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# PROPOSED QUALIFICATION REQUIREMENTS FOR SELECTED RAILROAD JOBS

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16. Abstract

This report proposes minimum, safety-related knowledge, performance and training requirements for the jobs of railroad engineer, conductor, brakeman and train dispatcher. Analyses performed were primarily based upon job and task analytic documentation already in existence, and were critically reviewed by government and civilian railroad specialists.

Recommendations are also offered for the conduct of job training and for techniques to measure and evaluate job knowledge and performance.

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## PREFACE

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Critical review of interim analyses and draft documents was provided by W. McCarthy and R. Folden of the Federal Railroad Administration (FRA), H. Bird (FRA, Atlanta Regional Office), D. Largess (Transportation Safety Institute), W. Martin (FRA, Chicago Regional Office) and J. Sheridan (FRA, Boston Regional Office).

Project consultants from the Boston and Maine Railroad on technical aspects of the railroad jobs studied were P. Johnson, L. Moore and H. Welch.

Finally, we wish to thank the many officials of the following railroads for their assistance and hospitality in providing us with abundant job information during our visits to their facilities:

- Burlington Northern
- Chicago and North Western
- Elgin, Joliet and Eastern
- Penn Central

The opinions, findings and conclusions expressed in this report are those of the authors and not necessarily those of the above named individuals and organizations.

The responsible officer for this project at Dunlap and Associates, Inc. was J. T. Fucigna, Executive Vice-President.

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# 1. INTRODUCTION

## 1.1 BACKGROUND OF THE CONTRACT

The U.S. Secretary of Transportation was empowered by the Federal Railroad Safety Act of 1970 to prescribe rules, regulations, orders and standards and to conduct research, development, testing, evaluation and training appropriate for all areas of railroad safety. The Federal Railroad Administration (FRA) was delegated the responsibilities and authority for the development and promulgation of essential regulations and standards to promote safety in all areas of railroad operations. Essential to job safety, is the assurance that personnel in safety-critical jobs possess the minimum knowledge and skills required for safe performance of their jobs. Thus, a thorough understanding of each safety-critical, railroad job in terms of its minimum requisite, safety-related knowledge and skills is crucial.

Once these job specifications have been delineated, then it is important to specify the training necessary to establish these minimum knowledge and performance requirements. The development of valid and reliable instruments and procedures for testing the possession of such knowledge and skills is the last step in the assurance of safety-related job performance.

The FRA commissioned the Human Factors Branch of the Transportation Systems Center (TSC) to provide consultation and the necessary research in areas such as the above, where human capabilities and limitations may seriously influence operational safety. In the case of this project, TSC has contracted with Dunlap and Associates, Inc. to provide the following analyses for the jobs of railroad engineer, conductor, brakeman and train dispatcher:

- Minimum knowledge requirements for safe performance of duties
- Minimum skill requirements for the safe performance of duties
- Minimum training requirements for the safe performance of duties
- Proposed written test items for job knowledge
- Proposed proficiency checks as tests of job skills.

Explicit knowledge and performance requirements are provided herein for each job studied. Detailed training requirements for each job are also presented and are to be considered initial, first draft attempts at defining reasonable bounds to the entry-level, training problem for each job. No detailed or comprehensive written tests of job knowledge are proposed at this time. However, numerous examples of written test items are included by way of defining an initial approach to measurement and evaluation. Greater elaboration in the definition and scope of written test items is realistically constrained by the absence of a standardized course curriculum (to include

detailed lesson plans) for each job. Examples of specific rating forms for the evaluation of job performance during a checkride* are also provided.

## 1.2 ORGANIZATION OF THE REPORT

Chapter 2 outlines the methods and procedures employed in developing the final products. In Chapter 3, the specific knowledge, performance and recommended training requirements for each job are specified. Chapter 4 provides the reader with some background and possible approaches to the implementation of training requirements.

In Chapter 5, considerations for the development and application of measurement and evaluation techniques are discussed. Chapter 6 concludes with general recommendations for the use of developed products and possible follow-up research and development. In Appendices A and B, respectively, are included sample written test items and performance rating forms for each job under study.

*This term refers to the cycle of duty for a railroad performer (over-the road trip for an engineer, a trick for a dispatcher, an over-the-road trip or yard shift for a conductor, and an over-the-road trip for a brakeman) during which his performance is continuously monitored and evaluated by a job expert or evaluator using a performance rating form.

# 2. METHOD

## 2.1 GUIDELINES

There were several guidelines which were stated by TSC at the outset of this contract. It was stipulated that the analytical efforts should be primarily concerned with over-the-road freight operations, as opposed to passenger operations and yard operations. Although there is a great deal of commonality among all these operations, it was felt that over-the-road freight operations, on the whole, were the most demanding in terms of knowledge and skill requirements. Diesel/electric locomotion was another given, to the exclusion of all other forms of existing locomotion.

It was also made clear the requirements developed should be minimum, safety-related requirements, amenable to evaluation and regulation by the Federal Railroad Administration under provisions of the Federal Railroad Safety Act of 1970. The scope and detail of the analysis should, therefore, be sufficient to determine that personnel in safety-critical railroad jobs "possess that minimum of knowledge and skills required to assure safe performance of their jobs."* Implicit in the concept of safety-related requirements was any item of knowledge or performance whose absence, omission, or erroneous handling could result in significant injuries or death to a locomotive or train crew member as well as bystanders.

It was also necessary to bear in mind that the knowledge and skill requirement identified be measurable. Knowledge requirements must be so stated as to define behavior which is measurable by oral and/or written examinations. Skill or performance requirements must be expressed so as to specify behavior which may be observed and evaluated in the real world or simulated environments.

It was set forth in the contract that "the job performance and training criteria...shall be derived from descriptive and analytical documentation to be provided by TSC; therefore, travel for additional data collection should be limited to that necessary for checking initial conclusions. The contractor must through in-house personnel or consultants, possess and apply detailed knowledge of railroad operations with respect to the jobs under study."** The contract also stated that the "derivation of the products...shall be guided by, but not necessarily constrained by, the formats and techniques specified for air crew members in the Federal Aviation Regulations."**

*Contract No. DOT-TSC-736, p. 2
**IBID, p. 3

As a final guideline it was the intent to include only requirements which were felt to have nationwide impact, to the exclusion of highly limited, regionalized situations or practices. In keeping with this commitment, the language used to express the requirements was carefully chosen to reflect generally accepted, railroad terminology, avoiding any complex psychological terms or obscure railroad terms.

## 2.2 INFORMATIONAL RESOURCES

Various types of informational resources were used in developing the material presented in this report. Foremost amongst these were the task and skill analyses for the jobs of the engineer, dispatcher and conductor, generated by or under contract from TSC.

Carrier produced materials in the form of rule books, operational and training manuals, courses of study and examinations were used. Other sources included the Track-Train Dynamics reports, railroad accident data, National Transportation Safety Board studies, reports and articles found in the open literature and various industry publications, such as the Air Brake Association and the Railway Fuel and Operating Officers Association. Titles of the specific reports used are listed in the section on References.

In addition to documentary resources, information was obtained from site visits to four railroads, i.e., Burlington Northern; Chicago and North Western; Elgin, Joliet and Eastern and the Penn Central. First hand information on the job of train dispatcher was obtained from the first three railroads visited. A trip of several hours duration was taken by the project staff in a freight train locomotive cab on the fourth railroad.

Early drafts of the requirements and evaluation considerations were reviewed by project consultants: an engineer, a dispatcher and a conductor, all operating personnel with the Boston and Maine Railroad. Their comments were incorporated into the preliminary products.

Finally, informal critical reviews of the preliminary products were reviewed by several governmental railroad specialists. This final report reflects comments received from all reviewers.

It should be noted that various informational resources often differed in their approach and content. There were differences of opinion even amongst the reviewers. Where such differences were apparent, the most universal position was adopted--that is, the position thought to represent the majority of informed thinking.

## 2.3 TECHNICAL APPROACH

The processes involved in developing the various products presented in this report are illustrated in Figure 2-1 and discussed chronologically in the following paragraphs. Although each job studied was in some way unique, the overall approach in developing the final products was basically the same.

For each job, resource material, primarily in the form of governmental reports was compiled (1, Figure 2-1). The material was analyzed to identify safety-related tasks (2). For purposes of this study, safety-related tasks were defined as tasks whose improper performance could cause injury or death to any personnel. Improper performance could be:

- Omitting a required activity, either because of not being aware of a dangerous situation; or being aware of the situation, but not knowing what to do.

- Performing an activity incorrectly. No distinctions were made between various levels of hazard. All potentially dangerous items were considered safety-related and included in the inventory of tasks.

There were, however, a few job-related tasks that were not included as they were considered to be non-safety-related. Such tasks as paper work associated with the payroll, car accounting for billing purposes and other such purely administrative tasks were not included.

Once the safety-related tasks were identified, the material was reviewed to ensure that only the minimum required safety-related tasks were included (3). As specified in the objectives of this study, the concern was to develop guidelines for minimal, acceptable levels of knowledge and skills--"need to know or do items" versus "nice to know or do" items.

To force a distinction between which items were essential, safety-related and which items were non-essential, a somewhat stringent, hypothetical question was posed: "Should employment be denied to an individual who did not know this item of information, or could not perform this task?" In using this question in the decision process, certain assumptions had to be made. For example, when developing the requirements for the train dispatcher, it was assumed that at least an assistant chief dispatcher would always be available to provide advice and assistance for unusual occurences. The minimum requirements, therefore, did not include items that required a high level of sophistication (found in the assistant chief dispatcher) usually achieved through years of experience.

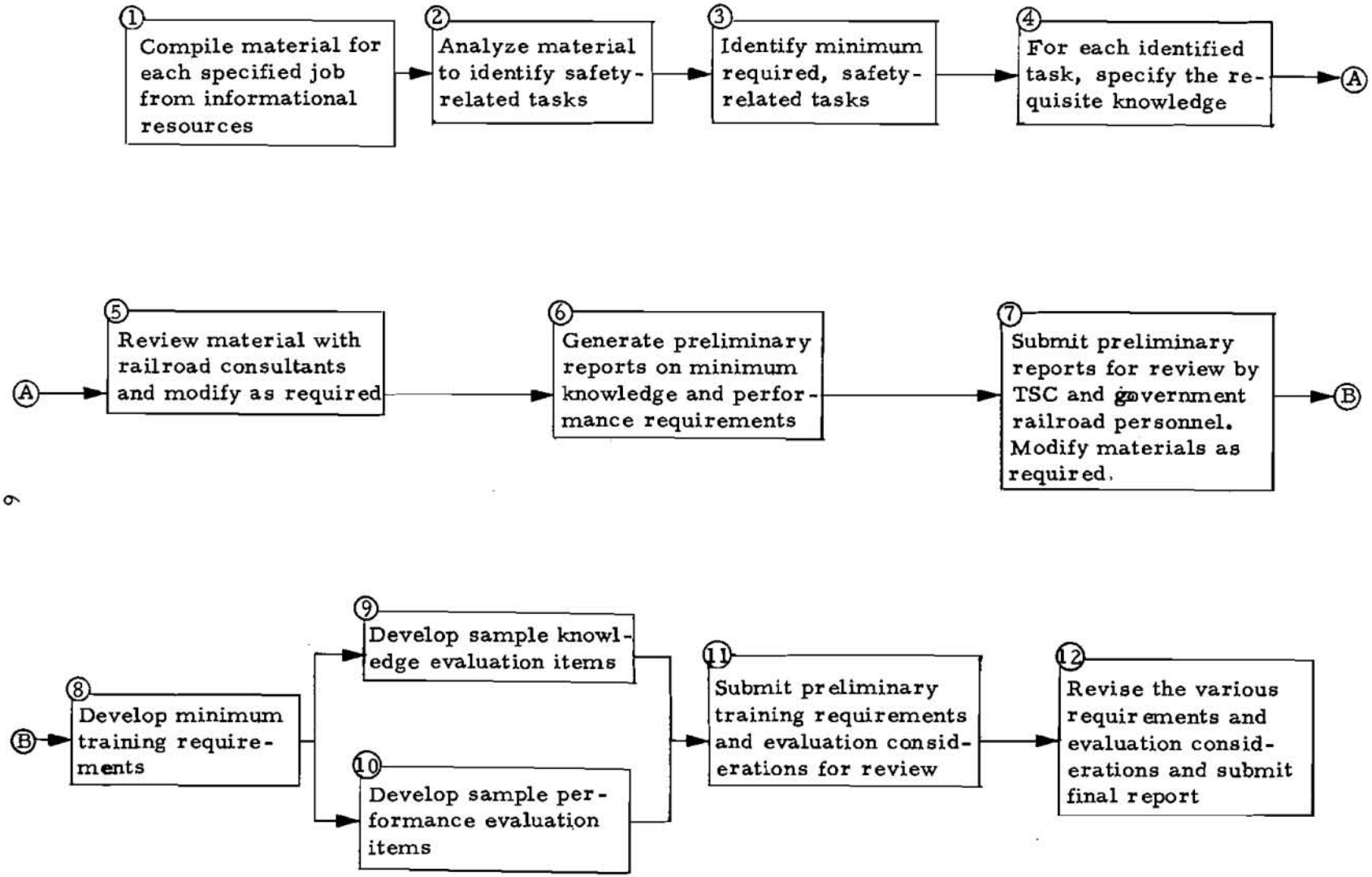


Figure 2-1 TECHNICAL APPROACH

For each of the identified, minimum safety-related tasks, the associated background knowledge was specified (4). Items of knowledge identified were carefully selected as being essential to accurate and reliable task performance. This information was specified in what has been referred to as "behavioral terms," that is, in terms that are measurable by either written or oral examination.

The knowledge requirements were organized into topical groupings, primarily in terms of railroad organization, equipment and facilities, and operations. The performance requirements were organized to follow the sequence of a checkride or trick from start to finish. Draft copies of the material were reviewed by the three project consultants (5). Their comments were incorporated into the Preliminary Reports (6) submitted to TSC and other government railroad personnel for review (7).

The minimum training requirements were developed from the knowledge and performance requirements and from a review of the railroad industry training approaches (8). For each item in the knowledge and performance inventories, the topics of instruction and estimated hours of training were developed. The topics were organized by optimum location for training, e.g., classroom, yard. As with the knowledge and performance requirements, the training requirements denote entry level or initial qualification training. In-service or refresher training was not addressed.

Sample evaluation items were developed as examples of the types of tests that could be used to ensure that the training was effective and that the trainee possessed the required knowledge and skills. No attempt was made to develop complete test instruments; only samples of selected test items were generated. For knowledge evaluation, twenty multiple choice questions were generated for each job (9). For the evaluation of job performance, a checklist was developed for each job that could be used as a rating instrument (10).

The training requirements and evaluation considerations were submitted to TSC for review along with discussions on various approaches and techniques for conducting training and evaluation (11). Recommendations for revisions were received and a final report (12) was generated (this volume).

# 3. PROPOSED JOB QUALIFICATION REQUIREMENTS

## 3.1 INTRODUCTION

### 3.1.1 Scope

Included within this chapter are the inventories of minimum, safety-related knowledge, performance and training requirements for the jobs of railroad engineer, conductor, brakeman and train dispatcher. They constitute the major recommendations of this report concerning the job qualification requirements for these jobs.

The terms "skill" and "performance," in the context of requirements, have been used interchangeably up to this point. Inherent in the concept of a skill are several facets. A skill is generally considered to be higher order behavior on the part of an individual, requiring some significant training or learning to establish it. Moreover, once established the behavior is characterized by ease and precision of performance and adaptability to changing conditions. Frequently skills are considered by many to be entirely within the psychomotor domain of behavior. Finally, the precision of performance inherent in a skill should be defined by objective performance criteria (such as time, accuracy, rates of output). After much consideration with regard to the nature of the activities embodied by the railroad jobs under study, for several reasons, it was decided to adopt the term "performance requirements" instead of "skill requirements." Higher order behavior was not always involved in each job. As important a job as that of a brakeman is, it would be tenuous to consider many of his job activities to be skills. In addition, many of the behaviors required of such individuals as the engineer and conductor involve cognitive capacities (e.g., judgment, and decision-making), not just psychomotor activities. Most important, objective performance criteria which fully define a skill statement are nearly entirely lacking for all jobs under study. For these reasons, therefore, the term performance requirement was considered to be the most universally applicable term for the jobs which are subjects of this report.

The term "training requirements" means many things to many people. It may include such qualitative aspects as the specification of knowledge and performance required by a job and associated training objectives. In addition, it may denote the required resources to accomplish the instructional objectives of a training program, such as hours of instructional time for basic types of course content, types and numbers of instructors, required facilities and equipment (classrooms, operational equipment time, simulators, mockups and other training devices, audio-visual aids, student training aids, etc.). The training requirements presented in this report will encompass the basic

resources required to conduct a minimum, safety-related training course for each job under study. Specifically, these include the major topics of instruction and the associated minimum training hours of related qualification training for the engineer, dispatcher, conductor and brakeman.

The training which should occur in the classroom, on specialized training equipment, or in the real world to qualify a trainee for independent job performance is also suggested. That the major part of knowledge development is most efficiently handled in a classroom environment is an undeniable fact. However, certain aspects of operational knowledge and skill development are most efficiently handled in other environments, such as a rail yard, dispatching facilitiy, or a locomotive cab or simulator. To account for these training efficiencies, allocations of subject matter and training time to environments other than the classroom have thus been made. Without exception, the reader will note that a period of on-the-job qualification training is stipulated for all jobs prior to certification of an individual as a qualified job holder. This is considered to be an essential factor to assure the safe performance of individuals when assuming their respective jobs.

At this time only initial qualification training is considered. Unquestionably, periodic refresher or requalification training is required in operating rules for all railroad employees. Other topics in need of refresher or in-service training for many employees would include air brakes, signals, and electrical and mechanical matters, especially when prompted by the introduction of modified or entirely new equipment. However, requalification or refresher training requirements are not addressed at this time.

There is one final and very important consideration which the reader should bear in mind when reviewing the knowledge, performance and training requirements presented in this chapter. Namely, it should be clearly understood that the entire body of requirements set forth here will not apply to all job holders on all railroads at all times. Railroads differ in their modes of operation, such as terrain features of operating territories, equipment or hardware in service, train traffic control methods and signal systems, operating procedures and rules, etc. Several requirements which vary in their applicability to all railroads have nevertheless been included because of their substantial, safety-impact on railroad operations when in effect and their significant distribution throughout the railroad industry.

### 3.1.2 Organization of Requirements

Each set of job qualification requirements is contained within an individual subchapter for the railroad engineer, conductor, brakeman and train dispatcher. A brief outline of the duties and responsibilities, and critical areas of knowledge and performance precedes three tables which contain the knowledge, performance and training requirements for each job.

## 3.2 RAILROAD ENGINEER

### 3.2.1 Job Summary

The railroad engineer is the individual in immediate, direct control of the motion of a train. He is responsible for obeying all directions and signals, and controlling train movements (stopping, starting, backing, etc.) and speed between stops; beyond this, he must always exercise discretion, care and vigilance in moving the train so as to prevent injury or damage.

In carrying out his duties, several basic functional capacities clearly must be within the repertoire of the engineer. He must have perceptual/motor coordination. This is the ability to perceive information which affects the safe control of the train and to integrate this information into the smooth, effective and safe control of the train via the brake and power systems. Control information comes from the entire visual surround (outside information, and information from the dials and gauges within the cab) auditory cues and vestibular cues produced by train motion. This information must be processed in a timely manner to account for the substantial control lag and great inertial forces of a modern freight train (150 or more cars in length, possibly 15,000 tons in weight).

The engineer must have anticipation or the ability to take control actions (throttle, brake) sufficiently in advance of such territorial features as curves, grades, grade crests, etc. so as to safely control the train at all times. He should possess a sound capability for clear and concise oral communication, via the train radio, with the dispatcher and the train crew.

Long term memory for railroad operating rules, the layout of controls and displays in locomotives to be operated, and the physical features of the operating territory is also needed. Short term memory for weather advisories, changes in the load consist, train orders received enroute, etc. is also required.

The engineer must possess observational skills required to conduct the inspections of the cab, engine room, and exterior of the locomotive and to promptly detect malfunctions and breakdowns within the locomotive consist.

Foremost among his many talents, the engineer must demonstrate vigilance or the capacity to be attentive to all critical, informational inputs throughout a several hour trip within a relatively confined workspace (the locomotive cab).

### 3.2.2 Critical Areas of Knowledge and Performance

In consideration of the duties and responsibilities of a railroad engineer as they related to the safe movement of trains, several major factors influenced the structuring of the knowledge, performance and training requirements. First, the engineer must have a thorough operational knowledge of how to operate the locomotive(s) within the context of the operating territory to which he is assigned. He must account for the impact of terrain features on track-train dynamics. The engineer must be thoroughly versed in the content and application of operating rules which, in fact, are safe operating procedures in written form. He must also be able to account for the effects of changes in train make-up on train handling. The engineer must have a sound and practical understanding of the type and magnitude of physical forces which can develop within his train and the degree to which he can control them under various circumstances.

The requirements for physical strength are minimal for the engineer, as the operation of controls on the control stand does not require extraordinary strength. Fundamentally, the engineer is a sophisticated information processor and controller of a very complex, and often difficult to monitor, man-machine system.

Table 3-1 specifies the minimum, safety-related knowledge requirements and Table 3-2 specifies the minimum, safety-related performance requirements for the railroad engineer. In Table 3-3 are found the minimum training requirements for the railroad engineer.

TABLE 3-1 RAILROAD ENGINEER MINIMUM KNOWLEDGE REQUIREMENTS

A railroad engineer must demonstrate a practical knowledge and understanding of at least the following subjects which are applicable to a railroad's modes of operation:

A. Railroad Organization

1. Functions performed by such departments as Safety, Signal and Communication, Mechanical, Engineering, Maintenance of Way, Car, Bridge and Building, Police and Fire, and Transportation.

2. Duties and authority of key operational personnel, such as division engineer, master mechanic, trainmaster, road foreman, engineer, pilot, fireman, brakeman (front, rear), conductor, train dispatcher, tower operator and train order operator, car inspector, crew dispatcher, yard master and agent.

B. Equipment and Facilities

1. Locomotives

a. Locomotive types and capabilities (e.g., horsepower or tonnage ratings)

b. Diesel-electric power generating equipment

1) Function, location, interrelationships and general requirements for safe operation of major components, i.e., engine, generator and traction motors

2) Function and location of the operating controls and displays for the power and electrical control systems (e.g., selector lever, reverse lever, throttle lever, load current meter, speedometer, wheel slip indicator) for each type of locomotive to be operated

3) Function and location of auxiliary controls and displays (i.e., indicators, switches, circuit breakers and fuses on engine control and circuit breaker panels) for each type of locomotive to be operated

4) Concepts of operation

a) Multi-unit operation

b) Causes and effects of engine overspeed, generator and traction motor overload

c. Braking equipment

1) Air brakes

a) Function, location, interrelationships and general requirements for safe operation of major components, i.e., compressor, main and equalizing reservoirs, valves, brake cylinders, rigging and shoes

TABLE 3-1 RAILROAD ENGINEER MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

b) Function and location of the operating controls and displays for the air brakes (e.g., automatic brake lever, independent brake lever, main and equalizing reservoir pressure gauges, brake pipe and cylinder gauges, brake pipe flow indicator) for each type of locomotive to be operated

c) Concepts of operation

- Requirements for charging and maintaining air pressure
- Causes of overcharged and undercharged brakes; procedures for correction
- Effects of train length and ambient temperature on brake application and release time; brake pipe gradient
- Causes and prevention of penalty brake applications
- Causes and prevention of unintentional brake releases
- Conditions for which independent brakes are recommended and not recommended
- Conditions for which automatic brakes are recommended and not recommended

2) Dynamic brake

a) Function, location, interrelationships and requirements for safe operation of major components, i.e., generators, motors, cooling grids

b) Function and location of the operating controls and displays (e.g., control lever, load current meter) for each type of locomotive to be operated

c) Concepts of operation

- Conditions under which the dynamic brake is available and useful
- Conditions under which the dynamic brake is not recommended
- Advantages and disadvantages of using the dynamic brake in conjunction with air brakes; interlock with air brakes
- Limitations on use of the dynamic brake, e.g., maximum permitted application time at certain voltages, use over extended distances

3) Handbrakes

a) Location and operation of various types of handbrakes in service

b) Situations requiring operation of handbrakes and blocking of wheels

d. Sanding equipment

1) Function, location and requirements for safe operation of major components for manual and automatic sanding systems

TABLE 3-1 RAILROAD ENGINEER MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

2) Concepts of operation

a) Situations requiring automatic or manual sanding

b) Benefits of and precautions for sanding

e. Safety and communications equipment

1) Function, location, and operation of all such equipment, to include safety control pedal, electronic alertness control, emergency brake valve, automatic train stop, automatic train control, overspeed control, train radio auditory signals (e.g., whistles, bells, horns), flares, fusees, torpedoes, and fire extinguishers

2) Situations requiring use of safety and communications equipment

2. Cars

a. Types of cars in service

b. Function, location, and requirements for safe operation of couplers and draft gears, air brake components, (i.e., reservoirs, valves, brake pipe and connectors, cylinders, brake rigging, shoes, retainers and caboose valve), and handbrakes

c. Concepts of operation

1) Performance characteristics of loaded versus unloaded cars

2) Requirements for handling special cars or hazardous cargoes

3) Performance characteristics of friction and roller bearings

4) Potential for thermal cracking of wheels due to excessive braking

3. Trackage and associated equipment

a. Common types of trackage, e.g., main, siding, single and multiple

b. Functions of trackage associated equipment, i.e., towers; switches, derails and component parts; detectors and transmitters for information on overheated journals and train speed

4. Terminals, yards, enginehouses, turntables

a. Functions of these facilities

b. Requirements for safe operation within or near these facilities

5. Signals

a. Aspects, indications, and typical locations of various types of wayside signals and cab signals

b. Meanings of various types of hand, flag, and lamp signals

TABLE 3-1 RAILROAD ENGINEER MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

c. Types and meanings of horn/whistle signals

6. Train control systems

a. General design and operational features of the train control system(s) in service, e.g., train order, manual and automatic block systems, automatic cab signals, centralized traffic control (CTC)/traffic control system (TCS), and verbal train control

b. Territory where each system is in operation, if more than one is employed

C. Physical Characteristics of the Road*

1. Location of significant terrain features, such as ascending and descending grades, curves, undulating territory, bridges, tunnels, and potential hazards (e.g., slides, washouts, vandalism)

2. Location of various railroad equipment and landmarks, such as stations, yards, interlockings, sidings, crossovers, track crossings, highway grade crossings, and emergency telephones

D. Rules and Regulations

1. Operating rules and instructions covering topics such as:

- General rules
- Signals and their use
- Movement of trains and engines
- Superiority of trains
- Movement by train order
- Movement by manual and automatic block signals
- Movement by automatic cab signals
- Movement by CTC/TCS
- Movement by verbal train control
- Equipment operation, e.g., air brakes, dynamic brake, telephone, etc.
- Train handling
- Safety

2. Timetable and special instructions

3. Work rules and hours of service regulations

4. Power Brake Law

5. Special and bulletin notices

6. Federal Communications Commission and railroad rules for train radio operation

7. Federal regulations governing locomotive inspection, safety appliances and handling of hazardous materials

*Territory in which the engineer will be operating

TABLE 3-1 RAILROAD ENGINEER MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

E. Operational Procedures

1. Trip preparation

a. Required trip information, i.e., train orders, timetable and rules, special notices, official railroad time, and load consist information (e.g., location of heavies, empties; high, wide loads; hazardous cargo; train length)

b. Procedures for communicating with yard personnel and crew prior to movement

c. Procedures for performing inspections of locomotive consist, i.e., exterior from ground, engine room(s), lead unit cab, trailing unit cab(s)

2. Initial movement

a. Required conditions prior to starting the locomotive

b. Procedures for starting the locomotive

c. Post-start inspections

d. General considerations for accelerating, running, stopping and backing

e. Procedures for forming a locomotive consist and changing operating ends, to include lead or trail setup requirements and air brake application and leakage tests

f. Procedures for coupling the locomotive(s) to cars, verification of the coupling, and conduct of air brake tests

3. Over-the-road operations

a. Basic handling

1) Factors affecting the use of power and braking

a) Train and track considerations affecting tractive and braking forces, i.e., friction (rolling resistance, wind resistance, rail adhesion, wheel-shoe resistance, track curvature and alignment), grade, type and location of locomotive consists; train length, speed, weight and weight distribution

b) Environmental considerations, i.e., moisture, snow, and visibility restrictions

c) Time and distance considerations, i.e., required stopping distances for various grades, curves, and train lengths and weights

d) Handling considerations which affect the development of lateral and vertical forces which can cause wheel lift, rail spread and roll over and possible derailment

TABLE 3-1 RAILROAD ENGINEER MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

2) Slack control

a) Conditions which promote slack development and its location within the train

b) Procedures for controlling slack, i.e., bunching and stretching

c) Consequences of ineffective slack control, i.e., run-in, drawbar pull

b. Intermediate handling

1) Grade and curve territories

a) Procedures for negotiating, stopping and restarting trains on:

- Level territory with curves
- Straight territory with light (less than 1.5%) and heavy (more than 1.5%) ascending grade(s)
- Straight territory with light and heavy descending grade(s)
- Light and heavy, ascending and descending grades with curves
- Cresting grades
- Undulating territory
- Sag or dip territory
- Hump, knoll or hogback territory

b) Procedures for controlling train by such methods as cycle braking (where permitted), dynamic braking coupled with automatic braking, throttle modulation, and retainers (when required)

c) Precautions for avoiding wheel slip, wheel slide, traction motor commutator stall burns, flashover, and excessive drawbar forces

d) Effects of certain actions on grades and curves, e.g., stopping on a cresting grade: speed changes within, near the beginning or end of curves; excessive use of throttle or brakes on curves; dynamic braking on crossovers, turnouts and heavy curves

2) Power assistance

a) Remote control equipment (RCE)

- Available modes of operation and associated advantages and precautions
- Procedures for setting up and checking out RCE configuration
- Procedures for combined power and braking operations

b) Pusher and helper equipment

- Situations requiring pusher and helper assistance
- Procedures and precautions for operating with, or as a pusher or helper

3) Braking assistance

a) Procedures for setting up and checking out the repeater relay system

TABLE 3-1 RAILROAD ENGINEER MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

b) Procedures for operating with the repeater relay system

c. Special handling

1) Procedures following loss of the dynamic brake on moderate to heavy downgrade

2) Procedures after emergency brake application

3) Procedures after unintentional brake release

4) Procedures after break-in-two

5) Procedures after derailment

6) Procedures for correcting and/or reporting operating difficulties, e.g., engine malfunction and shutdown, excessive air pressure leakage, overcharged brakes, broken brake pipe, sticking brakes, sanding malfunction or failure, traction motor malfunction or failure, overheated journal bearing, open ground relay, low oil or water pressure, high coolant temperature, low main reservoir pressure

d. Communications

1) Techniques for providing clear and concise oral and written communications

2) Procedures for operating train radio in communications to and from the dispatcher, outside crew, and caboose

3) Forms of train orders

4) Procedures for telephone communications

5) Requirements for completion of work order or defect report

4. Trip completion

a. Requirements for securing (engine running) and shutting down the power consist

b. Procedures for completing and filing operational and maintenance reports with proper authorities

F. Effective Job Performance

1. Factors affecting engineer performance

a. General fitness requirements

b. Major sources of performance decrements, i.e., attitude, distraction, fatigue and physical impairments (i.e., alcohol, drugs, injury, disease and sensory or motor impairment)

2. Injury avoidance

TABLE 3-1 RAILROAD ENGINEER MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

a. Types and locations of potential hazards and injuries, i.e., electrical, thermal, chemical, acoustical, and physical force (e.g., being struck, falling)

b. Precautions when moving on or about tracks, getting on and off locomotives and cars, inspecting or maintaining the locomotive, operating handbrakes, using tools or appliances, working near rotating equipment (shafts, belts, etc.), and working near high voltage equipment

G. Railroad Terminology Required for Reliable Communication

1. Standard railroad terms

2. Local railroad terms

TABLE 3-2 RAILROAD ENGINEER MINIMUM PERFORMANCE REQUIREMENTS

A railroad engineer must demonstrate an ability to perform satisfactorily at least the following activities which are applicable to a railroad's modes of operation:

A. Trip Preparation

1. Obtain required information for the trip, to include train orders, timetable and rules, special notices, correct time (where required) and load consist information (e.g., location of heavies, empties; high, wide loads; length of train)

2. Perform locomotive inspections, to include exterior from ground, engine room(s), lead unit cab, and trailing unit cab(s)

B. Starting and Initial Movement

1. Start the engine(s) and perform necessary checkouts

2. Form the locomotive consist and test the air brakes

3. Couple the locomotive(s) to the cars and verify the coupling

4. Charge (as required) and test the air brake system

5. Obtain a departure clearance

6. Move the train through the yard to the designated main track

C. Over-the-Road Operations

1. Basic handling

a. Accelerate the train and hold maximum authorized speed

b. Decelerate the train and hold minimum authorized speed

c. Under appropriate conditions, slow down and stop the train using "bunch" and "stretch" braking methods employing the following systems, as required:

- Automatic brakes (service applications)
- Independent brakes
- Dynamic brake
- Automatic brakes in conjunction with dynamic brake
- Power braking

d. From a stretched condition, bunch slack and start the train

e. Enter and leave a siding

f. Pick up and set off cars

TABLE 3-2 RAILROAD ENGINEER MINIMUM PERFORMANCE REQUIREMENTS (Cont.)

g. While enroute:

1) Identify and comply with the indications of all wayside and/or cab signals

2) Comply with all train orders received

3) Report or respond to reports of the condition of own train, the condition of passing trains, malfunctioning signals or roadside equipment, defective tracks, switches, and other hazardous conditions

4) Control throttle so as to avoid unnecessary stress on the engine, generator and traction motors

5) Control the throttle and brakes so as to avoid wheel slip and wheel slide

6) Control slack within the train avoiding excessive buff action and coupler or draft gear strain

7) Control the automatic brakes so as to prevent failures, sticking brakes, and unintended releases while underway or stopped

8) Use the dynamic brake at appropriate locations after the proper time delay

9) Recognize and take appropriate control and signalling actions (horn/whistle) sufficiently in advance of:

- Highway grade crossings
- Environmental hazards (natural, man-made)
- Equipment and trains on adjacent track
- Message pick-up points
- Onset or offset of grades, grade crests and undulating territory
- Onset or offset of curves

10) Restart the train after a penalty brake application

11) Respond to an application of automatic brakes from the caboose

2. Intermediate handling

a. Grade and curve territories

1) Negotiate, stop at designated location(s) and restart the train as appropriate on:

- Curve territory
- Light and heavy descending grade(s)
- Light and heavy ascending grade(s)
- Cresting grade
- Undulating territory
- Sag or dip territory
- Hump, knoll or hogback territory

TABLE 3-2 RAILROAD ENGINEER MINIMUM PERFORMANCE REQUIREMENTS (Cont.)

2) Where permitted, employ throttle modulation, cycle braking and dynamic braking in conjunction with automatic braking in the above territories

3) Employ manual sanding, as appropriate

b. Power assistance

1) For operations involving remote control equipment (RCE), perform the following activities:

a) Set up and check out the configuration prior to use

b) Employ brake and power functions

c) Switch between independent unit, and multiple unit modes of operation

2) Operate with a pusher or helper unit

3) Operate as a pusher or helper unit

c. Braking assistance

1) Set up and check out the repeater relay system

2) Operate with a repeater relay system

3. Special handling

a. Recommend and/or take appropriate action following a failure of the dynamic brake on a moderate to heavy downgrade*

b. Recommend and/or take appropriate actions to correct such operating difficulties as:

- Engine shutdown
- Excessive air pressure leakage
- Overcharged brakes
- Broken brake pipe
- Sticking brakes
- Sanding malfunction or failure
- Traction motor malfunction or failure
- Overheated journal bearing
- Low oil or water pressure
- High coolant temperature
- Low main reservoir pressure

c. Make an emergency brake application (under appropriate conditions)

4. Communications

a. Employ the train radio in communications from the locomotive to dispatcher, and the locomotive to the caboose or outside crew

* Recommended for performance testing only on a train simulator

TABLE 3-2 RAILROAD ENGINEER MINIMUM PERFORMANCE REQUIREMENTS (Cont.)

b. Execute a work order or defect report

D. Trip Completion

1. Move the train from the main track, through the yard, to the designated track

2. Stop the train at the appropriate destination and secure the locomotive consist; shut down the locomotive consist, if appropriate

3. File any required operational and maintenance reports with proper authorities

TABLE 3-3 MINIMUM TRAINING REQUIREMENTS FOR THE RAILROAD ENGINEER

The following major topics of instruction and estimated training hours, as they are applicable to a railroad's modes of operation, constitute what is recommended as minimum training requirements for the railroad engineer:

| A. CLASSROOM TRAINING | Estimated Min. Hours |
|---|---|
| 1. Review of Railroad Objectives and Organization | 2 |
| a. Roles of safety and efficiency in railroad operations | |
| b. Organization of the operating departments | |
| c. Duties and authority of an engineer | |
| d. Duties and authority of supervisors to whom the engineer reports, and other railroad personnel who work with and under the authority of the engineer | |
| 2. Railroad Terminology Required for Reliable Communications | 2 |
| 3. Overview of Equipment and Facilities | 3 |
| a. Locations and functions of major facilities (towers, yards, stations, etc.) and wayside equipment (signals, switches, interlockings, etc.) | |
| b. Nomenclature, function and capabilities of the types of locomotives and cars in service | |
| 4. Diesel-Electric Power Generating Equipment | 12 |
| a. Function and location of major power system components, related controls and displays; operational concepts | |
| b. Function and location of major dynamic braking system components, related controls and displays; operational concepts | |
| c. Function and operation of sanding equipment | |
| 5. Air Brake Equipment | 16 |
| a. Functions and location of major components, related controls and displays | |
| b. Operational concepts | |
| 6. Operation of Safety and Communications Equipment | 4 |
| a. Safety control pedal, automatic train stop, automatic train control and other safety equipment | |

TABLE 3-3 MINIMUM TRAINING REQUIREMENTS FOR THE RAILROAD ENGINEER (Cont.)

| | Estimated Min. Hours |
|---|---|
| b. Auditory and visual signalling devices (e.g., bells; horns; whistles; torpedoes; fusees; hand, flag, lantern signals) | |
| c. Train radio | |
| 7. Railroad Rules and Regulations | 48 |
| a. Operating rules, e.g.: | |
| • General rules<br>• Signals and their use (types and meanings of all signals)<br>• Movement of trains and engines<br>• Superiority of trains<br>• Movement by train orders<br>• Movement by any other train control system(s) in service<br>• Equipment operation (e.g., air brakes, dynamic brake, train radio)<br>• Train handling<br>• Safety | |
| b. Timetable and special instructions | |
| c. Special and bulletin notices | |
| d. Federal regulations affecting the engineer (e.g., hours of service, power brake, locomotive inspection) | |
| 8. Train Handling Procedures and Track-Train Dynamics | 24 |
| a. Basic operations, e.g.: | |
| • Required information and reports (pre/post trip), inspections and tests<br>• Factors affecting the use of power and braking systems<br>• Starting, accelerating, running, slowing, stopping and backing<br>• Coupling and uncoupling<br>• Slack control<br>• Handling on grade and curve territories<br>• Handling in degraded operating environments (e.g., visibility restriction, snow, rain, flooding, vandalism)<br>• Operating with power assistance (e.g., remote control equipment, pushers)<br>• Operating with braking assistance | |
| b. Emergency procedures, e.g.: | |
| • Failure of dynamic brake<br>• Unintentional release of automatic brakes<br>• Break-in-two<br>• Fire<br>• Derailment | |

TABLE 3-3 MINIMUM TRAINING REQUIREMENTS FOR THE RAILROAD ENGINEER (Cont.)

| | | Estimated Min. Hours |
|---|---|---|
| 9. | Common Train Malfunctions/Failures and Associated Corrective Actions | 4 |
| 10. | Reporting Requirements | 1 |
| | a. Condition of own train | |
| | b. Condition of other trains, track and wayside equipment | |
| 11. | Effective Job Performance | 4 |
| | a. Factors affecting engineer performance | |
| | b. Injury avoidance | |
| | Total Minimum Classroom Hours | 120 |

B. EQUIPMENT TRAINING*

1. Basic Train Handling

On "captured track" or off-line trackage, with an actual locomotive and rolling stock, each trainee should perform such actions as inspecting and starting the locomotive, acceleration, speed holding/balancing, slowing and stopping(employing all braking systems), backing, coupling and uncoupling, and shutting down the locomotive. Where a locomotive/train simulator is available, the above actions should be performed throughout a full range of operational train speeds; with light, medium and heavy freights; on light and heavy grades and curves.

2. Application of and Compliance with Operating Rules

During train handling runs, the trainee should be exposed to as wide a range as possible of typical signal aspects and train orders, as well as other situations requiring slowing, stopping or signalling.

3. Malfunction Recognition and Correction

During train handling runs, the trainee's ability to effectively handle operating difficulties and potentially dangerous conditions (e.g., overheated engine, overheated journal bearings, engine shutdown, sticking, brakes, low oil or water pressure, low main reservoir pressure) can be achieved by stipulating the occurrence(s) of such conditions when they don't occur spontaneously or it is unsafe to

*This phase of training should be interspersed with classroom training on a daily basis, where possible.

TABLE 3-3 MINIMUM TRAINING REQUIREMENTS FOR THE RAILROAD ENGINEER (Cont.)

| | Estimated Min. Hours |
|---|---|
| make them occur. Such stipulations should be made at the discretion of the instructor, during the latter half of this training phase, and the trainees should be required to take or describe the appropriate corrective actions. Many locomotive malfunction indications can be made to occur more realistically in a train simulator, thus providing training in malfunction detection and correction. | |
| 4. Emergency Procedures<br>The same approach as in 3 above can be applied to the training of appropriate responses to such situations as loss of dynamic braking on a downgrade, break-in-two, fire, derailment, etc. | |
| Total Minimum Equipment Hours | 40 |
| C. ON-THE-JOB QUALIFICATION TRAINING<br>To qualify as a fully operational railroad engineer, it is recommended that the graduate from the previous training phases operate as a full-time apprentice for a period of at least 4 weeks under the cognizance of a fully qualified "instructor" engineer. The territory covered on these trips should be that to which the apprentice will be assigned. Training trips should be scheduled to give a more or less even distribution between daytime and nighttime runs. | |
| Total Minimum On-The-Job Qualification Hours | 160 |
| TOTAL ESTIMATED MINIMUM TRAINING HOURS | 320 |

## 3.3 RAILROAD CONDUCTOR

### 3.3.1 Job Summary

Together with the engineer, the conductor is responsible for the safe transportation of people and material on the train. The job of freight conductor involves checking the train prior to departure to ensure that the train and its contents are ready for the trip. Once underway his primary responsibilities are ensuring that the scheduled pick-ups and set-offs are made and supervising the brakeman in the various activities involved in the switching of cars. Decisions must be made as to the arrangement of the pick-ups to ensure safe and efficient operation. At times, the conductor may assist the brakeman in the coupling, uncoupling or switching process.

The conductor serves as a safety check on the movement of the train that is being controlled by the engineer. He ensures that the train orders are effected, that the proper speeds are maintained and the required brake tests are performed. In the event that there are unplanned events during the trip that require immediate attention, or a deviation from the schedule, the conductor and engineer have the responsibility to initiate the appropriate protective action.

Throughout a trip, the conductor must communicate with various railroad personnel on board the train and,where required, with the dispatcher and operators along the route.

The conductor is responsible for the documentation that is associated with every train trip. This includes the normal accounting of set-offs and pick-ups and the reporting of unusual events such as delays or accidents.

The job of a conductor may be thought of as incorporating the functions of a supervisor, planner, inspector, communicator and data collector. The capacities that a conductor should possess are several. As an information processor, he should be able to receive and correctly interpret orders from the dispatcher and perceive status information from the train and the environment. As a decision-maker, he should be able to formulate plans for long and short range planning and actions. His motor skills include being able to operate switches and equipment when required. The conductor should have physical agility to the extent of being able to maneuver on and off cabooses and cars and perform some brakeman tasks occasionally. He must be an effective oral and written communicator as well as being able to recall information from such sources as rulebooks, notices and schedules.

And finally, the conductor must be able to effectively direct the work of the train crew, assume responsibility and provide direction during normal and adverse situations that may occur in the course of a trip.

### 3.3.2 Critical Areas of Knowledge and Performance

The critical areas of knowledge and performance that relate to the job of conductor stem from two sources. First there are the safety-related tasks that are performed by the brakeman such as switching, coupling and inspecting air brakes. For purposes of this report it is acknowledged that a conductor will likely have been previously employed as a brakeman and therefore possesses the knowledge and skills required of a brakeman. Second, there are the safety-related tasks that are inherent to the conductors job. These are primarily related to the duties of supervision, and assuming responsibility.

Much of the work of a conductor is involved in preparing and executing reports related to car handling and lading. Although there are many safety-related aspects to this work that are noted in the requirements, it was not considered as primarily safety-related and therefore not as evident in the requirements as it may be in actual practice.

In developing the knowledge, performance and training required for the conductor, the focus was in these two areas, namely the brakeman's tasks and those tasks that required the conductor to supervise or assume responsibility.

Table 3-4 specifies the minimum, safety-related knowledge requirements and Table 3-5 specifies the minimum, safety-related performance requirements for the conductor. In Table 3-6 are found the minimum training requirements for the conductor.

TABLE 3-4 CONDUCTOR MINIMUM KNOWLEDGE REQUIREMENTS

A conductor must demonstrate a practical knowledge and understanding of at least the following subjects which are applicable to a railroad's modes of operation:

A. Railroad Organization

1. Supervisory structure of the assigned division

2. Duties and authority of the members of tbe train crew, engine crew, yard crew, crew dispatcher, yardmaster, train dispatcher, agents and operators

B. Basic Principles of Personnel Supervision

1. Methods for developing mutually respectful working relationships and conveying the importance of safety in the discharge of duties

2. Use of praise and criticism in evaluating job performance

C. Railroad Equipment

1. Locomotives and cars

   a. Basic types of locomotives, cabooses and cars in service to include flat, hopper, boxcar, gondola, tank and their ladings

   b. Location and use of flagging, first aid, fire fighting and repair equipment

2. Sidings and towers

   a. Locations and car capacity of sidings and type of derail available, e.g., hand thrown, pipe connected

   b. Locations of towers

3. Yards

   a. For road conductors, the location, designation and car capacity of tracks for set offs and pick ups within yard limits

   b. For yard conductors, the function, location and use of main tracks, classification tracks and associated signals, hump facilities and retarders

TABLE 3-4 CONDUCTOR MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

D. Railroad Rules and Regulations

1. Rules of safety and personal conduct while working on or near railroad equipment
2. Rules for signals and their use
3. Rules for the protection of trains and track work
4. Rules for the movement of trains and operation of switches
5. Timetable, special rules, and notices
6. Required brake tests and inspections (Power Brake Law)
7. Radio rules including those of the Federal Communications Commission
8. Hours of service regulations
9. Forms of train orders
10. Provisions of Federal regulations related to safety appliances and handing of hazardous material

E. Railroad Operations

1. Signals
   a. Flagging signals
      1) Signalling procedures involving hands, flags, lanterns, paddles, torpedoes and fusees
      2) Basic types of flagging signals, i.e.:
         - Movement (e.g., stop, reduce speed, proceed, back up)
         - Air brake (e.g., apply, release)
         - Defect (e.g., sticking brakes, dragging equipment)
         - "Blue flag"
      3) Procedures and precautions for signalling while riding side ladders
   b. Wayside signals
      1) Types of wayside signals, e.g., train order boards, automatic block, home interlocking
      2) Aspects and indications of all signals
   c. Whistle/horn signals
   d. Radio set operating procedures

TABLE 3-4 CONDUCTOR MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

2. Switches

   a. Types of switches, e.g., electrical lock, mechanical time lock, dual control

   b. Component parts, e.g., ball or weight, arm or lever, latches, release lever, lock hole, banners, switch point

   c. Operating procedures and precautions concerning flying levers, falling balls or weights and alignment of switch points

3. Couplers

   a. Component parts and associated equipment, e.g., knuckle, coupler housing, coupler, knuckle pin, lift lever rod and holder

   b. Uncoupling procedures and precautions

   c. Coupling procedures, precautions and inspections

4. Air brakes

   a. Basic principles of operation for the air brake system

   b. Major components, i.e., brake pipe, reservoirs, brake cylinder, rigging, shoes, cut-out valve, retainer valve

   c. Required inspections of brake pistons and shoes during air brake testing

   d. Function and operation of the retainer valve

   e. Purpose of and procedures for bleeding air

   f. Air hoses

      1) Component parts and associated equipment, i.e., hose connection, angle cock, handle and gasket

      2) Procedures and precautions for connecting air hoses

      3) Procedures and precautions for breaking air hose connections when cars pull apart and when disconnecting by hand

      4) Procedures for replacing hoses and changing gaskets

5. Hand brakes

   a. Component parts, e.g., handwheel, release lever and rigging

   b. Procedures and precautions for setting and releasing

TABLE 3-4 CONDUCTOR MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

6. Back-up hose and conductor's valve

   a. Purpose and use of back-up hose; associated brake test

   b. Purposes and use of conductor's valve

7. Derails and rerails

   a. Purposes of derails and rerails

   b. Procedures and precautions in the use of derails and rerails

8. Preparation for movement and trip coordination

   a. Required supplies and documents for trip

   b. Requirements to verify and report changes in load consist information, as a result of pick-ups and set-offs, before the train is ready for movement

   c. Procedures for registering at intermediate stations

   d. Procedures for picking up train orders

9. Underway inspections

   a. Requirements for inspecting the conditions of own and passing trains for dragging equipment, shifted load, hot boxes, sticking brakes, open doors (especially refrigerator cars), etc.

   b. Technique for calculating train speed

   c. Procedures for reporting and/or correcting dangerous and defective conditions

10. Documentation

   a. Use of reports on cars picked up or set off, e.g., train list, wheel report, blind siding report

   b. Use of reports on trip, e.g., conductor's trip record, train register, delay report

   c. Use of reports on defects, damage or accidents, e.g., defective car report or bad order form, accident report, personal injury and property damage reports

F. Personal Safety

1. Proper method of mounting, dismounting and riding on the side ladders of cars and walkways of locomotives

TABLE 3-4 CONDUCTOR MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

2. Requirements for safe and protective clothing

3. Hazards to be encountered while walking on or about yard trackage, e.g., moving cars on adjacent track, falling objects, electrical equipment

G. Railroad Terminology Required for Reliable Communication

1. Standard railroad terms

2. Local railroad terms

TABLE 3-5 CONDUCTOR MINIMUM PERFORMANCE REQUIREMENTS

A conductor must demonstrate an ability to perform satisfactorily at least the following activities which are applicable to a railroad's modes of operation:

A. Initial Operations

1. Obtain or receive required trip information, such as notices from bulletin boards timetable changes, standard railroad time, train list and train orders

2. Verify that the car numbers of the train agree with the train list and that the cars are correctly blocked

3. Supervise the coupling of the locomotive consist to the load consist

4. Perform a walk-around inspection, noting:

   - Location(s) of hazardous materials and high or wide loads
   - Positions of brake pistons and shoes
   - Integrity of couplings
   - Position of handle on angle cocks
   - Positions of hand brakes
   - Condition of wheel flanges
   - Presence of tools, supplies, flagging equipment

5. Perform a roll-out inspection, noting and taking appropriate actions regarding sticking brakes, dragging equipment, open doors or shifted loads

6. Use the radio to request a clearance from the yard master to proceed and inform the engineer that the caboose is moving (when applicable on long trains)

B. Over-the-Road Operations

1. As necessary, use hand and lantern signals to direct the engineer to stop, reduce speed, proceed, back up, release air brakes, and apply air brakes

2. Ensure the proper deployment of any required torpedoes and fusees

3. Ensure compliance with whistle/horn signals, such as "Flagman protect rear of train" and "Inspect train line for leak or for brake sticking"

4. Supervise the unlocking, aligning and relocking of switches

5. Supervise car pick-ups and set-offs, to include:

   a. Opening, aligning and locking switches; cleaning switch points, where required

TABLE 3-5 CONDUCTOR MINIMUM PERFORMANCE REQUIREMENTS (Cont.)

b. Coupling and uncoupling cars, i.e.:

- Giving proper signals for movement and stopping
- Aligning couplers and operating lift levers
- Connecting and disconnecting air hoses
- Verifying that the coupling is successful

c. Ensuring that required air brake tests are performed

d. Reporting sufficient or insufficient air pressure in the caboose as a result of underway air brake test(s)

e. Cutting out air brakes on a car

f. Removing and setting a derail on a siding

g. Bleeding reservoirs on a set-off car

6. Supervise the replacement of a knuckle

7. Supervise the replacement of an air hose and changing of a gasket

8. Supervise the setting and releasing of hand brakes and verify correct brake position

9. Register at intermediate stations, as required

10. Continually inspect own and passing trains, reporting such items as a hot box, dragging equipment, shifted load, sticking brakes, sliding wheels, and open doors

11. Signal passing trains of their status after inspection

12. Calculate the approximate speed of the train using mileposts and a watch

13. Operate a wayside telephone

14. Pick up train orders from an order stand

15. Use the back-up hose to control and stop the train during backing

16. Maintain or complete required record forms, such as train lists, train register, delay reports, defective car report and accident reports

C. Contingency Operations

1. Ensure train protection (front and/or rear, as required) in the event of an unscheduled stop

2. Secure any loose cargo

3. Operate the conductor's valve

TABLE 3-5 CONDUCTOR MINIMUM PERFORMANCE REQUIREMENTS (Cont.)

4. Set and release brake retainers, when appropriate

5. Notify the dispatcher or supervisor of any hazardous wayside condition, e.g., defective switches, improperly displayed signals, objects fouling the track, fires, vandalism

D. Terminating Operations

1. Herd the train into the yard

2. Submit train documents to the appropriate authorities

3. Supervise the uncoupling of the engine, aligning of switches and setting of brakes along the way to the enginehouse

TABLE 3-6 MINIMUM TRAINING REQUIREMENTS FOR THE CONDUCTOR

The following major topics of instruction and estimated training hours as they are applicable to a railroad's modes of operation, constitute what is recommended as minimum training requirements for the conductor:

| A. CLASSROOM TRAINING | Estimated Min. Hours |
|---|---|
| 1. Review of Railroad Objectives and Organization | 2 |
| a. Roles of safety and efficiency in railroad operations | |
| b. Duties and authority of a conductor | |
| c. Duties and authority of supervisors to whom the conductor reports and other railroad personnel who work with and under the authority of the conductor. | |
| 2. Railroad Terminology Required for Reliable Communication | 1 |
| 3. Basic Techniques of Personnel Supervision | 2 |
| 4. Railroad Equipment | 6 |
| a. Review of the basic types of locomotives, cars and cabooses in service and their major operational and safety components | |
| b. Locations of towers and train order stands | |
| c. Locations, car capacity and type of derail at each siding along the route | |
| d. For road conductors, the designation, location and car capacity of tracks for set offs and pick ups within yard limits | |
| e. For yard conductors, the function, location and designation of all yard trackage and associated signals, hump facilities | |
| 5. Railroad Rules and Regulations | 44 |
| a. Railroad operating rules, to include: | |
| • Rules of signals, signalling and the movement of trains<br>• Rules for the operation of switches and derails and the associated movement of trains<br>• Rules associated with the operation and inspection of brakes<br>• Timetable and associated special rules and notices<br>• Rules for radio operation (Federal Communications Commission rules)<br>• Rules for movement by train orders and forms of train orders | |
| b. Regulations on permitted hours of service | |

TABLE 3-6 MINIMUM TRAINING REQUIREMENTS FOR THE CONDUCTOR (Cont.)

| | | Estimated Min. Hours |
|---|---|---|
| | c. Provisions of Federal regulations related to safety appliances and the handling of hazardous material | |
| 6. | Review of Signals, Signalling and Communications | 4 |
| | a. Various types of flagging devices employed and the meaning of each | |
| | b. Aspects and indications of the various types of wayside signals | |
| | c. Locomotive whistle/horn signals and communicating signals | |
| | d. Radio equipment procedures | |
| | e. Techniques for providing clear and concise oral and written communications | |
| *7. | Switches and Switching | 2 |
| | a. Various types of switches and derails in use | |
| | b. Component parts and operation | |
| *8. | Coupling and Uncoupling Procedures | 2 |
| | a. Method for coupling and uncoupling cars, including signals for movement | |
| | b. Method for replacing a knuckle | |
| | c. Proper speeds for coupling | |
| 9. | Review of Air Brakes | 8 |
| | a. Basic operating principles of the air brake system and the function and location of major components | |
| | b. Power Brake Law and the items to be checked during brake tests | |
| | c. Situations requiring the conductor to: | |
| | . Cut out air brakes on a car<br>. Use retainer valve<br>. Bleed air<br>. Make service and emergency brake applications | |
| | *d. Methods for connecting, disconnecting, replacing and maintaining air hoses | |
| 10. | Preparation for Movement and Trip Coordination | 6 |

TABLE 3-6 MINIMUM TRAINING REQUIREMENTS FOR THE CONDUCTOR (Cont.)

| | | Estimated Min. Hours |
|---|---|---|
| | a. Required supplies and documents | |
| | b. Requirements for noting the location of hazardous materials and overdimension cars | |
| | c. Requirements for verifying and reporting load consist changes and readiness of train for movement | |
| | d. Procedures for registering at stations and picking up train orders | |
| | e. Technique for calculating train speed while underway | |
| 11. | Emergency Situations | 4 |
| | Instructions for handling accidents and emergency situations (e.g., hot box, fire, crew injury) | |
| 12. | Documentation | 6 |
| | a. Types of safety-related reports generated or used by the conductor and their purposes (e.g., train list, defective car report) | |
| 13. | Review of Personal Safety Considerations | 1 |
| | Total Minimum Classroom Hours | 88 |
| B. | YARD TRAINING | |
| *1. | Equipment Inspections | 4 |
| | a. Review of the items to be inspected on own train while underway and passing trains | |
| | b. Review of the items to be inspected while standing (e.g., brake piston and shoe positions, couplings, air hose connections, condition of lading) | |
| | c. Procedures for correcting and/or reporting defective conditions | |
| *2. | Back-Up Hose and Conductor's Valve | 2 |
| | a. Purposes, use and associated test for the back-up hose | |
| | b. Purposes and use of the conductor's valve | |
| 3. | Rerails | 2 |
| | a. Functions and applications for rerails | |

TABLE 3-6 MINIMUM TRAINING REQUIREMENTS FOR THE CONDUCTOR (Cont.)

| | Estimated Min. Hours |
|---|---|
| b. Procedures for use | |
| Total Minimum Yard Hours | 8 |
| C. ON-THE-JOB QUALIFICATION TRAINING | |
| To qualify as a fully operational freight train conductor, it is recommended that the graduate from previous training phases complete 8 days of on-the-job training over the territories in which the trainee will work, carrying out job responsibilities under appropriate supervision | |
| Total On-The-Job Qualification Hours | 64 |
| TOTAL ESTIMATED MINIMUM TRAINING HOURS | 160 |

*For trainees with recent experience as brakemen, this item may be omitted or covered only in very general terms

## 3.4 BRAKEMAN

### 3.4.1 Job Summary

At one time the term "Brakeman" may have described the major activity of this member of the train crew in setting and releasing hand brakes. Today, with air brakes, the emphasis in the job of a brakeman has shifted to the activities associated with setting off and picking up cars and train protection.

When setting off and picking up cars, the brakeman may be involved in throwing switches, uncoupling and coupling cars and connecting and disconnecting air hoses. These tasks, and the related actions of climbing on and off of cars are probably the tasks most likely to produce serious personal injury in all of railroading.

When serving as a flagman the brakeman assumes the responsibility of maintaining the safety of his own and any approaching train. Other major activities involve the setting and releasing of retainers, inspection of own and other trains for hazardous conditions and assisting the conductor in correcting defective conditions.

To accomplish these tasks a brakeman should posses certain functional capacities. He should have motor skills and strength to enable him to manipulate switches and lift lever arms, and physical agility to maneuver on and off cabooses and cars.

The brakeman must be able to accept and understand directions from the conductor. He must be able to communicate effectively by the spoken word and be able to report signals (when in the cab) and inspect trains.

### 3.4.2 Critical Areas of Knowledge and Performance

For each of the jobs discussed in this report, the enumerated tasks are fundamentally related to the safe movement of trains. The brakeman, in conjunction with the performance of tasks related to the safe movement of trains, is exposed to many conditions which involve personal risk. Accident data indicate an overrepresentation of the brakeman in personal injury, railroad accidents. Thus, in developing the knowledge, performance and training requirements for the brakeman the focus was on those aspects of task performance which were related to the safe movement of trains and the personal safety of the brakeman.

No distinctions were made between the jobs of front end and rear brakeman. Although it is recognized that some railroads require a specific amount of experience as a front end brakeman before being permitted to qualify for

a rear (or flagman) position, it was felt that the basic duties were quite similar (except for some differences, such as calling signals in the cab, or using the back-up hose in the rear). As listed, the knowledge, performance and training requirements are applicable to both positions.

Table 3-7 specifies the minimum, safety-related knowledge requirements, and Table 3-8 specifies the minimum, safety-related performance requirements for the brakeman. In Table 3-9 are found the minimum training requirements for the brakeman.

TABLE 3-7 BRAKEMAN MINIMUM KNOWLEDGE REQUIREMENTS

A brakeman (front end and rear end) must demonstrate a practical knowledge and understanding of at least the following subjects which are applicable to a railroad's modes of operation:

A. Railroad Organization

1. Supervisory structure of the assigned division
2. Duties and authority of the members of the train crew, engine crew, yard crew and the crew dispatcher

B. Locomotives and Cars

1. Basic types of locomotives, cabooses and cars in service, e.g., flat, hopper, boxcar, gondola, tank and their ladings
2. Location and use of flagging, first air, fire fighting and repair equipment and the locomotive emergency brake valve

C. Railroad Rules and Regulations

1. Rules of safety and personal conduct while working on or near railroad equipment
2. Rules for signals and their use
3. Rules for the protection of trains and track work
4. Rules for the movement of trains and operation of switches
5. Timetable, special rules, and notices
6. Required brake tests and inspections (Power Brake Law)
7. Radio rules including those of the Federal Communications Commission
8. Hours of service regulations

D. Railroad Operations

1. Signals
   a. Flagging signals
      1) Signalling procedures involving hands, flags, lanterns, paddles, torpedoes, fusees

TABLE 3-7 BRAKEMAN MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

2) Basic types of flagging signals, i.e.:

- Movement (e.g., stop, reduce speed, proceed, back-up)
- Air brake (e.g., apply, release)
- Defect (e.g., sticking brakes, dragging equipment)
- "Blue flag"

3) Procedures and precautions for signalling while riding side ladders

b. Wayside signals

1) Types of wayside signals e.g., train order boards, automatic block, home interlocking

2) Aspects and indications of all signals

c. Whistle/horn signals

d. Radio set operating procedures

2. Switches

a. Types of switches, e.g., electric lock, mechanical time lock

b. Component parts, e.g., ball or weight, arm or lever, latches, release lever, lock hole, banners, switch points

c. Operating procedures and precautions concerning flying levers, falling halls or weights and alignment of switch points

3. Couplers

a. Component parts and associated equipment, e.g., knuckle, coupler housing, coupler, knuckle pin, lift lever rod and holder, air hose

h. Uncoupling procedures and precautions

c. Coupling procedures, precautions and inspections

4. Air brakes

a. Major components of the air brake system, i.e., brake pipe; reservoirs; brake cylinder, rigging, shoes, cut-out valve; retainer valve

b. Required inspections of brake pistons and shoes during air brake testing

c. Function and operation of the retainer valve

d. Purpose and procedure for bleeding air

e. Air hoses

1) Component parts and associated equipment i.e., hose connection, angle cock, handle and gasket

TABLE 3-7 BRAKEMAN MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

2) Procedures and precautions for connecting air hoses

3) Procedures and precautions for breaking air hose connections when cars pull apart, and when disconnecting by hand

4) Procedures and precautions for dumping air

5) Procedures for replacing hoses and changing gaskets

5. Hand brakes

a. Component parts, e.g., handwheel, release lever and rigging

b. Procedures and precautions for setting and releasing

6. Back-up hose and conductor's valve

a. Purpose and use of the back-up hose and conductor's valve

b. Operating procedures and associated brake test

7. Equipment inspection

Requirements for inspecting the conditions of own and passing trains for dragging equipment, shifted load, hot box, sticking brakes, open doors, (especially refrigerator cars), etc.

E. Personal Safety

1. Mounting, dismounting and riding on cars, including:

a. Proper method of mounting, dismounting and riding on the side ladders of cars and walkways of locomotives

b. Precautions to be observed, e.g., clearances between train and wayside objects and/or other trains

2. Requirements for safe and protective clothing

3. Hazards to be encountered while walking on or about yard trackage, e.g., moving cars on adjacent track, falling objects, electrical equipment

F. Railroad Terminology Required for Reliable Communications

1. Standard railroad terms

2. Local railroad terms

TABLE 3-8 BRAKEMAN MINIMUM PERFORMANCE REQUIREMENTS

A brakeman (front end and rear end) must demonstrate an ability to perform satisfactorily at least the following activities which are applicable to a railroad's modes of operation:

A. Initial Operations

1. Obtain or receive required trip information, such as notices from bulletin boards, timetable changes, and standard railroad time

2. Assist in coupling the locomotive consist to the load consist

3. Perform a walk-around inspection, noting:

   - Location(s) of hazardous materials and high or wide loads
   - Positions of brake pistons and shoes
   - Integrity of couplings
   - Position of handle on angle cocks
   - Positions of hand brakes
   - Presence of tools, supplies, flagging equipment
   - Condition of wheel flanges

4. Perform a roll-out inspection, noting and taking appropriate actions regarding sticking brakes, dragging equipment, open doors or shifted loads

5. Operate the radio set as required

B. Over-the-Road Operations

1. As necessary, use hand and lantern signals to direct the engineer to stop, reduce speed, proceed, back up, release air brakes, and apply air brakes

2. Deploy torpedoes and fusees

3. Comply with whistle/horn signals, such as "Flagman protect rear of train," and "Inspect train line for leak or for brake sticking"

4. Call all signals when in the cab

5. Assist in the set-off and pick-up of cars

   a. Open, align, lock and inspect switches; clean switch points as required

   b. Couple and uncouple cars, to include:

      - Giving proper signals for movement and stopping
      - Using a back-up hose to control back-up movement
      - Aligning couplers and operating lift levers
      - Manually connecting and disconnecting air hoses
      - Verifying that the coupling is successful

TABLE 3-8 BRAKEMAN MINIMUM PERFORMANCE REQUIREMENTS (Cont.)

c. Report sufficient or insufficient air pressure in the caboose as a result of underway air brake test(s)

d. Cut out air brakes on a car

e. Remove and set a derail on a siding

f. Bleed reservoirs on a set-off car

6. Replace a knuckle

7. Replace an air hose and change a gasket

8. Set and release hand brakes and verify correct brake position

9. Continually inspect own and passing trains, reporting such items as: a hot box, dragging equipment, shifted load, sticking brakes, sliding wheels and open doors

10. Operate a wayside telephone

11. Signal passing trains of their status after inspection

12. Operate the locomotive emergency brake valve and conductor's valve

C. Contingency Operations

1. Protect the train (front and/or rear, as required) in the event of an unscheduled stop

2. Walk ahead of the train inspecting for unsafe conditions, if authorized

3. Secure any loose cargo

4. Set and release brake retainers, when authorized

5. Notify the supervisor of any hazardous wayside condition, e.g., defective switches, improperly displayed signals, objects fouling the track, fires, vandalism

D. Terminating Operations

1. Herd the train into the yard

2. Uncouple the engine and accompany it to engine house, aligning switches along the way and setting brakes where required

TABLE 3-9 MINIMUM TRAINING REQUIREMENTS FOR THE BRAKEMAN

The following major topics of instruction and estimated training hours, as they are applicable to a railroad's modes of operation, constitute what is recommended as minimum training requirements for the brakeman (front end and rear end):

| A. CLASSROOM TRAINING | Estimated Min. Hours |
|---|---|
| 1. Railroad Objectives and Organization | 2 |
| a. Roles of safety and efficiency in railroad operations | |
| b. Duties of a brakeman | |
| c. Duties and authority of immediate supervisors and crew members who work with the brakeman | |
| 2. Railroad Terminology Required for Reliable Communication | 2 |
| 3. Railroad Equipment | 3 |
| a. Basic types of locomotives in service and their major operational and safety components | |
| b. Types of cars and cabooses in service and their major operational safety components | |
| 4. Railroad Rules and Regulations | 6 |
| a. Purpose of rules | |
| b. Railroad operating rules, to include: | |
| • Rules of signals, signalling and the movement of trains<br>• Rules for the operation of switches and the associated movement of trains<br>• Rules associated with the operation and inspection of air and hand brakes<br>• Rules associated with the use of timetables, supplementary notices and special rules<br>• Rules for radio operation (including Federal Communications Commission regulations)<br>• Rules for personal safety | |
| c. Regulations on permitted hours of service | |
| 5. Signals and Signalling | 3 |
| a. Use of the various types of flagging devices employed and the meaning of each | |
| b. Aspects and indications of the various types of wayside signals in use | |

TABLE 3-9 MINIMUM TRAINING REQUIREMENTS FOR THE BRAKEMAN (Cont.)

| | Estimated Min. Hours |
|---|---|
| c. Requirements for calling signals when in the locomotive cab | |
| d. Locomotive whistle/horn signals | |
| e. Radio equipment procedures | |
| 6. Air Brakes | 1 |
| Basic operating principles of the air brake system and the major system components | |
| 7. Personal Safety Considerations | 1 |
| a. Responsibilities for the safety of oneself and fellow workers | |
| b. Safe and protective clothing to be worn while on duty | |
| Total Minimum Classroom Hours | 18 |
| B. YARD TRAINING | |
| 1. Personal Safety | 2 |
| a. Hazards to be encountered and precautions for walking in yards and/or near tracks | |
| b. Proper method of mounting, dismounting and riding on side ladders of cars and walkways of locomotives; associated precautions | |
| 2. Switches and Switching | 2 |
| a. Various types of switches in use (e.g., dual control, electric lock ) and their component parts | |
| b. Switch and derail operation | |
| 3. Coupling and Uncoupling | 2 |
| a. Coupler operation, component parts and associated equipment | |
| b. Method for coupling and uncoupling cars, including signals for controlling the speed and direction of train movements | |
| c. Precautions when moving between cars and when coupling and uncoupling cars | |
| d. Method of replacing a knuckle | |

TABLE 3-9 MINIMUM TRAINING REQUIREMENTS FOR THE BRAKEMAN (Cont.)

| | Estimated Min. Hours |
|---|---|
| 4. Air Brakes | 4 |
| a. Purpose and use of the locomotive emergency brake valve | |
| b. Items to be checked during brake test | |
| c. Function and operation of the retainer valve | |
| d. Purpose and instructions for bleeding of air | |
| e. Air hoses | |
| • Component parts of the air hose assembly<br>• Method for connecting and disconnecting air hoses<br>• Procedures for installing a new gasket and replacing a hose | |
| f. Purpose and use of the back-up hose | |
| g. Purpose and use of the conductor's valve | |
| 5. Hand Brakes | 1 |
| a. Component parts of hand brakes and associated equipment | |
| b. Procedures for setting, releasing and checking the position of the hand brake | |
| 6. Equipment Inspections | 1 |
| a. Requirements for inspecting and reporting the condition of own and passing trains, including specific situations/conditions to be noted | |
| b. Procedures for correcting and/or reporting defective conditions | |
| Total Minimum Yard Hours | 12 |

C. ON-THE-JOB QUALIFICATION TRAINING

To qualify as a fully operational brakeman, it is recommended that the graduate from previous training phases serve as an apprentice brakeman in both yard operations and on road trips for 5 days. This should be done under the direct supervision of a senior conductor or train/yard master. Day and night shifts should be more or less evenly

TABLE 3-9 MINIMUM TRAINING REQUIREMENTS FOR THE BRAKEMAN (Cont.)

| | Estimated Min. Hours |
|---|---|
| distributed. Where distinctions are made between yard and road brakeman, the on-the-job qualification training should be weighted in favor of the intended working situation. | |
| Total On-The-Job Qualification Hours | 40 |
| TOTAL ESTIMATED MINIMUM TRAINING HOURS | 70 |

## 3.5 TRAIN DISPATCHER

### 3.5.1 Job Summary

The job of the train dispatcher has been described in a comprehensive report by Devoe (1974) i.e., An Analysis of the Job of Railroad Train Dispatcher. In addition to analyzing each of the dispatcher's tasks, the report discusses the characteristics and problems associated with the job and the personal attributes of a dispatcher in terms of physical and psychological factors.

Basically, the train dispatcher is responsible for the safe movement of trains within a defined area of a railroad's operating territory. In this capacity, the dispatcher plans operations, coordinates movement of trains, and manages contingencies as they arise. To accomplish these tasks, the train dispatcher must be familiar with the organization of the railroad, the types of equipment employed in terms of locomotives and rolling stock, the territory over which the railroad operates, train control operations including the maintenance of records, and the railroad's rules and regulations.

In planning operations, the dispatcher obtains information from superiors, the previous dispatcher on duty and other informational sources on the condition of trains, tracks and the weather. Routing and scheduling decisions are made to move traffic in the most expeditious manner.

To coordinate the movement of trains, the dispatcher must be versed in the operation of such train control systems as train order, centralized traffic control (CTC) or traffic control system (TCS), automatic and manual block or whichever combinations of these are in effect in his territory. Communications via radio, telephone or in a written form must be initiated and monitored and information disseminated to the various railroad personnel involved in train movements. In addition, all actions that are taken, milestones that are achieved and unusal situations that arise must be precisely recorded in special record forms.

The most taxing aspect of the dispatcher's job is the management of contingencies such as equipment malfunctions and adverse weather and track conditions. The dispatcher must be able to detect and compensate for these situations in a timely and effective manner so as not to compromise the safe movement of trains.

Because the dispatcher's duties encompass practically all aspects of an operating railroad, he must possess a wide variety of knowledge. In the area of railroad organization, the dispatcher must be familiar with the functions performed by the various railroad departments and the duties and authority of key personnel. In the area of railroad equipment, the dispatcher

must know the capabilities and limitations of each locomotive type and the characteristics of various types of rolling stock and lading, particularly special cars and hazardous lading.

To make effective decisions on train movements, the dispatcher must also be familiar with the physical characteristics of the territory under his control, such as the location of sidings, grades and highway crossings. When controlling in train order territory, the dispatcher must thoroughly understand the implications of each form of train order as well as the procedures for its implementation. When controlling in CTC territory the dispatcher must know the function of each control and indicator on the CTC board and associated rules of operation.

One of the most outstanding characteristics of a dispatcher is his role as a supervisor and decision-maker. In these capacities he must be able to think quickly and project the consequences of his decisions into the future to ensure their accuracy. As a leader and primary command and control agent for the railroad, the dispatcher must be able to command the respect of all operating personnel who must abide by his decisions, especially under the chronic and sometimes excruciating stress which permeates his job environment.

### 3.5.2 Critical Areas of Knowledge and Performance

In developing the job knowledge, performance and training requirements, the focus was solely on safety. No consideration was given to those elements of the dispatcher's job that would contribute only to greater efficiency and cost-saving to the carrier.

Another area of concern was complex situations that confront a dispatcher. When events occur one at a time, a dispatcher usually has sufficient time and available alternatives to cope with the situation. However, when several events occur at the same time or when one event triggers others, such as when a delayed train affects the schedule of several others, the dispatcher's task loading is significantly greater. It is not possible to predict all of the various combinations of events that could confront a dispatcher. Because the guidelines for this study specified minimum requirements, the handling of complex and unpredictable interactions of events was considered beyond the scope of the study. Also, it was assumed that since dispatcher functions being considered were for an entry-level position, a more senior individual such as the chief or assistant chief dispatcher would always be available for advice on handling complex situations.

Although the dispatcher's personal safety is not as involved in his job performance as it is for the other railroad positions in this study, the enormous amount of responsiblity which he bears for the safety and well-being of others makes nearly every decision and action a critical, safety-related item.

Table 3-10 specifies the minimum safety-related knowledge requirements and Table 3-11 specifies the minimum safety-related performance requirements for the train dispatcher. In Table 3-12, are found the training requirements for the train dispatcher.

TABLE 3-10 TRAIN DISPATCHER MINIMUM KNOWLEDGE REQUIREMENTS

A train dispatcher must demonstrate a practical knowledge and understanding of at least the following subjects which are applicable to a railroad's modes of operation:

A. Railroad Organization

1. Functions performed by such departments as Safety, Signal and Communication, Mechanical, Engineering, Maintenance of Way, Car, Bridge and Building, Police and Fire, and Transportation

2. Duties and authority of key operational personnel such as chief and assistant chief train dispatcher, train and engine crew, operators, yardmasters, and railroad transportation officials associated with the movement of trains

B. Railroad Rolling Stock and Lading

1. Trains

   a. Designations and composition of basic types of trains, such as passenger (local commuter, through), freight (general purpose, unit, run through, local) mixed freight and passenger, wreck, and work

   b. Typical operational characteristics for each type of train

2. Locomotives

   a. Power and/or tonnage ratings

   b. Basic components (power and braking systems)

   c. Capabilities, limitations and restrictions on operation

3. Cars and lading

   a. Basic types of freight and passenger cars

   b. Special types of cars and track equipment (e.g., track cars, on-track equipment, hy-rail vehicles)

   c. Basic components (e.g., air brake system, trucks, drawbars, journals)

   d. Restrictions on movement for particular ladings, and high or wide loads

C. Railroad Territory

1. Geographical and physical characteristics of the operating territory under control, to include the location of such items as:

   - Wayside signals (type, function)
   - Crossings, crossovers, switches
   - Sidings (length)
   - Major changes in grades and curves

TABLE 3-10 TRAIN DISPATCHER MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

- Stations, yards, interlockings
- Narrow and low passages
- Bridges, drawbridges, tunnels, trestles
- Railroad and highway grade crossings
- Terrain threat areas (e.g., flooding, washouts, landslides)
- Vandalism threat areas

2. Jurisdictional boundaries of towns along tbe right of way

D. Rules and Regulations

1. Railroad operating rules (with particular attention to any changes in rules) governing:

   - Dispatchers and operators
   - Signals, interlockings and switches
   - Movement of trains and engines
   - Movement by train orders
   - Movement by automatic block signals (ABS)
   - Movement by manual block signals (MBS)
   - Movement by automatic cab signals
   - Movement by automatic train control (ATC), automatic train stop (ATS)
   - Movement by centralized traffic control (CTC) or traffic control system (TCS)
   - Issuance of clearances
   - Issuance of radio and telephone communications (including Federal Communications Commision rules)

2. Federal regulations governing safety appliances and the transportation of hazardous materials

3. Hours of service regulations and labor agreements

E. Train Control Operations

1. General design and operational features of the train control system(s) in service, e.g., train order, CTC or TCS, ABS, MBS, ATC, ATS, automatic cab signals and verbal train control

2. Operating features of communications systems, such as telephone (railroad and commercial), radio, and printer systems (where applicable)

3. Techniques for providing clear and concise oral and written communications

4. Information to be received prior to going on duty and to be transmitted prior to going off duty

TABLE 3-10 TRAIN DISPATCHER MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

5. Location and function of all controls and displays at the dispatching work station (with special emphasis on the consequences of actions taken when operating CTC controls)

6. Implications of starting, stopping and moving trains when considering:

   a. Environmental, geographic and track conditions such as weather, grades and curves, highway grade crossings, and sidings

   b. Special trains and cargoes such as overdimension cars, special cargoes and priority trains

7. The forms and procedures for issuing, recording, verifying and annulling train orders

8. Format, required entries and use of such documents as:

   - Rulebook
   - Timetable and Special Instructions
   - Train Dispatcher's Record of Movement of Trains (Train Sheet)
   - Train Order Book
   - Work Orders
   - Transfer Book or Sheet
   - Track Permits (CTC)
   - Train Consist Reports
   - Train Charts
   - CTC Graphs

F. Contingency Operations

1. Sources of assistance for unplanned events and emergencies, such as variations from scheduled movements (slow or late movements), equipment malfunctions (e.g., switches, hot box detector), environmental degradation (e.g., flooding, snow blockage), track damage, train problem (hot box, break-in-two, derailment) and a train collision

2. Possible corrective actions for unplanned events and emergencies

G. Arithmetic Computations

1. Running times and delays of trains between points

2. Locomotive requirements in terms of horsepower and/or tonnage for a planned trip

3. Lengths of trains and siding capacities

TABLE 3-10 TRAIN DISPATCHER MINIMUM KNOWLEDGE REQUIREMENTS (Cont.)

H. Effective Job Performance

1. General fitness requirements

2. Major sources of performance decrements, such as attitude, distraction, anxiety, fatigue, and physical impairments (e.g., alcohol, drugs, injury, diseases, sensory or motor impairment)

I. Railroad Terminology Required for Reliable Communication

1. Standard railroad terms

2. Local railroad terms

TABLE 3-11 TRAIN DISPATCHER MINIMUM PERFORMANCE REQUIREMENTS

A train dispatcher must demonstrate an ability to perform satisfactorily at least the following activities which are applicable to a railroad's modes of operation:

A. Relieving Dispatcher on Duty

1. Obtain or receive and acknowledge receipt of required information, such as:
   - Notices from bulletin boards or books
   - Instructions from supervisors (e.g., chief or assistant chief train dispatcher)
   - Location and identification of all trains within area of responsibility
   - Outstanding train orders, clearances, and track permits
   - Priority or dangerous cargoes
   - Locations of work crews, track cars and on track equipment which relate to or affect movement of trains
   - Special condition or situations
2. Determine the available duty time of train and engine crews
3. Verify the status and readiness of all support equipment (e.g., CTC boards, hot box recorders, communications equipment)

B. Planning Operations

1. Obtain information on trains from designated personnel, to include locomotive and load consists, weather and track conditions, and any special handling information
2. Formulate routing or scheduling plans (as applicable) in accordance with rules of safety, the timetable, and the existing traffic situation

C. Coordination of Train Movements

1. Observe and follow movements of each train and work crew within the territory of responsibility employing, where appropriate, the CTC board, radio and telephone communications links, and the Train Dispatcher's Record of Movement of Trains
2. Monitor and annotate hot box detector recordings, as required
3. Receive and issue traffic and equipment advisories
4. Receive requests for, and generate train clearances
5. Receive requests for, and generate track permits for maintenance of way activities, specifying time permits and employing appropriate protection techniques
6. Generate and issue train orders and instructions to meet such requirements as:
   - Fixing a meeting point for two trains
   - Directing a train to pass or run ahead

TABLE 3-11 TRAIN DISPATCHER MINIMUM PERFORMANCE REQUIREMENTS (Cont.)

- Giving right over an opposing train
- Giving right over another train in same direction
- Issuing time orders (running late, waiting)
- Running sections
- Running extra trains
- Issuing a holding order
- Annulling a schedule or a section
- Annulling an order or part thereof
- Superseding an order or part thereof
- Temporarily suspending CTC and ABS from service
- Issuing slow and cautionary orders
- Providing for movement against the current of traffic
- Designating speed restrictions
- Issuing temporary stop orders
- Issuing protection orders
- Issuing a timetable
- Providing for check of trains

7. Coordinate movements initiated or extending beyond own territory of responsibility

8. Use a CTC board (where applicable) to designate and establish a clear routing, block signals and switches, and remove a portion of track from service

9. As applicable, maintain such official records as the Train Order Book, Train Dispatcher's Record of Movement of Trains (Train Sheet), Transfer Book, Work Permits, and CTC Graphs

10. Arrange for the pick up and set off of cars

11. Issue train schedule information to work crews and track cars

D. Management of Contingencies

1. Detect and appropriately respond to unplanned events, such as:

   a. Deviations from scheduled or planned movements, e.g., extra train movements, higher priority movements, and slow or late movements

   b. Malfunctions of equipment, e.g., signal and/or switch, communications equipment, hot box detector, CTC display/control board

   c. Other unplanned events, e.g., break-in-two, hot box, adverse weather conditions, dragging equipment, derailment within yard, requirement to relay priority information, vandalism, unknown object on tracks, requirement to replace a crew en-route, and a sick or injured crew member

2. Respond to emergencies resulting from:

   a. Train operation, e.g., derailment, collision, train fire, broken axle, brake failure, engine failure, and a communications failure

   b. Road bed or track conditions, e.g., trestle or bridge damage, road bed damage, track obstruction, and rail damage

TABLE 3-11 TRAIN DISPATCHER MINIMUM PERFORMANCE REQUIREMENTS (Cont.)

c. Environmental conditions, e.g., terrain slide, flooding, track washout, and snow blockage

E. Preparation for Going Off Duty

1. Update transfer book
2. Transmit required information to relief dispatcher (see A.1)
3. File necessary reports with appropriate parties

TABLE 3-12 MINIMUM TRAINING REQUIREMENTS FOR THE TRAIN DISPATCHER

The following major topics of instruction and estimated training hours, as they are applicable to a railroad's modes of operation, constitute what is recommended as minimum training requirements for the train dispatcher:

| | | Estimated Min. Hours |
|---|---|---|
| **A.** | CLASSROOM TRAINING | |
| 1. | Review of Railroad Objectives and Organization | 4 |
| | a. Roles of safety and efficiency in railroad operations | |
| | b. Organization of the operating departments | |
| | c. Duties and authority of a dispatcher | |
| | d. Duties and authority of supervisors to whom the dispatcher reports and other railroad personnel who work with and under the authority of the dispatcher | |
| 2. | Railroad Terminology Required for Reliable Communications | 4 |
| 3. | Locomotives, Rolling Stock and Lading* | 8 |
| | a. Types of trains in service in the assigned territory | |
| | b. Locomotives in service and their power and/or tonnage ratings, capabilities, limitations and restrictions on operation | |
| | c. Nomenclature and function of types of cars in service; restrictions on the movement of high and wide loads and hazardous materials | |
| 4. | Railroad Rules and Regulations | 80 |
| | a. Operating rules, e.g.: | |
| | . General rules<br>. Rules and instructions governing dispatchers and operators<br>. Rules governing signals, interlockings and switches<br>. Rules governing movement of trains and engines<br>. Rules for movement by train orders<br>. Rules for movement by automatic block signals<br>. Rules for movement by manual block signals<br>. Rules for movement by automatic cab signals<br>. Rules for movement with Automatic Train Control (ATC) and Automatic Train Stop (ATS)<br>. Rules for movement by Centralized Traffic Control (CTC) and Traffic Control Systems (TCS)<br>. Rules governing issuance of clearances<br>. Rules governing radio and telephone communication | |

*Visits to yards to view actual equipment are recommended to supplement classroom instruction.

TABLE 3-12 MINIMUM TRAINING REQUIREMENTS FOR THE TRAIN DISPATCHER (Cont.)

| | Estimated Min. Hours |
|---|---|
| b. Federal regulations governing safety appliances and the handling of hazardous material | |
| c. Hours of service regulations and labor agreements | |
| 5. Basic Signal and Train Order Operation* | 24 |
| a. Operational characteristics of each train control system in service, e.g.: . Train order . CTC or TCS . Cab signals and automatic and manual block systems . ATC or ATS . Verbal train control | |
| b. Operating features of each communications system in service, e.g.: . Telephone (railroad and commercial) . Radio (including Federal Communications Commission rules) . Printer Systems (where applicable) | |
| c. Function and location of all controls and displays associated with the dispatching work station (with special emphasis on the environmental effects of operating certain CTC controls) | |
| d. Procedures for handling train orders, to include issuing, recording, verifying and annulling the various forms of train orders | |
| 6. Documentation | 8 |
| a. General requirements for maintaining complete, accurate, concise and legible written records | |
| b. Format, entry requirements and use of each document employed by the train dispatcher (e.g., Train Order Book, Transfer Book, Train Dispatcher's Record of Movement of Trains) | |
| 7. General Operating Procedures | 20 |
| a. Relieving the dispatcher prior to going on duty | |
| b. Obtaining planning information (e.g., condition of power and load consists, weather and track information, special handling information, traffic and equipment advisories) | |
| c. Formulating routing and scheduling plans in accordance with the Operating Rules, timetable and existing traffic situation | |

*Visits to appropriate dispatching facilities to view on-going operations are recommended to supplement classroom instruction.

TABLE 3-12 MINIMUM TRAINING REQUIREMENTS FOR THE TRAIN DISPATCHER (Cont.)

| | Estimated Min. Hours |
|---|---|
| d. Monitoring and predicting the movements of trains | |
| e. Generating track permits and train clearances | |
| f. Monitoring and annotating hot box detector recordings | |
| g. Coordinating movements initiated or extending beyond own territory | |
| h. Arranging for pick up and set off of cars | |
| i. Issuing train schedule information to work crews and track cars | |
| j. Expediting enroute train crew changes | |
| k. Briefing of relief dispatcher prior to going off duty | |
| 8. Management of Contingencies | 8 |
| a. Unplanned events and emergencies requiring action by the dispatcher | |
| b. Available resources and countermeasures for dealing with unplanned events and emergencies | |
| 9. Techniques for Clear and Concise Telephone and Radio Communication | 1 |
| 10. Effective Job Performance | 3 |
| a. General fitness requirements | |
| b. Sources of performance decrements (e.g., alcohol, drugs, fatigue) | |
| Total Minimum Classroom Hours | 160 |
| B. ON-DIVISION TRAINING | |
| The trainee should be given two days to ride in the locomotive cab over the territory for which he will be responsible as a dispatcher. It is during this time that he should be come familiar with such physical characteristics of the territory as the location of sidings, crossovers, crossings, bridges, tunnels, significant changes in grade and curvature, set off and pickup points and jurisdictional boundaries along the right of way. | |
| Total Minimum On-Division Hours | 16 |

TABLE 3-12 MINIMUM TRAINING REQUIREMENTS FOR THE TRAIN DISPATCHER (Cont.)

| | Estimated Min. Hours |
|---|---|
| C. ON-THE-JOB QUALIFICATION TRAINING | |
| To qualify as a fully operational train dispatcher, it is recommended that the graduate from previous training phases perform as a full-time apprentice for a period of at least four weeks under the cognizance of a fully qualified dispatcher, at the desk where the trainee will ultimately operate. The trainee should be exposed to both day and night-time tricks. | |
| Total Minimum On-The-Job Qualification Hours | 160 |
| TOTAL ESTIMATED MINIMUM TRAINING HOURS | 336 |

# 4. BACKGROUND FOR THE CONDUCT OF TRAINING

## 4.1 TYPES OF TRAINING

In general, the approaches to job training fall into two major categories: informal and formal. As context for the discussions contained within this chapter and elsewhere throughout the report, these approaches to training will be briefly defined and contrasted.

### 4.1.1 Informal Training

On-the-job training (OJT), in its classic sense, is the essence of an informal training approach. It consists of placing the trainee (apprentice) in the actual job environment as an observer and practitioner of job elements under the supervision and guidance of a competent job holder. The job holder serves as the instructor or manager of training.

The major thrust of this approach is skill development through the process of "learning by doing." Job knowledge and skills are acquired in a concurrent fashion with the trainee observing the performance of the job holder, asking questions, being told information, being asked questions and actually performing parts of the job. It is generally an unstructured and uncontrolled experience subject to the sometimes distracting influences of the real-world job environment. The quality of learning is a function of the proficiency of the job holder and his natural ability to instruct, as he likely has not been formally trained in teaching techniques.

Although the control and structure inherent in formal training is basically lacking in an informal approach, it has been shown that, given enough time, trainees in an OJT situation can eventually learn the job. In this situation, training costs are apparently minimal if one doesn't consider the time spent in training. However, the quality of instruction is only as good as the individual job holder acting as an instructor.

While informal training is largely an unprogrammed procedure, it has an important role as a method for job qualification. OJT is a particularly important phase for skill refinement in the railroad jobs which are the subject of this report. If minimizing training time is not an overriding concern due to the low number of candidates to be qualified and the infrequency of the need to train candidates, then an informal training approach has merit. This assumes, of course, that the job holders selected to train candidates are competent. However, informal training cannot realistically be expected to bear the brunt of the burden for training in the railroad industry today. The efficiencies and training effectiveness provided by formal training are apparently demanded, in many cases, by immediate needs for

trained railroad personnel, especially railroad engineers. As a consequence, the focus of this training requirements analysis was directed at a specification of learning experiences imbedded mostly within the context of a formal training program.

### 4.1.2 Formal Training

In contrast to informal approaches, the objectives of a formal training program are to provide planned, structured, and controlled learning experiences to meet visible and understandable learning goals which are termed behavioral or training objectives. In a formal training program, student achievement or non-achievement of learning goals is evaluated through written testing of job knowledge and performance testing of job skills.

The major elements and processes of a formal training program may be summarized in the following fashion:

- Thorough analysis and articulation of job knowledge and performance requirements, incorporating "need to know or do" (job performance related) items versus "nice to know or do" (general interest) items.

- Development of behavioral or training objectives in support of the previous analysis. Such objectives should embody a specification of what behaviors should be demonstrated during or after instruction, the conditions under which the behaviors are to be demonstrated, and the standards of performance (evaluative criteria) which trainees must meet in performing the required behaviors.

- Partitioning of training objectives into units of instruction (the aggregate constituting the entire training program) governed by lesson plans outlining the methods, procedures, basic content and strategy for knowledge and skill development.

- Careful selection of instructors to moderate the learning experience who are both subject matter experts and effective communicators (i.e., are verbally articulate, perceptive of and sensitive to the responses of students to their instruction).

- Use of training facilities with demonstrated learning effectiveness, such as a classroom for the development of job knowledge, equipment and system mock-ups and simulators for the development of job skills.

- Interim and final evaluation of student progress via oral and written examinations of acquired job knowledge, and standardized assessment of job performance.

In contrast to a purely informal training approach, one can see that a properly managed formal training program can result in a highly focussed, efficient and consistent means for qualifying job candidates. The key to success would be the quality of the aforementioned elements and processes in developing and implementing the program.

A formal approach to training can substantially reduce the total time spent by a candidate in training when compared to that consumed by pure OJT. Formal training also is economically justified by frequent needs to train a group of candidates at one time, as quickly as possible. There are greater apparent personnel and material costs associated with many formal training programs. However, these costs should be justified by the efficiency of training achieved (considering the number of candidates qualified over time), the consistency of training achieved (everybody is trained to the more or less same standards of excellence by a standard instructional staff using the same course guidance documentaion), and the proficiency of course graduates upon entering their jobs.

## 4.2 TRAINEE PREREQUISITES AND SELECTION

The success of a training program in producing proficient performers, is greatly influenced by the qualities and background of the trainees who enter the program. Someone who is unmotivated, and lacking aptitude for the job requirements will be a poor candidate for training. Thus, it is prudent to select those candidates for training whose experience, capabilities and attudes are consonant with job requirements.

Some of the factors which might be considered in a trainee's background and experience prior to acceptance into a training program are age, health, education level and previous work experience. As a minimum it would seem desirable that a candidate be able to read, speak and understand the English language. Previous railroad experience is seen as desirable background for the selection of job training candidates, with the exception of the brakeman which is an entry-level job for the railroad industry. Some railroad carriers have apparently had success in training people for the jobs of engineer and conductor who have come in "off the street." However, selecting candidates for engineer, dispatcher and conductor training programs from among the ranks of in-service personnel does have significant potential payoffs. Namely, such a procedure will enable the carrier to gain some appreciation of such relevant qualities of the candidate as interest in and aptitude for railroading, willingness to accept responsibility, integrity, conscientiousness, etc. Screening of a candiate's previous on-the-job performance would tend to minimize the chances of expending valuable training resources on someone who is unsuitable.

From a review of carrier promotional policies it seems evident that engineer training candidates have been frequently drawn from the ranks of brakemen and firemen, conductors from the ranks of brakemen and trainmen, and train dispatchers from the eschelons of tower operators and train directors. These are merely examples of previous jobs which have been deemed as relevent past experience for the jobs which are the subject of this report and do not exhaust all possibilities.

With regard to specific techniques for selecting training candidates, several warrant discussion. First, the opportunity should be extended to any candidate to volunteer for training, based upon a notice of solicitation and brief statement of job requirements, salary, and opportunities for advancement. Such an approach will identify people who of their own volition aspire to the job in question. Such intrinsic job motivation is desirable.

A personal interview will uncover additional information about a candidate's sincerity of job interest, level of motivation, and character. If the candidate is a current employee of the carrier or previous employee of another carrier, then a review of his job record to date would be most valuable to include ratings of supervisors, results of tests taken, fitness reports, etc.

The area of psychological testing for selection is one which is receiving some attention by carriers today. Psychological tests may address such areas as general intelligence, specific aptitudes and achievements (e.g., mechanical, mathematical, etc.) and traits or states of mind (e.g., manifest anxiety, authoritarianism, etc.). Although the perennial questions of validity and reliability may be raised about the entire concept of psychological testing (i.e., do tests measure what they profess to measure in a consistent fashion?), there is reason to believe they may be useful diagnostic tools when applied in concert with other approaches. The utility of psychological testing or screening of railroad employees is one deserving of further attention and research.

In summary, the importance of selecting a candidate for training best suited to the requirements of the job is paramount from the standpoints of both the candidate and the employer.

## 4.3 INSTRUCTOR CHARACTERISTICS

In choosing instructors for training endeavors, there are several general areas of qualification which should be considered. First, the individual should be thoroughly knowledgeable in the subject matter of the course having what is called "subject matter expertise." Second, the individual should have a dem-

onstrated ability to communicate and instruct via oral and written methods coupled with a competence in human relations. Third, an instructor should have an infectious enthusiasm for his subject matter and instructional duties. Such an enthusiasm, or lack thereof, is quite apparent to students and greatly affects their attitudes towards course material.

For the classroom phases of instruction stipulated in the training requirements, the instructor with the most complete qualifications should be selected. For the OJT phases of training, the qualifications may be relaxed somewhat in the area of instructional competence. More specifically, such an individual wouldn't necessarily have to have the poise and technique of a classroom instructor, but would have to have subject matter expertise, enthusiasm, and an ability to communicate and teach practical matters.

It is suggested that instructors selected for classroom duties be people who formerly held or presently hold (with distinction) the job being trained. For railroad engineer training, individuals with backgrounds such as road foremen of engines or travelling engineer should be considered. In regard to train dispatcher training, persons with backgrounds as chief or assistant chief dispatchers should be considered. For conductor and brakeman training, senior conductors or trainmasters may be considered. Corporate officers with these backgrounds could also be very well suited to the task. The previous suggestions are only examples of relevant operational backgrounds for instructors and are not meant to be construed as an exhaustive itemization. For OJT instructors, special consideration should be given to competent job holders (engineers, dispatchers, conductors) with demonstrated skill in interpersonal relations who would volunteer to assume responsibility for guiding a trainee's apprenticeship.

## 4.4 TRAINING RESOURCES

Certain facilities and equipment must be available for conducting programs of training.

### 4.4.1 Classroom Facilities

For the development of required job knowledge, the classroom environment is the most effective medium, even though a considerable amount of operational job knowledge will be derived from the OJT setting.

As a minimum, classrooms should be commodious, cheerful, well lighted and ventilated. They should contain a lectern for the instructor's lesson plans, notes and references. A chalkboard should be centrally located at the front of the room. In addition, if the instructor wishes to make use of audio-visual materials to support the instruction (prudent use of these materials is recom-

mended as they are attention-getting and potent channels through which information may flow to the learner), a projection screen and chart stand should be located at the front of the room. The classroom should contain a sufficient number of comfortable seats with writing surfaces for note taking. Seats should be arranged to give an unobstructed view of the instructor and any training aids he may employ.

4.4.2 Reference Materials

Certain reference materials should be available to trainees during and after formal training hours. References, of a general nature, which might be considered for use in training programs for the engineer and dispatcher are the latest editions of the following:

- For the Engineer

  - Association of American Railroads and the Railway Progress Institute. Track train dynamics-guidelines for: train handling, train makeup, track and structure, engineer education. Chicago: Author, 1973.

  - Association of American Railroads and the Railway Progress Institute. Track train dynamics to improve freight train performance thru: train handling, train makeup, track and structure, engineer education. Chicago: Author, 1973.

  - The Air Brake Association. Management of transportation and train handling. Chicago: Author, 1972.

  - The Railway Fuel and Operating Officers Association. Diesel-electric locomotives-questions and answers on machinery, air brake operation. Chicago: Author, 1971.

  - The Railway Fuel and Operating Officers Association. The modern locomotive handbook. Chicago: Author, 1972.

- For the Dispatcher

  - Devoe, D.B. An analysis of the job of railroad train dispatcher. Report No. FRA-ORD&D-74-37. Cambridge, Mass.: DOT/Transportation Systems Center, April, 1974.

Individual carriers should consider preparing their own student textbook materials, tailored to their course content. Other valuable references specific to any given railroad, which should be available to all trainees are:

- Copies of the latest editions of operating rules, and special instructions; such material appears to be well suited to incorporation in programmed texts

- The Timetables

- Samples of the safety-related report forms and records the individual must complete from time to time on the job

4.4.3 Simulation and Mock-Up Facilities

These are special and sophisticated forms of training aids. Simulation provides the opportunity for trainees to operate replica or actual operational equipment in a simulated, but highly realistic, operational setting. Fundamental to the training effectiveness of a simulator are the following features:

- The ability for an instructor to control the scope and difficulty of the operational training problem to meet training objectives and student proficiency levels

- The capacity for a student to operate equipment and simulated vehicles without the risk of accident or injury which could result from gross operating errors in the real world with the real equipment

- The ability to confront a wide range of normal and emergency operating conditions in a relatively short period of time which would be difficult, dangerous or impossible to schedule in the real world during OJT

Within the railroad industry, simulators have been used for the training of railroad engineers. The Atchison, Topeka & Santa Fe and the Southern Pacific railroads both have sophisticated engineer training simulators in service. The Burlington Northern is in the process of acquiring one shortly. Simulator based training programs have apparently received a great deal of acceptance by the industry and are achieving some considerable time savings in the qualification training and retraining of railroad engineers. The Railroad Education Bureau of the Simmons-Boardman Publishing Company is furthering the notion of regionalized, simulator-based training for candidate engineers from many railroads. Such a concept entails the development of basic knowledge related to the operation of trains and, most fundamentally, the development of basic train handling skills on a simulator. Comprehensive training and testing on operating rules and route familiarization would be matters for individual railroads. Thus, although not all railroads can afford or justify the costs of owning individual simulators themselves, the concept of centralized or regionalized simulator training is undergoing serious cost-benefit analysis by the railroad industry.

In consideration of a developing simulator technology in the training of railroad engineers, the training requirements analysis for the railroad engineer does consider a simulator training phase in lieu of train operation on captured or off-line trackage. For the purposes of this report, the following generalized capabilities of an engineer training simulator are assumed:

- Faithful reproduction of the physical dimensions, layout, functioning and kinds of operating equipment (displays and controls) to be found in a locomotive cab

- Availability of an instructor's problem control capability, to include provisions for the:

  - start, freeze, and recycling of training exercises
  - insertion of equipment malfunctions (e.g., sticking brakes, air pressure leakage, sanding malfunction, traction motor malfunction, low oil or water pressure, overheated engine, low main reservoir pressure, etc.)
  - introduction of emergency conditions such as dynamic brake failure, break-in-two, unintentional brake release, etc.

- Realistic and representative dynamic portrayal of the outside cab visual environment during problem runs (e.g., view of trackage, signals, wayside terrain, passing trains, etc.), with associated track-train dynamics induced by the operation of throttle and brakes over track geometry

- Realistic portrayal of auditory cues associated with the use of the throttle, air brakes, whistle/horn, bell and events happening in the outside environment

- Simulation of train radio operations

- Representation of problem associated motion cues along the "x," "y" and "z" axes (e.g., slack adjustments, use of power and brakes) This is desirable, but possibly not essential, given an OJT follow-up phase

Mock-ups of equipment without the associated operational dynamics may also be useful training aids. Schematic cutaways of equipment and comprehensible diagrams serve to provide trainees with insight which can reinforce their understanding and application of requisite operational procedures.

### 4.4.4 OJT Facilities

These training facilities include the real equipment in the operational setting and qualified job holders serving as models of performance and in-

structors. Trainees should be able to observe and perform operational functions in the job setting, commensurate with their current and developing skill levels and under the supervision of qualified personnel.

For all occupations under study, some period of structured OJT should be required prior to any final assessment of job knowledge (especially operating rules) and certification of requisite job performance.

## 4.5 MANAGEMENT OF TRAINING

### 4.5.1 Knowledge Development

In regard to the development of background knowledge in support of job performance requirements, some understanding of the equipment design (type and functional interrelationships of major components) and theory of operation is desirable for the systems and equipment which will be operated. However, extensive descriptions of minute system components could unduly burden trainees--especially if the individual will have little or no opportunity to use this knowledge and understanding on the job. It is not, however, sufficient to teach a trainee just rote operational procedures without giving him some idea of underlying principles and rationale--the whys and wherefores related to what he has to do. This understanding is essential for two major reasons:

- To enhance the reliability and accuracy of on-the-job performance; knowing why certain things must be done helps one to remember what has to be done

- To establish and maintain student motivation, self-esteem and encourage a professional attitude toward job performance

The guiding principle for establishing the breadth and depth of required student knowledge is a determination of the essentiality of any knowledge for reliable and accurate on-the-job performance.

The use of lesson plans in classroom instruction is essential to a well conceived and carried out program of formal instruction. The classic lesson plan contains four parts: a preparation phase where the unit training objectives are communicated to the trainees; a presentation phase where the content of the lesson is developed by the instructor; an application phase where the content of the lesson is applied to job requirements; and an evaluation phase where the instructor interrogates the class to determine assimilation of lesson content. Classroom lesson modules should run no more than 50 minutes in length, with a 10 minute break between modules.

Training aids should be given careful consideration for embellishing and reinforcing course content. If well prepared and effectively utilized, such training aids as motion pictures, overhead transparencies, slides, flipcharts, videotape recordings, models, etc. can provide variety and enhance the quality of instruction.

The training requirements analysis does assume that trainees will be given homework assignments in support of classroom activities. All aspects of course subject matter are subject to independent or home study by trainees prior to the material being covered, reinforced and expanded upon in class. Independent study assumes that relevant textbook materials such as those suggested in Section 4.4.2, are available to trainees. Of particular importance would be homework assignments in the area of rules training. Much efficiency in learning can be gained if, prior to covering a certain section of rules in class, the trainees have an opportunity to review the content of the particular rule(s) outside of class. Such an opportunity would be afforded via a specific homework assignment made with a reasonable lead time.

Case study and problem solving approaches are particularly well suited to the development and application of job knowledge. In the case of operating rules, it is recommended that much of the class time be spent not in reviewing content of operating rules line by line, but in having trainees apply what they have learned about operating rules, primarily through independent study, to operating situations and circumstances postulated in the classroom. The case study/problem solving approach is an ideal way to do this. The instructor could prepare descriptions of operational situations, based on real life occurrences, which involve a specific operating rule or several rules and require students to apply the rule(s) to determine the safe course of action.

Field trips to operational work sites during the course of instruction should also be considered. Prudently scheduled trips do much to stimulate the interest of trainees and concretely reinforce class learning. Field trips are recommended, as appropriate, in the training requirements.

### 4.5.2 Skill Development

The primary means for the development of job performance requirements is through observation and operation. Assuming that the trainee has been given the minimum required background knowledge, he now has the opportunity to observe the performance of the job and to perform and practice all the elements of the job in order of progressive difficulty. As mentioned earlier, observation and operation may take place in the real

world or simulated environments. Structured and repeatable training exercises designed to meet specific training goals should govern skill development during formal training. With OJT, there is less control of the training problem.

Information processing, decision-making, and procedural skills may also be practiced and developed in the classroom through problem solving and case studies. Application of rules knowledge to operational situations (in essence a skill) can be conducted through the case study method in the classroom as discussed earlier. In addition, simulated pencil and paper problems for training dispatchers are possible. Hypothetical dispatching situations could be posed by the instructors and students could be asked to formulate the appropriate train orders. Various dispatcher record keeping functions (use of train sheets, train order book, transfer book) could also be practiced in the classroom.

# 5. CONSIDERATIONS FOR THE EVALUATION OF PROFICIENCY

## 5.1 OBJECTIVES OF EVALUATION

Simply stated, evaluative methods and techniques are directed towards objective answers to the following questions:

- Does the candidate or job holder possess the knowledge required for safe and proficient job performance?
- Can the candidate or job holder meet the performance requirements demanded by the job?

Measurement techniques provide the data by which evaluative decisions may be made. Succeeding sections will examine measurement techniques which are appropriate to knowledge and performance evaluation.

## 5.2 KNOWLEDGE EVALUATION

### 5.2.1 Written Tests

For the reasons of efficiency, coverage, and consistency, written test instruments are the backbone of knowledge assessment. There are two basic types. The first is the recognition type where the learner must select the correct response from amongst several alternatives for each test item. The second is the supply type where the learner must supply, via recall, the correct answer to a question.

Although easy to construct and administer, supply type instruments (i.e., completion tests, and essay tests) because of the subjective nature of the answers are difficult to score. Completion items frequently engender mechanistic or rote memory responses. Essay tests do allow for considerable sampling of the depth of a learner's knowledge, but are limited in terms of their ability to cover a range of knowledge. For these reasons supply test items are not recommended for extensive application in the testing of railroad knowledge.

Of the recognition type, the true/false test is a well known variant. It lists as its advantages: ease in developing a large number of items which can cover a large content area in a relatively short period of time, and rapid and easy scoring. Among its disadvantages are two significant ones. First, unless the language of the question is precise, there is a chance for misinterpretation. Specifically, it is difficult to generate statements which are absolutely true or false without qualification or exceptions. Second, the

guessing factor is 50:50 and this would generally preclude the true/false item from entirely composing a test.

Receiving considerable use in knowledge testing is the multiple choice test item. In this case, the learner is required to choose the correct answer from among a set of alternatives (generally 4 to 5 in number). This form of test item yields a more reliable measure of learning as the effect of guessing is reduced. The plausible incorrect alternatives can require the learner to make fine discriminations. Scoring of this type of test is quite easy. The potential drawbacks for this form of testing are that good test items do require care and time to construct. Long questions and numerous alternatives can increase reading time and result in fewer items being incorporated in a test.

When constructing multiple choice test items, several suggestions should be borne in mind:

- The stem (question) should be a direct question
- The stem should set up a clear, definite and singular problem
- Any words which might otherwise be repeated in each response, should be included in the stem
- The correct response should not be systematically different from the other responses
- If possible, the alternatives should be presented in some logical or systematic order
- All responses should be made plausible and attractive to the less knowledgeable student
- Each test item should stand alone; a former response should have no bearing on an item which follows it
- The correct choice should be randomly positioned among the alternatives

The third form of recognition testing is the matching test item. In this case, the learner must match each element of a list of content items with another list of content items. This is a compact and efficient way of making a rapid survey of similar content categories (e.g., symptoms, definitions, terminology, etc.). However, it is not well suited for the measurement of higher order abilities. Great care is also needed to avoid awkward arrangements of items. When constructing matching test items, the following points should be considered:

- A given matching sequence should be confined to a single page
- Responses used should be related, but mutually exclusive
- The number of items to be matched should be relatively small (6-8)

- The number of possible responses should exceed the number of items to be matched by two or three
- The directions should clearly indicate the basis for matching
- The statements in the response column should be kept short

In consideration of the nature and breadth of material constituting required background knowledge for the railroad jobs under study, it is recommended that the recognition type of written test be emphasized in formal, written examinations. The multiple choice form of recognition tests appears best suited to handle the majority of testing requirements, augmented by true/false and matching test items as desired. (See Appendix A for sample written test items for each job). Supply test items appear to be best suited to short, informal quizzes which would be reviewed and corrected in class. Here the requirements for ease and objectivity in scoring would not be as great as with final or formal written exams.

### 5.2.2 Oral Tests

Formal, oral testing of student knowledge is not feasible unless the class size is rather small (not exceeding 5 or 6 people). It does permit in depth responses, but is rather time consuming. The problem of scoring is complicated by the natural tendency of instructor and student to assist someone who is having difficulty with a particular question. Moreover, grading by an instructor has to be more or less instantaneous (without too much time to reflect upon a student's answer), or the procedure becomes tedious for the other students. Oral testing is therefore not recommended for formal evaluation purposes.

However, frequent and recurring oral interrogation of students is essential to the conduct of an effective training program. Such informal oral testing during classroom training is necessary for the instructor to know if the students are assimilating the course material. Informal oral testing during skill development phases (OJT, simulators) is useful to measure a student's grasp of procedures and required actions which may be unsuitable or difficult to assess in the job or simulated environments. Instead of creating concrete situations in all cases and requiring trainees to demonstrate the appropriate action(s), a hypothetical situation can be raised in a question by the instructor and students can be asked what they would do in response. Some examples of topics suitable to in situ knowledge testing (real world job environments, simulated environments):

- Knowledge and application of operating rules
- Knowledge of the physical characteristics of the operating territory
- Knowledge of malfunction trouble shooting, and emergency procedures

### 5.2.3 Approaches to Knowledge Evaluation

One must assume that classroom material presented to the trainees consists only of essential background knowledge which will reinforce and support their job performance. Given this, then the knowledge test instruments should be designed to measure a student's grounding in the required knowledge as well as his application of this knowledge to appropriate job performance situations. Although some straight feedback of facts, definitions, concepts is desirable via written tests, rote knowledge testing should not be emphasized. In job qualification or final written exams, a majority of questions should be developed that assume possession of certain knowledge and require trainees to apply that knowledge (principles, facts, procedures) correctly in the solving of job performance problems. This approach is of particular importance for testing a trainee's grasp of operating rules. Recitation of the content of operating rules will not assure that they will be applied correctly on the job.

With any of the railroad jobs in question, it is impossible to conduct complete tests of job knowledge. Thus training administrators are confronted with the task of developing written test instruments which will validly sample requisite job knowledge. As a rule, the weighting of sampling for knowledge tests should reflect the emphasis in training hours given individual topics of instructions during formal training phases.

## 5.3 PERFORMANCE EVALUATION

### 5.3.1 Rating of Performance

Fundamental to the determination of job proficiency is an assessment of job performance in the real world. This generally involves direct observation of job performance. Where it is possible, measures taken of human performance should be objective and quantitative, assuming that the measures may be related to some criteria of acceptability (further discussion of criteria appears in Section 5.4).

Where performance of a job itself is being objectively and quantitatively measured, in contrast to a concrete product produced by job performance, appropriate classes of measures taken fall into two major categories:

- Time (to accomplish certain tasks, perform required operations)
- Accuracy (precision in the control of certain equipments, vehicles, accuracy of estimates or computations, judgments, etc.)

These categories of measurement have to be assigned to appropriate aspects of job performance. Once it is decided which aspects of job performance are suitable to time and accuracy measurement, decisions have to be made as to how the measures will be obtained. Automated scoring of time and accuracy is one possibility, but likely only feasible in a simulated

environment. Measures of time and accuracy would likely have to be taken manually in the job setting, although a retrofit of scoring instrumentation is possible in some cases. Again, quantitative measures of performance are only of real benefit when some job standards or criteria are available by which the "goodness" or "acceptability" of obtained values of these measures may be determined. At present within the railroad-industry, such criteria appear to be basically unavailable. Of particular note is the joint government/carrier research program currently underway on track-train dynamics. The rigorous investigations being undertaken as to the dynamics of train motion and the effects of train handling procedures thereon, hold great promise for the identification and development of potentially useful quantitative measures for evaluating the railroad engineer's performance.

Not all aspects of job performance, whether due to an incomplete understanding of the job or the nature of the job itself, are amenable to objective scoring. For instance, the railroad employee's conformance to operating rules in a given situation, ability to anticipate potential problems, ability to perceive and react appropriately to a potentially dangerous situation are all examples of performance which appear to defy objective measurement. In these cases, and a multitude of others, performance measurement for the railroad jobs under study appears to be feasible only through direct observation and evaluation by job experts or evaluators. So-called ratings of job performance are prone to the criticism that they involve human judgment and that they may suffer from interrater reliability problems. The facts of life are, however, if any substantial and comprehensive evaluation is to be made of the performance of engineers, conductors, brakemen and dispatchers, it will be necessary for job experts to evaluate or rate the performance. Some evaluations will involve observing discrete tasks to see if they are performed completely and correctly within time constraints. In many cases this involves a basic yes/no decision on the part of the evaluator. In cases where functions and tasks are not easily broken down into manageable parts or where functions or sequences of tasks are performed repetitively throughout a tour of duty, then rating of a category of performance along a psychometric scale is appropriate.

In consideration of the foregoing, the recommended approach to performance measurement and evaluation employs job experts as performance evaluators during checkrides conducted in the job environment.* What is necessary to insure a comprehensive and consistent approach to the evaluation task is that evaluation instruments be made available to the job evalu-

*Where sophisticated training simulators are available, such checkrides could be accomplished in this setting. Such an evaluation could be more rigorous, as a range of normal operating conditions and emergency procedures could be presented which would be difficult to stage in the real world in a limited period of time.

ators. Drafts of such instruments for each of the jobs under study are included in Appendix B. Given the present understanding of the performance parameters operating for each job, rating job performance appears to be the most effective approach to performance evaluation.

### 5.3.2 Interrogation

As an ancillary and indirect performance measurement approach within the job context, interrogation has merit. The job context cannot be relied upon to provide a full range of contingencies for the job performer to accommodate during any given tour of duty. However, the performance evaluator may gain some valuable insight into the capacity of an individual to handle a given problem by posing a problem and asking "what would you do in this case?" Although a vicarious inquiry, it does provide the evaluator with information about a performer's readiness to respond which extends beyond the constraints of a given time and place.

## 5.4 EVALUATIVE CRITERIA

In regard to knowledge testing, one must ask the question, "what constitutes a passing score for a given examination?" The answer is not necessarily simple or straightforward. Assuming that a given test is a valid and reliable measure of required job knowledge (determining the validity and reliability of paper and pencil tests is a complex matter), then it remains to determine what minimum score is a passing score. When a test is first introduced, an arbitrary passing score may be assigned. Then to refine the accuracy of this absolute passing score, on the job, follow-up monitoring of the performance of those individuals with passing scores, would be necessary. Basically, this would involve determining how many of these people perform successfully on the job. Should, in the estimate of job experts, a significant number of individuals be judged as deficient in required job knowledge, then the existing passing score should be revised upward.

Another approach to the scoring and evaluation of written knowledge tests is not to set an absolute numerical passing score but to evaluate tests scores along a hypothetical "normal curve" of frequency distribution. The details of this method are beyond the scope of this discussion. Basically, any given test score is evaluated in terms of the average performance for all who have taken the exam. This method of test scoring is used frequently in the academic world. However, when considering the circumscribed objectives of training, average performance may not be a valid indicator of requisite job knowledge. An absolute passing score appears to be a necessity.

The concepts of absolute and relative evaluative criteria also apply to the assessment of job performance. Where valid, absolute criteria for job performance exist along the quantitative dimensions of time and accuracy or can be developed, they should be used to evaluate performance if the

associated performance measurements are feasible. Where absolute criteria are lacking and the quantitative measurements are available, then normative or average performance criteria may be applied. When neither of these criterial or measurement approaches are available, then the thrust of performance measurement will have to be that of structured human judgment of performance along the lines proposed.

## 5.5 SUGGESTED STRATEGY FOR EVALUATION

There are several recommendations for the conduct of knowledge and performance evaluation within the context of entry level job training.

Daily quiz and review sessions should be conducted during the course of classroom training. Quizzes can employ short answer questions and should be corrected and reviewed in class. A fairly comprehensive written examination of acquired knowledge, emphasizing recognition forms of test items, should be conducted at the end of formal training. Such an exam should sample requisite job knowledge acquired during classroom training. A passing grade on this examination should be a prerequisite to a candidate's enrollment in the on-the-job qualification phase of training.

Where elements of the job are practiced during formal training, performance could be evaluated using the appropriate versions of the performance rating forms suggested in Appendix B. At the conclusion of the on-the-job qualification phase, a very detailed and comprehensive test on operating rules should be administered to each candidate. This is desirable at this time, as operating rules will have likely taken on substantial practical meaning for the trainee during OJT. A passing score on this rules exam would be essential to job qualification, as would be a satisfactory rating of job performance on a final checkride.

# 6. GENERAL RECOMMENDATIONS

To maximize the value of the knowledge, performance and training requirements included within this report, it is recommended that the FRA distribute copies of these requirements to railroad carriers throughout the country for their critical comments. Incorporation of this feedback into modified recommendations will enhance their potential value to the industry and increase the likelihood of their adoption by the carriers.

Consideration should be given to intensive, additional study of the jobs of railroad engineer and train dispatcher. These job studies should be directed toward the identification and validation of objective, system-based performance criteria to uniformly evaluate proficiency. The track-train dynamics program and developing simulator technology are fertile media for doing this with the railroad engineer. Unfortunately, less well developed research media exist for explorations with the job of train dispatcher.

Obviously, considerably more work is needed on the development of standardized written achievement tests for railroad jobs. However, the effective development of standardized achievement tests seems dependent upon the existence of a standardized course curriculum for each railroad job in question. Such curricula do not presently exist.

The undertaking of efforts to develop standardized or guideline course curricula for the railroad engineer, conductor, brakeman and train dispatcher deserves early attention. Initial efforts should be directed at developing behavioral objectives that are consonant with the knowledge, performance and training requirements developed to date. These behavioral objectives should then be partitioned into units of instruction or lesson plans. Where certain units such as the design and operation of a specific locomotive, radio controlled equipment, or dynamic braking do not apply to all railroads, such lessons should be modularized so they may be used as needed by a carrier. Certain subject matter, such as operating rules, varies with respect to its organization and content among railroads. Lesson plans dealing with such subjects would have to be somewhat schematic in their outline of content. They should emphasize instructional methodology and leave the details of content to be filled in by a local instructor.

Lesson plans and exercises should be developed for all phases of classroom, equipment and field training. Each guideline curriculum package should contain not only detailed instructor's lesson plans, but student study guide and reference material tailored to course content. In addition, a course guide should specify for the training administrator what resources and procedures are essential to conduct the course.

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# APPENDIX A

# SAMPLE WRITTEN TEST ITEMS

## INTRODUCTION

Presented in this appendix are examples of approaches to the development of written test instruments for measuring job knowledge required for the railroad engineer, train dispatcher, conductor and brakeman. These exhibits are initial, first draft efforts at a definitive approach to the measurement and evaluational problem underlying the certification of job holders.

Only general reference materials were used in the preparation of sample questions to allow for the widest possible application to the industry. Specifically, the following documents were employed:

- Association of American Railroads. The standard code of operating rules. Chicago: Author, 1965.
- Association of American Railroads and the Railway Progress Institute. Track train dynamics-guidelines for: train handling, train makeup, track and structure, engineer education. Chicago: Author, 1973.
- Association of American Railroads and the Railway Progress Institute. Track train dynamics to improve freight train performance thru: train handling, train makeup, track and structure, engineer education. Chicago: Author, 1973.
- The Air Brake Association. Management of transportation and train handling. Chicago: Author, 1972.
- The Railway Fuel and Operating Officers Association. Diesel-electric locomotives-questions and answers on machinery, air brake and operation. Chicago: Author, 1971.
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The sample questions included for each job must not be construed as comprehensive tests of knowledge. They represent only examples of the kinds of items which could be used as part of an overall evaluation of job knowledge at the end of training.

The "correct answer" called for in all questions would be the most correct and most complete answer.

## SAMPLE WRITTEN TEST ITEMS FOR THE RAILROAD ENGINEER

1. A train of superior right is one which is given precedence by...

   a. Train order
   b. Gross tonnage
   c. Timetable
   d. Present speed
   e. Direction

2. The term "buff" describes...

   a. Stretching coupler forces
   b. The standard safety color for electrical hazards
   c. Compressive coupler forces
   d. The tendency for cars to lean when travelling around curves

3. A train of superior class is one which is given precedence by...

   a. Train order
   b. Gross tonnage
   c. Timetable
   d. Present speed
   e. Direction

4. Brake pipe gradient refers to...

   a. The drop in pressure which releases the brakes
   b. The increase in pressure experienced on an upgrade
   c. The difference between brake pipe pressure on the first and last cars of a train
   d. The tapering thickness of the brake pipe from the front to back of any car

5. As the length of a freight train increases, the release time for air brakes...

   a. Increases
   b. Stays about the same
   c. Decreases
   d. Increases and decreases unpredictably

6. The brake pipe flow indicator is a gauge which indicates...

   a. When a train is charged
   b. When excessive leakage is present
   c. When the brakes are being applied from the caboose
   d. All of the above

7. "Super light", minimum brake pipe reductions, which are then released without any additional reduction, can lead to...

   a. Stuck brakes
   b. "Freezing" of the automatic brake valve
   c. Unintentional application of independent brakes
   d. Automatic cut out of the interlock with dynamic braking

8. Break-in-two's are most frequently the result of...

   a. Failure of the dynamic brake/air brake interlock
   b. Failure of the sanding system
   c. Rapid running out of slack
   d. Rapid bunching of slack

9. Attempted graduated release of freight train brakes can cause...

   a. Cascading of brake shoes on alternate cars
   b. Unintentional release of brakes
   c. Rupture of the auxiliary and emergency reservoirs
   d. All of the above

10. An emergency brake application should be made only when...

    a. A malfunctioning or missing signal is observed
    b. Radio contact with the dispatcher is lost
    c. Forward visibility drops to less than 40 feet
    d. It is necessary to make the shortest possible stop

11. A penalty brake application results when...

    a. The pneumatic foot valve is not operated correctly
    b. The conductor feels that the train's speed is excessive
    c. The brake shoes on more than one axle of a locomotive wear down excessively
    d. The points of an upcoming switch are misaligned

12. "ENG 549 WORKS EXTRA 645 AM UNTIL 545 PM BETWEEN A AND B". Under this form of train order on a single track, the work extra must:

    a. Clear the time of regular trains and, whether standing or moving, provide flag protection in both directions.
    b. Clear the time of only other work trains and, whether standing or moving, provide flag protection only in the direction of movement.
    c. Clear the time of first class trains and, whether standing or moving, provide flag protection against second class and extra trains in both directions.
    d. None of the above.

13. When coming upon a red, burning fusee on or near the tracks, the engineer must...

    a. Immediately order a fusee thrown from the cab
    b. Assume or hold reduced speed before stopping the train within a half mile's distance
    c. Continue present movement if no hand, flag or lamp signals are visible
    d. Stop and then may proceed at reduced speed for not less than one mile

14. For a signal which is imperfectly displayed or missing at a location where a signal is usually shown, the engineer must assume that...

    a. The signal is being repaired and continue present movement
    b. Vandalism has occurred and report this immediately to the dispatcher
    c. The signal is displaying its most restrictive indication and respond accordingly
    d. None of the above

15. If while coordinating a backing movement by radio with a member of the rear end crew radio contact is broken, the engineer should immediately...

    a. Attempt to reestablish radio contact
    b. Stop the train
    c. Slow to minimum maintainable speed
    d. Sound two short blasts with the whistle/horn

16. When the train stops under circumstances in which it may be overtaken by another train, the engineer should...

    a. Immediately advise the dispatcher
    b. Reestablish train movement as soon as possible
    c. Immediately signal for protection of the rear of the train (and the front, if necessary)
    d. Order the crew to leave the train until movement can be reestablished

17. The whistle/horn signal to direct a flagman to protect the rear of the train is...

    a. Two long blasts
    b. One long and three short blasts
    c. Two short blasts
    d. Two long, one short, and one long blast

18. Which of the following situations would prevent the locomotive from moving when the throttle is opened...

    a. Defective main control fuse
    b. Hand or air brakes are set
    c. Reverser handle is in neutral position
    d. All of the above

19. A diesel-electric locomotive may be operated through water...

    a. Under no circumstances
    b. If the water is no more than 2 inches above the rail
    c. If the water is no more than 1 inch above the rail
    d. Of any depth, if the speed is slow enough

20. A steady "wheel slip indicator light" could mean a...

    a. Locked armature bearing
    b. Slipped pinion
    c. Broken ring gear
    d. Faulty wheel slip relay setting

## SAMPLE WRITTEN TEST ITEMS FOR THE CONDUCTOR

1. A conductor is responsible for the safe performance of duties by...

   a. Himself
   b. Himself and the rear brakeman only
   c. The train crew only
   d. Both the train and engine crew

2. When it is necessary to get off moving equipment, always step down first with the...

   a. Leading foot
   b. Right foot
   c. Trailing foot
   d. (Depends on which way the car is moving)

3. Blue signals displayed on a stopped car may be removed only by the...

   a. Brakeman with authorization from the conductor
   b. Conductor with authorization from the dispatcher
   c. Yardmaster
   d. Workmen who placed them

4. Three short whistle/horn blasts indicate that a standing train (not in an interlocking) is about to...

   a. Move forward
   b. Back-up
   c. Release air brakes
   d. Uncouple the lead from the trailing unit(s)

5. When the term "Signal Indication" is used, it refers to...

   a. The appearance of a fixed signal
   b. The information conveyed by the aspect of a signal
   c. The title given to the signal
   d. None of the above

6. A switch may be left open for a following train if...

   a. The conductor is sure that the following train requires an open switch
   b. The banner indicates the switch is open
   c. A member of the crew of the following train is left in charge of switch
   d. The dispatcher is notified

7. The normal position of a derail is...

   a. Non-derailing position
   b. Derailing position
   c. (There is no normal position, it depends on how it is used)
   d. Unlocked position

8. Reporting that a train is clear of the main track (where required) must not be made until the...

   a. Brakeman returns to the train
   b. Until last car clears the main track
   c. Under any circumstances
   d. Switch has been secured in the normal position

9. As a conductor of a slow moving extra train in automatic block territory, what kind of protection must you provide against following trains or engines on the same track...

   a. No protection is needed
   b. Rear of train must be protected
   c. Both front and rear of train must be protected
   d. Fusees must be dropped

10. If the timetable lists the train on which you are conductor as a second class train but your train order tells you to take a siding to allow an extra to pass, you should...

    a. Follow the timetable
    b. Follow the train order
    c. Stop movement and contact dispatcher
    d. None of the above

11. The following train order is received: NO 5 MEET EXTRA 95 EAST AT B. This is understood to mean that...

    a. The first train to arrive at B should take the siding
    b. No. 5 should take siding at B
    c. Extra 95 East should take siding at B
    d. (No information about which train should take the siding is understood from the train order, the dispatcher must designate how the meet should occur)

12. Which of the following modifications to train orders is not permitted...

    a. Adding
    b. Superseding
    c. Annulling
    d. Changing

13. On a single track, the superiority of trains is determined as follows...

    a. Right is superior to class or direction
    b. Class is superior to right or direction
    c. Direction is superior to right or class
    d. None of the above

14. A momentary pull on the release rod of an ABD control valve will release...

    a. Only the brake cylinder air pressure
    b. Only the auxiliary and emergency reservoir air pressure
    c. Both the brake cylinder air pressure and the auxiliary and emergency reservoir air pressure
    d. Main reservoir pressure

15. A back-up hose is used...

    a. As a replacement for a failed air hose
    b. To control throttle and brakes when backing-up
    c. To control brakes from rear when backing-up
    d. Instead of the reverse lever

16. When a retainer valve on a car is set to the "Ex" (exhaust) position...

    a. The brake cylinder air is released
    b. Main reservoir air is released
    c. The auxiliary and emergency reservoir air is released
    d. The brakes are released

17. The purpose of examining a passing train is to...

    a. Make sure that it is on schedule
    b. Count the number of cars if it has to take a siding
    c. Check for defects
    d. All of the above

18. A conductor is responsible for knowing (check all applicable statements)...

    a. How to take over control of the locomotive and proceed if the engineer becomes incapacitated
    b. How to stop a train in an emergency
    c. Capacity of sidings along the route
    d. Identification of common cars in service
    e. Federal regulations related to conditions of cars and the handling of hazardous material

19. To ensure safe and efficient operation, the conductor must keep records of the following (check all that apply)...

    a. All cars picked up or set off
    b. Any enroute delays
    c. A log of all oral communications with the engineer and dispatcher
    d. The location of all overdimension cars in the train
    e. The number of cars in passing trains

20. If radio communication fails during the time that a train is movement is being directed by radio...

    a. A torpedo should be detonated
    b. The movement should be stopped immediately
    c. The last complete message should be followed
    d. The movement should continue until it is appropriate to stop

## SAMPLE WRITTEN TEST ITEMS FOR THE BRAKEMAN

1. The safest method of performing any duty on the railroad should be used...

   a. Wherever possible
   b. Whenever it does not interfere with efficient operation
   c. In critical situations
   d. Always

2. The person most responsible for safety is...

   a. The dispatcher
   b. The engineer
   c. The conductor
   d. Yourself (every railroad employee must consider himself as most responsible for safety)

3. Riding on the roof of any moving car...

   a. Is not advisable
   b. Is prohibited
   c. Should be done only as required by duties
   d. Provides an excellent position for inspecting cars

4. If required to get off moving equipment, always step down first with...

   a. The right foot
   b. The leading foot
   c. The trailing foot
   d. (Depends on which way the car is moving)

5. Blue signals displayed on a stopped car may be removed by the...

   a. Brakeman with authorization from the conductor
   b. Yardmaster
   c. Conductor with authorization from the dispatcher
   d. Workmen who placed them

6. Three short whistle blasts indicate that a standing train (not in an interlocking) is about to:

   a. Start
   b. Apply air brakes

c. Back-up
d. Release air brakes

7. The whistle/horn signal informing the flagman to protect the rear of the train is...

a. One short and three long blasts
b. One long and three short blasts
c. Three long and one short blasts
d. One long blast

8. When in the cab of an engine, the brakeman is responsible for...

a. Calling signals
b. Protecting the front of train when authorized
c. Inspecting own and passing trains
d. All of the above

9. A hand, flag or lamp swung at right angles to the track is an indication to...

a. Reduce speed
b. Stop
c. Back
d. Release air brakes

10. When placing two torpedoes on a track, they should be placed as follows...

a. On the same rail and separated
b. One torpedo on each rail
c. One torpedo on top of the other
d. Next to each other on the same rail

11. Dual control switches refer to switches that...

a. For safety reasons, must be operated with both hands simultaneously
b. May be operated by hand or from a remote control station
c. Control a crossover
d. Control a switch and derail at the same time

12. The normal position of a derail is...

    a. (There is no normal position)
    b. Non-derailing position
    c. Derailing position
    d. Unlocked position

13. When uncoupling cars, if a lift lever is inoperative...

    a. Use some object in the hole at the bottom of the coupler to adjust the lock pin
    b. Stop any movement, cross over and lift the lever on the other car
    c. Call the dispatcher
    d. Use a brake club to free the lift lever

14. When the brake pipe air pressure is reduced, the air brakes...

    a. Are applied
    b. Are released
    c. Cannot operate
    d. Are overheated

15. Before disconnecting air hoses, the angle cock handle should be turned...

    a. In line with the air hose
    b. Towards the rear of the train
    c. Towards the front of the train
    d. At right angles to the hose

16. On a train authorized to start movement, the hand brakes should be released...

    a. Before air is connected
    b. After air is connected
    c. After slack is adjusted
    d. Any time

17. A brakeman is responsible for knowing (check all applicable answers)...

    a. Details of how diesel-electric locomotives operate
    b. Location of major parts of a car's brake system
    c. Use of tools and equipment stored in the caboose
    d. How to replace a knuckle

18. The reason for examining a passing train is to...

    a. Make sure that it is on schedule
    b. Count the number of cars if it has to take a siding
    c. Check for defects
    d. All of the above

19. If radio communication fails during the time that a train movement is being directed by radio...

    a. The movement should be stopped immediately
    b. The last complete message should be followed
    c. The movement should continue until it is appropriate to stop
    d. The movement should be slowed

20. Where only one time is listed in a timetable for a train, unless otherwise indicated, it is the...

    a. Arrival time
    b. Departure time
    c. Average of both arrival and departure times
    d. (Unable to determine unless specified)

## SAMPLE WRITTEN TEST ITEMS FOR THE TRAIN DISPATCHER

1. The rules specifying the precise manner in which train orders are to be written are primarily designed to...

   a. Provide an accurate record of all train orders
   b. Ensure uniformity throughout the railroad industry
   c. Keep the dispatcher alert
   d. Eliminate the possibility of any misunderstanding

2. If it is desired to have one train (EXTRA 622 WEST) run ahead of another train (No. 3) at point J, which of the following train orders conveys that information...

   a. NO 3 ALLOW EXTRA WEST TO PASS AT J
   b. EXTRA 622 WEST HAS RIGHT OVER NO 3 AT J
   c. EXTRA 622 WEST PASS NO 3 AT J
   d. All of the above

3. When an extra train must run ahead of another train, how is it decided as to which train will take the siding...

   a. Unless otherwise provided, the train to be passed will take the siding
   b. The extra train always takes the siding
   c. The first mentioned train always takes the siding
   d. The dispatcher must issue orders as to which train takes the siding

4. Which of the following forms of train orders may not be combined with any other form of train order (check all applicable)...

   a. Holding order-Form J
   b. Annulling a schedule or a section-Form K
   c. Annulling an order-Form L
   d. Annulling part of an order-Form M

5. When train orders are transmitted by telephone, the dispatcher must...

   a. Write the order as reported by the first operator and underscore each word and figure in the order as it is repeated by the other operators
   b. Write the order as he transmits it and underscore each word and figure as repeated by each operator

c. Write the order in the train order book and underscore it when transmitted and repeated by each operator
d. Write and transmit the order in the most convenient manner

6. When issuing an order that specifies "Restricted Speed," the dispatcher is telling the train to...

a. Be prepared to stop within one half the range of vision
b. Stop and proceed with caution
c. Be prepared to stop short of a train, obstruction or switch not properly lined, watch for broken rails, and not exceed designated speed
d. Not exceed 25 miles per hour

7. On single track, the superiority of trains is determined as follows...

a. Right is superior to class or direction
b. Class is superior to right or direction
c. Direction is superior to right or class
d. None of the above

8. The term "COMPLETE" may be abbreviated as...

a. COM
b. X
c. C&E
d. no abbreviation is permitted

9. When two or more engines of a non-work extra are coupled, the train order should be addressed to...

a. Number of the following engine
b. Numbers of both engines
c. Number of the leading engine
d. Either engine number

10. In TCS or CTC territory, train movements are governed by...

a. Signals whose indications supersede the superiority of trains
b. Both signals and the superiority of trains
c. Train orders for both opposing and following movements on the same track
d. Timetable and train orders

11. In TCS or CTC territory, when maintenance of way equipment is authorized by the dispatcher to use the track between points A and B for four hours, which of the following statements are true (check all that apply)...

    a. The train dispatcher (or operator) must block or place lever markers on all signal and switch levers in the specified territorial limits
    b. The train dispatcher must not permit any train or engine to enter the limits during the specified time
    c. The train dispatcher must not remove the blocks or lever markers before the four hour period expires, even if the work has been completed and the equipment is clear of the track
    d. The train dispatcher must send an appropriate train order

12. If a manual block is occupied, a passenger train may...

    a. Be admitted if there are no opposing trains
    b. Not be admitted to that block under any circumstances
    c. Be admitted to that block at restricted speed
    d. Be admitted to that block if flag protection has been provided

13. A train dispatcher is responsible for knowing (check all applicable statements)...

    a. How to take control of a train if called upon
    b. The names of major parts of a car's braking system
    c. The types of common cars in service on the railroad
    d. Federal regulations related to the conditions of cars and the handling of hazardous material

14. The primary purpose of observing a hot-box recorder graph is to...

    a. Ensure that both the detector and recorder are operating properly
    b. Locate an overheated journal
    c. Check the speed of the train
    d. Enable review and analysis of information on the heat condition of all wheels

15. In radio communication, the word "mayday" indicates...

    a. An urgent message
    b. A request for permission

c. A distress message
d. A safety message

16. The term "signal indication" refers to...

a. The appearance of a fixed signal
b. The information conveyed by the aspect of a signal
c. The title given to a signal
d. None of the above

17. The primary purpose for completing the required transfer documents is to...

a. Ensure that the relieving dispatcher is provided with the proper information
b. Keep a record of which dispatcher was responsible for each action
c. Check on the time that the relief dispatcher gets to work
d. Ensure that the train orders are transferred from the dispatcher to the operators

18. The primary purpose of the Clearance Form is to...

a. Provide a convenient form for listing train orders
b. Ensure that the operator is performing his duties
c. Assist the train dispatcher and operator in maintaining orderly records
d. Ensure that the train has the authority to move

19. When superseding an order, which of the following apply...

a. Use the same order number if part of the order is superseded
b. Use the same form of order, adding the words "instead of_____"
c. Use a new order stating that the original order is "superseded".
d. Use the original order number if the superseded order must be reissued

20. Once issued, a holding order will remain in effect...

a. For twelve hours
b. For twenty-four hours
c. Until it is annulled
d. Until it is fulfilled

# APPENDIX B

## SAMPLE PERFORMANCE RATING FORMS

### INTRODUCTION

As heretofore stated, the recommended approach to the evaluation of job performance is that of a checkride at the end of on-the-job qualification training. Such a checkride should be conducted by an appropriate job expert or evaluator. The structure for events to take place on the checkride, where control of events is possible, is provided by the statement of performance requirements for each job (Tables 3-2, 3-5, 3-8 and 3-11).

It is proposed that the candidate's performance during the checkride be evaluated along the dimensions or performance categories specified in the performance rating forms included in this Appendix. In general the forms carry the following information:

- Identifying information, such as
  - Date
  - Time evaluation begun, time evaluation finished
  - Name of persons being evaluated
  - Name of the evaluator
  - Route/territory involved
  - Weather conditions
- Instructions for using the form
- Performance categories
- Rating columns bearing the titles "Satisfactory", "Marginal," and "Unsatisfactory"
- Space for writing explanatory comments for "marginal" or "unsatisfactory" evaluations made

In regard to the ratings of performance, the particular categories chosen do weight evaluation towards the negative end of the scale. However, with the objectives of safe and effective discharge of duties in mind, it does not seem relevant to identify "superior" performance (individual carriers may wish to do so). Adequate or satisfactory performance is the mandate and conversely some gradation of inadequacy to help identify the nature and extent of remedial action needed.

As an evaluator would likely make multiple observations and evaluations of given performance items during a checkride, a working copy of the evaluation form should be used during the checkride whose information ultimately could be summarized and transferred to a master evaluation form for final record. For any "marginal" or "unsatisfactory" ratings, it would be most important for the evaluator to indicate the rationale or reasons for the rating as well as the recommended course for remediation of the inadequacy (additional training, future reexamination, etc.).

## RAILROAD ENGINEER PERFORMANCE RATING FORM

Engineer's Name_____ Carrier_____ Origin/Destination_____ Date_____

Engine Consist_____ Train Consist (loads, empties, tons)_____ Time Begun_____ Time Finished_____

Weather_____ Evaluator's Name_____

Instructions: Place a checkmark in each column for each category of performance observed, each time it is observed. If an event is not applicable, mark "N/A" in the first column for that event. If an event was not observed, mark "N/O" in the first column for that event.

| | Satisfactory | Marginal | Unsatisfactory |
|---|---|---|---|
| Trip Preparation | | | |
| . Essential pre-departure information and materials obtained | | | |
| . Conduct of equipment inspections | | | |
| . Conduct of brake tests | | | |
| Over-the-Road | | | |
| . Coupling/uncoupling operations | | | |
| . Use of whistle/horn/bell | | | |
| . Normal starting | | | |
| . Use of throttle | | | |
| . Use of independent brakes | | | |
| . Use of automatic brakes | | | |
| . Use of dynamic brake | | | |
| . Use of combined dynamic and automatic brakes | | | |
| . Use of sanding | | | |
| . Normal stopping | | | |
| . Emergency stopping/restarting | | | |
| . Slack control | | | |

RAILROAD ENGINEER PERFORMANCE RATING FORM (Cont.)

| | Satisfactory | Marginal | Unsatisfactory |
|---|---|---|---|
| Over-the-Road Cont. | | | |
| . Detection, counteraction of locomotive malfunctions | | | |
| . Responses to emergencies (e.g., hot box, break-in-two, derailment) | | | |
| . Detection and reporting of defects (own train, other trains, tracks, bridges, tunnels, signals, etc.) | | | |
| . Train radio procedures | | | |
| . Picking up, setting out operations | | | |
| . Changing of operating ends | | | |
| . Operation with power assistance | | | |
| . Operation with braking assistance | | | |
| . Familiarity with terrain | | | |
| . Signal observance | | | |
| . Train order handling | | | |
| . Overall rules compliance | | | |
| Trip Termination | | | |
| . Securing of train at destination | | | |
| . Filing of appropriate reports | | | |
| SUMMARY YARD/TERMINAL PERFORMANCE | | | |
| SUMMARY OVER-THE-ROAD PERFORMANCE | | | |
| OVERALL FITNESS | | | |
| General Comments | | | |

CONDUCTOR PERFORMANCE RATING FORM

Conductor's Name_____ Carrier_____ Origin/Destination_____ Date_____

Weather_____ Evaluator's Name_____ Time Begun_____ Time Finished_____

Instructions: Place a checkmark in each column for each category of performance observed, each time it is observed. If an event is not applicable, mark "N/A" in the first column for that event. If an event was not observed, mark "N/O" in the first column for that event.

| | Satisfactory | Marginal | Unsatisfactory |
|---|---|---|---|
| Preparation for Trip | | | |
| . Required trip information obtained, e.g., train list and train orders | | | |
| . Supplies and tools checkout | | | |
| . Supervision of initial train coupling and inspection | | | |
| . Verification of train make-up | | | |
| . Location of hazardous materials and overdimension cars | | | |
| . Determination that it is clear to proceed | | | |
| Over-the-Road | | | |
| . Coordination of set-off and pick-up of cars | | | |
| . Direction of train crew in providing necessary protection | | | |
| . Communications with engineer, via radio and communicating signals | | | |
| . Communications with dispatcher or operator, via radio and via wayside telephone | | | |
| . Supervision of brake tests | | | |
| . Record keeping, e.g., train list, defective car report, and delay report | | | |
| . Registration at intermediate stations | | | |
| . Pick up and implementation of train orders | | | |
| . Inspection of own and passing trains | | | |

CONDUCTOR PERFORMANCE RATING FORM (Cont.)

| | Satisfactory | Marginal | Unsatisfactory |
|---|---|---|---|
| Over-the-Road Cont. | | | |
| . Use of back-up hose | | | |
| . Use of conductor's valve | | | |
| . Determination of train speed | | | |
| . Reporting of any unusual conditions | | | |
| . Detection of and response to unplanned events and emergencies | | | |
| . Supervision of brakeman tasks | | | |
| Terminating Trip | | | |
| . Supervision of uncoupling of train | | | |
| . Submission of required reports and documents | | | |
| SUMMARY YARD/TERMINAL PERFORMANCE | | | |
| SUMMARY OVER-THE-ROAD PERFORMANCE | | | |
| OVERALL FITNESS | | | |

General Comments

BRAKEMAN PERFORMANCE RATING FORM

Brakeman's Name_____ Carrier_____ Origin/Destination_____ Date_____

Weather_____ Evaluator's Name_____ Time Begun_____ Time Finished_____

Instructions: Place a checkmark in each column for each category of performance observed, each time it is observed. If an event is not applicable, mark "N/A" in the first column for that event. If an event was not observed, mark "N/O" in the first column for that event.

| | Satisfactory | Marginal | Unsatisfactory |
|---|---|---|---|
| In Yard | | | |
| . Obtaining of required trip information | | | |
| . Assistance in engine and train coupling | | | |
| . Conduct of brake inspections | | | |
| Over-the-Road | | | |
| . Signalling | | | |
| - Calling of signals when in cab | | | |
| - Use of signals for movement | | | |
| - Use of flagging devices to protect train | | | |
| - Compliance with received signals | | | |
| . Switching | | | |
| - Unlocking and inspecting of switches | | | |
| - Alignment and relocking of switches | | | |
| - Removal and setting of derails | | | |
| . Coupling | | | |
| - Coupling and uncoupling of cars | | | |
| - Replacement of knuckle(s) | | | |

BRAKEMAN PERFORMANCE RATING FORM (Cont.)

| | Satisfactory | Marginal | Unsatisfactory |
|---|---|---|---|
| . Air hoses | | | |
| - Connecting, disconnecting of air hoses | | | |
| - Changing of a gasket | | | |
| - Replacement of a hose | | | |
| . Brakes | | | |
| - Inspection of brakes during tests | | | |
| - Setting and release of hand brakes | | | |
| - Cutting out of air brakes on bad car | | | |
| - Setting and release of retainer valve(s) | | | |
| . Observance of timetables, special rules, train orders | | | |
| . Signalling to other trains | | | |
| . Inspection of own and passing trains | | | |
| . Detection and correction of problems (e.g., loose cargo, dragging equipment, etc.) | | | |
| . Operation of radio set | | | |
| . Operation of wayside telephone | | | |
| Personal Conduct<br>. Mounting and dismounting of cars | | | |
| . Riding on cars | | | |
| . Observance of other personal safety rules | | | |
| SUMMARY YARD/TERMINAL PERFORMANCE | | | |
| SUMMARY OVER-THE-ROAD PERFORMANCE | | | |

BRAKEMAN PERFORMANCE RATING FORM (Cont.)

| | Satisfactory | Marginal | Unsatisfactory |
|---|---|---|---|
| OVERALL FITNESS | | | |

General Comments

TRAIN DISPATCHER PERFORMANCE RATING FORM

Dispatcher's Name_____ Carrier_____ Territory_____ Date_____

Types and Numbers of Trains Handled_____ Time Begun_____ Time Finished_____

Weather_____ Evaluator's Name_____

Instructions: Place a checkmark in each column for each category of performance observed, each time it is observed. If an event is not applicable, mark "N/A" in the first column for that event. If an event was not observed, mark "N/O" in the first column for that event.

| | Satisfactory | Marginal | Unsatisfactory |
|---|---|---|---|
| Preparation for Duty | | | |
| . Essential information obtained before assuming duty | | | |
| . Status of operating equipment verified | | | |
| On-Duty Activities | | | |
| . Formulation of routing/scheduling plans | | | |
| . Information obtained on trains and track conditions | | | |
| . Control of train movements in: | | | |
| - CTC territory: establishment of routings, blocking of signals and switches | | | |
| - Train Order Territory: transmittal of train orders, generation of train clearances | | | |
| . Issuance of work or track permits | | | |
| . Annotation of hot box recorders | | | |
| . Handling of traffic and equipment advisories | | | |
| . Arrangements for pick up or set off of cars | | | |
| . Coordination of movements beyond own territory | | | |

TRAIN DISPATCHER PERFORMANCE RATING FORM (Cont.)

| | Satisfactory | Marginal | Unsatisfactory |
|---|---|---|---|
| **Preparation for Duty (Cont.)** | | | |
| Issuance of train line-ups | | | |
| • Handling of train *crew* changes | | | |
| • Communications with operators and other personnel by telephone and radio | | | |
| • Record keeping, e.g., Train Order Book, Record of Movement of Trains (train sheet) and work permits | | | |
| • Detection of and response to unplanned events and emergencies | | | |
| **Preparation for Going Off Duty** | | | |
| Updating of transfer book | | | |
| • Briefing of relief dispatcher | | | |
| OVERALL FITNESS | | | |

General Comments

# APPENDIX C

## REPORT OF INVENTIONS

A diligent review of the work performed under this contract has revealed no new innovation, discovery, improvement or invention.