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14. ABSTRACT

This report documents stakeholder perspectives and opinions on the fatigue and safety of freight locomotive engineers. This work follows an online survey sponsored by the Federal Railroad Administration, developed by the Virginia Tech Transportation Institute, and distributed to members of the Brotherhood of Locomotive Engineers and Trainmen and the Sheet Metal Air Rail Transportation-Transportation Division labor unions. In this follow-on research, the team worked with labor and industry focus groups to gain a more in-depth understanding of fatigue and safety issues from a stakeholder perspective. Views on fatigue and safety concerns varied by stakeholder category. Labor stakeholders attributed fatigue to management policies and practices, including variable scheduling. Industry stakeholders described lifestyle choices and personal responsibility as being critical to fatigue management.

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1 inch (in) = 2.5 centimeters (cm)	1 millimeter (mm) = 0.04 inch (in)
1 foot (ft) = 30 centimeters (cm)	1 centimeter (cm) = 0.4 inch (in)
1 yard (yd) = 0.9 meter (m)	1 meter (m) = 3.3 feet (ft)
1 mile (mi) = 1.6 kilometers (km)	1 meter (m) = 1.1 yards (yd)
	1 kilometer (km) = 0.6 mile (mi)
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1 square inch (sq in, in^2) = 6.5 square centimeters (cm^2)	1 square centimeter (cm^2) = 0.16 square inch (sq in, in^2)
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1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)	1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)
1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)	10,000 square meters (m^2) = 1 hectare (ha) = 2.5 acres
1 acre = 0.4 hectare (he) = 4,000 square meters (m^2)	
MASS - WEIGHT (APPROXIMATE)	**MASS - WEIGHT (APPROXIMATE)**
1 ounce (oz) = 28 grams (gm)	1 gram (gm) = 0.036 ounce (oz)
1 pound (lb) = 0.45 kilogram (kg)	1 kilogram (kg) = 2.2 pounds (lb)
1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)	1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons
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1 tablespoon (tbsp) = 15 milliliters (ml)	1 liter (l) = 2.1 pints (pt)
1 fluid ounce (fl oz) = 30 milliliters (ml)	1 liter (l) = 1.06 quarts (qt)
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1 pint (pt) = 0.47 liter (l)	
1 quart (qt) = 0.96 liter (l)	
1 gallon (gal) = 3.8 liters (l)	
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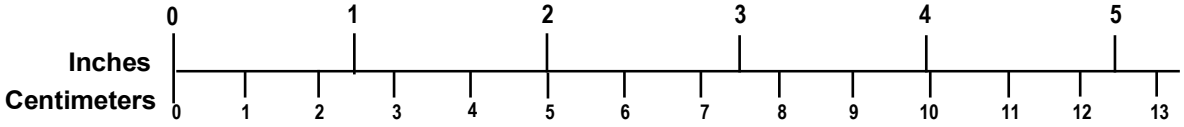

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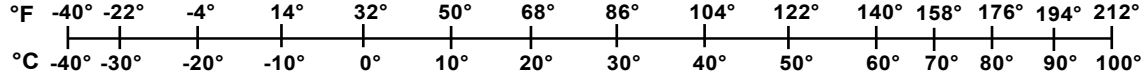

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Contents

Executive Summary

As a follow-up to an online survey conducted in 2022 (Dunn & Soccolich, 2023), the Federal Railroad Administration (FRA) sponsored a team of researchers from Virginia Tech Transportation Institute (VTTI) to develop a more in-depth understanding of the issues raised in the survey results. Between March and May 2023, the team conducted virtual focus groups with labor (i.e., rail union) and industry (i.e., Class I railroad and short line railroad) representatives to document stakeholder perspectives on the factors contributing to fatigue and the potential impacts on locomotive engineer safety.

Opinions differed across groups, as well as between Class I and short line railroad industry representatives. All groups agreed that fatigue is an issue in the rail industry, although each group differed on who is responsible for fatigue and how it should be addressed. The greatest disparity of opinion occurred between labor and Class I railroad stakeholders. Labor largely attributed fatigue issues to policies and practices related to variability in scheduling, as well as possible punitive measures (if available fatigue management options were used). Industry representatives, for the most part, placed more emphasis on personal responsibility and the lifestyle choices of locomotive engineers. The results of these discussions highlight the opinions and experiences of locomotive crews and management personnel.

1. Introduction

This report documents stakeholder perspectives and opinions on the fatigue and safety of freight locomotive engineers. This work follows an online survey sponsored by the Federal Railroad Administration (FRA), developed by the Virginia Tech Transportation Institute (VTTI), and distributed to members of the Brotherhood of Locomotive Engineers and Trainmen (BLET) and the Sheet Metal Air Rail Transportation-Transportation Division (SMART-TD) labor unions (Dunn & Soccolich, 2023). In this follow-on research, the team worked with labor and industry focus groups to gain a more in-depth understanding of fatigue and safety issues from a stakeholder perspective.

1.1 Background

Railroads operate 24 hours a day and 7 days a week to meet customer needs. Research consistently shows that the shiftwork common in the industry can cause disruptions to sleep and circadian rhythms, resulting in fatigue, reduced alertness, and impaired human performance (Akerstedt et al., 1987; Lal & Craig, 2001). Based on the findings of the Dunn and Soccolich (2023) survey, freight locomotive crews (i.e., locomotive engineers and conductors) experience high levels of scheduling variability, which may increase their risk of fatigue and associated safety-related issues (e.g., fatigue-related driving events during their commute).

Focusing specifically on the rail industry, Gertler et al. (2013) examined the fatigue status of safety-critical railroad employees (i.e., locomotive crews and dispatchers) and concluded that the risk of a human factors accident increases from 11 to 65 percent with exposure to fatigue, while the economic cost of a human factors accident involving fatigue is four times that of a non-fatigue-related accident (approximately $1,600,000 compared to $400,000). Dispatchers and locomotive crews typically experience the highest exposure to fatigue due to long work hours and nighttime shiftwork, while passenger train and engine workers experience the least exposure to fatigue due to the predictability of passenger train and engine work schedules and less nighttime work.

1.2 Objectives

The objective of this research was to document labor and industry stakeholder perspectives and opinions on the factors that contribute to locomotive crew fatigue and its potential impact on safety.

1.3 Overall Approach

The team conducted focus group sessions to expand on a fatigue survey previously distributed to labor union members. The focus groups included stakeholders from labor (i.e., BLET) and industry (i.e., Association of American Railroads (AAR) and American Short Line and Regional Railroads (ASLRRA)-selected representatives). The methodology is discussed in more detail in Section 2.

1.4 Scope

The scope included three focus groups, one representing labor and two representing industry management. Due to scheduling difficulties, researchers were not able to include planned focus

group participation from SMART-TD, a union group representing railroad conductors. As a result, labor perspectives were obtained from locomotive engineers only.

Each focus group comprised four to seven participants. The focus group results were consistent with the results obtained from the previously completed online survey.

1.5 Organization of the Report

This report is organized into the following sections:

- Section 2 describes the fatigue study methodology.
- Section 3 discusses feedback from the focus groups.
- Section 4 presents concluding remarks.

2. Methodology

The research team conducted focus groups comprising labor and industry management representatives to better understand stakeholder perspectives on fatigue and locomotive crew safety. Stakeholder representatives included participants from three groups: BLET labor union members (i.e., locomotive engineers), industry representatives from ASLRRA, and industry representatives from AAR. Members of the SMART-TD labor union, which represents conductors, were unable to participate due to scheduling constraints.

Each focus group included four to seven participants. FRA representatives helped facilitate the focus groups and served as notetakers for each session. The team posed open-ended questions and led the resulting discussion with participants. The same topics were covered in each group, but questions varied by stakeholder. Researchers sought independent input from each group, so participants were not asked to directly respond to concerns or statements made in other focus group sessions. Participants did not receive the questions before their session.

All focus group sessions were conducted remotely over Microsoft Teams and lasted approximately two hours. All sessions were automatically transcribed using Teams transcription tools. Participant information and responses were de-identified for anonymity. Researchers used the transcripts along with session notes to create a summary of each focus group session (Section 3).

3. Focus Group Summaries

3.1 Perspectives from Labor Focus Group Participants

Participants in the labor focus group included locomotive engineers with 13 to 27 years of railroad industry experience. All labor participants presented similar perspectives. Summaries of common themes that emerged from the focus groups are presented below.

3.1.1 Factors That Impact Fatigue at Work

Labor identified lineup scheduling as one of the factors that impacts crew fatigue at work. Lineup schedules were described as inaccurate and sometimes random, impacting family time and the work life balance. Participants also mentioned that schedules were managed better in the past when the industry used chalkboards instead of computers

Labor group members also experienced instances where they were not able to rest for an appropriate period. Specifically, participants mentioned that once activated, they have four hours to answer a phone call. However, during these four hours there may not be any opportunity to rest because of additional work-related phone calls. They report that regardless of status (e.g., being on the "do not call" list or when a rest agreement is in place), they still experience repeated phone calls to take shifts.

Similarly, engineers also reported that a 12-hour shift will always be pushed to the full 12 hours by management. These long shifts that max out allowable work time increase fatigue.

3.1.2 Impact of Commute Times on Fatigue

Labor representatives agreed that commute times have impacted their fatigue levels. For example, after a shift, they often plan to set an alarm and nap before driving home. However, the desire to get home after a long day can lead to them beginning their commute despite feeling fatigued.

In one specific case, a locomotive engineer had a 2.5-3-hour commute home. This locomotive engineer reported fighting drowsiness and microsleep during his commute home. To help mitigate his fatigue, he occasionally napped in parking areas along the route.

Conversely, one participant with a shorter commute of 35 minutes felt the ride home had a positive effect on his fatigue. This engineer reported that he used the commute home as a time to decompress after long work shifts.

3.1.3 Impact of Fatigue on Safety

Locomotive crew fatigue was identified as a safety concern because participants reported that drowsiness impacts their ability to focus on the task at hand. Locomotive engineers also reported that they have experienced safety incidents from inattention, stress, and fatigue and that fatigue and stress impact them more than any other workplace factor.

Participants stated that they often do not report fatigue-related safety incidents because they prefer not to draw attention to themselves and potentially be targeted for punitive measures. They mentioned they were not aware of a mechanism to report fatigue-related safety incidents, either anonymously or otherwise.

3.1.4 Strategies for Mitigating Fatigue

Labor participants identified multiple strategies that may help mitigate fatigue. They reported that active engagement in the operation of the locomotive helps reduce feelings of fatigue and that they were more prone to fatigue and drowsiness when a computer or associated technology was operating the locomotive.

Engineers reported using coffee, energy drinks, and or prescription medication as temporary solutions to reduce fatigue.

Conversations between crew members were also identified as a healthy and positive fatigue mitigation strategy.

A major theme identified during the focus group discussion was the lack of, and subsequent need for, healthy strategies to mitigate fatigue.

3.1.5 Company Fatigue Management Plans and Policies

While group participants were aware of a variety of policies and procedures in place intended to help reduce fatigue, they commonly found that using these policies and procedures may have negative repercussions. They felt that the railroad industry lacks sensitivity for workers and the fatigue issue and that policies are enacted to meet federal guidelines purely as "check the box" exercises. As an example, one engineer reported his railroad required employees to view the same sleep video they have shown in the past.

Group members reported that conditions could be much worse without regulations, but indicated that regulations related to fatigue management needed to be improved to be effective.

3.2 Perspectives from Railroad Industry Focus Group Participants

The team led two sessions of industry focus groups, one for AAR participants and one for ASLRRA participants. The AAR focus group was comprised of seven industry stakeholders and the ASLRRA group included six representatives.

3.2.1 Factors that Impact Fatigue at Work

Stakeholders from the industry focus groups identified multiple factors that impact fatigue at work, although key differences between Class I and short line railroads were reflected in the responses. Class I railroads operate under an on-call system that may change day-to-day and week-to-week, which can inhibit the ability of locomotive engineers to plan out their work and rest schedules. Short line railroads, on the other hand, have more consistent schedules.

Industry stakeholders from Class I railroads identified the importance of understanding how the scheduling boards work and how crew actions can impact schedules for others on the board. For example, a locomotive engineer laying off before they are on call can improve their time off, but this makes things more difficult for those behind them with less seniority on the list. In this way, a locomotive engineer who was fourth on the list may be next out as those ahead take time off. Similarly, the longer engineers wait to get off the board, the more time off they will have. These factors increase scheduling unpredictability.

There were different opinions in the Class I railroad stakeholder group about scheduling variability. The group emphasized unpredictability and inability to plan as factors that contribute

to fatigue, citing the day-to-day variability in scheduling (i.e., a day shift one day, an afternoon shift the next day, a midnight shift after that). However, the group also said that the locomotive industry is more predictable today than ever. Since the industry runs constantly and night work is unavoidable, locomotive engineers must monitor their status and note changes on the board to understand when they may receive a call and what shifts they may work allowing them to prepare for the upcoming shift.

Industry stakeholders from short line railroads agreed that locomotive engineers should monitor their railroads' schedules and plan for adequate rest. They acknowledged that fatigue and stress are issues but report that staffing is closely managed. Consistent schedules reduce fatigue as the work is more predictable but, conversely, sticking to a schedule can also be fatiguing and stressful (i.e., pressure to meet train schedules or getting tasks done on time), especially when unexpected events occur.

A key difference between short line and Class 1 railroads is that short line crews often work many different jobs (e.g., locomotive engineer, conductor, yardmaster, track inspector, customer service). Mental fatigue becomes a challenge as workers perform several jobs. Working as an engineer one day and a mechanic the next can increase the risk of fatigue on smaller short lines.

Finally, short line stakeholders emphasized that doing a job correctly and safely is prioritized over doing a job quickly. An example provided by one stakeholder related to a specific run of approximately 80-90 miles on low speed track (i.e., 10 miles per hour). Slower speeds and long trip times may introduce boredom and mental fatigue, especially late at night or early morning.

3.2.2 Impact of Commute Times on Fatigue

Class I railroad stakeholders emphasized that commute times are a complex issue and are largely in the hands of the locomotive crew. Short line railroad stakeholders agreed that commute times contribute to work-related fatigue and stress; however, they also pointed out that management has no control over where their crews live. Commute times are up to the worker. Crew members commute from locations across the country for various reasons, including economic (e.g., cost of living in California versus Nebraska). Much of the responsibility is placed on the locomotive crew to get proper rest during their required rest time. Longer commute times were mentioned as being potentially problematic if a locomotive crew has worked third shift and have been awake for a long. Hours of service limits were also highlighted as helping to reduce fatigue risk.

Additionally, external factors impact commute times, and these vary depending on where people live. For example, engineers who live in New York reportedly deal with 2-hour-plus commute times on a regular basis, due to traffic. Locomotive engineers in rural Iowa, on the other hand, do not regularly deal with traffic congestion, but may experience poor weather conditions. The short line group members reported that being late due to external factors (e.g., traffic congestion, crashes, and weather) is not excusable because short line workers have at least 24 hours' notice to prepare for work and arrive on time.

3.2.3 Impact of Fatigue on Safety

Class I railroad stakeholders acknowledge that the issue of fatigue is complex and depends on many factors (e.g., amount of sleep, hours of duty, time of day). One stakeholder described the difference between experiencing fatigue and being unfit for duty. Railroads must ensure that personnel can safely perform their duties. An example strategy mentioned is having personnel

complete self-assessments (e.g., Karolinska Sleepiness Scale[1]) before and during their shift and providing personnel with the opportunity to report any concerns to management.

Class I railroad stakeholders indicated that they have mechanisms in place for reporting fatigue-related safety events and close calls.

Stakeholders from short line railroads agreed that fatigue is a genuine concern in the railroad environment. They are aware that fatigue causes a loss of focus and situational awareness, slows down reactions, and strains mental capacity. A comparison was made between sleep deprivation and alcohol consumption, with stakeholders agreeing that both have similar negative effects on performance. The impact of non-work-related factors was also discussed, and both negative and positive events (e.g., divorce, death in the family, upcoming family vacation, or anything fun/exciting that occurs outside of work) were acknowledged as potentially impacting workplace performance. Short line stakeholders understood there are many factors that impact workplace safety and performance, and locomotive engineers must be attentive on the job.

Short line stakeholders believe that the extent or prevalence of fatigue is unknown because incidents are not reported unless there is an outcome that requires an investigation. All short line stakeholders indicated that investigations would assess whether fatigue was a contributing factor by checking work history for the weeks prior to the incident and interviewing the worker. They mentioned that the consistent scheduling practices used in short line railroads means engineers can work multiple outside jobs if they choose. During an investigation it will be determined if the worker is getting enough rest or if their second job is interfering with their rest time. One stakeholder highlighted small tourist and museum operations as an example of this issue. These organizations usually have a small volunteer workforce with crews operating the locomotives in their spare time or off duty hours. The same risks exist for these crews as for other short line railroad operations but there may be less understanding of the risks.

3.2.4 Strategies and Resources for Mitigating Fatigue

Class I railroad stakeholders identified the strategies that crews use to mitigate fatigue, including standing up and moving around when possible or opening a window to let in cold air. One stakeholder indicated they encourage increased in-cab communication between the crew, or, if needed, radio communication with another crew member to keep them attentive. This strategy could help the crew through periods of fatigue. Training was also mentioned, including educating workers on how much caffeine really works and when to limit intake. Unhealthy coping strategies were also discussed, including the downside of energy drinks and the impact of an unhealthy diet on fatigue and overall health (e.g., being overweight increases the risk of sleep apnea). Snacks such as sunflower seeds, pistachios, and boiled peanuts that require effort to consume were mentioned as strategies to remain alert.

Class I railroad representatives said crews have the option to lay off fatigued if needed. Local management monitors when employees are laying off. Class I railroad stakeholders highlighted other strategies such as fatigue and risk management procedures, reference materials, counseling with health services, and screening and medical testing for sleep apnea.

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[1] The Karolinska Sleepiness Scale (KSS) measures the subjective level of sleepiness at a particular time during the day. On this scale subjects indicate which level best reflects the psycho-physical sate experienced in the last 10 min. The KSS is a measure of situational sleepiness. It is sensitive to fluctuations.

Short line railroad stakeholders agreed that the more predictable scheduling and crews' knowledge of schedules helps mitigate fatigue risk. Stakeholders emphasized the importance of regular education on fatigue mitigation, and mentioned FRA's *Railroaders Guide to Healthy Sleep* website as a useful resource. Other strategies identified included the strategic use of caffeine and naps, or the "nappuccino" (i.e., a cup of coffee immediately followed by a nap), blackout curtains, and a white noise machine.

3.3 Final Perspectives Across the Focus Groups

Stakeholders discussed that in the short line rail industry, sleep disorders do not disqualify someone from being hired, but if screening indicates an individual is at high risk, then they will be sent to complete a sleep study and required to use a CPAP machine (at company expense). Future screening to assess sleep disorder risk is conducted every three years during a required medical exam and if the worker's risk status has changed (e.g., weight gain, snoring, increased neck circumference) then they will be sent for additional testing.

During focus group wrap-up, there was additional discussion from engineers suggesting how helpful access to music would be in the locomotive cab while operating, which is currently disallowed. This is a potential area for continued discussion.

FRA's Confidential Close Call Reporting System, also known as C3RS, could be a place for crews to report fatigue-related close calls, if their railroads participate in the program. Locomotive engineers reported a reluctance to using C3RS or any railroad-initiated safety reporting system.

4. Conclusion

This research study conducted focus groups with labor representatives and industry representatives to examine issues related to fatigue and its potential impact on the safety of locomotive engineers. The data collected for this study consisted of a small number of participants in each group. One labor group (i.e., conductors) was unable to participate.

Labor stakeholders attributed fatigue to management policies and practices, including variable scheduling. Industry stakeholders described lifestyle choices and personal responsibility as being critical to fatigue management. Stakeholders from Class I railroads and short line railroads reported differences in scheduling and predictability, with short line railroads having a more structured scheduling system.

Results of the discussions highlight key points for each railroad stakeholder group. This work follows an online survey that was sponsored by the Federal Railroad Administration and conducted in 2022.

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Abbreviations and Acronyms

ACRONYM	DEFINITION
AAR	Association of American Railroads
ASLRRA	American Short Line and Regional Railroad Association
BLET	Brotherhood of Locomotive Engineers and Trainmen
FRA	Federal Railroad Administration
OMB	Office of Management and Budget
SMART-TD	Sheet Metal Air Rail Transportation-Transportation Division
VTTI	Virginia Tech Transportation Institute