforce challenges including work–life balance issues, an aging workforce, retirement rates, and attracting a new population of railroaders (1). One of the longest standing challenges for railroads and the transportation industry at large, however, is workforce diversity, specifically with regard to gender. According to the U.S. Bureau of Labor Statistics (BLS) (2), women accounted for only 7.4% of all workers employed in rail transportation in 2020; the lowest percentage of women employed in any transit-related occupation. Despite more recent efforts to diversify the workforce, the rail industry acknowledges that it has a long way to go before becoming representative of the overall U.S. demographic (3), and more work needs to be carried out to better understand how to effectively attract, retain, and advance female workers (4, 5). As these efforts continue and gender diversity gradually improves in the rail industry (5), it also becomes increasingly important for leaders to understand the implications of these changes and how gender might influence critical outcomes such as rail safety.

Safety and safety culture are top priorities in the rail industry (6). A strong organizational safety culture, or the extent to which safety is prioritized over competing

goals (6), has been shown to be closely tied to and positively affect safety-related outcomes such as safe work behaviors, accidents, and injuries (7). Organizational leaders are known to play an essential role in the development and maintenance of a strong safety culture (6, 8)—effectively ensuring employees can “fully commit themselves to making safety their highest priority and be dedicated to safety in all aspects of their work” (p. 1) (6). Perceptions of safety culture, however, have been shown to vary both between and oftentimes within organizations. Management status and gender are two such factors that may differentially affect people's safety culture perceptions.

Many studies, both in rail and beyond, have shown that managers tend to have more positive safety culture perceptions than employees (9–11). This variation has

<sup>1</sup>Research and Organizational Development, Short Line Safety Institute, Washington, DC

<sup>2</sup>Department of Psychological Sciences, University of Connecticut, Storrs, CT

### Corresponding Author:

Julia Leone, [julia.leone@shortlinesafety.org](mailto:julia.leone@shortlinesafety.org)

often been explained by differences in daily work demands and experiences (12, 13). There is also some limited evidence to suggest that women tend to have more positive safety culture perceptions than men (14–17). This variation has been suggested to stem from gender differences in sensitivity to safety issues and risk aversion (15, 18), and in the types of jobs men and women tend to assume (16, 19). Most of this work, however, has been conducted with samples from outside the U.S. and, none to our knowledge has been conducted in the rail industry or has considered the potential for gender to interact with management status to affect safety culture perceptions. Research examining factors that affect such perceptions traditionally examine only one factor at a time; essentially ignoring the potential for factors to interact in some interesting way that provides additional context or more actionable insights. Understanding how gender and management status interact to affect such a critical outcome such as safety culture, which is so closely tied to rail safety, is needed so that we may be better prepared to support the recruitment and advancement of female railroaders both now and in the future.

Archival data collected by the Short Line Safety Institute (SLSI) from workers employed at a variety of short line and regional railroads across the U.S. are utilized in the current study to further explore gender diversity in the rail industry and to investigate if and how employee gender and management status interact to affect safety culture perceptions. The SLSI is a non-profit organization with a mission to improve the safety and safety culture in short line and regional railroads. It provides resources such as confidential and non-punitive safety culture assessments, hazardous materials training and exercises, leadership development training, and online resources and templates free of charge to any interested railroad. The SLSI also has the most robust model for assessing safety culture in the U.S. railroad industry (20), and is able to provide its services via a partnership with the Federal Railroad Administration's (FRA) Office of Research, Development and Technology (RD&T). Thus, in addition to contributing to research to better understand gender diversity, one of rail's longest standing challenges (21), and the implications for safety culture, one of rail's top priorities, this work can be used by the SLSI to identify opportunities for improvement in railroad safety and safety culture, and to guide the SLSI's development and future implementation of safety culture resources and materials, as well as diversity-oriented recruitment programs and tactics.

### Safety Culture in the Rail Industry

The U.S. Department of Transportation Safety Council defines safety culture as “the shared values, actions, and

behaviors that show a commitment to safety over competing goals and demands” (p. 2) (6). The more people's attitudes, behaviors, and organizational policies align to prioritize safety over competing demands, the stronger an organization's safety culture is said to be. In transportation and beyond, research consistently demonstrates that a strong safety culture has profoundly positive effects on important safety outcomes; namely, less frequent and severe accidents and incidents, and fewer fatal and non-fatal injuries among the public and employees (6, 22, 23). These implications can further extend to a reduction in environmental and property damage, as well as days, wages, and productivity lost owing to injury. Given the importance of safety in rail transportation, building and maintaining strong safety cultures are a top priority (6).

### Gender Diversity in the Rail Industry

Workforce diversity, specifically with regard to gender, has been continually identified by FRA as a top five workforce development challenge for the rail industry (1, 3, 24, 25). Women have been historically underrepresented in rail as well as transportation more generally. In 2020, women accounted for 24.1% of all workers employed in transportation (2). The only other industries that had even lower female representation were mining (14.5%) and construction (10.9%). Within the transportation industry itself, rail had the least female representation, with women accounting for a mere 7.4% of all workers (2). Although gender breakdowns by job types were made available by the BLS in 2021 (26), a breakdown was only available for locomotive engineers and operators, showing that 3.8% of this group was female. Gender breakdowns were not available for any other job type (i.e., railroad conductors and yardmaster, other rail transportation workers).

In addition to being severely underrepresented in rail and transportation as a whole, women have also been outnumbered in transit leadership positions (21). In 2021, women accounted for 24.3% of supervisors of transportation and material moving workers (26). Alexander (4) cites a variety of other work to suggest that women hold anywhere from 11% to 21% of corporate management and supervisory transit roles (27–29). More specific to rail, research from the Community of European Railway and Infrastructure Companies (CER) suggested that among their sample of 887,300 European railroaders, 19% were reportedly women in managerial positions (30). Most of these female managers were mid-level (20%), followed by team leaders (18.4%) and top-level management (18.3%). Comparing their 2013 and 2014 assessment results, the CER showed an overall positive trend, however, with women in managerial positions having increased by 1.1% (30). Although this increase in

female representation in management was promising, it corroborated previous work documenting a glass ceiling effect, or a decrease in female representation toward the top; (31–33) an effect so pervasive in transportation that programs such as the Women’s Transportation Seminar have specifically been created to combat it (4).

Given the limited amount of detailed demographic data available specifically for the U.S. rail industry, the present study poses the following questions:

*Research Question 1a:* What does gender diversity generally look like in the U.S. rail industry?

*Research Question 1b:* What differences, if any, are there in railroad worker demographic characteristics (e.g., age, race, education, management status, etc.) by gender?

### **Why Is Gender Diversity Important for the Future of the Rail Industry?**

As of June 2022, the U.S. labor force participation rate for women (ages 16 + ) was 56.8% (34). That said, however, the percentage of women working in rail is far lower than the percentage of women currently participating in the labor force (4). Knowing that these women are highly educated—earning the majority of the degrees awarded in higher education today (35)—and that older railroaders are increasingly exiting the workforce, “women present an undertapped resource that can be used to fill available positions within in the transit industry; organizations cannot afford to ignore half of their potential workforce” (p. 3) (4).

### ***Gender Diversity Is Important for Occupational Well-Being***

Research suggests that gender diversity has a variety of benefits for organizations and their employees. For male-dominated organizations, much like those in rail, increased gender diversity has been shown to have a positive impact on the occupational well-being of both men and women. Occupational well-being relates to “employees feeling they are free from harmful experiences on the job; a good fit for the job and the organization; and physically, mentally, and financially well” (p. 56) (36). In male-dominated industries, both male and female managers (37), and men and women more generally (38), have been found to have poorer mental and physical health. Women have also been found to experience higher levels of stress (37), and men have a proclivity to return to work sooner after injury—posing a major health and safety risk (39). Altogether, it is clear that *all* can serve to benefit from increased gender diversity in male-dominated organizations. Given the overall lack of

female representation in rail, increased gender diversity could be especially impactful for this industry.

### ***Gender Diversity Is Important for Organizational Performance***

Gender diversity in management teams might soon become a key asset to the rail industry, as a vastly experienced generation of railroaders begins to exit the workforce and organizations scramble to adapt and thrive in an ever-changing work environment. According to upper echelon theory (40), the demographic characteristics of top management can have a significant effect on firm performance. Although there is “potential for conflict within diverse management teams” (p. 121) (41), studies show that the benefits often outweigh the costs. Outside the transportation sector, for example, previous research has found that female representation at the top was important for organizational performance, measured as return on asset over a three-year period (42). Other work has established a relationship between the general diversity of organizations’ management teams and innovation; such that, higher levels of diversity were associated with greater innovation revenue (43). Even more motivating, it was found that women in leadership were especially essential for this relationship: at least 20% of an organization’s management team needed to be female for diversity to make an impact on innovation performance (43). Similar results have been uncovered in a study that found that the presence of more women in the boardroom could improve women’s individual experiences and contributions on the board (44). Taken together, it has been supported that “a critical mass of diverse perspectives—not simply tokenism—is required for an organization to derive benefits” from gender diversity (45) With such little gender diversity in the rail industry today, such a finding should motivate organizations to enhance the quality of their recruitment and advancement strategies for female workers.

### ***Gender Diversity Is Important for Environmental and Social Responsibility***

Gender diversity is also becoming particularly important for the future of railroads and their environmental and social responsibility. A recent study in the transportation sector, for example, has shown that diversity among board members is critical for corporate social responsibility performance, or the sector’s commitment to eco-friendly practices that help sustain the economic, environmental, and social well-being of society and the planet (46). Similar findings have been reported in studies with workers from the broader industrial sector, in which women have also been traditionally underrepresented.

For example, in a qualitative study including supply chain managers and consultants, gender diversity at both managerial and operational levels was found to lead to more socially responsible, sustainable decisions (47). Given the FRA's firm commitment to reducing the transportation sector's emissions (48), these results support efforts to enhance gender diversity in management.

### **Gender Diversity Is Important for Safety and Safety Culture**

The present study proposes that gender diversity may have important implications for railroad safety and safety culture. Although no work to our knowledge currently exists relating to the effects of gender on safety/safety culture in railroads specifically, there is some limited evidence from research conducted with workers employed in other safety critical industries (i.e., aviation, manufacturing) outside the U.S. to suggest that women tend to have more positive safety culture perceptions and are involved in fewer safety-related accidents than men. The results of these studies are detailed in the following section, along with more explicit implications of what these differences could mean for railroad safety culture and gender diversification efforts.

### **Safety Culture Perceptions Can Vary**

#### ***Safety Culture Perceptions by Management Status***

There is much research to suggest that safety culture perceptions may vary both between and within organizations (49). For example, it has been well established that safety culture perceptions can vary between departments (50), work groups (51), hierarchical positions and work environments (11), and even between individuals who have/have not been involved in safety-related accidents (52). One factor that has received extensive attention, and has become particularly important for the SLSI to consider when evaluating safety culture perceptions in short line and regional railroads (the sample included in the present study), is management status.

Similar to the results of previous research examining differences across hierarchical positions (11, 53–55), managers and craft employees in the railroads that the SLSI serves tend to have different perceptions of their organization's safety culture. Namely, managers generally have higher, more positive safety culture perceptions than craft employees do (9, 10). Differences in perceptions have been attributed to differences in managers' and craft employees' daily work demands and experiences (12, 13), and in their understanding and response to psychological measures of safety culture (55). Such variations, however, can lead to unmet expectations and miscommunications (51, 56)—an issue that may soon become increasingly

problematic as older, more experienced employees begin to exit the workforce and a new, potentially more diverse labor force enters the industry (3).

Based on previous research conducted both in the rail industry and beyond, the current study poses the following questions:

*Research Question 2a:* Do perceptions of safety culture vary by management status in the current sample?

*Research Question 2b:* If so, are these perceptual differences in line with previous research, such that managers have more positive perceptions of safety culture than craft employees do?

#### ***Safety Culture Perceptions by Gender***

There are a variety of positive implications that may come along with a more diverse labor force, particularly with regard to gender. Aforementioned, for example, greater workforce gender diversity can positively affect the occupational well-being of all workers across an organization regardless of gender, and increased gender representation in management can positively affect organizational performance, innovation, and lead to more socially responsible, sustainable decisions. Furthermore, a handful of studies suggest that gender may be another factor, like management status, that can affect safety culture perceptions.

In a sample of Ghanaian industrial workers, for example, women were found to have more positive perceptions of workplace safety, were more compliant with safety management procedures, and were involved in fewer accidents than men (16). The authors drew on theories of job congruence and person–environment fit to explain that these findings could be the result of gender differences in the types of jobs and specific job attributes that men and women pursue/are assigned to (i.e., less physically demanding roles with fewer workplace hazards) (16). Additionally, they cited previous research (18) establishing that women tend to be more risk averse than men; namely, they tend to judge situations as more unsafe, better grasp the severity of negative outcomes and actively try to avoid them. Similar conclusions and explanations were reported in a sample of Norwegian air traffic controllers (15) and manufacturing workers in China (16). In this latter sample, however, researchers were unable to support previous work (16) that showed gender differences in safety performance (17).

Finally, work has examined how gender affects specific safety culture dimensions (14). In a sample of workers from five Saudi Arabian factories, gender differences were revealed on dimensions related to commitment to safety, prioritizing safety and caution, such that women

tended to have higher scores than men. In Saudi Arabia, however, the authors stressed that labor laws limit women's involvement in higher-risk environments; as such, the women sampled were mainly employed in industries that were considered lower-risk (i.e., food processing) (14). They also reported, however, that despite this caveat, the types of occupational health problems men and women experienced as a result of on-the-job hazards differed; specifically, women were more susceptible to ergonomic problems than men.

Taken together, although limited and conducted outside of the U.S. and the rail industry, the existing literature has been consistent in its finding that women in other safety-critical industries tend to have higher safety culture perceptions than men, and that these disparities may be explained by differences in men and women's sensitivity to safety issues, risk aversion, and in the types of jobs that they traditionally assume. With this said, the present study extends the existing literature and poses the following questions:

*Research Question 3a:* Do perceptions of safety culture vary by gender in the current sample?

*Research Question 3b:* If so, are these perceptual differences in line with previous research, such that women have more positive perceptions of safety culture than men do?

Explorations of if, where, and why there are gender differences in safety culture perceptions and related safety outcomes are particularly important for the future of the rail industry, as they could serve to better inform the design of jobs and recruitment strategies that attract, retain and advance more qualified women to/in the industry.

### **Safety Culture Perceptions by Gender and Management Status**

Research examining factors affecting safety culture perceptions tends to only examine the effect of one factor at a time; essentially ignoring the potential for factors to interact in a way that provides additional context or more actionable insights. No previous research to our knowledge has probed for an interactive effect between gender and management status on safety culture perceptions—an effect that may provide timely insights for the rail industry as it works to increase its workforce and management gender diversity. Given that management status and gender might both be meaningful factors that affect safety culture perceptions in the rail industry, the following questions are posed:

*Research Question 4a:* Is there an interaction between gender and management status on safety culture

perceptions? In other words, does the effect of a worker's gender on their perceptions of their organization's safety culture depend on whether or not they are a manager or a craft employee?

*Research Question 4b:* If so, what are the nature of these effects?

## **Method**

### **Participants**

Archival survey data collected from workers employed at 23 short line and regional railroads geographically dispersed throughout the U.S. were included in this study. Employees at these railroads were surveyed between May 2016 and June 2018, and their participation in this survey was voluntary and not compensated. This sample was taken from a larger archival dataset that includes surveys completed by employees of 67 short line and regional railroads who were surveyed between May 2016 and May 2022 as part of the SLSI's safety culture assessments conducted for those railroads. The sample of railroads included in this study was selected according to the availability of self-reported demographic information (i.e., age, race, education, job/organization/railroad industry tenure, management status). Demographics were only collected for railroads with rosters of 25 or more employees. Several of the demographics measured in this survey were removed or modified after June 2018; thus, survey data collected from railroads after this date were not included.

In total, 1,621 workers from 23 short line and regional railroads with rosters of 25 or more employees agreed to participate. Only those who provided their gender (male or female), current management status (manager or craft employee), and responded to at least half of the safety culture survey questions were included in analyses for the present study. This decreased the total sample size to 1,239 ( $N_{\text{craft employee}} = 814$ ,  $N_{\text{manager}} = 425$ ). In line with rail industry trends, 89.9% of the workers in the overall sample self-identified as male ( $N_{\text{male}} = 1,113$ ,  $N_{\text{female}} = 126$ ). Women only accounted for 7.7% of craft employees ( $N_{\text{male craft employee}} = 751$ ,  $N_{\text{female craft employee}} = 63$ ) and 14.8% of rail management ( $N_{\text{male manager}} = 362$ ,  $N_{\text{female manager}} = 63$ ). The average number of self-identified females per railroad was five, but ranged from zero to 69, and the average number of self-reported males per railroad was 48 but ranged from 10 to 226. Six of the 23 railroads had no self-reported female craft employees, and nine of the 23 railroads had no self-reported female managers.

The majority of participants (68%) were employed at larger organizations with over 100 employees. The average age of railroaders in our sample was 42 years, and the most common level of education attained was some college or technical vocational schooling. Nearly 80% of

**Table 1.** Demographic Characteristics of Railroad Participants by Gender

Gender	Male		Female		Total	
	<i>n</i>	Mean (SD)/%	<i>N</i>	Mean (SD)/%	<i>n</i>	Mean (SD)/%
Age (in years) <sup>a</sup>	1,029	41.55 (11.55)	115	45.19 (12.40)	1,144	41.92 (11.69)
Race					1,204	100%
White, European decent	857	88.5%	94	87.9%	951	88.5%
Black, African American, African American Indian, Alaska Native	39	4.0%	2	1.9%	41	3.8%
Asian, Asian American	16	1.7%	3	2.8%	19	1.8%
Hispanic, Latino/a	6	0.6%	3	2.8%	9	0.8%
Hispanic, Latino/a	50	5.2%	5	4.7%	55	5.1%
Highest Educational Level <sup>a</sup>					1,194	100%
Some high school	20	1.9%	2	1.7%	22	1.8%
High school graduate (or GED)	327	30.5%	12	9.9%	339	28.4%
Some college (or technical vocational school)	391	36.4%	29	24.0%	420	35.2%
Two-year college degree (Associate's)	130	12.1%	22	18.2%	152	12.7%
Four-year college degree (Bachelor's)	177	16.5%	42	34.7%	219	18.3%
Graduate degree or beyond (Master's, MBA, PhD, MD, Lawyer)	28	2.6%	14	11.6%	42	3.5%
Job Tenure (in years)	963	7.45 (7.68)	106	7.25 (7.65)	1,069	7.43 (7.67)
Organization Tenure (in years)	973	10.40 (9.05)	106	9.60 (8.07)	1,079	10.31 (8.95)
Railroad Tenure (in years) <sup>a</sup>	976	12.93 (10.28)	106	10.88 (9.00)	1,082	12.73 (10.18)
Management Status <sup>a</sup>					1,239	100%
Craft Employee	751	67.5%	63	50.0%	814	65.7%
Manager	362	32.5%	63	50.0%	425	34.3%
Organizational Size <sup>a</sup>					1,239	100%
Small/medium (25-99)	376	33.8%	22	17.5%	398	32.1%
Large/XL (100 + )	737	66.2%	104	82.5%	841	67.9%

Note. SD = standard deviation; GED = general educational development. Sample sizes may vary as survey participation was voluntary. All demographics were self-reported by participants.

<sup>a</sup>Indicates a significant difference between male and female railroad participants ( $p < .05$ ).

our sample was white and, on average, reported having been in their current job for seven years, with their organization for 10 years, and in the railroad industry for 13 years. Sample demographics are reported in Table 1.

### Procedure

An anonymous survey designed to measure safety culture in short line and regional railroads was distributed to railroads that participated in the SLSI's safety culture assessment between May 2016 and June 2018. The survey was presented using the Qualtrics platform and took approximately 30 min to complete. To maximize participant confidentiality, data collection and analysis was managed by a team at the University of Connecticut, in partnership with the SLSI.

### Measures

**Gender.** Participants were asked to indicate their gender by selecting the choice that best applied to them in a dichotomous item on the survey (male or female).

**Management Status.** Participants were asked to indicate their current management status by selecting the category that best applied to them (manager, craft employee, prefer not to respond). It should be noted that those who selected "prefer not to respond" were treated the same as those who opted not to respond to this question and were excluded from present study's analyses.

**Safety Culture Perceptions.** Safety culture perceptions were measured using a 78-item survey developed, evaluated, and implemented by the SLSI for use in U.S. short line and regional railroads. This 78-item survey tool is organized into nine key scales (3–19 items per scale): Continuous Improvement, Coworker Safety/Helping Behaviors, Formal Safety Indicators, Individual Safety Behaviors, Management Commitment to Safety, Organizational Commitment to Safety, Risk-Taking Behavior, Safety Communications, and Training Quality. These scales were designed to measure different, key aspects of safety culture that have been empirically shown to be related to one or more safety-relevant outcomes in the transportation industry. The survey is used by the SLSI as a diagnostic tool that, together with other methods of assessment, help identify strengths and gaps

in a railroad's safety culture. The reliability coefficient ( $\alpha$ ) for the nine safety culture survey scales as a whole is 0.93, demonstrating strong reliability for the overall survey instrument. The internal consistency of the individual subscales is similarly strong, ranging from 0.81 to 0.95.

All survey items were scored on a 1–5 Agree/Disagree scale, in which 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = Strongly Agree. Survey scale scores were averaged for each participant to represent their average safety culture perceptions. A participant's average perception of their railroad's safety culture can be interpreted/described according to the following criteria: 1–2.99 = poor; 3.00–3.99 = moderate (ok/acceptable/adequate), with room for improvement; 4.00–4.49 = positive/good/well; 4.50–5.00 = highly/very good.

### Data Analysis

All analyses were carried performed using SPSS Statistics 28. A series of one-way analysis of variance (ANOVA) and chi-square tests explored if there were any significant differences between genders on demographic variables included in the survey. A univariate analysis tested the interaction between gender and management status on safety culture perceptions. If statistically significant differences are observed, additional analyses will be conducted to explore if the subscales that comprise safety culture scores are diagnostic of where the observed differences lie.

## Results

### Gender Differences on Demographic Variables

No significant differences were observed between men and women as regards race, job, and organization tenure ( $ps > 0.05$ ). Significant mean differences were observed between males and females as regards age ( $F(1, 1142) = 10.10, p = 0.002$ ), education ( $\chi^2(5, N = 1,194) = 68.66, p < .001$ ), organizational size ( $\chi^2(1, N = 1,239) = 13.83, p < .001$ ), railroad industry tenure ( $F(1, 1080) = 3.88, p = 0.049$ ), and management status ( $\chi^2(1, N = 1,239) = 15.34, p < .001$ ). Women tended to be older than men ( $M_{\text{female}} = 45.19, SD = 12.40$ ;  $M_{\text{male}} = 41.55, SD = 11.55$ ) and were more likely to be employed at larger organizations (82.5% of women versus 66.2% of men). Compared to men who most commonly reported having some college or technical vocational schooling (34.4%), women most commonly reported having a Bachelor's degree (34.7%). Despite being employed in the railroad industry for fewer years than men ( $M_{\text{female}} = 10.88, SD = 9.00$ ;  $M_{\text{male}} = 12.93, SD = 10.28$ ), women were more likely to be managers



**Figure 1.** Effect of gender on safety culture perceptions by management status.

(50.0% of women versus 32.5% of men). It is important to recall, however, that women only accounted for 14.8% of management, and nine of the 23 railroads had no self-reported female managers.

### Interaction Effect of Gender and Management Status on Safety Culture Perceptions

There was a statistically significant main effect of management status ( $F(1, 1235) = 22.73, p < 0.001$ ), however, with managers ( $M = 4.05, SD = 0.51$ ) tending to perceive safety culture more positively than craft employees ( $M = 3.68, SD = 0.63$ ), on average. There was no significant main effect of gender on safety culture perceptions ( $p = .683$ ); men and women tended to have similar average safety culture perceptions ( $M_{\text{female}} = 3.89, SD = 0.52$ ;  $M_{\text{male}} = 3.80, SD = 0.63$ ). Finally, there was a statistically significant interaction between gender and management status on safety culture perceptions ( $F(1, 1235) = 6.37, p = 0.012$ ; Figure 1). A test of simple effects determined that the effect of gender on safety culture perceptions was significant for craft employees ( $F(1, 1235) = 4.48, p = 0.035$ ) but not managers ( $F(1, 1235) = 2.15, p = 0.143$ ). That said, female craft employees ( $M = 3.83, SD = 0.53$ ) tended to have higher, more positive perceptions of safety culture, on average, than male craft employees ( $M = 3.66, SD = 0.64$ ).

### Supplemental Analyses

In light of this statistically significant interaction effect, additional analyses were conducted to explore what

might be driving the difference observed between male and female craft employees in their average safety culture perceptions. Aforementioned, safety culture scores were computed by averaging scores across nine safety culture scales: Continuous Improvement, Coworker Safety/Helping Behaviors, Formal Safety Indicators, Individual Safety Behaviors, Management Commitment to Safety, Organizational Commitment to Safety, Risk-Taking Behavior, Safety Communications, and Training Quality. A series of ANOVAs was used to identify what safety culture scales exhibited significant differences between male and female craft employees. The results of these analyses suggested that the difference observed was driven primarily by differences between male and female craft employees on two of the safety culture scales: Continuous Improvement ( $F(1, 808) = 5.92, p = 0.015$ ) and Risk-Taking Behavior ( $F(1, 797) = 14.95, p < 0.001$ ).

According to SLSI, Continuous Improvement constitutes employee perceptions of a railroad's engagement in ongoing, iterative correction of safety issues, while Risk-Taking Behavior constitutes employee perceptions of their own engagement in behaviors that could increase risk of accidents and injuries (note: higher scores on the Risk-Taking Behavior scale were indicative of less risky behaviors). On average, female craft employees ( $M = 3.75, SD = 0.69$ ) tended to have higher, more positive perceptions of their railroad's commitment to continuous safety improvement than male craft employees ( $M = 3.51, SD = 0.74$ ). Female craft employees ( $M = 4.59, SD = 0.65$ ) were also more likely to report engaging in fewer risk-taking behaviors than male craft employees ( $M = 4.12, SD = 0.93$ ). The implications of these findings are discussed further in the following section.

## Discussion

Results from this study are consistent with and extend the limitedly available industry-wide data related to workforce and management gender diversity in rail transportation (30, 34). In a sample of U.S. short line and regional railroads, we found that women accounted for 10.2% of our overall sample: 7.7% of craft employees and 14.8% of management. Although the percentage of female railroaders is increasing over time and recruitment efforts targeting women are in effect, such as female youth mentoring programs, engaging with community colleges and universities, and advertising jobs on specific websites (4, 57), results of this study highlight the continuous severe underrepresentation of women in the industry. Further contributing to lacking rail industry statistics related to gender diversity, our study found that women tended to be slightly older and more educated than men,

were more likely to be employed at a larger organization, and even though they tended to be employed in the industry for fewer years than men, were more likely to be in management positions.

Although we find it encouraging that half of the women in our sample were in management positions, we cannot overlook that women only accounted for 14.8% of management in our sample, and that there were no self-reported female managers in nine of the 23 railroads. With this said, a limitation of our current survey is the non-response bias produced by 24% of people who declined to provide their gender or management information, or who did not consent and/or complete 50% of the safety culture survey. Those who did not provide this information or respond to the survey may represent a particular group that could provide more insight into this issue of gender diversity in the rail industry. Rather than rely on self-report data, future research could collect human resources data to more accurately capture the gender composition of these railroads, as well as quell any concerns related to self-identification. In addition, future research should also look to collect this basic demographic information in broader samples (e.g., Class 1 and commuter railroads; aviation, trucking, etc.), as the present study's data were limited to a sample of railroaders employed in U.S. short line and regional railroads and may not be generalizable to those employed in the broader rail or transportation industry. Collecting this information in broader samples would allow us to capture a more detailed demographic snapshot of the transportation landscape and have a benchmark for future demographic comparisons.

Consistent with previous research, our study showed that managers tended to perceive safety culture more positively than craft employees (9–11). Our research, however, was not able to fully support the seemingly consistent, yet limited research related to gender differences in safety culture perceptions (14–17). In our sample, male and female railroaders tended to have similar overall safety culture perceptions; that is, until we took management status into account. Specifically, we found that the effect of a worker's gender on their perceptions of their organization's safety culture depended on whether or not they were a manager or a craft employee. Female craft employees were revealed to have more positive safety culture perceptions than male craft employees, but no differences in gender were seen between male and female managers. This is significant because without testing for an interaction between gender and management status on safety culture perceptions, no gender differences would have been detected. The safety culture survey used in this current study assessed nine different aspects of safety culture and allowed us to take a closer look into the specific safety culture dimensions that were driving



differences between male and female craft employees. Differences on two particular safety culture dimensions were identified: Continuous Improvement and Risk-Taking Behavior. Compared to male craft employees, female craft employees tended to have more positive perceptions of their railroad's commitment to continuous safety improvement and were more likely to report engaging in fewer risk-taking behaviors. This aligns with previous research which suggests that women tend to be more sensitive to safety issues and more risk averse than men.

When considering these results, it is important to keep in mind that job type (i.e., train yard and engine, mechanical, maintenance of way, administrative/other) and management level (i.e., administrative, middle management, senior leadership) could not be ascertained from the current survey. Therefore, findings are limited to only self-reported management status and gender identification. Understanding which job types and management levels are and are not currently held by women in the rail industry could not only help better explain this study's findings but also help tailor future recruiting efforts. If, for example, male and female craft employees systematically tend to perform different types of jobs (i.e., if women tend to be employed in support/administrative roles and men tend to perform more of the boots on the ground/operational roles in which safety culture is more relevant), this could help explain why the female craft employees in our sample tended to have higher, more positive perceptions of safety culture than male craft employees. In addition, it could point to a need for increased gender diversity not only within railroads but also within particular job types. Ensuring female representation across different job types is important for showing the railroad as a career destination for women as well as helping women visualize their advancement within the industry.

Future research studies should aim to take job types and management levels into account, as well as consider how increasing gender diversity within a male-dominated work environment affects organizational safety culture and its safety-related outcomes. For example, what is the effect of adding one or multiple women to a male-dominated craft employee or management team? How do these changes affect safety and safety culture both within the team and within the organization? Answers to such questions may better prepare the industry to diversify its workforce and maintain positive safety cultures.

Limitations of this study aside, management and senior leadership should be cognizant that perceptions of safety culture can differ. In this study, we showed that management and craft employees as well as male and female craft employees differed in their safety culture perceptions; with management having higher, more

positive perceptions than craft employees, and female craft employees having higher, more positive perceptions than male craft employees. This can be addressed in a broader railroad management training program. A training program that educates managers on how to be the most effective safety leaders includes teaching them clear and concise communication skills, which can be tailored to their various employees. Clear communication can help promote the railroad's safety vision, with the goal of having all employees possessing the same, positive view of their railroad's safety culture.

## Conclusions

Our study contributes to the understanding of the U.S. short line and regional railroad industry's current workforce demography and factors that affect safety culture. Continued research studies and data collection focused on women and gender issues will help keep safety, gender diversity, and equality at the forefront of the railroad industry.

## Acknowledgment

The Short Line Safety Institute and the University of Connecticut would like to thank the Federal Railroad Administration's (FRA) Office of Research, Development and Technology (RD&T) for their partnership and support.

## Author Contributions

The authors confirm contribution to the paper as follows: study conception and design: Leone, Lacey; data collection: Barnes-Farrell; analysis and interpretation of results: Lacey, Barnes-Farrell; draft manuscript preparation: Leone, Lacey. All authors reviewed the results and approved the final version of the manuscript.


## Declaration of Conflicting Interests


The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.


## Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This project is made possible through Federal Railroad Administration, BAA Contract 69A36520401590RRDDC Enhancing Safety Culture of Class II and III Railroads Across North America.

## ORCID iDs

Julia Leone  <https://orcid.org/0000-0003-4218-7603>

Samantha Lacey  <https://orcid.org/0000-0001-5941-7626>

Janet Barnes-Farrell  <https://orcid.org/0000-0001-8714-4813>

## Data Accessibility Statement

The data are not publicly available owing to confidentiality restrictions. Please contact the Short Line Safety Institute at [slsi@shortlinesafety.org](mailto:slsi@shortlinesafety.org) with any questions.

## References

1. Stewart, M. F., and L. Parker. *Railroad Industry Modal Profile: An Outline of the Railroad Industry Workforce Trends*. DOT/FRA/ORD- 16/09. U.S. Department of Transportation, Washington, D.C., 2016.
2. U. S. Bureau of Labor Statistics. *Household Data Annual Averages*. <https://www.bls.gov/cps/aa2020/cpsaat18.pdf>. 2020.
3. Stewart, M. F. *Railroad Industry Workforce Development Survey [Research Results]* (No. RR 20-19). U. S. Department of Transportation. Federal Railroad Administration. Office of Research, Development, and Technology, Washington, D.C., 2020.
4. Alexander, A. *Attracting, Retaining, and Advancing Women in Transit*. Report No. Project J-7, Topic SF-21. The National Academies Press, Washington, D.C., 2020.
5. Rust, D. L., and R. A. Mundy. Women in North American Railroad Operational Roles: Opportunities and Challenges. *Research in Transportation Economics*, Vol. 84, 2020, pp. 1–7.
6. Morrow, S., and M. Coplen. *Safety Culture: A Significant Influence on Safety in Transportation*. No. DOT/FRA/ORD-17/09. U. S. Federal Railroad Administration. Office of Research, Development, and Technology, Washington, D.C., 2017.
7. Hofmann, D. A., M. J. Burke, and D. Zohar. 100 Years of Occupational Safety Research: From Basic Protections and Work Analysis to a Multilevel View of Workplace Safety and Risk. *Journal of Applied Psychology*, Vol. 103, 2017, pp. 375–388.
8. Zohar, D., and D. A. Hofmann. Organizational culture and climate. In *The Oxford Handbook of Organizational Psychology* (S. W. J. Kozlowski, ed.), Oxford University Press, New York, 2012, pp. 643–666.
9. Lacey, S. R. *Development and Initial Evaluation of the Safety Climate Survey Short-Form (SCS-SF)*. Unpublished Master's Thesis. University of Connecticut, Storrs, CT, 2021.
10. Lacey, S., J. Leone, and J. Barnes-Farrell. Keeping Safety on Track: Factors Affecting Perceptions of Safety Training Quality in the U.S. Railroad Industry. Poster presented at the American Psychological Association Conference, Minneapolis, MN, 2022.
11. Xu, X. P., D. N. Deng, Y. H. Gu, C. S. Ng, X. Cai, J. Xu, X. S. Zhang, D. G. Ke, Q. H. Yu, and C. K. Chan. Changing Patient Safety Culture in China: A Case Study of an Experimental Chinese Hospital From a Comparative Perspective. *Risk Management and Healthcare Policy*, Vol. 11, 2018, pp. 83–98.
12. Waring, A. Developing a Safety Culture. *The Safety and Health Practitioner*, Vol. 10, 1992, pp. 42–44.
13. Glendon, A. I., and D. K. Litherland. Safety climate factors, group differences, and safety behaviour in road construction. *Safety Science*, Vol. 39, 2001, pp. 157–188.
14. AlMousa, N., N. Althabet, S. AlSultan, F. Albagmi, H. AlNujaidi, and K. F. Salama. Occupational Safety Climate and Hazards in the Industrial Sector: Gender Differences Perspective, Saudi Arabia. *Frontiers in Public Health*, Vol. 10, 2022, pp. 1–9.
15. Bergheim, K., J. Eid, S. W. Hystad, M. B. Nielsen, K. Meams, G. Larsson, and B. Luthans. The Role of Psychological Capital in Perception of Safety Climate among Air Traffic Controllers. *Journal of Leadership and Organizational Studies*, Vol. 2, 2013, pp. 232–241.
16. Gyekye, A. S., and S. Salminen. Organizational Safety Climate: Impact of Gender on Perception of Workplace Safety. *International Journal of Psychology Research*, Vol. 6, 2011, pp. 461–478.
17. Hung, K., and S. H. E. Billy. Safety Climate and Employee Health among Blue Collar Workers in Hong Kong and China: Age and Gender Differences. *Safety*, Vol. 1, 2000, p. 20.
18. Byrnes, J. P., D. C. Miller, and W. D. Schafer. Gender Differences in Risk Taking: A Meta-Analysis. *Psychological Bulletin*, Vol. 125, 1999, pp. 367–383.
19. Konrad, A. M., J. E. Ritchie, Jr., P. Lieb, and E. Corrigan. Sex Differences and Similarities in Job Attribute Preferences: A Meta-Analysis. *Psychological Bulletin*, Vol. 126, 2000, pp. 593–641.
20. Kidda, S., and H. Howarth. *Short Line Safety Institute: The Most Robust Model for Assessing Safety Culture in the U.S. Railroad Industry [Research Results]* (No. RR 19-15). U. S. Department of Transportation. Federal Railroad Administration, Washington, D.C., 2019.
21. TransitCenter. *Want to Improve Transit? Hire (and Promote!) More Women*. <https://transitcenter.org/women-power-will-change-transit-better/>. 2018.
22. Transport Canada, TP 15058E. *Rail Safety Management Systems Guide: A Guide for Developing, Implementing, and Enhancing Railway Safety Management Systems*. <http://www.tc.gc.ca/eng/railsafety/guide-sms.htm>. 2010.
23. Transportation Safety Board of Canada. *Railway Investigation Report*. Report No. R13D0054. Minister of Public Works and Government Services Canada, Gatineau, QC, 2013.
24. Stewart, M. F. *Railroad Industry Modal Profile: An Outline of the Railroad Industry Workforce Trends, Challenges, and Opportunities*. Report No. DOT/FRA/ORD- 11/20. U.S. Department of Transportation, Washington, D.C., 2011.
25. Reinach, S., and A. Viale. *An Examination of Employee Recruitment and Retention in the US Railroad Industry*. Report No. DOT/FRA/RRP-07/01. U.S. Department of Transportation, Washington, D.C., 2007.
26. U. S. Bureau of Labor Statistics. *Household Data Annual Averages*. <https://www.bls.gov/cps/cpsaat11.pdf>. 2021.
27. National Transportation Institute. *Women in Trucking (WIT) Index*. <https://www.driverwages.com/wit-index/>. 2017.
28. Voie, E. Gender Diversity Makes Good Business Sense. *CIO Review: The Navigator for Enterprise Solutions*. <https://wt.memeberclicks.net/assests/docs/Media/cio-review-ellen-voie.pdf>. 2016.
29. U. S. Bureau of Labor Statistics. *Employed Persons by Detailed Occupation, Sex, Race, and Hispanic or Latino Ethnicity*. <https://bls.gov/cps/cpsaat11.pdf>. 2018.

30. Community of European Railway and Infrastructure Companies (CER). *Women in Rail. Annual Report on the Development of Women's Employment in the European Railway Sector*. <http://www.cer.be>. 2015.
31. Morrison, A. M., R. P. White, and E. Van Velsor, and the Center for Creative Leadership. *Breaking the Glass Ceiling: Can Women Reach the Top of America's Largest Corporations?* Pearson Education, London, 1992.
32. Powell, G. N., and D. A. Butterfield. Investigating the "Glass Ceiling" Phenomenon: An Empirical Study of Actual Promotions to Top Management. *Academy of Management Journal*, Vol. 37, 1994, pp. 68–86.
33. Sneider, J. Narrowing the Gender Gap. Class I Diversity Strategies Help Women Break Through the Glass Ceiling. *Progressive Railroading*, Vol. 55, 2012, pp. 22–25.
34. U. S. Bureau of Labor Statistics. *The Employment Situation*. <https://www.bls.gov/news.release/pdf/empisit.pdf>. 2022.
35. National Center for Education and Statistics. *Degrees Conferred by Race and Sex*. <https://nces.ed.gov/fastfacts/display.asp?id=72>. 2019.
36. Fine, C., V. Sojo, and H. Lawford-Smith. Why Does Workplace Gender Diversity Matter? Justice, Organizational Benefits, and Policy. *Social Issues and Policy Review*, Vol. 14, 2020, pp. 36–72.
37. Gardiner, M., and M. Tiggemann. Gender Differences in Leadership Style, Job Stress, and Mental Health in Male- and-Female-Dominated Industries. *Journal of Occupational and Organizational Psychology*, Vol. 7, 1999, pp. 301–315.
38. Berdahl, J. L., M. Cooper, P. Glick, R. W. Livingston, and J. C. Williams. Work as a Masculinity Contest. *Journal of Social Issues*, Vol. 74, 2018, pp. 422–448.
39. Stergiou-Kita, M., E. Mansfield, A. Colantonio, J. Moody, and S. Mantis. What's Gender Got to do with it? Examining Masculinities, Health, and Safety and Return to Work in Male Dominated Skilled Trades. *Work*, Vol. 54, 2016, pp. 721–733.
40. Hambrick, D. C., and P. A. Mason. Upper Echelons: The Organization as a Reflection of its Top Managers. *Academy of Management Review*, Vol. 9, 1984, pp. 193–206.
41. Carson, C. M., D. C. Mosley, and S. L. Boyar. Performance Gains Through Diverse Top Management Teams. *Team Performance Management: An International Journal*, Vol. 10, 2004, pp. 121–126.
42. Krishnan, H. A., and D. Park. A Few Good Women-On Top Management Teams. *Journal of Business Research*, Vol. 58, 2014, pp. 1712–1720.
43. Lorenzo, R., N. Voigt, K. Schetelig, A. Zawadzki, I. Welpel, and P. Brosi. *The Mix that Matters: Innovation Through Diversity*. The Boston Consulting Group, 2017. <https://www.bcg.com/publications/2017/people-organization-leadership-talent-innovation-through-diversity-mix-that-matters>.
44. Kramer, V. W., A. M. Konrad, S. Erkut, and M. J. Hooper. *Critical Mass on Corporate Boards: Why Three or More Women Enhance Governance*. Wellesley Centers for Women, Wellesley, MA, 2006, pp. 2–4.
45. Ivey, S., M. Powers, and A. Clark. *Building a Business Case for Increasing Diversity in the Transportation Workforce*. <https://onlinepubs.trb.org/onlinepubs/trnews/trnews323BusinessCase.pdf>. 2019.
46. Kuzey, C., M. M. Fritz, A. Uyar, and A. S. Karaman. Board Gender Diversity, CSR Strategy, and Eco-Friendly Initiatives in the Transportation and Logistics Sector. *International Journal of Production Economics*, Vol. 247, 2022, pp. 1–18.
47. Ruel, S., and M. M. Fritz. Gender Diversity in Supply Chains: Towards More Sustainable Decisions? Evidence from Interviews. *Supply Chain Forum: An International Journal*, Vol. 22, 2021, pp. 205–222.
48. Rail Climate Considerations (n.d.). *DOT/FRA*. <https://railroads.dot.gov/rail-network-development/environment/rail-climate-considerations>
49. Zohar, D. Thirty Years of Safety Climate Research: Reflections and Future Directions. *Accident Analysis & Prevention*, Vol. 42, 2010, pp. 1517–1522.
50. Zohar, D., and G. Luria. A Multilevel Model of Safety Climate: Cross-Level Relationships Between Organization and Group-Level Climates. *Journal of Applied Psychology*, Vol. 90, 2005, pp. 616–628.
51. Huang, D. T., G. Clermont, J. B. Sexton, C. A. Karlo, R. G. Miller, L. A. Weissfeld, K. M. Rowan, and D. C. Angus. Perceptions of Safety Culture Vary Across the Intensive Care Units of a Single Institution. *Critical Care Medicine*, Vol. 35, 2007, pp. 165–176.
52. Brown, R. L., and H. Holmes. The Use of a Factor-Analytic Procedure for Assessing the Validity of an Employee Safety Climate Model. *Accident Analysis & Prevention*, Vol. 18, 1986, pp. 455–470.
53. Beus, J. M., S. M. Jarrett, M. E. Bergman, and S. C. Payne. Perceptual Equivalence of Psychological Climates Within Groups: When Agreement Indices Do Not Agree. *Journal of Occupational and Organizational Psychology*, Vol. 85, 2012, pp. 454–471.
54. Cheyne, A., J. M. Tomas, S. Cox, and A. Oliver. Perceptions of Safety Climate at Different Employment Levels. *Work & Stress*, Vol. 17, 2003, pp. 21–37.
55. Huang, Y. H., M. M. Robertson, J. Lee, J. Rineer, L. A. Murphy, A. Garabet, and M. J. Dainoff. Supervisory Interpretation of Safety Climate Versus Employee Safety Climate Perception: Association with Safety Behavior and Outcomes for Lone Workers. *Transportation Research Part F: Traffic Psychology and Behavior*, Vol. 26, 2014, pp. 348–360.
56. Singer, S. J., D. M. Gaba, J. J. Geppert, A. D. Sinaiko, S. K. Howard, and K. C. Park. The Culture of Safety: Results of an Organization-Wide Survey in 15 California Hospitals. *BMJ Quality & Safety*, Vol. 12, 2003, pp. 112–118.
57. Hunter, S. *Activities That May Impact The Diversity of The Caltrans Workforce*. California Department of Transportation, Sacramento, California, 2022.