



National Transportation Safety Board
Washington, D.C. 20594

Safety Recommendation

Date: June 25, 1998

In Reply Refer To: R-98-26 through -30

Honorable Jolene M. Molitoris
Administrator
Federal Railroad Administration
Washington, D.C. 20590

At 10:52 p.m. on June 22, 1997, Union Pacific Railroad (UP) freight trains 5981 North and 9186 South collided head-on in Devine, Texas. The trains were operating on a single main track with passing sidings in dark (nonsignalized) territory in which train movement was governed by conditional track warrant control authority through a dispatcher. The conductor from 5981 North, the engineer from 9186 South, and two unidentified individuals who may have been riding on 5981 North were killed in the derailment and subsequent fire. The engineer from 5981 North received minor injuries, and the conductor from 9186 South was seriously burned. Estimated damages exceeded \$6 million.¹

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the third-shift dispatcher to communicate the correct track warrant information to the traincrew and to verify the accuracy of the read-back information because the UP management had not established and implemented workload policies and operational procedures to ensure a safe dispatching system and the Federal Railroad Administration had failed to provide standards and oversight in all aspects of train dispatching operations. Contributing to the accident was the lack of an installed positive train separation control system that would have prevented the trains from colliding by automatically intervening in their operation because of inappropriate actions being taken.

¹For more detailed information, read Railroad Accident Report--*Collision and Derailment of Union Pacific Railroad Freight Trains 5981 North and 9186 South in Devine, Texas, on June 22, 1997* (NTSB/RAR-98/02).

At the time of the Devine accident, the UP verification process of track warrants relied on the train dispatcher to detect an inaccurate read-back message and to ensure that a complete and accurate transmission was received from the traincrew. This verification process, in which the train dispatcher just followed the oral repeat-back received from the crew, did not provide a redundancy feature that would confirm whether an accurate repeat-back of the original transmission had registered with and been noted by the train dispatcher.

On the day of the accident at Devine, the third-shift dispatcher understood that when communicating a track warrant to a traincrew, his primary tasks were to read the information as presented on the screen and verify its accuracy, comparing the oral read-back from the traincrew with the information on the screen; he believed that he had been following the established UP track warrant communication procedures. The Safety Board concluded that the third-shift dispatcher did not communicate the accurate information in track warrant 8289 to the crew of train 9186 South. Track warrants have not been addressed in the Code of Federal Regulations (CFR) and, therefore, their use as a method of operation for train movement has not been federally directed. The Safety Board believes that the FRA should revise 49 CFR 220 to address track warrants and other current railroad operating practices.

The use of after-arrival instructions creates an inherent danger by giving a traincrew conditional authority, under which, if a condition is met, their train is allowed to proceed into a block of track even though that track is occupied by an opposing train. Should a failure occur in the transmission or comprehension of a track warrant that results in the omission or inaccurate communication of the condition, two opposing trains may occupy the same block of track at the same time. Once an error has occurred in dark territory and two trains are on the same track at the same time, no wayside signals are available to warn one train of the presence of the other.

The Safety Board has investigated other railroad accidents in which the avoidance of a collision depended on the use of a rule or standard operating practice that proved to be insufficient to prevent an accident. In the Devine accident, the third-shift dispatcher failed to adhere to procedural policy and to follow verbatim the read-back message from the traincrew. The system employed by the UP at the time of the Devine accident allowed for such a failure to occur and permitted the third-shift dispatcher to overlook a critical element during the issuance of track warrant 8289. Hence, the UP method used for dark territory operations needs to be revised to ensure that an oversight by a dispatcher cannot occur. The Safety Board concluded that had the UP after-arrival system in dark territory operations not been used in the Devine accident area, the opposing trains 5981 North and 9186 South would not have been occupying the same block of track. The Safety Board believes that the FRA should require railroads to discontinue permanently the use of after-arrival orders in dark territory.

The Safety Board has previously examined the FRA oversight of train dispatching. After the Safety Board investigated the derailment of an Amtrak train at Fall River, Wisconsin,² in October 1986, it urged the FRA to:

Conduct a thorough study of the selection process, training, duties, and responsibilities of train dispatchers to determine whether the workload is beyond the normal job stress level and to determine what selection and training standards are used for train dispatchers. Establish selection and training standards and limits of workload for dispatchers. (R-87-66)

In 1990, the FRA reported to the U.S. Congress that the imposition of Federal training standards for train dispatchers was not necessary. The FRA based its judgment on a number of factors that it found during the FRA nationwide review of train dispatching.

In a September 1991 letter to the Safety Board, the FRA wrote of its intent to implement a formal research and development study of dispatcher training programs, workload measurement models, occupational stresses, and fatigue effects. The FRA stated in January 1995 that it had found that train dispatchers continue to provide safe, efficient service to the industry; however, it believed that several dispatching areas, particularly training and testing, had shortcomings. In February 1995, the Safety Board advised the FRA that it was disappointed that many of the study's findings and concerns were not adequately addressed in the published recommendations for action. For example, the study identified several major safety-related problems in the occupational stress, workload, and environmental policies affecting dispatchers, but the FRA still has not completed satisfactory regulatory activity to establish dispatcher standards. Therefore, the Safety Board concluded that the FRA has failed to develop dispatcher standards and needs to accelerate the establishment of regulatory standards for train dispatchers.

Because the FRA has only partially met the intent of Safety Recommendation R-87-66 by conducting a study of the selection process, training, duties, and responsibilities of train dispatchers, the Safety Board is classifying Safety Recommendation R-87-66 "Closed--Unacceptable Action/Superseded" and issuing a new safety recommendation to the FRA. The Safety Board believes that the FRA should develop and establish dispatcher selection and training standards, dispatcher trainer standards, and workload limits for dispatchers by January 1, 2000.

During its investigation of a train collision that occurred in July 1988, near Altoona, Iowa,³ the Safety Board examined the FRA's surveillance and enforcement of compliance with Federal regulations. The Safety Board cited the FRA as contributing to the cause of the Altoona accident

²For more information, see Railroad Accident Report--*Derailed of Amtrak Passenger Train 8 Operating on the Soo Line Railroad, Fall River, Wisconsin, on October 9, 1986* (NTSB/RAR-87/06).

³For more information, see Railroad Accident Report--*Head-On Collision between Iowa Interstate Railroad Extra 470 West and Extra 406 East with Release of Hazardous Materials near Altoona, Iowa, July 30, 1988* (NTSB/RAR-89/04).

because of the inadequate FRA surveillance and enforcement of compliance with Federal regulations.

The Safety Board investigated an earlier accident having similar circumstances as those that occurred in the June 1997 Devine accident. In August 1991, near Ledger, Montana,⁴ a Burlington Northern Railroad Company (BNSF)⁵ train was operating in dark territory, and the radio transmission for authority to the main track was improperly delivered. The train dispatcher failed to detect an improper read-back from the crew in the field. In the Ledger accident, the train dispatcher did not detect the crew's misreading of a train station when the crew read the track warrant back to the train dispatcher. Thus, two trains had authority to proceed to the same block of track from opposite directions at the same time. The trains collided head-on and three crewmembers were fatally injured.

After its investigation of the Ledger head-on collision between the two BNSF freight trains, the Safety Board found that several procedural dispatching errors occurred during the train radio transmissions that precipitated the accident. Three years before the Ledger accident, the FRA, in its *National Train Dispatcher Safety Assessment of 1987-88*, had recommended that the BNSF immediately implement a program for dispatchers to teach and enforce radio procedures that comply with all applicable Federal and carrier radio rules. The Safety Board found that had either the FRA or the BNSF adequately followed up on the recommendations to the BNSF, the Ledger accident would not have happened.

Following the June 1997 Devine accident, the FRA documented significant dispatcher procedural deficiencies at the UP Harriman Dispatch Center (HDC) in Omaha, Nebraska, that had preexisted that accident. Although the FRA had in place a routine operating practices oversight program for the HDC, the FRA has no record that its previous routine inspections had cited these dispatcher procedural deficiencies. The Safety Board concluded that the FRA's surveillance and enforcement of compliance with Federal regulations at the HDC before the Devine accident were inadequate and ineffective. Therefore, the Safety Board believes that the FRA should evaluate its surveillance and enforcement of compliance with Federal regulations at dispatching centers and take appropriate corrective actions to ensure that Federal oversight is adequate and effective.

In its investigations, the Safety Board relies on data recovered from the event recorders to determine train speed, direction of travel, distance, throttle position, brake application, and cab signal aspects, when applicable, before and during an accident. As was demonstrated in the Safety Board's investigation of the February 1996 freight train derailment near Cajon Junction,

⁴For more information, see Railroad Accident Report--*Head-On Collision between Burlington Northern Railroad Freight Trains 602 and 603 near Ledger, Montana, on August 30, 1991* (NTSB/RAR-93/01).

⁵The Burlington Northern Railroad Company and the Atchison, Topeka and Santa Fe Railway Company merged on October 1, 1995, and formed the Burlington Northern and Santa Fe Railway Company.

California,⁶ certain critical data are retrieved only in the event recorder of the lead locomotive unit and not in the event recorders of the trailing units. In the Devine accident, the event recorder data for train 9186 South and the lead locomotive of train 5981 North were destroyed by impact forces or fire, or both, and critical event recorder data were lost that could not be retrieved from the other event recorders.

The Safety Board has investigated other accidents in which the event recorder data were compromised due to impact forces or water or fire exposure. In its Corona, California,⁷ Knox, Indiana,⁸ and Mobile, Alabama,⁹ accident investigations, the Safety Board found that critical operational data were lost because the event recorders were not crashworthy. Since 1993, when the FRA required the use of locomotive event recorders, the Safety Board has advocated the development of standards for the crashworthiness of these devices.

Three of the five event recorders in the Devine accident were destroyed either from crash forces or fire exposure. The event recorder on the lead locomotive of 5981 North was destroyed by damage incurred in the accident. Data were recovered from the event recorders on the two trailing locomotives of 5981 North. The event recorders on the lead locomotive and the trailing locomotive of 9186 South were destroyed in the postaccident fire. From a fire resistance standpoint, the type of encasement employed by the manufacturer did not protect the event recorders from thermal destruction. None of the event recorders on the locomotives were designed to meet crash forces or fire exposure standards. The Safety Board concluded that had the event recorders been designed to withstand crash forces and fire exposure, the three destroyed event recorders would have survived and could have provided data for the investigation.

The Safety Board is familiar with the crashworthiness standards in the aviation industry that require the ability to withstand impact shock forces of 3,500 g¹⁰ and fire exposure at 1,100° F for 1 hour, which allow the retrieval of event recorder data after a catastrophic event occurs to the aircraft. Similar standards are not available in the railroad industry. Although the FRA assured the Safety Board in August 1997 that actions have been taken to develop standards for crashworthiness, no standards have been established. Therefore, the Safety Board believes that the FRA, working with the railroad industry, should develop and implement event recorder crashworthiness standards for all new or rebuilt locomotives by January 1, 2000.

⁶For more information, see Railroad Accident Report--*Derailment of Freight Train H-BALTI-31 Atchison, Topeka and Santa Fe Railway Company near Cajon Junction, California, on February 1, 1996* (NTSB/RAR-96/05).

⁷For more information, see Railroad Accident Report--*Atchison, Topeka and Santa Fe Railway Company (ATSF) Freight Trains ATSF 818 and ATSF 891 on the ASTF Railway in Corona, California, on November 7, 1990* (NTSB/RAR-91/03).

⁸For more information, see Railroad Accident/Incident Summary Report--*Knox, Indiana – September 17, 1991* (NTSB/RAR-92/02/SUM).

⁹For more information, see Railroad Accident Report--*Derailment of Amtrak Train No 2 on the CSXT Big Bayou Canot Bridge near Mobile, Alabama, on September 22, 1993* (NTSB/RAR-94/01).

¹⁰An acceleration equal to the acceleration of gravity, about 32 feet per second per second.

A positive train separation (PTS) control system can prevent trains from colliding by automatically intervening in the operation of a train when an engineer does not comply with the requirements of a signal indication or operating rules. The Safety Board has long advocated a PTS control system and since 1970¹¹ has issued safety recommendations calling for this preventive measure. Since most train collisions result from human error, a highly effective train control system is needed. Greater security is provided by a train control system capable of intervening should a failure to observe signals and operating rules occur for whatever reason.

Following its investigation of the head-on collision between two BNSF freight trains near Ledger, the Safety Board urged the FRA in July 1993 to:

Establish a firm timetable that includes at a minimum, dates for final development of required advanced train control system hardware, dates for an implementation of a fully developed advanced train control system, and a commitment to a date for having the advanced train control system ready for installation on the general railroad system.
(R-93-12)

The Safety Board classified Safety Recommendation R-93-12 "Open--Acceptable Response" on July 8, 1994, after the FRA took action to seek the "final system definition, migration path, and timetable" for a PTS control system by December 1994.

The Safety Board has investigated numerous train collisions in which the probable cause or contributing cause was the inattention of the traincrew to wayside signals. After its investigation of the Thedford, Nebraska,¹² accident, the Safety Board stated that had a PTS control system been in place, it could have detected that the engineer was not responding appropriately to the signal indications and could have slowed and stopped the train, thus preventing the collision.

The Silver Spring, Maryland, accident¹³ in February 1996 was the latest in a series of collisions that could have been prevented if a PTS control system had been in place. The Safety Board determined that the probable cause of the accident was the apparent failure of the engineer and the traincrew because of multiple distractions to operate their train according to signal indications and the failure of the FRA, the Federal Transit Administration, the Maryland Mass Transit Administration, and the CSX Transportation Inc. . . . to provide a redundant safety system that could compensate for human error. As a result of the Silver Spring accident investigation, the Safety Board reiterated Safety Recommendation R-87-16, which asked the FRA to promulgate Federal standards to require the installation and operation of a train control

¹¹For more information, see Railroad Accident Report--*Head-on Collision Between Penn Central Trains N-48 and N-49 at Darien, Connecticut, August 20, 1969* (NTSB/RAR-70/03).

¹²For more information, see Railroad Accident Report--*Collision and Derailment Involving Three Burlington Northern Freight Trains near Thedford, Nebraska, on June 8, 1994* (NTSB/RAR-95/03).

¹³For more information, see Railroad Accident Report--*Collision and Derailment of Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Corporation Amtrak Train 29 near Silver Spring, Maryland, on February 16, 1996* (NTSB/RAR-97/02).

system on main line tracks that will provide for positive separation of all trains,¹⁴ and Safety Recommendation R-93-12.

The FRA and the railroad industry share responsibility for the development and implementation of a PTS control system. Under its regulatory authority, the FRA can order a railroad to install a PTS control system. In the Devine accident, a PTS control system could have detected that the 9186 South engineer was not responding appropriately to the track warrant and then have slowed and stopped the train, thus preventing the head-on collision. The Safety Board concluded that had a PTS control system been installed and working in the Devine accident area, the two trains would not have been allowed to enter the same block of track traveling in opposite directions and, as a result, the head-on collision on June 22, 1997, would not have occurred.

Therefore, the National Transportation Safety Board recommends that the Federal Railroad Administration:

Revise 49 Code of Federal Regulations 220 to address track warrants and other current railroad operating practices. (R-98-26)

Require railroads to discontinue permanently the use of after-arrival orders in dark (nonsignalized) territory. (R-98-27)

Develop and establish dispatcher selection and training standards, dispatcher trainer standards, and workload limits for dispatchers by January 1, 2000. (R-98-28)

Evaluate your surveillance and enforcement activities at dispatching centers and take appropriate corrective actions to ensure that Federal oversight is adequate and effective. (R-98-29)

Working with the railroad industry, develop and implement event recorder crashworthiness standards for all new or rebuilt locomotives by January 1, 2000. (R-98-30)

Furthermore, the National Transportation Safety Board reiterates Safety Recommendation R-87-16 to the Federal Railroad Administration:

Promulgate Federal standards to require the installation and operation of a train control system on main line tracks that will provide for positive separation of all trains. (R-87-16)

Also, the Safety Board issued Safety Recommendations R-98-18 through -25 to the UP and Safety Recommendation R-98-31 to the Texas Railroad Commission. If you need additional information, you may call (202) 314-6430.

¹⁴Issued to the FRA in May 1987 after the review of accident investigations since 1967 in which the accidents could have been prevented had a mandated train separation system been in effect.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.


By: Jim Hall
Chairman