U.S. Department
of Transportation
**Federal Railroad
Administration**

TRAIN DISPATCHERS FOLLOW-UP REVIEW

Report to Congress

Office of Safety

January 1995

U.S. Department
of Transportation

**Federal Railroad
Administration**

Administrator

**400 Seventh St., S.W.
Washington, D.C. 20590**

JAN 5 1995

The Honorable Albert Gore, Jr.
President of the Senate
Washington, D.C. 20510

Dear Mr. President:

Pursuant to the authority delegated to me by the Secretary of Transportation, the Federal Railroad Administration (FRA) submits the enclosed report, "Train Dispatchers Followup Review," as required by the Rail Safety Enforcement and Review Act, Public Law 102-365. This report responds to the Congressional mandate to assess corrective actions taken by the rail industry in addressing concerns identified in FRA's National Train Dispatcher Safety Assessment of 1987-88.

To carry out Congress' mandate, FRA conducted team inspections at 20 train dispatcher offices representing a wide variety of operational methodologies. Current dispatching practices were documented in the areas of staffing, communications, training, operational testing, workload and stress, hours of service, and computer-assisted train dispatching. Our inspection methodology included interviews with dispatchers, supervisors, and union officials, onsite observations, record reviews, and selective desk auditing on each duty shift. Our inspection teams were composed of operating practices and signal and train control inspectors, many with prior train dispatching experience.

In general, FRA found train dispatchers continue to provide safe, efficient service to the industry. However, FRA believes there are shortcomings in several areas, specifically training and testing, that require additional FRA emphasis.

On behalf of the FRA, I am pleased with the vision presented to ensure the future viability of train dispatcher training. I look forward to working with Congress to advance our shared objective of improving safety in the railroad industry. A copy of this report has also been sent to the Speaker of the House of Representatives.

Sincerely,

Jolene M. Molitoris

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Enclosure

US Department
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The Honorable Newt Gingrich
Speaker of the House of Representatives
Washington, D.C. 20515

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EXECUTIVE SUMMARY

This report[1] documents the findings of the Federal Railroad Administration (FRA) during a national followup review of select train dispatcher offices. The review was mandated by Section 17 of the Rail Safety Enforcement and Review Act of 1992 which required FRA to evaluate corrective actions taken in response to concerns identified in FRA's national train dispatchers' assessment of 1987-88. Concerns noted in the national review included the following general topics:

- ***Staffing***
- ***Communications***
- ***Training***
- ***Operational Tests and Inspections***
- ***Operating Rules and Procedures***
- ***Occupational Stress and Workload***
- ***Environment***
- ***Software***

FRA Conclusions

At the present time, available accident data discloses no statistically significant pattern of accidents caused by inadequately trained dispatchers.[2] However, FRA believes that the rapidly evolving changes in train dispatching technology, along with changes in new dispatcher candidate availability, presents a future potential for diminished safety due to insufficient dispatcher training and testing standards. Therefore, FRA proposes the following:

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[1] *While this report was in clearance, all of the Federal railroad safety laws were repealed, revised and reenacted without substantive change, and recodified as positive law in title 49 of the U. S. Code. See Public Law 103-272 (July 5, 1994). To expedite publication of the report, references to the original laws have not been revised and, therefore, should be read accordingly. The provisions of law formerly contained in the Federal Railroad Safety Act of 1970 and the older Federal railroad safety statutes are not at 49 U.S.C. subtitle V, part A, and sections 4(b)(1)(i) and (t) of Public Law 103-272. The provisions formerly in the Hazardous Materials Transportation Act and the Sanitary Food Transportation Act of 1990 are not at 49 U.S.C. chapters 51 and 57, respectively.*

[2] *Most dispatcher-caused accidents were due to other issues, such as miscommunication or operating rule noncompliance.*

1. ***FRA will facilitate a partnership between the Burlington Northern Railroad (BN), the National Railroad Passenger Corporation (Amtrak), and the American Train Dispatcher's Department of the Brotherhood of Locomotive Engineers (ATDD). The partnership will work to develop a model train dispatcher training program within 24 months of this report, taking advantage of BN's advanced technology and training capabilities, ATDD's experience and expertise in train dispatcher training needs, and Amtrak's experience in dispatching high-density, high-speed passenger operations.***

2. ***Within 36 months of this report, FRA will publish an Advance Notice of Proposed Rulemaking (ANPRM) proposing minimum training standards for train dispatchers, to include initial, periodic, refresher, and physical characteristics training; and minimum operating rule training and testing standards.[3] These standards will be based upon data developed through the partnership between FRA, BN, ATDD, and, Amtrak. As part of the review, FRA will examine railroad operating rules to assess consistency, standardization, and applicability to today's railroad environment.***

Scope of this Review

The scope of this review was generally limited to a followup on issues identified in the 1987-88 assessment. FRA formulated an inspection plan which involved onsite audits of 20 representative railroad dispatching offices where over 150 train dispatchers were monitored. FRA conducted inspections with two teams, each with a team leader and several operating practices and signal and train control inspectors from the eight FRA regions. The project manager, team leaders, and the majority of team members, had extensive train dispatcher experience prior to joining FRA. All data collected during the assessment was analyzed by FRA Office of Safety headquarters technical staff in Washington, D.C. Railroads audited were selected based upon a matrix which provided review of varying operational methodologies, dispatching technologies, and geographical differences. Major passenger and hazardous materials traffic routes weighed heavily in determining audit sites. Inspection methodology included interviews, onsite observations, record reviews, and selective desk auditing on each duty shift. Prior to initiation of the field portion of the review, FRA contacted the ATDD to obtain local labor contacts. At offices where ATDD represented train dispatchers (some train dispatchers are exempt employees), FRA's team chief met with

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[3] *The ATDD has offered a proposed outline of basic training standards (see Appendix 2).*

local union officials to discuss respective concerns and recommendations. In addition, at the conclusion of each site visit, FRA conducted a detailed exit meeting with responsible railroad management to advise them on FRA findings and recommendations. Copies of inspection reports were provided to respective officials at those meetings.

General Findings

In general, FRA found that train dispatchers continue to do a noteworthy job and railroads continue efforts to improve the conditions of train dispatchers through technology and workplace enhancements. Many of the environmental problems noted during the 1987-88 effort have been corrected with closure of older dispatching offices and movement to centralized system or regional centers with enhanced technological and environmental conditions. However, FRA identified several concerns that have not been sufficiently addressed by the industry, including training and operational testing.

During the followup review, FRA gave immediate notice to railroad representatives when deficiencies were noted. In most instances, here applicable, corrective action was immediately initiated by railroad management. With publication of this report, all parties have FRA's concerns and recommendations to effect correction.

The summaries that follow provide a synopsis of the core of FRA's work. The full report contains more detailed discussion of each issue. This summary is not a substitute for the full text, but it includes the major FRA findings.

Summary: Staffing: As noted during the 1987-88 national assessment, FRA found on some railroads that an insufficient number of qualified dispatchers precluded filling normal vacancies in regular jobs when they occurred. As a result, some train dispatchers are required to work assigned rest days.[4]

Due to the unique operational characteristics of each office, FRA believes the only lasting solution to this problem is for rail labor and management officials to identify staffing needs for each location.

Summary: Communications: FRA found an improving situation in communications capabilities utilized by train dispatchers.

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[4] *FRA determined that, on average, train dispatchers are required to work rest days about twice a month.*

However, some problem areas remain that must be resolved in both hardware and human interface areas. For example:

Hardware: FRA found several dispatcher desks where "bleed-over" from neighboring dispatcher districts and automatic wayside detectors is common;[5] diverse and sometimes incompatible communication systems are in place in the same dispatchers office; and no dedicated emergency channels or call prioritizing capabilities were available. Train dispatchers related to FRA inspectors that reliability of locomotive onboard radios has improved considerably, but there are occasional instances when crew communications were inhibited by inoperative radios.

Human Interface: FRA found that on some railroads there is an underutilization of available frequencies which creates interfering radio transmissions. For example, channels intended for road train use were used by yardmasters and terminal switching crews; channels intended exclusively for dispatcher communications were used by road crews engaged in such duties as adding or removing cars from their trains or to conduct other communications of no value to the train dispatcher or other trains; maintenance-of-way employees frequently used the dispatching channel to communicate with each other, even though separate channels were available for this purpose; and supervisors, administrative personnel, clerks, and even railroad taxi drivers used the dispatching channel for purposes not related to the safety of train operations.

Perhaps of most concern to FRA was the frequent radio rule noncompliance by radio users. During the followup review, FRA documented numerous instances of improper radio usage, some serious in nature (e.g., failure of the dispatchers and train crews to comply with Title 49, Code of Federal Regulations, (49 CFR) Part 220.61 (transmissions of train orders by radio); and failure to assure on-track authorities are properly transmitted and repeated. FRA documented several instances where train dispatchers issued critical train movement authorities without obtaining proper identification and/or location of involved trains.

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[5] *On some dispatcher desks, FRA noted frequent interference from automatic "talking" hot journal or dragging equipment detectors. Typically, on some railroads, the "talkers" override the frequency to broadcast their message irrespective of user exchanges underway. Train dispatchers complain that this interruption is distracting and a impediment to efficient communications.*

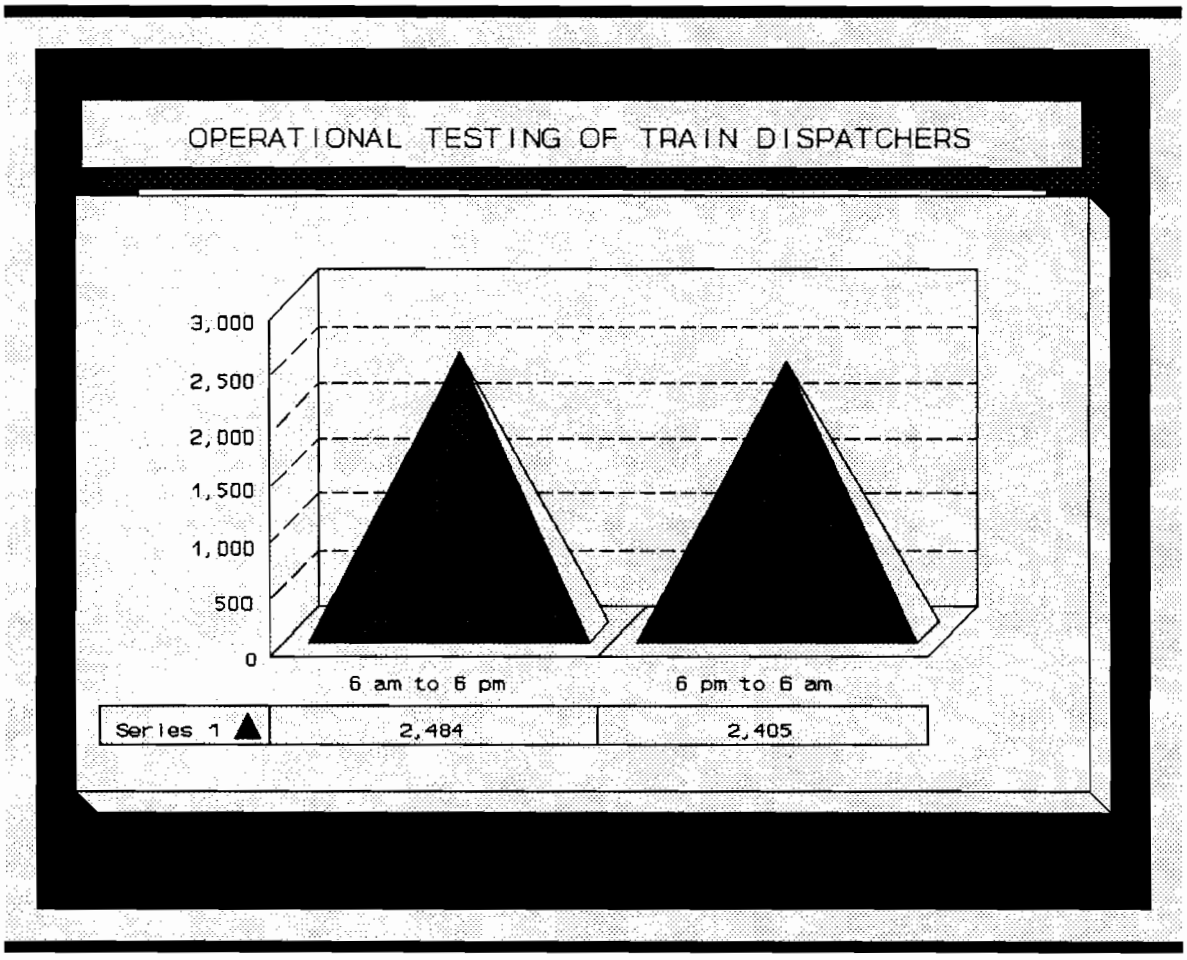
FRA conducted a national safety inquiry into communication issues in compliance with Section 11 of the Rail Safety Enforcement and Review Act of 1992. The issue of radio communications is discussed in the Report to Congress on this subject published July 1994. FRA believes that there is a pressing need for FRA, rail labor, and rail management to promote employee compliance with radio rules and standards. While railroads and suppliers are working to resolve shortcomings with equipment, there is no justification for radio users not complying with Federal and railroad company radio standards. FRA accident/injury records reveal that improper radio usage is a causal factor in a number of serious train accidents/incidents every year. FRA has undertaken an aggressive enforcement approach when radio rule noncompliance is observed and will continue to do so.

Summary: Training: All railroads visited during the 1993 assessment have initial hire training programs with varying levels of formality. A few railroads have made significant improvements in initial dispatcher training, to include the use of computer-assisted dispatching (CAD) simulators. However, FRA continues to find a pattern of inconsistency regarding training content, duration, methodology and resources from railroad to railroad, particularly as it pertains to recurring training. As a result, several issues identified by FRA during the earlier national assessment have been only partially addressed by the industry. Specifically, problems still exist in dispatcher training areas such as: Defining on the job training (OJT) parameters; inconsistent and variable standards/policies for periodic retraining of dispatchers; no formal policy is in place regarding periodic retraining; railroad policies concerning dispatcher familiarization road trips varied widely, and objectives and measurement tools for such training were nonexistent; periodic retraining continues to suffer due to an insufficient number of relief employees; most railroads do not provide for supervisory personnel to train/familiarize themselves with changes in technology; and when rule or technology changes occur, shift train dispatchers are not always afforded an opportunity to familiarize themselves before being put into situations requiring "real time" application.

After the 1987-88 assessment, FRA reported to Congress that there was insufficient justification to warrant Federal involvement in establishing national train dispatcher training standards. Obviously, FRA preference then was that the railroad industry would work cooperatively to resolve problems and develop voluntary initiatives to address dispatcher training in a uniform, consistent manner. This has not occurred.

Summary: Operational Testing and Operating Rules: **Testing**: FRA believes that clear, consistent operating rules and quality operational testing are essential elements in promoting safety in rail operations. The industry has not satisfactorily addressed

concerns raised in this area during the 1987-88 assessment, and FRA continues to find serious deficiencies in operational testing in terms of frequency and quality of tests. FRA's inspections revealed that most railroads are not performing operational tests to the standards outlined in their programs filed with FRA. Most tests were predictable by time of day, day of month, and content of the test, although FRA did note a more reasonable distribution of tests between daytime and nighttime hours than was apparent during the earlier assessment. FRA found that tests to evaluate critical operational procedures were infrequently conducted. A summary of specific problems FRA identified includes: Some railroads with nonagreement dispatchers took a position that since train dispatchers were company officers, operational



testing was not required; on some railroads, train dispatchers were included in the program but the quality of testing was wholly substandard (e.g., train dispatchers were tested infrequently--up to 18 months between tests); system or division officers did not periodically test and inspect dispatchers from the field and record the results; a disproportionate ratio of tests were predictable (e.g., toward the end of the month); and

failure rates were artificially low compared to FRA testing results. Of most concern to FRA is that rules governing the issuance of mandatory directives, the use of blocking devices, and the granting of track and time authority are critical to safety; yet they were tested for very infrequently.

A number of accidents have resulted from human failures that can be effectively addressed through operational testing. For example, a review of FRA's accident data 1991 through 1993 disclosed that five serious accidents were attributed, wholly or in part, to train dispatcher error: Four of the five were caused by crew "readback" and dispatcher "hearback" failures (i.e., the incorrect movement limits were repeated by the crew and the dispatcher failed to notice the error). However, only a few railroads have means to test for such error potential.

Federal regulations require that each railroad conduct periodically operational tests to determine the extent of compliance with its code of operating rules and timetable special instructions. Train dispatchers are employees subject to this requirement. FRA believes that many railroads have not fulfilled the intent of the regulation in terms of train dispatcher testing.

Rules: FRA has noted a trend characterized by a lack of standardization of operating rules and procedures among some railroads. This lack of standardization impacts not only operating and maintenance crews, but also train dispatchers by fostering confusion and ambivalence. During the followup assessment, FRA noted that operating rule interpretation and application varied from railroad to railroad; that several railroads had informally changed certain rules without sufficient notification to all affected employees; and that inconsistencies were apparent among divisions of the same railroad on basic rule interpretations.

FRA believes that central rules guidance is essential to ensure consistent application of operating rules. Train dispatchers need clear, comprehensive direction on operating rule application, and rail management should provide that support around the clock as the need arises.

Summary: Train Dispatcher Stress/Work Load: In the 1987-88 report, FRA recognized the need for additional study of these potential problem areas. As stated then, FRA is without the necessary expertise to properly assess and evaluate factors such as stress, fatigue, and workload. Evaluation of such complex human factors requires substantial research with input from experts in the health and human factors communities. FRA is in the early stages of formulating research parameters for the study of train dispatcher stress through FRA's Office of Research and

Development. This will be a consultative approach, involving FRA, labor, management, and suppliers.

We do note, however, that some train dispatcher stress has been attributed to communications and training concerns. As the industry continues to work toward resolution of these issues, a corresponding reduction in "job stressors" should become evident.

Summary: Train Dispatcher Environment: In general, FRA noted significant improvement in train dispatcher working environments since the original assessment. Rail labor and management have worked to enhance dispatcher workstations to include lighting, soundproofing, layout, and security. Most railroads have tightened access and limited "tour" groups to reduce distractions. FRA is satisfied with the overall progress being made in this area.

Summary: Software Reliability: FRA noted significant improvement in software management on most railroads utilizing CAD systems. This is due, in part, to refinements in software development and acquired industry experience in CAD operations. FRA did encounter a few software related problems relating to track occupancy and signal/console display at two offices during the 1993 followup. While these anomalies were resolved with FRA onsite, FRA continues to find such problems which demonstrates that even though the software for each track segment is typically developed separately, the test program for those individual segments should be integrated and complete. The assurance program should not permit skipping over tests because of the similarity to previously installed software routines. A formal program is particularly important when vital logic is involved. An initial step in the formulation of a formal program would be to identify the vital elements of the software program.

FRA believes that software improvements are evolutionary and enhancements in CAD capabilities will continue to advance. However, FRA believes that formal software verification procedures should be required for all new or altered CAD software. Railroads should be prepared to demonstrate the validity of the software verification and conflict checking procedures with FRA upon request.

Agency Proposals: 1987-88

In the Report to Congress after the 1987-88 national assessment, FRA proposed three specific actions:

1. *FRA [would] evaluate the requirements of 49 CFR Part 217 (Railroad Operating Rules). The agency intends to resolve ambiguities contained in this Part, and to scrutinize*

dispatcher operating rules instruction programs submitted by each railroad. FRA further intends to evaluate operating rules training options, and will make changes in the rule as deemed necessary to ensure safety.

2. *Because of the diverse control and communications systems, and operating procedures currently in use, FRA does not believe regulations in these areas are now advisable. Further, several railroads have initiated comprehensive training programs since the conclusion of the initial assessment. These programs are dissimilar, but each is far more comprehensive than those evaluated during the assessment. FRA intends to conduct in-depth reviews of these new programs. The agency is also considering convening a task force consisting of FRA dispatching specialists, railroad experts, and organized labor to evaluate training procedures in areas other than operating rules. FRA would then issue guidelines to the entire industry regarding these areas.*

3. *Through the Office of Research and Development, FRA intends to contract with outside experts to help develop workload measurement models, and to study occupational stress of train dispatchers.*

FRA's Response to 1987-88 Proposals

1. ***FRA Response to Action Item No. 1:*** *FRA has been unable to undertake a thorough review of the regulation as originally hoped when the first Report to Congress was prepared. This is as a result of other priority regulatory requirements which have consumed limited operating practices staff time subsequent to the 1987-88 assessment (e.g., the random drug testing regulations; the regulations governing certification of locomotive engineers; the regulation regarding utility employees, etc.).*

   Nonetheless, FRA has taken a proactive enforcement approach in the areas of operating rule training and operational testing over the past several years. FRA has attempted to address the issue through focused enforcement audits of operating rule programs. Noncompliance has been handled with positive enforcement action. With this approach, FRA has noted general improvements in administration of operational testing programs on targeted railroads. For example, one of the audited railroads has responded by acquiring a sophisticated computerized data management system to better control and monitor field testing; another railroad has reallocated supervisory resources by creating new positions to address inadequate training and testing of certain employees.

FRA recently developed a draft "model" operational testing program format for larger railroads. This enables FRA to provide interested parties with an outline of a common "model" format within which effective testing programs may be developed to fit unique railroad operational needs. It is available for interested railroads.

2. ***FRA Response to Action Item No. 2:*** *FRA did not establish a task force consisting of industry and FRA representatives as originally proposed. This, again, was due to personnel unavailability as a result of pressing regulatory requirements as outlined above. However, FRA has been proactive in responding to industry requests for FRA interaction with employees. Both headquarters and regional personnel have conducted hundreds of meetings with rail labor and management groups since the 1987-88 effort, where an active interchange of ideas has occurred. In 1992, the FRA Administrator met with the President of the ATDD to discuss train dispatcher training and corollary issues. FRA has also included officials of the ATDD in regional FRA workshops. In addition, FRA recently initiated "roundtable" discussions, which involve the FRA Administrator and staff, meeting with industry representatives from rail labor, management, and suppliers. Problematic issues are discussed at the meetings, with all having opportunity to offer input.*

3. ***FRA Response to Action Item No. 3:*** *FRA, through its Office of Research and Development, has begun working with outside experts to develop a program for evaluating train dispatcher workload, stress, and fatigue. The FRA Office of Safety was involved in the initial planning stages of the work. Unfortunately, the project was delayed before it could be implemented due to funding reallocation. FRA hopes to continue the development of a formal program to evaluate dispatcher-related workload, stress, and fatigue, within the next 18 to 24 months, resources permitting.*

Special Acknowledgement: FRA recognizes the indispensable contribution of the ATDD officers, individual train dispatchers, and railroad management officials throughout this assessment. The support and involvement of these individuals significantly enhanced FRA's ability to identify and document findings reported herein.

CHAPTER 1

INTRODUCTION

Report Summary

This report is structured to provide the reader an overall representation of some of the most significant train dispatcher issues present in today's railroad environment. Even though the 1993 review serves as followup to the earlier national assessment, FRA offers a review of historical data (See Appendix 1) to provide interested readers insight into the evolution of the train dispatcher position. This report is structured as follows:

- *Introductory commentary is provided in Chapter 1 to furnish a framework for specific discussion of FRA findings and recommendations in following chapters.*
- *In Chapter 2, FRA addresses labor concerns.*
- *In Chapters 3-4, FRA addresses significant general issues related to train dispatcher performance.*
- *In Chapter 5, FRA summarizes the report with discussion of specific conclusions and recommendations.*
- *Appendix 1 provides an overall historical perspective.*
- *Appendix 2 is the ATDD's proposed basic training standards outline.*

FRA Involvement with Train Dispatchers

FRA has long recognized the vital role of the train dispatcher in safe railroad operations. A detailed discussion of train dispatcher functions and responsibilities is included elsewhere in this report.

National Train Dispatcher Assessment of 1987-88: In 1987, FRA deviated from the traditional single railroad system safety assessment concept to a "focused" effort: The nationwide study of train dispatching processes. FRA chose to initiate this assessment due to rapid changes in train dispatching practices, such as:

- *Introduction of new technology which resulted in changes in train control methods. This included computer-assisted train dispatching (CAD) and communications capabilities.*

- *Changes in operating rules and methods of traditional train operations. This included the widespread transmission of train movement authorities via radio in lieu of traditional written train orders.*

- *Mergers, consolidations, line sales and other economic factors netted consolidations of train dispatching offices and, in many instances, an expansion of geographic territorial responsibilities for existing dispatcher positions.*

- *Concerns that excessive work loads and increased occupational stress on train dispatchers could result from the above-mentioned factors.*

FRA published the results of the national assessment in 1990 and provided Congress a corollary report on train dispatcher training. In the national dispatcher's assessment report after the 1987-88 effort, FRA concluded the following:

Summary of Findings: 1987-88

Staffing

The assessment disclosed that staffing inadequacies existed on several railroads. An insufficient number of employees assigned to offices leads to several problems:

- *A shortage of relief employees results in dispatchers working on their normal rest days. While this may not be of concern in a short-term situation, FRA believes problems can result if this situation continues.*

- *In some instances, railroads were so understaffed that employees were required to work for periods in excess of that permitted by the Hours of Service Act.*

- *Initial and periodic training can suffer from staff shortages. Due to the insufficient number of relief employees, dispatchers at some offices were not permitted to make familiarization trips over the railroad.*

Communications

Congestion of radio frequencies was a concern in many areas of the country. This was particularly true at locations where major railroad terminals were located. Sources of this congestion include employees of foreign railroads in joint operating territory and nonessential transmissions by

a variety of employees. In addition, it was noted that inadequate radio equipment was in use on several railroads.

Finally, FRA determined that on numerous occasions train dispatchers did not comply with required radio standards and procedures. These deficiencies included transmissions of mandatory directives in accordance with Federal requirements.

Training

There was a noticeable pattern of inconsistency. The length and depth of initial training provided to dispatchers varied widely. Major variations were noted even among different dispatching offices on the same railroad. During the 1987-88 assessment, FRA noted:

- *There were inconsistencies among railroads, and among different dispatching offices of the same railroads, regarding initial and periodic operating rules instruction.*

- *FRA noted major differences regarding training on dispatcher control and communications systems, technical and administrative procedures, and physical characteristics. At some offices training was exclusively on-the-job, even though new technology control and communications systems were in place.*

- *Policies concerning familiarization trips varied widely. Such trips should be a component of both initial training and periodic retraining. The number and frequency of such trips was insufficient on some carriers.*

While there was no evidence that accidents had resulted from inadequate training, poor training could impact train dispatcher efficiency and productivity. Failure to provide adequate training of this type could also contribute to stress, fatigue, and work overload.

Operational Testing

A prime area of concern noted during the assessment was that the required program of operational tests and inspections was seriously inadequate on most railroads. The purpose, as stated in 49 CFR Part 217, is that this program be a primary tool for determining dispatcher knowledge of and compliance with the carrier's operating rules and special instructions. It was apparent to FRA that this program was not given the necessary emphasis as it relates to train dispatchers.

Following is a brief synopsis of operational testing conditions noted during the 1987-88 assessment:

- *The programs often did not include all safety critical rules and instructions which pertain to dispatchers.*

- *The level of program activity at certain offices was so minimal as to render the program meaningless.*

- *Changes in operating rules and the application of new technology have not been incorporated into all testing programs.*

- *Low failure rates at some offices were questionable. FRA observation of operations at these offices often produced failure rates which were appreciably higher than those recorded by carrier officers.*

Operating Rules and Procedures

FRA noted a general lack of consistency in railroad rule applications from location to location. FRA noted that local adaptations to railroad operating rules and procedures were made for purposes of expediency without the knowledge or consent of central system rules authorities.

Occupational Stress, Work Load, and Environment

It was apparent that most railroads are providing better working environments for train dispatchers. There were also some indications the railroads are attempting to adjust workloads to reasonable levels. FRA noted some inadequacies in these areas in 1987-88 however. Following are examples:

- *High noise levels were noted at several dispatchers offices. Sustained high levels of noise are generally accepted as negatively impacting employee performance. At some offices, the noise could be mitigated by sound absorbing partitions. At other locations, the source of the noise was obsolete broadcast type loud speakers.*

- *At some locations multiple dispatchers work within a single room. This environment can create distractions unless the room is properly designed and acceptable levels of decorum are required from employees.*

- *Not all offices were secure against entry by unauthorized persons. FRA Inspectors noted occasions when unauthorized persons were in dispatchers offices and served as a source of disruption or distraction.*

- *At offices noted, some dispatchers appeared to be working at or near the limits of their abilities due to a heavy work load. Most offices had no formal and uniform method to measure, analyze and equalize workload.*

- *At several locations, the devices used to block track sections were ineffective, compromising safety.*

- *Several offices either lacked recall systems or used systems which did not adequately identify locations of on-track movement in voice control territory.*

- *Many railroads have not adopted or have not fully implemented the latest technology available for voice controlled block systems.*

Software

With the adoption of CAD systems, the role of software integration and conflict checking is critical. FRA noted that some railroads rely on less formal software verification procedures than others. FRA believes formal software verification is essential.

Review: FRA Dispatcher Related Work Prior to 1987-88: In 1971, FRA commissioned the Transportation Systems Center (TSC) to analyze the responsibilities of the railroad train dispatcher. The subsequent report, entitled "***An Analysis of the Job of Railroad Train Dispatcher***," was published in 1974. The report summarized:

> *"....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 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 stress and tension identified as aspects of the dispatcher's job at least forty years ago are not notably lessened today...."*

FRA commissioned TSC to prepare a second report in 1975. That report, entitled "***Proposed Qualification Standards for Selected Railroad Jobs***," included information pertaining to train dispatchers. The report detailed both the minimum knowledge requirements and minimum performance requirements for train dispatchers. It summarized the job of train dispatcher as follows:

> *"... responsible for the safe movement of trains within the defined area of a railroad's operating territory. In this capacity the dispatcher plans operations, coordinates the movement of trains and manages the contingencies as they arise.*
>
> *To accomplish these tasks, the train dispatcher must be familiar with the organization of the railroad, the types of equipment employed in terms of locomotives and rolling stock, the territory over which the railroad operates, train control operations including the maintenance of records, and the railroad's rules and regulations. In the planning of operations, the dispatcher obtains information from superiors, the previous dispatcher on duty and other informational sources on the condition of trains, tracks, and the weather. Routing and scheduling decisions are made to move the traffic in the most expeditious manner."*

Today, 23 years after FRA commissioned the first study, a train dispatcher's duties remain basically the same even though the dispatcher's "tools" have changed considerably. What was state-of-the-art technology in the 1970's is now, on most major railroads, superseded by computer-dependent traffic control systems--computer systems which use operating rules logic to help regulate the issuance of mandatory directives, route traffic, and provide conflict checking capabilities. Additionally, communication systems have been upgraded and now provide the capability to route, store, and prioritize incoming radio and telephone calls to the dispatcher.

The Current Review

In 1993, FRA initiated a followup review to the 1987-88 national assessment in response to Section 17 of the Rail Safety Enforcement and Review Act of 1992. This mandate required "...the Secretary...to transmit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Energy and Commerce of the House of Representatives, a report concerning any action that has been taken by the Secretary and the railroad industry to rectify any continuing problems associated with unsatisfactory work place environments in certain train dispatching offices identified in the National Train

Dispatcher Safety Assessment for 1987-88, published by the Federal Railroad Administration in July 1990. The report shall include recommendations for legislative or regulatory action to ameliorate any such problems that affect safety in train operations." During the assessment, FRA developed information regarding the following subjects:

- *Staffing: Evaluation of the staffing capacities and practices of each railroad included in the assessment, and evaluation of the workload assigned to dispatchers.*

- *Communications: The number and types of communication devices monitored by the dispatcher and any new technology employed by the railroads.*

- *Training: Initial and periodic training, including classroom and/or on-the-job (OJT) training, training and testing on the railroad's operating rules and instructions, and training on the physical characteristics of the railroad.*

- *Operational Testing/Operating Rules: The number of operational tests and inspections conducted on train dispatchers by each railroad. This included the number of failures recorded for each office.*

- *Occupational Stress and Work Load: Review of dispatcher hours of service records and records of train movements.*

- *Environment: Examine the physical working environment of train dispatchers, to include potential distractions.*

- *Software: Observation of operating procedures to determine if railroad protection of employees and equipment and CAD software verifications are adequate (i.e., rule matrix conflict checking capabilities).*

In addition, FRA inspectors determined compliance with Federal regulations and recordkeeping requirements. The operating practices of each railroad were evaluated by determining what rules and procedures were in effect, and by monitoring train dispatchers and other railroad employees who interact with them.

Technological Advances: The railroad industry continues to make progress in the application of new technologies in train dispatching and communications. The application of new technologies is a continuous process and during review of the data submitted by FRA's field inspection staff since the 1987-88 study, it became apparent the changing technology would require modifications in the techniques used by FRA during any future train dispatcher assessment activity. As a result, when FRA prepared the inspection plan for this project, it was decided to

include staff experts in the specialties of signal, communication, and computer systems in the field work as well as the evaluation of the assessment. The procedures employed by FRA during this particular assignment resulted in the accumulation of a significant amount of valuable information.

Train Dispatcher Field Inspection Schedule

RAILROAD	OFFICE LOCATION	INSPECTION DATE (1993)
C S X TRANSPORTATION	JACKSONVILLE	Apr 26-30
FLORIDA EAST COAST	ST AUGUSTINE	"
UNION PACIFIC	OMAHA	May 10-14
CHICAGO AND NORTH WESTERN	CHICAGO	"
SOUTH SHORE (NICTD)	MICHIGAN CITY	"
LONG ISLAND	JAMAICA	May 24-28
SOUTHERN PACIFIC	ROSEVILLE	"
CONRAIL	MT LAUREL	June 7-11
BURLINGTON NORTHERN	SEATTLE	"
AMTRAK	PHILADELPHIA	June 14-18
NORFOLK SOUTHERN	BLUEFIELD	June 21-25
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY	PHILADELPHIA	June 28-Jul 2
GUILFORD TRANSPORTATION	NORTH BILLERICA	July 12-16
ILLINOIS CENTRAL	HOMEWOOD	"
KANSAS CITY SOUTHERN	SHREVEPORT	Aug 2-6
WISCONSIN CENTRAL	STEVENS POINT	"
CP RAIL	MILWAUKEE	Aug 23-27
GRAND TRUNK WESTERN	PONTIAC	"
BURLINGTON NORTHERN	FORT WORTH	Sep 13-17
SANTA FE	SCHAUMBURG	Sep 27-Oct 1

CHAPTER 2

LABOR CONCERNS

No discussion of the functions and responsibilities of the train dispatcher can be complete without due consideration of the role labor organizations and the collective bargaining process play in the process. About 75 to 80 percent of railroad employees are members of the various railway labor organizations. For collective bargaining purposes, these organizations are generally divided into two categories, operating and nonoperating.

Operating unions represent those employees who are engaged in the actual physical movement of trains and cars (e.g., engineers, conductors, trainmen, hostlers). Nonoperating unions represent all other employees. This includes workers engaged in clerical, construction, maintenance activities, workers who operate and/or maintain the general railroad plant including signal and communications systems, and workers who operate yards and stations.

Train dispatchers fall within the category of nonoperating employees. On railroad properties where dispatchers are represented by a collective bargaining organization, it is almost invariably the ATDD. Since the mid-1980's, several major railroads have elected to promote train dispatchers to exempt, nonunion positions.

Although the wage movements of the train dispatchers craft have closely paralleled the operating crafts, working rules covering these employees are more similar to other industrial workers than they are to the operating crafts. Train dispatchers are less immediately affected by cyclical traffic fluctuations. Craft lines between dispatchers and groups such as yardmasters and clerks have been relatively straightforward. Competition for membership has not significantly strained interorganizational relationships.

Impact of Working Rules: Historically, work rules in the railroad industry evolved for the same general reasons which caused the development of working rules in other heavy industries: To protect employees from unfair and unrestricted managerial discretion; to equitably allot limited opportunities for work; and to protect employees against the financial impact of technology. (*Kaufman, 1952*)

Early work rules were often simply verbal instructions from management. With the growth of the industry, the rules were published and posted for clarity and uniformity. When the rules became more numerous and complex, railroads adopted and issued books to promote consistency. As railroad labor organizations

assumed greater prominence, these work rules became subject to the collective bargaining process. This process resulted in numerous collective bargaining agreements in effect on each railroad property and at various levels of organization within each railroad (e.g., regional and/or divisional). In many instances the agreements have been complicated by awards and findings of public law boards and other government panels, commissions and agencies.

For many years, the railroad industry endeavored to improve engineering, mechanical, and operational procedures to enhance safety, reduce costs, and obtain competitive advantage over rival companies. One result has been a persistent long-term trend toward reduced railroad employment. This has had a profound impact on train dispatchers. For example, in the mid-1980's many railroads adopted computerized data processing to streamline office work. This technology grew and was subsequently applied to train control functions. The development of automated traffic control has enabled some railroads to extend the limits of train dispatching districts while reducing the number of employees necessary to operate a dispatching office. Technology has also enabled the consolidation of multiple divisional train dispatching field offices. And improved communications and control equipment have radically reduced the need for wayside block and interlocking stations and train order offices.

Revised labor agreements, together with improved planning and scheduling, including use of database predictors, have enabled railroads to reduce the number of classification points and major terminals necessary to meet service requirements. In many cases traffic handled at these points has been reduced to "run through" service or local industry and switching service. Although such service yards remain necessary from an operational standpoint, the level of traffic may not be sufficient to warrant support personnel at the yard. These cutbacks have had a significant impact on traditional craft lines, labor agreements, and dispatcher workload.

Current Involvement: FRA has benefited from the input of the ATDD throughout this project. As stated, each team leader met with representatives of the ATDD (where appropriate) during each site visit. FRA headquarters staff also met with an ATDD vice president after conclusion of the field work to discuss findings of the followup review and solicit ATDD input on findings and recommendations. A summary of ATDD concerns is provided below.

> *Staffing*: ATDD believes train dispatcher staffing must be sufficient to provide enough qualified employees to enable dispatchers to take regular days off as well as to provide opportunities for participation in field familiarization and other corollary activities (e.g., rules training).

Communications: Train dispatchers told FRA inspectors during the assessment that many positive changes have taken place since the 1987-88 assessment. ATDD officials told FRA that they anticipate continuing improvements, especially with the advent of data communications capabilities. However, ATDD believes communication problems remain that need resolution to enhance the ability of the train dispatcher to contribute to safe, efficient train operations. Specifically, ATDD is concerned with the interference automatic talking detectors have on dispatcher communications; on the lack of radio discipline by employees using the dispatcher frequency to conduct business unrelated to train dispatching; and the lack of privacy train dispatchers have in some offices (i.e., ATDD believes each dispatcher should have a separate office for respective workstations).

Training: ATDD, like FRA, is concerned with the lack of train dispatcher training standardization for initial hires and refresher training for reassigned journeymen dispatchers. ATDD also points out the need for carefully crafted initial training depending upon candidate background and experience (e.g., dispatcher candidate coming from ranks of train order operator requires certain training while a candidate coming from other than the traditional operator pool will require a much different approach).

ATDD also expressed concern over a lack of consistency in train dispatcher "road days" (i.e., territorial familiarization). ATDD believes it is essential that train dispatchers have scheduled opportunities to review their assigned dispatching districts. ATDD recommends that such trips be conducted in the field either from a highway-rail (hi-rail)[6] vehicle or from a moving train. ATDD would like to be involved in evaluating any proposed alternative methods to accomplish this goal.

The ATDD expressed strong support for the use of simulators in dispatcher training--both initial and recurring training. In addition, ATDD recommended that dispatchers who have been away from dispatching for one or more years should be required to go through a retraining period.

Operational Tests and Inspections: While not specifically addressed in formal remarks, ATDD representatives relayed to FRA inspectors during the review that they recognize the

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[6] *A "hi-rail" vehicle is a rubber-tired motor vehicle equipped with retractable flanged wheel sets capable of being lowered and operated on the rails. In general, hi-rail vehicles are assigned to railroad engineering departments.*

importance of operational tests and have pride in their ability to properly respond. However, some dispatchers expressed dissatisfaction with testing programs that provide no feedback unless the test is a failure. Programs would be better served if train dispatchers were notified after a test has been conducted since positive feedback is equally important.

Operating Rules and Procedures: ATDD officials believe that train dispatchers will benefit through more standardized, consistent operating rules. In addition, an ATDD representative related that he supported the effort to rewrite operating rules in "plain English." The ATDD did offer two specific recommendations in this area:

1. *ATDD expressed concern that, in some territories (particularly heavy commuter lines), rail employees do not have one complete listing of all scheduled trains. Instead, employees must procure a public timetable for this information. This cumbersome process leads to confusion and could be rectified if each employee had one employee timetable which listed all scheduled trains.*

2. *ATDD believes that railroad accident reports should include operating rules in effect at the time of an accident. This would help determine whether more accidents occur under some operating rules than others.*[7]

Occupational Stress and Work Load: The ATDD recognizes the difficultly in quantifying these issues and is supportive of the FRA research in this area. ATDD does believe that some issues, if properly addressed, can reduce stress (e.g., inadequate training, congested radio frequencies, poor office environments).

Environment: Train dispatchers as a group, expressed satisfaction with many of the environmental enhancements that have been made over the past several years. However, ATDD pointed out a number of issues which continue to detract from overall environmental quality. One is the continuing disruption caused by non-dispatchers who gain access to dispatcher workstation areas. This includes tour groups, technicians, and railroad employees not on official business. The other major concern is related to the first,

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[7] *FRA develops this information on all FRA investigated accidents. For those qualifying accidents not investigated by FRA, railroads still must report on Form FRA F6180.54 the method of operation and cause code for the accident.*

and that is the ATDD believes train dispatchers should be provided individual offices to separate the workstations.

Software: The ATDD recognizes the importance of software reliability. As primary software users, train dispatchers need to be involved in software evaluation, development, and implementation. Some railroads have successfully integrated train dispatcher input into improving software and developing new applications. FRA believes such interaction is essential and commend those in labor and management who foster this team approach.

Other ATDD Issues

1. ***Fitness testing***: The ATDD expressed total opposition to any attempt to design or implement a "fitness for duty" test for train dispatchers. The ATDD had serious misgivings about how such tests would be administered and what criteria would be used to make a decision whether a dispatcher could work on any given day. The ATDD pointed out that train dispatchers are already subjected to alcohol and drug tests, but the parameters for those tests are clear and specific. There is no such guarantee for "fitness" testing.

2. ***Certification***: The ATDD has suggested that Federal certification should be required for train dispatchers. The main reason offered was the lack of consistency in dispatcher training among the various railroads.

CHAPTER 3

TRAIN DISPATCHER RESPONSIBILITIES

Analysis of Responsibilities and Functions

Basic to any assessment of train dispatcher performance is a thorough understanding of the job. One objective of the 1987-88 national assessment was to evaluate and quantify the duties and responsibilities of the train dispatcher. In the simplest of terms, the train dispatcher is responsible for the safe, efficient, and effective utilization of a segment of a railroad, called a dispatching district.

The dispatcher's first responsibility is to provide safely for the movement of all trains over a district, with maximum efficiency, consistent with the railroad's operating rules and practices. Concurrently, the dispatcher must also allow for the maximum utilization of maintenance forces by optimizing the time available for inspection, repair and capital improvement of the railroad track structure and signals. The dispatcher's principal duties include:

- *scheduling the movement of trains to provide for safe meeting and passing with minimum delay;*
- *managing unexpected events and emergency situations to protect the public, railroad employees, and railroad property; and*
- *arranging for the use of track by engineering forces to permit timely maintenance and renewal while minimizing train delay and providing protection for such operations.*

The dispatcher must maintain detailed and accurate records of the activity which he/she authorizes. This includes the train dispatchers record of train movements, mandatory directives for the occupancy or obstruction of track, directives for the movement of trains not otherwise authorized by the operating rules, and orders restricting the movement of trains. Individual railroads often require additional activities which need documentation as well, such as locomotive fleet management information.

Impact of Federal Regulations on Train Dispatcher Duties

Specific Federal regulations govern some aspects of the a train dispatcher's activities. These include 49 CFR Parts:

- *217-Railroad Operating Rules*

- *218-Railroad Operating Practices*
- *219-Control of Drug and Alcohol Use*
- *220 Radio Standards and Procedures*
- *221-Rear End Marking Device*
- *228-Hours of Service*

In addition, the dispatcher must have a limited knowledge of 49 CFR §236 (signal regulations); 49 CFR §215 (freight car safety standards); 49 CFR §231 (safety appliance regulations); 49 CFR §232 (power brake regulations); and, 49 CFR §240 (certification of locomotive engineers). The requirements imposed by these regulations establish specific obligations for train dispatchers as follows:

- ***49 CFR §217*** imposes requirements on railroads to develop programs for the training and testing of employees whose activities are governed by their operating rules. This operating rules training is required for dispatchers because a detailed knowledge of all essential elements of the operating rules is central to the train dispatchers performance. The operational testing of dispatchers is required because the performance of the dispatcher is also a central factor in determining the overall level of compliance with the operating rules.

- ***49 CFR §218*** includes the requirements of the Blue Signal Regulations. Where train dispatchers are required to provide protection for workmen on other than main tracks, the regulation provides specific task requirements (e.g., application of effective blocking devices) and specific recordkeeping requirements. Additional requirements include yard limits, flag protection of trains and locomotives, protection of occupied camp cars, and prohibitions against tampering with locomotive safety devices.

- ***49 CFR §219*** imposes pre-employment alcohol and drug testing requirements and mandatory post-accident testing where the dispatcher is directly and contemporaneously involved. The regulation also authorizes reasonable testing for specific qualifying events. This part also subjects train dispatchers and the crews they supervise to random drug testing.

- ***49 CFR §220*** imposes specific training requirements for employees who are authorized to use a radio in connection with railroad operations. It prescribes specific procedures for radio usage, and prohibits the use of the radio to circumvent a signal system. It also specifies procedures

for writing, transmitting and receiving train orders which are conveyed by radio.

- *49 CFR §221* imposes performance standards for rear end markers on trains when display is required. The regulation indirectly prohibits the dispatcher from authorizing a train to enter a main track without an effective marker when display is required. It also establishes repair or replacement requirements, which must be factored into the dispatchers planning when the device becomes defective en route.

- *49 CFR §228* prescribes specific recordkeeping requirements for employees who perform train dispatcher job functions. These include the hours of duty record for the employee, and the train dispatcher's record of train movements which includes a comprehensive chronicle of events for the dispatching district. On most railroads, the train dispatcher is also the designated individual assigned to monitor train and engine crews' time on duty while on line of road. The dispatcher must monitor the remaining time and participate with office management in determining the disposition of the train crew and the location of the crew change when necessary.

The train dispatcher must have a basic understanding of Federal equipment regulations in order to interpret and respond to reports and inquiries from crews. For example, a train crew contacts the dispatcher to report the absence of a sill step and handhold on a freight car which is about to be picked up en route. A dispatcher must be aware that this movement can only be made if repairs of the character required cannot be made at this point. The dispatcher must then make the proper decision on proper handling of the car to a point where repairs can be made.

Similarly, the dispatcher must have a fundamental knowledge of the requirements of the signal and train control regulations, particularly where cab signal operation is involved. Should the cab signal fail en route, the dispatcher must evaluate the situation and determine restrictions to be imposed.

The train dispatcher must also have a basic understanding of the requirements outlined in the regulations governing railroad certification of locomotive engineers. For example, the dispatcher must know how to respond to a foreign line engineer in need of an engineer pilot to guide a train movement.

Contacts

The train dispatcher's work environment requires an extensive range of contacts with various employees, contractors, railroad officials, and, on occasion, public authorities. The interpersonal relationships employed by the train dispatcher exist in essentially four tiers:

Tier 1: The dispatcher must accept, implement, and enforce managerial policies and priorities as directed by the supervisor. The dispatcher also receives instructions and priorities from the supervision of nonoperating departments. The dispatcher considers these orders and instructions and then accepts, rejects, negotiates or appeals these demands based upon his/her projections of their impact on the safety and efficiency of train operations in his/her assigned territory.

Tier 2: The dispatcher also deals with employees who require specific direction, and who have a duty to adhere to those directions. This group of employees includes train directors, block operators, train and engine crews, and maintenance-of-way personnel.

Tier 3: The third group of contacts for the train dispatcher include those employees over whom the dispatcher has no direct authority and responsibility, but with whom the dispatcher must negotiate and plan in order for the dispatching district to function as an integrated whole. These employees include yardmasters, power dispatchers, power directors, and mechanical department personnel.

Tier 4: The final group involves personnel who need information from the dispatcher for reporting and planning purposes, including clerical personnel; crew management and information systems personnel; employees of other railroads; and local emergency response organizations.

Direct Control Functions

The duties and responsibilities discussed above might well be described as "traditional" functions, duties common to nearly all train dispatchers. They have historically formed the framework of the dispatcher's position. However, gradual technical evolution during the 20th Century, combined with a trend toward centralization, have added many new responsibilities to the job. A great number of dispatchers across the nation are now assigned the responsibility of operating traffic control devices necessary to command signal systems. While the interlocking features of the vital circuitry significantly diminish the probability of

dispatcher error leading to conflicting authorities, the system does not relieve or diminish the degree of vigilance required by the dispatcher to prevent train delay or to eliminate the confusion inherent in the rerouting of trains.

Many train dispatchers are also responsible for monitoring hazard detection devices. These devices typically include overheated journal detectors, dragging equipment detectors, loose/broken wheel, thin flange, excessive dimension, and slide fence detectors. Proper notification of affected employees must be made when alarms are activated, and the dispatcher must follow up to ensure proper inspections/corrections are made before permitting the train to proceed. The range of responsibility and depth of dispatcher involvement in these duties are generally a function of the age and design of the equipment. Some designs utilize graphic printers which must be reviewed by the dispatcher and interpreted as the tape is produced. Other systems employ internal alarms which respond to readings which lie outside of preestablished norms. Still other systems communicate directly with train crews.

The response required from the dispatcher in dealing with the detectors also varies with the equipment. Some systems automatically set the next absolute signal in advance of the train to stop. Other systems require that the dispatcher hold the next absolute signal at stop until the detector readout is examined. Automatic wayside detectors with verbal radio transmission capability notify the crew directly but do not necessarily notify trains on adjacent tracks of the potentially unsafe condition.

Communications

The train dispatcher is responsible for the effective management of the available communications network. These systems usually consist of dedicated company telephone lines which may include continuously monitored open circuits; selector specific automatic telephones; one or more commercial telephone lines; and one or more radio transceivers which broadcast over one or more radio channels. While some of the more technically advanced offices integrate communications equipment into a consolidated system, the practice is far from standard.

Although the proper priority and sequence for responding to communications inputs generally follow the order in which the inputs are received, a burst of simultaneous activity may require the dispatcher to evaluate the probable nature of the calls based upon both experience and the traffic situation at hand.

Administrative Duties of Train Dispatchers

Some railroads have elected to shift "clerical and administrative duties," formerly accomplished by clerks, to the train dispatcher. While FRA did not observe any trends or patterns in this direction either in the 1987-88 national assessment or during this followup review, our inspectors did find that, on some railroads, the level and priority of the administrative duties was sufficient cause for concern. In general, dispatchers on some railroads still must take time from train management duties to call for crew taxis, fuel trucks, signal maintainers, etc. In addition, some dispatchers update operational information in desk publications, complete written reports, etc.

CHAPTER 4

TRAIN DISPATCHER PERFORMANCE CRITERIA

Staffing

Historically, the railroad train dispatcher's office was closely associated with railroad operating divisions. Offices were usually located at respective division headquarters. Since the national assessment, the situation has changed on most major railroads: Centralized system or regional control centers are now the norm.

Likewise, the organizational structure of operating divisions and dispatching offices have been modified to coincide with technological advances and changes in the operational structures of railroads. Mergers and marketing strategies have contributed to recent decisions to substantially increase the size and responsibilities of operating divisions. The divisional managers or superintendents may report to regional managers or directly to senior system level officers.

The concept of dispatching centers removed from direct control of operating divisions notably changes the traditional relationship of superintendents and dispatchers. Although overall management of a division is still the responsibility of the division manager or superintendent, the main tracks are directly controlled by train dispatchers. The concept thus requires that the organizational structure of the railroad be redefined. Although dispatchers at centralized centers have been removed from divisional oversight, there remain some basic organizational philosophies that have not changed. For example, train dispatchers normally still report to a chief dispatcher and there are typically assistant chief dispatchers in the reporting chain.[8] With the advent of centralized control centers, there are several chief dispatchers assigned, and they often report to a high level dispatching center officer while maintaining a "dotted line" reporting responsibility to the respective division superintendent, who may be located hundreds or thousands of miles from the center.

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[8] *Many years ago, railroads determined that a position was needed to "bridge the gap" between the train dispatcher and the chief dispatcher. This led to establishment of assistant chief dispatcher positions. Most railroads continue to use assistant chief dispatchers to perform a substantial portion of the supervisory and administrative duties inherent in train dispatching work.*

The Hours of Service Act: The Hours of Service Act, Title 45 United States Code Section 61-64b, limits the number of duty hours for certain employees engaged in or connected with the movement of trains. Section 3(a) of the law states:
"No operator, train dispatcher, or other employee who by use of the telegraph, telephone, radio, or any other electrical or mechanical device dispatches, reports, transmits, receives or delivers orders pertaining to or affecting train movements--

> (1) shall be required or permitted to be or remain on duty for more than nine hours, whether consecutive or in the aggregate, in any twenty-four-hour period in any tower, office, station, or place where two or more shifts are employed; and
>
> (2) shall be required or permitted to be or remain on duty for more than twelve hours, whether consecutive or in the aggregate, in any twenty-four-hour period in any tower, office, station, or place where only one shift is employed."

Although the term "shift" is not defined by the law, the legislative history of the 1969 amendments indicates that it means a tour of duty constituting a day's work for one or more employee(s) who are scheduled to begin and end work at the same time. This principle, with examples, is included in 49 CFR §228, as a portion of ***Appendix A-Requirements of the Hours of Service Act: Statement of Agency Policy and Interpretation.*** Since almost all dispatching offices employ two or more shifts, train dispatchers can work no more than nine hours in any 24-hour period except during qualified emergencies. Instances of service in excess of the statutory periods are referred to by FRA as excess service. Railroads are required to report each instance of excess service to FRA.

Communications

Historically, railroads depended on hand printed or typed orders to convey important information to employees engaged in the movement of trains. Train order operators copied train orders transmitted by train dispatchers over land lines and then hand delivered the completed orders to the engineers and conductors of affected trains. The initial mode of such transmissions was by telegraph, followed by dedicated railroad-owned telephone lines (dispatcher lines) which linked the dispatchers with the various block operators. To complement this system, wayside telephones were installed so that train crews could communicate with dispatchers and operators in the event of accidents and other unexpected circumstances.

As in 1987-88, FRA found diverse communications systems in use by dispatchers. Most dispatchers were responsible for several different technologies at each work station, including: Radios, telephones, mobile and cellular devices, wayside detector reporting, facsimile machines, computer links for delivery of mandatory directives at remote locations, and transmission of coded signal information and data transmission systems for storage of information.

Radio Communications: The utilization of two-way radio communications was a significant technological advancement for railroads that began in the 1950's. Radios provided a means of reliable communication between the dispatcher and crews and enabled the elimination of thousands of wayside dispatcher telephones.

When railroads began utilizing radio systems, operating divisions were generally much smaller than they are today. Train dispatching districts were also smaller and the dispatching offices located more closely to each other. There were usually several train order and interlocking operators located along any given route. Although a railroad might have a few remote radio base stations linked to a train dispatching office, the number of remote base stations did not provide complete radio coverage.

During the early era, radios limited to two-channel capability were installed on locomotives. Normally, one channel was utilized for line of road communications with operators and dispatchers, while the other was used for yard switching operations. About 1970, railroads began installing four or eight channel radios on locomotives. The industry also began purchasing portable radios for use by conductors, trainmen, and maintenance employees. For the past several years, the recommended standard of the AAR has been to equip new locomotives with 97 channel radios. Many railroads have underway a comprehensive program of replacing older radio hardware installed on existing locomotives.

During the 1987-88 assessment, FRA determined that some railroads were investing heavily in the complete upgrading of their radio communications systems, but that the upgrading was only partially accomplished. To compound the problem, mergers resulted in many railroads having relatively incompatible radio systems throughout locomotive fleets. This led to varying degrees of unreliability and ineffectiveness. During the 1993 review, FRA noted that radio systems had been upgraded at considerable expense to the industry, resulting in correction of many of these problematic conditions.

As noted during the earlier assessment, although all dispatching offices were not equipped with current technology systems, there

were common elements that modern train dispatching communications networks generally contain:

- *Numerous wayside base radio stations linked to the dispatching console.*
- *Company and public access telephone lines.*
- *Data communication interface links to convert software driven command inputs into electric impulses for signal and switch control.*
- *Links to remote printers and/or data facsimile machines.*
- *Direct voice communication lines with other essential carrier personnel, particularly with those frequently contacted.*

The more elaborate systems consist of a computer-interfaced voice communications console. This type of system routes incoming calls from any source, displays the source on the dispatcher's cathode ray tube (CRT) in sequential order, and deletes the calls from the screen after the dispatcher has completed the conversation. These systems eliminate the need for a dispatcher to monitor several lines simultaneously.

During the 1993 review, it was apparent to FRA that many of the radio-related problems noted earlier had been corrected and that several railroads had installed new systems which integrated most of the criteria suggested above. However, as discussed elsewhere in this report, some radio-related problems remain in both hardware application and human interface with that hardware (i.e., proper utilization in accordance with rules and regulations).

Data Communications: FRA believes that future communications between train dispatchers and crewmembers on board moving trains will eventually evolve to data communications rather than voice communications. This concept is already in use in some applications in the railroad industry. For example, most CAD systems work with no direct electrical connections between the visual display and field circuits. Data to and from the computer hardware and software systems, including display screens or boards, connects through interface devices with the track, switch, and signalling circuitry. The corresponding visual images presented to dispatchers are greatly expanded and enhanced, and now include full route displays using different colors for each condition which exists. These conditions include the route selected for a particular movement, position of switches, signal indications, and actual track section occupancy by trains and on-track equipment.

There are also interfaces with the main frame computer systems, which provide the capability of uploading or downloading information to and from the various corporate databases. The dispatcher now has the ability to easily obtain information necessary for the efficient operation of the railroad. Further, since much of the planning required of the dispatcher is mathematical in nature, computer assisted systems blend well with the dispatching environment. Locomotive capabilities, train and siding lengths, duty periods of train crews, and many other factors which enter into the dispatcher's planning can now be calculated by the computer.

FRA supports the move toward data communications as a means to reduce potential human "hearback-readback" errors which have contributed to several fatal collisions over the past several years.

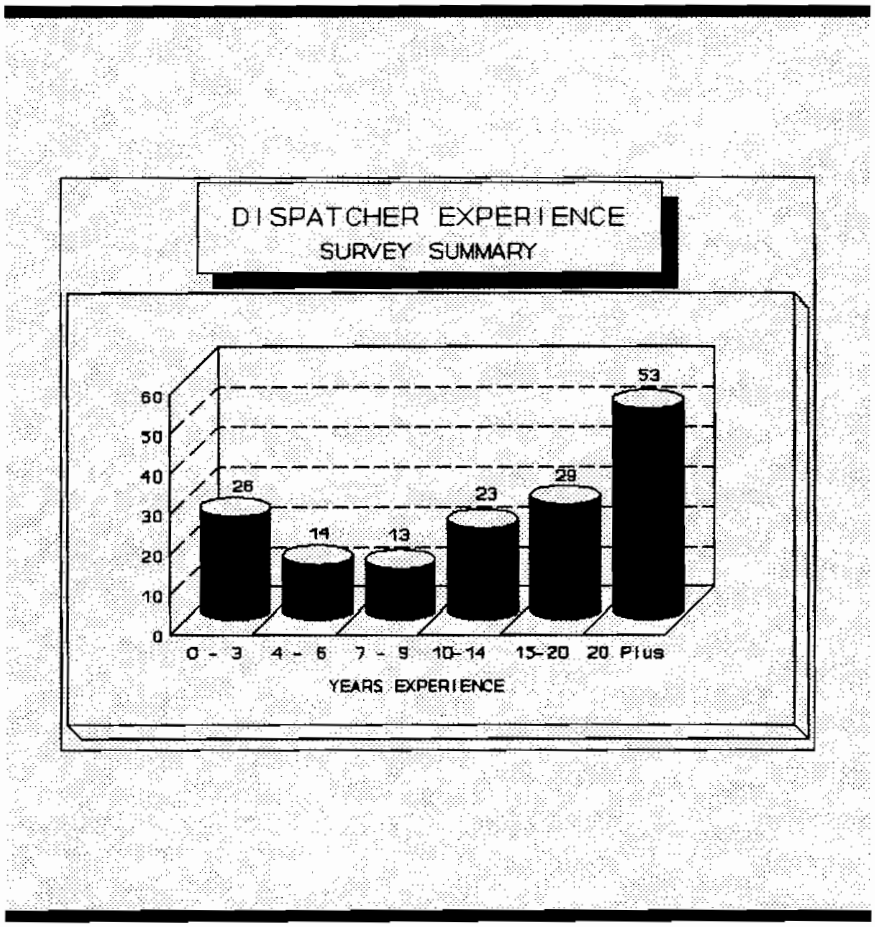
Advanced Train Control Systems: Currently the AAR and the Canadian Railway Association are involved in a joint venture to develop Advanced Train Control System (ATCS) technology. These new generation systems involve train and wayside devices and include elaborate error protection and detection capabilities. ATCS systems include several "levels" of technology. The higher levels are programmed with the capability to stop on-track equipment operations (i.e., "positive train separation") when such operations are not conducted in accordance with all applicable rules and movement restrictions. FRA has been involved in evaluation of ATCS systems as part of the national communications safety inquiry and, as previously stated, provided a Report to Congress on this and corollary issues in July 1994.

Training

FRA found that dispatcher training remains a "mixed bag." Some railroads, including the Burlington Northern, CSX Transportation, Union Pacific, and the Atchison, Topeka and Santa Fe, among others, have allocated considerable resources to providing initial dispatcher training. Other railroads have less formal and developed programs for new dispatchers.

During the 1987-88 assessment, FRA noted that the dispatcher workforce was experienced with 65 percent indicating 10 or more years of dispatching background. Those indicating 20 or more years were in the largest group and comprised 25 percent of the total. At the opposite end of the spectrum, those with less than one year through three years of experience made up 12 percent of the total. The smallest group, 6 percent, had between four and six years train dispatching experience.

During the 1993 review, FRA noted that the dispatcher workforce was still dominated by experienced employees. For example, about 66 percent of the train dispatchers interviewed indicated they had over 10 years of dispatching background and about 34 percent more than 20 years experience. At the opposite end of the spectrum, those with less than three years of experience made up 16 percent of the total. While the FRA sample during the 1993 review was considerably smaller than that national assessment in 1987-88, the trends seem to follow logic: As the dispatcher workforce continues to age, there are increased numbers of less experienced people filling the vacancies.



New technology, consolidations, mergers and abandonments have altered the scene considerably. As alluded to in the general staffing discussion above, railroads are experiencing varying levels of difficulty finding suitable replacement candidates to fill vacancies.

With the advent of CAD and other technological advancements, a need to reassess the methods used to instruct dispatchers has arisen. Railroads have had to reassess the depth of training required for dispatcher positions due to an increase in the sophistication of the technology employed and decrease in the number of employees with experience as operators. As mentioned, the traditional pool for train dispatchers has been train order operators since they perform safety critical duties similar to or in consort with train dispatchers and develop relevant corollary knowledge and skills. When railroad employees without operator experience are selected as dispatcher trainees, training programs must compensate for the lack of specific knowledge and skills. In recent years, in a few instances, some railroads have selected

candidates without prior railroad experience for train dispatcher training. These candidates do not ordinarily understand the fundamentals of the industry nor do they have any knowledge of railroad operating or safety rules and practices. Initial train dispatcher training for such candidates must necessarily be designed differently than for a candidate coming from the operators position.

During the 1987-88 project, FRA noted that available accident data disclosed no statistically significant pattern of accidents caused by inadequately trained or inexperienced dispatchers. Most dispatcher-caused accidents were due to other issues, such as human miscommunication, or failure to properly apply operating rules leading to conflicts between trains or maintenance equipment. In the years since the national assessment, FRA is aware of at least one accident where training on a derivative CAD option (computerized track warrant control) was raised as a factor by the National Transportation Safety Board in their report on a fatal head-on collision.[9] FRA's investigation of that accident revealed factors other than training were key to the cause (i.e., human "hearback-readback" miscommunication of a movement authority between the dispatcher and train crew). FRA concurs that the involved dispatcher's unfamiliarity with the CAD features may have been a distraction to overall dispatcher duties. However, listening for correct readback of a movement authority is a fundamental requisite of train dispatching observed in the industry for many years. In this instance, FRA believes the dispatcher's attention may have been diverted from the task at hand (i.e., listening to the crew's readback of the clearance) due to preoccupation with other tasks. Such preoccupation has been identified as a problem for air traffic controllers as well as train dispatchers, who, instead of listening to a clearance readback to assure accuracy, are

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[9] *A fatal head-on collision occurred involving Burlington Northern freight trains Nos. 602 and 603 near Ledger, Montana, on August 30, 1991. Investigation revealed that the primary cause of the accident was a "hearback-readback" error between the crew on Train No. 603 and the train dispatcher located in BN's Seattle dispatchers office. The dispatcher issued a track warrant via radio to the conductor on Train No. 603 limiting movement authority to "Ledger." The authority limit was misunderstood by the conductor who, during required readback to the dispatcher, misstated his authority limit as "Shelby," some 20 miles beyond Ledger. The dispatcher failed to recognize and correct the readback error. The crew of Train No. 603, believing that they had authority beyond what they actually did, proceeded beyond Ledger precipitating the head-on collision with Train No. 602.* *Report No. NTSB/RAR-93/01 (adopted May 25, 1993)*

distracted with other duties (e.g., planning the next move, etc.). Nevertheless, FRA recognizes the potential risk that improperly trained dispatchers could present to safe and efficient train operations. Absent standardized training guidelines, such potential problems seem more likely in light of rapidly evolving technology and reduction in traditional train dispatcher recruitment pools.

Historically, railroads trained their dispatchers through OJT mixed with varying degrees of classroom instruction. Part of the training invariably included physical characteristics orientation over that portion of the railroad the dispatcher would control. FRA continues to believe that this is still the most beneficial approach, to integrate OJT (including physical characteristics orientation) and classroom training into cohesive and comprehensive programs.

On-the-Job Training: There are many benefits to a structured, measured OJT training program. Working with an experienced dispatcher simultaneously provides the candidate with both knowledge and a limited amount of practical experience. Far from being "theoretical" in nature, the candidate can observe first hand the consequences of dispatcher decisions on train movements. However, there are a number of drawbacks to OJT. For example, it is always situational, i.e., events may not occur which require the application of specific functions of the traffic control equipment, operating rules, special instructions, bulletin notices, timetables or other important job elements. Additionally, any faults or weaknesses the trainer possesses may be acquired by the trainee. The "trainer dispatcher" is usually selected because of accumulated seniority enabling him/her to hold a regular assignment which facilitates scheduling flexibility. Frequently, dispatcher trainers are not provided instructions on methods and means of providing meaningful training. The knowledge, skills, and abilities needed to provide training may not be the same as those required to function successfully as a train dispatcher. At a position with a heavy workload, the trainer may lack the time to provide detailed instruction. Not all railroads provide monetary incentives to trainers. Rules which make the trainer responsible for the errors and omissions of the trainee may also serve as disincentives to OJT. Additionally, it is difficult to assess the progress of a trainee in an OJT training program. Periodic evaluations are seldom provided, and when conducted subjective criteria may be used which may have limited validity. Given these negatives, it is important that other methods of training be used to supplement OJT.

During the followup review, FRA found that when circumstances permit, many railroads continue to initially qualify employees on the least difficult dispatching positions in an office. As candidates become more proficient, they are trained and qualified

on progressively more challenging positions. Where employees work under a collective bargaining agreement, assignments after being qualified are governed by seniority. This often leads to junior employees working the least desirable and most difficult assignments in an office.

Classroom Training: Formal classroom training provides an atmosphere where instruction and training can be conducted without the interruptions which occur during OJT. Training scenarios can be interrupted by the instructor or student at appropriate times, repeated or discussed and dissected for clarification. Students learn the application of the operating rules and practices in a uniform and precise manner. Significant combinations of operating situations can be simulated as can emergencies or unusual occurrences that a trainee might not encounter during OJT, such as emergency procedures. In a classroom setting, specific goals and objectives can be established and formal evaluations can be conducted. The trainee can be provided with formal feedback on the progress.

Simulators: With the advent of advancing technology, the railroad industry has taken advantage of the flexibility that simulators offer in the training of locomotive engineers and train dispatchers. Long utilized in military and commercial aviation, simulators provide excellent hands-on procedural training opportunities.

FRA reexamined the use of simulators during the 1993 followup review and again commends those railroads which have integrated their use in dispatcher training programs. As pointed out in the 1987-88 assessment report, some of the obvious benefits in the use of simulators for dispatcher training include:

- *Simulators permit training challenges (e.g., traffic types/levels) to be arranged in an order of increasing complexity optimizing useful training.*

- *Simulators permit immediate review and assessment of each training experience.*

- *Simulators provide for unlimited repetition of a multitude of dispatching problems to achieve individual understanding and mastery. There is no need to interfere with actual operations.*

- *Simulators permit students to experience uncommon but important events or situations without having to wait for actual occurrence.*

- *Simulators allow flexible scheduling and can be programmed to meet overall training objectives on an individual to individual basis.*

- *There is no jeopardy to individuals or train operations should errors be made.*

- *While not directly related to dispatcher training, simulators can also serve as verification tools for software or hardware before added to CAD systems.*

Minimum Training Levels: In the earlier national assessment report, FRA listed the recommended minimum initial training requirements for train dispatchers from previous research in the field (*Devoe, 1974, pp. 63-66*). As referred to in the Executive Summary, FRA is appreciative of input officers of the ATDD provided regarding their recommended training program elements based upon membership input and experience with select railroad training programs. FRA is aware that many railroad training programs incorporate elements from both the 1974 report and the ATDD guidelines. In FRA's opinion, it is essential that training programs incorporate feedback from their workforce in the design and implementation of training programs.[10]

Periodic Retraining: In order to comply with 49 CFR §217, railroads must periodically reinstruct their employees in the meaning and application of the railroad's operating rules. As was noted during the national assessment, the quality and scope of each retraining program varies from railroad to railroad, but is generally deficient in terms of standardization, consistency, and application. For example, FRA found that some programs provided only for instruction on recent changes to the railroad operating rules, while other programs provided a comprehensive review of all the carrier operating rules. All the dispatching offices examined during the 1993 review had written examinations incorporated into their programs, an improvement over findings documented in 1987-88. FRA confirmed that about 90 percent of dispatchers are instructed either annually or biennially on their railroad operating rules.

Physical Characteristics Training: FRA believes that physical characteristics training/orientation is an important part of the dispatcher training equation. Typically, physical characteristics orientation requires train dispatchers to ride

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[10] *The ATDD has training requirements stipulated in collective bargaining agreements. The requirements vary from railroad to railroad, but generally specify between 60 and 120 days of training. Specific training program requirements are not detailed in these agreements. The agreements are basically intended to ensure that dispatchers who are required to learn new positions or new equipment are given an adequate opportunity to do so. Those railroads who do not have collective bargaining agreements with the ATDD are not bound by these standards.*

trains or hi-rail cars over respective dispatching districts. These trips serve to keep dispatchers current on the physical characteristics on those portions of the railroad over which they dispatch trains. The importance of familiarization trips is increased when consolidations, line changes, or changes in operating methodologies occur. The ATDD has expressed strong concern that train dispatchers are not being provided the opportunity to become familiar with the territory they dispatch. FRA supports the concept of territorial familiarization for the following reasons:

- *Dispatchers can accurately assess the ramifications of operating constraints such as curvature and grade on train movement decisions. They can interface with train and engine crews and maintenance-of-way employees in the field. Likewise, train crews/maintenance-of-way employees benefit from interface with train dispatchers.*

These road trips are intended to expose dispatchers to a view of the physical characteristics of the railroad. FRA found little argument from railroad supervision that such trips are highly desirable. However, several railroads have elected either to eliminate or alter (i.e., through viewing video tapes of selected districts) their policy on physical characteristics orientation. The change in industry approach is due to several factors:

- *Historically train dispatchers were stationed in division offices with relatively compact (e.g., 150-300 miles) dispatcher districts. It was not difficult for dispatchers to literally walk outside the office door and get on a train, ride their territory, and return, sometimes the same day.*

- *With movement to centralized system and regional dispatching centers, the dispatching districts, for the most part, have increased.*[11] *Today, it is not uncommon to find train dispatchers with hundreds of miles of territory that may lie a thousand or more miles from the dispatchers console.*[12]

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[11] *On one railroad, FRA noted one dispatching district comprised over 1200 miles of nonsignalled territory.*

[12] *For example, train dispatchers sitting at consoles in the Atchison, Topeka and Santa Fe Railway Systems Operations Center in Schaumburg, Illinois, control train movements across the Santa Fe system--Illinois to California and points in between. It is the same for CSX Transportation (center in Jacksonville, Florida), Union Pacific (center in Omaha, Nebraska), and all other major railroad dispatching centers.*

Gone is the opportunity for a train dispatcher to "walk out the door" and board a train to ride the territory. Now such activity may require the railroad to transport the dispatcher several thousand miles before even arriving on the territory. Once there, due to the size of the dispatching districts, it may take a week of train riding just to see it all. The benefit of such trips in terms of dispatcher familiarization is doubtful due to the brief exposure and significant distances involved.

- *The problem today is compounded further in offices where dispatchers are represented by labor unions endorsing broad bumping rights within the center (i.e., one dispatcher exercises seniority and bumps to another desk displacing someone of lesser seniority who bumps to another desk, etc.) This "rippling" effect discourages railroads from endorsing field physical characteristics training because the bumping could result in some portion of a center's train dispatchers constantly being on field trips. Railroads have questioned the benefit of such field training given the expense involved.*

While there is no evidence that the lack of physical characteristics training has played a direct role in dispatcher caused train accidents, FRA has long advocated train dispatcher physical characteristics familiarization as a means to enrich the ability of a train dispatcher to efficiently move trains, thereby having an indirect impact on safety. FRA believes overall operational efficiency goes hand in hand with safety. Interfacing train dispatchers with operating and maintenance crews serves as an enhancement to this process.

Operational Tests and Inspections

A train dispatcher, like any skilled occupation, continues the learning process throughout a career. Proficiency and productivity increase over time as a dispatcher gains experience. After a dispatcher is integrated into the office workforce, the railroad management must continue to assure that performance meets established standards. This quality assurance program is accomplished by conducting unannounced operational tests and inspections on train dispatchers.

In November 1974, FRA published final regulations on railroad operating rules (49 CFR Part 217) which mandated, among other things, that railroads periodically instruct certain employees on the meaning and application of the railroad's operating rules, and that railroads periodically conduct operational tests and inspections to determine the extent of employee compliance with operating rules, timetables and special instructions under the

various operating conditions on the railroad. Train dispatchers are included in the group of employees to which this regulation applies. This regulation codified what many railroads had been doing for decades: Conducting "efficiency tests" on employees involved in the various aspects of the railroad operation.

FRA ardently advocates this concept. There is strong indication that quality operational testing of crews correlates to a safer operation.[13] Long term benefits of a test and inspection program normally result in a reduction in accidents, injuries, and property damage through identification and correction of rules violations. Short term benefits and program credibility can be achieved when employees detect a genuine commitment from senior management and they are provided timely feedback on the results of the testing program.

In the 1987-88 report, FRA said that operational testing programs should be flexible enough to provide for special emphasis as conditions warrant. For example, when the method of operation of a portion of the railroad changes, such as from direct control, ABS, etc., to CAD, emphasis should be placed on testing for CAD rules. Likewise, rules and instructions which generate abnormally high failure rates should also be a priority. Finally, when noncompliance with rules or instructions is identified as an accident cause, additional testing should be conducted to ensure that noncompliance in that area is not a systemic problem. This process can be facilitated when railroads integrate their databases. Personnel, discipline, and accident/incident databases all include information which can be used to increase the effectiveness of testing programs.

Operating Rules and Procedures

As discussed at length in the 1987-88 report, railroad operating rules are the cornerstone of safe railroad operations. The intent of operating rules and procedures is to prevent accidents by prescribing the duties of employees and specifying a predictable and consistent response to events. If employees could not rely on operating rules to govern the behavior of fellow employees, chaos would result. An example highlighted in the original report is worth repeating to demonstrate the vital role rules play in routine railroad operations:

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[13] *During several recent enforcement activities which focused on operational testing, FRA noted distinct correlation between train accident causal codes and a lack of testing of crews on those rules. Conversely, where strong testing was conducted, few accidents were evident.*

Scenario: Movement of train against current of traffic in automatic block signal system territory: *After obtaining authorization, a locomotive engineer can operate a train against the current of traffic promptly, expeditiously and with a high degree of confidence. The engineer's knowledge of operating rules and experience in their application provides assurances that:*

- *Rules require the train dispatcher to set stop signals or issue orders which will prevent opposing movements from entering the block in which a train will be authorized to move against the current of traffic.*

- *Rules require other engineers and track car drivers not to pass stop signals without permission of the dispatcher.*

- *Rules require the train dispatcher to determine that the block ahead is clear of opposing trains before authorizing a movement against the current of traffic.*

- *Rules require the train dispatcher to issue appropriate instructions if the block ahead is occupied by a preceding train moving against the current of traffic.*

- *Rules prohibit employees operating other trains or track cars from entering the block outside of yard limits without permission of the dispatcher.*

- *Rules require employees operating trains on adjacent tracks to provide protection if they experience an emergency application of the automatic train air brake and may have equipment fouling.*

It has been said that operating rules became necessary when railroads first operated more than one train at a time. In reality, certain basic operating rules are necessary even for railroads which have only one locomotive. Development of these rules was for the most part evolutionary, not revolutionary, reactive not proactive. After accidents, rules or procedures were developed to address the specific conditions which allowed the accident to occur.

Because a single failure on the part of a person or machine can have catastrophic consequences, safeguards including redundancy are essential. Historically, train order operators provided one such level of redundancy. Train orders were issued by the train dispatcher over an open telegraph or telephone wire. Communications over the open wire were monitored by the employees directly involved in the proceedings as well as other employees with access to the open wire.

Current Conditions: Advancing technology has resulted in broad changes in operating rule application in recent years. FRA expects that changes will continue to occur at a rapid rate. Although many classes and crafts of employees are governed by the operating rules, the train dispatcher routinely deals with the most complex and safety critical of these rules. Rules and instructions are frequently revised to reflect changes in operating conditions. Because of their accessibility, high degree of visibility, and leadership responsibility, dispatchers assume a role as a functional source of rules interpretations for operating and engineering employees in the field. Promoted train dispatchers have comprised a significant percentage of railroad rules examiners over the years.

Instruction on the meaning, intent, and application of the operating rules should be provided in writing in a concise and consistent format. The goal of this instruction should be to assure that all employees understand and apply the rules in the same manner. Rules and instructions should be so worded that there can be no misunderstanding as to the their application.

In properly designed modern CAD systems, electronic hardware and software are designed with a two step philosophy so that safety critical commands may not be inadvertently executed. An example of this is the removal of blocking device protection from electronic control systems. This function requires two separate actions by the dispatcher in order to complete the command. Principal high density routes are primarily electronically controlled. Other main tracks are controlled by mandatory directive systems such as TWC, DTC, manual block system, etc. Some Class 1 railroads have dispatching positions which include sections of CTC, ABS, and nonsignalled territory. In such cases dispatchers must be familiar with the intricacies of several different methods of operations. Different rules and procedures need to be applied to achieve the same results from different systems.

Railroads increasingly utilize computer assistance in mandatory directive territory. Computer systems are in service which provide a visual indication of the status of blocks in direct traffic control territory. Operating rules logic can be programmed and the dispatcher can be prevented by computer conflict checking from issuing overlapping authority. Further safeguards are provided in traffic control territory, where "vital circuits" in the field will prevent many dispatcher errors from resulting in conflicting movements.

Each railroad enforces its own operating rules. An employee who violates an operating rule is subject to discipline. The severity of the discipline assessed is often commensurate with the seriousness of the violation, ranging from a verbal reprimand to termination without reinstatement rights. Most collective

bargaining agreements specify the rights and obligations of the parties in disciplinary proceedings.

Federal Role: In the aviation industry, which uses public air space, rules of the airways and control of traffic are generally a Government responsibility. The rules and procedures are promulgated by the Federal Government. However, in the railroad industry, which uses private rights-of-way, traffic control is a function and responsibility of individual railroads. The rules and procedures are generally promulgated by railroads. Train dispatchers are employees of the individual railroad companies. Where two or more railroads operate over a joint line, agreements normally specify that the host railroad's operating rules apply.

Federal regulation of operating rules is both direct and indirect. As alluded in the section on operational testing, 49 CFR Part 217 (recently amended) requires Class 1 and 2, Amtrak and major commuter railroads, to file with FRA headquarters a copy of their operating rules and timetables, and to provide copies of their programs of rules instruction and operational tests-inspections to FRA inspectors upon request (Class 3 railroads must also have rules/timetables/programs available to FRA upon request). Other applicable direct regulations include:

- ***Part 218.*** This part requires railroads to have in effect specific operating rules in the following six distinct areas:

  1. Procedures for the protection of workmen who inspect, repair or maintain locomotives and cars.

  2. Train operations within yard limits.

  3. Flag protection of train and locomotive movements on the main track outside yard limits.

  4. Hump yard protection of train and engine service employees who are required to go between rolling equipment.

  5. Procedures for the protection of occupied camp cars.

  6. Prohibitions against tampering with safety devices.

- ***Part 220.*** This part governs the use of two way radios in railroad operations. It sets forth minimum Federal radio standards and procedures.

- ***Part 221.*** This part requires that under certain conditions, the rear end of trains must be equipped with an approved rear end marking device.

Among the Federal regulations with an indirect impact:

- ***Part 213.*** The Track Safety Standards govern the maximum permissible speeds for freight and passenger trains based on the condition of the track on which they operate.

- ***Part 219.*** This part governs the use of alcohol and drugs by employees in safety sensitive positions.

- ***Part 236.*** specifies the rules, standards, and instructions governing the installation, inspection, maintenance and repair of signal and train control systems, devices and appliances.

FRA was granted further authority over railroad rules and procedures by the *Federal Railroad Safety Authorization Act of 1980*. Subject to review and appeal, FRA may issue an emergency order when it determines that an operating rule or procedure is so unsafe as to present an imminent danger. FRA uses this power judiciously, and only if all other avenues of correction have failed to resolve the safety issue. There were no such imminent dangers found during the 1993 followup review.

FRA Analysis: State of Operating Rules Today: FRA has noted a lack of direction exhibited by some railroads in application of traditional operating rules and practices. Specifically, it is FRA's perception that railroads are lessening protective features of some operating rules through inconsistent application and unchecked "local" modification to facilitate expediency. This is an undesirable development and FRA has discussed it at length with railroad rules officials who concur and pledged to work toward correction.

Two major rules associations have been formed by railroads to standardize operating rules for respective participating members. These associations are the ***General Code of Operating Rules Committee*** *(GCOR)* which is comprised of most western/midwestern railroads, and the ***Northeast Operating Rules Advisory Committee*** *(NORAC)* which is comprised of most railroads in the east/northeastern section of the United States. These "standard" codes of operating rules reflect respective member railroad regional needs and interests. The goal of the associations was to standardize operating rules with other railroads to promote consistency and efficiency. FRA was highly supportive of this effort and continues to advocate standardization due to the growing interdependence railroads share as a result of market pressures.[14] However, FRA believes much needs to be done before

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[14] *In addition to the two rules associations, a number of railroads maintain independent operating rule codes (e.g., CSX, Norfolk Southern, Illinois Central, Kansas City Southern, etc.).*

the goal of standardization is fully recognized among common rule group railroads. The success of these programs is dependant on the degree of upper management support for collective rule committee decisions. For example, FRA has been present at rule committee meetings where decisions to standardize a specific operating procedure have been made, only to be rejected by one or more member railroads later due to upper management disagreement. The issuance of numerous "special instruction" sections in railroad timetables then becomes required, necessitating amendments to the "standard" operating rules.[15] FRA believes that this is undesirable from a safety and efficiency perspective, due to the permissive ambivalence created with inconsistent application of the rules in given settings. A number of railroad operating rules officials agree with this assessment but feel powerless to remedy the situation. This has direct implication for train dispatchers who, with varying levels of frequency, deal with employees on their dispatching districts who may have a differing view of how to conform to a rule.[16]

Occupational Stress/Workload

Stress: In the 1987-88 assessment, FRA discussed at length the complex issues surrounding occupational stress and workload issues for train dispatchers. During the 1993 followup, it was apparent that some of the stressors that existed in the dispatching environment in 1987-88 continue today. Factors observed which continue to generate dispatcher stress include frequent or occasional work overloads due to fluctuating traffic levels, handling maintenance of way work order authorities during high train movement periods, ambiguous operating rules and instructions and inconsistent application of those rules from area to area, the substantial safety responsibilities inherent in a train dispatcher's position, and the need to balance on-time train performance with requested signal and track maintenance requirements. In addition, during the 1993 followup, at some

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[15] *For example, a review of operating documents for five member railroads of a common code revealed 241 total special timetable instructions modifying operating rules. This means that in 241 instances the "common" rulebook has been amended and operating personnel may have separate, perhaps conflicting, sources of rules guidance.*

[16] *FRA also encountered instances where local management officials have modified operating rules for purposes of expediency without the consent or knowledge of the central system rules authority. This, too, leads to employee confusion over rules application.*

locations, FRA noted significant negative impact on the morale and outlook of train dispatchers due to the threat of office relocations to centralized system centers. Finally, as has been pointed out by ATDD, some train dispatcher stress has been attributed to insufficient staffing, radio frequency interference, and basic training concerns. As the industry continues to work toward resolving these issues, a corresponding reduction in "job stressors" should be noted.

As documented during the earlier national assessment, the growing reliance on computer assisted dispatching systems has replaced the historic "human handshake" verification of movement authorities between a dispatcher and an operator in the field. Today, most major railroads have programmed operating rules logic into new or existing computer systems which, in most instances, drastically improves safety by eliminating potential for human misunderstanding. As the new technology advances, some train dispatchers, especially those with considerable seniority and experience in the earlier manual systems, are suspicious of the new systems and express frustration with the changes. This no doubt leads to the potential for additional stress.

Work Load: A train dispatcher's function is to permit safe and efficient train and on-track equipment movements within an assigned territory, while at the same time permitting track, signalling and equipment maintenance to proceed in a timely manner. To perform this function properly the dispatcher must contemplate the rules, procedures and schedules involved and decide how each will effect what he needs to accomplish. It is inevitable that these duties will also be affected by unexpected and emergency events from time to time.

During the 1993 review, as was the case in the 1987-88 assessment, FRA found the workload measurement data gathered during the project to be inconclusive. FRA did note, however, evidence that dispatchers at some locations were required to sustain extremely heavy workloads. This was particularly true during periods of peak traffic and maintenance activity. These high workloads were evident at both existing and new dispatching centers.

As alluded to above, the escalated application of CAD on the national rail system over the past 10 years has been a remarkable tool which has enhanced railroad safety and efficiency. FRA applauds the technological advancements which provide secure software guarding against human error in managing train operations. However, the 1993 followup review confirmed what was found earlier during the national assessment: There has been a downside to the electronic revolution in train dispatching due to the expanded responsibility such systems bring to the human sitting at the console. This is manifested in drastic expansion of many dispatcher territories and responsibilities. This

tendency, to expand territories, consolidate desks, and maximize dispatcher manpower resources, is a direct result of technological advancements in train control technology. While we now have more experience in working with such advanced systems today than we did in 1987-88, it is still a relatively new phenomenon, and therefore, due to the relative recency with which the advanced technology systems are being implemented, there is no data to evaluate their potential impact on dispatcher stress, fatigue and work overload. Since the dispatcher is an integral link in the safe management of line segments, it is essential that dispatcher-CAD interface be efficient. To do so, train dispatchers must trust and utilize the safety features of CAD.

In terms of examining the workload issue, as in the 1987-88 assessment, FRA developed data by determining the number of trains handled and authorities issued by dispatchers during respective work shifts. Data was also collected regarding the number of control points and interlockings controlled by each dispatcher, the number, type, and effectiveness of communication devices each dispatcher was responsible for, the methods of operation and the total track miles of each position. In addition, FRA evaluated the amount of administrative duties performed by each dispatcher. The intent of this exercise was to correlate this data and attempt to reach meaningful conclusions. Most railroads utilize similar procedures to determine workloads when planning office or position consolidations. However, FRA found this to be an imprecise method of determining dispatchers' workloads. This process does not take into account the varied tasks which a dispatcher must complete to move even one train across assigned territory. Therefore, the summation of all individual tasks a dispatcher must consider and deal with in relatively short time frames are not properly equated.[17]

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[17] *As noted in the 1987-88 report, railroads have conducted time and motion studies to better define this problem. However, during the 1993 review we found the same shortcomings, i.e., these studies generally only average workloads over an eight hour period. Such averages fail to account for brief but intense periods when dispatchers may be working at capacity. For example, on a commuter railroad in a metropolitan area dispatchers may handle over 100 train movements in less than one hour during rush periods; on freight railroads it is common for most of the daily track maintenance authorities to be done in a one hour period while simultaneously directing train movements. In order for useful data to be gathered a system needs to document a dispatcher's mental estimates of what is required to perform all individual tasks involved in the dispatching district. Parameters for measurement need to be established to assure workloads are indeed being measured (e.g., control machine capabilities, communications equipment capabilities, etc.).*

As with occupational stress, FRA found that evaluation of employee workloads is a field which requires unique expertise. Although the 1993 inspection teams again focused on this subject during observations of individual dispatchers, the data gathered was scientifically inadequate.

Environment

During the 1987-88 assessment, FRA inspection teams encountered a number of offices where the environment was not conducive to efficient train dispatching. Some of the more common findings included locations with train dispatchers working in loud, open areas without privacy; or, working in cramped spaces with insufficient ventilation and poor lighting; and, occasions where dispatchers were disturbed by employees entering the office without supervision, etc. However, during the 1993 followup, FRA inspection teams noted marked improvement in almost all locations. Railroads have responded to FRA and employee concerns in many locations, and today, for the most part, train dispatchers are provided satisfactory working environments. We understand comments from some members of ATDD regarding the desirability of single offices for each train dispatcher. While we concur that such an arrangement may be highly desirable, there is no evidence that the lack of such individual privacy, by itself, detracts from a dispatcher's ability to safely perform tasks.[18]

Software Reliability

At the time of the 1987-88 audit, FRA expressed concern over the fact that some railroads did not have a formal means to conduct a safety analysis and evaluation of CAD software. FRA found instances where railroads did not have in place procedures for software quality assurance. FRA pointed out that large projects of the U. S. Department of Defense, National Aeronautics and Space Administration, and the Federal Aviation Administration, require that software be developed according to standards for quality assurance. The purpose of such a systematic methodology is to organize the developmental tasks so that they can be controlled by the various specialists and managers who understand the technical details and rules that should control the logic flow.

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[18] *There are a number of major railroads that already provide or intend to provide individual offices to train dispatchers to the maximum extent possible.*

FRA concerns were based upon some railroads assuming an informal approach to software specification and design. Railroads typically worked with the vendor in configuration management to assure that changes, modifications, and error corrections were compatible with all possible combinations of software logic. If an error in software design was found there was lacking a control that required and documented that the error be corrected in all parts of the system.

As chronicled in our earlier report, software problems can be of two basic types--design errors and hardware defects. Design problems can show up when a previously unused path through the logic is exercised or when a seldom used or unexpected set of inputs is encountered. Hardware defects should be detected by periodic verification checks. Software faults can be minimized by design redundancy and/or by a systematic test program that searches for any unacceptable design fault. Design redundancy requires that independent software designs be prepared by separate design teams and that the two programs be run concurrently. Outputs from the two programs must agree before the answer is executed. This type of redundancy was not used in some of the CAD systems we reviewed then, and we believe it may not always be used in all CAD systems now.

CHAPTER 5

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

General Conclusions

1. From the earliest days of railroad operations, train dispatchers have played a crucial role in promoting a safe and efficient rail system. During the followup review FRA found that, today, as a general rule, the nation's train dispatcher workforce is competent, professional, and doing a good job managing train operations and on-track maintenance of way activities.

2. As noted throughout this report, the railroad industry has experienced significant changes since the 1987-88 assessment. Advancements in computer assisted dispatching systems and the consolidation of dispatching offices have revolutionized the train dispatcher's working environment and the tools available to do the job.

3. The rail industry has corrected many significant train dispatcher concerns identified by FRA during the 1987-88 assessment:

   - *Throughout the 1993 followup review FRA found most train dispatchers to be competent and most train dispatching hardware-software to be sound and compatible with prudent operating practices.*

   - *The train dispatcher workforce continues to be dominated by experienced individuals. The availability of sufficient qualified dispatchers to fulfill future railroad needs is a growing concern.*

   - *Overall, the industry has upgraded communication and control systems used by train dispatchers. These changes have resulted in larger operating divisions and consolidation of dispatching offices. FRA found train dispatcher workstation environments have improved significantly on most railroads.*

4. Despite noted improvements, FRA believes that changes in train dispatching technology, along with a lessening of traditional recruit dispatcher candidate availability, warrant an escalated level of FRA involvement in two primary areas: Training and operational testing.

Summary of Specific Concerns and Recommendations[19]

STAFFING

CONCERN: The assessment disclosed that staffing inadequacies continue to exist on some railroads to the point that insufficient extra qualified personnel are available to fill vacancies in regular jobs. An insufficient number of employees assigned to offices leads to several problems, including:

- A shortage of relief employees results in dispatchers working normal rest days. FRA noted that on several railroads, train dispatchers were required to work assigned rest days, on average, about twice a month. While this may be of limited concern in a short term situation, FRA believes problems can result if train dispatchers are not able to take rest days over a sustained period of time.

- FRA noted several instances over the past year where dispatching offices were understaffed to the point of requiring employees to work for periods in excess of that permitted by the Hours of Service Act.

- Initial and periodic training can suffer from staff shortages. Due to the insufficient number of relief employees, dispatchers at some offices were not permitted to take familiarization trips over the railroad.

RECOMMENDED ACTION:

This issue needs resolution through cooperative labor-management agreement. In many instances the addition of only one or two individuals would provide adequate backup. In that regard:

1. ***FRA recommends that rail labor and management continue their efforts to devise suitable screening criteria to identify, early in the recruitment process, whether or not an individual has the aptitude to become a journeyman train dispatcher.***

2. ***FRA recommends that AAR and ATDD consider establishment of an "availability pool" listing journeymen dispatchers who are available for employment. This would include***

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[19] *As mentioned in the report, FRA provided each audited railroad a listing of findings at the conclusion of each inspection. FRA has followed up with a detailed item by item report for each audited railroad comparing 1987-88 concerns versus 1993 findings. FRA will provide each railroad a copy of respective detailed findings for corrective action.*

individuals "on the market" due to dispatcher consolidations. Some railroads have had success staffing dispatcher vacancies with such individuals. A centralized listing of experienced train dispatchers could prove a valuable resource for railroads in need of dispatchers and individuals in need of employment. Possible sources for the listing would be the Railroad Retirement Board or the Department of Labor job data bank.

COMMUNICATIONS

CONCERN: Train dispatchers commented to FRA during the review that improvements have been made in communications over the past several years. FRA's own observations confirmed that train dispatcher communications capabilities have indeed been enhanced since the 1987-88 assessment. However, there are some remaining concerns that require continued industry attention. Congestion of radio frequencies continues to be a concern in some dispatching districts. Sources of congestion include nonessential transmissions by a variety of employees as well as improper use of assigned frequencies. FRA also noted that on numerous occasions train dispatchers and employees in the field did not comply with required radio standards and procedures. These deficiencies included improper transmission of mandatory directives in accordance with Federal requirements. Specific FRA concerns are:

Hardware Concerns

- There are dispatcher desks that still experience "bleed-over" from neighboring dispatcher districts. In addition, some dispatchers related frustration with automatic wayside detectors which override their frequencies and interrupt radio transmissions with trains.

- There still exist diverse and sometimes incompatible communication systems in the same dispatchers office. For example, FRA noted several offices where "open speaker" systems are used resulting in a need for constant monitoring by train dispatchers. This monitoring process created interference when dispatchers had to listen for verbatim readback of mandatory directives and critical information.

- Several dispatcher offices did not have a dedicated emergency channel. Additionally, some communication systems did not have capability to prioritize incoming calls into regular versus emergency.

- Chief and assistant chief dispatchers could not monitor the shift dispatcher's radio communications from their workstation.

- Dispatchers related that reliability of locomotive onboard radios had improved considerably, but there were still instances where crew communications were inhibited by inoperative radios.

- Problems with the reliability of some systems were of continuing concern. Desk audits disclosed several specific locations where communications could not be initiated between the dispatcher and field personnel despite upgraded and modern systems. Similar concerns were experienced with mobile and cellular telephone systems. It appears the problem is rooted in peculiar atmospheric or terrain conditions rather than equipment malfunctions.

Human Interface Concerns

- FRA found that some railroads continue to underutilize available frequencies. This creates interfering radio transmissions. Specifically, during the 1993 review FRA found the following sources of interference:

  - Channels intended for road train use were used by yardmasters and terminal switching crews.

  - Channels intended exclusively for dispatcher communications were used by road crews engaged in such duties as adding or removing cars from their trains or to handle other communication of no value to the train dispatcher or other trains.

  - Maintenance of way employees frequently used the dispatching channel to communicate with each other, even though separate channels were available for this purpose.

  - Supervisors, administrative personnel, clerks, and even railroad taxi drivers used the dispatching channel for purposes not related to the safety of train operations.

- At most offices assessed, FRA noted frequent radio rule noncompliance. Many exceptions were extremely serious in nature, to include failure of the dispatchers and train crews to comply with 49 CFR §220.61 (transmissions of train orders by radio), and failure to assure on-track authorities are properly transmitted and repeated. These deficiencies also included occasional failure of train dispatchers and employees in the field to properly identify their stations,

failure of the train dispatcher to require employees to use proper identification, and failure to use the words "over" and "out" when required.

- In violation of radio standards, several instances were noted where train dispatchers issued critical train movement authorities without obtaining proper identification and/or location of involved trains.

- In violation of radio standards, a few dispatchers were observed issuing mandatory train movement directives to employees operating the controls of moving trains (i.e., no attempt was made to identify the receiving employee).

- While the majority of train dispatchers utilized proper radio procedure, there were some who did not. Additionally, the radio procedures used by employees in the field calling train dispatchers were seldom in compliance with Federal radio standards. Train dispatchers took no action to remedy the noncompliance by setting an example or openly requesting proper compliance.

RECOMMENDED ACTION:

1. ***FRA conducted a national safety inquiry into communication issues in compliance with Section 11 of the Rail Safety Enforcement and Review Act of 1992. The issue of radio communications is discussed at length and appropriate recommendations made in the Report to Congress published in July 1994. FRA continues to pursue appropriate enforcement action when instances of noncompliance with Federal radio standards are observed.***

2. ***While FRA has addressed the overall issue of railroad communications in the other report, there is a crucial need for both labor and management to join FRA in promoting employee compliance with radio rules and standards. Despite real or perceived shortcomings with equipment, there is no justification for railroad radio users to observe anything other than proper compliance with Federal radio standards. FRA accident/injury records reveal that improper radio usage is a causal factor in a number of serious train accidents/incidents every year. FRA has undertaken an aggressive enforcement approach and will continue to do so.***

3. ***In addition, railroad management must ensure that employees not essential to the train dispatching function, utilize a segregated frequency to conduct business. Using the road channel for communications not related to train operations creates congestion and impedes safety and efficiency. This is especially true in terminal areas.***

4. ***FRA recognizes the priority that must be accorded to wayside detector messages. FRA recommends that railroads evaluate automatic wayside detector transmissions to ensure broadcast messages are limited in range to assure reception by the passing train, but not interfere unnecessarily with voice communications outside the defined area.***

TRAINING

CONCERN: The railroads FRA visited during the 1993 followup effort have implemented some formal training for new train dispatchers. Some railroads have made significant improvements in dispatcher training, to include the use of CAD simulators and interactive video. However, FRA continued to note a pattern of inconsistency from railroad to railroad (and within the same railroad for periodic retraining), regarding training content, duration, methodology and resources. As a result, several issues identified by FRA during the 1987-88 assessment have only partially been addressed. FRA found inconsistencies in areas such as:

- OJT, in some instances, has been delegated to subordinates without adequate direction, control, or evaluation methodology. Additionally, some management officials did not have definitive opinions, nor did they provide direct guidance, regarding necessary components of dispatcher training programs. This leads to unstructured and inconsistent training.

- As in 1987-88, FRA found training shortcomings which could impact the efficiency of train operations, but none that resulted in unsafe conditions.

- The increasing use of complex technology and reduced numbers of subordinates have prompted most railroads--but not all--to move away from exclusive OJT for initial training. As stated, FRA believes a mix of complementary training methods is the most effective.

- FRA continued to find that standards and policies for periodic retraining of dispatchers varied widely among railroads. At some locations there was no formal policy in place regarding periodic retraining.[20]

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[20] *In the bigger centers, a train dispatcher could conceivably be bumped to a desk not worked for months. While CAD reduces the potential impact of such moves, extended time away from a desk could lead to increased possibility of error.*

- Railroad policies concerning familiarization trips varied widely. The number and frequency of such trips were not defined on some railroads. Almost all railroads that provide for physical characteristics training have no objectives for such training, nor do they have a means to measure the effectiveness of the training.

- At some locations, initial and periodic training continues to suffer because of staff shortages. Due to the insufficient number of relief employees, dispatchers at some offices were not permitted to make familiarization trips over the railroad or participate in simulator refresher exercises.

- Most railroads do not provide for supervisory personnel to train/familiarize themselves with changes in technology. Additionally, when rules or technology changes occur, many train dispatchers are not afforded an opportunity to familiarize themselves before being put into "real time" applications.

After the 1987-88 assessment, FRA reported to Congress that there was insufficient justification to warrant Federal involvement in establishing national train dispatcher training standards. That judgment was based upon a number of factors revealed at that time during FRA's extensive review of national dispatching, including:

- FRA's accident database failed to disclose a statistically significant pattern of accidents caused by inadequately trained dispatchers.

- There existed no clear evidence to indicate that any pattern of unsafe activities has resulted from inadequate dispatcher training.

- With the advent of computerized control systems and corollary inherent "fail safe" software, dispatcher actions are closely monitored more than ever before in history.

- Most train dispatchers observed were experienced and well qualified. For the most part, FRA found dispatching procedures and systems sound and effective on virtually every railroad.

- The railroad industry has always recognized the importance of maintaining a proficient dispatcher workforce. As a result, most railroads had long established training programs for dispatchers.

As in 1987-88, FRA found no evidence during the 1993 review that inadequate training has directly resulted in train accidents.

Nevertheless, training directly impacts train dispatcher efficiency and productivity, which has potential to impact safety. Failure to provide well defined training may also contribute to train dispatcher stress, fatigue, and work overload. Given the potential for diminished future safety as a result of rapidly evolving changes in train dispatching technology and changes in new dispatcher availability, FRA believes Federal intervention is warranted.

RECOMMENDED ACTION:

1. ***Due to the inconsistency and lack of precise management direction regarding the future of train dispatcher training needs, FRA believes that without Federal focus, the complexion of the train dispatcher workforce will change to the point that potential safety risks could develop in the future. Obviously, FRA would have preferred that the railroad industry had worked cooperatively to implement voluntary initiatives uniformly addressing train dispatcher training issues. That has not happened.***

   Therefore, within 24 months of this report, FRA will facilitate a partnership between the BN, Amtrak, and the ATDD. The partnership will work to develop a model train dispatcher training program, taking advantage of BN's advanced technology and training capabilities, ATDD's experience and expertise in train dispatcher training needs, and Amtrak's experience in dispatching high density, high speed passenger operations.

2. ***Within 36 months of this report, FRA will publish an ANPRM proposing minimum training standards for train dispatchers, to include initial, periodic, refresher, and physical characteristics training; and minimum operating rule training and testing standards. These standards will be based upon data developed through the partnership between FRA, BN, ATDD, and Amtrak. As part of the review, FRA will examine railroad operating rules to assess consistency, standardization, and applicability to today's railroad environment.***

OPERATIONAL TESTING

CONCERN: A primary area of concern noted during the 1987-88 assessment was that operational testing of train dispatchers was seriously inadequate on most railroads. FRA's 1993 inspection teams recorded the same concern. FRA found that most railroads were not performing operational tests involving train dispatchers to the degree outlined in respective §217 programs. For example, FRA determined that infrequent tests were performed to evaluate

train dispatcher handling of critical operational procedures, and several railroads failed to have a comprehensive program for effectively testing train dispatchers. Overall testing of train dispatchers was inadequate due to the following:

- on railroads with nonagreement dispatchers, railroads took the position that since train dispatchers were officers, operational testing was not required. FRA does not agree. Such policies are contrary to Federal regulations and impede the goal of determining rules compliance by employees in safety critical positions.

- on some railroads, train dispatchers were included in the testing program but the quality of testing was wholly substandard. Among the general patterns of deficiencies noted were:

  - Some railroads tested train dispatchers so infrequently that individuals could not remember the last time they were tested. FRA review of records at one location revealed an 18 month gap in the testing of one dispatcher.

  - System or division officers did not periodically test and inspect dispatchers from the field and record the results.

  - The assessment period bridged various carriers' test reporting periods. During the periods for which data was requested a total of 66,494 tests and inspections were conducted on dispatchers. Failures numbered 1302 or 1.95 percent. Individual railroad testing programs produced failure rates of less than 1 percent. FRA's own inspections indicate that the failure rate is often appreciably higher.

  - Most railroads conducted a high percentage of observations or tests for compliance with general rules. Rules governing the issuance of mandatory directives, the use of blocking devices, and the granting of track and time authority are critical to safety, yet they were infrequently tested. As previously mentioned, FRA's accident database for 1991 through 1993 disclosed several serious train accidents attributed, wholly or in part, to train dispatcher-crew miscommunication, yet few railroads have operational "hearback-readback" tests.

  - Not all railroads used testing results to generate useful management reports. Nonuse of such information is poor management practice in that such data provides

insight into areas where additional training may be needed.

- Testing of dispatchers was predictable. Over 50 percent of the tests reviewed were conducted in the last week of the month (no doubt to fulfill company mandated "quotas").

- Changes in operating rules and the application of new technology have not been incorporated into all testing programs.

- Several railroads that documented test failures for train dispatchers could not provide explanation of corrective action taken.

RECOMMENDED ACTION:

FRA will include Federal minimum testing standards as part of the ANPRM on training standards (see above). In the interim, railroad management must improve the operational testing of train dispatchers. FRA intends to continue focused audits on railroad operational testing, to include the testing of train dispatchers. Civil penalties will be issued where appropriate.

OPERATING RULES

CONCERN: FRA has observed a lack of standardization of operating rule application among the railroads. This has impacted not only operating and maintenance crews, but also train dispatchers by creating confusion and lack of clarity of rule purpose. During the followup assessment, it was apparent to FRA that railroad interpretation/application of the same operating rules varied. FRA noted several railroads that had informally changed certain rules without proper notification to all effected employees. Other noted inconsistencies involved individual railroads which differed on basic rule interpretations. For example, on one railroad a rule permits changes to on track equipment authorities without changing the original written document. The same rule on another railroad is applied differently--the entire document has to be voided and rewritten when the work authority changes. Perhaps what is more significant, however, was FRA's observation that application of rules protecting train and on track equipment varied from division to division of the same railroad. For example, one division interpretation of the rule required written authority for equipment operating within yard limits. On another division this was not required by local rule interpretation. Additionally, FRA ascertained that a few locations still existed where two train dispatchers shared common control of a particular track segment, yet procedures to prevent conflicting movements

were, for the most part, inadequate or nonexistent. For example, each dispatcher could authorize placement of on-track equipment or employees onto the segment of track without the knowledge or concurrence of the other dispatcher. This condition is not common nor is it acceptable to FRA or the railroads. Once such situations are encountered, rail management has always reacted to correct the problem. Some additional general issues we noted during the 1993 followup regarding undesirable operating practices involving train dispatchers included:

- The protection of engineering forces (maintenance of way/signal) by some railroads is not sufficient in all instances where employees/equipment foul a track. FRA observed at least one dispatcher who failed to completely block a track prior to issuing authority for maintenance personnel to occupy the track.

- On one railroad, FRA observed that train dispatcher instruction books were outdated and contained operating procedures that had been canceled or amended.

- FRA noted several locations where train dispatchers had no ready access to a rules official should a need for rules interpretation be necessary.

- At one location, FRA noted that CAD rules matrix software permitted track and time permits to be inadvertently removed by one dispatcher on an adjoining territory without the knowledge of the dispatcher that applied the blocking protection.

- At another location, FRA found dispatchers removing blocking protection and displaying signals for a portion of track without confirming that the person being protected was aware of the move. This resulted in a train-track equipment collision with significant damage to the track equipment.

- Some railroad operating rules require dispatchers to apply blocking devices to signals and switches prior to permitting a train to pass a stop signal. FRA observed dispatchers authorizing trains to pass stop signals without providing the blocking devices.

- On one railroad, FRA overheard maintenance employees ask a dispatcher to place restrictions on a track so the employees could work on the track without obtaining track and time permits as required by GCOR.

- As discussed in the section on operational testing, several accidents have resulted from miscommunication of mandatory authorities between train dispatchers and train/maintenance crews. FRA believes such errors are due, in some measure,

to procedural, workload, and memory factors. Rather than address this concern through operational tests and fortification of operating rules, some railroads have actually lessened applicable rule requirements. For example, traditionally most railroad rules required that, when transmitting and repeating mandatory directives, all station names, directions, time and other numerals had to be pronounced then spelled. Over the past few years, many railroads have changed these rules to delete these requirements. This, in effect, removes a safeguard designed to limit potential for human miscommunication, especially in terms of movement authority limits.

RECOMMENDED ACTION:

1. ***FRA will include a review of railroad operating rules as part of the ANPRM on training standards (see above). In the interim:***

   - ***Railroad management should provide train dispatchers clear, direct instruction on the application of operating rules. Such guidance should be available to dispatchers on all shifts. In addition, rules instruction and operational testing must be accomplished in accordance with the railroad program per 49 CFR Part 217.***

   - ***FRA urges railroads to work together to resolve unnecessary rule conflicts. This can perhaps best be accomplished through railroad rules associations/groups with upper management support of decisions made. FRA will be watching developments in this area closely and correlating operational testing failures and train accidents with rules application.***

   - ***Railroads should revise operating rules to include requirements that station names and all numerals be pronounced then spelled during mandatory directive transmission and repeat. This additional safeguard gives all involved one more opportunity to confirm movement limits and lessens opportunity for miscommunication.***

   - ***FRA recommends that operating rules groups include representatives from railroad signal departments and select rail labor representatives to serve as a resource in development and implementation of standardized operating rules.***

SOFTWARE

CONCERN: During the 1993 followup audit, FRA found that many of the software concerns documented during the 1987-88 assessment have been remedied. However, FRA encountered some CAD software problems relating to track occupancy and signal/console display at two offices. In both instances, the involved railroads responded and resolved the anomalies while FRA was onsite. The fact that problems are still arising demonstrates that even though the software for each track segment is typically developed separately, the test program for those individual segments must be integrated and complete. The assurance program should not permit skipping tests because of the similarity to previously installed software routines. A formal software verification program is particularly important when vital logic is involved. An initial step in the formulation of a formal program would be to identify the vital elements of the software program.

A specific example of this issue involves CAD operation in direct train control territory, such as TWC or DTC. Applicable rules should be reduced to a matrix of logic that is programmed into the computer. As dispatchers manipulate various requests for block occupancy, the computer logic should verify whether the block can be authorized and if so under what restrictions. However, if the rules matrix does not search for all conflicts, the safety of the operation remains primarily dependent on observation of the rules.

RECOMMENDED ACTION:

1. ***FRA recommends that railroads adopt formal software verification procedures for all new or altered CAD software. Railroads should be prepared to demonstrate the validity of the software checking procedures to FRA upon request.***

2. ***Railroads should continue to work toward development of operating rule matrix simplification for CAD software conflict checking. Through experience, FRA has found that a complex rule matrix hinders rather than helps software integration in each line segment. In order to have a simple matrix, railroad rules officers must ensure operating rules are clear, concise, and consistent for respective operating methodologies.***

##

APPENDIX 1

HISTORICAL PERSPECTIVE

Methods of Train Operations

Visual Rules: Prior to the 1830's, train movements in America were exclusively controlled by verbal understandings between railroad crews. Multiple train movements at the same time on the same track were virtually unknown. In 1830, there were 40 miles of railroad track in America. By 1867 this total had grown to 40,000 miles, and by 1880 the total reached 90,000 miles.

In 1832 the New Castle and Frenchtown Railroad, which operated between New Castle, Delaware, and Frenchtown, Maryland, dispatched the first American train by fixed signals. The original system consisted of a series of black and white flags on tall posts at set intervals. When the railroad found that signals of this type were ineffective during reduced visibility, they modified the poles to include a system of peach baskets which were suspended by pulleys, replacing the flags. From a distance these signals appeared to be balls hoisted on a pole. When the train was on time a white "ball" was hoisted on the pole. If the train was late or disabled a black "ball" was raised.

As traffic on railroads increased, some railroads responded by posting flagmen at intervals on the line of road. These employees were often stationed within sight distance of one another and they relayed signals to keep trains separated. Although this system provided a reasonable degree of protection, it was extremely labor intensive, and its effectiveness was drastically reduced by darkness and inclement weather.

With the explosive growth of the industry, these primitive traffic control systems were rapidly outdated and as traffic increased, so did the number of accidents associated with inadequate control. In response, the railroad industry was soon searching for more effective systems.

Timetable Operation: By the mid-19th Century, many American railroads had adopted a method of operation governed by "time card" or "timetable." This method of operation established published authorities for the regular movement of trains identified within a schedule. The system established a time interval method of operation which worked on the theory that if trains were separated by a sufficient time interval, and the trains maintained schedule, collisions could not occur. The timetable method of operation developed many of the fundamental concepts of railroad operating practices that survived up through the early 1980's, including the concept of superiority of trains

by class (i.e., type of train--passenger versus freight for example) and direction. Rules were established by individual railroads setting forth the procedures for meeting opposing trains and passing preceding trains traveling in the same direction.

Because the communications systems of the day were limited to face to face conversations and written instructions issued in advance, it was not feasible to issue revised or amended directions pertaining to timetable authority to trains once enroute. The timetable established a sense of security and order in railroad operations. For this reason, it quickly acquired the proportions of a "bible" in the railroad industry. Failure to understand or strictly abide by the directions in the timetable could have the most dire consequences.

The timetable specified meeting points for opposing trains moving on the same track, and helped to keep the distance interval between trains operating in the same direction by establishing leaving and waiting times at specific locations. Because the timetable and applicable operating rules prescribed the time that the main track was to be clear for the use of trains of designated classes, trains could operate at speeds significantly higher than the visual breaking distance. This method of operation was inflexible, however, and could not address breakdowns and delays on line of road. If one train were delayed on a high density line, the balance of traffic would also be delayed since other trains were not permitted to depart until the delayed train arrived.

Train Orders: When Samuel Morse invented the telegraph in 1837, which permitted the first reliable and instantaneous transmission of language over long distances, the first glimmer of technological enhancement was born for railroads. The first real impact occurred in 1851 when Superintendent Charles Minot of the New York and Erie Railroad used a newly installed telegraph line to issue the first "train order," when he ordered an opposing train to wait at a forward station. Minot's message, which changed the meeting point between two trains, established a precedent. The move was safe because he first determined that the train being held at the meeting point had received the message.

A progressive system of train dispatching by "timetable and train order" was rapidly adopted by the industry. The timetable continued to serve as the "framework" or organizational plan for the daily movement of trains, while the train order established a system for managing previously unplanned events. The control and management of this system, however, remained a part-time responsibility of senior division officers until 1859 when the Pennsylvania Railroad appointed the first full-time train dispatcher. The ability to immediately revise schedules, hold

and reroute trains and identify delays and emergences from division headquarters offered such advantage that the use of train dispatchers quickly evolved into a full-time and specialized occupation.

Block Signalling: As the railroad industry grew and trains became more frequent and speeds increased, the timetable method of separating trains by time interval became progressively less satisfactory. Railroads found themselves in a dilemma where the time necessary to space trains interfered with the full and financially advantageous utilization of tracks.

The solution was found by revising the method of separating trains, from the use of time to the use of distance. This methodology--the "block system," increased both the capacity and the safety of a railroad line by dividing it into lengths of defined limits and regulating the use of each length by signals. The concept was simple: No train was permitted to enter into a block unless that block was known to be clear. Block "offices" were established at the entrance to each block. These offices were manned during the hours of a railroad's operation. Each office had telegraphic communication with the offices on adjoining sides. Each office kept records of the passing of trains, and each "block operator" was required to obtain permission from the operator at the other end of the block prior to admitting a train.

Manual Block System: In 1865, the first manual block signal system in the United States was placed in service between Trenton and Philadelphia. The term "manual block" means that the actual signal aspect displayed by a signal is set by the operator, rather than automatically by track circuit.

The first manual block signal system was "absolute," i.e., only one train or engine could occupy the block at a time. Later, the system was modified to allow for "clear" or unoccupied blocks, and "permissive" or occupied blocks. Permissive blocks could be occupied by preceding trains. The operational safeguard was found in an operating rule that required a following train to proceed at "restricted speed" (i.e., prepared to stop short of a train or obstruction).

While the manual block system was another improvement in railroad safety, the system was less than perfect and relied heavily on human performance, memory and coordination. Collisions were inevitable. With the rapid and continued growth of railroad systems, the number of new tracks and junction points grew swiftly. Under the early manual block signal system there was no coordination between switches and signals to prohibit conflicting movements. Although signals at junction points were generally controlled by one man, there were often many switchtenders assigned to handle the switches.

The solution to this problem was the invention of the interlocking machine, a device for the coordinated control of switches and signals from a central location. In England, crude interlockings, which independently interlocked switches and signals, had been perfected as early as 1843. The integrated system of switch and signal interlocking followed in 1859. The first interlocking machine in the United States was imported from England by the Philadelphia and Trenton Railroad in 1870. By 1874, interlocking machines of American manufacture had arrived.

Automatic Block Signal Systems: In 1872, the closed electric track circuit was first installed on the Philadelphia and Erie Railroad in northwestern Pennsylvania. This was the first "fail safe" automatic signal system. The circuit functioned to clear a signal to a proceed indication only when the rails were intact and unoccupied. Any break in the circuit would result in a restrictive indication. Thus, the trains themselves "set the signals" between junctions.

As American railroads entered the 20th Century, timetables and train orders were the primary means used to move trains. Train dispatchers functioned largely as "quarterbacks," arranging meets and passes through operators, monitoring train progress through recording "OS" (i.e.-train had passed the station) reports from block stations, and writing and transmitting orders for each train as necessary. Operators in the field received and delivered train orders, operated interlocking devices as directed, and reported train progress and other matters of interest to the dispatcher. Train crews received and/or copied train orders and operated manual switches as directed.

As early as 1903, some railroads, principally the larger multiple track carriers on the eastern seaboard, began to convey more train movement authority upon the signal systems. Rules were adopted which provided that signal indications superseded the superiority of trains for both opposing and following movements. This system expedited train movements to some extent, but the train dispatcher was still required to work through operators at block and interlocking stations along the route.

Traffic Control Systems: The solution to improving the traffic capacity of high density lines was found in traffic control systems such as *"centralized traffic control" (CTC)*. CTC is a method of train operation whereby trains are governed by block signals, whose indications supersede the superiority of trains for both following and opposing movements. The control of signals, switches, and other interlocking appliances is centralized at a remote location, making it possible for a train dispatcher to directly control traffic without operators and without train orders. Instructions may be generated entirely by signal indication, and the dispatcher has a direct visual or

visual/audible display panel to identify the location and progress of trains. The first CTC system in the United States was installed on 40 miles of the Toledo and Ohio Central Railroad at Fostoria in 1927.

In CTC, when the dispatcher inputs a command, a coded message is electrically generated and transmitted to a controlled point in the field to request activation of a switch or signal. Once the dispatcher's command interfaces with the field component, the command cannot override the interlocking features of the switches and signals at the field location. The communications circuit is "nonvital" because a failure of this circuit cannot produce an unsafe condition. The communications circuit can use ordinary telephone lines for command transmission, without interfering with the lines used for voice communications.

Other traffic control operational improvements were developed during the 1950's and 1960's. These improvements included "NX" interlocking devices which permit the dispatcher to select the entrance and exit points for an interlocking movement while the machine lines intermediate turnouts, crossovers and clears intermediate signals; and, "fleet" modes of operation which permit an interlocking to automatically re-clear a predetermined route. Although such systems often reduced the time or the complexity of sequences required for a train dispatcher to accomplish a traffic control function, the same systems often enabled railroads to consolidate or increase the amount of territory under an individual train dispatcher's control.

Computer-Assisted Dispatching *(CAD)*: First employed by the industry in 1966, CAD has revolutionized train management into the 1990's. CAD has enabled even the largest railroads to implement systemwide train control functions from a single system location. Basically, CAD provides an automated means whereby a train dispatcher can manage the movement of trains. CAD systems typically consist of computer hardware and specialized software programs designed for railroad applications. One of the most significant enhancements has been the protections afforded by software to inhibit inadvertent conflicts in train movement authorities (i.e., two trains being authorized at the same place and time) without visual and audible warnings to the dispatcher.

All CAD systems have enhanced existing CTC capabilities through a number of subsystems, such as "automatic train routing." Some systems have been designed to promote a "paperless" dispatcher environment. Trains can be tracked and recorded automatically, and written movement authorities, where necessary, can be generated, recorded and filed completely within the computer system.

On light density lines where the railroad is unable to justify the capital investment to upgrade to CTC, CAD systems have proven

to be a significant improvement to assist train dispatchers with the management and operation of direct train control in nonsignalled territory.

Direct Train Control: This is an umbrella term for a method of operation derived from traditional timetable/train order methodology. Adopted to varying degrees by most of the major railroads over the past 10 years, these methods of controlling train movements have simplified operations by eliminating timetable schedules, train orders, superiority, train registers, operators, and the attendant array of complicated operating rules. These systems are predicated upon the train dispatcher having direct radio contact with all trains and on track equipment, hence the informal name "radio train dispatching." In place of the train order, there is a written document known variously as a "track warrant," "DTC clearance," "OCS clearance," "RCBS clearance," "track permit," "Form D," etc. There are two basic direct control systems presently in use on today's railroads:

1. *One that uses **fixed blocks** (f) (i.e., the limits are constant and are identified both in the timetable and by wayside signs); and,*

2. *One that uses **variable blocks** (v) (i.e., the limits are not constant and are created by the train dispatcher for each train).*

   Individual railroads identify this method variously as:

   f *Direct Traffic Control (SP, CNW, CSX)*

   v *Track Warrant Control (BN, UP, ATSF, KCS)*

   v *Form D Control System, or DCS (NORAC roads)*

   v *Occupancy Control System, or OCS (Canadian roads)*

   v *Track Permit Control System, or TPCS (IC, P&L)*

   v *Voice Controlled Track Occupancy (BAR)*

   v *Radio Controlled Block System (DW&P, GTW)*

   v *Manual Block System (FEC)*

Railroad Operating Rules: Since the earliest days of railroading, the problem of devising precise rules applicable to varying train operational situations proved to be a difficult proposition. Early rules were often ambiguous and failed to cover contingencies which investigations later disclosed caused

accidents. It has been said that most railroad operating rules are "written in blood," because as railroad operations evolved, investigations disclosed that previously unanticipated human mishaps caused serious accidents. In response, railroads modified their rules or adopted new rules in order to prevent a recurrence. As the operating rules became more comprehensive, they also grew in complexity and volume. This led to a need for railway officers to share experiences and information with each other. The General Time Convention in the 1880's was the first real effort in this regard. In 1889, this organization adopted the first standard code of operating rules, entitled "***Uniform Train Rules and Rules for the Movement of Trains by Telegraphic Orders.***" This organization was among the first efforts the railways made to form common industry associations, and it was the predecessor theme which led to formulation of the Association of American Railroads (AAR). Through a consensus of its members, the AAR refined the common rules into the "***Standard Code of Operating Rules***" and formed a standing committee composed of representatives of member railroads. The group functioned as the central AAR rules authority and provided interpretative guidance to member railroads on rule application. Although the work of this committee was influential, it was only an advisory group and many railroads elected to vary the AAR standards to meet their unique operational needs.

Another trend which has significantly modified railroad operations and the train dispatchers role in operations, is the growing diversification of the industry itself. Passenger operations have largely become a specialized segment of the industry isolated to major metropolitan areas. Correspondingly, the influence of those considerations held vital to passenger operations have declined, both in terms of administrative "efficiency/economy" equations, and in terms of operational priorities.

Railroad's which primarily handle time sensitive commodities, such as trailer and container shipments, have a greater incentive to invest in technology tailored for high speeds. For railroads trafficking primarily in bulk commodities, reliability and economy, rather than speed and elapsed time, are critical. Increasingly, as a result of these conditions, railroads departed from the AAR Standard Code in favor of developing rules tailored to their individual needs. Such diversification, however, resulted in a greater burden to transportation employees who regularly or intermittently operate over foreign lines. It also significantly increased the demand for operating rules instruction.

In 1974, FRA promulgated Part 217 of Title 49, Code of Federal Regulations. Included in this regulation are requirements that each affected railroad must periodically instruct each employee

whose activities are governed by the operating rules on the meaning and application of the rules.

As mentioned in the report, in order to reduce the burden on railroad employees and efficiently address training requirements, the ***General Code of Operating Rules Committee*** and the ***Northeast Operating Rules Advisory Committee*** were formed. These organizations have developed their own "standard" codes of operating rules which reflect their member railroad's regional needs and interests.

These efforts, to consolidate operating rule codes for commonality in the industry, constituted a significant step toward standardizing the rules. While some limited operational flexibility may have been sacrificed, the new rule book philosophy was aimed at making the rules easier for employees to locate, understand and apply. As discussed in the report, it is FRA's belief that this singular issue--inconsistent interpretation and application of operating rules, is a matter of significant concern due to the permissive ambivalence and negative impact it has on train dispatcher, train crew, and supervisory personnel understanding of operating rule safeguards. FRA will continue to address this issue as highlighted in the report.

##

APPENDIX 2

Train Dispatcher Training Program

A. Introduction
   1. Railroad Transportation Concepts
      a. Yard Operations
      b. Car Identification
      c. Use of Equipment Register
      d. Intermodal Equipment & Concepts

B. Safety
   1. Safety Performance
   2. Employee Decisions
      a. Protective Equipment
   3. Safety Committee
   4. Safety Communication
   5. Safety Rules
   6. Safety Examination

C. Federal Regulations
   1. Hours of Service Act
   2. Disqualification Procedures (49 C.F.R. § 209.5-335)
   3. Penalties Against Individuals (45 U.S.C. § 438(a))
   4. Drug/Alcohol Regulations
      a. Operation Red Block
   5. Radio Procedures & Train Orders (49 C.F.R. §§ 220.1-220.61)
   6. Accident Reports

D. Operating Rules
   1. Fundamental Overview
      a. Dispatcher-specific Rules
      b. Application to Other Crafts
      c. Maintenance of Way Rules
      d. Safety Rule Book
      e. Examination (Note: While this training program is intended to be linear, rules training should be done concurrently with other elements of training, and the examination should be done at the end of the training package).

E. Signals
   1. Overview
      a. Traffic Control Systems
      b. Automatic Block Signal Systems
      c. Highway Grade Crossing Warning Systems
      d. Classification Yards
      e. Defect Detectors
      f. Interlockings

F. Communications
   1. Overview
      a. MicroWave Systems
         (1) Geographical Layout
         (2) Description of Equipment
         (3) Back-up Systems in Place
      b. Fiber Optic Systems
      c. Open Wire and Cable Systems
      d. Leased Systems
   2. PBX Systems
   3. Dispatcher Radio Systems
   4. Mobile Access Radio Systems
   5. Alarm Systems
   6. Dispatcher Communications System
      a. Telephone
      b. Radios
   7. Reporting Trouble
      a. Follow-Up Procedures
   8. Physical Examination of Communications Systems
   9. Demonstrate Competence to Use Communications Systems

G. Engineering
   1. Overview
      a. Division Engineer Administration
      b. Roadmaster
      c. B&B Supervisor
      d. Track Inspectors
      e. Program Maintenance
      f. Track Geometry Car

H. Mechanical
   1. Overview (Cars)
      a. Freight Car Familiarization
         (1) Major Components and Their Functions
         (2) Wheel & Truck Defects
         (3) Safety Appliances
      b. Power Brake Law
   2. Overview (Locomotives)
      a. Shop Orientation
      b. Heavy Repair Shop
         (1) Locomotive Types
         (2) Major Components and Their Functions
      c. Locomotive Servicing
   3. Locomotive Operations

I. Hazardous Material
   1. Emergency Response Procedures
   2. Accident Reporting
   3. Proper Train Placement

J. Excessive Dimension Cars

K. Special Trains

L. Operating Plan-Schedules

M. Labor Agreements
   1. Train Dispatcher Agreements
   2. Operating Craft Agreements
      a. Crew Calling

N. Hands-On Training (OJT)
   1. Road Review; Physical Characteristics of Territory
   2. Simulator Training
      a. Computer-Assisted Dispatching
      b. Track Warrant or Manual Block Dispatching
      c. Single and Double Track ABS
      d. Train Orders and Dispatcher's Bulletins
      e. Train Sheet
   3. On-the-Job Training With On-Duty Dispatchers

O. Conclusion
   1. Qualification on Trick Train Dispatcher Positions
   2. Qualification on Chief Train Dispatcher Positions
   3. Completion of Testing Requirements
      a. Operating Rules
      b. Physical Characteristics

<u>Note 1</u> - While this training cycle is linear, it is intended that periodic review be done throughout the course.

<u>Note 2</u> - It is anticipated that employees promoted from other crafts, as well as "new hires", will be included in the training groups. Employees who are conversant with certain phases of the course (for example, engineers or signalmen) will assist in training those who are not familiar with such subject matter.