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**Federal Railroad
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Yardmasters and Yard Safety in the U.S. Railroad Industry: An Exploratory Study

Office of Research
and Development
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13. ABSTRACT This report presents the results of an exploratory study of railroad yardmasters. The purpose was to identify issues and risks associated with yardmaster tasks and responsibilities that have the potential to compromise safety in railroad classification (switching) yards. Analysis of 2004 Federal Railroad Administration (FRA) train accident and incident data helped to determine the involvement of yardmasters in train accidents and injuries, and focus groups with yardmasters provided information about yardmaster tasks and responsibilities and the yardmaster's role in yard switching safety. Analysis of FRA train accident/incident data indicates that yardmasters contributed to less than one-fifth of 1 percent of reportable train accidents (7 out of 3,775) and one-fifth of 1 percent of all employee-on-duty injuries (13 out of 5,693). Fifty-six yardmasters participated in nine focus groups conducted in three U.S. cities. Focus groups addressed five topic groupings: training and experience; communications and information flow; stress, distractions, difficulties, and workload; fatigue, staffing, and work schedules; and best practices and lessons learned. Yardmasters identified and discussed a number of issues related to each topic, as well as provided lessons learned and best practices. Lastly, the report suggests several future studies to further enhance FRA's understanding of the yardmaster's role in railroad yard switching safety.				
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METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

- 1 inch (in) = 2.5 centimeters (cm)
- 1 foot (ft) = 30 centimeters (cm)
- 1 yard (yd) = 0.9 meter (m)
- 1 mile (mi) = 1.6 kilometers (km)

AREA (APPROXIMATE)

- 1 square inch (sq in, in²) = 6.5 square centimeters (cm²)
- 1 square foot (sq ft, ft²) = 0.09 square meter (m²)
- 1 square yard (sq yd, yd²) = 0.8 square meter (m²)
- 1 square mile (sq mi, mi²) = 2.6 square kilometers (km²)
- 1 acre = 0.4 hectare (he) = 4,000 square meters (m²)

MASS - WEIGHT (APPROXIMATE)

- 1 ounce (oz) = 28 grams (gm)
- 1 pound (lb) = 0.45 kilogram (kg)
- 1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

VOLUME (APPROXIMATE)

- 1 teaspoon (tsp) = 5 milliliters (ml)
- 1 tablespoon (tbsp) = 15 milliliters (ml)
- 1 fluid ounce (fl oz) = 30 milliliters (ml)
- 1 cup (c) = 0.24 liter (l)
- 1 pint (pt) = 0.47 liter (l)
- 1 quart (qt) = 0.96 liter (l)
- 1 gallon (gal) = 3.8 liters (l)
- 1 cubic foot (cu ft, ft³) = 0.03 cubic meter (m³)
- 1 cubic yard (cu yd, yd³) = 0.76 cubic meter (m³)

TEMPERATURE (EXACT)

$$[(x-32)(5/9)] \text{ } ^\circ\text{F} = y \text{ } ^\circ\text{C}$$

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

- 1 millimeter (mm) = 0.04 inch (in)
- 1 centimeter (cm) = 0.4 inch (in)
- 1 meter (m) = 3.3 feet (ft)
- 1 meter (m) = 1.1 yards (yd)
- 1 kilometer (km) = 0.6 mile (mi)

AREA (APPROXIMATE)

- 1 square centimeter (cm²) = 0.16 square inch (sq in, in²)
- 1 square meter (m²) = 1.2 square yards (sq yd, yd²)
- 1 square kilometer (km²) = 0.4 square mile (sq mi, mi²)
- 10,000 square meters (m²) = 1 hectare (ha) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

- 1 gram (gm) = 0.036 ounce (oz)
- 1 kilogram (kg) = 2.2 pounds (lb)
- 1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

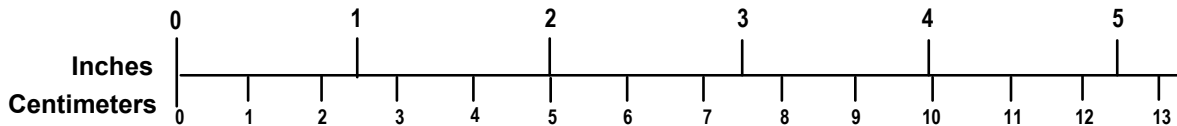
VOLUME (APPROXIMATE)

- 1 milliliter (ml) = 0.03 fluid ounce (fl oz)
- 1 liter (l) = 2.1 pints (pt)
- 1 liter (l) = 1.06 quarts (qt)
- 1 liter (l) = 0.26 gallon (gal)
- 1 cubic meter (m³) = 36 cubic feet (cu ft, ft³)
- 1 cubic meter (m³) = 1.3 cubic yards (cu yd, yd³)

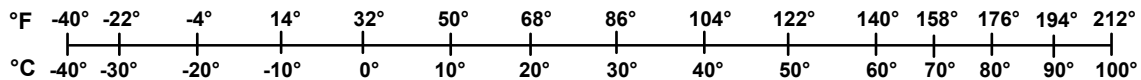
TEMPERATURE (EXACT)

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Preface

A novel means of further reducing train accidents/incidents in railroad classification, or switching, yards is to examine the role that yardmasters play in yard switching safety. Yardmasters are the front-line supervisors of all activity that takes place in railroad yards. Yardmasters manage track use in yards, as well as communicate and coordinate with yard track users. They interact with a number of different yard employees and crafts and are responsible for, and must be aware of, inbound/outbound trains, switch crews operating in the yard, and the yard infrastructure, yet no public research has been conducted to identify potential safety issues and risks associated with yardmaster tasks and responsibilities.

The overall purpose of this exploratory research was to identify issues and risks associated with the yardmaster's job that may compromise safety in railroad switching yards. The study involved an analysis of train accident/incident data and the conduct of focus groups with yardmasters around the United States. This research was performed under the Federal Railroad Administration's (FRA) Office of Research and Development Contract DTFR53-01-D-00029.

The authors would like to thank a number of individuals who assisted in the conduct of focus groups with yardmasters. First, the authors would like to express thanks in particular to Dr. Thomas Raslear, FRA Office of Research and Development Human Factors Program, for supporting and encouraging this research. The authors would like to give a special thanks to Mr. James Cumby and Mr. James Stem, United Transportation Union (UTU), and Mr. Rusty Strain, United Supervisors Council of America (USCA, part of the Transportation Communication International Union), for facilitating this research by providing union contacts and helping to identify candidate focus group locations. The authors would also like to thank UTU and USCA general and local chairpersons for helping to identify and recruit yardmasters willing to share their views and experiences.

The authors would like to acknowledge and thank Mr. Royal Gelder and the Belt Railway Company of Chicago (BRC) for allowing the authors to visit BRC's switching operations and observe several BRC yardmasters on the job before finalizing the yardmaster focus group questions. Thanks are also extended to Ms. Judith Gertler and Ms. Susan McDonough, both of Foster-Miller, for reviewing a draft manuscript of the final report and providing critical feedback. Thanks to Ms. Susan McDonough for also providing program administration support.

Lastly, but most importantly, the authors wish to thank all of the yardmasters who participated in the focus groups. Their willingness to openly share their experiences and opinions provided an important, but understudied, perspective on railroad yard switching safety.

Executive Summary

Analysis of 2004 Federal Railroad Administration (FRA) accident data shows that the rate of yard accidents (22.46 yard accidents per million yard switching miles) is more than 5 times greater than the overall train accident rate (4.33 accidents per million train miles) and more than 10 times the rate of accidents on other-than-yard track (2.11 accidents per million train miles). Furthermore, while the other-than-yard track accident rate has declined over the last several years (down 9.2 percent from 2001 to 2004), the yard accident rate has actually increased over 22 percent from 2001 to 2004. Efforts to further improve railroad safety, therefore, must include reducing accidents and incidents in switching yards.

While some research has examined yard switch crews and yard safety, no research to date has explicitly focused on the role of the yardmaster in the safety of switching yards. Yardmasters offer an additional and valuable perspective to yard safety because they manage the work flow in the yard, and they are often responsible for making up trains that operate on the main track. Both of these responsibilities carry important safety and productivity consequences in yards and on main track.

Yardmasters have numerous tasks and responsibilities that have the potential to result in temporary task overload and distraction. Furthermore, the yard environment is fast-paced and highly dynamic, with constant changes to train makeups, track occupancies and assignments, track conditions, and traffic flow. In addition, yardmasters are not normally covered under the Hours of Service (HOS) Law. Yardmasters generally work 8-16 hours (h) per day, and on occasion they may work longer. Task overload and distraction, combined with a fast-paced and highly dynamic environment and possible mental fatigue, can lead to errors and increase the risk of hazardous yard moves, incorrect or hazardous train consist arrangements, and possible negative health and well-being effects on yardmasters.

The purpose of this exploratory research was to identify potential yard safety issues related to the tasks and responsibilities of a yardmaster that may warrant further research and understanding by FRA and others, and to identify yardmaster-related lessons learned and best practices that can be shared across the railroad industry. Specific objectives of this exploratory research include the following:

- Understand the role yardmasters play in contributing to yard accidents.
- Characterize the nature of yardmaster injuries.
- Identify yardmaster job-related issues and risks that have the potential to compromise yard switching safety.

This study used combined quantitative and qualitative methods to examine the yardmaster's role in yard switching safety. The quantitative approach involved analysis of 1 year (yr) of FRA train accident and incident data to determine the yardmaster's role in yard switching accidents and to characterize the nature of yardmaster injuries. The qualitative approach involved nine focus groups with yardmasters around the country to provide greater insight into potential yard safety issues related to yardmaster tasks and responsibilities. No attempt was made to validate any statements made by yardmasters.

FRA train accident and incident data for 2004, the most recent year for which a complete set of accident/incident data were available, were analyzed first. The purpose of this analysis was to determine the number, type, and nature of reportable train accidents and injuries where yardmasters were involved. An additional goal of the analysis was to determine the utility of the FRA train accident database in identifying the role that yardmasters play in train accidents.

Complete 2004 train accident and incident datasets were downloaded from FRA's Web site for analysis. Analysis included train accidents on all track types (yard, main, etc.) and only those accidents that contained the word yardmaster in the narrative. This resulted in a total of 27 unique cases in 2004 where yardmaster appeared in the narrative. Of these 27 cases, 25 occurred on yard track, 1 occurred on main track, and information on the type of track was missing for the last case. Review of each of the 27 narratives indicated whether or not a yardmaster contributed to the particular accident.

Results of this review indicate that yardmasters are associated with few FRA-reportable train accidents. Yardmasters contributed to train accidents in less than one-fifth of 1 percent of the cases (7 out of 3,775). In all seven accidents, the yardmaster provided incorrect information or instructions/permissions (directives), or he/she failed to provide critical information, to the switch crew.

Analysis of the 2004 FRA casualty database revealed that yardmasters suffer very few injuries: one-fifth of one percent of all 2004 employee-on-duty injuries (13 out of 5,693) occurred to yardmasters or assistant yardmasters. A majority of the injuries, 8 of 13 (or 62 percent), were sprains or strains. The top two bodily locations of the injuries were to yardmasters' arms or hands (5 of 13 injuries) and the torso (5 of 13 injuries). Four of the 13 injuries (31 percent) were a result of slips, trips, or falls.

The United Transportation Union (UTU) and the United Supervisors Council of America (USCA, part of the Transportation Communication International Union) assisted in identifying cities in which to conduct focus groups and in recruiting participants. UTU and USCA represent a majority of yardmasters at U.S. Class I railroads. Focus groups took place in each of three different major cities across the United States. Each focus group lasted up to 2 h and was led by a moderator and a moderator's assistant. The same pre-established set of questions guided each focus group.

Fifty-six yardmasters from five U.S. Class I railroads participated in nine focus groups conducted between August and December 2005. The 56 yardmasters provided a convenience sample and were not statistically sampled to be representative of all yardmasters in the United States. Thus, while these 56 yardmasters provided significant insights into yardmaster operations issues, results may not be representative of all yardmaster operations or experiences. Of the 56 yardmasters, 3 were women. Participants ranged in age from 27 to 60 with an average age of 45. Fifty-one of the 56 yardmasters (91 percent) worked full time (100 percent) as a yardmaster. Ninety-three percent of all participants worked another railroad craft before becoming a yardmaster; a majority had prior experience as switchmen (66 percent) and/or clerks (27 percent).

Focus group questions concentrated around five major topics: (1) training and experience; (2) communications and information flow; (3) stress, distraction, and workload; (4) fatigue, staffing, and work schedules; and (5) best practices and lessons learned. Each topic contained two to five questions. Key themes from the focus groups included the following:

- *Training to become a yardmaster has remained essentially unchanged and is primarily on the job.* Participant training primarily involved unstructured, informal on-the-job training (OJT). Some newer yardmasters also received classroom training on the mechanics of using the railroad's train management computer system. In the past, this unstructured OJT was acceptable because experienced managers were available to field questions and provide direction to compensate for the unstructured OJT. More recently, participants observe that local managers have little railroad and yard operations experience. Thus, while training has generally remained the same over time, the support structure has changed.
- *Previous experience as a switchman or clerk is helpful to the job.* Most participants worked as clerks or switchmen before becoming yardmasters, and they felt this experience prepared them for the job. Experience as a clerk provided an understanding of how trains are processed, and experience as a switchman helped participants learn the yard layout and how to switch cars. These experiences enabled participants to get to know some of the crews that they were now supervising.
- *The yardmaster's job requires a combination of technical and managerial knowledge, skills, abilities, and other attributes.* Participants identified both technical skills, such as clerical and computer skills, and managerial qualities, such as the ability to supervise others and multitask, as important to the job.
- *Factors that contribute to effective communication and information flow include railroad experience, good communication skills, few interruptions, and minimal disruptions while communicating with switch crews.* Factors that contribute to poor communication and information flow include railroad inexperience, interruptions and distractions, and task overload.
- *Principal sources of stress include interactions with management, dispatchers, and crews; workload; and equipment problems.* Examples of stressful interactions with management include excessively high expectations and demands placed on yardmasters, management second-guessing yardmaster decisions, and intimidation. Participants cited inexperienced and uncooperative switch crews as additional sources of stress, as well as poor communication and cooperation with some dispatchers. Workload-related stressors include distractions, excessive or redundant communications, multitasking, productivity pressure, and a lack of opportunity to take a break. Equipment-related stressors include inadequate and poorly maintained locomotives and track, as well as computer failures.
- *Difficult aspects of the job mirror sources of stress and include interactions with others, workload, and problems with equipment and resources.*
- *Primary sources of distraction include events beyond the control or influence of the yardmaster.* Examples include incoming communications, changes to plans, malfunctioning equipment, delays, inclement weather, and distractions associated with the switch crews, such as crew inexperience and the consequent lack of big picture that requires the yardmaster to pay more attention to the crew rather than other tasks.
- *The general consensus among participants was that too few yardmasters were available to work, resulting in forced overtime in the form of an extended work shift.*

Participants also identified a number of ways to improve working conditions. Some key suggestions include:

- *Enhance yardmaster training through job skill and procedural improvements.* Suggestions included improved computer and communication skills training, development of a more formal OJT qualification program, and use of tabletop simulations.
- *Enhance communications and information flow.* Suggestions included improving radio equipment and FRA radio rules, reducing yardmaster responsibilities, increasing yardmasters' authority in yards, and streamlining communications to and from the yardmaster.
- *Reduce stress, distraction, difficulties, and workload through improvements in personnel/staffing, interaction and communication with others, equipment and facilities, and practices and procedures.* Personnel/staffing-related suggestions include adding clerks and more yardmasters to distribute workload. Interaction and communication improvements include reducing the number of managers with whom yardmasters interact, increasing positive interactions with managers, and improving the timeliness of information communicated to the yardmaster. Equipment and facility-related enhancements include improvements to track, on-track equipment, and office equipment and furniture. Suggested improvements to practices and procedures include changing work schedule practices and adding a break, such as a meal period.
- *Reduce fatigue by changing work schedules and work schedule practices.* Suggested improvements to work schedules include alternate work schedules, establishment of a maximum number of hours that can be worked in a shift (8-12 h maximum was recommended), allow an overtime shift to be split, provide more than 8 h of rest after working overtime, and provision of a 20-minute (min) meal/rest period. Another suggestion was to increase the number of yardmasters available to work.
- *Advice to new yardmasters about how to work safely and efficiently focused on general disposition and job-specific knowledge and skills.* Disposition-related suggestions include treat people with respect, do not try to be everyone's friend, be patient and keep your cool, and be flexible. Job-specific knowledge and abilities include maintain situation awareness and know the yard.

Finally, based on the accident/incident analysis and focus groups, the study identifies several opportunities for future research to further understand the role of yardmasters in railroad yard switching safety and to potentially increase railroad yard switching safety:

- Conduct a survey to characterize yardmaster work schedules and sleep patterns.
- Analyze FRA train accident data from 1991 to 2005.
- Develop a framework for revised FRA accident/incident databases.
- Conduct a task analysis and cognitive task analysis of the yardmaster's job.
- Develop yardmaster training objectives.

1. Introduction

1.1 Background

Analysis of 2004 FRA accident data shows that the rate of yard accidents (22.46 yard accidents per million yard switching miles) is more than 5 times greater than the overall train accident rate (4.33 accidents per million train miles¹) and more than 10 times the rate of accidents on other-than-yard track (2.11 accidents per million train miles). Furthermore, while the other-than-yard track accident rate has declined over the last several years (down 9.2 percent from 2001 to 2004), the yard accident rate has actually increased over 22 percent from 2001 to 2004.² Thus, any effort to further improve railroad safety must include reducing accidents and incidents in switching yards.

While some research has examined yard switch crews and yard safety (e.g., Reinach & Gertler, 2001), no research to date has explicitly focused on the role of the yardmaster in the safety of switching yards. A search of the Transportation Research Information Services online transportation research database (available at <http://trisonline.bts.gov/search.cfm>) for the terms *yardmaster* or *yard master* yielded a total of 8 reports or articles out of almost 450,000 records. All eight focused on modeling or analysis of railroad operations, including railroad yard operations, rather than on yard safety. In addition, all 8 reports were published more than 20 yr ago, between 1973 and 1983. Yardmasters offer an additional and valuable perspective to yard safety because they manage the work flow in the yard, and they are often responsible for making up trains that operate on the main track. Both of these responsibilities carry with them important safety and productivity consequences in yards and on the main track.

Yardmasters are the frontline supervisors of all activity that takes place in railroad switching yards. Yardmasters manage track use in yards; they also communicate and coordinate with yard track users. They interact with a number of different yard employees and crafts, including yard crews, mechanical and maintenance of way employees, carmen, and trainmasters, as well as other railroad employees, such as train dispatchers and road crews. They are responsible for, and must be aware of, inbound/outbound trains, switch crews operating in the yard, and the yard infrastructure. Often in large yards several yardmasters may work together to supervise and run the entire yard.

According to the General Code of Operating Rules (GCOR):

The yardmaster is responsible for and shall directly supervise yard crews, clerks, and all other employees working in the yard. The yardmaster must see that they work in a safe, efficient, and economical manner, according to the rules, regulations, and instructions of the railroad. Yardmasters must ensure the prompt and regular movement of cars, especially the proper makeup of trains and their movement into and out of the yard. At locations where yardmasters are on duty, employees in train, engine, and yard service must comply with the yardmaster's

¹ SOURCE: FRA Office of Safety data retrieved from <http://safetydata.fra.dot.gov> February 10, 2006. According to FRA, 2004 data are preliminary.

² Ibid.

instructions.... (GCOR Section 1.46 General Responsibilities/Duties of Yardmasters).

Yardmaster job descriptions such as those found on carrier Web sites clearly present the job requirements and necessary knowledge, skills, and abilities that must be brought to the job. Yardmasters must master or maintain a wide and diverse variety of knowledge areas, skills, and abilities. While dispatchers are the lynchpin of railroad safety along main track, yardmasters are the lynchpin of railroad yard safety. Similar to train dispatchers, yardmaster responsibilities have also increased recently due to increased business and workforce reductions (e.g., elimination of some clerical positions). For instance, in some switching yards the yardmaster may control track switches and provide point protection in addition to his/her other yard supervisory and management responsibilities.

Yardmasters have numerous tasks and responsibilities that have the potential to result in temporary task overload and distraction. Furthermore, the yard environment is fast-paced and highly dynamic, with constant changes to train makeups, track occupancies and assignments, track conditions, and traffic flow. In addition, yardmasters are not normally covered under the HOS Law.³ Yardmasters generally work 8-16 h per day, and on occasion they may work longer. Task overload and distraction, combined with a fast-paced and highly dynamic environment and possible mental fatigue, can lead to errors and increase the risk of hazardous yard moves (e.g., conflicting instructions from the yardmaster to two different yard crews), incorrect or hazardous train consist arrangements (which can affect safety on the main track if a train leaves the yard with a consist that is not in the right order, such as placement of HAZMAT), and possible negative health and well-being effects on yardmasters (e.g., an increase in coronary heart disease).

1.2 Objectives

The purpose of this exploratory research was to identify potential yard safety issues related to the tasks and responsibilities of a yardmaster that may warrant further research and understanding by FRA and others, and to identify yardmaster-related lessons learned and best practices that can be shared across the railroad industry. This research is also intended to provide a public source of information about the job of a yardmaster and his/her contribution to railroad yard switching safety.

Specific objectives of the exploratory research include the following:

- Understand the role yardmasters play in contributing to yard accidents.
- Characterize the nature of yardmaster injuries.
- Identify yardmaster job-related issues and risks that have the potential to compromise yard switching safety.

³ Whether or not a yardmaster is covered under HOS depends on the specific job tasks and duties that a yardmaster is carrying out in a given shift. According to 49 CFR § 228 Appendix A, “The approach of the law [as applied to yardmasters, for instance] is functional” (p. 297).

1.3 Overall Approach

The overall approach used in this study combined quantitative and qualitative methods to examine the yardmaster's role in yard switching safety. The quantitative approach involved analysis of 1 yr of FRA train accident and incident data to determine the yardmaster's role in yard switching accidents and to characterize the nature of yardmaster injuries. The qualitative approach involved nine focus groups with yardmasters around the country to provide greater insight into potential yard safety issues related to yardmaster tasks and responsibilities. No attempt was made to validate any statements made by yardmasters. Furthermore, the views, concerns, lessons learned, best practices, and suggested improvements to yard safety and yardmasters' work documented in this report are based on the opinions and perceptions of the yardmasters who participated in the focus groups and should not be attributed to FRA.

1.4 Scope

This exploratory study focuses on the tasks and responsibilities of yardmasters as they relate to yard switching safety. This study does not address the jobs of other railroad employees who work within the confines of switching yards or who manage these yards. These other employees include yard switch crews, carmen, maintenance of way employees, signalmen, mechanical employees, trainmasters, terminal managers, and superintendents. Each of these employee groups has some responsibility for yard safety. Results touch upon these other groups as they relate to the yardmaster's work, but these other employees are not the central focus of this study.

1.5 Organization of the Report

The remainder of the report is divided into several sections. Section 2 contains the results of the FRA train accident/incident data analysis. Section 3 discusses the focus group methods. Section 4 provides a demographic profile of those who participated in the focus groups. Section 5 presents the results of the focus groups. Section 6 summarizes the key themes based on the FRA train accident/incident data analysis and focus group results; this section also presents some recommendations for possible future research. Section 7 contains a list of references. Following Section 7 is a set of supporting appendixes. Appendix A presents supplemental yardmaster accident data. Appendix B presents a brief discussion of a systems model of human error in the context of the FRA accident/incident databases. Appendix C contains supporting information and data on yardmaster injuries. Appendix D contains the focus group questions. Lastly, a list of abbreviations and acronyms is included for reference.

2. FRA Accident/Incident Data Analysis

Analysis of FRA train accident and incident data for 2004, the most recent year for which a complete set of accident/incident data were available, was the first step in beginning to examine the role yardmasters play in yard switching safety. The purpose of this analysis was to determine the number, type, and nature of reportable train accidents and injuries where yardmasters were involved. An additional goal of the analysis was to determine the utility of the FRA train accident database in identifying the role that yardmasters play in train accidents. Given (1) yardmasters' work environment away from moving on-track equipment, (2) their upstream involvement, in time and space, in the movement of on-track equipment (that is, yardmasters issue directives about moving the equipment, they are not responsible for the actual movement and operation of the equipment), and (3) current FRA train accident reporting requirements that focus more on the operating crews and less on upstream factors, it was expected that the FRA train accident database would contain minimal information about the involvement of yardmasters in train accidents.⁴ Section 2.1 presents the findings from the analysis of train accident data, and Section 2.2 presents the findings from the analysis of yardmaster injuries.

2.1 Analysis of Train Accidents Involving Yardmasters

The initial approach was to search for train accident cause codes that indicated the involvement of yardmasters. A majority of these codes, however, focus on the operating crewmembers or others closest in time and space to the train accident or physical structures, such as mechanical and track issues. A few train accident cause codes suggest the possible involvement of yardmasters in train accidents. Some of these include:

- **H305** Instruction to train/yard crew improper
- **H405** Train orders, track warrants, direct traffic control, track bulletins, radio, error in preparation, transmission or delivery
- **H406** Train orders, track warrants, direct traffic control, track bulletins, written, error in preparation, transmission or delivery
- **H501** Improper train make-up at initial terminal
- **H99E** Computer system configuration/management error (non vendor)
- **H996** Oversized loads or excess height/width cars, mis-routed or switched

Each of these codes relates to a train authority (directive) or some other activity or responsibility that can be associated with yardmasters. Due to the ambiguity in code descriptions, however, review of the narratives in each case was necessary to verify the involvement of a yardmaster.

Complete 2004 train accident and incident datasets were downloaded from FRA's Web site for analysis. Accidents on all track types (yard, main, etc.) were included since, although yardmasters are responsible for operations within yard limits and track, it was possible for a yardmaster to have contributed to an accident just outside a yard on a main track. For example, it is possible that a yardmaster could give an improper authority to make a move on the main

⁴ An electronic keyword search for *yardmaster* in the entire FRA Guide to Accident/Incident Reporting (FRA, 2003) yielded only citations in Appendix D, Employee Job Codes.

track when, in fact, the dispatcher did not authorize it. Therefore, the analysis included all track types.

Since it was necessary to review the narratives in each accident case, analysis included only those train accidents that contained the word yardmaster in the narrative. This resulted in a total of 27 unique cases for 2004 where yardmaster appeared in the narrative. These 27 cases represent 0.7 percent of the 3,775 total unique cases (accidents) contained in the 2004 train accident database.⁵ Of these 27 cases, 25 occurred on yard track, 1 occurred on main track, and information on the type of track was missing for the last case.

The presence of yardmaster in the narrative did not necessarily mean that a yardmaster contributed to the particular accident. The following two example narratives illustrate train accidents where a yardmaster clearly (1) was involved and (2) was not involved:

1. Coming into ALS yard, yardmaster told crew they were lined up, switch was lined against them, engineer applied too much independent brake, derailling 3 cars on trra trk....
2. Pulling from track when yardmaster notified crew to stop the train account cars were derailed. Found cars derailed account broken rail.

In addition, a number of cases existed where it simply was not clear from the narrative whether or not the yardmaster contributed to the accident.

Review of each of the 27 narratives helped to determine whether a yardmaster contributed to the particular accident, a yardmaster did not contribute to the accident, or it was not clear from the narrative that a yardmaster contributed to the accident. Results of this review indicate that yardmasters contributed to the accident in only 7 of the 27 cases where the narrative contained yardmaster (26 percent of the sample). In another 9 cases, it was unclear whether or not a yardmaster contributed to the accident (33 percent); in 11 cases, the yardmaster did not contribute to the accident (41 percent). Appendix A presents the 20 cases where it was either unclear whether or not the yardmaster contributed to the accident, or where it was clear that he/she did not contribute to the accident. Overall, it was evident that a yardmaster contributed to a train accident in only 7 of the 3,775 train accidents in 2004, or about one-fifth of 1 percent.

Table 1 presents the accident narratives for the seven cases where it was evident that the yardmaster contributed to the accident, as well as the primary train accident cause (and code) associated with each case. In addition, Table 1 includes a brief description of the role the yardmaster played in contributing to each accident based on a distillation of the narrative.

Based on the train accident cause codes, four of the seven accidents were associated with improper instructions given to the train/yard crew (H305). In each case, the narrative was consistent with the cause code. Analysis of train accident cause codes for the remaining three accidents revealed that one each resulted from: absence of a man on or at leading end of movement during a shoving movement (H306), improper use (except actuation) of the

⁵ The initial 2004 database contained 4,340 cases, of which 564 were duplicate cases (i.e., two railroads reporting on the same accident). This resulted in 3,776 unique cases; 28 of these included a reference to yardmaster in their narratives. Upon reviewing the narrative sections of these 28 accidents, however, one more duplication was found, where two different cases had unique incident reporting numbers but described the same accident. Consequently, 1 of the 2 cases was removed, resulting in a starting total of 3,775 unique cases, and 27 included yardmaster in the narrative.

independent brake (H525), and other train operation/human factors (H999). Thus, in two cases where the yardmaster contributed to the accident based on a review of the narratives, the train accident cause code focused on the operating crew, not the yardmaster. Furthermore, neither of these cases had a secondary train accident cause code, principally H305, that would indicate the role of the yardmaster in contributing to the accident and that would show consistency with the narrative.

Analysis of the narratives suggests that in all seven accidents, the yardmaster provided incorrect information or permission/instructions (directives), or failed to provide critical information, to the switch crew. In three cases (#2, #3, and #7), the yardmaster gave the switch crew instructions or permission to shove into an already occupied track. In two other cases (#5 and #6), the yardmaster provided incorrect information to the switch crew. In one of these instances, the yardmaster told the crew they had 3,000 feet (ft) of clearance when, in fact, a derail was in place that the yardmaster did not see; in the second instance, the yardmaster told the crew they were lined up for their next move when, in fact, a switch was lined against their move. Lastly, in one case (#4), the yardmaster gave the hostler of a foreign railroad permission to move an excess height car (auto rack) under a tower where there was insufficient clearance.⁶ In the last case (#1), the yardmaster failed to provide critical information about a recently installed turnout, of which the switch crew was unaware.

Table 1. 2004 train accidents where yardmaster was included in the accident narrative and the yardmaster contributed to the accident

No.	Train Accident Narrative ⁷	Train Accident Cause Code	Train Accident Cause	Yardmaster Role
1.	Interchanging 79 cars on track #4 at Highlawn. While shoving south (conductor position at approximately mp 18.7 protecting) train diverged into side of standing cut (120 cars) on track #3 at mp 18.5. CN had installed diverging track from #4 to #3 at said location, and CN (IC) yardmaster failed to notify conductor of the temporary turnouts just installed. See attached drawing and cora guide, turnouts installed for CN bridge work. (originally shown as CNIC changed to IC per FRA).	H305	Instruction to train/yard crew improper	Failed to communicate information about temporary turnout

⁶ In this case, the yardmaster was expected to know clearance points since the tower was within the yard.

⁷ Extracted verbatim from the FRA Accident/Incident database.

No.	Train Accident Narrative ⁷	Train Accident Cause Code	Train Accident Cause	Yardmaster Role
2.	At approximately 1540 8/25 train M39931-24 shoving northward on throughfare No4 M399091-24's train which was shoving northward from f-yard lead onto throughfare No4 track. Yardmaster waived investigation and accepted responsibility for giving M390 to shove which resulted in the impact. Employee was issued a formal reprimand.	H305	Instruction to train/yard crew improper	Gave instruction/permission to shove into occupied track
3.	YSC08-16 switching cars with yardmaster in tower taking shove but he looked at wrong track and gave crew okay to shove cars in, and struck cut that was in the track.	H305	Instruction to train/yard crew improper	Gave instruction/permission to shove into occupied track
4.	BNSF hostler requested of BRC hump yardmaster authority to wye lite power BNSF 1070, up 4455 on wye beneath hump tower. BRC humpmaster said ok to do so. BNSF crew observed empty autorack in west leg of wye, and asked humpmaster if they could shove car to east leg. Humpmaster also ok'ed this move. BNSF hostler move lined move ahead and began to shove car beneath hump. Excess height car would not clear, and conductor was unable to stop move before some damage occurred to roof panels of ETTX. [Same accident as reported by different railroad: H305 Hostler brought two engines to BRC railway to wye the power. BRC hump yardmaster gave BNSF crew permission to wye the power under the hump tower. BNSF crew notified BRC hump yardmaster of ETTX 80164 6 was in their way. BRC hump yardmaster then gave permission to crew to tie on to ETTX 801646 and move it to the east leg of the wye. In performing this move, ETTX 801646 lodged under the BRC hump tower. BRC has claimed all responsibility.]	H305	Instruction to train/yard crew improper	Gave instruction/permission to move excess height car onto track with insufficient height clearance
5.	Shoving back to add cars to outbound train. Yardmaster told the crew they had approximately 3000 ft. Crew made blind shove, shoved over derail placed by MOFW causing cars to derail 2/25 - corrected Q8.	H306	Shoving movement, absence of man on or at leading end of movement	Communicated incorrect clearance

No.	Train Accident Narrative ⁷	Train Accident Cause Code	Train Accident Cause	Yardmaster Role
6.	Coming into ALS yard, yardmaster told crew they were lined up, switch was lined against them, engineer applied too much independent brake, derailling 3 cars on trk. trra est tra damage = \$12,000.	H525	Independent (engine) brake, improper use (except actuation)	Communicated incorrect switch alignment
7.	YNI39r-11 hump job was instructed by hump yardmaster to shove 8 cars into bowl 41. The track was already full, thus shoving cars out the end of rail into side of the YNI32r-11.	H999	Other train operation/human factors	Gave instruction/permission to shove into occupied track

The goals of this analysis were to gain a better understanding of the role that yardmasters play in train accidents based on actual train accident data and, more generally, determine the value of the FRA train accident database at identifying the contribution of yardmasters in train accidents. Based on review of the 2004 FRA train accident data, yardmasters are associated with few FRA-reportable train accidents. Yardmasters contributed to train accidents in less than one-fifth of 1 percent of the cases (7 out of 3,775). Another nine cases may have involved the yardmaster, but these cases were not definitive (see Appendix A). In all seven cases where the yardmaster contributed to the accident, the yardmaster provided incorrect information or permission/instructions (directives), or he/she failed to provide critical information, to the switch crew.

It is possible that yardmasters are simply rarely involved in, or rarely contribute to, train accidents. An alternative explanation is that the accident database is not structured to adequately collect information on upstream factors, such as the involvement of yardmasters (as supervisors) and their contribution to train accidents. That is, yardmasters may play a greater role in train accidents than the FRA train accident database indicates. FRA Rail Equipment Accident/Incident Report form 6180.54, which is the source for the FRA train accident database, contains no explicit fields to identify the involvement of yardmasters or other supervisors. The form primarily collects information about operating conditions and one or more train crew's involvement in the accident (e.g., fields 40-45 ask about injuries to, and length-of-duty of, the train crew. An other category exists for injuries to others, but due to the nature and location of their job, yardmasters are highly unlikely to be the ones injured in train accidents. In other words, FRA Form 6180.54 focuses on the sharp end of the accident, that is, the operating crews, conditions, and structural problems closest in time and space to the accident, and not upstream factors, such as supervisory and organizational factors that, in fact, may have contributed to the accident. Appendix B contains further discussion of a systems model of human error and its relationship to the FRA accident/incident databases.

2.2 Analysis of Yardmaster Injuries

Yardmasters work in an office environment (see Figure 1); thus they are not exposed to yard switching-related hazards, such as moving on-track equipment. They are like train dispatchers in

this respect. Analysis of the 2004 FRA casualty (incident) database helped to determine the prevalence of injuries to yardmasters and describe the nature and circumstances of their injuries.

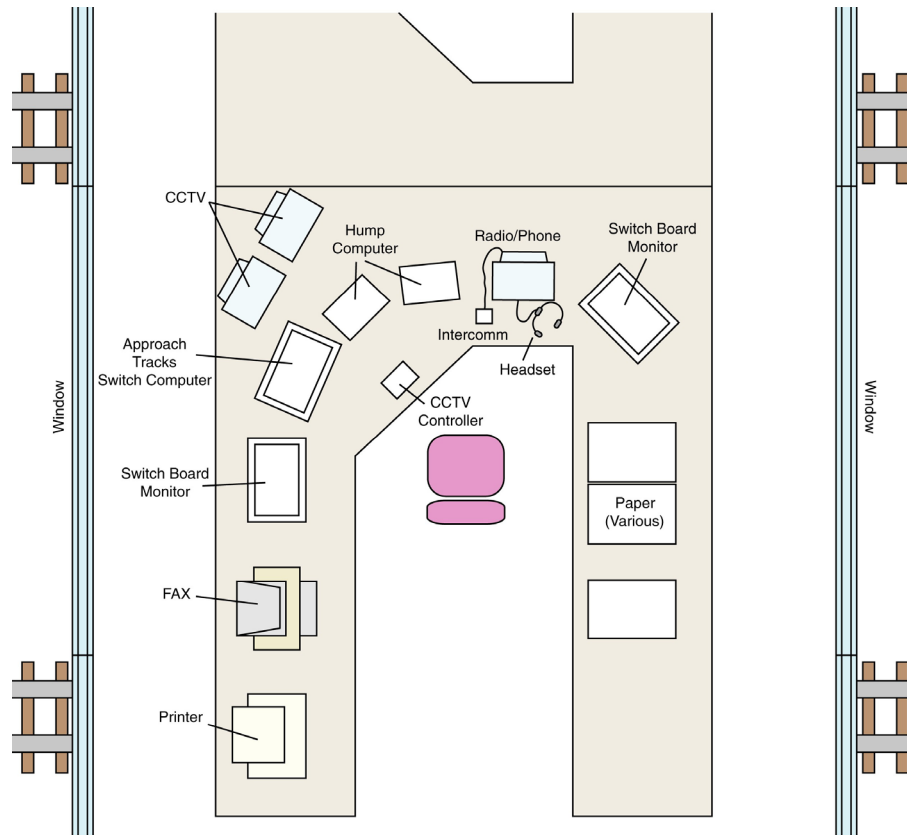


Figure 1. Diagram of a yardmaster's office in tower overlooking hump tracks

There were 5,693 employee-on-duty injuries in 2004. Thirteen of these occurred to yardmasters (or assistant yardmasters; both share the same job type code, 523), or 0.2 percent of all 2004 employee-on-duty injuries. Of the 13 injuries, only 4 included narratives that provided more detailed description of the injury. Of the four, two involved a vehicle, one involved reaching over a printer, and one involved a chair that broke.

Appendix C contains detailed information on the nature and circumstances of the 13 injuries. Briefly, a majority of yardmaster injuries (8 of 13, or 62 percent) were sprains or strains. The top two bodily locations of the injuries were to yardmasters' arms or hands (5 of 13, or 38 percent) and torso (5 of 13, or 38 percent). Four of the 13 injuries (31 percent) were a result of slips, trips, or falls. No one particular physical act led to a significant number of injuries (3 of the 13 injuries, or 23 percent, occurred while the yardmaster was sitting). Thirty-eight percent of the injuries (5 of 13) were associated with a human factor probable cause, while another 38 percent of the injuries were associated with an equipment problem. In terms of the time of day that the injury occurred, the number of injuries was fairly evenly distributed among the 12 a.m. to 8 a.m. (n=4), 8 a.m. to 4 p.m. (n=5), and 4 p.m. to 12 a.m. (n=4) periods. Analysis of injuries by month (mo) shows that no injuries occurred in 4 mo (January, February, August, and November), 3 injuries occurred in May, and all other months were each associated with 1-2 injuries. Lastly, analysis by age indicates that 5 of the 13 injuries (38 percent) occurred to

yardmasters between 45 and 54 yr old, 4 injuries (31 percent) occurred to those 34 yr old or younger, 3 injuries (23 percent) occurred to those 35 to 44 yr old, and 1 injury (8 percent) occurred to a yardmaster 55 yr old or older. Exposure data for time-of-day, month, and age were not available to normalize these latter findings. Appendix C contains detailed figures and tables for these 13 yardmaster injuries.

3. Focus Group Methods

Focus group interviews are a qualitative data collection research method in which typically 8-10 open-ended questions are posed to a group of 6-9 individuals. Each focus group lasts 1-2 h, is conducted at a neutral, offsite location, such as a hotel conference room, and participants are compensated for their time. Participants' answers are based on their own experiences. Focus groups favor individual expression of ideas over group consensus. De-identified results are reported in aggregate, based on the topic being addressed. No one correct answer exists when participating in a focus group. Furthermore, responses are not quantified. The advantages of focus groups are in the richness, or quality, of information gathered in the group setting and the broad range and depth of information and insights, sometimes unanticipated, that can be obtained from participants. Focus groups tap participants' experiences, opinions, and attitudes toward a topic, and they are well suited to enable the exploration of how yardmasters' job tasks and responsibilities influence U.S. switching yard safety.

UTU and USCA assisted in identifying cities in which to conduct focus groups and in recruiting participants. UTU and USCA represent a majority of yardmasters at U.S. Class I railroads. Union officials helped identify three cities, including at least one east of the Mississippi River and one west of the Mississippi River, to ensure access to yardmasters from most of the U.S. Class I railroads.⁸ An additional criterion was that at least two Class I railroads had to have a switching yard in each city to provide an adequate potential pool of focus group participants from which to draw.

Union general chairpersons assisted in identifying local chairpersons responsible for yardmasters in each city that had been identified. Next, researchers worked with local chairpersons to recruit yardmasters to participate in the focus groups. Selection criteria assisted local union officials in recruiting focus group participants. Participants had to currently work as a yardmaster at least once per week; they had to have at least 1 yr of yardmaster experience (working as a yardmaster at least 1 day (d) per week); they could not be a general union chairperson or state legislative representative; and they had to be interested in sharing their experience as a yardmaster. Participation in the focus groups was completely voluntary.

Three focus groups were conducted in each of three different major cities across the United States. Focus group times varied in each city to give yardmasters working each shift an opportunity to participate. Generally, one focus group took place in the early afternoon to accommodate yardmasters before starting second shift, one took place in the late afternoon to accommodate yardmasters coming off first shift, and one took place at night to accommodate yardmasters before starting third shift.

Krueger's *Focus Groups: A Practical Guide for Applied Research* (1994) helped structure the focus groups. Each focus group lasted up to 2 h and was led by a moderator and a moderator's assistant. A pre-established set of questions (see Appendix D) guided each focus group.

⁸ Historically, the Mississippi River has provided a natural border that separates the four largest U.S. Class I railroads; specifically, Union Pacific Railroad and BNSF Railway operate primarily west of the Mississippi River while CSX and Norfolk Southern operate primarily east of the Mississippi River.

Moderators used the same set of focus group questions for each focus group in each city. At the completion of each focus group, moderators compensated and thanked participants for their time.

4. Focus Group Participant Profile

Fifty-six yardmasters from five U.S. Class I railroads participated in nine focus groups conducted between August and December 2005. The 56 yardmasters provided a convenience sample and were not statistically sampled to be representative of all yardmasters in the United States. Thus, while these 56 yardmasters provided significant insights into yardmaster operations issues, results may not be representative of all yardmaster operations or experiences. Of the 56 yardmasters, 3 were women. Participating yardmasters ranged in age from 27 to 60 with an average age of 45. Table 2 presents railroad industry experience data for participating yardmasters.

Table 2. Focus group participant industry and yardmaster experience (yr)

	Mean	Median	Range
Age	45.5	48.1	27.3–60.0
Railroad industry experience	21.0	26.3	3.0–41.0
Yardmaster experience	13.0	11.0	1.0–36.5

Fifty-one of the 56 yardmasters (91 percent) said they worked full time (100 percent) as a yardmaster, 3 yardmasters worked less than full time, and data were missing for 2 yardmasters. Of the three that reported less than full-time employment as yardmasters, one worked a special assignment, a second worked as a computer clerk, and data were missing for the third yardmaster.

Table 3 presents the current work schedule for participating yardmasters. Participant work schedules were relatively evenly split across shifts.

Lastly, 93 percent of all participants worked another railroad craft before becoming a yardmaster. Table 4 presents a breakdown of railroad crafts worked before becoming a yardmaster. A majority of participating yardmasters had prior experience as switchmen (66 percent) and/or clerks (27 percent).

Table 3. Focus group participant current work schedules

Shift	Percent of Yardmasters
First	25.0
Second	26.8
Third	19.6
Rotating	17.9
Extra Board	10.7

Table 4. Railroad crafts worked before becoming a yardmaster

Craft	Number of Yardmasters
Switchman ⁹	37
Clerk	15
Car retarder operator	5
Locomotive engineer/fireman/hostler	3
Trainmaster/terminal manager/manager	3
Carman/car maintenance, inspection, or repair	2
Maintenance of way	1
Block/tower operator	1
Railroad police	1

NOTE: Some participants worked more than one craft before becoming a yardmaster.

⁹ This category includes all trainmen, variously referred to as switchmen, conductors, brakemen, groundmen, and yard foremen depending on the railroad and specific job assignment.

5. Focus Group Results

Focus group questions concentrated around five major topics and each topic contained 2-5 questions. Focus group topics included:

1. Training and experience
2. Communications and information flow
3. Stress, distraction, and workload
4. Fatigue, staffing, and work schedules
5. Best practices and lessons learned

Appendix D contains a complete set of focus group questions. Results have been de-identified to protect the anonymity of focus group participants and the carriers for whom participants worked. The nature of focus group research is to rely on participant opinions, attitudes, and experiences. Results are based on what yardmasters reported. No attempt was made to validate any statements.

The first focus group question asked participants to describe the job of a yardmaster in their own words. As noted in Section 1.1, GCOR offers the following definition:

The yardmaster is responsible for and shall directly supervise yard crews, clerks, and all other employees working in the yard. The yardmaster must see that they work in a safe, efficient, and economical manner, according to the rules, regulations, and instructions of the railroad. Yardmasters must ensure the prompt and regular movement of cars, especially the proper makeup of trains and their movement into and out of the yard. At locations where yardmasters are on duty, employees in train, engine, and yard service **must comply with the yardmaster's instructions....** (Section 1.46 General Responsibilities/Duties of Yardmasters).

The GCOR definition encompasses a majority of the job descriptions that participating yardmasters provided at the beginning of the focus groups. A few, however, passed along succinct hyperboles that conveyed a more colorful description of the job of a yardmaster. Observed one participant, yardmasters “baby sit.” Another explained that their job is like being a “traffic cop.” And a third simply noted that they do “everything.” A fourth yardmaster compared the job to that of an air traffic controller, “...only on the ground. We bring ‘em in, brake ‘em apart, put ‘em together, and we dispatch ‘em out of the yard.” Finally, a fifth yardmaster summarized the safety component of their job in one sentence: We “keep the trains from running into each other.”

5.1 Training and Experience

This section is divided into three subsections: yardmaster training and experience; knowledge, skills, abilities, and previous experience; and suggestions to improve yardmaster training.

5.1.1 Yardmaster Training and Preparation

After describing the job of a yardmaster, participants described their training to become a yardmaster. Regardless of when participants began as yardies (another term for yardmasters), training to become a yardmaster consists of primarily informal, unstructured OJT, where a student sits with a variety of yardmasters over the course of several weeks or months to learn the job. Some participants noted that they also received classroom training to learn how to use the computer system that is used to manage inbound and outbound trains and to generate reports. A number of these participants were critical of the OJT and/or the classroom instruction. One participant notes that classroom instruction teaches you "...the tools you need to move inventory or identify different trains...but [it] doesn't teach any of the basic, common sense things that says you can't work two jobs on the same lead or someone's gonna be sittin' there watching." In describing the OJT, another participant observes that there is "no formalized training...There's no manual, there's no anything that you're going to get. You're lucky if you can find a couple of old...maps lying around and you can make photo-copies..."

According to participants, the quality and quantity of OJT depends on a number of factors, though most yardmasters spent from 1 week (wk) to several months qualifying (OJT) on each position (job). One participant explains that the amount of OJT you receive depends upon how busy the yard is or on the need for warm bodies in the seat. Another participant explains that in the last 2 yr, the carriers "provide just enough [training] in order to keep themselves out of hot water, but the training and support for the yardmasters [is] not there." Another participant draws a comparison to becoming a yardmaster in the past versus becoming a yardmaster now:

If they think you're half-way qualified, they're gonna put you in there, which, 5 [or] 10 yr ago, probably wouldn't have been that big of a deal when you had a manager sitting behind you and he knew what was going on, but now [a manager] has been out on the railroad 7 mo, [and he has] never been on the road, never been a conductor, never pulled a pin, all he knows is that rule book.

A number of yardmasters shared this sentiment. These yardmasters observed that years ago, when you trained to become a yardmaster, a support structure existed in the form of experienced and knowledgeable yard managers who compensated for the lack of structured OJT. That support is generally gone now, even though the informal, unstructured OJT remains. A number of participants explained that current yard managers (such as a trainmaster or terminal superintendent), who yardmasters used to turn to for help, can often no longer help the student or experienced yardmaster since these managers often have less yard operating experience than the yardmasters.

When asked how prepared they felt at the conclusion of their training, participants generally felt prepared working the job, but a number of participants qualified their statements by noting that it was not until they had several weeks to several months of experience at a particular position that they began to feel comfortable. That is, they felt that they had "just enough training to get by," but "experience is the name of the game." As one participant observes, "I don't think there's anybody that doesn't sweat it out the first time." Another yardmaster remarked that at the end of his training, he felt like a "deer in...headlights." One participant described the overwhelming responsibility that lies on the yardmaster's shoulders and that weighs on their minds as they begin to work on their own. Explained this participant, "I, like others, I guess was pretty

confident in my own abilities, but when you sit and ponder that your carrier has left you in charge of a multi-million dollar operation with sensitive shipments that affect the economy of the United States,...it's pretty mind boggling.”

Some of the more experienced participants suggested that they felt comfortable immediately after their training because more experienced people (yardmasters and managers) were always around whom they could talk to and ask questions. But the general sentiment from most participants was that, regardless of the training, comfort and proficiency in the job come with experience. As one participant explains, “It doesn't take long to lock up a big yard with inexperience.” Another explains that it “takes a good year to get comfortable with it...even if you half-way know what you're doing startin' off.” A third participant notes that after “6 mo... you're good enough not to need too much supervision, but [it takes] 5 yr to be really comfortable.” In fact, several participants observed that you are “not a good yardmaster for about 5 yr.” One participant even remarked, “I'm still learning today.”

The amount of time necessary to become comfortable depends on how many locations one works and the shift(s) one works, according to several participants. That is, the more locations one works, the longer it takes to become comfortable, since unique aspects of the job exist at each location. The shift(s) one works affects how quickly he/she learns, since some shifts are associated with greater workloads than other shifts.

5.1.2 Recommended Yardmaster Knowledge, Skills, Abilities, and Prerequisite Experience

Next, focus group participants identified the skills and abilities, and important prerequisite experience, necessary to become a good yardmaster. Participants identified the following skills and abilities as critical to becoming a good yardmaster:

- *Common sense.*
- *Ability to multitask.* As one participant explained, “You need to multitask while you're multitasking.” Another participant noted that you must be able to hear what is being said while focusing on something else.
- *Organizational and clerical skills and the ability to plan, strategize, coordinate, and prioritize.*
- *Good written and oral communication and listening skills.* One participant explains that yardmasters must have “the ability to communicate with...people. Be able to articulate what you want them to do.” Another participant explains that you “need to know what you're asking people to do, and not ask people to do something you wouldn't do.” A third participant explains that you need to “make sure you get your thought across clearly, to the guy you're talking to.” A fourth participant explains, you “have to be specific; generalities won't do, because if you're not specific...they [switch crews] may know what you want, but they'll do it their way, instead of how you anticipate them doing it.” Two participants point out the importance of good communications, especially with new and inexperienced switch crews. They explain that it is important to be able to break down what is in your mind and explain to the crews what you want them to do since they may not yet be familiar with the railroad lingo you use or the yard configuration. Separately, one participant pointed out the importance of being able to

listen to the radio. Notes this participant, “The radio is the lifeline of everything out there.”

- *Supervisory/leadership/management skills.* Also referred to as people skills, participants noted that it was important to be diplomatic when interacting with others, as well as to be able to negotiate and work with different personalities. Related to this is the ability to lead and motivate others. Explains one participant, “You have to sell the railroad to the crews.” Notes another participant, “You really gotta know who you’re working with that day. There are so many personalities.” A number of participants explained how important it was to know the personalities of the yard crews and others with whom you interact. One participant also suggested that yardmasters have an “outgoing personality.”
- *Patience/even-tempered/thick-skinned/ability to manage stress.* Notes one participant, you “cannot be a hothead.” Another participant points out that a yardmaster must be able to accept criticism. Adds another participant, you must “have a high stress threshold.”
- *Flexibility/open-mindedness.* One participant explained that you must be “...able to change your plans, and think on your feet.” Another participant explains, “If you come to work with a pen, throw it out the window and go get a no. 2 pencil.” In terms of flexibility in planning, another participant describes the need to “develop...Plan A all the way through Plan D, because it might take part of A, part of C, B didn’t ever work, and [now] you’re working your way down through D...” One participant asked the following rhetorical question that conveys the need for flexibility: “Who plays chess? Truly, if you play a decent game of chess, you have a chance at this job....You literally firefight it, it’s not because of bad planning, but you don’t know what’s going to hit you. It’s just like a move that you didn’t expect; you have to reorganize.” Though it is important to be flexible, participants also noted the value in being strong-willed at times. Explains one participant, you have to “be able to stand your ground... [and] have a backbone.”
- *Quick thinking.* Explains one participant, you must “be a quick study.”
- *Computer skills and a basic understanding of computers.*

One participant summarizes some of the skills and abilities that a good yardmaster needs as follows:

You have to be organized, you have to have a pretty high level of intensity, you gotta stay on top of your job, gotta be ready to come in and work 8 h, you gotta be focused, task oriented, you have to have endurance, be able to work without a break, or without a lunch for 8 h, and it’s nonstop from the time you sit down in that chair to the time you get up. It’s go time. You’re gonna take 100 phone calls and make 100 phone calls, and you’re gonna talk to and make probably 100 decisions.

Another participant compared a yardmaster’s job to that of an air traffic controller.

Participants overwhelmingly identified two types of prerequisite experience that they felt were important to becoming a good yardmaster: switchman experience and/or clerical experience. Participants identified switchman experience as important because they felt that the more

knowledge and understanding a yardmaster had of the yard and switching operations, the better job that yardmaster could do. Explains one participant: “[You] need to be able to walk in the shoes of the people you supervise.” Similarly, a second participant points out that yardmasters should “know the job that they’re trying to get somebody to do.”

Yardmasters considered clerical experience important because this experience gave the yardmaster prerequisite knowledge of the computer system and how to complete requisite paperwork. Traditionally, the career path to becoming a yardmaster was for an individual to work as a clerk or switchman first. In the past, each yardmaster had his/her own clerk who assisted with handling the paperwork, and he/she became familiar with the yardmaster’s job since he/she was supporting the yardmaster. Recently, the number of clerks has declined due to the implementation of computer systems that have automated a number of the clerical tasks and responsibilities. As the clerical ranks shrunk, some of the clerical tasks passed to the yardmaster. Participants considered clerical experience to be a valuable asset as a yardmaster.

Some other prerequisite experiences that one or more participants identified as helpful to becoming a good yardmaster were working around heavy equipment; any clerical experience, railroad or otherwise; locomotive engineer experience; carman experience; prior experience managing people; and, in general, any railroad experience.

5.1.3 Suggested Improvements to Yardmaster Training

Lastly, participants offered suggestions on how they would improve yardmaster training. The following organizes suggestions into two groupings: job skill suggestions and procedural suggestions.

Job skill suggestions to improve yardmaster training

- *More thorough and formalized computer training.* Several participants made it clear that it was very important to teach student yardmasters how to use the computer system (e.g., computer functions), including any shortcuts, abbreviations, and acronyms that are used to make the job easier or more efficient. Notes one participant, “You need to be able to navigate your way through some of these yard screens.” Related to this, one participant also suggested that railroads provide student yardmasters with a computer manual that can be used as a reference to explain how to perform different functions.
- *Ensure yardmasters are familiar with all of the crafts and jobs, including technical aspects, with whom they are expected to interact.* Several yardmasters suggested that hands-on training is the best way to convey this knowledge, preferably through previous operating experience in the yard, or at the least, some hands-on exposure. One participant explains:

Across the board, just get knowledgeable, not only as a yardmaster, but also trainman, different classes of cars and why trains are built and why it’s important to get them right, and classed right, not having the dangerous...[loads] next to the reefer.... As a yardmaster, I’d like to know how to be on the ground, [I have] never been on the ground; as a carman, [I] know the parts of the car, and what’s wrong with it, [and] some things

about an engine, [but] I can't give them any feedback if they say they have problems with it.

Another participant states very simply, "Get on the ground, ride some jobs, [and] walk the yard." A third participant suggests that student yardmasters obtain:

A cross-sampling of all the jobs. Let them work with mechanical for a week, let them work with traffic department for 1 wk, then they'll understand why they're doing what they are [doing].... Then they [will also] have an investment in what they're doing....I think a week in every craft that reports to the yardmaster...is very important.

- *Provide instruction on the language (lingo) used in the yard.*
- *Provide communications and personal interaction (i.e., people) skills training.*

Procedural suggestions to improve yardmaster training

- *Train on the job with a yardmaster who is working his/her regular shift or with an experienced yardmaster.* One participant explains that, for a regular yardmaster, "That's his home...when someone walks into your home...you know how to show him around." This sparked a conversation among several participants that focused on comparing OJT with a regular yardmaster versus an extra board yardmaster. They pointed out that a regular yardmaster will be coming back to that job and therefore will take care of it. They also noted that the (regular) switch crews get accustomed to the regular yardmaster, so work flows more easily with that regular yardmaster. Participants pointed out that the regular yardmaster will be better able (and motivated and have more time) to instruct a student yardmaster because of these advantages. An extra board or relief yardmaster works a job for one shift and then he/she is off to the next assignment, which may or may not be at the same location and shift. According to participants, the regular yardmaster has a routine that he/she can show the student yardmaster; the extra board yardmaster is more likely to be busy managing the yard and will have less time to give to instructing the student yardmaster because he/she is less familiar with the location.
- *Develop a formal program to qualify yardmasters on each territory or location.*
- *Provide job previews to prospective yardmasters before they bid on the job.* Similarly, for those student yardmasters who are sent away to receive classroom instruction, one participant suggests "...if you're going to go away to school, sit up in [the] tower first, so things will make sense. That way you'll know what you're looking for when you go to school."
- *Provide refresher training during a yardmaster's first year on the job if he/she is rotating to different positions/locations/yards.* The concern is that a yardmaster may have trained for 1-2 wk at a particular location, but he/she may not return to work at that location for several months.
- *Reinforce and solidify learning by going back and forth between classroom instruction and OJT.*

- *Use tabletop simulation.* Two participants suggested using simulated scenarios of yard events in the classroom and discussing or asking why the yardmaster did what he/she did.
- *Use experienced yardmasters for classroom instruction and mentoring.*
- *Slow down the pace of training.* In the words of one participant, “Less of a get thrown to the wolves thing...more of a gradual, slow thing.”

5.2 Communications and Information Flow

Next, participants answered a series of questions that focused on communications and information flow, since these are paramount to the yardmaster’s job as supervisor of all yard activities. Participants first described the flow of information to and from the yardmaster and identified all parties with whom they communicate. A second question addressed what information is provided to and from yardmasters. A third question asked participants to identify what affects good and bad communications, and lastly, a fourth question solicited suggestions on how to improve communications. This section contains the following three subsections that discuss the results of participant responses to these questions: current communications and information flow, factors contributing to effective (good) and poor (bad) communications and information flow, and suggestions to improve communications and information flow.

5.2.1 Yardmaster Communications and Information Flow: Current Practices

According to participants, yardmasters communicate with a large number of individuals. One participant summed up the consensus feeling as follows:

Everybody contacts the yardmaster.... We deal with the locomotive people, the engineering department...the car department, the contractors, officers, it’s a catch-all. This yardmaster [telephone] number has become a number that everybody calls if they want to get anybody on the line that might remotely know what... is going on...they call the yardmaster.

Another participant explains, “You hang up one call and there’s another one right there, all shift....”

According to participants, during their day-to-day operations, yardmasters may speak to a whole variety of parties from both their own railroad and other railroads. The following list presents those parties that focus group participants identified. The list also presents information that is provided to and from yardmasters. The list is not exhaustive and is presented in no particular order of significance or frequency.

- *Switch crews.* Switching instructions; location of train, power, and/or cars; information on accidents, emergencies, broken rail, and dead power.
- *Incoming road crews.* What track to come in on, what to do with the power, and information about a shuttle van.
- *Other yardmasters.* Overview of what is going on in the yard at turnover time; coordination with other yardmasters working other positions in same yard.

- *Trainmasters.* Information on why trains are not moving; instructions to move one or more cars.
- *Car department personnel.* Information on what tracks need to be serviced (cars on the track) and bad orders.
- *Signal department personnel.*
- *Maintenance of way personnel.*
- *Mechanical department personnel.* Information on where locomotives are in the yard that need to be serviced.
- *Territory and chief dispatchers and tower operators.* Information on inbound trains.
- *Railroad managers and officers, such as corridor managers, terminal superintendents, and assistant terminal superintendents.* Information on operational situations; instructions regarding what managers/officers want done in the yard.
- *Shuttle van (a.k.a. limousine) and taxi drivers.*
- *Contractors.*¹⁰
- *Power desk personnel.*
- *Pilot coordinators.*
- *Fuel truck drivers.*
- *Customers and customer service representatives.* Information about the location and progress of one or more cars.

Means of communications available to yardmasters include the radio (multiple channels), intercom, computer (e.g., instant messaging, email), cell phone (including push-to-talk instant communications), and face-to-face communications with those who come into the yardmaster's office.

Many participants expressed frustration that, as a central source of communication and information flow for yard activities, they end up speaking to a number of different parties, but they felt that some of these calls and requests for help or information should not be directed at them. Observes one participant, "These people shouldn't be calling me... they direct the calls to us because we're the yardmaster.... The janitor will call if he doesn't have soap." Another participant points out the potential safety implications and frustration of fielding so many calls and requests for information: "The more we're focusing on calling a cab, doing this, doing that, doing this, our main job over here is getting less and less attention....that's the problem we're having on our carrier, [it] is that we're getting so pulled away from our real job that we don't have time to do our actual job."

¹⁰ Contractors refer to those who work in intermodal facilities that adjoin railroad property or tracks. In some instances, contractors were responsible for loading and unloading intermodal cars, and the yardmaster interacted with these individuals, similar as if they were another switch crew.

A second source of frustration about communications stems from yardmasters' relationship with railroad management. Participants identified the following management-yardmaster communications issues:

- *Managers give conflicting instructions to yardmasters.* One participant described a situation where two different managers request conflicting moves to be made. In the example, one manager asked the yardmaster to pull a train together (assemble cuts of classified cars together to make an outbound train) late to ensure that a few more cars that were coming into the yard could be included, while a second manager, separately, instructed the yardmaster to pull the train early to be sure the train left the yard on time. Observed one participant, "We have too many managers."
- *Multiple managers call the yardmaster with the same question.* One participant described the situation where, if one manager calls and does not get the answer he/she wants, the next manager up will call with the same question, and so on.
- *Managers are inexperienced.* Several participants noted that they have had managers, to whom they directly report, who were new to the yard, or otherwise knew very little of yard operations, yet instruct yardmasters how to run the yard and how to do their job.
- *Managers convey incomplete information to yardmasters.* In one example, a participant described a situation where a manager may tell a yardmaster one piece of information but not provide additional details that would help the yardmaster understand the bigger picture and, therefore, could help him/her plan more appropriately.

5.2.2 Factors that Affect Effective and Poor Communications

Next, participants described what affects good and bad communications and information flow. The following first presents job-related factors that contribute to effective (good) communications and then job-related factors that contribute to poor (bad) communications.

Factors that contribute to effective communication and information flow between yardmasters and others

- *Being left alone.*
- *Railroad experience, including knowledge of railroad terminology/lingo that makes communicating to and from crews easier.*
- *Good communication skills.* Examples that were mentioned included being able to get your point across, knowledge of who you are talking to, and the ability to communicate the consequences of what you are asking someone to do.
- *Willingness and time to share information.* Participants explained that when other yardmasters or dispatchers, for example, do not share critical information with a yardmaster, the yardmaster may have to wait, which will cause others to wait on the yardmaster, creating a cascading effect. Another example included delayed information to the yardmaster about a hot (priority) car. Given that these cars and entire trains made up of hot cars require priority movement and therefore immediate attention from the yardmaster, a delay in communication about a hot car can be troublesome.

- *Uninterrupted contact with the crews.* When the phone, radio, and intercom are all going off, one participant explains that he has to wait for the clatter to stop before he can talk again. Notes this participant, “I always call on the phone ‘cause then I have their attention and I can talk directly with them.”

Factors that contribute to poor communication and information flow between yardmasters and others

- *Interruptions and distractions.* Examples include switch crews that visit the yardmaster’s office and trainmasters who visit the yardmaster’s office and continuously ask questions of, or give instructions to, the yardmaster.
- *Radio rules and regulations.* A number of participants felt that FRA radio rules and procedures were antiquated, given today’s technology. An example that was given was that for some means of communications, specific language must be followed, while other means of communication do not require specific language. One participant suggested that this leads to errors.
- *The need for simultaneously monitoring multiple channels and radio clutter/traffic.* One participant pointed out that, in reference to the radio, he/she has to monitor a main channel, a yard channel, a hump channel, a classification channel, a carman channel, a signalman channel, and a car shop channel. A dialog among several participants exemplifies the issue. One participant begins by saying that he/she is “forever flipping through channels trying to get this crew on this channel, that crew on that channel....” A second participant builds on this comment: “All our departments work on different channels, [and] so whenever you want to get a hold of somebody, you gotta go to their channel.” A third participants adds:

So that’s taking away from you being able to monitor your channel. What’s going on with your crews? So, if I’m flipping over to the car department channel or trying to reach a cab, or trying to talk to this one or that one at that channel, guess what I’m not doing? I’m not listening to my channel where my jobs are working....

- *Task overload.* Related to the need to monitor multiple radio channels at the same time, one participant explained that a yardmaster can lose focus of little details about what is happening in the yard when he/she is being overwhelmed with requests for information from numerous parties.
- *Cell phones.* According to at least one participant, cell phones can create a safety-related hazard if someone tells a crew to make a move and nobody else hears it, which can be unsafe because other crews are unaware of the move.
- *Inexperienced trainmasters and switch crews.* According to participants, inexperience can result in extra work for the yardmaster if, for example, a yardmaster must explain everything or if a yardmaster is asked to do something that is not easy to do.
- *Being cut out of the communication loop.* Yardmasters provided one example where a railroad officer instructed a switch crew on what to do but did not inform the yardmaster

of the instruction to the switch crew. Another example included dispatchers authorizing road trains to enter a yard without clearing with the yardmaster.

- *Allowing yourself to get mad or stressed, or having to interact with others who are angry.* Notes one participant, “Don’t call me with your voice already angry.”
- *Having to respond to requests for information that do not pertain the movement of cars in the yard.* Examples include customers or customer service representatives who ask the yardmaster about the location of a particular train.
- *The tightly coupled and dependent nature of yard operations.* Participants explained that changes by one yardmaster affect other yardmasters’ moves within the yard. One participant gives an example where a yardmaster may give one crew instructions to make a move that will depend on a second crew completing their move as planned and in a certain time frame. If that second crew does not finish in the allotted time window or has to make a change, it affects the first move. This can create delays and necessitate additional communications to switch crews, such as a new job briefing with that first crew. One participant added that when his/her instructions to crews change frequently, he/she may begin to lose his/her authority as some crews begin to wonder, “Doesn’t he know what he’s doing?” Another participant countered, however, that most crews understand why the changes are being made.

5.2.3 Suggestions to Improve Communications and Information Flow

Lastly, participants suggested means to improve communications and information flow to and from the yardmaster. The following list presents participants’ suggestions.

- *Update FRA radio rules.* A number of participants complained that FRA radio rules required unnecessary communication, for example, the use of “over and out.” Participants felt that FRA radio rules increase unnecessary radio chatter and should be updated to improve this situation.
- *Reduce yardmaster responsibilities.* Several participants suggested taking some current responsibilities and giving them to someone else, to allow yardmasters to concentrate on the yard. One participant suggested adding a yardmaster to spread out responsibilities.
- *Reduce the amount of, and streamline, communications with the yardmaster.* One participant suggested that yardmasters need a filter to help eliminate communications that are not relevant to yard movements and operations. For example, one participant suggested removing communications that are between dispatchers and road crews, and that do not pertain to yard movements (e.g., track warrants), since yardmasters do not need to hear about that. Another participant suggested limiting access to the yardmaster’s phone number. As an example, one participant said that once he logged 119 incoming phone calls on a Sunday morning during a light, 8-h shift; this did not include outgoing phone calls. Another suggestion was to simplify the communication structure between yardmasters and managers by identifying only one manager to interface with the yardmaster. Currently, any number of managers may contact a yardmaster with potentially conflicting demands. Suggests one participant, “Eliminate some of the manager interference....”

- *Increase yardmasters' authority in the yard.* Several participants suggested that if one individual presents information, including competing demands from different managers, to a yardmaster in a timely manner, and the yardmaster has sole authority to instruct the switch crews to make the moves, everything could be accomplished. According to these participants, the combination of streamlining communications (see above) and increasing yardmaster authority can lead to highly effective yard management. Explains one participant, "If you had free will, and...eight managers wanted eight different things to happen, and they told whoever this [one] person [whom] you work with directly, and gave you free will [to run the yard], and you sat down and knew that those eight things had to be done, they'd be done."
- *Include the yardmaster in all communications that involve yard moves.* Yardmasters provided an example where a trainmaster directly instructs a switch crew to make a particular move; in this case, the yardmaster should be informed of the move.
- *Provide complete and timely information to the yardmaster.* One participant asked that managers let the yardmaster know immediately when plans that affect the yard change, or as soon as they have a plan, a manager should communicate this to the yardmaster. Another participant suggested sitting down with the trainmaster to share information so that together, they can maximize the number of trains that enter and depart the yard. The general sentiment among these comments is that the earlier the yardmaster has the information, and the more complete the information, the better he/she is able to manage the flow of traffic in the yard.
- *Improve switch crew training so that new employees can better understand their jobs, as well as the railroad lingo.*
- *Improve radio equipment and usage.* A few participants noted problems with the radios, including difficulty in having to figure out which channel people are using in order to communicate with them. This participant volunteered that without a cell phone or push-to-talk communication, it can be difficult to contact people.

5.3 Stress, Distractions, and Workload

This section summarizes results of questions that explored yardmaster stressors, distractions, and difficulties. This section concludes with participant recommendations on how to reduce stress, distractions, difficulties, and workload.

5.3.1 Sources of Stress

Participants identified the following sources of stress:

- *Manager expectations, demands, interactions, and level of involvement.* Several participants felt that managers' expectations are too high with regard to getting trains out on time. Notes one participant, "They give you a piece of coal and want it [turned] into a diamond." Another participant explains that managers "second-guessing your moves" can be disrupting; it can be stressful and can create additional work. A number of participants expressed frustration with managers who micromanage by telling yardmasters how to do their work and who second-guess yardmaster decisions. One

participant explains, “What’s stressful for me is that I have a manager looking over my shoulder.” Another participant notes that, due to managerial second-guessing, when he first started working as a yardmaster he “...lived on Tums and aspirin.” Another participant explains that what is stressful is developing, over several hours, a plan for what needs to be done and how, and then a manager comes in and says, “We’re not going to do it that way, we’re gonna do this [different plan].” On the other side, one participant explains, “I have no problem with changes, changes are to be expected. It’s the micromanagement that bothers me.” Another participant explains what is stressful: “When you’re trying to do the job and you have a trainmaster coming in and getting mad at you when something hasn’t happened.”

- *Management rotation and inexperience.* A number of participants expressed concern over, or stress caused by, management inexperience and the rotation of managers through their yards. One participant described the job of yard managers as “a steady revolving door” where managers do a tour of duty at a yard and then move on. One of the reasons this was stressful, according to one participant, was that a manager may not like you and could fire you, even though you know he/she will be gone in 6 mo. Another participant offers a seasoned view of the pattern and the frustration it can create: “We know what will work and what won’t work...I have been [at this yard] 30 yr...I have seen the wheel reinvented 30 times...[and] I have seen 20 superintendents come through, and they [each] have had their own agenda...and in a year, they are gone!”
- *Task and information overload.* Participants observed a pattern of fewer yardmaster positions, fewer yardmasters, larger areas of responsibility, and increased business (i.e., more trains and, therefore, more yard traffic). This has resulted in more workload and consequently more stress. One participant explained that it is stressful being responsible for so much and covering larger and larger territories. A second participant estimated that workload has tripled in the last 7-10 yr. Several participants noted that the workload can be overwhelming. Says one participant, “There is so much put on the yardmaster these days that it’s almost overwhelming at times.” Another participant explains, “Train traffic is almost unbearable...[and] now with less people [switch crews] and less equipment.”
- *Forced overtime/staffing.* Related to the increase in business and decrease in yardmasters, participants noted that sometimes they are required to work an extended shift, typically 4-8 additional hours on top of an 8-h shift. Explains one participant, “When there’s 2 h until the end of my shift and I know I ain’t got no relief...I really get stressed.” Observes another participant, “We’re under a constant manpower shortage. When I walk in the door, I don’t know if I’m going to be here for 8 h or 16.” Some participants noted that 4 h of additional overtime can be manageable, but an additional 8 h is more difficult or stressful. A third participant explains that there is “so much stuff comin’ in on you for 16 h...After 12 h, you’re outta gas.”
- *Intimidation.* One participant explained, “We were all threatened, they said that we’re looking at these jobs as being manager positions, and you’ll all be out of a job, if you don’t like your job you can go back on the ground, or go be a clerk, or whatever you was before...so there’s a level of intimidation...that is tremendous.”

- *Productivity pressure.* Several participants explained that pressure to bring trains in and get trains out on time is stressful.
- *Inadequate and poorly maintained resources (locomotives, track).* A number of participants identified the inadequacy of the locomotives and/or track as a source of stress. Several participants remarked that they have inadequate (in both supply and quality) yard locomotives to move the trains in the yards. One participant notes that he/she has “absolute junk” as far as industry and yard switch engines. Other participants complained about being short on locomotives in the yard or not having locomotives for the outbound trains to leave. Another participant explained that it is stressful when equipment, such as a remote control locomotive, malfunctions, but the yardmaster is still expected to get the work done. Another participant explained that pressure comes from trying to get the work done with inadequate engines and poor track maintenance. Another participant explains that the pace of the day depends on getting the switch crews off successfully at the start of the shift, which is dependent on equipment and track, among other factors. The yardmaster notes that if the day starts off rocky, then the whole day is rocky, explaining that if locomotives do not work, or lead tracks are out of service, for example, this can lead to stress. If, on the other hand, things get off to a good start, then the day goes well.
- *Exclusion from safety programs and safety management of the yard.* One participant noted that, at his yard, yard safety programs and safety management did not include yardmaster participation. Other participants, however, said that yardmasters at their yards were a part of the safety process.
- *Uncooperative switch crews.* Some participants noted that they found it difficult to get their crews to do the work sometimes. Others, though, said that they had no such problems with their switch crews.
- *Inexperienced switch crews.* One participant explains:

The fact that they fire a lot of people stresses me because I don't want a man to lose his job for rule violations. It's stressful on me. I don't want a man to get fired because I told him to go over here [some part of the yard], and he wasn't experienced enough to go over and do something, or get something, and now he's on the street.

A second participant adds:

The response that I get [from a manager] when I say I don't want to send that man down there [is]... 'he's qualified.' But the man has never been down there, and it's dark, and he's going down hill, with 15 derails, and he's riding the cut that he knows nothing about, [but management maintains] 'He's qualified.' You stress out for that because you don't want nothing to happen....It's not only his job, but his life.

- *Lack of cooperation and communication between yardmasters and dispatchers.* Several participants described a lack of cooperation and communication between dispatchers and yardmasters. Participants explained that their interaction with dispatchers was stressful

because sometimes they need head room on the main track to swing out briefly to make a yard move, but they may not be able to obtain a signal from the dispatcher for some time to make the move. Observes one participant, yardmasters are “hemmed in by signals.” The result is that a yardmaster may have to reformulate his/her plan or carry out other movements in less time than originally planned due to the delay. Other participants felt that the issue was a lack of teamwork due to the compartmentalization of each job, where the dispatcher and the corridor manager are concerned about only his/her territory, while the yardmaster and his management are concerned about their yard, rather than the railroad focusing on the overall network. As a result, yardmasters and dispatchers may not interact optimally. One participant described a scenario where a yardmaster needs a signal from a dispatcher to allow his/her switch crew to swing out to make a move. A dispatcher may promise the yardmaster that he/she will receive the signal, but then the yardmaster does not receive the signal for a long time. Participants understood that dispatchers have to change plans constantly, like they do, but the lack of information about the dispatcher’s plan with respect to the signal that was needed was stressful to at least one participant. Explains the participant, “Just tell me that I’m not going to get the signal, and I’ll stop worrying about it.” This participant felt that if he/she simply knew that he/she would not receive the signal, he/she could work around the fact that he/she was not going to get the signal.

- *Excessive communications.* Several participants complained that too much chatter on the radio occurs or too many people call about the same thing.
- *Communications with through trains.* One participant commented that, in his/her yard, run-through trains may operate on a different channel every day, and consequently it is difficult to get a hold of the crew if you need to. Explains this participant, “[If] You [want to] try to stop one of ‘em...it ain’t gonna happen.”
- *Computer failures.*
- *Being placed into service as a yardmaster too early.* One participant noted that because of understaffing, he was forced to start before he felt ready.
- *Perceived discrepancy between amount of authority and amount of responsibility.* One participant explained, “We have a minimal amount of power [authority], but a much greater amount of responsibility. The ratio between those two is just too great.” Another participant gave an example where he/she was reprimanded for allowing a crew to work over the Hours of Service law when the crew was not in his/her yard and he/she had no communication with the crew. Adds a third participant, there’s “always a fire to put out and it’s not a fire that we made on our own.”
- *Distractions and multitasking.* Notes one participant, “If you take away...[a] few of the things that we have to do, then it becomes more focused.”
- *Being left out of a communication between a yard crew and a dispatcher or manager.*
- *Lack of an opportunity to take a break.* Several participants noted that the lack of built-in breaks to step away from the job, such as a meal time, is stressful. Most yardmasters do not have built-in breaks or meal periods. Consequently, many yardmasters eat at their desks or simply do not eat. Further, if a yardmaster wants to go to the bathroom or

otherwise step away from his/her desk, he/she has to be prepared to respond to any emergencies that arise during this break. At least one participant noted that he takes his radio with him when he uses the toilet.

5.3.2 Difficult Aspects of the Job

Next, participants identified the most difficult aspects of their job. The following list summarizes those difficult aspects of the job that participants identified.

- *Disparity between productivity expectations and available resources.* Several participants observed that the job is made difficult by the disparity between what needs to be done, such as bringing in a certain number of trains into the yard, and the resources available, such as limited yard capacity, to make it happen. One participant explains it this way: what is difficult is “trying to get an infinite amount of cars into a finite yard.” Another participant notes that “trying to do too much with too little” is difficult. A third participant describes a difficult situation where he/she has carried out his/her plan and is at the end of his/her shift, he/she feels that he/she cannot switch any more cars at the moment, and a manager looks at the car count and asks the yardmaster to go ahead and switch out one more cut of cars, even though the yardmaster knows that this will plug up the yard later. Observes this participant, “They’re playing the numbers game....It might help the hump man, but pretty soon it’s all gonna back up anyway.”
- *Personal interactions with others.* Several participants noted that interacting with some crews and managers can be difficult. Notes one participant, “dealing with disgruntled crews” is difficult. Another participant observes that yardmasters have to walk a fine line between keeping the switch crews happy and keeping management happy. A fourth participant points out that the amount of people and personalities that you have to interact with during a shift can be difficult.
- *Multitasking.* One participant explains that the work itself is not difficult, it is the multitasking that makes the job difficult. Another participant explains that what is difficult is having too many things on your plate.
- *Motivating the switch crews.* A few participants commented that motivating the crews to get the work done can be difficult.
- *Interaction with dispatchers.* Several participants noted that interacting with dispatchers can be difficult. Specific aspects that were difficult included obtaining signals to make certain swing out yard moves, reaching dispatchers on the phone, and general interactions with dispatchers regarding directing trains into and out of yards. Observes one participant, “Dispatchers make or break us.”
- *Distractions.*
- *Stress of the job.*
- *Operational challenges associated with multiple yards.* One participant explains that “it’s harder than a jigsaw puzzle” to build a train or switch cars around in an environment where the yardmaster is working with a number of yards under his/her control.

- *Office equipment failures.* Participants expressed frustrations with office equipment that did not work. One example that was given was an office printer that never worked.
- *Face-to-face field job briefings.* One participant observed that he/she is required to conduct face-to-face job briefings with the switch crews, which means he/she is not at his/her desk performing other duties during this time. These face-to-face job briefings can last an hour or more. This was problematic since the switch crews that received the earlier briefings were now working, but the yardmaster could not be at the desk to field calls or work since he/she was continuing to conduct the face-to-face job briefings with other switch crews.

5.3.3 Distractions

Participants next identified the most distracting aspects of their job. Participants identified the following sources of distraction:

- *Incoming communications.* Participants identified several distractions related to incoming communications. They include:
 - Incoming calls while trying to plan.
 - Constant calls about items unrelated, or at best peripherally related, to the job. Notes one participant, “You get all these phone calls about mediocre stuff that don’t pertain to you.” Another participant rhetorically asks, “Why am I trying to figure out what power we’re going to throw together for an outbound train?”
 - Redundant questions. Several participants remarked that occasions exist where multiple managers will call and ask the same question.
- *Delays and workload associated with moving trains into and out of yards.* Several participants described situations where they had to wait on a dispatcher to swing out to build a train, to move a train from one yard to another, or to move a train out of the yard. Participants noted that it can be distracting to leave a move because it is waiting on a signal and have to return to it later. Related to this issue is the distraction of poor communication with the dispatcher. Participants noted that a dispatcher may give you half the story or a yardmaster may prepare an outbound train because the dispatcher said it was OK to bring it out, and then the dispatcher did not take the train for several hours. Another participant explained that obtaining the authorities (e.g., faxed paperwork and telephone calls to dispatchers or corridor managers) to move a train from one yard to another can create more work and can be distracting.
- *Management and FRA rule violation testing.* Several participants explained that having managers and/or FRA inspectors on hand for efficiency or rule violation tests can be distracting and dangerous. According to participants, their presence in the office monitoring switch crews can distract the yardmaster. Participants also explained that once a crewmember has been charged with a rule violation (written up), the crewmember will no longer be productive for that yardmaster who depends on the crew to get the work done. Yardmasters identified as another distraction FRA inspectors who conduct surprise inspections on the switch crews on the ground (e.g., an inspector who comes out from behind a building and flags a crew down), but who do not notify the yardmaster that this

testing is taking place. Consequently, a crew may stop all of a sudden, and the yardmaster does not know why, or a crew will stop unbeknownst to the yardmaster, and the yardmaster may already be planning another move to that part of the yard, such as sending another crew into, or removing a derail on, the still-occupied track.

- *Changes to plans.* Participants noted that it can be distracting to have someone change your plans. One participant notes that what is distracting is “to come in and throw my plan right into the toilet.”
- *Malfunctioning equipment.* Examples include remote control equipment and power going dead.
- *Inclement weather, such as rain and fog.*
- *Switch crew-related distractions.* Participants identified several distractions associated with their switch crews. These include:
 - Crew inexperience and lack of big picture, and the consequent need to watch these crews more.
 - Unrelated conversations. Participants noted that some yardmaster offices are co-located with switch crew ready rooms, as opposed to separately located in a tower, and conversations between crewmembers unrelated to the yardmaster can be overheard and can be distracting.
 - Early quits and overtime. Participants explained that some crews want to work either 6 (early quit) or 12 (overtime) h, and this gets on yardmasters’ nerves.¹¹
 - Carrying out a move in a way other than that planned by the yardmaster. One participant explained that it can be distracting when a switch crew does not carry out a move or carries out a move in a different order than that which the yardmaster instructed. This is a problem because the yardmaster has a mental picture of what is going on in the yard, and, if the crew does not make the instructed move or does it another way, the crew is no longer where the yardmaster thinks they are.

5.3.4 Suggestions to Reduce Stress, Distractions, Difficulties, and Workload

Lastly, participants suggested ways to reduce stress, distractions, difficulties, and, more generally, workload. Participants made the following recommendations:

- *Inform yardmasters if FRA or management is going to be conducting surprise inspections in the yard and potentially stopping crews.*
- *Solicit job improvement and safety-related suggestions from yardmasters.* Notes a participant, “Ask the people who are doing the work day in and day out how to do your job better....We know what will work and what won’t work.”

¹¹ It is not clear how this is distracting, but one possibility is that the distraction is the demand to try to accommodate crews rather than being allowed to focus on getting the work done.

- *Add yardmaster positions to reduce workload.* Suggestions included dividing the job into two positions where either (1) one yardmaster handled the phones and the other yardmaster handled other responsibilities or (2) one yardmaster handled inbound/outbound traffic and a second yardmaster handled the yard. Explains one participant, “If we could just have one guy to just handle the phones, or something, sitting next to me that would really take the load off.” Other participants suggested reducing the number of crews and trains with which a yardmaster works or otherwise reducing the number of responsibilities. One participant suggested adding a yardmaster job to enable yardmasters to work (rotate) a different job, such as a clerk, their fifth day.
- *Provide a meal/break period.* Several participants suggested a 20-30 min break to allow the yardmaster to eat, smoke, or otherwise step away from the desk. One participant suggested providing a 20-min meal period during which time all yard movements would stop.
- *Provide stress management seminars or techniques.*
- *Provide paid access to a fitness center.*
- *Provide clerks.* One participant observes, “A clerk to handle paperwork would be a tremendous relief.”
- *Increase positive interaction between managers and yardmasters.* Suggestions included increasing trust in, and respect for, yardmasters; having company officials visit and talk with yardmasters on a regular basis to get to know them; and showing compassion for employees. Participants described a currently adversarial relationship with some managers and suggested that by increasing respect for yardmasters and trusting their decisions, the relationship will improve. Separately, yardmasters note that often a yardmaster does not interact with a company official except when something has gone wrong or a problem exists.
- *Improve timeliness in communications between managers, such as trainmasters, and yardmasters.*
- *Change the centralized nature of operations.* At least one participant observed that currently everything goes through a dispatcher; since the dispatcher is busy, work in the yard may not get done or is delayed.
- *Improve tracks, on-track equipment, and facilities.* Track suggestions included introducing regular track maintenance, partial (e.g., add a few turnouts and crossovers) upgrades, and even completely new yard designs. Facilities suggestions focused on updating the office equipment (e.g., printer, fax machine), furniture (e.g., chairs), and office environment (e.g., windows, air conditioning/heating).
- *Reduce the number of managers with whom yardmasters interact.* Participants noted having to answer the same or similar questions from multiple managers.
- *Increase yardmaster authority over yard movements and support their decisions.* Participants suggested that managers should focus on managing and planning, leaving management of the yard to the yardmaster. As part of this management process, participants also suggested that managers should support yardmaster decisions.

- *Enable yardmasters to build seniority locally to increase job stability.*
- *Change work scheduling strategies.* Suggestions included (1) introducing a shift pay differential and staggering days off as a means to balance seniority across shifts and days; (2) moving to a 6-h work day; (3) providing additional days off, such as 4 d on and 3 d off, or three 12-h days followed by 3 d off; and (4) requiring a maximum of 4 h additional overtime (i.e., 12-h maximum workday). Regarding a 6-h workday, one participant observes, “You’ll have them in line for that job.”
- *Reduce the amount of radio rules.* Notes one participant, “There are more rules in place [right now] that garble up the radio.”
- *Reduce the number of people interacting in the yardmaster’s office to reduce the noise level.*
- *Improve switchman/conductor training.*
- *Do not include yardmasters in daily morning telephone briefings.*
- *Enable switch crews to start working sooner.*

5.4 Fatigue, Staffing, and Work Schedules

This section summarizes responses that address the extent to which yardmasters perceive fatigue as a problem and presents participant suggestions on how to reduce fatigue among yardmasters.

5.4.1 Fatigue: The Nature and Extent of the Problem

Focus group participants offered a range of responses to the question of whether or not fatigue is currently a problem. A general consensus existed that too few yardmasters were available to work and that what was needed were more yardmasters available to fill in. A number of participating yardmasters currently work overtime. Yardmasters primarily discussed overtime in terms of additional hours worked during the same shift. For instance, a yardmaster may work an additional 4-8 h on top of his/her 8-h shift. Some discussion of overtime also occurred in terms of working days off.

Responses and opinions about whether or not fatigue was a problem varied depending on personal preferences, seniority, and carrier practices. Some participants like their schedule. Some do not work, nor are they forced to work, overtime. Others used to work overtime but rarely do so now. Others are forced to work overtime, but they accept it since, for example, they receive overtime pay. A majority of participants, however, took some exception or issue with their current or past work schedules.

The biggest issue for participants was forced overtime where a yardmaster must continue to work 4-8 h beyond his/her original 8-h shift until he/she is relieved. Some participants noted that forced overtime, typically doubling up (working 16 h straight), is worse in the summer months when more vacation time is taken. Others explained that overtime varies by yard or carrier. At some locations, yardmasters must seek their own replacement if the yardmaster scheduled to replace that yardmaster does not work for any reason; at other locations, however, a centralized crew calling system looks for relief. Notes one participant, “Once or twice a week I’m forced to work a 16-h day.” Another participant explains that he/she doubles up (i.e., works two 8-h shifts

back-to-back) 3-4 times per month. Several participants explain that working multiple 16-h days in a row, such as when other yardmasters take vacation, is especially difficult.

Others, though, explain that they do not have to work overtime if they prefer. Says one participant, “People that want to double have been doubling...[while] people that don’t want to double have not been forced. I can’t even remember the last time I’ve doubled, and I’m young. It [being forced to double] hardly ever happens.” Another participant adds, “If you only want to work 40, you can only work 40. They tell you that you have to stay, but if I’m fatigued, I’m leaving.” Another participant countered this comment, however, by noting that at his railroad, an investigation would occur if a yardmaster left during his/her shift. Another participant added that, at his/her railroad, a yardmaster cannot leave if he/she does not have relief.

Participants identified the following challenges or problems associated with working more than 8-h shifts:

- *It can be mentally exhausting.* Notes one participant, “After 10 h, I’m brain dead.” Another participant explains that the hours spent dealing with phone calls can be mentally fatiguing. Observes this participant, “I am the complaint desk.” Another participants explains, “Some people have the ability to maintain thinking and control for 16 h on this railroad. I don’t. After my 8 h are done, I’m exhausted. I’ve given it 110%.”
- *After working 8 or 16 h, yardmasters may have to return to work 8 h later.* Participants explained that this was particularly difficult. Explains one participant, “By the time I get home [and take care of things] I may get 5 h of sleep.”
- *Doubling up after 8 h rest.* One participant explains, “What messes you up is when you come back from short rest and you get popped with a double.”
- *Doubling up third to first shift.* One participant explains that doubling up first to second shift, or second to third shift, is not bad, but doubling “third to first is a killer.”
- *Post-work fatigue.* A number of participants noted that at one time or another they had slept in their vehicles in the parking lot after work because they were so tired. Says one participant, once “I slept in my car for 3 ½ h before driving home.” Others noted that they had fallen asleep on their way home. One participant said that after working 16-h days, 2 d in a row, he fell asleep in his vehicle while stopped at a stoplight.
- *It is easier to double up at the same position than if you have to work at one yard for 8 h and then travel to another yard for another 8 h, since you can just continue with your plan if you double up at the same position.*
- *No built-in break from work.* One participant pointed out that, whereas managers may work 12-16 h a day, they can get up and walk around, they can take a break, and they can have lunch. This participant observed that, in contrast, a yardmaster cannot leave his/her post.

Relief work (i.e., the extra board) is difficult for some participants as well. One participant explains, “I work 4 nights and 1 day [shift].... 4 d after 8 h [a day, and] you’re toasted.” A second participant describes his/her situation: “Right now I’m on the extra board, and it’s a very big problem. I’ve got called out to come in at 6 in the morning...[and after I] did my 8 h, [I]

spent some time with the family, ate dinner, [and] before you know it, I get another call [at] 8 at night to report at 10 at night.”

Separately, some participants noted that it was difficult to take personal days.

5.4.2 Suggestions to Reduce Fatigue

Participants provided suggestions for how they would reduce fatigue among yardmasters. Suggestions include the following:

- *Offer alternate work schedules.* Suggestions included the “Texas two-step” whereby a yardmaster works a 12-h shift 2 d in a row and then has 2 d off, then works 3 d at 12 h per shift followed by 3 d off, then returns to working 2 d at 12 h per shift, and so on. Explains one participant, “If I know I’ll have 3 d off, I’ll work an extra 4-hr every day.” Other work schedule suggestions included 3 d on followed by 3 d off, 4 d work weeks where yardmasters put in four 10-h days, and 3 d work weeks (4 d off) where yardmasters work three 12-h shifts.
- *Set a maximum number of hours that yardmasters can work in a shift.* This topic was the source of much discussion among focus group participants, though no clear consensus existed on the exact number of maximum hours that a yardmaster could work. A number of participants suggested capping the number of hours that a yardmaster can work to 12 h. Some suggested a maximum of 9 h. Others suggested a maximum of 8 h. Explains one participant, “12 h is tolerable, 16 is another story...I think it affects your decision making, your productivity, and your health.” To enforce a maximum number of hours that can be worked, a number of participants suggested adding yardmasters under the Federal HOS law. Others suggested that yardmasters should be under HOS because they provide instructions to crews, collar live tracks, and otherwise may serve from time to time as an additional member of a switch crew, who are under HOS. Explains one participant, “I don’t think a yardmaster should be required to work more than 12 h. I think they should be under the HOS law, just like any other member of an operating craft.” Others disagreed, however, and did not want a limit on the number of hours they could work and did not want to be placed under HOS laws.
- *Allow split (overtime) shifts.* A number of participants observed that due to contractual agreements between labor and management that stipulated that overtime would be paid for a full 8-h period, if yardmasters worked overtime, their railroads required them to work the entire 8-h period. The preferable option was to split the overtime shift so that 2 yardmasters would work, and be paid for, 12 h each, instead of 1 yardmaster doubling up for 16 h and a second yardmaster working 8 h.
- *Allow more than 8 h off after working a 16-h shift.*
- *Do not allow yardmasters to work mornings and nights the same day.*
- *Increase the number of yardmasters available to work.* Notes one participant, “More yardies.” A number of participants suggested this solution.
- *Add undisturbed breaks, such as a 20-min meal period.*

- *Increase the number of personal days available.* One participant noted that he/she had one personal day available, and another participant said that he/she had two such days.
- *Provide a pay differential (increase pay) for third shift work.* Yardmasters suggested offering a pay differential as a way to attract more senior yardmasters to work these shifts, thus enabling younger, less senior yardmasters to work other shifts.
- *Synchronize yardmaster shift start times with other yard employees.* Yardmasters gave an example where car department employees were on a different schedule; as a result, when a yardmaster needed something to be done, he/she had to wait for a carman to come on duty.

5.5 Best Practices and Lessons Learned

The last set of focus group questions focused on yardmaster best practices and lessons learned. The goal of these questions was to elicit information related to the yardmaster's job that could potentially increase safety in switching yards around the country. Focus groups afford an excellent opportunity to identify safety-related best practices and lessons learned since participants have firsthand knowledge of yard switching operations.

First, participants discussed what they have learned on the job that would help a new yardmaster work safely and efficiently. The following list summarizes participants' suggestions.

- *Treat people with respect.* Notes one participant, "You get more flies with sugar than you do with vinegar." Later, this same participant explains, "If you treat 'em with respect, you're gonna get a lot more out of them." Another yardmaster explains, "Treat people with respect. Sooner or later it's gonna come back and haunt you if you come up there [to the yardmaster's office] being a hard nose."
- *The safety of the crews is the yardmaster's priority.* One participant explains that what is important is, "Did all your employees go home safely?" Others noted that it was important to take care of the crews and employees in the yard.
- *Be patient, thick-skinned, and keep your cool.* A number of participants expressed these related sentiments. One participant reminds future yardmasters that they will "lock horns" with management sometimes but then go on about your business. Another participant reminds future yardmasters to know how to not get rattled.
- *Do not try to be everyone's friend.* One participant observes, "No matter how hard you try, you're not going to please everybody." Explains another participant, "Be able to stand up to the guy in front of you and tell him 'No.'" A third participant explains that yardmasters must be in control because ultimately they will have to answer if something goes wrong.
- *Managers should not come in thinking they know it all.*
- *Maintain situation awareness.* A number of participants suggested that yardmasters listen to the radio, "Maintain focus at all times," "Always be aware of your surroundings," "Know what you're doing" (in terms of the implications and consequences of your decisions), and "...know where your crews are and... how long it takes to make a move."

- *Know the yard.*
- *Be flexible.* One participant explains, “Be able to change every time something comes along.” Another participant suggests, “Always expect the unexpected,” and “Don’t take anything for granted.” Others suggest coming up with a number of alternative plans. Suggests one participant, “Come up with some alternative solutions because it’ll never come out the way you planned.”
- *Do your best at work, but leave the job at work.* Explains one participant, “There is so much to do, you’re not going to remember everything. Do the best job you can. If you can tell yourself, ‘I’ve done the best job that I can,’ that’s the best thing I can tell you.” Another suggests, “Take a deep breath, don’t take the job home, [and] forget about it as soon as you walk out.”
- *Communicate effectively with your crews.* One participant suggested that it was important to make sure that the crews that you instruct know what you are asking them to do. Some suggested that it is best to tell a crew what needs to be done, but not precisely how to do it, except in those cases where it is necessary to specify how to do it, since crews can better manage their actions than the yardmaster can. Explains one participant, “Tell them what you need, but don’t tell them ‘this is how you do it.’” Another participant suggested explaining to crews why you are asking them to do something.
- *Trust the crews.* Related to the ability to communicate with crews, one participant suggested putting faith in the crews that work for you. Notes one participant, “If you put faith in them, they’re gonna bring it back to you.”
- *Pay attention to the yardmaster you are sitting with, and everything that is going on in the yard, during OJT.*
- *Arrive early to find out what is going on in the yard before you start your shift.*
- *Respect the sovereignty of territories.* Participants noted that it is important to respect the territory that you control and those that other yardmasters in the same yard control, otherwise someone could get hurt.
- *Pay yardmasters the same rate once they are qualified.* According to one participant, some yardmasters currently receive 85-90 percent of full pay during their first year of service after qualifying to become a yardmaster.

Lastly, participants identified other improvements to the yardmaster’s job they would make to increase yard switching safety and offered any additional thoughts they wanted to share before each focus group ended. A majority of responses duplicated responses to earlier focus group questions. Participants, however, did have a few new safety-related suggestions, which include the following:

- *Install yard cameras to increase yardmasters’ situation awareness.*¹²

¹² A number of switching yards have installed close captioned cameras; in these instances, yardmasters can access a number of views of different parts of a yard, and in many cases, they can pan and zoom.

- *Provide yardmasters with a detailed map of the yard and surrounding area.* Several participants commented on the utility of such a job aid. Few appeared to currently have an updated yard map.
- *Yardmasters should know how to safely build trains.*
- *Improve rules training.* According to at least one participant, computer-based rules training is inadequate.
- *Inform the yardmaster whenever a person enters yards limits.* One participant explains, “We’ve had managers go out there to the engine where the crew is at and change something [or stop the crew]...that we don’t know about! That is totally unsafe.” Another participant asked that a manager notify the yardmaster if he/she attaches himself/herself to the crew so that the yardmaster is aware of that extra person working in the yard.
- *Train limo (i.e., taxi, van) drivers to drive around the yard safely.*
- *Managers should be located closer to the yards for which they are responsible.* Participants explained that in some cases, managers work in locations 25 miles from the yard.
- *Provide an extra carry-all driver to carry crews, paperwork, etc.*

6. Key Themes and Recommendations

This section presents key themes from the results of the train accident/incident analysis and focus groups with 56 yardmasters. It also contains recommendations for further study of yardmaster operations. Section 6.1 presents key findings from the train accident/incident analyses. Section 6.2 and Section 6.3 present, respectively, focus group key themes and suggestions to increase yard safety. Lastly, based on the results of the accident/incident analyses and focus groups, Section 6.4 suggests possible future research activities.

6.1 Train Accident/Incident Analysis Key Findings

The following key findings summarize the analysis of yardmaster-related train accidents and injuries in 2004.

- *Yardmasters are associated with few FRA-reportable train accidents.* Based on review of the 2004 FRA train accident data, yardmasters are associated with few FRA-reportable train accidents. In less than one-fifth of one percent of the cases (7 out of 3,775) were yardmasters identified as contributing to train accidents, according to review of the narratives. In all seven accidents where the yardmaster contributed to the accident, the yardmaster provided incorrect information or instructions/permissions (directives), or failed to provide critical information, to the switch crew. Another nine accidents may have been due, at least in part, to the yardmaster.
- *The utility of the FRA accident database in identifying the contributory role of yardmasters in train accidents is limited.* Review of the FRA accident report form shows that the form is focused on collecting information on operators at the sharp end of the accident (those closest in time and space to the accident), not on collecting information on yardmaster and other supervisory and organizational factors that may have contributed to the accident.
- *Yardmasters incur few injuries.* Analysis of the 2004 FRA casualty database revealed that one-fifth of one percent of all 2004 employee-on-duty injuries (13 out of 5,693) occurred to yardmasters or assistant yardmasters. A majority of the injuries, 8 of 13 (or 62 percent), were sprains or strains. The top two bodily locations of the injuries were to yardmasters' arms or hands (5 of 13, or 38 percent) and the torso (5 of 13, or 38 percent).

6.2 Focus Group Key Themes

This section presents key themes that emerged from the focus group discussions. These themes tie together one or more of the specific issues or problems raised by yardmasters during the focus groups. The themes are significant because they are safety-related and likely to be applicable to many, if not most, U.S. railroads.

- *Training to become a yardmaster has remained essentially unchanged and is primarily on the job.* Participants explained that their training primarily involved unstructured, informal OJT. Some newer yardmasters also received classroom training on the mechanics of using the railroad's train management computer system. Participants noted that, in the past, yardmasters accepted this unstructured OJT because a number of

experienced managers were always around who could field questions and provide direction to compensate for the unstructured OJT. More recently, however, participants note that local managers have little railroad operations experience, including yard operations experience. Thus, while training has generally remained the same over time, the support structure has changed. Upon qualifying, participants generally felt prepared to work the job, but it was not until they had several weeks to several months of experience at a particular position that most began to feel comfortable.

- *Previous experience as a switchman or clerk is helpful to the job.* Most participants worked as clerks or switchmen before becoming yardmasters, and they felt this experience was essential in preparing them to do the job. Experience as a clerk helped provide an understanding of how trains are processed, and experience as a switchman helped participants learn the yard layout and how to switch cars, and it enabled participants to get to know some of the crews that they were now supervising.
- *The yardmaster's job requires a combination of technical and managerial knowledge, skills, abilities, and other attributes.* Participants identified technical skills, such as clerical and computer skills, and managerial qualities, such as the ability to supervise others and multitask, as important to the job. Some of the suggestions made by participants could be incorporated into future yardmaster training programs or used as prerequisites to better prepare yardmasters for the job.
- *Factors that contribute to effective communication and information flow include railroad experience, good communication skills, few interruptions, and minimal disruptions while communicating with switch crews.* Factors that contribute to poor communication and information flow include railroad inexperience, interruptions and distractions, and task overload.
- *Principal sources of stress include interactions with management, dispatchers, and crews; workload; and equipment problems.* Examples of stressful interactions with management that were identified include excessively high expectations and demands placed on yardmasters, management second-guessing yardmaster decisions, and intimidation. Participants cited inexperienced and uncooperative switch crews as additional sources of stress, as well as poor communication and cooperation with some dispatchers. Workload-related stressors include distractions, excessive communications (including redundant communications), multitasking, productivity pressure, and a lack of opportunity to take a break. Equipment-related stressors include inadequate and poorly maintained locomotives and track, and computer failures.
- *Difficult aspects of the job mirror sources of stress and include interactions with others, workload, and problems with equipment and resources.* Participants discussed a number of difficult aspects of the job; a large number of which also served as sources of stress. These included interactions with others, such as managers, dispatchers, and switch crews; workload and productivity-related challenges; and inadequate resources and equipment failures.
- *Primary sources of distraction include those events that are beyond the yardmaster's control or influence.* Participants identified a range of distractions. Specific examples include incoming communications, changes to plans, malfunctioning equipment, delays,

inclement weather, and distractions associated with the switch crews, such as crew inexperience and the consequent lack of big picture that requires the yardmaster to pay more attention to the crew rather than other tasks.

- *The general consensus among participants was that too few yardmasters are available to work, resulting in forced overtime typically in the form of an extended work shift.* Although yardmasters offered a range of responses to the issue of forced overtime, a majority of participants took some exception to this practice, where a yardmaster must continue to work 4-8 h beyond his/her original 8-h shift until he/she is relieved. In some locations, the yardmaster is responsible for finding his/her own relief, while in other locations, a centralized facility finds relief. Further complicating this issue are local labor agreements that discourage split shifts, where 2 yardmasters could split up an 8-h shift so that each works 12 h rather than one yardmaster working 16 h and a second yardmaster working 8 h.

6.3 Yardmaster Suggestions to Increase Yard Safety

Participants identified a number of ways to improve working conditions. The following presents some key suggestions.

- *Enhance yardmaster training, including job skill and procedural improvements.* Job skill suggestions include improved computer training and communication skills, as well as ensuring that yardmasters are familiar with all of the crafts and jobs with which he/she will interact. Procedural suggestions include development of a more formal OJT qualification program, provision of job previews to prospective yardmasters, and use of tabletop simulations to improve yardmaster decisionmaking.
- *Enhance communications and information flow through improvements to the job, equipment, and others.* Communication and information flow are critical to the yardmaster's job. Participants suggested a number of ways to improve communication and information flow. These include improvements to radio equipment and FRA radio rules, reducing yardmaster responsibilities, increasing yardmasters' authority in yards, streamlining communications to and from the yardmaster, and provision of all yard-related information to the yardmaster in a timely manner.
- *Reduce stress, distraction, difficulties, and workload through improvements in personnel/staffing, interaction, and communication with others, equipment and facilities, and practices and procedures.* Participants identified a number of means to reduce stress, distractions, difficulties, and workload. Some personnel/staffing-related suggestions include adding clerks and more yardmasters to spread out the workload. Suggested improvements to interaction and communication with others include reducing the number of managers with whom yardmasters interact, increasing positive interactions with managers, and improving the timeliness of information communicated to the yardmaster. Equipment and facility-related enhancements include improvements to track, on-track equipment, and office equipment and furniture. Lastly, some of the suggested improvements to practices and procedures include changing work schedule practices and adding a break, such as a meal period.

- *Reduce fatigue by focusing on changes to work schedules and work schedule practices.* Some suggested improvements to work schedules include alternate work schedules, establishment of a maximum number of hours that can be worked in a shift (8-12 h maximum was recommended), allow an overtime shift to be split, provide more than 8 h rest after working overtime, and provision of a 20-min meal/rest period. Another suggestion was to increase the number of yardmasters available to work.

Lastly, focus group participants generated advice to new yardmasters about how to work safely and efficiently. Advice focused on two areas, general disposition and job-specific knowledge and skills. Participants suggested the following general attributes: treat people with respect; do not try to be everyone's friend; be patient, thick-skinned, and keep your cool; be flexible; do your best at work, but leave the job at work; and trust the crews and be able to communicate effectively with them. The following job-specific advice was also offered: keep safety as your top priority, maintain situation awareness, know the yard, arrive early to find out what is going on in the yard before you start your shift, and respect the sovereignty of each yardmaster's territory.

6.4 Recommendations for Future Research

The purpose of this exploratory research was to identify potential yard safety issues related to the tasks and responsibilities of a yardmaster that may warrant further research and understanding by FRA. Based on the results of the accident/incident analysis and focus groups, several human factors research studies exist that FRA may consider to further understand the role of the yardmaster in railroad yard switching safety and to potentially increase railroad yard switching safety. Each potential study is briefly described below.

6.4.1 Conduct Survey to Characterize Yardmaster Work Schedules and Sleep Patterns

Participants identified a host of issues and problems associated with yardmaster fatigue and work schedules, especially with regard to extended shifts. Yardmasters are not typically covered under Federal HOS laws. Focus group results provide some insight into the issues and causes, but they do not provide quantitative information on the prevalence of yardmaster fatigue. A reliable assessment of yardmaster work schedules and sleep patterns could quantify the extent and magnitude of yardmaster fatigue. Such a study could validate or invalidate the information collected in the focus groups, and it could pave the way for improved work schedules.

Recently, FRA and the railroad industry have focused on the issue of fatigue among train and engine crew personnel, dispatchers, maintenance of way workers, and signalmen. Since railroading is a 24 h per day, 7 d per week operation, a number of crafts, including yardmasters, can be subject to fatigue. The purpose of this project would be to conduct a field survey of yardmasters to characterize their work schedules and sleep patterns and to assess their level of work-related fatigue. The survey methodology would involve a random sample of actively working yardmasters.

6.4.2 Analyze FRA Train Accident Data from 1991 to 2005

One yr of yardmaster train accident data yielded few results due to so few accidents for which it was evident that yardmasters contributed. Expanding the analysis of train accidents over a 15-yr period may provide ample data to provide a more robust set of findings with regard to the nature of those accidents to which yardmasters have contributed. If it is assumed, conservatively, that 7 accidents occur each year (where a yardmaster has clearly contributed to the accident), as they did in 2004, 15 yr would provide data on approximately 105 yardmaster-contributed accidents to review. Analysis would be similar to that which was conducted in this study, where all accidents would be culled to select only those with yardmaster in the narrative. This study would be somewhat limited in scope and effort; therefore, it could be a part of one or more other yardmaster-related follow-on studies.

6.4.3 Develop Framework for Revised FRA Accident/Incident Databases

The role of the FRA accident/incident databases is to inform FRA, the railroads, and the public about the incidence and nature of train accidents and incidents. A widely accepted approach to understanding human error within complex systems is known as the Swiss cheese model of error (Reason, 1990). This model depicts errors as arising from holes in an organization's defenses against accidents at various levels of an organization, beginning with the operator and working back to organizational decisions and conditions. Active failures by the operator at the sharp end combine with latent conditions or factors upstream in the organization to result in an accident/incident. Accidents/incidents occur when all of the active *and* latent holes line up. Accidents/incidents are prevented when the holes do not line up because of defenses in one or more of the layers.

Currently, FRA's accident/incident reporting processes generally require data to be provided on the operator and operator's condition and behavior preceding the accident, but they do not ask for information on upstream factors, such as the role of the yardmaster and other supervisors, and organizational factors. In fact, the FRA train accident/incident databases have no formal place to insert information on these upstream factors even if this information has been collected. Section 2.1 briefly discusses this issue.

Effective accident/incident databases should be capable of identifying a broad range of factors that may have contributed to an accident/incident, from an operator's action moments before an accident/incident to supervisory actions and failures to a senior-level executive decision made years earlier. The purpose of this project would be to review accident/incident databases in other modes of transportation and other industries, then developing a framework for a systems approach to accident/incident reporting and supporting database structures. This project would also address exposure data, which are needed to normalize the information to allow apples-to-apples comparisons (e.g., accident rates) to be made.

6.4.4 Conduct Task Analysis and Cognitive Task Analysis of Yardmaster's Job

A task analysis and cognitive task analysis could provide FRA, the railroad industry, and researchers with an objective, baseline understanding of the tasks, work flow, and demands of yardmaster work. The results of this effort would serve as the starting point, or foundation, for many other recommended yardmaster projects. A task analysis and/or cognitive task analysis could also support yardmaster training program development.

6.4.5 Develop Yardmaster Training Objectives

FRA Office of Research and Development's Human Factors Program previously sponsored the development of training objectives, syllabi, and test designs to aid in creating more uniform railroad dispatcher training programs across the United States (Reinach, Gertler, & Kuehn, 1998). This approach enabled FRA to assist the railroad industry in enhancing safety in a nonregulatory manner. FRA may consider this approach, or a similar one, to assist the railroad industry in enhancing yardmaster training.

Based on the results of the focus groups, yardmasters receive training in one of two ways: either all OJT (for those who trained a number of years ago) or a combination of classroom instruction and OJT (for those who became a yardmaster more recently). FRA could sponsor the development of a common set of training objectives that railroads could use to base or modify their own yardmaster training programs to ensure that a minimum set of core learning performance objectives are satisfied. The goal of the research would be to help the railroads produce adequately prepared yardmasters. The research would be another nonregulatory approach to increasing safety by helping the railroads to help themselves.

The product of the research could be a document that contains training objectives and other instructional design tools and assistance that railroads could adapt for their own purposes. Much like the earlier FRA-sponsored training research, this approach would be based on input from the industry, modeled after current training practices, and nonprescriptive. Railroads would be encouraged to select and adapt those components of the training objectives that are appropriate and specific to their own operational circumstances and training needs. Development of such training aids requires knowledge of instructional design methods, yard operations, and yardmaster subject matter expertise.

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Appendix A.

2004 Accident Supplemental Data

In 2004, 27 accidents took place in which yardmaster appeared in the narratives. Analysis of the narratives of each of these accidents suggests that yardmasters contributed to the accident in 7 of the 27 cases. Section 2.1 discusses these accidents. In 9 other cases, it was unclear from the narrative whether or not a yardmaster contributed to the accident (33 percent). In each of these nine cases, the train accident cause code did not further clarify the situation, even when the cause implied the involvement of the yardmaster, most notably, “Instruction to train/yard crew improper” (H305). Finally, in 11 cases, it was clear that the yardmaster did not contribute to the accident (41 percent). Analysis of these 11 accidents reveals that in 5 cases (45 percent), the yardmaster was informing the crew that an accident or derailment had occurred; in 3 cases, the yardmaster was referenced in the narrative as part of the description of precursor events that eventually led to the accident but did not contribute to the accident; in 2 cases, the yardmaster was mentioned in the narrative because a crewmember had made a movement to a location without yardmaster permission; and in 1 case, a mechanical problem occurred with a hump retarder that the yardmaster was operating. The following 2 tables present the 20 accident cases where it was unclear (questionable) whether the yardmaster contributed to the accident (Table A-1) or it was clear that the yardmaster did not contribute to the accident (Table A-2).

Table A-1. 2004 accidents with yardmaster in the narrative where it was questionable whether or not the yardmaster contributed to the accident

No.	Train Accident Narrative ¹³	Train Accident Cause Code	Train Accident Cause
1	Yardmaster instructed Y39316 to shove cars on W12 in clear. Track showed to have 1000ft remaining on track - upon shoving in clear, car went into the side of trimmer pulling train up north lead.	H305	Instruction to train/yard crew improper
2	Yardmaster misunderstood engineer and crew shoved cars into track that would not hold cars. Yardmaster did not look up setoff in the computer.	H305	Instruction to train/yard crew improper
3	Yardmaster instructed crew on the B72102 to take trk 11 from B.P. yard to Grand Jct for storage. Train contained a highcar which struck bridge.	H305	Instruction to train/yard crew improper
4	St Paul transfer 4758 was backing into the east end of earl track and collided with standing equipment six cars from west end. Four empty grain hoppers jack-knifed towards the river damaging track, roadbed and roadway. Crew and gym were tested for cause and taken out of service. Yardmaster signed waiver accepting five days suspension; conductor signed waiver accepting five days suspension.	H305	Instruction to train/yard crew improper

¹³ Extracted verbatim from the FRA Accident/Incident database.

No.	Train Accident Narrative ¹³	Train Accident Cause Code	Train Accident Cause
5	Yard crew shoved track thinking yardmaster was watching for them. They failed to protect the shove and impacted the other switch job. No hazardous materials leaking. H306	H306	Shoving movement, absence of man on or at leading end of movement
6	A crew on either 2 nd or 3 rd shift shoved track 912 without [being] sure it was coupled. When the move was stopped, 5 cars on the east end of 912 continued east and impacted track 913 that had been left to foul the lead per yardmaster's instructions earlier that day. Division is unable to concretely name the responsible employee.	H309	Failure to stretch cars before shoving
7	Road switcher 119 (rs-119) was assigned to deliver 74 cars to the NS at NS Oakwood yard in Melvindale, Michigan. At 1805 hours RS-119 received permission from the NS yardmaster to proceed into the yard via the allen cross over. They entered the yard, passed over the switching lead then crossed over the eastbound to the westbound track. Just as the two engines of the consist started onto the westbound track, their movement was side-collided by an NS remote control locomotive pulling 29 cars operating on the switching lead. Collision occurred at the 7th & 8th cars behind the units, both load.	H607	Failure to comply with restricted speed or its equivalent not in connection with a block or interlocking signal
8	MM90 with engines #4422, 4303 proceeding west on track #11b sideswiped coach #6049 west out on coach lead. Yardmaster signed rule 982. Engr signed for rules 80 & 956. Cond signed for 941 & 942. [Same accident as reported by different railroad: Coach #6049 on coach lead fouling track #11b was sideswiped by mm90 with engines #4422, 4303 proceeding west. h&i for assistant conductor. h&i for conductor canceled 9/24/04. waiver for yardmaster. Note engineer and conductor were not on the equipment at the time of the accident.]	H607	Failure to comply with restricted speed or its equivalent not in connection with a block or interlocking signal
9	Job R91691-11 shoved 88 cars north into CC02 and shoved into side of I55391-11 on the north end of C yard track CC04. There was no one protecting the leading end of the shove as rule book allows blind shove if crew knows track is clear. According to yardmaster's list, there were only 81 cars being in CC02, when there were actually 88. Additional 7 cars causing crew to exceed length of track and shove out of track into the side of I55391-11 on track CCo4. Yardmaster waived investigation and accepted responsibility. He was assessed letter of reprimand.	H999	Other train operation/human factors

Table A-2. 2004 accidents with yardmaster in the narrative where the yardmaster did not contribute to the accident

No.	Train Accident Narrative ¹⁴	Train Accident Cause Code	Train Accident Cause
1	Inbound ICIBP was recrewed at the Bedford Park IM gate by a VRL crew. When the crew began pulling the train into the ramp, the yardmaster informed the crew the train had derailed. Investigation revealed flange and part of tread had broken away from wheel 13 of DTTX 62210. When the crew finally stopped the train, a total of five cars, eighteen tubs, had derailed. Derailed cars traveled approximately 1800 feet causing track and signal damage. Per UP \$15,496 equipment damage.	E60C	Broken flange
2	RCL switch job Y-2052-13 moving south with 3 bad order cars off track 302 with switchman protecting point collided with switch job Y-2041-13 moving north out of track 2044 with 26 cars and 3 employees inside cab heading for city yard with permission for 204 to have city yard lead. Yard job 2052 fouled the clearance points without yardmaster permission.	H307	Shoving movement, man on or at leading end of movement, failure to control
3	Yardmaster reported AIII's #1416-1417 on track #11a could not couple. Inspection found coupler pin pushed in.	H399	Other general switching rules
4	M33571-28 entered yard limits - instructed by yardmaster to come to Oaks on #1 track. Crew went by the signal at Oaks, displaying lunar indication. Train then impacted M39671-28 standing in track directly ahead. Crew of M33571-28 accepted responsibility and were each assessed a 60 day suspension.	H403	Movement of engine(s) or car(s) without authority (railroad employee)

¹⁴ Extracted verbatim from the FRA Accident/Incident database.

No.	Train Accident Narrative ¹⁴	Train Accident Cause Code	Train Accident Cause
5	<p>MGALMAD began shove toward the southend long side for track #2 with conductor on the point. The crew stopped for conductor to align switches for track #2. Conductor issued a 10-15 car movement toward entry of track #2 and went north to protect the shove in vehicle. After receiving cleared for 40 cars, engineer stated he was in throttle 1 or 2 and going 6-7 mph. Engineer made a reduction upon hearing 15 cars and gradually thereafter. Upon hearing 3 cars he set more brake. When he heard “that will do”, engineer stopped the train and got an emergency application, not knowing why. At the time conductor said “that will do”, it was anticipated that some slack action roll occurred, but the s train suddenly stopped the train. Instead of shoving another 2 or 3 car lengths, conductor said it was ok where it stopped. Conductor traveled back south to make the cut and was told by the TRAA yardmaster that the train was reported on the ground by the TRAA police officer.</p>	H506	Lateral drawbar force on curve excessive, train make-up
6	<p>Q15731 received permission to enter UPRR yard from 16th street yardmaster. After stopping, crew began pulling into yard and derailed cars. Download showed excessive amperage and released too late.</p>	H514	Failure to allow air brakes to fully release before proceeding
7	<p>At 11:20 pm on 12-01-04 engine CWRO 215 and 207, two light locomotives engine 215 and 207, collided on the westbound. As a result one conductor was injured both locomotives derailed with extensive damage to both. The derailment is a result of a violation of part 240.117 (e) (2) failure to stop within one half the engineers range of vision). One engine crew on the 207 failed to get permission to occupy a segment of track controlled by the yardmaster.</p>	H607	Failure to comply with restricted speed or its equivalent not in connection with a block or interlocking signal
8	<p>W38r-06 dragging cut of cars out of rip 513 going west. Crew stopped, made reverse movement to shove south 12. Crew moved 12 car lengths east when informed by yardmaster the job was on the ground.</p>	H702	Switch improperly lined

No.	Train Accident Narrative ¹⁴	Train Accident Cause Code	Train Accident Cause
9	Crew on R96691-31 was told to tie onto track A13 on south end and stay in the clear by the yardmaster. R96791-31 was coming out of track A3 at the south end and used 12 pocket to 7 lead to go F yard. The conductor on R96791-13 lined the lead switch to normal position and continued his movement. This resulted in the lead switch being lined against R96691-31's movement. R96691-31 started coming out of track A13 and did not see the lead switch lined against their movement and pulling car south, ran through the lead switch. The conductor, working in the yard, told the engineer to back up to get more cars causing three cars to derail. Engineer accepted responsibility and was assessed a formal reprimand.	H702	Switch improperly lined
10	During normal humping, yardmaster had 10 cars left on retarder. All 10 cars overspeed. GATX20673 coming out of B17 at 20 mph and couple up to 8229 causing damages.	M407	Automatic hump retarder failed to sufficiently slow car due to foreign material on wheels of cars being humped
11	Pulling from track when yardmaster notified crew to stop the train account cars were derailed. Found cars derailed account broken rail.	T202	Broken rail - Base

Appendix B.

Discussion of a Systems Model of Human Error and Its Relationship to the FRA Accident/Incident Databases

One benefit of the FRA train accident database is in providing a better understanding of the incidence and nature of train accidents. Given the significant role that railroad employees play in moving trains, any database of train accidents should focus on, among other factors, human error and its etiology. Reason (1990) has developed a widely accepted approach to understanding human error within complex systems. Commonly known as the Swiss cheese model of error, Reason's generic error modeling system depicts errors as arising from holes in an organization's defenses against accidents at various levels of an organization, beginning with the operator and working back to organizational decisions and conditions. Active failures by the operator at the sharp end combine with latent conditions or factors upstream in the organization to result in an accident. Accidents occur when all of the active *and* latent holes line up. Accidents are prevented when the holes do not line up because of defenses in one or more of the layers.

In the railroad industry, as in other industries, accident investigators often blame the operator, such as a switchman or locomotive engineer, for the accident because the operator is associated, in time and place, with the last event that goes wrong. Railroad and FRA accident reporting requirements perpetuate this approach by requiring data to be collected about the operator and the operator's condition and behavior preceding the accident but not data on upstream factors, such as the adequacy of operating rules and procedures. In fact, often accident databases, such as the FRA train accident database, have no formal place to insert information on upstream factors, even if the information has been collected.

Dekker (2002) refers to this approach of focusing on the operator at the sharp end of the accident as a route to understanding why an accident occurred as the bad apple theory (Dekker, 2002), since the approach seeks to fix a problem by blaming the operator (the bad apple). This common but simplistic approach typically does little to correct the underlying factor(s) that have allowed or set up the operator to err. In fact, human error in industrial environments and transportation systems is much more complicated to decode than simply blaming the operator. As Reason (1997) notes:

...human error is a consequence not a cause. Errors...are shaped and provoked by upstream workplace and organizational factors. Identifying an error is merely the beginning of the search for causes, not the end.... Only by understanding the context that provoked the error can we hope to limit its recurrence (p. 126).

Petersen (2003) refers to these upstream conditions as traps that are left for an operator in a workplace that set up the operator to fail, which lead to an accident. Effective accident investigations and databases should be capable of identifying a broad range of factors that may have contributed to an accident/incident, from an operator's action moments before an accident/incident to supervisory actions and failures to senior-level executive decision made years earlier.

Appendix C. 2004 Yardmaster Injury Data

Appendix C presents a number of tables and figures detailing the nature and circumstances of the 13 employee-on-duty injuries in 2004 to yardmasters or assistant yardmasters. Table C-1 shows a breakdown of yardmaster injuries by nature. Table C-2 breaks down injuries by bodily location. Table C-3 presents the triggering event for yardmaster injuries. Table C-4 presents the physical action before the injury. Table C-5 presents the probable cause of yardmaster injury. Figure C-1 presents the time of yardmaster injury. Figure C-2 shows the monthly distribution of yardmaster injuries. Lastly, Figure C-3 presents an age distribution of yardmasters injured in 2004.

Table C-1. Nature of yardmaster injury, 2004

Nature of Injury	Frequency
Sprain or strain	8
Bruise or contusion	3
Cut/laceration	1
Puncture wound—other than needle stick	1
Total	13

Table C-2. Bodily location of yardmaster injury, 2004

Location of Injury on Body	Frequency
Arm or hand	5
Torso	5
Head or face	2
Leg or foot	1
Total	13

Table C-3. Triggering event for yardmaster injury, 2004

Event which Caused Injury	Frequency
Defective/malfunctioning equipment	3
Slipped, fell, stumbled, other	2
Bodily function/sudden movement, e.g., sneezing, twisting	1
Slipped, fell, stumbled, etc. on oil, grease, other slippery surface	1
Slipped, fell, stumbled, etc. due to object, e.g., ballast, spike, material, etc.	1
Struck by falling object	1
Struck against object	1
On track equipment, other incidents	1
Sudden, unexpected movement, other	1
Other	1
Total	13

Table C-4. Physical action before yardmaster injury, 2004

Physical Action Just Before Injury	Frequency
Sitting	3
Other	2
Carrying	1
Opening	1
Pulling	1
Repairing	1
Standing	1
Walking	1
Ascending	1
Getting out	1
Total	13

Table C-5. Probable cause of yardmaster injury, 2004

Probable Cause	Frequency
Equipment	5
Human factor	5
Undetermined	2
Environmental	1
Total	13

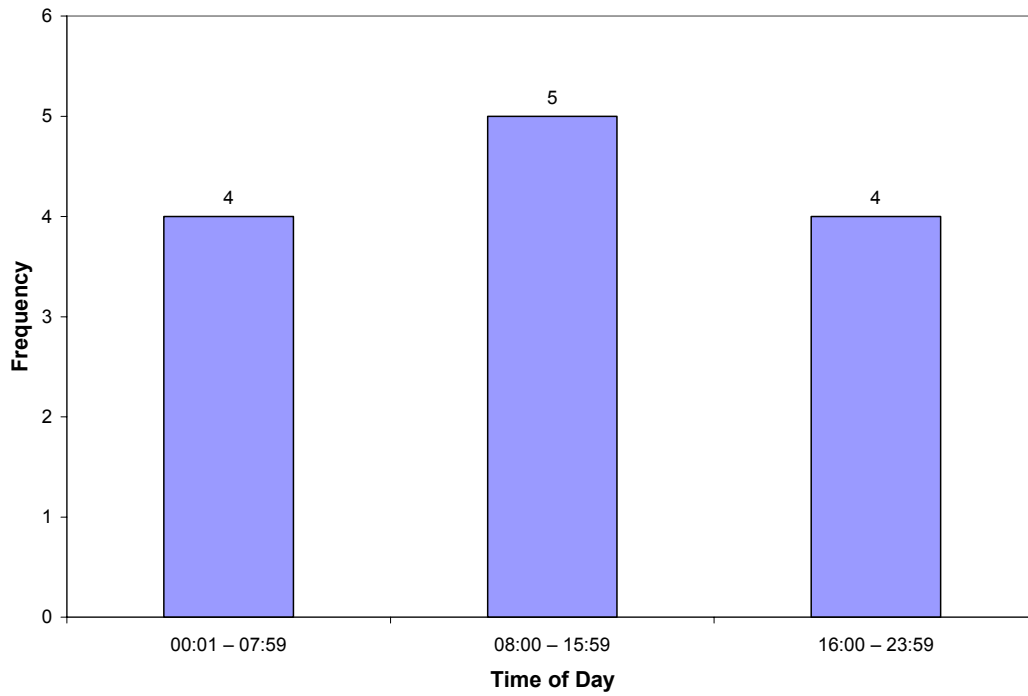


Figure C-1. Time of yardmaster injury, 2004

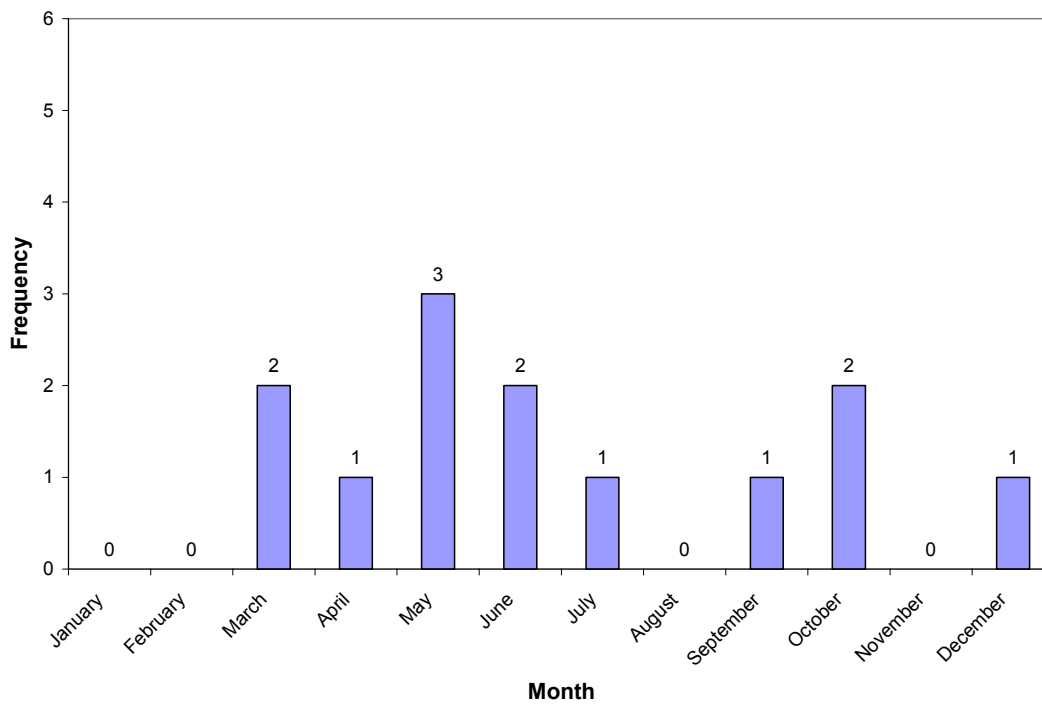


Figure C-2. Month of yardmaster injury occurrence, 2004

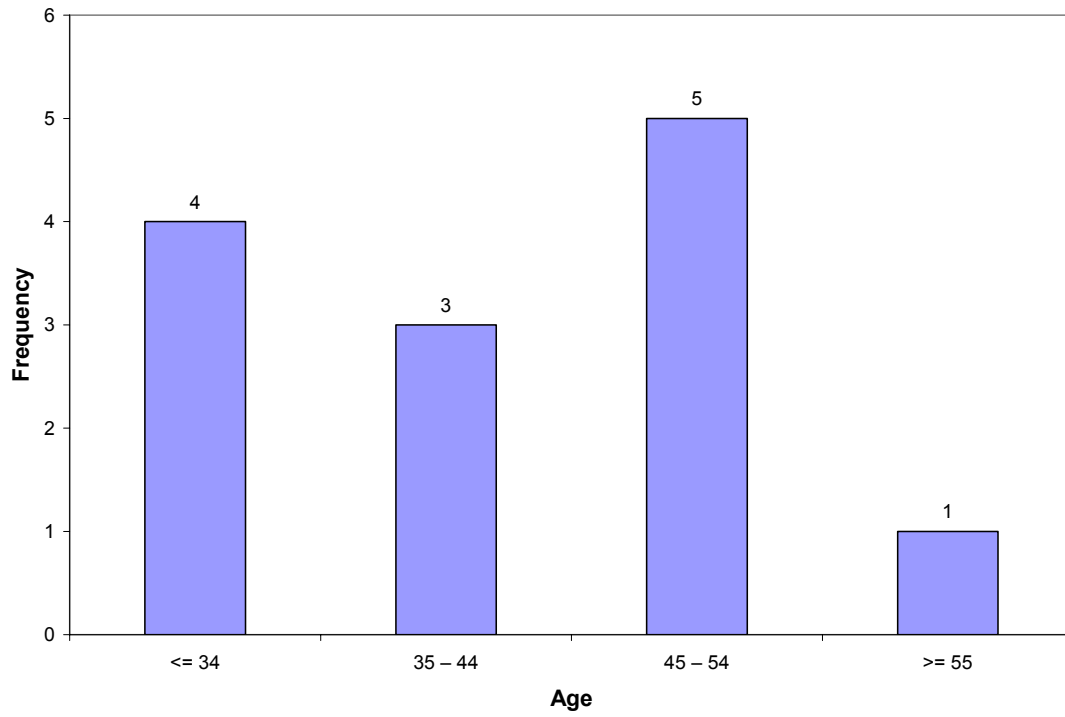


Figure C-3. Age of injured yardmaster, 2004 (yr)

Appendix D.

Focus Group Questions

The following questions guided focus group sessions with yardmasters.

Opening Question

1. First, tell us a bit about what you do as a yardmaster....

Training and experience

2. Briefly describe your training to become a yardmaster.
3. At the end of your training, how prepared did you feel? How much hands-on experience do you feel you needed before you felt adequately prepared?
4. What are the necessary skills to be a good yardmaster?
5. What prerequisite experience do you feel is important to become a good yardmaster?
6. How would you improve training?

Communications and information flow

7. Describe how information flows to you and from you. For example, who provides information to you and to whom do you provide information?
8. What information is provided to you and from you?
9. What affects good and bad communication and information flow?
10. How would you improve communications and information flow?

Workload, distractions, and stress

11. What are the most stressful aspects of your job?
12. What are the most difficult parts of your job?
13. What are the most distracting parts of your job?
14. How would you reduce workload and stress?

Fatigue, staffing, and work schedules

15. To what extent is fatigue a problem for you?
16. How would you improve your work hours and schedule to reduce fatigue?

Best practices and lessons learned

17. What have you learned on the job that would help a new yardmaster work safely and efficiently?
18. In addition to the suggestions you have made so far, what other improvements to your job would you make to increase yard safety?

Closing

19. Are there any other thoughts before we wrap this meeting up?

Abbreviations and Acronyms

BRC	Belt Railway Company of Chicago
CFR	Code of Federal Regulations
d	day(s)
FRA	Federal Railroad Administration
ft	feet
GCOR	General Code of Operating Rules
h	hour(s)
HOS	Hours of Service
min	minute(s)
mo	month(s)
OJT	on-the-job training
USCA	United Supervisors Council of America
UTU	United Transportation Union
wk	week(s)
yr	year(s)