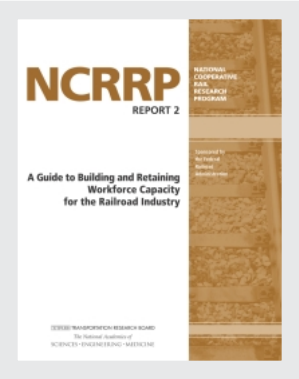


# A Guide to Building and Retaining Workforce Capacity for the Railroad Industry

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NATIONAL COOPERATIVE RAIL RESEARCH PROGRAM

NCRRP REPORT 2

# A Guide to Building and Retaining Workforce Capacity for the Railroad Industry

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NCRRP was authorized in October 2008 as part of the Passenger Rail Investment and Improvement Act of 2008 (PL 100-432, Division B). The Program is sponsored by the Federal Railroad Administration (FRA) and managed by the National Academies of Sciences, Engineering, and Medicine, acting through its Transportation Research Board (TRB), with program oversight provided by an independent governing board (the NCRRP Oversight Committee [ROC]) including representatives of rail operating agencies.

NCRRP carries out applied research on problems that address, among other matters, (1) intercity rail passenger and freight rail services, including existing rail passenger and freight technologies and speeds, incrementally enhanced rail systems and infrastructure, and new high-speed wheel-on-rail systems; (2) ways to expand the transportation of international trade traffic by rail, enhance the efficiency of intermodal interchange at ports and other intermodal terminals, and increase capacity and availability of rail service for seasonal freight needs; (3) the interconnectedness of commuter rail, passenger rail, freight rail, and other rail networks; and (4) regional concerns regarding rail passenger and freight transportation, including meeting research needs common to designated high-speed corridors, long-distance rail services, and regional intercity rail corridors, projects, and entities.

NCRRP considers research designed to (1) identify the unique aspects and attributes of rail passenger and freight service; (2) develop more accurate models for evaluating the impact of rail passenger and freight service, including the effects on highway, airport, and airway congestion, environmental quality, energy consumption, and local and regional economies; (3) develop a better understanding of modal choice as it affects rail passenger and freight transportation, including development of better models to predict utilization; (4) recommend priorities for technology demonstration and development; (5) meet additional priorities as determined by the advisory board; (6) explore improvements in management, financing, and institutional structures; (7) address rail capacity constraints that affect passenger and freight rail service through a wide variety of options, ranging from operating improvements to dedicated new infrastructure, taking into account the impact of such options on operations; (8) improve maintenance, operations, customer service, or other aspects of intercity rail passenger and freight service; (9) recommend objective methods for determining intercity passenger rail routes and services, including the establishment of new routes, the elimination of existing routes, and the contraction or expansion of services or frequencies over such routes; (10) review the impact of equipment and operational safety standards on the further development of high-speed passenger rail operations connected to or integrated with non-high-speed freight or passenger rail operations; (11) recommend any legislative or regulatory changes necessary to foster further development and implementation of high-speed passenger rail operations while ensuring the safety of such operations that are connected to or integrated with non-high-speed freight or passenger rail operations; (12) review rail crossing safety improvements, including improvements using new safety technology; and (13) review and develop technology designed to reduce train horn noise and its effect on communities, including broadband horn technology.

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# FOREWORD

By Lawrence D. Goldstein
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*NCRRP Report 2: A Guide to Building and Retaining Workforce Capacity for the Railroad Industry* uses a comprehensive review and analysis of employee characteristics of the railroad industry—including an assessment of past trends and current forecasts and a detailed gap analysis of employee supply and demand—to formulate a series of competency models describing workforce requirements for the passenger and freight railroad industry. The report also presents a strategy for improving employee retention and develops recommendations for enhancing educational programs designed to attract new employees to the industry—employees who meet the demands of these competency requirements.

The competency models presented in the report focus on performance needs rather than credentials, establishing criteria for exemplary rather than minimal characteristics. These models encompass the four major categories of employment within the industry as well as subcategories providing detail for each. This report serves as a guide to the industry on how to respond to the long-term need for building an effective workforce to support the growth of the rail industry, both passenger and freight, in a changing and evolving environment.

Used as a guide, this report can assist the railroad industry as a whole, from management to human resource recruiters, in building a quality workforce for the future. It will also be useful to college and university educators as they formulate curricula and build training programs to attract new workers into the industry.

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The American railroad industry continues to change dramatically. Freight railroads have merged and consolidated, rationalizing their assets and workforce. Further, both the freight and passenger railroad labor pools have aged and have decreased in size with the retirement of their members. It is widely perceived that, in the face of expanding demand and potential growth, the railroad industry will be unable to attract and maintain a sufficient number of new, qualified employees at all levels.

Without major changes in programs to train, maintain, and enhance the workforce, trends suggest that the future will continue to present significant challenges for both freight and passenger rail services. These challenges have been exacerbated as aging workers reach retirement and qualified replacements are hard to find. Yet the railroads continue to expand, particularly in the amount of cargo that is expected to be moved by freight rail in the future. Investments are being made to increase capacity of freight rail and to improve passenger rail services as a function of changing demand. In addition, new technologies are expected to increase efficiency while requiring new and different skills from future workers. Seeking ways to address these changing and evolving conditions is the focus of this study.

In response to these challenges, a team headed by QinetiQ North America, with assistance from the Hile Group and the University of Wisconsin, Department of Engineering Professional

Development, has prepared a report addressing a broad range of issues and concerns affecting workforce capacity and training. Building on information gathered from previous studies completed by the Federal Railroad Administration and others, meetings with focus groups, and interviews with experts in the industry, the research team developed options for building a quality future workforce, including implementation strategies designed to help slow down and reverse the long-time pattern of contrition.

The detailed set of competency models presented in the study covers all levels and types of employment within the industry: management, operations and maintenance, safety, and craftworkers. It identifies past employment characteristics and projected declines in total workforce, describes gaps in existing education and training programs, and recommends strategies to reverse those trends. It also proposes steps for educational institutions to expand and create new approaches to attract young professionals into training programs for the industry. The competency models focus on the concept of performance and defining criteria necessary to measure high performance, detailing the skills and technical training required to deliver an effective future workforce.

# CONTENTS

SUMMARY

# A Guide to Building and Retaining Workforce Capacity for the Railroad Industry

The U.S. railroad industry continues to face challenges related to the changing demographics of the railroad workforce, such as an aging population reaching retirement as well as a new outlook on employment and different needs in terms of work–life balance from the younger generations searching for work today. At the same time, the railroad industry faces an anticipated increase in economic expansion based on (1) government projections for the freight portion of the industry, (2) the development of high-speed rail, and (3) new technologies that are expected to improve the efficiency of operations. According to data collected by industry associations, cargo has steadily increased over the last several years. The Federal Highway Administration's (FHWA's) Freight Analysis Framework projects a 55% increase in tons moved by rail, from 2.3 billion tons in 1998 to almost 3.6 billion tons projected in 2020 (Association of American Railroads, 2013). These factors pose significant safety and efficiency risks, as well as threats to the railroad industry in building and maintaining strong workforce capacity.

Previous studies have begun to address the issue of workforce capacity in the railroad industry, including a Federal Railroad Administration (FRA) sponsored examination of recruitment and retention issues for craftworkers specifically in the freight industry, conducted by Reinach and Viale (2007). The research provided insight into the challenges involved in recruiting and retaining qualified U.S. freight railroad employees to (1) replace the large number of employees who recently retired or who will be reaching retirement in the next several years and (2) meet the current and forecasted increase in demand for freight rail transportation service.

In 2011, FRA developed a task force to examine workforce development initiatives throughout the industry. Its findings are documented in "Railroad Industry Modal Profile: An Outline of the Railroad Industry Workforce Trends, Challenges, and Opportunities," which serves to describe the current state of the workforce. The task force did not attempt to instantly solve the rail workforce challenges. Rather its approach expanded on the identification of recruitment and retention issues to encompass the larger industry (i.e., all employees and types of carriers) and related supporting relationships (e.g., educational partnerships).

This current effort builds upon the previous work by continuing to characterize the current state of workforce development issues in the railroad industry, including the business and executive leaders, the engineering and operations professionals, and the craftworkers. This was done in an effort to identify strategies to build and maintain a strong, comprehensive workforce capacity. These efforts include a review of existing literature on workforce capacity in the railroad industry in the United States and abroad; an examination of the existing educational and training opportunities for current and prospective railroad workers; interviews with human resource departments of railroad agencies; interviews with business leaders and executives in the industry; focus groups conducted with craftworkers on the issues of recruitment, education, training, and retention; and surveys geared toward engineering and operations managers and craftworkers.

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Based on the data collected in this study, the research team developed competency models to provide insight into the key knowledge, skills, and confirming behaviors of effective workers throughout the railroad industry. These competency models were created so as to enable the development of employee performance measurement tools and systems, which provide the foundation for highly effective employee development programs as well as guide university and technical college curricula. Competency models differ from other approaches to job task assessment in that they focus on performance, rather than credentials, and define exemplary, rather than minimal performance. Because competency models provide consistent and relatively unbiased criteria for exemplary performance in a role or function, they have utility in recruitment and retention, performance management, professional development, succession planning, compensation and benefits, and resource planning and staffing.

The research team used those competency models to conduct a needs/gap analysis in an effort to highlight the discrepancies between the knowledge, skills, and abilities of those who are entering the workforce with the current opportunities for training and access to educational programs. This needs or gap analysis was imperative in order to fulfill the next task of identifying effective strategies for building and maintaining the workforce. The following sections summarize some key findings in this study and successes in, challenges of, and suggested strategies for building and maintaining a strong workforce capacity.

## Key Findings

- **Passing along the knowledge.** With a majority of the current workforce retiring or nearing retirement, there is a need to pass along information that these individuals possess.
- **Tailoring industry practices to fit the needs of multiple generations.** Attrition rates are the highest in the first 2 to 5 years. During the recruitment process, the railroads provide a realistic job preview. Employees report that this outlook is often worse than reality, but unpredictable schedules still can greatly affect family relations. There is a need to take into account the needs of the younger generation of workers seeking employment now.
- **Disparaging outlook on labor–management relations.** Throughout this study, a common theme was observed among craftworkers, an "us vs. them" perception about management. The overall sentiment was that these new managers do not understand the tasks at hand and take disciplinary actions that are short-sighted, and often times far too harsh.
- **Evolvement of recruiting techniques to embrace a technology-centered generation.** Public relations and social media are some of the strongest tools to brand a company and recruit new hires.

## Recruitment Practices and Recommendations

### Recruitment Successes

- Increased use of the Internet for ease of application process.
- During hiring process, more realistic outlook provided about working for the railroad.
- Selling of the desirable aspects, including the competitive benefits and pay, of working in the rail industry.
- Partnering with, or recruiting and hiring from, the U.S. military and railroad educational programs.

### Recruitment Challenges

- Enhancing the railroad industry's sometimes "outdated" image.
- Poor visibility of the railroad industry as a career.
- Lack of visibility of open positions, internally and externally.

- Lack of predictable schedule, resulting in poor work–life balance.
- Hiring people with more railroad knowledge into management roles.
- Recruiting individuals with the right disposition and skill set for the rail industry.

### Recruitment Recommendations

- Focus on the marketing, branding, and promoting of the railroad as a serious contender highlighting environmental conscientiousness and technological advances.
- Create a strong presence in social media.
- Encourage the choice of a rail career for younger generations through re-imaging the brand and introducing students at a younger age to the railroad, through programs such as science, technology, engineering, and math (STEM).
- Highlight the benefits, stability, and longevity of a railroad career.
- Increase visibility of open positions to current rail employees.
- Capitalize on the high employee referral rate.
- Focus recruiting efforts toward identified target populations, such as veterans, as well as women and minorities.

## Training Practices and Recommendations

### Training Successes

- On-the-job training with skilled and willing mentors creates positive training experiences.
- State-of-the-art railroad education and training centers, such as the Railroad Education and Development Institute in Atlanta, Georgia, with over 10,000 students participating in programs geared toward conductors, locomotive engineers, management trainees, yardmasters, communications and signal workers, track workers, and more.

### Training Challenges

- Catering training to the workforce's varied education and experience levels.
- A lack of consistency and standardization of time and material in training programs throughout the industry.
- A lack of quality and experienced trainers to conduct training.
- Experienced workers who can be averse to providing on-the-job training, afraid that, if they make a mistake, they will be held liable.

### Training Recommendations

- Build world-class training facilities and programs where new hires receive high-intensity classroom training and extensive hands-on training.
- Greater standardization and emphasis on training across all railroad companies.
- Create and nurture a culture of preceptorship and mentoring.

## Retention Practices and Recommendations

### Retention Successes

- Benefits, retirement plan, and pay were listed as the driving reasons for continued work in the industry.
- Workers indicated they enjoy a sense of pride in their work as well as camaraderie with co-workers.

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## Retention Challenges

- With the unpredictable schedules, railroad employees said it could be difficult to maintain a family and social life and cited work–life balances as a retention challenge.
- Many of the railroad employees, specifically the craftworkers, expressed a culture of animosity with management, stating it felt like us (craftworkers) versus them (management).
- Railroad practices to hire people with college degrees without any experience in the railroad industry create a difficult dynamic between management and labor, causing a stressful work environment throughout the industry.
- Passing on the knowledge of the experienced employees nearing retirement to the younger generations is a critical challenge facing the railroad industry today.
- Harsh discipline policies were seen to be a cause of workers having increased stress and lower morale, and seeking employment elsewhere.
- The promotion process may need to be revised in order to motivate workers to advance, as many stated that taking a supervisory position could result in a pay decrease from an inability to collect overtime.

## Retention Recommendations

- Increase benefits by paying for medical insurance; providing more vacation time; and offering paid sick leave, a match to 401(k) retirement plans, and a stock purchase program.
- Implement a rewards and recognition program as statistics show that younger generations have greater loyalty to organizations if they are recognized and rewarded for their contributions.
- Improve disciplinary practices for both efficiency and appropriateness.
- Encourage and incentivize experienced and willing employees to mentor new hires.
- Implement practices that support a positive work–life balance.

CHAPTER 1

# Introduction

The U.S. railroad industry is expected to continue its economic expansion based on (1) government projections for the freight portion of the industry, (2) the development of high-speed rail, and (3) new technologies that are expected to improve the efficiency of operations. According to data collected by industry associations, cargo has steadily increased over the last several years. The Federal Highway Administration's (FHWA's) Freight Analysis Framework projects a 55% increase in tons moved by rail, from 2.3 billion tons in 1998 to almost 3.6 billion tons projected in 2020. Table 1 provides statistical data on the U.S. Class I Railroad growth metrics from 2006 to 2012.

The railroad industry has been affected by three major economic impacts: (1) deregulation of the U.S. railroad industry by the Staggers Act in 1980, (2) a significant increase in business, and (3) the retirement of a large number of employees in 2002, especially those from the operating crafts such as locomotive engineers and conductors, due to the passing of the Railroad Retirement Reform bill that allowed railroad employees with 30 or more years of service to retire at age 60, rather than the previous requirement of 62.

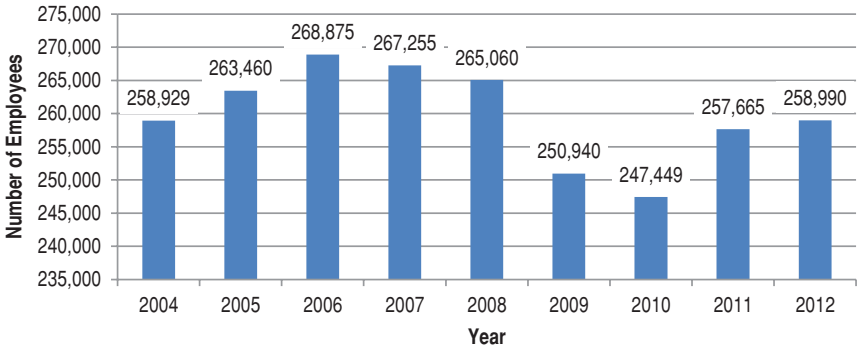
Since the Staggers Act in 1980 deregulated the industry, railroads began to consolidate operations in an effort to improve operational efficiency. For example, in 1980, Class I railroads owned 270,623 mi of track and employed 458,000 persons. In 2005, they owned 164,291 mi of track and employed 162,000 individuals, a more than one-third reduction in track miles and a nearly two-thirds reduction in the workforce over the 25-year period.

Figure 1 presents this trend in total number of employees from 2004 to 2012. The industry experienced an employment lull in 2010, but data suggests an upward trend in new hires. By the end of 2012, the industry had a total of 258,990 employees, with a large portion having worked for the railroads for 30 years or more (see Figure 2). Figure 3 provides similar information broken down by job category.

**Table 1. U.S. Class I railroad growth metrics, 2006–2012.**

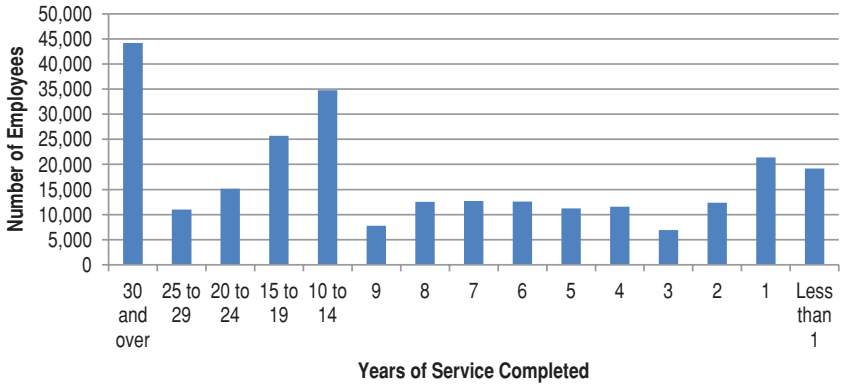
| Year | Total Carloads | Tons (Thousands) | Ton-Miles (Millions) | Train Miles (Thousands) |
|---|---|---|---|---|
| **2006** | 32,114,399 | 1,956,572 | 1,771,897 | 562,607 |
| **2007** | 31,458,931 | 1,939,738 | 1,770,545 | 543,475 |
| **2008** | 30,624,773 | 1,933,766 | 1,777,236 | 524,223 |
| **2009** | 26,005,348 | 1,668,254 | 1,532,214 | 436,235 |
| **2010** | 29,209,122 | 1,850,996 | 1,691,004 | 475,906 |
| **2011** | 29,996,959 | 1,885,437 | 1,729,256 | 493,311 |
| **2012** | 28,374,746 | 1,759,715 | 1,712,567 | 500,046 |

Source: Association of American Railroads (2013).



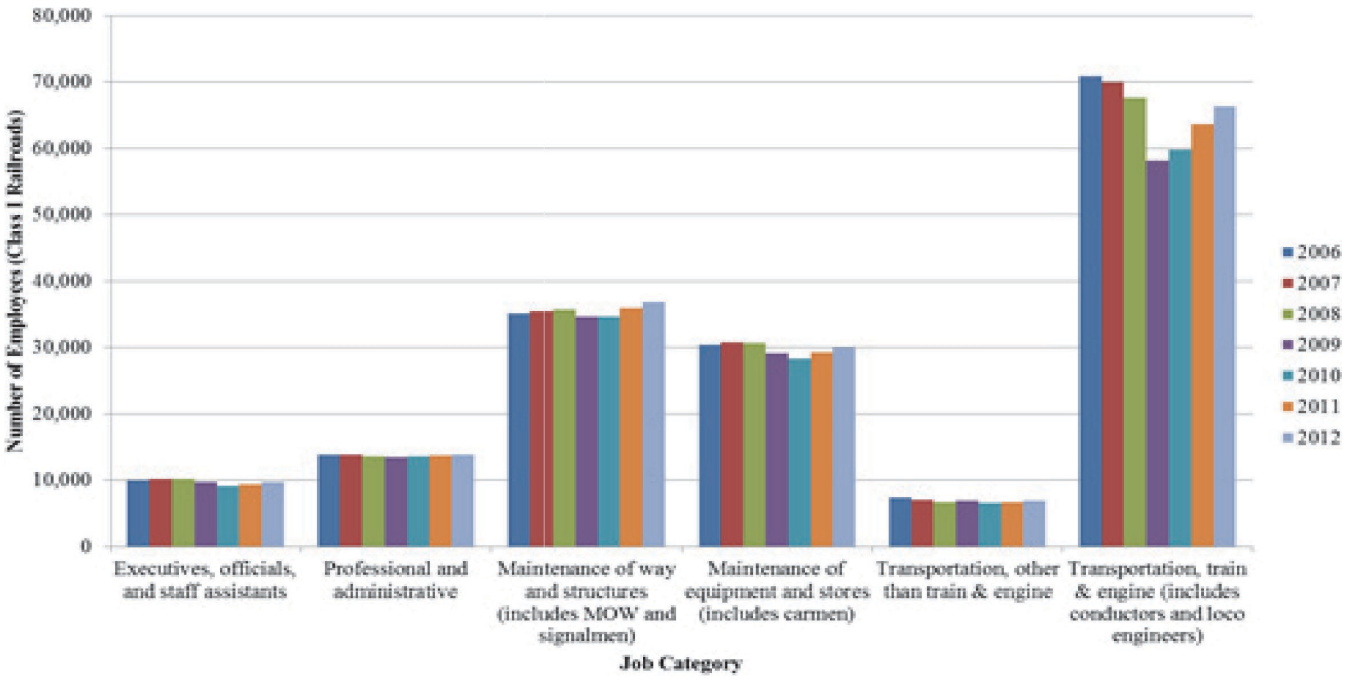

Source: Railroad Retirement Board (n.d.), Table D5.

***Figure 1. Total number of U.S. railroad employees by year, 2004–2012.***



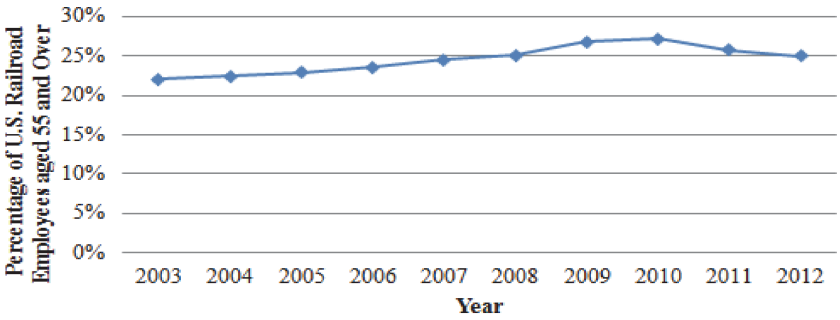

Source: Railroad Retirement Board (n.d.), Table D12.

***Figure 2. Number of employees by years of service completed, 2012.***




Source: Association of American Railroads (2013).

***Figure 3. Railroad employees by job category, 2006–2012.***



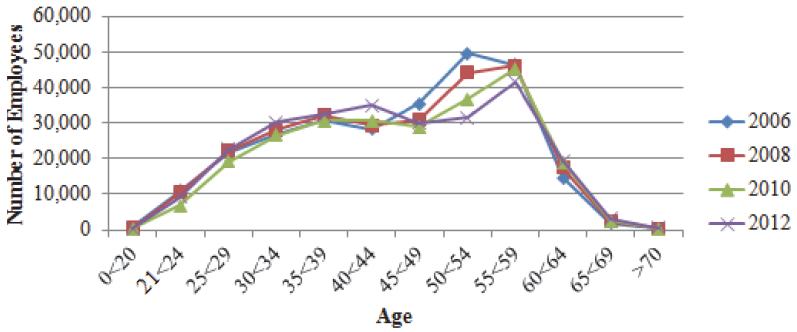

Source: Railroad Retirement Board (n.d.), Table D4.

***Figure 4. Percentage of U.S. railroad employees aged 55 and older, 2003–2012.***

According to the Railroad Retirement Board (RRB) data, the number of retired railroad employees increased sharply in 2002, almost doubling the 2001 retirement figure (6,285 in 2001 versus 11,127 in 2002). See Figure 4 and Figure 5. Data provided in Figure 6 depicts updated projections for retired persons at the end of 2012.

In response to the changing demographics of railroad labor and increased business projections, the railroad industry anticipates hiring up to 80,000 employees over the next several years. The result of the increased retirements combined with increased business is a greater demand in moving a larger volume of cargo with smaller and less experienced crew and supporting craft bases. These factors represent significant safety and efficiency risks.

To address these issues, the Federal Railroad Administration (FRA) sponsored an examination of recruitment and retention issues for craftworkers specifically in the freight industry; for the detailed report, view Reinach and Viale (2007). The research provided insight into the challenges involved in recruiting and retaining qualified U.S. freight railroad employees to (1) replace the large number of employees who recently retired or who will be reaching retirement age in the next several years and (2) meet the current and forecasted increase in demand for freight rail transportation service. Data from structured interviews and focus groups in three different cities across the United States showed that major challenges or barriers to recruiting new railroad employees include railroad work schedules, an incremental pay rate system for some crafts, and finding individuals with the right skill sets for the job. Major challenges to retaining railroad employees include reducing the need to relocate employees, reducing or eliminating furloughs, providing a realistic job preview during the hiring process, and improving work schedules. Despite these challenges, many focus group participants had been in the industry for their entire




Source: Railroad Retirement Board (n.d.), Table D10.

***Figure 5. Railroad employee age distribution shift, 2006–2012.***

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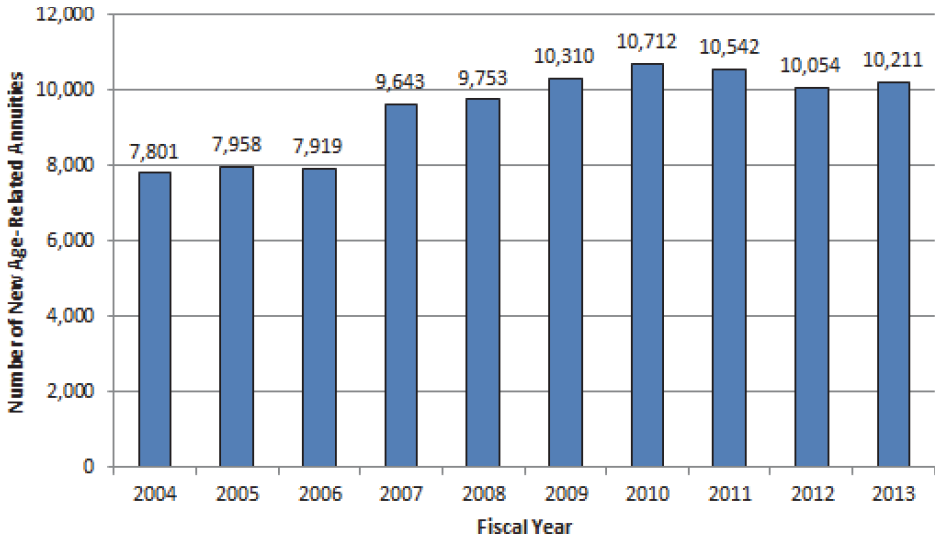


Source: Railroad Retirement Board (n.d.), Table B2.

***Figure 6. Number of new age-related annuities by fiscal year, 2004–2013.***

careers, were generally satisfied with their jobs, and would recommend the railroad industry to friends and family members.

After the seminal work previously described, FRA developed a task force to examine workforce development initiatives throughout the industry, not only in craftworkers. Its findings are documented in "Railroad Industry Modal Profile: An Outline of the Railroad Industry Workforce Trends, Challenges, and Opportunities," which serves to describe the current state of the workforce. The task force did not attempt to instantly solve the rail workforce challenges. Rather its approach expanded on the identification of recruitment and retention issues to encompass the larger industry (i.e., all employees and types of carriers) and related supporting relationships (e.g., educational partnerships). The task force effort proposed a long-term framework for workforce development that entails:

1. Pipeline development programs—programs geared toward reshaping the public image of the rail industry and emphasizing the multitude of railroad career options available. Programming will begin early as students' career decisions are being formed and refined through the post–high school years or into college.
2. Qualitative enhancements—programs to help improve either the current workforce or the manner in which the research team gauges and tracks the status of the current workforce. These programs help ensure that the newly hired employee from the pipeline enters a workforce that will ensure continuous development as their careers progress.

## Objectives and Scope of Study

This study built upon the previous work by characterizing the current state of workforce development issues in the railroad industry. Based on the data collected in this study, the research team identified best practices for building and maintaining a competent workforce into the future.

The scope of the research included the following:

- Determining benchmark workforce development initiatives;
- Developing competency models for key employee groups;

- Evaluating existing practices in recruitment, training and education, and retention against competency models; and
- Making recommendations for future best practices based on existing gaps between the existing workforce and current workforce development practices.

## Overall Approach

The research began with a literature review to examine previous work examining the issues surrounding recruitment, training and educational development, and retention issues in the industry. International workforce development issues in related industries were explored.

A goal of workforce development initiatives is to forecast the long-term workforce capacity needs as a function of anticipated changes to the industry. For the current and emerging workforce, a key strategy is to use competency modeling. Through this approach, the rail industry can execute a number of critical talent management initiatives. Competency modeling provides an objective and rigorous assessment of the knowledge, skills, and mindsets that are crucial to employee success in industry job roles. These competencies can describe current as well as future performance attributes. Using qualitative research methods such as structured interviews and focus groups, the research team formulated competency models for various job categories among the three major strata of the workforce: rail executives and business leaders, engineering and operations professionals, and craftworkers. These individuals encompass a vast majority of the workforce and/or are critical groups for maintaining railroad operations.

The next step in the research was to characterize recruitment, training, and retention strategies currently in use in the industry. This was done in part through interviews conducted as part of the competency modeling efforts. For craftworkers, the research team conducted a comprehensive set of focus groups and the results are presented in this report. These focus groups and structured interviews conducted during competency modeling efforts form the basis for an industry-wide survey. The results of the survey characterize current and potential recruitment, training, and retention strategies. The research team used these results along with structured interviews with rail industry human resources (HR) departments and an evaluation of international workforce development initiatives to analyze what "works," what does not, and what could be implemented in the future.

To further expand upon industry best practices in workforce development, the research team compared competency models with existing educational training programs to determine whether workforce development needs are being met from a training and education perspective.

CHAPTER 2

# Literature Review

## Industry Workforce

### Railroad Recruitment

#### *Challenges*

According to the Bureau of Labor and Statistics, the railroad industry workforce is projected to grow by roughly 1% each year through 2018 (Federal Railroad Administration, 2011). In 2004, an Association of American Railroads press release announced that freight railroads were projected to hire more than 140,000 workers by 2014 based on RRB projections (Federal Railroad Administration, 2011). However, this hiring effort will not necessarily meet the demand projected by the industry. The most recent trend in retention issues within the railroad industry is the upswing of retiring Baby Boomers. This situation is creating a struggle to maintain current employees and convince the millennial generation that the railroad industry is a viable career option. "In a time of tight labor markets, talent can be very hard to find—and very expensive to replace. When a good employee walks, the business takes a hit," and the railroad industry is no stranger to this struggle (Cappelli, 2000).

U.S. freight and passenger rail organizations need to develop efficient and effective recruitment strategies to hire qualified workers to successfully fulfill the need for the expected increase in the rail transportation industry. This effort will be difficult for several reasons. First, the industry must find an effective way to replace the large number of retired employees and those reaching retirement age. At the moment, only a few rail-specific engineering education programs exist. Not only does this reduce the pool of applicants for rail positions, but it also may lead to a skills gap not seen previously in the industry. In the past, there was an abundance of qualified, skilled workers for the industry. However, as technology continues to advance within locomotive and rail operations, more advanced and specific technical expertise is required in employees. As the current workforce continues to retire, that knowledge may be lost if there is not a strategic, effective plan for a knowledge transfer from more experienced employees to new hires. There is increased pressure on recruiting functions to help ensure higher start rates and less new-hire attrition (Federal Railroad Administration, 2011).

Beyond the aging workforce, researchers face great difficulty when trying to ascertain a comprehensive status of the entire industry due to inadequate human resource monitoring in the domains of recruitment and retention. The lack of standardized human resource data collection efforts across the industry provides a great hindrance to the development of recruitment and retention strategies. Other contributing factors include the public image of the railroad industry. At one time in history, the railroad was perceived as an attractive career choice. Over the years, the industry has receded from the forefront of popular career paths. Additionally, many rail hubs operate in rural areas. It is more difficult to recruit in rural areas because the smaller populations

make it more of a challenge to find qualified people to fill open technical positions. It is especially important to develop effective recruitment strategies for rural areas.

**Aging Workforce.** The aging workforce is the largest concern to the rail industry. The issue of an aging workforce is two-fold:

1. The industry needs to develop a method of capturing critical knowledge from the retiring employees and transferring that knowledge to new recruits; and
2. The industry needs to successfully attract new talent over time to sustain their workforce.

The aging workforce dilemma results from the Baby Boomer generation composing the majority of the current freight and passenger rail workforce. This generation, born between 1946 and 1964, is reaching retirement age. There has been and continues to be concern for retirements happening at once, wiping out a large section of the workforce. Due to an anticipated increase in retirements, there is a need to improve recruitment practices in order to replace and enhance the railroad workforce. In particular, the industry is worried about being able to recruit new employees to fill senior positions as most employees reaching retirement age belong to that category. The looming threat of retirements may cause railroads to lose many senior staff in a short period of time. It would be difficult to fill many senior positions with qualified personnel. Consequently, in addition to developing successful recruitment practices, it is critical for railroads to develop a strategy for knowledge transfer. Few formal knowledge management programs exist, which could be detrimental to the railroads if the rate of retirements begins to increase (Federal Railroad Administration, 2011).

**Lack of Data.** The railroad industry as a whole has not reached a consensus regarding the types of human resource data that should be collected to monitor recruitment and retention. As a result, there are inconsistencies from one railroad to another regarding the type of data collected as well as a lack of data in some instances. Furthermore, the workforce data that does exist is sparse and several years old. The unavailability of this information makes understanding the current status of the industry difficult for researchers. "There is no place to obtain a complete picture of the transportation workforce, let alone the factors and trends within it. Relevant workforce trends, total actual attrition, total hires, diversity hiring statistics and the percentage of total attrition related to retirements is also not available industry-wide" (Kesler et al., 2011). Without access to this information, it is difficult for government programs to identify or aid current challenges. "The Federal Railroad Administration Workforce Development Team wants to publish meaningful rail industry workforce metrics to be used by the wider industry annually, improving both transparency and program accountability" (Federal Railroad Administration, 2011). To produce this resource, the Federal Railroad Administration Workforce Development Team sought to establish "a baseline of metrics that will consolidate key workforce statistics from all railroad companies and entities." If proper and quality data is collected annually, it will give researchers as well as professionals within the rail industry the chance to compare data as projects and programs are being undertaken and completed (Federal Railroad Administration, 2011).

**Public Image.** Today, the rail industry faces a challenge with respect to public perception, leading to a lack of interest in railroad careers. The railroad industry has traditionally benefitted from a high degree of nepotism with tremendous family loyalty to this industry. Marketing to new generations of workers occurred in the home, where children were acquainted with the industry at an early age (Kesler et al., 2011). For many decades, this process produced a sufficient railroad workforce. Presently, the need to recruit new employees is being hindered by the negative perception of the industry. Surveys conducted across the railroad and transit industries have collected descriptions such as old fashioned, difficult and boring work, old and decaying industry, male oriented, overly bureaucratic, labor intensive, poor salaries, and limited prestigious projects

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(Everitt, 2008; Federal Railroad Administration, 2011; Kesler et al., 2011; Reinach and Viale, 2007; Vogel, 2001). A lack of hiring over the past decades and limited direct marketing to the public has contributed to the development of a negative perception of careers in this industry. The consequence of this limited interaction is an incorrect perspective of the health and vibrancy of the railroad industry (Federal Railroad Administration, 2011). The uncomplimentary image of railroad careers is deterring many people from seeking positions in this industry. Transforming the public appearance of the transportation industry as a favorable and respected career choice will be a key factor in addressing recruitment issues. The new generations (i.e., Generation X and Millennials) compose a new workforce that considers a wider set of career choices and values different job features. "The industry needs to adopt, to their best ability, the values of the new generations and ensure that careers embrace these new values and demonstrate the merit of working in the industry" (Kesler et al., 2011).

For the railroad industry to develop the workforce capacity needed to meet future demands, organizations will need to enhance their recruitment strategies and boost the overall recruitment effort. For example, Canada's rail industry is experiencing similar workforce issues with aging Baby Boomers on track for retirement. According to the current Railway Association of Canada Vice President Bruce Burrows, the Canadian railroads' short-term plan is to employ new workers to replace these retirees. Moving forward, within the next 5 years, they will need to hire 15,000 new locomotive conductors, rail car and diesel mechanics, and rail traffic controllers to meet the workforce needs of the Canadian rail industry. The railroads' workload has rebounded by an annual growth rate of 2.8%, above the national average (Railway Association of Canada, 2011–2012). Recruitment strategies in the freight and transit rail industries as well as related industries are explained in the following section.

### *Targeted Recruitment*

To use their recruitment efforts and resources most efficiently, railroads should target specific groups of people that will meet the requirements for working in the industry. Careers in the railroad industry require specific skill sets as well as an understanding of the demanding workload; thus, they are not suitable for all people. For this reason, railroads should target their recruitment efforts toward specific groups of people that will be interested in and qualified for these jobs.

**Veterans.** One population that research has proven to be a successful group to target is U.S. veterans. Several past research studies have recorded survey and focus group responses that indicate hiring veterans is a successful recruitment practice. Results from surveys of Class I railroads conducted by the Federal Railroad Administration revealed that the military is a primary source of non-engineering recruits for railroads. Most Class I railroads advertise in military publications and have been recognized by leading military magazines for their proactive work with transitioning service men and women and their outreach to help them prepare for civilian jobs (Federal Railroad Administration, 2011).

In another study conducted by Reinach and Viale (2007), the responses from interviews with Class I railroads identified hiring military personnel and working with military assistance programs as a very successful recruitment method compared to other methods railroads were using. Many railroads named partnerships with military organizations (e.g., Army Partnership for Youth Success) and the Veterans Administration as particularly successful recruitment practices. Having partnerships with these programs allows the railroads to educate representatives on the culture of the railroad work environment; the industry; and the knowledge, skills, and abilities that these jobs require. The relationship between the railroad and the military organizations helps the recruiters better understand the qualifications of the prospective employees they refer to the railroads. Recruiting through military outplacement services has resulted in several excellent applications as well according to participating railroads (Reinach and Viale, 2007). Researchers

from another study found transit organizations also recruited from the military. One organization specifically recruited veterans for managerial positions by partnering with a selection firm to select high potential candidates coming out of the military. In addition, this organization also works with West Point to attract its graduates (Anderson et al., 2009).

Veterans have many skills and experiences that lend themselves well to the railroad work environment. Veterans have discipline, experience with changing locations, and technical skills that would be used in the railroad. Veterans also have experience working in demanding conditions and operating heavy equipment. In 2012, Department of Transportation Secretary Ray LaHood acknowledged veterans as valuable potential employees because of the leadership and teamwork training experience that military personnel have (Tarancon, 2012). Veterans are not a new source of potential employees; in fact, railroads have been recruiting veterans for years. Of the seven U.S. Class I railroads, four—Union Pacific (UP), BNSF Railway, CSX Transportation, and Norfolk Southern—were listed among the top 50 military-friendly employers in the United States by *G.I. Jobs* magazine in 2006, 2007, 2008, and 2010 (Association of American Railroads, 2011). Veterans continue to be a great resource and critical source of potential recruits. The Association of American Railroads is working with the Department of Veteran Affairs to ensure that 500 railroad companies, including freight and inter-city passenger and commuter railroads, make it a priority to offer employment to veterans. In 2011, 1,600 organizations hired more than 90,000 veterans and military spouses. Those same companies have stated they plan to hire 170,000 in the next several years (Tarancon, 2012).

**Individuals Seeking a Second Career.** The railroad industry may not be attractive to younger people looking for a career, but as they mature, the stability and benefits of this industry become more attractive. Advertising jobs in the railroad industry to individuals seeking to move to a second career opens another pool of prospective recruits. The literature cited examples of organizations utilizing this tactic. To address the recruitment issue in Canada, railroads are aiming their advertising at older individuals looking for new careers as well as men and women looking for a post-secondary school education (Railway Association of Canada, 2011–2012). In a related industry, a bus transit system that was in need of drivers built a campaign around bus operations as a part-time second career with the slogan "Make a first step in a second career" (Vogel, 2001).

**Newer Generations.** As previously mentioned, the decline of nepotism within the railroad industry creates a challenge for recruitment. In the past, the railroad industry had been a career that was passed down from generation to generation. As Baby Boomers retire and Generation X and Millennials enter the workforce, it is clear that there are generational differences. It is an important recruitment strategy to understand and adjust to what future employees' expectations and needs will be for their jobs. Railroads indicate that they expect future railroad workers will vary from the workforces of previous generations. One example of generational differences that railroads noticed was newer generation employees seeking more vacation time and a more consistent work schedule compared with the previous generations of employees, even if it meant they were to receive a lower salary (Reinach and Viale, 2007).

Recruitment managers within the railroad industry need to keep these issues in mind in order to educate their organizations' leaders to tailor the work environment to meet the new workers' expectations and to develop recruitment strategies to entice these generations. Participating railroads observed that individuals from the youngest generations of workforce employees (i.e., Generation X and Millennials) are more apt to change jobs on a frequent basis as compared to older generations, especially while they are still young. In effect, this leads to an increase in turnover rates (Reinach and Viale, 2007).

Canadian railroads also have the same idea when it comes to dealing with generational differences and attracting younger generations. The Railway Association of Canada launched a fresh

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image in May 2011 that was designed to emphasize the railroad industry's qualities and attract a younger demographic that might not otherwise consider a career in rail. "Based on four communications pillars—enabler of the economy, a green solution for the environment, safe and innovative—these themes and messages have been designed to attract a younger, environmentally conscious and technology-savvy workforce" (Railway Association of Canada, 2011–2012). Railroads have features that, if advertised correctly, should draw the interest of young people.

Railroads have an environmentally friendly reputation and make extensive use of high-tech equipment. Rail is the most efficient transportation system in the world. It uses less energy, reduces pollution, lowers greenhouse gas emissions, and cuts traffic gridlock. The industry continuously looks for ways to be more efficient by investing in technology. The rail industry is very big on innovation, using the newest and most advanced technology there is. The railroad industry has features that members of the younger generations find appealing; however, the larger public is not aware of these attractive features. Railroads need to advertise these features in the right domains to attract the younger workers that they want.

### *Recruitment Techniques*

In general, railroads can employ several recruitment techniques in order to recruit the most diverse and qualified pool of applicants.

Due to the previously mentioned recruitment challenges, there are not enough people applying for jobs in the railroad industry. In order to recruit and hire enough qualified employees, the pool of applicants needs to be increased. Some options that have been mentioned in the literature include recruiting through internships, cross-skilling, advertising to individuals interested in a second career, and advertising to the newer generations. While these are all acceptable and traditional ways of attracting new recruits, it is imperative for the railroad industry to realize that becoming an employer of choice implies dedication to becoming an exciting and engaging industry to work for. A major issue with some traditional recruitment strategies is that companies recruit for the need as opposed to recruiting for the future. Instead of having a reactive approach to recruiting there should be an emphasis put upon proactive recruiting.

**Internships and Job Rotation Programs.** Offering internships or fellowships in different positions within the industry gives individuals a chance to explore the industry and experience a railroad career for a limited period of time. It encourages young people who may not have considered it without this trial opportunity to "test out" this industry. Offering internships or fellowships at a railroad is a viable recruitment technique and may lead to a larger pool of potential applicants. Survey participants from academia would like to see more support for internships and co-ops among the railroad engineering programs. They note that the number of internships has been variable each year and that more consistency is needed (Federal Railroad Administration, 2011).

UP has a successful internship program that has become a successful recruitment tool. UP recruits college students for internships in the areas of corporate audit, finance and accounting, information technology, marketing, and sales (Haas, Hernandez, and Estrada, 2012). Through the development of a successful internship program, UP is simultaneously developing an innovative recruitment tool. Anderson et al. (2010) suggest using an internship program as a recruitment strategy. "Students can be brought into the system at little cost using internship programs and other developmental opportunities. The students may be groomed to take over leadership positions very early by engaging in aggressive job rotation programs during their internship or apprenticeship period" (Anderson et al., 2010).

Job rotation programs can be used as another recruitment tool. Job rotation is a developmental approach where an employee works sequentially through a series of positions to cultivate varied skills and obtain extensive knowledge about the organization as a whole. Job rotation programs can

be a successful recruitment tool by exposing new employees to different positions early on. They provide the opportunity for employees to learn where in the organization their talents are best suited rather than have them contribute to the turnover rate because they were recruited for one position that was not the right fit. These programs can also be used to recruit current employees for more senior positions by offering the program to high achievers with high potential that have already worked for the organization for a period of time. Cronin et al. (2011) found that almost all of the participating organizations, both public and private, cited the use of job rotation programs. Note that job rotation may not always be feasible when it comes to craftworker positions; however, it is worth mentioning due to the benefits of this recruitment technique.

These programs typically provide employees with broad-based knowledge and skills they would not otherwise have if they stayed in only one job. The practice increases the employees' "understanding of the larger operations of the agency and [prepares them] for cross-functional roles and/or management jobs that require a great breadth of knowledge" (Cronin et al., 2011). An additional benefit to the employer is that the railroad becomes less dependent on any one individual (Cappelli, 2000). An example of this outside of the railroad industry is in semiconductor companies where, in response to high levels of attrition among machine operators, these companies began to certify operators on several different machines and then varied their positions periodically.

**Cross-skilling.** Cross-skilling is a technique that researchers have found to be a viable option for the railroad industry. Cross-skilling involves defining the knowledge, skills, and abilities (KSAs) needed for railroad positions that need to be filled and then comparing them with the KSAs for positions in similar industries that have an excess of employees. This comparison will determine the possibility of recruiting qualified individuals from a different industry, which will open up a new pool of potential recruits. "Cross-skilling offers an alternative solution, utilizing talent with transferable skills in the areas of the business where there is a skills surplus, or across other sectors and industries. The key to delivering a successful cross-skilling program is to specifically define the core competencies needed within the transferable skills. Cross-skilling should be properly managed through core competency ratings, technical assessments, training courses and mentoring through graduation" (Everitt, 2008).

**Employee Referral Program.** Employee referral programs can be an advantageous recruitment strategy. Employee referral programs are successful for a few reasons. First, people who have long careers in the rail industry are generally content with it. Reinach and Viale (2007) found that the majority of their focus group participants shared that they would suggest, or in some cases had already suggested, a career in the railroad industry to their friends and family. Additionally, in rural areas, where there is a limited applicant pool, employee referral programs can be very effective because they provide potential employees that may not otherwise have been recruited (Reinach and Viale, 2007). Research shows that the use of employee referrals and unsolicited walk-in applications are linked to lower voluntary turnover and higher skilled applicants than those recruited through other means such as advertisements or employment agency referrals (Breaugh, 2008; Anderson et al., 2009). Employees are able to identify effective matches for jobs because they typically have more direct knowledge of the job requirements than recruiters who do not perform the job on a daily basis (Cronin et al., 2011). Individuals who are referred by someone who is already employed in the railroad/transit industry are more likely to be committed to their job and remain longer because they are already familiar with the demands and lifestyle of the job. Employee referral programs can also act as a prescreening tool.

Lastly, employee referrals are also beneficial because they reduce some costs for recruiters who are often seeking new employees from cold calling or large expensive events (Cronin et al., 2011). Organizations that are having difficulty recruiting employees can look into the possibility of

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coming up with a process for referring new employees, such as offering monetary compensation for referrals that are successful (Reinach and Viale, 2007; Cook and Lawrie, 2004). For example, in a related industry, a bus transit system offers a $400 incentive for new operator referrals after 6 months of employment. It is also worthwhile to note that delaying the incentive encouraged the employees to mentor new hires (Anderson et al., 2009).

**Job Competency Models.** Developing job competency models is a technique that will help railroads successfully recruit individuals who are qualified for the job. This technique has been used by railroads and public transportation systems as well as the U.S. Department of Transportation (U.S. DOT) to fill many different kinds of positions. The U.S. DOT used this strategy to replace the senior staff that was retiring. The Human Resource Management department along with the Secretary's Management Council had previously concluded that the "traditional succession-planning model, focusing on filling existing top-level positions as they become vacant, would not serve DOT well in meeting its long-term goals" (Horkan and Hoefer, 2000). The solution was to develop "the competencies, skills, expertise, and experience needed to support both the departmental goals and each operating administration's mission-specific objectives in terms of future functional requirements" (Horkan and Hoefer, 2000). The U.S. DOT plans to continue to place value on finding the balance between searching for new hires and developing the skills of the current workforces, while modifying both methods as appropriate (Horkan and Hoefer, 2000).

Another example of innovation and reassessing job design was used by United Parcel Service (UPS). It recognized that its drivers possess an incredibly valuable skillset in the delivery business. The drivers are familiar with the nuances of their delivery routes and they have formed positive relationships with many of the customers they see on a regular basis. Hiring, training, and retaining new qualified drivers can be both a costly and time-intensive process. UPS found that driver attrition rates could be linked to the monotonous and strenuous task of loading packages at the beginning of the run. It therefore removed the loading task from the drivers' job and gave it to a new and different group of UPS workers. As a result, the turnover rate for drivers decreased radically (Cappelli, 2000). This is a prime example of the importance of understanding job requirements and how a simple job reassessment can positively impact turnover rates. It is important to note that the technique used by UPS was not necessarily a deliberate attempt to reduce turnover, but instead it highlighted the specific skills the company wanted to maintain.

Reinach and Viale's study (2007) found that railroads are utilizing this technique to aid with their problem of finding individuals with the right skill set. Some of the railroad workers participating in the study indicated that locating skilled workers has become more difficult recently due to the current lack of traditional high school shop classes that were present when they were students. In addition, railroads noted the issue of not being able to find individuals with the required skill sets in particular rural locations where the railroad operates (Reinach and Viale, 2007). To get around this obstacle, some railroads hire workers without the necessary competencies and develop training programs for their employees that train the specific KSAs needed for the jobs. Participating railroads in Reinach and Viale's study provided examples of KSAs that their employees must possess for a lengthy, fruitful career within the railroad industry. The researchers put together a list of examples that include the ability to work independently, being amendable to changes in work scheduling and work locations, a supporting belief in corporate values, a sense of personal responsibility and commitment, computer proficiency and technological skills, to name a few (Reinach and Viale, 2007). Developing job competency models can also help with cross-skilling—a recruitment technique mentioned in an earlier section (Everitt, 2008).

**The Internet and Social Media.** One important element to successful recruiting is knowing where to advertise. Recruitment efforts and money can be wasted by advertising in places

that potential employees are unlikely to utilize for their job search. In general, online recruitment is rapidly becoming one of the fastest-growing recruitment methods (Holm, 2012). This is evident for the rail industry as well. Railroads are putting more and more information about employment opportunities on their own websites and are listing their open jobs on other websites, including job placement and railroad-related sites (Reinach and Viale, 2007). Furthermore, the majority of Class I railroads require all potential candidates for employment to apply online now. Reinach and Viale (2007) report that railroads that participated in their surveys and focus groups stated that they have made several changes recently to increase the likelihood of attracting new qualified employees, one of which includes directing people to their websites. To attract people to their websites, railroads have begun to advertise their website address on company vehicles, locomotives, and clothing.

Internet-based tools have become popular as prescreening tools allowing railroads to select candidates with higher educational status. Social networking is also a growing strategy for recruiting new candidates: popular media include LinkedIn, Facebook, MySpace, and Twitter. Social networks present railroads with an opportunity for branding the organization as an employer of choice either through introducing itself to a new applicant pool or by dispelling and/or addressing negative connotations that may exist regarding the employer (Sarringhaus, 2011; Wilden et al., 2010). All size organizations may benefit from Internet branding, not just large ones as is the common perception (Porter, 2011). Further, younger generations who have grown up immersed in the information age expect companies to be invested in Internet-based content and branding. Human resource personnel profess that social media are powerful tools because of the immediacy and instant connectedness that the Internet fosters. Social networks can also be used internally to let existing employees know about opportunities arising from within the organization. Vice versa, social networking can keep management abreast of new skill and interest development in their employees (Anderson et al., 2009).

The Railway Association of Canada (RAC) is developing a social media–centered career website to attract potential railroaders and link them with prospective rail employers. Together the RAC's Careers web page and *Career Options* magazine are outreach strategies that position rail as an employer of choice (Railway Association of Canada, 2011–2012). There is also a portal on the website of the U.S. Department of Veterans Affairs (VA) that assists veterans in locating employment within the transportation industry (Tarancon, 2012).

**Advertisements Aimed at Younger Age Groups.** Researchers as well as professionals in the railroad industry have identified advertising to a younger age as a key recruitment strategy. Railroads suggested "job fairs, posters, working with guidance counselors, advertisements in football game programs, and other methods or programs to expose seniors to what working for the railroad industry is about" (Reinach and Viale, 2007). However, beginning advertising at an even earlier age would be more effective. The Federal Railroad Administration includes developing a pre-K–12 engagement program as an approach to solve many recruitment challenges (Federal Railroad Administration, 2011). Current programs advertising the rail industry to a younger audience will be discussed in a later section.

## Railroad Retention

### *Challenges*

Employee retention is a problem that is experienced at all levels and disciplines, and in both public and private sector organizations. Reinach and Viale (2007) collected responses from participating Class I railroads about their future expectations regarding retention issues for railroad craftworkers. The variety of responses included: difficulty in making work schedules more consistent, increased retirements due to a maturing group of staff, other blue collar industries

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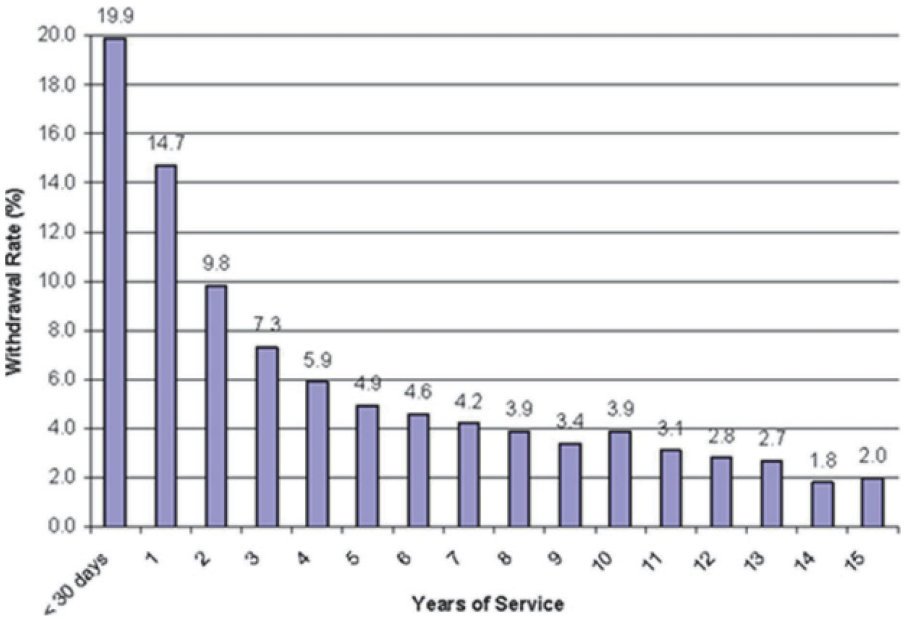
trying to recruit the same people, inability to limit employees' time away from home, reducing required relocations, and improved communications with employees (Reinach and Viale, 2007).

Past research has shown that if individuals are going to leave the industry, it will most likely be within their first 5 years. The RRB data found in Reinach and Viale's report and depicted in Figure 7 supports this observation. The figure shows this trend from 1999 through 2002. The withdrawal rate declines from approximately 20% during the first 30 days to about 5% following 5 years of completed service. After 5 years of employment, the average withdrawal rate stops reducing at a drastic rate, dropping from 5% at 5 years of service to 2% by 15 years of service (Reinach and Viale, 2007).

There is excessively high attrition throughout the railroad industry, especially among the craft professions. According to railroads, newly hired employees may leave during the training period as a result of acknowledging a poor person–job fit. Some new hires do not completely appreciate the stress of the railroad culture day to day, until they have lived it. "Common features that many focus group participants disliked about their job included work schedules, labor–management animosity, and issues related to pay" (Reinach and Viale, 2007). Other findings included people leaving the industry because "working for the railroad industry creates a strain on family relationships and has caused some focus group participants to lose friends because of their work schedules and unavailability" (Reinach and Viale, 2007). New hires may also leave before the 5-year mark; they simply do not like the demands for travel; rotating shifts; and/or that the work requires physical strength, situational awareness, and stamina (Federal Railroad Administration, 2011). Some new hires are also dismissed because they fail promotional or rules tests, fail a drug and/or alcohol test, or they exhibit an unsatisfactory performance (i.e., unsafe work habits).

Anderson et al. (2009) found that it was believed by the public rail sector that employees leave because the private sector was very attractive to their employees. "They thought that the private sector promised better pay and more responsibility for similar experience in the public sector" (Anderson et al., 2009). There is also the issue of mass exodus due to retirement. Despite the poor economy, and often dwindling retirement packages and pension plans, employers recognize the potential number of Baby Boomer retirees as a challenge for their organizations.




Source: Reinach and Viale (2007).

***Figure 7. Withdrawal rate by years of service, 1999–2002.***

The bigger issue is that the challenges surrounding retention actually begin with recruitment. For long-term retention of employees, individuals who are suited for this type of work need to be adequately prescreened and selected to avoid individuals who are not suited for the industry. Money and effort put into retention programs will be wasted if the individual is just not right for the target position.

### *Retention Strategies*

The literature regarding railroad industry employee retention offers some suggestions of practices that organizations have implemented in an effort to promote retention.

**Realistic Job Previews.** Realistic job previews (RJPs) can be a valuable retention technique. The goal of RJPs is to provide applicants with an accurate description of both the positive and negative aspects of the position during the recruitment process to discourage uninterested applicants and encourage those truly interested. To increase effectiveness, RJPs should be incorporated into all recruitment sources, job postings, and advertisements (Anderson et al., 2010). RJPs will clearly inform the potential candidates for employment what the position involves and requires. Some railroads have found that the more detailed and accurate the information that potential new hires are given before accepting a position, the more apt these workers are to remain employed within the company for a lengthier period of time (Reinach and Viale, 2007). When railroads were asked about any recent changes to their methods of promoting retention, placing greater importance on realistic job descriptions was mentioned.

Railroads indicated that they emphasize realistic job expectations during the hiring process. The information provided in RJPs should detail what job candidates can expect in terms of their responsibilities to the company and what the company will provide in return to the candidate if he or she is hired (Anderson et al., 2010). Some options include providing RJPs in the form of videos, brochures, workplace tours, verbal presentations, and/or work simulations. It is important for organizations to understand that effective RJP approaches must be done in a way that allows for discussion and questions, if applicable. Therefore, often times what is considered a "one-way RJP approach," such as a video or information packet, may be less effective than a "two-way approach" such as a conversation between an employee and job candidate (Anderson et al., 2010; Breaugh, 2008).

**Employee Engagement.** Making sure that employees are engaged and committed to their jobs and organization can prevent voluntary turnover. Although compensation is considered one of the top retention strategies, ultimately all it provides is an extrinsic motivation for employees to stay at a company. As a single incentive, it is a vulnerable strategy because outside businesses can match compensation. It is the intrinsic, or internal, motivation that needs to be generated and fostered by companies to ensure that not only are their employees being paid competitively but are also developing a sense of accomplishment and loyalty to their jobs. A technique for keeping associates connected to their work is loyalty to their colleagues. Although the concept of company loyalty in U.S. culture has diminished over the years, allegiance to colleagues has not. "By encouraging the development of social ties among key employees, companies can often significantly reduce turnover among workers whose skills are in high demand" (Cappelli, 2000). In this manner, when a person vacates a job, they are not only leaving their position but also leaving their core social network.

Employees have a greater sense of loyalty when there is a relationship with the employee's supervisor. "An employee's relationship with his supervisor largely determines his view of the company" (Gary, 2004). Equally important there needs to be an emphasis behind the company's mission, vision, and goals; if employees do not know or understand what they are working toward or for, then there is little "buy in" to accomplish their jobs. Linking institutional strategies

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and priorities with personal areas of development and responsibility helps to develop the sense of intrinsic motivation employees need to maintain longevity within a company (Clawson and Haskins, 2011). Retention strategies are most successful when the business places its people as its top priority.

Anderson et al. (2009) report several employee engagement techniques that were mentioned by railroads during focus groups and surveys. Engagement surveys are used by railroads to determine how engaged current employees are in their jobs. Employee engagement surveys typically measure organizational commitment, job satisfaction, and organizational citizenship behaviors. The results of these surveys identify areas in which the organization can improve and help create an action plan.

Another technique to promote retention is creating a high-potential workplace. Organizations should create a working environment where employees feel that they can contribute, that their voice is heard, and that they are working with other high-potential employees. This type of environment will likely make the employees feel engaged and can decrease their likelihood of leaving (Anderson et al., 2009). Employee appreciation is another retention strategy. One railroad discussed its weekly newsletter that details stories about employees who have gone above and beyond in their jobs. (Reinach and Viale, 2007). Organizations can also recognize employee involvement. By recognizing employee contributions, organizations show their commitment to increasing employee involvement and ownership.

Clear definition of career path is important for improving job satisfaction, employee motivation, and employee commitment (Griffin et al., 2000). Employees are less likely to leave if opportunities for growth are made available within that organization. Leadership programs are important in this regard. An example program at one railroad defined the type of leadership that the organization wanted in top roles and then identified high-potential junior-level employees. These junior employees were then involved in a development program that involved a succession plan to clearly lay out their career paths. In another organization, recent college graduates were used. The graduates were brought on board for a 12-month rotational program through many of the organization's departments. At the end of the year, the graduates were promoted. Some individuals from the graduating class are now in managerial roles within the company.

Employee engagement can also take the form of mentoring and training programs. "Individuals who have spent at least a few years on the railroad are encouraged, with union support, to mentor new hires and teach them not only the technical matters of the railroad, but also the railroad culture. This has helped to assimilate new hires into the railroad at a faster pace, thus reducing the likelihood of turnover within the first 5 years" (Reinach and Viale, 2007). This is true not only for craftworkers but also for managers as well. Studies suggest granting managers some autonomy for identifying the types of training and development opportunities they would like to engage in (Anderson et al., 2010). If interesting and useful courses are offered to managers in addition to any required training, they will view the employer as one that "cares" about its staff and may be more inclined to stay with the system. Training should be considered a business strategy that focuses on interventions for (Eno Transportation Foundation, 2008; Anderson et al., 2010):

- Making connections between the business goals of the company and employee education,
- Improving upon workers' output, and
- Assisting the trainers to learn new skills so they may succeed in their new roles.

**Hiring from Within.** Another employee retention practice is hiring from within the organization. In some organizations, when a supervisor leaves the organization, their highest potential

subordinate is promoted into the position. This sets off a similar chain of promotions until an entry-level position is left vacant. With this method, the hiring manager and recruiter are responsible for filling a lower skill level (e.g., entry-level) position instead of a skilled supervisor position. The organization reports there is less risk and a larger applicant pool at the lower level, making it easier to fill the position. Furthermore, after examining the results of many different turnover studies, it illustrated that promotions given to existing employees is directly related to a decrease in overall employee attrition (Carson et al., 1994). To prepare employees for advancement, employers need to implement structured employee development practices (Cronin et al., 2011).

**Competitive Benefits and Incentives.** Some people choose to leave the railroad industry to seek higher compensation elsewhere. In many cases, railroads do not have the flexibility to increase compensation for their craftworkers due to collective bargaining agreements that govern pay scales (Reinach and Viale, 2007). An example is conductor pay. Conductors begin by making 75% of their full salary, reaching the full 100% of their salary after successfully finishing 5 years of employment. It should also be noted, however, that collective bargaining agreements can also be a benefit because pay scales are set through negotiation. Thus, while at times a collective bargaining agreement can be seen as an obstacle to offering desirable pay, other times these agreements assist in securing competitive wages for employees. Correspondingly, public transit systems may be unable to pay managers as much as other government, private sector, and transportation industry competitors (Anderson et al., 2010).

To combat the problem of employees facing reduced or only slightly increased compensation, railroads can offer other incentives that will hopefully retain their employees. This issue is being addressed by some organizations with increased perks such as take-home vehicles, free cell phones, and safety equipment (Vogel, 2001). In Reinach and Viale's study (2007), they note several new practices that railroads are establishing to promote retention. One promising practice was tuition reimbursement for National Academy of Railroad Sciences (NARS)–trained conductors. In this program, the railroad reimburses the employee for up to one-third of the tuition fees each year for 3 successive years, as long as the employee possesses a satisfactory record of employment. Other practices that railroads are working on include trying to abandon the incremental pay stages for certain positions in the industry (Reinach and Viale, 2007).

Cronin et al. (2011) find that organizations have begun to supplement their traditional benefits with innovative bonuses such as offering telecommuting ability (working from home), schedule flexibility, and job autonomy. Employees might see these benefits as a reason to remain with the organization even though they have an opportunity to make more money elsewhere. Some organizations indicated that an effort to redesign their benefits programs by including tuition reimbursement, technology training, and schedule flexibility helped to retain their younger workers (Cronin et al., 2011). In Anderson et al.'s study (2010), railroads noted that upper managers tend to stay with an organization because they are invested in the retirement system. Thus offering a competitive retirement package can be an effective retention tool as well. Participants in Cronin et al.'s study (2011) also mentioned retirement benefits as a strong solution to retention challenges.

Railroads can also offer a better work–life balance as an incentive to remain with the railroad. Work–life balance programs are typically designed to address challenges associated with assisting employees in maintaining their work and personal responsibilities (Cronin et al., 2011). Incentives that improve work–life balance can include improving existing work schedules, reducing forced relocations, and offering rewards in the form of days off. To ensure that their work–life programs cover a range of employee needs and interests and are aligned with employees' needs, organizations should conduct a thorough needs assessment. This needs assessment will also

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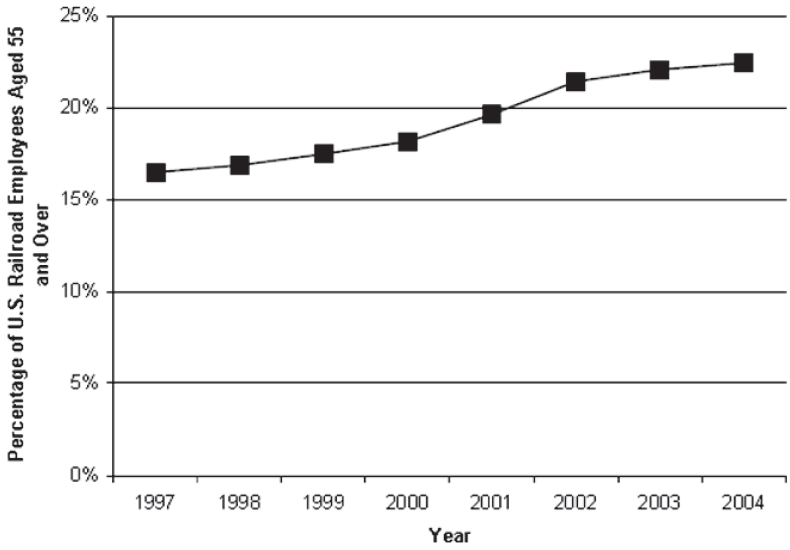
ensure that money and human resources (HR) are not being wasted on creating innovative yet ineffective practices (Cronin et al., 2011).

Employees are looking for a work environment that does not infringe upon their life outside of work. One practice that organizations are utilizing is analyzing how work is distributed and how schedules are designed among their employees (Cronin et al., 2011). Employee feedback has informed organizations that typical and predictable work schedules are more appealing. Specifically, organizations have received feedback that "one of the reasons employees choose to stay employed with them is that they are not expected to work more than 40 hours in a week and that they can expect to work approximately 8 hours in a day if working 5 days a week" (Cronin et al., 2011).

Reinach and Viale (2007) has similar findings in terms of work–life balance programs that organizations are implementing. An example program that was provided established conductors' and engineers' work schedule predictability. Additionally, railroads are trying to reduce forced relocation. This involves employing more local hires as a recruitment strategy. It was also reported that railroads are making mandatory transfers more manageable for the workers who must relocate by providing assistance in the adjustment to moving to a new location. Railroads also reported improvements to the working conditions and atmosphere, including more emphasis placed on work/rest issues, enhancements in the locomotive cab setting, cleaner working environments, access to health and wellness centers as well as childcare, and also healthier options in vending machines (Reinach and Viale, 2007).

**Utilizing Older Workers.** Statistics are revealing a new trend of older employees opting to continue working in the labor force instead of retiring. This trend can be seen in Figure 8. In 1994, nearly 12% of the workforce was listed as over the age of 55. This percentage changed to 15.6% in 2004 and was predicted to surpass 21% in 2014 (Toossi, 2005). Middle and older age groups were expected to exceed the amount of younger workers as the Baby Boom generation reached ages 45–64 by 2010. This suggests that older workers must either have a need, or at the very least, the desire to remain in the workforce past what was once considered a standard retirement age. However, it is necessary to consider the impact of the natural aging




Source: Reinach and Viale (2007)

***Figure 8. Percentage of U.S. railroad employees aged 55 and older, 1997–2004.***

process on job competencies and this is particularly true for safety-critical positions (Popkin et al., 2008).

## International Workforce Development Initiatives

A review of existing literature on workforce development initiatives in the international transportation industry was conducted in an effort to glean an understanding as how these challenges have been addressed abroad. There are several operational and cultural differences that do not allow those initiatives to be directly transferrable to the U.S. rail industry; however, there are important lessons learned that can inform future recruitment and retention practices in the United States. It should be noted that workforce development is an area of overlap in terms of recruitment and retention efforts as well as education and on-the-job training. As a result, there may be some overlap in the subsections that follow; however, the research team believes all the information in this report to be pertinent, and thus should not be omitted so as to fit neatly into one category. Included in this review is transit, as the transit industry identified workforce development initiatives that provide useful information and practices applicable to the rail industry.

### Key International Agencies

#### *International Transit Studies Program*

The International Transit Studies Program (ITSP) is a U.S. initiative examining international agencies. Part of the Transit Cooperative Research Program (TCRP) and overseen by the Transportation Research Board (TRB), ITSP was funded by the Federal Transit Administration on an annual basis from 1994 to 2013 (TRB, 2014).

Every year, two ITSP research projects were conducted on themes related to public transportation. In the fall of 2007, the theme was "Innovative Practices in Transit Workforce Development," focusing on Canada, France, and Belgium. This theme was chosen because the United States was, as it is now, facing substantial transit workforce challenges and sought to gain valuable awareness of how agencies abroad have successfully addressed this same challenge (Eno Transportation Foundation, 2008). The results of the Innovative Practices in Transit Workforce Development project are presented throughout the remainder of this section on international workforce development initiatives.

#### *Motor Carrier Passenger Council of Canada*

The Motor Carrier Passenger Council of Canada (MCPCC) was founded in 1999 as a Sector Council Program of the Canadian federal government to address human resource challenges in the Canadian bus industry. The agency spearheaded a nationwide study, "On the Move," in an effort to address the market for and the responsibilities of the passenger transit industry in Canada. This study "identifies workforce demographics, skill and competency requirements, occupational supply and demand, key HR challenges, selected best practices, and the impact of technology and the business environment on human resources. Key findings of the study highlight sector growth; potential skill gaps and deficiencies due to large numbers of anticipated retirements as well as difficulty in recruiting new employees possessing requisite skills; increasing costs of training; shrinking labor pool of qualified resources; and accessibility to training" (Eno Transportation Foundation, 2008).

As a result of "On the Move," MCPCC created and put into practice several policies and publications to address these challenges. For instance, MCPCC began collaborating with transit professionals on the National Occupational Standards for Bus Operators, which has made the position of bus operator a profession with nationwide standards that inform training and

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certification programs. Furthermore, MCPCC initiated certification and accreditation programs for bus operators that will assist individuals in finding valuable and trusted programs that will enable attendees to be more attractive to agencies, and in turn, these transit agencies, and the public, will benefit from a skilled and knowledgeable workforce. They have also advocated for an increase in apprenticeship programs, such as the Red Seal Occupation Group that allows apprentices to learn a valuable skill while earning wages and contributing in a meaningful way to their employers (Eno Transportation Foundation, 2008).

MCPCC also led The Bus Council's Comprehensive Approach. This effort was conducted to gain deeper insight into the state of Canada's transportation workforce as well as to identify the needs of the industry for the future. Some key findings include the importance of the transit industry working in collaboration with government and other relevant industries, such as academia and manufacturers, to promote industry status and continued growth and development. Illustrating technology and the importance of innovation, in addition to highlighting the positive implications for the environment is key for the growth of the transit industry, as is providing passenger safety and excellent customer service for all of society's members (Eno Transportation Foundation, 2008).

### *Canadian Urban Transit Association*

The mission of the Canadian Urban Transit Association (CUTA), founded in 1904, is to enhance and continuously improve the public transportation system in Canada. Part of CUTA's mission is to encourage the federal government to promote and contribute to the success of the transportation industry through public policy. CUTA boasts programs that are focused on strengthening the transportation workforce and have hosted several different youth summits (Eno Transportation Foundation, 2008), most recently in May 2013. These programs will be discussed in more detail later in this report.

### *Association du Transport Urbain du Quebec*

The Association du Transport Urbain du Quebec (ATUQ), a partnership of several transit agencies in Quebec, identified the key workforce challenges they are facing as training, applying skills learned in training to basic day-to-day operations, advancements in and integration of technology, and finally the significant amount of ATUQ employees reaching the age of retirement. ATUQ made training for front-line management first priority by looking to universities for assistance in this matter. Laval University was chosen because of a strong reputation for business management skills and teaching students how to put into practice what is learned in the classroom. Five topics highlighted in course work were "(1) labor relations, (2) day-to-day management, (3) defining the role of the front-line manager, (4) communications skills, and (5) change management" (Eno Transportation Foundation, 2008, p. 13). The training was reported to be successful in the level of engagement by participating agencies, networking opportunities, the focus on putting into practice what was learned in the classroom, actual improvements in management back on the job, cost efficiency, and strong leadership by the trainers. Suggestions were made to Laval University to tailor future course work to be specific to transportation management as well as to address how the size of an agency affects the management skills needed (Eno Transportation Foundation, 2008).

### *International Association of Public Transport*

The International Association of Public Transport (UITP) is a worldwide agency based out of Brussels, serving primarily Europe's transit needs. UITP business leader Petra Mollet identified several workforce challenges her organization is seeking to address including safety while on the job, specifically violence from passengers and concerns of terrorism in several European countries, which can pose a challenge to recruiting and retaining workers (Eno Transportation Foundation, 2008).

### *Veolia Transport*

Veolia Transport is a leading transit service provider throughout the world, with a strong base in Bordeaux, France, that supplies bus and light-rail services to the area. It places a high value on both training and communication. An extensive corporate training programing, known as Veolia Environment Campus, allows for in-depth training for all employees interested in acquiring new skills, career development, and management training (Eno Transportation Foundation, 2008).

### *Swedish National Road Administration*

The Swedish National Road Administration (SNRA) falls under Sweden's Ministry of Industry, Employment, and Communications and is an authority of the nation's road transport system that tasks itself with providing a skilled workforce to the transit agencies in the country. HR director Lena Rosen indicates that SNRA spends a great deal of time finding the right people for open positions at the agency and one of the key attributes they look for in a candidate is a positive attitude (Rahn et al., 2003).

## Recruitment Efforts

### *Recruitment Challenges*

**Aging Workforce.** Transit industries across the globe appear to be facing challenges due to aging workforces. Changing demographics and a fast-approaching wave of employees retiring from transit workforces appears to be a worldwide theme. In Canada in particular many of the railroad industry's members are close to retirement age. At the same time, Canadian transit officials have stated there is an increased need for freight and passenger transportation at a national level. This is even further complicated by staff reductions during recent periods of nationwide recession (Railway Association of Canada, 2011–2012). They anticipate competition for employees from the oil sands of Alberta, which can pay quite well with entry-level wages starting around $25/hour (Eno Transportation Foundation, 2008).

**Generational Differences and an Outdated Public Image.** Agency managers in both Montreal and Toronto have indicated that the younger generations entering the workforce now place a greater level of importance on work–life balance than the country's prior generations, making the transit industry a less desirable career now (Eno Transportation Foundation, 2008).

In an effort to recruit younger workers with an updated image, RAC launched a campaign in May 2011 designed to emphasize the railroad industry's qualities and "attract a younger demographic that might not otherwise consider a career in rail. Based on four communications pillars—enabler of the economy, a green solution for the environment, safe, and innovative—these themes and messages [were] designed to attract a younger, environmentally conscious and technology-savvy workforce" (Railway Association of Canada, 2011–2012).

Railroads have features that, if advertised correctly, should draw the interest of young people. They have an environmentally friendly reputation and make extensive use of high-tech equipment. Rail is the most efficient transportation system in the world. It uses less energy, reduces pollution, lowers greenhouse gas emissions, and cuts traffic gridlock. The industry continuously looks for ways to be more efficient by investing in technology. The rail industry emphasizes innovation, using the newest and most advanced technology. These features would be appealing to members of the younger generations, but they are not well-known. Railroads need to advertise these features in the right domains to attract the younger workers (Railway Association of Canada, 2011–2012).

### *Recruitment Techniques*

Railroads can employ several recruitment techniques in order to recruit the most qualified and diverse pool of applicants.

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**Improved Image of Transit Industry.** Increasing the accuracy of the public image of the transit industry will ensure that younger workers see it as an innovative and ecologically sound option with a commitment to employee development.

The MCPCC was founded in 1999 as a means of addressing human resource challenges in the bus industry of Canada. It strives to enhance the public image of the bus industry in Canada by strengthening HR policies and procedures, acknowledging employees' successes, offering educational and training resources, and creating industry standards (Eno Transportation Foundation, 2008).

The image of the transit industry has been improved, particularly in Europe, through a shift in focus to the environment, in addition to sustainability initiatives. In Canada, Quebec transit agencies worked on advertising transit careers as environmentally conscious while stressing the importance of technology to recruit younger people looking to begin employment (Eno Transportation Foundation, 2008). Furthermore, the Société de Transport de Montreal (STM) implemented the Green Plan, a program put into place by the Quebec government to inform environmental policies throughout the nation. These efforts not only benefit the environment, but also boost the public image of the industry and therefore enhance it as a potential career to the environmentally conscious younger generations (Eno Transportation Foundation, 2008).

RAC indicates that the first step in hiring a qualified workforce is to strengthen the reputation and profile of the transportation sector as a valued source of employment, especially in the eyes of the nation's youth as they prepare to enter the workforce. As a means of accomplishing this task, RAC hired Colleen Walsh, an HR expert, to lead several vital HR leaders in the industry in a workforce development initiative. This analysis-driven assessment will work toward gaining an understanding of the changing needs of the rail industry workforce, while strengthening the public image of the railroad industry so as to address the issue at hand. Furthermore, this initiative focused on modifying the image of the railroad industry through four key areas: environment, economy, innovation, and safety (Railway Association of Canada, 2011–2012).

**Address Generational Differences and Attract at a Younger Age.** Quebec transit agencies will begin to work on advertising transit careers as environmentally conscious, while stressing the importance of technology to recruit younger people looking for employment (Eno Transportation Foundation, 2008).

CUTA organized partnerships with 27 primary schools in Ontario though the Ministry of Education in an effort to introduce the transportation industry to students at a young age (Eno Transportation Foundation, 2008). It also periodically sponsors youth summits, most recently on sustainable transportation in Calgary, Alberta, in May 2013. The summit provided attendees with an opportunity to "learn about regional transit and sustainable transportation issues and opportunities [and] explore career possibilities in public transit and other sustainable transportation fields." Featured activities included technical tours of local transit facilities and sessions led by industry experts as well as a DJ dance party aboard a chartered light-rail train (Leading the Way Youth Summit, n.d.).

GO Transit has a "Bring Students to Work Day" where, starting in the 9th grade, students can shadow workers to gain exposure to work in the transportation industry (Eno Transportation Foundation, 2008).

Vice President of RAC Bruce Burrows acknowledges that the recruitment process can be difficult, particularly because the general population and especially the younger generations may not be aware of the industry's importance to the economy, the environmental benefits of using rail versus other modes of transportation, the applied use of innovation and technology, and the overall progressive qualities of the industry as a whole. Increasing awareness of these factors will

be vital in successfully recruiting young people as well as more experienced workers looking for a new career. Walsh acknowledges a departure from the rail industry's prior culture of workers recruiting their children to join the workforce, stating that "Young people are not inclined to follow those kinds of traditions anymore" (Railway Association of Canada, 2011–2012).

RAC has also begun to advertise in *Career Options* magazine, which targets young readers through free distribution to high schools and community colleges. The magazine has a quick-response scan code that directly links to RAC's Career on Track website, which will connect users with employers in the railroad industry looking to hire. The website will also feature a daily blog written by several rail engineering students as well as a career adviser. The Career on Track website will also list available pre-employment training programs and display comments from the current workforce so as to paint a clearer picture of what working in this industry really looks like (Railway Association of Canada, 2011–2012).

**Academic Partnerships, Internships, and Apprenticeships.** RAC has already partnered with five community colleges (George Brown–Toronto, Confederation College–Thunder Bay, Red River College–Winnipeg, Southern Alberta Institute of Technology–Calgary, and the British Columbia Institute of Technology–Vancouver) to offer a pre-employment conductor program, which the organization wishes to build upon in the workforce development program led by Walsh. The hope is that this effort will better position the colleges to prepare potential new hires with strong skills, knowledge, and abilities through creating industry-wide standards, beginning by teaching these standards through course curriculum. RAC is also starting to reach out to high school students who previously may not have been aware of the railroad as a viable career option (Railway Association of Canada, 2011–2012).

The Toronto Transit Commission (TTC), the largest transit system in Canada, includes subways, buses, streetcars, and paratransit services in its network. The Director of Employment Services Christine Jeffries notes that TTC is currently collaborating with local high schools and community colleges to introduce courses related to the transportation field and attract younger workers. They are also working with two different internship programs, "Career Edge," a 6- to 12-month internship for college graduates, and "Career Bridge," also a 6- to 12-month internship offered to individuals who have received degrees outside of Canada. TTC is also working with universities and taking part in co-op programs in the hopes of building strong candidates to hire in the future (Eno Transportation Foundation, 2008).

Due to the anticipation of an increased retirement rate in the next few years, Régie Autonome des Transports Parisiens (RATP) is starting to recruit people as young as 14, by partnering with academic and professional institutions and offering career opportunities post-graduation. For instance, "[in] 2006, 224 non-graduate youths signed employment contracts in operations and management. Another 170 contracts were signed in the skilled professions" (Eno Transportation Foundation, 2008).

**Job Competency Models.** England's Department of the Environment, Transport, and the Regions is an umbrella organization to several agencies, including the Highways Agency. A 10-year transport policy was issued in England allowing the Highways Agency to establish separate business, corporate, and management objectives as a means of improving agency functionality. These objectives focus on goals and budget, upcoming changes and updating the agency, and personal and professional development plans, respectively. These new policies helped the Highways Agency become more focused on excellence in people, rather than solely focusing on engineering and technologies (Rahn et al., 2003).

As part of striving for employee excellence, the Highways Agency distributes "Planning for Success" folders to personnel. These folders contain four components. First is the "Core

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Competency Framework," which lists the abilities and behaviors one must possess to have a successful career at the agency. Second is the "Notes for Guidance for Completion of Performance and Development Plans," which includes the rationale for and guidelines to complete a personalized performance and development plan. Third, the "Performance and Development Plan" subfolder gives "clearer job expectations, setting what is expected in terms of output (objectives) and behavior (competence)" (Rahn et al., 2003). Fourth, the "Voluntary Self-Assessment Form" is for employees to fill out on their own (Rahn et al., 2003).

**The Hiring Process.** STM executives Serge Fortin and Catherine Favron indicated that the Quebec Ministry of Education partnered with STM to provide a pre-hire training program for bus drivers. This program is funded by the Ministry of Education, spans 6 weeks, and has improved the level of training as well as the quality according to STM. In return, STM is obliged to hire students who have successfully completed training by evidence of certification. They must also pass a rigorous selection process after receiving certification from the pre-hire training program for bus drivers. Thus, the process entails not only certification from the Ministry of Education, but also passing a driving test and customer service assessment. Once these criteria are met, the applicants continue to an interview where they are screened for three things: experience, motivation, and behavior. Fortin and Favron indicate that 75% of those applying for bus driver positions at STM are hired after making it through their selection process. These new employees are now able to receive refresher training when needed because of the STM and Quebec Ministry of Education partnership (Eno Transportation Foundation, 2008).

Veolia Transport is a leading transit agency worldwide with a strong base in Bordeaux, France, that supplies bus and light-rail services to the area, and it places a high value on both training and communication. Veolia describes its hiring process as in-depth, beginning with high visibility at local job fairs, placing advertisements in local newspapers, and encouraging employees to discuss job opportunities within their communities. In their training procedures, new hires attend a month-long course, followed by hands-on training for a week, and are assessed by an exam of 20 challenging questions. Once workers begin at Veolia, they are placed on the Extra Board and must take part in a 3-week training program to learn their specific route and other essential information in operating the machinery. If they are assigned a different route, they must attend another 1- to 3-day training course prior to working that route. After 9 successful months on the job, they become "regular" employees and are represented by a labor union (Eno Transportation Foundation, 2008).

RATP boasts a five-step hiring process, which has been reviewed positively by applicants. The first stage of the process is the initial screening of applications. It should be noted that due to the Diversity Charter signed by RATP in 2004, all applications are made anonymous—without name, photo, or other identifying information—to ensure non-discrimination and equal opportunity of applicants. Once applicants are screened in, the next four phases include a cognitive test, personality test, briefing on company standard policies and procedures, and tests related to the specifics of the job at hand. The last stage involves interviewing with management. Family are encouraged to attend the information session about the company in an effort for applicants to determine if working at RATP would be a good fit, personally and professionally (Eno Transportation Foundation, 2008).

**Second Careers.** The railroad industry may not be attractive to younger people looking for a career, but as they mature, the stability and benefits of this industry become more attractive. This tactic opens another pool of prospective recruits. To address the recruitment issue in Canada, railroads are aiming their advertising at older individuals looking for new careers as well as men and women looking for a post-secondary school education (Railway Association of Canada, 2011–2012).

## Retention Efforts

### *Veolia Environment Campus Social Observatory*

The Veolia campus also boasts a "Social Observatory," founded in 2001, which observes and analyzes the social, economic, and cultural needs of the company and workforce. The Social Observatory works with local research programs and universities to collect information through surveys, new programs, and conferences on relevant issues. These efforts have resulted in an awareness of differences between young people entering the workforce and those who are aging out of the workforce. These include the ever-increasing diversity of the workforce and the growing desire for workers to change companies as they advance in their careers. The Social Observatory has also cataloged difficulties that transit workers face due to the nature of their work. These include high divorce rates, familial discord due to non-traditional work schedules, and being "geographically single—living in one place during the work week and reunited with family on the weekend" (Eno Transportation Foundation, 2008). As a result of these efforts, HR departments have put into place a number of social initiatives in an effort to empower Veolia Transport's workers to improve their environments, both at home and on the job (Eno Transportation Foundation, 2008).

### *"Wind Down" Program*

TTC's innovative "Wind Down" program was established in response to a significant number of employees reaching retirement. TTC offers to re-hire retirees on a part-time basis to impart the knowledge acquired over the span of the career to newer hires. Wind Down has proven to be a cost-effective program to transmit knowledge gained by experience (Eno Transportation Foundation, 2008).

### *Labor–Management Relations and Mentors*

**Motor Carrier Passenger Council of Canada.** MCPCC also led The Bus Council's Comprehensive Approach. This effort was conducted to gain deeper insight into the state of Canada's transportation workforce today, as well as identify the needs of the industry for the future. Some key findings include the importance of the transit industry working in collaboration with government and other relevant industries, such as academia and manufacturers, to promote industry status and continued growth and development. Illustrating technology and the importance of innovation, in addition to highlighting the positive implications for the environment, is key for the growth of the transit industry, as is providing passenger safety and excellent customer service for all of society's members (Eno Transportation Foundation, 2008).

**Société des Transports Intercommunaux de Bruxelles.** The Société des Transports Intercommunaux de Bruxelles (STIB) is looking to retain current knowledge while revamping its organization for future success. Initiatives began with fostering mentor relationships between seasoned and new employees while attempting to unite these workers despite potential generational differences by forming a new agency-wide culture. STIB also began a new program to train potential managers and is conducting internal discussions for all employees focused on changing company culture in a positive manner. STIB has also implemented a "value-based management" system "using classic tools such as customized position descriptions, job classifications, and performance appraisal standards" (Eno Transportation Foundation, 2008). From these initiatives, "competency data—including managerial skills and customer-oriented behaviors—will serve as a reference for use in making hiring and promotion decisions, planning for succession, and classifying jobs" (Eno Transportation Foundation, 2008).

### *Certifications and Training*

An employer with a professional image is more attractive to prospective employees and is better able to retain its current workforce because employees are more apt to feel pride in

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their employer when they are viewed as professional. CUTA developed SmartDriver, a program aimed at increasing safety while reducing fuel consumption and emissions and increasing passenger well-being and care. This 2-day workshop aimed at bus drivers teaches advanced driving skills that decrease harmful effects on the environment. After completion of this program, drivers showed a 10.3% reduction in fuel consumption. Benefits from the program included less toxicity to the environment and increased passenger comfort and satisfaction. Furthermore, CUTA states the SmartDriver program enhances the professional image of transit workers, which in turn allows the workers a sense of pride in their career (Eno Transportation Foundation, 2008). Professional certifications, such as the National Occupation Standards, has led to an increased professional image of the transit industry (Eno Transportation Foundation, 2008).

### *Benefits and a Culture of Well-Being*

RATP offers many benefits to employees, including competitive wages, health care coverage for employees and their families, as well as a national pension, and workers' compensation. Perhaps as a result, their attrition rate is notably low (Eno Transportation Foundation, 2008).

Regular employees of RATP belong to different labor unions. These labor unions, as in the United States, are in place to represent the best interests of the workforce. In an effort to improve labor and management communications and relations, RATP has put into place a "social alarm" policy, which allows any issues to be addressed immediately through the three-step process of first discourse with a general manager, then addressing department-level heads, and finally going to the unit-level head. ITSP participants found this process to be similar to the U.S. grievance process; however, the social alarm policy seems more spread out across different levels (Eno Transportation Foundation, 2008).

To address the goal of improving the well-being of employees, RATP managers are joining forces with local doctors and health care professionals to offer programs aimed at promoting healthy lifestyles. In addition to helping employees enjoy living healthfully, another goal of this initiative is to reduce sick absences (Eno Transportation Foundation, 2008).

SNRA shared information gleaned from exit interviews on what plays a role in contributing to job satisfaction for employees. Being able to organize, or having control over, one's own work was listed as most important. Other key factors included benefits such as competitive salary, vacation time, and opportunities to receive education, as well as working as part of a team with good co-workers, enjoying oneself at work, and contributing to society by being a part of something significant (Rahn et al., 2003).

NCC International is a privately owned company focused on property development and prides itself on understanding the importance of having fun in the workplace in order to retain an experienced workforce. The agency describes itself as a "young, exciting company in which the focus is on innovation, participation, and the expertise of each employee" (Rahn et al., 2003). NCC International also has recognized the importance of engaging students at a young age in an interest in civil engineering, while also advertising itself as a potential employer to universities.

Hans Grimmig GmbH is a small, family-operated construction company located in Germany. The company says that, in a competitive job market for recruiting skilled workers, they succeed because they make an effort to let candidates know that every employee is respected and treated like family. In discussing the values of the company, Dieter Grimmig states, "Our main goal is to instill staff with the notion that they don't go to work, but rather go to their company" (Rahn et al., 2003). Besides fostering a strong culture of community, they also offer attractive benefits, including profit shares and company cars, to their employees.

## Lessons Learned

A review of existing literature on the international transit workforce yields several noteworthy results. Included in these findings are some similarities and differences in workforce challenges, in addition to lessons learned. Though not everything learned will be easily incorporated into the workforce development efforts put forth by the U.S. railroad industry, certainly, these findings can inform future recruitment and retention practices in the United States.

Similarities exist between workforce development challenges and efforts of the United States and other countries reviewed. First is the need to improve the public image of the transit industry so that attracting a strong workforce is possible. The changing demographics and values of the workforce was also a common theme, especially the fast-approaching wave of retirement for a significant portion of the international transit workforce. All countries found themselves looking either to retain that knowledge base or to hire new skilled workers that would be easily trained through new program initiatives (Eno Transportation Foundation, 2008).

A few noteworthy differences in workforce initiatives between the United States and other countries exist. One important factor is the higher wages paid to Canadian workers. It should also be noted that "fare collection ratios appear to be generally higher in Canada than in the United States" (Eno Transportation Foundation, 2008), thus perhaps leading to higher wages for Canadian workers. Another difference between transit agencies in the United States and Canada is the relative cost of health care. In the United States, employers hold the responsibility of offering health care to their workforce, whereas in Canada, the federal government provides basic health care for all residents, in addition to Canada's relatively new Compassionate Care Leave program. This government-funded program, beginning in 2004, allows people time off from work without loss of job or pay in order to care for sick family members.

Government funding for transit industries also differed on the international level. For instance, the national transport tax based on capital and employee wages and paid by French employers to their nation's transit systems largely differs from the funding the U.S. railroad industry has (Eno Transportation Foundation, 2008). Through this funding, agencies like RATP were able to put many remarkable policies and procedures into place in an effort to address identified workforce challenges. There is a lack of any comparable monetary aid available to similar transit agencies in the United States (Eno Transportation Foundation, 2008).

Internationally, it appears students are exposed to the possibility of a career in the transit industry at a younger age than their U.S. counterparts. For instance, partnerships made with secondary schools, as well as universities and other academic institutions, in Canada and France proved to be significant in promoting the industry to students who otherwise may be unaware of this potential career path. The United States can learn from other nations introducing their youth to the transportation industry at the primary school level in an effort to promote careers and life-long passions in rail.

The Canadian transit industry has also been successful in workforce development efforts through combining government, business, and labor under the umbrella of MCPCC. Through these collaborations, national standards can be established, therefore reducing costs to both government and agencies. Studies compared this model to the practices in the United States, where often standards are developed at a state or local level, thus increasing costs to government and agencies because of duplicated efforts and isolated training protocols. A comparison of U.S. and Canadian workforce initiatives can be seen in Table 2.

**Table 2. Comparison of U.S. and Canadian workforce initiatives.**

| Workforce Initiative | Current U.S. Approach | MCPCC Model |
|---|---|---|
| Labor & Management Partnership for Attracting and Developing Transit Employee | State & Local | National |
| Career Ladder Programs | State & Local | National & Provincial |
| Partnerships with Transit and Universities for Training | State & Local | National & Local |
| National Certification of Transit Positions | No | Yes |
| National Occupational Standards | No | Yes |
| Sector Based Tripartite Forum for the Advancement of Transit Training & Certification Programs | No | Yes |

Source: Eno Transportation Foundation (2008).

Through a review of the international efforts in transit workforce development, one common theme was heard repeatedly. Workforce planning and development must be an integral part of an organization's strategic and business planning processes. Investing in the human capital of an organization must be a bottom-line item for all organizations, just as important as product and service development and delivery" (Rahn et al., 2003). Achieving this goal is imperative to the transit workforce's future, both here in the United States and abroad.

CHAPTER 3

# Perspectives on Recruitment and Retention Practices, Strategies, and Challenges

The researchers conducted the following three major efforts in an examination of recruitment and retention efforts in the rail industry:

- Focus groups with the industry workforce
- Survey of the rail industry's operations managers, system engineers, and craftworkers
- Structured interviews with business leaders, executives, and human resource departments

The information compiled from these three efforts fed into the development of the competency models detailed in a later section.

## Focus Groups on Railroad Recruitment, Training, and Retention in Craftworkers

The research design included a series of targeted focus groups to inform the issues that were explored in a nationwide survey of railroad craftworkers. The objective of the focus groups was to discuss issues and concerns related to recruitment, training, and employee retention. The information provided by the focus group participants guided the research team in formulating questions that a cross section of railroad workers answered via an online survey. The guided questions used in the focus groups are available in Appendix A.

### Participant Recruitment

The researchers contacted national representatives for each of the major craft labor organizations in the railroad industry. These individuals provided local contacts in the three cities where focus groups were to be held—Waltham, Massachusetts; Chicago, Illinois; and Houston, Texas. The goal was to have two representatives from each of the crafts: train and engine service (T&E), dispatching, maintenance of way (MOW), signal, and car repair. A researcher contacted the local labor representative, described the project and requested two individuals from the craft, one of whom had worked 2 years or less. Only actively working employees of a railroad were eligible to participate; full-time labor organization employees were not. (One exception to this criterion occurred in Waltham. Because no signal employees were available for the first focus group, a full-time BRS employee who had left railroad employment 6 months before participated.)

### Participant Profiles

Ten individuals were recruited for each focus group so that each craft would have the opportunity for equal representation. Because it was likely that not all confirmed participants would attend, the goal was to have nine participants in each focus group session. A total of 59 people

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**Table 3. Focus group participants by location.**

| Location | Number of Railroads Represented | Crafts Represented | Total Number of Participants |
|---|---|---|---|
| Waltham, MA | 5 | T&E, signal, dispatching, MOW | 18 |
| Chicago, IL | 6 | T&E, signal, dispatching, MOW | 23 |
| Houston, TX | 2 | T&E, signal, car maintenance, MOW | 18 |

participated in the eight focus groups. Carmen attended only in Houston and dispatchers were represented in Waltham and Chicago. Because railroad freight T&E people do not work a regular schedule, no T&E workers holding this type of job were able to participate in the focus groups. It proved difficult to recruit recently hired people so the researchers accepted more experienced people.

Table 3 summarizes the participants by location and Table 4 provides information about their railroad experience. The participants in Waltham, on average, had 2 years less railroad experience than those in Houston and Chicago and their median experience was 7 years, in contrast to 10 in Houston and 14 in Chicago. The Waltham group also had the least experience with their current employer and the least experience in their present positions.

## Major Themes by Location

### *Waltham*

**Recruitment.** Eleven of the 18 Waltham participants reported having worked in another industry prior to starting a railroad career. They worked in a variety of industries including firefighting (retired), construction, metal finishing, oil drilling, electrical manufacturing, mutual funds, trucking, communications, and sales. Two had worked as prison guards. The majority reported getting a railroad job because they had a family member or friend who worked for their railroad employer. The others knew someone in the industry who suggested that they apply. One person commented, "You don't get into the railroad without knowing somebody," but several veteran railroad employees felt it was now more difficult to get hired by the larger railroads if you had a family connection. They felt that having a relative at the railroad might even be considered "a negative."

Participants came to railroad jobs through various paths. A signalman reported that he went to trade school and did not want to wire houses so when he learned about working for a railroad he applied. A dispatcher reported that his father got him a job as a coach cleaner when he was in college and he ended up staying with the railroad. The person who had worked in construction got his railroad job through his union.

There were a number of factors that made a railroad job desirable. All were attracted by the money and stability. The health insurance was also considered attractive. At the time they hired

**Table 4. Participant experience by location.**

| Location | Years of Railroad Experience | | Years with Current Railroad | | Years in Present Position | |
|---|---|---|---|---|---|---|
| | Mean | Median | Mean | Median | Mean | Median |
| Waltham, MA | 12.6 | 7 | 7.7 | 6 | 6.4 | 3 |
| Chicago, IL | 14.7 | 14 | 13.0 | 14 | 8.4 | 7 |
| Houston, TX | 14.7 | 10 | 11.6 | 10 | 10.2 | 8 |

on, most were not concerned about a pension but this benefit became desirable once they were working for a few years. The retired firefighter was looking for a second career that would not impact his firefighter pension. Prior training or railroad experience is not a prerequisite. There are a variety of jobs available and relocation is possible. One participant commented that "Getting in is the hard part."

One individual who was hired more recently said that he applied online for all positions and after several months he finally got an interview because of a family member. The hiring process for a Class I railroad takes about 2 months. Applications are completed online and include some basic testing. The railroad screens the applications and selects candidates for an interview and drug test. A job offer is contingent on a physical examination. For a smaller regional railroad that desperately needed people, the process took about 2 weeks.

One veteran railroader felt that the smaller railroads are still using the old hiring model that is relative centered. The Class I railroads have gone to a model where it is not possible to approach the recruiters. The railroad brings in several hundred applicants for T&E jobs and puts on a video show describing "all the horror stories." Anyone who is not scared away is given a drug test. Participants in MOW jobs reported that they were told about travel in their job preview. Dispatchers also reported having a job preview as part of their interview process. They "drew an ugly picture" including working nights and weekends. In fact, some said, the railroad painted a grimmer picture than what actually occurred on the job.

Recently some railroads have offered a bonus to those who stay at least 3 years. At Amtrak, if an engineer quits before 4 years, the individual must repay Amtrak for the engineer training. (This is common in the airline industry.)

**Training.** Participants' training differed by craft:

- Veteran *dispatchers* reported being trained "side by side" with someone already doing the job. They also did track car and front-end rides for territory familiarization. Two dispatchers hired in recent years had 8 to 12 weeks of formal rules training followed by on-the-job (OTJ) training. They felt their railroad needed a more formal training protocol rather than leaving it to the judgment of the senior dispatcher overseeing the trainee.
- A *signal maintainer's* training was OTJ. His supervisor allowed him to "shadow" an experienced maintainer. He said it made a difference once he got into maintaining. "The only way to learn a job is to do the job. . . . You need to attach yourself to someone and learn the job through them and learn it as quickly as you can." Another signal employee who worked for a small railroad said he was trained on the equipment that was on the property. There was a lack of sophisticated signal equipment on the system.
- Those from the *track department* reported having 3 weeks of training and then going out to a job site. That was where the real learning occurred. One commented, "You don't learn anything until you go out there and do it."
- A *locomotive engineer* trainee felt there was too much formal classroom training for engineers. She didn't know anything at the start and felt overwhelmed. She had 13 weeks of classroom information and only four field trips to see equipment. "You get all this information memorized and then you get out there and you start seeing things and it feels backwards." She felt there was a need for more hands-on experience in conjunction with the classroom lessons.
- An equipment operator in the *track* department had 4 days of training. He said, "You learn as you go."
- An *assistant conductor* from a passenger railroad had 8 weeks of formal classroom training followed by 6 weeks of OTJ training before going on the spare board. He said, "Everything that I have learned I learned from guys that have been here for 40 years."

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All agreed that training new people is becoming more difficult because the experienced people are all retiring. The result is that ***"Babies are training babies."*** An experienced railroader said, ***"If somebody shows they are interested in what's going on, I put more into [the on-the-job training]."***

A veteran railroader thinks there has been a change from one-on-one "word of mouth" training to the classroom method. People are being taught by the book. The result is that trainees miss a lot of practical techniques. The only training beyond the initial training was annual rules training for crafts where this is relevant.

When asked "What would you have to do to qualify for your supervisor's job?" all agreed that the railroad picks whomever it wants. In addition, all agreed that they would face a pay cut by going from an agreement position, where overtime is possible, to a salaried job. One of the dispatchers present told the group that at his railroad the chief dispatcher, an agreement position, must come from within the office. According to their labor agreement, the railroad may not bring in an outsider with no dispatching experience.

**Retention.** The next set of questions focused on why people stay in a railroad job. Participants offered many aspects of their jobs that keep them at the railroad. These reasons included the following:

- There is mobility within the company to other locations and jobs.
- "I enjoy the solitary aspect . . ." as a conductor working with an engineer.
- There is a sense of accomplishment when finishing a big construction job, e.g., laying miles of fiber optic cable.
- "What I like about the railroad is the closeness of everybody" and the sense of brotherhood.
- A conductor for a passenger railroad said he is having more fun at this job than he expected. He has a great time when working on the train.
- A dispatcher said, "We have a good group of guys and we have a lot of fun."
- "It's always been enjoyable."
- All agreed that the money was good. ***"Money is very nice."***

All agreed that they would not hesitate to recommend a railroad job to a friend or family member. One person added that it would only be people he enjoyed being with. One participant said that he would recommend a railroad job "in a heartbeat" to the right person. He thinks it is a great place to work but he would give a realistic picture of the job when making the recommendation.

All agreed ***that the railroads need to do a better job of PR.*** One participant reported that after the CSX TV commercial ran recently, he started getting questions from lots of people about railroading. Other participants suggested that the railroads go to trade schools and colleges to recruit.

When asked about recommendations to the railroad to encourage employee retention, one felt there was too much "nitpicking." Another felt his railroad had too many managers and that they should "Let the Indians do their work."

**Other.** When asked for other suggestions regarding recruitment and retention, participants brought up the following issues:

- Two participants commented that the freight railroads do not reach out to the female and minority workforce. This is not the case with Amtrak. The female participant cautioned that if railroads get too concerned with diversity, they can end up hiring the wrong people as not everyone is suited to a railroad career.
- Rate progression was mentioned as a detractor in hiring. Dispatchers and T&E workers take 5 years to reach full pay. Everyone agreed that once individuals are doing the job with full responsibility they should be earning full pay. "It is upsetting to know you are doing the same job as someone else and not getting the same money." Some claimed that when the railroad

hires, they do not tell new employees about this practice. Participants were not against step raises but they thought 5 years was too long. In the track department, employees reach full pay in two years.
- Participants felt that reducing the time on the job before full pay will encourage retention. They voiced the opinion that if you are 100% responsible you should get 100% pay.
- Other participants suggested that railroads go to high schools to teach the students about railroading and the opportunities in the industry. There are not a lot of railroads in New England so high school students do not know the opportunities that exist.
- One participant pointed out that railroads expect you to quit your job, go to training for 2 months, and then have a 90-day period where they can fire you without cause.

### *Chicago*

**Recruitment.** At all three focus groups, the majority of participants came to work in the railroad industry because a family member or close friend worked there. For those with a family member connection, they reported understanding railroading and they knew the unique characteristics of railroad work. A few participants reported finding their railroad job through an Internet search and former military people learned of the position through a VA advisor or the military outplacement service. These tended to be people hired more recently.

Many had worked another job before joining the railroad. Other industries/areas where participants worked prior to joining the railroad included construction, health care, telephone company, machine tool operations, high-power lines, post office, warehousing, and trucking.

Those recently hired applied online. They subsequently received a call from the railroad to come for an interview. The time from application to starting work ranged from 2 to 4 months. All reported having a job preview that covered the need to travel, work holidays and weekends, and irregular schedules. Some felt that the railroad wanted to "shake out" people in the hiring process and not after they were hired. One person with a family connection did comment that ***"Until that phone rings at three in the morning or you have to miss your son's birthday party, you don't understand what the job involves. That's why you lose so many people in that first year."*** This comment drew agreement from the others. At one focus group, several participants pointed out that they were not told that they were not eligible for overtime during their training period. They also stated that the vacation accrual policy was not adequately explained and they were not told that there is no sick leave allowance.

Participants were critical of the railroad policy to hire only people with college degrees. They felt that having a degree does not guarantee success in a railroad job.

Participants at one focus group suggested that the railroads attend job fairs at high schools and colleges.

**Training.** Training varies by craft as follows:

- **Yardmaster.** The one yardmaster participant reported that he went to "Choo Choo U" where he had 7 weeks of classroom training to learn operating rules, procedures for hazardous materials, and the railroad's computer system. He didn't really learn how to be a yardmaster until he had 3 weeks of OTJ training and actually did the job. He said he was fortunate that he had an experienced yardmaster to teach him. He feels that the current training focuses on what "not to do" and accountability and that new hires don't know what they are supposed to do.
- **Conductor.** Conductor participants reported that the training was useful in that it provided a mixture of classroom and hands-on training. One conductor said he didn't really learn the job until he did it. Another commented that "Whenever somebody new comes in, I try and show him what I know." When trained for the remote control operator position, a vendor representative came to do the training, was another comment.

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- **Dispatcher.** Training at a large Class I railroad consists of several weeks of classroom training to learn the rules followed by OTJ training. When assigning a trainee to a desk for training, it is important to have the supervising dispatcher be experienced and willing to teach, but this is not always the case. One dispatcher reported that "Three days after I marked up I had someone training with me." An experienced dispatcher said that no one in his office has a bad OTJ training experience because it is a small office and everyone has to work cooperatively. He said that, "I'm eager to have a new guy learn my job because it means I can have my time off." Dispatchers used to have road trips so that they could see the territory that they are dispatching but this does not happen any longer because the dispatching center is short-staffed and cannot afford to give dispatchers training days.
- **Signal.** Initial training for all signalmen involved a combination of school and OTJ training in several cycles. Everyone stressed the importance of the OTJ training and the importance of having someone willing to teach you. One participant reported that ***"[I] had a really good foreman who showed me how to do stuff."*** Another reported that the National Signal Consortium is putting together an online training program but railroads have to pay to participate and his employer was not a part of the consortium. This participant saw this as a "wonderful opportunity." Two experienced signalmen talked about wanting to teach people who show interest. Everyone agreed that education and experience are key to doing the job.
- **MOW.** Participants reported a variety of experiences. One learned the job after working as a conductor so he felt he already knew the railroad and had an advantage over others who were new to railroading. All had limited classroom time and learned the job by doing it. One participant felt that the railroad should rely more on the old heads to teach the new people but they "go by the book," which does not teach how the job is really done. He further suggested that the managers should go out on the ground and see what is going on so they understand.

Participants reported that a major problem across all crafts is that "You have new people training new people." A MOW foreman who came to railroading from the military talked about the "battle buddy" system in the military. When he enlisted, this person "showed you the ropes" and passed on his experience. He found this extremely helpful and thought this was a model that the railroads could follow.

Participants thought the initial training could be improved by the following:

- Provide more hands-on time for dispatchers. Trainees are not ready to dispatch after classroom training. They really don't understand the job and the field dropout rate is high.
- Use trainers who have field experience not inexperienced management trainees.
- Use skills testing in candidate screening, at least for dispatching.
- Implement a formal mentoring program to pair a trainee with an experienced employee.

In terms of refresher training, participants felt there wasn't enough because the railroads are short-staffed. The signal departments have seen a lot of change in technology over the past 5 to 6 years but there isn't always training on the new equipment. The manager may be trained and then he trains those under him. Participants had no interest in applying for their supervisor's job. The primary reason was that it would involve a pay cut. They would end up working more hours for less pay. The potential for a management bonus and a different pension did not compensate for their no longer being eligible for overtime. They felt the railroads have "made a huge mistake" in hiring inexperienced people as supervisors instead of bringing people up through the ranks and paying them more.

**Retention.** Participants stayed with their jobs for a number of reasons:

- The pay is good and there is an excellent retirement system. (For someone without a college education, "you are making good money.")
- Job stability.

- Camaraderie of co-workers.
- Some expressed a sense of pride in the work they do. ***"When you fix a switch and see the train go by, you know you did your job."***
- Signalmen enjoyed the challenge of always learning something new and tackling challenging problems every day.
- Amtrak pays for additional training on employee's time.

When asked if there was anything the railroad could do to encourage people to stay, participants offered the following:

- Tailor training (OTJ especially) to the individual.
- Use experienced people willing to train for OTJ training. Don't just assign whoever is available.
- An employee who makes an error needs remedial training. Having unpaid time off doesn't correct the underlying problem.
- Stop creating larger maintenance territories.
- Hire more staff so existing workforce is not stretched to the limit.
- Hire managers who have worked the job and "know what happens on the ground."
- Ask the workers for their opinion. When an issue is brought to management's attention, follow up with the employee who commented.
- Acknowledge employees for a job well done. One participant reported getting a letter from the superintendent thanking him and the other people for their work during a recent snowstorm.
- Provide better quality tools and equipment, e.g., better quality work boots used to be provided.
- Stop trying to blame or harass the employees. There is an ***"us vs. them"*** culture.

Everyone would recommend a railroad job to another person but would make sure that person understood the nature of the job and the railroad. They would be more likely to recommend to a person under 30 who does not have family responsibilities.

**Other.** Participants offered the following additional comments:

- There is too much emphasis on the need for a college degree to work at a railroad.
- The railroads need a better screening process for jobs and should give the experienced people as well as the supervisor a say in the hiring process.

### *Houston*

**Recruitment.** A majority (13) of the 18 participants in Houston had worked elsewhere before coming to the railroad industry. They reported working in printing, warehousing/distribution, telecommunications, automotive repair, construction, pipeline, steel, and the Federal Reserve Bank. Two came from the military. All but three knew someone working in the railroad industry. Only three came from railroad families.

Participants were attracted to the railroad jobs because of earning potential and the benefits in a stable industry/company. Several pointed out that there were not many places where someone with a high school education could make the same amount of money. Some liked working outdoors. One signalman said that he always wanted to work with anything electronic. He was a telephone installer in the military and wanted to do something similar after his military discharge.

Those hired more recently reported applying online and that it "wasn't difficult at all." The time from application to job offer ranged from 2 to 4 months although one person reported that the process took 6 months until he started work.

Several participants reported that their railroad recruits at military job fairs. One participant thinks that railroads like ex-military people because these individuals are used to discipline and

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are "ready to go at any time." At one time Harris County reimbursed the railroad for half of the first 90 days' salary for veterans that were hired.

All participants reported having a comprehensive job preview that included the work schedule. One participant said that they make it sound harsher than it actually is. "Once you are there, you see it's like that but you can still have a life." There were still surprises once on the job. These included the following:

- **Insurance.** There is a 12-month waiting period for dental coverage.
- **Claims process.** This is the process by which employees get paid for extra time worked such as when they should have been on meal break. One participant commented that ***"A new guy wouldn't have a clue what to put on the claim form."***
- **Drug testing policy.** A participant was surprised to learn that if an employee tests positive for drugs and the individual goes to drug rehab, the employee may come back to work. Most companies would let the person go.
- **Bumping.** Participants in all three focus groups brought up the fact that they were not told about the bumping process prior to joining the railroad. They felt that if the railroad did a better job of manpower planning, there would not be so much bumping. In some crafts, bumping can occur system-wide; in others, such as carmen, it occurs just within the location.

**Training.** Training experiences varied by craft as follows:

- Carmen went to a class. According to one participant, the problem is that they teach things in the initial class that the carman might not need to use for several years and by that time, the knowledge is gone.
- MOW personnel went to a class where they worked on maintenance track with a trainer. This class covered the tools but not how to actually do the job. This class was followed by OTJ training which was "good." One participant pointed out that he did not learn about track and time in class. Fortunately, another MOW person was willing to teach him.
- In school, the conductor learns how to move around a train. Years ago, the new hire was trained as a brakeman and worked up to switchman and then conductor. Now the new hire goes to training and becomes a conductor right away. Once they pass the test, they are certified as a conductor.
- Signal work requires a combination of class followed by field work. The classroom portion teaches the basic principles but most of the learning occurs in the field. Then if a signalman goes from construction to maintenance, someone must do OTJ training for this employee. A Class I railroad has the Yellow Signal Book which provides instruction on how to do maintenance and this is a big help.

Participants saw a number of areas where training could be improved. Participants reported that rules classes are now done online and no one is available to answer questions. They preferred the classroom method for this reason. They felt that today there is too much reliance on classroom training and that there should be more OTJ training.

Everyone stressed that OTJ training is where you really learn the job and that "Everybody helps everybody." Unfortunately, many experienced people have retired and over time the experience base is shrinking. ***"The knowledge is getting lost."*** One participant said that his labor organization was willing to identify people willing to do OTJ training. "If the railroad asked the union to identify OTJ training people, we would find people who want to do it." Another felt that if the railroad did a better job of manpower planning that there would be more senior people available to work with the new hires. A conductor commented, ***"I try to take the new guys under my wing [because someone did that for me]."***

One carman thought that refresher training and recertification of carmen on "things that can cause big damage" would help. Several participants felt that there was a need for territory

familiarization for MOW personnel. A signalman talked about his foreman assigning a buddy to every new employee. He said that this system worked because "We all care about each other." Another signalman reported that, at their morning job briefing, people talk about their experiences solving difficult signal problems so that others can learn from them. He found this valuable.

When asked about applying for their supervisor's job, all agreed that the railroad would have to pay a higher rate because they all can make more money as an hourly worker. A typical comment was "I make as much as my foreman. Why would I take that job?" One participant was willing to apply for the job because he saw it as a way to move up in the organization. He pointed out that there were some benefits, such as an additional week of vacation and the potential to earn a bonus, which the job offers.

**Retention.** People stay because of the benefits, retirement plan, and pay. One participant said that without the benefits he would look for something else. Several participants pointed out that after 10 years, people have to stay because there are no other jobs where they could get the same pay and benefits. Beyond the monetary benefits, ***"It's the people we work with that make it worth going to work."*** Several voiced this sentiment.

In one of the three focus groups, the consensus was that the participants would no longer recommend a railroad job because of the way the railroad treats its employees. They felt there was too much stress. The participants in the other two groups would recommend railroad work to a family member or friend.

Participants in all three groups offered a number of ways that the railroad could increase their job satisfaction. These included the following:

- "Treat your employees as your best customer."
- Hire supervisors who have experience doing the job.
- ***"Don't rush me."*** Trust the experienced employee's assessment of how long a repair will take. (signal)
- Acknowledge a job well done. One participant commented, "You don't get as much praise as you should."
- Management should take on a more "one team" concept. There is too much "us vs. them."
- Share the wealth with the employees who keep the railroad running.
  - All medical insurance
  - Bonuses
  - More vacation time
  - Paid sick days
  - 401(k) match
  - Stock purchase program

**Other.** When asked for other suggestions regarding recruitment and retention, participants brought up the following:

- One focus group talked about job-related stress and thought this should be on the survey. They talked about always being in fear of losing their jobs because of rules compliance.
- One participant believed that by not hiring from railroad families, knowledge is lost. In addition, job candidates from railroad families "know what to expect."
- Everybody wants to work for the railroad so there is no need for the railroads to advertise.
- A few thought that the railroads could do a better job in their selection of new hires. ***"Guys are getting hired who can't do the job."*** (This comment came from a signalman.)
- If job candidates are recruited through the Texas Workforce Commission, then "you know what you are getting." (This is a state agency that aids employers as well as job seekers.)

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### Overall Themes

- People in New England and Chicago were more likely to come from railroad families in contrast with Houston.
- Many have worked in other industries prior to joining a railroad.
- Only a small number of participants found their jobs through Internet research. Most were referred to the railroad industry by family or friends.
- The railroads don't need to advertise for job applicants. They get plenty of applicants through word of mouth.
- The pay, benefits, retirement program, and co-worker camaraderie keep people in their railroad jobs. They believe that with only a high school education, they could not earn as much elsewhere.
- Implementing a buddy system would help new hires more quickly become productive railroad employees.
- There are many things that railroad management could do to increase job satisfaction. These include hiring supervisors/managers who have done the job that they oversee, acknowledging a job well done, and adopting a team approach to managing craftworkers.
- Overall, the railroads provide an accurate job preview. In fact, the reality of the jobs may not be quite as extreme as the railroad recruiters describe. The job preview, however, did omit discussion of some important factors such as rate progression, lack of sick pay, and bumping. Bumping was an issue in Houston and rate progression was an issue in Boston and Chicago.

## Survey of Workforce on Railroad Recruitment, Training, and Retention

Rail industry craftworkers, operations managers, and systems engineers were the focus of this examination of recruitment and retention issues in the railroad industry. These employees include individuals responsible for the movement of trains (e.g., locomotive engineers, conductors, and trainmen), construction and non-construction maintenance, and communications and signaling. The research team successfully surveyed this stratum of the railroad population with the cooperation of industry and labor associations. The process of surveying the workforce was completed not only to examine the industry's recruitment and retention strategies, but also to further gather representative demographic information unavailable from earlier research methods.

### Key Findings

1. The biggest recruitment effort in this craftworker sector was recommendation from a family member or friend. Close to 70% of these participants initiated applying to this industry for this reason. When questioned if they would in turn recommend the railroad industry, the answers were divided. Only 17% indicated a definitive recommendation and an additional 35% indicated a probable recommendation to work in the railroad industry. Contrastingly, 18% would not recommend this industry and 30% stated they are unlikely to endorse this industry to a family member or friend.
2. There was a strong sentiment that proper mentoring and training is needed for new hires. Over a quarter of this group received less than a month of training. On-the-job mentoring was hampered by unwilling trainers/mentors, unwilling supervisors, and inexperienced classroom instructors. The sufficiency of this training varied by job categories. The dispatchers reported sufficient training, whereas signalmen, freight train and engine service, and passenger–freight train and engine service indicated their training was insufficient to absent.

3. Job satisfaction was fair for 58% of this group. Almost a quarter reported a neutral stance on their satisfaction levels. An overwhelming 72% indicated that improving labor–management relations was the key element to retaining railroad employees. Other highlighted suggestions included increase or offer sick leave, increase pay, hire experienced supervisors, increase acknowledgment from management for a job well done, and cover more health insurance costs.
4. For the rail engineering and operations group, interest in the rail industry grew from recommendations of friends and/or family members. Survey respondents reported that they were attracted to the salary, pensions, and job security offered by the railroads.
5. Job satisfaction was neutral to positive for operations managers and system engineers. They reported finding the work interesting and challenging, but many did not see this field as a life-long career option. Increase pay, improve predictability of work schedules, offer more training and educational opportunities, and increase opportunities for growth and career advancement were cited as ways to improve employee satisfaction and retention.
6. Operations managers and systems engineers report a lack of formal training when entering the rail industry. The greatest obstacle to training was a lack of time. All believed OTJ training was the most effective method and many participated in employer-provided and/or non-employer continuing education and training.

## Results of Craftworker Recruitment and Retention Survey

### *Survey Design and Response*

With cooperation from the industry unions, the research team received a sample of names and addresses for individuals belonging to the target craftworker labor categories. A mailed invitation was delivered to randomly selected individuals requesting participation in this survey. All identifying information, including name, address, union participation, and individual responses are strictly confidential. Such information will not be divulged; and all data presented in this document is aggregate with specific identifiers redacted to protect confidentiality. Appendix B contains the survey questions distributed to craftworkers.

The research team received 256 responses from the various labor categories, which equates to a 14.6% response rate to the mass mailing to the various craftworkers. Although this is a limited response, the data provides a reasonable and informative representation of worker characteristics, attitudes, and experiences. Figure 9 provides a statistical comparison of this sample to the railroad industry population. Percentages of labor categorization were calculated separately for the sample and the population.


***Figure 9. Comparison of labor categorization between survey respondents and the railroad population.***

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### *Craftworker Demographics*

Responses were collected for the following demographic information: craftworker labor category, age, sex, marital status, race/ethnicity, and years worked in the industry.

**Craftworker Labor Categories.** Respondents for the craftworker survey selected the labor category that best fits their current responsibilities from the following options: dispatcher, MOW, freight T&E, passenger T&E, signalman, and mechanical department. Participants were given the option to write in their labor category under the option "other." The "other" category, comprising 2% of the responses, consisted of yard masters, freight conductors, bridges and structures, and one person who indicated both freight and passenger T&E. Figure 9 breaks down the labor categories by percentage of respondents to this survey.

**Age.** With a range of ages varying between 21 and 69 years, the average age of these respondents was 49.32 ± 10.5 years. The proportion of craftworkers in their fifties and sixties, compared to craftworkers under the age of 50, matches the current demographics within the industry today.

**Sex and Marital Status.** As expected, a majority of the respondents were male. The males comprised 97.1% of the participant pool. A significant proportion of the respondents (79.2%) reported being married. The remaining statuses were single (11%), divorced (6.5%), partnered (6.8%), and widowed (1.3%).

**Race/Ethnicity.** The majority of these respondents reported White/Caucasian as their race/ethnicity, occupying 88.8% of the subject pool (see Figure 10). The remaining percentages included Black or African American, 4.1%; Hispanic American, 1.2%; American Indian or Alaskan Native, 0.8%; and 2.9% elected not to answer. Participants who selected "multiple ethnicity/other" constituted 2.1%; written responses included "American," "half Hispanic / half White," "Polish and Italian," "White/Asian," and "White/Spanish."

**Years in the Industry.** With a combined total of 4,885 years in the railroad industry, the respondents reported a mean of 20.1 ± 12.5 years in this field. The respondents' number of years working for the railroad ranged from less than a year to more than 46 years (Figure 11). No significant differences were detected in the mean of years worked in the railroad industry between the six labor categories (Table 5).

**Geographic Locations.** Figure 12 presents a map of the geographic locations of the participants who completed this survey.

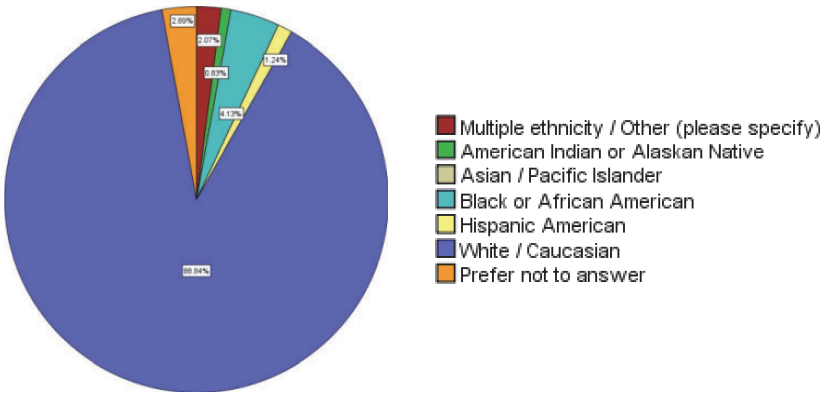


***Figure 10. Ethnicity distribution of respondents to craftworker survey.***

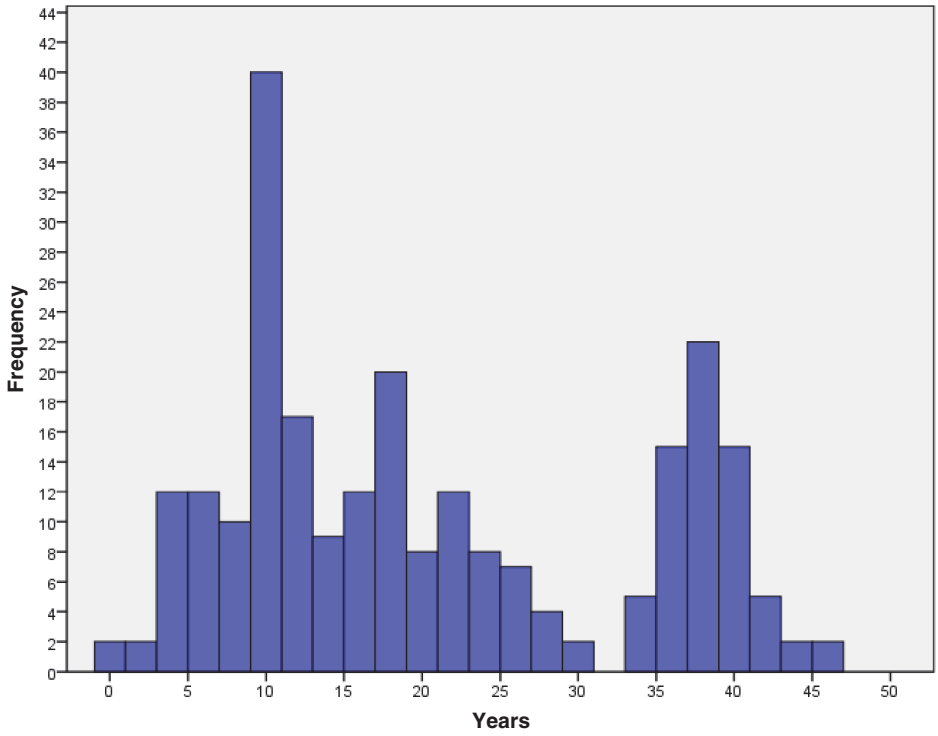


***Figure 11. Number of years that respondents to the craftworker survey had in the railroad industry.***

### *Responses on Pre-railroad Employment Experience*

Respondents were asked several questions pertaining to their opportunities and experiences upon entering the railroad industry. Where warranted, a breakdown of responses to questions by labor category is presented.

**Prior Experience Before Joining the Railroad Industry.** A large percentage (81.6%) of these respondents worked in a different industry prior to joining the railroad. The breakdown by field is as follows: construction, 25.5%; transportation, 9.4%; military, 7.8%; law enforcement/criminal justice, 5.7%; education, 5.2%; food industry, 4.2%; telecommunications, 4.2%; health care, 1.6%; and finance, 1.0%. The remaining 35.4% of the respondents selected the option "other." From the "other" category, the following fields were reported: advertising, agriculture, automotive industry (includes mechanics), aviation, city worker, coal mining, computer/electronics, factory worker, furniture restoration, landscaping, logging, manufacturing,

**Table 5. Average number of years by labor category that respondents to the craftworker survey had in the railroad industry.**

| | Dispatcher | MOW | Freight Train and Engine Service | Passenger Train and Engine Service | Signalman | Other |
|---|---|---|---|---|---|---|
| Mean Years | 18.6 | 16.9 | 20.6 | 20.8 | 21.6 | 23.6 |
| SD | ±11.9 | ±13.2 | ±11.8 | ±12.4 | ±14.6 | ±12.9 |
| Range | 8–39 | <1–40 | 3–46 | 7–45 | 2–40 | 10–38 |

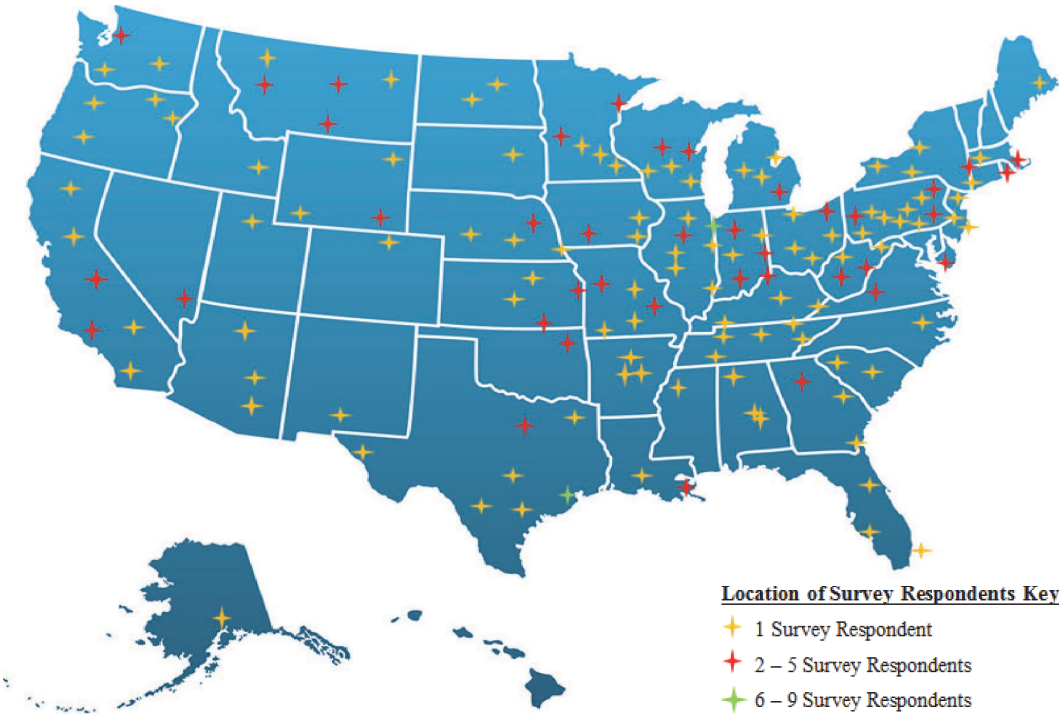


***Figure 12. Geographic distribution of respondents to craftworker survey.***

maintenance, newspapers, nuclear technician, plumber, production, real estate, retail/sales, textile industry, and welder.

In Figure 13, the prior vocations of respondents are presented by labor category. Respondents with a background in the military, construction, or transportation primarily elected positions in freight T&E. Other prior construction workers also chose employment in the trades of MOW and signalmen. No other significant trends in career paths were noted.

Awareness of railroad employment opportunities primarily resulted from suggestions from a family member or friend, with 68% of respondents selecting this option. Not only did awareness come from this source for all respondents who have a family member in the railroad industry, but also 63% of this subset stated that this affected their decision to join the railroad industry. The second largest source that provided awareness of employment opportunities was newspaper and Internet job postings, with 28% of respondents selecting this option and 14.2% of this group selecting "other" as a source. Written responses included proximity to railroads, unemployment office, and word of mouth from acquaintances. Suggestions for improved visibility of job openings include media advertising, emphasis on benefits available to employees, education centers, Internet job postings, local radio ads, more coverage of the railroad industry, trade magazine advertisements, and social media.

**Image of Railroad Industry.** The researchers inquired about the respondents' perceived image of the railroad industry before applying for a job opening. Over 60% of respondents indicated a positive image, followed by 37% who did not have a positive or negative view of the railroad. The remaining percentage indicated a negative view of the industry. No statistical difference between labor categories was detected for the pre-existing image of the railroad industry.

Additionally, input on the reasons this group chose to work for the railroads was solicited. Wages, health insurance, and pension were some of the most popular answers that influenced respondents' reasons for joining the railroad industry. Figure 14 shows other reasons and the

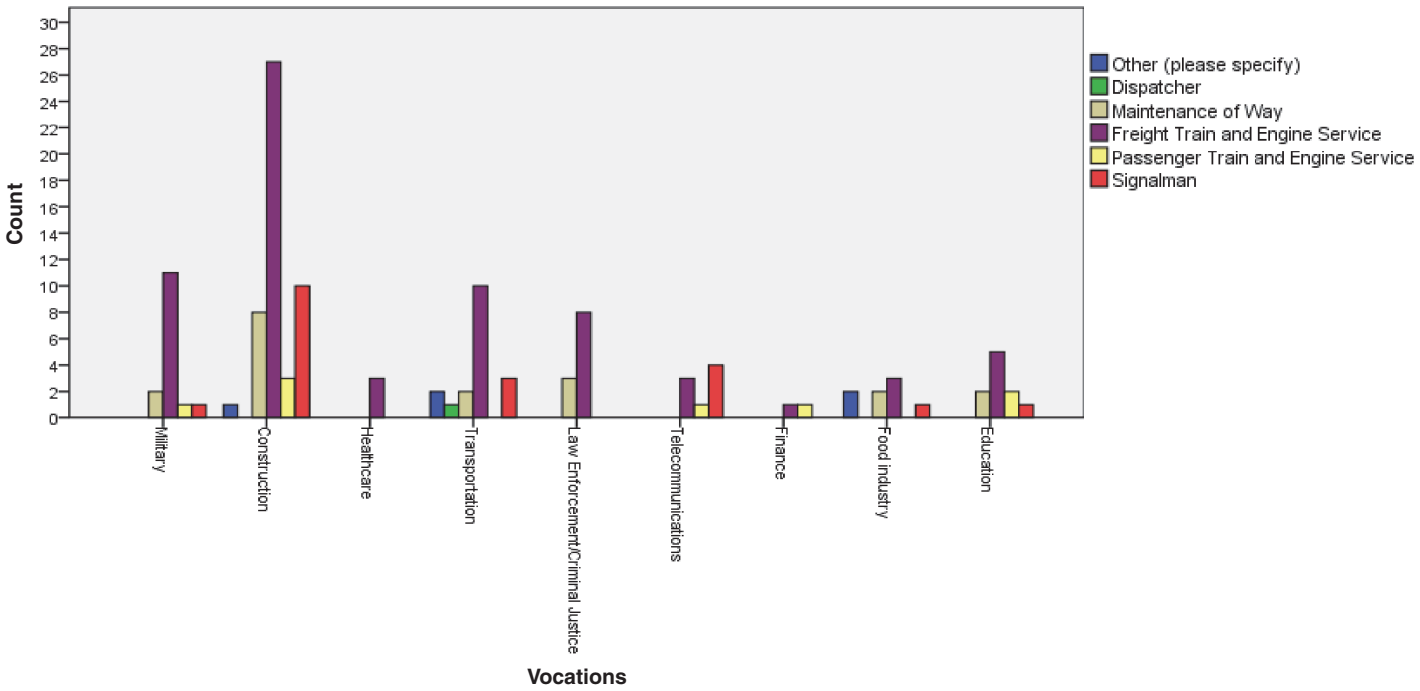


*Figure 13. Prior vocations of participants in the craftworker survey.*

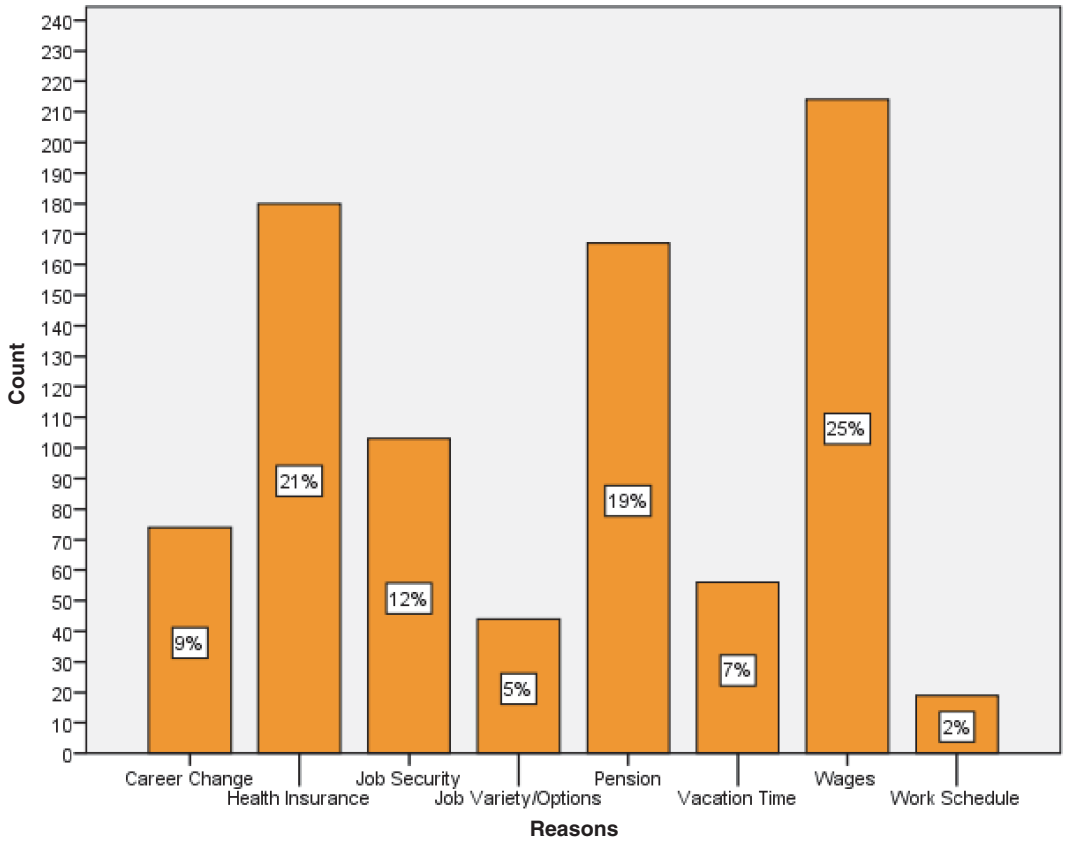


*Figure 14. Reasons provided in the craftworker survey for joining the railroad industry.*

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percentage of respondents who selected them. These survey takers had the option to write in other factors that influenced their decision. Write-in responses included "lack of career choice," "economy tanked in 2004—railroad was one of the few hiring," "frequency of pay check (twice a month)," "wanted to stay in area," "liked railroads," "needed a job," "needed a challenge and discipline," "first offered job," "union workforce," and "wanted to work outside."

As to the craft sector selected, the survey results demonstrate that pay and availability of position were the primary reasons for choosing a craft. Other reasons endorsed were that the participant possessed the necessary skill set or saw an opportunity to acquire new skills and experience. A small percentage indicated that the offered position was an opportunity for career advancement. A few cited that the work schedule impacted their decision in craft selection. The responses for the labor category are represented and displayed in Figure 15. Different reasons were observed for selecting each craft based on the identifying labor categories. No statistical differences in reasons for choosing a craft based on age were noted.

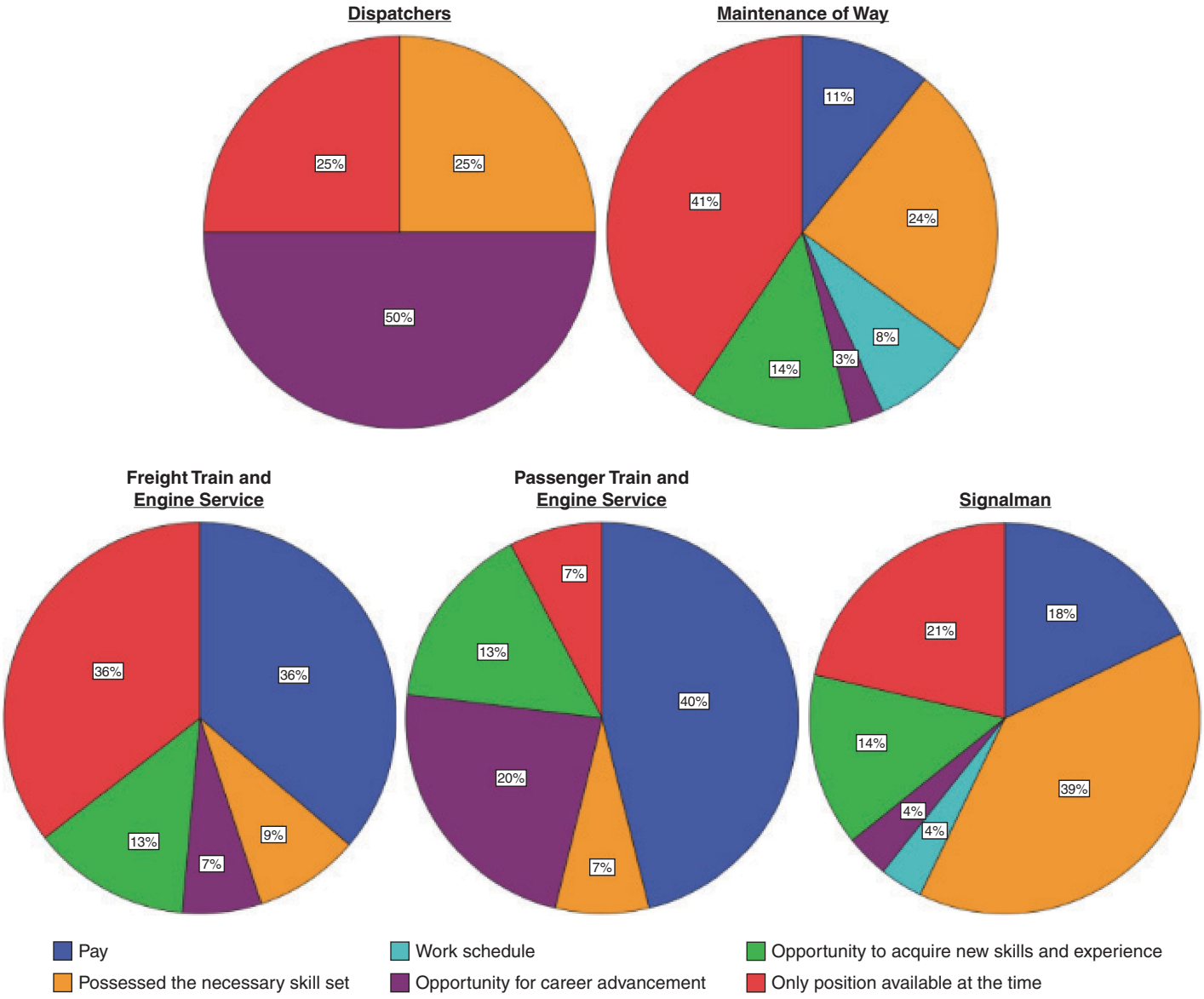


***Figure 15. Reasons by labor category for selecting the railroad industry.***

**Application Process.** In the survey, the craftworkers reported an overall satisfactory experience (68.6%) with the application process for employment with the railroad. An excellent experience was indicated by 17.6%; whereas 8.4% and 5.4% reported unsatisfactory or poor experience, respectively. The labor categories did not differ in their rating of the application process.

A vast majority (71.5%) of the respondents were hired within 3 months, while another 15.1% of respondents indicated that the hiring process took 3 to 6 months (see Figure 16). An additional 13.4% of this population stated that the hiring process lasted longer than 6 months. Differences were observed in the hiring process between labor categories. All dispatchers in the survey were hired within 1 month. MOW applicants saw the hiring process take less than 2 weeks for 23% of the respondents, between 2 weeks and 1 month for 18%, 1 to 3 months for 28%, 3 to 6 months for 18%, and over 6 months for 13%. For the freight T&E category, 19% were hired within 2 weeks; for the rest, the hiring process took 2 weeks to 1 month for 22%, 1 to 3 months for 34%, 3 to 6 months for 12%, and over 6 months for 12%. For the passenger T&E category, 13% were hired within 2 weeks, while time frames ranged from 2 weeks to 1 month for 27%; 1 to 3 months for 20%; and 3 to 6 months for 7%; 33% were hired after 6 months. And finally the signalmen reported the following hiring time frames: 14% within 2 weeks; 21% between 2 weeks and 1 month; 17% from 1 to 3 months; 34% from 3 to 6 months; and 14% over 6 months.

The researchers inquired whether there were aspects of the job that applicants did not learn about until they started working for the railroad. Over half of all respondents indicated that company discipline policies and job bidding procedures were not discussed prior to working in the industry. Other topics with a major endorsement included bumping, work schedules, and

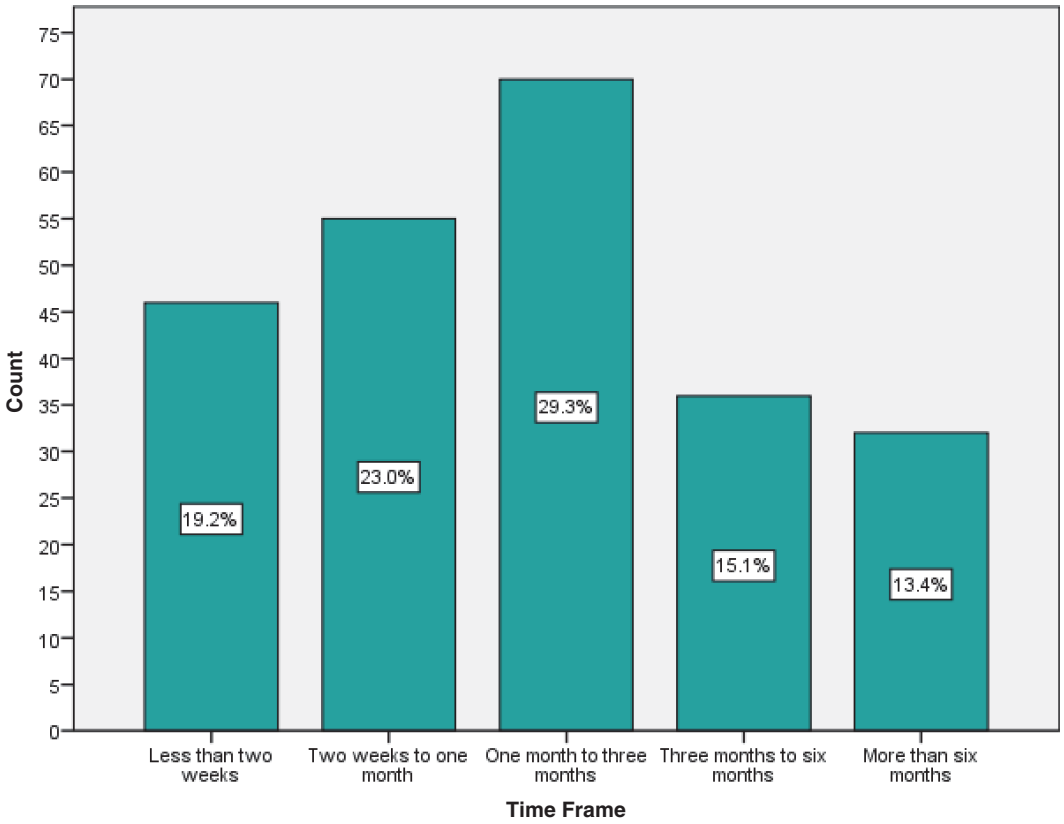


*Figure 16. Time frame of application process for survey respondents.*

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acquiring seniority rights. Write-in answers given by the respondents are as follows: "Federal Employer's Liability Act"; "forced promotions"; "railroads put customers before employee safety"; "instability of job"; "lack of timely and accurate information"; "chronic health risks"; "the 'us against them' attitude between trainmen and management"; and "all of the above." See Figure 17 for a histogram of participants' responses. Participants were allowed to choose multiple items.

### *Education and Training Opportunities*

A vast majority (68.8%) of the respondents had a high school diploma or general educational development (GED) certification as their highest level of education. A little over 20% of respondents had an associate's degree, and less than 10% had a bachelor's degree. A small percentage (1.4%) attended some high school but did not receive a diploma. No differences between labor categories were detected in terms of educational levels upon entering the railroad industry.

Prior to joining the railroad industry, only 8.4% of respondents had ever received any education or course work specific to the railroad industry. Four respondents indicated exposure through construction work, railroad museum participation, 2-week classroom training, or conductor school. Of these who received educational exposure, 50% indicated their educational program was sufficient and the other 50% that the exposure was limited.

An overwhelming majority (72%) of respondents indicated that the most helpful element in preparing to enter a career in the railroad was guidance from someone else already working in the industry. The guidance came from family, friends, acquaintances, and co-workers. Twenty-two percent of respondents indicated that their previous employment was the most helpful preparation for working in the railroad industry. In particular, some indicated a military background was instrumental because it enabled "adjusting to a variety of situations with minimal stress and working with many different personalities of people." "Learning from individuals

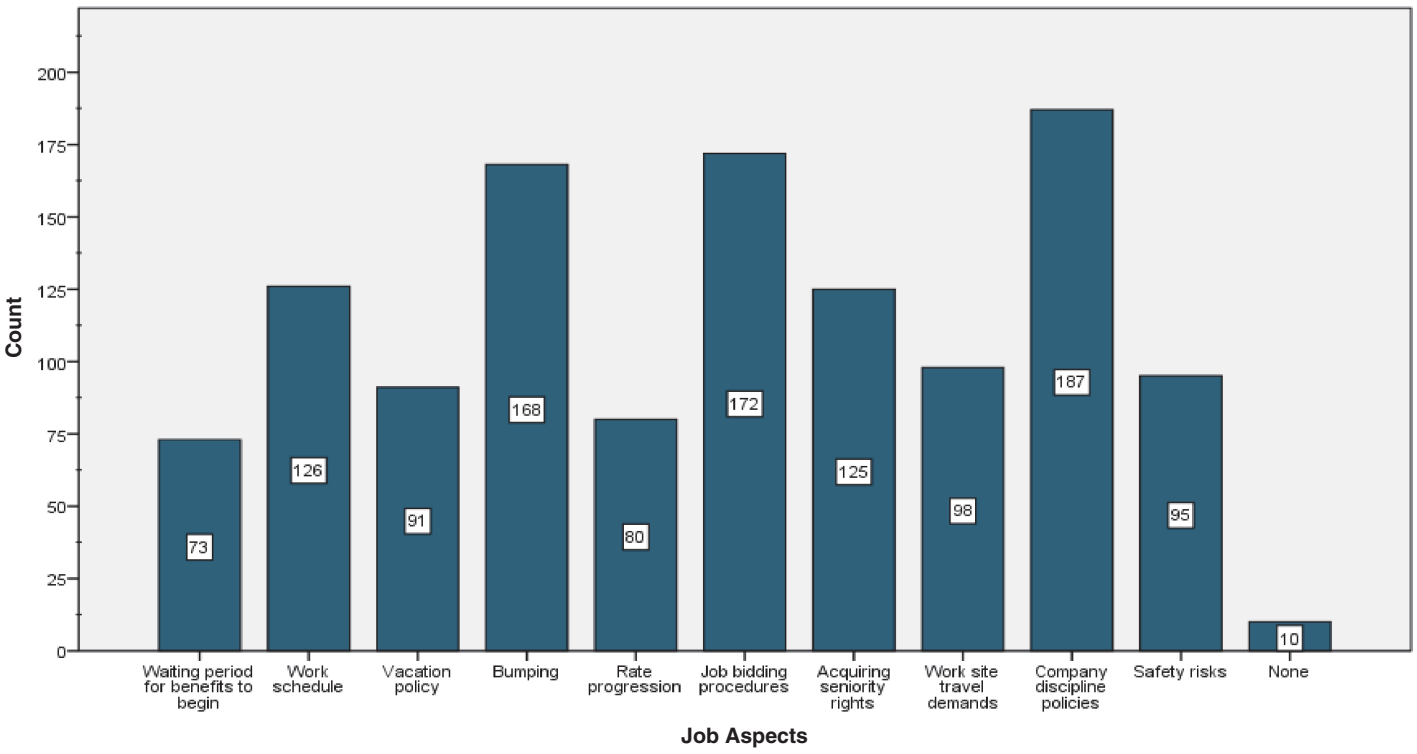


***Figure 17. Job aspects identified in the craftworker survey as not discussed in the hiring process.***

with decades of experience is where I actually gained the most knowledge" was strongly endorsed throughout the survey.

**On-the-Job Training.** Overall, the training period for almost 80% of the respondents lasted no more than 6 months (see Figure 18). Respondents who received less than a month of training make up 31.1% of the total, while 23.1% reported a training period of 2 to 3 months and 24.4% indicated a training period of 4 to 6 months. Only a small percentage (11.8%) received training beyond 6 months. Of important note, 9.7% revealed that they received no training at all.

All the dispatchers in this group received training lasting anywhere from 2 to 6 months; 60% noted training from 2 to 3 months and 40% indicated 4 to 6 months (Figure 19). For MOW, only 8% received training longer than 6 months and a smaller percentage (5%) indicated a period of 2 to 3 months. Over half (59%) of the MOW respondents indicated less than a month of training and 28% stated they received no training. In the freight T&E category, only 3% did not experience any training period; 24% had less than a month; 27% had 2 to 3 months; 36% had 4 to 6 months; and 10% indicated longer than 6 months. All of the respondents in the passenger T&E category were involved in a training period: 27% for less than a month; 33% received 2 to 3 months; 13% recorded 4 to 6 months; and 27% received over 6 months of training. These percentages contrast with the 65% of signalmen reporting either no training (29%) or less than 1 month of training (36%). Two- to three-month training periods occurred for 7% of this subset, 4 to 6 months for 4%, and over 6 months for 25%.

When asked if the training that was received adequately prepared the person to conduct their job in a safe and satisfactory manner, the respondents as a group were split between sufficiency and insufficiency. Sufficient training or more than sufficient training was elected by 41.6% and

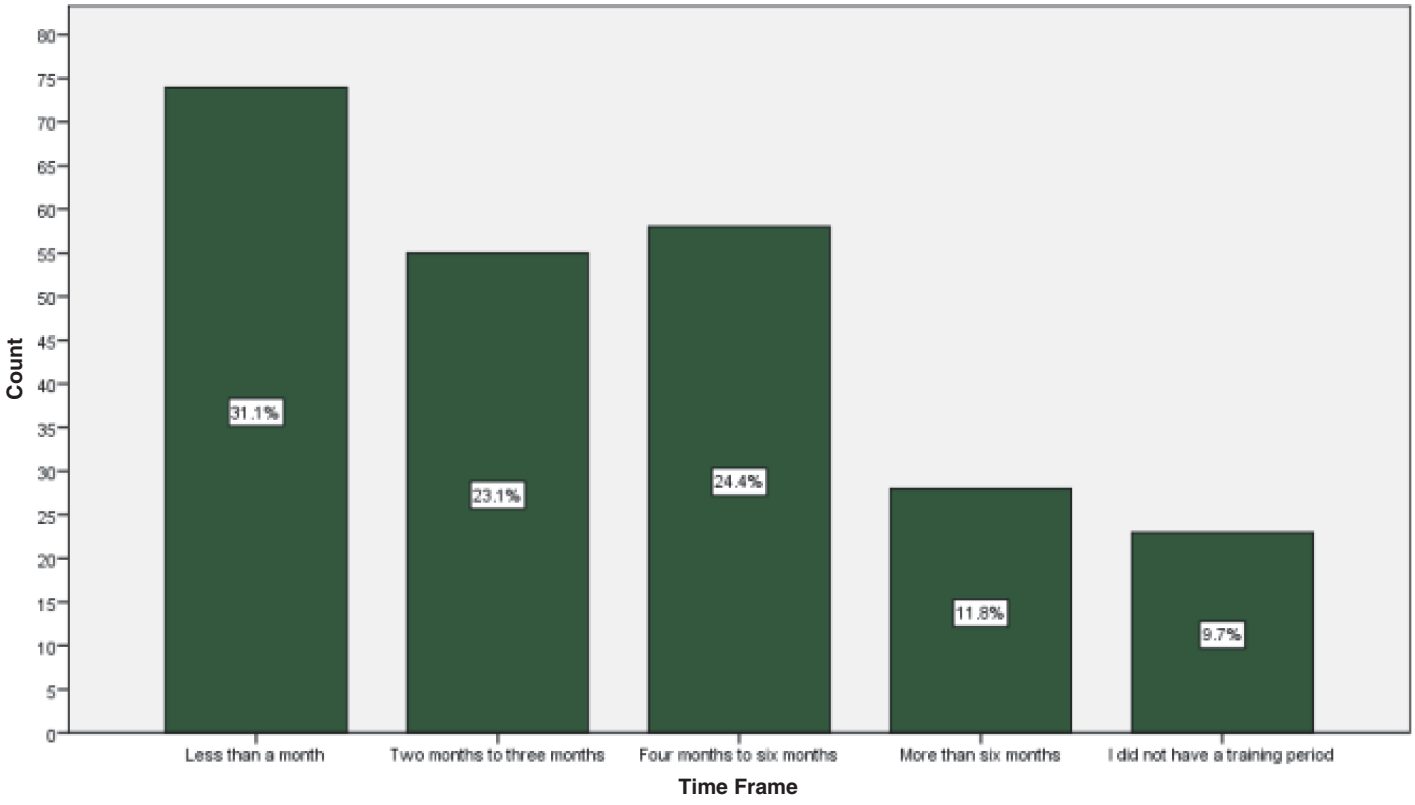


***Figure 18. Training periods of craftworker survey respondents.***

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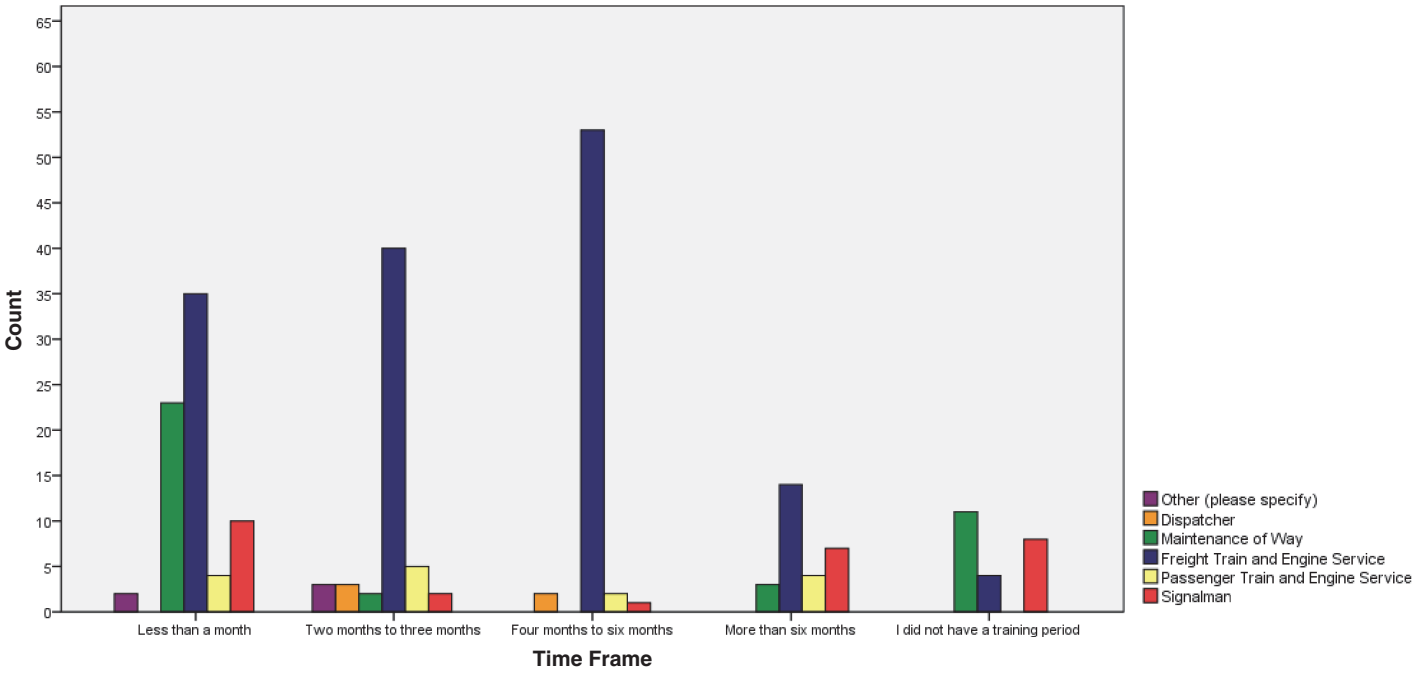


*Figure 19. Training periods by labor category of craftworker survey respondents.*

9.2% of this group, respectively. Insufficient or nonexistent training was endorsed by 40.3% and 5.5%, respectively. The remaining 3.4% of the group were not sure if their training was either sufficient or insufficient. The breakdown by labor category is in Table 6.

These respondents indicated in a majority (58.4%) that working with experienced people in the field was the most effective type of training in building their skill set, knowledge, and confidence. Forty percent chose on-the-job training as the second favored training. Labor categories did not differ in this response.

Lack of time (33.3%) and assignment to someone who was unwilling to provide training (36.2%) were cited as some of the biggest obstacles these persons experienced during their training period. Others cited unwilling supervisors (19.3%) and inexperienced classroom instructors (15.6%) as other factors faced during their training period. Respondents also indicated qualification of instructors and quality of instruction were the two key components to successful training. One person relayed that their instructor "spoke poor English" and therefore it was difficult to understand and follow the course material. One individual was

**Table 6. Opinion of training by labor category of craftworker survey respondents.**

| | More than Sufficient (%) | Sufficient (%) | Insufficient (%) | Absent (%) | Unsure (%) |
|---|---|---|---|---|---|
| Dispatcher | – | 100.0 | – | – | – |
| Maintenance of Way | 15.4 | 56.4 | 18.0 | 2.5 | 7.7 |
| Freight Train and Engine Service | 8.3 | 33.7 | 48.0 | 6.5 | 3.5 |
| Passenger Train and Engine Service | 6.5 | 40.0 | 53.3 | – | – |
| Signalman | 10.7 | 53.6 | 28.6 | 7.1 | – |

assigned to a trainer who was out on vacation, and therefore not able to train. Time pressures, poor management cooperation, and inexperienced staff were all contributors to the negative views of the person's training.

### *Railroad Retention Efforts*

**Job Satisfaction.** A majority of respondents reported being satisfied (46.4%) or extremely satisfied (11.8%) with their current job (Figure 20). Almost a quarter (23.6%) reported a neutral stance on their job satisfaction. The remaining participants selected dissatisfaction (14.3%) or extreme dissatisfaction (3.8%) with their current job. No differences were detected in job satisfaction across the job categories. Neither number of years in the railroad industry nor age affected the job satisfaction variable; in other words, no differences were seen in job satisfaction based on number of years in service or the age of the survey taker.

Many of the selections suggesting ways in which the railroad could increase job satisfaction were heavily endorsed by the participant pool (Figure 21). The number one suggestion, with 72% endorsement, was for the railroad to improve labor and management relations. With over 50% each, the following are presented based on their rank order: increase or offer paid sick leave (61.7%), increase pay (60.9%), hire more experienced supervisors (58%), offer 401(k) match (56%), cover more of the health insurance costs (55.6%), improve predictability of work schedules (54.3%), and acknowledgment from management for a job well done (52.7%). Percentages for other factors are provided in Figure 21. There was an opportunity for survey participants to write in suggestions.

Respondents consistently commented on the lack of qualification and experience of supervisors and the need for improved relations between the management and labor. Several people indicated that the disciplinary policies enforced by management are counterproductive to the working environment. Comments included "Management needs to look at themselves instead of blaming crews for problems with the railroad"; "Get management to be HONEST and STRAIGHT FORWARD"; "It is widely accepted . . . that the Labor Relations Department of my employer does everything possible to negatively affect the morale and increase the stress levels of those in . . . service"; and "Start hiring management with field experience. Not kids out of college that don't have a clue about railroading."

**Long-Term Career in the Railroad Industry.** An overwhelming majority (80%) of the respondents indicated that they plan to make working for the railroads a lifelong career. Only a small percentage indicated that this will not be a permanent long-term industry for them (5.5%).

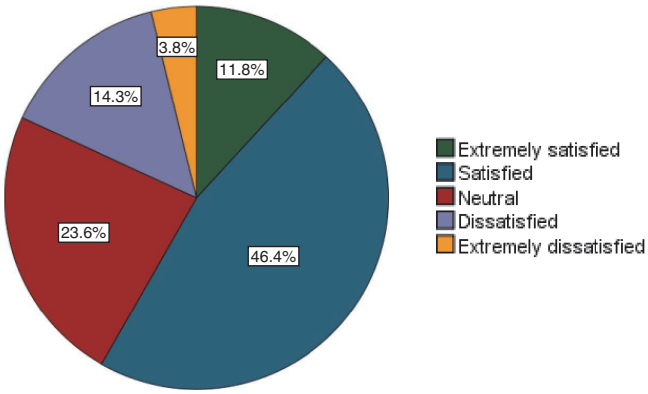


***Figure 20. Job satisfaction of craftworker survey respondents.***

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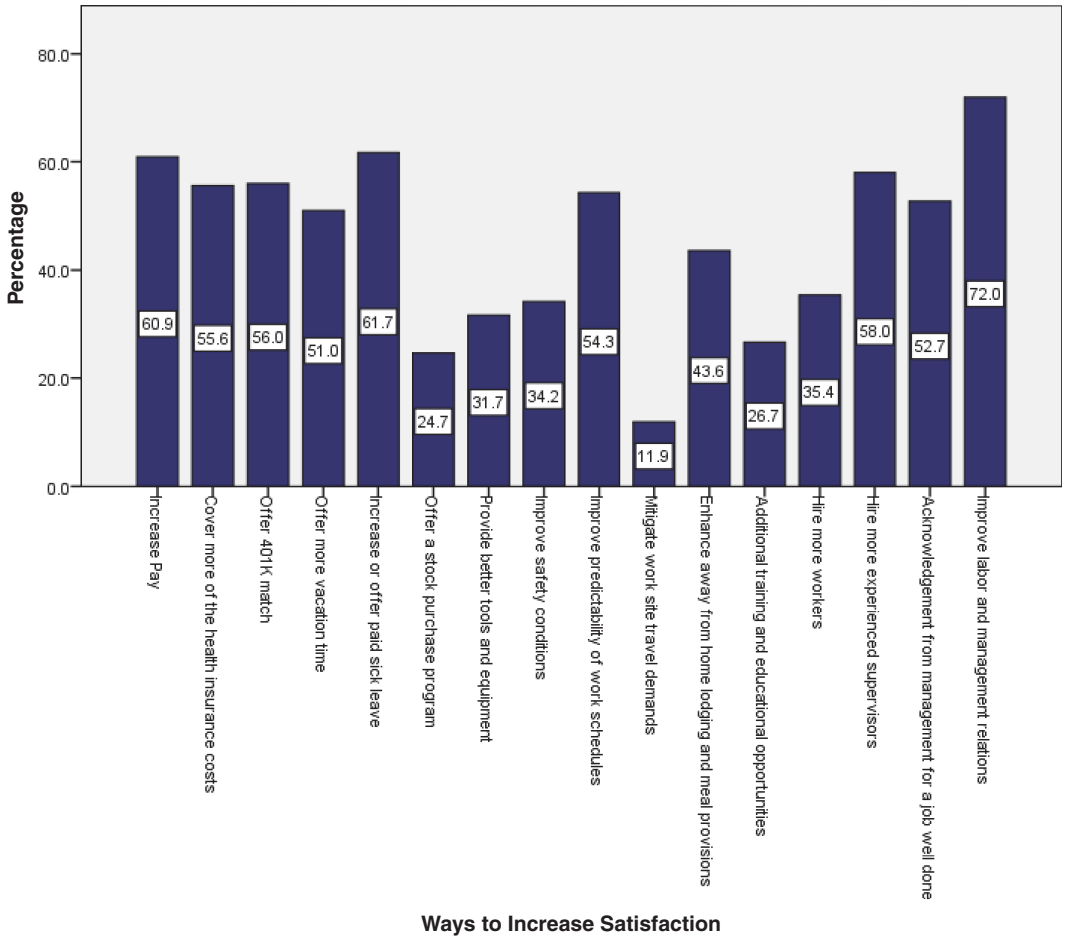


***Figure 21. Actions suggested by craftworker survey respondents to increase job satisfaction.***

The remaining participants were unsure about their plans to remain in the railroad industry. No differences were noted between the labor categories or for the different age groups.

As expected given national statistics on the number of railroad employees reaching retirement age, almost half of the respondents have plans to retire within the next 5 to 10 years (Figure 22). Interestingly, 32.8% of the respondents did not predict any career movement in the near future. These respondents indicated that they will be working in the same position. Only 3.8% envisioned a promotion to a management position. Close to 10% foresaw a change to a different position.

When surveyed regarding factors that would affect their willingness to continue working in the industry, this group suggested the following in rank order (shown in Figure 23): wages (84.4%), pension (79.0%), health insurance (75.7%), job security (53.1%), participation in union (39.9%), friendship with co-workers (38.3%), work schedule (27.2%), mobility within the company to other locations or jobs (13.2%), training and educational opportunities (13.2%), and travel opportunities (5.3%).

**Opportunities for Career Advancement.** Most of the respondents selected either very satisfied (5.9%) or satisfied (29.8%) with the current opportunities for advancement in the railroad industry (Figure 24). An additional 33.6% took a neutral stance on this topic; whereas, 12.6% and 6.3% were either dissatisfied or very dissatisfied with advancement opportunities. A small portion (11.8%) stated they did not wish to advance.

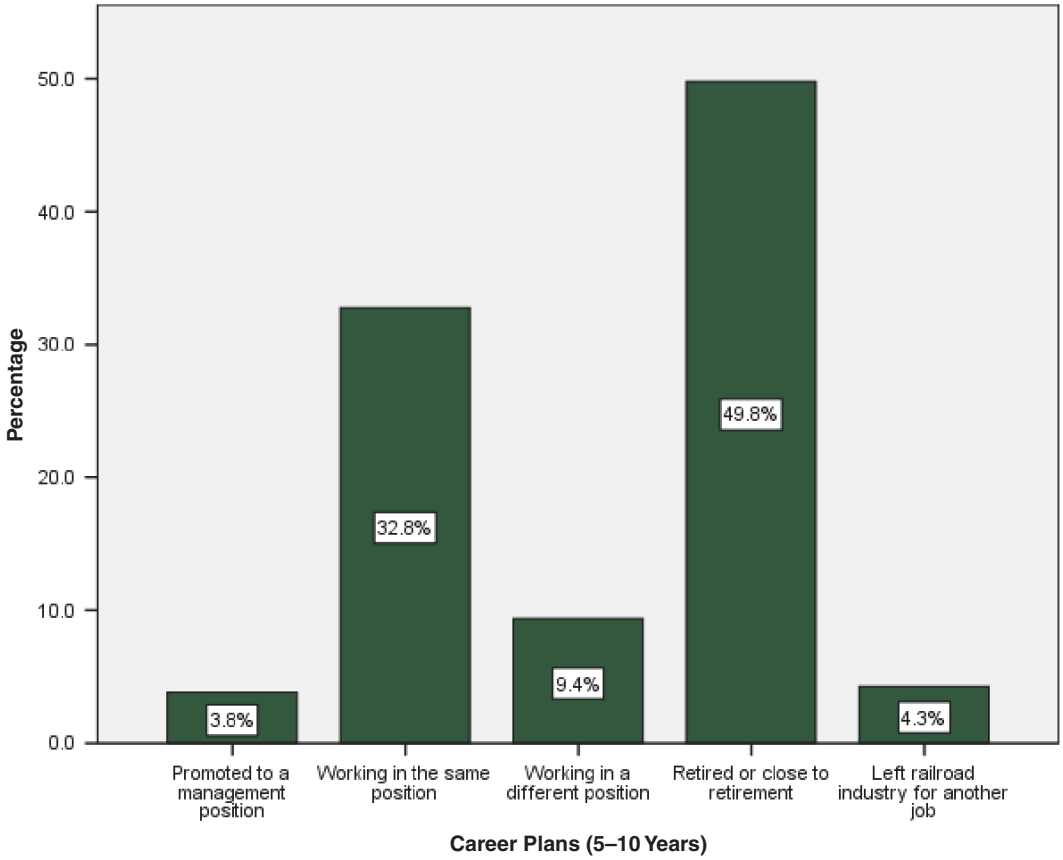


***Figure 22. Craftworker survey results—career plans.***

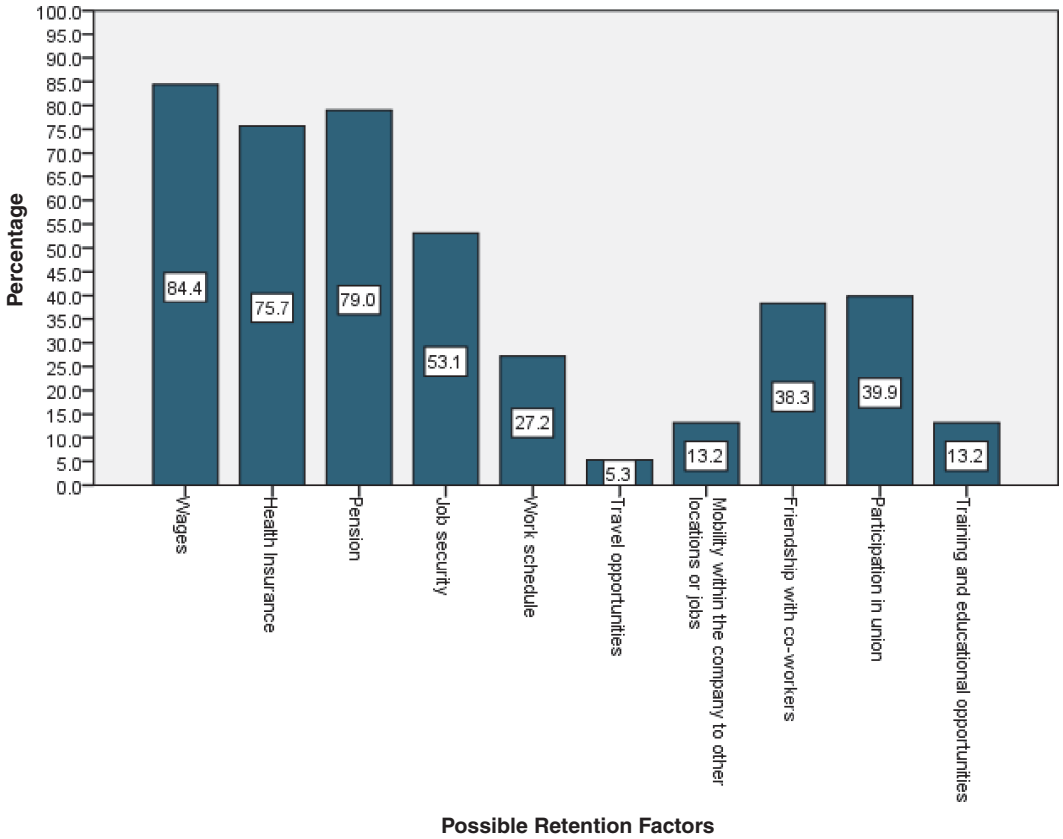


***Figure 23. Factors to increase willingness to work in the railroad industry suggested by craftworker survey respondents.***

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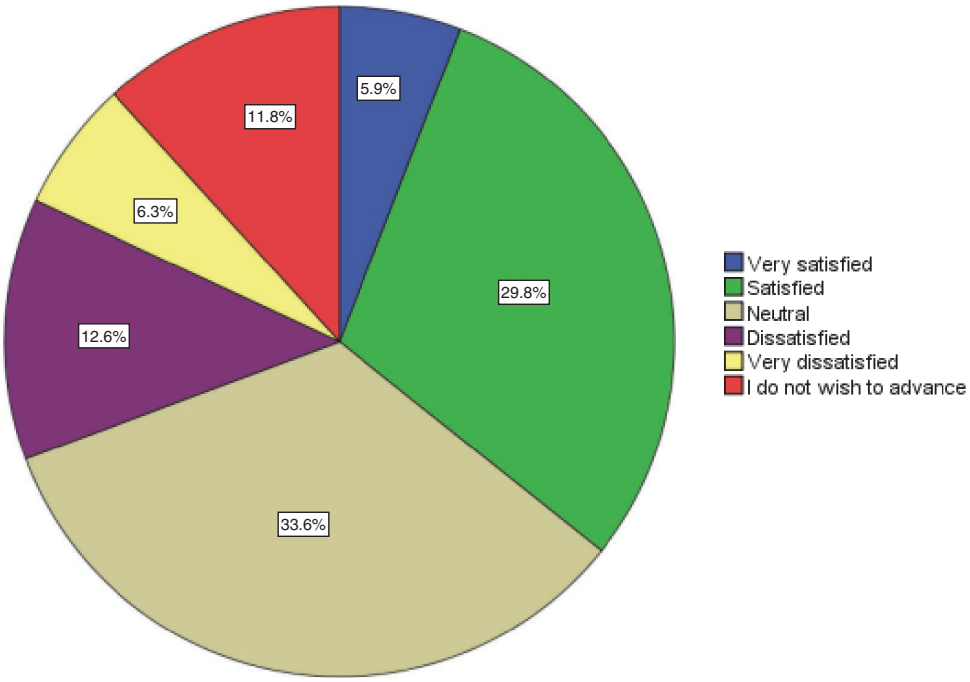


***Figure 24. Opinions on career advancement by the craftworker survey respondents.***

No differences were noted in satisfaction levels for career advancements across the different labor categories. The survey results also did not indicate differences in opinion for advancement opportunities across the age categories.

When asked for conditions that need to change in order to promote career advancement, 40.7% suggested hiring more from within; 30.9% advocated for offering more training to employees to expand skill sets and knowledge; and 23.5% favored improved communication when new positions become available (Figure 25). Respondents were given an opportunity to write in suggestions. They presented the following: "Advancement has always been on favoritism"; "It's all in who you know that determines if you get the position or not"; "Quit promoting on the buddy system. Make advancement opportunities based on experience, not on friends or outside. Quit hiring these college degree kids and have them run a terminal"; "Stop hiring family and friends over qualified people"; "Stop passing over overly qualified black workers"; "They need to do a better job of hiring qualified supervisors"; and "Matching pay for instructor/trainers may attract more experienced and qualified train operating craft to apply."

**Job-Related Stress.** Most of the respondents (75.8%) reported that their current level of stress did not persuade them to consider leaving this industry nor their current position. Twelve and a half percent indicated that they would consider switching to a different job within the industry due to their current level of stress. The remaining subset (11.7%) noted that the stress associated with their current position invokes thoughts of switching to jobs outside of the industry.

When asked to rate how each of the factors listed in Table 7 contributes to their overall stress at work, the survey takers selected management policies and decisions as well as company discipline policies as the two greatest contributors to their stress levels. Other factors ranking as stressful included ambiguous operating rules or procedures, loss of sleep, inadequate staffing, lack of control over schedule, communication problems, and inadequate time off. Table 7 highlights the mean stress level for each factor stated in the survey.

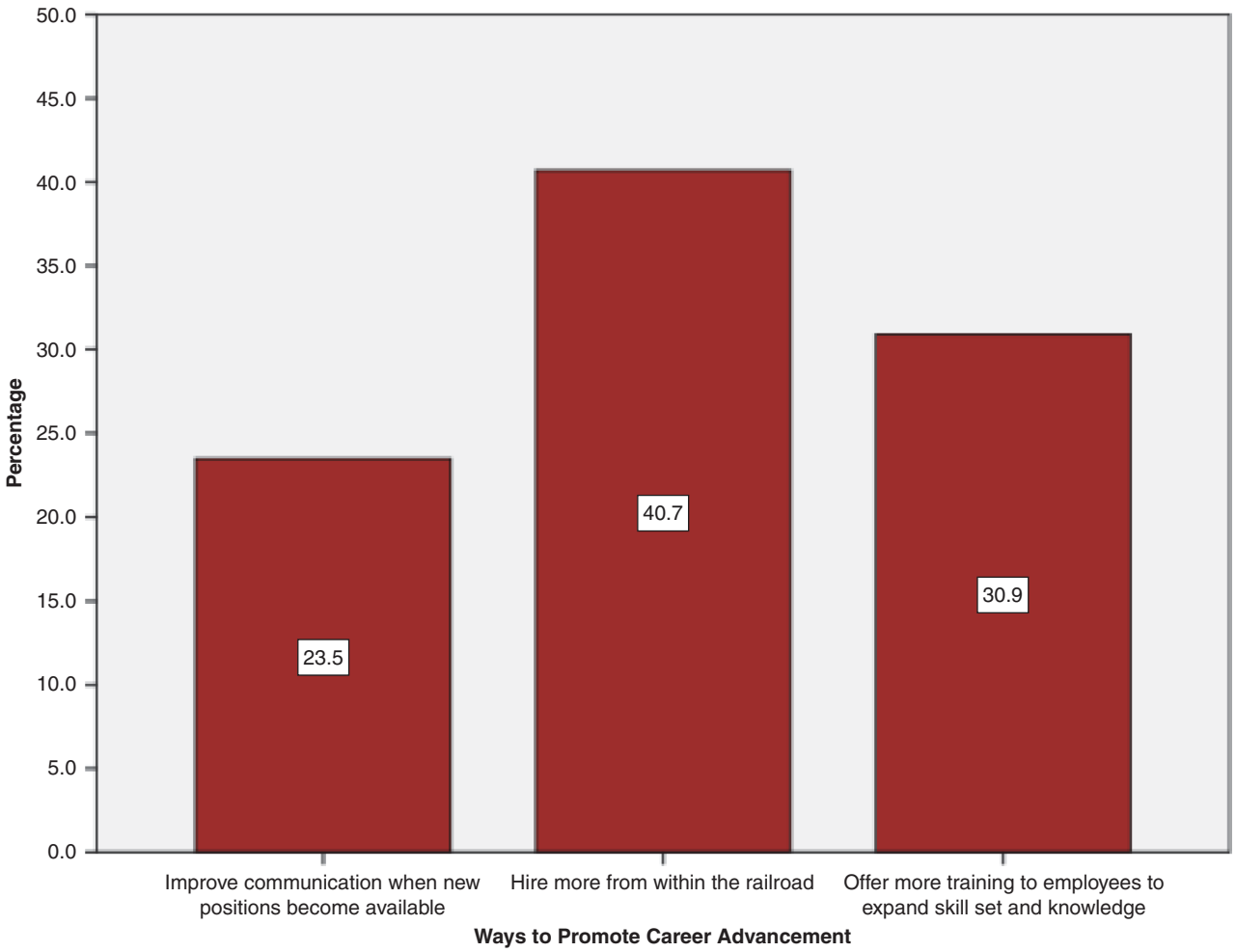


***Figure 25. Changes needed for career advancement according to craftworker survey respondents.***

For these respondents, a large majority (60.9%) indicated that working for the railroad affected their relationships with family and/or friends negatively (Figure 26). The remaining group endorsed no change (16.4%), a positive change (13.0%), or unsure how it affects relationships (9.7%).

The final question to these participants was "Would you recommend a career in the railroad to a family member or close friend?" The group surveyed was split between answers of yes and no (Figure 27). The largest percentage (35%) was elected for "probably yes" and 16.7% stated "definitely yes." On the other hand, 30.3% probably would not recommend the railroad industry and an additional 17.9% would definitely not recommend this industry to a family member or a close friend. No differences were detected between the age categories in response to this question.

Differences were noted in the likelihood of a recommendation of a career in the railroad industry across the different labor categories. The dispatchers among these respondents would likely recommend this industry, with 100% answering either probably or definitely yes. A similar trend was observed with signalmen: 78.6% endorsed a possible or definite yes. For the MOW group, 75.7% of this subset suggested they would consider recommending working in the railroads. The passenger T&E group was split in their recommendations with 53.3% answering probably yes or definitely yes. The freight T&E group had the least favorable recommendations as only 38.3% would steer a family member or friend to a career in the railroad industry. Figure 28 provides a graphical representation of the selected items to this question.

**Table 7. Average stress levels of craftworker survey respondents for a variety of job-related factors.**

| | No stress | Little stress | Stressful | Very Stressful | N/A |
|---|---|---|---|---|---|
| Responding to emergencies | | ● | | | |
| Lack of control over schedule | | | ● | | |
| Long travel distance to out of town work sites | | ● | | | |
| Loss of sleep | | | ● | | |
| Coordination with other departments | | ● | | | |
| Commuting to and from work | | ● | | | |
| Pressure to finish a task | | ● | | | |
| Ambiguous operating rules or procedures | | | ● | | |
| Management policies and decisions | | | ● | | |
| Company discipline policies | | | ● | | |
| Singled out by management for rule violation | | | ● | | |
| Job security | | ● | | | |
| Surges in workload | | ● | | | |
| Communication problems | | | ● | | |
| Inadequate staffing | | | ● | | |
| Personal safety | | ● | | | |
| Responsibility for the safety of others | | | ● | | |
| Inadequate time off | | | ● | | |

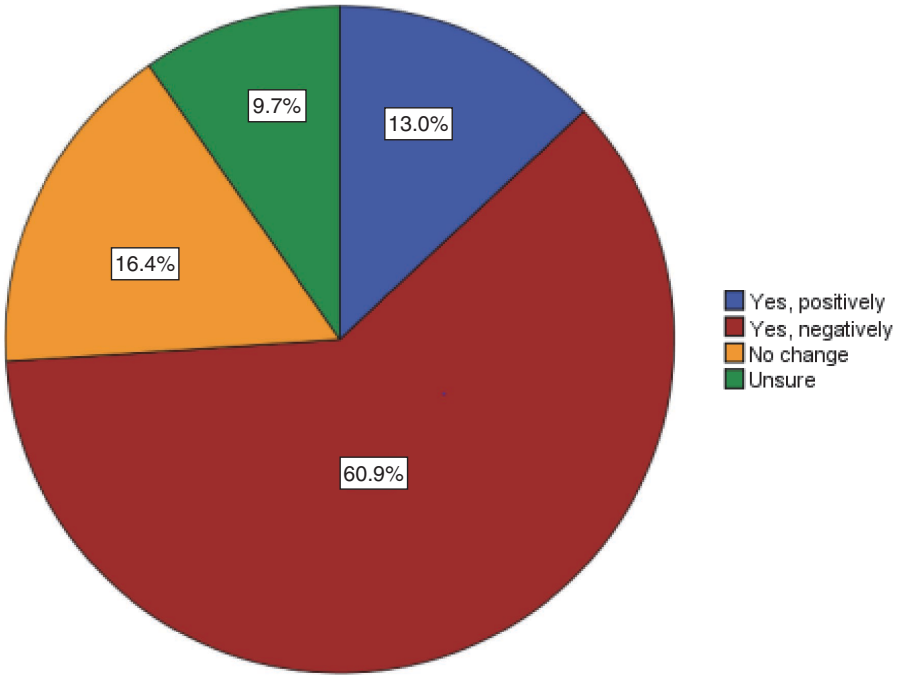


***Figure 26. Effect of the industry on the relationships of craftworker survey respondents.***

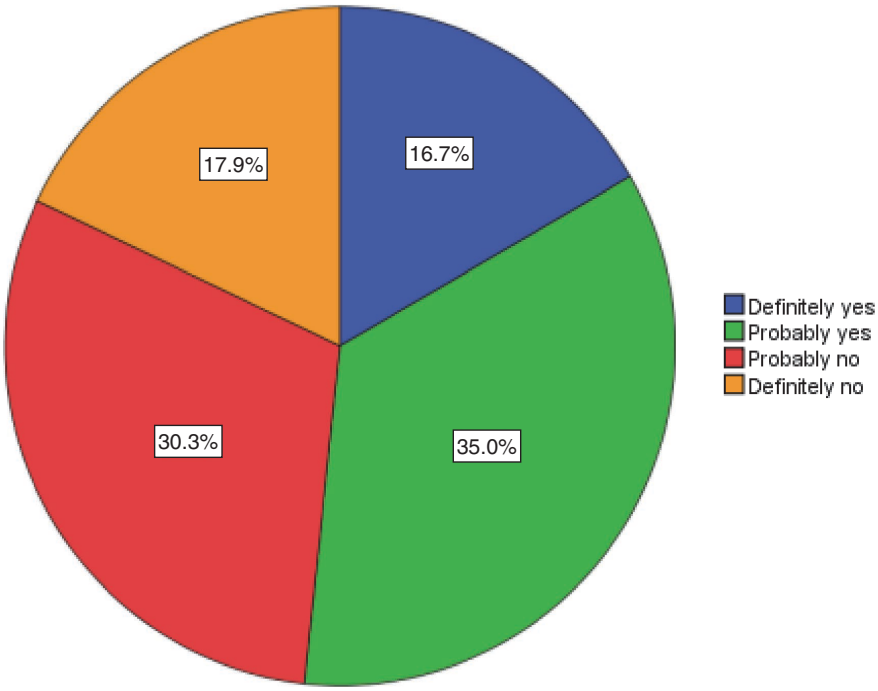


***Figure 27. Likelihood of industry recommendation by craftworker survey respondents.***

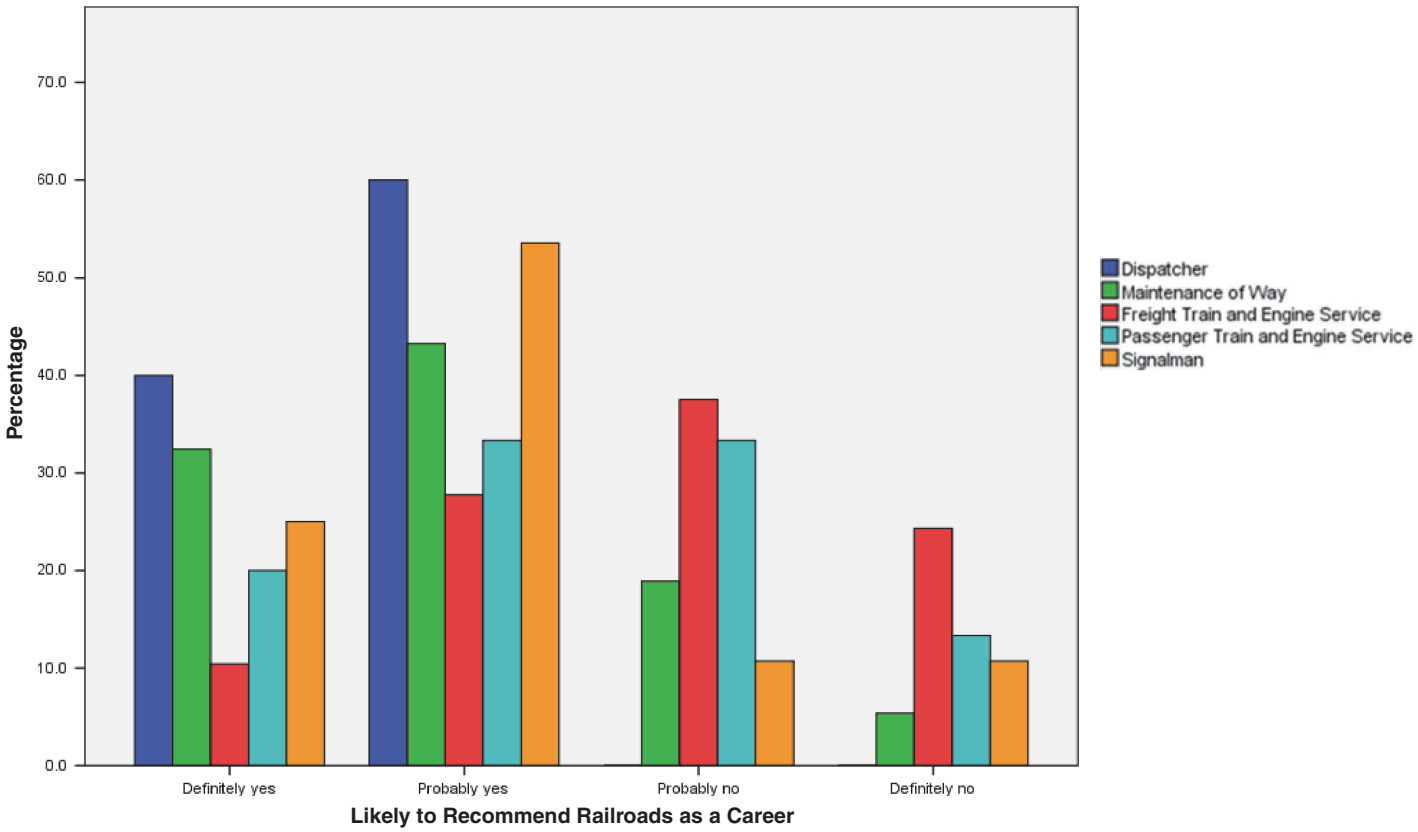


***Figure 28. Likelihood of industry recommendation by craftworker survey respondents by labor category.***

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## Results of Rail Engineering and Operations Recruitment and Retention Survey

### *Survey Background*

An email invitation to participate in the survey was sent to a blind list of "rail industry professionals" on 31 October 2014. It explained that responses would be anonymous and that the goal of the survey was "to better understand the effectiveness of rail industry workforce recruitment and retention activities, . . . the preferences of working professionals [and] how rail companies can better attract and retain rail industry professionals."

Data used for this analysis was collected on 19 November 2014: 181 respondents started to take the survey and 19 dropped out immediately; of the 162 that continued, 31 provided partial responses and 131 completed the survey. For those who participated, the average response time was 12 minutes. This report includes data from the complete and incomplete responses.

The limited response does not provide a statistically valid sample of the industry, but the data seems to provide a reasonable and informative representation of worker characteristics, attitudes, and experiences.

Appendix C contains the survey questions distributed to the rail industry.

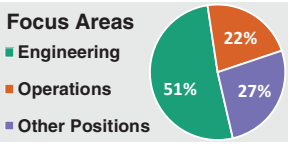


***Figure 29. Self-selected focus areas of the respondents to the rail engineering and operations survey.***

### *Primary Data Filter*

Survey respondents were asked to indicate the area that best describes the focus of their current responsibilities: engineering, operations, or none of the above. This question provides the primary filter used throughout this report and all responses are first differentiated as engineering, operations, or other positions. Figure 29 depicts the percentage of all responses by focus area (from complete and incomplete responses). Figure 30 shows the approximate location of each respondent's primary workplace (for complete responses only).

### *Secondary Data Filters*

Three secondary data filters are used throughout the report: education, age, and rail industry experience. Figures 31 through 33 use line thickness to illustrate relative number of responses within each of the secondary data filters in the context of the primary filter: focus of current responsibilities.

**Education.** Respondents were asked to indicate their highest level of completed education: high school/equivalent (HS*), associate degree/military equivalent (2-yr*), bachelor's degree (4-yr), or master's or doctoral degree (MPhD). Figure 31 graphically displays the results. This filter is applied throughout the subsection.

**Age.** Respondents were asked to indicate their age range: under 25; 25–34; 35–44; 45–54; 55–62; or 63 and older. Figure 32 graphically displays the results. This filter is applied throughout this subsection.

**Experience.** Respondents were asked to indicate how many years they have worked in the railroad industry. Figure 33 graphically displays the results. Responses were grouped and the filter applied throughout this subsection uses these labels: <5, 5–10, 11–20, 21–30, 31–40, 41–50, and 51+.

### *Results of the Retention and Recruitment Survey for Engineering*

For respondents who identified engineering as the focus of their current responsibility, Figure 34 categorizes their education, age, and experience by annual income and employer type. From this

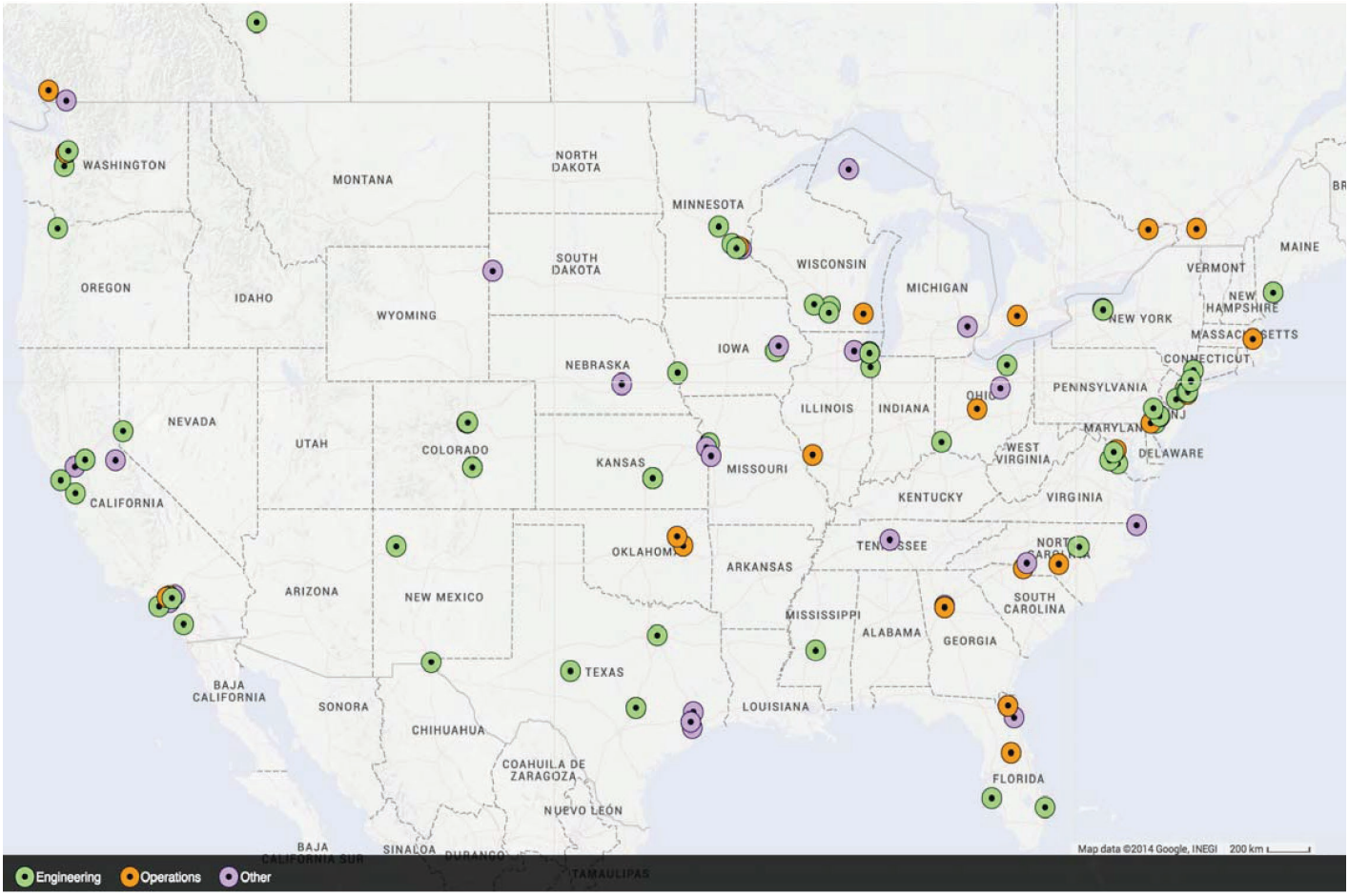


*Figure 30. Locations of respondents to the rail engineering and operations survey.*


*Figure 31. Education by focus area of respondents to the rail engineering and operations survey.*

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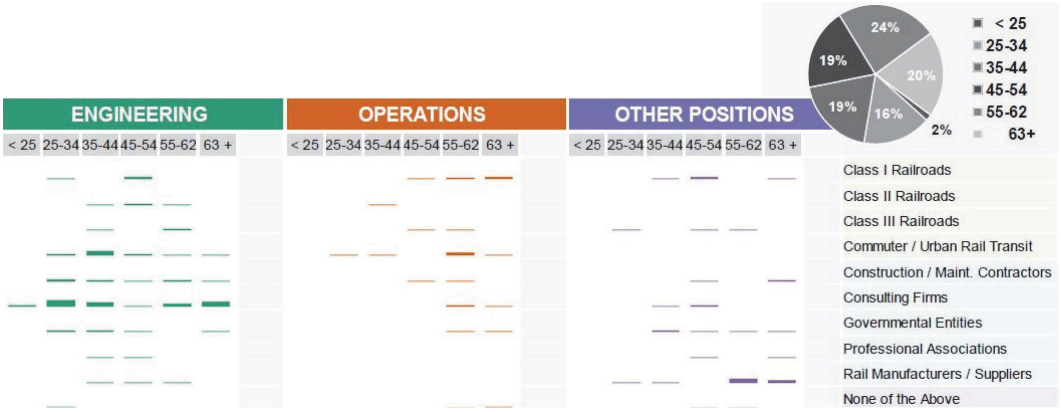


***Figure 32. Age by focus area of respondents to the rail engineering and operations survey.***

data and other survey responses, the research team developed profiles of the respondents in the following areas:

- Industry image, recruitment, and employee satisfaction
- Education and access to rail-related courses
- Getting onboard with a rail career
- OTJ training and continuing education
- Employee satisfaction and retention
- Education, professional participation, and 5- to 10-year plans

**Industry Image, Recruitment, and Employee Satisfaction—Engineering.** The data shown in Figure 34 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' initial image of the railroad industry, how they learned about employment opportunities, current job satisfaction, and whether they recommend that others consider working in the industry:

- **Respondents with annual income exceeding $115,000** (>$115K) had a neutral image of the railroad industry before starting their job search, became interested in opportunities in response to one-on-one recruitment initiatives or other personal contacts (including suggestions from

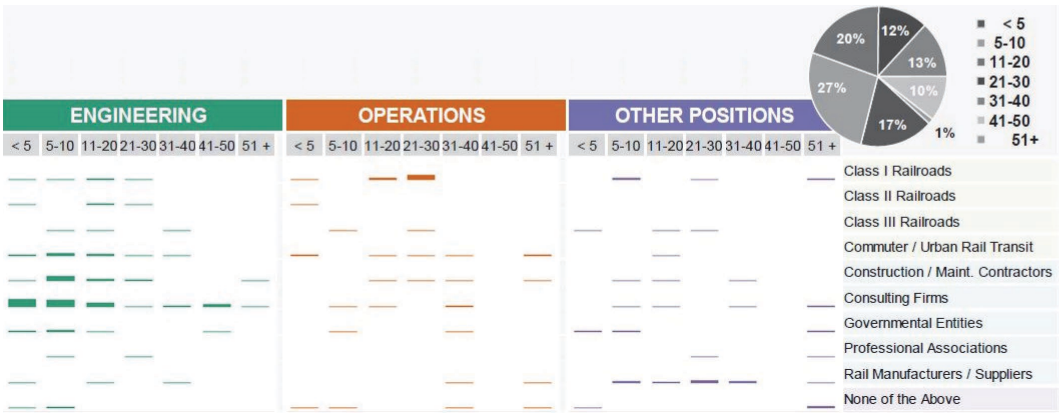


***Figure 33. Experience by focus area of respondents to the rail engineering and operations survey.***

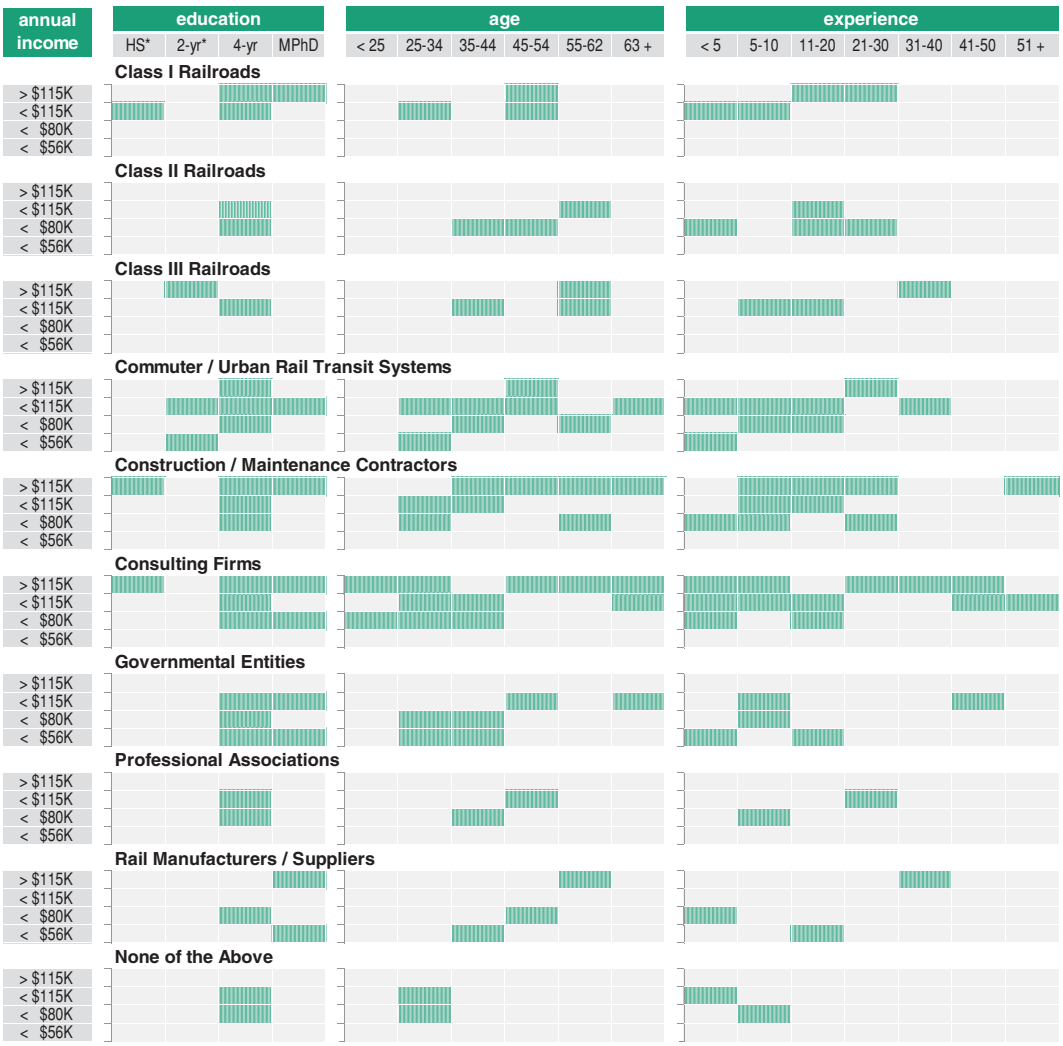


***Figure 34. Education, age, and experience of engineering-focused respondents to the rail engineering and operations survey by annual income and employer type.***

family or friends), find the work satisfying or extremely satisfying, and would recommend a railroad career.

- **Respondents with annual income between $80,000 and $115,000** (<$115K) had a neutral or positive image of the industry, became interested in opportunities in response to one-on-one recruitment initiatives or experience as an intern, find the work extremely satisfying or satisfying, and are very likely to recommend a railroad career.
- **Respondents with annual income between $56,000 and $80,000** (<$80K) had a neutral image of the industry, became interested in opportunities through position postings and other recruitment initiatives, find the work satisfying, and would recommend a railroad career.
- **Respondents with annual income less than $56,000** (<$56K) had a neutral or positive image of railroads initially, may have been influenced by family or friends who worked in the industry, find the work satisfying, and would recommend a railroad career.

**Employee Education and Access to Rail-Related Courses—Engineering.** The data shown in Figure 34 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' level of completed education, whether it included rail-related

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course work, and whether respondents feel they had sufficient access to rail-related courses and seminars:

- **Respondents with annual income >$115K who are 45 years old or older** hold bachelor's, master's, or doctoral degrees with no formal rail-related course work; they recalled none when asked whether there had been sufficient access to rail-related courses.
- **Respondents with annual income <$115K who are 25 to 44 years old** hold bachelor's degrees with no formal rail-related course work; the majority of respondents recalled there having been none, or a small number, of rail-related courses or seminars.
- **Respondents with annual income <$80K who are 25 to 44 years old** hold bachelor's degrees with no formal rail-related course work; the majority of respondents recalled there having been no courses, or only a small number, available related to the rail industry.
- **Respondents with annual income <$56K who are 25 to 44 years old** have post-graduate, bachelor's, or 2-year degrees (or equivalent military experience); for the majority of respondents, this did not include formal rail-related course work and, at best, only a few courses or seminars related to the rail industry were available.

**Getting Onboard with a Rail Career—Engineering.** The data shown in Figure 34 and other responses to the survey allowed the research team to develop the following profiles concerning why the respondents chose rail-related work, their experience with the application process and time-to-start, and what was the most helpful preparation for a career in rail:

- **Respondents with annual income >$115K who are 45 years old or older** were attracted by the salary, pension, or interest in trains/railroading; found the application process satisfactory, or excellent, and likely started within a month; and found the most helpful preparation for a rail career was guidance from one or more people in the industry.
- **Respondents with annual income <$115K who are 25 to 44 years old** were attracted by salary, job security, interest in trains/railroading, or job variety/options; found the application process satisfactory and likely started within a month; and found the most helpful preparation for a rail career was previous experience, guidance, or mentoring from people in the industry.
- **Respondents with annual income <$80K who are 25 to 44 years old** were attracted by job variety/options, security, or salary; found the application process satisfactory and likely started within a month; and found the most helpful preparation was previous experience or guidance.
- **Respondents with annual income <$56K and who are 25 to 44 years old** were attracted by the opportunity to make a career change; found the application process satisfactory and likely started within a month; and found the most helpful preparation was mentoring or educational course work.

**On-the-Job Training and Continuing Education—Engineering.** The data shown in Figure 34 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' training experience (including duration and any obstacles); the most effective type of training (related to skill set, knowledge, and confidence) for the position currently held; participation in non-employer- (NE) and employer-provided (EP) continuing education/training in the past 2 years; and whether respondents feel they were provided with adequate preparation for working in a safe and satisfactory manner:

- **Respondents with annual income >$115K who are 45 years old or older** had no formal training period (greatest obstacle was lack of time), found OTJ training was most effective, participated in NE and EP training, and feel they had sufficient preparation for safe and satisfactory work.
- **Respondents with annual income <$115K who are 25 to 44 years old** had no formal training (greatest obstacle was lack of time), found on-the-job or in-the-field training was most effective, participated in NE and EP training, and feel they had sufficient preparation for safe and satisfactory work.

- **Respondents with annual income <$80K who are 25 to 44 years old** had no formal training period (greatest obstacle was lack of time), found OTJ training was most effective, participated in NE and EP training, and feel they had sufficient preparation for safe and satisfactory work.
- **Respondents with annual income <$56K who are 25 to 44 years old** had no formal training period (greatest obstacle was lack of time), found OTJ training was most effective, may have participated in EP training, and feel they had sufficient preparation for safe and satisfactory work.

**Employee Satisfaction and Retention—Engineering.** The data shown in Figure 34 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' satisfaction with their job and opportunities for advancement, whether they intend to make rail a life-long career, priorities affecting their willingness to continue working within the industry, and suggested employer initiatives for increasing job satisfaction:

- **Respondents with annual income >$115K who are 45 years old or older** are satisfied with their job and satisfied or neutral about opportunities; see rail as a life-long career; say their priorities are interesting/challenging work, wages, and travel opportunities; and suggest these employer initiatives: growth/advancement opportunities, acknowledgment from management for a job well done, and increased pay.
- **Respondents with annual income <$115K who are 25 to 44 years old** are satisfied with their job and opportunities; see rail as a life-long career; say their priorities are interesting/challenging work, wages, and job security; and suggest these employer initiatives: increased pay, growth/advancement opportunities, and improved predictability of work schedules.
- **Respondents with annual income <$80K who are 25 to 44 years old** are satisfied with their job and opportunities; are unsure about rail as a life-long career; say their priorities are interesting/challenging work, wages, and job security; and suggest these employer initiatives: increased pay, improved predictability of work schedules, and growth/advancement opportunities.
- **Respondents with annual income <$56K who are 25 to 44 years old** are satisfied with their job and satisfied or neutral about opportunities; do not see rail as a life-long career; say their priorities are work schedule and job security; and suggest these employer initiatives: increased pay, improved predictability of work schedules, and additional training and educational opportunities.

**Education, Professional Participation, and 5- to 10-Year Plans—Engineering.** The data shown in Figure 34 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' age, education level, rail-related professional membership, years of industry experience, and expectations for the next 5 to 10 years.

- **Respondents with annual income >$115K** are 45 years old or older; have a college degree (bachelor's, master's, doctoral); belong to a rail-related professional organization; may be relatively new to the industry or have 21 to 40 years of experience; and anticipate being promoted, near retirement, or retired in 5 to 10 years.
- **Respondents with annual income <$115K** are 25 to 44 years old; have a bachelor's degree; belong to a rail-related organization; have rail experience ranging from recently hired to 20 years; and anticipate being promoted or near retirement in 5 to 10 years.
- **Respondents with annual income <$80K** are 25 to 44 years old; have a bachelor's degree; are likely to not belong to a rail-related professional organization; have up to 10 years of industry experience; and anticipate being promoted in 5 to 10 years.
- **Respondents with annual income <$56K** are 25 to 44 years old; may have a 2-year degree (or equivalent military experience)or a bachelor's, master's or doctoral degree; are likely not a member of a rail-related professional organization; may have up to 20 years of industry experience; and anticipate being promoted in 5 to 10 years.

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### *Results of the Retention and Recruitment Survey for Operations*

For respondents who identified operations as the focus of their current responsibility, Figure 35 categorizes their education, age, and experience by annual income and employer type. From this data and other survey responses, the research team developed profiles of respondents in the following areas:

- Industry image, recruitment, and employee satisfaction
- Education and access to rail-related courses
- Getting onboard with a rail career
- OTJ training and continuing education
- Employee satisfaction and retention
- Education, professional participation, and 5- to 10-year plans

**Industry Image, Recruitment, and Employee Satisfaction—Operations.** The data shown in Figure 35 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' initial image of the railroad industry, how they learned about

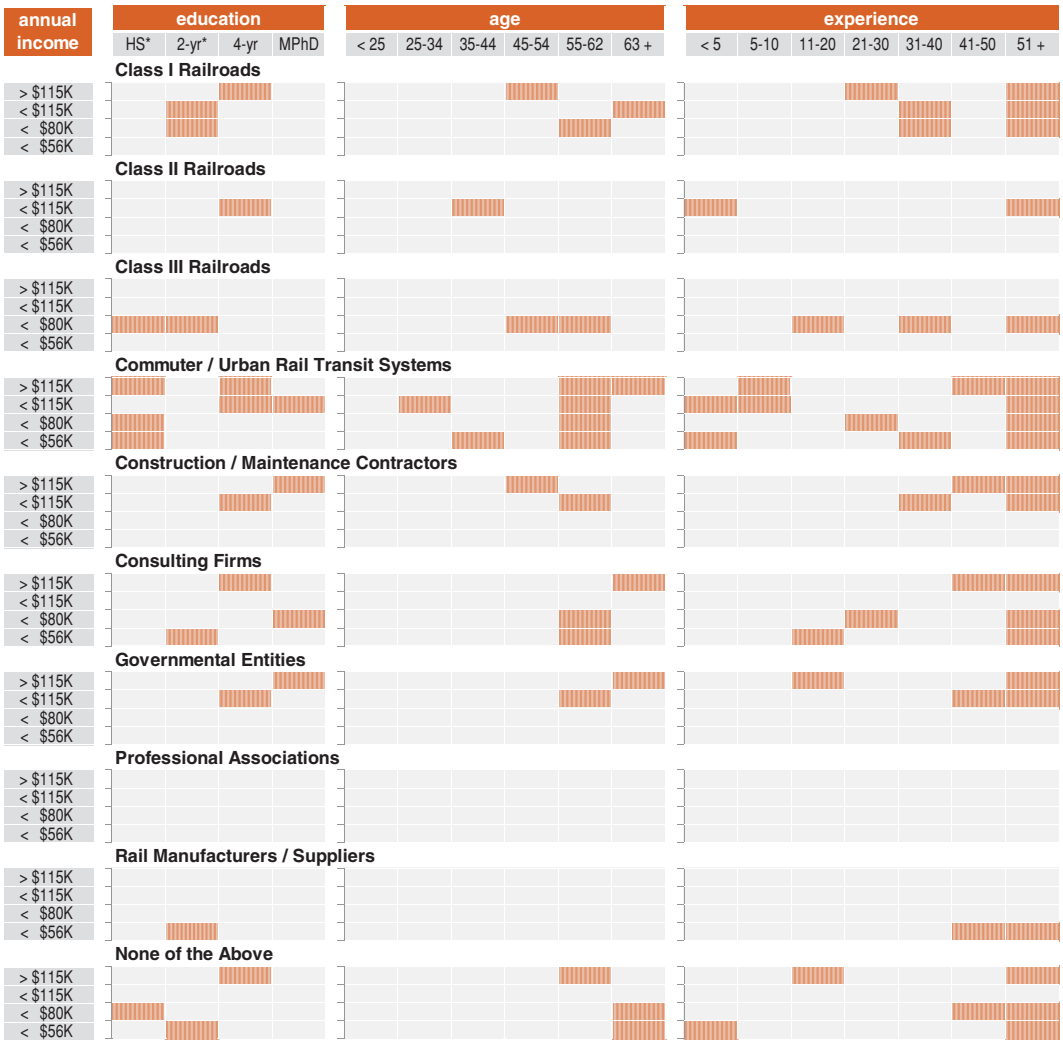


***Figure 35. Education, age, and experience of operations-focused respondents to the rail engineering and operations survey by annual income and employer type.***

employment opportunities, current job satisfaction, and whether they recommend that others consider working in the industry:

- **Respondents with annual income >$115K** had a positive image of the industry before starting job search, became interested in opportunities because of suggestions from family or friends who worked in the industry or after an internship, find the work satisfying, and would be likely to recommend a railroad career.
- **Respondents with annual income <$115K** had a positive image of the industry, became interested in opportunities because of suggestions from family or friends, find the work satisfying, and would be very likely to recommend a railroad career.
- **Respondents with annual income <$80K** had a positive image of the industry, became interested because of suggestions from family or friends who worked for a railroad, find the work satisfying, and would be very likely to recommend a railroad career.
- **Respondents with annual income <$56K** had a positive or neutral image of the industry, became interested in rail opportunities because of suggestions from family or friends or after an internship, find the work satisfying or extremely satisfying, but are unsure about recommending a railroad career to others.

**Employee Education and Access to Rail-Related Courses—Operations.** The data shown in Figure 35 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' level of completed education, whether it included rail-related course work, and whether they feel they had sufficient access to rail-related courses and seminars:

- **Respondents with annual income >$115K who are 63 years old or older** have a 4-year degree, which did not include formal rail-related education; only a small number of rail-related courses or seminars had been offered.
- **Respondents with annual income <$115K who are 55 years old or older** have a 4-year degree, which did not include formal rail-related education; some respondents had no options for rail-related courses, while some had access to many options.
- **Respondents with annual income <$80K who are 55 to 62 years old** have a high school diploma or 2-year degree (or the equivalent); no formal rail-related education, although some reported having had sufficient access to rail-related courses and seminars.
- **Respondents with annual income <$56K who are 55 to 62 years old** have a 2-year degree (or equivalent military experience); no formal rail-related education and few, if any, courses or seminars related to the rail industry had been offered.

**Getting Onboard with a Rail Career—Operations.** The data shown in Figure 35 and other responses to the survey allowed the research team to develop the following profiles concerning why the respondents chose rail-related work, their experience with the application process and time-to-start, and what was the most helpful preparation for a career in rail:

- **Respondents with annual income >$115K who are 45 years old or older** were attracted by the salary, interest in trains/railroading, job security, or pension; found the application process satisfactory and likely started within 2 weeks; and found the most helpful preparation for a rail career was guidance from one or more people in the industry.
- **Respondents with annual income <$115K who are 55 years old or older** were attracted by job variety/options, career change, or interests; found the application process to be excellent and likely started in 3 to 6 months; and found the most helpful preparation for a rail career was educational course work, participation in a rail-related club/organization, or previous employment.
- **Respondents with annual income <$80K who are 55 to 62 years old** were attracted by the salary, variety/options, a career change, or interests; found the application process to be

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satisfactory and started in 2 weeks; and found the most helpful preparation was course work or previous employment.
- **Respondents with annual income <$56K who are 55 to 62 years old** were attracted by the salary, job variety/options, job security, or interest in trains/railroading; found the application process to be excellent and likely started in 1 to 3 months.

**On-the-Job Training and Continuing Education—Operations.** The data shown in Figure 35 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' training experience (including duration and any obstacles); the most effective type of training (related to skill set, knowledge, and confidence) for the position currently held; participation in NE and EP continuing education/training in the past 2 years; and whether respondents feel they were provided with adequate preparation for working in a safe and satisfactory manner:

- **Respondents with annual income >$115K who are 63 years old or older** had no formal training period (greatest obstacle was lack of time), found OTJ training was most effective, may have participated in NE and EP training, and feel they had sufficient safety preparation.
- **Respondents with annual income <$115K who are 55 years old or older** had no formal training period (greatest obstacle was lack of time); on-the-job training was most effective; may have participated in NE and EP training; sufficient safety preparation.
- **Respondents with annual income <$80K who are 55 to 62 years old** had no formal training period (greatest obstacle was lack of time), found OTJ training was most effective, participated in EP, may have participated in NE training, and feel they had sufficient safety preparation.
- **Respondents with annual income <$56K who are 55 to 62 years old** had no formal training period (greatest obstacle was lack of time), found OTJ training was most effective, may have participated in NE or EP training, and feel unsure whether they had sufficient safety preparation or that they had sufficient safety preparation.

**Employee Satisfaction and Retention—Operations.** The data shown in Figure 35 and other responses to the survey allowed the research team to develop the following profiles summarizing the respondents' satisfaction with their job and opportunities for advancement, whether they intend to make rail a life-long career, work priorities, and suggested employer initiatives for increasing job satisfaction.

- **Respondents with annual income >$115K who are 63 years old or older** are satisfied with their job and opportunities; see rail as a life-long career; say their priorities are interesting work, pension, and wages; and suggest these employer initiatives: growth/advancement opportunities, additional training, acknowledgment of a job well done.
- **Respondents with annual income <$115K who are 55 years old or older** are satisfied with their job and opportunities; see rail as a life-long career; say their priorities are interesting work, wages, job security; and suggest these employer initiatives: increased pay, growth/advancement opportunities, improved work schedule predictability.
- **Respondents with annual income <$80K who are 55 to 62 years old** are satisfied with their job and opportunities; are unsure about a rail career; say their priorities are interesting work, pension, wages; and suggest these employer initiatives: hiring more workers, increased pay, and improved work schedule predictability.
- **Respondents with annual income <$56K who are 55 to 62 years old** are satisfied/extremely satisfied with job and satisfied/neutral with opportunities; do not see rail as a life-long career; say their priorities are interesting work, job security, training/educational opportunities; and suggest these employer initiatives: increased pay and more solicitation of worker input by management.

**Education, Professional Participation, and 5- to 10-Year Plans—Operations.** The data shown in Figure 35 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' age, education level, rail-related professional membership, years of industry experience, and expectations for the next 5 to 10 years.

- **Respondents with annual income >$115K** are 63 years old or older, have a 4-year degree, may belong to a rail-related professional organization, are likely to have some 40 years of experience, and anticipate being near retirement or retired in 5 to 10 years.
- **Respondents with annual income <$115K** are 55 years old or older, have a 4-year degree, may not belong to a rail organization, may have relatively new experience or 31 to 40 years of experience, and anticipate being in the same job, near retirement, or retired in 5 to 10 years.
- **Respondents with annual income <$80K** are 55 to 62 years old, are likely to have a high school diploma (or GED) or a 2-year degree (or equivalent military experience), may or may not belong to a rail-related professional organization, have 21 to 40 years of industry experience, and anticipate being promoted, near retirement, or retired in 5 to 10 years.
- **Respondents with annual income <$56K** are 55 to 62 years old, are likely to have a high school diploma (or GED) or a 2-year degree (or equivalent military experience), may or may not belong to a rail-related professional organization, may be fairly new to the rail industry, and anticipate being near retirement or retired in 5 to 10 years.

### *Results of the Retention and Recruitment Survey for Other Positions*

For respondents who identified the focus of their current responsibility to be neither engineering nor operations, Figure 36 categorizes their education, age, and experience by annual income. From this data and other survey responses, the research team developed profiles of respondents in the following areas:

- Industry image, recruitment, and employee satisfaction
- Education and access to rail-related courses
- Getting onboard with a rail career
- OTJ training and continuing education
- Employee satisfaction and retention
- Education, professional participation, and 5- to 10-year plans

**Industry Image, Recruitment, and Employee Satisfaction—Other Positions.** The data shown in Figure 36 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' initial image of the railroad industry, how they learned about employment opportunities, current job satisfaction, and whether they recommend that others consider working in the industry:

- **Respondents with annual income >$115K** had a neutral or positive image of the industry before starting job search, became interested in opportunities because of suggestions from family or friends who worked in the industry or other personal contacts, find the work satisfying, and would probably recommend a railroad career.
- **Respondents with annual income <$115K** had a neutral image of the industry, learned about job opportunities from personal recommendations or newspaper ads, and find the work satisfying but are unsure about recommending a railroad career to others.
- **Respondents with annual income <$80K** had a neutral image of the industry; learned about opportunities from family, friends, or one-on-one contacts; and find the work satisfying but are unsure about recommending a railroad career to others.
- **Respondents with annual income <$56K** had a neutral image of the industry, became interested in opportunities because of suggestions from family or friends who worked in the industry, find the work satisfying, and would also recommend it as a career.

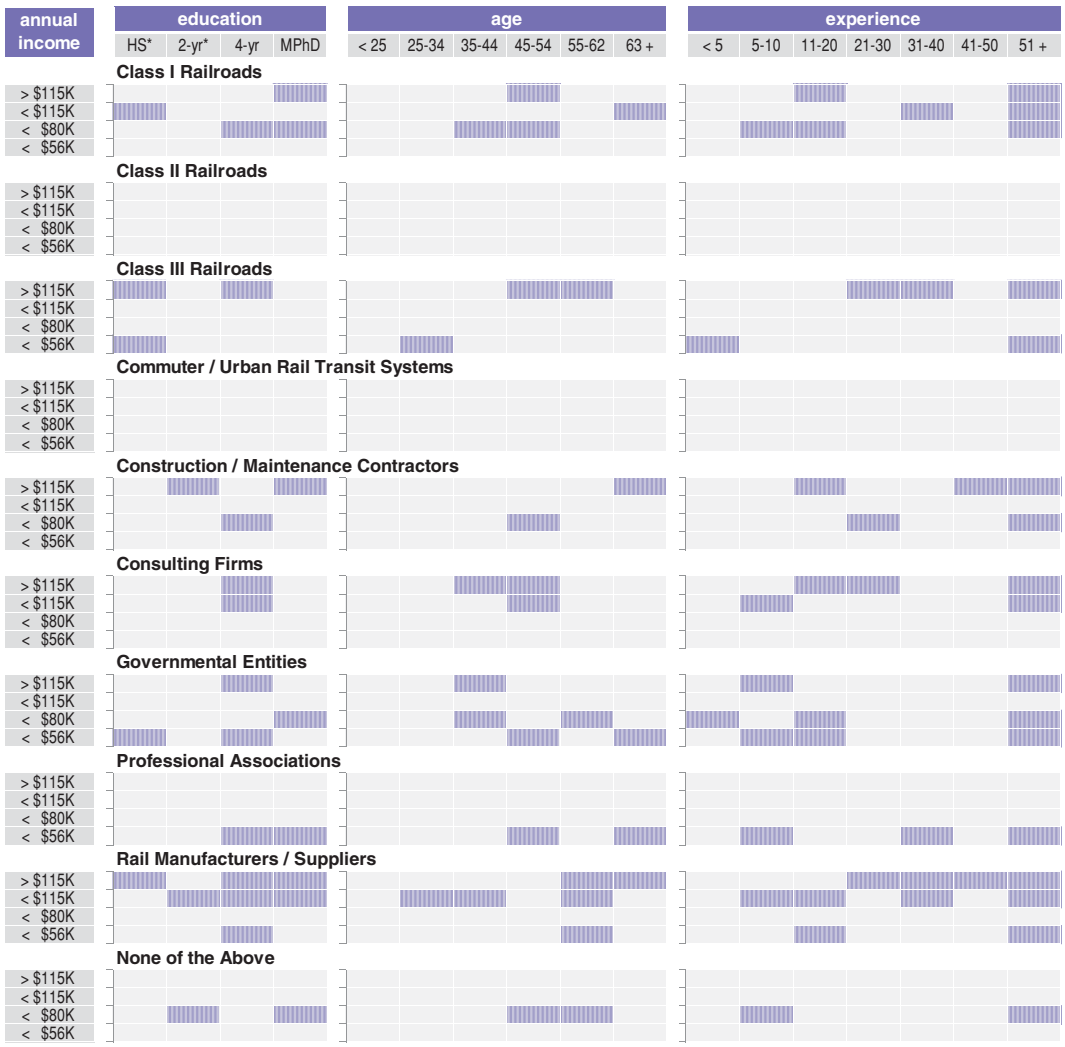


***Figure 36. Education, age, and experience of rail engineering and operations survey respondents with other positions by annual income and employer type.***

**Employee Education and Access to Rail-Related Courses—Other Positions.** The data shown in Figure 36 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' level of completed education, whether it included rail-related course work, and whether they feel they had sufficient access to rail-related courses and seminars:

- **Respondents with annual income >$115K who are 63 years old or older** have a 4-year or post-graduate degree, which did not include formal rail-related education, although some rail-related courses or seminars may have been offered.
- **Respondents with annual income <$115K who are 55 to 62 years old** have a 4-year or post-graduate degree, which did not include formal rail-related education; some respondents had no options for rail-related courses, while some had access to many options.
- **Respondents with annual income <$80K who are 45 to 54 years old** have a 4-year or post-graduate degree, which did not include any formal rail-related education, and few, if any, rail-related courses or seminars were offered.
- **Respondents with annual income <$56K who are 45 years old or older** have a 4-year degree, which did not include any formal rail-related education, although rail-related courses or seminars may have been offered.

**Getting Onboard with a Rail Career—Other Positions.** The data shown in Figure 36 and other responses to the survey allowed the research team to develop the following profiles concerning why respondents chose rail-related work, their experience with the application process and time-to-start, and what was the most helpful preparation for a career in rail:

- **Respondents with annual income >$115K who are 63 years old or older** were attracted by the salary or job variety/options, found the application process to be excellent and likely started within 2 weeks, and found the most helpful preparation for a rail career was guidance from one or more people in the industry or previous employment.
- **Respondents with annual income <$115K who are 55 to 62 years old** were attracted by the salary or job security, found the application process to be excellent and likely started within 2 weeks, and found the most helpful preparation was guidance from others or previous employment.
- **Respondents with annual income <$80K who are 45 to 54 years old** were attracted by the salary or job security, found the application process to be satisfactory and likely started within a month, and found the most helpful preparation for career was previous employment.
- **Respondents with annual income <$56K who are 45 years old or older** were least attracted by the salary or work schedule, found the application process to be excellent or satisfactory and likely started within 2 weeks, and found the most helpful preparation for rail career was guidance from one or more people in the industry.

**On-the-Job Training and Continuing Education—Other Positions.** The data shown in Figure 36 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' training experience (including duration and any obstacles); the most effective type of training (related to skill set, knowledge, and confidence) for the position currently held; participation in NE and EP continuing education/training in the past 2 years; and whether respondents feel they were provided with adequate preparation for working in a safe and satisfactory manner:

- **Respondents with annual income >$115K who are 50-plus** had no formal training period (greatest obstacle was lack of time), found OTJ training was most effective, may have participated in NE or EP training, and feel they had sufficient preparation for safe and satisfactory work.
- **Respondents with annual income <$115K who are 55 to 62 years old** had no formal training period (greatest obstacle was lack of time), found OTJ training was most effective, did not participate in NE and EP training, and feel they had sufficient preparation for safe and satisfactory work.
- **Respondents with annual income <$80K who are 45 to 54 years old** had no formal training period (greatest obstacle was lack of time), found OTJ training was most effective, participated in EP and NE training, and feel they had sufficient preparation for safe and satisfactory work.
- **Respondents with annual income <$56K who are 45 years old or older** had no formal training period (greatest obstacle was lack of time), found OTJ training was most effective, may have participated in NE or EP training, and feel they had sufficient preparation for safe and satisfactory work.

**Employee Satisfaction and Retention—Other Positions.** The data shown in Figure 36 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' satisfaction with job and opportunities for advancement; whether they intend to make rail a life-long career; priorities affecting their willingness to continue working within the industry; and suggested employer initiatives for increasing job satisfaction.

- **Respondents with annual income >$115K who are 45 years old or older** were satisfied/extremely satisfied with their job and satisfied with opportunities; see rail as a life-long career; say their priorities are interesting/challenging work, job and career mobility, and wages; and

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suggest these employer initiatives: growth/advancement opportunities, increased pay, and acknowledgment from management for a job well done.

- **Respondents with annual income <$115K who are 55 to 62 years old** were satisfied/extremely satisfied with their job and satisfied/neutral with opportunities; see rail as a life-long career; say their priorities are interesting/challenging work, wages, and job security; and suggested these employer initiatives: increased pay, acknowledgment from management for a job well done, and more vacation time.
- **Respondents with annual income <$80K who are 45 to 54 years old** were satisfied with their job and neutral about opportunities; half see rail as a life-long career; their priorities are wages, interesting/challenging work, job security, and pension; and they suggest these employer initiatives: increased pay, improved predictability of work schedules, and growth/advancement opportunities.
- **Respondents with annual income <$56K who are 45 years old or older** were satisfied with their job and opportunities; half see rail as a life-long career; their priorities are wages, interesting work, and training/educational opportunities; and they suggest these employer initiatives: increased pay, additional training/educational opportunities, and growth/advancement opportunities.

**Education, Professional Participation, and 5- to 10-Year Plans—Other Positions.** The data shown in Figure 36 and other responses to the survey allowed the research team to develop the following profiles concerning the respondents' age, education level, rail-related professional membership, years of industry experience, and expectations for the next 5 to 10 years.

- **Respondents with annual income >$115K** are 45 years old or older (and likely to be over 60); have a bachelor's, master's, or doctoral degree; belong to a rail-related professional organization; have 11 to 40 years of rail industry experience; and anticipate being close to retirement or retired in 5 to 10 years.
- **Respondents with annual income <$115K** are 55 to 62 years old; have a bachelor's, master's, or doctoral degree; belong to a rail-related professional organization; have 31 to 40 years of rail industry experience; and anticipate being close to retirement or retired in 5 to 10 years.
- **Respondents with annual income <$80K** are 45 to 54 years old; have a bachelor's, master's, or doctoral degree; belong to a rail-related professional organization; have 5 to 10 years of rail experience; and anticipate having the same position in 5 to 10 years.
- **Respondents with annual income <$56K** are 45 to 54 years old or 63 years old or older; likely have a bachelor's degree; may or may not belong to a rail-related professional organization; are likely to have 5 to 20 years of industry experience; and anticipate being promoted, close to retirement, or retired in 5 to 10 years.

## Summary of the Railroad Competency Model Survey

An email invitation to participate in the survey was sent to a blind list of "rail industry professionals" on 31 October 2014. It explained that responses would be anonymous and that "The goal of the survey is to better understand rail industry workforce development needs and gain a better understanding of the roles and responsibilities of working professionals" including knowledge, skills, and attitudes.

Survey respondents were asked to indicate the area that best describes the focus of their current responsibilities: engineering, operations, or none of the above. (The latter were not presented with the full survey and their responses are not included in this analysis.) Responses to the question on focus of current responsibilities provide the primary filter used throughout this subsection.

Data used for this analysis were downloaded on 8 December 2014:

- 129 respondents began taking the survey
- 21 dropped out almost immediately

- 11 went through the entire survey but provided no responses
- 26 selected "none of the above" as their primary focus
- 25 provided a partial response and are included in this analysis
- 46 completed the survey in its entirety

Of these 71 participants, 42 are in engineering (29 completed the survey) and 29 are in operations (17 completed the survey). Figure 37 shows the approximate location of each respondent's primary workplace (for complete responses only).

This limited response is not a statistically valid sample of the industry, but it is an interesting representation of knowledge and skills, which provides a model that could be refined by a company or professional organization and deployed to glean more detailed insights about worker knowledge, skills, and attitudes.

### *Engineering*

For respondents who identified engineering as the focus of their current responsibility, Figure 38 categorizes their education, age, and experience by annual income and identifies the percentage of respondents who work for each of the employer types.

**Responses.** Respondents who indicated that engineering is the focus of their current responsibilities were presented with the functions shown in Figure 39 and asked to select one of five terms (see the legend for Figure 39) that most closely characterizes their responsibilities regarding those functions.

**Comments and Training Recommendations from Engineering Respondents**

- Engineering Support Systems
  - Heavy focus on theory of technology (software and hardware) to perform all these functions—this is especially true with the Class I railroads.


***Figure 37. Locations of respondents to the railroad competency model survey.***

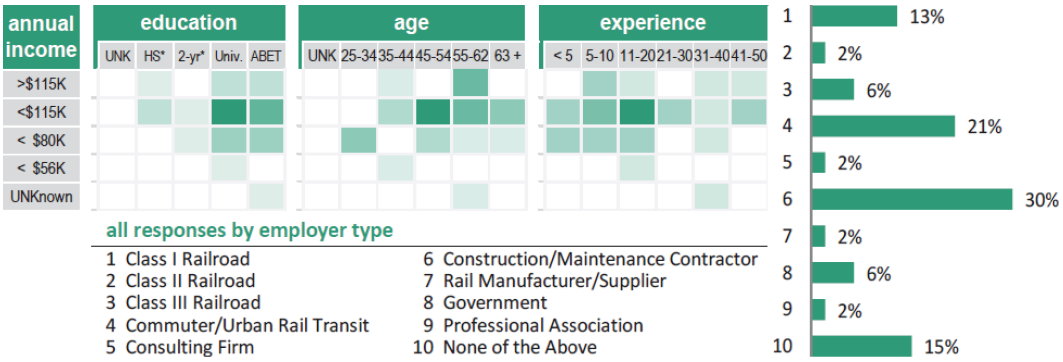


***Figure 38. Categorization of system engineers' education, age, and experience by annual income and response by employer types.***

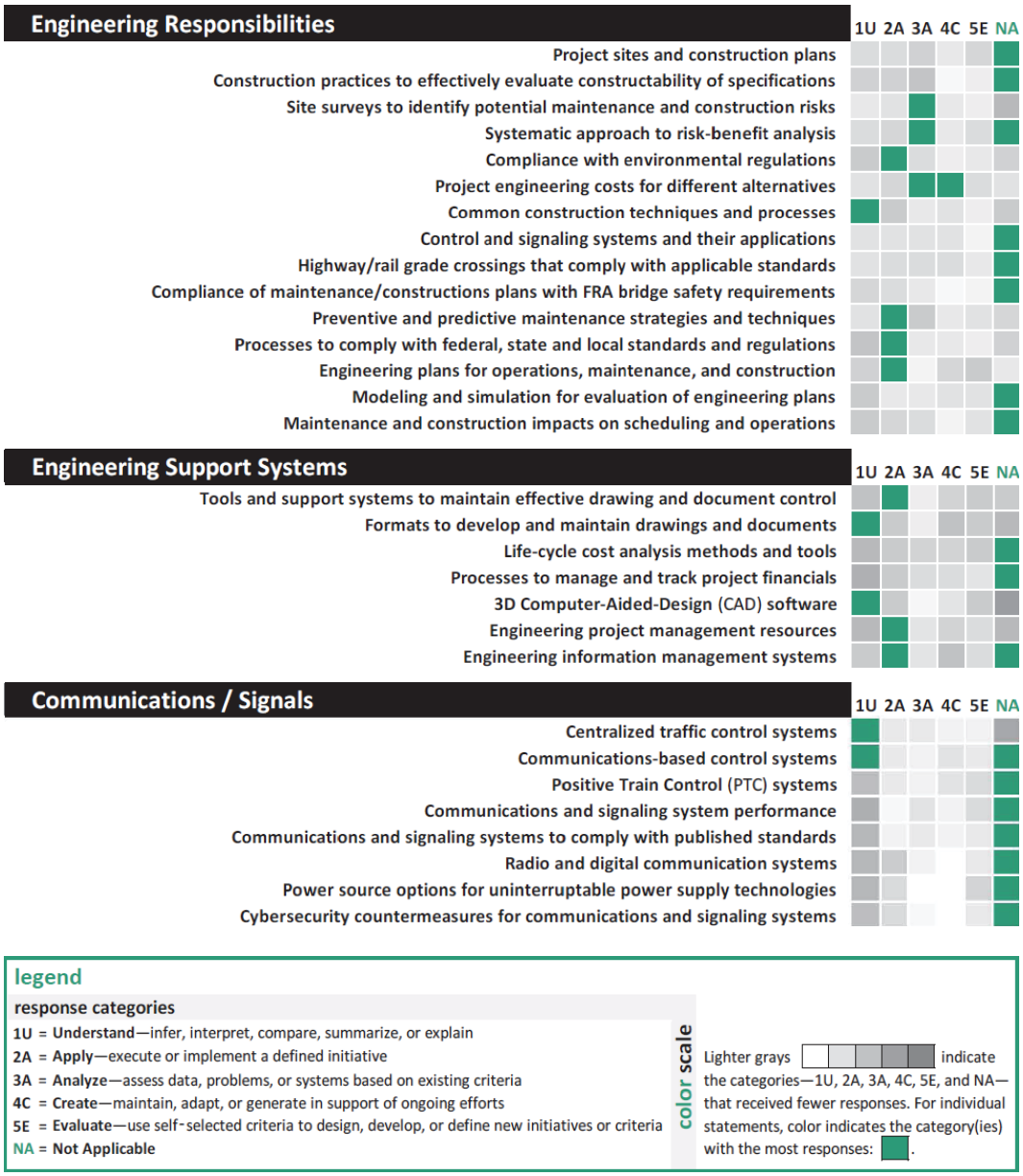


***Figure 39. Engineering responsibilities of respondents to the railroad competency model survey.***

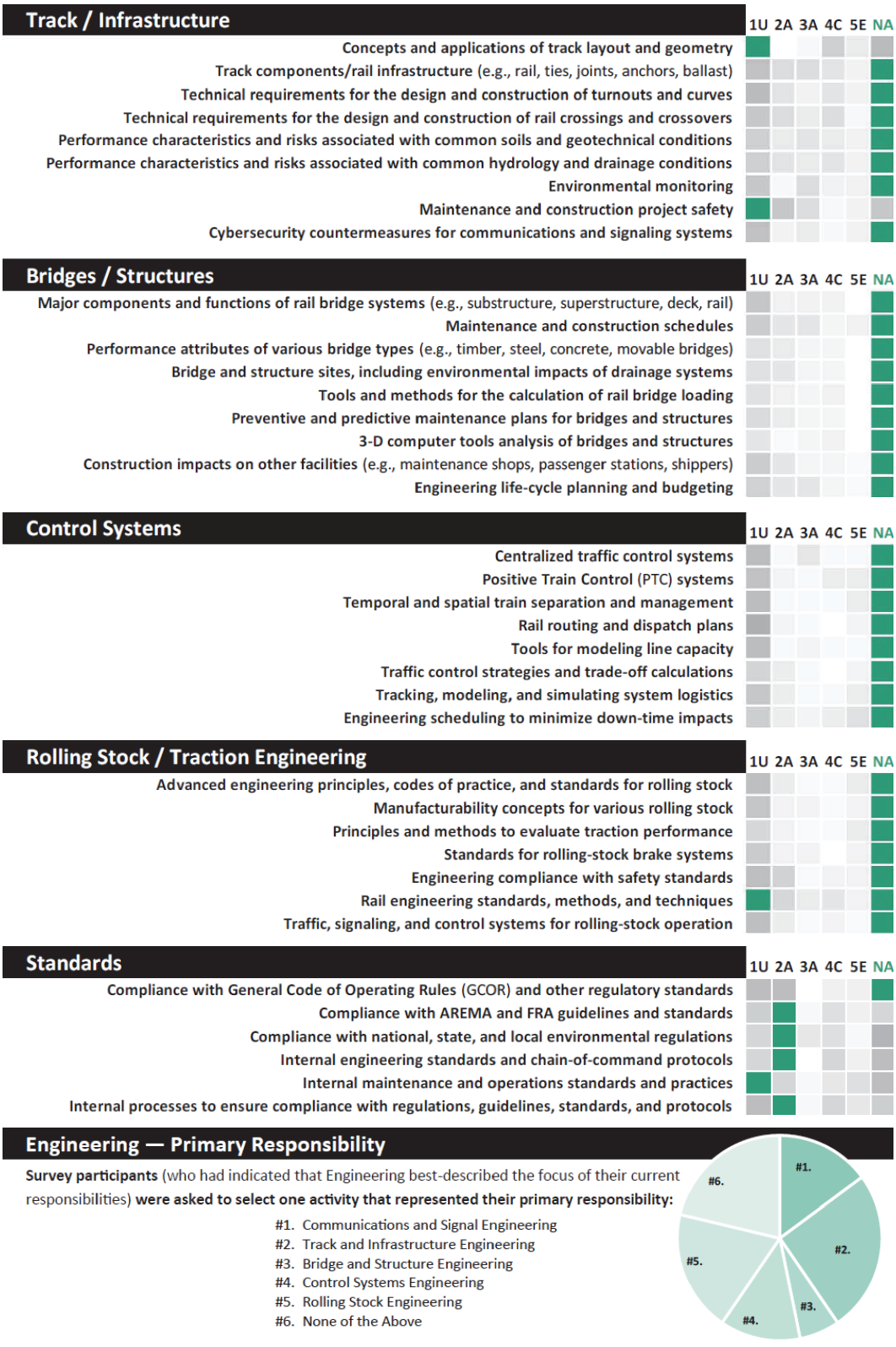


***Figure 39. (Continued).***

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  - Training should start early, depending on whether the state has well-trained trainers. Depending on location, the technical institute has to be contacted and related classes on train control, traction power, track work, etc. have to be initiated by systems.
  - Contractors and the materials and training are provided to the technical school instructors.
  - Implementation of maintenance and asset management.
  - Passenger rolling-stock (including metro, commuter, light-rail vehicles, regional) design and operational considerations.
  - FRA and ADA compliance issues.
  - Railroad bridge rating—including fatigue analysis of aged structures.
  - The ability to apply threat management, error management, and cockpit resource management to rail safety.
  - Traction power substation design, signal engineering, overhead catenary system, and track system.
  - In addition to applying three-dimensional (3D) computer-aided design (CAD) software, the ability to create and design specific approaches and templates to facilitate development of drawings and documents specific to standards for railways and/or railway equipment industry.
- Communications/Signals
  - Depending on the state, training needs are different—in areas like New York, Chicago, San Francisco, and Boston, many are familiar with these systems and it may be easier to hire staff with some background in transit systems. In other states, training needs to be started at the technical college level with the help of system providers.
  - Field training.
- Track/Infrastructure
  - Cybersecurity is a complicated subject and should be considered—although hackers may not have found ways to attack satellites yet, it would bring havoc to the transportation industry.
- Bridges/Structures
  - U.S. bridges have no security—the culture seems to react instead of being proactive. Equipment alone cannot provide security and people must be active participants. Everyone must be aware of their surroundings. The workforce needs to be trained to be vigilant and alert, and the "it's not my job" attitude has to change.
  - Prioritization of repairs or replacement of bridges based on analysis.
- Control Systems
  - More modeling instruction courses.
- Rolling Stock/Traction Engineering
  - Consultants are relied on to support design review and testing activities on vehicle hardware and software systems [doors, propulsion, HVAC (heating, ventilation, and air conditioning), etc.] and other special testing activities like electromagnetic interference and electromagnetic compatibility testing. Training to support the management and performance of these duties would be valuable.
- Standards
  - Bridge maintenance permitting requirements.

### *Operations*

For respondents who identified operations as the focus of their current responsibility, Figure 40 categorizes their education, age, and experience by annual income and identifies the percentage of respondents who work for each of the employer types.

**Responses.** Respondents who indicated that operations is the focus of their current responsibilities were presented with the functions shown in Figure 41 and asked to select one of five terms (see the legend for Figure 41) that most closely characterizes their responsibilities regarding those functions.

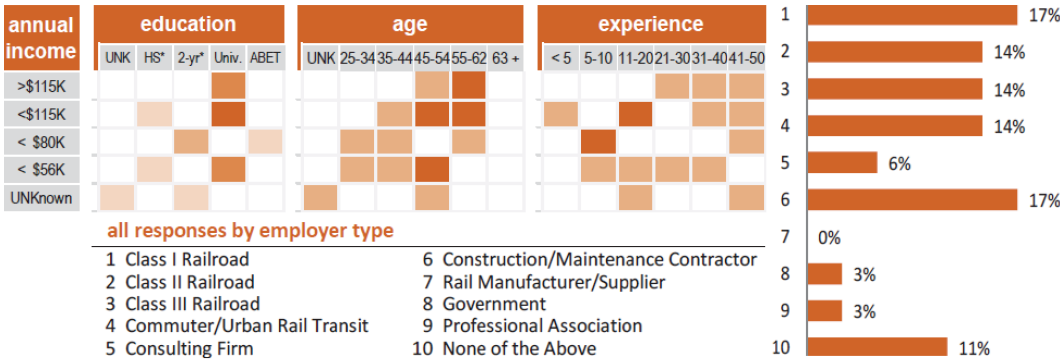


***Figure 40. Categorization of operations respondents' education, age, and experience by annual income and employer types.***

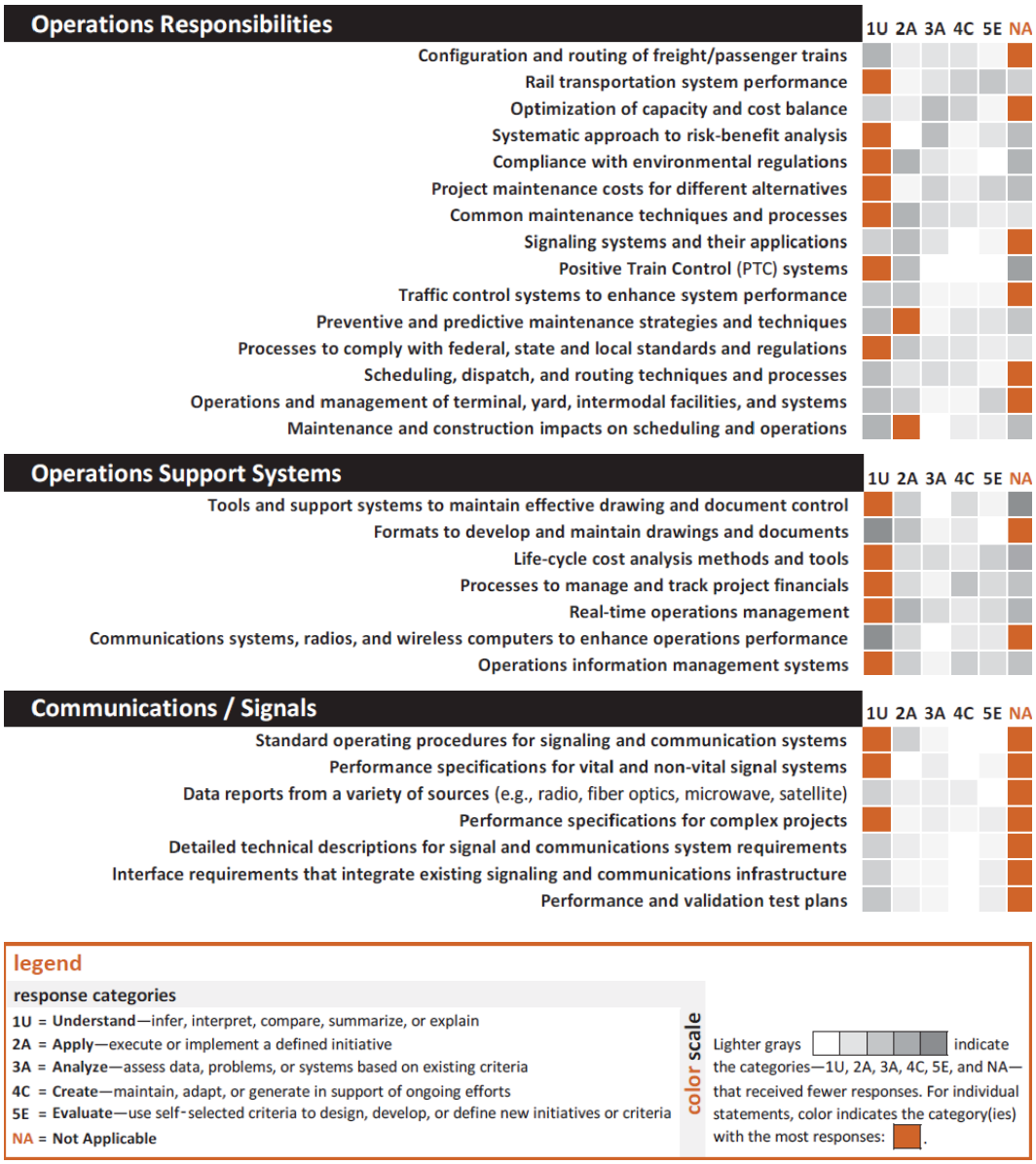


***Figure 41. Operations responsibilities of respondents to the railroad competency model survey.***

*(continued on next page)*

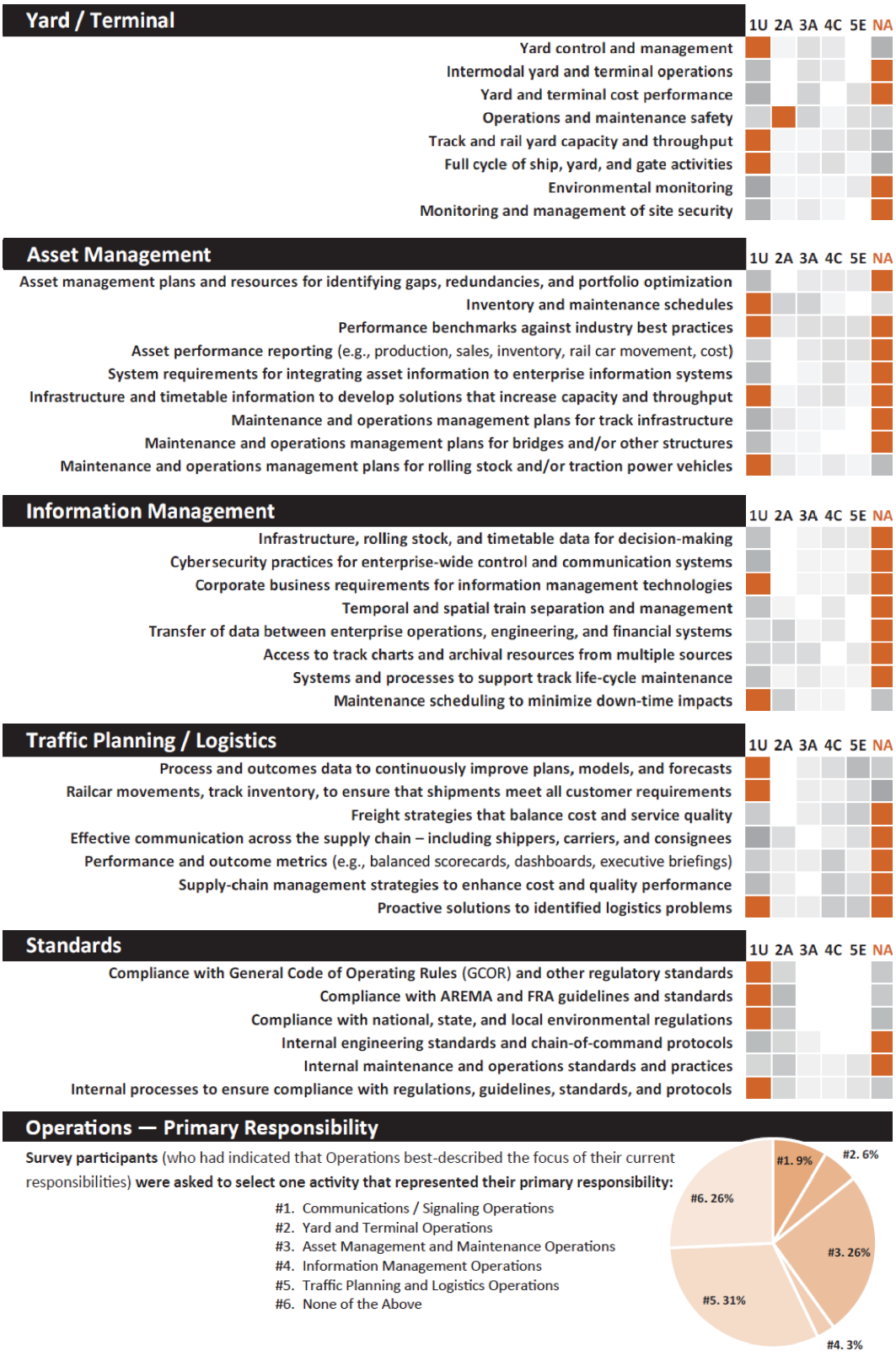


***Figure 41. (Continued).***

**Comments and Training Recommendations from Operations Respondents**

- Operations Support Systems
  - As organizations become more complex, generalized instruction in areas other than one's own normal sphere of activities seems more valuable.
  - Fleet management.
  - Service quality—especially reliability at the car/container level.
  - Importance of communicating effectively with management as to the importance of various operating systems and strategies, particularly as it relates to obtaining funding for new programs.
  - Training must be continuous and include an effective mix of classroom training and real-world, hands-on application.
  - Understanding interface of operations with supply chain management of customers.
- Communications/Signals
  - Event-reporting cars and containers.
  - Additional radio system training (outside the company).
  - Upper management needs to have a cursory understanding of the federal regulations and hire people to execute them—this is especially true in the chemical industry.
- Yard/Terminal
  - Fleet management.

### *All Respondents*

Figure 42 categorizes the education, age, and experience of all respondents by annual income and identifies the percentage of respondents who work for each of the employer types.

**Responses.** Respondents were presented with the functions shown in Figure 43 and asked to review the definitions (see the legend for Figure 43) and select one term that most closely characterizes their responsibilities regarding those functions.

Figure 44 presents the results of respondents being asked to select the term (see the legend for Figure 44) that matches their skill level with the effectiveness activities described.

**Comments and Training Recommendations from All Respondents**

- Project Management
  - From an engineering perspective, only a top-level understanding of project management would be beneficial.

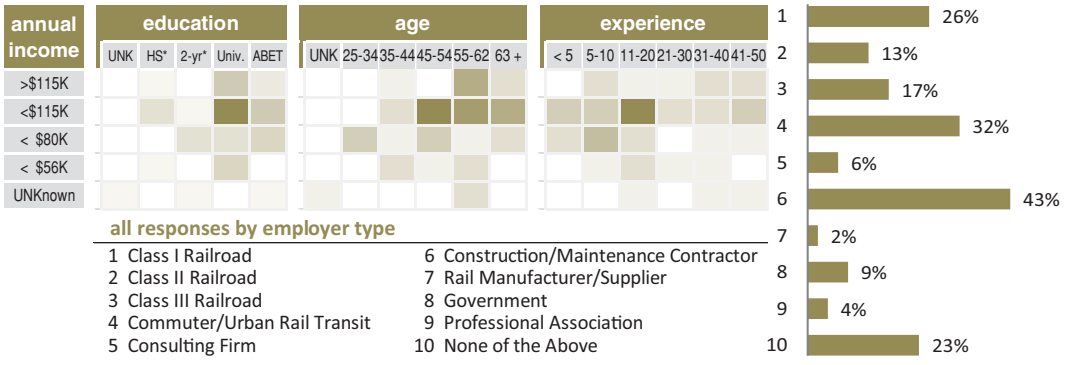


***Figure 42. Categorization of respondents' education, age, and experience by annual income and employer types.***

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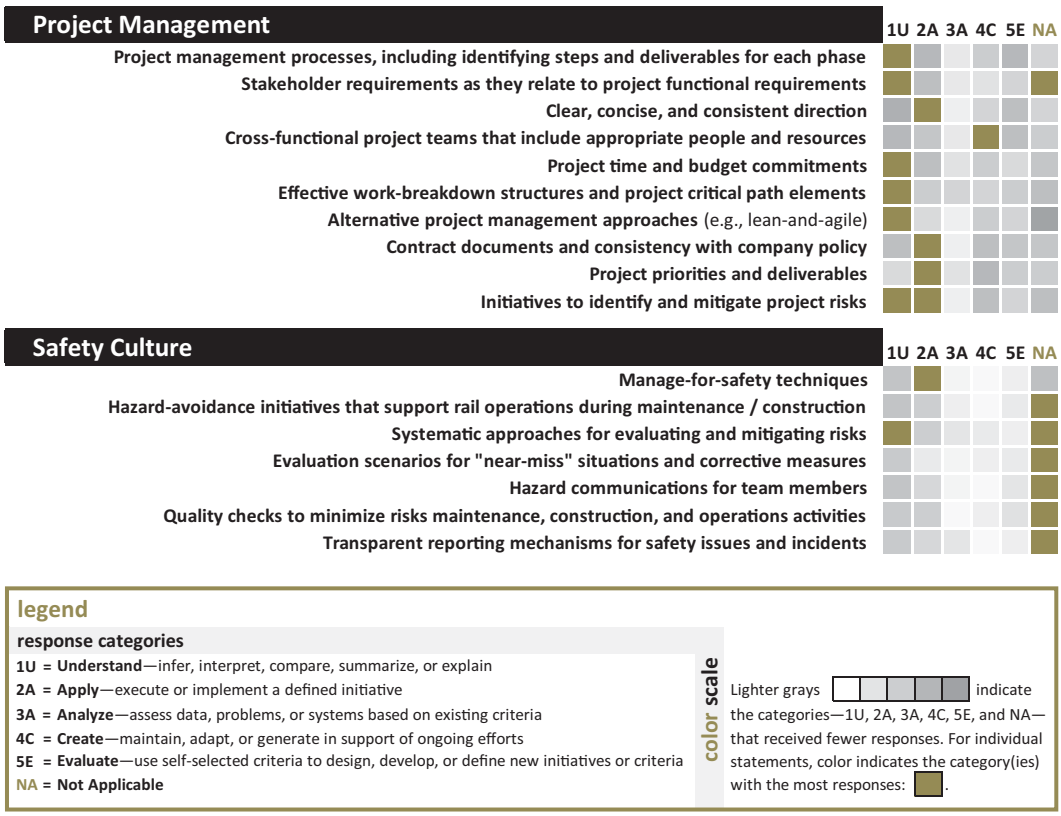


***Figure 43. Project management and safety culture responsibilities of all respondents to the railroad competency model survey.***

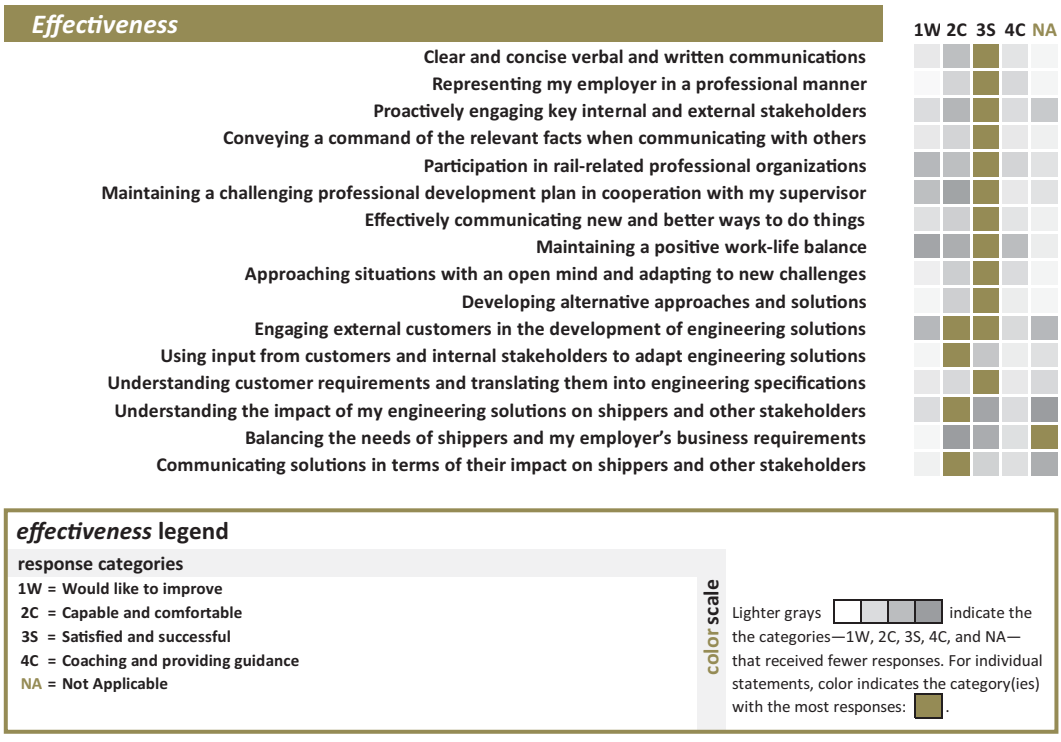


***Figure 44. Effectiveness levels of all respondents to the railroad competency model survey.***

- Safety Culture
  - Regional railroads can still "get our arms around the railroad" and get closer to stakeholders (owners, employees, patrons, general public) than the Class I counterparts who seem too compartmentalized and driven by an obsession with reducing costs with no concept of the effect on future (or current) operations, etc. Much of the failure of contemporary railroads to perform adequately (e.g., the inability to move the fall harvest in a timely manner, massive traffic erosion, etc.) is the result of an abandonment-focused culture in too many of the big Class I and regional railroads.
- Additional Comments
  - Examine programs offered by other academic institutions including Michigan Technological University, Michigan State University, University of Illinois, etc.
  - "Co-op programs are GREAT! Wish I had taken one, although I did get railroad and rapid transit experience during a work break in my education, which had a similar effect and started off my proposal writing skills and railroad-related design work later."
  - The educational requirements for rail-related vocations vary significantly between Class I railroads and the regional railroads (Class II and III). Also, educational requirements for people employed by railroads and commuter agencies involved in passenger transportation need to focus on safety and customer satisfaction—versus those involved in freight handling.
  - The short-line railroad industry is in need of experienced railroad engineering consultants with a knowledge of "getting it done right and fast" to emphasize the need to keep trains moving.

## Structured Interviews with Railroad Human Resource Personnel

### Purpose and Methodology

To gain further insight into the railroad industry's current recruitment and retention methods, as well as educational and training policies, the research team made efforts to interview HR departments throughout the industry. The Association of American Railroads (AAR) assisted by querying different Class I railroads for willingness and availability to participate. Unfortunately, response rates to both the research team and AAR were quite low. It should also be noted that the researchers attempted to reach out to passenger rails through cold calls with limited success. In the end, the researchers were able to connect with some HR personnel at Class I railroads. AAR was also able to provide valuable information as to where to locate statistics on railroad demographics that ultimately painted a brighter and fuller picture of railroad industry demographics. The review of statistics and structured interviews provided an insightful glimpse into railroads' perspectives on current recruitment and retention practices, as well as strategies and challenges to building and maintaining workforce capacity in the railroad industry. Appendix E contains the guided questions used during phone interviews.

The interviewed HR professionals highlighted points of particular interest in terms of methods, success stories, and challenges related to recruitment, education and training, and retention in the railroad industry. A discussion of the information gleaned from these dialogues follows. For the purposes of anonymity, individuals are referred to as HR.

### Recruitment

#### *Recruitment Methods*

Railroads were first queried about what they look for in candidates as they begin the recruitment process. One of the most important characteristics of potential employees is flexibility

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and the willingness to be able to commit to working an unpredictable schedule. HR departments explain the attractiveness of this quality by pointing to the fact that the railroad is a 24/7 operation and that it takes ***"a special sort of individual to adapt to that type of working environment."*** Leadership and decision-making skills are also of the utmost importance when considering if candidates would be a good fit in the railroad industry workforce. HR professionals also indicated that strong communication skills and the ability to listen and follow directions are critical. The railroads look for individuals with "personal integrity who display ethical behavior. For instance, HR states that employees cannot cut corners when conducting their jobs and that following the rules by the book can often mean the difference between life and death."

When asked about any recent changes made to the recruitment process, railroads discussed their need for a fresh outlook on hiring. For quite some time, there was a hold on recruitment. Many new employees who were hired in the 1980s and before remained working for the railroad, and thus, a relaxed attitude about hiring existed. **"*The need simply was not what it was now.*"** If potential candidates were not aggressively pursuing employment in the railroad, they simply did not get hired into the workforce. Furthermore, railroads interviewed indicate that in the past, they would place advertisements in the local newspaper for a hiring session and "around a thousand people would show up. They would take the first hundred or so people who would arrive, interview them and then hire about twenty folks." This is no longer the case, they state. Now, they proactively recruit top candidates, especially to fill empty management positions. Railroads also reported some success using tools like social media to attract passive candidates who may not have known about a career in the railroad.

When asked about branding and trying to sell the railroad as a viable career, HR discusses the importance of stressing the stability that comes with working for the railroad; however, with the improvement of the economy this is admittedly starting to lose its luster. Nevertheless, the stability of a career in the railroad does continue to ring true for interested candidates. HR states to some extent **"*the railroad really is the backbone of our country.*"** Financially speaking, HR emphasizes that the railroad "has a good, strong track record of performance." HR also praises the merits of management and the leadership of the company; HR states that "they have always been forward looking, innovative, and progressive." With respect to generating future business, the leadership of the railroad was aware that the importance of coal would not last forever, and in the past 5 years, the value of coal dropped dramatically. The railroad, however, continued to thrive, as leadership had already begun to invest heavily in intermodal transportation. This type of leadership ensures ongoing stability. Finally, when trying to recruit new employees, HR makes it a point to discuss the outstanding benefits, including highly competitive pay and outstanding retirement plans, with all potential hires.

### *Success Stories in Recruitment*

Railroads were asked about any success stories they may have with regard to recruitment. HR reports a great deal of pride with a new recruitment initiative in which they are focusing on hiring veterans. In the last 4 years, HR reports "an average of approximately 26%" of external hires have come from the military. Talent advisors and recruiters have established relationships with military bases, "with some of these folks also having military backgrounds." They use these relationships to recruit veterans at all levels. They have also participated in military career fairs. Recruiting employees who have been in the military makes perfect sense and allows for hiring qualified candidates. This is in part because the working environment is very similar. **"*Both military folk and railroad employees work outside, no matter the condition, time of day, or time of year.*"** HR tells a story about a Marine who in his job interview discussed having to protect his platoon in extreme weather conditions. Because veterans are accustomed to working in extreme weather, and often times in more dangerous conditions than they will face at the

railroad, "they are well prepared to deal with whatever may come their way, in many different environmental conditions." Rules and safety are vital to both careers. ***"Both the military and the railroads live and breathe rules and safety every day, as it is truly the only way to ensure being able to leave work and go home safely."*** Both fields use heavy machinery and both must understand the importance of how to use them properly and safely because one slip up could be quite costly. Thus, the culture of doing things the right way, not cutting corners, and following the rules by the book will be familiar to a veteran beginning a career for the railroad. Finally, the need for strong leadership and decision-making skills is of the utmost importance in both careers.

### *Recruitment Challenges*

Despite changes in recruitment methods and reported success stories, the industry does continue to face challenges when hiring new, skilled workers. One of the biggest barriers when attracting future employees is that a career in the railroad is not for everyone, especially the new generation entering the workforce today. "The idea of unpredictable schedules is quite unappealing to millennials when competing with new tech companies where the culture is very different and much more flexible." In interviews with HR departments, the idea that workers "are married to the railroad" is revealed. This is because rail employees often miss birthdays, holidays, anniversaries, and other important events with friends and family, ***"a lifestyle that does not sit well with today's generation.*** The railroads, however, understand this and that they must adjust their scheduling policies, stating time off should really mean time off, and not mean one must be accessible by phone on days off in case he or she is called in to work. Railroads point to the need to use technology better to help them with such scheduling issues." Also, with the economy improving, people have more options for employment and may not be drawn to the stability of working for the railroad as they once were.

Challenges of recruiting skilled workers in the rail industry seem to lead back to early education. For instance, "railroads feel that they have largely been left out of initiatives like STEM and the Association of Career Technical Educators," and thus feel that "they are lagging behind other career fields that young students have become interested in from an early age." People entering today's workforce have many options and railroads therefore feel that, to some extent, they are losing out to competing industries when recruiting qualified employees.

Interviews with HR departments also revealed sentiments that the way craftworkers are sometimes recruited through hiring sessions is not the most successful way, as it can be too impersonal. Hiring sessions occur where a recruiter will talk to a group of potential candidates who have shown up for 2 hours, then interview the potential candidates for 20 minutes, and "then make quick decisions as to [who] moves on to the next step of the onboarding process." This method of recruiting does not help the railroads hire the best talent. Through discussion, HR feels more "one-on-one time with pre-screen phone calls to get to know the candidates better prior to hiring sessions would benefit the railroad in the long-term."

***"The railroads need to use technology better to recruit.*** The people who are coming to these hiring sessions often have to take a day off from work to wait around and they may not even get a chance for an interview. This likely doesn't sit well with candidates because it isn't a good experience or introduction to the railroad." ***"Because technology is much more widespread, with so many people having smartphones and computers now, using technology to recruit makes so much sense.*** Ten years ago, the assumption was that many folks looking for employment as a craftworker may not have known how to navigate technology. This may have been true then, but it is a different time now." Suggestions include sending text messages of videos so that potential candidates can view videos of what it would be like to be a conductor, for example, to see whether the potential job is even appealing job to them.

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## Education and Training

### *Education and Training Methods*

An interview conducted with the director of training for a Class I railroad offered insight into the education and training methods employed by railroads. From this interview, the researchers gleaned that educating and/or training employees is mostly up to the discretion of the individual railroad employers. This appears to be the case despite industry-mandated annual training requirements for safety, among other certifications and requirements applicable to certain positions in the workforce. For instance, the Code of Federal Regulations, Part 243 (CFR 243), relevant to all rail employees, will mandate annual requirements for safety starting in 2018. This interviewee states that "the regulation discusses the need for refresher training; however, currently he is not aware of any programs that offer training specific to CFR 243." In November of 2014, a Human Resources Bench-Marking Meeting took place among the Class I railroads. The agenda was centered on staffing and training, led by human resources and operations professionals in the industry as they begin to assist each other in developing programs to satisfy CFR requirements, as well as continuing to try to provide quality training for employees.

Due to limited academic institutions that cater to the specific needs of the railroad, this director of team training states that they will ***"often times bring in someone at an apprentice level with a basic education in electrical or diesel mechanics and then continue to train."*** He says that there is no railroad curriculum anywhere. Two schools he discusses are Bossier Parish Community College in Bossier City, Louisiana, and Northwest Louisiana College but reiterates the skills taught there are general and not tailored to the needs of the railroad industry. He also discusses a welding program at Tyler Junior College from which they will hire graduates but then need to continue to train them because the program does not focus on track welding. Welding programs are hard to find in general according to HR, however, again industry has requirements when it comes to this craft.

### *Education and Training Successes*

Concerning success in education and training, railroads were quick to highlight the development of training centers. For example, when beginning employment at CSX, new employees are first sent to the Railroad Education and Development Institute to train there for as long as the position they were hired for requires. A suggestion for improved training is "to mix OTJ training with time at a training center. Rather than all training occurring first, [they] spend time at the training center, conduct hands-on training, return to the training center, and continue the cycle until new hires can successfully enter their craft." This "reinforces the learning of skills necessary for exemplary performance." In this industry, "things can change quickly," with proper training protocol new employees can apply what they "have learned in the pristine environment of the training facility in the real world."

Other Class I Railroads have also begun their own training programs in an effort to address the need for more highly skilled and knowledgeable workers. BNSF has partnered with the National Academy of Railroad Sciences (NARS) through Johnson County Community College. Not only do they educate new students to the rail industry, but they also offer training for BNSF employees. NARS employs the use of a simulator to prepare students and experienced engineers for different safety situations on the rail. The faculty at BNSF's training facility is headed by Dave Tolle who has a great deal of experience, along with 70 other seasoned railroad workers. One result of programs like these, says students and faculty alike, "is a railroader who gets smarter faster and who's better able to grapple with today's increasingly technical crafts." NARS also boasts the training tool "Net-Sims," which is a network-based simulator that employees can access through the corporate website as a link to the academy. The "Net-Sims" is especially useful for engineers looking to be re-certified from their home location (Hansen, 2005).

Canadian National has a different approach to training in that it has training centers located throughout its system, as opposed to in one centralized location. Jim Kvedaras, spokesman for Canadian National, states that safety training is a huge focus of theirs. He states, "We have kept up a steady stream of hiring and training for train and engine service employees and some mechanical forces, to keep pace with retirements and our business growth" (Hansen, 2005). Kansas City Southern (KCS) has a similar decentralized approach and also contracts out training centers, including using BNSF as a training facility for their employees. Conductors and engineers alike spend time in the classroom before getting on the railroad, with re-certification training on a computer occurring every 3 years. Mechanical department apprentices for KCS take part in a 3-year program with the Railway Education Bureau, and also receive 40 hours of training a year, while signalmen and MOW personnel receive training over a 2-year period. New hires at KCS are assigned a mentor at their start date, in addition to receiving classroom training.

### *Education and Training Challenges*

During the interview process, the railroads expressed several challenges related to education and training. Regarding the previously mentioned mandated requirement for safety with the upcoming addition of CFR 243, there is the hope that the rail industry can come to a common agreement on training curriculums. If the industry was able to inform colleges and training centers of their needs, perhaps standardized curriculums would be developed. This could in turn make the training process of railroad employees less complicated than some feel it is currently.

The lack of academic institutions and training centers in many locations throughout the United States also is a major challenge the railroad faces. It is difficult to educate or train prospective workers when training centers are not in the vicinity. This is likely why several Class I railroads have started to develop their own training centers, but it is fair to say that this may be more difficult for some of the smaller railroads to duplicate.

## Retention

The research team was not able to discuss retention policies and issues with any HR experts on this matter; however, what follows are the results of limited discussions on retention in the railroad workforce.

### *Retention Methods*

A discussion of retention methods begins with the appealing benefits that accompany a career in the railroad. Pay is very competitive and the pension or retirement packages offered by railroads are really beyond compare to other industries. Often times, as heard from employees themselves in focus groups and survey results, this is enough to keep people working for the railroad. If an employee of the railroad, in particular a craftworker, is able to stay long enough to achieve seniority, the issue of unpredictability in schedules becomes much more tolerable, as it is the newer employees who are often the ones to work the difficult shifts, including nights and holidays. Furthermore, many railroads offer tuition assistance to employees. If a craftworker comes in under a low-level mechanical job "he or she may be able to take advantage of the tuition benefit, moving up while accruing seniority, until reaching a more senior position."

### *Retention Successes*

HR professionals interviewed were not easily able to highlight success stories in terms of retention at this time; however, it could stand to reason that the sharp increase in retention rates after 2 years in the industry is a success. For instance, ***"if folks make it past two years of employment in the industry, retention rates do increase.*** Throughout the industry, HR departments can see attrition rates of about 25%; this attrition decreases sharply to an estimated 10% or less after two years of employment."

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### *Retention Challenges*

Several challenges came up in discussions with HR professionals about maintaining workforce capacity in the railroad industry. Most important is the issue of unpredictable schedules. Related to the issue of difficult schedules is that some people "don't realize what it will truly be like until they are on the job for some time. They may decide even though the pay and benefits are great, they would prefer to take a less financially rewarding job so as not to miss out on important events and maintain a regular schedule." Other times, "the person's family or significant other may not realize how difficult the schedule can be. Employees sometimes have to choose between their family and the railroad, and often times, people choose family as the more important part of their life."

Another challenge as it pertains to retention in the railroad industry is the changed mindset and work ethic of the new generation entering the workforce today. This generation places a greater emphasis on work–life balance, and as such will not be as apt to work a job with long, unpredictable hours, especially as options for employment continue to grow with the improvement of the economy. Furthermore, as seen through a review of existing literature, today's generation of workers are less apt to stay in one career, let alone one workplace as long as the workers of past generations did. The need to move around from one company to the next to obtain career advancement seems to be an issue all employers, not just the railroad, will need to contend with as they try to maintain a strong workforce moving forward.

Another issue highlighted as a potential retention challenge is the current command and control of the industry. Though the railroad has softened up a bit, according to HR, "workers report feeling like they are being watched over so as to be caught doing something wrong, rather than something good." This sentiment was echoed in focus group discussions and a review of the survey results from the craftworkers. Many feel that there is a culture of craftworkers versus management, and this can lead to qualified workers leaving the workforce for a more autonomous career, especially those from younger generations. Referring to success stories in recruiting veterans, this type of strict culture is something ex-military personnel may be more comfortable with than others. Nevertheless, it continues to be an issue railroads need to address in order to better maintain a quality workforce.

## Conclusion

Railroads have made a significant amount of progress recently in how they build and maintain their workforce capacity. As they continue to strive to find and retain skilled workers, HR professionals interviewed are aware that they need to keep looking to the future to improve. They are cognizant that what used to work when recruiting and retaining workers in the past is no longer the most effective way to build a successful workforce. They also understand the importance technology will play when looking for and hiring new potential. HR departments have made strides in recognizing who will be a good fit for their industry, such as veterans, and have taken matters into their own hands in educating their workers through the development of their own training centers and academic partnerships. It is the hope of the researchers that information discovered in this project will only further assist the industry to become as robust as it once was.

# Structured Interviews with Executive Leaders

## Survey Design

The research team conducted brief, targeted telephone interviews of well-established, highly regarded U.S. railroad industry subject matter experts from trade associations, management, unions, and regulatory agencies. These interviews led to the list of prospective executive leader interviewees. It also refined the questions included in the Executive Leader Interview Tool

(see Appendix D), ensuring the inquiry is relevant, reliable, and unbiased by the standards of working railroad subject matter experts as well as consistent with research protocols. Finally, interviews shaped early thinking about prospective executive leadership patterns, trends, and competencies and contributed to the list of executive leadership development programs known for their efficacy.

The prospective pool of interviewees were narrowed and qualified by known performance results, personal demographics, and industry demographics. Participants provided their written and informed consent to participate in the study and to be quoted pseudonymously in this report. Their pseudonyms are as follows: Adams, Bennett, Graff, Hayden, Jeffreys, Oliver, Peterson, Remington, Sutter, and Travers.

Interviews were conducted by telephone exclusively with just-in-time transcription into Microsoft® Word. Interviewees reviewed the draft interviews for correctness and returned them to the researchers with their consent for use.

## Executive Leader Demographics

Demographics of the participants are provided in Table 8. Note that individual interviewees fall into multiple categories, a reflection of their varied and rich professional trajectories.

Also of interest were the relative arcs of interviewee professional development and rise to senior leadership. All interviewees but one earned bachelor's degrees early in their adult lives. Undergraduate degrees were most often in civil or mechanical engineering, though degrees in

**Table 8. Demographics of participants in the executive leader interviews.**

| Demographic | | No. |
|---|---|---|
| Experience | Class I freight railroad | 7 |
| | Class II, III, short-line/regional freight railroad | 3 |
| | Class I passenger railroad | 0 |
| | Regional passenger railroad | 1 |
| | Railroad industry association | 2 |
| | Regulatory | 1 |
| | Substantial other-industry experience | 4 |
| Title | President/General Manager | 3 |
| | Executive Vice President | 4 |
| | Vice President | 8 |
| | Terminus Director | 2 |
| Rail Corridor | North American East Coast Corridor | 4 |
| | North American West Coast Corridor | 7 |
| | North American Mid-central Corridor | 6 |
| Area of Responsibility | Operations: Transportation | 6 |
| | Operations: Mechanical | 3 |
| | Operations: Engineering | 1 |
| | Operations: Signal/Telecom | 1 |
| | Operations: Other | 2 |
| | Safety | 4 |
| Gender | Male | 8 |
| | Female | 2 |
| Race | Caucasian | 9 |
| | Ethnic minority | 1 |
| Employment Status | Retired | 3 |
| | Currently employed | 7 |

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economics, business, and psychology were also reported. Post-graduate degrees followed in early to mid-career, most often as part of interviewees' rail-related professional development.

Fifty percent of the railroad executives interviewed came up the traditional railroad "haws pipe"; they started out as young people walking trains, in the shop, or working on the business/office side and made their way steadily up the organizational chart on the strength of strong outcomes and gritty effort. Two were identified early on as "high fliers" and put on the fast development track with stretch assignments and additionally intense accountabilities. Interestingly, 30% of the interviewees made at least one jump from work at a Class I carrier to a regional or short line or vice versa, with their depth and/or breadth of authority and responsibility expanding as they moved. An additional 20% made similar moves, though theirs were in and around regulatory agencies and industry associations. Two joined the railroad mid-career from entirely separate industries, merged into middle management, and begin rapid ascents in part because their work was enhanced by non-traditional expertise and practices. Three worked as transportation sector consultants, with two of them assisting railroads as part of their project work. One interviewee loved railroading beginning with the toy train around his family's Christmas tree and eventually found a tiny railroad to purchase, moving immediately, unconventionally, and successfully into an executive leadership position.

## Data Analysis

The interviewers reviewed the data, distilling for trends, patterns, and connections that might prove useful later when the two streams of analysis were brought together. The interviews were then handed off to the grounded theory researcher for further study.

To protect the anonymity of interview participants as provided in the informed consent agreement, any identifying information (individuals' names, names of employers and corporations) was deleted and/or pseudonyms were used. Grounded theory methods (Glaser and Strauss, 1967; Corbin and Strauss, 2009) were then employed to discover and develop themes in the data. Using NVivo software for computer-assisted qualitative data analysis, the researcher coded the interview transcripts to pull together interview excerpts that illustrate each competency in the model.

To provide independent analysis, the early stages of data coding were conducted before the interviewer distillations were read. After the initial, independent analysis was complete, the interviewer distillations were integrated into the grounded theory researcher's analysis. In this way, the team of analysts was able to develop a model that benefits from the rich industry-insider insights provided by the interviewers as well as from the independent, industry-outsider's perspective. Details from these interviews are embedded within the competency model for rail business leaders and executives.

CHAPTER 4

# Workforce Competency Models

This chapter focuses on the research team's efforts to develop competency models for key railroad industry employee groups. Competency models will allow the industry to benchmark existing knowledge, skills, and attitudinal attributes for industry employee groups and to forecast the long-term workforce capacity needs as a function of anticipated changes to the industry that may affect these employees. Through competency models, the rail industry can execute a number of critical talent management initiatives. Competency models provide an objective and rigorous assessment of the knowledge, skills, and mindsets that are crucial to employee success in industry job roles. These competencies can describe current as well as future state performance attributes. Competency models enable the development of employee performance measurement tools and systems, which provide the foundation for highly effective employee development programs. In a similar fashion, competency models can (and do) guide university and technical college curricula.

The competency models approach differs from other approaches to job task assessment in that it focuses on performance, rather than credentials, and defines exemplary, rather than minimal, performance. In addition, competency models can be used to evaluate the capabilities of individuals as well as organizations. Competency models are a powerful tool that can be applied across the spectrum of HR activities. Because competency models provide consistent and relatively unbiased criteria for exemplary performance in a role or function, they have utility in recruitment and retention, performance management, professional development, succession planning, compensation and benefits, and resource planning and staffing.

There are a variety of approaches an organization can take in employing competency models. Organizational competency models examine the attributes and core capabilities across the enterprise and are used to guide strategic decisions and direction. Functional competency models are generally applied vertically within an organization to a broad class of employees with similar functions (e.g., engineering). Role-based competency models are applied horizontally within an organization to a broad class of employees with similar roles (e.g., managers). And finally, job-specific competency models define the attributes of workers within a specific job role (e.g., software design engineer).

The basic steps in the development of a competency model include the following:

1. Literature review. This first step is to identify the general scope, nature, and responsibilities of a job class or role. This may include, but is not limited to, academic and regulatory requirements, history and educational trends, and workforce demographics.
2. Review of organizational artifacts. The second step is to identify the scope, nature, and responsibilities of a job class or role within a specific organization. This may include, but is not limited to, organizational charts, job descriptions, performance assessment tools, policies and procedures, and related materials.

3. Structured interviews with key stakeholders. The next step is to identify the true roles and responsibilities of individual contributors within a role or function. Another goal of this phase is to identify and differentiate exemplary performance.
4. Development of the model. In this phase the hierarchal structure of the competency model is developed. Core competencies are defined by knowledge, skill, and mindset attributes, which are then associated with observable behaviors. The development also includes the development of a measurement instrument.
5. Validation of the model. Once the model has been developed, it needs to be validated. In this phase, the model and measurement system are applied to exemplary and common performers. The goal is to ascertain if the model, and related measurement tools, is effective in differentiating exemplary performance attributes.
6. Implementation of the model. Following validation, the model is implemented and continuously improved to support organizational talent management goals and objectives.

## Rail Business Leaders and Executives

The research team generated a collection of 11 core competencies—a competency model—for highly successful executive leadership in the railroad industry. The research is based upon interviews with industry exemplars who will remain anonymous. The following section, couched substantially in the words of the interviewees, lays out the competency model. This work is relevant to a larger understanding of the particular challenges that the United States railroad industry faces in developing its executive leadership cohort in the years to come.

### The Competency Model

Table 9 provides a brief overview of the 11 core competencies that emerged from interviews with the 10 railroad executives who participated in the study. Core competencies are presented in order of relative significance (measured both quantitatively and qualitatively) as revealed in the interviews.

Please note that, not surprisingly, the integration of safety systems and processes with operations was ubiquitous throughout all interviews, and all competencies, confirming dramatic improvements in railroad safety as experienced by this generation of standout executives.

The following subsections discuss each of the core competencies, illuminating their important features, noting relationships among competencies, and illustrating the analyses with quotations from participants' interviews. This has been done in order to put the voices of the interviewees' front and center, and to limit the research team's commentary to what is necessary to guide readers through that chorus of voices.

In the interest of assessing the consistency and alignment with which the railroad industry as a whole frames, nurtures, and rewards railroad professionals' knowledge, skills, and abilities from early development through promotion up the chain of command into, for some, executive leadership, see the subsection "Competencies Overlap: Executive Leaders, Operations Managers, and System Engineers" for points of overlap between executive leader competencies and those of system engineers and operations managers.

*Connect with the human beings around you.*

#### *Communication*

"We seem to be buried in communications these days, internal and external." (Bennett)

As the list of "key related terms" in Table 9 suggests, this competency is vast and complex. It was clearly near the top of the list of abilities the interviewees viewed as most important in executive leadership. "Communication" includes skills widely recognized as the sending and

**Table 9. Rail business leaders and executives core competencies.**

| Core Competency | Key Related Terms |
|---|---|
| **Communication** | Staying informed, reading, writing, listening, speaking, ability to reach diverse audiences, influence and persuade others, create understanding |
| **Integrity** | Honesty, trustworthiness, conscience, compliance, credibility, fairness, ethics, morality, humility, ego in check |
| **Mentoring received and delivered** | Developing others' potential, nurturing, delegation, coaching, evaluation, providing feedback, networking |
| **Diversity** | Valuing multiple perspectives/teamwork, ethnicity, gender, background |
| **"TLK"** | |
| Thinking | • Systems thinking, critical questioning, analysis, thinking ahead, innovation, improvement, taking initiative and risk, solving problems |
| Learning | • Curiosity, intelligence, seeking knowledge |
| Knowledge | • Industry knowledge, technical expertise, professional experience, "basic railroad fundamentals" |
| **Shared decision making** | Creating change, shared decision making |
| **Performance** | Measuring results, reliability, responsibility, delivery, accountability, sustainability |
| **Political awareness** | Organizational politics, industry-wide politics, public relations/image |
| **Financial discipline** | Economics, money, bottom line |
| **Understanding and advocating for the new railroader** | Efforts toward employee retention, concern for employees' families and family life, promoting work–life balance, quality of life, professional development |
| **Technologies** | Information and computer technology; the electronics in rail equipment; social media; the social phenomenon that is changing how younger generations think, learn, and work |

receiving of information and messages—speaking, listening, reading, and writing—as well as abilities that in classical times traveled under the banner of "rhetoric": to express ideas, create understanding, influence people's thoughts and actions, persuade people, build relationships, and reach diverse audiences.

For Graff, proficiency in what he calls "translations" is a key to leadership success.

> ***Translation. That's almost like an instinct. Sometimes I have to take the message from the techies, massage it, and pass it on to the non-techies. And it's a key skill for people who are wildly successful. They can talk to the people in the trenches, and they can talk to the press.*** (Graff)

Sutter is working on his own translation skills even today, as he makes an essential transition from senior field-level leadership to the corporate office.

> ***And, the one thing that [my boss] . . . has said is, 'Here is your item you have to fix now. . . . You need to slow down and really think about what is on the page before you hit Send.' I am a person who frequently formulates ideas on the fly. I write that same way. A lot of my writing comes across that way, too. For those who have never worked with me, it gets a little strange. Too many quotations, too much off-beat terminology to make sure I'm making the point.***
>
> ***Now I have to learn how to be much more of a building-speak person. But I also never want to lose my ability to speak to the field. When the field reads my writing, they know exactly what I'm saying. But here at Headquarters, it can really strike them as odd.*** (Sutter)

Oliver agrees with Graff and Sutter on the strategic importance of the ability to tailor an executive's message to a variety of audiences.

> ***As you gain responsibility, your job increasingly requires you to write for and present to more and more people at senior levels corporately, customers, employees, regulators, politicians. You have to know your audience and be able to speak with them to get your message across.*** (Oliver)

And for Remington, a leader's skill in "communications" connects directly to her/his ability to form strong relationships.

> ***Communication and relationships. The ability to make connections with other human beings around you. To be able to address the right audience, convey an idea effectively, and understand what another person is saying is just extremely important. When you can prove you have that skill, it puts you in another, more advanced category.*** (Remington)

*Can I look myself in the mirror?*

### *Integrity*

"Integrity and trustworthiness. These attributes underlie everything an effective executive thinks about doing." (Bennett)

The rich array of terms related to this core competency are generally viewed as elements of a person's character. Listening to the interviewees, however, the team began to see *Integrity* in a new light, as a feature of relationships and reputation that leaders can and must develop through their day-to-day actions and communications.

> ***Credibility. Which means things like being honest, reliable, treating people the same. Following through on your commitments.*** (Adams)

> ***Fairness in business conduct. Can I look at myself in the mirror and honestly say I have conducted myself in a fair, reasonable, non-hostile way that engenders respect?*** (Bennett)

> ***It was a thing of conscience and common sense, in my mind. Having walked on that surface and gotten my feet tangled up in that wire, it simply would not have been right to ask my people to work in those conditions.*** (Jeffreys)

Because this analysis focuses on competencies specifically for the most powerful people in the railroad industry, the researchers wish to highlight and conclude this subsection with a statement from Oliver regarding the relationship between power and integrity. Oliver's assessment is that the more powerful an executive is, the greater her or his responsibility to obey the rules and to set a positive example for everyone in the organization.

> ***Integrity. I've seen both sides of this business. Some people think you get to a certain level and you're above the law. I believe it's the opposite. As a leader, you can't expect people in your organization to comply if you're not doing so yourself. Comes right down to something as basic as PPE.*** (Oliver)

*Pushing my people to be the best they can be.*

### *Mentoring Received and Delivered*

Mentoring is typically thought of in positive terms, and indeed it is a powerful positive force in any organization. However, one of the interviewees reported some serious gaps and problems with the mentoring she received—and did not receive—as she was climbing the ladder in her organization.

> ***[The area I supervised] got the best responses on the assessment—this was true across the whole organization. Always came out with the best results. [Yet those] fantastic reviews in relation to other operational functions didn't even get reflected on me . . . Did not come through in individual evaluations of my performance.*** (Adams)

Though Adams does not say so explicitly, in the context of her full story, there is reason to wonder whether the fact that she was a female executive might have blocked her from receiving the positive feedback, mentoring, and evaluation her performance seemed to merit.

Yet Adams also reported some stellar instances of mentoring from which she benefited.

> ***In that role I was writing letters on his behalf. [He would ask me:] "Have you considered this? Have you talked to that person?" Pushing me to make sure I'd talked to all the people, had all perspectives the issue required. Connecting me. Who's who, their input, how do I synthesize?*** (Adams)

Adopting a popular image to describe a certain form of leadership, Bennett compares himself to the coach of a football team.

> ***I'm more a coach than a general. I don't give orders, as if to military recruits, and expect them to be followed out of a sense of duty. Think of a college football team with 90 players on the roster. The coach is the leader, disciplinarian, ultimate play caller, and hopefully has a system in place to motivate the squad to be competitively successful. He is re-hired or fired at the end of the season depending on owner and fan reaction.*** (Bennett)

Graff, too, adopts the coach description, though it sounds as if his players have a slightly tougher time than Bennett's. Of course Graff sees his toughness as essential to the growth and success of his supervisees.

> ***I'm supportive of my people. I beat them up, like a good coach would do. And I make them keep going. I try to do it in a supportive way. But I do push them, otherwise people won't reach their potential. Developing people is my job. We need it; I need it; they need to build their potential so they can do their very best work.*** (Graff)

Yet even the "beat them up" coach recognizes the importance of support and nurturing. Underneath his hard-driving exterior, this coach is apparently deeply caring and concerned.

> ***Particularly in this day and age, the whole sink or swim thing has got to go. In the past, there were other people around, so there was help. But today we ask so much of people, that you gotta keep an eye on them. If you're going to give them something they could get into trouble on, then you have to help them.*** (Graff)

Hayden evokes the same "sink or swim" approach that Graff dismisses, but with a twist that makes his mentoring model line up pretty well with Graff's and even Bennett's:

> ***Throw people in and help them succeed is what you have to do. That's what people did with me. They threw me in the pool.*** (Hayden)

Asked about his past mentors, Jeffreys tells a brief story that illustrates how he learned to think and care about his people first ("I love people," he comments elsewhere):

> ***[Jim] was larger than life to me. His response to Hurricane Hugo in 1989 is the stuff of railroad legend. After Hugo had come ashore, done terrible damage, Jim was surrounded by people who were trying to get the railroad back up and running. He said, "I don't want to hear about another damn train until I know how you are taking care of my people!"*** (Jeffreys)

Describing one of his early supervisors, Sutter provides further illumination of what makes mentoring successful.

> ***He would let me blow things up. He'd know it was going to blow up. [He'd say] "If you're not going to move it over a little in this direction, then I have $20 that says it's going to blow up." I lost a lot of $20 bets. He was a great coach, never let me take it too far, to a place that could not be saved.*** (Sutter)

Reflecting on approaches to leadership in a way that fits with the comments of the other interviewees, Travers makes an important distinction. She notes the difference between a demanding environment—which is necessary to profitability—and a demanding style of leadership.

> ***There will have to be a change in management style. The heavy-handed approach won't work. It has to be collegial and coaching, not demanding. A demanding environment, yes, to make money. But not demanding in terms of leadership style.*** (Travers)

### *Diversity*

*Talk to the left fielder.*

> ***There is a growing hunger for cross-pollination, working from multiple perspectives.*** (Sutter)

> ***Take advantage of diversity. Listen to the left fielder.*** (Remington)

Not only was valuing diversity a significant and substantial theme in the participants' reflections on executive leadership, but it was also noted as a multi-faceted, multi-dimensional value—and practice—for railroad executives.

To prevent "insight monopolies," leaders want viewpoints shared across levels within an organization:

> ***Too many companies have a hard time transmitting valuable information and viewpoints from top to bottom of their organizations—and from bottom to top. Perspectives may differ, but no one has a monopoly on useful insight. When we hire a body, a brain usually comes with it.*** (Bennett)

As a way of reducing "silo-ing," the participants also prize a "healthy" range of professional experiences across different areas within an organization:

> ***I think in a lot of ways you become a better railroader when you work for a small railroad. You have to wear many hats, which is healthy.*** (Graff)

In addition to these more general kinds of diversity, interviewees spoke of the importance of valuing and growing two specific kinds of diversity, those of gender and ethnicity.

> ***Females are horribly missing in the operating department. We have huge gaps there. Only one AVP in the northern region is female. I think we're doing okay with Latinos in the field. Not with Asian or Indian employees. The boss I had in Northern California is our lone African American executive.*** (Sutter)

Jeffreys expressed his concern about how much talent the railroad industry is missing out on because the leadership network tends (as Adams experienced and expressed) to exclude women and ethnic minorities.

> ***Still largely a Good Old Boys' network. Obviously predominantly white male. "Bubba-ville." And it is absolutely clear to me that a lot of minority and female talent is being missed by this industry. Good gracious, it's a huge miss.*** (Adams)

Adams acknowledged the broader cultural rhythms that create long-time networks, which can preclude participation for some. Her other jobs as life partner of an executive-level husband and mother of teenage daughters limited her opportunities for conventional networking.

> ***I didn't have time to be part of the Old Boys' network. Did not have time to go out for drinks, get out on the golf course. And relationships are developed during those times.*** (Adams)

Other valued kinds of diversity include academic and professional. Adams observed that her college degree in psychology helped her understand and navigate co-workers' personalities and organizational politics. Bennett came to the railroad industry with a background in business and finance, which he found helped him understand and predict fiscal dynamics in the organizations he led.

*Have a continuous hunger to learn.*

### *TLK—Thinking, Learning, and Knowledge*

> ***Questioning: We learn more by not accepting things at face value.*** (Bennett)

This is the only main competency in the analysis broken into (three) distinct parts. The research team hopes it is obvious why the terms and concepts collected under Thinking, Learning, and Knowledge were grouped together. The distinctions among these related ways in which railroad executives *use their minds* were maintained.

**Thinking.** Several interviewees pointed to analysis as a kind of thinking that is crucial to the success of industry leaders. Their comments also helpfully illustrate and develop an understanding of what analysis means in action. Adams provides a good starting point with her definition of analysis.

> ***Looking at the data. Understanding how it affects [the organization].*** (Adams)

Graff elaborates with insight into how skillful analysis helps executives keep their heads above water.

> ***. . . executives need to be able to put it all together and know which things to react to. Otherwise you get overwhelmed and go crazy.*** (Graff)

But analysis alone doesn't yield results. Sutter explains how a keen analytical mind needs to mesh with organizational politics to innovate.

> ***Working from solid data. Get your arms around the issue. Then test it. Find somebody who is willing to try it out. Get buy-in, have them help you check your assumptions and strategy, and then if it pans out, go system-wide with it.*** (Sutter)

Bennett notes how his background in financial analysis helped him when he joined the leadership of a major railroad:

> ***I started out as a transportation analyst for a Wall Street research firm before moving into the rail industry. . . .*** (Bennett)

The participants also valued other kinds of thinking: envisioning the future, questioning, and weaving one's insights into those of colleagues.

> ***I had to stay many steps ahead of others. . . . Always trying to think a couple of years down the road.*** (Adams)

> ***In my 37 years, a lot of smart people have passed through here. The ones who really stand out are the ones who are not afraid to ask questions. Not afraid to admit what they don't know.*** (Remington)

> ***The worst thing you can bring to a problem you're trying to solve is your solution. Best is to suppress it, let the people you're working with get their ideas out, and then begin blending. And most of the time, if you've got the right team in the room—and we've got some very, very smart people working here—somebody is going to come up with something close to what you were thinking. Gives you an opening to offer some of what you've got, if you still want to have some influence on the discussion.*** (Sutter)

While analytical thinking allows leaders to take data apart and see patterns, democratizing ideas, posing questions, and seeing to the future introduce more creative and courageous modes of thinking into a deeper understanding of executive leadership competencies.

Several interviewees emphasized the value and importance of innovation. Bennett, however, noted (without explaining why) that the railroad industry is not an easy place to "build a better mousetrap":

> ***In any case, it's hard to be innovative in this industry, either with the major carriers or in terms of regulatory constraints. . . . I love the opportunity to design a better mousetrap: a better way to deliver services to a customer, to finance getting something done, to work through an issue with a hostile customer. Solving a problem is extremely interesting and satisfying to me.*** (Bennett)

Sutter offers a similar concern, linking the difficulties in "taking initiative and risk" to the heavy responsibilities that come with executive leadership.

> ***A core competency out in the field was without question taking initiative and risk . . . thinking outside of the box. But at headquarters, it all has to go in slow motion.*** (Sutter)

**Learning.** Learning is the second sub-theme in this subsection. In contrast with knowledge and analysis, learning is the active and continuous process of seeking new knowledge and making it part of one's understanding of the world. Remington notes how the culture of his railroad foregrounds and promotes learning in the workplace.

> ***I have a continuous hunger to learn. . . . This learning is always going on in the railroad business: for example, quizzing each other during industry meetings happens all the time. So for younger people to get exposed to this is really important.*** (Remington)

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Graff explains how he seeks to develop his own expertise at the same time he relies on the knowledge of his team.

> ***The ability to develop expertise. So, in my current job, I am learning the technology I'm responsible for. So now I lead and deliver using the people on my team who have expertise that I don't have, personally.*** (Graff)

Hayden adds a valuable dimension to this discussion of the importance of learning as a competency for executive railroad leaders: he finds that one of his most important skills is *facilitation*, the art and science of promoting and supporting learning in others.

> ***I've benefited from facilitator training. It's probably the single most beneficial training I've had in dealing with various types of people, any group from high-school-educated folks on the shop floor who may not be well-spoken but certainly know their business and what they do up to the folks who have Ph.Ds. in stress analysis and very specific and technical things—smart and well educated but have their needs and fears and frustrations, as well.*** (Hayden)

Finally, echoing organization guru Peter Senge, Graff points out that learning is crucial not just for individuals but also for organizations. Railroads, he says, are built to be learning organizations; their day-to-day functioning requires organizational learning.

> ***You want to work for a learning organization. There's nothing stodgy about railroads. They are quick-moving, very smart organizations.*** (Graff)

**Knowledge.** Here is where the obvious is stated: Railroad executives need extensive knowledge of their industries, organizations, and people. This knowledge is key, in many ways the basis of their success as leaders and the starting point for all other kinds of thinking and learning.

Peterson observes how his "broad base of knowledge" was the key to earning him the respect and credibility he needed when he stepped into a leadership role.

> ***The broad base of knowledge that I had was key to my work as an executive. The subject matter expertise I developed about the complexity of the rail industry . . . over the course of my career . . . [provided me with] a real strong, on-the-ground knowledge of railroading. What that did for me was give me credibility when I got my first promotion into leadership. I could walk the walk and talk the talk with the operational level as well as the office. I was able to maintain my professionalism and credibility because I knew what I was talking about.*** (Peterson)

Oliver echoes Peterson's remarks on knowledge, emphasizing how the growth of the industry puts increasing pressure and weight on leaders' breadth and depth of knowledge.

> ***I have always worked in the rail environment. So I know operations from the ground up, which is a great advantage, both in terms of technical ability and ability to relate. I started as an agreement employee and then had increasing levels of management responsibility over 26 years. Our business is very difficult to understand if you've never been in it. Continuous movement, you know, and service provided 24/7/365. People get on a train, and they think they know how it runs, and they have no idea about the complexity of the environment.*** (Oliver)

Making a point that is crucial to the effectiveness of future industry leaders, Oliver goes on to note that many in the upcoming generations of railroad leaders will not have had the opportunities to learn railroading "from the ground up." He wonders how they will carry with them the deep understanding of the experiences of line workers if they lack those personal experiences.

> ***So, future executives will need to develop a deep knowledge of the railroad workforce in some other way. Of conductors, laborers in the shop, driving spikes in the field. The people who really run the railroad. Front line or supervision. How will we instill that in folks who haven't been out there working in the rain, snow, 24/7? It is very different working in those conditions in your office than it is if you're the one out there clearing switches.*** (Oliver)

Peterson briefly re-states exactly the same concern.

> ***It's going to be very interesting, because they will have to have some strong real-life experiences in the field in order to make solid decisions going forward.*** (Peterson)

*That pyramid has leveled out.*

### *Shared Decision Making*

This theme already appeared as a part of the discussion on diversity. Shared decision making earned status as an executive leadership competency in its own right due to the frequency with which the interviewees discussed it as a democratizing organizational strategy. Encouraging and gathering input from multiple perspectives across the organization was one of the competencies the participants valued the most.

One take on the challenges and promises of participative decision making comes from Graff. He observes that managers have to overcome their reluctance to rely on their people, to "load them up." Only that way, he notes, can the organization learn workers' potentials.

> ***These kids today are smart. They want to be challenged, and too often we coddle them. How do you know how much they can handle until you load them up? My people will be working their butts off, not delegating very well. And they say, "I'm not sure they can do it." And I say, "How will you know until you ask them?"*** (Graff)

Peterson provides a historical perspective on the flattening of organizational pyramids in the industry.

> ***There's been so much transition in the railroad industry. In the early days when the executive walked down the hall, you wouldn't even look at them. They wouldn't acknowledge you. That's the way it was back then, and that pyramid has leveled out significantly. Much different today. The people we're bringing into our organizations are smart, confident, and they know where they want to go.*** (Peterson)

Another executive describes a similar strategy in the briefest of terms:

> ***I take my cues from what [employees across the organization] are seeing, and the rest takes care of itself.*** (Jeffreys)

In harmony with Jeffreys, Hayden observes that the top value and strategy in his approach to leadership comes down to trust.

> ***Trust of the folks that work for me is the most important thing for me.*** (Hayden)

Sutter vividly describes the melding of diverse perspectives to yield results to which virtually everyone in the organization is committed.

> ***Here I spend the majority of my time drawing other people's ideas up and out of them (usually in that process somebody is going to come up with something that is close to yours), and blending them and slamming them into one another to come up with an outcome that is not too debatable. Sometimes that takes days, multiple meetings.*** (Sutter)

With a different perspective but also (like Peterson) with a historical view in terms of leadership style, Bennett delegates decision making but with a view to the future.

> ***Participation in "global" decisions fosters individual advancement and buy-in. . . . The dictatorial military style doesn't work today. My approach is "softer" than many. It's designed to push decision making down in the organization rather than issuing edicts from the top . . . I want to be able to retire knowing that my successors understand how key decisions are made, and why. In the last few years this has worked out very well, and our people are reaching the right conclusions on their own a very high percentage of the time.*** (Bennett)

Bennett observes at several points that the financial structure of his employee-owned railroad not only helped promote shared decision making but also made it unavoidable and standard operating procedure.

> ***[Under] the aforementioned employee ownership plan, we want every employee to think like an owner and strive to be the best at his or her responsibility. Our teammates have a meaningful stake in the outcome of what they can accomplish together.***

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***[My organization] was the first and is the only short-line railroad with a formal employee stock ownership program. . . . More than half of our present roster of employees have become stockholders without a required personal investment other than time, attitude, initiative, and commitment to team play. Fifteen are fully vested in the plan and should have six-figure interests to be paid out when they leave, retire, or die. This income supplements railroad retirement, of course, but it's much more than that. The employee stock ownership program is a mechanism that focuses everybody's eye on the ball to create value for our customers and each other. Two other short lines which followed [our organization] with that model have been bought out, and their employees did very well in those transactions.*** (Bennett)

*Getting results and knowing the why.*

### *Performance*

In a variety of ways, the interviewees all expressed a deeply felt understanding that their roles as industry leaders depend on delivering results in noticeable and measurable ways. They were also very clear that their jobs depend on expecting a high level of performance from everyone else in the organization and finding a way to get them to meet those expectations.

In this memorable story, Jeffreys explains how these two kinds of performance—of the leader and of the rest of the people in the organization—are closely related, each depending on the other.

***My whole managerial approach changed at that time. I had been Assistant Train Master, Train Master, Terminal Manager in charge of a facility. But when I got to [a new city], I went out into the yard, and I asked a guy to talk to me, help me get oriented. He said, "You guys aren't serious about safety. Where I'm sitting now, my normal spot is soaked because the roof has been leaking for 2 years, people been going to fix it for 2 years. So, I'm not much interested in talking to you."***

***So. I went to the Engineering office and asked that the hole in the roof be fixed that day. And it was. So the next day I went back and said, "Okay, so I got your roof fixed, now I want to talk to you about safety." The guy said, "Sit down, I'll talk to you. Finally somebody who listens, who really cares."*** (Jeffreys)

Taking the specific point of view of safety, Jeffreys also notes the mutuality of responsibility.

***It is my job, my responsibility to get you home to your family every night for the long haul. And you have a responsibility as well: to take advantage of all the tools we provide you to get yourself home safe as well. And to tell me how you are going to do so.*** (Jeffreys)

In other cases, expectations for leaders to deliver results is perceived more bluntly.

***They pay me a lot of money, and so they expect me to perform in a big way. I have got to deliver if I want to continue to work here, and I want to continue to work here.*** (Graff)

Sutter notes the realities of relentlessly high performance expectations even for those already at the executive level.

***You might feel like you are being groomed, but if you don't deliver, the niceties are over. I have always felt I have to earn the right to go to the next place. I have never done what I was doing because I hoped it would polish my resume for promotion.*** (Sutter)

*Do the right thing.*

### *Political Awareness*

Political awareness, or "the political read," involves nurturing productive relationships of three kinds: within one's organization, among one's own and other organizations, and with members of the public and/or public representatives (for example, regulators).

In a lively illustration of careful and caring cultivation of good relationships with the public, Bennett told a story about a woman whose view from her front porch was blocked by some of his organization's railroad cars.

***We received a message from an elderly woman who lived in a retirement community not far from [our organization's] spur track. She spent most of her time at home, out on her porch on pleasant afternoons. Her message asked why the railroad had left railcars parked for weeks, blocking the scenery for her and her neighbors. I was pleased that she called, because it was just something that our trainmen simply hadn't considered. So I looked into it and promptly saw to it that the cars were moved and her view was opened up, for which she was embarrassingly grateful. The public too often sees the railroad***

***as an annoyance rather than a good corporate citizen and community asset, and we can easily become overly absorbed in our own affairs.*** (Bennett)

Note that for Bennett, this is a story about doing the right thing for a neighbor, but it also tells the tale of changing—one mind at a time—the general public's impression and image of the railroad industry. Remington makes a similar observation about the spareness of railroading's public image:

***Something that's neat about railroads is that most people don't know that much about how railroads work. We stay in the background except when bad things happen.*** (Remington)

In describing her mentoring of her people around relationships with the public, Adams points out that the issue is both moral and political.

***My overriding expectation is that you will do the right thing. Whatever you do needs to withstand scrutiny from Public Television, CNN, emails, everything. I pushed them to be front and center. I played a background role; my team was visibly doing everything out front. "Watch what you say, watch how you say it," I told them. "How would it look if it were on CNN?"*** (Adams)

Relationships with fellow railroading organizations also require care, strong ethics, and proactive solving of problems to facilitate communication and cooperation among railroad leaders.

***In the job I have now [where I am responsible for the rail networks that cross virtually the entire US], relationships with all the other railroads have to be in good standing, resolved across companies so that [my boss] can have open conversations with his counterparts in those organizations rather than having to work through the issues that are my responsibility to handle.*** (Sutter)

Putting it more bluntly, Sutter asks himself:

***Have I successfully worked the boss's issues?***

Politics internal to one's organization deserve equally careful attention. Oliver explains how he needed to teach his people to focus on those elements over which they had control in order to improve on-time performance.

***Focus on that we're moving PEOPLE, not just trains. Consider the customer, whatever we're doing. . . . Up to then we had had long-time goals of 95% on-time performance. We never, ever met that goal in a long-term way. Maybe a month here and there, but we couldn't ever sustain it. We knew this was mainly because of [an affiliated organization]. So I did not want to set a goal we could not meet. I asked my team to analyze what they control. Worry about yourself, don't focus on the things you can't control. Don't worry about what everybody else is doing. From the exercise, we learned about many more things we could do, many more things that were actually under our control. Two years ago we went with 95.7%. Exceeded 95%. And we continue to do it today.*** (Oliver)

Graff, by contrast, tells a story about political awareness and development that is more personal.

***I blew it in [my previous position]. There I had the attitude of "lead, follow, or get the F out of my way." I didn't sugarcoat it. And that alienated a lot of people. I created some bad blood, unnecessarily, really. So when I left there I made a pact with myself that I would have no negative relationships here. Zero. None. If there is anything bad in a relationship, then it's all mine to fix. And I hold myself to that commitment here every single day.*** (Graff)

Graff took the opportunity provided by a change of positions and organizations to make a new commitment to positive relationships within his organization. This is a superb example of the sort of developing political awareness to which the participants repeatedly commit themselves.

### *Financial Discipline*

*You have to recognize that the financial side is there.*

In answering the questions asked, nearly all of the interviewees grappled directly with questions of money. Finances literally function as the bottom line in every business, and it's obvious that the participants take financial issues very seriously. It was also noted, however, that financial dynamics and challenges typically were understood as opening up opportunities of other kinds or providing insights into areas beyond the financial.

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Graff, for example, noticed how a shift in the scope of one's organization's finances makes possible not only enhanced financial aptitude but also a more finely attuned relationship with customers.

> ***If a person goes from a company that deals in billions of dollars to one that deals with millions, you become much better at managing money. And you get much more in tune with your customers, who are the source of that money.*** (Graff)

Jeffreys is openly cautious about publicly linking safety concerns with financial concerns. But it's clear that he thinks about that relationship all the time.

> ***Discussions about the financial benefits of safety have to be kept within the inner circles of leadership. . . . I don't talk about it in public. In so many ways, take grade crossing incidents, for example, the fatalities can be multiples, and then you have to contract with outside law firms to represent you. Legal counsel charges $300 to $600 an hour to represent you, which obviously can really become expensive. And that's on top of medical expenses, down time, employee replacement costs, claims, a lot more. So preventing those events is an extremely important thing to do from the financial side also. And I know that. But that's not the side of it I am focused on. If we take care of our people, and our people take care of themselves—and each other—the rest will follow.*** (Jeffreys)

For Jeffreys, financial awareness and responsibility are a means to a higher end: responsible and safe conduct by everyone in the organization.

Graff noted how shifts in the financial landscape of families whose members work in his organization are presenting new challenges for focusing and motivating employees.

> ***Today, unlike the old days, you've mostly got dual-income families who are trying to raise kids and who face all kinds of complications that are real. It's hard to come up with financial incentives that can compete with people's commitments to their families, their personal lives.*** (Graff)

Previously, as part of the discussion of *shared decision making*, Bennett highlighted the benefits of his organization's history of employee ownership. Here, with a focus on the financial dimension, Bennett's strong belief that the financial commitment employees make by taking partial ownership in his organization plays out in tangible ways in the daily functioning of his railroad was revisited.

> The employee stock ownership program is a mechanism that focuses everybody's eye on the ball to create value for one's customers and each other. (Bennett)

*Because I couldn't afford to lose the guy.*

### *Understanding and Advocating for the New Railroader*

The participants were prompted to look to the future and point to where executive leaders in the rail industry will need to direct their attention moving into the 21st century. A very strong theme that emerged from their responses focused on ways to attract, understand, develop, advocate for, and keep the new generation of railroaders—including future leaders.

**Attracting and Keeping Young Talent.** Hayden starts this conversation with a blunt numerical account of how much harder it is becoming for railroads to keep their talent.

> ***The railroads have to be cognizant of the fact that the retention rate isn't going to be as great as what we would like. Retention rates for new hires at entry-level . . . 25% at best, I'm guessing. Management hiring and trainee programs . . . if we retain 50% we're doing very well.*** (Hayden)

This shifting market for organizational leaders also draws Remington's attention. He notes that the new generation is less tied to a single organization—or even a single industry—than when he was coming up.

> ***Generally speaking, back then people in the railroad didn't have the formal education to have options outside the railroad. We all went through the normal climbing and attrition over our lives as railroaders. Today's talent makes itself very marketable—and to companies outside of the railroad. This is a big, big change for us.*** (Remington)

Peterson offers a similar observation, pointing to the qualities of executive leadership that he believes will attract and retain railroad talent. Note that every item he lists is a competency highlighted in this report.

> ***One of the great challenges for leaders is getting the respect of the people they are leading. You have to find that through integrity, your knowledge base, strong people skills, your communication skills. The danger for the railroad industry is that the kids who develop those skills will be successful whatever industry they're in.*** (Peterson)

In connection with changes in leadership styles discussed under "Mentoring Received and Delivered," several interviewees noted that it's not just the leaders who are changing; the whole culture of the industry involves new kinds of relationships and roles. These new roles include those of the incoming generation of employees.

> ***[Key competency for industry leaders:] Understanding the new railroader. There's been so much transition in the railroad industry . . . It's much different today. The people we're bringing into our organizations are smart, confident, and they know where they want to go.*** (Peterson)

Graff agrees with Peterson on the shift in interests and capabilities of today's new hires:

> ***These kids today are smart. They want to be challenged. And too often we coddle them.*** (Graff)

Travers goes a step further, explaining what she sees as the key leadership strategy by which to bridge the high expectations and ambitions of new employees with the risks of their taking on more responsibility than they may be ready for.

> ***If you look at the next generation that is coming up, it's pretty different in a lot of ways, particularly in how they communicate and expectations for the workplace. They use media a lot more. They want responsibility quickly. How do you do that when they're not ready, but it's what they want? [You have to put] safeguards in place to give them responsibility without risk to anyone.*** (Travers)

Graff has a similar take on how to manage the unprecedented speed and urgency of new employees' responsibilities:

> ***. . . today we ask so much of people, that you gotta keep an eye on them. If you're going to give them something they could get into trouble on, then you have to help them.*** (Graff)

Sharing a personal story, Peterson highlights a shift he made as he rose through the ranks of rail leaders. Based on his early painful personal experience, he pledged to himself never to ignore urgent family circumstances in the lives of the people working for him.

> ***When our first baby was due, my boss wanted me to go to a class for work. I asked not to go because the class schedule conflicted with [my wife's] due date. But my boss was completely unsympathetic. "You have no choice," he said. "If you want the job, you will go to school. If you leave it, you'll have to do the whole two-week school again." I'll tell you what, that set in my head for the rest of my career. And I never did that to any person who reported to me.*** (Peterson)

Adams shared a similarly personal story of the traditional railroad culture in which the skills of many of today's railroad executives were honed.

> ***Leaving when I did was probably the best decision I ever made. I know this is personal, right? Everybody's circumstances are their own. My husband's job required weekly travel. I was raising two teenage daughters and traveling three times a month. My executive-level peers had absolutely no understanding of my situation. Most had stay at home wives who supported them.*** (Adams)

Graff notes that these movements toward more respect and concern for railroaders' lives beyond the workplace are driven by the expectations of the new hires themselves, but he also sees the shift reflected in U.S. society at large.

> ***The whole work–life balance thing is much bigger than it used to be. I say that because the people we're bringing on now, they're saying it. The whole culture of telling people they have to move: that's not going to work anymore.*** (Graff)

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**Anticipating What the Next Generation of Railroaders Will Need to Know.** Here is what the participants saw as they looked into their crystal balls to predict the needs of future generations of employees in the rail industry.

For Sutter, getting people working together to support and guide one another is the key.

> ***Teamwork and collaboration across departments and work groups will be really important. . . . You can call it knowledge transfer if you want. But at the end of the day, there are too many new kids out there. So they're going to have to teach each other. . . . Executive leaders will have to be hugely okay with failure on some level, because there is newness on every corner, on every job, on every train.*** (Sutter)

Where Sutter's approach focuses on organizational structures and systems, Graff finds the solution to rampant new-ness in the personal qualities of hard work, honesty, and passion.

> ***They gotta have a good work ethic, that's all there is to it. They need to come to the realization that transportation is a nonstop business. Airlines stop for about 8 hours a night. Freight railroads don't stop for anything. Let's be honest about this. We are going to need good people, people who are honest and have some passion.*** (Graff)

Remington notes the impact of ongoing and future changes specifically on union–management relationships, and the news is good, based on the special, shared meeting ground of safety.

> ***The union–management conflict myth is evaporating as we speak. Both sides are seeing that we need one another. So need to figure out what the next era of professional relationships looks like. The distinction between union worker and management is changing every day. Safety has been front and center in this change.*** (Remington)

*Dealing with advanced technologies is like drinking from a fire hose.*

### *Technologies*

Often when society talks about "technology" in the 21st century, it is understood to mean information technology and computer technology. And of course these are important kinds of technology in the lives of the interviewees (see the subsection on thinking and especially analysis of quantitative data). However, a more old-fashioned sense of technology (i.e., machinery) is also prominent in the participants' reflections on the role of technologies in railroad leadership.

When Oliver mentions technology, he is talking about social media. He recognizes the significance of social media to the future of the railroad industry (and everything else), but he does not deal with them personally or directly.

> ***I don't keep up with the technology side at all. We have a Communications/Customer Satisfaction Department whose job it is to work Twitter, Facebook, etc. And they do a great job. I leave the technology to them.*** (Oliver)

Peterson speaks of information technology as a social phenomenon that is changing how younger generations think, learn, and work.

> ***Their life experiences are clearly different from their bosses'. Because of the influences of social media and TV, this is clearly a significantly different generation. They show a wider variance than there has been with prior generations. The grip of technology has really taken hold of how we think and react. Here on the job and at home. Decision-making processes are just changing. A whole bunch. . . . I found it really interesting that my grandson got an iPad when he went into sixth grade.*** (Peterson)

As noted previously, however, important technologies are not limited to computers. Hayden offers a personal story to illustrate a dynamic consuming the entire industry (and society): the urgent need to know how to use railroading technologies and the enormous promise they offer for safety and productivity.

> ***[Around 1996], the latest technology was wheel-impact detectors, and we had three on the whole system [of my previous railroad]. Fast-forward to fall 2008, and one of the committees that I come to—one***

***dealing with advanced technologies and research at [my new organization]—it was like drinking from a fire hose. Over ten to twelve years, there was an explosion of technology, growing while I was doing something else. We rely on technology and need to know what it can do without getting into the details. Knowing how it works, how it can be made reliable, and knowing what its faults are—those are important skills for people coming up in the industry today.*** (Hayden)

Hayden sounds a familiar note of the urgency and pervasiveness of technological awareness in the industry and beyond.

***People have to be technologically savvy. Technology is taking over the world, not just the railroad industry.*** (Hayden)

Peterson gets the last word on technology in the railroad industry, pointing to it as a source of excitement, dynamism, and apparently limitless possibilities.

***This is an exciting time. Technology is changing so much. You look at it today and think, Who knows what railroading is going to be able to do?*** (Peterson)

### *Conclusion*

When asked for three words to describe his leadership style, Sutter began immediately with, "Optimism, absolutely." While optimism was not named explicitly enough by other interviewees to qualify as a core competency, it characterizes the spirit of every interview conducted.

The industry executives who agreed to spend time being interviewed did so generously, often driving the interview well beyond the time planned. They offered their reflections (sometimes quite self-critical); stories drawn from their vast experience; and ultimately, their collective best vision of a healthy, sustainably competitive railroad industry for the ages. They were "all in," fiercely committed to the remarkable people from the ground up through the board room. Most of all and regardless of tenure, they affirmed railroading's complex past and exciting, challenging future.

Sutter, who is currently in a particularly challenging mid-career stretch assignment, was relentless in his remarks about making railroad performance better, *more* right, every day.

***Tenacious. When something locks in my head and is statistically tied to what I am trying to solve, and it threads all the way through to the front line, then I am a fanatic, a bulldog. You have to be. The guys I used to work with in the field knew this about me, would shake their heads when they saw me coming at them with something. Because they knew I would be relentless about it. "Surely," I would say, "we can do better than this. I know you can figure this out, and I look forward to seeing how you do it."***

***. . . It's really just getting your hands on and mind around what everybody knows is already happening (and not happening) on the ground and working it so that you can take daily performance to levels people can't even imagine.*** (Sutter)

This research effort found 11 key competencies identified and discussed by railroad executive leaders who participated in the interviews. The basic names of the competencies themselves present relative few surprises. However, the textures and nuances of the comments the interviewees offered and the stories they tell can point the way to more focused, more successful development of future railroad leaders. Given the new challenges facing the industry, many of which are explicitly identified by these participants, the research team strongly believes the findings in this report will prove valuable and possibly crucial to creating a thriving 21st century for the North American railroad industry.

## Competencies Overlap: Executive Leaders, Operations Managers, and System Engineers

Table 10 notes points of overlap between executive competencies and those of operations managers and system engineers.

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**Table 10. Competency overlap between executives, operations managers, and system engineers.**

| Executive Competency | Operations Manager Competency | System Engineer Competency |
|---|---|---|
| Communication | • Operations<br>• Communications & signal operations<br>• Yard & terminal operations<br>• Asset management<br>• Commitment to safety<br>• Business acumen & customer awareness<br>• Project management<br>• Personal effectiveness<br>• Utilization of information management tools & support systems | General<br>Emphasized in:<br>• Safety<br>• Project management<br>• Personal effectiveness |
| Integrity | Emphasized in all, with additional stress on working to consistent, reliable standards and regulatory compliance | All<br>Emphasized in:<br>• Personal effectiveness<br>• Commitment to standards<br>• Utilization of engineering tools & support systems |
| Mentoring Received and Delivered | Yard & terminal operations | |
| Diversity | • Communications & signal operations<br>• Business acumen & customer awareness<br>• Personal effectiveness<br>• Commitment to standards | • Communication & rail signal<br>• Project management<br>• Personal effectiveness |
| "TLK"<br>Thinking<br>Learning<br>Knowledge | Emphasized in all | General<br>Emphasized in:<br>• Track & infrastructure<br>• Communication & rail signal<br>• Bridges & structures<br>• Commitment to safety<br>• Project management<br>• Personal effectiveness<br>• Utilization of engineering tools & support systems |
| Shared Decision Making | All<br>Emphasized in:<br>• Business acumen & customer awareness<br>• Personal effectiveness | All<br>Emphasized in:<br>• Personal effectiveness<br>• Utilization of engineering tools & support systems |
| Performance | • Operations<br>• Communications & signal operations<br>• Yard & terminal operations<br>• Traffic planning & logistics<br>• Business acumen & customer awareness<br>• Personal effectiveness | Emphasized in all |
| Political Awareness | • Business acumen & customer awareness<br>• Personal effectiveness | • Project management<br>• Personal effectiveness |

**Table 10. (Continued).**

| Executive Competency | Operations Manager Competency | System Engineer Competency |
|---|---|---|
| Financial Discipline | • Operations<br>• Communications & signal operations<br>• Yard & terminal operations<br>• Asset management<br>• Business acumen & customer awareness | • Project management<br>• Personal effectiveness |
| Understanding and Advocating for the New Railroader | Personal effectiveness | Personal effectiveness |
| Technologies | Operations<br>• Communications & signal operations<br>• Yard & terminal operations<br>• Business acumen & customer awareness<br>• Utilization of information management tools & support systems | General<br>• Track & infrastructure<br>• Communication & rail signal<br>• Bridges & structures<br>• Project management<br>• Utilization of engineering tools & support systems |

Note that executive's "TLK" competency includes the large majority of sub-competencies related to technical and specialized railroading knowledge for half of the executives interviewed. The remaining executives who did not come up through the haws pipe offer mastery-level technical competencies outside the bounds of technical railroading, including business, economics, logistics, marketing, and psychology.

## Rail Transportation Operations Manager Competency Model

### Overview

The rail transportation operations manager competency model was developed to provide insight into the key knowledge, skill, and attitudinal attributes of effective operations professionals in the rail industry. Given the wide range of roles and responsibilities, as well as the highly varied nature and structures of organizations within the industry, this model is designed to provide a more "generic" description of competencies common to effective practitioners while exploring competencies of common operations "disciplines." Because competent practice is couched within the culture of the employer, not every attribute described here will apply to every operations managerial role. Rather, the model gives a comprehensive, yet general, assessment of competent practice within the industry.

The model includes seven core competencies that are common across organizations in the rail industry. Similarly the model contains competencies associated with five disciplines. For each competency, knowledge, skill, and attitudinal attributes that define the competency are presented. In addition, confirming behaviors are presented that describe how one can demonstrate the presence of the competency in professional practice.

#### *Target Subject Audience*

The target subject audience is operations managers working within the rail industry, including a wide range of job roles and responsibilities. Most of these persons are employed by passenger and freight rail companies and are responsible for the efficient movement of people and goods.

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Persons in this role generally "rise through the ranks" and most have a mix of OTJ training and formal training through an employer or trade school. Depending on the organization, operations managers may assume various roles and responsibilities, ranging from dispatch and rail yard management to construction project management and maintenance. Operations managers often work in increasingly complex and data-rich environments where timely and accurate decision making is essential.

### *Assumed Background*

For the purpose of this model, rail transportation operations professionals are defined as those with a minimum of a bachelor's degree in transportation, logistics, operations management, engineering, or a related field and who have work experience and employment within the rail industry or related sectors.

### *Levels of Engagement*

The target audience includes individual contributors and operations managers working in operations roles. The competency model describes the knowledge, skills, mindset, and confirming behaviors of effective operations managers within the industry. In developing the model, the research team gathered input from managers and individual contributors representing Class I, Class II, and Class III railroads; transit and commuter rail organizations; federal and state regulatory bodies; and rail engineering consultancies. This broad engagement provides insight into the critical factors that define competency within the industry.

### *About the Model*

In developing this model, the research team reviewed the competency modeling literature and benchmarked models used in a number of technology-based companies and agencies. In addition, the research team incorporated aspects of the "bodies of knowledge" promulgated by relevant engineering societies and professional organizations. Finally, the research team reviewed job descriptions and current job postings within the rail industry.

The rail transportation operations manager competency model is broader in nature and looks at a more holistic approach when compared to job task analyses and skill checklists that are common to vocational job models. The model has a hierarchical structure, with seven core *competencies.* Each competency is then made up of *attributes* that provide boundary, scope, and definition to the competency. Attributes describe knowledge, skill, and mindset of competent practitioners. Attributes are then further clarified by confirming behaviors.

### *Topics in the Model*

The overall structure of the competency model provides for consistent definition of competencies and their attributes. But since competent practice is defined within the context and culture of the local organization, individual competencies, and level of detail associated with them, will vary based on organizational characteristics. The rail transportation operations manager model was created for general application within a broadly defined industry; therefore, the model contains "generic" knowledge, skill, and mindset attributes.

In this model, the following seven core competencies and five discipline competencies are described:

- Domain knowledge—operations
  - Communications and signal operations
  - Yard and terminal operations
  - Asset management
  - Information management
  - Traffic planning and logistics

- Commitment to safety
- Business acumen and customer awareness
- Project management
- Personal effectiveness
- Commitment to standards
- Utilization of information management tools and support systems

## Competency: Domain Knowledge—Operations

This competency describes the knowledge, skills, and mindset demonstrated by competent operations practitioners. The attributes define a level of advanced understanding and application of technical and business principles, rules, regulations, and technologies relevant to the rail industry.

Attribute—Understand (Knowledge)

- Systems approach to concepts and practices as applied to rail transportation operations including one or more of the following:
  - Rail transportation system analysis.
  - Rail/industrial yard operations.
  - Signaling and control.
  - Scheduling, dispatch, and routing.
  - Safety operations management.
  - Maintenance management.
  - Intermodal operations.
- Logistics and the movement of people and goods.
- Supply chain structures and management.
- Relationships between capacity and flow in rail system operations.
- Cost and service quality.
- Industry-specific rules, standards, and processes.
- Applicable codes and regulatory requirements.

Attribute—Apply (Skill)

- Problem-solving methods and techniques.
- Common performance metrics to rail operations.
- Computer methods and techniques for operations and asset management.
- Industry standard measurement methods and techniques.
- Industry standard communication protocols and terms.
- Inspection and quality assurance techniques.

Attribute—Value (Mindset)

- Process discipline.
- Creative and open to alternative approaches.
- Personal and professional accountability.
- Personal and professional ethics.

Confirming Behaviors

- Maintains professional knowledge and skills by taking courses, attending conferences, and reading professional journals/other technical publications.
- Shares expertise through participation in formal and informal professional development activities including teaching, coaching, and mentoring.

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- Effectively applies technical and business knowledge to solve a range of problems.
- Keeps informed about technical, structural, and business changes in the rail industry.
- Is sought out as an expert to provide advice or solutions to operations and business problems.
- Recognizes personal limitations and seeks expert assistance and advice—submits to regular peer review.
- Evaluates network flows and their impact on rail system operations.
- Evaluates supply chain performance and potential implications for rail system operations.
- Employs tools and techniques for analyzing and predicting rail network performance.
- Selects and applies appropriate problem-solving and risk management methods and service reliability strategies to minimize and mitigate unanticipated delays and service disruptions.
- Performs professional activities based on sound professional and ethical standards.
- Delivers on commitments to meet schedule and budget expectations.
- Employs a quality systems approach to operations and embraces a commitment to continuous improvement.
- Efficiently applies practices in the configuration and routing of trains.

## Competency: Communications and Signal Operations

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of communications and signals. The attributes define a level of advanced understanding of operating principles that satisfy all FRA requirements, train control and signaling systems, train scheduling, and railroad communications technologies and practices.

Attribute—Understand (Knowledge)

- Operating principles of various signaling technologies.
- Centralized traffic control.
- Radio and digital communication systems.
- Integrated information management.
- Positive train control.

Attribute—Apply (Skill)

- Principles and concepts of the temporal and spatial separation of trains, including signal systems, mechanical and electronic interlocking, and various forms of communication.
- Rules, regulations, standards, and specifications that govern the operation of signal systems.
- Standards, practices, and applications of radio communications.
- Standards, practices, and applications of digital communications.
- Line capacity analysis.
- Technical and economic performance of traffic control systems.
- Rail operations modeling and simulation software.

Confirming Behaviors

- Understand and apply appropriate operating procedures for rail line and railcar signaling and communication systems.
- Develop performance specifications for vital and non-vital signal systems.
- Integrates and applies data from a wide array of communications technologies including radio, fiber optics, microwave, satellite, etc.
- Collaborates with rail engineering professionals and key stakeholders to develop performance specifications for complex projects.

- Develops detailed technical descriptions for signal and communications system requirements.
- Integrates positive train control systems into existing signaling and communications infrastructure.
- Develops performance testing and validation plans for signaling and communications systems.

## Competency: Yard and Terminal Operations

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of yard and terminal operations. The attributes define a working knowledge of the fundamentals of the relationship between yards and operations and the design of conventional yard and terminal trackage.

Attribute—Understand (Knowledge)

- Train configuration and routing.
- Capacity planning and management.
- Intermodal operations.
- Switching operations.
- Car and locomotive inspection.
- Brake inspection regulations, procedures, and processes.
- Hazardous materials—types, handling, and transportation.

Attribute—Apply (Skill)

- Implications of railroad yard and terminal configuration on operating procedures and practices.
- Safety implications of railroad yard and terminal configuration and operating procedures.
- Automated train and rail routing systems.
- Terminal operating and information management systems.
- Key performance indicators (KPIs) and performance metrics for terminal operations.
- Safety standards for the safe operation and inspection of braking systems.
- Guiding regulations and standards, including FRA, state and federal regulations, safety standards, maintenance, quality, and environmental.
- Information systems for the management and tracking of container terminal operations.
- Discharge and load procedures.

Confirming Behaviors

- Performs economic analysis methods to assure cost-effective management of yards and terminals.
- Continuously evaluates yard and terminal site conditions for safety hazards.
- Demonstrates and promotes a "safety first" lifestyle.
- Implements appropriate yard control and planning solutions to manage the entire yard network.
- Provides practical answers to co-worker questions about intermodal freight yards and terminal operations.
- Monitors the track and rail yard inventory to assure effective throughput management.
- Manages full spectrum of terminal operations, incorporating different elements of container terminal operations across the full cycle of ship, yard, and gate activities.
- Evaluates and manages key health, safety, security, and environmental issues in container terminals.

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## Competency: Asset Management

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of asset management. The attributes define a level of advanced understanding of efficient and sustainable asset management concepts and practices employed to optimize the delivery and performance of physical assets.

Attribute—Understand (Knowledge)

- Inventory management and condition assessment.
- Life-cycle cost and trade-off analysis.
- Preventive and predictive maintenance.
- Capacity assessment and planning.
- Strategic sourcing.
- Supply chain management.
- Asset management standards, including PAS 55 and ISO 55000.

Attribute—Apply (Skill)

- Asset management techniques, tools, and methodologies.
- Life-cycle financial analysis.
- Life-cycle costing tools and methods.
- Risk management analysis tools and methods.
- PAS 55 and ISO 55000 standards.
- Preventive and predictive maintenance methods and reliability management practices.

Confirming Behaviors

- Develops asset inventory, using standard asset management software tools.
- Develops and implements inventory and maintenance schedules.
- Implements asset management plans.
- Conducts gap analysis of compliance using accepted industry asset management standards and practices.
- Collects, organizes, analyzes, and manages asset documentation.
- Analyzes and routinely reports asset performance (production, sales, inventory, rail car movement, cost) metrics.
- Employs industry standard tools to identify and mitigate threats to asset management objectives.
- Designs and implements a system for integrating asset information to enterprise information systems.
- Evaluates infrastructure and timetable solutions to increase capacity and throughput.
- Identifies redundant assets and develops plans to optimize asset portfolio.

## Competency: Information Management

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of information management. The attributes define a level of advanced understanding of integrated information management for rail transportation systems.

Attribute—Understand (Knowledge)

- Data sources.
- Data structures.
- Data attributes.

- Computer networks and interface systems.
- Data analysis and visualization.
- Computer and network communication standards and protocols.
- Cybersecurity.

Attribute—Apply (Skill)

- Safety/security standards and regulations.
- Communications and railway signaling principles.
- Rail data reporting standards and methods using database tracking and other computer tools.
- Rail data management applications.
- Decision support information technology systems.
- Information modeling, analysis, and data visualization techniques.
- RailML or similar source data structures to manage infrastructure, rolling stock, timetable, and other data schemes.

Confirming Behaviors

- Integrates a variety of data including infrastructure, rolling stock, timetable, and other data schemes to support critical business decision making.
- Monitors and analyzes information and data from multiple sources to make informed maintenance management decisions.
- Implements cybersecurity practices to secure enterprise-wide control and communication systems.
- Evaluates and recommends new information management technologies based on organizational business requirements.
- Develops robust interfaces to simplify the transfer of data between various enterprise engineering, operations, and financial systems.
- Generates electronic and printed track charts from common data sources.
- Performs a wide array of track analysis and maintenance management activities.
- Evaluates information system maintenance needs and creates work orders in an efficient, integrated process.

## Competency: Traffic Planning and Logistics

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of traffic planning and logistics. The attributes define a level of advanced understanding of how to employ contemporary planning and logistics concepts to optimize rail operations.

Attribute—Understand (Knowledge)

- Train configuration and movement.
- Routing and load planning and management.
- Capacity and throughput planning and management.
- Financial planning and management.
- Rail system performance.
- Intermodal transport planning and logistics.

Attribute—Apply (Skill)

- Safety practices and hazards common to rail industry.
- Rail freight (shipping and receiving) processes, procedures, and pricing.

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- Passenger rail processes, procedures, and pricing.
- Continuous improvement principles and methods.
- KPIs and metrics.
- Statistical methods as applied to modeling of capacity and throughput.

Confirming Behaviors

- Develops and continuously improves plans, models, and forecasts incorporating key process and outcome metrics for logistics performance.
- Coordinates railcar movements, tracks inventory, and ensures customer shipments meet all customer requirements.
- Verifies the accuracy, completeness, and condition of incoming and outgoing shipments.
- Assists with the development and implementation of strategic supply chain initiatives.
- Plans, researches, and negotiates freight strategies and competitive rates.
- Establishes and maintains effective communication with shipper, carrier, and consignee.
- Prepares and publishes reports on performance and outcome metrics.
- Performs analysis to identify supply chain performance trends and to enhance cost containment and cost avoidance.
- Proactively seeks to identify supply chain and logistics problems and swiftly implements appropriate solutions.

## Competency: Commitment to Safety

This competency describes knowledge, skill, and attitudinal attributes that create a culture of safety. The attributes represent an advanced understanding and application of tools and processes in the operations of rail transportation systems, including rolling stock, rail system operations, maintenance, and rail system management and labor practices. Integral to this competency is creating a culture of safety, engaging a systems approach to safety, identifying and mitigating risks, and effective safety communications.

Attribute—Understand (Knowledge)

- Principles and advanced practices in systems safety.
- Hazards and risks inherent to rail industry.
- Hazards and risks inherent to rail system operations.
- Hazard analysis and reporting.
- Risk management.

Attribute—Apply (Skill)

- Methods and techniques to apply safety standards into daily rail operations activities.
- Methods and techniques employed in the analysis and mitigation of hazards.
- Recognize and immediately react to potential hazards.
- Systematic approach to implement safety programs and practices in rail operations.
- Principles, practices, and processes for inspections and audits.
- Principles and practices of communication for complex technical and business information as related to safety.
- Principles and practices of environmental safety and industrial hygiene.

Attribute—Value (Mindset)

- Constant vigilance.
- Propensity to act.
- Uncompromising expectation for safety.

Confirming Behaviors

- Creates a culture of safety.
  - Uncompromisingly expects safety at all levels of the organization.
  - Clearly communicates safety performance expectations and potential consequences for non-compliance.
  - Leads regular safety reviews.
  - Leads scheduled inspections.
  - Leads safety audits.
  - Incorporates safety metrics into operations.
  - Holds self and others accountable for safety performance.
  - Makes safety performance transparent across organization.
  - Recognizes and rewards team member identification of actual/potential risks, near misses.
- Uses a systems approach.
  - Integrates safety practices throughout operations and across organizational boundaries.
  - Coordinates safety activities with key internal stakeholders.
  - Applies safety management principles and practices.
  - Systematically analyzes "near miss" incidents and implements timely corrective actions based on findings.
  - Effectively engages engineering, education, and enforcement strategies to achieve safety performance objectives.
  - Actively participates in safety review panels.
  - Engages federal, state, and local incident responders in a proactive manner to develop and implement safety programs.
- Identifies and mitigates risk.
  - Applies a systematic and rigorous approach to hazard identification and mitigation.
  - Applies a rigorous and systematic inspection/documentation process for locomotives, freight cars, and braking systems.
  - Is constantly vigilant with regard to hazards in the immediate work environment.
  - Suspends operations and does not proceed until risks have been effectively mitigated.
- Effectively communicates.
  - Aggressively and clearly communicates immediate hazards to team members—advises corrective/protective measures.
  - Communicates safety issues throughout chain of command in clear, concise, and timely fashion.
  - Creates timely safety reports—engages appropriate regulatory standards.
  - Aligns safety communications to organizational goals and objectives.

## Competency: Business Acumen and Customer Awareness

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of business acumen and understanding the customers' business environment. The attributes represent an understanding and application of financial and business management concepts, methods, and practices.

Attribute—Understand (Knowledge)

- Concepts, methods, and practices of financial management.
- Concepts, methods, and practices of supply chain management.
- Concepts, methods, and practices of logistics and operations management.
- Cost–benefit trade-offs.
- Financial targets and budget requirements.

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- Contemporary concepts and practices of supervision and management.
- Impact of functional unit financial performance on achievement of enterprise goals and objectives.
- Customer's business, including markets, products, operations, and situational environment.
- Impacts of rail transportation system on customer business activities.

Attribute—Apply (Skill)

- Generally accepted standard financial management methods and techniques.
- Strategies and techniques to identify and mitigate financial risk.
- Financial management tools and software applications.
- Sound supervisory and management skills.
- Industry standard communication protocols and lexicon standards.

Attribute—Value (Mindset)

- Empathy for the customer.
- Systems mindset—approach.
- Respect for others.
- Fiduciary responsibility.

Confirming Behaviors

- Develops and manages working relationships.
  - Engages customers to understand operational performance requirements.
  - Actively engages craftworkers in all aspects of operations and management.
  - Actively engages organized labor in all aspects of operations and management.
  - Treats all constituents with respect and demonstrates value for ongoing business relationships.
  - Identifies and supports opportunities to collaborate across organizational boundaries.
  - Works across all areas and understands the big picture.
  - Supports cross-functional activities, communicates vertically and horizontally within the organization.
  - Develops an effective internal collaboration network, shares best practices.
- Manages people.
  - Manages performance to unit and enterprise targets and goals.
  - Accommodates organized labor work rules and contracts.
  - Understands and communicates expectations clearly and in concise behavioral terms.
  - Is fair in corrective and disciplinary actions.
  - Actively participates in the professional and personal development of those within the span of control.
- Manages program finances and budget.
  - Understands and manages cost/service quality trade-offs.
  - Manages performance to financial targets and budget requirements.
  - Identifies and mitigates financial risk.
  - Protects shareholder value.
- Understands the customer's business environment.
  - Delivers required products and services in a predictable and reliable manner.
  - Tailors product and process solutions to enhance the performance of the customer's supply chain.
  - Provides timely and accurate communication to customer.
  - Provides clear communication and frequent updates in the event of unanticipated service interruptions.

- Analyzes and manages information.
  - Analyzes and reports technical and financial performance.
  - Analyzes and reports service delivery and reliability.
  - Weighs and selects best alternative based on customer requirements.
- Manages quality.
  - Employs continuous improvement methodologies.
  - Employs robust quality tools and techniques in the implementation and evaluation of operations actions.
  - Employs tools and techniques to identify and proactively manage risk.

## Competency: Project Management

This competency describes knowledge and skill attributes demonstrated by competent operations professionals in the area of project management. The attributes represent an intermediate understanding and application of generally accepted project management methods and processes. In addition, the attributes describe abilities in the use of project management software.

Attribute—Understand (Knowledge)

- Concepts, methods, and practices of project management.
- Project phases and handoffs.
- Impacts of project schedule on operations.
- Impacts of unanticipated delays on rail transportation system performance.
- Principles of drawing and document control.

Attribute—Apply (Skill)

- Generally accepted standard project management methods and techniques.
- Project management tools and software applications.
- Drawing and document management systems.
- Company-specific project management and team communication requirements.
- Verbal, written, virtual, and graphical communication methods and techniques.

Attribute—Value (Mindset)

- Project management discipline.
- Ownership and responsibility for deliverables.
- Systems mindset—approach.
- Attention to detail.

Confirming Behaviors

- Engages a systematic approach to project management.
  - Implements generally accepted project management standards and processes.
  - Leads and participates in assigned projects.
  - Employs computer tools and templates to issue standard reports.
- Takes ownership and responsibility for project impacts.
  - Extrapolates from experience and uses findings to make sound contributions to current projects.
  - Implements an effective project plan and leads or contributes in all phases of assigned projects.
  - Clearly and effectively communicates operations priorities and technical requirements to project managers.
  - Proactively identifies and mitigates risks to operations.

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- Planning integration.
  - Works across all areas and understands the big picture.
  - Manages handoffs and impacts of project activities on operations.
  - Employs appropriate tools to track and manage projects.
- Problem solving.
  - Identifies problems and practical solutions.
  - Systematically identifies and records root causes variables.
  - Remains flexible and adaptable to changes and new challenges in the project environment.
  - Consults internal resources to solve problems.

## Competency: Personal Effectiveness

This competency describes knowledge, skill, and attitudinal attributes demonstrated by competent professionals that contribute to their overall effectiveness in rail transportation operations. The attributes represent an advanced understanding and application of key behaviors in areas such as effective communication; working across boundaries; building collaborative relationships; creating a culture of accountability; managing information; commitment to professional development; and professionalism, ethics, and values.

Attribute—Understand (Knowledge)

- Time management methods and techniques.
- Task management methods and techniques.
- Individual and team accountability.
- Team principles.
- Regulatory requirements and implications on operations at federal, state, and local levels.
- Professional development needs and potential learning resources.

Attribute—Apply (Skill)

- Methods and techniques employed in the development of cross-functional teams.
- Stress management.
- Active listening.
- Early identification and early mitigation of unanticipated events.
- Methods and techniques to manage rapidly changing conditions.
- Systematic approach to evaluate and resolve alternative and/or conflicting points of view.
- Principles and practices of communication for complex technical and business information.
- Principles and practices of environmental safety and stewardship.

Attribute—Value (Mindset)

- Safety.
- Strong work ethic.
- Commitment to reliability.
- Personal credibility.
- Professional ethics.

Confirming Behaviors

- Effectively communicates.
  - Effectively communicates directions and expectations through written, verbal, and electronic channels.
  - Effectively employs industry and company standards in radio communications.
  - Proactively engages key stakeholders including trades and craftworkers.
  - Empathetic to needs and requirements of key stakeholders.

  - Conveys concepts and information at appropriate levels of complexity to assure that recipients understand the message.
  - Communicates risks up the chain of command in a timely and effective manner.
- Works across boundaries.
  - Effectively engages key stakeholders across a broad constituency of internal and external interest groups.
  - Works appropriately and effectively across organizational boundaries—extending influence throughout the supply chain.
- Builds collaborative relationships.
  - Builds and maintains productive relationships with government agencies, trades, labor unions, and customers.
  - Builds consensus.
  - Interested in others' viewpoints and acknowledges their perspectives and ideas.
  - Provides assistance, information, and support to others.
  - Assures customer satisfaction.
- Creates a culture of accountability.
  - Clearly communicates performance expectations of self and others.
  - Establishes clear goals and metrics that are tied to organizational objectives.
  - Drives to deliver high-quality and reliable rail operations.
  - Demands continuous attention to safety.
  - Strives to assure that operations meet commitments made to customers.
- Manages information.
  - Routinely employs industry- and company-specific tools and techniques to store and share information.
  - Systematically evaluates new information to assess real and potential impacts on operations.
  - Identifies and engages appropriate resource people.
- Commits to professional development.
  - Works with managers and peers to identify professional development needs and growth opportunities.
  - Maintains a personal professional development plan.
  - Actively participates in formal and informal learning activities.
  - Supports the development of others.
- Has a high standard of professionalism, ethics, and values.
  - Demonstrates personal integrity.
  - Is honest and forthright with people.
  - Engages external and internal stakeholders with respect.
  - Is open to new and different ways of doing things.
  - Approaches challenging tasks with a "can-do" attitude.
  - Conveys a command of the relevant facts and information.
  - Maintains a sense of humor.

### Competency: Commitment to Standards

This competency describes knowledge, skill, and attitudinal attributes demonstrated by competent professionals in the application and interpretation of published regulations and standards for rail operations.

Attribute—Understand (Knowledge)

- Applicable rail industry and governmental standards.
  - General Code of Operating Rules (GCOR).
  - FRA inspection standards.
  - U.S. DOT hazardous materials regulations.

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  - Emergency Response Guidebook (ERG 2012).
  - U.S. Occupational Health and Safety Administration (OSHA) regulations (Standards—29 CFR) for railroad facilities.
  - National Environmental Protection Act (NEPA).
  - Corporate operations guidelines / standard operating procedures.
  - Federal and corporate drug and alcohol regulations and policies.
  - Any federal, state, local, or corporate standards as applicable to rail operations.
- Locomotive, freight car, and brake inspection standards.
- Special rules for duty personnel.
- Federal and state environmental policies and standards.

Attribute—Apply (Skills)

- Incorporation and satisfaction of relevant operations standards into daily operations.
- Incorporation and satisfaction of relevant and appropriate safety standards into daily operations.
- Development and employment of standard operations and maintenance manuals specified by the employer.
- Management of operations activities to meet spirit and letter of relevant standards.

Attribute—Value (Mindset)

- Importance of conformity and adherence to standards.
- Maintenance of high standards for all aspects of operations.
- Uncompromising commitment to safety.
- Uncompromising commitment to quality.

Confirming Behaviors

- Evaluates operations and maintenance activities to assure compliance with appropriate regulatory requirements and industry standards.
- Assures compliance with the federal, state, and local laws across all aspects of ongoing operations.
- Regularly inspects work activities to assure compliance with rail transportation safety codes, and other regulations.
- Establishes business metrics to assure ongoing compliance to standards and regulations.
- Collaborates with internal stakeholders in the development and implementation of corporate operations and maintenance standard operating procedures.
- Communicates non-compliance up the chain of command in a timely and effective manner.

## Competency: Utilization of Information Management Tools and Support Systems

This competency describes knowledge and skill attributes demonstrated by competent professionals in the area of engaging organizational information management systems. The attributes represent an understanding and application of information flow in the rail industry.

Attribute—Understand (Knowledge)

- Industry standard operations management practices and information technology platforms and software.
- Industry standard formats for data input, analysis, and results reporting.
- Drawing and document management.

- Structure, functionality, and applicability of technical communications systems and structures.
- Impact of cost and service delivery trade-off.

Attribute—Apply (Skill)

- Design and development of data structure strategies and analysis protocols.
- Methods and applications of operations management systems.
- Radio and wireless digital communication systems.
- Methods and applications of drawing and document management.

Attribute—Value (Mindset)

- Attention to detail.
- Cost efficiency.
- Process discipline.

Confirming Behaviors

- Actively manages projects in corporate information technology systems.
- Develops effective information management practices using corporate support systems.
- Collaborates and shares information with external stakeholders to assure consistent and accurate transmission of information across organizational boundaries.
- Develops and maintains drawings and documents in industry-accepted standard formats.
- Manages operations information and documentation using standard processes, procedures, and templates.
- Proficient in use of computers to employ and manage operations in real time.

## Rail Transportation System Engineer Competency Model

### Overview

The rail transportation system engineer competency model was developed to provide insight into the key knowledge, skills, and mindset of effective engineering practitioners in the rail industry. Given the wide range of engineering roles and responsibilities, as well as the highly varied nature of organizations within the industry, this model is designed to provide a "generic" description of competent practice as well as exploring aspects of engineering disciplines common to the rail industry. Though the model gives a comprehensive, yet general assessment of competent practice within the industry, it will not address every engineering job role; this is because competent practice is couched within the culture of the employer, and not every attribute described here will apply to every situation.

The model includes six core competencies that are common across organizations in the rail industry. Similarly, the model includes competencies associated with five engineering disciplines. For each competency, knowledge, skill, and mindset attributes that define the competency are presented. In addition, confirming behaviors are presented that describe how the presence of the competency can be demonstrated in professional practice.

#### *Target Subject Audience*

The target subject audience includes engineers working within the rail industry, defined as persons with a minimum of a bachelor's degree in engineering or related field. The audience represents a wide range of job roles and responsibilities. Passenger and freight rail companies, government agencies, consultancies, manufacturers, construction companies, or other rail industry employers may employ these engineers. In addition, these engineers may assume various roles

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and responsibilities, ranging from design and construction to operations and maintenance. Engineers may be generalists or specialize in one of the many disciplines within the industry.

### *Assumed Background*

For the purpose of this model, rail transportation system engineers are defined as those with a minimum of a bachelor's degree in engineering and who have work experience and employment within the rail industry or related sectors.

### *Levels of Engagement*

The target audience includes individual contributors and project team leaders. The competency model describes the knowledge, skills, mindset, and confirming behaviors of effective engineers within the industry. In developing the model, the research team gathered input from managers and individual contributors representing Class I, Class II, and Class III railroads; transit and commuter rail organizations; federal and state regulatory bodies; and rail engineering consultancies. This broad engagement provides insight into the critical factors that define competency within the industry.

### *About the Model*

In developing this model, the research team reviewed the competency modeling literature and benchmark models used in a number of technology-based companies and agencies. In addition, the research team incorporated aspects of the "bodies of knowledge" promulgated by relevant engineering societies and professional organizations. Finally, the research team reviewed job descriptions and current job postings within the rail industry.

The rail transportation system engineer competency model is more holistic than the functionally focused models favored at the vocational level. The model has a hierarchical structure, with 11 competencies, 5 of which represent technical disciplines. Each competency is then made up of attributes that provide boundary, scope, and definition to the competency. Attributes describe knowledge, skills, and mindset of competent practitioners. Attributes are then further clarified by confirming behaviors.

### *Topics in the Model*

The overall structure of the competency model provides for consistent definition of competencies and their attributes. But since competent practice is defined within the context and culture of the local organization, individual competencies, and level of detail associated with them, will vary based on organizational characteristics. The rail transportation system engineer model was created for general application within a broadly defined industry; therefore, the model contains "generic" knowledge, skill, and mindset attributes.

In this model, the following six general and five specific (discipline) competencies are described:

- Domain knowledge—engineering
  - Track and infrastructure engineering
  - Rolling stock engineering
  - Communication and rail signal engineering
  - Engineering of bridges and structures
  - Control systems engineering
- Commitment to safety
- Project management
- Personal effectiveness
- Commitment to standards
- Utilization of engineering tools and support systems

## Competency: Domain Knowledge—Engineering

This competency describes knowledge, skill, and attitudinal attributes demonstrated by competent practitioners in engineering and technology. The attributes define a level of advanced understanding and application of scientific principles, engineering constructs, and technologies relevant to the rail industry.

Attribute—Understand (Knowledge)

- Systems approach to concepts and advanced core engineering practices as applied to rail transportation engineering.
- Engineering drawings, models, and diagrams.
- Modeling and simulation.
- Site characteristics.
- Industry-specific design standards and processes.
- Applicable codes and regulatory requirements.
- Concepts of and technical platforms supporting 3D engineering design.
- Environmental standards and policies.
- Public policy.

Attribute—Apply (Skill)

- Advanced concepts in problem-solving methods and techniques.
- 3D-CAD methods and techniques.
- Computer methods and techniques.
  - Programmable calculator.
  - Office productivity software.
  - Digital communications technologies.
  - Tablets and mobile devices.
- Industry standard measurement methods and techniques.
- Validation measurement and assurance techniques.

Attribute—Value (Mindset)

- Process discipline.
- Open to alternative solutions.
- Personal and professional accountability.
- Personal and professional ethics.
- Personal and professional integrity.

Confirming Behaviors

- Maintains engineering skills and Professional Engineer knowledge in a discipline by taking courses, attending conferences, and reading professional journals/other technical publications.
- Shares expertise through participation in professional development activities.
- Synthesizes and integrates concepts and advanced core engineering practices from discipline areas; math and related engineering formulas; and other common technical terms, procedures, and principles of engineering practice.
- Effectively applies technical knowledge in a discipline to solve a range of problems.
- Keeps informed about cutting-edge technology, tools, hardware, and software in discipline.
- Is sought out as an expert to provide advice or solutions in his/her technical area.
- Recognizes personal limitations and seeks expert assistance and advice—submits to regular project peer review.
- Evaluates design of complex systems and assesses compliance with standards of practice, user needs, and relevant constraints.

- Selects and applies appropriate problem-solving and risk management methods and techniques to the solution of engineering problems.
- Prepares, reads, and interprets engineering drawings, models, and diagrams.
- Justifies an engineering solution based on sound professional and ethical standards.
- Delivers on commitments to meet schedule and budget expectations.
- Develops and explains discipline-related requirements for all stages and activities of the design, construction, and operations phase of a project.
- Employs a quality systems approach to engineering activities.
- Conducts engineering analysis and develops recommendations to maintain and improve system efficiency, reliability, safety, environmental compliance, and cost performance.

## Competency: Track and Infrastructure Engineering

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of track and infrastructure engineering. The attributes define a level of advanced understanding of infrastructure of the railway and application of track standards and railroad track engineering concepts, including track component and system design, construction, evaluation, maintenance, load distribution, and wheel/rail interaction. In general, engineers performing this function are formally prepared in civil or environmental engineering.

Attribute—Understand (Knowledge)

- Concepts and applications of track layout and geometry.
- Attributes and applications of common track components, including rail, ties, joints, anchors, and ballast.
- Technical requirements for the design and construction of turnouts and curves.
- Technical requirements for the design and construction of rail crossings and crossovers.
- Technical requirements for the design and construction of highway crossings.
- Performance characteristics and risks associated with common soils and geotechnical conditions.
- Performance characteristics and risks associated with common hydrology and drainage conditions.
- Applicability and appropriate implementation of track design and construction standards.

Attribute—Apply (Skill)

- Track design and construction standards.
- Contemporary safety standards and procedures are effectively satisfied in the design and construction of rail systems.
- Applicable rail engineering standards, methods, and techniques for CAD.

Attribute—Value (Mindset)

- Process discipline.
- Open to alternative solutions.
- Personal and professional accountability.
- Personal and professional ethics.

Confirming Behaviors

- Synthesizes and integrates concepts of rail geometry in the design of rail systems.
- Effectively applies technical knowledge to solve common infrastructure design challenges; drawing from related disciplines.
- Remains current on evolving regulations and published design guidelines for rail infrastructure.

- Evaluates design of complex rail systems and assesses compliance with standards of practice, user needs, and relevant constraints.
- Evaluates and coordinates design efforts between rail/track engineering and that of bridges and structures as well as terminals and rail yard engineering.
- Evaluates and coordinates design efforts between rail/track engineering and that of soils and geotechnical engineering.
- Evaluates and coordinates design efforts between rail/track engineering and that of soils and hydrology and drainage engineering.
- Evaluates and coordinates design efforts between rail/track engineering and that of environmental engineering.

## Competency: Rolling Stock Engineering

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the engineering of rolling stock. The attributes define a level of advanced understanding of rail vehicles for both freight and passenger rail and their performance and safety requirements. In general, engineers performing this function are formally prepared in mechanical or electrical engineering.

Attribute—Understand (Knowledge)

- Locomotive types—performance characteristics and selection criteria.
- Locomotive types—design requirements related to intended use.
- Freight rail car types—performance characteristics and selection criteria.
- Freight rail car types—design requirements related to intended use.
- Passenger rail cars—design requirements and performance characteristics for conventional and high-speed rail cars.
- Passenger rail cars—design requirements and performance characteristics for rail car mechanical and electrical systems (HVAC, power, plumbing, etc.).
- Passenger rail cars—design requirements and performance characteristics for rail car safety systems and emergency.
- Conventional traffic systems and their interface to rolling stock.
- Principles and practical application of vehicle dynamic behavior and vehicle track interaction in rolling stock design and maintenance.

Attribute—Apply (Skill)

- Advanced mechanical or electrical engineering of locomotives and rail cars.
- Engineering principles, codes or practice, and standards associated with rolling stock design.
- Rolling stock manufacturing systems and processes.
- Application of principles and methods related to design for traction.
- Application of principles and methods related to design for braking systems.
- Assurance that contemporary safety standards are effectively employed in the design of rolling stock.
- Assurance that contemporary safety standards and procedures are effectively employed in the design and construction of rail systems.
- Application of rail engineering standards, methods, and techniques to CAD tools and related software.

Attribute—Value (Mindset)

- Process discipline.
- Open to alternative solutions.

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- Personal and professional accountability.
- Personal and professional ethics.

Confirming Behaviors

- Recognizes and selects the appropriate type(s) of rolling stock and traction solutions for a given requirement.
- Identifies the main subcomponents of each type of rolling stock.
- Incorporates personal safety and emergency evacuation scenarios in the design of locomotives and passenger rail cars.
- Understands the functional, interface, and safety requirements of rolling stock.
- Designs, plans, and develops technical drawings for rolling stock projects, materials, and modifications.
- Performs inspections to ensure compliance in accordance with specifications and/or drawings and all applicable federal regulations.
- Ensures rail vehicles are operating efficiently and safely and meet all regulations.
- Recognizes and identifies rail vehicle-related hazards.
- Calculates the dynamic forces acting on a rail vehicle under various situations.
- Quantifies the desirable vehicle dynamic performance criteria.
- Designs structural elements to account for dynamic loadings, suspension design, and ride index.

## Competency: Communication and Rail Signal Engineering

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of communications and signals. The attributes define a level of advanced understanding of operating principles that satisfy all FRA requirements, train control and signaling systems, train scheduling, train stopping-distance calculation, and railroad communications technologies. In general engineers performing this function are formally prepared in electrical and computer or mechanical engineering.

Attribute—Understand (Knowledge)

- Operating principles and practices for rail communications and signaling.
- Crossing systems.
- Automatic block signals.
- Signal siting and location.
- Centralized traffic control.
- Radio and digital communication systems.
- Power sources and uninterruptable power supply technologies.
- Integrated information management.
- Positive train control.

Attribute—Apply (Skill)

- Principles and concepts of the temporal and spatial separation of trains, including signal systems, mechanical and electronic interlocking, and various forms of communication.
- Rules, regulations, standards, and specifications that govern the design and maintenance of signal systems.
- Methods and technologies used in current railroading practice.
- Line capacity analysis.
- Economics of traffic control systems.
- Principles and practices for cybersecurity as applied to rail communications and signaling systems.

- Rail simulation software.
- Inspection testing and maintenance operations for signaling systems.

Attribute—Value (Mindset)

- Process discipline.
- Open to alternative solutions.
- Personal and professional accountability.
- Personal and professional ethics.

Confirming Behaviors

- Implements operating principles and engineering design practices common to all crossings.
- Demonstrates a basic understanding of the operation of rail line and railcar signaling and communication systems.
- Designs and implements vital and non-vital signal systems in Class I and rail transit markets.
- Works in a wide array of technologies, including wireless, fiber optics, microwave, radio, global positioning system (GPS), etc.
- Employs contemporary technologies and applicable standards in the design and operation of signal systems.
- Is proficient in the implementation and certification of communications and signaling technology.
- Works collaboratively with rail engineering staff and other practice centers around the firm on large, complex projects.
- Performs design calculations, including safe braking and power draw.
- Incorporates uninterruptable power supply technologies into the design of critical communications and signaling systems.
- Checks calculations and drawings for accuracy and conformity to appropriate standards.
- Writes clear, concise, and detailed technical specifications for signal systems.
- Reviews and routinely improves block design, time distance curves, and braking charts.
- Integrates positive train control systems into existing signaling systems and infrastructure.
- Develops and conducts field tests and inspections.
- Applies principles and practices of preventive and predictive maintenance to communications and signaling systems.

## Competency: Engineering of Bridges and Structures

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of bridges and structures. The attributes define a systematic and integrated overview of the design, construction, and preservation of all types of railroad bridges and structures. In general engineers performing this function are formally prepared in civil and environmental engineering.

Attribute—Understand (Knowledge)

- Major components and functions of rail bridge systems, including substructure, superstructure, deck, and rail.
- Construction and performance attributes of various bridge types, including timber, steel, concrete, and movable bridges.
- Attributes of bridge sites, including drainage systems and retaining structures.
- Rail bridge loading.
- Preventive and predictive maintenance of bridges and structures.

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Attribute—Apply (Skill)

- FRA bridge standards and regulations in the design of bridges and structures.
- Advanced bridge and structural engineering techniques and analysis methods.
- Specialty bridge design and analysis software.
- American Association of State Highway and Transportation Officials (AASHTO) rail bridge guidelines.
  - Geometric layout.
  - Design loads.
  - Materials.
  - Superstructure design
  - Substructure design.
  - Wall design.
  - Load ratings.
- Rail bridge and structure simulation software.

Attribute—Value (Mindset)

- Process discipline.
- Open to alternative solutions.
- Personal and professional accountability.
- Personal and professional ethics.

Confirming Behaviors

- Coordinates and oversees the design of multiple subsystems to optimize bridge and structure design.
- Manages and supervises design for the development of plans, specifications, and estimates required for bridges.
- Identifies and recommends approaches to preventive and predictive maintenance.
- Incorporates design for maintenance and design for constructability concepts in bridge and structural design and construction.
- Understands techniques and practices for bridge inspection.
- Determines creative and innovative methods and solutions for complex bridge engineering problems.
- Addresses common problems and failure modes.
- Understands the difference in ratings: Cooper, Equivalent Cooper, 286K, Performance, and more.
- Complies with the requirements of a bridge management program.

## Competency: Control Systems Engineering

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of train control systems. The attributes define obtaining a working knowledge of the fundamentals as it relates to different types of systems (such as advanced train control, positive train control, and centralized traffic control) and their proper testing, verification and maintenance. In general, engineers performing this function are formally prepared in civil and environmental or industrial and systems engineering.

Attribute—Understand (Knowledge)

- Systems, structures, and methods associated with computer-aided dispatch.
- Rail system operations, including:
  - Communications and signals
  - Rail yard operations.

  - Asset management.
  - Information management.
  - Transportation logistics.
- Positive train control.
- Centralized traffic control.
- Control system integration.

Attribute—Apply (Skill)

- Principles and concepts of the temporal and spatial separation of trains; including signal systems, mechanical and electronic interlocking, and various forms of communication.
- Contemporary rail operations systems and structures.
- Comprehensive application of rail routing and dispatch operations.
- Line capacity analysis.
- Economics of traffic control systems.
- Logistics modeling and simulation software.

Attribute—Value (Mindset)

- Process discipline.
- Open to alternative solutions.
- Personal and professional accountability.
- Personal and professional ethics.

Confirming Behaviors

- Coordinates and oversees the operation of train dispatch and control systems.
- Manages and supervises the design and certification of positive train control systems.
- Assesses risk and designs positive train control systems to mitigate risks.
- Incorporates design for safety concepts in train control system design and operations.
- Employs and monitors performance metrics in the design and operation of train control systems.
- Develops interface to other operations and maintenance systems and structures.
- Addresses common problems and failure modes.
- Understands, identifies, and takes proactive actions to prevent common cyber threats to train control technologies.

## Competency: Commitment to Safety

This competency describes knowledge, skill, and attitudinal attributes demonstrated by competent practitioners that create a culture of safety. The attributes represent an advanced understanding and application of tools and processes in the design and construction of rail transportation systems, rolling stock, rail system operations and maintenance, and rail system management and labor practices. This competency includes creating a culture of safety, demonstrating a systems approach to safety, identifying and mitigating risks, and effective safety communications.

Attribute—Understand (Knowledge)

- Principles of systems engineering in safety.
- Hazards and risks inherent to rail industry.
- Human factors.
- Hazard analysis.

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- Risk management.
- Design for safety.
- Industrial hygiene.

Attribute—Apply (Skill)

- Methods and techniques employed in the analysis and mitigation of hazards.
- Methods and techniques to apply safety standards, practices, and research findings into daily engineering practice.
- Recognize and identify potential hazards.
- Systematic approach to evaluate and resolve risks inherent to rail system design and operations.
- Principles and practices of communication for complex technical and business information.
- Principles and practices of environmental safety and industrial hygiene.

Attribute—Value (Mindset)

- Constant vigilance.
- Propensity to act.
- Uncompromising expectation for safety.
- Sustainable practice.

Confirming Behaviors

- Creates a culture of safety.
  - Uncompromisingly expects safety at all levels of the organization.
  - Leads regular safety reviews.
  - Incorporates safety metrics into design and operations performance.
  - Holds self and others accountable for safety performance.
  - Makes safety performance transparent across organization.
  - Recognizes and rewards team member identification of actual/potential risks, near misses.
- Uses a systems approach.
  - Integrates safety practices throughout product/project life cycle.
  - Integrates safety considerations across engineering, operations, and maintenance.
  - Applies design for safety principles and practices.
  - Systematically analyzes "near miss" incidents, and implements timely corrective actions based on findings.
  - Effectively engages engineering, education, and enforcement strategies to achieve safety performance objectives.
  - Actively participates in safety review panels.
- Identifies and mitigates risk.
  - Applies a systematic and rigorous approach to hazard identification and mitigation.
  - Is constantly vigilant with regard to hazards in the immediate work environment.
  - Suspends operations and does not proceed until risks have been effectively mitigated.
- Effectively communicates.
  - Aggressively and clearly communicates immediate hazards to team members—advising avoidance activities.
  - Communicates safety issues throughout the chain of command in clear, concise, and timely fashion.
  - Applies a systematic and rigorous approach in developing safety communications.
  - Produces safety documentation that is complete in a clear, concise, and timely manner.
  - Aligns safety communications to organizational goals and objectives.

## Competency: Project Management

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of project management. The attributes represent an advanced understanding and application of generally accepted project management methods and processes. In addition, the attributes describe abilities in the application and operation of project management software and information systems.

Attribute—Understand (Knowledge)

- Concepts, methods, and practices of project management.
- Project life-cycle phases and handoffs.
- Coordination requirements with key stakeholders.
- Impacts of critical elements on overall project performance.
- Principles of drawing and document control.
- Contracts requirements.

Attribute—Apply (Skill)

- Generally accepted standard project management methods and techniques.
- Project management tools and software applications.
- Drawing and document management systems.
- Financial management methods and techniques.
- Risk management methods and techniques.
- Quality management methods and techniques.
- Environmental health and safety methods and techniques.
- Oral, written, virtual, and graphical communication methods and techniques.

Attribute—Value (Mindset)

- Project management discipline.
- Ownership and responsibility for deliverables.
- Systems mindset—approach.
- Attention to detail.

Confirming Behaviors

- Engages a systematic approach to project management.
  - Implements generally accepted project management standards and processes.
  - Leads assigned projects.
  - Employs appropriate quality systems and tools.
  - Employs computer tools and templates to issue standard reports.
- Takes ownership and responsibility for project deliverables.
  - Identifies appropriate people and resources to solve engineering problems.
  - Extrapolates from experience and uses findings to make sound and timely decisions for current projects.
  - Implements an effective project plan and leads all phases of assigned projects.
  - Clearly and effectively communicates project priorities and technical requirements to contractors, consultants, and internal team members.
  - Proactively identifies and mitigates project risks.
- Integrates planning.
  - Works across all areas and understands the big picture.
  - Manages handoffs between key project activities.
  - Employs appropriate tools to track and manage all project phases.

- Actively solves problems.
  - Identifies problems and practical solutions.
  - Systematically identifies and records root-cause variables.
  - Implements design solutions through application of engineering knowledge and industry standards.
  - Remains flexible and adaptable to changes and new challenges in the project environment.
- Manages contractors and consultants.
  - Monitors and measures the performance of consultants and contractors.
  - Develops effective drawing and document control.
  - Consults internal resources to solve problems.

## Competency: Personal Effectiveness

This competency describes knowledge, skill, and attitudinal attributes demonstrated by competent practitioners that contribute to their overall effectiveness as rail transportation system engineers. The attributes represent an advanced understanding and application of key behaviors, including professionalism and ethics, effective communication, working across boundaries, building collaborative relationships, creating a culture of accountability, knowledge management, and a commitment to professional development.

Attribute—Understand (Knowledge)

- Time management methods and techniques.
- Task management methods and techniques.
- Individual and team accountability.
- Team principles.
- Government structure and function at federal, state, and local levels.
- Professional development needs and potential learning resources.

Attribute—Apply (Skill)

- Methods and techniques employed in the development of cross-functional teams.
- Methods and techniques to apply reference information, industry best practices, and research findings into daily engineering practice.
- Stress management.
- Active listening.
- Systematic approach to evaluate and resolve alternative and/or conflicting points of view.
- Principles and practices of communication for complex technical and business information.
- Principles and practices of environmental safety and stewardship.

Attribute—Value (Mindset)

- Safety.
- Strong work ethic.
- Commitment to rail industry.
- Personal credibility.
- Professional ethics.
- Sustainable practice.

Confirming Behaviors

- Has professionalism, ethics, and values in engineering practice.
  - Demonstrates personal integrity.
  - Engages external and internal stakeholders with respect.

  - Approaches challenging tasks with a "can-do" attitude.
  - Is open to new and different ways of doing things.
  - Is honest and forthright with people.
  - Represents employer/sponsor in a professional manner.
  - Conveys a command of the relevant facts and information.
  - Maintains a sense of humor.
  - Is active in professional organizations.
- Effectively communicates.
  - Prepares clear, concise, and accurate written engineering documentation.
  - Effectively communicates engineering activities through written, verbal, and electronic channels.
  - Effectively leads project teleconference calls.
  - Proactively engages key stakeholders including trades and craftworkers.
  - Empathetic to needs and requirements of key stakeholders.
  - Conveys concepts and information at appropriate levels of complexity to assure that recipients understand the message.
  - Effectively participates in public meetings.
- Works across boundaries.
  - Effectively engages engineering resources across technical disciplines.
  - Effectively engages craft- and tradeworkers.
  - Effectively engages operations, labor, and business constituents.
  - Effectively engages key stakeholders across a broad constituency of internal and external interest groups.
  - Works appropriately and effectively across organizational boundaries—extending engineering influence throughout the supply chain.
- Builds collaborative relationships.
  - Builds and maintains productive relationships with government agencies, trades, contractors, consultants, labor organizations, and the general public.
  - Builds consensus among key stakeholders.
  - Actively engages and supports team activities.
  - Is interested in others' viewpoints and acknowledges their perspectives and ideas.
  - Provides assistance, information, and support to others.
  - Talks to external and internal customers to identify their levels of satisfaction.
  - Demonstrates a commitment to working with others to meet their needs—while satisfying the company's engineering and business requirements.
- Creates a culture of accountability.
  - Strives to deliver high-quality engineering projects on time and on budget.
  - Demands continuous attention to safety.
  - Strives to assure that projects meet published design and performance standards.
  - Communicates project risks up the chain of command in a timely and effective manner.
  - Clearly communicates performance expectations of self and others.
  - Establishes clear goals and metrics that are tied to project and organizational objectives.
  - Tracks and communicates project progress against plan.
- Manages knowledge.
  - Routinely employs proven practices to find and apply research and best practices in support of engineering activities.
  - Systematically evaluates new information to determine feasibility and applicability to engineering activities
  - Identifies and engages appropriate internal and external engineering and technical resource people.

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  - Critically evaluates all information presented in projects, and develops relationships on a system level.
- Commits to professional development.
  - Works with managers and peers to identify professional development needs and growth opportunities.
  - Maintains a personal professional development plan.
  - Actively participates in formal and informal learning activities.
  - Supports the development of others.

## Competency: Commitment to Standards

This competency describes knowledge, skill, and attitudinal attributes demonstrated by competent practitioners in the application and interpretation of published engineering standards.

Attribute—Understand (Knowledge)

- Applicable rail industry and governmental standards, regulations, and guidelines.
- Federal, state, and local government regulatory codes.
- Project plan and specification requirements.
- Construction and construction inspection standards and practices.
- Operations and maintenance standards and practices.
- Federal and state environmental policies and standards.

Attribute—Apply (Skills)

- Incorporate and satisfy relevant and appropriate engineering standards.
- Incorporate and satisfy relevant and appropriate safety standards.
- Develop and employ design, construction, operations, and maintenance manuals specified by the employer.

Attribute—Value (Mindset)

- Importance of conformity and adherence to engineering standards.
- Maintenance of high technical standards.
- Uncompromising commitment to safety.
- Uncompromising commitment to quality.

Confirming Behaviors

- Evaluates engineering design, operations, and maintenance to assure compliance with appropriate regulatory requirements and engineering standards.
- Assures compliance with the federal, state, and local environmental laws throughout all stages of the project and throughout ongoing operations.
- Regularly inspects projects to assure compliance with transportation safety codes and other regulations.
- Establishes program and project metrics to assure ongoing compliance to engineering standards and regulations.
- Selects and applies standard methods and techniques to produce a quality product.
- Reviews project specifications and plan to assure conformity with the laws, ordinances, and accepted professional standards that pertain to the given engineering area of specialty.
- Collaborates with internal stakeholders in the development and implementation of corporate design, operations, and maintenance standards.

### Competency: Utilization of Engineering Tools and Support Systems

This competency describes knowledge and skill attributes demonstrated by competent practitioners in the area of engaging organizational tools, resource people, and support systems. The attributes represent an understanding and application design software and modeling tools that are common to the engineering practice in the rail industry.

Attribute—Understand (Knowledge)

- Industry standard project management practices and software.
- Industry standard formats for data input, calculations procedures, and results reporting.
- Drawing and document management.
- Engineering CAD/3D design software.
- The structure, functionality, and applicability of geographic information systems (GIS).
- Statistical tools and techniques for the collection, organization, analysis, and interpretation of data.
- Engineering economic analysis.

Attribute—Apply (Skill)

- Methods and applications of project management systems.
- Methods and applications of 3D engineering CAD.
- Methods and applications of drawing and document management systems.
- Employs industry-accepted economic analysis tools and practices in the evaluation of project alternatives.

Attribute—Value (Mindset)

- Attention to detail.
- Cost efficiency.
- Process discipline.

Confirming Behaviors

- Actively establishes and manages projects in corporate systems.
- Develops effective drawing and document control using tools and support systems.
- Develops and maintains drawings and documents in industry-accepted standard formats.
- Manages project financial information using standard processes, procedures and templates.
- Operates various project management and 3D CAD analysis programs and tools to complete various project tasks.
- Proficient in use of computers and programmable calculators.

## Rail Transportation Craftworker Competency Model

### Overview

The craftworker competency model was developed to provide insight into the key knowledge, skills, and confirming behaviors of effective craftworkers in the rail industry. Because competent practice is couched within the culture of the employer, and may vary from one region of the United States to the next, not every attribute described here will apply to each specific trade of craftworker everywhere. Rather, this model is designed to give a comprehensive, yet general, assessment of competent practice within the industry. For each competency, job functions, knowledge, skill, and attitudinal attributes that define the competency are presented.

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The model includes competencies for the following six groups of crafts that are commonly employed across organizations in the rail industry:

- Train and engine personnel
- Dispatchers
- Signal personnel
- Communications personnel
- Mechanical personnel
- MOW workers and machinery operators

### *Target Subject Audience*

The target audience for these models includes human resource hiring managers in the rail industry as well as educational and training curriculum designers and policymakers. Passenger and freight rail companies, manufacturers, construction companies, or other rail industry employers may employ these craftworkers. These competency models will aid in future workforce planning and development, educational programming, and policymaking within the rail industry.

### *Assumed Background*

For the purpose of this model, craftworkers are made of up rail employees responsible for the safe movement of trains, dispatch, construction and non-construction maintenance, and communications and signaling. Education and/or training vary by craft.

### *Levels of Engagement*

The target audience includes individual contributors and project team leaders. The competency model describes the knowledge, skills, mindset, and confirming behaviors of craftworkers within the industry. This broad engagement provides insight into the critical factors that define competency within the industry.

### *About the Model*

The following competency models are hierarchical in structure. Core competencies are defined by knowledge, skill, and mindset attributes, which are then associated with observable behaviors. The models are designed as such in an effort to quantify and determine competence among all crafts.

### *Topics in the Model*

The overall structure of the competency model provides for consistent definition of competencies and their attributes. Since competent practice is defined within the context and culture of the local organization, individual competencies and the level of detail associated with them may vary based on organizational characteristics. The craftworker competency model was created for general application within a broadly defined industry; therefore, the model contains "generic" knowledge, skill, and mindset attributes.

In this model, the following six domain knowledge competencies for each craft are included, along with three general competencies as they relate to craftworkers in general:

- Domain knowledge—train and engine personnel
  - Locomotive engineers
  - Conductors/brakemen
  - Remote control operators
- Domain knowledge—dispatchers
- Domain knowledge—signal personnel

- Domain knowledge—communications personnel
- Domain knowledge—mechanical personnel
  - Boilermakers
  - Carmen
  - Electricians
  - Mechanics
  - Pipefitters
  - Shop laborers
- Domain knowledge—MOW workers and machinery operators
  - Foremen
  - Large-machine operators
  - Small-machine operators
  - Track inspectors
  - Trackmen/laborers
  - Welders
- Commitment to safety
- Personal effectiveness
- Commitment to standards

For each domain competency, job functions, knowledge, skills, and mindset that define the competency are presented; after which a section on confirming behaviors relevant to all craftworkers follows.

## Competency: Domain Knowledge—Train and Engine Personnel

This competency describes knowledge and skill attributes demonstrated by competent train and engine personnel.

### *Discipline: Locomotive Engineers*

Locomotive engineers operate and control the movement of the train. They are responsible for working in conjunction with a conductor or brakeman to assure the safe and efficient movement of the train. Today, most locomotive engineers worked as a trainman prior to becoming an engineer. Railroads conduct engineer training, including on-the-job training. Federal certification is required every 3 years.

**Job Functions.** The locomotive engineer has two primary functions:

1. ***Operation of train:*** Locomotive engineers operate freight or passenger trains and must be knowledgeable about the route for each trip. They must direct and control the movement of the train in a safe and efficient manner. In passenger operations, they must know the schedule in order to make sure the train operates without issue and on time.
2. ***Constant inspection of train:*** They must check the speed, air pressure, battery, and other various mechanics of the train, such as brakes and gauges, to ensure that the train is operating correctly.

Attribute—Understand (Knowledge)

- Railroad's operating and safety rules and FRA regulations that apply to engineers.
- The dangers inherent in railroad operations.
- Regulations governing the transportation of hazardous materials.
- Railroad signal and communication protocols including hand or flag signals.
- Railroad radio communication protocols.

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- Relevant written documents, e.g., track warrants, track bulletins, rule book, timetable.
- Overall operation and structure of a freight or passenger locomotive.
- Physical characteristics of the territory, including length of sidings, location of signals and switches, grades, curves.

Attribute—Apply (Skill)

- Control the movement of the locomotive on level track, up/down hill, on a curve, and at a grade crossing in a safe and efficient manner giving consideration to track condition, equipment condition, and environmental factors.
- Monitor status of train including air brake gauges, speed indicator, and load indicators.
- Determine appropriate time to accelerate or apply brakes giving consideration to locomotive and train characteristics and to terrain and weather conditions.
- If a yard engineer, execute the train preparation procedure including checking that hazardous materials are properly place and secured in the consists.
- Conduct job/safety briefing with train crew.
- Secure the locomotive so that it may be left unattended.
- Complete all required reports for unusual occurrences.
- Get on/off stationary and moving equipment.
- Safely walk between cars.
- Recognize equipment sounds/noises and vibrations associated with malfunctions or irregularities.

Attribute—Value (Mindset)

- Constant vigilance.
- Propensity to act.
- Uncompromising expectation for safety.
- Personal and professional accountability.
- Personal and professional ethics.

### *Discipline: Conductors/Brakemen*

Conductors and brakemen are responsible for the train consist and for directly supervising train crew, other than the engineer. Along with the engineer, conductors and brakemen are responsible for the safe and efficient train operation, while adhering to the railroad's rules and procedures.

**Job Functions.** The conductor/brakeman has five primary functions.

1. ***Managing the train consist.*** The conductor must understand train makeup rules and apply them both in the yard and on the mainline.
2. ***Coordinating with the locomotive engineer for safe and efficient en route operation.*** En route, the conductor supervises overall operation and administration of the train.
3. ***Interacting with dispatchers/roadway workers and others outside the locomotive cab.*** The conductor handles all radio communications.
4. ***Dealing with exception situations, e.g., diagnosing and responding to train problems.*** The most common unanticipated events are train equipment issues which the conductor must troubleshoot and if possible correct.
5. ***Managing paperwork.***

Attribute—Understand (Knowledge)

- Railroad's operating and safety rules and FRA regulations that apply to conductors.
- Implications of car placement, car consist, and car weight and shape.

- Relationship between train's consist and train handling.
- The dangers inherent in railroad operations.
- Regulations governing the transportation of hazardous materials.
- Railroad signal and communication protocols including hand or flag signals.
- Railroad radio communication protocols.
- Relevant written documents, e.g., track warrants, track bulletins, rule book, timetable.
- Physical characteristics of the territory, including length of sidings, location of signals and switches, grades, curves.

Attribute—Apply (Skill)

- If a yard conductor/brakeman, assists the engineer in executing the train preparation procedure.
- Inspects all cars prior to leaving the yard or siding.
- If working in a yard, makes up freight and passenger trains in accordance with the switch list.
- Gets on/off stationary and moving equipment.
- Flags for vehicular traffic at crossings when required.
- Removes or replaces broken knuckles.
- Attaches/releases brake lines.
- Communicates with yardmaster or dispatcher for train movement authority.
- Communicates wayside signals audibly to engineer.
- Aligns switches.
- Records times of departure and arrival.
- Documents equipment problems.
- Collects passenger fares (passenger service only).

Attribute—Value (Mindset)

- Constant vigilance.
- Propensity to act.
- Uncompromising expectation for safety.
- Personal and professional accountability.
- Personal and professional ethics.

### *Discipline: Remote Control Operators*

Remote control operators operate and control the movement of a switching locomotive in a railroad yard from the ground using an operator control unit (OCU). They usually work in conjunction with a second remote control operator who has only safety-override control of the locomotive.

Attribute—Understand (Knowledge)

- Railroad's operating and safety rules and FRA regulations that apply to remotely controlled locomotive operations.
- Knowledge of both flat and hump switching operations.
- The dangers inherent in railroad yard operations.
- Regulations governing the transportation of hazardous materials.
- Railroad signal and communication protocols including hand or flag signals.
- Railroad radio communication protocols.
- Layout of OCU and function of each button, lever, and indicator light.
- Relevant written documents, e.g., switch list and rule book.
- Physical characteristics of the yard including switching tracks, location of switches, and main-line track.

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Attribute—Apply (Skill)

- Takes control of remote control zone in yard.
- Conducts safety briefing.
- Executes the train preparation procedure to assure that the OCU and onboard controller are operating properly.
- Controls the movement of the locomotive on yard track for both flat and hump switching operations.
- Monitors status and position of the switching locomotive.
- Determines appropriate time to accelerate or apply brakes giving consideration to number of cars being moved, type of switching operation, and weather conditions.
- Communicates with other remote control operators and yardmaster as required.
- Secures the locomotive so that it may be left unattended.
- Completes all required reports for unusual occurrences.

## Competency: Domain Knowledge—Dispatchers

This competency describes knowledge and skill attributes demonstrated by competent dispatchers. The railroad dispatcher is responsible for the safe, efficient, and economical movement of trains and other railway vehicles over the railroad, as well as for the protection of those who work on the railroad. Many of the larger railroads see dispatching as a first step in a career path to railroad management.

**Job Functions.** The dispatcher has four primary functions:

1. ***Planning:*** The dispatcher must perform preliminary planning prior to assuming dispatching responsibility each day. This includes a brief "handover" period when the dispatcher working the position during the previous shift tells the new dispatcher about current and planned train movements within the territory.
2. ***Controlling track use:*** The dispatcher is responsible for determining which trains may travel across the territory and when MOW inspectors, crews, and equipment may access the track.
3. ***Managing unplanned and emergency events:*** The dispatcher must re-schedule trains and request assistance when an unplanned or emergency event occurs.
4. ***Record keeping:*** Today's computer-based dispatching systems do not require the dispatcher to keep detailed written records, but, depending upon an individual railroad's procedures, some written reports may be necessary.

Attribute—Understand (Knowledge)

- Basic operational and administrative structure of the railroad.
- Railroad's operating and safety rules, including applicable FRA regulations.
- Movement authority and protective authority, including procedures for controlling signals, switches, and blocking devices.
- Track bulletins, train dispatcher bulletins, special instructions, and other forms of operational updates.
- Procedures for an unplanned or emergency event.
- General principles of railway signaling.
- Terminology, jargon, and shorthand used by dispatchers.
- Characteristics of rolling stock.
- Physical and operating characteristics of different types of equipment used on the railroad.
- Physical characteristics of the dispatcher's assigned territory.
- Procedures for transport of hazardous materials.
- Electric power traction systems used by the railroad, if applicable.

- Appropriate radio and telephone communications protocols.
- Recordkeeping and reporting requirements, including appropriate computer skills.

Attribute—Apply (Skill)

- Applies and removes blocking devices.
- Issues and removes speed restrictions.
- Safely authorizes, dispatches, and monitors the use of tracks by non-shunting equipment and work crews.
- Uses clear and coherent communication skills and procedures.
- Understands and uses all manual and computer-based dispatcher planning aids employed by the railroad.
- Implements appropriate procedure in response to an unplanned event of emergency.
- Completes required records via electronic devices or paper.
- Manages and dispatches helper services, e.g., extra engine or qualified pilot (freight operations only).
- Rapidly effects de-energization of one or more specific traction power sections (for electrified railroad only).

Attribute—Value (Mindset)

- Process discipline.
- Open to alternative solutions.
- Propensity to act.
- Personal and professional accountability.
- Personal and professional ethics.

## Competency: Domain Knowledge—Signal Personnel

This competency describes knowledge and skill attributes demonstrated by competent signal personnel. It should be noted that signal and communications functions may be divided differently across the different positions—electricians, communication maintainers, signalmen, and linemen—at different railroads.

**Job Functions.** The signalman has one primary function:

1. ***Construction, installation, repair, maintenance, testing, and inspection of signal systems:*** These signal systems include automatic block signal systems; traffic control systems; train stop; train control and cab signal systems; interlocking systems; rail–highway grade crossing protection; automatic classification yards; hot box detectors; broken flange detectors; other similar devices, appliances, and systems; and positive train control systems.

Attribute—Understand (Knowledge)

- Railroad's operating and safety rules and FRA regulations that apply to signalmen and all roadway workers.
- Typical railroad rules and regulations including changes that are a result of accidents and imposed by Homeland Security.
- FRA regulatory testing requirements, frequency of testing requirements, and operating rules.
- Basic principles of electricity and measurement.
- Basic principles of signal systems and track circuits.
- Operation of rail line and railcar signaling and communication systems.
- Proper conduct of troubleshooting and repairs on signaling and communications systems along rail lines and on railcars.

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- Operation of computer systems used in communication and signal systems on railcars and along rail lines.
- Proper function of communication lines, wires, and cables; radio, fiber optic, microwave, and data transmission equipment and circuitry; as well as testing equipment.
- Roadway worker rules and protections.

Attribute—Apply (Skill)

- Installs, inspects, tests, maintains, or repairs all signal equipment including grade crossing warning systems, signals, switches, and signal equipment, such as interlocks and hot box detectors.
- Installs, troubleshoots, maintains, test, and repairs positive train control systems.
- Installs, tests, maintains, and repairs retarder systems.
- Installs, tests, maintains, troubleshoots, and repairs switches and switch machines.
- Compiles reports including maintenance and FRA tests performed, any repairs made, and equipment requiring replacement.
- Connects outgoing and incoming lines to signal/communication equipment including data processing equipment and following diagrams.
- Wires signal/communication facilities.
- Splices cable.
- Troubleshoots, repairs, or replaces electrical equipment such as relays, timers, counters, meters, switches, control devices, or programmable controls.
- Troubleshoots, repairs, or replaces electronic and microprocessor-based equipment including communications systems, constant warning time grade crossing devices, analyzers, control systems, logic control, or robotics.
- Aligns, adjusts, and calibrates communications/signal equipment according to specifications.
- Performs fractional mathematics when testing, maintaining, or installing various pieces of signal equipment, i.e., when using Ohm's law or calculating actual train speeds for crossing warning detection times.
- Operates proper electric, pneumatic, or hydraulic hand tools such as drills, impact wrenches, power saws, and grinders.
- Operates material-handling equipment such as forklifts, crane trucks, hand trucks, and overhead hoists.
- Operates signal vehicles, boom trucks, and crane trucks on tracks. May require possession of a commercial driver's license.
- Operates excavating and cable burying equipment.
- Assembles and installs signal foundations, signal bridges, cantilevers, gate mechanisms, etc.
- Determines and receives all forms of on-track-authority.

Attribute—Value (Mindset)

- Constant vigilance.
- Propensity to act.
- Uncompromising expectation for safety.
- Personal and professional accountability.
- Personal and professional ethics.

## Competency: Domain Knowledge—Communications Personnel

This competency describes knowledge and skill attributes demonstrated by competent communications personnel. It should be noted that signal and communications functions may be divided differently across the different positions—electricians, communication maintainers, signalmen, and linemen—at different railroads.

**Job Functions.** The electrician or communication maintainer has three primary functions:

1. ***Maintenance and repair of electrical system:*** The worker is responsible for the maintenance and repair of electrical systems on low horsepower systems, diesel engine systems, and other electrical systems used in railway and railcar equipment.
2. ***Installation, inspection, and test of communication systems:*** The worker is responsible for very high frequency/ultra high frequency (VHF/UHF) radios and radio dispatching systems, public address and video surveillance systems, automatic revenue collection equipment, alarm monitors, GPS networks, fiber optic systems, and communication computer networks.
3. ***Documentation of repair status and procedure:*** Depending on individual railroad procedures, the worker is responsible for documenting the status of equipment, what repairs it needs or has had, and what procedures were followed.

Attribute—Understand (Knowledge)

- Typical railroad rules and regulations including changes that are a result of accidents and imposed by Homeland Security.
- Basic understanding of the operation of railcar electromechanical systems.
- How to conduct troubleshooting and repairs on electromechanical systems in railcars.
- Operation of rail line and railcar signaling and communication systems.
- How to conduct troubleshooting and repairs on signaling and communications systems along rail lines and on railcars.
- Operation of computer systems used in communications and signal systems on railcars and along rail lines.
- Proper function of communications lines, wires, and cables; radio, fiber optic, microwave, and data transmission equipment and circuitry; as well as testing equipment.

Attribute—Apply (Skill)

- Constructing, installing, repairing, maintaining, inspecting, testing, and removing communications lines and their supports; wires and cables; radio, fiber optic, microwave, and data transmission equipment and circuitry; computers, printers, and monitors; telephones; security cameras; batteries; connectors; various parts; and testing equipment.
- Installation, maintenance, repair, and inspection of all electrical equipment including wiring, relays, and air conditioning/refrigeration relative to locomotives and passenger cars.
- Inspection and test of electrical circuitry and equipment using standard electrical and/or electronic testing equipment.
- Operation of proper electric, pneumatic, or hydraulic hand tools such as drills, impact wrenches, power saws, and grinders.
- Operation of material-handling equipment such as forklifts, crane trucks, hand trucks, and overhead hoists.
- Operation of railroad/locomotive equipment between various shop locations, service tracks, and switching areas.
- Operation and alignment of a switch and derailers.
- Signaling locomotive mover for movement of locomotive using lantern, hand, or radio to indicate when to start, stop, and backup.
- Conduct of tests and analysis of results to troubleshoot equipment.
- Cutting, splicing, and pulling of cable on ground and on pole.

Attribute—Value (Mindset)

- Propensity to act.
- Uncompromising expectation for safety.

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- Open to alternative solutions.
- Personal and professional accountability.
- Personal and professional ethics.

## Competency: Domain Knowledge—Mechanical Personnel

This competency describes knowledge and skill attributes demonstrated by competent mechanical personnel. Mechanics are responsible for diagnosis, adjustments, repairs, or overhaul of railroad equipment.

### *Discipline: Boilermakers*

**Job Functions.** The boilermaker has two primary functions:

1. ***Repair:*** Renew and repair any system pertaining to boilers, tanks, and drums.
2. ***Fabrication:*** Weld, forge, heat, shape, and bend metal; operate punches, brakes, shears, welders, wire-feed welders, plasma arc cutters, and oxygen/acetylene cutting torches and welders. Read and understand blueprints.

Attribute—Understand (Knowledge)

- Relevant company and FRA rules, regulations, and safety requirements that apply to boilermakers.
- Machines and tools, including their designs, uses, repair, and maintenance.
- Materials and methods to repair locomotives and equipment.
- Locomotive mechanical characteristics, components, and systems.
- Locomotive operation.
- Blueprints, drawings, and technical documentation to troubleshoot, rebuild, and repair locomotives and components.

Attribute—Apply (Skill)

- Ensures compliance with all railroad rules and regulations for safety, operations, and the FRA.
- Positions, aligns, and secures structural parts and related assemblies of pressure vessels, such as boilers, tanks, and vats; analyzes defective units and repairs as necessary.
- Inspects, patches, drills, chips, cuts, taps, welds, bolts, rivets, screws, clips, caulks, clamps, flanges, flues, or bonds component parts to assemble products.
- Lays out, cuts apart, builds, or repairs boilers, tanks, and drums.
- Lays out and fits up sheet iron or sheet steel work made of 16 gauge or heavier, including fronts and doors, gates and gate rigging, ash pans, front-end netting and diaphragm work, engine tender steel underframe, pressed steel tender truck frames and locomotive cabs.
- Builds, repairs, removes, and applies steel cabs and running boards.
- Interprets blueprints, sketches, or product specifications to determine sequence and methods of fabricating, assembling, and installing sheet metal products.
- Selects gauge and type of metal, or nonmetallic material, according to specifications.
- Operates precision machines such as drills, presses, lathes, and other power hand tools.
- Sets up and operates fabricating machines, to cut, bend, block and form, or straighten materials; trims, files, grinds, deburrs, buffs, and smooth surfaces.
- Straightens or reshapes bent plates or structures.
- Assembles and installs a variety of metal tubes.
- Removes and replaces rivets and caulks seams to repair riveted shells and structures.
- Cuts and shapes defective parts, using oxygen/acetylene torch.
- Fabricates any and all parts for locomotives and cars on or off of them.

- Operates material-handling equipment such as chain hoists and overhead hoists.
- Operates electric and gas welding equipment.
- Signals crane operator or attaches rigging to lift parts to specified position.
- Operates locomotives as required.
- Operates railroad computer programs used to track and document repairs.

Attribute—Value (Mindset)

- Uncompromising expectation for safety.
- Personal and professional accountability.
- Personal and professional ethics

### *Discipline: Carmen (Freight Car and Railcar Repairers)*

**Job Functions.** The carman or freight car repairer has two primary functions:

1. ***Inspection:*** The carman performs inspections required by federal safety regulations, company standards, and AAR standards, including inspecting railcar frames and bodies for holes, cracks, and other defects; safety appliances including handholds, sill steps, grab iron, brake platforms, and running boards; and wheels to ensure that rim treads, plates, hub axles, and bearings are in good repair. The carman is also responsible for the air brake system and hazardous materials inspections.
2. ***Rebuild and repair:*** Compliant with FRA, AAR, and company standards, the carman is responsible for maintaining, replacing, and/or repairing air brake pipes, valves, gaskets, air hoses, brake assemblies and shoes, draft gear components, and other equipment as required. The carman operates electrical and gas welding equipment to join a variety of metals and alloys and operates acetylene torches for cutting and/or shaping metal parts such as aluminum, cast iron, steel, and bronze.

Attribute—Understand (Knowledge)

- Relevant company and FRA rules, regulations, and safety requirements that apply to carmen.
- Machines and tools, including their designs, uses, repair, and maintenance.
- Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations governing the shipment of hazardous materials by rail.
- Basic understanding of railcar mechanical characteristics, components, and air systems.
- Blueprints, drawings, sketches, and technical documentation.
- Computer-aided programs to obtain railcar information regarding car characteristics, destination, lading, and repair records and/or to file data such as repair information, bad orders, and car releases.

Attribute—Apply (Skill)

- Ensures compliance with all railroad and FRA rules, regulations, and safety requirements.
- Inspects car components for compliance with railroad, FRA, and AAR standards.
- Identifies defective components and performs necessary repairs to comply with established rules and standards.
- Removes and replaces couplers, draft gears, and yokes.
- Inspects, replaces, and/or repairs gaskets; air hose; train line; bulkhead and other interior load restraining equipment; and steel sections such as side sheets, cross bearers, crossties, and underframing.
- Builds or repairs components such as freight doors, wooden floors, or interior walls.
- Repairs or replaces steel parts such as grab irons, handholds, ladders, brackets, steps, and other components.

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- Inspects and salvages parts from dismantled and/or scrapped cars.
- Inspects and applies end-of-train device and performs airbrake tests.
- Welds, cuts metal, sandblasts, replaces doors and performs general car construction.
- Interprets blueprints, drawings, and technical documentation to troubleshoot, rebuild, and repair railcars.
- Cleans, lubricates, and maintains tie-down devices and other special equipment on railcars.
- Paints cars and car components; stencils letters and numbers on cars.
- Operates light and heavy cranes, forklifts, other car-moving shop equipment, and various vehicles to the job site.
- Operates proper electric, pneumatic, or hydraulic hand tools such as drills, impact wrenches, saws, and grinders.
- Operates acetylene torch for cutting or shaping metal parts.
- Operates railroad computer programs used to track and document repairs.

Attribute—Value (Mindset)

- Uncompromising expectation for safety.
- Personal and professional accountability.
- Personal and professional ethics.
- Constant vigilance.

### *Discipline: Electricians*

**Job Functions.** The electrician has two primary functions:

1. ***Locomotive system maintenance:*** Test, inspect, and repair switches, heaters, air conditioners, DC power systems, event recorder tapes, lights, water coolers, batteries, low-voltage systems, high-voltage systems, traction motors, cooling fans, and fuel pumps.
2. ***Equipment maintenance:*** Troubleshoot, repair, install, inspect, calibrate, and replace electrical high-voltage, mechanical, and electro-magnetic equipment; perform preventive maintenance on a variety of tools/equipment and machinery to ensure proper function.

Attribute—Understand (Knowledge)

- Relevant company and FRA rules, regulations, and safety requirements that apply to electricians.
- Machines and tools, including their designs, uses, repair, and maintenance.
- Diesel locomotive electrical systems.
- Locomotive electrical characteristics, components, and systems.
- Locomotive operation.
- Blueprints, drawings, and technical documentation to troubleshoot, rebuild, and repair locomotives.
- Railroad computer programs used to track and document locomotive repairs, maintenance, and history.

Attribute—Apply (Skill)

- Ensures compliance with all railroad and FRA rules, regulations, and safety requirements.
- Inspects, maintains, troubleshoots, repairs, and tests diesel engines.
- Inspects, maintains, troubleshoots, repairs, and tests locomotive electrical systems and components.
- Performs adjustments and calibrations to electrical components.
- Performs maintenance and servicing of diesel locomotives.
- Performs modifications and constructs mechanical assemblies.

- Rebuilds power assemblies.
- Interprets blueprints, drawings, and technical documentation to troubleshoot, rebuild, and repair locomotive electrical systems.
- Uses various non-power hand tools such as hammers, screwdrivers, files, wrenches, etc.
- Operates various electric, pneumatic, or hydraulic power tools such as drills, impact wrenches, saws, and grinders.
- Operates material-handling equipment such as hand trucks, overhead or mobile cranes, and forklifts to assist in assignments.
- Operates locomotives as required.
- Operates railroad computer programs used to track and document repairs.
- Inspects and tests electrical systems and equipment to locate and diagnose malfunctions using visual inspections, testing devices, and computer software.
- Reassembles and tests equipment after repairs.
- Splices wires and solders connections to fixtures, outlets, and equipment.
- Installs new fuses, electrical cables, or power sources as required.
- Locates and removes or repairs circuit defects such as blown fuses.
- Adjusts, repairs, or replaces defective wiring and relays in ignition, lighting, air conditioning, and safety control systems, using electrician's tools.
- Refers to schematics and manufacturers' specifications that show connections and provide instructions on how to locate problems.
- Maintains equipment service records.
- Cuts openings and drill holes for fixtures, outlet boxes, and fuse holders, using electric drills and routers.
- Measures, cuts, and installs frameworks and conduit to support and connect wiring, control panels, and junction boxes, using hand tools.

Attribute—Value (Mindset)

- Process discipline.
- Uncompromising expectation for safety.
- Personal and professional accountability.
- Personal and professional ethics.

### *Discipline: Mechanics (Diesel Mechanics, Machinists)*

**Job Functions.** The mechanic has two primary functions:

1. ***Locomotive engine maintenance:*** Repair running gears such as wheels, springs, hangers, and brake rigging traction motors. Test and repair brake systems, safety appliances, couplers, draft systems, air compressors, safety valves, lube oil pumps, filter systems, fuel systems, radiators, and shutters. Install, disassemble, assemble, repair, or replace locomotive diesel engine components. Perform scheduled and preventive maintenance on tools and equipment.
2. ***Inspection:*** Inspect locomotive components and diagnose malfunctions in diesel engines, locomotive systems, equipment, and components.

Attribute—Understand (Knowledge)

- Relevant company and FRA rules, regulations, and safety requirements that apply to mechanics.
- Machines and tools, including their designs, uses, repair, and maintenance.
- Diesel engines and diesel locomotive mechanical systems.
- Locomotive mechanical characteristics, components, and systems.
- Locomotive operation.

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- Blueprints, drawings, and technical documentation to troubleshoot, rebuild, and repair locomotives.
- Railroad computer programs used to track and document locomotive repairs, maintenance, and history.

Attribute—Apply (Skill)

- Ensures compliance with all railroad and FRA rules, regulations, and safety requirements.
- Inspects, maintains, troubleshoots, repairs, and tests diesel engines.
- Inspects, maintains, troubleshoots, repairs, and tests locomotive mechanical systems and components.
- Performs adjustments and calibrations to mechanical and electrical components.
- Performs maintenance and servicing of diesel locomotives.
- Performs modifications and construct mechanical assemblies.
- Rebuilds power assemblies.
- Assembles, fits, aligns, and tests diesel engines and other locomotive components to ensure smooth performance.
- Interprets blueprints, drawings, and technical documentation to troubleshoot, rebuild, and repair locomotives.
- Uses various non-power hand tools such as hammers, screwdrivers, files, and wrenches.
- Operates various electric, pneumatic, or hydraulic power tools such as drills, impact wrenches, saws, and grinders.
- Operates material-handling equipment such as hand trucks, overhead or mobile cranes, and forklifts to assist in assignments.
- Operates locomotives as required.
- Operates railroad computer programs used to track and document repairs.

Attribute—Value (Mindset)

- Process discipline.
- Uncompromising expectation for safety.
- Personal and professional accountability.
- Personal and professional ethics.

### *Discipline: Pipefitters (Sheet Metal Workers)*

**Job Functions.** The pipefitter has two primary functions:

1. ***Fabrication:*** Fabricate, cut, shape, and modify items utilizing various methods (e.g., seaming, riveting, brazing, or welding). Utilize pipe threaders, pipe bending, pipe coupling, sheet metal brakes, shears, snaps, metal-cutting saws, drills, wire-feed welders, and oxygen/acetylene cutting torches, and repair various components of locomotives.
2. ***Inspection and repair:*** Inspect and properly repair piping on the following systems on locomotives: air brakes, exhaust system, lube oil, cooling water, air compressor, radiator, and fuel system. Install, disassemble, assemble, repair, or replace locomotive and diesel engine components as required.

Attribute—Understand (Knowledge)

- Relevant company and FRA rules, regulations, and safety requirements that apply to pipefitters.
- Machines and tools, including their designs, uses, repair, and maintenance.
- Materials and methods to repair locomotives and equipment.
- Locomotive mechanical characteristics, components, and systems.
- Locomotive operation.

- Blueprints, drawings, and technical documentation to troubleshoot, rebuild, and repair locomotives and components.

Attribute—Apply (Skill)

- Ensures compliance with all railroad rules and regulations for safety, operations, and the FRA.
- Interprets blueprints, sketches, or product specifications to determine sequence and methods of fabricating, assembling, and installing sheet metal products.
- Selects gauge and type of metal, or nonmetallic material, according to specifications.
- Builds, erects, assembles, installs, dismantles, and maintains parts made of copper, brass, tin, zinc, and white/black metal including brazing, soldering, tinning, and leading.
- Bends, fits, cuts, threads, brazes, connects, and disconnects air, water, gas, oil, and steam pipes.
- Operates pipe threading machines.
- Performs oxy-propane and arc welding.
- Cuts and shapes defective parts, using oxygen/acetylene torch.
- Operates material-handling equipment such as chain hoists and overhead hoists.
- Operates locomotives as required.
- Operates railroad computer programs used to track and document repairs.

Attribute—Value (Mindset)

- Process discipline.
- Uncompromising expectation for safety.
- Personal and professional accountability.
- Personal and professional ethics.

### *Discipline: Shop Laborers (Utility Workers)*

**Job Functions.** The shop laborer has two primary functions:

1. ***Equipment operations:*** Operate forklift, mobile crane, track mobile, and shop tractor.
2. ***Equipment and shop maintenance:*** Sand, fuel, and clean locomotives. Clean and organize shop work area: sweep and clean work surfaces, store parts, empty and discard garbage; operate power-driven equipment such as a vacuum cleaner, electric broom, or steam cleaning gun.

Attribute—Understand (Knowledge)

- Relevant company and FRA rules, regulations, and safety requirements that apply to shop laborers.
- Basic knowledge of locomotive characteristics, components, and systems.
- Locomotive operation.
- Railroad computer programs used to track and document locomotive repairs, maintenance, and history.

Attribute—Apply (Skill)

- Ensures compliance with all railroad and FRA rules, regulations, and safety requirements.
- Operates heavy-duty equipment and licensed and unlicensed vehicles and works around all types of moving equipment.
- Performs tasks associated with work assignments such as cleaning, sweeping, forklift operation, handling material, and fueling locomotives.
- Cleans interior/exterior of locomotives, equipment, and mechanical parts.
- Supplies locomotive with necessary materials.

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- Completes routine reports and makes entries into log and inventory records.
- Cleans empty cars.
- Checks fuel or water sight glass/gauge to determine fluid levels on tools, machines, or equipment (hydraulic, lubricating, fuel, cooling, etc.) and performs preventive maintenance on a variety of tools, equipment, or machinery.
- Operates mechanical washing system, including preparation of cleaning solutions to clean grease, scales, dirt, and other foreign matter from locomotives, freight cars, and equipment.
- Operates locomotives as required.
- Operates railroad computer programs used to track and document work history.

Attribute—Value (Mindset)

- Process discipline.
- Uncompromising expectation for safety.
- Personal and professional accountability.
- Personal and professional ethics.

## Competency: Domain Knowledge—MOW Workers and Machinery Operators

This competency describes knowledge and skill attributes demonstrated by competent MOW workers and machinery operators. MOW workers must ensure that the integrity of the track structure remains within FRA regulatory compliance and that the railroad right-of-way remains clear, safe, and navigable at all times. Often times, MOW workers must operate machinery in order to effectively perform their jobs. Disciplines are included to distinguish specific attributes.

**Job Functions.** The MOW worker and machinery operator perform three primary functions:

1. ***Monitor condition of track:*** MOW workers must routinely inspect, maintain, check, clear, and repair the tracks. Often times these tasks must be completed using specialized equipment and machinery.
2. ***Ensure area adjacent to track is clear:*** Workers must keep this area clear for safety. Their work can include removing debris, clearing drainage trenches, installing drainage systems, trimming back trees and shrubs, reapplying gravel, and other activities. Keeping this area clear promotes visibility so that train drivers can clearly see what is ahead of them, reduces track obstructions by keeping the area around the track clear of potential obstructions, and reduces fire hazards.
3. ***Operate variety of machinery:*** Workers must know how to safely operate specialized on- and off-track machinery to maintain and repair track and surrounding area, as well as discern which pieces of equipment and tools are suited for each task.

Attribute—Understand (Knowledge)

- Machines and tools needed to perform tasks, including their designs, uses, repair, and maintenance.
- Materials, methods, standards, and tools involved in the construction or repair of the track.
- Relative policies, procedures, strategies, and regulatory standards to maintain track and nearby area to ensure safety of people, property, and surrounding community.
- Railroad's operating and safety rules and FRA regulations that apply to MOW workers.

Attribute—Apply (Skill)

- Inspects tracks regularly for signs of problems or deviations from federal safety standards, including missing or damaged ties, plates, and fasteners; damaged or defective rails; ballast

and drainage, maintenance of continuous welded rail (CWR); joint bar defects, missing bolts, missing/ineffective anchors, etc.
- Ascertains the overall condition of the track, implements appropriate remedial actions (i.e., slow order, repair, or remove track from service) based upon observed track conditions, and monitors for any potential obstructions.
- Operates self-propelled on- and off-track specialized equipment such as light cranes; ordinary motor trucks; tampers; regulators; tie handlers; hoists/booms; undercutters; tractors, graders, and other heavy equipment; large cranes; dump trucks; bulldozers; bob cats; backhoes; etc. to maintain and repair the railroad tracks and related infrastructure (i.e., right-of-way, bridges, culverts, catenary systems, etc.).
- Loads, unloads, and delivers materials; supplies; equipment; and new, used, or scrap parts and materials to and from storage areas, stock piles, and job sites.
- Loads, unloads, and hauls scrap, used materials, and other debris.
- Operates mechanical yard sweepers and vacuum trucks.
- Operates automatic equipment, including preparation of cleaning solutions to chemically clean grease, scales, dirt, and other foreign matter from metal machinery, parts, filters, and materials.
- Checks, changes, and replenishes fluid levels on tools, machines, or equipment (hydraulic, lubricating, fuel, cooling, etc.).
- Operates booms, hoists, jacks, power tools, etc. as required.
- Hooks and directs crane to transfer and position material or parts.
- Operates hand-held, hand-supported power-operated machinery or equipment such as power washers, jackhammers, air chisels, hand-held tampers, spiking guns, pneumatic wrenches, shot/sand blasters, rail saws, rail drills, grinders, chain saws.
- Operates personnel-lifting equipment such as bucket-lifts, platform-lifts, safety pallets.
- Inspects machinery to identify would-be problems or defects.
- Services, repairs, adjusts, and tests machines, devices, moving parts, and equipment.

Attribute—Value (Mindset)

- Constant vigilance.
- Propensity to act.
- Uncompromising expectation for safety.
- Personal and professional accountability.
- Personal and professional ethics.

### *Discipline: Foremen*

**Job Function.** The foreman oversees the work of either a track gang or a production gang. Depending upon the size of the gang, there may also be an assistant foreman.

Attribute—Understand (Knowledge)

- Full operational knowledge of federal track safety standards, track structure, and related terminology.
- Requirements of the federal track safety standards that apply to the inspection of track and the restoration and renewal of the track for which he/she is responsible.
- Railroad's operating and safety rules, including application of roadway worker protection requirements to protect of self and those operating under his/her on-track safety.
- Rules on the physical characteristics of the railroad.
- The dangers inherent in track work and the use of all equipment employed for this purpose.
- Procedures for securing track time.

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- Procedures for responding to an unplanned or emergency event.
- FRA track safety standards, roadway worker protection standards, roadway maintenance machine standards, and applicable OSHA standards such as Respiratory Protection (1910.134), Hazard Communication (1910.1200), and Lockout/Tagout (1910.147).

Attribute—Apply (Skill)

- Ensures proper and safe use of all equipment employed in track installation and repair.
- Applies and follows roadway worker protection procedures for the protection of self and employee under his/her protection.
- Assigns workers as appropriate to the track work to be undertaken.
- Conducts on-track safety and job safety briefing prior to each day's work and each time conditions change.
- Responds to unplanned or emergency event in a timely fashion in accordance with railroad procedures.

### *Discipline: Large-Machine Operators*

**Job Function.** The large-machine operator uses self-propelled track equipment such as a ballast tamper, ballast regulators, tie handlers, and undercutter and off-track equipment such as a crane and backhoe.

Attribute—Understand (Knowledge)

- Basic to full operational knowledge of federal track safety standards, track structure, and terminology.
- Railroad's operating and safety rules, including roadway worker protection.
- The dangers inherent in track work and the use of self-propelled equipment.

Attribute—Apply (Skill)

- Properly and safely uses selected self-propelled equipment in use on the railroad.
- Inspects, and detects any malfunction of, self-propelled equipment.
- Follows roadway worker protection procedures.

### *Discipline: Small-Machine Operators*

**Job Function.** The small-machine operator uses small hand-held or push-along (not self-propelled) track equipment such as grinders, tie borers, and rail saws.

Attribute—Understand (Knowledge)

- Basic operational knowledge of track structure and terminology.
- Railroad's operating and safety rules, including Roadway Worker Protection.
- The dangers inherent in track work and the use of hand-held or push-along power equipment.

Attribute—Apply (Skill)

- Properly and safely uses all hand-held or push-along power equipment in use on the railroad.
- Inspects, and detects any malfunction of, hand-held or push-along power equipment.
- Follows roadway worker protection procedures.

### *Discipline: Track Inspectors*

**Job Function.** The track inspector performs inspection of track and identifies conditions that do not meet FRA safety standards. A foreman is also qualified to be a track inspector.

Attribute—Understand (Knowledge)

- Full operational knowledge of federal track safety standards, track structure, and terminology.
- Requirements of the federal track safety standards that apply to the inspection of track and the restoration and renewal of the track for which he/she is responsible.
- Railroad's operating, physical characteristics, and safety rules, including roadway worker protection.
- The dangers inherent in track work and the use of all equipment employed for this purpose.
- Procedures for securing track time.
- Procedures for responding to an unplanned or emergency event.
- Procedures for reporting the results of track inspections.

Attribute—Apply (Skill)

- Contacts dispatcher to secure access to track for inspection.
- Inspects track in accordance with FRA track safety standards, detects deviations from those standards, and prescribes appropriate remedial action or safely compensates for those deviations. Inspection may be by high-rail vehicle or on foot.
- Identifies conditions that must be corrected to achieve compliance with FRA track safety standards.
- Removes track from service if identified deviations cannot be corrected or safely compensated for.
- Performs minor repairs, e.g., replaces missing spikes and bolts, repairs pull aparts, replaces broken bars.
- Reports inspection results in accordance with railroad and FRA procedures and in a timely fashion.

### *Discipline: Trackmen/Laborers*

**Job Function.** The trackman/laborer position is a labor-intensive job requiring the use of hand tools for work on the track and right-of-way. Most MOW employees begin their career with the railroad as a trackman/laborer.

Attribute—Understand (Knowledge)

- Basic operational knowledge of track structure and terminology.
- Railroad's operating and safety rules, including Roadway Worker Protection.
- The dangers inherent in track work.

Attribute—Apply (Skill)

- Properly and safely uses all hand tools in use on the railroad's right-of-way.
- Selects appropriate hand tool for task, e.g., for bolt installation and removal, or tie plate replacement.
- Follows roadway worker protection procedures.

### *Discipline: Welders*

**Job Function.** The welder position involves electric, thermite, and gas welding of track.

Attribute—Understand (Knowledge)

- Basic to full operational knowledge of track structure and terminology (Many welders are required to be qualified to the level of track foreman/track inspectors).

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- Railroad's operating and safety rules, including roadway worker protection.
- The dangers inherent in track work, the use of welding equipment, and the application of the appropriate safety rules and OSHA standards related to welding and welding safety.

Attribute—Apply (Skill)

- Properly and safely uses welding equipment in use on the railroad's right-of-way.
- Detects any malfunction of welding tools and equipment.
- Follows roadway worker protection procedures.
- Welds all track to be in compliance with federal track safety standards.

## Confirming Behaviors for Craftworker Domain Knowledge Competencies

Mentoring/Transfer of Knowledge

- Commits to acquiring appropriate knowledge and/or skills.
- Takes the first step to initiate colleague-to-colleague relationship.
- Is trusted counselor or guide.
- Is responsible for overall career guidance and support for their mentee.
- Creates a safe environment built upon mutual respect and trust for the mentoring relationship.

Proper Escalation

- Ensures that all facts are gathered and all alternatives have been considered.
- Has thorough understanding and subject matter expertise of role to ensure appropriate issues and concerns are presented up.
- Has courage to bring an issue or situation to someone's attention even if there may be repercussions.

Action Oriented/Proactivity

- Performs work with energy and drive.
- Values planning but will take quick, decisive action when an opportunity presents itself.
- Is willing to take on tasks that are viewed as challenging.

Good Judgment

- Recognizes when to escalate situations to the appropriate people in the appropriate channels.
- Makes decisions authoritatively and wisely after contemplating various courses of action.
- Refrains from jumping to conclusions, takes time to collect facts, and makes an educated decision.
- Can appropriately balance needs versus desires.
- Considers long- and short-term implications of decisions.

Attention to Detail

- Expresses that things be done right, thoroughly, and precisely.
- Completes all work in accordance with policies, procedures, and standard operating procedures.
- Reviews work for accuracy and thoroughness.
- Carefully monitors quality and standard of work for self and teams.
- Double-checks the accuracy of information and work product to provide consistent work.

Effective Oral Communication

- Adapts communication style to a situation in order to meet goals, reach consensus/understanding, or create buy-in.
- Requires direct interaction with all involved parties, including listening to the needs and concerns of others.
- Confronts and clarifies miscommunication.
- Effectively listens when in communication with another, requiring shutting out distractions and focusing mentally on the speaker.
- When using electronic forms of communication, confronts miscommunication or lack of clarity by having a phone or in-person conversation.
- Uses appropriate body language when speaking with another to show interest and understanding to the other person.
- Provides a timely and appropriate response.

Effective Written Communication

- Uses correct grammar, punctuation, and spelling when writing.
- Takes appropriate notes based upon a conversation or training that can be understood and comprehended by all readers.
- Proofreads all communications to ensure accuracy and understanding before submitting or sending.

## Competency: Commitment to Safety

This competency describes the knowledge, skills, and mindset demonstrated by competent practitioners that create a culture of safety. This competency includes creating a culture of safety, demonstrating a systems approach to safety, identifying and mitigating risks, and effective safety communications.

Attribute—Understand (Knowledge)

- Hazards and risks inherent to rail industry.
- Human factors.
- Hazard analysis.
- Risk management.
- Design for safety.
- Industrial hygiene.

Attribute—Apply (Skill)

- Methods and techniques employed in the analysis and mitigation of hazards.
- Methods and techniques to apply safety standards, practices, and research findings into daily engineering practice.
- Ability to recognize and identify potential hazards.
- Systematic approach to evaluate and resolve risks inherent in the specific trade.
- Principles and practices of environmental safety and industrial hygiene.

Attribute—Value (Mindset)

- Constant vigilance.
- Propensity to act.
- Uncompromising expectation for safety.

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Confirming Behaviors

- Creates a culture of safety.
  - Uncompromisingly expects safety.
  - Participates in regular safety reviews.
  - Holds self and others accountable for safety performance.
  - Makes safety performance transparent across organization.
  - Recognizes and rewards team member identification of actual/potential risks and near misses.
- Uses a systems approach.
  - Integrates safety practices throughout product/project life cycle.
  - Applies design for safety principles and practices.
  - Systematically analyzes "near miss" incidents and implements timely corrective actions based on findings.
  - Actively participates in safety review panels.
- Identifies and mitigates risk.
  - Applies a systematic and rigorous approach to hazard identification and mitigation.
  - Constantly vigilant with regard to hazards in the immediate work environment.
  - Suspends operations and does not proceed until risks have been effectively mitigated.
- Effective communication.
  - Aggressively and clearly communicates immediate hazards to team members—advising avoidance activities.
  - Communicates safety issues throughout chain of command in clear, concise, and timely fashion.
  - Reviews all safety documentation made available by employer.
  - Aligns safety communications to organizational goals and objectives.

## Competency: Personal Effectiveness

This competency describes the knowledge, skills, and mindset demonstrated by competent practitioners that contribute to their overall effectiveness as railroad craftworkers. This competency is characterized through demonstrated professionalism, ethics, and values in craft practice; effective communication; building of collaborative relationships; and creation of a culture of accountability.

Attribute—Understand (Knowledge)

- Time management methods and techniques.
- Task management methods and techniques.
- Individual and team accountability.
- Team principles.
- Government structure and function at federal, state, and local levels.
- Professional development needs and potential learning resources.

Attribute—Apply (Skill)

- Stress management.
- Active listening.
- Systematic approach to evaluate and resolve alternative and/or conflicting points of view.
- Principles and practices of communication for complex technical and business information.
- Principles and practices of environmental safety and stewardship.

Attribute—Value (Mindset)

- Safety.
- Strong work ethic.
- Commitment to rail industry.
- Personal credibility.
- Professional ethics.

Confirming Behaviors

- Professionalism, ethics, and values in respective craft.
  - Demonstrates personal integrity.
  - Treats all with respect.
  - Approaches challenging tasks with a "can-do" attitude.
  - Is open to new and different ways of doing things.
  - Is honest and forthright with people.
  - Represents employer/sponsor in a professional manner.
  - Conveys a command of the relevant facts and information.
  - Maintains a sense of humor.
  - Is active in professional organizations.
- Effective communication.
  - Prepares clear, concise, and accurate written documentation when indicated.
  - Effectively communicates activities through written, oral, and electronic channels.
- Building of collaborative relationships.
  - Builds and maintains productive relationships with government agencies, trades, contractors, consultants, labor organizations, and the general public.
  - Actively engages and supports team activities.
  - Interested in others' viewpoints and acknowledges their perspectives and ideas.
  - Provides assistance, information, and support to others.
- Creation of a culture of accountability.
  - Demands continuous attention to safety.
  - Communicates project risks up the chain of command in a timely and effective manner.
  - Clearly communicates performance expectations of self and others.

## Competency: Commitment to Standards

This competency describes the knowledge, skills, and mindset demonstrated by competent practitioners in the application and interpretation of standards in the rail industry.

Attribute—Understand (Knowledge)

- Applicable rail industry and governmental standards, regulations, and guidelines.
- Federal, state, and local government regulatory codes.
- Construction and construction inspection standards and practices.
- Operations and maintenance standards and practices.
- Federal and state environmental policies and standards.

Attribute—Apply (Skills)

- Incorporation and satisfaction of relevant and appropriate standards in trade.
- Incorporation and satisfaction of relevant and appropriate safety standards.
- Employment of design, construction, operations, and maintenance manuals specified by the employer.

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Attribute—Value (Mindset)

- Maintenance of high technical standards.
- Uncompromising commitment to safety.
- Uncompromising commitment to quality.

Confirming Behaviors

- Assures compliance with the federal, state, and local environmental laws throughout ongoing operations.
- Complies with transportation safety codes and other regulations.
- Selects and applies standard methods and techniques to produce a quality product.
- Reviews project specifications and plan to assure conformity with the laws, ordinances, and accepted professional standards that pertain to the given trade.

CHAPTER 5

# Education

When looking at recruitment issues in the railroad industry, it is imperative to examine education as a key factor in building and maintaining a skilled workforce. A review of the literature indicates that most education in rail-related topics begins at the university level (Lautala, 2007). Currently education in the United States for engineering students interested in the field of transportation is mostly concentrated on the highway sector, demonstrating the recent focus the country has placed on traffic safety and constructing new roads (Sunderland and Harrington-Hughes, 2011). Since 1960, education in the United States has shied away from the railroads, which has resulted in workers who are not ready to face the changes needed to deal with new, higher tech railroad technology and engineering. The following sections highlight railroad educational opportunities.

## Rail-Related Education in the United States

### Literature Review

#### *Early Education*

A comprehensive review of the literature reveals that little is currently being done to educate children in an elementary school setting about the railroad and related industry employment. However, research indicates that young children need to be exposed to the railroads as a possible career option early on and that existing programs at the community college and university level may be too late to pique students' interest (Reinarch and Viale, 2007).

Ways to successfully introduce the railroad to young students can be gleaned from looking at programs for science, technology, engineering, and math (STEM) and competitive programs, such as 1st Robotics. These programs have been introduced to educate students and provide them with the knowledge, skills, and abilities to work in a highly technological world, as well as give them the forum to apply STEM concepts to real-life technological problems. The hope for the students who participate in these programs is that they eventually will contribute to the success of the U.S. workforce, improve the country's economy, and keep the United States successful and relevant in science, research, and technology among the other world powers (Chairman's Staff, Joint Economic Committee, 2012).

The National Science Foundation and other government agencies, universities, and research institutions have handsomely invested in STEM because they believe that education in and exposure to these fields will lead to participants successfully joining these workforces (Dorsen et al., 2006). As these programs continue and more data becomes available, the rail industry, universities, elementary educators, and relevant government agencies can continue to look to these programs as a guideline to achieve their goals in recruiting, educating, and retaining a competent rail workforce.

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### *Community College Programs*

A successful example of a community college program is The National Academy of Rail Sciences at Johnson County Community College in Overland Park, Kansas. NARS holds a partnership between Johnson County Community College and BNSF railway. Currently the program provides training to students through several different avenues. These include classroom education, online courses, small teleconferences meant to foster discussion, self-paced training on computers, and use of locomotive simulators. Areas of educational and training focus include mechanical, conductor, locomotive engineer, engineering maintenance, signal systems, telecommunications, and supervision/leadership in the rail workforce. Hands-on experience is emphasized at NARS and those students who complete the program earn a certificate, enabling them to qualify for jobs in the rail industry (Hansen, 2005).

### *University Education Programs*

A study conducted by the American Railway Engineering and Maintenance-of-Way Association of 239 North American universities with accredited civil engineering programs indicated that currently programs in these universities have a minimal amount of attention given to railroad systems (Sunderland and Harrington-Hughes, 2011). The majority of individuals who later end up working in the field of transportation engineering enter into programs for civil engineering in academia. However, most of these civil engineering programs do not have specific transportation or rail engineering programs in their curricula. At the graduate level, only a small number of programs advertise transportation engineering as an area of concentration and, furthermore, most of these programs focus on highways, traffic and planning, and transit, with rail engineering largely ignored. The knowledge required of railway engineers spans many disciplines, including not only civil engineering, but also electrical, mechanical, and systems engineering, as well as an understanding of public transportation design, development, and management (Sunderland and Harrington-Hughes, 2011).

**Penn State Altoona.** In 2011, Penn State Altoona became the first university in the United States offering an undergraduate degree in rail transportation engineering. This program falls under the university's business and engineering division, focusing the first 2 years on traditional civil engineering and the following 2 years on areas such as rail operations and safety, communications and signals, track location, maintenance, and construction. Seen on the university website is the following statement: "Executives in the transit industry, project managers, consulting engineers, and government officials have all told us of their need to hire engineers with the kind of training Penn State now offers at the Altoona campus. If you are interested in the role of railroads in protecting the environment or fighting highway congestion, this is the program for you. If you want to be a part of a developing passenger rail system in this country, you will need the training that Penn State Altoona now offers" (Penn State Altoona, 2013). Coordinator of the rail transportation engineering program Steve Dillen indicates that though Class I railroads have already lent support in developing the program, the transit sector is expected to become more involved as the program grows (Sunderland and Harrington-Hughes, 2011).

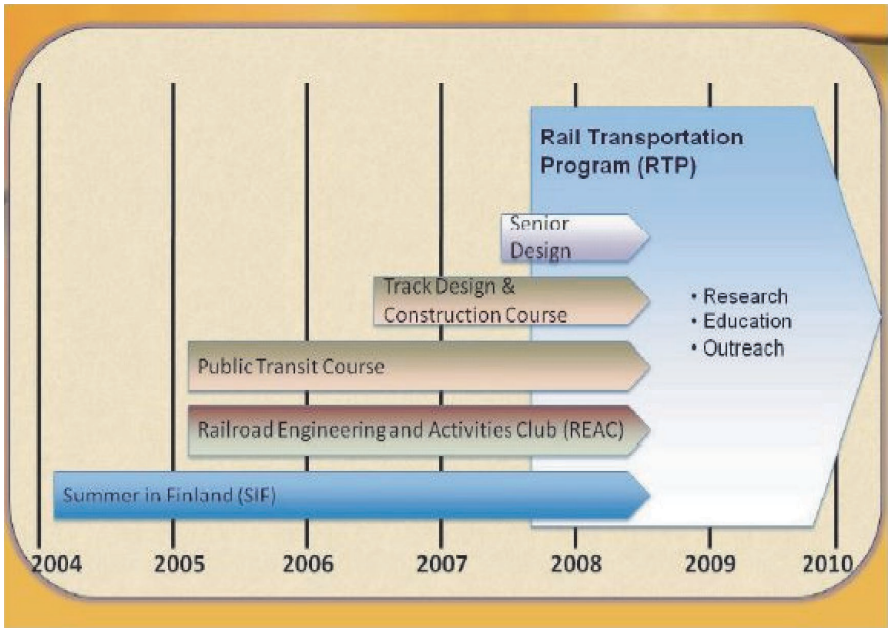
**The University of Illinois at Urbana–Champaign.** The Department of Civil and Environmental Engineering at the University of Illinois at Urbana–Champaign currently offers six courses in railroad engineering and houses a program entitled "RailTEC" (Rail Transportation and Engineering Center). RailTEC provides seminars, short courses, workshops, and conferences for students, faculty, and rail professionals in the industry by combining education and research programs. The university has also housed foreign experts in high-speed rail as professors (Sunderland and Harrington-Hughes, 2011). This university serves as the headquarters to The National University Rail (NURail) Center, an association of seven partner colleges and universities that came together in recent years to address the rail and engineering needs in

education. NURail includes researchers and educators from this university, University of Illinois at Chicago, Michigan Technological University, Massachusetts Institute of Technology, Rose-Hulman Institute of Technology, University of Kentucky, and University of Tennessee, Knoxville (National University Rail Center, 2015).

**Michigan Technological University.** Michigan Technological University (Michigan Tech) is home to the Michigan Tech Transportation Institute, an organization that offers multidisciplinary education and research for the transportation industry (Figure 45). The FRA recently awarded a contract to the university to construct a web portal as a means of sharing rail education materials. A smaller sector of this organization is the Rail Transportation Program (RTP), which has been headed by Pasi Lautala, Ph.D., beginning in 2004, designed to educate students and engineers about the railroad industry. This group also hosts international experts on rail to provide instruction to students. Also in the works for Michigan Tech is a professional certificate program in railway engineering for those already in possession of a bachelor's degree in engineering (Sunderland and Harrington-Hughes, 2011).

Michigan Tech also offers a 5-week summer international program in railway engineering, where students spend 3 weeks studying at the Tampere University of Technology in Finland, called the Summer in Finland program. There they are exposed to rail facilities and take part in different design projects, while being exposed to both real-life and classroom education (Lautala and Sproule, 2009; Sunderland and Harrington-Hughes, 2011).

The university is also home to the Railroad Engineering and Activities Club, the student chapter of the American Railway Engineering and Maintenance-of-Way Association. The purpose of this club is to help promote networking between students, faculty, and industry workers, in an effort to inspire engineering students to consider a career in the railroad industry (Lautala and Sproule, 2009; Sunderland and Harrington-Hughes, 2011). They are also part of NURail, as previously discussed.




Source: Lautala and Sproule (2009)

***Figure 45. Development of rail transportation activities at Michigan Tech.***

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### *Industry–University Partnerships*

Lautala and Sproule (2009) found that industry–university partnerships can play an integral part in recruitment for the railroad industry, specifically for railroad engineers. They discuss how developing a relationship between industry and universities can help interest, edify, and recruit more railroad engineers to the industry, while highlighting possible challenges that may occur throughout this process (Lautala and Sproule, 2009).

From the study comes a better sense of what a new engineer's road to a career in the railroad industry looks like. Lautala and Sproule (2009) discuss the effects of exposure, or lack thereof, to rail education and the influences on selection of employment. Perhaps the most interesting result of the study was the importance of multiple exposure types to railroad education in terms of the university setting. Seventy percent of students who rated exposure to rail topics as either very or extremely important to their career selection had more than one type of contact with these topics, whereas 80 percent of students who stated university education was only somewhat or not important to career choice had only had been exposed to rail topics by one method. This suggests that the effectiveness of recruitment for railroad engineers in universities would benefit from students having multiple opportunities for exposure to rail topics (Lautala and Sproule, 2009).

Past research, including a 1980 study (Patton), suggests annual federal funding should be distributed to assist different forms of railroad education, including small seminars and courses to build up rail-related course content and research programs at the university level. A more recent study indicated that—due to high retirement rates, bimodal workforce age distributions, high profits in the rail industry, and an increased number of recently promoted supervisors—there are an increasing number of open positions in railroad industry management without qualified candidates, resulting in an increasing need for educational programs in railroad industry management (Lautala, 2007). However, as previously mentioned, there are few accredited university programs that currently focus curricula toward railroad systems.

This limited course curricula in rail topics may be in part due to financial constraints and lack of expertise in universities. Industry–university partnerships may help tackle both of these issues. Some of the most typical industry–university partnerships include internships and cooperative education, industry-sponsored team projects, enterprises, engineer-in-residence programs, and consortiums (Lautala and Sproule, 2009).

Lautala and Sproule (2009) discuss that both Michigan Tech and the railroad industry have benefited from their partnership. Since the advent of the partnership, railroad companies have successfully been recruiting engineering students, while RTP at Michigan Tech has received approximately $400,000 in research funding. RTP states the rail industry should give thought to the following action items:

- Get the word out on the demand for railroad engineers.
- Identify and assist interested universities.
- Consider financial support for selected universities.
- Increase the quantity and quality of cooperative education and internship assignments.
- Develop a comprehensive long-term strategy.

The weight of much of the work for creating these partnerships lies with the industry. It will need to reach out to key contacts at universities and discuss the needs of the industry as well as the benefits the universities will experience. Lautala and Sproule (2009) offer the following suggestions for universities to engage in these partnerships as well:

- Identify a faculty champion and internal level of interest.
- Identify the most effective mix of activities.
- Explore industry assistance in the development process.

**Table 11. University and rail industry motivations for partnership.**

| | Rail Industry | Universities |
|---|---|---|
| Primary motive | Improved access and education of undergraduate students<br>Potential savings in recruitment, training, and attrition | Identified demand for railroad engineers<br>"Niche" area<br>Potential financial support |
| Challenges | Satisfaction with current procedures<br>No perceived challenges in recruitment or education by top management<br>Lack of confidence in university capabilities | Lack of potential research funding or support<br>Limited opportunities for academic publications<br>Lack of faculty expertise |
| Areas of strength | Rail-specific training in real-life environment<br>Training of motivated employees<br>Abundant resources and expertise | Introduction and attraction to rail<br>Identification of motivated students<br>Education in general skills and education |

Source: Lautala and Sproule (2009).

- Identify the potential for collaboration with other universities.
- Consider an incremental approach for acquiring or inquiring about industry support.

Universities and the rail industry have different motivating factors to enter into these partnerships as illustrated in Table 11.

## Educational Programs Currently Offered in the United States

This subsection compiles, summarizes, and assesses the educational and training resources available to the current and potential railroad workforce and determines that there is insufficient geographical overlap between these resources and rail hubs (see Figure 46). Certificates as well as academic degrees conferred by commercial or educational institutes are covered.

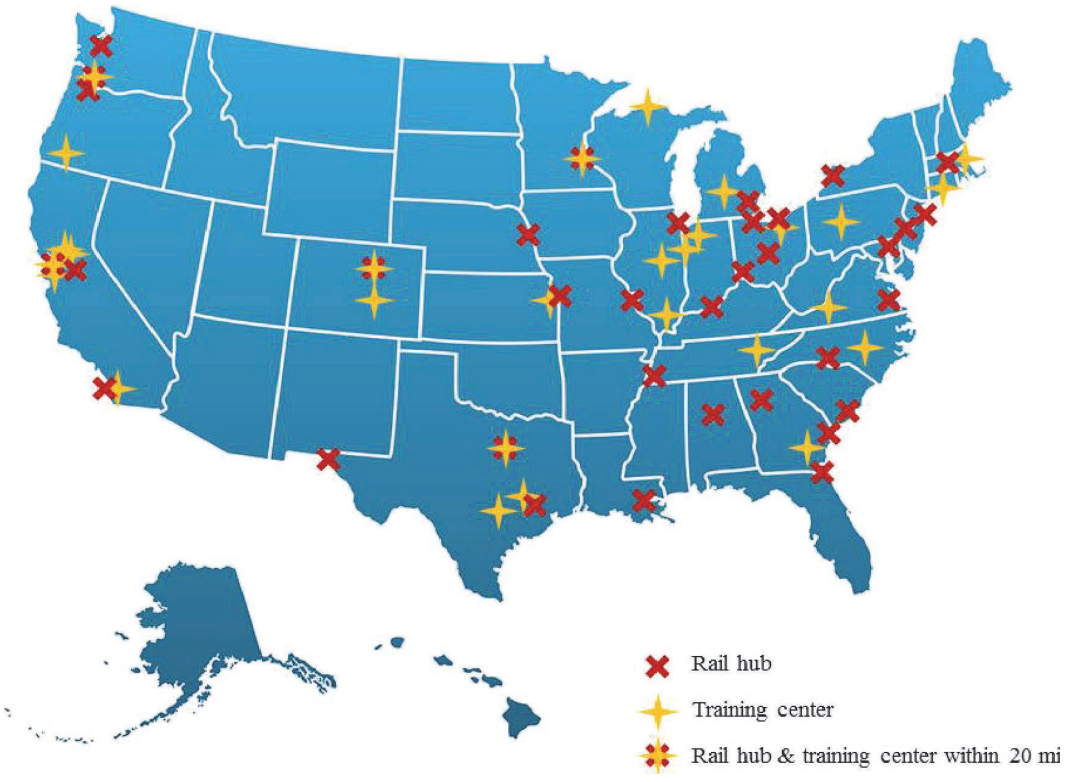


*Figure 46. Map plotting rail hubs and training centers, as of February 2015.*

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### *Non-academic Certificates*

- ARC-Tech.net
- Johnson County Community College
- Dakota County Technical College
- Keeping Track Railroad Consulting & Training
- Michigan State University
- University of Tennessee, Knoxville
- Mineta Transportation Institute
- Modoc Railroad Academy
- Northwest Railroad Institute
- Okefenokee Technical College
- Transportation Certification Services

### *Mixed Offerings*

- Tarrant County College
- Virginia Polytechnic Institute and State University

### *Academic Degrees*

- University of Maryland, College Park
- University of Illinois at Urbana–Champaign
- Michigan Technological University
- Penn State Altoona
- University of California, Berkeley
- University of California, Davis
- California State Polytechnic University
- Massachusetts Institute of Technology
- North Carolina State University
- Purdue University
- Texas A&M University
- Colorado State University, Pueblo
- Gateway Community College
- Sacramento City College

The positions for which the preceding educational resources offer education/training and the types of education/training offered are identified in Table 12.

## Educational Opportunities in Executive Leadership

The research team compared three formal leadership development programs. Based on the recommendation of an interviewee, the program and curriculum descriptions available online for the Stanford Executive Program (SEP) were reviewed. In addition, the research team took a look at program and curriculum descriptions available online for Harvard Business School Program for Leadership Development (PLD) and the Center for Creative Leadership's Leadership at the Peak (LAP).

These programs are relevant to this study because they offer pathways to the knowledge, skills, and abilities specific to executive leaders without requiring full-time, on-campus enrollment. Also relevant to this study, participants in these programs are already in positions of leadership and therefore have organizations into which to apply new learning about running a business and leading people, as well as stewarding organizational change.

**Table 12. Educational/training resources by position and training type.**

| Institution | Operations Manager | Systems Engineer | Conductor / Brakeman | Locomotive Engineer | Railroad Dispatcher | Electrician & Communications Maintainer | Signalman & Lineman | Mechanical Personnel | Maintenance-of-Way | Limitations & Challenges |
|---|---|---|---|---|---|---|---|---|---|---|
| ARC-Tech.net | ■ ▲ | ■ ▲ | ■ ▲ | ■ ▲ | ■ ▲ | ■ ▲ | ■ ▲ | ■ ▲ | ■ ▲ | Limited curricula. |
| Johnson County Community College | | | ⬟ | | | ⬟ | ⬟ | | ⬟ | |
| Dakota County Technical College | | | ⬟ | | | | | | | |
| Keeping Track Railroad Consulting & Training | | | | | | | | | | No publicly available curricula. |
| Michigan State University | | | | | | | | | | General rail certificate available. |
| University of Tennessee, Knoxville | | | | | | | ■ | | | General transportation certificate available. |
| Mineta Transportation Institute | | | | | | | | | | High-speed rail certificate available. |
| Modoc Railroad Academy | | | ■ ⬟ | ■ ⬟ | | | | | | |
| Northwest Railroad Institute | ■ | | ■ | ■ | ■ | | | ■ | ■ | General rail certificate available. |
| Okefenokee Technical College | | | | | | ⬟ | | | | |
| Transportation Certification Services | | | | | | | | | | Can administrate certification training by contract with carriers. |
| Tarrant County College | | | | | ⬢ ⬟ | | | | | |
| Virginia Polytechnic Institute and State University | ● | ● | | | | | ● | | | General transportation graduate degrees and certificate available. |
| University of Maryland, College Park | ● | ● | | | | | ● | | | |
| University of Illinois at Urbana–Champaign | ● | ● | | | | | ● | | | |
| Michigan Technological University | ● | ● | | | | | ● | | | |
| Penn State Altoona | ✚ | ✚ | | | | ✚ | ✚ | ✚ | | |
| University of California, Berkeley | ● | ● | | | | | | | | |
| University of California, Davis | ● | ● | | | | | | | | |
| California State Polytechnic University | | | | | | | | | | Offers M.S. in transportation planning |
| Massachusetts Institute of Technology | | | | | | | | | | Graduate degrees in transportation. |
| North Carolina State University | | | | | | | | | | Offers M.S. in civil engineering with specialization in transport systems and materials. |

*(continued on next page)*

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**Table 12. (Continued).**

| Institution | Operations Manager | Systems Engineer | Conductor / Brakeman | Locomotive Engineer | Railroad Dispatcher | Electrician & Communications Maintainer | Signalman & Lineman | Mechanical Personnel | Maintenance-of-Way | Limitations & Challenges |
|---|---|---|---|---|---|---|---|---|---|---|
| Purdue University | | | | | | | | | | Offers M.S. in civil engineering with specialization in transportation engineering. |
| Texas A&M University | | | | | | | | | | Offers graduate and undergraduate degrees in transportation engineering. |
| Colorado State University, Pueblo | | | | | |  | | | | |
| Gateway Community College | | | | | |  |  |  | | |
| Sacramento City College |  | | | | | | | | | |


## Stanford Executive Program

- Six-week on-campus offering. Program and curriculum descriptions focus a great deal on required and optional classroom-based sessions in contrast to PLD.
- For seasoned executives with at least 12 to 15 years of senior management experience and strategic responsibilities at the company- or country-wide level.
- "Prepares senior executives to drive results at the highest levels of global management."
- Tuition is $61,500 with an option to add the $5,800 Individual Leadership Skills Development module.
- Participants who complete the program receive Stanford Graduate School of Business Alumni status.
- Non-credit, non-degree program. Participants receive a certificate of completion.

## Program for Leadership Development

- Six-month program blending on-campus and off-site modules. Program and curriculum descriptions refer to content in high-level terms, emphasizing application to participants' organization in contrast to SEP.
- For functional managers with approximately 10 years of experience.
- "Provides the valuable tools, critical business skills, and broader perspective you need to take on greater cross-functional leadership responsibilities."
- Tuition is $43,000 with an option to add the $22,000 Module 5.
- Participants receive Harvard Business School Alumni status.
- Non-credit, non-degree program.

### Leadership at the Peak

- Five-day classroom event with pre-work and follow-up activities. The program combines high-level leadership topics, 360-degree feedback, fitness time, and nutritional advice.
- For senior leaders in top three levels of the organization, with at least 15 years of managing others, and from organizations with 500 or more people.
- ". . . senior leaders strengthen their ability to meet the challenges of leading the organization. In addition, every assessment, activity, and feedback session allows participants to drill down into the areas that are personally most essential."
- Tuition is $11,800.
- Participants receive access to myCCL, an online leadership community.
- Non-credit, non-degree program.

### Development Strategies

The following list presents the development strategies that compose the SEP, PLD, and LAP:

- Action plan development: case-study development specific to participant's organization and individual action plan for personal use
- Blended learning: classroom and on-the-job application
- Case studies
- Coaching (with assigned coach)
- Cross-functional (interdisciplinary) approach
- Feedback (360, as part of LAP)
- Informal sessions and networking with guest speakers
- Peer learning (cohorts)
- Simulation
- Virtual learning: web-based modules

### Academic Curriculum

Table 13 presents content areas offered to participants in the SEP, PLD, and LAP.

Executive leaders may possess a bachelor's and/or master's degree, but they were not mentioned as industry requirements. Pasi Lautala of Michigan Technological University observed that the valuation of formal college and university education seems to be increasing in the industry. "One or two leadership generations ago," he said, "having a college degree was not necessarily considered a strength in promotion considerations. This is changing quite a bit today. Most executives, especially more recent ones, hold college degrees and, in many cases, return to postgraduate or higher education while in the company." *Railway Age* editor Bill Vantuono had a similar insight that the last 5 years have seen an explosion of college graduates and graduate-level courses for professional development.

Today's craftworkers who aspire to higher levels of management and leadership will no doubt seek out those programs, creating the need to identify and track impact and return on investment linking higher education to executive railroad workforce development and retention.

## Educational Opportunities Abroad

### University Programs

Europe is facing similar demographic difficulties with their workforce as the United States. As a result of this situation, the U.S. Department of Education and the European Union (EU) conducted a 2-year project called Tuning Transatlantic Cooperation in Rail Higher Education.

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**Table 13. Academic curriculum content areas for executive leaders.**

| Content Area | SEP | PLD | LAP |
|---|---|---|---|
| Accounting | X | X | |
| Business Growth | X | | |
| Business Models | X | | |
| Business Process Design | X | | |
| Communication and Collaboration | X | | X |
| Conflict Resolution | X | | |
| Corporate Finance | X | | |
| Corporate Governance | X | | |
| Customer Service | X | | |
| Ethics | X | | |
| Finance Management | X | X | |
| Global Strategies (financial, as an example) | X | | |
| Goal-setting | | | X |
| Innovation | X | X | |
| Leadership | X | X | X |
| Marketing | X | X | |
| Microeconomics | X | | |
| Operations | X | X | |
| Organizational Change | X | X | |
| Organizational Climate | | | X |
| Performance Management | X | | |
| Public Policy | X | | |
| Strategy | X | X | X |
| Supply Chain | X | | |
| Technology (platforms, as an example) | X | | |
| Workforce (selection and incentives, for example) | X | | X |

The lead university in the United States was Michigan Tech and in Europe, the Instituto Superior Tecnico in Lisbon. The project examined available education programs in the United States and abroad (Sunderland and Harrington-Hughes, 2011).

Despite the limited rail workforce, Europe has more educational programs in the areas of transportation and railroad, most at the graduate level. South America and Asia also have more abundant educational opportunities available for degrees in rail and transport (Sunderland and Harrington-Hughes, 2011).

### *France*

The Professional Certificate in Railway and Guided Transport Systems is a 1-year program including coursework, internship, and thesis; it is intended to prepare both new recruits and experienced engineers for positions in engineering and management. The program was developed at the suggestion of French railway companies and is managed by over 20 institutions and six universities (Sunderland and Harrington-Hughes, 2011).

Institut Catholique d'Arts et Metiers provides students with a master's degree in railway engineering and was also developed with the assistance of the French railway industry. It is a 1-year program that includes course work on topics such as "the railway environment, operation of infrastructure and networks, production and maintenance of the rolling stock, on-board computers and information management, traction and braking, bodies and bogies, incorporation of equipment, and project management" (Sunderland and Harrington-Hughes, 2011). Students also must complete a 4-month internship working in the railroad industry (Sunderland and Harrington-Hughes, 2011).

### *Germany*

Germany is at the head of the university transportation and railway education programs in Europe, with the Technical University of Dresden (TUD) leading the way in terms of rail education. TUD offers bachelor's degrees in transport engineering, transport economics, and interdisciplinary transport-related courses as well as a master's degree in rail systems engineering. The master's degree program offers four different concentrations, including railway construction and railway infrastructure, railway signaling and railway telematics, railway operation, and local public transportation. The university is home to several different transport research institutes, two of which focus on railroad. The TUD Institute of Railway Systems and Public Transport focuses on the planning, construction, and operation of railway systems. The other rail-focused research institute at TUD is the Institute of Railway Vehicles and Railway Technology and focuses on rail vehicle technology, electric railways, and vehicle modeling and simulation (Sunderland and Harrington-Hughes, 2011).

Several other universities in Germany offer degrees in railroad education, including the Technical University of Berlin, which offers both bachelor's and master's degrees in transportation, with a focus on track and railway operations, rail vehicles, and electric railway systems (Sunderland and Harrington-Hughes, 2011).

RWTH Aachen University is home to four transport research institutes—the Institute of Railway Technology, the Institute of Rail Vehicles, the Institute of Automatic Control, and the Institute of Transport Science—and awards undergraduate and graduate degrees. At this university and in Germany in general, co-op programs are becoming increasingly popular for engineering students, with high school students starting to work at rail companies after graduation and then alternating periods of course work with fieldwork (Sunderland and Harrington-Hughes, 2011).

### *Spain*

In an effort to address the limited skilled rail workforce, Spanish universities and industries have formed partnerships to address the issues facing the railroad industry. The Technical University of Madrid in 2011 housed the first World Congress on Railway Training where delegates from 34 countries came together to discuss the changing needs of the railroad, focusing discussions and presentations on rail training needs, methodologies, educational issues, and best practices. In addition to housing this conference, the university's department of civil engineering has a 6-year program that offers a transport area of specialization (Sunderland and Harrington-Hughes, 2011).

The Catalan Government Railways in Spain has taken an active role in assisting universities, such as the Engineering School of Vilanova I Geltru and the Polytechnic University of Catalonia to develop course work in the master's degree programs focused on railway traction power systems in an effort to train and educate the region's next generation of railroad engineers (Sunderland and Harrington-Hughes, 2011).

### *United Kingdom*

The Rail Research UK Association is a partnership between the railroad industry and universities in the UK and is the main research program for transport in the UK. The goals of the association are to:

- Support and facilitate railway research in academia.
- Develop a common understanding of research needs to support the rail industry and its development.
- Identify opportunities for research, development, and application in railway science and engineering.
- Provide solutions to the rail industry.

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In 2014 the University of Birmingham began offering a bachelor's degree in civil and railway engineering as well as electrical and railway engineering, in response to the growing industry and thus the many possibilities for career opportunities after graduation (University of Birmingham, 2013). In addition to the new bachelor's program, the University of Birmingham continues to offer a number of postgraduate degrees in railway systems engineering and integration. Other universities with research and programs dealing with the railway are the Institute for Transport Studies at the University of Leeds, Manchester Metropolitan University, University of Southampton, and Newcastle University (Sunderland and Harrington-Hughes, 2011).

### *Brazil*

The University of Sao Paulo is Brazil's most respected university graduating engineers and has a department of transportation engineering on the Sao Carlos campus offering master's and Ph.D. degrees in transportation engineering. Many of the other Brazilian universities have a transportation concentration in engineering programs, however, with little focus on railroad (Sunderland and Harrington-Hughes, 2011).

The Brazilian Council for Urban Transportation is responsible for community forums in large cities that have little to no rail coverage, so as to educate the communities' engineers on how railways offer value to the public. These forums have taken place in cities such as Fortaleza, Natal, Maceio, Recife, Curitiba, and Porto Alegre (Sunderland and Harrington-Hughes, 2011).

### *India*

The Indian Institute of Technology comprises seven engineering and technological schools in seven cities throughout the country, each offering a transportation concentration in the civil engineering degree. Originally there was not a specific concentration on rail; however, as a result of an urgent need for rail engineers, the university implemented an independent degree in metro rail transport in 2008, specializing in technology and management. Before this program came to be, when the rail system was going through major construction, the Delhi Metro Rail Corporation (DMRC) sent its engineers to different countries to learn about railway technology. Elattuvalapil Sreedharan, the principal advisor of DMRC, was also able to convince the Ministry of Human Resource Development in India that the country was facing such a "severe shortage" of skilled rail engineers that it should establish a railway engineering program in different engineering colleges and universities throughout the country (Sunderland and Harrington-Hughes, 2011).

### *China and Taiwan*

The most complete and successful transportation and railway engineering programs appear to be in China and Taiwan. The universities in these countries have a rich history in training their students in very specific focuses on transportation occupations. Many of the best technical universities in China and Taiwan have their own institutes dedicated to transportation and railroad research projects. Tongji University's College of Traffic and Transportation Engineering in Shanghai houses three different research institutes. The university awards bachelor's, master's, and Ph.D. degrees (Sunderland and Harrington-Hughes, 2011).

Both Southeast University and South China University of Technology offer bachelor's degrees in traffic and transportation engineering, while the latter offers an additional graduate degree with a concentration on railway engineering (Sunderland and Harrington-Hughes, 2011). Other important engineering universities include National Taiwan University, with ties to course development at the University of Illinois at Urbana–Champaign, and Beijing Jiaotong University, whose Dr. Mei Han spent time working at Michigan Tech's RTP in 2011 (Sunderland and Harrington-Hughes, 2011). Southwest Jiaotong University has produced so many Chinese railway engineers that its alumni are said to have provided input on the rail projects throughout

China (Sunderland and Harrington-Hughes, 2011). Finally, another important university offering all levels of degrees in transportation and rail education is Lanzhou Jiaotong University, formerly known as Lanzhou Railway University (Sunderland and Harrington-Hughes, 2011).

### *Japan*

Nihon University offers graduate programs in transportation engineering and socio-technology; however, no concentration is offered specifically in railroad engineering and only two courses center on railway topics (Sunderland and Harrington-Hughes, 2011).

### *University Opportunities in Review*

Countries that have continuously had strong educational programs in railroad engineering, such as China and Taiwan, also appear to have well-running, well-established, efficient rail systems (Sunderland and Harrington-Hughes, 2011). While the majority of foreign schools with civil engineering programs offer at least a master's degree in transportation and/or rail engineering, no U.S. schools offer such a degree (Sunderland and Harrington-Hughes, 2011).

Furthermore, industry can be very influential in identifying and describing the need for education in railroad engineering and also can play a critical role in funding for academic programs, such as seen in Europe and Asia (Sunderland and Harrington-Hughes, 2011).

## International On-the-Job Training Opportunities

### *Partnerships*

**Association du Transport Urbain de Quebec.** ATUQ made training for front-line management its first priority and sought university assistance in this matter. Laval University was chosen because of a strong reputation for business management skills and teaching students how to put into practice what is learned in the classroom. The course work highlighted five topics: "(1) labor relations, (2) day-to-day management, (3) the role of the front-line manager, (4) communications skills, and (5) change management" (Eno Transportation Foundation, 2008). Judging by the level of engagement by participating agencies, the networking opportunities produced, actual improvements in real management, and cost efficiency, the training was successful. For future training, suggestions were made to Laval University to tailor course work to be specific to transportation management as well as to address the interaction between the size of an agency and the management skills needed (Eno Transportation Foundation, 2008).

**Toronto Transit Commission.** Other programs include those aimed at "training up" current employees. Director of Employment Services Christine Jeffries states that TTC is committed to offering training to current employees to advance their careers through programs such as the Route Supervisor Program, a 6-week course to learn the responsibilities of supervisory positons, and the Engineer in Training program, which provides TTC employees with assistance in obtaining engineering licenses while working for the company (Eno Transportation Foundation, 2008).

**Veolia Environment Campus.** Veolia Environment Campus comprises four business lines: Veolia Water, Veolia Energy, Veolia Environmental Services, and Veolia Transport. It is housed in Jouy-le-Moutier, France, and serves all four business lines with training course development. The purpose of this training campus is to build competence among employees, to enhance the mission and culture of the organization, to support opportunities for career advancement in the workforce, and to enhance the professional and successful image of the organization to the public (Eno Transportation Foundation, 2008).

Specific to the business line of Veolia Transport, the campus offers training through classroom instruction, use of simulators, and hands-on learning in the field. Veolia Transport is

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committed to ensuring career advancement for all of its employees and uses annual evaluations to help achieve this goal. It also partners with a local university to offer diploma and certification courses (Eno Transportation Foundation, 2008).

### *Professional Certifications and Licensing*

On an international level, learning and training is often sponsored in some part or whole by the government, which allows for the standardization of the training programs and certifications (Rahn et al., 2003).

**National Occupation Standards.** MCPCC began collaborating with transit professionals on the National Occupational Standards for Bus Operators, which has made this position a profession with Canada-wide standards that inform training and certification programs. Furthermore, MCPCC initiated certification and accreditation programs for bus operators in order to bolster workplace skills and knowledge, as well as advocating for an increase in apprenticeship programs. The apprenticeship programs, such as the Red Seal Occupation Group, allow employees to add to their skillset while continuing to earn wages and contribute to their employer (Eno Transportation Foundation, 2008).

**Institution of Railway Signal Engineers.** The Institution of Railway Signal Engineers (IRSE) is an organization based in London and dedicated to those either interested in working in railroad signaling or already established in the profession. IRSE initiated a policy in 1994 to issue licenses to ensure competence and professionalism in railway signal engineering in the United Kingdom. The process of obtaining a license is a thorough one, ensuring that all workers are competent in their jobs, as well as physically and mentally fit to perform. Workers are reviewed first by employers for ability. After successful completion of the workplace assessment, registered competence assessors, licensed physicians, and mental health professionals, all registered with IRSE, are able to determine if applicants are able to receive or renew their license. These licenses are valid for 5 years. There are as many as 50 different classifications of licenses to account for the many different types of positions in this profession. These appear to work as competency models, as they list the knowledge, skills, and abilities one must possess in order to be a licensed professional (Institution of Railway Signal Engineers, 2014).

**Office of Rail and Road.** The Office of Rail and Road (ORR; formerly the Office of Rail Regulation) works to maintain the health and safety of rail with headquarters in London. Part of ensuring the proper functioning of the rail system means making sure train drivers are experienced and knowledgeable in their profession (Office of Rail Regulation, 2014a) As a result, the Office of Rail Regulation issued the *Guide to the Train Driving Licences and Certificates Regulations 2010* (TDLCR). One of the many reasons that TDLCR was created is to reassure the public that train drivers are competent professionals and that the rail is a safe mode of transportation. TDLCR was created in response to European Commission Directive 2007/59/EC and put in place to eventually standardize licenses and certifications for all train drivers throughout the EU, making rail more cohesive throughout these countries. This standardization also widens opportunities for employment throughout the EU for train drivers. Another benefit of issuing licenses and certifications to train drivers is that it elevates the level of professionalism in the industry, thus serving as an effort to retain talent (Office of Rail Regulation, 2014b).

New train drivers are required to apply for a license prior to employment; however, existing drivers need only acquire their license prior to October 29, 2018. The license is granted after the applicant is proven to be competent, as well as medically and physically fit, in addition to being over the age of 20 years old with proof of appropriate education. All assessors from the employer, as well as physicians and mental health professionals, must be recognized and approved by ORR (Office of Rail Regulation, 2014b).

### *Management Programs*

**Canadian Urban Transit Association.** CUTA programs that are focused on strengthening the transportation workforce in Canada include Transit Ambassador, SmartDriver, and Partnership with Ontario Schools. Transit Ambassador concentrates on training supervisors and management with a strong focus on customer service. Transit Ambassador offers courses such as a train-the-trainer class, in addition to a trainer development course, which emphasize not only providing great customer service, but also increasing employee morale to enhance overall job satisfaction (Eno Transportation Foundation, 2008).

**Veolia Transport.** Veolia also has a procedure in place for recruiting managers. This is done through a corporate training program, "Veolia University," which spans 2 years and exposes participants to different positions though hands-on education. Upon completion, they are eligible to become a manager for the company (Eno Transportation Foundation, 2008).

**Swedish National Road Administration.** The Swedish National Road Administration (SNRA) has a development program made of up four parts: a trainee program (largely made of university-recruited civil engineers), a career choice seminar, a program for the development of new managers, and a similar program focused on continued development for experienced managers. The seminar on career choice has proven to increase retention of young workers. The new manager's development program is an intensive 5-day seminar available to members of SNRA who have worked there for at least 5 years. During those 5 days, they work with a teacher/mentor to cultivate individualized 6-month plans, matching their interests with their budding skills. The program for experienced managers is about 1 year in length and affords attendees the opportunity to hone their management skills to further advance their careers and empower them to contribute to the success of the agency. "SNRA's motto is to 'hire for competence and train for skills'" (Rahn et al., 2003).

**Highway Agency.** England's Highway Agency is emphasizing leadership skills in its workforce with several initiatives, including developing a "Good Manager Guide," which spells out characteristics of effective managers in a chart form easily accessible by employees. Competency modeling guides have also been written so that employees know what skills they should possess and how to do their jobs effectively. Coaching and mentoring programs as well as career development counseling are offered to staff, in addition to interchange assignment opportunities to allow employees the chance to learn new skills. They also provide their workforce with several learning resource centers that can be accessed at employees' leisure (Rahn et al., 2003).

CHAPTER 6

# Assessment of Industry Needs/Gap Analysis for Railroad Workforce

The following needs/gap analysis seeks to identify potential gaps between the previously developed competency models and existing training and educational programs available to those either working in the railroad industry or seeking to gain employment in the railroad industry. This has been done by systematically comparing attributes of knowledge and skill identified through an examination of the existing literature; review of focus group discussions with craftworkers; exploration of the resulting data obtained in a nationwide survey of craftworkers, as well as engineering and operations professionals; and structured interviews held with human resources professionals and business leaders and executives. In the scope of this study, OTJ training was not included in the needs/gap analysis, as this form of training is couched within the culture of the employer and thus difficult to ascertain.

The needs/gap analysis looks at each stratum of the industry and includes a breakdown of the following rail engineering and operations professionals and craftworkers:

- Rail operations manager
- Rail system engineer
- Train and engine personnel
- Dispatchers
- Signal personnel
- Communications personnel
- Mechanical personnel
- Maintenance-of-way personnel and machine operators

Both the knowledge and skills are analyzed to determine whether the attributes identified in competency models are "well supported," "supported," or "poorly supported" by existing training and educational programs. OTJ training is not included as part of the evaluation in this task. To be characterized as well supported, an educational or training program must explicitly list in course descriptions how it will teach the required knowledge or skills. Attributes are indicated as supported where either a relevant title of a course or training program or the offering of an internship with direct in-the-field learning is listed. Poorly supported attributes are not mentioned at all in the descriptions of educational or training programs.

The discrepancies identified through this analysis will be further explored in the following chapter so as to suggest strategies for building and maintaining a skilled and knowledgeable workforce for the entire railroad industry.

## Gap Analysis—Operations Manager

Currently, there are 11 master's programs that specialize in transportation engineering. Two of these programs offer several courses specific to the railroad industry. The University of Illinois at Urbana–Champaign and Colorado State University, Pueblo, offer specialized courses

pertaining to the railroad industry. Four schools offer Ph.D. degrees in transportation engineering and three institutions offer either certificates or training programs. All resources available in transportation engineering provide a comprehensive course of study for success as a rail operations manager. Given the breadth of available programs, a majority of knowledge and skill attributes are fully supported for operations managers.

### *General Education*

Rail operations managers possess a minimum of a bachelor's degree in transportation, logistics, operations management, engineering, or a related field.

### *Domain Knowledge and Competencies*

1. Advanced understanding and application of technical and business principles, rules, regulations, and technologies relevant to the rail industry.
2. Advanced understanding of operating principles that satisfy all FRA requirements, train control and signaling systems, train scheduling, and railroad communications technologies and practices.
3. Working knowledge of the fundamentals on the relationship of yards with operations and design of conventional yard and terminal trackage.
4. Advanced understanding of efficient and sustainable asset management concept and practices employed to optimize the delivery and performance of physical assets.
5. Advanced understanding of integrated information management for rail transportation systems.
6. Advanced understanding of how to employ contemporary planning and logistics concepts to optimize rail operations.
7. Understanding and application of financial and business management concepts, methods, and practices.
8. Intermediate understanding and application of generally accepted project management methods and processes.

### *Attributes—Well Supported*

The Transportation Group at the University of Illinois at Urbana–Champaign offers a master's degree in transportation engineering with an emphasis on railroad transportation engineering, railroad track engineering, railway signaling and control, and railroad project design and construction. All attributes for the operations domain are fully supported by either the rail-specific courses or courses in transportation engineering. As listed in the competency models, communications and signal operations, asset management, information management, and traffic planning and logistics competencies are also addressed at this institution.

As part of the master's program in engineering at Colorado State University, Pueblo, students have access to the Transportation Technology Center, Inc., a subsidiary of AAR focusing on transportation research and testing organizations in an effort to provide emerging technology solutions for the railroad industry. Courses specific to the railroad include designing the railroad track, crossings, and bridges along with the understanding of controlling the response of structures under dynamic loading; analysis and design of electric power systems for railroads including power supplies, AC/DC and linear motors, third rails, catenaries, and substations/distribution systems; fleet management business and economics; risk analysis; information systems; vehicle planning and control; productivity, safety, and environmental compliance; kinematic and kinetic dynamic analysis; and time and frequency domain simulations of dynamics systems used in vehicles. By earning this degree, graduates have a foundation in the domain of operations and traffic planning as well as logistics.

The master of civil engineering degree with an emphasis on transportation engineering at Michigan Technological University covers transportation planning, public transit systems,

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railroad track engineering and design, as well as applications and analysis for complex dynamic systems. This program supports the operations domain knowledge, information management, and portions of traffic planning and logistics.

Covering the domains of operations, communications and signal operations, and business acumen with customer awareness, Michigan State University holds a 4-week comprehensive course for railroad employees. Topics include introduction to railway and transportation issues; railway infrastructure, rolling stock, and command and control; working with customers and financial stakeholders; leadership development and managerial issues.

Northwest Railroad Institute offers a 6-month rail operations training program. During the program, participants receive comprehensive overviews of railroad operations, safety rules, the General Code of Operating Rules (GCOR), yard switching operations, and handling of hazardous materials. This program fulfills the necessary requirements of the operations domain and competency in yard and terminal operations.

For specific management skills concerning high-speed rail, the Mineta Transportation Institute offers a graduate certificate in high-speed rail management. The course introduces students to the high-speed passenger rail mode and its attributes and technical components. Students gain general enterprise management and the management competencies required for organizing high-speed rail project development and implementation.

### *Attributes—Supported*

The following institutions do not provide courses specifically tailored to the railroad; rather, their programs focus on transportation or engineering and may include topics pertaining to the railroad. Skills and knowledge in these programs are transferrable to the railroad industry.

University of California, Berkeley, places strong emphasis on transportation policy, planning, and development. Transportation economics, logistics, analysis, and management are covered in detail. This program supports the domain of operations and competencies in the areas of yard and terminal operations, asset management, information management, and traffic planning and logistics.

To support aspects of asset management, information management, and traffic planning and logistics, the University of California, Davis, has a graduate program (master's and Ph.D.) in transportation engineering. Focused topics include transportation survey methods and analysis, technology and policies, traffic management, and flow in transportation networks. All these skills are transferrable to the rail industry.

Also supporting assessment, information management, and traffic planning logistics are the following degree programs: master's at California State Polytechnic University, master's and Ph.D. at Massachusetts Institute of Technology, master's at North Carolina State University, master's and Ph.D. at Texas A&M University, and master's and Ph.D. at Virginia Tech.

Virginia Tech's graduate program addresses the competency of communications and signal operations. The scope of its course work includes signal system design and operations, traffic simulation techniques, advanced traffic control strategies, and incorporation of surface street systems into intelligent transportation systems.

Massachusetts Institute of Technology, along with Texas A&M University, train their graduates in the project management of transportation industries. In the competency area of business acumen and customer awareness, individuals can receive training from California State Polytechnic University and Massachusetts Institute of Technology.

### *Attributes—Poorly Supported*

All knowledge and skill attributes are either fully supported or supported by these educational programs. Many of the institutions provide applicable and transferrable skills, even though the course work is not rail specific.

## Gap Analysis—System Engineer

Currently, there are 11 programs that specialize in transportation engineering, a majority offering a master's degree. Two of these programs offer several courses specific to the railroad industry. Four schools offer Ph.D. degrees in transportation engineering and three institutions offer either certificates or training programs. All resources available in transportation engineering provide a comprehensive course of study for success as a system engineer. The University of Illinois at Urbana–Champaign, Michigan State University, and Colorado State University, Pueblo, offer specialized courses pertaining to the railroad industry. Given the breadth of available programs, a majority of knowledge and skill attributes are fully supported.

Applicable certifications are available through Gateway Community College, Johnson County Community College, and Okefenokee Technical College. However, given the general educational requirements of system engineers, only higher educational institutions are discussed. Further, system engineers gain advanced knowledge and skill attributes through OTJ training and job experience.

### *General Education*

System engineers possess a minimum of a bachelor's degree in engineering and have work experience and employment within the rail industry or related sectors.

### *Domain Knowledge and Competencies*

1. Advanced understanding and application of scientific principles, engineering constructs, and technologies relevant to the rail industry.
2. Advanced understanding and application of track standards and railroad track engineering concepts, including track component and system design, construction, evaluation, maintenance, load distribution, and wheel/rail interaction.
3. Advanced understanding of rail vehicles for both freight and passenger rail and their performance and safety requirements.
4. Advanced understanding of operating principles that satisfy all FRA requirements, train control and signaling systems, train scheduling, train stopping distance calculation, and railroad communications technologies.
5. Advanced understanding of the design, construction, and preservation of all types of railroad bridges and structures.
6. Working knowledge of the fundamentals as it relates to different types of systems (such as advanced train control, positive train control, and centralized traffic control) and their proper testing, verification, and maintenance.
7. Advanced understanding and application of generally accepted project management methods and processes.

### *Attributes—Well Supported*

The Transportation Group at the University of Illinois at Urbana–Champaign offers a master's degree in transportation engineering with an emphasis on railroad transportation engineering,

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railroad track engineering, railway signaling and control, and railroad project design and construction. All attributes for the general, track and infrastructure, and communication and rail signal engineering domains are fully supported by either the rail-specific courses or courses in transportation engineering.

As part of the master's program in engineering at Colorado State University, Pueblo, students have access to the Transportation Technology Center, Inc., a subsidiary of AAR focusing on transportation research and testing organizations in an effort to provide emerging technology solutions for the railroad industry. Courses specific to the railroad include designing the railroad track, crossings, and bridges along with the understanding of controlling the response of structures under dynamic loading; analysis and design of electric power systems for railroads including power supplies, AC/DC and linear motors, third rails, catenaries, and substations/distribution systems; fleet management business and economics; risk analysis; information systems; vehicle planning and control; productivity, safety, and environmental compliance; kinematic and kinetic dynamic analysis; and time and frequency domain simulations of dynamics systems used in vehicles. By earning this degree, graduates have a foundation in the domain of operations, track and infrastructure engineering, and engineering of bridges and structures.

The master's degree in civil engineering with an emphasis on transportation engineering at Michigan Technological University covers transportation planning, public transit systems, railroad track engineering and design, as well as applications and analysis for complex dynamic systems. This program supports track and infrastructure domain detailed in the competency model.

Covering the domains of track and infrastructure and rolling stock engineering, Michigan State University holds a 4-week comprehensive course for railroad employees. Topics include introduction to railway and transportation issues; railway infrastructure; and rolling stock.

### *Attributes—Supported*

Northwest Railroad Institute offers a 6-month rail operations training program. During the program, participants receive comprehensive overviews of railroad operations, safety rules, GCOR, yard switching operations, and handling of hazardous materials. The program is applicable for the overall knowledge of the railroad industry, rules and regulations, and operations guidelines.

The following institutions do not provide courses specifically tailored to the railroad; rather, the programs focus on transportation or engineering and may include topics pertaining to the railroad. Skills and knowledge in these programs are transferrable to the railroad industry.

University of California, Berkeley, offers a master's degree in civil and environmental engineering. The program covers the operation, management, control, design, and evaluation of passenger and freight transportation systems. This course work is applicable to the skills needed for track and infrastructure domain.

To support aspects of track and infrastructure engineering and rolling stock engineering domains, the University of California, Davis, has a graduate program (master's and Ph.D.) in transportation engineering. Focused topics include transportation survey methods and analysis, traffic management, flow in transportation networks, and transportation planning. All these skills are transferrable to the rail industry.

Virginia Tech's graduate programs address the competency of communications and signal operations. The scope of their course work includes signal system design and operations, traffic simulation techniques, advanced traffic control strategies, and incorporation of surface street systems into intelligent transportation systems.

Massachusetts Institute of Technology, along with Texas A&M University, train their graduates in the project management of transportation industries. In the competency area of business acumen and customer awareness, individuals can receive training from California State Polytechnic University and Massachusetts Institute of Technology.

### *Attributes—Poorly Supported*

The area of control systems engineering is not fully covered in the above curricula; specifically, the knowledge base needed for positive train control implementation and use. This may be covered in the communications portions of the offering, but the descriptions do not directly address this emerging, vital knowledge attribute.

## Gap Analysis—Train and Engine Personnel

Train and engine personnel consist of conductors/brakemen and locomotive engineers. Traditionally, all locomotive engineers start as a conductor or brakeman and work their way up to becoming a locomotive engineer. Eight institutions offer education and training to prospective and current train and engine craftworkers. Though most of these places overlap in education for all train and engine personnel, three are geared specifically to either locomotive engineers or conductors/brakemen: Dakota County Technical College offers certification in railroad conductor technology through completion of a 15-week course; Johnson County Community College, in partnership with the National Academy of Railroad Sciences, offers courses and certification for conductors; and Transportation Certification Services is a contracting agency that railroads can hire to perform locomotive engineer certification in compliance with federal regulations.

Penn State Altoona offers a bachelor's degree in rail transportation engineering, covering many aspects of educational and training requirements for all train and engine personnel. ARC-Tech.net offers 2- to 8-day courses on topics in railroad safety pertinent to all train and engine personnel. Modoc Railroad Academy (three locations in Medford, Oregon; Marion, Illinois; and Akron, Ohio) offers licensing programs and internships for rail conductors and locomotive engineers. Northwest Railroad Institute offers a 6-month rail operations training program that provides important information for train and engine craftworkers. Similarly, Sacramento City College offers an associate's degree, as well as a certificate of achievement in railroad operations.

### Discipline: Locomotive Engineers

Locomotive engineers operate and control the movement of the train's engine. They are responsible for working in conjunction with a conductor or brakeman to assure the safe and efficient movement of the train. Many locomotive engineers were at one time conductors who advanced to locomotive engineer after gaining experience in the railroad industry.

#### *Job Functions*

The locomotive engineer has two primary functions:

1. ***Operation of train.*** Locomotive engineers operate freight or passenger trains and must be knowledgeable about the route for each trip. They must direct and control the movement of the train in a safe and efficient manner. In passenger operations, they must know the schedule in order to make sure the train operates without issue and on time.
2. ***Constant inspection of train.*** They must check the speed, air pressure, battery, and other various mechanics of the train, such as brakes and gauges, to ensure that the train is operating correctly.

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### *Attributes—Well Supported*

Many attributes of knowledge and skill are well supported through the various institutions offering education and training to locomotive engineers. Penn State Altoona addresses all knowledge attributes in its bachelor's level program in rail transportation engineering as evidenced in the descriptions of required courses with the exception of two attributes: (1) relevant written documents, e.g., track warrants, track bulletins, rule book, timetable and (2) overall operation and structure of a freight or passenger locomotive. It does, however, cover topics in the fundamentals of engineering review that are designed to aid in professional engineering licensure, which may touch on these attributes that were not explicitly stated in any of the course descriptions. Both Northwest Railroad Institute and Sacramento City College are also comprehensive in supporting knowledge and skills needed by engineers. ARC-Tech.net addresses knowledge including railroad safety and operations protocols.

### *Attributes—Supported*

In addition to offering programs for conductors, Modoc Railroad Academy offers licensing programs and internship for locomotive engineers. The programs aimed at locomotive engineers are longer in duration, spanning a total of 20 weeks. Again, limited information exists about what is covered in these programs. It does stand to reason that many attributes of knowledge and skill would be supported in such programs. Similarly, internships and special topics may vary in knowledge and skill gained by attendees at Penn State Altoona and Sacramento City College.

### *Attributes—Poorly Supported*

No attributes appear to be poorly supported for locomotive engineers.

## Discipline: Conductors/Brakemen

Conductors and brakemen are responsible for the train consist and for directly supervising train crew. Along with the engineer, conductors and brakemen are responsible for the safe and efficient train operation, while adhering to the railroad's rules and procedures. Eventually, conductors or brakemen may be promoted with further training to become a locomotive engineer.

### *Job Functions*

The conductor/brakeman has five primary functions:

1. ***Managing the train consist.*** The conductor must understand train makeup rules and apply them both in the yard and on the mainline.
2. ***Coordinating with the locomotive engineer for safe and efficient en route operation.*** En route, the conductor supervises overall operation and administration of the train.
3. ***Interacting with dispatchers/roadway workers and others outside the locomotive cab.*** The conductor handles all radio communications.
4. ***Dealing with exception situations, e.g., diagnosing and responding to train problems.*** The most common unanticipated events are train equipment issues which the conductor must troubleshoot and if possible correct.
5. ***Managing paperwork.***

### *Attributes—Well Supported*

Though geographical constraints may exist for those wishing to receive education or training to become a conductor, there are several centers throughout the country that seem to support attributes of knowledge and skill quite well. Penn State Altoona covers all attributes of understanding and knowledge with the exception of relevant written documents, e.g., track

warrants, track bulletins, rule book, timetable. Johnson County Community College appears to address all attributes of understanding and knowledge with the exception of physical characteristics of the territory, including length of sidings, location of signals and switches, grades, and curves; however, both of these programs offer internships where some of these attributes may be addressed. Both of these attributes, along with the other key knowledge requirements, appear to be addressed through the program at Sacramento City College. Furthermore, through classes in GCOR at schools including Johnson County Community College, Dakota County Technical College, Northwest Railroad Institute, and Sacramento City College, course attendees are exposed to an in-depth look at railroad operations and safety concerns, preparing them for the safe and efficient movement and operation of trains. Finally, ARC-Tech.net addresses knowledge including railroad safety and operations protocols.

The programs offered to conductors seem to support attributes for skills well. For instance, many course descriptions speak directly to skills needed by conductors to perform their tasks in a safe and efficient manner. At Dakota County Technical College, courses include mechanical operations and utilization of railroad equipment and safety standards where students learn important freight car mechanical practices and inspection of cars to meet safety standards. At Northwest Railroad Institute, students in the yard switching operations course develop skills needed for train preparation procedures and car inspection.

Sacramento City College appears to support all skills well through courses like railroad air brakes and internships in railroad operations, where successful completion of the internship depends on being able to make up trains, couple and uncouple cars and locomotives, troubleshoot air brake systems, get on and off moving equipment up to 20 miles per hour, remove and apply knuckles of cars (knuckles weigh up to 90 pounds), and throw switches.

### *Attributes—Supported*

Modoc Railroad Academy is based in three locations: Medford, Oregon; Marion, Illinois; and Akron, Ohio. These academies offer a rail conductor internship program lasting 8 weeks, as well as licensing programs; however, limited information exists about what is covered in these programs. Similarly, internships and special topics may vary at Penn State Altoona, Johnson County Community College, Dakota County Technical College, and Sacramento City College.

### *Attributes—Poorly Supported*

Most attributes for conductors/brakemen are supported. However, there appears to be no mention of collecting passenger fare in these training and education centers. It should also be noted that many of these academic institutions seem to focus on freight versus passenger trains.

## Gap Analysis—Railroad Dispatcher

There is one certificate program available that supports the knowledge requirements of a railroad dispatcher position and to a limited extent, the applied or skill attributes. This program is available at Tarrant County College in Fort Worth, Texas. Development of dispatching skills comes from OTJ training (referred to as posting) with an experienced dispatcher. Nearly all railroads have dispatcher training programs run by in-house training staff.

### *Job Functions*

The dispatcher performs four primary functions:

1. ***Planning.*** The dispatcher must perform preliminary planning prior to assuming dispatching responsibility each day. This includes a brief "handover" period when the dispatcher working the position during the previous shift tells the new dispatcher about current and planned train movements within the territory.

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2. ***Controlling track use.*** The dispatcher is responsible for determining which trains may travel across the territory and when maintenance-of-way inspectors, crews, and equipment may access the track.
3. ***Managing unplanned and emergency events.*** The dispatcher must reschedule trains and request assistance when an unplanned or emergency event occurs.
4. ***Performing required record keeping.*** Today's computer-based dispatching systems do not require the dispatcher to keep detailed written records but, depending upon an individual railroad's procedures, some written reports may be necessary.

### *Attributes—Well Supported*

The Railroad Dispatcher Certification Program at Tarrant County College provides foundation training in the rules, regulations, and procedures of railroad dispatching. With the exception of railroad-specific management of unplanned or emergency events, this program covers all of the knowledge attributes.

Admission to the program requires 30 semester hours of credit from a regionally accredited college or university. The program appears to cover the majority of the knowledge competencies for a railroad dispatcher. This program is geographically limited to the Fort Worth area.

### *Attributes—Supported*

The Tarrant County College dispatcher certificate program offers training to develop the skills necessary for dispatching. It utilizes a simulator for this purpose. The dispatcher candidate will require OTJ training once hired by a railroad to learn the railroad's computer-based dispatching system and to develop territory familiarity. The Tarrant County College training will build the following skills:

- Application and removal of blocking devices.
- Issuance and removal of speed restrictions.
- Safe authorization, dispatch, and monitoring of the use of tracks by non-shunting equipment and work crews.
- Clear and coherent communication skills and procedures.

### *Attributes—Poorly Supported*

Railroad-specific skills that are not supported include the following:

- Understanding and use of all manual and computer-based dispatcher planning aids employed by the railroad.
- Implementation of appropriate procedure in response to an unplanned or emergency event.
- Completion of required records via electronic devices or paper.
- Management and dispatch of helper services, e.g., extra engine or qualified pilot (freight operations only).
- Rapid effect of the de-energization of one or more specific traction power sections (for electrified railroad only).

## Gap Analysis—Signal Personnel

There are certification programs and educational institutions providing several courses to support the knowledge attributes and applied skills needed for signal personnel. They have limited geographic overlap with rail hubs. The limited geographic spread of these resources means that these attributes are unsupported in coastal rail corridors as well as in southern areas of the country. Both Gateway Community College (Connecticut) and Johnson County Community College (Kansas) offer certifications applicable to signalmen and linemen. Penn State Altoona,

Northwest Railroad Institute (Washington), and Sacramento City College offer a few courses primarily focused on the history of railroading, railroad rules and regulations, and safety regulations and operating procedures.

### *Job Functions*

The signalman or lineman has one primary function.

1. ***Construction, installation, repair, maintenance, testing, and inspection of signal systems:*** These signal systems include automatic block signal systems, traffic control systems, train stop, train control and cab signal systems, interlocking systems, rail–highway grade crossing protection, automatic classification yards, hot box detectors, broken flange detectors, other similar devices, appliances, and systems, and positive train control systems.

### *Attributes—Well Supported*

Gateway Community College offers an associate's degree in railroading engineering technology. This college's signaling and communications track trains students to maintain and repair rail line and railcars where signaling and communications are used. All of the knowledge and applied attributes of this craft are well supported by this degree. Upon successful completion of this degree, the graduates understand railroad rules and regulations, the operation of rail line and railcar signaling and communications systems, and possess skills for entry-level troubleshooting and repair work on the signal and communications systems.

A second resource available for both current and future signalmen and linemen is Johnson County Community College. Partnering with the National Academy of Railroad Sciences, Johnson County Community College offers certification for signalmen. Upon successful completion of this course, the student should be able to describe basic company organization, operating and safety rules pertaining to signalmen, basic principles of electricity and measurement, as well as protective devices. The student should have a basic understanding of signal systems, track circuits, and FRA rules. The certificate appears to encompass all the necessary knowledge and applied skills for success as a signalman or lineman. At the end of the program, the person should be able to (1) describe and explain the operation of various track circuits, relay and control circuits, traffic control systems, locks, and applicable rules and standards; (2) describe and maintain automatic block signaling systems, centralized traffic systems, and power switches and locks; (3) be familiar with ground testing and isolation, as well as applicable rules and standards; and (4) perform interlocking plant and route plant analysis, explain classification yards, grade crossing warning systems, gates, and other devices.

### *Attributes—Supported*

Penn State Altoona, Northwest Railroad Institute, and Sacramento City College provide opportunities to understand the basics of railroad operations as well as FRA rules, regulations, and safety requirements. Internships in railroad operations are available at Northwest Railroad Institute and Sacramento City College. These programs provide knowledge regarding the railroad industry, but the practicums at these two institutions do not appear to provide in-depth experience for signalmen and linemen.

### *Attributes—Poorly Supported*

All attributes (knowledge and skill) are fully supported by educational resources such as Gateway Community College and Johnson County Community College. Only the following applied attribute is not clearly addressed in any of these resources.

- Compile reports, including maintenance and FRA tests performed, any repairs made, and equipment requiring replacement.

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## Gap Analysis—Communications Personnel

There are a total of six certification programs and educational institutions providing several courses to support the knowledge attributes and applied skills needed for this position. They have limited geographic overlap with rail hubs. Available programs are located at Gateway Community College, Johnson County Community College, Okefenokee Technical College, Penn State Altoona, Northwest Railroad Institute, and Sacramento City College. They offer a few courses primarily focused on the history of railroading, railroad rules and regulations, and safety regulations and operating procedures. ARC-Tech.net provides training on machine safety and operation of hoisting equipment.

### *Job Functions*

The electrician or communications maintainer has three primary functions:

1. ***Maintenance and repair of electrical system:*** The worker is responsible for the maintenance and repair of electrical systems on low-horsepower systems, diesel engine systems, and other electrical systems used in railway and railcar equipment.
2. ***Installation, inspection, and test of communications systems:*** The worker is responsible for VHF/UHF radios and radio dispatching systems, public address and video surveillance systems, automatic revenue collection equipment, alarm monitors, GPS networks, fiber optic systems, and communications computer networks.
3. ***Documentation of repair status and procedure:*** Depending on individual railroad procedures, the worker is responsible for documenting the status of equipment, what repairs it needs or has had, and what procedures were followed.

### *Attributes—Well Supported*

Gateway Community College offers an associate's degree in railroad engineering technology, with an electromechanical track. Not only are students exposed to various career opportunities within the railroad industry for individuals with an electromechanical-oriented degree, but they also receive an understanding of the operation of railcar electromechanical systems and experience troubleshooting and repairing these systems. All of the knowledge and applied attributes of this craft are well supported by this degree. Upon successful completion of this degree, the graduates understand railroad rules and regulations and the operation of rail line and railcar signaling and communications systems, and possess skills for entry-level troubleshooting and repair work on the signal and communications systems.

A second resource available is Johnson County Community College, which offers the Railroad Signal Certificate in which skills overlap between electricians and communications maintainers. Partnering with the National Academy of Railroad Sciences, Johnson County Community College also offers a locomotive electrical certificate. Upon successful completion of this course, the student should be able to describe basic company organization, operating and safety rules pertaining to signalmen, basic principles of electricity and measurement, as well as protective devices. The student should have a basic understanding of signal systems, track circuits, and FRA rules. The certificate appears to encompass all the necessary knowledge and applied skills for success as an electrician and/or communications maintainer. At the end of the program, the person should be able to (1) describe and explain the operation of various track circuits, relay and control circuits, traffic control systems, locks, and applicable rules and standards; (2) describe and maintain automatic block signaling systems, centralized traffic systems, power switches and locks; (3) be familiar with ground testing and isolation, as well as applicable rules and standards; and (4) perform interlocking plant and route plant analysis, explain classification yards, grade crossing warning systems, gates, and other devices.

At Okefenokee Technical College, a technical certificate of credit in locomotive electrical systems can be obtained. Students are introduced to microcomputers, industrial safety procedures, soldering technology, industrial wiring, DC and AC motors, as well as several courses devoted to current circuits, alternating currents, and solid state devices. Additional course work focuses on magnetic starters and braking, motor control, locomotive electrical systems, and the railroad industry. According to this program, students are trained for entry-level positions in the rail industry.

### *Attributes—Supported*

Penn State Altoona and Sacramento City College provide comprehensive and in-depth studies on the railroad industry; rail operations; safety rules and regulations; and FRA rules, regulations, and safety requirements. Penn State Altoona has a course dedicated to railroad communications and signals. The course provides information on the separation of trains, including signals, interlocking, and communications. ARC-Tech.net provides practical experience with operating different types of hoisting equipment. Internships in railroad operations are available at Northwest Railroad Institute and Sacramento City College. These programs provide knowledge regarding the railroad industry, but the practicums at these two institutions do not appear to provide in-depth experience for electricians and communications maintainers.

### *Attributes—Poorly Supported*

All attributes (knowledge and skill) are fully supported by educational resources such as Gateway Community College, Johnson County Community College, and Okefenokee Technical College. The following attributes were not explicitly addressed but may be covered under general descriptions:

- Operation of railroad/locomotive equipment between various shop locations, service tracks, and switching areas.
- Use of lantern, hand, or radio to signal locomotive mover when to start, stop, and back up the locomotive.

## Gap Analysis—Mechanical Personnel

This sector of the workforce has approximately eight educational training opportunities via certifications, bachelor's degrees, associate's degree, workshops, and practicums. Offering a bachelor's degree in rail transportation, Penn State Altoona provides specific courses in the principles of railroad track location, alignment, elements, and safety regulations and the basics of rail operations and safety principles and a practicum in repair of locomotives and cars. Johnson County Community College provides certification for locomotive electricians, machinists, and freight car repairmen. As a contract company for railroad training, ARC-Tech.net offers an overview of railroad worker protection and maintenance machine safety. Other units are taught but not necessarily geared toward mechanical personnel.

Upon successful completion of the electromechanical degree at Gateway Community College, students have a basic understanding of the operation of railcar electromechanical systems and demonstrate the ability to troubleshoot and repair electromechanical systems. The University of Tennessee, Knoxville, hosts workshops for mechanical personnel. This sector may benefit from a unit aimed at train crews and mechanical forces that inspect freight cars. It is a hands-on workshop providing 34 professional development hours.

During the 6-month training program at Northwest Railroad Institute, mechanical personnel receive an overview of the railroad industry; in-depth knowledge of railroad operations and safety rules, GCOR, air brakes and train handling rules, freight car and locomotive daily inspection, and handling of hazardous materials; as well as OTJ training in railroad field operations. At

Okefenokee Technical College, the locomotive mechanical systems certificate prepares students to work as mechanical technicians. Particular attention is given to diesel and electrical locomotives. Finally, at Sacramento City College, students receive an overview of the railroad industry as well as a specific course on railroad air brakes.

Although a few of these programs offer a comprehensive educational resource, many of the mechanical personnel rely on OTJ training, apprenticeships, and job experience. With a high school degree or GED, many do not consider higher education a possible option, especially given the geographic restrictions and available resources.

## Discipline: Boilermakers

### *Job Functions*

The boilermaker has two primary functions:

1. ***Repair:*** Renew and repair any system pertaining to boilers, tanks, and drums.
2. ***Fabrication:*** Weld, forge, heat, shape, and bend metal; operate punches, brakes, shears, welders, wire feed welders, plasma arc cutters, and oxygen/acetylene cutting torches and welders. Read and understand blue prints.

### *Attributes—Well Supported*

All knowledge attributes are well supported by the following programs: Sacramento City College, Okefenokee Technical College, and Johnson County Community College. However, no single program covers all of the necessary knowledge attributes needed for developing a successful boilermaker. Only a few of the applied skill attributes are well supported. Compliance with railroad rules, regulations for safety and operations, and knowledge of the FRA are covered in detail by Sacramento City College, Johnson County Community College, and Okefenokee Technical College. Okefenokee Technical College also trains students on how to interpret blueprints and sketches. The expected result upon completion is for a person to be ready for an entry-level position as a technician. ARC-Tech.net provides courses covering a wide range of maintenance, inspection, and safe operation of hoisting equipment, a necessary requirement of boilermakers.

### *Attributes—Supported*

At Johnson County Community College, interested persons may elect to obtain a railroad freight car certificate or railroad track welding certificate. Students learn to safely inspect, test, and repair freight cars in accordance with FRA, AAR, and BNSF Railway procedures and policies. Upon successfully obtaining the welding certificate, students should be able to cut and weld using oxyfuel (OFC) and shielded metal arc welding (SMAW). OFC will cover straight-line cutting, beveling, piercing, and gouging. The SMAW portion will cover flat position and will be limited to fillet welds. The student should be able to discuss electrical safety in SMAW, handle welding cables properly, understand eye hazards, list safe clothing requirements, and discuss environmental safety. Although not geared toward boilermakers, it is an opportunity to gain skills transferrable to this position.

### *Attributes—Poorly Supported*

The aforementioned programs do not address the practical and technical skills required of boilermakers:

- Laying out, cutting apart, building, or repair of boilers, tanks, and drums.
- Laying out and fitting up of sheet iron or sheet steel work made of 16 gauge or heavier, including fronts and doors, gates and gate rigging, ash pans, front-end netting and diaphragm work, engine tender steel underframe, and pressed steel tender truck frames and locomotive cabs.

- Building, repair, removal, and application of steel cabs and running boards.
- Selection of gauge and type of metal, or nonmetallic material, according to specifications.
- Operation of precision machines such as drills, presses, lathes, and other power hand tools.
- Setup and operation of fabricating machines to cut, bend, block and form, or straighten materials and to trim, file, grind, deburr, buff, and smooth surfaces.
- Ability to straighten or reshape bent plates or structures.
- Assembly and installation of a variety of metal tubes.
- Removal and replacement of rivets and caulk seams to repair riveted shells and structures.
- Cutting and shaping of defective parts, using oxy-acetylene torch.
- Fabrication of any and all parts for locomotives and cars on or off the same.
- Operation of electric and gas welding equipment.
- Signaling of crane operator or attaching of rigging to lift parts to specified position.
- Operation of locomotives as required.
- Operation of railroad computer programs used to track and document repairs.

## Discipline: Carmen

### *Job Functions*

The carman or freight car repairer has two primary functions:

1. ***Inspection:*** The carman performs inspections required by federal safety regulations, company standards, and AAR standards, including railcar frames and bodies for holes, cracks, and other defects; safety appliances including handholds, sill steps, grab iron, brake platforms, and running boards; and wheels to ensure that rim treads, plates, hub axles, and bearings are in good repair. The carman is also responsible for the air brake system and hazardous materials inspections.
2. ***Rebuild and repair:*** Compliant with FRA, AAR, and company standards, the carman is responsible for maintenance, replacement, and/or repair of air brake pipes, valves, gaskets, air hoses, brake assemblies and shoes, draft gear components, and other equipment as required; operation of electrical and gas welding equipment to join a variety of metals and alloys; and operation of acetylene torches for cutting and/or shaping metal parts such as aluminum, cast iron, steel, and bronze.

### *Attributes—Well Supported*

Attending workshops and courses offered by Penn State Altoona, Johnson County Community College, and Okefenokee Technical College, carmen would obtain the necessary foundation of knowledge attributes to thrive as a carman. These programs cover FRA rules, regulations, and safety requirements; machines and tools, including their design, use, repair, and maintenance; blueprints, drawings, sketches, and technical documentation; railcar mechanical characteristics, components, and air systems.

Applied attributes—including compliance with all railroad and FRA rules, regulations, and safety requirements; inspection of car components for compliance with railroad, FRA, and AAR standards; identification of defective components and performance of necessary repairs to comply with established rules and standards; interpretation of blueprints, drawings, and technical documentation to troubleshoot, rebuild, and repair railcars; inspection and application of end-of-train device and performance of airbrake tests; operation of light and heavy cranes, fork lifts, and other car-moving shop equipment; and operation of acetylene torch for cutting or shaping metal parts—are well supported by Johnson County Community College; University of Tennessee, Knoxville; Okefenokee Technical College; Northwest Rail Institute; ARC-Tech.net; and Sacramento City College. However, no single institution provides a comprehensive coverage of skills needed as a carman.

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### *Attributes—Supported*

Sacramento City College offers a railroad air brakes course covering inspection of the load, undercarriage, air brake connections, hand brake systems, drain valves, and cut-out cocks. This course provides a basis for the skill of inspection, replacement, and/or repair of gaskets, air hose, train line, bulkhead and other interior load restraining equipment, steel sections such as side sheets, cross bearers, crossties, and under framing.

### *Attributes—Poorly Supported*

The following knowledge attribute is not supported by current educational programs:

- Knowledge of computer-aided programs to obtain railcar information regarding car characteristics, destination, lading, and repair records and/or to file data such as repair information, bad orders, and car releases.

Applied attributes that do not receive explicit attention include the following:

- Inspect and salvage parts from dismantled and/or scrapped cars.
- Clean, lubricate, and maintain tie-down devices and other special equipment on railcars.
- Remove and replace couplers, draft gears, and yokes.
- Build or repair components such as freight doors, wooden floors, or interior walls.
- Repair or replace steel parts such as grab irons, handholds, ladders, brackets, steps, and other components.
- Paint cars and car components; stencil letters and numbers on cars.
- Operate proper electric, pneumatic, or hydraulic hand tools such as drills, impact wrenches, saws, and grinders.
- Operate railroad computer programs used to track and document repairs.

## Discipline: Electricians

### *Job Functions*

The electrician has two primary functions:

1. ***Locomotive system maintenance:*** Test, inspect, and repair switches, heaters, air conditioners, DC power systems, event recorder tapes, lights, watercoolers, batteries, low-voltage systems, high-voltage systems, traction motors, cooling fans, and fuel pumps.
2. ***Equipment maintenance:*** Troubleshoot, repair, install, inspect, calibrate, and replace electrical high-voltage, mechanical, and electro-magnetic equipment; perform preventive maintenance on a variety of tools/equipment, and machinery to ensure proper function.

### *Attributes—Well Supported*

Johnson County Community College offers a locomotive electrical certificate which provides a comprehensive introduction and a base for most knowledge and skill attributes needed for this line of work. The certificate program comprises four courses aimed at introducing students to the basic electrical theory and concepts related to locomotive electrical systems as well as the operation, maintenance, and troubleshooting of EMD low-horsepower locomotive electrical systems, EMD diesel engines and support systems, and GE Dash 8/9 locomotive systems.

Okefenokee Technical College offers a technical certificate of credit in locomotive electrical systems. Students are introduced to microcomputers, industrial safety procedures, soldering technology, industrial wiring, DC and AC motors, as well as several courses devoted to current circuits, alternating currents, and solid state devices. Additional course work focuses on magnetic starters and braking, motor control, locomotive electrical systems, and the

railroad industry. According to this program, students are trained for entry-level positions in the rail industry.

Gateway Community College offers an associate's degree in railroad engineering technology, with an electromechanical track. Not only are students exposed to various career opportunities within the railroad industry with an electromechanical-oriented degree, but they also receive an understanding of the operation of railcar electromechanical systems and experience troubleshooting and repairing these systems.

Penn State Altoona and Sacramento City College provide comprehensive and in-depth studies on the railroad industry; rail operations; safety rules and regulations; and FRA rules, regulations, and safety requirements. ARC-Tech.net provides practical experience with operating different types of hoisting equipment.

### *Attributes—Supported*

All attributes for this position are either well supported (by multiple resources) or poorly supported (by none).

### *Attributes—Poorly Supported*

Skill attributes not explicitly stated in the curricula include the following:

- Perform modifications and construct mechanical assemblies.
- Rebuild power assemblies.
- Operate various electric, pneumatic, or hydraulic power tools such as drills, impact wrenches, saws, and grinders.
- Operate railroad computer programs used to track and document repairs.
- Refer to schematics and manufacturers' specifications that show connections and provide instructions on how to locate problems.
- Maintain equipment service records.

## Discipline: Mechanics

### *Job Functions*

The mechanic has two primary functions:

1. ***Locomotive engine maintenance:*** Repair running gears such as wheels, springs, hangers, and brake rigging traction motors. Test and repair brake systems, safety appliances, couplers, draft systems, air compressors, safety valves, lube oil pumps filter systems, fuel systems, radiators, and shutters. Install, disassemble, assemble, repair, or replace locomotive diesel engine components. Perform scheduled and preventive maintenance on tools and equipment.
2. ***Inspection:*** Inspect locomotive components and diagnose malfunctions in diesel engines, locomotive systems, equipment, and components.

### *Attributes—Well Supported*

Okefenokee Technical College offers training for entry-level positions as locomotive mechanical technicians through a technical certificate of credit in locomotive electrical systems. Students are introduced to microcomputers, industrial safety procedures, soldering technology, industrial wiring, DC and AC motors, as well as several courses devoted to current circuits, alternating currents, and solid state devices. Additional course work focuses on magnetic starters and braking, motor control, locomotive electrical systems, and the railroad industry.

Penn State Altoona and Sacramento City College provide comprehensive and in-depth studies on the railroad industry; rail operations; safety rules and regulations; and FRA rules, regulations,

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and safety requirements. Penn State Altoona also offers a practicum in the repair of locomotives and cars from a mechanical perspective. ARC-Tech.net provides practical experience with operating different types of hoisting equipment.

### *Attributes—Supported*

All attributes for this position are either well supported (by multiple resources) or poorly supported (by none).

### *Attributes—Poorly Supported*

No documentation was available to determine if students are exposed to railroad computer programs used to track and document repairs.

## Discipline: Pipefitters

### *Job Functions*

The pipefitter has two primary functions:

1. ***Fabrication:*** Fabricate, cut, shape, and modify items utilizing various methods (e.g., seaming, riveting, brazing, or welding). Utilize pipe threaders, pipe bending, pipe coupling, sheet metal brakes, shears, snaps, metal-cutting saws, drills, wire feed welders, oxygen/acetylene cutting torches and repair various components of locomotives.
2. ***Inspection and Repair:*** Inspect and properly repair piping on the following systems on locomotives: air brakes, exhaust system, lube oil, cooling water, air compressor, radiator, and fuel system. Install, disassemble, assemble, repair, or replace locomotive and diesel engine components as required.

### *Attributes—Well Supported*

Knowledge and skill acquisition of FRA rules, regulations, and safety procedures are well supported by Penn State Altoona and Sacramento City College. Penn State Altoona also offers a practicum in the repair of locomotives and cars from a pipefitter perspective. Practical experience with operating different types of hoisting equipment may be obtained by training sessions with ARC-Tech.net.

### *Attributes—Supported*

To gain experience with aspects of welding, pipefitters may take advantage of the railroad track welding certificate at Johnson County Community College. Students learn to cut and weld using OFC and SMAW, handle welding cables properly, understand eye hazards, list safe clothing requirements, and discuss environmental safety.

The Northwest Railroad Institute and Sacramento City College each provide a unit on air brakes and train handling. However, this is a small aspect of the job functions required of a pipefitter.

### *Attributes—Poorly Supported*

Most of the skills indicated for a pipefitter are not addressed by current educational programs. Those unaddressed skills are as follows:

- Select gauge and type of metal, or nonmetallic material, according to specifications.
- Build, erect, assemble, install, dismantle, and maintain parts made of copper, brass, tin, zinc, white/black metal including brazing, soldering, tinning, and leading.
- Bend, fit, cut, thread, braze, connect and disconnect air, water, gas, oil, and steam pipes.
- Operate pipe threading machines.
- Operate railroad computer programs used to track and document repairs.

### Discipline: Shop Laborers

#### *Job Functions*

The shop laborer has two primary functions:

1. ***Equipment operations:*** Operate forklift, mobile crane, track mobile, shop tractor, and power hand tools.
2. ***Equipment and shop maintenance:*** Sand, fuel, and clean locomotives. Clean and organize shop work area: sweep and clean work surfaces; store parts; empty and discard garbage; and operate power-driven equipment such as a vacuum cleaner, electric broom, or steam cleaning gun.

#### *Attributes—Well Supported*

Available programs at Johnson County Community College, Penn State Altoona, Northwest Railroad Institute, and Sacramento City College provide opportunities to understand the railroad operations as well as FRA rules, regulations, and safety requirements. Basic knowledge of locomotives and their operations are additionally supported.

#### *Attributes—Supported*

All attributes for this position are either well supported (by multiple resources) or poorly supported (by none).

#### *Attributes—Poorly Supported*

Most of the applied attributes are not covered by courses designed specifically for railroad shop laborers. Workers in this craft may seek educational training in other areas and apply the skills to the railroad industry. Poorly supported skills are as follows:

- Knowledge of railroad computer programs used to track and document locomotive repairs, maintenance, and history.
- Operation of heavy duty equipment and licensed and unlicensed vehicles and knowledge of how to work around all types of moving equipment.
- Performance of tasks associated with work assignments such as cleaning, sweeping, forklift operation, handling material, and fueling locomotives.
- Cleaning of interior/exterior of locomotives, equipment, and mechanical parts.
- Supply of locomotive with necessary materials.
- Completion of routine reports and log and inventory records entries.
- Cleaning of empty cars.
- Checking of fuel or water sight glass/gauge to determine fluid levels on tools, machines, or equipment (hydraulic, lubricating, fuel, cooling, etc.) and performance of preventive maintenance on a variety of tools, equipment, or machinery.
- Operation of mechanical washing system, including preparation of cleaning solutions to clean grease, scales, dirt, and other foreign matter from locomotives, freight cars, and equipment.
- Operation of railroad computer programs used to track and document work history.

## Gap Analysis—Maintenance-of-Way Workers

Six educational centers offer degrees, certificates, or workshops that provide course work and practicum geared specifically to persons interested in pursuing MOW positions. Penn State Altoona offers a bachelor's degree in rail transportation engineering well supporting the knowledge attributes. ARC-Tech.net is a resource and company training program providing 2- to 8-day courses covering railroad safety and operations. Johnson County Community College offers a track welding certificate applicable to MOW.

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MOW workers may partake in short-term workshops at the University of Tennessee, Knoxville, with a focus on track inspection, safety standards, track maintenance, track design, and worker safety. Northwest Railroad Institute has a 6-month rail operations training program. Highlighted topics include an introduction to railroading, railroad operations and safety rules, freight car and locomotive daily inspection, and OTJ training. Similarly, Sacramento City College offers an associate's degree in railroad operations with an emphasis on railroad operations and safety. The program includes an internship in railroad operations. Geographic locations of these institutes limit the number of MOW workers able to benefit from such programs. All of the knowledge and skill attributes are covered by educational opportunities; however, it is difficult to find a program that is all encompassing of knowledge, skills, and practicum.

### *Job Functions*

The MOW worker and machinery operator performs three primary functions:

1. ***Monitor condition of track:*** MOW workers must routinely inspect, maintain, check, clear, and repair the tracks. Often times these tasks must be completed using specialized equipment and machinery.
2. ***Ensure area adjacent to track is clear:*** Workers must keep this area clear for safety. Their work can include removing debris, clearing drainage trenches, installing drainage systems, trimming back trees and shrubs, reapplying gravel, and other activities. Keeping this area clear promotes visibility so that train drivers can clearly see what is ahead of them, reduces track obstructions by keeping the area around the track clear of potential obstructions, and reduces fire hazards.
3. ***Operate variety of machinery:*** Workers must know how to safely operate specialized on- and off-track machinery to maintain and repair track and surrounding area, as well as discern which pieces of equipment and tools are suited for each task.

### *Disciplines*

*Foreman*—This position oversees the work of either a track gang or a production gang. Depending upon the size of the gang, there may also be an assistant foreman.

*Large-machine operator*—This position involves using self-propelled track equipment, such as a ballast tamper, ballast regulators, tie handlers and undercutter, and off-track equipment, such as a crane and backhoe.

*Small-machine operator*—This position involves using small hand-held or push-along (not self-propelled) track equipment such as grinders, tie borers, and rail saws.

*Track inspector*—This position inspects track and identifies conditions that do not meet FRA safety standards.

*Trackman/laborer*—This is a labor-intensive job requiring the use of hand tools for work on the track and right-of-way.

*Welder*—This position involves electric, thermite, and gas welding of track.

### *Attributes—Well Supported*

The curriculum from Penn State Altoona is based on civil engineering but includes courses specific to transportation and rail. The bachelor's degree provides a foundation in railroad overview, track location and maintenance, operations, and safety and practicums in operations, track, or mechanical. The program appears to fully cover all of the knowledge attributes. The program is limited to Altoona, Pennsylvania, and a commitment to a bachelor's degree. Training provided by ARC-Tech.net covers all of the knowledge attributes and applied skills with specific target populations of foremen, track inspectors, and employees who operate hoisting equipment.

For a full coverage of knowledge related to the history of the railroad industry and railroad operations, MOW workers may take a 6-month rail operations training program at Northwest Railroad Institute. Available are two units covering operations and safety rules and GCOR. This 6-month program emphasizes yard switching operations, inspections, hazardous material handling, and field operations training. During the training, students receive practical experience in a working railroad environment. They learn to make up trains, switch and spot rail equipment, couple and uncouple rail cars and locomotives, troubleshoot air brake systems, and line track switches. They work in teams to inspect, repair, and replace damaged or useless track.

Lastly, Sacramento City College offers courses covering the knowledge attribute of relative policies and procedures ensuring safety. Students apply skills learned in the classroom to field operations: making up trains, coupling and uncoupling cars and locomotives, hooking up air hoses, troubleshooting air brakes systems, getting on and off stationary equipment, removing and applying knuckles of cars (knuckles weigh up to 90 lb), and lining different types of switches.

### *Attributes—Supported*

The Penn State Altoona degree appears to support the applied attributes, but it is unclear whether the practicums provide in-depth experience, particularly in skills related to the operation of equipment. The University of Tennessee, Knoxville, supports the knowledge attributes and applied attributes related only to track inspection, safety, and track maintenance.

### *Attributes—Poorly Supported*

Several of the programs available to MOW workers allude to hands-on experience; it is unclear how extensive the training is in regards to the following attributes:

- Operation of self-propelled on- and off-track specialized equipment such as light cranes; ordinary motor trucks; tampers; regulators; tie handlers; hoists/booms; undercutters; tractors, graders, and other heavy equipment; large cranes; dump trucks; bulldozers; bob cats; and backhoes to maintain and repair the railroad tracks and related infrastructure (i.e., right-of-way, bridges, culverts, catenary systems, etc.).
- Loading, unloading, and hauling of scrap, trash, and other debris.
- Operation of mechanical street and yard sweepers.
- Operation of automatic equipment, including preparation of cleaning solutions to chemically clean grease, scales, dirt, and other foreign matter from metal machinery, parts, filters, and materials.
- Operation of hand-held, hand-supported power-operated machinery or equipment such as power washers, jack hammers, air chisels, hand-held tampers, spiking guns, pneumatic wrenches, shot/sand blasters, rail saws, rail drills, grinders, chain saws, etc.
- Operation of personnel-lifting equipment such as bucket-lifts, platform-lifts, safety pallets, etc.

## Conclusions

It is important to note that although some rail industry knowledge, skills, and abilities are well supported by educational or training resources in principle (see Table 12), a lack of geographically appropriate resources can reduce this to an almost complete lack of functional support. Very few current or prospective railroad employees can relocate across the country for the time it takes to complete these training regimens, and this is particularly true of certificate or associate's degree programs which typically occur over a longer period of time. While there is geographic overlap between educational/training resources and rail hubs in the San Francisco Bay area, at the Oregon/Washington state border, in the St. Paul, Minnesota, area, in Dallas/Ft. Worth, and in Denver, Colorado, there are also significant numbers of rail hubs in Ohio and on the East Coast that are largely unsupported by geographically proximate resources.

CHAPTER 7

# Strategies for Building and Maintaining a Railroad Workforce

## Strategies for Business Leaders and Executives

Interestingly enough, one of the most recurring *how to's* behind effective development and retention of railroad executives is taking a long-view approach, starting with the development of effective supervisors and managers. All interviewees observed that executive development really starts as far back as the first-time-supervisor training offered to railroaders who make the initial transition to formal leadership (Figure 47).

While supervisory training may be offered and completed as a stand-alone course with application back on the job, interviewees indicated a minimum of 1 year was needed to teach processes aimed at developing mid-to-upper managers on their way toward executive positions.

The individuals interviewed had experience in developing leaders ranging from in-house to academic institutions. There was great similarity in the strategies offered as the most effective for creating opportunities to build new knowledge and practice strategies for managing individuals, crews, and departments. The strategies that the interviewees recommended fell into formal organizational, informal organizational, and voluntary categories.

### Formal Organizational Strategies

The following 10 strategies characterize the organizational values, as well as the intentional decisions by organizational leaders, that contribute to the development of supervisors, managers, and senior leaders in consistent ways across the system:

- Blended learning: classroom + hands-on
- Cohort approach
- Continuous learning
- Development through built-in accountability and ownership within role/responsibilities
- Guest speakers/panels
- Movement around different functions

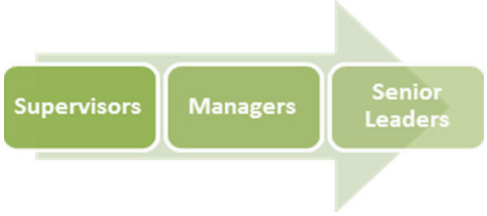


***Figure 47. Executive development from supervisors to senior leaders.***

- Process approach
- Projects and stretch assignments
- Promote from within
- Succession planning

### *Blended Learning: Classroom + Hands-On*

Blended learning is a strategy that describes an approach to training that combines formal, typically instructor-led, classroom learning with experiential learning that takes place outside of the classroom where what is learned can be observed and applied. This approach recognizes the need for application and demonstration of learned concepts, skills, strategies, and processes.

Nick Little at Eli Broad College of Business at Michigan State University (MSU) said about the approach to teaching the certificate course in railway management, "We make it as experiential as possible, very applied." He also said that MSU provides enough information for people to go back and anchor their learning into their home organization's issues, using the information gained to solve their problems. ***"We don't provide solutions,"*** said Little. ***"We provide the toolkit."***

NARS interviewees Tammie Barlow, manager II, and Dr. Terry Murphy-Latta, director, said that effective strategies for developing professional skills include prioritizing hands-on learning opportunities and constant development. Effective learning blends and combines conceptual classroom events with practical hands-on experience.

### *Cohort Approach*

A cohort approach within an organization groups people with similar professional objectives in order to create a professional learning community where participants can learn and receive support from each other. This approach creates a support group, so to speak, going through a similar learning curve at the same time, although not necessarily within the same department or geographic location.

An interviewee from a Class I organization described the preferred approach used currently is through cohort experiences. Groups of individuals from across departments are grouped together and learn from one another through assigned readings and projects focusing on real-world issues in need of analysis and resolution.

### *Continuous Learning*

This approach is a broad organizational value that can just as easily describe a culture as an approach to something specific like leadership development. Continuous learning means that individuals add to their existing knowledge, skills, and abilities along their career path in order to respond to a dynamic professional setting that is ever-changing and evolving.

A Class I interviewee reported that continuous education is encouraged, and the railroad lays out options for professional development within the organization, as well as tuition-reimbursement support for undergraduate or graduate college degrees. The interviewee followed up with, ***"More focused executive development is also utilized, such as public speaking and other leadership development programs through both vendors and universities."***

NARS representatives Tammie Barlow and Terry Murphy-Latta pointed out that once established, senior leaders continue their professional development. Even with formal training provided, it can take decades to truly learn the industry. "If you stop learning, you're pretty much done," said Murphy-Latta.

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### *Development Through Built-in Accountability and Ownership Within Role/Responsibilities*

This approach ties leadership development to what is expected of an individual as he or she performs his/her job day to day, which contrasts with classroom learning events. As a part of leadership development, this can be accomplished by adding responsibilities or assigning special or short-term projects for individuals to manage through others.

A Class I interviewee indicated using an approach to development that places 70% of attention on real accountability and ownership, 20% on projects and go-and-see opportunities, and 10% on formal training founded in principles of adult learning theory [summarized in TEAL Center (2011)]. Another strategy for grounding learning in an individual's existing full-time job is the inclusion of a management trainee's boss into what he or she is learning and preparing to apply.

When asked how to develop the talent of individuals who may, in turn, be next-generation leaders, the AAR interviewee responded, "Throw work at them. Put them in positions where they'll get a chance to excel. Give guidance and make sure they're comfortable."

*Railway Age* editor Bill Vantuono emphasized the real-time learning experiences of focusing on customers and service. ***"When you go out to get new business, you are solving a particular problem—a logistical problem—in which you provide a transportation solution that is less costly and more efficient."*** Leaders learn how to support the delivery of service quality, reliability, and safety by working with customers to develop mutually beneficial solutions. Vantuono described a similarly hands-on approach regarding leaders' interaction with their own employees when he said, "Railroaders of the year make it their business to go out and make time to spend with their people out on the railroad."

### *Guest Speakers/Panels*

Nick Little of MSU indicated that in the current certificate course in railway management, there is a module on leadership in which two recognized leaders from the industry talk about what they did to get where they are within leadership. Little indicated feedback is good about that module.

### *Movement Around Different Functions*

Moving individuals around as part of their leadership development experience is an intentional strategy used by an organization to grow or groom a leader-in-training. Often, this includes relocating to a new department; being assigned a new job title and/or position within the organizational chart, sometimes to a new higher ranking position; moving to another geographic location. Sometimes, these changes occur simultaneously.

One Class I interviewee noted that 70% of the railroad's top leadership team had been in three or more major departments in their careers. That movement around different functions is linked to being able to view things from multiple perspectives in order to enhance collaboration and team work across functional areas. Currently, viewing things from multiple perspectives is a key competency that the industry values in its leaders. Alongside those perspectives, access to different departments exposes developing leaders to the multiple viewpoints and goals that span organizational departments.

NARS interviewees Tammie Barlow and Terry Murphy-Latta confirmed that people are moved through different levels of the organization as part of their preparation for management positions. In addition, an important outcome for manager trainees is understanding that all departments within a railroad interconnect and are one another's internal customers.

### *Process Approach*

Process approach, like continuous learning, can be seen as an organizational value in addition to a specific strategy used in leadership development. In this report, this approach offers a contrast to classroom- or event-based learning, where individuals get a finite exposure to learning materials and opportunities to demonstrate what is comprehended and understood. Instead, learning as a process takes the long view in terms of the acquisition and demonstration of necessary knowledge, skills, and abilities. That railroads tend to value the evolution of senior leaders from those first trained as supervisors aptly illustrates process approach. In the following paragraphs, rail-leader developers characterize the presence, as well as benefits, of a process approach.

A Class I interviewee said, ***"We like to find people who are strong on the fundamentals of business or their craft. We'll be happy to let them experience, grow, and learn their railroad knowledge from within."*** That patience and expectation that time and experience will supply learning opportunities regarding management and leadership skills is an indicator of a proponent of process learning. Another indicator was when the individual pointed out that there are "so many kinds of disciplines, functions, and processes within a railroad, it is not practical to attempt to develop training courses on every facet."

Seeing the limitations of content delivery as a means of imparting knowledge is another characteristic of the process approach, which often focuses more on experiential learning and application, as well as coaching and on-the-job observation to assess performance.

Pasi Lautala of Michigan Tech had a recommendation to evaluate the benefits and drawbacks of current recruitment and development processes affecting new managers and future leaders. "We really need to look internally whether the current criteria for selecting and developing managers produces optimal outcomes for the industry." The "one-size-fits-all" approach makes candidate pools small, as they limit managerial candidates to those who are willing to fit themselves to the form, potentially leaving great talent outside if their personal or family situation does not meet the requirements of the career path. "I don't think that would fly with Google, or with Apple, or with anyone else," he said.

Lautala points to successful process changes that have already occurred in the industry as an indicator that workforce changes have, in fact, improved some since previous generations and result in a more stable workforce. Those changes include providing more leeway in terms of time frames by which employees are moved around the system, allowing an employee to decline a less-desired physical location without fear of losing future opportunities, putting effort into finding promotion opportunities within a desired location, and creating nontraditional pathways for progressing careers of talented individuals. The research team points out that the potential to tweak/improve practices is another positive feature of a process approach.

### *Projects and Stretch Assignments*

Integrated into the above-mentioned preference for developing leaders within a cohort was embedding learning experiences into assigned projects and/or stretch assignments. This is worth examining a bit more closely. As a Class I interviewee described it, the development of senior leaders and executives starts at management training. An important leadership development project at that point in an individual's career is shifting from being a team player to being a team coach, the metaphor offered by the interviewee. Deliverables such as financial reports and budgets also provide new opportunities to demonstrate the application of management skills that, upon mastery, position an individual for the potential to work toward other leadership roles down the road.

On the topic of preferred assessment methods for leadership skills, a Class I interviewee listed project outcomes and leaders-in-training's observations from the management of

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projects alongside their depth of understanding communicated during cohort discussions and demonstrated assertiveness and willingness to stick their necks out with ideas and perspectives.

From these observations, the research team sees that a Class I interviewee values performance-based indicators that leadership knowledge, skills, and abilities have been learned and provides leaders-in-training with multiple opportunities to demonstrate their proficiency in order to be considered for additional opportunities for promotion.

### *Promote from Within*

One of the most common responses to the question of preferred approaches for developing leaders was the response ***"promote from within."*** Interviewees representing both a Class I and a short-line railroad said this. *Railway Age* editor Bill Vantuono said about CEOs that many "have long-term experiences within railroading, and most still come up through the ranks."

Nick Little of MSU indicated that engaging in leadership development at or after the 5-year mark in the railroad industry helps employees demonstrate their marketability for the next level within an organization. Nick reported that over 85% of participants of the certificate course in railway management have been promoted within 2 years of course completion. In most cases, that promotion has been within their current organization, not achieved by moving to another railroad or company.

### *Succession Planning*

Related to promoting from within is keeping an eye open for replacements to today's leadership corps, which came up in both Class I and short-line railroad interviews. At a Class I, extensive succession planning takes place, including annual assessments of available candidates to fill positions for both highest levels and several layers into the organization. The short-line interviewee referred to that organization's succession plan as a "leadership-in-waiting group." While those people may still need to be brought along, they are under consideration for promotion.

## Informal Organizational Strategies

The following three strategies describe approaches to developing leaders that occur more organically as a result of relationships that naturally build among leaders-in-training and their supervisors and colleagues:

- Informal mentorships
- Professional association conference attendance and/or participation
- Work groups made up of multiple generations

### *Informal Mentorships*

Informal mentorships represent a workplace-specific approach in which an individual learns and grows through opportunities to work alongside and talk to supervisors or more experienced colleagues in their workplace. While the leader-in-training is the one being mentored, it is likely that the learning goes both ways, particularly as railroading is characterized by communication and interaction. In this report, the research team views this as distinct from networking, which is discussed in more detail in the section on voluntary strategies.

Over the course of a manager's career, informal mentorships naturally develop to help a person learn their roles and continuously improve, according to a Class I interviewee. Relationships are encouraged, sustained over time. In a similar vein, the short-line interviewee said, ***"The leadership aspect becomes relevant when your breadth of experience becomes wide enough that you can see yourself as a valuable mentor of others."***

The value of mentoring to Millennials was brought up during the conversation with NARS; Millennials are defined as those born after 1980 [see Pew Research Center (2010) for more information on Millennials]. According to Terry Murphy-Latta, Millennials prefer constant access to feedback, so it stands to reason they will appreciate and rely upon the opportunities to make mentoring relationships with their colleagues.

### *Professional Association Conference Attendance and/or Participation*

Attending a conference and/or participating in a professional association incorporates some of the previously mentioned strategies, such as blended learning and stretch assignments, such as when an individual volunteers as a presenter.

In addition, it is often through association events that an individual experiences the two-sided nature of mentoring, both finding people who mentor them and acting, in turn, as a mentor to others coming up behind them on a learning curve. This dual nature to mentoring was described well by the short-line interviewee. The interviewee pointed to the American Short Line and Regional Railroad Association as an industry meeting place that is attended by leaders who are in the process of growing their skill sets and expanding their influence. Although mentioned once already, it feels appropriate to repeat that this individual connected mentoring others as an important aspect of leadership, which occurs during and as a result of industry meetings.

### *Work Groups Made up of Multiple Generations*

In this report, work groups are considered distinct from cohorts. Interviewees described cohorts as a way to group a body of leaders-in-training as part of formal leadership development processes. Multi-generation work groups naturally occur in a department because of the range of ages and backgrounds among coworkers, a characteristic general to today's workforce and not unique to railroading.

"We're seeing great things come because of the mixture of seasoned, middle-term, and short-term employees pulling together," said a Class I interviewee. This perspective strikes the research team as extremely valuable considering the number of generations working side by side in today's workforce, not only in railroad but across industries.

## Voluntary Strategies

Interviewees also described two approaches to leadership development that individuals take upon themselves, sometimes outside the context of the workplace or railroad organization:

- Club or professional association participation
- Networking

While it may seem redundant to list professional associations as both an informal organizational strategy and a voluntary strategy, this demonstrates that some organizations encourage employee participation and provide release time to participate in conferences and meetings. The extent to which those opportunities are used to develop and extend an individual's leadership skills, however, depends upon the person, ultimately.

### *Club or Professional Association Participation*

Participation in professional associations or clubs represents a leadership development tool; they offer one of the most available avenues for open peer exchange across industry companies. A metric that Michigan Tech pays attention to in order to assess the attractiveness and competitiveness of its program include participation in the railroad club, number of students involved in the program and rail-content classes, and number of AREMA scholarships awarded to Michigan Tech students over other academic institutions.

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### *Networking*

Networking refers to another kind of relationship-focused approach to professional development that is related to, but different from, informal mentorships. Networking is not necessarily tied to a person's workplace or organization.

As part of a focus on diversity and inclusion, a Class I railroad represented in the interviews provides informal, voluntary professional networks to employees based on a distinctive identity or demographic, although all groups are open to all employees equally. These groups are great for networking, said an interviewee, and helps put people into contact with others outside their department, giving them resources outside of their immediate boss and coworkers. Further, these groups create informal leadership opportunities that alert upper management to prospective future leaders because of the focus on interpersonal skills, teamwork, and motivating others.

Pasi Lautala shared an approach used at Michigan Tech to help make students ready for industry jobs, although, he pointed out, railroads are the ones best suited for talking about their specific requirements for new hires. Michigan Tech works with students one-on-one and through the railroad club to educate them on specific jobs within the railroad and requirements for being qualified for them.

Nick Little of MSU also discussed the power of networking. In the railway management program offered at his learning institution, people who work within the rail industry learn in a mixed stakeholder group, which includes customers and suppliers. The value of networking, says Little, results in a tremendous degree of powerful discussion about how each stakeholder helps out the others. Through networking, "people can work better with their suppliers."

## Relationships Among These Strategies

Although listed individually, these strategies work together as a unified approach to leadership development. With organizations valuing continuous learning as a process, it is easy to imagine leaders-in-training experiencing, for example, broadened accountability, movement to a different function, informal mentorship with a superior, and attendance at an association conference pretty much simultaneously. While there may be some challenge in keeping track of all that is being learned and the many types of skills being developed and reinforced, individuals who encounter these approaches will not come up against experiences that contradict one another.

## Observations About Competency Needs of Future Leaders

When asked what is different about developing tomorrow's railroad leaders in contrast with today's, two professional needs emerged. Although not directly tied to approaches and strategies for developing leadership knowledge, skills, and abilities, the research team thought it appropriate to duly note interviewees' comments about next-generation leaders' needs.

### *Technology*

Railroads must prepare up-and-coming leaders for a world of constantly changing technology, said Terry Murphy-Latta from NARS. The representative from AAR corroborated this insight when he said, ***"People have to be technologically savvy. Technology is taking over the world, not just the railroad industry."*** He went on, "Knowing how it works, how it can be made reliable, knowing what its faults are, and how to use the data that comes from technology to provide business solutions—those are important skills for people coming up in the industry today."

### *Supply Chain*

When asked, Nick Little indicated next-generation areas of focus for tomorrow's railroad leaders must include the supply chain in order to "understand how it applies to the big picture

of commodities." He pointed out that railroad professionals "can be change agents within the industry." Up-and-coming railroaders need lessons in transportation and modal choice in order to educate customers about how railway can best help meet their needs. Little's insight integrates with the previous discussion about college degrees, since MSU offers a master's degree in supply chain management that includes an elective track in railway management. Little pointed to that program as an avenue for up-and-coming rail leaders.

## Strategies for the Workforce

A review of existing research and extensive efforts in data gathering highlighted some of the biggest challenges involved in recruiting, educating, training, and retaining the workforce of the railroad industry:

- **Passing along the knowledge.** With a majority of the current workforce retiring or nearing retirement, there is a need to pass along information that these individuals possess. Persons with years in the industry understand not only the history of the railroad, but have a keen sense of best practices in their individual crafts. Educational institutions offer courses or practicums; however, access to these programs are severely limited by location, accessibility, and affordability. The railroads provide their own training, yet the participants in the study indicate that often times these do not adequately prepare for the job at hand. Railroads also offer mentorship programs, but new hires may be paired with either a new employee or an experienced employee who is unwilling to train.
- **Tailoring industry practices to fit the needs of multiple generations.** Attrition rates are the highest in the first 2 to 5 years. During the recruitment process, the railroads provide a realistic job preview. Employees report that this outlook is often worse than reality, but unpredictable schedules still can greatly affect family relations. Rate progression policies deter, and increase frustration among, new hires. For some positions, such as dispatchers or train and engine personnel, it takes 5 years to reach full pay. All partakers in this study agreed that, once one is doing the job with full responsibility, one should be earning full pay.
- **Disparaging outlook on labor–management relations.** Throughout this study, a common "us vs. them" theme was observed among craftworkers about management. Craftworkers felt that managers are hired by nepotism or favoritism that is masked under management-labeled programs. They were discouraged by the hiring of new managers with college degrees and no railroad experience. The sentiment was that these new managers do not understand the tasks at hand and take disciplinary actions that are short-sighted, and often times far too harsh.
- **Evolvement of recruiting techniques to embrace a technology-centered generation.** Public relations are one of the strongest tools to brand a company and recruit new hires. The railroad industry is slow to recognize the power of social media. The industry is taking proactive steps by utilizing online job screening methods in order to streamline the recruitment process, but other opportunities exist using social media.

Following is a review of the reported challenges and successes and suggested strategies in recruiting, training, and retaining employees in order to build and maintain a strong workforce capacity.

### Recruitment Practices and Recommendations

#### *Recruitment Successes*

Structured interviews and focus group results revealed the following railroad employee recruitment successes:

- **Increased use of the Internet for ease of application process.** At this time, most Class I railroads require job seekers to apply online. More recent hires reported applying online and that it "wasn't difficult at all." The time from application to job offer ranged from 2 to 4 months,

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although there are cases of the process taking 6 months. The railroads dedicate websites to job opportunities and include explanations of careers. The websites provide an overview of the hiring process and an explanation of the benefits offered at each railroad.

- **More realistic outlook on working for the railroad.** As an effort to screen out applicants and increase retention among hired workers, the industry provides a comprehensive job preview including the work schedule. One individual stated that "they make it sound harsher than it actually is. Once you are there, you see it's like that but you can still have a life."
- **Selling the desirable aspects of working in the rail industry.** Rail workers were attracted to the railroad industry because of earning potential and the benefits in a stable industry. Several of the focus group participants pointed out that there were not many places where someone with a high school education could make the same amount of money. A few others reported they wanted to work outdoors.
- **Success partnering with or hiring from the U.S. military and NARS.** HR personnel highlighted the success from targeting recruitment efforts toward military personnel. A screener and an interviewer for the railroad industry look for individuals who can handle the environment and the unpredictable work schedule, have strong work ethics, and are rule driven in their job performance. Additionally, many technical and decision-making skills acquired in the military are valuable to the rail industry. Programs such as NARS identify highly skilled applicants who are likely to succeed as a conductor.

### *Recruitment Challenges*

- **Improving the railroad industry's brand.** The railroad still has an "old" image that does not necessarily attract younger generations of workers. The railroad is not viewed as an appealing, viable, and long-term career option.
- **Visibility of the railroad industry as a career.** A majority of the participants from focus groups sought the railroad industry as a career because a family member or close friend worked there. Others learned about positions through Veterans Administration staff or the military outplacement service. This appears to be the strongest trend in the recruitment methodology. Only a few participants reported finding their railroad job through an Internet search.
- **Lack of visibility into open positions, internally and externally.** Some participants in focus groups stated that open positions were not always well advertised to internal applicants.
- **Lack of predictable schedule, no work–life balance.** All focus group participants reported having a job preview that covered the need to travel and work holidays, weekends, and irregular schedules; however, some stated it is hard to understand what it will actually be like until one is in the job. One participant did comment that, "Until that phone rings at three in the morning or you have to miss your son's birthday party, you don't understand what the job involves. That's why you lose so many people in that first year."
- **Hiring appropriate people into management roles.** Current employees believe that management has no practical experience working on the rail.
- **Recruiting individuals with the right disposition and skill set for the rail industry.** The rail industry requires individuals who are comfortable working in outside environments and unpredictable schedules and who understand that their personal life may take a second seat to the industry.

### *Recruitment Recommendations*

- **Focus on marketing and branding the railroad as a serious contender.** When it comes to branding and marketing, the rail industry needs to emphasize new technology and process improvements in the railroad. This includes showcasing the dichotomy between the rich history behind the railroad industry and the future of rail. Market the marriage of tradition with technology. After a railroad commercial aired on television, one worker "started getting questions from lots of people about railroading," suggesting that marketing is effective in informing

people of the career options available in the rail industry. The U.S. rail industry can also look to international initiatives discussed in this report that focus on highlighting the environmental friendliness of the rail industry as well as other benefits to society. These include STM's Green Plan and RAC's image rebranding, which highlight rail and other industries' advances in environment, economy, innovation, and safety.

- **Presence in social media.** In today's market, much of recruiting and industry knowledge comes from a social media presence. Utilize social media platforms such as LinkedIn, Monster, Facebook, and Twitter to have a greater impact on advertisement and recruitment.
- **Encourage the choice of a rail career for younger generations.** This can be done through visiting more high school and college career fairs. Significantly increase participation in STEM and technical competitions. The railroad industry can take advantage of these highly visible branding opportunities. Talking to students earlier in their career about the viability and perks of working for the railroad can have a large impact. Again, looking toward international initiatives may prove beneficial when trying to appeal to younger generations, drawing from previously reported initiatives in this report like CUTA's Youth Summits. These summits appeal to younger generations by hosting activities like DJ dance parties on light-rail trains, while educating attendees of possible career opportunities in transportation. Another example is RAC's use of advertising in *Career Options* magazine, targeting young readers through free distribution to high schools and community colleges. The magazine has a quick-response scan code that directly links to RAC's Career on Track website, which will connect users with employers in the railroad industry looking to hire. This also helps build a presence in social media. Additionally, follow similar recruitment strategies employed by the military targeted toward young generations.
- **Highlight the benefits, stability, and longevity of a railroad career.** Focus group participants mentioned that there were a number of factors that made a railroad job desirable. All were attracted by the money and stability offered. The health insurance was also considered highly attractive. At the time of hiring, most were not concerned about a pension, but this benefit became desirable once they were working in the industry for a few years.
- **Detail the perceived negatives of the industry.** Although applicants received a comprehensive job preview, hired individuals reported impactful surprises once on the job. These include a 12-month waiting period for dental coverage, the claims process, drug testing policy, and bumping. HR personnel stated that they try to emphasize the cost to a personal life that a job in the railroad entails, particularly before much seniority is gained, such as missing birthdays and anniversaries, or being on call at undesirable hours. Perhaps establishing a mentoring program of experienced employees to discuss the benefits, as well as the downsides, of working for the railroad from a true-account perspective would be beneficial to new hires.
- **Increase visibility of open positions to current rail employees.** Participants indicated a high degree of nepotism and favoritism when it comes to promotion. Additionally, the railroads do not advertise positions to internal applicants, according to the focus group.
- **Capitalize on the high employee-referral rate.** Sixty-eight percent of all new hires are through internal networks. Create a special employee-referral bonus for those who refer applicants within a specific age demographic.
- **Focus recruiting efforts in specific target areas.** Continue efforts to recruit military veterans but expand efforts to recruit more women and minorities.

## Training Practices and Recommendations

### *Training Successes*

- **On-the-job training with experienced, willing mentors.** New hires typically receive classroom-style training. The greatest advantage to new hires was a partnership with an experienced worker in their particular craft. ***"The only way to learn a job is to do the job. . . . You need to attach***

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***yourself to someone and learn the job through them and learn it as quickly as you can."*** This sentiment was echoed numerous times throughout the interviews and focus groups.

- **State-of-the-art railroad education and training centers.** Several of the railroads developed centers for new hires to receive not only classroom instruction but also OTJ-style training. Centers, such as the Railroad Education and Development Institute (REDI) in Atlanta, Georgia, have over 10,000 students participate in their programs geared toward conductors, locomotive engineers, management trainees, yardmasters, communications and signal workers, track workers, and more.

### *Training Challenges*

- **Education and experience levels.** The survey responses indicate that only 68% of survey responders had a high school diploma or GED. It is important that there is an examination of the content of the training to make sure that those receiving the training can understand and apply what they have been taught in order to safely and efficiently perform their jobs. There were a very small percentage of respondents (8.4%) who received any education or course work specific to the railroad industry. This also needs to be taken into consideration when looking at training. The railroad needs to think through how they can train new employees who have no previous experience working in this industry.
- **Consistency and standardization of time in training.** Training is not consistent across the different roles prior to starting the job. The amount of time spent receiving training fluctuated greatly with some receiving 6 months of training and others receiving none at all. This needs to be standardized and reinforced across the different roles, training centers, and different railroads.
- **Lack of quality and experienced trainers.** Many respondents made comments on the lack of qualified trainers responsible for conducting the training. Quality of instructor was viewed as being just as important as the content being taught. There should be a thorough and formal review of those responsible for training the workforce.
- **Provision of OTJ training.** The majority of respondents preferred OTJ training to the traditional classroom-style training. However those already working in the yard are averse to mentoring or OTJ training, afraid that if they make any mistakes, they will be held liable. If OTJ training is the most beneficial and practical way to provide training for these new employees, the perceived risk needs to be lessened for current employees.

### *Training Recommendations*

- **Build world-class training facilities and programs.** Create a railroad training center where new hires receive high-intensity classroom training and extensive hands-on training. Stagger the learning process with classroom training, hands-on experience, then more classroom instruction, followed by a practicum. Model programs after centers like REDI or take examples from outside programs such as GE and Johnson and Johnson.
- **Create greater standardization and emphasis on training across all railroad companies.** Create a standardized curriculum or suite of training programs. The programs should entail tutelage of an essential foundation of knowledge about the railroad industry and the crafts. The goal of the programs should be to develop and foster subject matter experts in their craft as well as create a greater breadth and knowledge of different roles. There should be an opportunity for individuals to develop specialized skills and in-depth knowledge.
- **Create a culture of preceptorship and mentoring.** Each employee, prior to starting on their own, should go through a preceptorship, where they shadow someone else who is in their role to understand the logistical and tactical requirements of the role first-hand. This will set them up for success during the first days/weeks/months on the job. Following the preceptorship, there should be a formalized and encouraged mentoring program to pass on historical and institutional knowledge to newer/younger employees. Furthermore, creating a more informal

"buddy" system may be warranted, given suggestions from focus group discussions centered around many new hires' confusion related to processes such as bidding on jobs, collective bargaining agreements, bumping, etc.

## Retention Practices and Recommendations

### *Retention Successes*

- **Benefits, retirement plan, and pay.** Those interviewed indicated that the benefits, retirement plan, and pay were the driving reasons for continued work in the industry. Without these highly sought-after perks, the industry would see a higher attrition rate among their employees. "For someone without a college education, you are making good money."
- **Sense of pride and camaraderie.** Workers enjoyed seeing first-hand the fruits of their labor and felt fulfilled by the work they accomplished together. ***"When you fix a switch and see the train go by, you know you did your job."***

### *Retention Challenges*

- **Work schedules.** With the unpredictable schedules, railroad employees find it difficult to maintain a family and social life. On-call junior-level staff are the first deployed at undesired times (early morning calls). This is just one way in which working in the rail industry may place stress on family life through missed birthdays, anniversaries, and other important events and the stress it places on family takes its toll on the individual. ***"The employees are not treated with respect by the railroad. The hours and lack of a schedule are detrimental to our lives and those of our families."***
- **Labor–management animosity.** Many of the railroad employees expressed a culture of us (craftworkers) versus them (management). They stated they often felt like they were being watched for the sole reason of being caught doing something wrong and were not acknowledged by management for a job well done.
- **Finding qualified and experienced managers.** Many of the participants were critical of the railroad policy to hire only people with college degrees without experience in the railroad industry. They felt that having a degree does not guarantee success in a railroad position. "Lower or entry-level management hiring for the transportation department from sources outside the rail industry has negative effects on work performance and management/worker relations. ***Those hired often lack the ability to perform their jobs efficiently even with considerable training. They often have no concept of the actual time or knowledge required to perform a task they assign, as they have never done that task themselves.*** Many are too unwilling to take suggestions or criticism to help improve relations and performance."
- **Passing on knowledge from employees nearing retirement.** As many workers are set to retire from the railroad in the coming years, the industry faces the challenge of maintaining the knowledge these experienced workers have acquired throughout their careers, through passing it on to newer generations of workers.
- **Disciplinary practices of the rail yards.** Seventy-two percent of respondents said increased job satisfaction could come from improved labor and management relations. Disciplinary practices enforced by management are viewed as adding additional stress and lowering morale. Associated with these disciplinary practices is high turnover and turnover is incredibly costly to any organization. ***"Employees don't leave jobs because they don't like the organization or what they're doing, they leave their jobs because they don't like their manager."***
- **Promotion process.** Current employees believe that the bulk of hiring for higher-level positions happens externally or through favoritism and nepotism. Employees are looking for greater visibility into open positions and want to be incentivized to apply, for example, through an increase in pay. Interestingly, all members of the focus groups did not seem motivated to apply

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for their supervisor's job, agreeing that they would face a pay cut by going from an agreement position, where overtime is possible, to a salaried job. As a result, current promotion processes may impede the railroad's ability to hire managers with experience.

### *Retention Recommendations*

- **Increase benefits.** Employees recommended railroads pay for medical insurance, provide more vacation time, and offer paid sick leave, a 401(k) match, and a stock purchase program.
- **Implement a rewards and recognition program.** Statistics show that younger generations have greater loyalty to organizations if they are recognized and rewarded for their contributions. This program would also provide the opportunity to recognize the tenured employees, encourage peers to recognize one another for their hard work, and for management to acknowledge a job well done.
- **Improve disciplinary practices.** The industry could benefit from a review and revision of the standardized disciplinary practices across the different organizations as well as a review of ad hoc practices to review efficiency and appropriateness. Practices should be evaluated as to whether they are outdated or simply have remained on legacy principles. The focus group participants felt that an employee who makes an error needs remedial training; having unpaid time off does not correct the underlying problem. There needs to be a greater emphasis and understanding on allowing employees to try out different or new roles. Railroads should place less of an emphasis on the repercussions or liabilities that are associated with mistakes but encourage employees to seek out new and different experiences in order to develop and retain human capital.
- **Encourage experienced and willing personnel to mentor new employees.** Seventy percent of how employees learn and develop is through hands-on experience; twenty percent is through mentoring; and only ten percent is through formal classroom training. Pairing mentorship and hands-on experience creates the biggest opportunity to pass along knowledge. Those surveyed stated that a common problem is that ***"you have new people training new hires." "Stop having babies train babies."***

## Conclusions

This report has highlighted several important factors related to workforce capacity across the railroad industry, accounting for business executives and leaders, engineering and operations managers, and craftworkers. This information was drawn from many varied sources to include all stakeholders in the railroad industry. These extensive efforts included a review of existing literature and educational resources, both in the United States and abroad; interviews with business executives and human resource professionals; focus groups held with craftworkers in three different locations in the United States; and two surveys distributed nationwide and targeted toward engineering and operations managers as well as craftworkers. This research ultimately led to the development of competency models, completion of a needs/gap analysis, and finally suggested strategies for building and maintaining a strong workforce capacity.

From these efforts, the research team recommends the railroad industry work toward improving labor–management relations; employing managers with experience on the railroad who are also willing to serve as mentors; accounting for the varied needs of multiple generations of workers; offering solutions for a positive work–life balance, especially when it comes to retaining workers from younger generations; and rebranding the image of the railroad to make it an appealing and attractive career option. It is hoped that these findings will guide the railroad industry into a successful future.

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APPENDIX A

# Focus Group Questions

## Recruitment

Our first topic is going to be about how you came to work in the railroad industry.

- First, I would like to know if any of you worked elsewhere before taking a job in the railroad industry. (If any response, ask where they worked.)
- At what point in your career did you think about working for a railroad? Probe: Consider it in high school? College?
- How did you initially learn about job opportunities in the railroad industry?
- What attracted you to work in the railroad industry? What was your perception of the industry at that time?
- How did you find out about your first job in the industry? Probe: Was it through a friend, family member, advertisement? Social media?
- What additional ways could the railroads use to publicize railroad jobs?
- After submitting your application, what was the hiring process like for you? Probe: Was there a job preview? How was the position explained to you?
- Once on the job, to what extent did the job prove to be as explained to you during the hiring process? What was different?

## Initial/Refresher Training

Now I'd like to move on to training.

- How did you obtain the skills for your present job? (Have everyone respond. Order by craft.) Probe: community college training, OJT, employer training program, mentoring, other. For mentoring, probe on willingness to share info.
- To what extent did this training prepare you for your job? *[Maybe ask this together with first question as we go around.]*
- What could be done to improve the training process?
- Beyond your initial training with the railroad, what training has your railroad offered you? Are there areas where you think training would help you do your job more effectively but your railroad has not offered training?
- How do you learn to use new equipment that the railroad purchases?
- Have you ever mentored another employee? What was that like?
- What would motivate you to apply for your supervisor's job?

## Retention

I'd like to spend some time talking about what has kept you in your job with the railroad.

- To what extent has your job met your expectations? Probe: likes, dislikes. Try to get at internal vs. external factors.
- What could your employer do to increase your job satisfaction?
- Why do you stay on the job?
- Would you recommend the railroad industry to a friend or family member? Why? Why not?
- If you wanted to make sure that you and others like you stay with the railroad for a long time, what recommendations would you make to the railroad?

## Wrap-up

- What other suggestions do you have regarding recruitment and retention?

APPENDIX B

# Recruitment and Retention Survey for Craftworkers

Welcome to the Railroad Industry Survey!

Demographics and General Railroad Questions

3. What is your age?

4. What is your sex?

- Male
- Female

5. What is your marital status?

- Single
- Married
- Partnered
- Divorced
- Widowed

Other (please specify)

6. Which race/ethnicity best describes you? (Please choose only one.)

- ○ American Indian or Alaskan Native
- ○ Asian / Pacific Islander
- ○ Black or African American
- ○ Hispanic American
- ○ White / Caucasian
- ○ Prefer not to answer
- ○ Multiple ethnicity / Other (please specify)

7. How many years have you worked in the railroad industry?

8. In which labor category do you belong?

- ○ Dispatcher
- ○ Maintenance of Way
- ○ Freight Train and Engine Service
- ○ Passenger Train and Engine Service
- ○ Signalman
- ○ Mechanical Department
- ○ Other (please specify)

Prev Next

## Demographics and General Railroad Questions

9. How does your work schedule impact your quality of life?

- ○ My work schedule has a negative effect on my quality of life.
- ○ My work schedule does not impact my quality of life.
- ○ My work schedule has a positive effect on my quality of life.

10. Does your work schedule cause you to consider looking for employment elsewhere?

- ○ I am considering switching to a different job within the industry.
- ○ I am considering switching to a different job outside of the industry.
- ○ I plan to remain in my current career path.

11. Use the following scale to rate how much each factor below contributes to your stress at work.

| | No stress | Little stress | Stressful | Very Stressful | N/A |
|---|---|---|---|---|---|
| Responding to emergencies | ○ | ○ | ○ | ○ | ○ |
| Lack of control over schedule | ○ | ○ | ○ | ○ | ○ |
| Long travel distance to out of town work sites | ○ | ○ | ○ | ○ | ○ |
| Loss of sleep | ○ | ○ | ○ | ○ | ○ |
| Coordination with other departments | ○ | ○ | ○ | ○ | ○ |
| Commuting to and from work | ○ | ○ | ○ | ○ | ○ |
| Pressure to finish a task | ○ | ○ | ○ | ○ | ○ |
| Ambiguous operating rules or procedures | ○ | ○ | ○ | ○ | ○ |
| Management policies and decisions | ○ | ○ | ○ | ○ | ○ |
| Company discipline policies | ○ | ○ | ○ | ○ | ○ |
| Singled out by management for rule violation | ○ | ○ | ○ | ○ | ○ |
| Job security | ○ | ○ | ○ | ○ | ○ |
| Surges in workload | ○ | ○ | ○ | ○ | ○ |
| Communication problems | ○ | ○ | ○ | ○ | ○ |
| Inadequate staffing | ○ | ○ | ○ | ○ | ○ |
| Personal safety | ○ | ○ | ○ | ○ | ○ |
| Responsibility for the safety of others | ○ | ○ | ○ | ○ | ○ |
| Inadequate time off | ○ | ○ | ○ | ○ | ○ |

12. Does your current level of job-related stress cause you to consider looking for employment elsewhere?

- ○ I am considering switching to a different job within the industry.
- ○ I am considering switching to a different job outside of the industry.
- ○ I plan to remain in my current career path.

Prev Next

## Railroad Recruitment Processes

13. How did you become aware of employment opportunities in the railroad industry? Please select all answers that apply.

- ☐ Suggestion from family member of friend
- ☐ Newspaper job postings
- ☐ Internet job postings, including railroad websites and job placement websites
- ☐ Career fair
- ☐ VA advisor
- ☐ Military outplacement service
- ☐ Educational institution
- ☐ Other (please specify)

14. What other ways, if any, would have helped you to identify a job in the railroad industry?

15. Did you work in another industry before joining the railroad?

- ○ Yes
- ○ No

Prev Next

## Railroad Recruitment Processes

16. What was your primary vocation before joining the railroad industry?

- ○ Military
- ○ Construction
- ○ Healthcare
- ○ Transportation
- ○ Law Enforcement/Criminal Justice
- ○ Telecommunications
- ○ Finance
- ○ Food industry
- ○ Education

Other (please specify)

17. Do you have a family member or friend who has worked in the railroad industry?

- ○ Yes
- ○ No

Prev Next

## Railroad Recruitment Processes

18. Did this affect your decision to join the railroad?

- ○ Yes
- ○ No

19. What was your image of the railroad industry before you started your job search?

- ○ Positive
- ○ Non-existent
- ○ Negative

20. Why did you choose to work for the railroad? Please select all that apply.

- [ ] Wages
- [ ] Health insurance
- [ ] Vacation time
- [ ] Pension
- [ ] Job security
- [ ] Job variety/options
- [ ] Work schedule
- [ ] Career change

Other (please specify)

21. Why did you select your craft?

- ( ) Pay
- ( ) Possessed the necessary skill set
- ( ) Work schedule
- ( ) Opportunity for career advancement
- ( ) Opportunity to acquire new skills and experience
- ( ) Only position available at the time

Other (please specify)

22. How would you rate your experience applying for a railroad position?

- ( ) Excellent
- ( ) Satisfactory
- ( ) Unsatisfactory
- ( ) Poor

23. After applying, how long did it take before you started training or working for the railroad?

- ( ) Less than two weeks
- ( ) Two weeks to one month
- ( ) One month to three months
- ( ) Three months to six months
- ( ) More than six months

24. Were there any aspects of the job that you did not learn about until you started working for the railroad? Please select all answers that apply.

- [ ] Waiting period for benefits to begin
- [ ] Work schedule
- [ ] Vacation policy
- [ ] Bumping
- [ ] Rate progression
- [ ] Job bidding procedures
- [ ] Acquiring seniority rights
- [ ] Work site travel demands
- [ ] Company discipline policies
- [ ] Safety risks
- [ ] None

Other (please specify)

Prev Next

## Education and Training Opportunities

**This part of the survey pertains to education and training opportunities prior to joining the railroad workforce.**

25. What is the highest degree or level of school you have completed?

- ○ Some high school
- ○ High school diploma/GED
- ○ Associates degrees
- ○ Bachelors degree

Other (please specify)

26. Please list any professional certifications you have been awarded.

27. Did you receive any education or course work specific to the railroad industry before joining this workforce?

- ○ Yes
- ○ No

Other (please specify)

Prev Next

## Education and Training Opportunities

28. In your educational program, do you feel you had sufficient access to railroad related courses and seminars?

- ○ Yes, there were many courses or seminars offered related to the railroad industry.
- ○ No, there were only a few courses or seminars offered related to the railroad industry

29. What was most helpful in preparing you to enter a career in the railroad industry?

- ○ Trade school training
- ○ Guidance from someone else already working in the railroad industry
- ○ Previous employment

Other (please specify)

Prev Next

## On-the-Job Training

**This section of the survey pertains to education and training opportunities after joining the railroad workforce.**

30. Do you feel your training adequately prepared you to conduct your job in a safe and satisfactory manner?

- ○ Training/Education has been more than sufficient
- ○ Training/Education has been sufficient
- ○ Training/Education has been insufficient
- ○ Training/Education has been absent
- ○ Unsure

31. How long was your training period before starting work in your position?

- ○ Less than a month
- ○ Two months to three months
- ○ Four months to six months
- ○ More than six months
- ○ I did not have a training period

32. What type of training has been the most effective in building your skill set, knowledge, and confidence for your current position?

- ○ On-the-job training
- ○ Classroom education
- ○ Working with experienced people in the field
- ○ Online courses

Other (please specify)

33. What obstacles did you face during your training period?

- ☐ Inexperienced classroom instructor
- ☐ Supervisors were unwilling to train
- ☐ Assigned to someone who was unwilling to train
- ☐ Lack of time
- ☐ None

Other (please specify)

Prev Next

## Railroad Retention Processes

34. Where do you see yourself in the next five to ten years?

- ○ Promoted to a management position
- ○ Working in the same position
- ○ Working in a different position
- ○ Retired or close to retirement
- ○ Left railroad industry for another job

Other (please specify)

35. Do you intend to make working for the railroad a life-long career?

- ○ Yes
- ○ No
- ○ Unsure

36. What factors affect your willingness to continue working in the industry? Please select all that apply.

- ☐ Wages
- ☐ Health insurance
- ☐ Pension
- ☐ Job security
- ☐ Work schedule
- ☐ Travel opportunities
- ☐ Mobility within the company to other locations or jobs
- ☐ Friendship with co-workers
- ☐ Participation in union
- ☐ Training and educational opportunities

Other (please specify)

37. Are you satisfied with your job?

- ○ Extremely satisfied
- ○ Satisfied
- ○ Neutral
- ○ Dissatisfied
- ○ Extremely dissatisfied

38. What could the railroad do to increase your job satisfaction? Please select all that apply.

- [ ] Increase pay
- [ ] Cover more of the health insurance costs
- [ ] Offer 401K match
- [ ] Offer more vacation time
- [ ] Increase or offer paid sick leave
- [ ] Offer a stock purchase program
- [ ] Provide better tools and equipment
- [ ] Improve safety conditions
- [ ] Improve predictability of work schedules
- [ ] Mitigate work site travel demands
- [ ] Enhance away from home lodging and meal provisions
- [ ] Additional training and educational opportunities
- [ ] Hire more workers
- [ ] Hire experienced supervisors
- [ ] Acknowledgement from management for a job well done
- [ ] Improve labor and management relations

Other (please specify)

39. Are you satisfied with opportunities for advancement in the railroad industry?

- ○ Very satisfied
- ○ Satisfied
- ○ Neutral
- ○ Dissatisfied
- ○ Very dissatisfied
- ○ I do not wish to advance

Prev Next

## Railroad Retention Processes

40. If you feel changes are needed in opportunities for career advancement, what do you think would be helpful? Please select all that apply.

- [ ] Improve communication when new positions become available
- [ ] Hire more from within the railroad
- [ ] Offer more training to employees to expand skill set and knowledge
- [ ] None needed
- [ ] I do not wish to advance.

Other (please specify)

41. Has working for the railroad affected your relationships with family and/or friends?

- ○ Yes, positively
- ○ Yes, negatively
- ○ No change
- ○ Unsure

Prev Next

## Railroad Retention Processes

42. Would you recommend a career in the railroad to a family member or close friend?

- ○ Definitely yes
- ○ Probably yes
- ○ Probably no
- ○ Definitely no

43. Please provide any additional comments regarding railroad recruitment, retention, and training opportunities here.

Prev Next

## Thank you for your participation.

APPENDIX C

# Recruitment and Retention Survey for Operations Managers and System Engineers

## Introduction

1. Select the description that best describes your current employer:
   a. Class I railroad
   b. Class II railroad
   c. Class III railroad
   d. Commuter/urban transit rail system
   e. Consulting firm
   f. Construction/maintenance contractor
   g. Rail manufacturer/supplier
   h. Government
   i. Professional association
   j. None of the above
2. How many years have you been with your current employer?
3. How many years have you worked in the railroad industry?
4. Indicate the area that best describes the focus of your current responsibilities
   a. Operations
   b. Engineering
   c. None of the above

## Recruitment Practices

5. How did you become aware of employment opportunities in the railroad industry? Choose the answer that best applies.
   a. Suggestion from family member or friend
   b. Newspaper job postings
   c. Internet job postings, including railroad websites and job placement websites
   d. Career fair
   e. Educational institution
   f. VA advisor
   g. Military outplacement service
   h. Other _____
6. Do you have a family member or friend who has worked or works for railroads?
   a. Yes. If so, did this affect your career decision to join the railroads?
      i. Yes
      ii. No
   b. No

7. What was your image of the railroad industry before starting your job search?
   a. Positive
   b. Neutral
   c. Negative
8. Why did you choose to work for the railroad? Select all that apply.
   a. Salary
   b. Health insurance
   c. Vacation time
   d. Pension
   e. Job security
   f. Job variety/options
   g. Work schedule
   h. Career change
   i. Interest in trains/railroads
   j. Other (please specify): _____
9. How would you rate your experience applying for a railroad position?
   a. Excellent
   b. Satisfactory
   c. Unsatisfactory
   d. Poor
10. After applying, how long did it take before you started training or working for the railroad?
    a. Less than 2 weeks
    b. 2 weeks to one month
    c. One to three months
    d. Three to six months
    e. More than six months

## Education and Training Opportunities

1. Indicate your highest level of completed education:
   a. High school/equivalent
   b. Associate's degree/military equivalent
   c. Bachelor's degree
   d. Master's or Ph.D. degree
2. Did your formal education include rail-related coursework?
   a. Yes
   b. No
3. Have you participated in rail-related continuing education or training offered by your employer in the past two years?
   a. Yes
   b. No
4. Have you participated in rail-related continuing education or training offered by an organization other than your employer in the past two years?
   a. Yes
   b. No
5. Are you a member of a professional organization that is related to the rail transportation industry?
   a. Yes
   b. No

6. In your educational program, do you feel that you had sufficient access to rail-related courses and seminars?
   a. Yes, there were many courses or seminars offered related to the rail industry.
   b. No, there were only a small amount of courses or seminars offered related to the rail industry.
   c. No, I don't recall any courses or seminars offered related to the rail industry.
   d. Not applicable.
7. What was most helpful in preparing you to enter a career in the railroad industry?
   a. Courses/seminar material in educational programs
   b. Internships within the railroad prior to graduation
   c. Professor/Supervisor/Mentor relationship and guidance
   d. Participation in a rail-related club or organization
   e. Guidance from someone within the railroad industry
   f. Previous employment
   g. Other (please specify):_____
8. Do you feel your training or education adequately prepared you to conduct your job in a safe and satisfactory manner?
   a. Training/Education has been more than sufficient
   b. Training/Education has been sufficient
   c. Training/Education has been insufficient
   d. Training/Education has been absent
   e. Unsure
9. How long was your training period before starting your position?
   a. Less than a month
   b. Two to three months
   c. Four to six months
   d. More than six months
   e. I did not receive a training period
10. What type of training has been the most effective in building your skill set, knowledge, and confidence for your current position?
    a. On-the-job training
    b. Classroom education
    c. Online courses
    d. Working with experienced persons in the field
    e. Other (please specify): _____
11. What obstacles did you face during your training period?
    a. Unwillingness to train properly
    b. Inexperienced classroom instructor
    c. Lack of cooperation from others
    d. Lack of time

## Retention Practices

1. Where do you see yourself in the next five to ten years?
   a. Promoted
   b. Same job
   c. Same organization, different position
   d. Retired or close to retirement
   e. Leave railroad for another job

2. Do you intend to make working for the railroad a life-long career?
   a. Yes
   b. No
   c. Unsure
3. What factors affect your willingness to continue working within this industry? Select and rank the three most important reasons, with 1 being the most important to you.
   a. Wages
   b. Health insurance
   c. Pension
   d. Job security
   e. Interesting/challenging work
   f. Work schedule
   g. Travel opportunities
   h. Camaraderie with coworkers
   i. Job and career mobility
   j. Workload
   k. Participation in union
   l. Training and educational opportunities
   m. Other (please specify): _____
4. What is your level of job satisfaction?
   a. Extremely satisfied
   b. Satisfied
   c. Neutral
   d. Unsatisfied
   e. Extremely dissatisfied
5. What could the railroad do to increase your job satisfaction? Select and rank the three most important reasons, with 1 being the most important to you.
   a. Increase pay
   b. Cover more of the health insurance costs
   c. Offer 401K match
   d. Offer more vacation time
   e. Increase in or offer paid sick leave
   f. Offer a stock purchase program
   g. Improve predictability of work schedules
   h. Growth/advancement opportunities
   i. Additional training and educational opportunities
   j. Acknowledgment from management for a job well done
   k. More solicitation of worker input by management
   l. Provide adequate tools
   m. Improve maintenance of locomotives/trucks
   n. Hire more workers
   o. Other (please specify): _____
6. Would you recommend working for the railroad to a family member or close friend?
   a. Yes
   b. Unsure
   c. No
7. What is your level of satisfaction with opportunities for advancement in the railroad industry?
   a. Very satisfied
   b. Satisfied
   c. Neutral

d. Dissatisfied
e. Very dissatisfied
f. I have no interest in advancement.

## Conclusion

1. Indicate your gender
   a. _____ Male
   b. _____ Female
2. Indicate your age range
   a. Under 25
   b. 25–34
   c. 35–44
   d. 45–54
   e. 55–62
   f. 63 and older
3. Indicate the range that corresponds to your annual wage from your current rail position
   a. Under $ 56,000
   b. $ 56,000–$ 79,999
   c. $ 80,000–$ 114,999
   d. $ 115,000 and greater
4. Provide the first 2 zip code digits for your primary work location (for non-US locations, enter 00)
   a. _____
5. If you have additional comments, please provide them here:

APPENDIX D

# Executive Leader Interview Tool

## Standard Questions (to be asked each interviewee)

1. Which among your core professional competencies have you found to be most essential to exemplary delivery on your executive responsibilities? Which competencies do you believe are requisite to effective executive leadership?
2. What are three words you use to describe your leadership style?
3. Against what results measures do you assess your own performance? Against what results measures does your organization measure your performance?
4. What key message do you communicate to your direct reports about how to most reliably meet your expectations?
5. What specific formal educational and work experiences have enhanced your development as an executive leader most powerfully?
6. What leadership development strategies or experiences do you *not* recommend?
7. What competencies, beyond those you have identified as most essential to your own success, do you believe the next generation of industry leaders will have to bring to the table?
8. Given the opportunity to influence this research about how the railroad industry might most effectively identify or recruit, develop, place, and sustain new leaders, what more or different would you like to add at this time?

## Menu of Representative Follow-up Questions (to be asked at the researcher's discretion)

1. What do you like about being an executive in this industry? What do you dislike?
2. Who has been your single most important mentor, and what did that person do to help you?
3. What is your favorite strategy for developing the skills of your direct reports?
4. What made you want to take on the responsibilities of leadership?
5. If you were to tell a story that illustrates your approach to leadership, what story would you tell?

## Support Resources We Will Request

- Interviewee's current résumé
- A copy of any "go-to" tool the interviewee carries with him/her and is willing to share
- Name and contact information for leadership development Subject Matter Experts (SMEs) whose work the interviewee endorses, and permission to contact those people

APPENDIX E

# HR Structured Interview Questions

Instructions for interviewer: Listed below are topics and associated questions to be discussed with HR departments of identified agencies in the railroad industry. These questions are broken up into 3 broad categories: (1) recruitment strategies, (2) retention strategies, and (3) training strategies.

Under each category, we list the key topics to investigate current standard policies and practices of HR agencies. Below each topic question, we provide queries to delve deeper into each topic. Please use these queries to engage the railroad HR professional in a meaningful conversation about the listed topics.

QinetiQ-NA ensures all information will be de-identified and used for research purposes under the NCRRP Project 06-01, "Building and Retaining Workforce Capacity for the Railroad Industry."

## Recruitment Questions

**Topic # 1:** How are potential new hires coming to apply for a position in the railroad industry?

*Query:*

- *Recruiting methods and strategies—which are most successful and are some more effective for attracting job candidates to specific crafts?*
- *Differences between internal vs. external hires.*
- *How do applicants hear about your openings?*
- *To what extent if any do you solicit local vocational schools, colleges, or universities for recent graduates seeking employment?*
- *Discuss the biggest barriers or obstacles to attracting qualified employees.*

**Topic # 2:** Describe the process of searching for and successfully hiring new workers, screening in or out of candidates during the interview process, as well as the onboarding of new hires.

*Query:*

- *Probe process of interviewing the candidate—who are they interviewing, do they meet their managers in this part of the process?*
- *Do you have a standardized interview guide/process used in recruitment?*
- *Describe the general process for recruiting, screening, and selecting new hires at your railroad. Who is involved in this process?*
- *What are the major reasons that job applicants are not hired?*

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**Topic # 3:** Do there seem to be variances in recruiting different positions, as well as in different locations?

*Query:*

- *Probe—regional differences, urban vs rural, difference in hiring different labor categories.*

**Topic # 4:** Please describe the demographics of new hires.

*Query:*

- *Probe—different educational levels, gender, ethnicity.*
- *Do you anticipate changes to these trends?*

**Topic # 5:** Please describe any recent changes the rail industry has made in order to improve upon recruiting new, capable workers to join the railroad industry.

*Query:*

- *Probe changes to procedures or programs.*
- *Inquire about standardized metrics of hiring.*
- *How do you attract qualified new employees?*
- *How have you changed the way you attract qualified employees over the last few years?*
- *What key knowledge, skills, and abilities will tomorrow's railroaders need to succeed?*
- *What are your railroad's top three recruitment challenges over the next 5 years?*
- *Tell us about one or two recent, particularly successful approaches to attracting railroad employees at your railroad? What has made each approach so successful?*

## Retention Questions

**Topic # 1:** Are the railroads keeping track of employees leaving, and if so, how?

*Query:*

- *Probe typical reasons employees leave.*
- *Are there different reasons why employees from different crafts leave?*
- *Probe programs used to track why employees leave (exit interview, etc.).*
- *Differences noted in different times when employees leave (after being hired, after 1 year, after 5 years, etc.)*
  - *Are there different reasons why employees with different amounts of service leave (e.g., those with less than 5 years of service versus those with over 20 years of service)?*
  - *In your experience, is there a certain amount of time (years of service) after which employees generally become career railroaders? To what do you attribute this drop-off in voluntary separations?*
  - *Why do new hires leave during training? Why do new hires leave during their probationary period?*

**Topic # 2:** How are the railroads working to ensure valuable employees remain on the workforce?

*Query:*

- *What are some initiatives and programs you have in place to measure employee engagement?*
- *Do you have an incentive program to retain associates?*

**Topic # 3:** What benefits are offered to employees?

*Query:*

- *What "perks" do associates receive? (example: EAP, Healthy Lifestyle program, monetary bonuses, etc.)*

**Topic # 4:** What is the potential for promotions and career advancement in the workforce?

*Query:*

- *Probe how employees find out about openings.*
- *What programs/policies are in place for employee training, development, and promotions?*
- *Who is responsible for promotions? HR or the line?*

**Topic # 5:** What is the overall workplace culture? Have there been changes made in recent years to the railroad's retention strategies?

*Query:*

- *What changes in company employment practices have there been over the last few years to promote retention?*
- *Tell us about one or two recent, particularly successful approaches to retaining railroad employees at your railroad. What makes each approach so successful?*
- *What are your railroad's top three retention challenges over the next 5 years?*

## Training Questions

**Topic # 1:** Please describe what programs or policies are in place for employee training and development.

*Query:*

- *Mandatory versus optional training.*
- *Training offered at initial hire and/or refresher courses.*
- *Tuition assistance.*

**Topic # 2:** Are you currently working with any local vocational schools, colleges, or universities to deliver effective training programs to employees?

*Query:*

- *Differences noticed between particular labor categories.*

*Abbreviations and acronyms used without definitions in TRB publications:*

| | |
|---|---|
| A4A | Airlines for America |
| AAAE | American Association of Airport Executives |
| AASHO | American Association of State Highway Officials |
| AASHTO | American Association of State Highway and Transportation Officials |
| ACI–NA | Airports Council International–North America |
| ACRP | Airport Cooperative Research Program |
| ADA | Americans with Disabilities Act |
| APTA | American Public Transportation Association |
| ASCE | American Society of Civil Engineers |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| ATA | American Trucking Associations |
| CTAA | Community Transportation Association of America |
| CTBSSP | Commercial Truck and Bus Safety Synthesis Program |
| DHS | Department of Homeland Security |
| DOE | Department of Energy |
| EPA | Environmental Protection Agency |
| FAA | Federal Aviation Administration |
| FHWA | Federal Highway Administration |
| FMCSA | Federal Motor Carrier Safety Administration |
| FRA | Federal Railroad Administration |
| FTA | Federal Transit Administration |
| HMCRP | Hazardous Materials Cooperative Research Program |
| IEEE | Institute of Electrical and Electronics Engineers |
| ISTEA | Intermodal Surface Transportation Efficiency Act of 1991 |
| ITE | Institute of Transportation Engineers |
| MAP-21 | Moving Ahead for Progress in the 21st Century Act (2012) |
| NASA | National Aeronautics and Space Administration |
| NASAO | National Association of State Aviation Officials |
| NCFRP | National Cooperative Freight Research Program |
| NCHRP | National Cooperative Highway Research Program |
| NHTSA | National Highway Traffic Safety Administration |
| NTSB | National Transportation Safety Board |
| PHMSA | Pipeline and Hazardous Materials Safety Administration |
| RITA | Research and Innovative Technology Administration |
| SAE | Society of Automotive Engineers |
| SAFETEA-LU | Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005) |
| TCRP | Transit Cooperative Research Program |
| TDC | Transit Development Corporation |
| TEA-21 | Transportation Equity Act for the 21st Century (1998) |
| TRB | Transportation Research Board |
| TSA | Transportation Security Administration |
| U.S.DOT | United States Department of Transportation |

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