REPORT NO. FRA-ORD&D-74-37

AN ANALYSIS OF THE JOB OF RAILROAD TRAIN DISPATCHER

D. B. Devoe

APRIL 1974
FINAL REPORT

Prepared for
DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
Office of Research, Development and Demonstrations
Washington DC 20591

/AS

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FRA-ORD&D-74-37		

4. Title and Subtitle	5. Report Date
AN ANALYSIS OF THE JOB OF RAILROAD TRAIN DISPATCHER	April 1974
	6. Performing Organization Code
	8. Performing Organization Report No.
7. Author(s) D. B. Devoe	DOT-TSC-FRA-73-13
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142	10. Work Unit No. (TRAIS) RR409/R4304
	11. Contract or Grant No.
	13. Type of Report and Period Covered Final Report 7/72 - 6/73
12. Sponsoring Agency Name and Address Department of Transportation Federal Railroad Administration Office of Research, Development and Demonstrations Washington DC 20591	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report constitutes a detailed study of the job of railroad train dispatcher, conducted to provide a data base for the derivation of criteria of job knowledge, skills and training consonant with safe operations. Documentation was reviewed; specialists were consulted, and selected dispatching operations were observed in detail. The report describes the responsibilities and duties of train dispatchers, their workplaces and job aids, the principal functions they perform, and the records they must maintain. Special characteristics of the job, such as workload, stress, inadequacies in aids, and trends toward improvements are discussed, and estimates are made of the physical and psychological attributes, job knowledge and skills basic to safe operations and possible approaches to assurance of safety through selection, placement and training.

17. Key Words	18. Distribution Statement
· Train Dispatcher · Job/Task Analyses · Safety	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	276	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

PREFACE

This report summarizes work performed in partial fulfillment of the requirements of Task 1A, "Task Analyses," of PPA RR309, "Human Factors in Railroad Operations," conducted by the Transportation Systems Center (TSC) for the Federal Railroad Administration (FRA). The Project Manager at TSC was D. B. Devoe; Project Monitors at the FRA were L. G. Regan and K. B. Ullman. Technical assistance in data gathering and reduction was provided by the Raytheon Service Company.

Substantial contributions to the collection of data and to the organization and writing of this report were made by Mr. H. Spiewak, Raytheon Service Company, whose invaluable assistance is acknowledged with sincere gratitude.

In addition, the following people made major contributions to this study:

John Collins, Dispatcher, Boston and Maine Railroad
Wilfred H. Holland, Consultant
William Martin, Chicago Regional Office, FRA
Charles P. Pfenning, President, American Train Dispatchers Association
Paul Phaneuf, Raytheon Service Company
Raymond Tenney, Chief Dispatcher, Boston and Maine Railroad

Grateful acknowledgement is made for the assistance of the many persons in the following organizations whose cooperation in providing guidance, data and access to facilities made this study possible:

American Train Dispatchers Association
Belt Railway of Chicago
Boston and Maine Railroad
Burlington Northern Railroad
Chicago and Western Indiana Railroad
Denver and Rio Grande Western Railroad
Illinois Central Gulf Railroad
Southern Pacific Transportation Company

CONTENTS

CONTENTS (CONT'D)

CONTENTS (CONT'D)

CONTENTS (CONT'D)

CONTENTS (CONT'D)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (CONT'D)

LIST OF ILLUSTRATIONS (CONT'D)

LIST OF TABLES

1. INTRODUCTION

1.1 PURPOSE

This report documents a detailed study of the job of Train Dispatcher. The report constitutes a data base from which minimum criteria of job knowledge, job skills and training consonant with safe operations can be derived. The data may also be used as a starting point for the development of aptitude and proficiency tests, training curricula and research requirements.

1.2 BACKGROUND

The Federal Railroad Safety Act of 1970 (Public Law 91-458) empowers the Secretary of Transportation to prescribe rules, regulations, orders and standards and to conduct research, development, testing, evaluation and training appropriate for all areas of railroad safety. The accomplishment of these functions was delegated to the Federal Railroad Administration (FRA).

Human performance was recognized as a major influence on the safety of railroad operations. In 1971, the FRA commissioned the Human Factors Branch of the Transportation Systems Center (TSC) to provide professional assistance in implementing the Safety Act's requirements in this area through a project entitled: "Human Factors in Railroad Operations." This project provided for consultation and research in the principal areas where human capabilities, limitations and behavioral characteristics may be determinants of operational safety.

In any job area, to determine whether regulatory action is required to assure safety and, if so, what kind of action, one must thoroughly understand what the job entails. Therefore, a series of tasks were established within this project to collect and organize information on those jobs that directly influence the safety of train movements. The program for such job analyses in Fiscal Year 1973 included a study of the job of the train dispatcher. This report documents the results of that study.

1.3 APPROACH

The approach to the study of the job of train dispatcher included the following steps: review of documentation, consultation, observation, analysis and reporting.

Very little literature was available as a base for the study. The codes of operating rules of several carriers were studied, and a few books of special instructions for dispatchers were obtained. Unpublished data from several evaluations of dispatching operations of individual carriers were provided by the FRA and the American Train Dispatchers Association. This material was reviewed and interpreted with the assistance of a consultant experienced in railroad operations, and a tentative listing of functions and tasks was prepared.

Observation of operations was accomplished by having project staff members visit dispatching offices, sit with trick dispatchers, observe their activities and ask questions about actions and reasons for them. Details of the operation, including workload, equipment, procedures and problems were recorded. Where appropriate, samples of documents were obtained, photographs were taken, and transactions were tape recorded. Visits included interviews with the Chief Train Dispatcher and, sometimes, the Division Superintendent.

Early in the study it became apparent that every division of every railroad is an individual entity with its own peculiar characteristics. As a result, every dispatching operation has its own procedures and aids, adapted to match its territory. Study of the available literature showed, however, that every dispatching office has essentially the same functions to perform even though they may be performed in slightly different ways. We therefore adopted a two-phased approach to our observations. One phase involved a detailed case study of a single dispatching operation, focusing on a single position, to be sure that no critical dispatching task in that operation would be overlooked. The second phase involved a broader survey of a number of widely different operations to sample the variations in tasks that might be expected nationwide.

Because it included train order, automatic block and centralized traffic control territories and was located conveniently close to TSC, the Boston and Maine Railroad was selected for the case study approach. The field survey included visits to the following operations:

Belt Railway of Chicago, Bedford Park, Illinois
Burlington Northern Railroad, Cicero, Illinois
Chicago and Western Indiana Railroad, Chicago, Illinois
Denver and Rio Grande Western Railroad, Denver, Colorado
Illinois Central Gulf Railroad, Chicago, Illinois
Southern Pacific Transportation Company, Tucson, Arizona

The variations in operations observed in the field survey were small enough with regard to essential tasks to give confidence that the descriptions and conclusions of this report are reasonably applicable to train dispatching operations throughout the United States.

1.4 ORGANIZATION OF THE REPORT

The next three chapters of this report describe the train dispatcher's job. Chapter 2 provides an overview of the dispatcher's responsibilities, his location within the company structure, his principal duties and some general observations. Chapter 3 describes the dispatcher's workplace, including his location, aids, work position layout and general working environment.

Chapter 4 describes and charts, in a framework of six major functions, the task details of the dispatcher's job. Chapter 5 describes safety-related problems inherent in the train dispatching job, as deduced from the data of the study. In Chapter 6 some guidelines are provided for the development of job performance criteria and selection and evaluation tests, derived from consideration of the physical and psychological attributes judged desirable for train dispatchers. Chapter 7 summarizes the study and offers appropriate recommendations.

2. GENERAL JOB DESCRIPTION

2.1 INTRODUCTION

The train dispatcher is responsible for all train movements on a line, or lines, of railroad having specific limits (territory). He is responsible for the safe and expeditious movement of all trains and work crews operating within his territory and provides specific direction to varying numbers of operators, train directors, conductors, enginemen and others, while maintaining detailed documentary records of all involvements.

2.2 ORGANIZATION

The train dispatcher reports to and receives instruction from the Chief and/or Assistant Chief Dispatcher. The Chief Train Dispatcher is the direct authority for the movement of all trains in his division and issues all orders in the name of the Superintendent. He is responsible for the preparation of all timetable train schedules and must authorize the movement of all trains not scheduled in the timetable.

Reporting to the train dispatcher are train directors, tower operators, and operators, who are responsible to the train dispatcher for all train movements within specific segments of his territory (such as train order blocks and interlockings).

Figure 2-1 shows a typical railroad company organization and illustrates how train dispatching and allied functions relate to the total organization.

2.3 DUTIES

2.3.1 Principal Duties

The train dispatcher, either directly or through operators:

1. Schedules and controls following, opposing or conflicting movements of trains by:

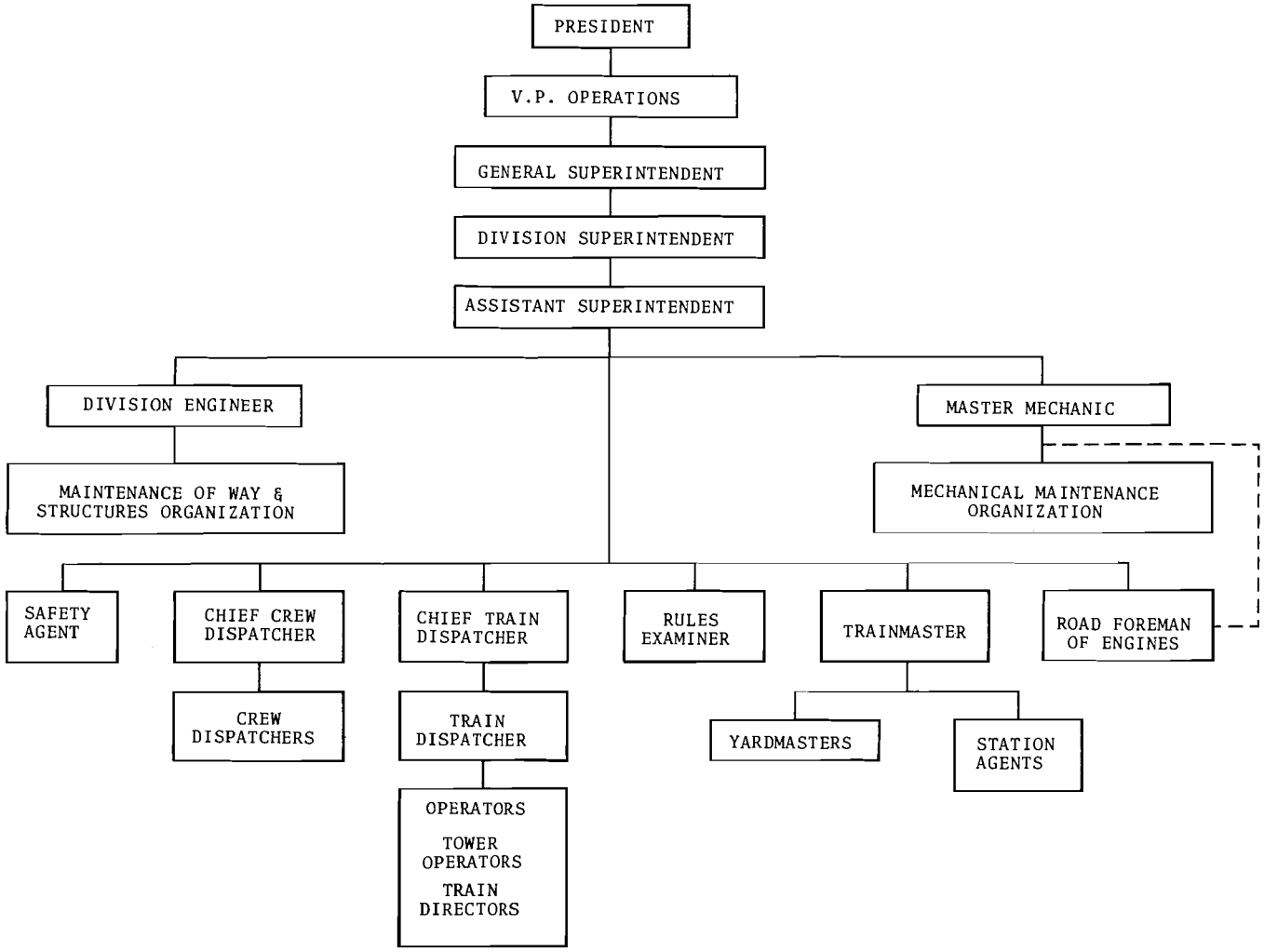


Figure 2-1. Typical Railroad Company Organization

a. issuing train orders and instructions and communicating them directly by telephone, telegraph, or radio;

b. controlling track switches and wayside signals either directly or by remote control, frequently with the aid of a model board (CTC) which shows by diagrams and lights the track occupancy and position of track switches and associated signals;

c. granting permission for trains to occupy tracks where train movements are governed by automatic signals activated by the trains occupying the track.

2. Maintains permanent records of train orders and permissions issued and the pertinent data concerning all train movements.

3. Issues permissions for track cars and work trains to occupy specific tracks for specific periods of time.

4. Monitors graph recordings of hot box detectors (if provided) and takes appropriate action if a hot box is detected.

Various additional duties may be assigned the train dispatcher as circumstances and operating policy require.

2.3.2 Organization of Work Day

Since the train dispatcher is in control of a dynamic, continually changing system, there is no "typical" arrangement of his duties. Grossly, we can identify a preliminary phase during which the dispatcher relieves the preceding dispatcher, "reads into" the status of his system and takes over control; an intermediate phase constituting most of his work; and a final phase in which he reviews the status of his system, cleans up unfinished tasks, and turns over control to the succeeding dispatcher. These phases are shown graphically in Figure 2-2, together with some of the more characteristic activities of each phase. The diagram does not, nor is it intended to, depict consistent levels or orders of activity. Instead, it has been structured in a manner which reflects, in gross terms, the activities which generally occur during

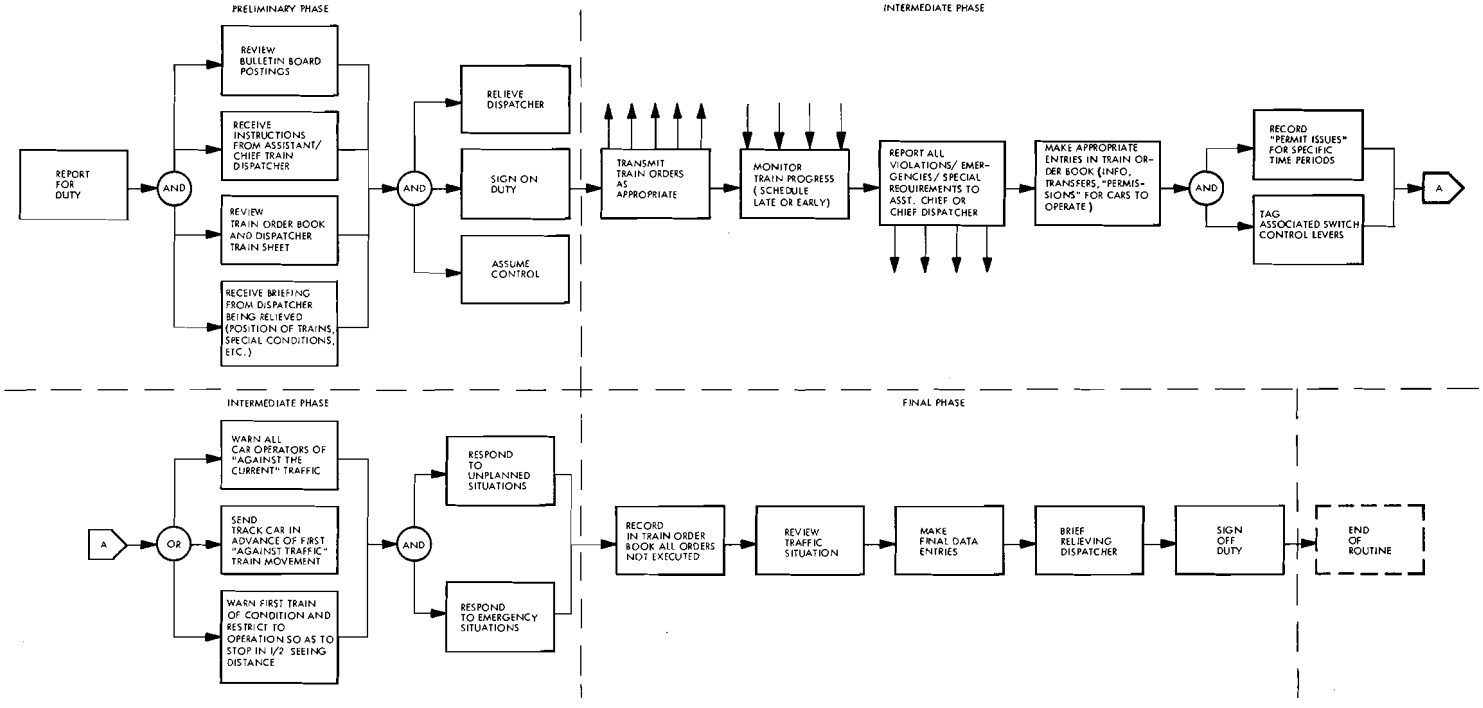


Figure 2-2. Characteristic Activities of the Train Dispatcher's Workday

the course of a work day. The preliminary and final phases of activity normally follow the sequence indicated. The remaining functions occur on an "as required" basis, responding to the needs dictated by the evolving traffic situation.

The details of how these tasks are performed will be examined in Chapter 4.

2.3.3 Dynamic Flow of Decision

The train dispatcher receives information from a variety of sources, which he must process in order to make decisions. Using the aids provided him, the dispatcher takes the actions required by his decisions, generally by issuing orders, and documents his activities. Figure 2-3 shows highlights of this general flow of activity, and also illustrates that the interactions of environmental factors with his physical and mental condition are all a part of the dynamic process in which he is involved.

2.4 GENERAL NATURE OF THE JOB

2.4.1 General Characteristics

The title "train dispatcher" dates back to the early days of the railroad industry and dispatchers must still perform many traditional tasks. In addition, technical progress and a trend toward centralization (in most cases encouraged by economics) have added many new aspects to the job.

With centralized train control, switches and signals extending over hundreds of miles of mainline track are frequently controlled by a single dispatcher, even extending to side tracks in major Centralized Train Control (CTC) dispatch systems operations. Train movements, signals and switching actions are indicated by a variety of status indication lights presented on a situation or status display board located adjacent to the train dispatcher. When automatic train control and speed control provisions are present, a train running through a stop signal or exceeding a speed limit can be electronically stopped or slowed, eliminating the possibility

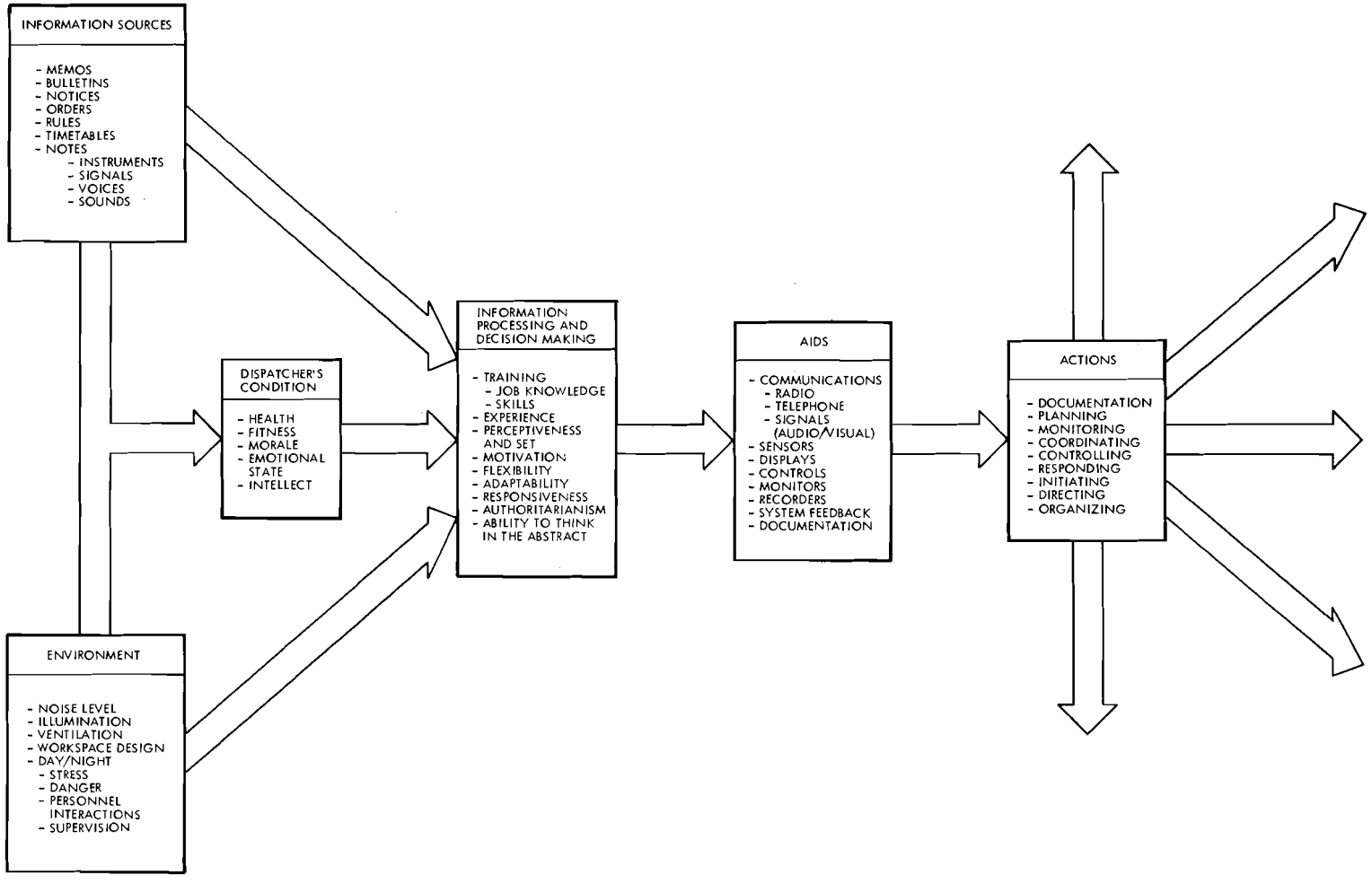


Figure 2-3. Highlights of Dispatcher's Information Processing and Decision Making Activities

of human failure. A system commonly used today is the automatic block, in which a signal guards the section of track immediately beyond and indicates whether another train is present. This system is uni-directional and if simultaneous two-way operation is necessary, two tracks must be used. A variety of automatic safety devices can be incorporated into the block system.

The use of two-way radio greatly expedites freight train operations. Many locomotives, cabooses, towers and dispatch centers are so equipped, enabling train dispatchers to talk to tower men, train engineers or conductors while enroute. Portable and fixed radio installations are used in large yards for contact between car inspectors, tower operators, locomotive engineers and other yard personnel.

Although the "dispatching" aspects of the job still predominate, with the advent of increasingly automated systems and a corresponding increase in scope of control responsibility, the train dispatcher position has become more that of an operations controller.

Many railroad companies have implemented austerity programs, usually involving reductions in force (layoffs) and centralization or consolidation of support functions. Although "streamlining" railroad operations has generally been beneficial, in some cases the consolidation of operations has resulted in an increase in the dispatcher's workload.

More than anyone else in the industry, the railroad dispatcher must be thoroughly familiar with specific and general rules and directives, and other job knowledge required of railroad employees with whom he interfaces. Appendices B through P contain illustrations of the job knowledge required of a train dispatcher.

2.4.2 Work Conditions

Performance of the train dispatcher activity involves a complex interaction of man, machine and environment. The information that is necessary for day-to-day performance in this capacity is obtained through various means (i.e., memos, rules, signals,

displays and voices) presented in an environment which may sometimes be counterproductive. Noise levels are often high, ventilation inadequate, and design of equipment and workspace poor. See Chapters 3. and 5. for expanded discussions of the train dispatcher's work conditions.

2.4.3 Performance

Basic to the successful performance of the train dispatcher's activity is the ability to effectively utilize those job aids which support the responsibilities and authorities recognized as critical components of the job. The actions required of the dispatcher are in many instances comparable to those of a management executive. He must plan, organize, coordinate, control and direct, in addition to initiating, monitoring and documenting practically all of his actions.

2.4.4 Status

Job prestige and the esteem in which train dispatchers are held appear to vary from company to company. Most railroads classify train dispatchers as "labor," and they have a national union (American Train Dispatchers Association). An exception is the Illinois Central Gulf Railroad, which gives dispatchers the status of officers of the company and accords them the respect and privileges commensurate with that level of employee, including a pension plan, annual merit system reviews, and wage and salary programs.

3. WORKPLACE

There is no "typical" workplace for a train dispatcher. Every office has a different mix of desks, CTC positions, aids, and interfaces with other operating groups, and where mixes are similar, the physical layouts still differ. Nearly all positions have some features in common -- a chair, flat space for documents, radio and telephone terminals, and often a CTC board. We will discuss several of the common features, particularly those that help determine the layout of the workplace, illustrating both similarities and differences, and then discuss problems related to the dispatcher's work environment.

3.1 TERRITORY AND AIDS

3.1.1 Territory

The work position for a given train dispatcher is identified by the territory he controls. On a small railroad, one dispatcher may control the entire system. On larger railroads, the territory may be a region (e.g., Central Desk, Connecticut Valley CTC, etc.), a district, a division, or a subdivision. Figure 3-1 shows how the Boston and Maine Railroad divides its territory among five train dispatchers.

A dispatching office may include one or several dispatcher positions. The offices surveyed had from one to thirteen positions. Fifteen positions in one office is probably the maximum in this country.

Since it is economical and convenient to centralize dispatching functions, a tendency for more, rather than fewer, train dispatcher positions to be grouped in one office is predicted.

The location of a dispatching office is determined by such factors as the size of the company, the availability of communications lines, and the history of development of the company. Our limited sampling included offices in modified switching towers,

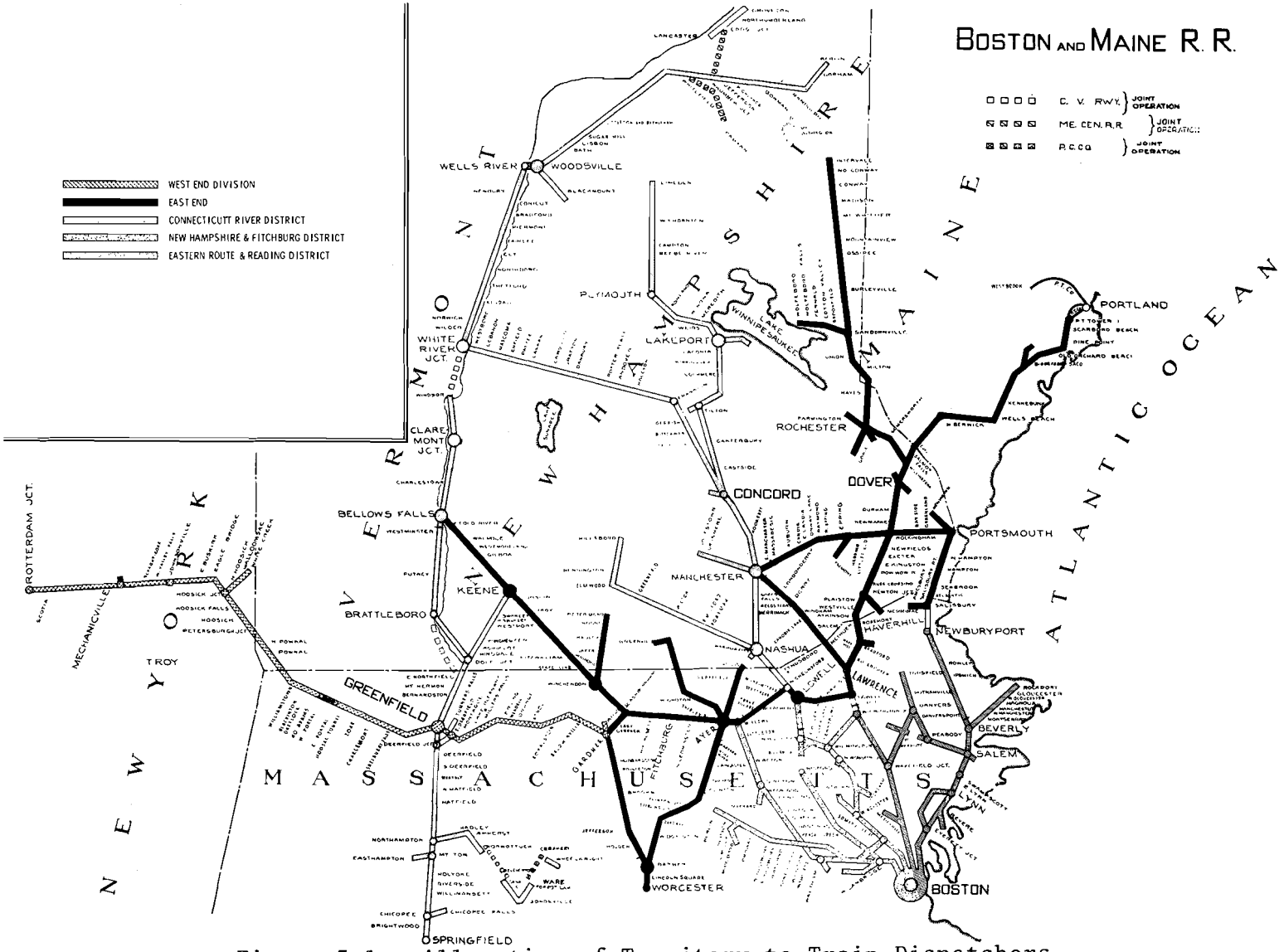


Figure 3-1. Allocation of Territory to Train Dispatchers

in or adjacent to station or yard offices, or in headquarters office buildings. Every office visited was within sight of train operations (not an unusual characteristic of railroad property). However, many dispatchers could not see train operations, having windowless locations, and only one of the dispatchers observed used direct viewing as an aid. Usually, most activities under the train dispatcher's control are beyond his range of vision.

3.1.2 Aids

At each train dispatcher's position, the aids provided him for performing his job help to determine the space and layout assigned to him. Some of the principal job aids are discussed below.

3.1.2.1 Communications - Because the train dispatcher must issue orders and receive information, the communications systems and equipment provided him are major job aids. In earlier days, high reliance was placed on the telegraph -- a mode now in very limited use. Telephone and radio provide most of today's communications. Our observations showed that most dispatchers have several telephone nets available (including micro-wave, company lines, leased lines, and commercial lines) for communicating with trackside phones, with operators, train directors and other dispatchers, and for general access to commercial telephone services. Generally, VHF radio channels are available for two-way communications with train and work crews. Supplementary information also comes to many dispatchers via teletypewriters, TelAutograph, and (still rare) computer printouts and display terminals.

3.1.2.2 Train Sheets and Train Order Books - The two basic documents for monitoring and controlling train movements are the train sheet and the train order book. These are described in detail in Section 4.2.

3.1.2.3 Centralized Traffic Control (CTC) - Centralized Traffic Control (CTC) is a system that permits one man at one position to set all the signals and switches within a given territory. Rules authorize the block signals within the territory to supersede the superiority of trains for all movements within the system. Such a system gives the man (the train dispatcher, or an operator or train director reporting to the dispatcher) control of traffic flow within his territory literally at his fingertips. Since its inception in 1927, CTC has been progressively adopted throughout the railroad industry, and the console and display panel typical of the CTC (see Section 3.3.2) are common fixtures in most train dispatching centers today.

3.1.2.4 Hot-Box Recorders

Many railroads have installed trackside devices for the detection of overheated journal boxes (hot-boxes) on passing cars and locomotives. The output from these detectors may be sent to a trackside display that can be seen by the train's rear-end crew or it may be sent to a remote recording device. Sometimes these hot-box recorders are located at a maintenance office, but often they are located in the dispatching office and must be monitored by the train dispatcher. Whenever a train passes a detection point, the recorder is actuated. Two pens (one for each side of the track) record temperatures on a moving roll of graph paper as each wheel passes the detector. Figure 3-2 shows a typical record from a hot-box recorder. When a recording starts, a gong sounds to alert the person responsible for monitoring. If the train dispatcher is assigned this responsibility, he must leave his position and inspect the recording without delay in order to take approprite action if journals are overheating. Although many dispatchers are not required to monitor hot-box recorders, others have several to attend to. Figure 3-3 shows a position where the dispatcher has eight hot-box recorders (an excessive number for one man to monitor).

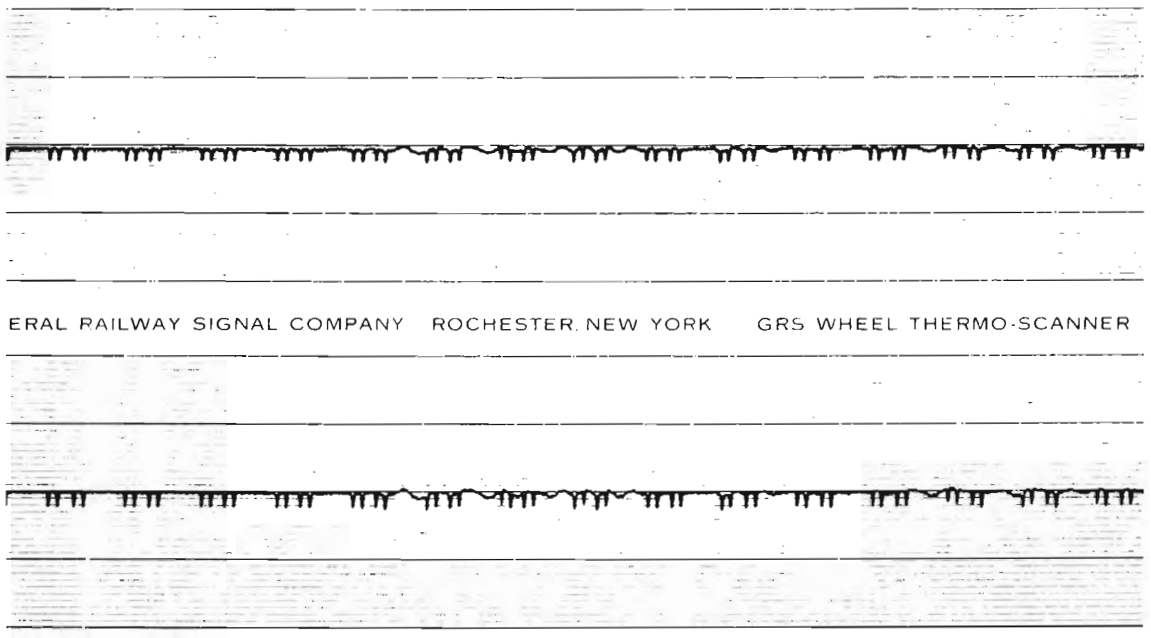


Figure 3-2. Record from Hot-Box Recorder. Each Line Represents One Side of a Train; Each Jog Represents Temperature of One Wheel

Figure 3-3. Dispatcher's Position with Eight Hot-Box Recorders to Monitor

3.2 WORK POSITION LAYOUT

3.2.1 Train Dispatcher's Desk

A desk is basic to every train dispatcher's position. In fact, in some railroads the position is referred to as the "desk" (e.g., East End Desk). Some in use today are wooden desks or tables; some are steel office desks; some are custom-made benches or consoles; some are specially designed computer input/output terminal positions. Figure 3-4 illustrates both the variety and similarities of train dispatchers' desks. Figure 3-5 shows a typical desk. Common to most dispatchers' desks is flat space to accommodate train sheets, which are large and awkward to handle. Since a new train sheet is started at the beginning of each day, the previous day's train sheet must be kept on hand until all movements started that day have been completed. Thus, two train sheets are frequently being maintained, monitored and manipulated at the same time. Other necessary documents and frequently used references (timetables, schedules, special notices, and the like) are also kept on the desk, in drawers, or nearby.

The communications equipment is either on the desk or on an adjacent table. A switchboard for selection of telephone circuits and one or more radio receivers or a switch box are always present with their associated speakers. Microphones for the phone system are generally mounted on booms in front of the dispatcher's desk chair, and a foot bar is usually provided for the transmission key to free the dispatcher's hands for other duties. A clock or watch, (dial or digital) is always prominently in view.

The equipment described so far is minimal for any position and basic for positions controlling train order territory only. Additionally, there may be file cabinets, a hot plate, personal property, and miscellaneous supplies.

Although certain basic equipment is almost always found at the dispatcher's position, there is no standard arrangement of the equipment (as is evident in Figure 3-4). In fact, different dispatchers using the same desk may vary the arrangement.

Figure 3-4. Train Dispatchers' Desks

Figure 3-5. Typical Dispatcher's Desk. A. Train Sheet. B. Train Order Books C. Bulletins D. Communications Panel

3.2.2 CTC Boards

The train dispatcher responsible for territory having Centralized Traffic Control has an input/output terminal known as a CTC board. Since the layout of every CTC territory is different, the CTC board is different for every dispatcher's position. However, there are basic display and control capabilities common to all.

The CTC display is a vertical black panel on which is portrayed a schematic diagram of the track layout, including sidings and crossovers (in white segments) and the locations of switches and signals (pilot lights). In early designs, occupancy of a block by a train was indicated by the illumination of an amber pilot light in the center of the block segment. Later boards have block segments that illuminate to show occupancy, sometimes color coded to differentiate between a selected route and an occupied segment.

Associated with each switch and signal is a capability to operate it. Figure 3-6 shows a section of a CTC board on which any track switch or wayside signal can be operated by a selector switch directly below its representation on the CTC board. Capabilities illustrated include:

A. Power Off Light (Red). Illuminates when AC power is lost at field location; also identifies a reporting station while it is sending.

B. Outgoing Signal Indicator (White). Goes ON when "Start Button" is pressed; goes OFF when relays are set.

C. Intermediate Section Occupancy Light (Amber). ON when section is occupied.

D. OS Section Occupancy Light (Red). ON when section is occupied.

E. In-Correspondence Light (Green). ON when the clearing signal at the field location is safe with respect to switch position.

F. Maintenance Call Switch (Toggle). Operates call flasher, klaxon, or other indicator at field location, summoning an employee to the phone.

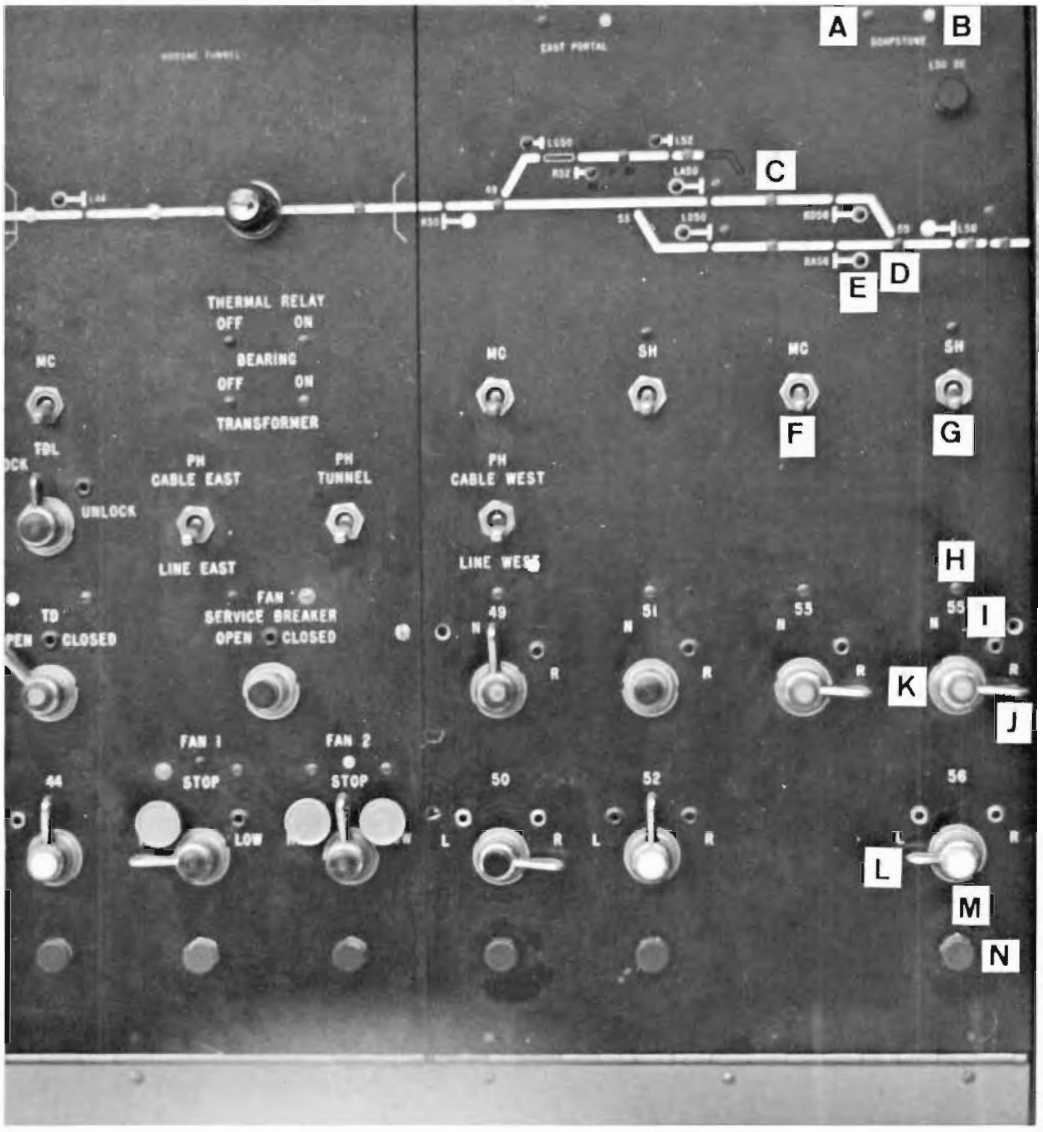


Figure 3-6 Section of a Typical CTC Board, Letters Keyed to Text

G. Switch Heater Control (Toggle). Operates switch heater at field location.

H. Out-Of-Correspondence Light (Red). ON when switch position at the field location is out of correspondence with the setting of the Track Switch Lever.

I. Blocking Hole. Permits insertion of a blocking peg that prevents inadvertent operation of the adjacent lever.

J. Track Switch Lever. Sets switch at field location in "normal" or "reverse" position.

K. Switch Locked Light (Red). ON when switch is locked.

L. Signal Lever. Sets signal at field location to be consistent with traffic moving "left" or "right".

M. Signal-Clear Light (White). Comes on to verify desired signal switching completed.

N. Start Button (Red). Must be pushed to initiate code transmission for any switch or signal action selected by levers.

The design of levers, switches and indicators may vary considerably among various models of CTC boards, and special controls and displays may be added as required for specific operations, but the basic functions for setting the switches and signals for desired routings are always provided.

Beyond these basic features, CTC boards may be found in a variety of configurations. Not only are all the types of equipment described below in operation today, but it is not unusual to find several different types in the same office.

As the railroads increased their CTC territory, CTC boards became increasingly larger. To keep switches within reach of the dispatcher, wrap-around and stacked designs were developed.

Even a relatively small wrap-around board can require the dispatcher to move around considerably in order to reach all switches (Figure 3-7). Two solutions to switch accessability have been adopted. One involves a wrap-around switching console, with the

Figure 3-7. Wrap-Around CTC Board

Figure 3-8. Separate CTC Board and Switching Console

display board separate and at some distance (Figure 3-8). The other is to consolidate the switches into a more compact keyboard (Figure 3-9), accepting the requirements to key in an identifying number for the switch or signal to be controlled in return for the convenience of being able to perform all operations from one position. The keyboard, by obviating the requirement to line up switches with the display, makes it possible to stack sections of the track display vertically (Figure 3-10).

Obviously, the dispatcher can look at only one section of a wrap-around display at a given time. While his attention is centered on one section, critical events may be happening in other sections. Several aids are used to overcome this problem. An audible alarm (gong) sounds once whenever track occupancy changes on any segment of the territory. Some large boards have mirrors to help minimize the dispatcher's head and eye movements. Where space permits, a large, straight, remote board may be used, permitting the dispatcher to scan all his territory with a minimum of head movement. Finally, stacking sections of the display vertically in front of the dispatcher reduces the field-of-view to be monitored. The representation of extensive territory may even result in a display that is both stacked and wrapped around (Figure 3-11).

Many CTC consoles contain one or more CTC graphs. For each control point (track switch) in the territory covered, a separate pen is provided, with pens spaced in scale with control-point spacing. When a train enters a CTC control point, the pen deflects, returning to the normal position when the train leaves the control point. CTC graphs are mounted horizontally, with pens at the edge away from the dispatcher and the graph paper moving at constant speed toward the dispatcher. Figure 3-12 shows a typical CTC graph installation; Figure 3-13 is a closeup of an actual graph.

In operation, the pens trace a set of vertical lines across the CTC graph, one line for each control point. Each jog in the line indicates an event at the control point. The dispatcher can manually enter a line with pen or pencil connecting the jogs at

Figure 3-9. Keyboard and Wrap-Around Display

Figure 3-10. Keyboard and Stacked Display

Figure 3-11. Stacked and Wrapped-Around CTC Display

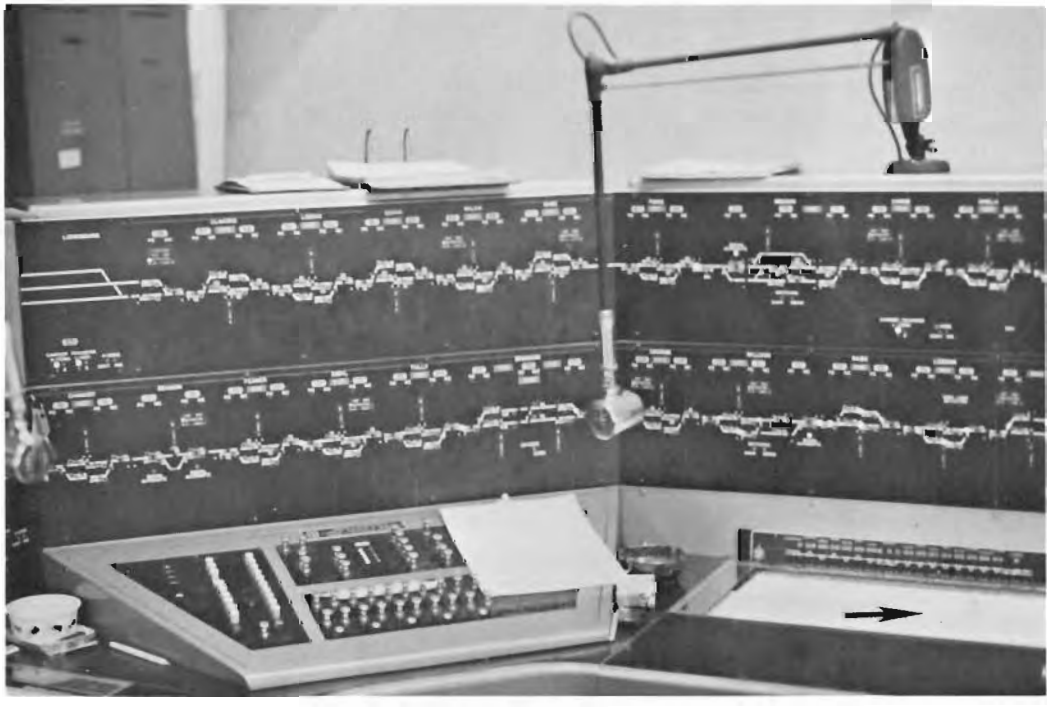


Figure 3-12. Graph on a CTC Console

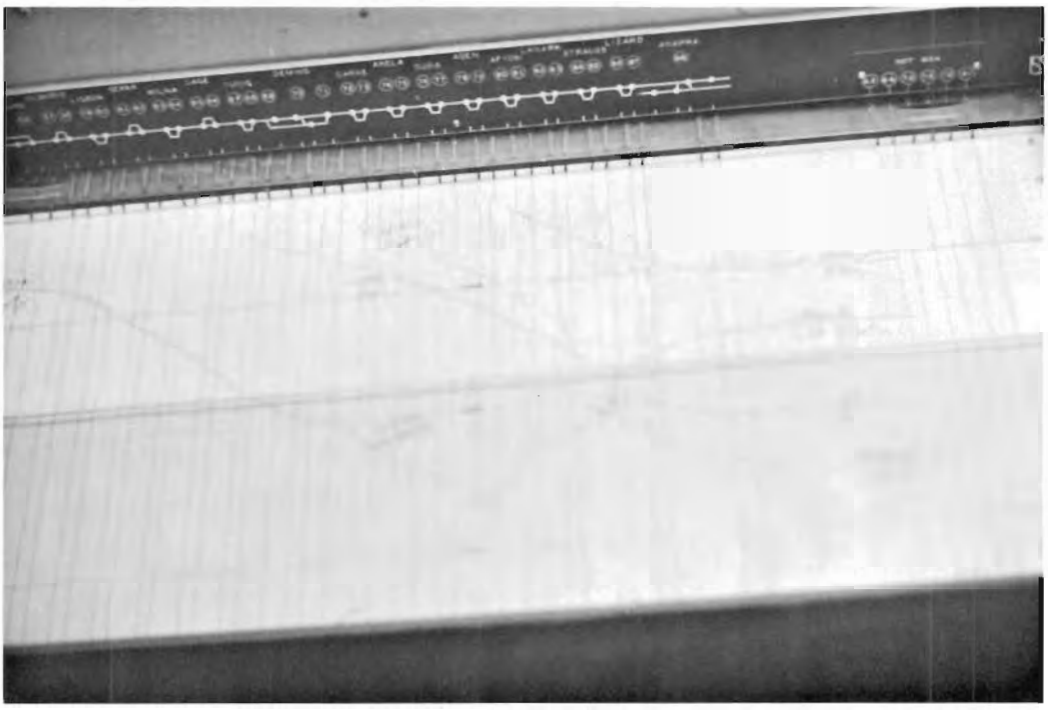


Figure 3-13. Closeup of CTC Graph

successive points caused by the same train, thus creating a set of traces for the trains under his control. This pictorial image is of considerable help to the dispatcher in keeping track of events in his territory. The slopes of traces show the average speed of trains; vertical traces show trains holding their positions; crossing traces show meets, and so on. The graph is also a permanent record of events on the territory and can be used to monitor observance of speed limits or to analyze events leading up to unusual occurrences.

3.2.3 Combinations

Although most railroads have some CTC territory, some divisions or sections are still controlled wholly by train orders. Thus, most dispatching offices will have some CTC positions and some train order desks. A position controlling CTC territory may

also have interspersed sections of train order territory, in which case the train dispatcher must perform the combined functions.

3.2.4 Trends

The explosive growth of digital computer technology has had its impact on the railroads, although conversion to partially automated systems is expensive and slow.

Two approaches can be identified as we view the impact of automation on the train dispatcher's job. One is to use computers as an aid to greater automation of the switching and signalling aspects of CTC and interlocking operations. Often the result is a reduction in the number of towermen and switchmen in the field without any great simplification of the train dispatcher's job. Physical operation of a CTC board may be reduced to simpler keying operations or light pen actions on a cathode-ray-tube display (Figure 3-14), but the train dispatcher still has as much territory to monitor (in the same display format) and as much documentation to prepare, and he does not have as many people to call on for assistance in emergencies.

A different approach to automation is illustrated by a new system now being installed by the Denver and Rio Grande Western Railroad. The D&RGW system uses its computer to relieve the dispatcher of onerous clerical duties, to make information readily available on demand and in selectable formats, and to organize communications capabilities. The system designers have also made significant improvements in the environmental factors, reducing the fatiguing and distracting elements characteristic of most dispatching offices.

When completed, the D&RGW system will be under the control of four train dispatchers located side-by-side in four positions of a large, carpeted, sound-proofed room, access to which can be gained only via doors bearing combination locks. A forty-foot display board of the entire system, readily visible from all control positions, is mounted on one wall, permitting a dispatcher to observe not only his own territory but relevant developments in adjacent territory.

Figure 3-14. Partially Automated Position with CRT and Light Pen

Figure 3-15 shows a train dispatcher's position in the D&RGW system with the display board in the background. In front of the dispatcher is a small model of the track in his territory into which he can insert plugs to lock in (block) sections of track dedicated for exclusive use. Switching and signalling actions are initiated via the small keyboard near his right hand, which can be moved by the individual dispatcher to the position most convenient to him. Switching is performed as on the keyboard type of CTC board.

To the dispatcher's right are two keyboard-display terminals (one for eastbound, one for westbound operations) that replace the train sheet (see also Figure 3-16). By answering a programmed set of questions that appear on the display, the dispatcher can initiate a train movement through keyboard entries. Once the initial "OS" is entered by the dispatcher, the system automatically tracks a train and updates its status in the computer memory. The dispatcher can call up the record on any train (or all trains), locate equipment, and generally query the status of the operation through terminal keyboard code entries. Periodically, the entire contents of the computer memory are printed out for permanent records, relieving the dispatcher of many of his documentation duties.

To the dispatcher's left is a compact communications terminal, pictured in the lower portion of Figure 3-17. Various sections of this terminal permit the dispatcher to select company or commercial phone systems, radio channels, and an intercom system. The microwave phone system is divided into blocks so that the dispatcher need not listen to the chatter of the entire system. A single earphone and a lip microphone permit the dispatcher to communicate quietly (without being overheard at adjacent positions). He can monitor whatever he has selected for the terminal speakers with his free ear.

By isolating the dispatcher from noise, distractions and unauthorized interruptions, by making necessary data readily and selectively available, and by reducing clerical duties, the D&RGW

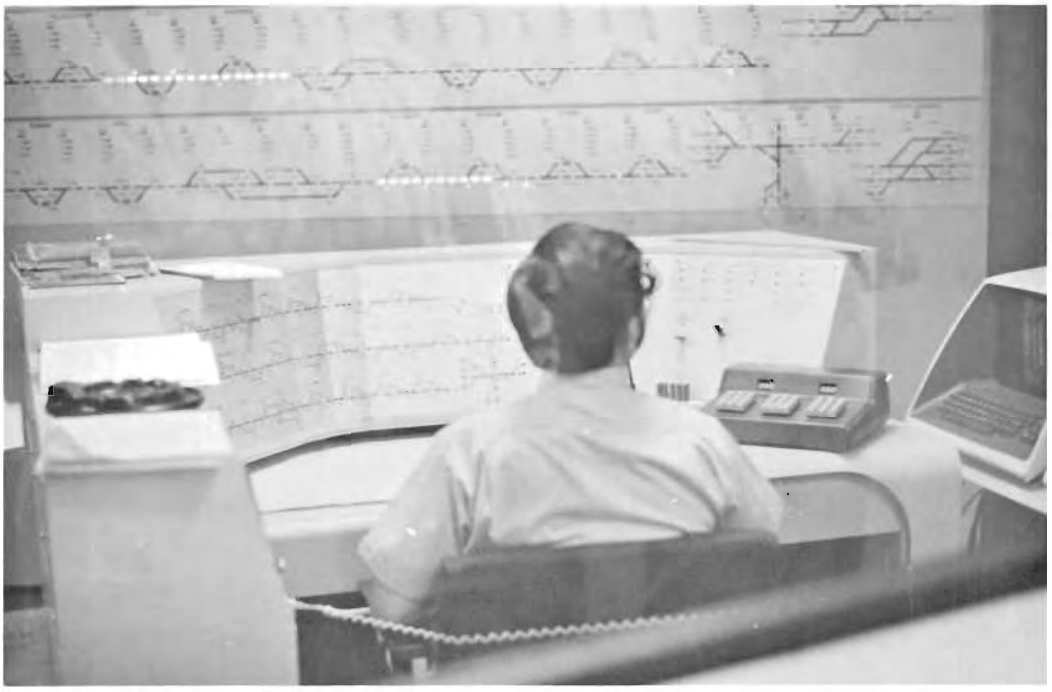


Figure 3-15. Train Dispatcher's Position in D&RGW System

Figure 3-16. Keyboard-Display Terminals

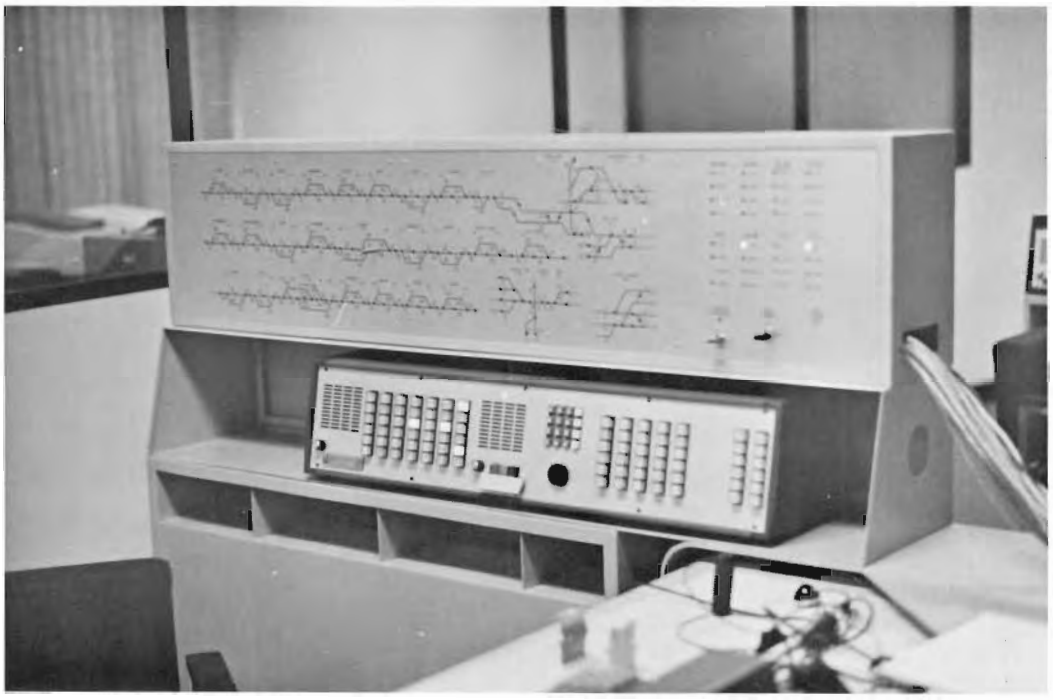


Figure 3-17. Communications Terminal

uses the computer to increase the proportion of the dispatcher's time available for performing his most critical functions--planning and decision making. Although this system still requires the writing and issuing of train orders in the traditional way, other systems are now being developed that will simplify those functions too.

To assure safety of operations, the dispatcher needs up-to-date information on the present and proposed future status of his system, the ability to communicate clearly and immediately with other people in the system, assistance in acquiring, recording, storing and retrieving information, and the ability to effect immediate changes in the operation of his system. Modern technology has created improvements in communications and control systems and, most significantly, has developed the high-speed digital computer and its accessories, with powerful capabilities to acquire, analyze, integrate, store, retrieve and display information. All

of these developments match the needs of the dispatcher. A tremendous potential exists, then, for great improvements in the train dispatching job, although, for economic reasons, widespread adoption of such advances can be expected to be slow.

3.3 WORK POSITION ENVIRONMENT

3.3.1 Workplace Arrangements

The train dispatcher positions in a dispatching office are usually grouped close together. The individual positions may be in one large room, in individual cubicles, or in separate rooms. In close proximity there is a supervisory position -- most often an Assistant Chief Dispatcher. The Chief Dispatcher generally has an office nearby, usually with several clerical positions. Sometimes the Superintendent of Transportation and the power dispatching group are located in the same general area.

Toilet facilities must always be available, although their accessibility to the train dispatcher varies. Hot plates, vending machines, water coolers, and similar conveniences are often provided (note the cup of coffee in many of the preceding photographs of dispatchers' positions).

No workplace arrangement is "typical". Figure 3-18 illustrates a particularly crowded arrangement, while Figure 3-19 illustrates one of the better arrangements observed. Space available determines many of the arrangements. In the worst case, several positions occupy one room and screens or partial partitions were erected to minimize distractions from adjacent positions. Figure 3-20 shows two adjacent CTC positions with a partition between them. The folding screen in the partition could be closed to increase privacy, but this adversely affected ventilation. On the other hand, some offices have been able to assign individual positions to separate rooms, with sound absorbent panelling and carpeting. Figure 3-21 shows such a room, with a window permitting observation by the Chief Dispatcher. There are a wide variety of cubicles, offices and combinations between these extremes.

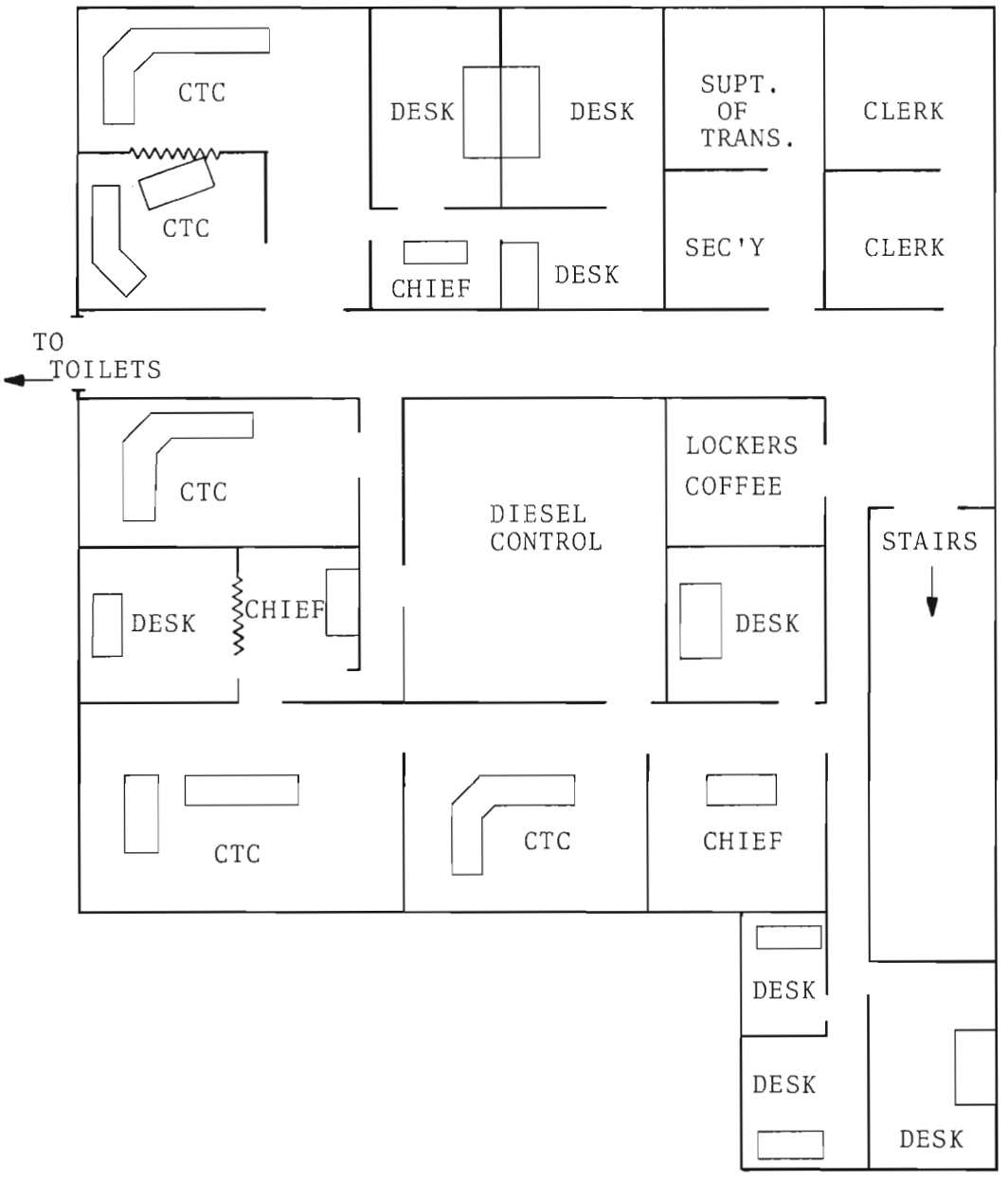


Figure 3-18. A Crowded Dispatching Office

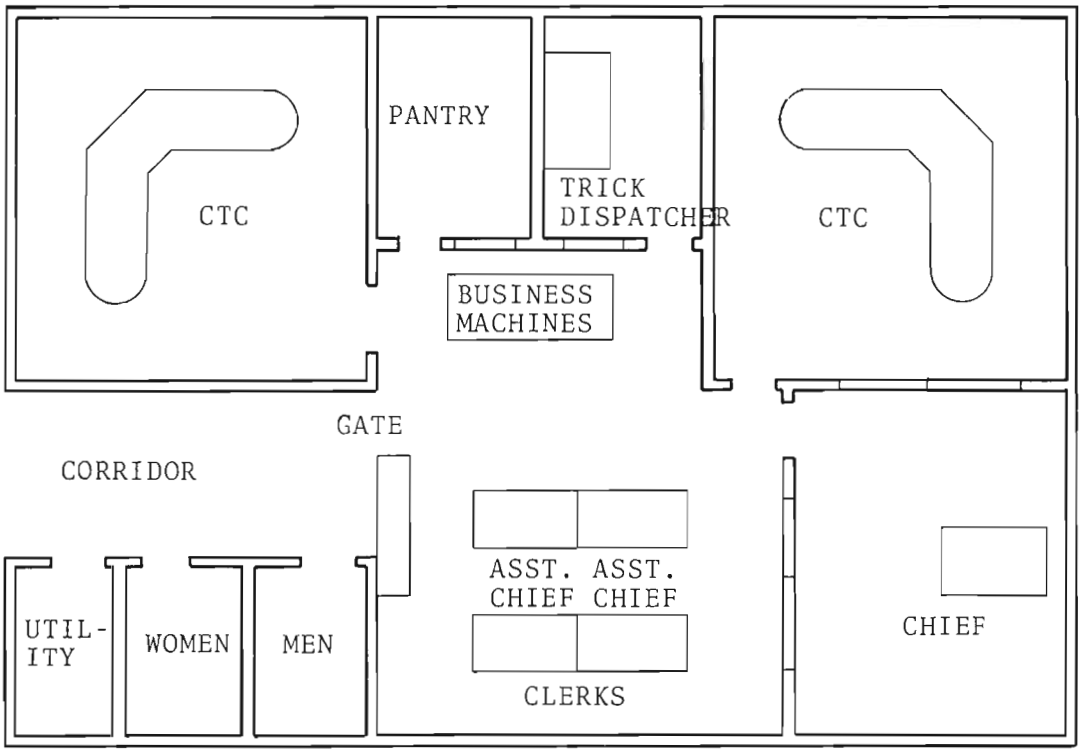


Figure 3-19. Layout of a Small Dispatching Office

Figure 3-20. Crowded Work Area

Figure 3-21. Uncrowded Work Area

3.3.2 Noise

When separate rooms are not provided, a dispatcher overhears much of the activity at adjacent positions, especially when communications problems cause the dispatchers to shout. Incoming telephone and radio channels are usually left open, and this background chatter can also be heard between partitions. Conversations between a dispatcher and a supervisor, a clerk, or a maintenance man are frequently audible at adjacent positions. The frequent bells or gongs in CTC boards and on hot-box recorders add to the background noise. In one large office noise levels as high as 90 decibels have been reported; generally anything above 70 decibels is considered objectionable.

Such a noisy environment distracts a train dispatcher and reduces his efficiency, and sustained exposure to high noise levels contributes to fatigue. The degree to which such interference can reduce the speed and effectiveness of a train dispatcher's decision-making ability warrants further study in the interest of safety.

Even when offices are enclosed and soundproofed, the open communications lines constitute a continuous background of noise. Although "muting" switches are provided on some equipment, they don't always function, exposing the dispatcher to a disturbing noise environment for extended periods of time. Malfunctioning communications can subject the dispatcher to a continuous, loud squeal that is particularly nerve-wracking. Aside from the general annoyance and tiring effects, communications noise can also cause misunderstanding of critical messages.

The dispatcher's job environment is not inherently noisy. With sound shielding, with selectivity of communications to be monitored, and with the communications system in good working order (as in the new D&RGW system), two dispatchers may work a few feet apart without mutual interference. However, in most dispatching offices there is need for improvement with regard to noise.

3.3.3 Temperature, Ventilation, Illumination

The general comfort level with regard to temperature and ventilation varies considerably among dispatching offices. Air conditioning, either central or individual, is still lacking in some facilities. The need to partition off individual positions for seclusion works against central ventilation, either for heating or for cooling. Generally, in new or remodeled buildings, adequate provisions have been made to maintain a comfortable working environment. However, where old facilities have been adapted to an expanding centralized dispatching facility, problems are numerous and persistant. Extremes of temperature and humidity in the climate usually produce discomfort at working positions. Sometimes the discomfort can be caused by protection against the climate -- on a cold day in a northern area, we found one dispatching office to be uncomfortably hot.

Overhead fluorescent lights, in some cases augmented by individual fluorescent or incandescent lamps and/or by sunlight from windows, are used consistantly. The illumination was not noted to differ from general office lighting except at a few CTC positions where the room lighting was dimmed to enhance the contrast of illuminated display panels. No complaints about lighting were heard, and no problems in illumination were noted in our limited survey.

3.3.4 Seclusion

The variety of rooms and cubicles assigned to train dispatcher positions has been noted in the preceding discussion. There is a trend toward providing a separate room for each dispatcher in the interest of minimizing noise and distractions (to the extent that ventilation permits). However, the most modern, custom-designed facility in operation -- the D&RGW office in Denver (Section 3.2.4) -- puts all four dispatchers together in one room. The room is secluded from outside personnel; the doors to the room have combination locks, and access to the dispatchers is tightly controlled (visitors can only watch operations through an observation window). But the four consoles are only a few feet apart.

This arrangement has obviously been carefully considered. Each dispatcher need listen only to what he wants to hear on his communications nets, and he can perform all conversation in a low voice through his lip microphone. The U-shaped console at his position gives him some visual isolation. The working experience of the D&RGW will provide useful information on the possible psychological benefits of sharing a common room and a common status panel when the distracting elements of proximity have been brought under control.

4. FUNCTIONAL ANALYSIS

4.1 INTRODUCTION

4.1.1 Purpose

The following functional analysis of the train dispatcher's job activity is intended to describe, in detail, the various tasks performed against an integrating framework of basic functions. Train dispatching involves numerous individual tasks and subtasks interrelating in continually changing combinations that do not lend themselves to the traditional task - subtask structure of task analysis. Therefore, we have adopted a functional rather than a task structure to tie these activities together into meaningful patterns.

4.1.2 Scope and Case Study Approach

In Section 1 we defined the two phases of our study (specific case study and general survey) and indicated that the general survey left us convinced that the details of task performance derived from a case study of any one dispatching operation would be fundamentally representative of all operations.

In this section, we show how specific tasks are accomplished by the Boston and Maine Railroad. A dispatcher from another system could find details that differ in his operation (such as maintaining a separate train order book for slow orders, or using a different place to record train consist data, or not recording exclusive-use permits on the train sheet), but by and large we feel he would agree that we are describing his job.

To help in understanding the unique ways that the Boston and Maine performs train dispatching tasks, however, we present here a brief description of the system.

4.1.3 The Boston and Maine System

The Boston and Maine Railroad provides services to portions of Maine, New Hampshire, Vermont, New York, and Massachusetts. The

general system and the train dispatchers' territories have been depicted in Figure 3-1.

A number of visits were made to the B&M Company headquarters, newly relocated at Iron Horse Park, Billerica, Massachusetts. These facilities, in addition to housing the administrative elements of the company, now serve as the site of a centralized dispatch system. The train dispatch functions for three of the four major territorial divisions (West End, East End, and Connecticut River), and all CTC territory are provided here. The dispatching function of the fourth division (Boston) is conducted at North Station in Boston.

The B&M operation includes manual block territory, automatic block territory, and CTC territory. In some cases, one dispatcher may be controlling all three types of territory.

A manual block system provides for a "space interval" separation whereby at a given time, a train has exclusive "rights" to a section or "block" of track. Block signalling supplements time-table and train-order operation through sensors which detect the passage of trains.

Because of the additional protection afforded by the manual block system in conjunction with detailed standard rules, an I.C.C. order of 1947 permits speed limits up to 79 miles an hour in such territory, while limiting passenger trains to less than 60 mph and freight to less than 50 mph on non-signaled track. A complete record of passage times (at his own and adjacent stations) is kept by each operator in order that the condition of each block be known at all times. The operator must obtain permission of the operator at the other end before clearing his signal to allow an approaching train to enter.

> "Manual block" is basically a safety feature rather than a capacity-increasing or economic feature. Since no signal indication in manual block provides information about the second block ahead, train speeds are limited by signal-sighting distances. Unless distant signals are provided, it is essentially a one-block system.

A major constraint on moving traffic is the block length, usually the distance between stations. The present trend toward fewer manned open offices for use as check points acts to increase the length of the block. One solution is "permissive blocking": a freight train is permitted to enter and proceed through a block already occupied by another freight train, provided the second train moves at restricted speed (not to exceed 15 miles per hour), prepared to stop short of a train or other obstruction.

Light traffic lines which provide long intervals between trains offer essentially the same following safety as "time-spacing" or "manual block" systems. The choice is generally a matter of company policy and maximum use of a single system avoids the necessity of switching from one set of rules to another.

Automatic operation of block signaling is provided by the "track circuit," a very complex system of detection and switching circuitry which, through a fail-safe concept, virtually eliminates malfunction of the automatic portions of the system. The track circuit has made it possible to shorten the blocks to the limits imposed by braking distances. Associated "distant signals" are located either on the same mast or on the same three indication signal arm, thus providing a two-block system which permits train operation at maximum authorized speed. Assurance is provided that the operator will receive the first restrictive indication in time to permit a stop short of the train ahead.

Centralized traffic control is provided through a CTC system. This is a block system under which train movements are authorized by block signals whose indications supersede superiority rules applying to opposing and following train movements on the same track.

A one man control unit providing the essentials of a CTC system was first used by the New York Central in 1927. Today, this type of system enables the dispatcher to directly control all train movements without recourse to participation of local operators for switch or signal setting. All controls and status indicators are located on a situation display panel. Control is effected by wire

transmission of discrete pulse coding signals that are processed into switch/signal activating impulses at field stations. In turn, following completion of the desired action, a return discrete pulse code sends a signal which (following decoding) presents a status indication on the display.

The Billerica operation includes three dispatcher positions (combined CTC and train order) grouped in the same room with the Assistant Chief Dispatcher, in close proximity to the office of the Chief. The principal communications interfaces in this office are diagrammed in Figure 4-1. Communications links identified in the figures as A-1 through A-18, B-1 through B-6, C-1 through C-150, and D-1 through D-4 are described in Table 4-1. Notes 1 through 6, relative to Figure 4-1, are presented in Table 4-2, and the respective interfaces/communication links are described in Table 4-3. Expanded detail related to communication links A-1 through A-18 is shown in Table 4-8, contained in Section 4.6 of this report.

Each of the dispatchers is assigned primary responsibility for a defined operational territory, and the control equipment necessary to support his operation is provided in his immediate work area. The same type of equipment is provided in each case.

Such internal coordination as is necessary for routine traffic entering or leaving territorial limits is handled informally through direct personal voice communications. Where special considerations are involved, the Assistant Chief Dispatcher generally acts as the focal point for directing or monitoring the situation. When special or urgent operational requirements are transmitted to the Chief Dispatcher from external sources, he communicates with the Assistant Chief Dispatcher on a person-to-person formal basis in order to insure immediate, possitive passing of information. The Assistant Chief Dispatcher then formally transmits the requirements to the respective dispatcher(s) as specific directions.

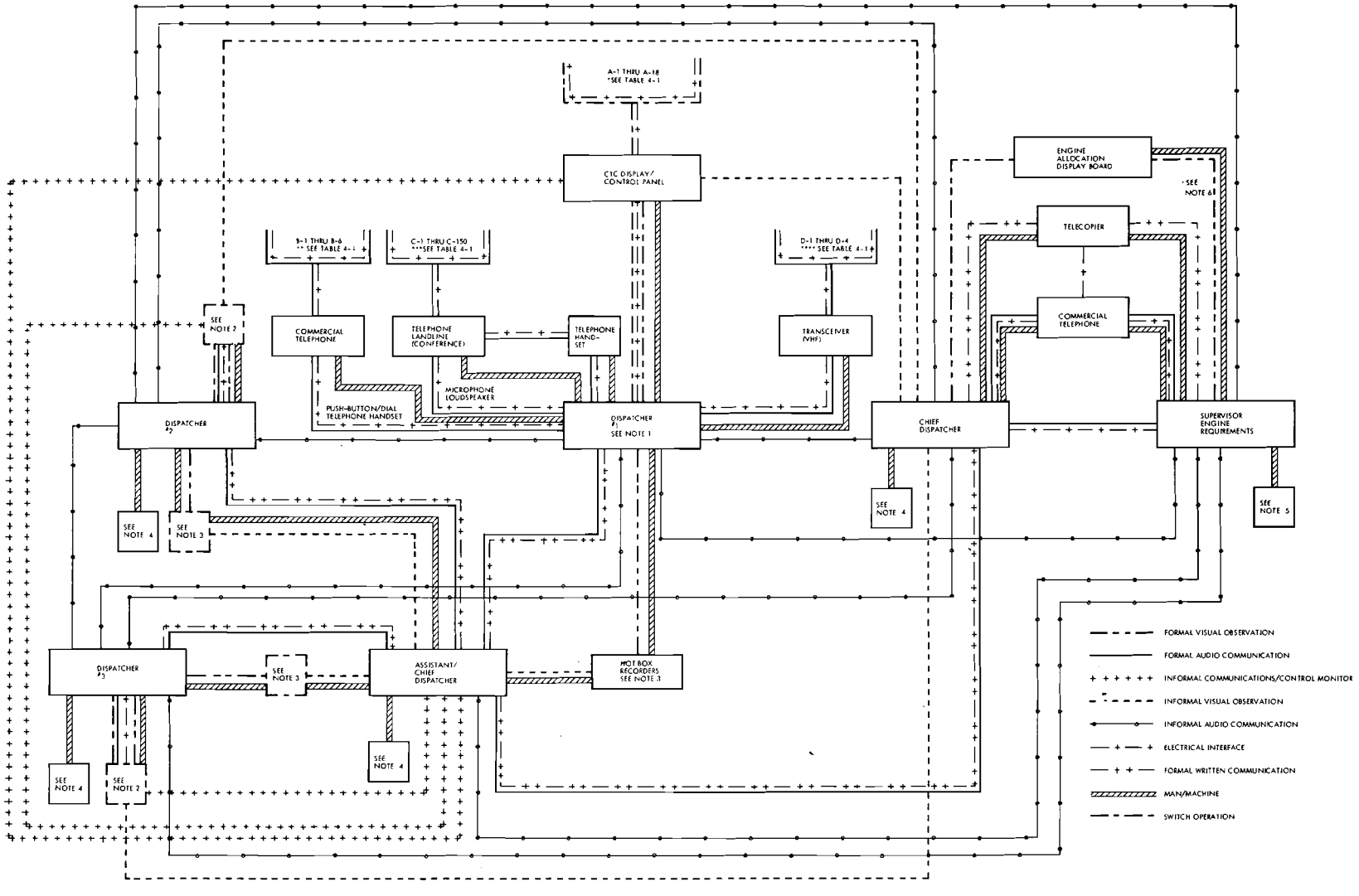


Figure 4-1. Boston & Maine Communications/Control Interfaces

TABLE 4-1. COMMUNICATION/CONTROL CAPABILITIES
(AS SHOWN IN FIGURE 4-1)

Links	Description
+A-1 through A-18	CTC System operational control circuits
++B-1 and B-2	Local internal telephone circuits restricted to "in-house" communications
++B-3 and B-4	In/out commercial lines with unlimited dial capability
++B-5 B-6	Used for WATTS Communications
+++C-1 through C-150	Terminals on an open conference circuit between Dispatcher #1 at Billerica, MA and all points between Gardner, MA and Mechanicsville, NY. The purpose of this circuit is to provide for two-way voice communication between the dispatcher, train crews, section and signal forces, towers, agents, supervisors, etc.
++++D-1 D-4	Four VHF radio communication two-way links providing for direct communications with trains, high rail cars, towers and yard officers

TABLE 4-2. NOTES FOR FIGURE 4-1

Note 1 - Since the activities of each of the three dispatchers are essentially the same -- differing only in scope of territorial responsibility -- and subject to random differences in traffic load and occurrences of unplanned or emergency incidents, we used only the position identified as dispatcher #1 as a representative case in our analysis.

Note 2 - The control display monitor and switching functions are fundamentally the same in each of the three dispatcher positions; therefore, the detail pertaining to functions "A" through "D" is shown for dispatcher #1 only.

Note 3 - Hot-box recorders located adjacent to each of the three dispatchers provide temperature chart recordings depicting the heat condition present at right and left journals as sensed by remotely located heat detection systems. Each of the dispatchers monitors the recordings pertinent to his area of responsibility. The Assistant Chief Dispatcher periodically monitors all recordings and assists the individual dispatcher in equipment adjustments not requiring the attention of a maintenance man.

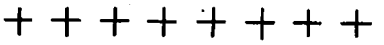
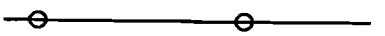
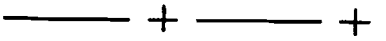
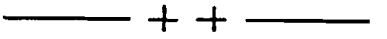
Note 4 - Utilizing a typewriter located adjacent to the position, Dispatchers 2 and 3, as well as the Assistant and Chief Dispatchers, maintain a running log of significant happenings and information in a capsule format. This expedites the briefing process at the time of relief from duty and provides a record of data relating to agreements, decisions, schedules, etc, either internal or external in nature, but important enough to be maintained in a record separate from the train order book or the dispatchers train sheet.

TABLE 4-2. NOTES FOR FIGURE 4-1 (Cont'd)

Note 5 - The Supervisor of Engine Requirements also maintains a running typewritten log of events he deems significant as related to his interaction with the Chief Dispatcher, Assistant Chief Dispatcher and external agents or agencies.

Note 6 - The Supervisor of Engine Requirements has the responsibility for posting or modifying power allocations associated with train operations. These postings are on a large magnetic display board and reflect decisions involving the Engine Supervisor and those persons responsible for train consists, and are coordinated with the Chief Dispatcher in order that information provided to the operations dispatchers remains current.

TABLE 4-3. DESCRIPTION OF INTERFACES SHOWN IN FIGURE 4-1

LINK SYMBOL	EXPLANATION
	Formal Visual Observation - a required task involving visual monitoring or examination.
	Formal Audio Communication - a required component task associated with specific performance requirements.
	Informal Communications/Control Monitor - the direct personal audio/visual monitor of communications and displays pertaining to the other dispatchers' operational situations on a random opportunity basis.
	Informal Visual Observation - the occasional direct visual observation as a quick means of establishing status.
	Informal Audio Communication - the internal direct voice inquiry relative to traffic information.
	Electrical Interface - Electrical switching or circuitry.
	Formal Written Communication - Information or direction passed by memo, notice, bulletin, message or note,etc.
	Man/Machine - Interface between Dispatcher and Equipment.
	Switch Operation - Task involving electromechanical switching initiated by mechanical action of the dispatcher.

4.2 FUNCTIONS

4.2.1 Functions of a Train Dispatcher

In spite of the variety of the train dispatcher's tasks, the functions he performs may be grouped into a few categories. In selecting the functional structure for this analysis, we sought the minimum number of descriptive terms that would fully answer the question: "What is the dispatcher doing at this time?" We identified six functions that appeared to cover all tasks:

1. Prepare Documentation
2. Conduct Preliminary Planning
3. Monitor/Coordinate Train Movements
4. Initiate/Stop Train Movements
5. Respond to Unplanned Events
6. Respond to Emergencies

For each of these functions, a set of sub-functions was developed to exemplify some of the major tasks involved in train dispatching. This total function/sub-function structure is presented in Figure 4-2 and forms the framework for the following analysis.

4.2.2 Organization of Functional Analysis

For each of the six functions identified in Figure 4-2, the following material is developed:

1. A brief summarizing the nature and importance of the function.
2. A Functional Flow Block Diagram (FFBD), showing the principal sub-functions or tasks that must be accomplished and their relative sequence.
3. A Task Performance Requirements Table, describing the nature of each sub-function.

4. (Where relevant) a Decision Flow Diagram (DFD) showing the major decisions involved in performing a function.

5. (Where relevant) an Operational Sequence Diagram (OSD), relating in one chart the principal actions and decisions of the dispatcher with the principal interfaces with displays, controls, communications and personnel.

Additional information is provided where appropriate. More detailed descriptions of the FFBD, DFD and OSD follow:

Functional Flow Block Diagrams. Following an analysis of the train dispatcher activity and a review of documentation delineating dispatcher requirements and constraints, Functional Flow Block Diagrams (FFBD's) were developed in order that the combination of observed performance and directives could be incorporated and translated into functions and functional relationships.

Functions/sub-functions were defined to a level at which an automatic or manually initiated action is identifiable to the extent suitable for development of Decision Flow Diagrams (DFD's) and/or Operational Sequence Diagrams (OSD's). The FFBD's present the relationship of a particular prime function to its sub-functions and associated functions. The relationship is graphically presented, sequentially, in a convention common to systems engineering methodology. The sequential representation does not imply time flow, but is an optimum means for displaying a functional design with no specific reference to hardware, personnel, software, or other requirements.

Functions are normally developed by iterative levels; each function is identified by a number code which denotes the level of analysis it represents, e.g., the number of decimals in an identifying number identifies the level of analysis.

Flow intersects are connected by an AND gate, an OR gate, or an AND/OR gate. The AND gates are used to indicate multiple mandatory requirements that must be completed as a condition to accomplishment of a succeeding function or sub-function; the OR

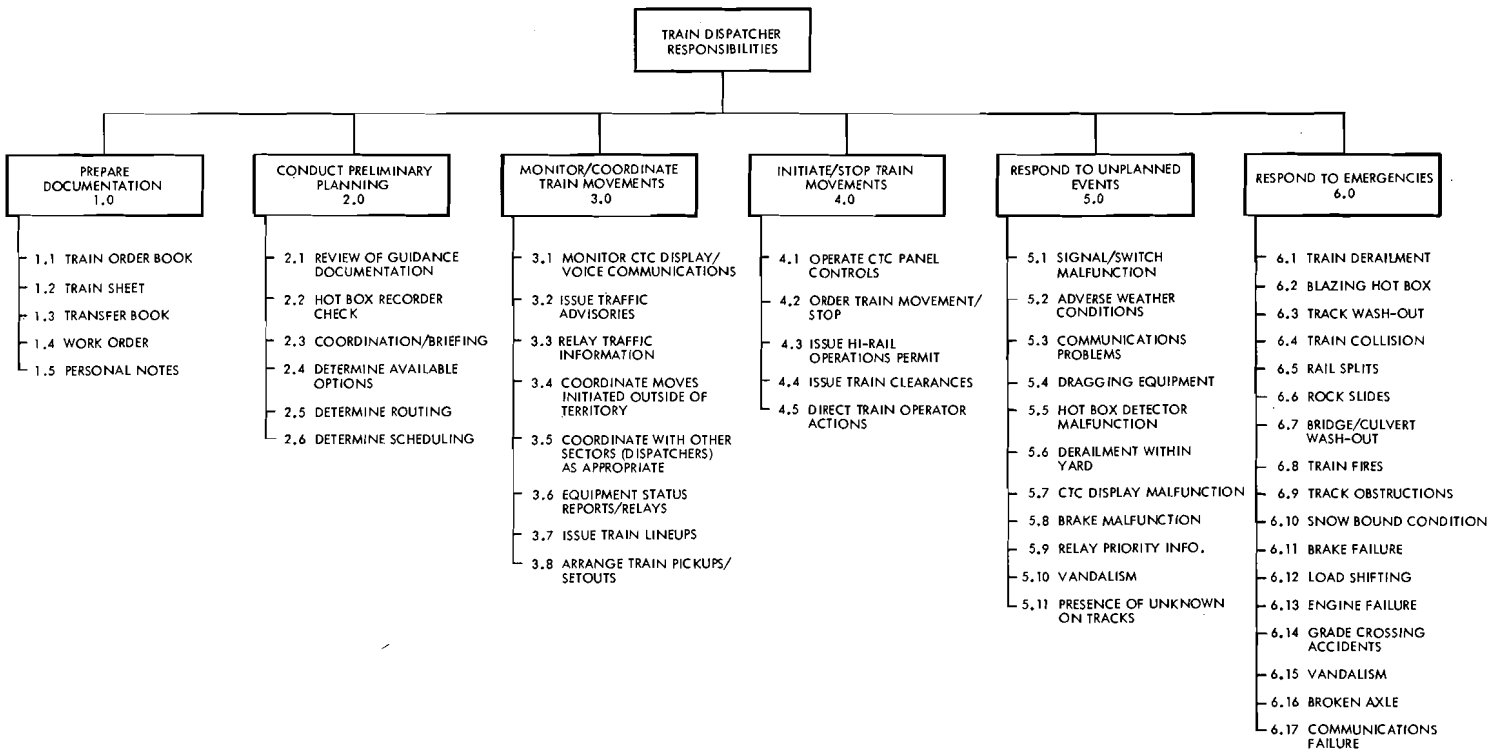


Figure 4-2. Functional Structure of the Train Dispatcher's Job

gates are used to identify decision points where only one of two or more flow paths may be taken. Diagrams are normally read from left to right, top to bottom; however, back flows have been used in the present analysis.

Decision Flow Diagramming. Decision Flow Diagrams (DFD's) provide a rational approach for consideration of a varied choice of alternatives, estimating their outcomes, selecting the best alternative for a particular purpose, and then carrying it out.

The essence of this systems analysis technique is the construct of a carefully simplified "real world" abstraction of those components of a particular FFBD which concern the decision making aspects of a function or sub-function. Care is exercised in model design to preserve all significant relationships for the problem to be resolved, but to delete from analytical consideration unimportant events. For this study, this technique serves as a bridge providing the additional visibility necessary to develop, in detail, the decision making elements of Operational Sequence Diagrams.

Operational Sequence Diagramming. Operational Sequence Diagrams (OSD's), as used in this study, provide for much greater expansion of detail while defining hardware, software and operator functions. Whereas the typical FFBD does not identify man-machine functions, or detail the associated parametric factors, the OSD is an information-decision-action flow diagram or schematic used for the dynamic description of a system.

The OSD is used to establish the sequence of operations required between subsystem interfaces at various levels of analysis. These interfaces in a man-machine system may be between human operators, between machines, between software programs or between any combination of the three. In addition, the OSD may be used to:

- Define and analyze communications requirements
- Aid in the design and layout of equipment

- Document an existing set of operations and decision making procedures
- Develop methods for testing/evaluating the system or its parts.

These uses in turn facilitate identification of potentially critical situations produced by inadequate procedures or equipment, as well as the development of requirements for training programs and provide information relevant to effective system operation. The charting symbology used for the construction of the OSD's is shown in Figure 4-3.

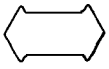
SYMBOL	MEANING	CODE LETTER/MEANING
	TRANSMIT	V - VISUAL
	CONTINUOUS OR AUTOMATIC	E - ELECTRICAL
	RECEIVE	A - AUDIO
	RECEIVE MULTIPLE INPUTS	T - TACTILE
	OPERATE	M - MECHANICAL
	OPERATIONAL REFERENCE POINT	
	DISPLAY	
	STORE	
	STORE & DISPLAY	
	DECISION	
	DISCUSSION	

Figure 4-3. Charting Symbology for Development of OSD's

4.3 PREPARE DOCUMENTATION - Primary Function #1.0

4.3.1 Brief

This major function includes those administrative tasks which involve the recording of data and information relevant to train operations. Actual preparation or development of the various forms of documentation occurs at differing intervals as required by the pertinent railroad rules and operating procedures.

4.3.2 Train Order Book Detail

Each train order must be written in full, in a book provided for this purpose. With the order, the names of those who have signed for it, the time, the responses which indicate when and from what office the order was repeated, and the train dispatcher's initials are entered. The entries must be made immediately -- never from memory or memoranda. When transmitting by telephone or radio, the dispatcher must write the order as he transmits it and must underscore each word and figure each time it is repeated. Train order records must be neat and legible, and the dispatcher's initials and the date must be shown at the top of each page. All authorized train movements must be recorded and the dispatcher must check all train orders not in effect by writing his initials across the face of the train order with a red pencil. A single red diagonal line drawn across the entire page indicates that all train orders on that page are no longer in effect. When all train orders up to and including a certain page are no longer in effect, a red "X" is drawn across the page. Those offices which are closed at the time of a train order transmittal must be identified as a reminder to issue the order when the office opens. When the train dispatcher issues an order that is to be delivered by another dispatcher, he must make a carbon copy of it in the train order book and underscore this copy each time he repeats the order.

4.3.3 Train Sheet Detail

Train sheets must be legible, neat, and maintained in proper format. With few exceptions, train sheet entries must be in ink.

Train time sequences are entered in the same manner as trains shown on timetables. Movement of hi-rail vehicles, such as superintendent's inspection cars, are recorded in pencil only, so that such record may be erased. The train dispatcher must record the time of train arrival and departure; the number of loaded and empty cars; tonnage; the names of conductors, engineers, and other crew members as required; the reporting time of engine and train crews at terminals, and the time such crews are relieved from duty. Also, he must record delays, weather reports and unusual occurences such as derailments, fires or accidents. Before issuing "running orders" to an extra, or "work orders" to a work extra, he must record all such train data and protect movements against opposing extra trains by train orders.

4.3.4 Transfer Book Detail

The train dispatcher being relieved must make an ink transfer of all outstanding train orders in the transfer book, identifying each by number, and furnishing the relieving dispatcher with all pertinent information. The relieving train dispatcher must carefully read all train orders transferred to him and check the number and address of each before signing the transfer. Before commencing operations, the relieving train dispatcher must thoroughly familiarize himself with train orders, lineups and CTC track permits in effect, and with the location of trains.

4.3.5 Additional Comments

It was observed that the book-keeping (documentation) requirements associated with train dispatcher activity constituted about 40 percent of total task time. The practice of documenting practically every utterance or act of the train dispatcher, which dates back to the period when all movements or operations were authorized only by the issuance of paper orders or permits, still persists. Manual recording of routine actions so monopolizes the typical train dispatcher's time that it detracts from other (sometimes critical) performance requirements.

FFBD #2 Figure 4-4 depicts typical documentary actions, shown in a representative sequence. Table 4-4 identifies, in a matrix format, the sub-function and performance factor components of Primary Function #1.0. OSD #1 (Figure 4-5) is provided to better illustrate the type of information processed and to associate this data with a specific documentary record. Examples of the various forms generally associated with train dispatching documentary requirements are shown in Figure 4-6, and a brief summary of representative categories of information entered on three commonly used documents is shown in Figure 4-7.

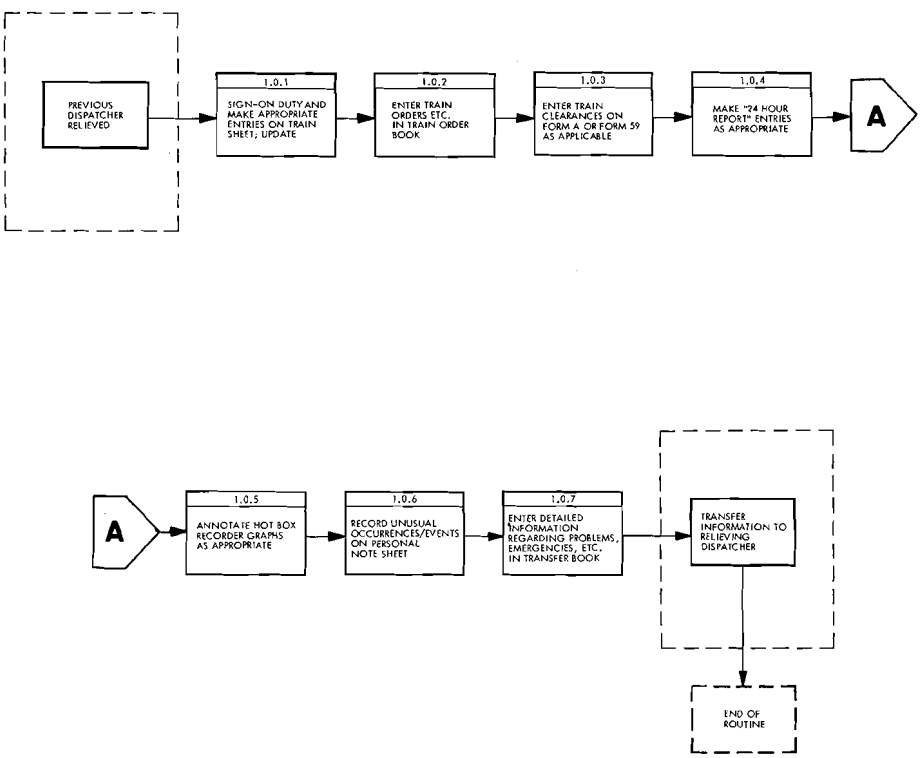


Figure 4-4. FFBD #2 Prepare Documentation

TABLE 4-4. TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #1.0

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
1.0.1	Sign - On Duty and Make Appropriate Entries in Train Sheet; Update	The formal assumption of responsibility signified by entering signature, date, time, etc. on the train sheet, and making data entries necessary for update of the train sheet						✓			✓
1.0.2	Enter Train Orders Etc. In Train Order Book	The formal recording of train orders and amplifying of special information relative to scheduled train movements	✓	✓			✓	✓		✓	✓
1.0.3	Enter Train Clearances on Form A or Form 59 as Applicable	The formal entry of clearance information citing pertinent train orders to be observed as a condition of the movement clearance	✓	✓	✓					✓	✓

TABLE 4-4. TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #1.0 (Cont'd)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
1.0.4	Make "24 Hour Report" Entries As Appropriate	The "book-keeping" activity associated with recording snow removal operations authorized (one example of a number of similar actions required of a train dispatcher by the various railroads)				✓	✓			✓	✓
1.0.5	Annotate Hot-Box Recorder Graphs as Appropriate	The notation of date/time/ location on hot-box recorder graphic recordings subsequent to review and the analysis of heat conditions, as well as such additional information necessary to document the occurrence of a hot-box condition and its results				✓	✓		✓		✓
1.0.6	Record Unusual Occurrences/Events on Personal Note Sheet	The entering of information pertinent to significant or unusual occurrences or emergencies into running log	✓			✓	✓			✓	✓

TABLE 4-4. TASK PERFORMANCE REQUIREMENTS
OF PRIMARY FUNCTION #1.0 (Cont'd)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
		for later reference or recall									
1.0.7	Enter Detailed Info. Regarding Problems, Emergencies, etc. in Transfer Book	Entering formal, detailed information relating to problems, emergencies, etc. for subsequent transfer to the relieving dispatcher. Information may be extracted from the personal notes developed as Function 1.0.6	✓	✓		✓	✓		✓	✓	✓

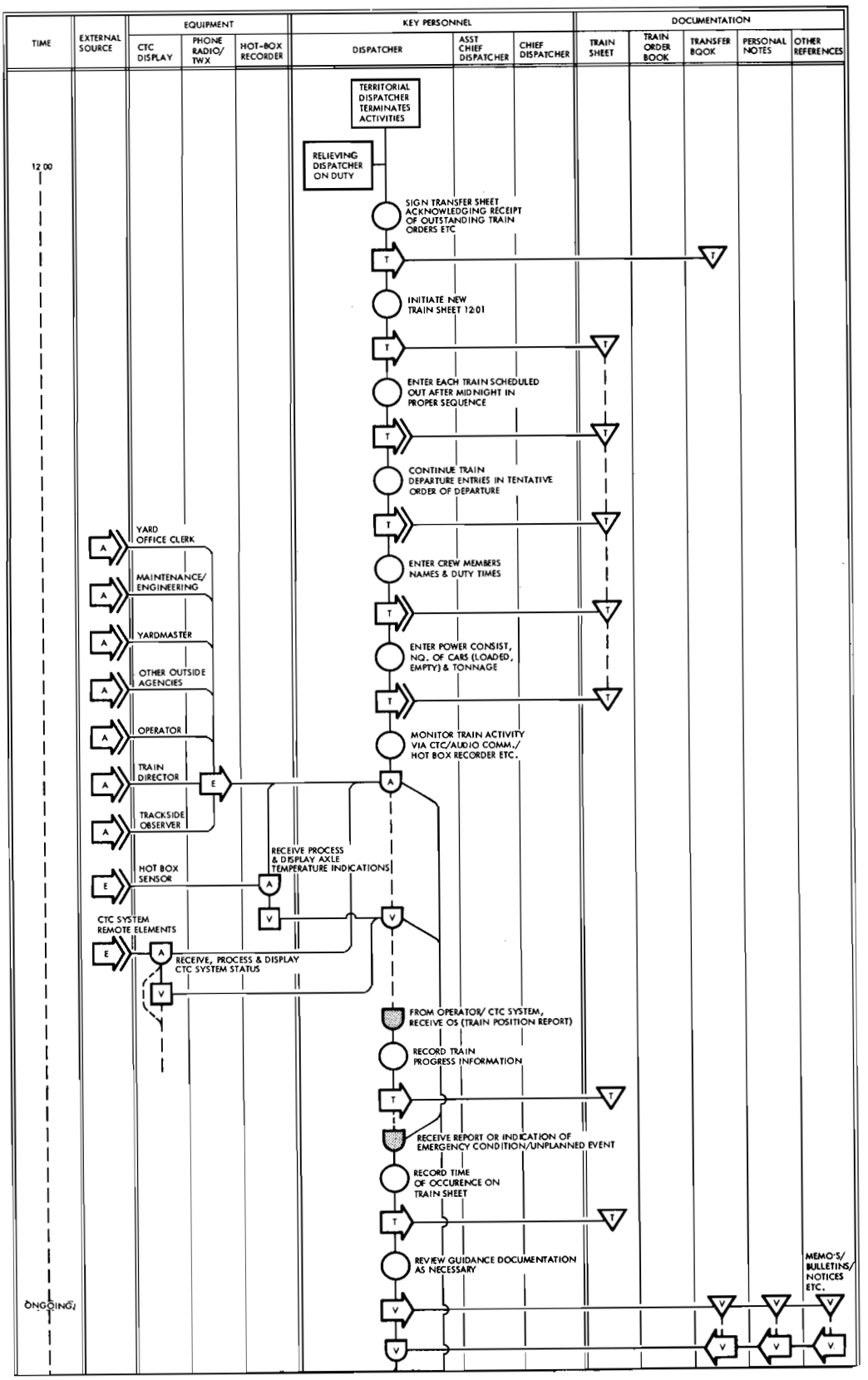


Figure 4-5a. OSD#1 Interface Detail of Documentation Development

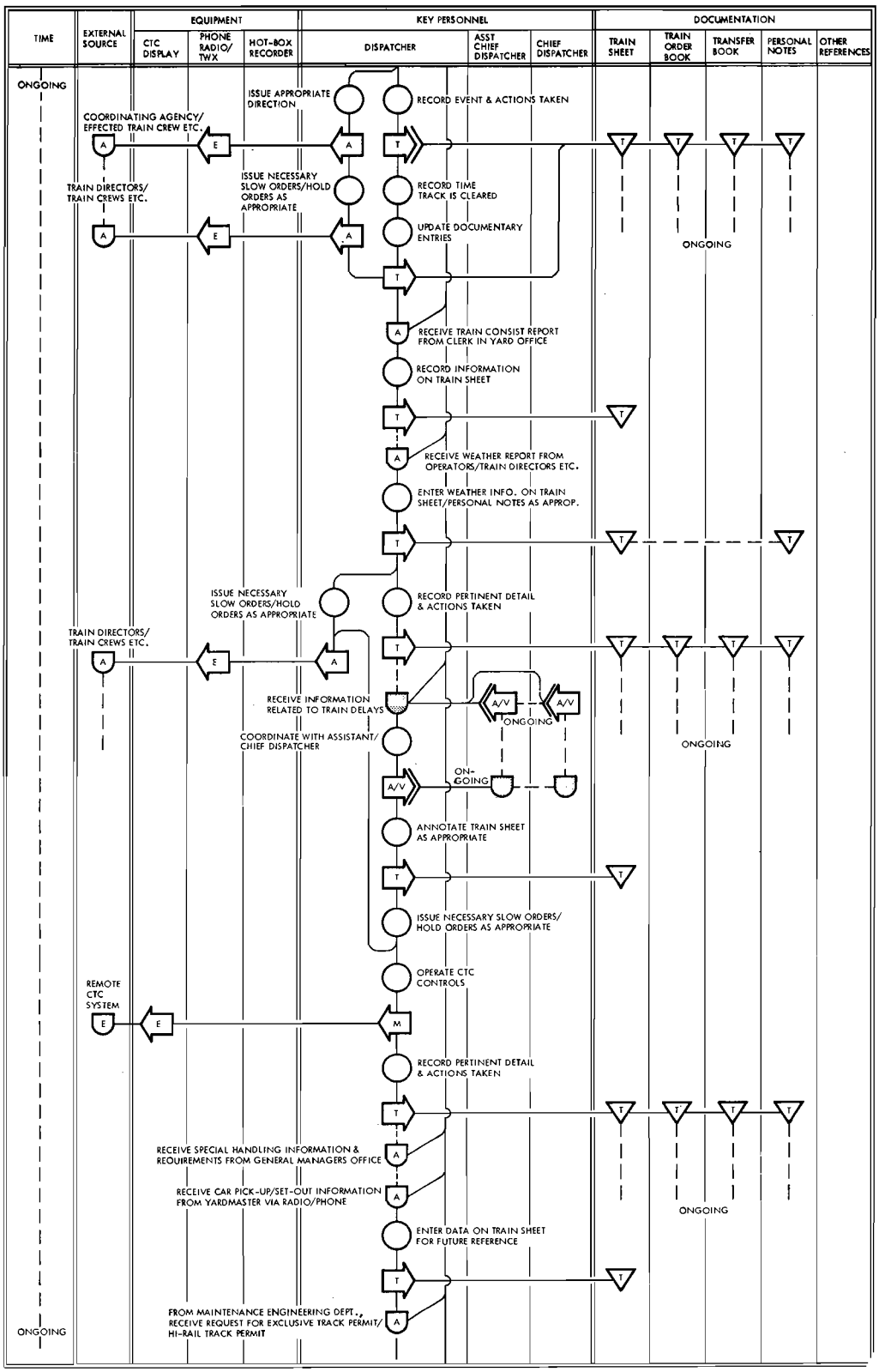


Figure 4-5b. OSD#1 Interface Detail of Documentation Development

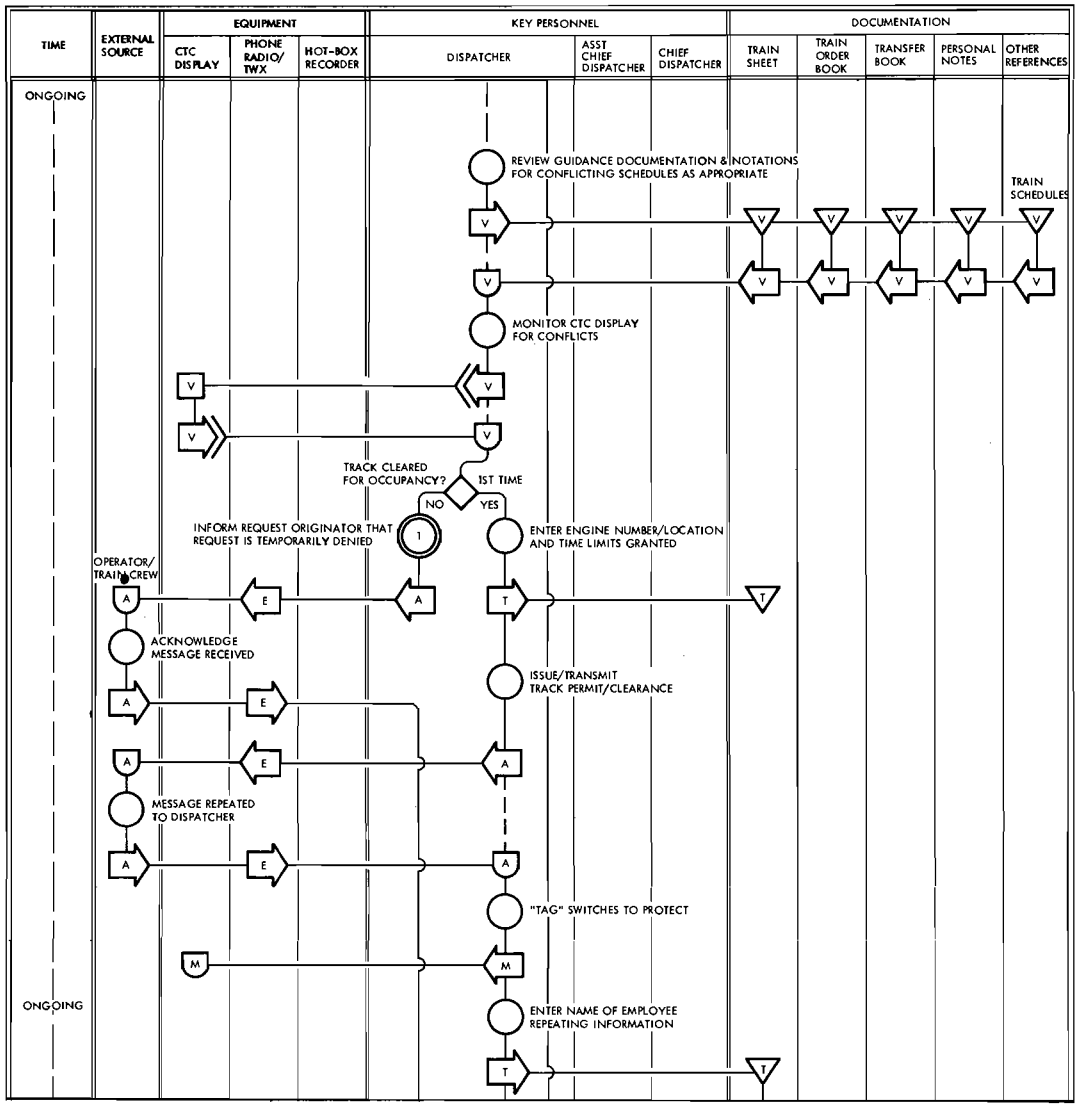


Figure 4-5c. OSD#1 Interface Detail of Documentation Development

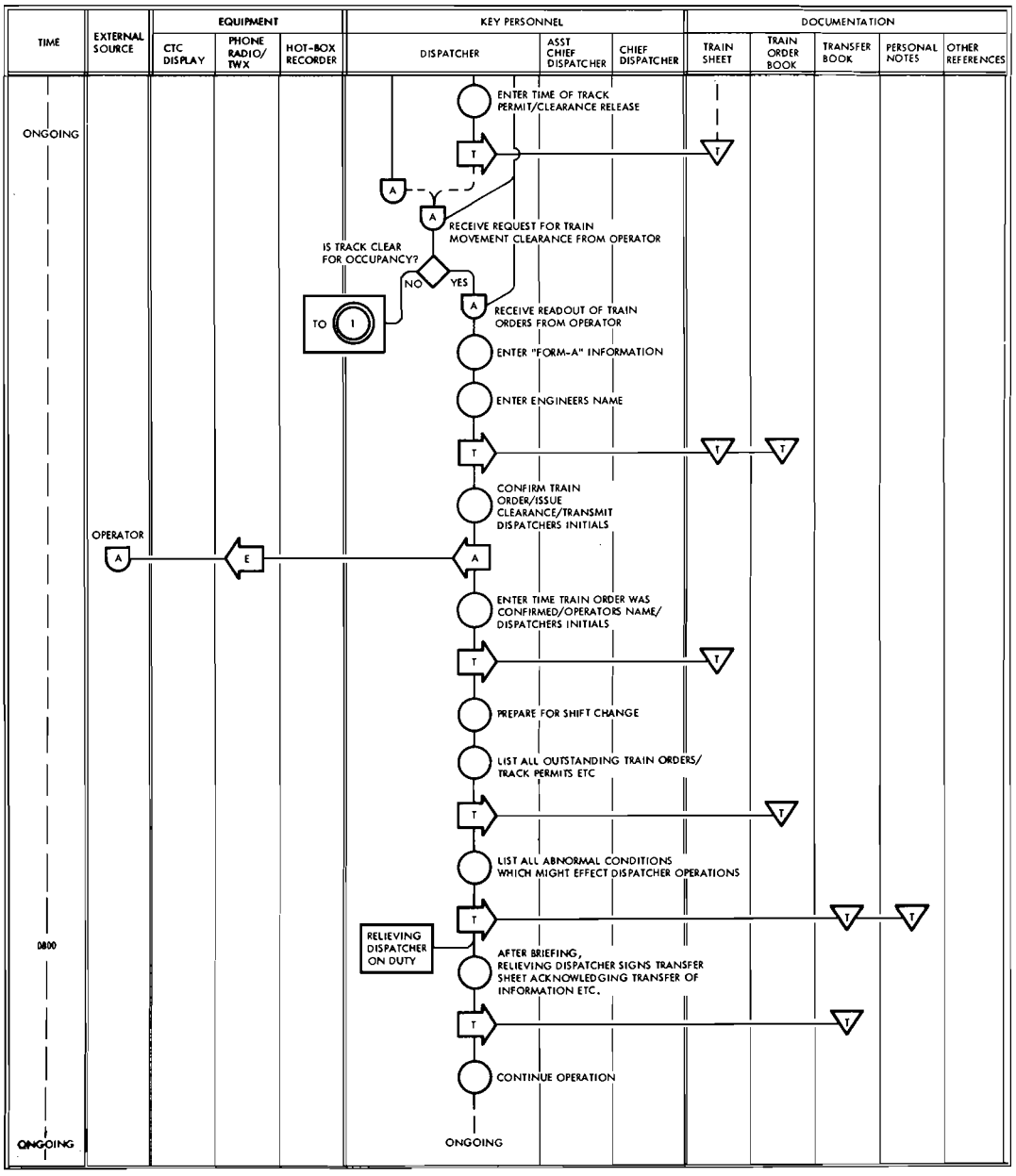


Figure 4-5d. OSD#1 Interface Detail of Documentaion Development

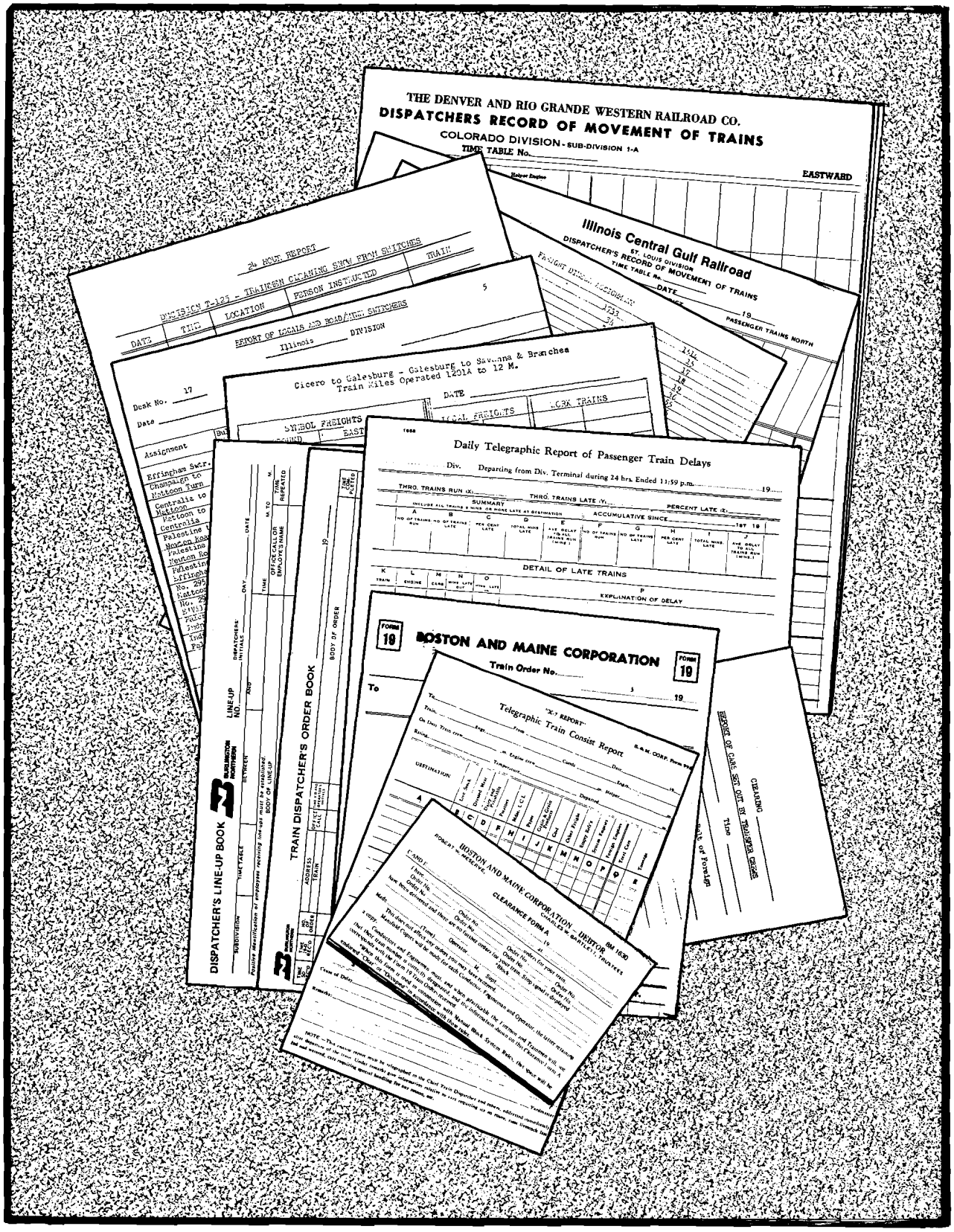


Figure 4-6. Sample Documentary Form Requirements

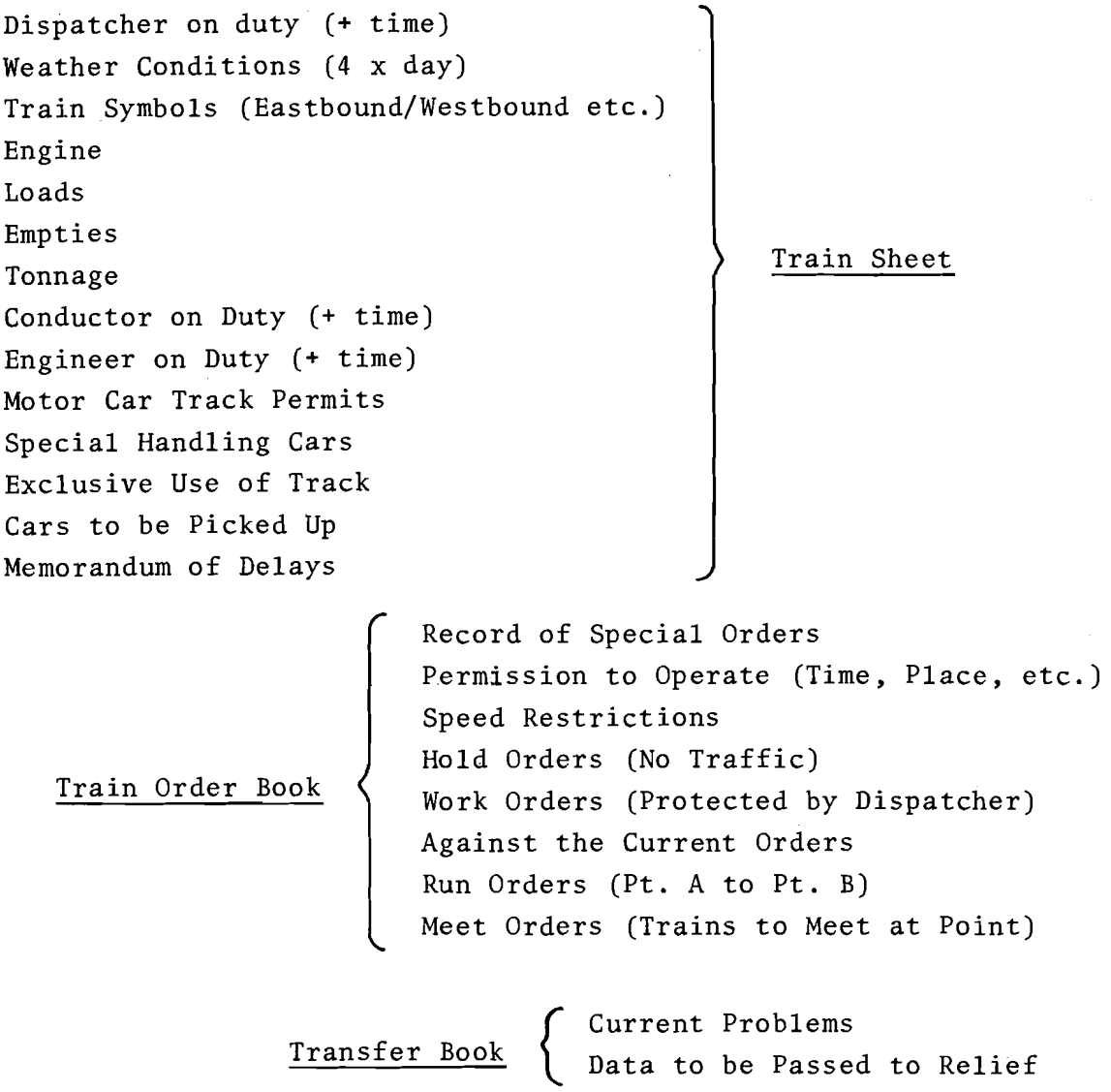


Figure 4-7. Summary of Representative Categories of Information Entries

4.4 CONDUCT PRELIMINARY PLANNING - Primary Function #2.0

4.4.1 Brief

Initial preliminary planning is done before assuming responsibility for the operating position (change of shift); it then becomes an ongoing response to traffic conditions. Although conducted under relatively non-stressful conditions, preliminary planning is a prerequisite to an efficient control operation and to the satisfactory performance of the remaining functions. Significant lead time is required in order to effect the scheduling and interactions characteristic of efficient train movements. Included in this function is the review of all documentation which has bearing on the operation; equipment check, traffic condition/status and familiarization with and/or determination of routes and schedules along with effecting the necessary coordination.

4.4.2 Additional Comments

FFBD #3 (Figure 4-8) depicts the preliminary planning process, shown in a representative sequence. Table 4-5 identifies, in a matrix format, the sub-functions and performance factor components of Primary Function #2.0. Examples of the various forms of directives and notices normally posted on a bulletin board for review by dispatching personnel are shown in Figure 4-9.

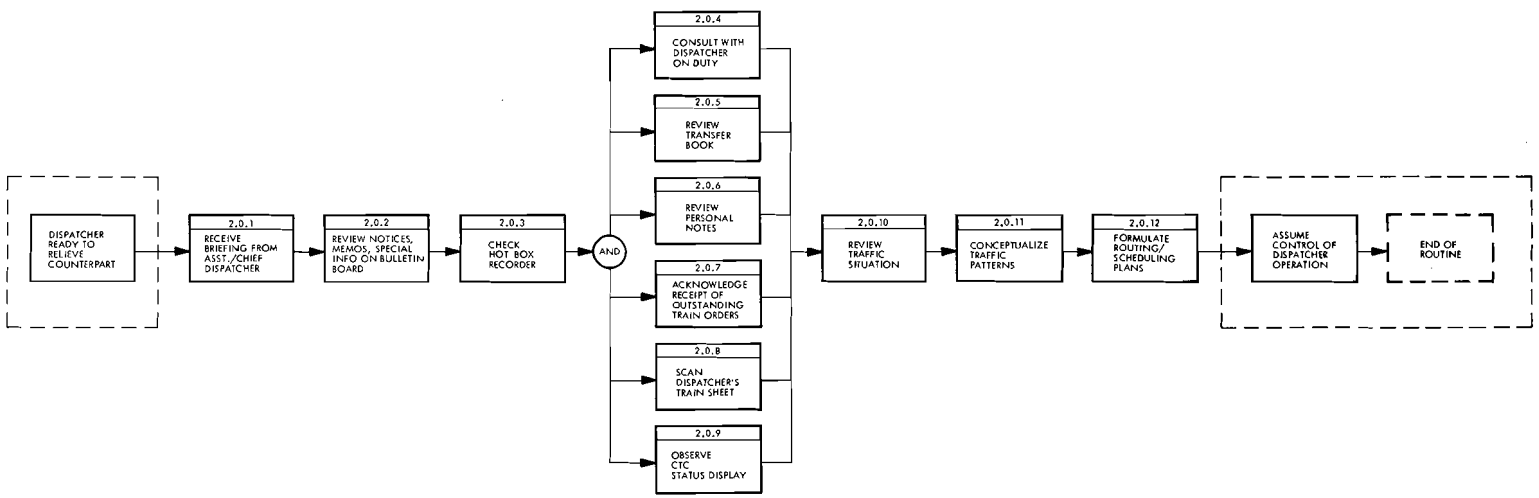


Figure 4-8. FFBD #3 Conduct Preliminary Planning

TABLE 4-5 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #2.0

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
2.0.1	Receive Briefing from Assistant/Chief Dispatcher	The initial briefing provided to the relieving dispatcher upon his arrival for duty by the Assistant and/or Chief Dispatcher, generally concerning items of great importance or priority	✓			✓			✓	✓	
2.0.2	Review Notices, Memos, Special Information on Bulletin Board	The reading or reviewing of the various information bulletins, memos, notices, etc. which are posted on the bulletin board	✓			✓			✓		
2.0.3	Check Hot-Box Recorder	The initial check of hot-box recorder graphs associated with the territory over which the relieving dispatcher will				✓					

TABLE 4-5 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #2.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
		exercise control, in order to assure that no "hot-box" condition presently exists									
2.0.4	Consult with Dispatcher on Duty	Discussion of the traffic picture and other pertinent conditions with the dispatcher to be relieved	✓	✓		✓			✓	✓	
2.0.5	Review Transfer Book	The review of information formally developed as "significant events" during the course of previous work shift	✓			✓				✓	

TABLE 4-5 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #2.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
2.0.6	Review Personal Notes	The joint review and appropriate discussion of items formally recorded as notes relating to "happenings" which occurred during the previous shift	✓	✓		✓			✓	✓	
2.0.7	Acknowledge Receipt of Outstanding Train Orders	The formal acknowledgement of outstanding train orders							✓	✓	✓
2.0.8	Scan Dispatcher Train Sheet	The review of data entered on the train sheet, which is frequently comprised of specific sections (often	✓			✓					

TABLE 4-5 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #2.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
		formerly separate forms) for the systematic recording of information related to train movements									
2.0.9	Observe CTC display	Visual examination of the CTC display reflecting the traffic condition associated with a specific territory	✓			✓					
2.0.10	Review Traffic Situation	Review of the various factors and data which comprise the overall traffic situation	✓	✓		✓					

TABLE 4-5 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #2.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
2.0.11	Conceptualize Traffic Patterns	Memorization of the details of the existing traffic picture	✓	✓		✓			✓		
2.0.12	Formulate Routing/ Scheduling Plans	The planning of schedules and routings for future train activities based upon all existing conditions and constraints, and with reference to established train orders, track permits, etc. previously reviewed	✓	✓		✓		✓	✓	✓	✓

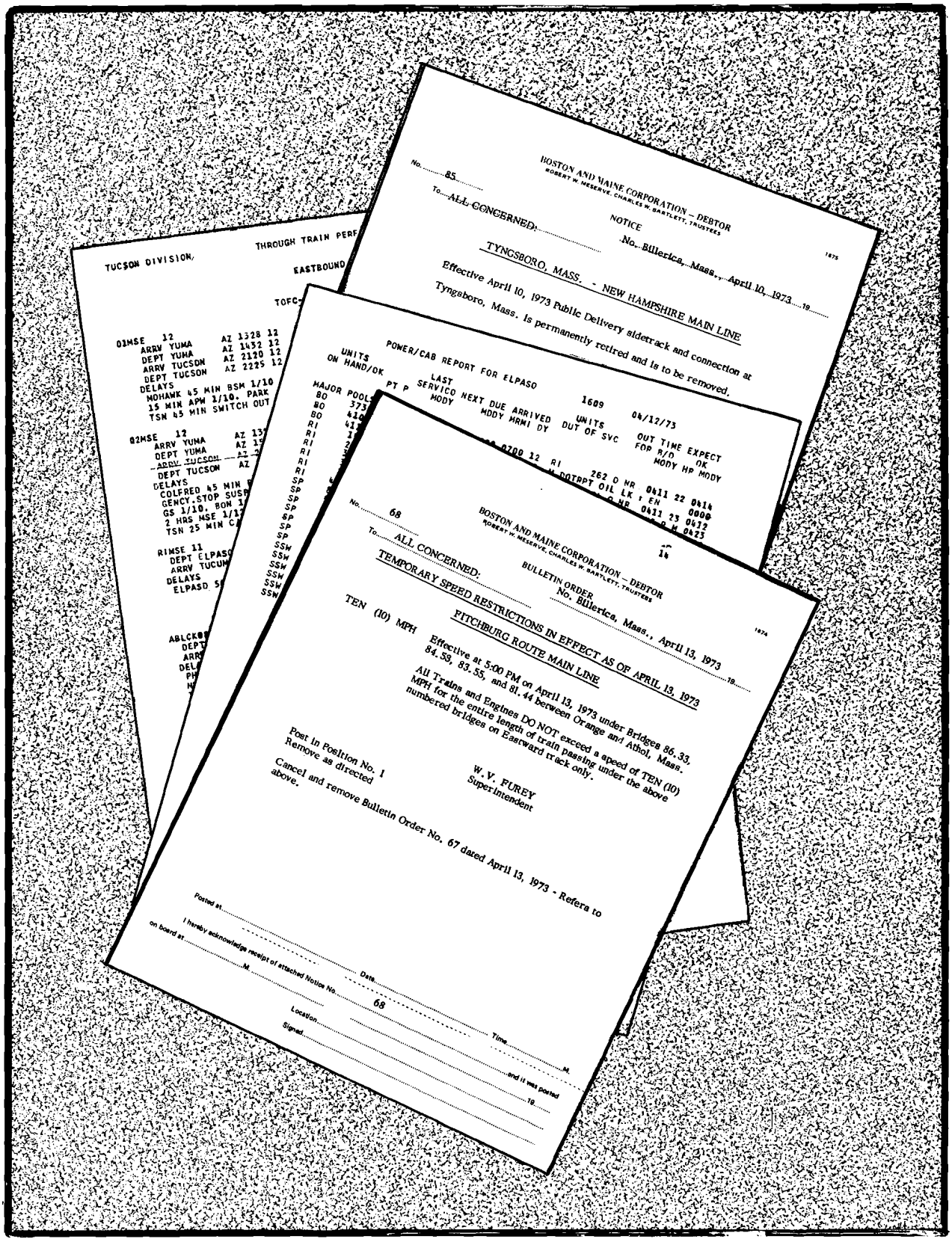


Figure 4-9. Sample Information Posting

4.5 MONITOR/COORDINATE TRAIN MOVEMENTS - Primary Function #3.0

4.5.1 Brief

This major function includes those activities which are relatively passive and responsive in contrast to those of Primary Function #4.0. Tasks included here are less demanding, less critical, and of lower priority. The dispatcher has more leeway and is able to order his responses based on his judgement relative to other task demands. In some cases he is able to omit certain advisory/coordination actions and routinely defer others to more opportune times. The dispatcher uses the CTC Situation Display Panel for automatically reported traffic information and his radio/telephone communications for progress reports, coordination, etc. Locally, he interfaces directly with other dispatchers and/or the Chief Dispatcher in receiving, delivering, or relaying traffic information. Basically, this function is subordinate to the remaining major functions in regard to criticality.

4.5.2 Additional Comments

Figure 4-10 (FFBD #4) illustrates the mechanics of the monitor/coordination activities of the train dispatcher, reflecting, in gross detail, related man/machine interfaces. Table 4-6 identifies, in a matrix format, the sub-functions and performance factor components of primary function #3.0.

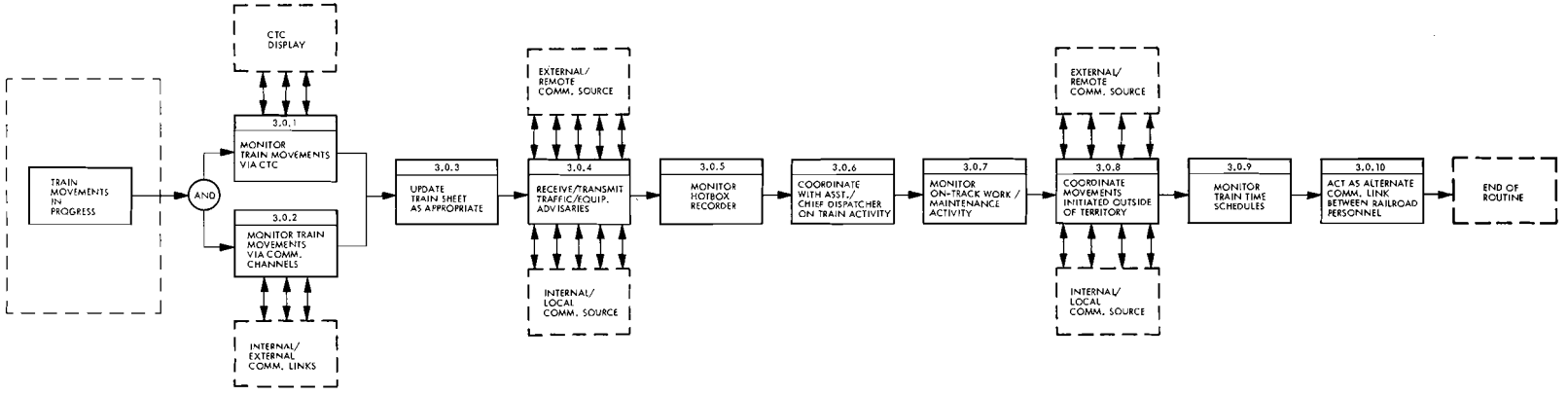


Figure 4-10. FFBD #4 Monitor/Coordinate Train Movements

TABLE 4-6 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #3.0

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
3.0.1	Monitor Train Movements Via CTC	The on-going periodic monitor of train movements by visual/audio reference to the CTC System Situation Display Panel	✓			✓			✓		
3.0.2	Monitor Train Movements Via Communications Channels	The on-going continuous audio monitor of train movements by reference to the various radio and telephone voice communication links through which train activities are reported	✓			✓			✓		
3.0.3	Update Train Sheet As Appropriate	The on-going periodic documentation activity conducted on the Train Sheet (hand written in ink) in response to traffic control needs				✓			✓		✓

TABLE 4-6 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #3.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
3.0.4	Receive/Transmit/ Traffic/Equipment Advisories	The actual reception/ transmission of audio reports relative to traffic or equipment associated with the dispatcher's overall area of responsibility				✓		✓	✓	✓	
3.0.5	Monitor Hot-Box Recorder	The periodic monitor of the hot-box recorder, in conjunction with train movements occurring in areas equipped with hot-box sensing equipment. See Fig. 3-2 for example of hot-box recorder graphs				✓					
3.0.6	Coordinate With Assistant/Chief Dispatcher on Train Activity	The control assistance, traffic information exchange, etc. conducted in coordination with the Assistant Chief Dispatcher	✓	✓	✓		✓	✓	✓	✓	

TABLE 4-6 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #3.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
3.0.7	Monitor On-Track Work/Maintenance Activity	The periodic on-going monitor of "on track" work or maintenance crew activity underway or planned to occur within the dispatcher's area of responsibility, using information obtained directly by audio inputs	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.0.8	Coordinate Movements Initiated Outside of Territory	The radio/telephone/telecopy receipt of information related to train movements initiated outside of the dispatcher's territory; and the subsequent coordination of pertinent direction related to pending movements within the territory, using both direct voice, internal and external communication links	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.0.9	Monitor Train Time Schedules	The monitoring of actual train movements against time schedules or limits imposed in order to detect early or late	✓			✓	✓		✓		

TABLE 4-6 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #3.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
		conditions etc., which could impact related movements									
3.0.10	Act as Alternate Communications Link Between Railroad Personnel	The periodic expediting assistance rendered in relaying messages from point to point, in lieu of the normal channels which may be inoperative or generally more time consuming				✓			✓	✓	

4.6 INITIATE/STOP TRAIN MOVEMENTS - Primary Function #4.0

4.6.1 Brief

This primary function includes those activities which form the major portion of the train dispatcher's workload over an extended period of time. It includes operation of the CTC panel for remote control of rail switches, signals, etc; two-way radio/telephone communication for issuance of train orders and hi-rail permits, and those aspects of the control requirements which are positive and self-initiated. It does not include activities which are responsive, passive, or administrative. The time spent on activities of this function depends on such factors as the reliability of railroad equipment, the occurrence of unplanned events or emergencies, and weather conditions that impact operations.

4.6.2 Additional Comments

A more detailed functional analysis is employed in Figure 4-11 (FFBD #5) illustrating the suddenly complex full scope of the train dispatcher's oft repeated procedures as necessary preliminaries to a "routine" move. Table 4-7 identifies, in a matrix format, the subfunctions and performance factor components of Primary Function #4.0.

To point out the decision making aspects of this "routine" action, an alternate format is used in Figure 4-12 (DFD #1), showing only representative conditions - but intended to reveal the much greater depth or scope of considerations which must come into play during the course of authorizing a train movement.

Because monitor and control of his territorial CTC System constitutes a major portion of the train dispatcher's activities, a functional analysis was conducted to identify cause and effect, man/machine, input/output, purpose and discrete identity of the various controls and status displays with which the dispatcher normally interfaces. Table 4-8 lists the functional interfaces associated with "Dispatcher #1 (West End Territory) Boston and Maine Railroad." Here again, the examples are typical of CTC System functions, which vary in number and specific purpose to

accommodate the peculiar needs of railroad territorial requirements. Table 4-8 is included in this section since it most directly relates to Function 4.1 "Operate CTC Controls," a subfunction of 4.0 "Initiate/Stop Train Movements" (See Figure 4-2, Functional Structure of the Train Dispatcher's Job).

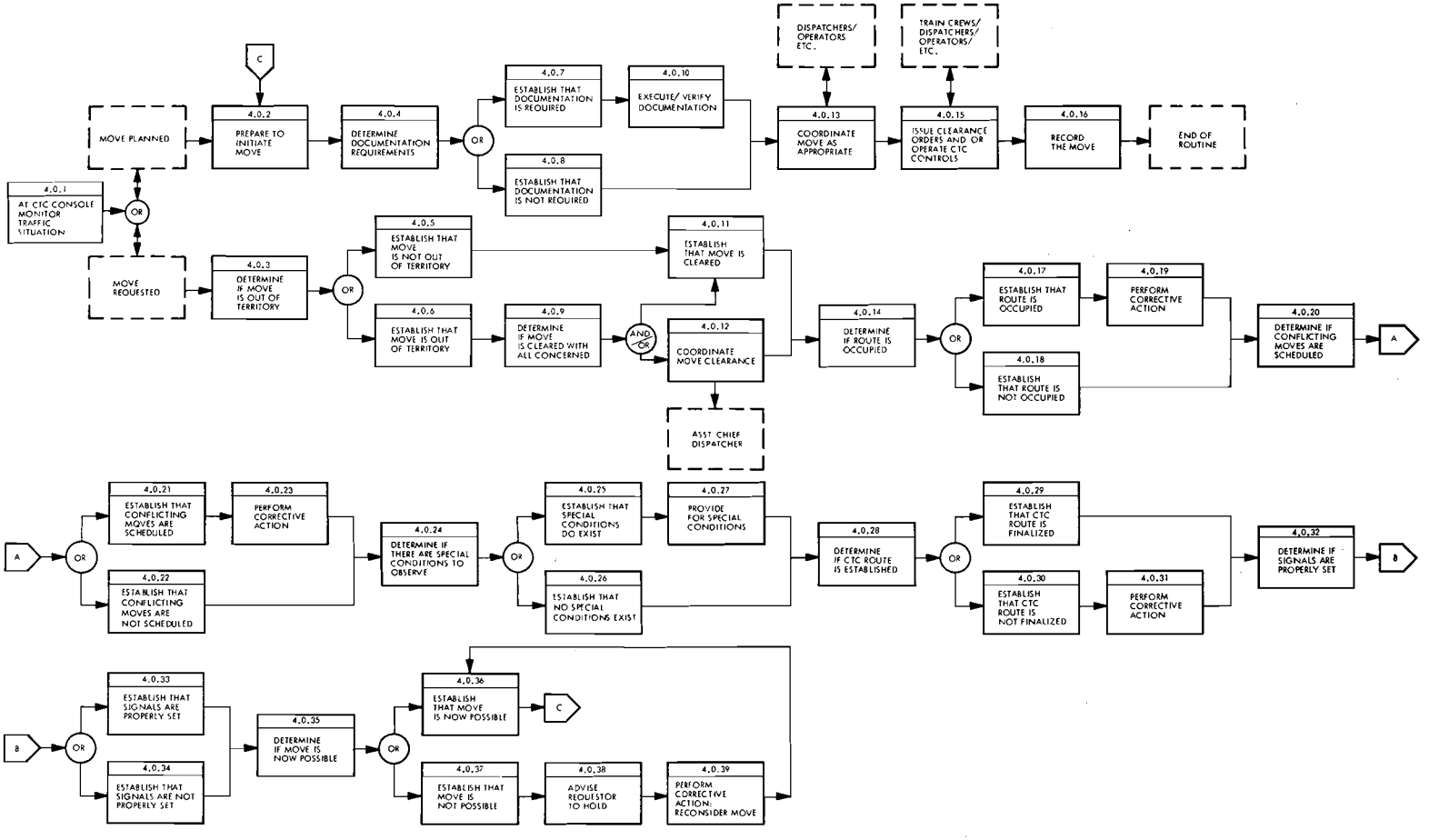


Figure 4-11. FFBD #5 Initiate/Stop Train Movements

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.1	At CTC Console Monitor Traffic Situation	The total audio-visual monitoring activity engaged in as a means for determining traffic status	✓			✓	✓		✓		
4.0.2	Prepare to Initiate Move	The decision to initiate a move, reached after a preliminary planning phase wherein routing, etc. is initially conceptualized	✓	✓		✓			✓		
4.0.3	Determine If Move is Out of Territory	The examination of a proposed train routing, subsequent to a move request, in order to establish whether or not a	✓	✓		✓			✓		

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
		move will continue outside of a territory									
4.0.4	Determine Documentation Requirements	The process of determining whether or not documentation is presently required as a condition of a pending move	✓				✓		✓		
4.0.5	Establish That Move Is Not Out Of Territory	The determination that a requested move will not proceed to a point outside of the territorial responsibility of the dispatcher	✓	✓					✓		

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.6	Establish That Move is Out of Territory	The determination that a requested move will proceed to a point outside of the territorial responsibility of the dispatcher	✓	✓					✓		
4.0.7	Establish That Documentation is Required	The determination that further documentary action is a prequisite to initiating a specific train movement	✓	✓					✓		
4.0.8	Establish That Documentation Is Not Required	The determination that further documentary action is not a prequisite to a specific train movement	✓	✓					✓		

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.9	Determine If Move Is Cleared With All Concerned	The coordination/verification activity conducted to insure that all parties with a "need-to know" are aware of the pending move and associated details.	✓	✓	✓	✓	✓	✓		✓	
4.0.10	Execute/Verify Documentation	The completion of data entries and appropriate orders, etc. relevant to a specific move, followed by a check to confirm that all data is present and correct as intended	✓	✓		✓		✓		✓	✓
4.0.11	Establish That Move Is Cleared	The process of determining that a specific move is in fact fully coordinated and cleared	✓	✓	✓	✓	✓	✓		✓	

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.12	Coordinate Move Clearance	The required interaction with the Assistant Chief Dispatcher as necessary to expedite pending move coordination/clearance in the event that these actions have not occurred	✓	✓			✓	✓	✓	✓	
4.0.13	Coordinate Move As Appropriate	The cooperating activity which occurs between the train dispatcher, other dispatchers, operators, etc. as appropriate, following completion of documentary requirements related to a specific pending move	✓	✓				✓	✓	✓	
4.0.14	Determine If Route Is Occupied	The actions undertaken to assure that a clearance route is in fact unoccupied and available for a specific pending move	✓			✓				✓	

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.15	Issue Clearance Orders And/Or Operate CTC Control	The issuance of a clearance for relay by train dispatchers/ operators, or direct transmittal to the train crew; in each case citing the train orders which apply. It may also include the remote control actions performed by the train dispatcher oeprating the CTC System			✓		✓	✓	✓	✓	✓
4.0.16	Record the Move	The documentation activity wherein data pertaining to time of commencement of the move is recorded							✓		✓
4.0.17	Establish That Route is Occupied	The finding that a proposed route is occupied	✓			✓			✓		

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.18	Establish That Route is Not Occupied	The finding that a proposed route is not occupied	✓			✓			✓		
4.0.19	Perform Corrective Action	The follow-on action necessary to establish an alternate route, in the event a route is already occupied	✓	✓		✓		✓	✓	✓	✓
4.0.20	Determine If Conflicting Moves Are Scheduled	The predetermining of potential conflicts in moves presently scheduled	✓			✓			✓	✓	

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.21	Establish That Conflicting Moves Are Scheduled	The determination that potentially conflicting moves are presently scheduled	✓			✓			✓		
4.0.22	Establish That Conflicting Moves Are Not Scheduled	The determination that potentially conflicting moves are not presently scheduled	✓			✓			✓		
4.0.23	Perform Corrective Action	The corrective action required in rescheduling to resolve potential conflicts	✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.24	Determine If There Are Special Conditions To Observe	The assessment of any special precautionary measures required for safe train operation	✓			✓			✓	✓	
4.0.25	Establish That Special Conditions Do Exist	The determination via various information sources that certain precautionary measures are required as a result of existent special conditions	✓			✓			✓		
4.0.26	Establish That No Special Conditions Exist	The determination via various information sources that no condition exists which would require extra precautionary measures	✓			✓			✓		

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.27	Provide For Special Conditions	The actions and special instructions provided to insure that existing special conditions are accommodated	✓	✓	✓	✓	✓	✓	✓	✓	✓
4.0.28	Determine If CTC Route Is Established	The assessment of the settings of the various CTC panel routing controls for conformance with the proposed routing	✓			✓					
4.0.29	Establish That CTC Route Is Finalized	The determination that the CTC routing control settings conform to planned move requirements	✓			✓			✓		

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.30	Establish That CTC Route Is Not Finalized	The determination that the CTC routing control settings do not conform to planned move requirements	✓			✓			✓		
4.0.31	Perform Corrective Action	The manipulation of CTC routing controls to effect the changes necessary to conform with planned move requirements	✓	✓	✓	✓	✓	✓	✓		
4.0.32	Determine If Signals Are Properly Set	The assessment of the settings of the various CTC panel signal controls for conformance with the desired condition	✓			✓					

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.33	Establish That Signals Are Properly Set	The determination that CTC control signal settings conform with the desired condition	✓			✓			✓		
4.0.34	Establish That Signals Are Not Properly Set	The determination that CTC control signal settings do not conform with the desired condition	✓			✓			✓		
4.0.35	Determine If Move Is Now Possible	The final assessment of overall traffic conditions and associated information in order to determine if a move can now be commenced	✓	✓		✓			✓		

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.36	Establish That Move Is Now Possible	The final determination that all restrictions have been met and a move is now possible	✓			✓			✓		
4.0.37	Establish That Move Is Not Possible	The determination that all restrictions have not been met and a move must still be delayed	✓			✓			✓		
4.0.38	Advise Requestor To Hold	The act of advising a clearance requestor to "hold" until problems are resolved			✓		✓	✓		✓	

TABLE 4-7 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #4.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
4.0.39	Perform Corrective Action: Reconsider Move	The accomplishment of corrective action (i.e., signal/control recycling; signal setting; verification of data etc.), and reconsideration of move requirements	✓	✓	✓	✓	✓	✓	✓	✓	✓

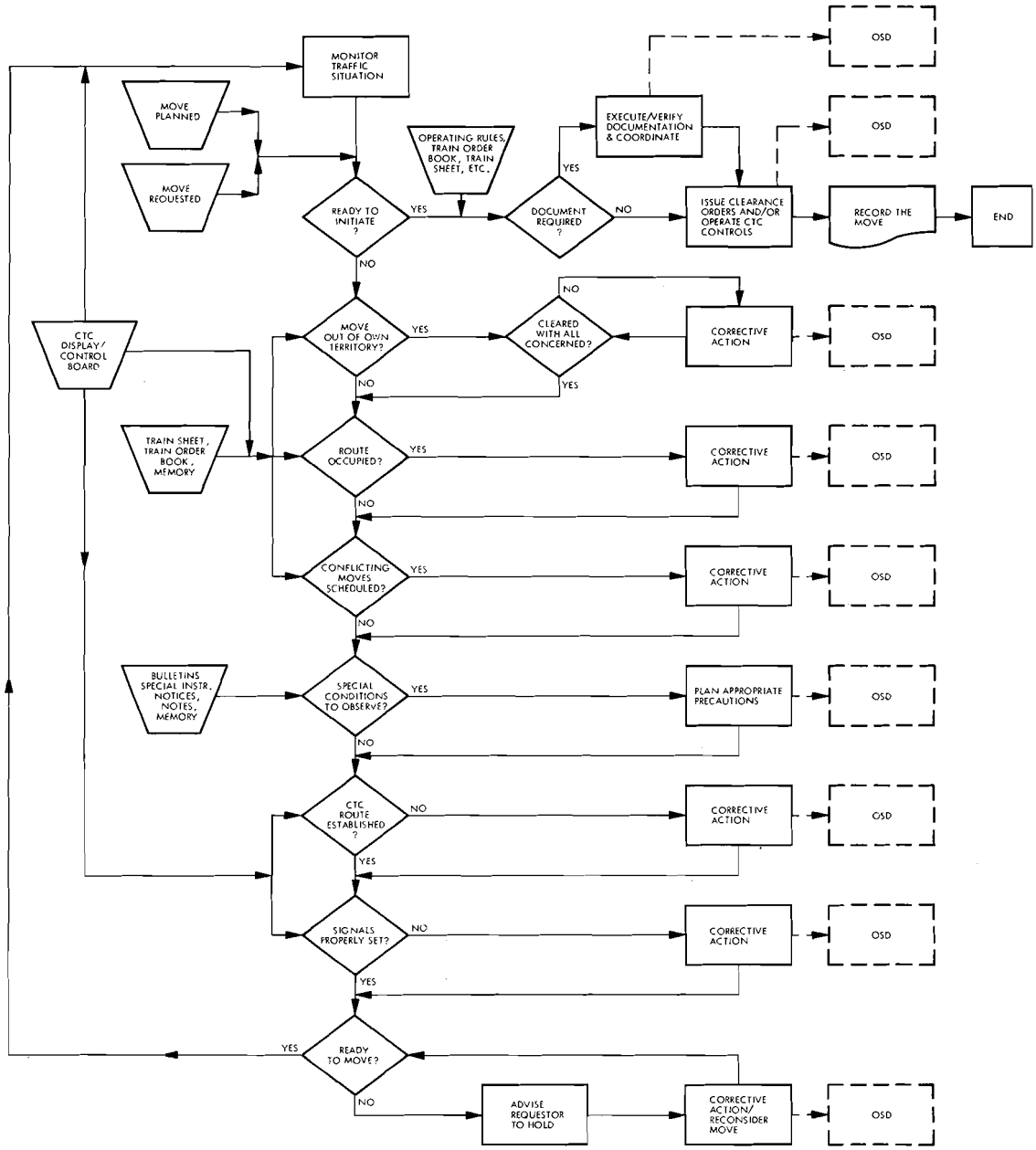


Figure 4-12. DFD #1 Decision Making Aspects of Train Movement Authorizations

TABLE 4-8. CTC MAN/MACHINE FUNCTIONAL INTERFACE

FUNCTION		IDENTIFICATION	PURPOSE	INTERFACE				LINK CHARACTERISTICS		STATUS DISPLAY/INDICATION			
NO.	LABEL/ COLOR			CAT.	FROM	TO	CONT. TYPE	INPUT (STIMULUS)	OUTPUT (RESPONSE)	PRELIMINARY LOCAL	PRELIMINARY REMOTE	POST ACTIVITY REMOTE	POST ACTIVITY LOCAL
A-1	SH	SWITCH HEATER	FREE FROZEN SWITCHES	E/M	CTC	SWITCH HEATER CONTROL	TOGGLE SWITCH	SWITCH FAILURE INDICATION	ACTIVATE HEATER MECHANISM	OUT OF CORRESPONDENCE LIGHT	INOPERATIVE FROZEN TRACK SWITCH	SWITCH FREED BY APPLICATION OF HEAT ENERGY (ELECTRICAL OR FIRE)	"IN CORRESPONDENCE" STATUS DISPLAY
A-2	PH	PHONE CHECK	TROUBLE SHOOTING/FAULT ISOLATION	E/A	CTC	TERMINAL *	TOGGLE SWITCH	VOICE COMMUNICATION FAILURE/ DEGRADATION/EXCESSIVE NOISE LEVEL	SEGMENT TEST (LINE CHECK, FAULT ISOLATION)*	INADEQUATE AUDIO COMMUNICATIONS	FAULTY TELEPHONE LINE CIRCUITS	ISOLATION OF GENERAL LOCATION OF PROBLEM, MAINTENANCE ACTION	CLEAR VOICE
A-3	MC	MAINTENANCE CALLER	OBTAIN MAINTENANCE SUPPORT	E/M/A/V	CTC	SIGNAL BUNGALOW	TOGGLESWITCH	EQUIPMENT FAILURE/DAMAGE	ACTIVATE MAINTENANCE CALL SIGNAL	MAINTENANCE REQUIREMENT	FLASHING WHITE LIGHT/KLAXON	RESPOND TO MAINTENANCE REQUEST; RETURN EQUIPMENT TO NORMAL CONDITION	"IN CORRESPONDENCE" STATUS DISPLAY
A-4	TD	TUNNEL DOORS	TUNNEL DOOR CONTROL	E/M	CTC	TUNNEL DOOR MOTOR CONTROL	THROW SWITCH	TRAFFIC/SEASONAL WEATHER REQUIREMENT	ACTUATE TUNNEL DOOR	DISPLAY LIGHTS GREEN (OPEN) RED (CLOSED)	OPEN/CLOSED TUNNEL DOORS	OPEN/CLOSED TUNNEL DOORS	"IN CORRESPONDENCE" STATUS DISPLAY
A-5	(NO LABEL)	TUNNEL SIGNALS	DIRECTIONAL TRAFFIC CONTROL (10 SIGNAL LIGHTS - 5 EACH DIRECTION)	E/M/V	CTC	TUNNEL SIGNALS	ROTARY SWITCH (2 POS.)	TRAFFIC CURRENT (WHEN ILLUMINATED, SIGNALS ARE OUT OF CORRESPONDENCE WITH SETTING)	SET TRAFFIC SIGNAL LIGHT TO PROPER DIRECTION	IMPROPER SIGNAL CONTROL SETTING	INCORRECT SIGNAL	CORRECT SIGNAL	DESIRED TRAFFIC SIGNALS IN CORRESPONDENCE; DIRECTION OF CURRENT & SETTINGS IN CORRESPONDENCE
A-6	N-R	TRACK SWITCH	TRACK ROUTING	E/M/V	CTC	TRACK SWITCH	THROW SWITCH	TRAFFIC REQUIREMENT (RED - OUT OF CORRESPONDENCE)	ACTIVATE TRACK SWITCH SIGNAL	MOMENTARY OUT OF CORRESPONDENCE SIGNAL	INCORRECT RAIL SWITCH SETTING	CORRECT RAIL SWITCH SETTING	"IN CORRESPONDENCE" STATUS DISPLAY (NO LIGHT)
A-7	L-R	SIGNAL LIGHTS	TRACK SIGNAL CONTROL	E/M/V	CTC	TRACK SIGNAL	THROW SWITCH	TRAFFIC REQUIREMENT	ENERGIZE LIGHT SIGNALS	GREEN OR "NO LIGHT" INDICATION	**GREEN, YELLOW & RED SIGNAL LIGHTS	**GREEN, YELLOW & RED SIGNAL LIGHTS	"IN CORRESPONDENCE" STATUS DISPLAY (GREEN LIGHT)
A-8	RECHECK (RED)	RECHECK SWITCH	VERIFY DISPLAYED STATUS INDICATIONS	E/M/A/V	CTC	TERMINAL *	SPRING LOADED TOGGLE	STATUS INFORMATION DISPLAY	TEST SIGNAL TO TERMINAL	QUESTIONABLE DISPLAY	UNIDENTIFIED PRESENCE, INCORRECT SWITCH/SIGNAL SETTING	RESET SENSOR; CORRECT SWITCH/ SIGNAL SETTING	CONFIRMATION/CORRECTION OF STATUS DISPLAY INDICATION
A-9	CANCEL (RED)	CANCEL SWITCH	CANCEL CONTROL ACTIVATION SIGNALS	E/M	CTC	TERMINAL *	SPRING LOADED TOGGLE	CHANGE OF CONTROL REQUIREMENTS/SITUATION	DEACTIVATE SIGNAL TO TERMINAL	ACTIVATION OF CONTROL RESULTS IN MOMENTARY WHITE LIGHT DISPLAY FOLLOWED BY AUDIO "BURP" INDICATION	ORIGINAL STATUS	ORIGINAL STATUS	ORIGINAL STATUS
A-10	(NO LABEL) RED	CODING ACTIVATION CONTROL	ENERGIZE CIRCUITS	E/M	CTC	TERMINAL *	PRESS TO ACTIVATE	SITUATION CHANGE REQUIREMENT	ACTUATE CONTROL CIRCUITS *	ORIGINAL STATUS (FOLLOWED BY MOMENTARY "RED" DURING SWITCHING CYCLE)	ORIGINAL STATUS	NEWLY SELECTED SWITCH/ SIGNAL/CONTROL STATUS	"IN CORRESPONDENCE"
A-11	(NO LABEL) WHITE	LIGHT CONTROL	ADJUST CTC SITUATION DISPLAY LIGHT INTENSITY	E/M	CTC	CTC DISPLAY	THROW SWITCH (3 POSITIONS; DIM/MED/BRIGHT)	CURRENT LIGHT LEVEL	ADJUST LIGHT INTENSITY	UNSATISFACTORY LIGHT LEVEL	N/A	N/A	MOST SATISFACTORY LIGHT CONDITION
A-12	FAN 1	TUNNEL FAN	PROVIDE TUNNEL VENTILATION	E/M	CTC	TUNNEL FAN 1	THROW SWITCH (3 POSITIONS; HIGH/MED/LOW)	OPERATIONAL REQUIREMENT/ WEATHER CONDITIONS	ADJUST FAN SPEED SETTING	ORIGINAL CONTROL SETTING	FAN OPERATION AT ONE OF 3 SPEEDS	FAN OPERATING AT NEWLY SELECTED SPEED	CONTROL SET AT NEWLY SELECTED POSITION
A-13	FAN 2	TUNNEL FAN	PROVIDE TUNNEL VENTILATION	E/M	CTC	TUNNEL FAN 2 *	THROW SWITCH (3 POSITIONS; HIGH/MED/LOW)	OPERATIONAL REQUIREMENT/ WEATHER CONDITIONS	ADJUST FAN SPEED SETTING	ORIGINAL CONTROL SETTING	FAN OPERATION AT ONE OF 3 SPEEDS	FAN OPERATING AT NEWLY SELECTED SPEED	CONTROL SET AT NEWLY SELECTED POSITION
A-14	HB-LW	HOT BOX LUNAR WHITE	CLEAR R/R CROSSING; TRAIN INSPECTION FOR HOT BOX, ETC.	E/M/V	CTC	SIGNAL CONTROL	TOGGLE SWITCH	EMERGENCY CONDITION, USUALLY HOT BOX	ACTIVATE LIGHT SIGNAL	TOGGLE SWITCH "DOWN"	TRAIN OPERATION RELATED EMERGENCY	LUNAR WHITE LIGHT SIGNAL ILLUMINATED AT APPROACH TO INTERLOCKING PLANT	TOGGLE SWITCH "UP"
A-15	PO	POWER OFF	POWER OUTAGE INDICATION	E/M/V	INTERLOCK	CTC	RED INDICATOR LIGHT	LOSS OF POWER FROM NORMAL POWER SOURCES	AUTO - SWITCHOVER TO BACKUP	RED LIGHT IN PROXIMITY TO LOCATION IDENTIFIER	LOSS OF COMMERCIAL POWER	SWITCH FROM PRIMARY (COMMERCIAL) TO BACKUP (BATTERY) POWER	RED LIGHT IN PROXIMITY TO LOCATION IDENTIFIER
A-16	(NO LABEL) WHITE	OUTGOING SIGNAL INDICATOR	INDICATES SENSED PRESENCE OF OUTGOING SIGNAL	E/M/V	TERMINAL	CTC	WHITE INDICATOR LIGHT	CTC OPERATIONAL REQUIREMENT	CONTROL ACTIVATION SIGNAL	MOMENTARY WHITE LIGHT INDICATION	ORIGINAL STATUS OF SWITCH/ SIGNAL/CONTROL	ACTIVATION OF SWITCH/SIGNAL/ CONTROL; CHANGE TO NEW CONDITION	"BLANK" OUTGOING SIGNAL INDICATOR
A-17	DE	DRAGGING EQUIPMENT INDICATOR	INDICATES DETECTED PRESENCE OF EQUIPMENT DRAGGING BETWEEN RAILS	E/M/V	SENSOR	CTC	PRESS TO DEACTIVATE BUZZER	OBJECT DRAGGING BETWEEN RAILS DETECTED	DEACTIVATE SIGNAL, COORDINATE CORRECTIVE ACTION (SWITCH, LUNAR WHITE LIGHT, ETC., ISOLATE TRAFFIC)	AUDIBLE CONTINUOUS BUZZ & RED FLASHING LIGHT SIGNAL	PRESENCE OF DRAGGING OBJECT IN CONTACT WITH SENSOR	DRAGGING OBJECT REMOVED; SENSOR RESET MANUALLY	RED INDICATOR LIGHT CONTINUES TO FLASH UNTIL SENSOR HAS BEEN RESET
A-18	(NO LABEL)	DIRECTION INDICATOR SWITCH	TO REFLECT DIRECTION OF TRAFFIC MOVEMENT IN EFFECT AND TO INDICATE PRESENCE OF TRAIN IN SPECIFIC AREA NOT CONTROLLED BY CTC	M	CTC	CTC	TOGGLE SWITCH	TRAFFIC SITUATION	N/A	SWITCH POSITION & WHITE LIGHT	TRAFFIC SITUATION	TRAFFIC SITUATION	SWITCH POSITION & WHITE LIGHT IN CORRESPONDENCE

LEGEND

INTERFACE CATEGORY

E - ELECTRICAL
M - MECHANICAL
A - AUDIO
V - VISUAL

N A - NOT APPLICABLE
* - SELECTED SYSTEM CIRCUITS TERMINALS
** - LIGHT DISPLAYED SUBJECT TO INTERLOCK INPUTS

4.7 RESPOND TO UNPLANNED EVENTS - Primary Function #5.0

4.7.1 Brief

This major function includes those activities which are not preplanned or scheduled. Although many of the sub-task activities are similar to pre-planned/scheduled tasks, varying degrees of departure from the routine are required. An "unplanned event" may necessitate considerable replanning and rescheduling of actions. Preoccupation with a particular unplanned event may delay execution of scheduled/planned events, and possibly affect accuracy and validity of input-output information. When equipment malfunctions, either local or remote, are involved, the additional job stresses become significant and the line between "unplanned events" and "emergency" becomes thin.

4.7.2 Additional Comments

In this major function the listing of unplanned events is purposely limited to those felt to be most representative.

Figure 4-13 (FFBD #6) depicts the typical actions required of a train dispatcher (in gross terms) in response to sample unplanned events. Table 4-9 identifies, in a matrix format, the sub-functions and performance factor components of Primary Function #5.0.

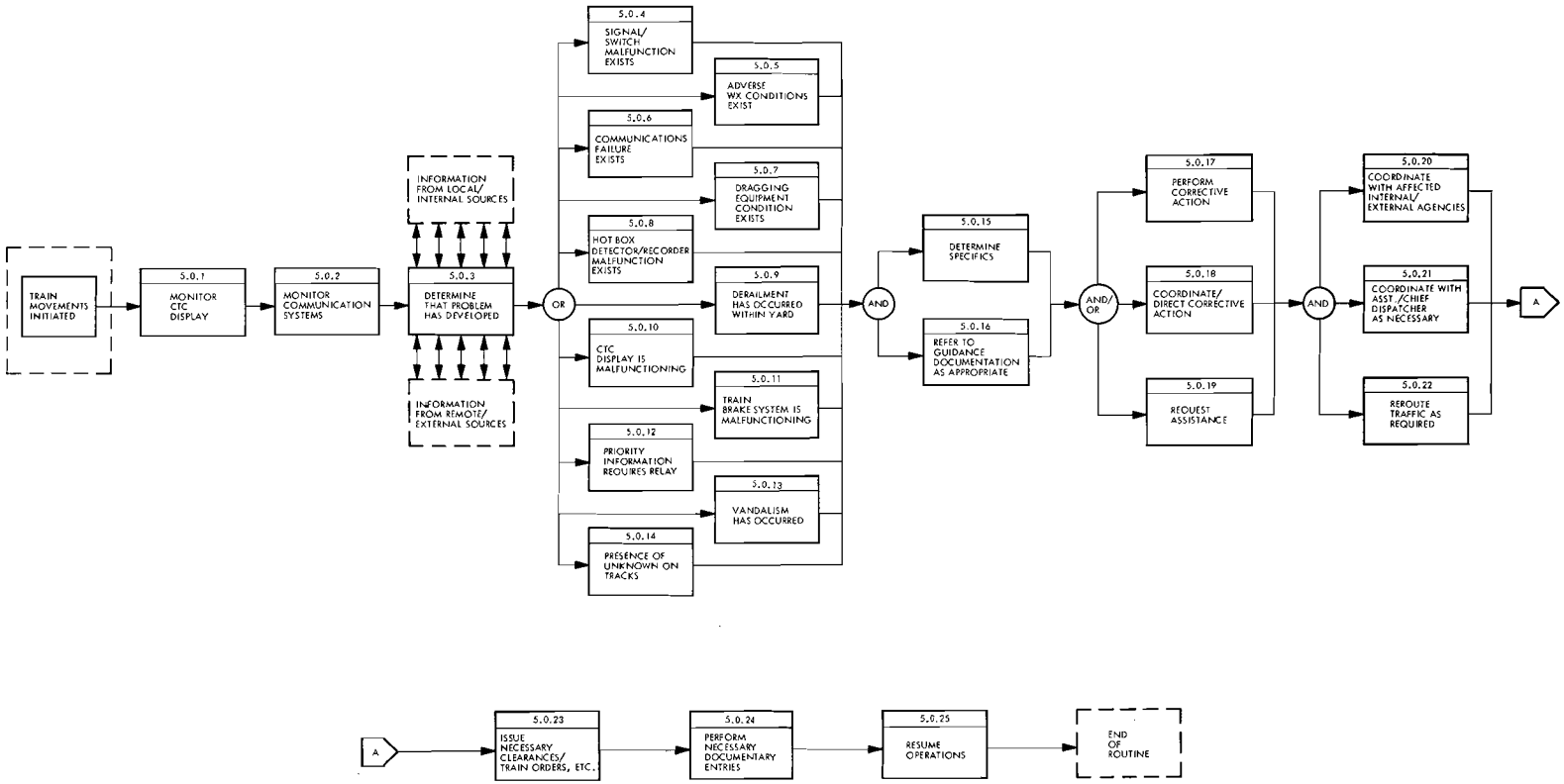


Figure 4-13. FFBD #6 Respond to Unplanned Events

TABLE 4-9 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #5.0

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
5.0.1	Monitor CTC Display	The audio/visual monitor of the CTC Status indicator panel				✓					
5.0.2	Monitor Communication System	The audio monitor of internal/external voice communication links				✓					
5.0.3	Determine That Problem Has Developed	The process of recognizing or being advised that an event has occurred which is out of the ordinary routine				✓			✓		

TABLE 4-9 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #5.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
5.0.4	Signal/Switch Malfunction Exists	The determination that a problem related to a switch or signal exists				✓			✓		
5.0.5	Adverse WX Conditions Exist	The determination that adverse weather conditions exist				✓			✓		
5.0.6	Dragging Equipment Conditions Exist	The determination that a "dragging equipment" condition exists				✓			✓		

TABLE 4-9 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #5.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
5.0.7	Communications Failure Exists	The determination that a communications failure exists				✓			✓		
5.0.8	Hot-Box Detector/ Recorder Malfunction Exists	The determination that a malfunction of the hot-box detector/recorder system exists				✓			✓		
5.0.9	Derailment Has Occurred Within Yard	The determination that a derailment has occurred				✓			✓		

TABLE 4-9 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #5.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
5.0.10	CTC Display Is Malfunctioning	The determination that the CTC display is malfunctioning				✓			✓		
5.0.11	Train Brake System Is Malfunctioning	The determination that a train brake system is malfunctioning				✓			✓		
5.0.12	Priority Information Requires Relay	The determination that it is necessary to provide a relay for priority information	✓			✓			✓	✓	✓

TABLE 4-9 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #5.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
5.0.13	Vandalism Has Occurred	The determination that vandalism has occurred				✓			✓		
5.0.14	Presence of Unknown On Tracks	The determination that some unidentified object is present on a portion of track				✓			✓		
5.0.15	Determine Specifics	The processes and procedures exercised while obtaining sufficient data to properly respond to a condition	✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE 4-9 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #5.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
5.0.16	Refer to Guidance Documentation as Appropriate	The researching of existing documentation related to an incident or condition as appropriate	✓	✓		✓			✓		
5.0.17	Perform Corrective Action	The direct performance of remedial procedures appropriate to the situation	✓	✓	✓		✓	✓		✓	✓
5.0.18	Coordinate/Direct Corrective Action	The indirect accomplishment of remedial actions by coordinating/directing the activities of other personnel	✓	✓	✓	✓	✓	✓	✓	✓	

TABLE 4-9 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #5.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
		who are most immediately involved in the situation									
5.0.19	Request Assistance	The process of obtaining support for direct internal actions as well as the appropriate specialized support necessary to resolve external problems	✓	✓	✓			✓	✓	✓	
5.0.20	Coordinate With Affected Internal/ External Agencies	The coordination necessary to provide directly concerned internal/external agencies with appropriate information						✓		✓	

TABLE 4-9 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #5.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
		concerning an incident or condition									
5.0.21	Coordinate With Assistant/Chief Dispatcher As Necessary	The passing of current information related to an incident or condition to a supervisor, thereby enabling issuance of advisories to other dispatchers and response to information queries by higher authorities etc.							✓	✓	
5.0.22	Reroute Traffic As Necessary	The process of altering previously established routings as necessary to allow for resolution of a particular	✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE 4-9 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #5.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
		situation and to ensure the necessary safety considerations									
5.0.23	Issue Necessary Clearance, Train Orders, Etc.	The process of developing the necessary documentary records and issuance of appropriate formal clearances responding to a particular situation	✓	✓	✓		✓	✓	✓	✓	✓
5.0.24	Perform Necessary Documentary Entries	The formal and informal recording of data for future reference	✓					✓	✓		✓

TABLE 4-9 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #5.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
5.0.25	Resume Operations	The resumption of normal activities	✓	✓	✓	✓	✓	✓	✓	✓	✓

4.8 RESPOND TO EMERGENCIES - Primary Function #6.0

4.8.1 Brief

The primary basis for differentiating between "unplanned events" and "emergencies" was the apparent level of immediate danger or threat to life and/or property involved. The development of the typical emergency is sudden, requiring immediate positive action on the part of the dispatcher. Events which were originally classified as "unplanned" can develop into emergencies. Examples are floods which lead to washout conditions and heavy snowfall which results in snowbound conditions. The important consideration here is the potentially catastrophic effects if action is not taken immediately to safeguard life and property.

4.8.2 Additional Comments

The few specific "emergencies" identified in this study are representative of an almost limitless variety of conditions which could occur. To properly perform under the stresses involved in these situations, the dispatcher, in addition to other requirements, must be capable of independent critical decision-making on matters with potentially catastrophic effects.

Figure 4-14 (FFBD #7) depicts the actions required of the train dispatcher in responding to an emergency. Here again, the actions are referred to in somewhat generalized gross terms. Table 4-10 identifies, in a matrix format, the sub-functions and performance factor components of primary function #6.0.

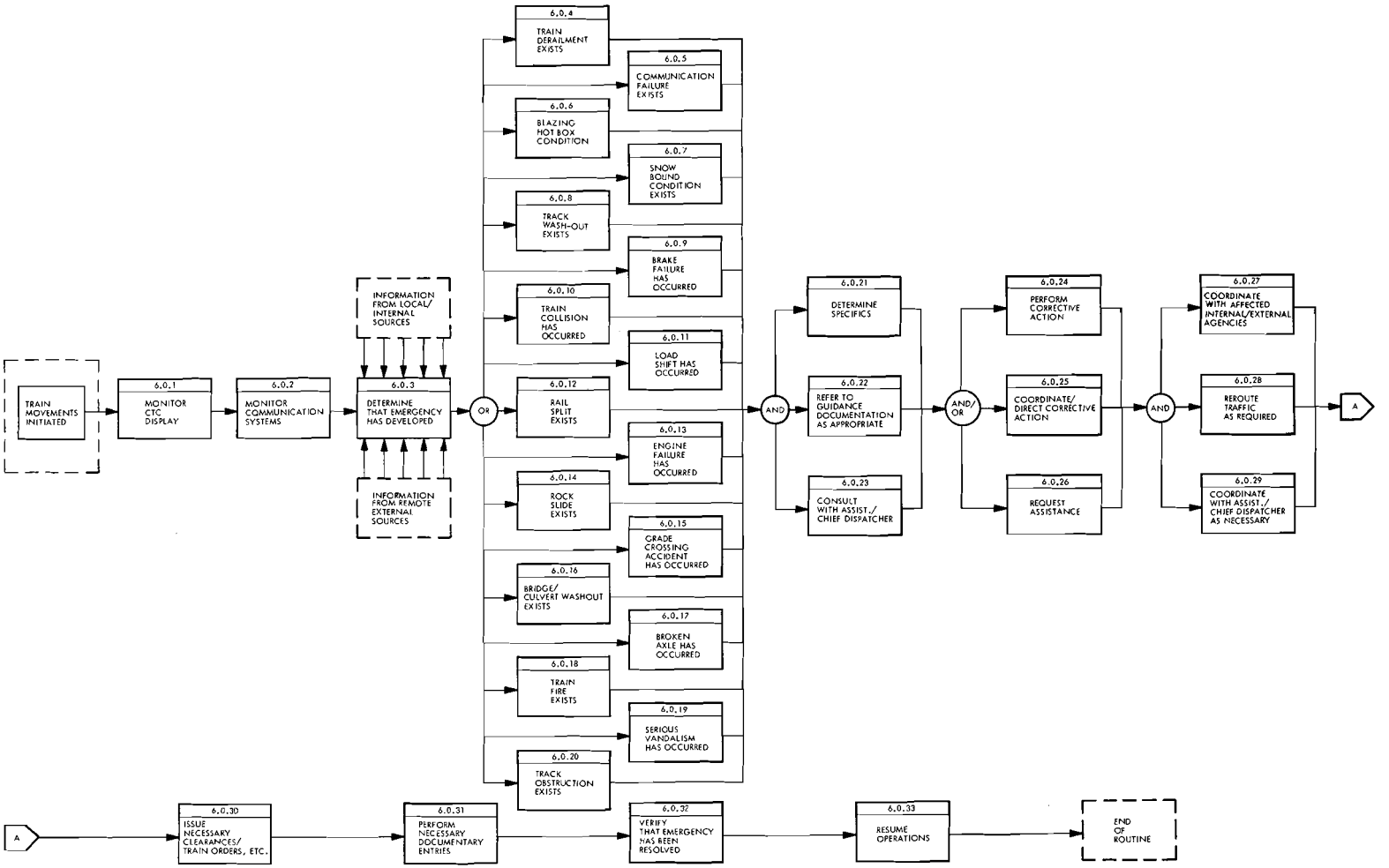


Figure 4-14. FFBD #7 Respond to Emergencies

TABLE 4-10 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #6.0

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.1	Monitor CTC Display	The audio/visual monitor of the CTC system operation by reference to the status display panel				✓					
6.0.2	Monitor Communication Systems	The audio monitor of the various communication links provided for two-way information passing relative to train operation				✓					
6.0.3	Determine That Emergency Has Developed	The determination that an emergency has developed, based on information derived either from local internal sources or remote external sources				✓			✓		

TABLE 4-10 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #6.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.4	Train Derailment Exists	The determination that a train derailment has occurred				✓			✓		
6.0.5	Communication Failure Exists	The determination that a communications failure has occurred				✓			✓		
6.0.6	Blazing Hot-Box Condition	The recognition of existence of a hot-box condition affecting train safety				✓			✓		

TABLE 4-10 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #6.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.7	Snow Bound Condition Exists	The recognition of the existence of a snow bound condition affecting train operation and safety				✓			✓		
6.0.8	Track Washout Exists	The recognition of the existence of a track washout condition affecting train operation and safety				✓			✓		
6.0.9	Brake Failure Has Occurred	The recognition of the existence of a brake failure condition affecting train safety				✓			✓		

TABLE 4-10 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #6.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.10	Train Collision Has Occurred	The determination that a train collision has occurred				✓			✓		
6.0.11	Load Shift Has Occurred	The determination that a load shift has occurred				✓			✓		
6.0.12	Rail Split Exists	The determination that a rail split has occurred				✓			✓		

TABLE 4-10 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #6.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.13	Engine Failure Has Occurred	The determination that an engine failure has occurred				✓			✓		
6.0.14	Rock Slide Exists	The determination that a rock slide has occurred				✓			✓		
6.0.15	Grade Crossing Accident Has Occurred	The determination that a grade crossing accident has occurred				✓			✓		

TABLE 4-10 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #6.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.16	Bridge/Culvert Washout Exists	The determination that a bridge or culvert washout has occurred				✓			✓		
6.0.17	Broken Axle Has Occurred	The determination that a broken axle has occurred on railroad rolling stock				✓			✓		
6.0.18	Train Fire Exists	The determination that a train fire has occurred				✓			✓		

TABLE 4-10 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #6.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.19	Serious Vandalism Has Occurred	The determination that serious vandalism has occurred whereby train movements and safety are affected				✓			✓		
6.0.20	Track Obstruction Exists	The determination that a track obstruction exists				✓			✓		
6.0.21	Determine Specifics	The obtaining of sufficient information to properly respond to the existing circumstances	✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE 4-10 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #6.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.22	Refer to Guidance Documentation as Appropriate	The reviewing of existing directives or guidelines related to a particular occurrence in order to insure compliance and full responsiveness	✓	✓		✓			✓		
6.0.23	Consult With Assistant/Chief Dispatcher	Consultation with the Assistant or Chief Dispatcher for advice or concurrence as to plan of action, and to keep the supervisory levels fully informed of developments	✓	✓		✓		✓	✓	✓	
6.0.24	Perform Corrective Action	The direct action required of the dispatcher in responding to a particular emergency condition	✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE 4-10 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #6.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.25	Coordinate/Direct Corrective Action	The direction and coordination of the efforts of externally located personnel immediately involved with an emergency condition		✓	✓	✓	✓	✓		✓	✓
6.0.26	Request Assistance	The requesting of either local internal support or specialized external support as necessary to fully respond to a particular class of emergency condition	✓	✓	✓		✓	✓	✓	✓	✓
6.0.27	Coordinate With Affected Internal/ External Agencies	The process of keeping informed such internal or external agencies as may have a direct interest or associated responsibility.				✓		✓		✓	

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.28	Reroute Traffic As Required	Altering original routings in order to provide the additional safety assurance necessary as a result of an emergency condition	✓	✓	✓		✓	✓	✓	✓	✓
6.0.29	Coordinate With Assistant/Chief Dispatcher	The on-going exchange of information between the dispatcher and the Assistant/ Chief Dispatcher, in order to assure proper coordination with other dispatcher activities while providing supervisory personnel with a full grasp of the situation	✓			✓		✓	✓	✓	
6.0.30	Issue Necessary Clearance/Train Orders Etc.	The issuance of the directions clearances, orders, etc. necessary to ameliorate an emergency condition	✓	✓	✓		✓	✓	✓	✓	✓

TABLE 4-10 TASK PERFORMANCE REQUIREMENTS OF PRIMARY FUNCTION #6.0 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.0.31	Perform Necessary Documentary Entries	The formal and informal recording of data necessary to maintain a useful account of a specific emergency condition for later consideration	✓	✓		✓		✓	✓		✓
6.0.32	Verify That Emergency Has Been Resolved	The follow-up activity necessary to assure that all possible actions are completed relative to the emergency, prior to resumption of routine operations	✓			✓		✓		✓	
6.0.33	Resume Operations	The resumption of routine operations separate from the emergency procedures	✓	✓	✓	✓	✓	✓	✓	✓	✓

4.9 RESPOND TO BLAZING HOT-BOX - Sub-Function #6.2

4.9.1 Brief

This class of emergency (subordinate to Prime Function 6.0) occurs fairly frequently. Once aware of the existence of a hot-box, the train dispatcher takes immediate action to determine the extent of the condition, communicating directly with the train crew or a trackside observer. After establishing that a hot-box is blazing (cotton waste fire), the train dispatcher issues the orders necessary to resolve the situation. He must consider the current traffic situation, the availability of sidings and the desires of management and his supervisor, as well as the availability of support.

4.9.2 Additional Comments

This function includes some of the interfaces which are not readily visible during observation of dispatcher activities. It also reveals the systematic, positive actions required of the dispatcher (as well as judgemental procedures), all of which might have serious far-reaching consequences. Figure 4-15 (FFBD #8) and Table 4-11, identifying the performance requirements of Sub-Function 6.2, show that the train dispatcher is a central figure in railroad operations, with his every action representing time and money -- perhaps life and death. Figure 4-16 (DFD #2) and Figure 4-17 (OSD #2) identify the decisions and details involved in the overall response to this class of emergency.

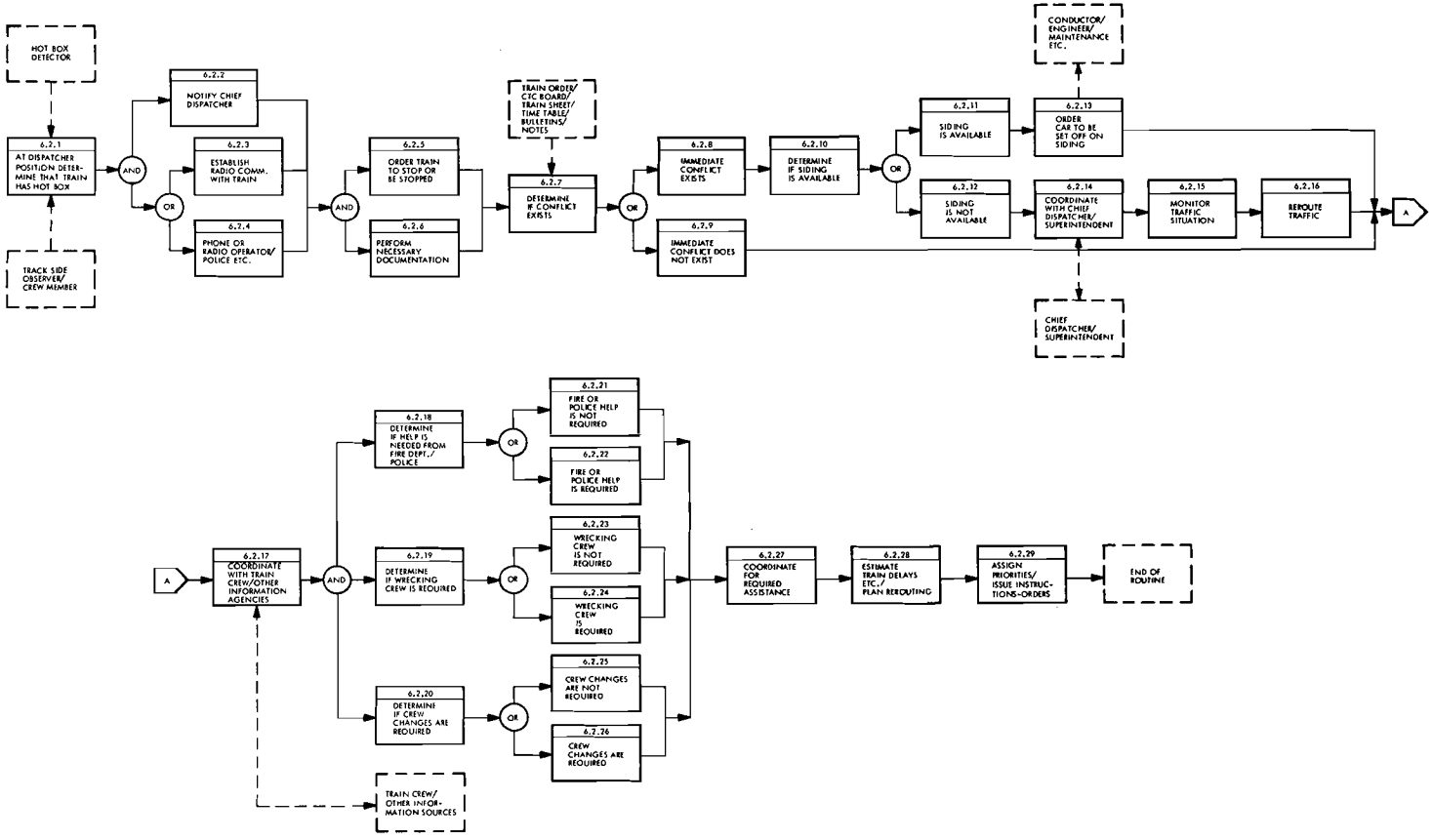


Figure 4-15. FFBD #8 Blazing "Hot-Box"

TABLE 4-11 TASK PERFORMANCE REQUIREMENTS OF SUB-FUNCTION #6.2

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.2.1	At Dispatcher Position, Determine That Train Has Hot-Box	The determination that a hot-box condition exists on a particular train, based on information derived from a hot-box detection system and/or audio reports from track-side observers or train crew members				✓			✓		
6.2.2	Notify Chief Dispatcher	The notification of the Chief Dispatcher (either directly or indirectly through the Assistant Chief) that a hot-box emergency exists						✓		✓	
6.2.3	Establish Radio Communication With Train	The establishment of 2-way radio communication with a train crew as the primary means for directing actions			✓			✓		✓	

TABLE 4-11 TASK PERFORMANCE REQUIREMENTS OF SUB-FUNCTION #6.2 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.2.4	Phone Or Radio Operator, Police, Etc.	communications with "operators" and the external agencies necessary to resolve an emergency situation via available communications links	✓	✓	✓	✓		✓	✓	✓	
6.2.5	Order Train To Stop Or Be Stopped	The direct or indirect issuance of a stop order			✓		✓			✓	
6.2.6	Perform Necessary Documentation	The recording of the information and data necessary to maintain a full account of an emergency	✓				✓	✓	✓		✓

TABLE 4-11 TASK PERFORMANCE REQUIREMENTS OF SUB-FUNCTION #6.2 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.2.7	Determine If Conflict Exists	Cross referencing and reviewing available information in order to determine existence of conflicts or potential conflicts	✓			✓			✓	✓	
6.2.8	Immediate Conflict Exists	The determination that a conflict presently exists which poses a direct threat to safe operations				✓			✓		
6.2.9	Immediate Conflict Does Not Exist	The determination that a conflict or an obvious potential for a conflict does not exist				✓		✓			

TABLE 4-11 TASK PERFORMANCE REQUIREMENTS OF SUB-FUNCTION #6.2 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.2.10	Determine If Siding Is Available	Review of known traffic conditions, rail conditions, etc. to establish the availability of a siding	✓			✓		✓	✓	✓	
6.2.11	Siding Is Available	The determination that a siding is available for subsequent "side-tracking" of the affected train or car				✓		✓			
6.2.12	Siding Is Not Available	The determination that a siding is not available for side-tracking a disabled train/car				✓		✓			

TABLE 4-11 TASK PERFORMANCE REQUIREMENTS OF SUB-FUNCTION #6.2 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.2.13	Order Car To Be Set Off On Siding	Communication with the conductor, engineer, maintenance crews, etc. to order the affected car (or train) to be set off on a siding			✓		✓	✓		✓	✓
6.2.14	Coordinate With Chief Dispatcher/ Superintendent Etc.	The coordination of actions with the Chief Dispatcher and/or Superintendent as necessary to resolve the particular emergency or to keep supervisors apprised of the emergency situation	✓	✓			✓	✓	✓	✓	
6.2.15	Monitor Traffic Situation	Visual/audio surveillance of the on-going traffic situation with special attention to potential effects of the emergency condition				✓			✓		

TABLE 4-11 TASK PERFORMANCE REQUIREMENTS OF SUB-FUNCTION #6.2 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.2.16	Reroute Traffic	The alteration of previously established traffic routings as necessary to maintain safe and expeditious traffic movements	✓	✓	✓		✓	✓	✓		✓
6.2.17	Coordinate With Train/Crew Information Agencies	The communication of current information related to resolution of the emergency		✓	✓	✓	✓	✓	✓	✓	
6.2.18	Determine If Help Is Needed From Fire Department/Police	The assessment of need for assistance from Fire or Police Departments	✓			✓			✓		

TABLE 4-11 TASK PERFORMANCE REQUIREMENTS OF SUB-FUNCTION #6.2 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.2.19	Determine If Wrecking Crew Is Required	The assessment of need for wrecking crew assistance	✓			✓			✓		
6.2.20	Determine If Crew Changes Are Required	The assessment of need for a replacement train crew	✓			✓			✓		
6.2.21	Fire Or Police Help Is Not Required	The determination that Fire or Police Department assistance is not required				✓		✓			

TABLE 4-11 TASK PERFORMANCE REQUIREMENTS OF SUB-FUNCTION #6.2 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.2.22	Fire Or Police Help Is Required	The determination that Fire or Police Department assistance is required to resolve the emergency situation	✓			✓			✓		
6.2.23	Wrecking Crew Is Not Required	The determination that "wrecking crew" support is not required	✓			✓			✓		
6.2.24	Wrecking Crew Is Required	The determination that a "wrecking crew" is required	✓			✓			✓		

TABLE 4-11 TASK PERFORMANCE REQUIREMENTS OF SUB-FUNCTION #6.2 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors							
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.2.25	Crew Changes Are Not Required	The determination that train crew changes are not required	✓			✓			✓		
6.2.26	Crew Changes Are Required	The determination that a new train crew should be provided as a result of the emergency, or in accord with company policy related to hours of work, etc.	✓			✓			✓		
6.2.27	Coordinate For Required Assistance	Coordination with the appropriate persons or agencies as necessary to obtain required support or assistance	✓	✓	✓	✓	✓	✓	✓	✓	

TABLE 4-11 TASK PERFORMANCE REQUIREMENTS OF SUB-FUNCTION #6.2 (Continued)

Sub-Function Number	Title	Description	Sub-Function Performance Factors								
			Planning	Organizing	Directing	Monitoring	Controlling	Initiating	Responding	Coordinating	Documenting
6.2.28	Estimate Train Delays Etc./Plan Rerouting	The estimation of train delays and development of corrective measures to minimize the impact on overall train operations	✓	✓		✓			✓	✓	
6.2.29	Assign Priorities/ Issue Instructions - Orders	Assessment of priorities and issuance of the instructions or orders necessary to insure compliance with the train dispatcher's decisions	✓	✓	✓	✓	✓	✓	✓	✓	✓

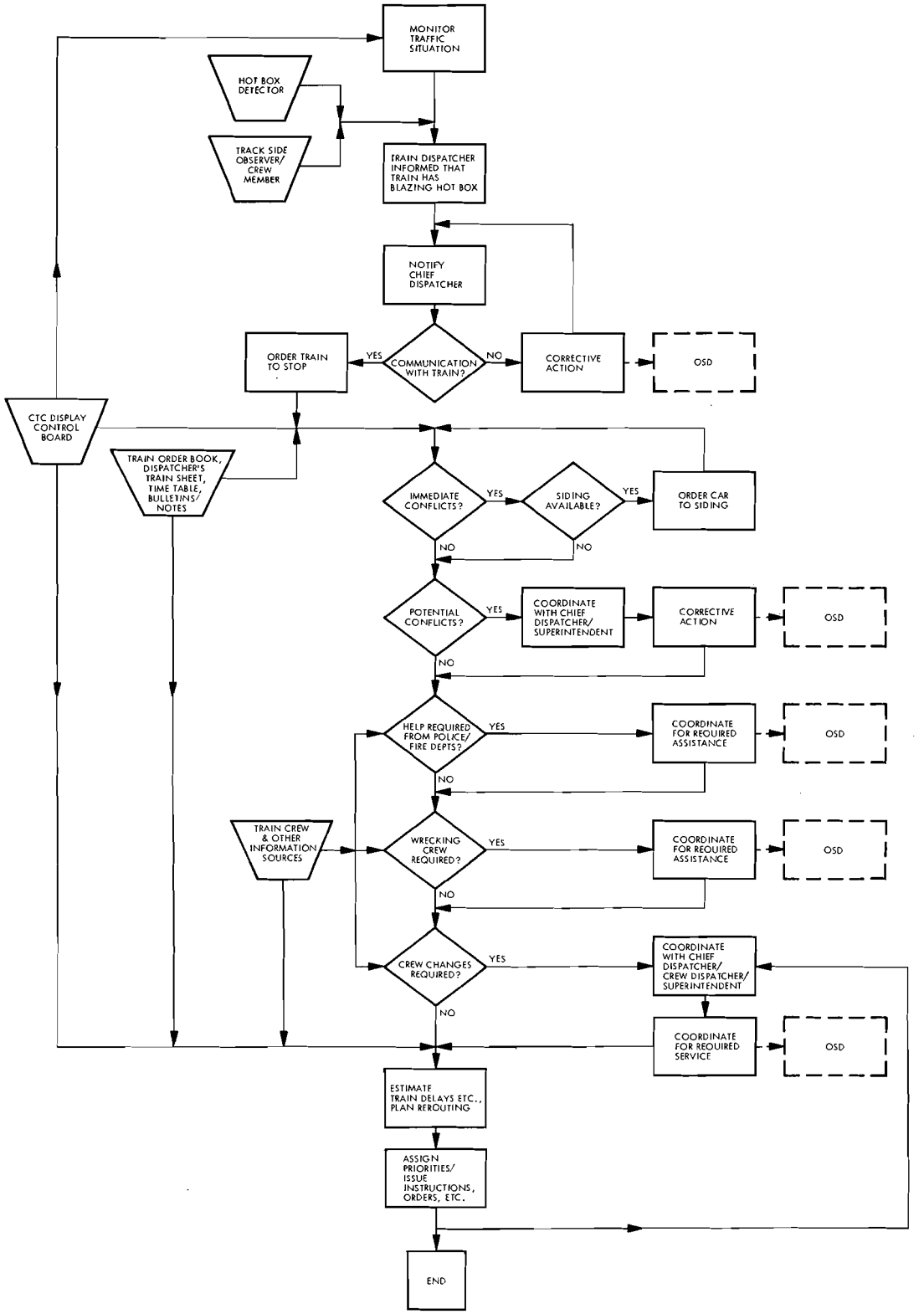


Figure 4-16. DFD #2, Decision Making Aspects of Responding to an Emergency "Hot-Box" Condition

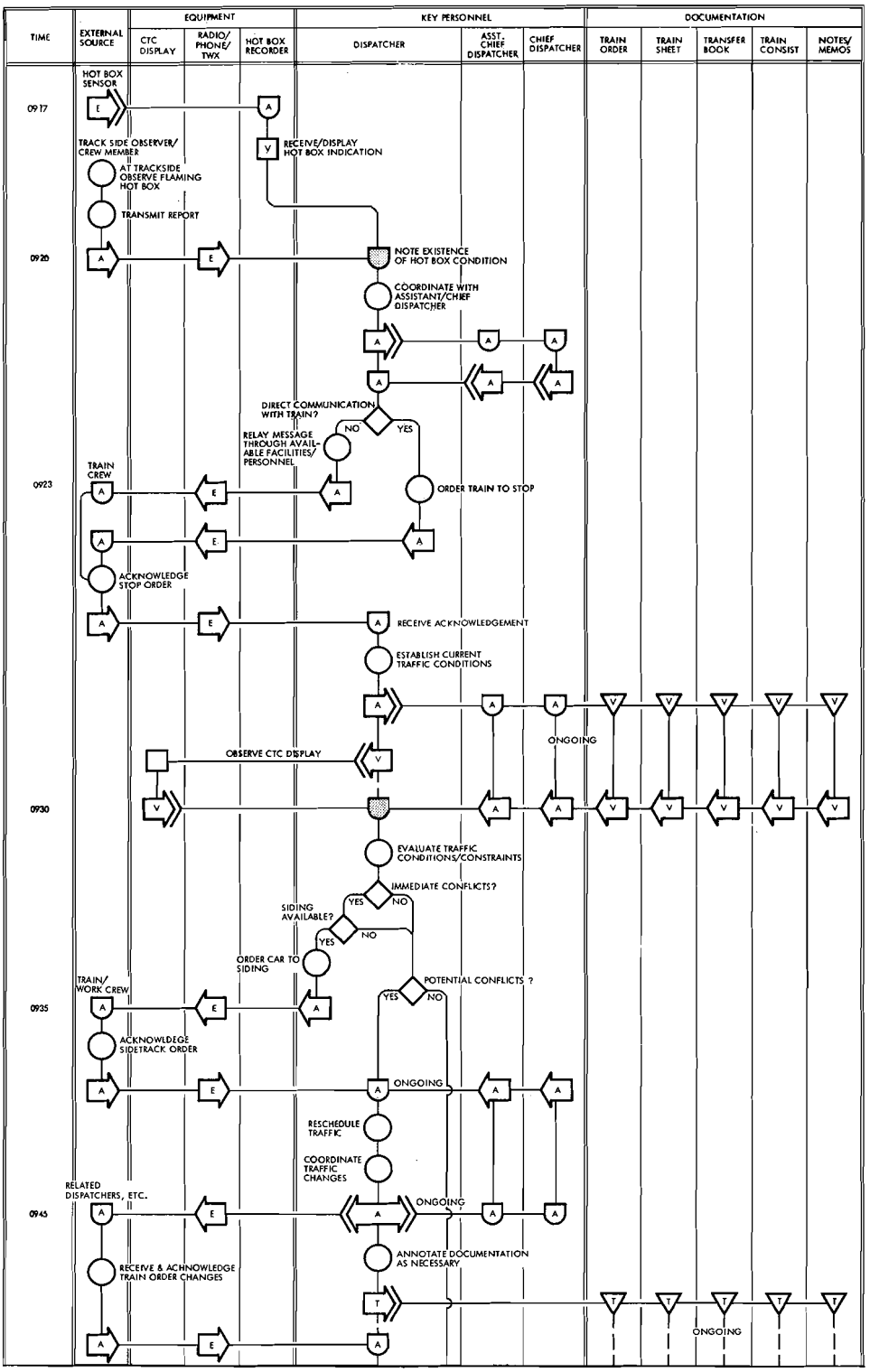


Figure 4-17a. OSD#2 Interface Detail Associated with a "Hot-Box" Emergency

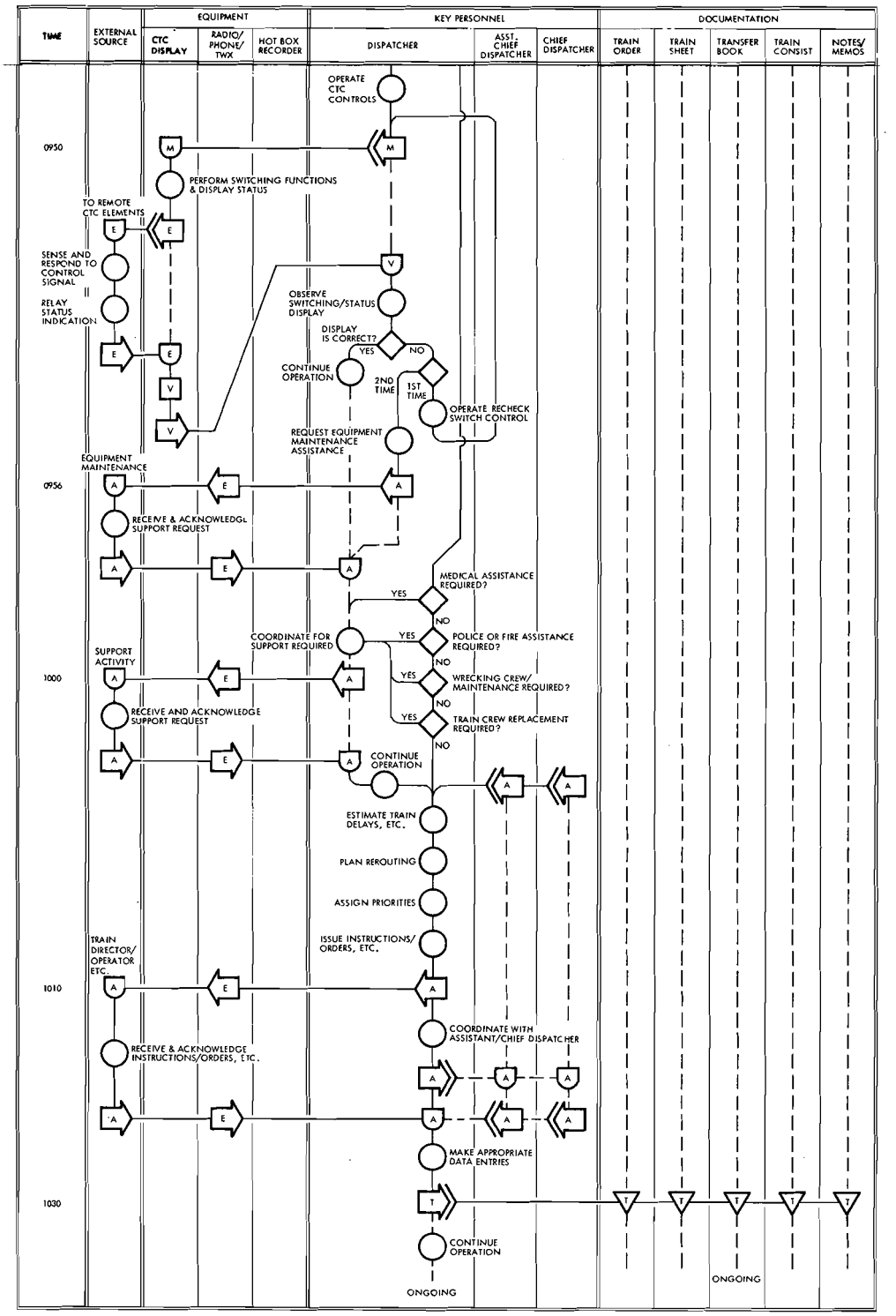


Figure 4-17b. OSD#2 Interface Detail Associated with a "Hot-Box" Emergency

4.10 DISTRIBUTION OF ACTIVITIES

4.10.1 Task Frequency Measurement

To identify the frequency of occurrence of the various dispatcher tasks, an analytical matrix format was developed that plots activity initiations against time. Certain tasks require very little time, effort and attention. Others, because of their complexity, require prolonged effort and great concentration; therefore, a dispatcher may spend more time on tasks that occur less frequently. One must consider the nature of the various functions as described elsewhere in this report in order to properly evaluate the dispatcher performance reflected in Figure 4-18.

4.10.2 Analytical Matrices

To construct the matrices reflecting frequency of occurrence and distribution of train dispatcher task involvement, detailed logs* of a train dispatcher's activities, as observed over a two-day period, were analyzed and plotted. In order to restrict the scattergraph plot to limits enabling the development of conclusions, the listing of categories of task activities was deliberately limited, with many sub-task activities grouped under functional terms established specifically for this matrix. Table 4-12, Definition of Functional Terms, identifies and explains the terminology.

Because of the limited sampling, these matrices do not provide a statistically sound basis for generalization on frequency of occurrence of various activities. They do illustrate, however, the variety of matters to which a train dispatcher must attend almost continually every day and the way in which the functions that we have analyzed individually intermingle, overlap and combine.

*The data were provided by the American Train Dispatcher's Association. For a sample of the logs see Table 5-1.

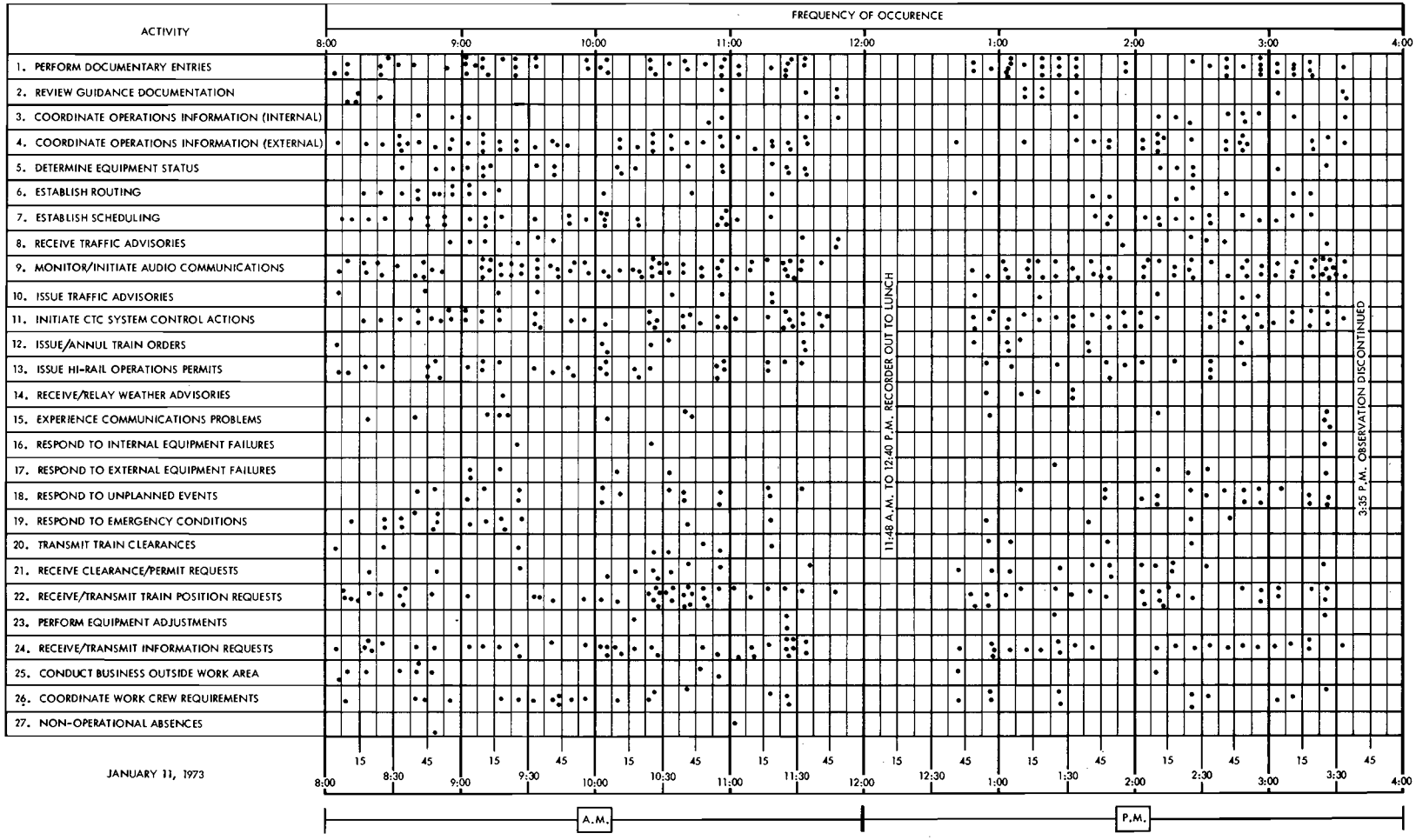


Figure 4-18a. Task/Frequency Distribution

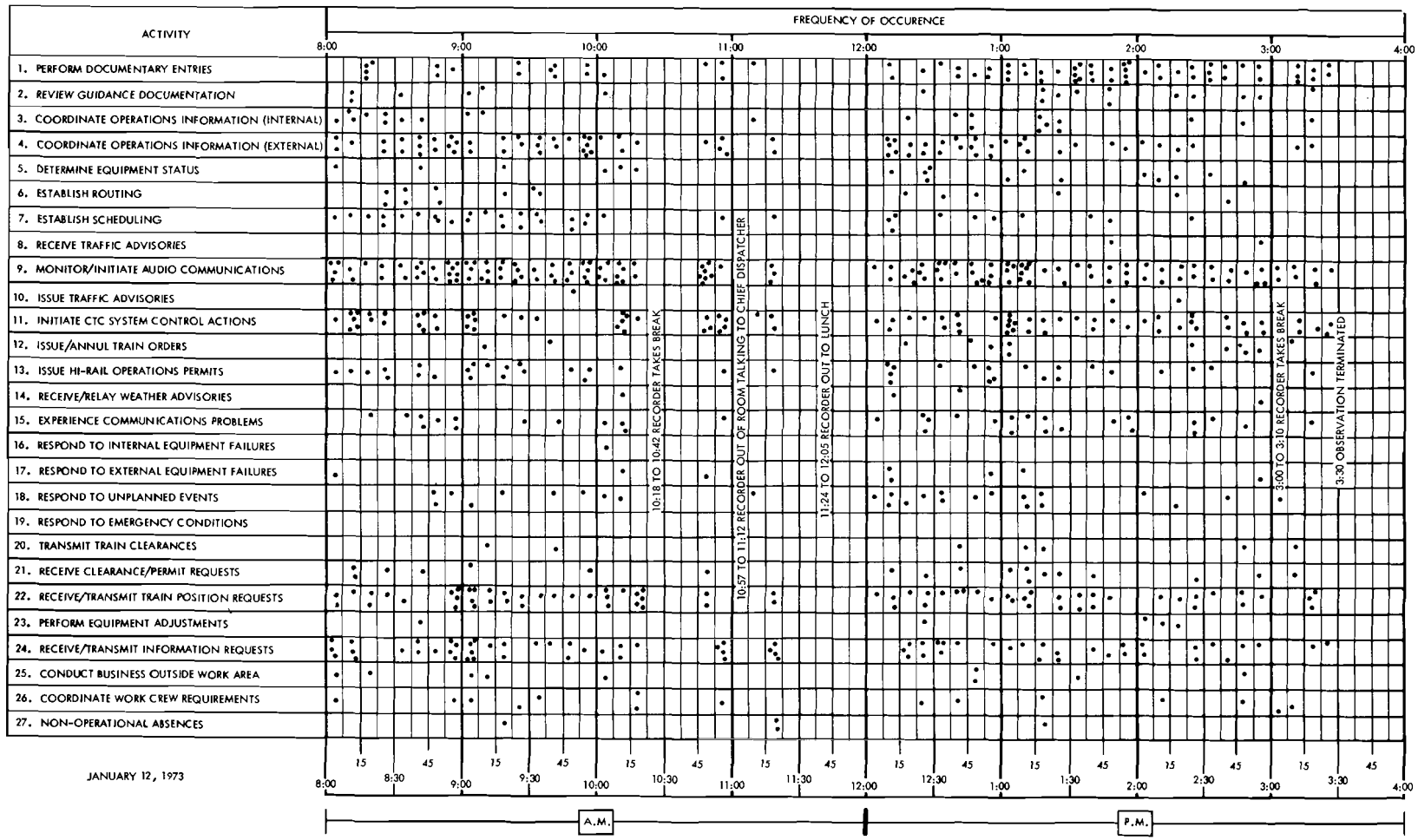


Figure 4-18b. Task/Frequency Distribution

TABLE 4-12. DEFINITION OF FUNCTIONAL TERMS

FUNCTIONAL TERMS	MEANING
1. Perform Documentary Entries	Includes all data entries, notations, checks, etc. performed on the following documents: a. Dispatcher's Train Sheet b. Train Order Book c. Work Order Book d. Transfer Book e. Personal Notes f. Other Report Requirements
2. Review Guidance Documentation	Visual review of information pertinent to dispatcher activity, e.g., bulletins, directives, memos, messages, notices, personal notes, etc.
3. Coordinate Operations Information (Internal)	Any transfer, exchange or dissemination of information, instructions, or requirements between the dispatcher and other dispatchers, operators, chief dispatcher, etc., within the general internal confines of the overall dispatch operation.
4. Coordinate Operations Information (External)	Includes the interchange of ideas, information, and situation occurrences between the dispatcher and operators, signalmen, trackmasters, etc.; it also includes direction provided to "operators" under the dispatcher's jurisdiction.
5. Determine Equipment Status	Actions taken by the dispatcher to determine the status of both internal and external equipment. These actions might include status checks performed through utilization of the CTC System, telephonic equipment reports, or work/maintenance crew reports.
6. Establish Routing	Preplanning by the dispatcher for traffic routing via the most expeditious line to reach destinations. Also includes alternate routing the dispatcher might select in order to move "through" traffic around potential or existing traffic problems.

TABLE 4-12. DEFINITION OF FUNCTIONAL TERMS (Cont'd)

FUNCTIONAL TERMS	MEANING
7. Establish Scheduling	Actions taken to establish track occupancy time schedules for main-line traffic, maintenance crews (hi-rail track permits), etc.
8. Receive Traffic Advisories	Includes receipt of information derived from external sources dealing with the traffic situation; i.e. track conditions, delays, early reports, weather conditions, traffic volume, etc.
9. Monitor/Initiate Communications	Includes all incoming and outgoing audio communications between the dispatcher and other railroad personnel.
10. Issue Traffic Advisories	Information as described in 8 above, transmitted to an external agent.
11. Initiate CTC System Control Actions	Control of train movements/operation through manipulation of CTC System.
12. Issue/Annul Train Orders	Action which a dispatcher takes both through use of communication channels and documentation when issuing or annulling a train order.
13. Issue Hi-Rail Operations Permits	Permission which the dispatcher gives a maintenance crew, wrecking crew, or special vehicle to occupy a particular segment of the track.
14. Receive/Relay Weather Advisories	Dispatcher receives and relays weather conditions; the frequency of advisories of course varies according to the nature of weather conditions as they influence traffic flow.
15. Experience Communications Problems	Includes any malfunction, degradation or disruption in communications either locally or remotely initiated. Also included are the frequent busy signals and unanswered calls which the dispatcher encounters when trying to contact other parties.

TABLE 4-12. DEFINITION OF FUNCTIONAL TERMS (Cont'd)

FUNCTIONAL TERMS	MEANING
16. Respond to Internal Equipment Failure	Actions the dispatcher takes to restore the CTC hot-box recorder, or internal communications equipment to its normal and effective operating level. His response might be in terms of immediate corrective action performed on the malfunctioning equipment or direction of maintenance support required to perform corrective procedures.
17. Respond to External Equipment Failure	Similar to the definition in 16 above, except that this activity is limited to actions taken by the dispatcher whenever external/remote equipment malfunctions; i.e., signalling and switching equipment, power failures, etc.
18. Respond to Unplanned Events	Response the dispatcher makes whenever events or situations arise which are not within the scope of his normal daily planned routine. The train dispatcher is usually the coordinator for all preventive or corrective actions taken whenever unplanned incidents arise. Examples of unplanned events include, but are not limited to: results of adverse weather conditions, deterioration of roadbed, operation without clearance, etc.
19. Respond to Emergency Conditions	Similar to the category described above except that the associated level of urgency is much higher. Typical emergency conditions are: train derailment, train collisions, severe weather conditions, structural collapses, etc.
20. Transmit Train Clearances	For example, transmit clearance for a train to enter main line from siding or from yard using radio or telephone message relay.
21. Receive Clearance/ Permit Request	Request received from trains to enter or cross main line, side tracks, or yard areas.

TABLE 4-12. DEFINITION OF FUNCTIONAL TERMS (Cont'd)

FUNCTIONAL TERMS	MEANING
22. Receive/Transmit Train Position Request	Requests from operators, signalmen, towermen, etc. regarding the exact position of a particular train.
23. Perform Equipment Adjustments	Immediate corrective action taken by the dispatcher to return equipment to normal level of service.
24. Receive/Transmit Information Request	Audio communications between the dispatcher and other railroad personnel concerning the interchange of information to facilitate operational procedures. Information received or transmitted relative to train consists is also included in this category.
25. Conduct Business Outside of Work Area	Includes any direct coordination or instructional activity conducted outside of the dispatcher's immediate work area.
26. Coordinate Work Crew Requirements	Actions which a dispatcher takes in determining/directing work crew activities. This would include the initial identification of category of support required, coordination of these requirements, along with follow-up communications while maintenance or wrecking crew procedures are being performed.
27. Non-Operational Absence	Any period in which the dispatcher is away from his work area for non-operational purposes, i.e., rest room, sickness, personal business, lunch breaks, etc.

5. JOB CHARACTERISTICS AND PROBLEMS

The train dispatcher is a critical control element in the total system. He is responsible for both the efficiency and the safety of the operation. His job is demanding; he is under almost constant tension, regularly assessing complex combinations of information, making critical decisions and responding to unexpected complications. His work environment is often far from ideal--uncomfortable, noisy, confusing. We will examine these problems, and some promising trends, in greater detail.

5.1 RESPONSIBILITIES

5.1.1 Train Movements

The train dispatcher's main function is to keep trains moving. Higher authorities (Superintendent of Transportation or Chief Train Dispatcher) set the schedules, but the train dispatcher must implement them. He authorizes train movements, plans train meets, determines priorities, and continually modifies all schedules to meet changing circumstances. He must bear in mind the urgency of particular operations, the location of perishable loads and loads requiring special handling, the location and possible routes for high, wide or exceptionally heavy loads, the necessity for maintenance crews and inspectors to have access to areas of track. He must also be aware of the time on duty of train crews under his control and the location of relief crews, the power assigned to each train and its interaction with track grades and curves, weather conditions and special conditions to determine expected train speed, and any other factors affecting train movements. He must continually keep track of the status of his total territory, anticipate future developments, make appropriate plans, and issue the necessary orders. In the case of a malfunction or an emergency, he must know and implement the required procedures, notify the proper authorities, summon whatever assistance is required, and adjust his system and operational plans to cope with the new situation.

5.1.2 Safety

Every carrier's code of operating rules opens with these words: "Safety is of the first importance in the discharge of duty." In determining where and when all trains will move, the dispatcher assumes considerable responsibility for the safety of operations. The degree of responsibility varies with the nature of the operation and is not clearly defined.

Where operations are controlled exclusively by train orders, the train dispatcher has primary responsibility for preventing train accidents. The greatest danger is the erroneous issue of a lap order--an order that authorizes two conflicting train movements at the same spot. The statistical records of the Office of Safety of the Federal Railroad Administration for the years 1968 through 1971 show a total of fifteen train accidents attributable to improper handling of train orders by the dispatcher. Two of the accidents, contributing heavily to the total toll of eight persons killed, fourteen injured, were head-on collisions in which both trains carried orders authorizing their use of the track at the accident point. These accidents resulted from laxity on the part of the dispatchers in such seemingly trivial duties as reviewing all current clearances when coming on duty and accepting a train report not given in the prescribed manner. Another potential error is the failure of the train dispatcher to notify a track crew of changes in lineup. Although the operating rules and procedures of a carrier generally protect against such errors, there are so many detailed provisions that the train dispatcher is continually in fear of such a slipup. The fact that such events are rare does not relieve the anxiety of the dispatcher.

Responsibility for the safety of a train movement moves from the train dispatcher and his subordinates when the train crew (particularly the engineer) can respond to signals. If a train is to be stopped by a train order signal, the train dispatcher is responsible for issuing a correct and timely order, the operator is responsible for setting the signal, and the engineer is responsible for obeying the signal. At a complex interlocking, the operator or train director is responsible for setting a safe route;

the equipment is assumed to assure the safety of switches and correctness of signals, and the engineer is responsible for obeying signals. In CTC territory, the train dispatcher is responsible for selecting a route and setting the machine, and again the responsibility for safety passes on to the equipment and the train crew. In automatic block territory, the equipment and the crew are responsible. In automatic train control territory, assurance of safety is essentially assigned to the equipment.

The above examples show that the adoption of certain safety devices tends to relieve the train dispatcher of some of the responsibility for safety of train movements. However, a single dispatcher may, and very often does, have a combination of train order, CTC and automatic block territories under his control. Consequently, his responsibility for the safety of a train movement will vary from total to nil as the train crosses these various territories, and he will have different trains in different types of territory at any given time. The fragmentation and fluctuation of the level of responsibility for safety add confusion to the dispatcher's job and increase the chances for a slipup to occur that can lead to an accident.

Another trend in the industry today is toward consolidation of operations. With the help of electrical and computerized control machines, control of operations has become increasingly centralized. The closing of stations and switch towers, with the consequent elimination of their operating crews, has left the train dispatcher with fewer people to help him in his functions and to share his responsibility for safety. Since the centralized machines have simplified the mechanics of control, it has been assumed that the dispatcher has been freed to control more territory and more train movements. The effect on the safety of operations of this increase in responsibility is not clearly understood, but it is currently a matter of serious concern in the industry, particularly with labor.

5.1.3 Records

The train dispatcher spends a great deal of his time creating and maintaining records of his operation (see Section 4.2). Some record keeping is essential for the efficient and safe control of train movements. Some record keeping is essential for business management. The records related to location and movement of trains are needed by the dispatcher as aids to his performance of the job. Some of the additional record keeping is imposed on the dispatcher simply because he is close to the source of the information to be recorded.

The information that the train dispatcher records in train order books and on train sheets constitutes a critical part of the data the dispatcher frequently needs to assess current and future status of the train movements under his control. The very act of recording the information may help him remember it. Similarly, permits for exclusive use of track, train line-up reports and the like are working references.

Some records kept by the train dispatcher serve both to help him do his job and to provide data for business management. For example, the record on the train sheet of the time a crew went on duty is necessary so that the carrier can maintain its hours-of-service records as required by law. The same information also tells the dispatcher at what time the crew will "go dead" on him. He must know this time in order to schedule the train for arrival at a destination where crews can be changed; he must minimize the time lost and disruption of schedules when a train goes dead on a main line or in the middle of a busy interlocking. Similarly, data recorded on train makeup help the dispatcher anticipate arrival times, select adequate sidings and the like, as well as helping the business office levy charges for service.

Many other records, however, are kept by the dispatcher but do not help him in his primary job of controlling train movements. The preparation of such documents as reports of train delays, local reports, engine failure reports, train mileage reports, and hot-box detector reports is assigned to the train dispatcher because

he sits where the information comes in. The preparation of each of these reports takes up time, distracts the train dispatcher's attention, and contributes nothing to his control of train movements. Because such activity can have a negative impact or the dispatcher's contribution to operational efficiency and safety, it is a key spot for attention in any attempt to improve the total system. The argument here is not that the reports are unnecessary, but that it may not be necessary that the train dispatcher prepares them.

5.1.4 Communications

The train dispatcher has a vast communications network at his command (see Section 3.2.1). It is his responsibility to utilize this network to transmit orders, to receive reports, and to relay information vital for the control of train movements.

However, as in the case of records, because of his access to communications the train dispatcher is often given additional duties that interfere with, rather than aid, the safe and efficient performance of his job. Unnecessary communications duties are generally less formal than unnecessary reporting. Two types of interference were observed: use of the dispatcher as a switchboard operator and use of the dispatcher as a relayer of messages. In the first case, a superior will ask the dispatcher to connect him with a particular train or office. In the second, almost anyone in the system may ask the dispatcher to pass on a message, even to the extreme of a radio communication to the front brakeman in Train XYZ telling him his check has come in, or asking him to pick up a loaf of bread on the way home.

Another aspect of communications loading is the necessity for the dispatcher to keep all lines open so that he can monitor developments in his territory and not miss calls addressed to him. With little or no selectivity of lines to monitor, the dispatcher hears numerous conversations (chatter) not relevant to his needs, along with whatever background noise is in the system. Many times, some of the similar noise from other dispatchers' positions is

audible. All of this auditory input is confusing and often distracting.

5.2 WORK LOAD

5.2.1 Hours of Work

Current law (45 USC 61-64) provides that train dispatchers shall work no more than nine hours in any twenty-four-hour period where two or more shifts are employed, or twelve hours where only one shift is employed, with relaxed provisions for emergencies. Most commonly, the day is broken into three eight-hour shifts, or tricks. First trick is usually 8:00 a.m. to 4:00 p.m., a second 4:00 p.m. to midnight, and third midnight to 8:00 a.m. Local conditions may cause variations in this pattern, with different ranges and overlapping tricks. It is common practice to man the first trick heavily, doubling up territories on tricks that are less busy (nights and weekends). Sometimes the third trick dispatcher is given additional clerical duties, such as preparing headings on train sheets and writing reports. In spite of its stresses, the first trick is popular because of its hours, and dispatchers with seniority generally are assigned to it, thus creating a beneficial match of experience with work load.

5.2.2 Traffic Load

Although trains operate around the clock, the heaviest work load for dispatchers occurs during daylight hours (first trick and early part of second trick). Not only are the freights that were made up during the night and all the commuter trains active in this period, but also most of the work done by local switchers, road maintenance crews and inspectors occurs in this same period.

There is no precise measure of the train dispatcher's workload. Number of trains handled per trick or per day is a common index (varying generally from 50 to 100 trains per trick). However, moving a dozen scheduled commuter trains through a CTC territory with all equipment in good shape may be less of a "load" than moving one freight past work crews, through opposing traffic, and over bad rail on train orders.

The aforementioned trend toward consolidating and centralizing train control tends to increase the extent of territory and the number of trains per shift that a dispatcher must handle. Simplifying the mechanics of controlling train movements does not necessarily simplify the dispatcher's job. As one dispatcher commented when questioned about automation of his territory: "It doesn't make my work easier, but it gives me better control."

Research is badly needed to determine how number of train movements, miles of territory, types of territory, types and condition of equipment and other factors interact to determine workload limits consistent with safety.

5.2.3 Unexpected Incidents

All of our observations confirmed our early conclusion that the definitive characteristic of the train dispatcher's workday is unexpected incidents. The initial plan for orderly movement of trains is not too difficult to establish, and tentative meets can be set up, times set aside for track repairs, and other special arrangements anticipated. Almost immediately, however, delays occur. Faulty locomotives can delay departures or cause breakdowns on the way; derailments may occur; trains may break in two; crew scheduling may be delayed through illness; maintenance crews may need extra time; a high priority movement may be introduced, and more serious accidents sometimes occur. Weather factors (fog, rain, snow, sleet, winds, etc.) can further complicate operations, and malfunctions in communications may slow down even routine operations. Such complications are daily events on any railroad.

For every delay or other change, the dispatcher must not only take corrective action but must also readjust every other part of his total scheme of operations that is in any way affected. In Sections 4.7 through 4.9 we have already shown in detail the kinds of action required of the dispatcher in response to emergencies and other unscheduled events. The point to be emphasized here is that such responses are not rare; they are a large part of the train dispatcher's everyday activities.

5.2.4 Work Distribution

If incidents affecting the train dispatcher's job usually occurred one at a time, he could probably cope with each one without undue stress. But often, "everything happens at once," and by the time a particular problem is resolved, several new ones have arisen.

In Section 4.8 and Figure 4-18 we have already noted the variety of occurrences logged for "typical" working days at one dispatcher's position. Even such a table fails to give the flavor of the heterogeneous nature of the dispatcher's work day. To add this dimension, the actual log of activities for a fifteen-minute segment of one of the charted work days is given in Table 5-1. This was characterized as a quiet day. The dispatcher on one belt railway told an observer that he sometimes controls as many as twenty trains at one time.

The train dispatcher, immersed in this flow of requests for information, need for information, processing of information, decision-making and other functions, creates some sort of dynamic model of the activities in his territory, relying heavily on his memory to keep track of status and to schedule actions. Only he can scan the train sheet, the train order books and the CTC board and immediately comprehend what they signify.

The train dispatcher is wedded to his position. He can seldom leave his area, and then only for a very brief period. In his absence, developments must await his return. Generally no one can step in for a few moments and "take over." In most of the operations surveyed, the dispatcher ate his lunch at his desk. Relief breaks were rare, and only when activities were relatively quiet.

At one office that was visited, the Chief Train Dispatcher would answer the phone in the absence of the train dispatcher, but he would simply ask the caller to wait; he would not attempt to make a decision or transmit information. Such a policy is common to most train dispatching offices. The principal exception noted was an office where an extra Assistant Chief Dispatcher was

TABLE 5-1. LOG OF FIFTEEN MINUTES OF ACTIVITIES AT A TRAIN DISPATCHER'S POSITION ON A QUIET DAY

846	Telephone maintainer in office asking about phone trouble.
846	Dispr calls D__ on radio, advises him train left track light on between S__ and A__.
846-847	Yard engine W__ wants to make a move, told to wait til track cars clear up.
847	Line up CTC.
847	E__ reports A&T ready to go.
847	Marking graph
848	Writing on train sheet.
848-851	Dispr goes to chief disprs office to discuss something.
851	Trainmaster in office asking about two trains and engines.
851-852	Someone at C__ asking about location of trains, discusses work.
851	Someone called dispr, dispr busy.
852	Someone at M__ wants track/time limits, told to wait.
852	Dispr called C__ on radio, no answer.
852-853	Writing on train sheet.
853	Dispr called B__ on radio, no answer.
853-855	H__ given track/time limits C__ to K__; discuss Form W order and other track cars.
854	Someone calling dispr, dispr busy.
855	Someone calling dispr, dispr busy.
855	Someone asking about yard engine at W__.
855-856	J__ OS'd train by and discussed consist.
856-900	Someone wants to move machinery across tracks, discusses location of trains.
856	J__ says train has some hoppers.
857	Car shop wants to discuss repairs, referred to chief dispr.
858	Dispr checked with C__ relocation of trains and when local will be ready.
858-859	Dispr called train on radio, asked location of another train.
859-900	Train called dispr on radio, reported broken train line. Dispr makes message re same, getting car number.
900	Someone says to tell B__ his check is here.
900	B__ on radio asks switch be thrown for him.

scheduled for the busy part of the day, with a principal duty of keeping up with developments at two CTC boards and relieving the train dispatchers as required. This practice permitted relief breaks and lunch breaks for those two dispatchers. Such an arrangement is rare, however, and would be costly in a large office.

5.3 STRESS

5.3.1 Responsibility and Liability

The train dispatcher is responsible for the safe and efficient movement of trains. Failure to do his job properly can result in delays in delivery of goods, damage, spoilage or destruction of perishable goods, damage or destruction of railroad equipment and property, and even human injuries and loss of lives. Such eventualities are costly (and could be disastrous) to the carrier, and the accompanying penalties are correspondingly severe. So the train dispatcher goes about his complex job aware that a slipup--a bad decision, a broken rule, etc.--can have dire consequences both for himself and others. Even if his mistake does not cause great damage or deaths, he is subject to loss of his job.

5.3.2 Operational Factors

Unfortunately, the interests of business and safety are not always compatible. Delays incurred because of excessive caution on the part of the dispatcher cause delays in delivery of goods to customers. Furthermore, delays increase the risks of spoilage of perishables, loss of lading through pilferage, and damage through vandalism. On the other hand, accidents, losses and damage resulting from the breaking of rules to speed up deliveries are also hazards faced by the train dispatcher; so that he often must choose between equally undesirable alternatives in decision-making. Claims are often heard that supervisory pressure is not always in the interests of safety.

Many of the daily decisions made by train dispatchers involve such conflicts. And the decisions must be made almost instantaneously--there is no time for deliberation, for careful weighing of

alternatives. The operating rules and other documents provided for guidance are often difficult to understand. They may be poorly worded, poorly organized, ambiguous, and even conflicting. The National Transportation Safety Board has urged the Federal Railroad Administration to attempt to improve and standardize railroad operating rules (NTSB, 1971), and the FRA has commenced a program with these objectives. (See Appendices B - P for typical rules relating to dispatching functions.)

Most people faced with the necessity of making frequent, quick, unsatisfactory decisions with severe penalties for mistakes become tense and anxious. So the basic nature of the train dispatcher's job is stressful.

5.3.3 Requirement for Memory

Despite the display boards, train sheets, train order books, train consist reports and other reference materials, the train dispatcher must rely heavily on his memory to maintain an up-to-date comprehension of the status of his operation (see Section 5.5.2). Forgetting is a human characteristic, and it is aggravated when the material to remember is detailed and complex. The train dispatcher adds to his job tension by his continual awareness of the consequences that could ensue from forgetting a critical detail.

5.3.4 Environmental Factors

The nature of the working environment (see Chapter 3) usually contributes to the stress of the train dispatcher's job. Crowded, noisy, uncomfortable working quarters, frequent interruptions, numerous sights and sounds competing for attention--all these conditions militate against thoughtful assembly and analysis of data, arriving at critical decisions, and acting on the decisions. This incompatibility of the job environment with the job demands serves to add to the tensions and anxieties experienced by the dispatcher.

5.3.5 Medical Consequences

The continual psychological stresses of the job may have serious adverse effects on the health of train dispatchers. Statistical summaries of the medical problems of train dispatchers are rare, and it is difficult to evaluate those that do exist because of the small numbers sampled. The following summary is derived from data provided by the American Train Dispatchers Association.

In 1929-30, a ten-month study of the mental health and physical health of 165 train dispatchers led to some disturbing conclusions. As a group, train dispatchers showed an exceptionally high incidence of optical nystagmus (a jumping of the eyes that reflects fatigue, attributed to frequent scanning of train sheets), deafness (attributed to the then-common use of headphones), diseases involving the heart, blood vessels and kidneys, and a group of symptoms usually associated with neuroses and anxiety states. The average age at death was 50 years, with an exceptionally high rate of deaths due to cardiovascular disease. These conditions were attributed to "...the stress and strain incident to the rate at which some train dispatchers are called upon to perform their duties." Although this study was conducted over forty years ago, working conditions at many positions have changed little. Train sheets are still in use, although they are now generally printed on green or buff paper to reduce eyestrain due to glare. Speakers have been substituted for earphones (although we have noted a return to earphones in the new D&RG system, Section 3.3.4). Perhaps traffic volume has decreased overall, but consolidation and centralization have increased the workload for many dispatchers, and the general increase in speed and length of trains has not made decision-making any easier for dispatchers today.

Later sets of data (1941-1950 and 1951-1955) showed a median age at death of about 57 for train dispatchers, as compared to a median of 65 for the general population of white males over age 25. About half of the deaths of train dispatchers in the latter sample were attributed to heart disease and another 20 percent involved blood vessels.

In a five-year follow-up study of coronary heart disease (CHD) among railroad workers, the investigators found an exceptionally high incidence of cigarette smoking among the train dispatchers and an excessive number of deaths from CHD (Taylor et al., 1970). The number of cases is too small to have statistical significance, but the figures are consistent with the findings of the earlier studies.

These studies, the complaints heard during our present survey, and our observations all cause us to conclude that the stress associated with the performance of train dispatching duties as they are now carried out is real, severe and potentially damaging to the physical and mental health of the dispatchers. The 1930 analysis concluded that "... the high percentage of mental disorders, including anxiety states and fatigue, are particularly prone to mental lapse favoring errors in the movement of trains." This potential appears to persist today and must be given attention in any program on railroad safety.

5.4 PRESENTATION OF INFORMATION

5.4.1 Basic Aids

The train dispatcher must base most of his decisions on a prediction of the dynamic status of his territory at the time his decision becomes effective. The effectiveness of his decisions, especially the safety of the operation, depends on the timeliness, accuracy and accessibility of the data furnished him and his skill in locating, integrating, and extrapolating the data.

To assure timeliness, as much information as possible is prepared in advance in the form of rules, timetables, bulletins and the like. A major reason for all of the communications aids is to permit information on progress and on changes to reach the dispatcher with a minimum of delay.

To assure accuracy of information, elaborate, repetitive checking procedures have been established for communicating train orders and clearances. CTC boards have built-in checks, such as out-of-correspondence lights.

To assure accessibility of data, train orders are numbered consecutively and lined out when they expire.

Some provisions are made to help the train dispatcher organize his information into a pictorial representation of the current status of his territory. Sections of the train sheet are arranged with a printed list of stations on the route, in geographical order, with a separate column for data on each individual train and with space for the orderly entry of the time at which each train passes each station. CTC boards always include a schematic diagram of the trackage under control, with occupancy lights showing the last-sensed position of each train in the system. CTC graphs, when marked by the dispatcher, give a concise picture of current status of traffic and how it has moved in the past.

Relatively few aids are provided to assist the train dispatcher in prediction of future status of his territory. He can deduce future conditions from the data entered in the train order books. CTC indicators show some of the provisions he has made for routing trains in the immediate future. And he can use his communications to ask other people in the system for predictions. In general, however, the train dispatcher must create and exercise his own mental model of the status of his system, present and future, to determine what actions are required to maintain a safe and efficient flow of traffic.

5.4.2 Inadequacies in Aids

The principal weaknesses in the train dispatcher's aids are the lack of timeliness and the lack of organization of the data. The latest information that a train dispatcher normally has on the location of any train in his territory is the time at which it passed the last reporting point or station (train, or OS, report). The dispatcher usually receives this information as a phone report from an operator at the field location or as the illumination of a track occupancy light on the CTC board. In either case, he must immediately enter the time manually on his train sheet. Communications difficulties can cause delays in the transmittal of OS reports by phone. If the train dispatcher is very busy, he may

sometimes miss a change on his CTC board. In spite of these possibilities, train sheets are generally accurate and up-to-date.

Affecting timeliness to a greater extent is the lack of routine progress or status reporting from trains between OS points. If a train is slow, or stopped, in a long block, the dispatcher has no knowledge of its exact location, nor of its probable arrival time at the next OS point. Multiply this uncertainty by the number of trains in the system at one time, and you can appreciate the lack of precision in the information the dispatcher may have on which to base his extrapolations. Of course, he can call trains by radio if he notes an undue delay, but many times radio communication is uncertain, due to terrain (train in cuts or tunnels) or to malfunctioning equipment. Furthermore, the train crews may be attending to some train malfunction and may not be available to respond to the dispatcher's call.

The organization of information at a train-order position is far from ideal. To determine current status, the dispatcher must scan one or two train sheets, with the information relevant to his problem possibly scattered over several locations on the sheet. In addition, he must review special permits (these may be on the train sheet, on separate forms, in a train order book, in his memory or notes, or in combinations of these locations). To predict future status he must mentally estimate speeds, check provisions of train orders, check bulletins and notices, check or remember timetable provisions, and integrate all of this information.

The CTC board integrates some status information and displays it on a schematic layout of the system. However, the dispatcher must still integrate the block-occupancy data on the board with train identification on the train sheet to be sure which train has caused the indicator to illuminate. The CTC graph, when available, can give a much better picture of status if the dispatcher keeps it current by drawing in and labelling the connecting lines representing trains.

None of these aids give the dispatcher much information on future status. Some of the better CTC boards now illuminate the established routing so that the dispatcher can see where a particular train is headed. Beyond that, the dispatcher must rely on his imagination to picture the future situation and to guide his issuance of orders and permits.

5.4.3 Trends Toward Improvements

Railroads are continually exploiting new technology, and many developments provide help to the train dispatcher.

Improvements in radio communications permit the dispatcher to receive and send more information, between more locations, more rapidly and clearly. One plan for extending and expanding the use of radio communications has been proposed by Bakeman (1972). Essentially, he would rely completely on formal radio clearances directly to train crews at successive control points, similar to air traffic control operations. Front and rear markers for each train would be manually advanced on a magnetic status display of the trackage, and a magnetic tape record of all radio transactions would be maintained. This proposal would relieve the dispatcher of the necessity to maintain train sheets and train order books, leaving him free to concentrate on the actual movement of traffic. Several similar systems have been successfully put into operation on a small scale. Of course, maintenance of radio equipment and strict observance of radio communications procedure are of primary importance in such systems.

A number of techniques have been proposed or developed for automatically identifying trains at OS points. Some devices read a code from the passing train and radio the information along with sensor-point identification to a central data collection point. Another approach is for the train to sense a locator or beacon interregator as it passes and for the train to relay positional information via its radio. In either case, the ultimate advantage to the dispatcher is that the OS time is automatically combined with train identity, relieving him of that frequent, time-consuming function.

We have already noted the trend toward the use of computers to automate train dispatching functions (Section 3.3.4). Systems now in being simplify route selection, maintain OS records automatically, search for, retrieve and display information on demand, and prepare reports. One system eliminates train sheets. Another, in development, will eliminate both train sheets and train orders, providing a display in each locomotive cab that shows current clearance data. Complete automation of train dispatching is a possibility, although we have no knowledge of any such systems under development.

5.5 SUMMARY

The principal problem affecting the job of train dispatcher today is the continual stress associated with controlling train movements safely and efficiently. The degree of responsibility, the conflict between the interests of safety and good business, the complexity of the operation, and the frequency of occurrence of operational problems keep the dispatcher at an undesirable level of tension and anxiety throughout his work period. This situation is often aggravated by inadequacies in the availability and organization of information, malfunctions and delays in communications, crowded, noisy, uncomfortable and distracting working conditions, the burden of unnecessary duties (particularly paperwork), excessive workload, and conflicting pressures from superiors.

There is some indication that the stresses of the train dispatcher's job are injurious to his physical and mental health, and therefore also incompatible with operational safety. More information is needed on this critical aspect of the job.

Two areas where modern technology can be applied to relieve the train dispatcher's job stresses are in the increase in detail and timeliness of status information and in the reduction of paperwork. Much has already been accomplished in these areas. However, such developments are slow and costly, and we can not expect any widespread changes in the nature of the train dispatcher's job in the near future. In the meantime, continuation of the trends

toward sound-shielding, air-conditioning, and separating dispatcher positions, simplifying necessary paperwork, eliminating unnecessary paperwork and improving and maintaining communications facilities will help reduce job stresses, improve the effectiveness of the dispatcher's job performance, and promote operational safety.

6. PERSONAL ATTRIBUTES OF TRAIN DISPATCHERS

The purpose of developing this detailed account of the job of train dispatcher is to assemble a data base as guidance for the determination of needs for standardization and regulation in the interest of safety. Some of the products to be derived from this information are basic physical and psychological attributes consonant with safe train dispatching, basic job knowledge and skills necessary for effective job performance, means for evaluating job proficiency, means for selecting potentially successful train dispatchers, and the basic training required to qualify a candidate to assume the duties of a train dispatcher. In other words, we are looking for answers to the following questions: What kind of person, physically and psychologically, makes a good train dispatcher? What skills and knowledge does he need to perform the job? How can we test whether a person possesses these qualifications? How can we select candidates most likely to make good train dispatchers? How can we best train them?

This report provides raw data for determining answers to these questions--not the answers. However, to provide a framework for the derivation of selection, training, performance and testing criteria, we shall make some tentative hypotheses based on the present study.

6.1 PHYSICAL ATTRIBUTES

6.1.1 General Attributes

An earlier report in this project (Devoe, et. al., 1972) included train dispatchers in a category characterized as critical with regard to safety hazard potential, but minimal with regard to physical demands and exposure to weather.

The train dispatcher is not required to perform heavy physical labor and is not exposed to extremes of weather and terrain. Many physical disabilities can be tolerated since the job is sedentary. Normal vision is required for reading, writing, and monitoring the

CTC board, but deficiencies are tolerable provided they can be corrected artificially (as with eyeglasses). Acute hearing is necessary, especially because of the poor quality of communications systems in many operations. Further study is needed to determine whether hearing aids are adequate to overcome hearing deficiencies when phone and radio messages are deteriorated.

6.1.2 Special Precautions

Our review of the impact of job stresses on the train dispatcher's health (Section 5.4.5) suggested that train dispatchers as a group, tend to die younger than the general population in their age group, with the principal causes of death being coronary heart disease and cerebrovascular disorders. Complaints of ulcers and other disabilities associated with anxiety states and fatigue are frequent among train dispatchers. Although more research is needed to substantiate these findings statistically, certain precautions are indicated in the physical evaluation for selection and monitoring of train dispatchers.

Persons with a history of cardiovascular problems or psychosomatic disorders should not be selected for work as train dispatchers. Although these people might function effectively, the chances are high that the stresses of the job would aggravate their conditions and, in the long run, would be detrimental to their well-being.

In spite of the minimal requirement for physical labor, the job of the train dispatcher is fatiguing. To the extent possible, dispatcher candidates should be screened for susceptibility to fatigue. Before clearcut physical criteria for stress tolerance can be established, however, research is needed on the relationship between general health and tolerance of fatigue as well as on the relationship between workload and fatigue.

6.1.3 Current Practices

The only physical requirements for the job of train dispatcher that we found in our survey are described in the following excerpt

from one carrier's operating rules.

> "No person defective in vision, color perception or hearing shall be employed in any branch of the service involving train or yard movements. Designated employees must pass an examination as to their vision, color perception and hearing, and will be re-examined as may be deemed necessary."

With some carriers, unless he becomes involved in circumstances which might cast doubt as to his current physical condition or it is suspected that sub-standard performance or excessive absence may be a result of a physical problem, the dispatcher may never be re-examined.

6.2 PSYCHOLOGICAL ATTRIBUTES

6.2.1 General Mental Health

We have already characterized the job of train dispatcher as psychologically stressful (Section 5.4). It would be highly undesirable to assign persons with a history of neurotic or psychotic disorders to train dispatching. Not only would the risk be high that, under stress, their ability to make quick, sound decisions would deteriorate, but also the chances of their problems recurring would be increased by the nature of the job. It is therefore in the best interests of both safety and employee welfare to screen out applicants known to have nervous disorders.

A more difficult problem is the development of nervous conditions in an initially healthy person because of the stresses of the job. The value to the employer of the employee's training and experience must be weighed against the risks of deteriorating job performance, and the employee's job security against the risks to his health and well-being.

No scheduling of physical and psychiatric screening is known that can track the general mental health of a dispatcher and identify that point where it is in the best interests of the employer and the employee to relieve him of the stresses of train

dispatching. Research toward such a capability would be a highly desirable project.

6.2.2 Aptitudes

In many fields persons most likely to be successful in a particular job can be identified through testing of aptitude--the capacity to acquire proficiency through training and experience. Aptitudes differ from proficiency in that aptitudes can be measured before a person has had training and experience on a job, whereas proficiency is the measure of the job knowledge and skills achieved as a result of training and experience. For example, an aptitude test might show that the examinee is good at solving puzzles involving prediction of future positions of moving objects; a proficiency test would show how well the examinee can plan and execute a train meet. Because aptitudes can be tested before training, aptitude tests can help select those candidates most likely to succeed in a job and screen out those least likely to succeed.

The development of a valid and reliable battery of aptitude tests for any job requires considerable study and pretesting. No such instrument is known to exist for train dispatchers and it is recommended that one be developed. The following discussion is offered as a takeoff point for further research.

General Intelligence. Many standardized tests of general intelligence exist today. The more successful tests are heavily weighted in favor of verbal skills. Because of the verbal nature of much of a train dispatcher's work (transmission and receipt of oral communications, maintenance of numerous written records and reports, requirements for knowledge of written rules, bulletins and notices), intelligence tests should be screened for applicability to prediction of job success. It is predicted that an IQ somewhat above normal will be found to be a requirement for train dispatchers.

Spatial and Temporal Visualization. A train dispatcher must be able to create some kind of mental model of his territory in

space and time and to predict its future configuration. Tests of spatial and temporal visualization should be considered as likely candidates for predictors of train dispatching performance.

Short-Term and Long-Term Memory. Regardless of the availability of train sheets, train order books, CTC displays, bulletins and other aids, the train dispatcher must rely on his memory in making decisions. Some of the information he needs is not on record anywhere, and he usually does not have enough time to screen the available information when under pressure. He needs short-term memory to check the current status of his system, such as the probable location of trains, work crews, rail cars, people waiting for orders, and planned meets. Long-term memory is needed to recall applicable rules, timetable orders, special notices and the like; the nature of the territory, including grades, curves, cuts, tunnels, location and length of sidings, and signal systems; performance characteristics of various locomotives; dimensions and weights of various cars, and all of the other factors determining what moves can be made safely and efficiently. Memory tests should definitely be included as candidates for a dispatcher's battery.

Decision Making. The combination of aptitudes that lead to skill in identifying problems, assessing all relevant data, and deciding on appropriate action should be evaluated in train dispatchers. Tests in problem solving, risk assessment, and decision making should be sought and evaluated. In this area particularly, it may be necessary to develop new tests.

Language Skills. The ability to comprehend written material and the ability to compose comprehensible communications are basic for the train dispatcher. Many tests of such skills are available and should be screened.

Numerical Skills. The dispatcher regularly must make complicated mental calculations. He must evaluate time and speed to set up train meets and account for crew duty hours, dimensions and weights to determine safe routing, and various costs to determine the most economical course of action. Again, a variety of tests of numerical skills are available for consideration.

Motor Skills. Most of today's train dispatching tasks do not seem to require muscular coordination and dexterity. The one exception is in those operations in which telegraphy is still used, but these are so rare that motor skills can hardly be considered a typical requirement.

6.2.3 Personality

The specification and measurement of personality attributes best suited for a particular job are less precise than for aptitudes. However, devices and techniques do exist for personality measurement, and they should be reviewed for applicability to the selection of train dispatchers. At this point we can only suggest what characteristics might be desirable to identify. From our observations, it would seem that a train dispatcher should be able to avoid excitement under stress. He should remain calm even when events requiring his attention are occurring in rapid succession. He should be able to divide his attention among a number of items without loss of efficiency. He should have tolerance for frequent change and for the need to rework plans and programs. He should have a high degree of self reliance and be able to make his own decisions in spite of conflicting requirements. His voice and manner of speaking should project this self assurance and authority.

A person's interest patterns can be used to predict job success. Interest measurement is suggested here because of the success of interest inventories (such as the Strong Vocational Interest Inventory) in job selection. Based on the observation that people successful in a particular job tend to have similar general interests, these tests create an interest profile of the examinee and match it against profiles typical of people in various jobs. Numerous evaluations have shown this technique to be of considerable value in job placement and career guidance and it should not be overlooked in searching for selection devices for train dispatchers.

6.3 JOB KNOWLEDGE AND SKILLS

6.3.1 Job Knowledge

As a minimum, to perform effectively a train dispatcher must be thoroughly familiar with the following classes of information: rules and regulations, details of territory, basic capabilities of locomotives, characteristics of cars and other track vehicles, special load characteristics, location and characteristics of signal systems, relevant documents, communications capabilities and procedures, emergency procedures, and special conditions of his territory. Each class of information is amenable to oral or written tests.

Rules and Regulations. The train dispatcher must know and understand the rules and regulations governing the operation of his railroad. The carrier's code of operating rules, safety rules and the Federal hours-of-work laws must be known in detail. He must know about special provisions relevant to his territory in the current timetable, and he must understand timetable format so well that he can quickly look up necessary information. He must be thoroughly familiar with the location and contents of all additional sources of information, such as notices, bulletins, and consist reports.

Details of Territory. The train dispatcher must know in detail the layout of trackage in his territory. He should become personally familiar with the entire territory through orientation rides on locomotives, but this desirable practice is not always followed. He must know such aspects of his territory as grades, curves, narrow or low passages (cuts, tunnels, underpasses), railroad and highway crossings, the location of stations, the location of yard and interlocking limits, the location and capability of all sidings, the location and nature of bridges, trestles and bad tracks, the location and nature of industrial spurs, sidings and other delivery points, and any other feature that can affect train movement.

Locomotive Capabilities. The dispatcher must know the capability and limitations of all types of power under his control in

order to estimate speeds, ability to stop and start, risks of break-in-two, and the like as a function of power consist.

Characteristics of Track Vehicles. The dispatcher must know the dimensions and weight of all types of cars under his control, particularly the exceptionally high and wide vehicles. He should know the dimensions of work and rescue equipment for passage and clearance, capabilities of track cars for safe scheduling, and variations in car lengths to match with siding capacities.

Special Load Characteristics. The dispatcher must be familiar with the carrier's provisions for handling special loads, such as perishables, livestock, explosives, flammables and noxious and lethal gasses.

Signal Systems. The procedures and capabilities for handling traffic vary considerably with the type of signal territory. The dispatcher must know the exact limits of train order, automatic block, CTC, and other territories under his control and the procedures appropriate to each.

Documents. The train dispatcher must know in detail every item of information that he must use and its location. He must be thoroughly familiar with procedures for maintaining train sheets, train order books, train lineups and other reports, and he must be able to locate information in any of these documents without delay.

Communications. The dispatcher must understand thoroughly the nature and operation of all communications aids available to him. He must know primary channels, but he must also know how to dispatch maintenance service to trouble spots, and what backup facilities are available when any communications capabilities are lost. He must know and observe the FCC regulations for radio communications.

Emergency Procedures. The dispatcher must know what steps he must take (and in what sequence) in emergencies, including whom to notify, how to determine details of the situation, how to locate and summon aid, and how to adjust operations in his territory to minimize disruptions of service.

Special Conditions. Every territory will have unique conditions that require special methods of train handling. The dispatcher must know about geographical and meteorological factors (susceptibility to landslides, washouts or deep snow); unique structures (bridges, tunnels, excessive grades, etc.); unique hazards (vulnerability to pilferage or vandalism); unique operating conditions (sharing another carrier's track), and all other special conditions in his territory.

6.3.2 Job Skills

It is difficult to summarize the many skills required of a train dispatcher, especially in a format amenable to testing. The real mark of skill in the train dispatcher is not related to individual tasks but to handling of combinations of tasks rapidly and effectively. Several types of skills, however, might provide a basis for the evaluation of the train dispatcher's proficiency: preparing documents, issuing orders, operating equipment, solving problems, monitoring status, and reporting status.

Preparing Documents. The accuracy with which a train dispatcher makes entries in his train sheet, enters train orders and clearances in his train order book, issues track car permits, and prepares other documents can be tested and scored.

Issuing Orders. Situations requiring the issuance of orders can be set up and the dispatcher scored on such factors as choice of appropriate mode (train order, permit, verbal communication, etc.), appropriate wording, appropriate procedure for verification of receipt and reaction to protests.

Operating Equipment. Tests can be prepared requiring the dispatcher to demonstrate skill in operating communications equipment, the CTC board, and any other devices available as job aids. Skills in interpreting equipment output, such as CTC board indications, hot-box detector recordings, and CTC graphs, can also be tested.

Solving Problems. This technique is probably the key method for evaluating a train dispatcher's proficiency, for it can be

made to cover any and all skills of importance. The dispatcher can be given a hypothetical problem situation and be asked to issue all orders and take all actions necessary for solution of the problem. Innumerable problems can be simulated; the challenge is to select those that most accurately reflect the general skill level of the dispatcher. Planning train meets in difficult terrain with long heavy trains, responding to an emergency, re-routing traffic around an accident, replanning a schedule as required because of a train delay, scheduling relief of delayed crews, scheduling efficient work crew time on a busy line, moving a freight train through a commuter train rush, and checking a train for hot-boxes when the recorder is malfunctioning are just a few of the job samples that could be selected for problem-solving tasks.

Monitoring Status. A test exercise could be interrupted to ask the dispatcher a set of key questions on the status of his territory. The speed and accuracy with which he obtains the necessary information and provides answers would be indexes of the effectiveness of his monitoring.

Reporting Status. At the conclusion of a complicated test exercise, the dispatcher could be scored on the clarity, completeness and accuracy of his presentation of the system's status to a relief dispatcher.

6.4 SELECTION, PLACEMENT AND TRAINING

It was not the intent of this effort to survey and report on selection, placement and training of train dispatchers. A more extensive survey of these procedures in the industry is currently in progress. However, in our study of what the dispatcher does, we gained some insights into these areas that will be summarized as a matter of interest. Our conclusions are based on limited samplings and are tentative at this time.

6.4.1 Staffing

Changes in staffing occur on a somewhat cyclical basis. Because railroad personnel tend to make lifetime careers of their

positions, a job opening is usually the result of retirement or death of an incumbent. Possibly because the latest hiring cycle extends over the last couple of years, we observed a considerable number of young personnel. The train dispatchers observed ranged in age from 20 to 65 years. Approximately 50 percent were between 22 and 35 years of age, with an average age of approximately 42 years. There appear to be no formal age requirements for this position.

6.4.2 Source of Personnel

The position of train dispatcher is normally staffed with personnel drawn from train towers. Certain "tower men" (still classed as Telegraph Operators) are informally identified as train directors and operate satellite CTC Systems with limited coverage, under the direction of a train dispatcher. Telegraph operators are also the source for staffing "operator" positions wherein they serve as extensions of the dispatcher, relaying train clearances to train crews, etc. In most cases, personnel who have extensive experience as train directors in CTC systems-equipped towers are favored for appointment as train dispatchers; however, candidates may be drawn from any class of railroad personnel, as well as the general public.

When a train dispatcher position is open, individuals considered for the position may be those who make direct personal inquiry of the chief dispatcher (subsequently referred to the Personnel Office if favorably considered); non-railroad persons who initially contacted the Personnel Office and were recommended by professional associates or friends; persons currently performing as "train directors" (usually upon recommendation of a train dispatcher); and personnel from any job classification currently employed by the railroad. In other words, there is no formally established manpower source, and it is generally left to the judgment of the chief dispatcher as to final selection of the candidate. The chief dispatcher position is itself appointive, usually reporting to the System's Superintendent of Operations. Figure 6-1 summarizes the typical career progression in this field.

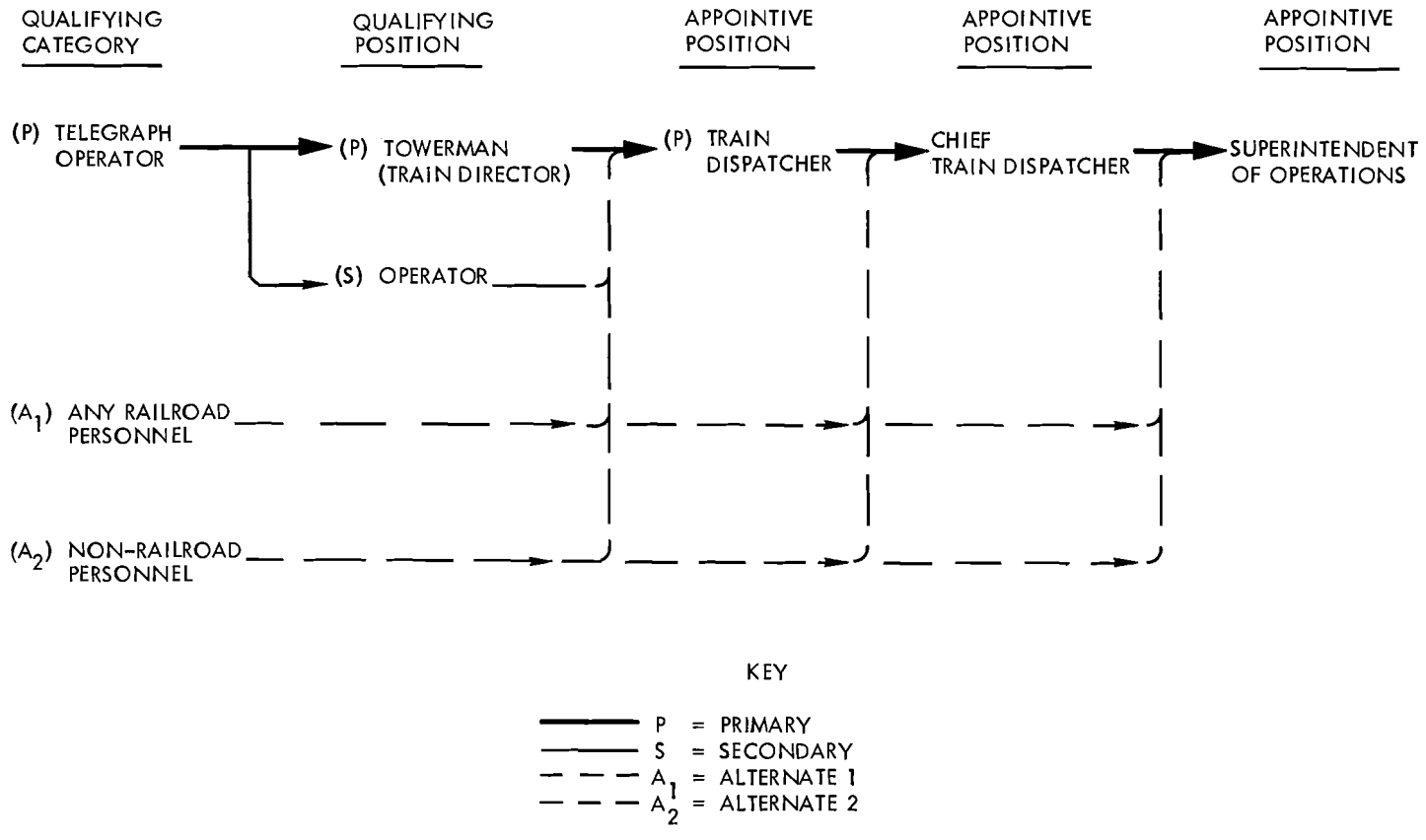


Figure 6-1. Career Progression in the Dispatcher Area

6.4.3 Educational Requirements

Educational requirements for railroad personnel are summarized in the following extract from typical operating rules:

> "For positions above that of laborer, no person shall be employed who cannot read and write the English language, or who does not possess a knowledge of elementary arithmetic."

In our survey, we found that such requirements do not fairly depict the average train dispatcher; however, no hard requirements exist as to minimum formal education standards.

In practice, persons with at least a high school education are preferred, and one railroad official whom we interviewed had noted a direct correlation between learning rate and level of education, with college educated persons generally quicker to qualify.

6.4.4 Types of Training and Qualification

Once he has been selected as a student dispatcher (trainee) and passed a physical examination, the new employee usually commences a period of on-the-job training (OJT) lasting 30-90 work days. Under the tutelage of an experienced train dispatcher, he gains actual work experience. During this period, a written and oral examination covering required job knowledge (i.e., operating rules, physical characteristics of the entire railroad, etc.) is administered by the Chief Rules Examiner. When he has passed this examination and received an acceptable performance evaluation, the trainee is certified as a train dispatcher, and generally placed in an "on call" spare dispatcher status. If the supervisory train dispatcher indicates a negative evaluation, the chief dispatcher makes a final determination as to whether the trainee will continue, be discharged, or demoted.

Some carriers operate train dispatcher training schools. One such school provides two months of classroom training, followed by on-the-job training at the various territorial dispatch positions.

Dispatchers must pass written and oral examinations as a condition to certification and employment.

Although all carriers recognize their desirability, orientation rides over the territory to be controlled are not always included in training programs.

Because the one requirement common to all carriers' qualification criteria is the passing of a test on the carrier's code of operating rules, representative rules and regulations have been included in the appendixes of this report. Most carriers require periodic refresher instruction on rules.

6.5 SUMMARY

As a basis for further development of job performance criteria and personnel selection aids, attributes of train dispatchers considered relevant to their job performance have been reviewed.

In spite of the sedentary nature of the train dispatching job and its sheltered locale, it is suggested that, because of stresses inherent in the job, persons with a history of cardiovascular or cerebrovascular diseases, psychosomatic disorders, neuroses and psychoses should be screened out during the selection process. The potential of aptitude testing as an additional aid to selection is recognized, and it is recommended that general intelligence, spatial and temporal visualization, short-term and long-term memory, decision-making ability, language skills and numerical skills be included in any battery of tests. It is also recommended that tests of such personality traits as the ability to avoid excitement under stress, to divide attention effectively and to convey assurance and authority, and self-reliance and pattern of interests, be considered.

To evaluate the proficiency of the qualified dispatcher, tests of job knowledge and skill are recommended. Job knowledge should include rules and regulations, details of territory, capacities and limitations of power equipment and cars, load characteristics,

location and characteristics of signal systems, relevant documents, communications capabilities and procedures, emergency procedures and special conditions. Job skills should include preparing documents, issuing orders, operating equipment, solving problems, monitoring status and reporting status.

A brief review of selection, placement and training methods in use today shows considerable variety among carriers but generally little in the way of formal evaluation of physical qualifications and proficiency once initial requirements are met. Periodic evaluation of changes in the physical and mental health of train dispatchers is virtually non-existent and is worthy of serious consideration.

7. SUMMARY AND RECOMMENDATIONS

7.1 SUMMARY

The details of the job of train dispatcher have been examined and presented in terms of his general duties and responsibilities, his work environment, and the specific functions and tasks that he performs. Special consideration has been given to the problems characteristic of the job that appear to be most closely related to operational safety.

The material and discussions in this report have been assembled as the data-organizing step in a process leading to the derivation of criteria for job knowledge, job skills, and training consonant with operational safety. This information also constitutes a starting point for the development of aptitude and proficiency tests, training curricula, and research requirements.

The information presented and discussed herein has been derived from an intensive analysis of the details of the train dispatcher's job as it is performed on one railroad and a general survey of train dispatching as performed on six other railroads to assess the nature and degree of inter-carrier variability. The report has been reviewed critically by a veteran train dispatcher. The picture of the train dispatcher's job presented here is considered to be reasonably representative of the job as it is currently performed today on the railroads of the United States.

In summary, the train dispatcher is responsible for the safe and efficient movement of rail traffic over all of his assigned territory. To aid him in this duty, he is provided with an extensive communications network and several special-purpose devices. As techniques and devices for command and control technology have been developed over the years, they have been applied to the various functions of train dispatching a little at a time. However, regardless of the sophistication of their latest dispatching aids, most carriers still retain portions of the earlier systems, thus increasing the heterogeneity of the dispatcher's job as the

state-of-the-art advances. Centralization and consolidation of operations have tended to add to the train dispatcher's workload and to the general noise and confusion in and about his workspace. Thus, the stresses and tension identified as serious aspects of the dispatcher's job at least forty years ago are not notably lessened today. Job selection is generally through progression from related jobs; training is primarily on-the-job in nature; proficiency evaluation is minimal. There are outstanding exceptions to this state-of-the-art and some promising trends, but no revolutionary industry-wide changes in the basic nature of the train dispatcher's job can be foreseen for the near future.

7.2 RECOMMENDATIONS

The FRA is continuing the support of work related to train dispatching under the present project. These first recommendations have already been granted support and are included here to make them a matter of record:

- Determine minimum job knowledge criteria for safe operations.
- Determine minimum job skill criteria for safe operations.
- Determine minimum training criteria for safe operations.
- Develop job knowledge tests.
- Develop job skill tests.
- Study aptitude tests as predictors of train dispatching skills.

It is further recommended that the FRA consider the following additional research efforts:

- Develop measures of dispatcher workload and of job stress.
- Study the relationship between job stress and physical and mental health in train dispatchers.
- Study the relationship between job stress and the effectiveness of job performance in train dispatchers.
- Survey the physical and mental health of train dispatchers.

Some carriers may consider it desirable to modify current methods and policy with regard to train dispatching as a means of enhancing operational safety and efficiency. For these carriers, the following suggestions are offered as insights gained from this study:

1. In selecting dispatcher candidates, screen out of consideration applicants with a history of: cardiovascular diseases, cerebrovascular diseases, psychoneuroses, psychoses and psychosomatic disorders.
2. Attempt to eliminate from the dispatcher's duties those tasks that do not directly contribute to the planning and control of train movements, particularly unnecessary paperwork and unnecessary communications.
3. Shield the dispatcher from noise, discomfort and distractions through improvements in workspace design and in the quality of communications systems.
4. Study, develop and use advanced aids, particularly those employing automation. Especially needed are improved methods for the retrieval and display of predicted status, and for generation of the data now manually recorded in train order books and on train sheets.

REFERENCES

Armstrong, J., "All About Signals." Milwaukee: Kalmbach Publishing Co., 1957.

Bakeman, J. R., "Train Dispatching by Radio." Annual Proceedings of the Railway Fuel and Operating Officers Association, 1972, 115-126, Chicago, 1972.

Devoe, D. B., Sussman, E. D., Feehrer, C. E., Hill, J. H., and Holland, W. H., "Human Factors in Railroad Operations; Initial Studies." DOT, Transportation Systems Center, Cambridge, Mass., Report No. DOT-TSC-FRA-72-8, November 1972.

McCord, C. P., "Life and Death by the Minute." Industrial Medicine, 17:10, 377-382, October 1948.

NTSB. "Signals and Operating Rules as Causal Factors in Train Accidents." National Transportation Safety Board, Washington, D.C., Report No. NTSB-RSS-71-3, December 1971.

Taylor, H. L., Blackburn, H., Keys, A., Parlin, R. W., Vasques, C., and Puchner, T. "IV. Five-Year Follow-Up of Selected U.S. Railroad Companies." Supplement I to Circulation, Vol. XLI and XLII, April 1970.

APPENDIX A
DEFINITIONS

Definitions

The following definitions provide only a limited example of the terms with which a train dispatcher must be completely familiar in order to properly interpret or provide direction during the conduct of his duties. This listing, although of course incomplete, also provides the reader with additional means for comprehending the information and data presented elsewhere in this report.

DEFINITIONS*

APPROACH SIGNAL -- A fixed signal used in connection with one or more signals to govern the approach thereto.

AUTOMATIC BLOCK SIGNAL SYSTEM -- A series of consecutive blocks governed by block signals, cab indicators, or both, actuated by a train, or engine, or by certain conditions affecting the use of a block.
Interlocking signals coming within the block signal limits may be made a part of the Block Signal System, and when so arranged they will be semi-automatic.
Automatic signals will display numbers based on the decimal system, odd numbers being used for outward, and even numbers for inward signals. Prefix letters may be used to designate certain branches or routes.
The number indicates the miles and nearest odd tenth of a mile in the next mile for outward and the miles and nearest even tenth of a mile in the next mile for inward signals, figured from the terminal or starting point of the numbering.
Illustrations: -- Signal Number 91 is for outward trains, and is located about nine and one-tenth miles from Boston.
Signal Number 112 is for inward trains and is located about eleven and two-tenths miles from Boston.

BLOCK -- A length of track of defined limits, the use of which by trains and engines is governed by block signals, cab indicators, or both.

BLOCK SIGNAL -- A fixed signal at the entrance of a block to govern trains and engines entering and using that block.

BLOCK STATION -- A place from which block signals are operated.

CENTRALIZED TRAFFIC CONTROL SYSTEM (CTC) -- A term applied to a system of railroad operation by means of which the movement of trains and engines over routes and through blocks on a designated section of track or tracks is directed by signals controlled from a designated point without requiring the use of train orders and without superiority of trains.

CURRENT OF TRAFFIC -- The movement of trains on the main track, in one direction, specified by the rules.

DIVISION -- That portion of a railroad assigned to the supervision of a Superintendent.

DUMMY MAST -- A mast placed on a bracket post or bracketed to the side of a cantilever post to indicate an unsignalled track between such post and the track or tracks for which signals are provided. The mast will be provided with a blue light as a marker.

DUAL CONTROL SWITCH MECHANISM -- A mechanism provided with a hand-throw lever and a selector lever so arranged that when selector lever is operated the control of switch will be transferred from the power operated switch machine to the hand-throw lever, or from the hand-throw lever to the power operated switch machine.

DWARF SIGNAL -- A low home signal usually set close to ground but may be located on a post up to approximately seven feet above ground level.

*Boston and Maine Railroad. Rules for the Government of the Operating Department, October, 1961.

ENGINE -- A unit propelled by any form of energy, or a combination of such units operated from a single control, used in train or yard service.

ENGINEMAN -- The employe in charge of and responsible for the operation of an engine.

EXTRA TRAIN -- A train not authorized by a time-table schedule. It may be designated as --

Extra - for any extra train except passenger extra or work extra.
Passenger Extra - for passenger train extra.
Work Extra - for work train extra.

FIXED SIGNAL -- A signal of fixed location indicating a condition affecting the movement of a train or engine.

GOVERNING SIGNAL -- The signal first in advance of a train governing its next movement.

HOME SIGNAL -- A fixed signal at the entrance of a route or block to govern trains or engines entering and using that route or block.

INTERLOCKING -- An arrangement of signals and signal appliances so interconnected that their movements must succeed each other in proper sequence and for which interlocking rules are in effect. It may be operated manually or automatically.

INTERLOCKING SIGNALS -- The fixed signals of an interlocking.

INTERLOCKING LIMITS -- The tracks between the opposing home signals of an interlocking.

INTERLOCKING STATION -- A place from which an interlocking is operated.

LEVER MARKER -- A card or other approved device for attaching to lever of control machine to serve as a reminder.

MAIN TRACK -- A track extending through yards and between stations upon which trains are operated by time-table or train order, or both, or the use of which is governed by block signals.

MANUAL BLOCK SIGNAL SYSTEM -- A block or a series of consecutive blocks, governed by block signals operated manually, upon information by telegraph, telephone or other means of communication.

MEETING POINT -- On single track, a place where one train meets another as prescribed by the rules.

NEUTRAL TRACK -- A track in Centralized Traffic Control System (CTC) territory which signalled for movements in either direction.

OPERATOR -- At stations - the telegrapher. At interlocking stations - the operator of interlocking; may be towerman, train director or train dispatcher.

PILOT -- An employe assigned to a train when the engineman or conductor, or both, are not fully acquainted with the physical characteristics or rules of the railroad, or portions of the railroad, over which the train is to be moved. (Also see Rule D-152a.)

POT SIGNALS -- Small revolving signals, used to indicate the position of a switch.

REGULAR TRAIN -- A train authorized by a time-table schedule.

ROUTE -- The track a train may use in passing from one point to another.

SCHEDULE -- That part of a time-table which prescribes class, direction, number and movement for a regular train.

SIDING -- A track auxiliary to the main track for meeting or passing trains.

SIGNAL ASPECT -- The appearance of a fixed signal conveying an indication as viewed from the direction of an approaching train; the appearance of a cab indicator signal conveying an indication as viewed by an observer in the cab.

SIGNAL INDICATION -- The information conveyed by the aspect of a signal.

SINGLE TRACK -- A main track upon which trains are operated in both directions.

SPRING SWITCH -- A switch equipped with a spring mechanism arranged to restore the switch points to normal position after having been trailed through.

STATION -- A place designated on the time-table by name.

SUBDIVISION -- A portion of a division designated by time-table.

SUPERIOR TRAIN -- A train having precedence over another train.

SPEEDS: Medium - A speed not exceeding 30 miles per hour.
Slow - A speed not exceeding 15 miles per hour.
Restricted - A speed that will permit stopping short of another train, obstruction, or switch not properly lined but not exceeding 15 miles per hour.
Yard - A speed that will permit stopping within one-half the range of vision, but not exceeding 15 miles per hour.

TIME-TABLE -- The authority for the movement of regular trains subject to the rules. It contains classified schedules with special instructions relating to the movement of trains.

TRAIN -- An engine or more than one engine coupled, with or without cars, displaying markers.

TRAIN OF SUPERIOR RIGHT -- A train given precedence by train order.

TRAIN OF SUPERIOR CLASS -- A train given precedence by time-table.

TRAIN OF SUPERIOR DIRECTION -- A train given precedence in the direction specified by time-table as between opposing trains of the same class.

TRAIN REGISTER -- A book or form which may be used at designated stations for registering signals displayed, the time of arrival and departure of trains and such other information as may be prescribed.

REGISTER STATION -- A station at which train register is located.

TWO OR MORE TRACKS -- Two or more main tracks upon any of which the current of traffic may be either specified direction. Two main tracks may be referred to as double track.

YARD -- A system of tracks within defined limits provided for the making up of trains, storing of cars and other purposes, over which movements not authorized by time-table, or by train order, may be made, subject to prescribed signals or special instructions.

YARD ENGINE -- An engine assigned to yard service.

APPENDIX B
GENERAL DIRECTIVES

General Directives

The following general directives are considered typical of railroad requirements falling under this heading. They apply to all categories of railroad personnel.

GENERAL NOTICE*

Safety is of the first importance in the discharge of duty.

Obedience to the rules is essential to safety and is required.

To enter or remain in the service is an assurance of willingness to obey the rules.

The service demands the faithful, intelligent and courteous discharge of duty.

The rules contained herein provide for the safety of employees and the public; for efficiency of operation and for the protection of the property of the Company and the traffic it transports.

*Boston & Maine Railroad; Rules for the Government of the Operating Department, 29 October 1961.

GENERAL RULES

A. Employees whose duties are prescribed by these rules must provide themselves with a copy.

Employees whose duties are in any way affected by the timetable must have a copy of the current timetable with them while on duty.

B. Employees must be conversant with and obey the rules and special instructions. If in doubt as to their meaning they must apply to proper authority for explanation.

C. Employees must pass the required examinations.

D. Persons employed in any service on trains are subject to the rules and special instructions.

E. Employees must render every assistance in their power in carrying out the rules and special instructions and must report promptly to the_____any violation thereof.

F. Accidents, failure in the supply of water or fuel, defects in tracks, bridges, signals, or any unusual conditions which may affect the movement of trains, must be promptly reported by quickest available means of communication to the proper authority.

G. The use of alcoholic beverages or narcotics by employees subject to duty is prohibited. Being under the influence of alcoholic beverages or narcotics while on duty, or their use or possession while on duty is prohibited.

H. The use of tobacco by employees on duty, while in the presence of or engaged in serving patrons in or about passenger stations or trains, is prohibited.

J. Employees on duty must wear the prescribed badge and uniform and be neat in appearance.

K. Employees on or about trains and at stations, must be courteous and orderly.

L. In case of danger to, or loss of, railroad property by fire, theft, or other causes, employees must unite to protect it.

Unauthorized possession of, removal or disposal of any material from railroad property or property served by the railroad is prohibited.

M. Employees must exercise care to avoid injury to themselves or others. They must observe the condition of equipment and the tools which they use in performing their duties and when found defective will, if practicable, put then in safe condition, reporting defects to the_____.

Employees are prohibited from riding or walking on the roof of any moving car.

They must inform themselves as to the location of structures or obstructions where clearances are close.

They must expect the movement of trains, engines or cars at any time, on any track, in either direction.

They must not stand on the track in frontof an approaching engine or car for the purpose of boarding same.

They must know and comply with the Safety and Fire Prevention Rules as outlined in "Rules for Prevention of Personal Accidents."

Employes must provide themselves with a copy of these Rules.

N. Employes must not absent themselves from duty, exchange duties with, or substitute others in their place, nor engage in other business which interferes with the proper performance of their duties as employes or which is detrimental to or in competition with the Railroad.

APPENDIX C
SPECIFIC JOB REQUIREMENTS

Specific Job Requirements

The following directives are extracted from the Burlington Northern Train Dispatchers Manual, January 1, 1971, and present a sampling of the specific requirements generally applicable to train dispatchers employed by all railroad companies.

TRAIN DISPATCHER*
SPECIFIC JOB REQUIREMENTS

GENERAL: Train dispatchers report to and receive instructions from the Chief Dispatcher. Train dispatchers must not permit unauthorized persons in the office. They are responsible for any hazards created by their train orders and must not issue train orders that are capable of more than one interpretation. They must not issue combinations and/or improper sequence of orders or instructions that might cause confusion, misunderstanding or be impracticable to comply with.

Safety is of the first importance. Nothing should be permitted to interfere with safe methods, operations, or practices in handling of trains, issuing train orders, train location line-ups, CTC track permits and other instructions. Safety must not be sacrificed to save time.

Communication failure may occur at any moment and train orders must be so handled that no hazard will exist as a result of such failure or by operators clearing trains without an OK from the train dispatcher.

RULES OBSERVANCE: Train dispatchers must report promptly to the Chief Dispatcher:

a. Any error or irregularity in the handling or execution of train orders, clearances, line-ups and CTC track permits;
b. Any known or apparent failure of inferior trains to clear superior trains in accordance with the rules;
c. Any apparent violation of speed restrictions;
d. Any violation or apparent misunderstanding of rules or instructions, by trainmen, enginemen, operators or others;
e. The possibility of violation of hours of service law by employes;
f. Inability to obtain prompt and efficient service from operators.

BULLETINS: Train dispatchers must read bulletins and will record the number of the last bulletin posted on the train sheet, as acknowledgement of understanding of all bulletins. Copy of all bulletins will be maintained in each dispatcher's office. If more than one division is involved, separate sets of bulletins for each division will be maintained.

STANDARD TIME: When a comparison of time is made with employes, train dispatcher must make notation of employe's name, occupation and time compared on the train sheet. Each dispatcher's district must have a standard clock available for time reference.

NEW TIMETABLE: Before the effective date for the new timetable, train dispatchers must check the train schedules and determine whether all trains which are authorized by the old timetable will be able to assume the corresponding schedule of the new timetable and proceed on this schedule. Should there be any doubt as to the trains' authority to proceed on its schedule, it should be run as an extra from its initial station.

HOURS OF SERVICE AND FULL CREW LAWS: Train dispatchers must have sufficient knowledge of the hours of service law regarding train dispatchers, operators, enginemen, yardmen and trainmen to guard against violations.

When crews are relieved under the provision of hours of service law at a location other than final terminal, notations must be made showing time and place relieved. Report must be made to Chief Dispatcher of such occurrences, also any violations of hours of service law by employes.

KNOWLEDGE OF DISTRICT: Train dispatchers must familiarize themselves with the physical characteristics of the territory in their charge, such as grade conditions, location of sidings and train order signals or other conditions that affect the movement of trains.

TELEPHONE OR RADIO CONVERSATIONS: Train dispatchers must be courteous in their conversations. Special care must be used and consideration given, when working with new or inexperienced employees. Train orders, line-ups, CTC track permits and track and time limits must be transmitted with care and at a speed regulated to the capacity of the individual with whom working.

NOTIFICATION OF TRAIN MOVEMENTS: Connecting divisions and dispatching districts must be kept promptly informed on train movements with which they are concerned. Terminals and other stations, as required, must be kept informed as to the expected arrival of delayed passenger trains.

TRAIN SHEET RECORDS: Train dispatchers must keep train sheet in a neat and legible manner, recording the required information thereon, including delays to trains and engines.

In the same manner as they are shown on timetables, trains should generally be entered on the train sheets, starting from the column of stations with the first train due out of its initial station after midnight and continuing in order of departure of trains. When practicable, a train in the same direction should not be entered closer to the station column than another train which is running at an earlier time.

The OS record must be currently maintained. If necessary information to complete the train sheet record is lacking such information must be obtained and placed thereon.

Accounts of accidents, injuries, and unusual happennings will be recorded on the train sheet, noting time of occurrence and time track is clear for traffic.

An extra train or a work extra being authorized must be entered on the train sheet before the running order, or work order, is transmitted. When Example 6 of Form G train order is issued, the train must be entered on both sides of the train sheet before the order is transmitted.

Whenever work trains are operated, they will be entered on the train sheet by a diagonal line drawn across the station column between the authorized station limits, and in addition, under the work train column on train sheet.

Information of train movements as received by annunciators or other means may be entered upon the train sheet in pencil as memorandum. Such information will not be used as evidence of the arrival or passing of a train.

TRAIN ORDER BOOK RECORDS: The records to be kept in the train order book must be neatly compiled and legible. The train dispatcher on duty will show his initials at the top of each page. When an individual is breaking in with the train dispatcher, that person's initials will be shown directly below each train order he issues.

Each train order must be written in ink in full in a book provided for that purpose in the office of the train dispatcher, and with it recorded:

(a) time train order signal displayed;
(b) indication displayed by train order signal;
(c) to what offices the order was transmitted;
(d) when the order was made complete or the "X" response sent at each office;
(e) the names of those who signed the order, when required.

When train orders are transmitted by telegraph, the train dispatcher must write the order the first time it is repeated, and must underscore each word and figure each time it is repeated.

When train orders are transmitted to a train by radio the train must be standing.

Train dispatchers must check off all train orders not in effect by writing his initials across the face of the order with a red pencil. A single diagonal line drawn

across the entire page with a red pencil indicates that all train orders on that page are no longer in effect. When all orders up to and including a certain page are no longer in effect, a page size "X" in red pencil will be drawn on this page.

When an office is closed at the time an order is transmitted to other offices, the address of the order for that office must be entered in the train order book and the order number entered on clearance page for that station as a reminder to issue such orders when that office opens. Such information must also be included or the transfer.

When listing addresses where more than one train gets the orders at the same station, place the station call opposite each address and have the time completed shown on the line opposite the last entry for that station.

For train orders delivered by the train dispatcher, the requirements as to the record and delivery are the same as at other offices.

When a train dispatcher issues a train order that is to be delivered by a train dispatcher, a carbon copy of the body of the order must be made in the train order book, and this copy underscored as it is repeated thereafter.

Line-up and CTC track permit records must be properly recorded. Line-up records include: number, name of station or individual copying and time issued. CTC track permit records include: permit stamp record and "REPORT CLEAR" requirement when applicable.

NUMBERING OF TRAIN ORDERS: Train orders, except slow or cautionary orders must be numbered consecutively each day, beginning at midnight. Each set of dispatchers will use a separate series of numbers. Adjoining dispatching districts must not use the same series of numbers. A higher series of numbers must be used for slow or cautionary orders. Separate train order books must be used for each dispatching district, an exclusive book used for slow or cautionary orders.

*Burlington Northern, Train Dispatchers Manual, January 1, 1971.

APPENDIX D
OPERATING RULES

NOTE.-Rules with a prefix "S" are for single tracks; those with a prefix "D" are for two or more tracks. Rules without a prefix are for single and two or more tracks.

OPERATING RULES
STANDARD TIME

1. Standard Time obtained from Washington, D.C., observatory will be transmitted by wire at 12.00 o'clock noon, daily.

2. Each conductor, engineman, and other employee as may be designated must carry, while on duty, a reliable railroad-grade watch, for which there must be a prescribed certificate on file with the Railroad.

3. Watches of conductors and enginemen must be compared, when commencing each day's work, with a clock designated by time-table as a standard clock. The time when watches are compared must be registered on a prescribed form.

3a. Conductors and enginemen not having access to a standard clock must compare watches daily with conductors or enginemen who have standard time and have registered, or must receive standard time by wire or telephone.

3b. Before leaving on their initial trips, conductors and enginemen will compare time with another member of the crew.

Other train employees must compare watches with conductor or engineman as soon as practicable.

4. Each time-table, from the moment it takes effect, supersedes the preceding time-table, and its schedules take effect on any division, or sub-division, at the leaving time at their initial stations on such division, or subdivision. But when a schedule of the preceding time-table corresponds in number, class, day of leaving, direction, and initial and terminal stations with a schedule of the new time-table, a train authorized by the preceding time-table will retain its train orders and assume the schedule of the corresponding number of the new time-table.

Schedules on each division, or subdivision, date from their initial stations on such division or subdivision.

Not more than one schedule of the same number and day shall be in effect on any division or subdivision.

5. Not more than two times are given for a train at any station; where one is given, it is, unless otherwise indicated, the leaving time; where two, they are the arriving and the leaving time.

Unless otherwise specified, the time applies:

On single track, at the switch where an opposing train clears; where there is no switch it applies at the station.

On two or more tracks, at the station.

Schedule meeting or passing stations are indicated by figures in full-faced type, with the numbers of the trains to be met or passed in small figures adjoining.

When trains are to be met or passed at a siding extending between two adjoining stations, the time at each end of the siding will be shown in full-faced type.

5a. Time at meeting or passing stations, located at the ends of two or more tracks at junctions and at terminal stations will be shown in schedules in full-faced type when the difference in the times of trains is five minutes or less.

6. The following letters when placed before the figures of the schedule indicate:

"s" - regular stop.

*Source: Rules for the Government of the Operating Department, Boston & Maine Railroad: October 29, 1961

"f" - flag stop to receive or discharge traffic.
"A" - arrive.
"e" - Stop to leave passengers on notice to conductor.
"v" - Stops only on signal to take passengers.

6a. The following letters when placed after the name of a station indicate:
"N" - Train order office-Open continously.
"D" - Train order office-Not open continously.
"T" - Telephone communication.
"X" - Yard limits.

OPERATING RULES*

NOTE.-Rules with a prefix "S" are for single tracks; those with a prefix "D" are for two or more tracks. Rules without a prefix are for single and two or more tracks.

OPERATING RULES
STANDARD TIME

1. Standard Time obtained from Washington, D.C., observatory will be transmitted by wire at 12:00 o'clock noon, daily.

2. Each conductor, engineman, and other employee as may be designated must carry, while on duty a reliable railroad-grade watch, for which there must be a prescribed certificate on file with the Railroad.

3. Watches of conductors and enginemen must be compared, when commencing each day's work, with a clock designated by time-table as a standard clock. The time when watches are compared must be registered on a prescribed form.

3a. Conductors and enginemen not having access to a standard clock must compare watches daily with conductors or enginemen who have standard time and have registered, or must receive standard time by wire or telephone.

3b. Before leaving on their initial trips, conductors and enginemen will compare time with another member of the crew

Other train employees must compare watches with conductor or enginemen as soon as practicable.

4. Each time-table, from the moment it takes effect, supersedes the preceding time-table, and its schedules take effect on any division, or sub-division, at the leaving time at their initial stations on such division, or subdivision. But when a schedule of the preceding time-table corresponds in number, class, day of leaving. direction, and initial and terminal stations with a schedule of the new time-table, a train authorized by the preceding time-table will retain its train orders and assume the schedule of the corresponding number of the new time-table.

Schedules on each division, or subdivision, date from their initial stations on such division or subdivision.

5. Not more than two times are given for a train at any station; where one is given, it is, unless otherwise indicated, the leaving time; where two, they are the arriving and the leaving time.

Unless otherwise specified, the time applies:

On single track, at the switch where an opposing train clears; where there is no switch it applies at the station.

On two or more tracks, at the station.

Schedule meeting or passing stations are indicated by figures in full-faced type, with the numbers of the trains to be met or passed in small figures adjoining.

When trains are to be met or passed at a siding extending between two adjoining stations, the time at each end of the siding will be shown in full-faced type.

5a. Time at meeting or passing stations, located at the ends of two or more tracks at junctions and at

*Source: Rules for the Government of the Operating Department, Boston & Maine Railroad: October 29, 1961.

terminal stations will be shown in schedules in full-faced type when the difference in the times of trains is five minutes or less.

6. The following letters when placed before the figures of the schedule indicate:
"s" - regular stop.
"f" - flag stop to receive or discharge traffic.
"A" - arrive.
"e" - Stop to leave passengers on notice to conductor.
"v" - Stops only on signal to take passengers.

6a. The following letters when placed after the name of a station indicate:
"N" - Train order office-Open continuously.
"D" - Train order office-Not open continuously.
"T" - Telephone communication.
"X" - Yard limits.

APPENDIX E
TRAIN MOVEMENT SUPERIORITY
AND
RIGHT-OF-WAY

SUPERIORITY OF TRAINS

S-71. A train is superior to another train by right, class or direction.

Right is conferred by train order; class and direction by timetable.

Right is superior to class or direction.

Direction is superior as between trains of the same class.

D-71. A train is superior to another train by right or class.

Right is conferred by train order; class by timetable.

Right is superior to class.

72. Trains of the first class are superior to those of the second; trains of the second class are superior to those of the third; and so on.

S-72. Trains in the direction specified by the timetable are superior to trains of the same class in the opposite direction.

73. Extra trains are inferior to regular trains.

MOVEMENT OF TRAINS AND ENGINES

82. Timetable schedules, unless fulfilled, are in effect for twelve hours after their time at each station.

Regular trains more than twelve hours behind either their scheduled arriving or leaving time at any station lose both right and schedule, and can thereafter proceed only as authorized by train order, unless otherwise provided.

S-83. Unless otherwise provided, a train must not leave its initial station on any region, district, division or subdivision, or a junction, or pass from one of two or more tracks to single track, until it has been ascertained whether all trains due, which are superior have arrived or left.

Stations at which train registers are located will be designated by timetable.

D-83. Unless otherwise provided, a train must not leave its initial station on any region, district, division or subdivision, or a junction, until it has been ascertained whether all superior trains due have left.

Stations at which train registers are located will be designated by timetable.

84. A train must not start until the proper signal is given.

85. Trains of one schedule may pass trains of another schedule of the same class, and extra trains may pass and run ahead of_____class trains and extra trains.

A section must not pass and run ahead of another section of the same schedule without first exchanging train orders, signals and numbers with the section to be passed. The change in sections must be reported from the next available point of communication.

86. Unless otherwise provided, an inferior train must be clear at the time a_____train in the same direction is due to leave the next station in the rear where time is shown.

S-87. An inferior train must keep out of the way of opposing superior trains and failing to clear the main track by the time required by rule must be protected as prescribed by Rule 99.

Extra trains must clear the time of opposing regular trains not less than five minutes, unless otherwise provided, and will be governed by train orders with respect to opposing extra trains.

S-88. At meeting points between extra trains, the train in the inferior timetable direction must take the siding, unless otherwise provided.

Trains must pull into the siding when practicable; if necessary to back in, the train must first be protected as prescribed by Rule 99, unless otherwise provided.

S-89. At meeting points the inferior train must take the siding and clear the time of the superior train not less than five minutes, except at schedule meeting points between trains of the same class, where the inferior train must clear the main track before the leaving time of the superior train.

The superior train must stop at scheduled meeting points with trains of the same class unless switch is properly lined and track clear. The inferior train must pull into the siding when practicable. If necessary to back in, unless otherwise provided, it must be protected as prescribed by Rule 99.

S-90. Engine whistle or horn signal 14 (n) must be sounded at least one mile before reaching a meeting or waiting point.

91. Unless some form of block system is used, trains in the same direction must keep not less than ten minutes apart, except in closing up at stations.

92. Unless otherwise provided, a train must not leave a station in advance of its scheduled leaving time.

93. Within yard limits the main track may be used, clearing the time of first-class trains at the next station where time is shown. Protection against_____ class, extra trains and engines is not required.

_____ class, extra trains and engines must move within yard limits at yard speed unless the main track is known to be clear.

A train or engine must not be moved against the current of traffic within yard limits until provision has been made for the protection of such movement.

NOTE.- Where Automatic Block Signal System rules are in effect, "known to be clear" includes when track is known to be clear by signal indication.

94. A train which overtakes another train so disabled that it cannot proceed will pass it, if practicable, and if necessary will assume the schedule and take the train orders of the disabled train, proceed to the next available point of communication, and there report to the_____. The disabled train will assume the right or schedule and take the train orders of the last train with which it has exchanged, and will, when able, proceed to and report from the next available point of communication.

95. Two or more sections may be run on the same schedule. Each section has equal timetable authority.

Unless otherwise provided, a train must not display signals for a following section without train order authority.

S-96. Unless otherwise provided, signals must not be ordered displayed to nor taken down at, other than a register station for the train displaying the signals.

97. Unless otherwise provided, extra trains must not be run without train orders.

98. Trains and engines must approach the end of two or more tracks, junctions, railroad crossings at grade, and movable bridges, prepared to stop, unless the switches are properly lined, signals indicate proceed, and track is clear. Where required by law, trains and engines must stop.

99. When a train is moving under circumstances in which it may be overtaken by another train, a member of the crew must drop lighted fusees at proper intervals and take such other action as may be necessary to insure full protection.

When a train stops under circumstances in which it may be overtaken by another train, a member of the crew must go back immediately with flagman's

signals a sufficient distance to insure full protection. When conditions require he will display lighted fusees and when necessary, in addition, place two torpedoes.

When recalled and safety of the train will permit, he may return and when conditions require, he will leave the lighted fuse and torpedoes.

When a train stops under circumstances in which it may be overtaken by another train, the engineman will immediately sound signal 14(c). When ready to proceed he will recall the flagman.

The front of the train must be protected in the same way when necessary by a member of the crew.

NOTE. - When trains or engines are operating under Automatic Block Signal or Traffic Control System Rules, protection against following trains or engines on the same track is not required.

101. Trains and engines must be fully protected against any known condition, not covered by the rules, which interferes with their safe passage.

102. When a train is disabled or stopped suddenly by an emergency application of the air brakes or other causes, adjacent tracks as well as tracks of other railroads that are liable to be obstructed must, while stopping and when stopped, be protected until it is ascertained they are safe and clear for the movement of trains.

103. When cars are pushed by an engine, and the conditions require, a member of the crew must take a conspicuous position on the leading car. When shifting over public crossings at grade not protected by a designated employee, or by gates, a member of the crew must protect the crossing.

104. Switches must be properly lined after being used. Except where switch tenders are stationed, conductors must know that switches used by them or members of their crew are left in proper position.

A switch must not be left open for another train or engine unless in charge of a member of the crew of such train or engine.

Employees lining switches must see that points fit properly.

When practicable, the engineman must see that the switches near the engine are properly lined.

A train or engine must not foul a track until switches connected with the movement are properly lined, or in the case of spring switches the normal route is seen to be clear. When waiting to cross from one track to another and during the approach or passing of a train or engine on tracks involved, all switches connected with the movement must be secured in the normal position. Switches must not be restored to normal position until a movement is completed or clear of the main track involved.

Where trains or engines are required to be reported clear of main track such report must not be made until switch has been secured in its normal position.

When a trailing movement through a spring switch is stopped before passing entirely through the switch, the movement must not be reversed until the switch has been properly set by hand.

Trains and engines must stop and examine main track spring switches before making facing point movements over them, unless receiving a signal indication permitting them to proceed.

NOTE. - Rule 104 applies only to hand-operated switches. When spring or remotely controlled switches are operated by hand, they are hand-operated switches and Rule 104 applies.

105. Unless otherwise provided, trains and engines using any track other than a main track must proceed expecting to find track occupied.

Sidings of an assigned direction must not be used in a reverse direction unless authorized by the _____or in an emergency under flag protection.

106. The conductor, engineman and pilot are responsible for the safety of the train and the observance of the rules, and, under conditions not provided for by the rules, must take every precaution for protection.

This does not relieve other employees of their responsibility under the rules.

107. When a passenger train is receiving or discharging traffic on the side toward a station, a train or engine must not pass between it and the station unless proper safeguards are provided.

108. In case of doubt or uncertainty, the safe course must be taken.

D-151. Where two main tracks are in service trains must keep to the_____, unless otherwise provided.

Where three or more main tracks are in service they shall be designated by numbers and their use indicated by special instructions.

D-152. When a train or engine crosses over to, or obstructs another track, the movement must be protected, unless otherwise provided.

APPENDIX F
RULES FOR MOVEMENT
BY
TRAIN ORDERS

RULES FOR MOVEMENT BY TRAIN ORDERS

201. For movements not provided for by timetable, unless otherwise provided, train orders will be issued by authority and over the signature of the_____ and only contain information or instructions essential to such movements.

They must be brief and clear; in the prescribed forms when applicable; and without erasure, alteration or interlineation.

Figures in train orders must not be surrounded by brackets, circles or other characters.

202. Each train order must be given in the same words to all employees or trains addressed.

203. Train orders must be numbered consecutively each day, beginning at midnight.

204. Train orders must be addressed to those who are to execute them, naming the place at which each is to receive his copy. Train orders for a train must be addressed to the conductor and engineman, and also to anyone who acts as its pilot. A copy for each employee addressed must be supplied by the operator.

Orders addressed to operators restricting the movement of trains must be respected by conductors and enginemen the same as if addressed to them.

205. Each train order must be written in full in a book provided for the purpose in the office of the train dispatcher; and with it recorded the time and the signals which show when, from what offices and by whom the order was repeated and the responses transmitted; and the train dispatcher's initials. These records must be made at once and never from memory or memoranda.

Additions to train orders must not be made after they have been repeated.

206. In train orders regular trains will be designated by numbers as "No.10," and sections as "Second 10," adding engine numbers if desired. Extras will be designated by engine numbers and the direction, as "Extra 798, 'east' or 'west'." Work extras will be designated by engine numbers, as "Work Extra 798." For the movement of an engine of another company, the initials will precede the engine number.

When two or more engines are coupled and a designation is made by engine numbers, the number of the leading engine will be used in train orders.

Even hours as "10 00 A.M." must not be used in stating time in train orders.

In transmitting train orders, time may be stated in figures only or duplicated in words.

In transmitting train orders by telephone, the numbers of trains and engines in the address may be pronounced and then spelled, letter by letter if so desired. All stations and numerals in the body of an order must first be plainly pronounced and then spelled, letter by letter thus: Aurora, A-u-r-o-r-a, and One Naught Five, O-n-e N-a-u-g-h-t F-i-v-e.

The letters duplicating names of stations and numerals will not be written in the order book nor upon train orders, except time, which may be duplicated in words.

When train orders are transmitted by telegraph, the train dispatcher must write the order as repeated by the first operator and must underscore each word and figure in the order as it is repeated by other operators. When transmitted by telephone, he must write the order as he transmits it and underscore each word and figure as repeated by each operator.

207. To transmit a train order, the word "Copy" followed by the number of copies and direction must be given to each office addressed - thus: "Copy 5 West" or "Copy 2 East."

208. A train order to be sent to two or more offices must be transmitted simultaneously to as many of them as practicable. When not sent simultaneously to all, the order must be sent first to the superior train.

The several addresses must be in the order of superiority of trains, each office taking its proper address.

A train order restricting the movement of a train must not be issued for it at the point where such movement is restricted if it can be avoided. When so sent, the fact must be stated in the order, the train must be brought to a stop before delivery is made, and special precautions must be taken to insure safety.

209. Operators receiving train orders must write or typewrite them in manifold during transmission. They must retain a copy of each train order. The word "Complete," the time, and the signature of the operator must be in his handwriting.

209(a). If the requisite number of copies of a train order cannot be made at one writing, operator must make additional copies from one previously repeated and must then repeat to the train dispatcher from the new copies each time additional copies are made. Initials of operator who recopies the order must be shown, but the date of issue, time completed and name of original receiving operator must not be changed. Operator must retain a copy of each additional writing showing thereon the time and day it was repeated to the train dispatcher.

Train dispatcher must check the repetition as prescribed by Rule 206, and if correct respond "OK," making notation in train order book showing station, time, and date.

210. When a train order has been transmitted, operators must, unless otherwise directed, repeat it at once from the manifold copy, in the succession in which the several offices have been addressed. Each operator receiving the order should observe whether the others repeat correctly. When the order has been repeated correctly by an operator, the response "Complete" and the time, with the initials of the_____will be given by the train dispatcher. The operator receiving this response will then write in the space provided the word "Complete," the time and his last name in full, and deliver a copy to each person addressed. When delivery to engineman will take the operator from the immediate vicinity of his office, the engineman's copy will be delivered by_____.

Engineman must show train orders to other members of the crew on the engine. Conductors must show train orders, when practicable to trainmen. When such employees are shown train orders they must read them and if necessary remind engineman and conductor of their contents.

211. Clearance Form ... must be filled out by the operator before clearing a train, showing thereon, without erasure or alteration, the total number of train orders and the number of each train order, if any, addressed to a train. He will then repeat from Clearance Form____to the train dispatcher the information shown thereon. The dispatcher will make the required record in the train order book, and if operator has correctly repeated the numbers of all train orders addressed to a train will respond by giving "OK," the time and his initials, which the operator will endorse on the Clearance Form_____.

If all orders held for a train have been completed, and communication fails before Clearance Form____has been OK'd by train dispatcher, the operator may deliver such orders accompanied by Clearance Form____, and bearing notation "Wire has failed," which will be acted upon as though "OK" had been given in the usual way.

When communication is restored, operator will notify train dispatcher of each train cleared, the time, and the numbers of the orders delivered, which train dispatcher will record in train order book.

Clearance Form_____ must be delivered together with all train orders to each person addressed. Conductor and engineman must, and other members of the crew when practicable will, see that the information shown on Clearance Form_____ corresponds with the train orders received.

Operators will retain a copy of each Clearance Form_____.

212. When so directed by the train dispatcher, a train order, having been transmitted, may be acknowledged before repeating, by the operator responding: "Order Number_____to Number (of train)_____, X," with the operator's initials and the office signal. The operator must then write on the order his initials and the time.

213. "Complete" must not be given to a train order for delivery to an inferior train until the order has been repeated of the "X" response sent by the operator who receives the order for the superior train or train whose movement is to be restricted.

214. When a train order has been repeated or "X"s response sent, and before "Complete" has been given, the order must be treated as a holding order for the train addressed, but must not be otherwise acted on until "Complete" has been given.

If the means of communication fails before an office has repeated an order or has sent the "X" response, the order at that office is of no effect and must be there treated as if it has not been sent.

216. When the train dispatcher issues a train order that is to be delivered to a train by the dispatcher, a carbon impression must be made in the train order book at the time the order is written. If later the order is to be sent to another office, it will be transmitted from the copy in the book. The requirements for delivery are the same as at other offices.

217. A train order to be delivered to a train at a point not a train order office, or at which the office is closed, must be addressed to "C&E_____ at (or between) _____, care of_____," and forwarded and delivered by the conductor or other person in whose care it is addressed, and who is responsible for its delivery. The numbers of such train orders must be shown in the usual manner on Clearance Form____ of the train making delivery.

For orders which are sent in the manner herein provided, to a train, the superiority of which is thereby restricted, the operator will be directed to make an extra copy of the order, which he will deliver to the person who is to make delivery of the order. On this copy, the person delivering the order must secure the signature of the conductor and engineman addressed. This copy he must deliver to the first operator accessible, who must at once transmit the signatures of the conductor and engineman to the train dispatcher, and preserve the copy. Under such circumstances "Complete" must not be given to the order for an inferior train until the train dispatcher has received the signatures of the conductor and engineman of the superior train or train whose movement is restricted.

218. When a train is named in a train order by its schedule number alone, all sections of that schedule are included, and each must have copies delivered to it.

219. An operator must not repeat or give the "X" response to a train order restricting the movement of a train which has been cleared, or of which the engine has passed his train order signal in proceed position, until he has obtained the signatures of the conductor and engineman to the order.

If necessary to issue a second Clearance Form____, the original Clearance Form____ must be destroyed, and the second Clearance Form___ must show the numbers of all train orders addressed to the train.

220. TRain orders once in effect continue so until fulfilled, superseded or annulled. Any part of an order specifying a particular movement may be either superseded or annulled.

Orders held by or issued for or any part of an order relating to a regular train become void when such train loses both right and schedule as prescribed by Rules 4 and 82, or its schedule is annulled.

When a conductor or engineman, or both, is relieved, unless otherwise provided, all train orders and instructions held must be delivered to the relieving conductor or engineman. Such orders or instructons must be compared by the conductor and engineman before proceeding.

221. Unless otherwise provided, a fixed signal must be used at each train order office, which shall indicate "Stop" where there is an operator on duty, except when changed to "Proceed" to allow a train to pass when there are no train orders for any train in that direction. While "Stop" is indicated, trains must not leave without Clearance Form____.

222. Operators must promptly record and report to the train dispatcher the time of arrival and departure of all trains and the direction of extra trains.

They must observe trains and report at once to the train dispatcher if the proper signals are not displayed.

223. The following signals and abbreviations may be used:

Initials for signature of_____.

Such office and other signals as are arranged by the_____.

C&E - Conductor and Engineman.

C&__ - Conductor and_____.

X - Train will be held until train order is made "Complete."

Com - Complete.

OK - Correct
OS - Train Report
No - Number
Eng - Engine
Sec - Section
Psgr - Passenger
Frt - Freight
Mins - Minutes
Jct - Junction
MP - Mile Post
MPH - Miles Per Hour
Dispr - Train Dispatcher
Opr - Operator
MBS - Manual Block Signal System
ABS - Automatic Block Signal System
TCS - Traffic Control System

The usual abbreviations for the names of the months and stations.

APPENDIX G
FORMS OF TRAIN ORDERS

FORMS OF TRAIN ORDERS

NOTE. - Forms with a prefix "S" are for single track, those with a prefix "D" are for two or more tracks; those without prefixes "S" or "D" are for single or two or more tracks. The prefixes "S" and "D" to be printed in italics. The words and figures in italics in the forms are examples, indicating the manner in which the orders are to be filled out.

S-A

FIXING MEETING POINTS FOR OPPOSING TRAINS

(1.) No.1 meet No.2 at B.
No.3 meet Second 4 at B.
No.5 meet Extra 95 east at B.
Passenger Extra 652 north meet Extra 231 south at B.
Extra 201 north meet Extra 231 south at B.

(2.) No.2 and Second 4 meet No.1 and No.3 at C and Extra 95 west at D (and so on).
No.1 meet No.2 at B Second 4 at C and Extra 95 east at D.

Example (1.) may be modified, if desired, as follows:

(a.) No.1 take siding and meet No.2 at B.

(b.) No.1 meet No.2 at B.
No.1 take siding at B.

Trains receiving these orders will run with respect to each other to the designated points and there meet in the manner prescribed by the rules.

B

DIRECTING A TRAIN TO PASS OR RUN AHEAD OF ANOTHER TRAIN

(1.) Extra 594 west pass No.1 at J.
Both trains will run according to rule to the designated point and there arrange for the rear train to pass promptly. Unless otherwise provided, the train to be passed will take siding.
When an inferior train receives an order to pass a superior train, authority is conferred to run ahead of the train passed from the designated point.

(2.) Extra 594 east run ahead of No.6 M to B.
The first-named train will run ahead of the second-named train between the designated points.
If delay to the following train is evident the first-named train will clear main track at first available point for second-named train to pass, and the train order must then be considered fulfilled.

S-C

GIVING RIGHT OVER AN OPPOSING TRAIN

(1.) No.1 has right over No.2 G to X.
If the seond-named train reaches the point last-

named before the other arrives, it may proceed, keeping clear of the schedule of opposing train as required by rule.

(2.) Extra 37 east has right over No.3 F to A.

The regular train must not go beyond the point last-named until the extra train has arrived, unless authorized by train order to do so.

These orders give right to the train first-named over the other train between the points named. If the trains meet at either of the designated points, the first-named train must take the siding, unless the order otherwise prescribes.

(3.) Extra 72 south has right over Extra 91 north A to Z and wait at N until 2 10 pm
P 3 25 pm
for Extra 91 north.

The first-named extra train must not pass the designated waiting points before the time given, unless the second-named extra train has arrived. The second-named extra train must clear the time specified at the designated points or any intermediate station not less than 5 minutes.

(4.) Extra 72 south has right over Extra 91 north A to H and wait at F until 9 59 am.
G 10 39 am.
H 10 55 am for Extra 91 north and will not leave M unless Extra 91 north has arrived.
Extra 91 north gets this order at M.

The first-named extra train will take siding and not leave M unless the second-named extra train has been met between A and M or has arrived at M, unless the order is annulled, and provisions made for further movement.

This form of order will only be used to give one extra train right over another extra train to or from a point intermediate to the originating and terminating points of both extra trains on the same subdivision.

D

GIVING RIGHT OVER ANOTHER TRAIN IN THE SAME DIRECTION

(1.) No.1 has right over No.3 A to Z.

(2.) Extra 62 east has right over No.4 Z to A and wait at Z until 12 50 pm.
Y 1 10 pm.
X 1 20 pm.

These orders give right to the train first-named over the other train between the points named. The second-named train must keep clear of the other as required by rule.

Under Example (2.) the first-named train must not pass the designated points before the times given.

(3.) Extra 57 west has right over Extra 61 west A to Z.

This order gives right to the first-named train over the second-named train between the points named.

If no time is given, the second-named train must not leave the point first-named ahead of the first-named train.

E
TIME ORDERS

(1.) No.1 run 50 mins late A to G.

(2.) No.1 run 50 mins late A to G.
and 20 mins late G to M, etc.

These orders make the schedule time of the train named, between the stations designated, as much later as stated in the order, and any other train receiving the order is required to run with respect to this later time as before required to run with respect to the regular schedule time. The time in the order should be such as can be easily added to the schedule time.

(3.) No.1 and No.3 wait at N until 9 59 am.
P 10 30 am.
R 10 55 am, etc.

The train, or trains, named must not pass the designated points before the times given. Other trains receiving the order are required to run with respect to the time specified at the designated points or any intermediate station where schedule time is earlier than the time specified in the order, as before required to run with respect to the regular schedule time of the train, or trains, named.

S-E

(1.) No.1 wait at H until 9 59 am. for No.2.

The train first-named must not pass the designated point before the time given, unless the other train has arrived. The train last-named is required to run with respect to the time specified, at the designated point or any intermediate station where schedule time is earlier than the time specified in the order, as before required to run with respect to the schedule time of the train first-named.

F
FOR SECTIONS

(1.) Eng 20 display signals and run as First 1 A to Z.

To be used when the number of the engine for which signals are displayed is unknown, and is to be followed by (2), both being single-order examples.

(2.) Eng 25 run as Second 1 A to Z.

(3.) Second 1 display signals B to E for Eng 99.

(4.) Eng 20, 25 and 99 run as First, Second and Third 1 A to Z.

To add an intermediate section, (5) will be used.

(5.) Eng 85 display signals and run as Second 1 A to Z.

Following sections change numbers accordingly.

The engine named will display signals and run as directed, and following sections will take the next higher number.

To substitute one engine for another on a section, (7) will be used.

(7.) Eng 18 instead of Eng 85 display signals and run as Second 1 R to Z.

The second-named engine will drop out at R, and be replaced by the first-named engine.

Following sections need not be addressed.

If the second-named engine is the last section, the words "display signals and" will be omitted.

To discontinue the display of signals, (8) will be used.

(8.) Second 1 take down signals at D.

The train named will take down signals as directed, and a following section must not proceed beyond the designated point.

To pass one section by another, (9) will be used.

(9.) Engs 99 and 25 reverse positions as Second and Third 1 H to Z.

Conductors and enginemen of the trains addressed will exchange orders and signals. Following sections, if any, need not be addressed.

Each section affected by these orders must have copies and must arrange signals accordingly.

To annul a section for which signals have been displayed over a division, or any part thereof, when no train is to follow the signals, Form K must be used.

When sections are run to an intermediate point of a schedule, the train orders must specify which engine or engines shall assume the schedule beyond such point.

G
EXTRA TRAINS

(1.) Eng 99 run extra A to F.

(2.) Eng 99 run passenger Extra A to F.

(3.) Eng 99 run extra A to F and return to C.
The extra must go to F before returning to C.

(4.) After Extra 98 east arrives at A Eng 99 run extra A to F.

(5.) Eng 99 run extra A to F.
This order is annulled at 7 10 pm.

The extra authorized by this form of order must be clear of the main track at the time specified or protected in both directions, as prescribed by rule.

This form of order must not be combined with Form S-A.

(6.) On Feb.17 after 6 45 am. Eng 99 run extra A to F.

The extra authorized by this form of order must not leave the first-named station before the time specified.

S-H
WORK EXTRA

(1.) Eng 292 works extra 6 45 am until 5 45 pm between D and E.

The work extra must, whether standing or moving, protect itself against extra trains within the working limits in both directions as prescribed by the rules. The time of regular trains must be cleared.

This may be modified by adding:

(a) Not protecting against eastward extra trains.

The work extra will protect only against westward extra trains. The time of regular trains must be cleared.

(b) Not protecting against extra trains.

Protection against extra trains is not required. The time of regular trains must be cleared.

(c) Not protecting against extra trains except protect against Extra 73 east after 10 30 am and Extra 85 west after 1 30 pm.

The work extra will not protect against the designated extra trains until the times specified, and the designated extra trains must not enter the work limits before those times. Protection against other extra trains is not required. The time of regular trains must be cleared.

When a work extra has been instructed by order to not protect against extra trains, and, afterward, it is desired to have it clear the track for a designated extra, an order may be given in the following form:

(2.) Work Extra 292 clears (or protects against) Extra 76 east between D and E after 2 10 pm.

Extra 76 east must not enter the working limits before 2 10 pm and will then run expecting to find the work extra clear of the main track, or protecting itself, as the order may require.

To enable a work extra to work upon the time of a regular train or trains, the following form will be used:

(3.) Work Extra 292 protects against No.55 (or class trains) between D and E.

The work extra may work upon the time of the train or trains mentioned in the order, and must protect itself against such train or trains. The regular train or trains receiving the order will run expecting to find the work extra protecting itself.

When a work extra is to be given exclusive right over all trains, the following form will be used:

(4.) Work Extra 292 has right over all trains between D and E 7 15 pm until 1 15 am.

This gives the work extra the exclusive right between the points designated between the time named.

The working limits should be as short as practicable, to be changed as the progress of the work may require.

Work extras must give way to all trains as promptly as practicable.

When extra trains are run over working limits they must be given a copy of the order sent to the work extra. Should the working order instruct a work extra to not protect against extra trains in one or both directions, extra trains must protect against the work extra, if the order indicates that the work extra is protecting itself against other trains, they will run expecting to find the work extra protecting itself.

D-H
WORK EXTRA

(1.) Eng 292 works extra on_____track (or _____tracks) 6 45 am until 5 45 pm between D and E.

The work extra must, whether standing or moving, protect itself within the working limits against extra trains moving with the current of traffic on the track or tracks named. The time of regular trains must be cleared.

This form may be modified by adding:

(a) Not protecting against extra trains.

Protecting against extra trains is not required. The time of regular trains must be cleared.

(b) Extra 173 east wait at E until 9 15 am.
Extra 209 east wait at E until 12 10 pm.
Other eastward extra trains wait at E until 5 45 pm.

The work extra will protect against the trains named after the times specified in the order. The time of regular trains must be cleared.

(2.) Work Extra 292 clears (or protects against) Extra 173 west on eastward track between B and E after 2 10 pm.
Extra 173 west moving against the current of traffic E to D.

Extra 173 west must not enter the working limits before the time stated and will then run expecting to find the work extra clear of the main track or protecting itself as the order may require.

To enable a work extra to work upon the time of a regular train or trains, the following form may be used:

(3.) Work Extra 292 protects against No.55 (or _____class trains) between D and E.

The work extra may work upon the time of the train or trains mentioned in the order and must protect against such train or trains. The time of other regular trains must be cleared.

The regular train or trains receiving the order will run expecting to find the work extra protecting itself.

When it is desired to move a train against the current of traffic over the working limits, provision must be made for the protection of such movement.

When a work extra is to be given exclusive right over all trains, the following form will be used:

(4.) Work Extra 292 has right over all trains on _____and_____tracks between G and H 7 10 pm until 1 01 am.

This gives the work extra the exclusive right to the track, or tracks, mentioned between the points designated between the times named.

The working limits should be as short as practicable, to be changed as the progress of the work may require.

Work extras must give way to all trains as promptly as practicable.

When extra trains are run over the working limits they must be given a copy of the order sent to the work extra.

J
HOLDING ORDER

(1.) Hold No.2.

(2.) Hold all (or eastward) trains.

When a train has been so held it must not proceed until the order to hold is annulled, or an order given to the operator in the form:

_____may go.

These orders will be addressed to the operator at the point where trains are to be held and will be delivered to conductors and enginemen of all trains affected.

Form J will be used only when necessary to hold trains until orders can be given, or in case of emergency.

K

ANNULLING A SCHEDULE OR A SECTION

(1.) No.1 due to leave A feb.29 is annulled A to Z.

(2.) Second 5 due to leave E Feb.29 is annulled E to G.

The schedule or section annulled becomes void between the points designated and cannot be restored.

Form K will not be combined with other forms of train orders.

L

ANNULLING AN ORDER

(1.) Order No.10 is annulled.

If an order which is to be annulled has not been delivered to a train, the annulling order will be addressed to the operator, who will destroy all copies of the order annulled but his own, and write on that:

Annulled by Order No._____.

An order which has been annulled must not be reissued under its original number.

M

ANNULLING PART OF AN ORDER

(1.) That part of Order No.10 reading Extra 263 west pass No.1 at S is annulled.

_____

(2.) That part of Order No.12 reading No.3 pass No.1 at S is annulled.

Form M will be used only when that part of the order not annulled is clear in its wording.

S-P

SUPERSEDING AN ORDER OR A PART OF AN ORDER

This order will be given by adding to prescribed forms the words "instead of_____."

(1.) No.1 meet No.2 at C instead of B.

An order which has been superseded must not be reissued under its original number.

When a train is directed by train order to take siding for another train, such instructions apply only at the point designated in that order, and do not apply to the superseding order unless so specified.

P

SUPERSEDING AN ORDER OR A PART OF AN ORDER

This order will be given by adding to prescribed forms, the words "instead of_____."

(1.) No.1 pass No.3 at C instead of B.

An order which has been superseded must not be reissued under its original number.

Q

ISSUANCE OF A NEW TIMETABLE

(1.) Timetable No.1 is affective at 12 01 am Sunday July 10.

Form Q will not be combined with other forms of train orders.

D-R

PROVIDING FOR A MOVEMENT AGAINST THE CURRENT OF TRAFFIC

(1.) No.1 has right over opposing trains on_____ track C to F.

The designated train must use the track specified between the points named and has right over opposing trains on that track between those points. Opposing trains must not leave the point last-named until the designated train arrives.

All trains between the points named moving with the current of traffic in the same direction as the designated train must, when practicable, receive a copy of the order, and may then proceed on their schedules, or rights.

This order may be modified as follows:

(2.) After No.4 arrives at C, No.1 has right over apposing trains on_____track C to F.

The train to be moved against the current of traffic must not leave the first-named point until the arrival of the first-named train.

A train must not be moved against the current of traffic until the track on which it is to run has been cleared of opposing trains, except when it is desired to move a train against the current of traffic over working limits of a work extra, the work extra must be instructed to be clear of, or protecting, on the track affected as prescribed by Example (2.) of Form D-H.

S

PROTECTION ORDERS

(1.) Westward extras following Extra 292 west between C and K wait at C until 2 10 pm.
D 3 50 pm.

When this form is used, Extra 292 west will not be required to protect against westward extras between the stations named until the time specified.

_____

(2.) Westward extras between C and K wait at
C until 7 30 pm.
D 9 15 am.

A regular train receiving this order will not be required to protect against westward extras between the stations named, until the time specified.

Form S will not be combined with other forms of train orders and must not be issued to a train when there are preceding extras between the designated points.

It must not be issued to protect passenger trains nor to include any part of the limits of a work extra.

When Form S is used to protect a train moving on one of two or more tracks, the order must state the track, or tracks, upon which the order is effective.

This form of order does not authorize train movements in the opposite direction.

T

CHECK OF TRAINS

This form to be used when it is desired to give a train or engine the information prescribed by Rules S-38 and D-83.

(1.) All (superior)(_____class) trains due at C at or before 6 50 am (have passed)(have arrived)(have left); as circumstances require.

This may be modified by adding "except_____."

U

AUTOMATIC BLOCK SIGNAL SYSTEM TEMPORARILY SUSPENDED FROM SERVICE

(1.) Automatic Block Signal System temporarily out of service from Signal_____at_____ to Signal_____

at_____, both inclusive,_____rules in effect.
Speed of passenger trains must not exceed_____ MPH and other trains_____MPH.

Trains must approach non-interlocked facing point switches, road crossings protected by automatic highway crossing protection devices, movable bridges, stations, interlockings, and first signal left in service, prepared to stop.

Lights in Automatic Block Signals out of service may be extinguished or left burning.

V

SPEED RESTRICTING ORDERS

(1.) Do not exceed_____MPH between_____and_____.
_____

(2.) Do not exceed_____MPH on No._____track between_____and_____.

This order may be modified by adding:
7 01 am and 4 01 pm.

When speed limit signs cannot be installed immediately, train order should state speed signs not in service.

X

TEMPORARY STOP SIGN ORDER

(1.) Between 8 01 am and 5 01 pm July 10 men working on track between D and F.
Temporary Stop Sign displayed in vicinity of MP 17 Pole 30 and MP 20 Pole 10.

Request for this order shall be addressed to the chief dispatcher. The request must clearly specify the time limits and date such protection is required; the location designated by mile post and pole numbers.

Before placing the yellow "PROCEED PREPARED TO STOP" advance and temporary Stop signs or commencing work under this order, the foreman in charge must first confirm with the train dispatcher that the desired order has been issued and verify the date and location designated by milepost and pole numbers and the time limits specified in the order.

This order will remain in effect for the time limits and date specified therein only, unless foreman in charge advises train dispatcher work is completed, Stop and yellow signs have been removed and track is safe for the passage of trains.

At location specified in this form of train order, Maintenance of Way and Structures employees are not required to provide flag protection for roadway equipment or track.

When this order is in effect, an unattended red sign reading "TEMPORARY STOP" will be displayed 1000 feet before reaching the point where main track is obstructed or impassable. Trains must approach prepared to stop short of this sign unless orally authorized to proceed by foreman in charge of work or a proceed signal with a green flag is received. When proceed signal with green flag is given, train must not exceed restricted speed until rear of train has passed the limit of restriction. A yellow sign reading "PROCEED PREPARED TO STOP" will be displayed one and one-half (1-1/2) miles before the red sign is reached.

Before orally authorizing a train to proceed, foreman must inform engineman the maximum speed permitted over restricted track.

A metal banner at right of track displaying green will indicate the leaving end of restriction shown in this order.

APPENDIX H
RULES GOVERNING SIGNALS AND THEIR USE

Signals and Their Use

Although knowledge of railroad signals primarily used by "outside" personnel may appear a bit remote when considering the train dispatch operation, it is indeed necessary for the dispatcher to be familiar with these signals in order that he may properly interpret situations and circumstances which might develop during the course of his exercise of traffic control.

On occasion, it is necessary that displayed signals (routine or emergency), as described to the dispatcher via radio or telephone, be readily understood. In other instances, because emergency direction might have to be given to persons having little or no knowledge of requirements, it is important that the dispatcher have intimate knowledge of signals and signalling equipment characteristics in order that explicit direction may be given.

SIGNALS AND THEIR USE*

Employees whose duties may require them to give signals, must provide themselves with the proper appliances, keep them in good order and ready for immediate use.
Flags of the prescribed color must be used by day, and lights of the prescribed color and type by night.
Day signals must be displayed from sunrise to sunset, but when day signals cannot be plainly seen, night signals must be used in addition.
Night signals must be displayed from sunset to sunrise.

FIXED SIGNALS

Rules 281 to 292, inclusive

Aspects may be shown by the position of semaphore arms, color of lights, position of lights, flashing of lights, or a combination of color, position, and flashing of lights.

Day and night aspects for color light signals shall have the same colors as the night aspects of the semaphore signals.

Day and night aspects for position light signals shall have the same positions as the day aspects of the semaphore signals.

Aspects shown are typical. Each road should show the aspects and colors of lights it uses.

NOTE. - In the following illustrations of typical signal aspects, Rules 281 to 292, inclusive.

R = Red
Y = Yellow
G = Green

NOTE. - When the color "Lunar" is used.

L = Lunar

NOTE. - When flashing color lights are used, they shall be indicated as follows:

FR = Flashing Red
FY = Flashing Yellow
FG = Flashing Green

COLOR SIGNALS

COLOR	INDICATION
(a) Red.	Stop.
(b)----------	Proceed at reduced speed, and for other uses prescribed by the rules.
(c)----------	Proceed, and for other uses prescribed by the Rules.
(d) White.	Flag stop (See Rule 28) and for other uses prescribed by the rules.
(e) Blue.	Workmen under or about an engine, car or train. See Rule 26.
(f) Purple.	Stop. (Indication for siding derails.)

FUSEES

A train or engine finding a fuses furning red on or near its track must stop. Train may then proceed at reduced speed for not less than one mile.

*Boston and Maine Railroad. Rules for the Government for the Operating Department; October 29, 1961.

APPENDIX I
RULES ASSOCIATED
WITH
BLOCK SIGNALS

RULES GOVERNING THE MOVEMENT OF TRAINS IN THE SAME DIRECTION BY BLOCK SIGNALS

251. On portions of the railroad, and on designated tracks so specified in the timetable, trains will run with reference to other trains in the same direction by block signals whose indications will supersede the superiority of trains.

253. The_____must be advised in advance, of any known condition that will delay the train or prevent it from making usual speed.

254. Except as affected by Rule 251 all Block Signal Rules and Operating Rules remain in force.

RULES GOVERNING OPPOSING AND FOLLOWING MOVEMENT OF TRAINS BY BLOCK SIGNALS

261. On portions of the railroad, and on designated tracks so specified in the timetable, unless otherwise provided, trains will be governed by block signals whose indications will supersede the superiority of trains and take the place of train orders for both opposing and following movements on the same track.

262. A train for which the direction of traffic has been established, must not move in the opposite direction without proper signal indication, or other prescribed authority.

263. The_____must be advised in advance of any known condition that will delay the train or prevent it from making usual speed.

264. Except as affected by Rule 261 all Block Signal Rules and Operating Rules remain in force.

APPENDIX J
RULES GOVERNING
MANUAL BLOCK SIGNAL SYSTEM

MANUAL BLOCK SIGNAL SYSTEM*

NOTE. - Manual Block Signal System rules will be used only on the territory specified in the timetable or in special instructions.

305. Block signals govern the use of the blocks, but, unless otherwise provided, do not supersede the superiority of trains; nor dispense with the use or the observance of other signals whenever and wherever they may be required.

306. When a block station is open at an irregular hour, trains must be notified, when possible, by train order.

307. A train having entered a block on other than a proceed indication, must not accept a proceed indication at any intermediate block station which was closed when such train entered the block, without receiving Clearance Form____.

308. When Clearance Form is used information will be shown as to condition of block "clear" or "occupied." If block is occupied train will proceed prepared to stop short of train or obstruction, but not exceeding 15 miles per hour.

308. (Optional) When Clearance Form____is used information will be shown as to condition of block "clear" or "occupied." If block is occupied train will proceed prepared to stop short of train ahead.

311. Signals must be kept in the position displaying the most restricted indication, except when displayed for an immediate movement.

312. Appliances must be operated carefully and only by those charged with that duty. If any irregularity affecting their operation is detected the signals must be displayed to give their most restrictive indication until repairs are made.

313. Operators must observe, as far as practicable, whether the indications of the signals correspond with the positions of the levers.

314. Operators must not make nor permit any unauthorized repairs, alterations or additions to the apparatus.

Any defects in the appliances must be promptly reported to the_____.

315. A block record must be kept at each block station.

317. On single track, to admit a train to a block, operator must examine block record and if block in advance is clear of opposing trains and preceding passenger trains, request operator at block station in advance to "Block for No._____." If it is proper for the train to be admitted, the operator in advance will reply, "OK, blocking for No. _____." Operator requesting block will then display the proper signal indication. Operators must promptly enter on block record the time block is given or received.

A passenger train must not be admitted to an occupied block, nor any train admitted to a block occupied by an opposing train or a passenger train, unless flag protection has been provided.

A train other than a passenger train may be permitted to follow a train other than a passenger train into a block under Permissive indication, train order or Clearance Form _____.

317. (Optional) On single track, to admit a train to a block, operator must examine block record and if block in advance is clear of opposing trains and preceding passenger trains, request operator at block station in advance to "Block for No._____." If it is proper for the train to be admitted, the operator in advance will reply "OK, blocking for No._____." Operator requesting block will then display the proper signal indication. Operators must promptly enter on block record the time block is given or received.

A train must not be admitted to a block which is occupied by an opposing train or by a passenger train except as provided in Rule 333 or by train order. A train may be permitted to follow a train other than a passenger train into a block under Permissive indication or Clearance Form_____.

NOTE. - Railroads that do not require blocking oppossing trains should omit this rule.

318. On two or more tracks, to admit a train to a block, the operator must examine the block record and display proper signal indication.

A passenger train must not be admitted to an occupied block, nor any train admitted to a block occupied by an opposing train or a passenger train, except under flag protection.

A train other than a passenger train may be permitted to follow a train other than a passenger train into a block under Permissive indication, train order or Clearance Form_____.

318. (Optional) On two or more tracks, to admit a train to a block, the operator must examine the block record and display proper signal indication.

A train must not be admitted to a block which is occupied by a passenger train except as provided in Rule 333 or by train order. A train may be permitted to follow a train other than a passenger train into a block under Permissive indication or Clearance Form _____.

NOTE. - Railroads that do not use Rule 317 (Optional) should omit "On two or more tracks."

319. When a train enters a block, the operator must give train number and time to the next block station in advance. When two or more tracks are used in the same direction, operators must also specify the track. When the rear of the train has passed_____feet beyond the Block Signal, he must give the record of the train to the next block station in the rear.

This information must be entered on the block records.

320. Unless otherwise provided, operators must not ask for the block until they have received a report of the train from the next block station in the rear.

321. Operators must, as far as practicable, observe all passing trains and note whether they are complete and in order. Should a train without markers pass a block station, the operator must notify the operator at the next block station in each direction, and must not report that train clear of the block, nor clear the signal for the block in the rear, until he has ascertained that the train is complete.

322. Should a train pass a block station with any indication of conditions endangering the train, or a train on another track, the operator must immediately notify the operator at the next block station in advance, and each must display Stop-indications to all trains that may be affected, and must not permit any train to proceed until it is known that its track is not obstructed.

325. When there is an obstruction between block stations, notice must be given to the nearest operator.

An operator informed of any obstruction in a block must immediately notify the operator at the other end of the block, and each must display Stop-indications to all trains that may be affected and must not permit any train to proceed without proper authority until it is known that its track is not obstructed.

326. When a train or engine clears the main track, the operator or train dispatcher must know it is clear of the block before giving block for another movement or displaying a clear indication for that block.

When a train or engine clears the main track, the conductor or engineman must report "Clear" to the operator or train dispatcher unless the switch involved is controlled by the operator or train dispatcher. A train or engine must not enter a block or foul the main track, or cross from one main track to another without permission of the operator or train dispatcher.

A train or engine having passed beyond the limits of a block must not back into that block without permission of the operator or train dispatcher.

The operator or train dispatcher must obtain control of the block before permitting a train or engine to reenter the block.

327. To permit a train or engine to enter a block or foul the main track or to cross from one main track to another, the operator must examine the block record and if all the blocks affected are clear of approaching trains he must provide or arrange for block protection before permission is given, and until movement is complete and block clear, trains will not be admitted to the block except as prescribed by Rule 289 or Clearance Form_____.

All crossover movements must be entered on the block record.

328. Unless otherwise directed, when two or more trains have been coupled and so move past any block station, they must be separated only at a block station and the operator notified.

When coupled trains are separated, the operator must regard each portion as an independent train.

329. When necessary to stop a train for which other than a Stop-indication has been displayed and accepted, the operator must give hand signals in addition to displaying the Stop-indication.

When a block station is open at an irregular hour, operators must use hand signals, in addition to block signals, to give the required indications until all trains have passed which have not been notified by train order that the block station is open.

Hand signals must not be used when the proper indication can be displayed by the block signals, except as prescribed by Rule 306 or 329.

333. When, from any cause, an operator is unable to communicate with the next block station in advance, he must stop all trains approaching in that direction. Should no cause for detaining a train be known, it may then be permitted to proceed with Clearance Form ____, provided _____minutes have elapsed since the passage of the last preceding train.

334. When hand signals are necessary they must be given from such a place and in such a way that there can be no misunderstanding on the part of members of the crew as to the signals, or as to the train or engine for which they are intended.

335. Block signals for a track apply only to trains moving with the current of traffic on that track. Operators will use_____for blocking trains moving against the current of traffic.

336. Operators are responsible for the care of the block station, lamps, and supplies, and, unless otherwise provided, of the signal apparatus.

339. If a Stop signal is disregarded, every effort must be made to stop the movement. The fact must be reported to the next block station in advance and then to_____.

340. To open a block station, the operator must notify the next block station in each direction and record the trains that are in the extended block.

When trains, which were in the extended block, when the block station was opened and which had passed his block station before it was opened, clear the block in advance he must repeat the record to the block station in the rear.

341. A block station must not be closed except upon authority of_____.

342. Unless otherwise provided, a block station must not be closed until the block in each direction is clear of all trains.

To close a block station, the operator must notify the next block station in each direction and when he receives the acknowledgement enter it on the block record, with the time it is received from each block station.

The block signals must then be secured in the clear position, all lights extinguished, and the block wires and, when necessary, circuits arranged to work through the closed block station.

344. Operators must not permit unauthorized persons to enter and loiter in the block station.

362. Trains must not pass a Stop-indication without receiving Clearance Form_____.

371. When a train is stopped by a home or block signal a member of the crew must, when practicable, immediately ascertain the cause.

Any unusual detention at block stations must be reported to_____.

373. A block station must not be considered as closed, except as provided for by timetable or_____.

*Boston and Maine Railroad; Rules for the Government of the Operating Department; October 29, 1971.

APPENDIX K
AUTOMATIC BLOCK SIGNAL SYSTEM

AUTOMATIC BLOCK SIGNAL SYSTEM

NOTE. - Automatic Block Signal System rules will be in effect only on portions of the railroad and on designated tracks so specified in the timetable or in special instructions.

505. Block signals, cab signals, or both, govern the use of the blocks, but, unless otherwise provided, do not supersede the superiority of trains; nor dispense with the use or the observance of other signals whenever and wherever they may be required.

508. Unless otherwise provided, block signals for a track apply only to trains or engines moving with the current of traffic on that track.

509. When a train or engine is stopped by a Stop-indication it must stay until authorized to proceed, and will then proceed at restricted speed, or in case of failure of means of communication it may proceed when preceded by a flagman to the next signal displaying a proceed indication.

510. When a train is stopped by a block signal which is evidently out of order, unless otherwise provided, the fact must be reported to_____.

511. Both switches of a crossover must be open before a train or engine starts to make a crossover movement, and the movement must be completed before either switch is restored to normal position.

512. Where switch indicators are used, the indications displayed do not relieve members of the crew from protecting their train as required by the rules.

513. Before a train or engine enters on or fouls a main track, or crosses from one main track to another at bolt-locked switches after a member of the crew operates the bolt lock, he must wait_____minutes before operating the switch; at non-bolt-locked switches, a member of the crew will operate the switch and wait_____minutes at the switch before making engine or train movement. This will not relieve members of the crew from the duty of promptly and properly protecting the movement.

513(a). When a train or engine has passed a signal permitting it to proceed and is delayed in the block, it must proceed at restricted speed to the next signal, unless otherwise provided.

513(b). Unless otherwise protected, entrance to a main track through a spring switch must be made under the provisions of Rule 513, operating the switch by hand.

514. A train or engine entering a block between signals must be protected as required by the rules and must proceed at restricted speed to the next signal in advance, unless otherwise provided.

515. A train or engine having passed beyond the limits of a block must not re-enter that block without permission of the_____or under flag protection, unless otherwise provided.

APPENDIX L
AUTOMATIC CAB SIGNAL RULES

AUTOMATIC CAB SIGNAL RULES

These rules apply to engines equipped with AUTOMATIC CAB SIGNALS when operating in AUTOMATIC CAB SIGNAL territory.

516. Automatic cab signal territory will be designated by timetable, unless otherwise provided. Cab signals must be cut in before entering and may be cut out after leaving Automatic Cab Signal territory.

517. Cab signal indications do not supersede fixed signal indications except when cab signal changes to a more restrictive or a more favorable indication at a point other than a fixed signal location.

When the cab signal changes from a restrictive indication to a more favorable indication, at a point other than a fixed signal location, speed must not be increased until train has run its length.

When the cab signal changes to a more restrictive indication, at a point other than a fixed signal location, enginemen must immediately comply with indication displayed, in accordance with Rule 518.

518. Cab signal Aspects:
(As designated by carrier per following examples)

(a) A green light indicates PROCEED.
(b) A yellow over green light indicates APPROACH NEXT SIGNAL NOT EXCEEDING MEDIUM SPEED.
(c) A yellow light indicates APPROACH NEXT SIGNAL PREPARED TO STOP.
(d) A red over yellow light indicates PROCEED AT RESTRICTED SPEED.

519. Should cab signals and fixed signal indications conflict, the more restrictive indication will govern. Such occurrence must be reported to_____.

The cab signal may be cut out under the following conditions: After passing through not less than two consecutive blocks where there is a confliction between the cab signal and fixed signal indications the cab signal may be cut out and the train may proceed in accordance with the indications of the fixed signals, but at not to exceed 40 miles per hour, to the first available point of communication where report must be made to the train dispatcher. Train will then be governed by the indications of the fixed signals, but at not to exceed 79 miles per hour, keeping clear of occupied block. After waiting one minute at Stop-and-Proceed signal it may be regarded that there has been a failure of wayside signal and train may proceed at restricted speed until a more favorable signal indication is encountered.

520. An engineman taking charge of an engine must know whether the cab signal is in service and functioning properly.

APPENDIX M
TRAFFIC CONTROL
SYSTEM RULES

TRAFFIC CONTROL SYSTEM RULES

NOTE. - Traffic Control System Rules will be used only in TCS territory specified in the timetable or in special instructions.

265. Rules 261 to 264, inclusive, apply in TCS territory and, except as affected by Rules 261 to 273, inclusive, all other Block Signal Rules, Interlocking Rules and Operating Rules remain in effect.

266. Trains or engines must not enter TCS territory unless the governing signal displays a proceed indication or authority is obtained from the train dispatcher or control operator.

267. Trains or engines must not foul or enter the main track, a controlled siding, or other controlled track at hand-operated switches without first obtaining authority from the train dispatcher or control operator.

268. When a train or engine has been stopped by a Stop indication, if no conflicting movement is evident, a member of the crew must immediately communicate with the train dispatcher or control operator, identify himself, his train and location, and be governed by instructions received. The instructions must be repeated by the employee receiving them to insure correct understanding. Before proceeding, Rule 275 must be complied with.

When the train dispatcher knows there is no opposing train or engine movement involved, he may authorize the train or engine to proceed in the following form: "You may proceed at restricted speed to the next signal." If the train dispatcher does not positively know there is no opposing train or engine movement involved, he may authorize the train or engine to proceed in the following form: "You may proceed under flag protection to the next clear or approach signal." When flagging from a Stop signal, train must wait ten (10) minutes after flagman has started.

269. When stopped by a Stop indication and communication has failed, train or engine must not proceed, except when not standing between Stop signals at a station, train or engine must move forward under flag protection to a point where they will be between Stop signals at a station, clearing main track when practicable, complying with Rule 275. Further movement must not be made except on signal indication or until authority is received from train dispatcher or control operator.

270. If any part of a train or engine overruns a Stop indication, front of train or engine must be protected immediately as prescribed by Rule 99 and member of crew must communicate with train dispatcher or control operator and be governed by instructions.

271. Within TCS limits, trains or engines may occupy a track or tracks within specified limits and between specified times to perform switching or other work when authorized to do so by the train dispatcher or control operator in the following form: "(Train or engine) may use (track or tracks) between____and____(or at____)____m until____m."

When requesting track and time limits, conductor will give his name, location, train or engine number, and specify time and working limits and track or tracks to be used. When such authority is granted, the instructions must be repeated to the train dispatcher or control operator. No movement may be made under this rule until the engineman has received and understands the track and time limits granted.

After the train or engine has entered the specified limits, the train dispatcher or control operator must block all signal and switch levers controlling movements into the specified limits and must not permit any other train or engine to enter the limits during the period track and time limits are in effect. Blocks must not be removed until track and time limits have expired unless conductor reports the train or engine clear of the track or tracks specified or work completed.

During the period track and time limits are authorized, the track or tracks specified may be used in either direction without flag protection. This does not modify requirements for proper observance of signal indications.

Trains and engines must be clear of the track or tracks specified or work completed, switches restored to normal position before expiration of the time specified, and train dispatcher or control operator so advised. If not clear by the time specified, protection must be provided as prescribed by Rule 99. If additional time is required, authority must be secured from train dispatcher or control operator before previously authorized time expires.

When two or more trains or engines are given the same or overlapping track and time limits, the train dispatcher or control operator must inform the conductor of each train or engine of the fact and such trains or engines must protect against each other and move at restricted speed within such limits.

272. When an employee's call light is illuminated, any employee observing it, except those on moving trains, must immediately communicate with the train dispatcher or control operator.

273. When TCS operation is interrupted or suspended, trains and engines must be governed by instructions from the train dispatcher, control operator or other prescribed authority.

APPENDIX N
DUAL CONTROL SWITCHES
AND
ELECTRIC LOCKED SWITCHES

DUAL CONTROL SWITCHES

275. When a train or engine is stopped by a signal governing movement over a dual-control switch, if no conflicting movement is evident, a member of the crew must immediately communicate with the train dispatcher or operator and be governed by his instructions. Such instructions must include information as to the route to be used. The instructions must be repeated to insure correct understanding.

When authorized to proceed, or when unable to communicate with the train dispatcher or operator, movement must not be made until after selector lever has been taken out of "power" position and placed in "hand" position. Hand-throw lever must be operated until switch points are seen to move with the movement of hand-throw lever. Switch must then be lined for the route to be used. Selector lever may be restored to "power" position and locked as soon as leading wheels of engine or car have moved onto the switch points.

275(a). When necessary to perform switching over dual-control switch, the switch may be operated manually by a member of the crew after authority to do so has been obtained from the train dispatcher or operator. The period of time the switch may be used must be clearly stated and understood.

Selector lever must be placed in "hand" position and left in that position until all movements over the switch have been completed. Hand-throw lever must be operated until switch points are seen to move with the movement of the hand-throw lever. Indications of Stop signals governing movements over the switch may be considered suspended while selector lever is in "hand" position, but movements must be made at restricted speed.

After final movement has been made over the switch, selector lever must be restored to "power" position, locked and train dispatcher or operator notified.

ELECTRIC LOCKED SWITCHES

276. Instructions for operation of electric locks are posted at or near electric lock and must be complied with.

277. When indication is received showing lock has released, lock and switch may be operated and train or engine may proceed without waiting_____minutes as required by Rule 513.

278. Authority to use an electric locked switch which is under control of the control operator, must be given verbally to member of crew by train dispatcher or control operator. The period of time the switch and track may be used and designated limits must be clearly stated and understood.

279. Seal on emergency release of electric lock must not be broken, or emergency release operated, without authority from the train dispatcher or control operator, except when communication has failed.

When necessary to release electric lock by use of emergency release, and movement is to be made to a main track, member of crew must wait_____minutes after release has been operated before changing main track switch. Train or engine may then proceed being governed by signal indication, or where there is no signal, when preceded by a flagman to the next Clear or Approach signal.

Train or engine must wait_____minutes after flagman has started.

When release seal is broken, or found broken or missing, report must be made promptly to the superintendent, and the control operator or train dispatcher.

APPENDIX O
CTC OPERATION

Rules Governing CTC System Operation

The following extracts of rules governing CTC System operation (Burlington Northern; Train Dispatchers Manual; January 1, 1971 and Boston & Maine; Rules for the Government of the Operations Department; October 29, 1961) are presented as typical of the great variety of directions provided relative to the CTC System. It should be understood that there are variations of the basic system installations responding to the individual railroads territorial needs and unique traffic conditioned requirements. In most cases it was found that rules applying to CTC operation were intermixed with rules governing other aspects of the operation.

RULES GOVERNING CTC SYSTEM OPERATION *

USE OF CTC SIGNALS INSTEAD OF TRACK FLAGS TO PROTECT MAINTENANCE OF WAY WORK: In CTC territory, maintenance of way work may be performed under CTC signal protection, provided by the train dispatcher.

When such protection is requested, and if the movement of trains permits, the train dispatcher will provide signal blocking on CTC machine for the specified territory, and then issue a CTC TRACK PERMIT to the foreman or supervisor in charge. The track permit must show "REPORT CLEAR" responsibility.

On CTC machines so equipped, the signal levers must be blocked and the work "Report" and the time must be shown on signal blocks. The blocking must not be released or the signals cleared to permit a train movement into the protected territory, even though the time authorized in the permit has expired, until the person authorized on the REPORT PERMIT calls in, identifies himself by name, states his location, and advises that the men and/or machines are clear, also that the track is OK for trains.

Other CTC TRACK PERMITS must not be issued authorizing movement of other on-track equipment into or through the protected area as described in this rule unless absolutely essential to the work being performed. When this is done, dispatcher must provide additional markers for blocking on his CTC machine or take such other action as is appropriate to protect each authorized movement in case the protection of the original permit is released by the individual in charge before the expiration of the authorized time. A complete understanding must be arrived at with the persons involved in event more than one permit is authorized in the same area to be sure all movements are clear before the blocking is removed.

Unnecessary delays to trains and to the work crew will be avoided if the foreman or supervisor is instructed to stay in frequent touch with the train dispatcher by telephone or radio.

CTC TRACK PERMITS

TIME PERMITS: In CTC territory when it is necessary for a track car or On-Track equipment to move on the main track beyond the control signals for that station, a CTC Track Permit must be issued by the control operator. Individual requesting permit must identify himself stating name, occupation, his location, describe the movement to be made and the time necessary to make such move.

Control operator will then issue a numbered CTC TRACK PERMIT making required record. The person copying the permit must repeat it back to control operator. The prescribed form must be used.

This authority when received, will permit movement between the specified times and between the points shown without flag protection against trains. A careful lookout must be maintained for other On-Track equipment. At the expiration of the time authorized, the movement must be clear of the main track or flag protection provided.

The control operator must protect such movement by providing blocking of the signals on the control machine governing movements into the designated territory. The blocking must not be removed until the expiration of the authorized time unless the movement is reported clear by the person to whom the permit was issued.

REPORT CLEAR PERMITS: When it is necessary to move On-Track equipment that cannot readily be removed from the rails, such as Hy-Rail equipment, tamping machines, track liners, ballast shapers, etc., the CTC Track Permit record must show "Report Clear" in addition to the time authorized. The employe to whom the permit is issued must be reminded of the REPORT CLEAR responsibility. The CTC control operator must provide the required blocking on CTC machine and also show the work "Report" and the time the permit expires on the signal lever blocks or markers provided. The blocking must not be removed until the person to whom the permit was issued reports in by name and advises that the men and equipment are in the clear.

In CTC territory, where more than one main track is in service, a Report Clear Track Permit must be issued when it is necessary for On-Track equipment to move on either of main tracks. The movement cannot be made on line-up only. Control operator must protect the movement as provided in first paragraph.

When the control operator cannot provide for the movement of ON-TRACK equipment due to a previously authorized train movement in the territory or when communication cannot be made with the control operator, movement on the main track may be made if the line-up permits movement or when protection is provided.

INSTRUCTIONS FOR HANDLING CENTRALIZED TRAFFIC CONTROL TERRITORY

Train dispatchers operating CTC control machines which have a graph sheet must, unless otherwise provided, enter on the graph sheet the proper identification of each train entering the limits. Then connect the automatic recording at each switch to an inked line with the recording at the next switch for the same train, making an additional reference to train identification leaving CTC limits.

CTC graph sheet must be kept legible, neat, in prescribed form, accurate and adjusted to compare with standard time. A record must be maintained in which the train dispatcher will record any irregularities in the operation of the CTC system, showing date, time of occurrence, and time Signal and/or Maintenance of Way Department notified. Any irregularity affecting the movement of trains must be promptly reported to the supervisor of the department affected.

In designating time limits use time of day such as: 8:45 AM until 10:01 AM. Do not refer to time limits as "for 45 minutes."

When granting verbal authority for movements not authorized by signal indications, such instructions must be recorded when issued. Where authorized and the dispatcher's telephone is equipped with a tape recording device, the instructions for such movement need not be written. Do not condone failure to repeat the instructions by the employe receiving them.

When authorizing a train to pass a stop indication that governs movement over a dual control switch, if the control machine indicates the dual control switch is lined and locked for the route to be used, member of crew will be advised by control operator that it is not necessary to hand operate that switch. Authority to pass the stop indication must not be given until train has stopped.

If the control machine does not indicate the dual control switch is lined and locked for the route to be used, member of crew must be instructed to hand operate it as provided in Rule 275(A) before proceeding.

When a portion of track is out of service, the controlled signals which govern the use of the block in which the obstruction is located must be left in Stop position and blocking provided.

When switches or signals cannot be operated due to track obstruction or other conditions, or are undergoing repairs, control operator must provide blocking and must not remove blocks until advised by the proper authority.

In CTC territory, when the main track is to be taken out of service between controlled switches of a siding, switches will be lined for siding and CTC blocking provided. The CTC blocking protection must not be removed until the control operator is advised by the employe in charge that the track is back in service. Signal aspects must be displayed to indicate siding is to be used.

If there is a spring switch at one end of the siding it must be lined for siding, spiked, a train order must be issued covering, and track flags placed before track is taken out of service. When practicable signal aspects will be displayed to indicate siding is to be used.

When safe to do so, and provided it will not interfere with the movement of trains, switches and signals may be operated by control operator on request of signal maintainer or maintenance foreman for test or adjustment purposes or for movement of heavily loaded track cars or On-Track equipment.

Switches must be kept in normal position and the signals at stop except when routes are lined for the immediate movement of trains.

The switches and signals must be lined sufficiently in advance to avoid delay to approaching train and must be restored to normal position immediately after the train has passed over the switch.

Do not change or cancel the indication of a signal or attempt to change the position of a controlled switch after a route is established and a train is approaching. This would cause the signal aspect to change immediately for the train, creating a hazardous situation. There is also a hazard involved in making such a change for motor car operators as well as train movements. No action to change position of a switch should be attempted while any part of the train is passing over that switch.

When a train is to be admitted to an occupied siding, engineer of such train must be advised before entering siding, train on siding must be advised when possible to do so. When two opposing trains are to be admitted to the same siding, the engineers of both trains must be advised of this fact before entering siding.

When setting up a meet between two opposing trains, do not be too hasty to line the switch and signal for one of the trains to take siding for the other. Time will be saved and a much better meet accomplished if, when practicable, the first train to arrive at that station takes siding.

A train order meet (Form S-A) must not be used to advance a train to the beginning of CTC territory. Use time or right of track train orders.

It is permissible for the train dispatcher to move a train to the beginning CTC territory by use of Form D-R, Form S-C or Form E order (whichever is necessary) without giving a copy of such order to the train being restricted when communications with that train are not available. Before issuing such an order, the signals governing movement leaving CTC (the point where the train is being Restricted) must be placed in Stop position and blocked. Blocking must not be removed until it has been definitely determined the train advanced has arrived in CTC territory or the time of the Form E order has expired.

*Burlington Northern, Train Dispatchers Manual; January 1, 1971.

MOVEMENT OF TRAINS AND ENGINES UNDER CENTRALIZED TRAFFIC CONTROL SYSTEM (CTC)*

265. On portions of the railroad, and on designated tracks so specified in the timetable, trains and engines will be governed by Automatic Signals and Interlocking, which will constitute a Centralized Traffic Control System (CTC) under the direction of a designated operator and will supersede superiority of trains from both directions.

Except as affected by CTC rules, all Operating Rules, Automatic Block Signal System Rules, Interlocking Rules, and Automatic Cab Indicator Rules remain in force and govern where they apply.

265a. Movement of trains and engines will be supervised by the train dispatcher, who may also operate CTC control machine.

OPERATOR

266. A train or engine may be given exclusive occupancy of a track, and when such permission is given, the operator must: -

(a) Notify trainman as to the clock time during which train or engine may occupy the main track and designate working limits. This authorization must be repeated by the trainman to the operator, and state his name. The time limit may be extended on request of trainman if conditions permit.

(b) Place in "STOP" position control machine levers for all signals governing movements over the designated working limits and attach lever markers to all such signal levers.

(c) While lever markers are attached, signal must not be cleared for any movement into the working limits.

(d) Record, on record sheet, engine number; time and working limits granted; name of employe repeating the authorization; the time when exclusive occupancy permission is released.

267. When trainman reports having finished using a hand-operated switch and that switch is closed and locked or when trainman reports having finished using a dual control switch and that the selector level has been restored to the "power" or switch machine position and is locked, the lever markers on the control levers must be removed and time work is completed or main track is cleared must be entered on record sheet.

268. Permission to unlock the electric lock on hand-operated switch must not be given in advance of time switch is to be used unless absolutely necessary, in which event operator must issue necessary instructions governing use of same.

269. In case of signal failure, or in emergency, operator may verbally authorize a train or engine to pass a "stop" signal, subject on a neutral track to provisions in Rule 270, and must: -

(a) Secure information that points of dual control switches are in proper position and safe for movement.

(b) Check the permits issued to trains or engines granting permission to hand-operate dual control switch, and those permitting exclusive occupancy of main track to determine whether a conflicting movement is involved, and if so, protect it.

(c) Make record of the signal number and train or engine number, give authorization for move directly to a member of the crew of the train or engine concerned, advising him that authority is given to move at restricted speed to the next signal, checking all intervening switches as to their position before passing over them, have authorization repeated by him, and record his name.

270. Except when permitting an engine to return to its train, a switcher or helper engine to go onto a train, or some such short, local move, when conditions are fully known, and the move to be made is already fully protected, operator must not authorize a train or engine to pass a home interlocking signal displaying "stop" indication when that signal governs movements on a neutral track until:

(a) Every train and engine moving in the opposite direction on any track within the territory controlled by the signal in question shall have passed one "O.S." point where its position, both as to location and track occupied, can be checked on the indicator board. In the case of a train or engine working between "O.S." points, personal check with conductor or engineman on telephone to establish its position will cover.

(b) Conditions have been fully explained to the Chief Dispatcher or Assistant Chief Dispatcher on duty, and he has authorized the move. Rule 269(c) applies.

* Boston and Maine Railroad; Rules for the Government of the Operations Department; October 29, 1961.

APPENDIX P
RADIO OPERATION

Rules Governing Radio Operation

Because radio is widely used today and will continue to gain increased usage as railroad companies modernize their systems, the use of radio equipment as a direct aid to the train dispatch operation is very significant. Examples of rules relating to radio operation, as prescribed by the Boston and Maine Railroad, are provided herein. These requirements appear to be very limited in their content; however, it is noted that the provisions of applicable FCC rules are cited as binding on railroad personnel. Unfortunately, conformance is lax, possibly due to the fact that copies of the FCC rules are not readily available.

RAILROAD RADIO
GENERAL AND OPERATIONAL RULES

GENERAL

The following rules and requirements cover use of railroad radio systems and govern employees using such systems.

A. Definition: A Railroad Radio Communication System is one employing radio for the transmission of intelligence between moving equipment, between moving equipment and a fixed point, or between fixed points.

B. Radio communication systems are under the jurisdiction of the Federal Communications Commission. The Railroad Company and its employees are governed by the Commission$$ Operational Rules. Violation is a federal offense.

OPERATIONAL RULES

400. All employees, except those specifically authorized to do so, are prohibited from making any adjustments to a railroad radio set. Employees so authorized must carry their FCC operator license or verification card when on duty. If it appears that a radio transmitter is not operating properly it should be promptly reported as prescribed by carrier's instructions.

401. No employee shall knowingly transmit any false distress communication, any unnecessary, irrelevant or unidentified communication, nor utter any obscene, indecent, or profane language via radio.

402. Before transmitting an employee operating a radio transmitting set shall listen a sufficient interval to be sure that the circuit is not already in use, particularly for distress traffic.

403. A distress call will be preceded by the word "Emergency" repeated three times. Such calls shall be used only to cover initial reports of derailments, storms, washouts, fires, obstructions to tracks, or other matters which would cause serious delay to traffic, damage to property, injury to employees or the traveling public, and shall contain as complete information thereon as possible. All employees shall give absolute priority to communications until there is assurance that no interference will result to the station in distress.

404. Any employee shall permit inspection of the radio equipment in his charge and all FCC documents pertaining thereto, by a duly accredited representative of the Federal Communications Commission at any reasonable time.

405. Employees shall identify the radio station from which they are calling by prefacing their call with the name of the railroad and the train number, engine number, caboose number or by such other name as is commonly used by employees to identify a fixed point or mobile unit.

406. Employees in other than train and yard service, transmitting or receiving communications by radio must state name, occupation and location before commencing conversation. Employees must insure being in communication with proper persons and must not take action until certain that all conversation has been heard, understood, finished and acknowledged.

407. In certain cases at crossings, junctions or paralleling tracks of the same or other railroad, interference

may develop. In such cases especial care in making identification shall be used and the employees concerned shall cooperate in handling their business by alternating calls and being as brief as possible.

408. If any communication from a station other than another railroad radio station interferes with Railroad Radio service the railroad employee will endeavor to ascertain the identity of such station and report the occurrence as soon as possible through authorized channels, to the)_____, giving the exact time, nature of the communication and identity of the station, if possible.

Internationally, the word "Mayday" indicates a distress message, the word "Pan," an urgent message and the word "Security," a safety message. Railroad employees may hear such messages sent by aircraft or, in coastal areas, report them immediately through authorized channels to the designated railroad official in addition to taking such appropriate action to relieve the distress as may be possible.

Any employee receiving inquiry concerning any violation shall answer within 24 hours after receipt of notice.

409. When radio is used to direct movement of train or engine, failure to maintain communication with employee directing the movement will require the movement to be stopped immediately. Further movement must not be made until communication has been established.