

SP20



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 24, 1986

In reply refer to: R-86-13 through -15

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Chairman and Chief Executive Officer
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Log R-554
7/29/86

About 7:40 p.m. on August 2, 1985, Burlington Northern Railroad Company (BN) mixed freight train Extra 6311 West collided head-on with Burlington Northern Railroad Company unit gravel train Extra 6575 East at milepost 12.5, near Westminster, Colorado. Extra 6311 West was traveling about 52 mph, and Extra 6575 East was traveling about 48 mph. The trains collided on the single main track during daylight hours in a 2° 41' left curve in a westerly direction about 50 feet west of a dual-lane bridge on U. S. Highway No. 36. The bridge was destroyed by derailed cars which struck structural support members and by fire which erupted following the collision. Three crewmembers of Extra 6311 West and two crewmembers of Extra 6575 East were killed. The Burlington Northern Railroad Company estimated the damage to be about \$4 million.^{1/}

On August 2, 1985, the train dispatcher and the operators at Longmont and the 31st Street Yard followed correctly the prescribed operating rules and procedures. However, the engineer of Extra 6575 East, unchallenged by the other crewmembers, operated the train 18 mph faster than the 30-mph speed limit allowed by the timetable special instructions. The crewmembers of Extra 6311 West failed to comply with the operating rules on two counts: the train departed Clear Creek without the proper authority; and, although not a particularly significant factor in the accident, the engineer of that train was operating 3 mph over the authorized 49-mph speed limit.

Since Extra 6575 East was restricted to 30 mph because the tonnage load exceeded the 100 tons per operative brake requirement specified in the timetable special instructions, the crewmembers allowed the engineer to operate the train overspeed in disregard of the speed restriction. The Safety Board cannot project how the higher speed rate might have changed the outcome of the accident. However, Extra 6575 East was traveling about 60 percent overspeed (30 mph vs 48 mph). The kinetic energy represented by the train at 48 mph was 344,391.2 Ft-Tons, whereas at 30 mph, the kinetic energy was 134,527.8 Ft-Tons, a difference of 209,863.4 Ft-Tons. If the lower and authorized speed had been observed and if the accident could not have been prevented, the lesser energy expenditure would have increased the chances of the accident being a survivable one. Also, at some other point on the railroad, there may have been sufficient time for the engine crews to have gotten clear of the train before the trains collided.

^{1/} For more detailed information, read Railroad Accident Report—"Head-on Collision of Burlington Northern Railroad Company Freight Trains Extra 6311 West and Extra 6575 East near Westminster, Colorado, August 2, 1985" (NTSB/RAR-86/02).

When one of the crewmembers on the locomotive of Extra 6311 West checked the train register at Clear Creek, he failed to perceive that the information recorded in the train register book was about Extra 6575 East of August 1. As a result of his misperception, he provided the other crewmembers with incorrect information about Extra 6575 East. There were no surviving witnesses who could testify that they saw the crewmember unlock the register box, remove the train register book, and read the entries. The train was standing between the witness in the Western River Paving Construction company so the witness' vision was blocked. However, since the 4:40 p.m. time quoted by a crewmember in the radio report to the conductor is a factual entry of record, the Safety Board concludes the train register book was removed from its repository and viewed by a crewmember. Since it is not known for certain who read the train register, the Safety Board could not determine the circumstances surrounding the dissemination of incorrect train register information. Although the tape recording of the radio message from the crewmember on the locomotive was not good quality, probably because of the distance between Clear Creek and the Longmont radio base station, the reception of the message on the caboose by the conductor would have been more easily understood.

Generally, the gravel train arrived at Clear Creek earlier than it would have on August 2. Therefore, the information that Extra 6575 East had arrived at Clear Creek at 4:40 p.m. on August 2 was probably not surprising to those crewmembers who had not read the train register. Between 4:40 p.m. and 7:10 p.m., the crew of Extra 6575 East would have had ample time to have proceeded from Longmont to Clear Creek, dumped the train load of gravel, and departed Clear Creek for the return trip to Longmont. The crew of Extra 6311 West had a copy of train order No. 28 and they knew Extra 6575 West could return to Longmont ahead of Extra 6311 West.

However, if the crew of Extra 6311 West had been more alert, they should have noticed that train order No. 28 was not issued until 5:07 p.m. Since the crewmembers of Extra 6311 West were experienced on the Third Subdivision, they should have recognized that, based on the running time of about 1 hour 40 minutes for Extra 6575 East to run from Longmont to Clear Creek, and the time that train order No. 28 was issued, Extra 6575 East could not have arrived at Clear Creek before 6:45 p.m. Further, if the crew of Extra 6311 West had allowed Extra 6575 East an hour to dump the gravel, the task would not have been completed until 7:45 p.m. If this logic had been developed, the crew of Extra 6311 West should have questioned why Extra 6575 East was not still in the wye track at Clear Creek. Even if the crewmembers of Extra 6311 West had not known the actual running and unloading time required by Extra 6575 East from Longmont to Clear Creek, the fact that train order No. 28 was not issued until 5:07 p.m. should have alerted the crew of Extra 6311 West that Extra 6575 East could not have registered at Clear Creek at 4:40 p.m., which was before the train order was issued.

When the Form W train order was modified as a revision of the Consolidated Code of Operating Rules by participating railroads, the required contact with the dispatcher was eliminated since the train order authority to accept the train register information was not needed. As a result, a positive check for the arrival of a conflicting train also was lost. Rule S-83(A) and example 5 of the rule gave the crew of Extra 6311 West the authority to use the train register information as evidence of Extra 6575 East's arrival at Clear Creek. Therefore, since there was no rule requiring the crew of Extra 6311 West to check with the dispatcher or one of the train order operators on either side of Clear Creek to determine the location of Extra 6575 East, no attempt was made to contact any of these or the train. Moreover, since the lead locomotive unit for Extra 6575 East on August 2 was the same lead unit that had been used on the gravel train on August 1, a casual glance probably would not have caused anyone reading the register to detect any

difference in the date of a day's separation. Train order number 20 dated August 1, on which Extra 6575 East signed the register at Clear Creek on August 1, was properly recorded in the train register book in the "signals carried" column. The train order was numbered in the same tens series as number 28 issued on August 2. However, the entry in the train register of a train arriving at 4:30 p.m., a time not yet occurring on August 2, should have caused the reader to question his identifying the gravel train's arrival at 4:40 p.m.

The conductor said that on August 2, he did not discuss the train orders with the engineer of Extra 6311 West because he was being hurried by yard personnel to move the train out of the yard. However, since rule 214 states that, "when practicable," the conductor and engineer must have an understanding of the train orders addressed to them which would be confirmed by a discussion, the conductor's not doing so cannot be termed a rules violation. Under the pressure exerted on him to leave the yard, the conductor could have decided that in this instance complying with that part of rule 214 was not practicable. Also, rule 214 states that all crewmembers are responsible for complying with the requirements of train orders. The crewmembers fulfilled the requirement of the train order by checking the register at Clear Creek, and even though the information or the lack of recorded information for August 2 was correct, the register was interpreted erroneously and provoked the wrong action. In all probability, for crewmembers, an understanding of the train order is the understanding of the requirements of the order. They may check the order number against the clearance card, the date, and perhaps, the completion time. The BN should insure that train crews compare and discuss train orders with other relevant times and dates. Had such a discussion of the train orders and relevant times occurred between the crewmembers of Extra 6311 West, this accident might have been prevented.

At the time of the accident, the BN did not provide the train crew with any alternative as a backup for verifying the train register information, except the Form W train order. The Form W train order permitted the train crew of Extra 6311 West to use the train register information as evidence that Extra 6575 East had arrived, but there was no requirement that any other action be taken to verify the information shown in the train register.

Nevertheless, there were available options. The crew of Extra 6311 West could have contacted by radio the Centralized Traffic Control or train order operators at the 31st Street Yard or the train order operator at Longmont to determine the location or status of Extra 6575 East, or the crew could have contacted by radio the crew of Extra 6575 East. Any one of the crewmembers on the locomotive of Extra 6311 West could have called the dispatcher using the telephone located in the T-box at Clear Creek. During the deposition proceedings, crewmembers testified that on occasions, under circumstances similar to those of the day of the accident, the crews of the two trains had contacted each other by radio to determine the other's location. None of these efforts are required by the BN operating rules or procedures and none were done on the day of the accident.

At least two options were available to the dispatcher on August 2. First, he could have held Extra 6311 West at Utah Junction until Extra 6575 East arrived at Clear Creek or as a minimum, until Extra 6575 East's running time from Longmont had expired. If Extra 6311 West had arrived at Clear Creek before Extra 6575 East (as it did), then Extra 6311 West would have had to make a reverse move across the Denver, Rio Grande and Western Railroad (D&RGW) crossing at Utah Junction so that Extra 6575 East could gain access to the Western Paving Construction Company's wye track. Secondly, the dispatcher could have given the two trains a train order to meet at Broomfield, or

another suitable location. The dispatcher said he did not provide a meet between the two trains at Broomfield because he did not know the time Extra 6311 West would leave the Denver yard. The most efficient and best move would have been for the train dispatcher to have held Extra 6311 West at Utah Junction until Extra 6575 East arrived at Clear Creek. Although the movement of Extra 6311 West did not become the responsibility of the train dispatcher until the train left Utah Junction, the dispatcher's permission should have been obtained before Extra 6311 West entered onto the main track under his control.

The Safety Board has investigated several accidents in which it has taken the position that the conductor should be in a position on the train to immediately know current operating conditions. ^{2/} Based on more than 30 major railroad accidents which involved the issue of joint responsibility assigned by the operating rules to the conductor and engineer for the safety of the train, the Safety Board recommended on May 16, 1985, that the Federal Railroad Administration (FRA):

Require that there be at least two crewmembers on locomotives of through freight trains who are qualified to operate the locomotive, that one of these two persons have total responsibility for the train and all employees thereon, and that the second person serve as the assistant to the person in charge. (Class II, Priority Action) (R-85-51)

A similar Recommendation, R-85-52, was issued to the Association of American Railroads (AAR), the United Transportation Union, and the Brotherhood of Locomotive Engineers.

At this time, neither the FRA nor the United Transportation Union has responded to the Safety Board's recommendations. The AAR has objected to the intent of the recommendation; the Board, however, in further dialogue with the AAR, has urged the AAR to reconsider the safety benefits implicit in the recommendation. The Brotherhood of Locomotive Engineers agrees with the Board's recommendation and is following up with the FRA and the industry, urging implementation of this concept. The Safety Board believes that if the conductor had been riding on the locomotive when Extra 6311 West arrived at Clear Creek, he could have read the train register, even though BN's interpretation of rule 83(A) does not require it, and the accident might have been prevented.

During the course of many accident investigations, the Safety Board has heard statements from railroad supervisors that if the rules were obeyed, accidents would not happen. This logic cannot be refuted so long as the rules are adequate. However, in many instances, railroad operating officers will not provide backup measures for safety assurance in case a rule is willfully or unintentionally broken. The Safety Board believes that if the railroad operating officers would provide safety backup procedures to safeguard train operations, many accidents would be prevented. Historically, railroad operating officers have been reluctant to provide backup procedures in the event of a rule's violation. Redundant safety procedures are essential in all transportation operations to ensure the highest levels of safety.

^{2/} Railroad Accident Reports--"Rear End Collision of Two Burlington Northern Freight Trains at Sheridan, Wyoming, March 28, 1971" (NTSB-RAR-72-4); "Penn Central Transportation Company Train Collisions, Leetonia, Ohio, June 6, 1975" (NTSB-RAR-76-2); "Rear End Collision of Two Seaboard System Railroad Freight Trains at Sullivan, Indiana, September 14, 1983" (NTSB/RAR-84/2); and "Head-On Collision of Two Burlington Northern Freight Trains at Motley, Minnesota, June 14, 1984" (NTSB-RAR-85-06).

BN supervisors assured Safety Board investigators that all necessary guidance for using the train register was covered in the biennial rules examinations. However, since all of the information provided for by column headings on the train register is not required at all register locations, the Safety Board believes the train register sheet could be simplified at intermediate locations. The Safety Board understands the problem of adapting the train register book for each location since it is used systemwide. However, the August 2 accident has pointed out the need for instituting a procedure that will eliminate the possibility of a train crewmember's misreading train register information. At the time of the accident, BN operating officers stated that plans were being made for the Track Warrant Control (TWC) system to supplant the train register system in the very near future. Since April 27, 1986, when the BN replaced the Consolidated Code of Operating Rules with the General Code of Operating Rules as the BN's operating authority, and placed the TWC system of operation into service on the Third Subdivision, train orders and intermediate train registers have been discontinued on the Third Subdivision. As of May 13, 1986, the BN had placed the TWC system of train operation into service on 37 Subdivisions of the system. By the end of 1986, the BN expects to be using the TWC system on 90 Subdivisions, and it plans to have the entire system operating with TWCs by the end of 1987. However, as long as the train register system is being used on the BN system, a backup system should be implemented to provide the safest operation possible.

The TWC system seemingly would provide a more positive control over train movements than the train register or train order, and the dispatcher should be able to monitor a train's progress more closely because he would have current information concerning the locations and movements of all trains. Train crews would have positive meet arrangements and would have to obtain the dispatcher's authority to go beyond a specified operating limit. However, the safety involved in the TWC method of moving trains still depends on the train crews obeying the TWC authority and the operating rules.

On April 6, 1984, the Safety Board investigated a train collision involving the TWC operation on the Atcheson, Topeka and Santa Fe Railroad at Castor, Texas. The TWC operation had become effective on February 1, 1984. The crew of an eastbound freight train had received a TWC to proceed to Castor and to clear the main track in the siding for a westbound freight train. The fireman, who was operating the train, became confused and thought that his train was to stay on the main track. (The engineer was in the engineroom checking on a problem.) The westbound train arrived at Castor first and as a result, since it was on the main track, the eastbound freight train collided head-on with the westbound train. One person was killed in the accident.

As the April 6 accident indicates, the TWC authority is no means to end all accidents. Moreover, the TWC most likely will impose a heavier workload on the train dispatcher, which could be dangerous. Therefore, all employees involved in train operations should be well trained in the TWC's application and use. When the BN placed the General Code of Operating Rules and the TWC system into service on the Third Subdivision, an extensive rules training program was carried out. For several days after the April 27, 1986, implementation date, company officers and supervisors worked with the employees on the job to assist the operating employees, including the train dispatchers, to become familiar with the new rules.

The Safety Board could not determine the effect of the radio system outage on the circumstances involving this accident. Since the engineer of a train normally cannot contact the dispatcher directly, it is questionable whether the engineer of either train would have gone through the routine of raising the dispatcher. If the radio system had been operable, even with a heavier work load, the dispatcher may have had the base station at Longmont "tuned in" and he might have stopped the movement of Extra 6311 West before the accident. However, since there is no concrete evidence to support the effect the disrupted radio service might have had on the outcome of the accident, it cannot be concluded that the outage of the radio system had any bearing on the accident.

The train dispatcher at McCook testified that even under the best atmospheric conditions, it was difficult for him to contact a train by radio in the Denver Yard or in the vicinity of Denver or to contact the operators at the 31st Street Yard. The problem in part is caused by the heavy usage of channel 1 in and around Denver and the distance between Denver and the location of the base station at Longmont, which serves the Denver area. The Longmont base station is apparently too far away to adequately serve the Denver area. Better coverage and improved communications might be achieved in the area if the point-to-point communications were routed through a repeater base station to increase the signal strength, if channel 2 could be used, or if the BN could obtain another channel to serve the Denver area. The lack of response to the emergency calls made by the conductor of Extra 6311 West probably was due to the conductor's radio signal not being heard in the Denver Yard area, which could have been the result of the transmission path, with incompatible terrain or obstacles to FM signals, or low receiver sensitivity. Additionally, when a radio transceiver is being used to transmit, the receiver will not simultaneously receive incoming signals. Also, if a transmitter has limited output power, as in the case of hand portables, or if the output power has deteriorated, the range of the radio is limited, and it may not be transmitting a signal strong enough to activate a distant receiver. The optimum range of a portable radio is about 5 miles. No doubt many employees in the Denver Yard were using portable equipment and the distance between the conductor at MP 12.5 and the Denver Yard was too great for effective communications. The BN should strive to provide more reliable radio communications over its territory in the Denver area. When the TWC method of operation is implemented, the radio will become more important than it has been in the past.

Therefore, the National Transportation Safety Board recommends that the Burlington Northern Railroad Company:

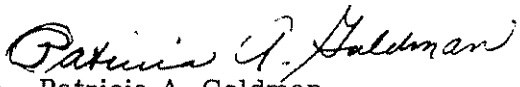
Implement, at intermediate train register locations, a backup procedure, such as telephone or radio verification of train arrivals, to provide train crews with a positive check on the status of other trains so long as the train register method is in operation. (Class II, Priority Action) (R-86-13)

Require crewmembers who check train registers at intermediate locations to sign the train register and to provide the conductor and the engineer with the register information on the reverse side of the clearance card. (Class II, Priority Action) (R-86-14)

Modify the radio system in use in the Denver area to provide reliable coverage in that area and to provide reliable and direct communications between mobile units and the train dispatcher at McCook. (Class II, Priority Action) (R-86-15)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "...to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any actions taken as a result of its safety recommendations and would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations R-86-13 through -15 in your reply.

GOLDMAN, Acting Chairman, and BURNETT, LAUBER, and NALL, Members, concurred in these recommendations.


By: Patricia A. Goldman
Acting Chairman

