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Rail Industry Job Analysis: Freight Conductor

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This document describes the results from a job analysis that was conducted for the position of Freight Conductor. Key aspects of the position were identified, including main tasks and knowledge, skills, abilities, and other characteristics (KSAOs) needed to carry out the requirements of the job successfully. The job analysis process is provided in detail, including meeting agendas, survey questionnaires, and a finalized list of job tasks and KSAOs identified by subject matter experts (SMEs). Conclusions report the specific results of the job analysis, including information from SME focus group discussions regarding demands and strains of the job. Implications for training and development are also discussed.

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1 foot (ft) = 30 centimeters (cm)	1 centimeter (cm) = 0.4 inch (in)
1 yard (yd) = 0.9 meter (m)	1 meter (m) = 3.3 feet (ft)
1 mile (mi) = 1.6 kilometers (km)	1 meter (m) = 1.1 yards (yd)
	1 kilometer (km) = 0.6 mile (mi)
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1 square foot (sq ft, ft^2) = 0.09 square meter (m^2)	1 square meter (m^2) = 1.2 square yards (sq yd, yd^2)
1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)	1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)
1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)	10,000 square meters (m^2) = 1 hectare (ha) = 2.5 acres
1 acre = 0.4 hectare (he) = 4,000 square meters (m^2)	
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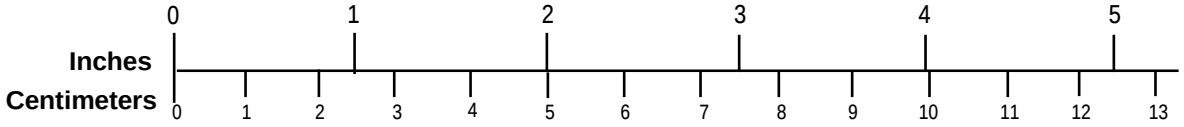

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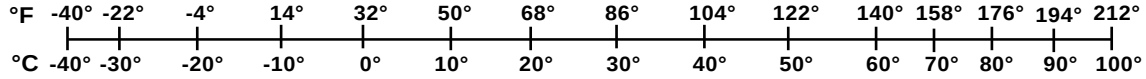

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Executive Summary

This document describes an analysis of the freight conductor job for yard and over-the-road operations in the U. S. railroad industry. The purpose of this job analysis was to identify key aspects of the freight conductor job, including the main tasks of the job, and the kinds of knowledge, skills, abilities, and other characteristics (KSAOs) that are needed to carry out the requirements of the job successfully. More specifically, the goal was to identify key knowledge areas, skills, abilities, and other characteristics that are appropriate to target in the occupational training and development of the freight conductor workforce. The results of a job analysis can be utilized to build (a) training programs that address relevant and measurable KSAOs, (b) performance appraisal systems that are legally justifiable and evaluate employees based on KSAOs that have been identified as relevant to the position, and (c) personnel selection procedures that will be legally defensible and accurately measure critical, job-related skills to ensure the organization will appropriately screen new talent.

The subject matter experts (SMEs) who participated in this comprehensive analysis indicated that freight conductors are responsible for 42 discrete tasks, clustered across 5 functional categories: (a) crew communication, (b) crew supervision, (c) form and record management, (d) train inspection, troubleshooting, and repair, and (e) train makeup and handling. Freight conductors need to possess a wide variety of KSAOs to perform job tasks effectively. Examples include knowledge of operating and safety rules, skill in working on and around moving industrial equipment, sound judgment and decisionmaking ability, and a strong commitment to safety. Conductors use a number of different tools and types of equipment, and work with a variety of railroad personnel such as locomotive engineers, dispatchers, and foremen. The job is also physically and psychologically demanding for workers because of the prevalence of irregular work hours, out-of-doors work, and the need to lift and move heavy equipment.

The current job analysis draws from a previous document prepared by Walsh, Golay, Barnes-Farrell, and Morrow (2010). The aforementioned report includes a detailed design and example resources for conducting a comprehensive job analysis. Excerpts from the current freight conductor job analysis are included as a reference to illustrate how the job analysis design is used in practice. That report, titled “A Job Analysis Design for the Rail Industry: Description and Model Analysis of the Job of Freight Conductor,” is available through the Federal Railroad Administration (FRA).

1. Introduction

This document outlines a framework for conducting systematic job analyses for the job of freight conductor. This project used a job analysis method grounded in the Combination Job Analysis Method (C-JAM; Brannick, Levine, and Morgeson, 2007; Levine, 1983), which uses multiple methodologies and sources to acquire information about the position.

For the job of freight conductor, a variety of types of KSAOs are required. To fully understand the extent of these characteristics, we conducted a thorough job analysis, gathering information from a number of SMEs. This report presents the results of that analysis.

2. Freight Conductor Job Analysis

A job analysis of freight conductors in yard and over-the-road operations was conducted between June 2009 and August 2010. A job analysis is a formal process to document the work-related tasks, job environment (e.g., tools or working conditions), and human attributes needed for a specific position. A job analysis can be used as a valuable tool for a number of human resource processes including personnel selection testing, determining content for training and development programs, and providing input on content for performance evaluations. The goal of the current job analysis was to identify key KSAOs that are trainable for the purpose of developing the freight conductor workforce.

The job analysis was carried out using a methodology grounded in C-JAM (Brannick, Levine, and Morgeson, 2007; Levine, 1983). C-JAM utilizes panels of SMEs to (a) generate task statements for tasks performed on the job and determine their relative importance, (b) identify KSAOs needed to perform the job effectively and determine their relative importance, and (c) link the two sets of information together to demonstrate that the KSAOs are job related. The analysts chose the C-JAM methodology because of its unique focus on *the job* in the identification of job tasks, *the worker* in the identification of KSAOs, and the relationships between the job tasks and KSAOs. The additional focus on quantifying the relative importance of job tasks and KSAOs also makes C-JAM appropriate as a means of determining training needs. The design also allows for supplemental information to be collected about the job, including the machines, tools, and equipment used, physical and psychological demands, and the job context. For additional information on topics described in this design, or on job analysis in general, consult Brannick et al. (2007).

The analysts began by reviewing available literature describing the freight conductor job and developing preliminary lists of task statements and KSAOs. After the lists were developed, six face-to-face meetings ranging from 1 to 3 hours were held with SMEs to (a) edit the task and KSAOs lists, (b) link the KSAOs to task categories, and (c) obtain information regarding the job context, demands, and tools used. In addition, two web-based surveys were administered to SMEs to collect ratings of importance on the tasks and KSAOs. Findings from the job analysis are described in detail in the following sections of this report.

2.1 Preliminary Work

Preliminary research was carried out between June and September 2009 to develop draft lists of task statements and KSAOs for freight conductors. The following sources were reviewed for relevant information:

- The O*NET report for railroad conductors and yardmasters (O*Net, 2009)
- An existing task analysis of conductors (Sanders, Jankovich, and Goodpaster, 1974)
- A cognitive task analysis of locomotive engineers, which included a discussion of the roles and responsibilities of freight conductors (Roth and Multer, 2009)
- The fifth edition of the General Code of Operating Rules (2005)
- The eighth edition of the operating rules of the Northeast Operating Rules Advisory Committee (2003)

- Conversations with rail experts from the United Transportation Union (UTU), FRA, and the John A. Volpe National Transportation Systems Center

After the initial development of task and KSAO lists, the draft lists were reviewed by two SMEs with railroad experience. The SMEs had, on average, 8 years of experience in their current job and 22 years of experience in the railroad industry. These lists were then vetted through additional SMEs via a series of three focus group meetings.

2.2 SME Panel Meetings 1–3: Task and KSAO List Editing

The first SME meeting was held in October 2009 in Kansas with four managers of conductor field training for a Class I railroad. The experts had worked as managers of field training for an average of 8 years and had an average of 21 years experience working for their organization in various railroad positions (e.g., conductor, engineer). The first half of the meeting was devoted to reviewing and editing the preliminary task list. After the project was introduced, the SMEs reviewed the method for constructing task statements and then worked as a group to edit the preliminary task list. The second half of the meeting was focused on editing the list of freight conductor KSAOs. To begin KSAO editing, the SMEs reviewed definitions of KSAOs and then worked as a group to edit the KSAO list. The edits to the KSAO list were relatively minor and primarily included revisions to wording.

The second SME meeting was held in November 2009 in Massachusetts with five conductors, one of whom was also a locomotive engineer. The SMEs had worked in their current positions and for their current organization for an average of 5 years. The SMEs were given copies of the edited task list from meeting 1 and the description of how to construct task statements. SMEs were then instructed to make any edits to the task list that they felt were necessary and to pay extra attention to the tasks that had been identified as problematic. During this meeting, the SMEs identified five functional categories for conductor job tasks. After each individual reviewed the information, the SMEs reconvened as a group and were instructed to come to a consensus regarding the edits to the task list and assignment of each task to a functional category.

A third meeting was held to finalize the list of tasks and functional categories for freight conductors. The group of SMEs from the second meeting also participated in the third meeting, with the exception of one new member who substituted for a conductor who was unavailable to attend. The current draft of the task list was presented, and the following questions were posed to the SMEs:

1. Are the categories meaningful?
2. Are additional categories needed?
3. Are the tasks situated under the appropriate category?
4. Are there any rare tasks that would not necessarily be done regularly but that might be done during a particular week or month or at certain times of the year?
5. Are there any critical emergency-related tasks that are missing?
6. Is the task list complete and accurate?

An explicit attempt was made to have SMEs consider tasks that were not done frequently but that could be carried out in emergency situations. During the meeting, only a limited number of changes were made to the task list. As a final check to ensure the task list was complete and accurate, the edited task list resulting from meeting 3 was sent to three SMEs who participated in the first meeting and were not present for meeting 2 or 3. The SMEs reviewed the task list and confirmed that, to their knowledge, the list was complete and accurate. No additional changes were suggested.

2.3 Final Task List for Freight Conductors

The final task list consists of 42 tasks arranged in five functional categories that represent the general duties of freight conductors. The functional categories and tasks are the following:

- *Crew Communication* – tasks related to communication with the train crew and other personnel (8 tasks)
    - Advise the engineer of any restrictions placed on equipment being handled.
    - Advise the dispatcher of any restrictions placed on equipment being handled.
    - Advise the proper authority when the train clears the main track or territory.
    - Remind the engineer that the train is approaching an area restricted by limits of authority, track warrants, track bulletins, or speed restriction.
    - Call out signals as they are encountered when operating in signal territory and as job activities change.
    - Contact the employee in charge (EIC) concerning train movements on the affected tracks (e.g., track bulletin, out-of-service tracks, work areas).
    - Receive, copy, repeat, and comply with mandatory directives issued by train dispatchers or control operators (e.g., track warrants, track bulletins).
    - Call for and release foul time as requested by workmen (e.g., foremen, contractors) when assigned as flagmen.

- *Crew Supervision* – tasks associated with oversight of railroad personnel (4 tasks)
    - Conduct pretrip planning briefings with train crew members, yard master, and other authorities.
    - Brief train crew members on work to be done, movements to be made, and any safety hazards.
    - Ensure crew members comply with applicable rules, special instructions, signals, and track authority.
    - Direct other crew members during switching or train operations.

- *Form and Record Management* – tasks having to do with the organization and management of forms and records (12 tasks)
    - Insert updates to required rule books and bulletins for all territories that are operated on.
    - Verify the accuracy of the train manifest, dispatcher bulletins, and train orders (i.e., authority for movement) before the start of a trip.
    - Verify that all hazardous material (hazmat) cars have all required documentation.
    - Update the signal awareness form.
    - Report car defects.
    - Update train list information per operating rules.
    - Complete delay reports for each trip noting any delays.
    - Complete a work train report, if applicable, when called for work train service.

- Deliver all appropriate paperwork (e.g., train list, general track bulletins, air slips) to the relieving conductor as required.
- Complete required FRA tie-up documentation.
- Record train times when trains are given permission to enter the work area when assigned as flagmen.
- Provide emergency responders with hazmat documentation in an emergency.

- *Train Inspection, Troubleshooting, and Repair* – tasks related to train inspection and maintenance (9 tasks)
  - Verify that hazmat cars are properly placed in train or switching movement.
  - Perform required air brake tests or verify that they have been properly completed.
  - Inspect cars/equipment en route and when stopped to ensure the safe and efficient operation of the train.
  - Inspect other trains en route (i.e., roll by inspection).
  - Locate, inspect, and report defects identified by a defect detector.
  - Determine whether to move, repair, or set out rail equipment with defects in accordance with applicable operating rules.
  - Replace faulty air hoses when necessary.
  - Replace broken knuckles when necessary.
  - Secure dragging equipment when necessary.

- *Train Makeup and Handling* – tasks pertaining to preparing the train for a trip and general handling of the train (9 tasks)
  - Join air hoses during train makeup.
  - Couple and uncouple train cars.
  - Remove and replace derailing equipment as needed.
  - Inspect and line switches as required.
  - Switch train cars in accordance with work-order instructions.
  - Install and remove end-of-train devices.
  - Provide protection when shoving cars.
  - Provide protection to other trains in accordance with rules during emergency brake application.
  - Apply the emergency brake to stop the train in extreme circumstances.

2.4 Task Rating Survey and Analysis

The next step in the job analysis was to quantify the relative importance of each of the job tasks by collecting SME assessments of any significant consequences to job performance if the task is completed incorrectly and how difficult the task is to complete correctly. The analysts developed a web-based survey to collect this information from SMEs. As suggested by the C-JAM methodology (Brannick et al., 2007), SMEs were asked to evaluate each task on two scales: consequences of error and task difficulty. The wording of the scales and response options are presented on the next page:

- *Consequences of Error* – How important (i.e., significant) are the consequences of performing the task incorrectly?
  1 – Consequences of error are not at all important

  2 – Consequences of error are somewhat important

  3 – Consequences of error are moderately important

  4 – Consequences of error are very important

  5 – Consequences of error are extremely important

- *Task Difficulty* – How easy or difficult is it to complete the task correctly relative to all other tasks?
  1 – Very easy

  2 – Somewhat easy

  3 – Not easy or difficult

  4 – Somewhat difficult

  5 – Very difficult

Selection of survey participants for the rating task was not random. Potential participants for the Web-based survey phase of the analysis described on page 10 were determined by UTU, who agreed to identify freight conductors in each of their regions who met the inclusion criteria.

The UTU National Legislative Director (a) reviewed the demographic profile of freight conductors employed at UTU; he then (b) contacted UTU General Chairmen throughout the country (5 regions) and requested that they nominate freight conductors in their group with at least 5 years of experience (as a freight conductor) to participate in the survey; specific effort was made to identify and invite women who met that criterion. No specific attempt was made to oversample on any other demographic characteristics. Demographic information was collected in the survey for purposes of describing the participant sample.

To increase the likelihood that nominated conductors would respond to the survey request, email invitations to the 24 selected individuals were issued directly by the UTU National Legislative Director.

The survey was accessible online for a 2-week period, and all participants received a reminder email 1 week into survey administration. Responses were received from 17 freight conductors from across the United States (71 percent response rate). Respondents had an average job tenure of 18 years and organizational tenure of 24 years. Respondents indicated working as freight conductors for an average of 22 years.

Task importance was calculated as suggested by Brannick et al. (2007). Specifically, ratings on consequences of error and task difficulty scales were totaled for each task. Then, the mean task importance value was calculated for each task across all SMEs. Figures 1–4 present the task list with the mean ratings of consequences of error, difficulty, and importance. All but three tasks had mean ratings on the consequences of error scale greater than or equal to 4, thus verifying that

the list includes only those tasks that are critically important. The greatest variability across SMEs was observed for the ratings of task difficulty.

Figures 1–5: Task List with Mean Ratings of Consequences of Error, Difficulty, and Importance

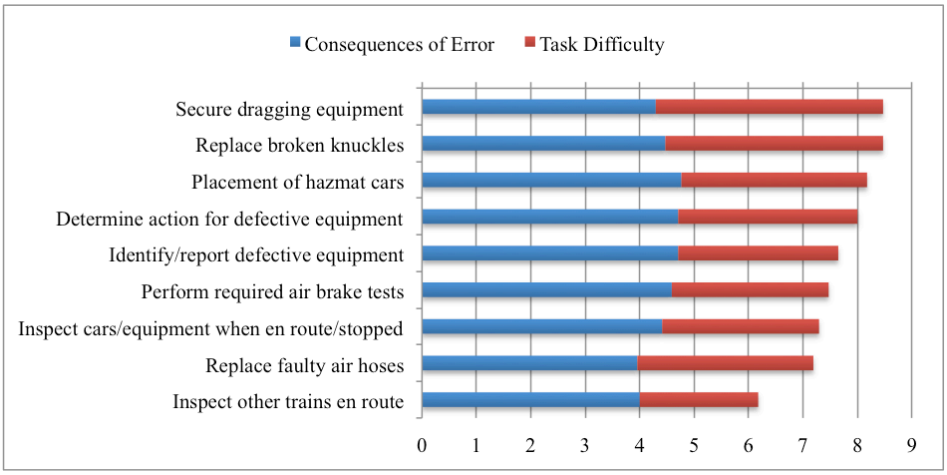

Figure 1. Train Inspection, Troubleshooting, and Repair

Note. "Consequences of Error" is the mean of the SMEs' ratings of the consequences of error if the task is not appropriately performed (range = 1–5). "Task Difficulty" is the mean of the SMEs' ratings for the difficulty of the tasks (range = 1–5). The overall length of the bar signifies the level of task importance (range = 1–10). It is the sum of Consequences of Error and Task Difficulty ratings.

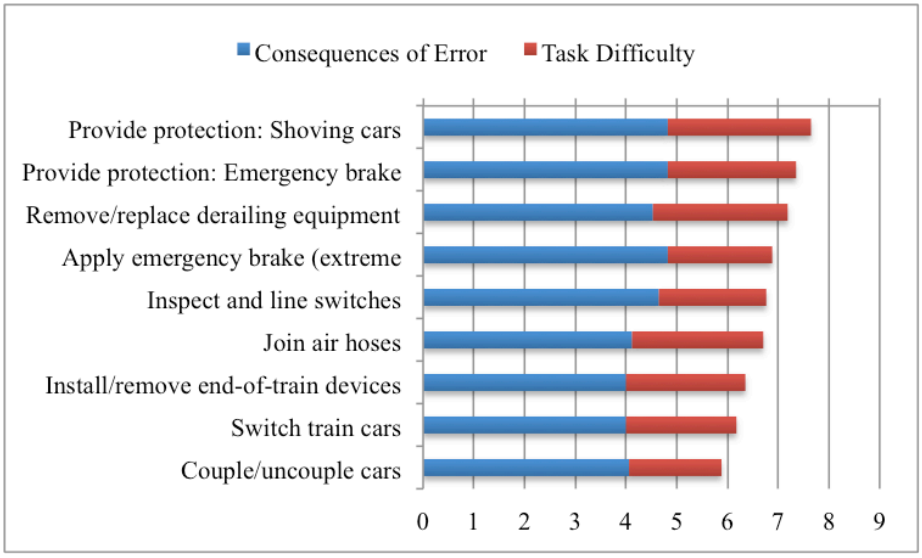

Figure 2. Train Makeup and Handling

Note. "Consequences of Error" is the mean of the SMEs' ratings of the consequences of error if the task is not appropriately performed (range = 1–5). "Task Difficulty" is the mean of the SMEs' ratings for the difficulty of the tasks (range = 1–5). The overall length of the bar signifies the level of task importance (range = 1–10). It is the sum of Consequences of Error and Task Difficulty ratings.

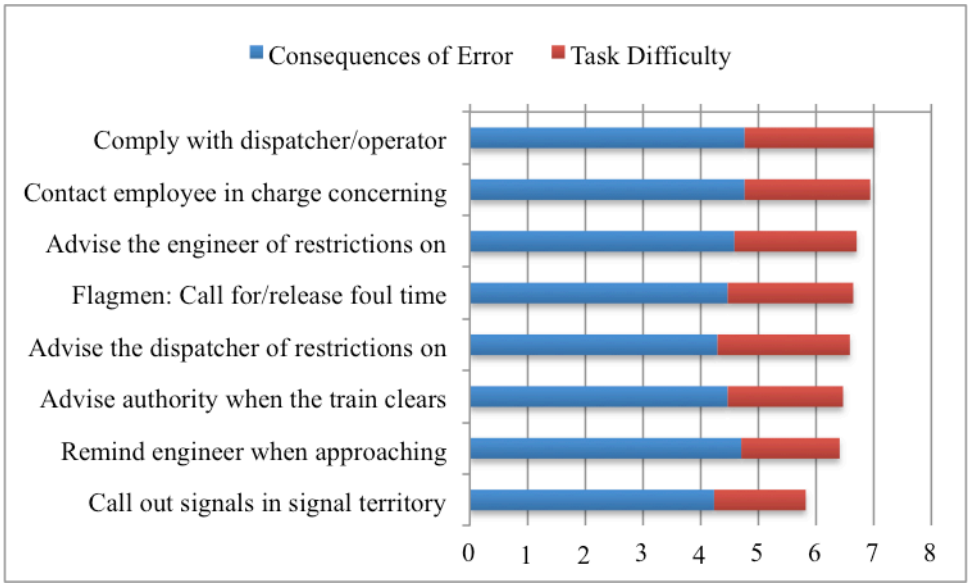

Figure 3. Crew Communication

Note. "Consequences of Error" is the mean of the SMEs' ratings of the consequences of error if the task is not appropriately performed (range = 1–5). "Task Difficulty" is the mean of the SMEs' ratings for the difficulty of the tasks (range = 1–5). The overall length of the bar signifies the level of task importance (range = 1–10). It is the sum of Consequences of Error and Task Difficulty ratings.

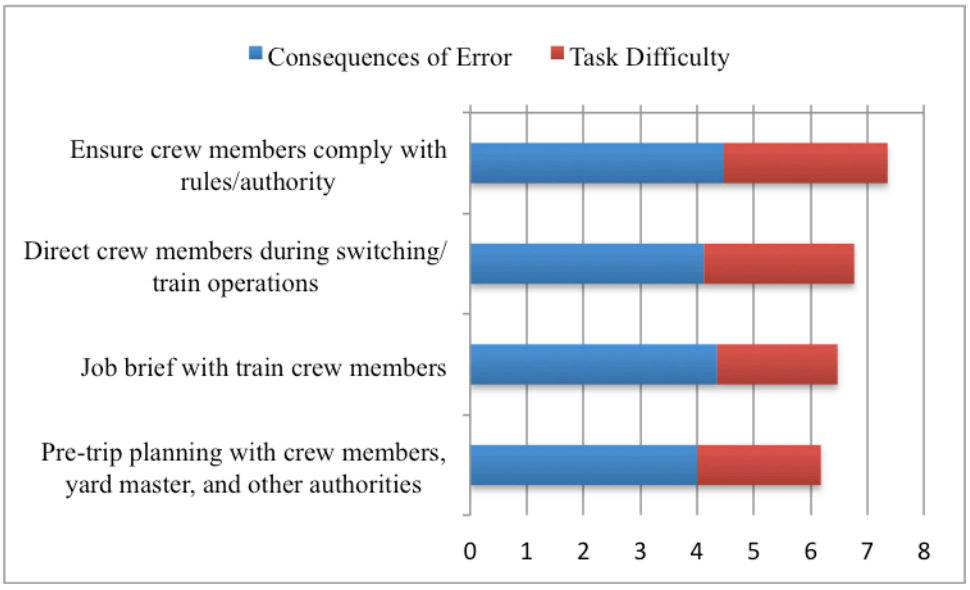

Figure 4. Crew Supervision

Note. "Consequences of Error" is the mean of the SMEs' ratings of the consequences of error if the task is not appropriately performed (range = 1–5). "Task Difficulty" is the mean of the SMEs' ratings for the difficulty of the tasks (range = 1–5). The overall length of the bar signifies the level of task importance (range = 1–10). It is the sum of Consequences of Error and Task Difficulty ratings.

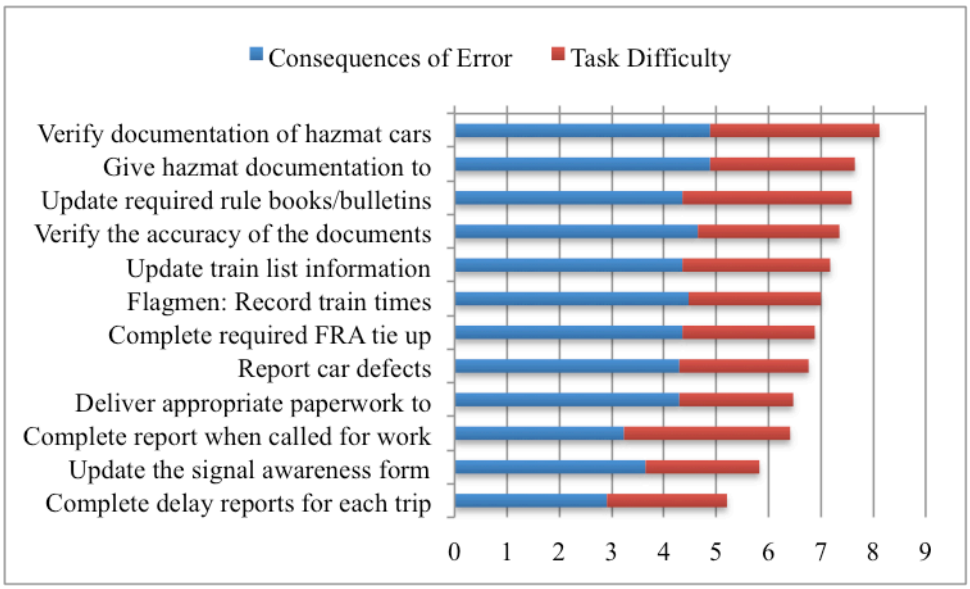

Figure 5. Form and Record Management

Note. "Consequences of Error" is the mean of the SMEs' ratings of the consequences of error if the task is not appropriately performed (range = 1–5). "Task Difficulty" is the mean of the SMEs' ratings for the difficulty of the tasks (range = 1–5). The overall length of the bar signifies the level of task importance (range = 1–10). It is the sum of Consequences of Error and Task Difficulty ratings.

2.5 SME Panel Meetings 4 and 5: KSAO Linkages to Functional Categories

The fourth SME meeting was held in June 2010 in New York with eight current and former conductors and locomotive engineers. The fifth meeting was held 1 month later in July 2010 with four of the same experts. SMEs in meeting 4 had an average job tenure of 11 years and organizational tenure of 16 years. The SMEs had worked as freight conductors for an average of 15 years. The participants in the fifth meeting had worked in their current jobs for an average of 7 years, had worked for their organizations for 11 years, and had 8 years of experience as freight conductors. The purpose of meetings 4 and 5 was to determine the KSAOs needed to perform the job tasks in each of the functional categories developed during the editing of the job task list.

In the fourth meeting, SMEs were given copies of the task list with their calculated importance values. Each SME reviewed the list individually, then the tasks were divided among groups to complete the linking activity. Group 1 was asked to link KSAOs to the *Train Inspection, Troubleshooting, and Repair* category, and Group 2 was tasked with linking KSAOs to the functional category *Train Makeup and Handling*. Once the SME groups had separate work spaces, they were handed copies of the task list, which only included their specific functional category, associated tasks, and importance values. Each group was also given one copy of the KSAO list. The SMEs were encouraged to discuss the KSAOs amongst themselves and only to assign the KSAO to the functional category if there was a consensus that the KSAO was needed to perform the tasks.

The fifth meeting was structured in a similar fashion. The four participating SMEs were split into two groups. Group 1 linked KSAOs to the tasks in functional categories *Crew*

Communication and *Form and Record Management*, whereas Group 2 linked KSAOs to the tasks in the *Crew Supervision* category.

Results of linking KSAOs with functional task categories are presented in Table 1. SMEs identified 22 knowledge areas, 29 skills, 16 abilities, and 4 other characteristics. All KSAOs were linked to at least one of the functional categories, and many KSAOs were generalized across multiple categories. For example, "skill in performing switching activities" was identified as needed to perform tasks in each of the five functional categories.

Table 1. KSAOs, Linked to Functional Task Categories

KNOWLEDGE	TITR	TMH	CC	CS	FRM
Terminology used in the classifying, blocking, and switching of rail cars	X	X	X	X	X
Terminology and rules associated with restricted equipment	X	X	X	X	X
Various types of rolling stock	X	X	X	X	X
Operating and safety rules	X	X	X	X	X
Proper procedures for handling and reporting emergency situations	X	X	X	X	X
Timetable information, special instructions, and track bulletins	X	X	X	X	X
Switch lists, track lists, and work orders	X	X	X	X	X
Consist information (e.g., placement of hazmat, equipment restrictions)	X	X	X	X	X
Hazmat placards, markings, and regulations	X	X	X	X	X
Required air brake tests and when they apply	X	X	X	X	X
Rules and procedures for switching of rail cars and equipment	X	X	X	X	
Function of track components and rail equipment	X	X	X		X
General railroad terminology	X	X	X		X
Basic duties of other railroad personnel that freight conductors interact with during normal performance of duties	X		X	X	X
The physical characteristics of the territory over which the conductor operates (e.g., tracks, signals, interlockings, yards, speeds, methods of operation, grade crossings)	X		X	X	X
The rule for movement of trains on tracks other than main tracks	X		X	X	
Reporting forms and records (e.g., delay report, wheel report, defective car report, work train report, tie-up sheet)	X		X		X
Operation of classification yards			X	X	X
Temporary and permanent speed restrictions			X	X	X
The types of track authority required for the movement of a train on main tracks			X	X	X
The types and functions of defect detectors	X		X		
Purpose and function of a rail yard			X		X

Note. X indicates that the KSAO was linked to the functional category. TITR = train inspection, troubleshooting, and repair. TMH = train makeup and handling. CC = crew communication. CS = crew supervision. FRM = form and record management.

(***Table 1, continued***)

SKILLS	TITR	TMH	CC	CS	FRM
Cutting out air brakes	X	X	X	X	X
Performing switching activities (classification of rail cars within a yard, industry switching, set off and pick up of rail equipment)	X	X	X	X	X
Making up trains	X	X	X	X	X
Securing trains and equipment	X	X	X	X	
Removing and installing air hoses	X	X	X	X	
Removing and installing knuckles	X	X	X	X	
Applying and releasing hand brakes	X	X	X	X	
Operating the various kinds of switches (e.g., hand operated, power switches)	X	X	X	X	
Determining the position of switch points	X	X	X	X	
Operating the various kinds of derails	X	X	X	X	
Installing and removing an end-of-train device	X	X	X	X	
Coupling and uncoupling air hoses	X	X	X	X	
Aligning drawbars	X	X	X	X	
Using telecommunication devices	X	X	X	X	
Troubleshooting basic malfunctions in equipment	X	X	X		X
Testing and inspecting equipment	X	X	X		X
Securing dragging equipment	X	X	X		X
Interpreting the block signal indication conveyed by the aspect(s) displayed by the signal	X		X	X	X
Working on and about moving equipment	X	X	X		
Giving and interpreting communications signals (e.g., hand, flag) with or without signaling equipment	X	X	X		
Interpreting and using timetable information	X		X	X	
Locating equipment restrictions in special instructions	X		X	X	
Understanding defect detector messages	X		X		X
Inspecting hazmat cars	X		X		X
Determining qualifying train and engine speeds			X	X	X
Identifying speed restrictions using timetables, roadway signs, bulletins, train messages, and the *Operating Rules Manual*			X	X	X
Identifying block signal aspects			X	X	X
Identifying whistle signals			X	X	
Locating info in the *North American Emergency Response Guide*	X		X		

Note. X indicates that the KSAO was linked to the functional category. TITR = train inspection, troubleshooting, and repair. TMH = train makeup and handling. CC = crew communication. CS = crew supervision. FRM = form and record management.

(***Table 1, continued***)

ABILITIES	**TITR**	**TMH**	**CC**	**CS**	**FRM**
Situational awareness	X	X	X	X	X
Communicate information orally and in writing	X	X	X	X	X
Hearing/auditory acuity	X	X	X	X	X
Sense and resolve problems as they arise	X	X	X	X	X
Coordinate and plan various movements safely and efficiently (e.g., setting out and picking up cars en route, placing cars at various industrial plants, classifying cars)	X	X	X	X	X
Active listening	X	X	X	X	
Judgment and decisionmaking	X	X	X	X	
See details accurately from a distance	X	X	X	X	
Accurately judge car counts and distances when switching, shoving, or coupling	X	X	X	X	
Recognize and distinguish between the colors of railroad signs and signals	X		X	X	
Identifying potential hazards	X	X	X	X	
Carry out tasks in harsh environmental conditions	X	X	X	X	
Work nontraditional schedules (e.g., night shifts, on-call, long hours)	X	X	X	X	
Comply with operating and safety rules while performing job tasks	X		X		
Lift heavy objects (e.g., 75 pounds or more)	X		X		
Ascend and descend ladders when necessary	X				

OTHER CHARACTERISTICS	**TITR**	**TMH**	**CC**	**CS**	**FRM**
Passion for safety	X	X	X	X	X
Conscientious	X	X	X	X	X
Dependable	X	X	X	X	X
Cooperative	X		X	X	X

Note. X indicates that the KSAO was linked to the functional category. TITR = train inspection, troubleshooting, and repair. TMH = train makeup and handling. CC = crew communication. CS = crew supervision. FRM = form and record management.

2.6 KSAO Rating Survey and Analysis

Following the identification and linking of KSAOs to job task categories, the analysts developed a web-based survey to assess (a) the relative importance of possessing the KSAO to perform the job duties of a freight conductor, and (b) whether the KSAO should be used to develop conductor training programs and/or as a selection factor for hiring new conductors. The sample for the KSAO rating survey consisted of current and former conductors who had participated in at least one of the previous SME meetings. The survey was accessible online for 2 weeks, and all participants received a reminder email 1 week into survey administration.

Participants were asked to rate all KSAOs on two of the four scales recommended by C-JAM (Brannick et al., 2007), KSAO importance, and KSAO trainability. The two scales that were selected are related to the training aspects of the job analysis and are designed to provide information that can be used for designing and evaluating training programs. These scales were chosen because the stated purpose of the current job analysis was to identify critical areas for conductor training. Similar scales have been used in previous job analyses (e.g., Morrow et al., 2009). A description of each scale and the associated response options are presented below.

- *KSAO Importance* – How important is it that freight conductors possess this KSAO?
  1 – Not at all important
  2 – Somewhat important
  3 – Moderately important
  4 – Very important
  5 – Extremely important

- *KSAO Trainability* – Can this KSAO be taught using a formal training program (e.g., classroom training, simulation training, field training)?
  0 – No
  1 – Yes

Responses to the KSAO rating survey were received from 8 of the 15 experts (53 percent response rate). Participants had an average job tenure of 8 years and organizational tenure of 15 years and had worked specifically as a freight conductor for an average of 11 years.

The percentage of SMEs who indicated that a KSAO was trainable was used to evaluate whether the KSAO should be used in training versus selection. If greater than 50 percent of SMEs reported that the KSAO was trainable, then the KSAO was considered a candidate for training. Conversely, KSAOs that did not meet this criterion were judged to be useful for purposes of employee selection. Furthermore, the importance ratings aid in prioritizing which KSAOs should be emphasized for each purpose, with priority given to more important KSAOs. The KSAOs that were assessed as trainable by the majority of SMEs are listed in Table 2.

Table 2. Trainable KSAOs, Ranked by Importance

KSAO	Mean Imp.	SD Imp.	Trainable
Knowledge: Consist information (e.g., placement of hazmat, equipment restrictions)	5.00	0.00	100.00%
Knowledge: Proper procedures for handling and reporting emergency situations	5.00	0.00	100.00%
Knowledge: Hazardous material placards, markings, and regulations	4.88	0.35	100.00%
Skill: Identifying block signal aspects	4.88	0.35	100.00%
Knowledge: Operating and safety rules	4.88	0.35	100.00%
Knowledge: Required air brake tests and when they apply	4.75	0.46	100.00%
Knowledge: Temporary and permanent speed restrictions	4.75	0.46	100.00%
Knowledge: The types of track authority required for the movement of a train on main tracks	4.75	0.46	100.00%
Knowledge: Timetable information, special instructions, and track bulletins	4.75	0.46	100.00%
Skill: Working on and about moving equipment	4.75	0.46	87.50%
Other Characteristic: Passion for safety	4.75	0.46	75.00%
Skill: Securing trains and equipment	4.75	0.46	75.00%
Skill: Identifying speed restrictions using timetables, roadway signs, bulletins, train messages, and the *Operating Rules Manual*	4.63	0.52	100.00%
Knowledge: The rule for movement of trains on tracks other than main tracks	4.63	0.52	100.00%
Ability: Comply with operating and safety rules while performing job tasks	4.63	0.52	87.50%
Skill: Determining the position of switch points	4.63	0.74	100.00%
Skill: Interpreting and using timetable information	4.63	0.74	100.00%
Skill: Interpreting the block signal indication conveyed by the aspect(s) displayed by the signal	4.63	0.74	100.00%
Skill: Giving and interpreting communications signals (e.g., hand, flag) with or without signaling equipment	4.63	0.74	87.50%
Knowledge: The physical characteristics of the territory over which the conductor operates (e.g., tracks, signals, interlockings, yards, speeds, methods of operation, grade crossings)	4.50	0.53	87.50%
Ability: Coordinate and plan various movements safely and efficiently (e.g., setting out and picking up cars en route, placing cars at various industrial plants, classifying cars)	4.50	0.53	75.00%
Ability: Recognize and distinguish between the colors of railroad signs and signals	4.50	0.76	62.50%
Ability: Situational awareness	4.50	0.76	62.50%
Skill: Determining qualifying train and engine speeds	4.38	0.52	100.00%
Knowledge: General railroad terminology	4.38	0.52	100.00%
Ability: Accurately judge car counts and distances when switching, shoving, or coupling	4.38	0.74	75.00%

Ability: Identifying potential hazards	4.38	0.74	75.00%
Knowledge: Rules and procedures for switching of rail cars and equipment	4.38	0.92	100.00%
Skill: Testing and inspecting equipment	4.38	0.92	100.00%
Knowledge: The types and functions of defect detectors	4.25	0.46	100.00%
Ability: Communicate information orally and in writing	4.25	0.71	100.00%
Skill: Locating equipment restrictions in special instructions	4.25	0.71	100.00%
Skill: Locating information in the *North American Emergency Response Guide*	4.25	0.89	100.00%
Skill: Understanding defect detector messages	4.25	0.89	100.00%
Skill: Inspecting hazmat cars	4.25	0.89	75.00%
Knowledge: Terminology and rules associated with restricted equipment	4.25	1.04	100.00%
Skill: Operating the various kinds of derails	4.25	1.16	100.00%
Skill: Coupling and uncoupling air hoses	4.14	1.07	87.50%
Skill: Performing switching activities (classification of rail cars within a yard, industry switching, setoff, and pickup of rail equipment)	4.13	1.13	87.50%
Knowledge: Terminology used in the classifying, blocking, and switching of rail cars	4.00	0.53	100.00%
Ability: Ascend and descend ladders when necessary	4.00	0.76	100.00%
Skill: Making up trains	4.00	0.76	87.50%
Skill: Aligning drawbars	4.00	0.82	87.50%
Skill: Identifying whistle signals	4.00	0.93	100.00%
Skill: Applying and releasing hand brakes	4.00	1.07	100.00%
Skill: Operating the various kinds of switches (e.g., hand operated, power switches)	4.00	1.07	100.00%
Skill: Troubleshooting basic malfunctions in equipment	3.88	0.64	100.00%
Knowledge: Switch lists, track lists, and work orders	3.88	0.64	75.00%
Skill: Installing and removing an end-of-train device	3.88	0.99	100.00%
Skill: Cutting out air brakes	3.75	1.04	100.00%
Skill: Securing dragging equipment	3.75	1.04	85.70%
Knowledge: Purpose and function of a rail yard	3.63	0.52	100.00%
Knowledge: Reporting forms and records (e.g., delay report, wheel report, defective car report, work train report, tie-up sheet)	3.63	0.52	100.00%
Knowledge: Function of track components and rail equipment	3.63	1.06	100.00%
Skill: Using telecommunication devices	3.63	1.19	100.00%
Knowledge: Basic duties of other railroad personnel that freight conductors interact with during normal performance of duties	3.38	0.74	75.00%
Knowledge: Operation of classification yards	3.38	0.92	100.00%
Skill: Removing and installing air hoses	3.38	1.06	87.50%

Ability: Lift heavy objects (e.g., 75 pounds or more)	3.25	0.71	87.50%
Skill: Removing and installing knuckles	3.25	1.04	100.00%
Knowledge: Various types of rolling stock	3.25	1.04	87.50%

Note. Mean Imp. = mean importance rating on a scale ranging from 1 (not at all important) to 5 (extremely important). SD Imp. = standard deviation of importance ratings. Trainable = the percentage of SMEs who indicated the KSAO could be trained using a formal training program.

SME responses indicate that the majority (61) of the KSAOs are trainable, whereas 10 of the KSAOs would be more appropriate as selection factors in the hiring of freight conductors, given the lack of trainability. The trainability percentages for two of the KSAOs (i.e., recognize and distinguish between the colors of railroad signs and signals, situational awareness) were relatively low but still greater than 50 percent. These particular KSAOs may also be appropriate to use as selection factors, rather than in training. The KSAOs that are more appropriate to use in employee selection are shown in Table 3.

Table 3. KSAOs to Be Utilized in Employee Selection, Ranked by Importance

KSAO	Mean Imp.	SD Imp.	Trainable
Ability: Judgment and decisionmaking	4.63	0.52	50.00%
Other Characteristic: Conscientious	4.50	0.53	25.00%
Ability: Carry out tasks in harsh environmental conditions	4.38	0.74	50.00%
Other Characteristic: Dependable	4.38	0.74	25.00%
Ability: Work nontraditional schedules (e.g., night shifts, on-call, long hours)	4.38	0.92	37.50%
Ability: Sense and resolve problems as they arise	4.13	0.83	50.00%
Ability: Active listening	4.00	0.76	50.00%
Ability: See details accurately from a distance	3.88	0.64	37.50%
Ability: Hearing/auditory acuity	3.88	0.83	37.50%
Other Characteristic: Cooperative	3.75	1.16	37.50%

Note. Mean Imp. = Mean importance rating on a scale ranging from 1 (not at all important) to 5 (extremely important). SD Imp. = Standard deviation of importance ratings. Trainable = the percentage of SMEs who indicated the KSAO could be trained using a formal training program.

2.7 SME Panel Meeting 6: Job Context, Tools, Demands, and Experience to Acquire KSAOs

A final meeting was held in August 2010 with SMEs to discuss additional information regarding the job context, tools used, and the demands of the job. Questions were also posed to SMEs regarding the experience needed to obtain the minimum acceptable level on two important KSAOs. Three SMEs participated in the final meeting. They had been at the current job for an average of 10 years and at their current organization for an average of 13 years. The questions asked of the SMEs and their responses are summarized below.

2.7.1 Job Context

A single question was posed to the SMEs regarding the people that freight conductors work with to perform the job successfully. SMEs indicated that freight conductors work with a range of personnel to perform job tasks successfully, including the following:

- Brakemen
- Dispatchers
- Engineers
- Maintainers
- Other emergency response personnel
- Railroad police
- Track foremen
- Trainmasters
- Yardmasters

These findings correspond with results presented earlier regarding the KSAOs needed to perform the job. This concurrence is due to the fact that a number of the KSAOs pertained to interpersonal interactions in one way or another. For example, the skill in giving and interpreting communications signals with or without signaling equipment, the ability to communicate information orally and in writing, and the ability to engage in active listening were identified as very important KSAOs. These KSAOs are necessary because they facilitate work-related interactions with the personnel that freight conductors must associate with on the job.

SMEs acknowledged that freight conductors may be exposed to a variety of hazardous materials and substances depending on the nature of the freight being transported. Although infrequent, such exposure may be the result of problems arising en route, such as a broken hose or a leaking valve. Thus, it is no surprise that KSAOs pertaining to hazardous substances (e.g., knowledge of hazmat placards, markings, and regulations; skill in inspecting hazmat cars) are some of the most important KSAOs a conductor needs to perform the job. Finally, SMEs also mentioned that conductors may be exposed to chemicals in addition to those being transported, such as chemicals applied to minimize weeds along the tracks or in the rail yard.

2.7.2 Tools Used

The SMEs were asked to identify examples of the kinds of tools and equipment used on the job. The types of tools and equipment discussed were consistent with results from the analysis of conductor tasks reported earlier. One of the primary categories of freight conductor tasks relates to train inspection, troubleshooting, and repair, which require skill in using multiple tools and pieces of equipment. The types of tools and equipment used by freight conductors include the following:

- Brake sticks
- Derails
- End-of-train devices
- Flags
- Fusees/Flares
- Hand and power tools (e.g., wrenches, hammers)
- Hand switches
- Lanterns
- Laptop computers
- Personal protective equipment (e.g., hard hats, safety glasses)
- Radio communication devices

2.7.3 Physical and Psychological Demands

Several questions focused on the demands of the job of freight conductor, including both physical and psychological demands. Physical demands identified by SMEs include the following:

- Climbing
- Lifting knuckles
- Maneuvering over steep terrain
- Sacrificing sleep/enduring fatigue
- Throwing switches
- Walking
- Working in different climates

The SMEs interviewed suggested that one of the most demanding aspects of working as a freight conductor is working nontraditional and unpredictable work schedules. Freight conductors' work schedules often include night and weekend shifts. Freight conductors are also subject to working on-call schedules, which can be unpredictable and involve very little notice before the start of a work shift. The SMEs suggested that, from their experience, the irregular work scheduling can lead to sleep deprivation and fatigue on the job. Moreover, SMEs remarked that lack of control over their work scheduling, and the ambiguity associated with working on call, can be problematic for getting adequate sleep and managing stress. Work scheduling was also identified as a driver of nonwork demands, including restricted time to meet personal and family obligations. This observation should be considered in light of ratings on one KSAO in particular. The ability to work nontraditional schedules (e.g., night shifts, on-call, long hours) was identified as a very important KSAO, but was also seen as not trainable. It is probable that some personnel will not be able to effectively adapt to the demands of working such nontraditional schedules.

When SMEs were asked to describe the psychological demands associated with the job, the discussion primarily concerned the possibility of inadvertently hitting and/or killing bystanders while the train is in operation. SMEs noted that they feel helpless on the train in these and similar situations.

2.7.4 Experience Needed to Acquire KSAOs

An additional set of questions was used to investigate SME perceptions of the amount and type of on-the-job training (OJT) needed to acquire the minimum acceptable level of performance on two KSAOs: 1) knowledge of the physical characteristics of the territory over which the conductor operates, and 2) ability to coordinate and plan various movements safely and

efficiently. These KSAOs were drawn from the results of the KSAO rating survey that suggested they were very important for freight conductors. SMEs remarked that the first KSAO, knowledge of the physical characteristics of the territory over which the conductor operates, required approximately 3 to 6 months of OJT, depending on the person and the number of trips. The SMEs stated that current training time is shorter than what is needed, and that trainees are told "the engineer will take care of you," even if they do not feel comfortable with the work. The experts suggested that the OJT be supervised, and that the supervision be reduced over time as the relevant knowledge is acquired.

The second important KSAO discussed was the ability to coordinate and plan various movements safely and efficiently. Again, the SMEs were in agreement that OJT is needed to acquire this ability. Specifically, the SMEs noted that approximately 3 months of supervised OJT is needed to acquire the minimum acceptable level of the ability. SMEs emphasized that the experience needs to be supervised experience such that the trainee is close to the trainer throughout OJT.

3. Conclusion

The purpose of this investigation was to conduct a systematic analysis of the job of a freight conductor and to identify key KSAOs that are appropriate to target in the training and professional development of the freight conductor workforce. Findings from the analysis indicate that freight conductors carry out tasks involving (a) crew communication, (b) crew supervision, (c) form and record management, (d) train inspection, troubleshooting, and repair, and (e) train makeup and handling. The most important KSAOs freight conductors need to perform those job tasks include the following: knowledge of the proper procedures for handling and reporting emergency situations, skill in identifying block signal aspects, judgment and decisionmaking ability, and a strong commitment to safety (other characteristic). Results from SME interviews suggest that many of the KSAOs are trainable (e.g., knowledge of operating and safety rules), and such KSAOs can and should be the focus of employee education in formal training programs. However, other KSAOs (e.g., ability to work nontraditional schedules; the ability to carry out tasks in harsh environmental conditions) should be considered when selecting and hiring new freight conductors because SMEs perceived such KSAOs as less appropriate for training.

In addition, conductors use a variety of tools and equipment on the job; for example, personal protective equipment and radio communication devices. Conductors also work with a variety of railroad personnel including locomotive engineers, dispatchers, and foremen. The job is physically and psychologically demanding—demands related to scheduling and fatigue being among the most prominent.

This analysis drew on expertise from a demographically diverse group of SMEs from multiple railroad carriers and geographic locations. They included both yard and over-the-road conductors, as well as engineers and brakemen. The multiple perspectives proved beneficial for using this analysis model, increasing its applicability to a wide variety of freight conductors. However, individual organizations may need information more specific to their operating practices and training needs. We suggest that these organizations conduct a more targeted job analysis to address this issue. A detailed description of how to conduct a job analysis was prepared by Walsh et al. (2010). This model analysis should provide a useful framework for future job analyses within the railroad industry. Also, it is important to note that although the initiative for conducting job analyses was specifically aimed at assisting in the development of effective training programs, the results of job analyses can be applied toward the development of other organizational infrastructures such as performance appraisals and personnel selection systems.

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Appendix

Task List with Mean Ratings of Consequences of Error, Difficulty, and Importance

Train Inspection, Troubleshooting, & Repair	Con	Dif	Imp
Secure dragging equipment when necessary.	4.29	4.18	8.47
Replace broken knuckles when necessary.	4.47	4.00	8.47
Verify that hazardous material cars are properly placed in train or switching movement.	4.76	3.41	8.18
Determine whether to move, repair, or set out rail equipment with defects in accordance with applicable rules.	4.71	3.29	8.00
Locate, inspect, and report defects identified by a defect detector.	4.71	2.94	7.65
Perform required air brake tests or verify that they have been properly performed.	4.59	2.88	7.47
Inspect cars/equipment en route and when stopped to ensure the safe and efficient operation of the train.	4.41	2.88	7.29
Replace faulty air hoses when necessary.	3.96	3.23	7.19
Inspect other trains en route (i.e., roll by inspection).	4.00	2.18	6.18
Train Makeup & Handling	**Con**	**Dif**	**Imp**
Provide protection when shoving cars.	4.82	2.82	7.65
Provide protection to other trains in accordance with rules during emergency brake application.	4.82	2.53	7.35
Remove and replace derailing equipment as needed.	4.53	2.66	7.19
Apply the emergency brake to stop the train in extreme circumstances.	4.82	2.06	6.88
Inspect and line switches as required.	4.65	2.12	6.76
Join air hoses during train makeup.	4.12	2.59	6.71
Install and remove end-of-train devices.	4.00	2.35	6.35
Switch train cars in accordance with work order instructions.	4.00	2.18	6.18
Couple and uncouple train cars.	4.06	1.82	5.88

Note. Con = mean consequences of error ratings. Dif = mean difficulty ratings. Imp = mean importance ratings. Task Importance ranges from 1 to 10 with 10 corresponding to greatest task importance. It is the sum of ratings of Consequences of Error (1–5) and Task Difficulty (1–5).

Crew Communication	Con	Dif	Imp
Receive, copy, repeat, and comply with mandatory directives issued by train dispatchers or control operators (e.g., track warrants, track bulletins).	4.76	2.24	7.00
Contact the employee in charge (EIC) concerning train movements on the affected tracks (e.g., track bulletin, out of service tracks, work areas).	4.76	2.18	6.94
Advise the engineer of any restrictions placed on equipment being handled.	4.59	2.12	6.71
Call for and release foul time as requested by workmen (e.g., foremen, contractors) when assigned as flagmen.	4.47	2.18	6.65
Advise the dispatcher of any restrictions placed on equipment being handled.	4.29	2.29	6.59
Advise the proper authority when the train clears the main track or territory.	4.47	2.00	6.47
Remind the engineer that the train is approaching an area regulated by limits of authority, track warrants, track bulletins, or speed restrictions.	4.71	1.71	6.41
Call out signals as they are encountered when operating in signal territory and as job activities change.	4.24	1.59	5.82
Crew Supervision	**Con**	**Dif**	**Imp**
Ensure crew members comply with applicable rules, special instructions, signals, and track authority.	4.47	2.88	7.35
Direct other crew members during switching or train operations.	4.12	2.65	6.76
Job brief with train crew members regarding work to be done, movements to be made, and any safety hazards.	4.35	2.12	6.47
Conduct pre-trip planning briefings with train crew members, yard master, and other authorities.	4.00	2.18	6.18
Form and Record Management	**Con**	**Dif**	**Imp**
Verify that all hazardous material cars have all required documentation.	4.88	3.24	8.12
Provide emergency responders with hazardous material documentation in an emergency.	4.88	2.76	7.65
Update required rule books and bulletins for all territories that are operated on.	4.35	3.24	7.59
Verify the accuracy of the train list, dispatcher bulletins, and train orders (i.e., authority for movement) prior to the start of a trip.	4.65	2.71	7.35
Update train list information per operating rules.	4.35	2.82	7.18
Record train times when trains are given permission to enter the work area when assigned as flagmen.	4.47	2.53	7.00
Complete required Federal Railroad Administration (FRA) tie up documentation.	4.35	2.53	6.88
Report car defects.	4.29	2.47	6.76
Deliver all appropriate paperwork (e.g., train list, general track bulletins, air slips) to the relieving conductor as required.	4.29	2.18	6.47
Complete a work train report, if applicable, when called for work train service.	3.24	3.18	6.41
Update the signal awareness form.	3.65	2.18	5.82
Complete delay reports for each trip noting any delays.	2.91	2.29	5.20

Note. Con = mean consequences of error ratings. Dif = mean difficulty ratings. Imp = mean importance ratings. Task Importance ranges from 1 to 10 with 10 corresponding to greatest task importance. It is the sum of ratings of Consequences of Error (1–5) and Task Difficulty (1–5).