



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

R-586

Date: December 9, 1987

In reply refer to: R-87-24 through -29

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On May 18, 1986, 14 of the 23 passenger cars of a Norfolk and Western Railway Company (N&W) passenger excursion train powered by a steam locomotive derailed near Suffolk, Virginia. Of the approximately 1,000 train passengers, all of whom were N&W employees and their relatives and guests, 177 were injured; 19 of the injured were hospitalized. The estimated cost of damage was \$231,530. ^{1/}

The continuous-welded rail (CWR) in the middle track in the accident area was artificially heated when installed in February 1986 to achieve an initial rail-laying temperature of 90° F to 95° F when the average ambient temperature was in the mid 30's as reported by the National Weather Service (NWS) at Norfolk, Virginia. Artificially applied heat is a common practice in the railroad industry, but it is difficult to achieve uniform rail temperatures throughout such an installation process. Thus, careful followup inspection is necessary when ambient temperatures increase because the rail may need to be adjusted as a result of nonuniform rail-laying temperatures--the rail anchors may require repositioning.

When tie replacement and surfacing work was done on the middle track during March and April 1986, the average ambient temperature varied from 31° F to 80° F during the day, with the average temperature being 52° F. This variation in temperature could have resulted in the rail being resecured at a temperature lower than that to which it was artificially heated when installed. The rail temperature can empirically be expected to be 15° F to 30° F greater than the ambient air temperature at the time the rail is resecured. The Association of American Railroads (AAR) has noted that, when the ambient temperature increases about 35° F to 55° F above the rail-laying temperature, the rail stresses increase to the point that track buckling is likely. The N&W could not establish whether followup adjustments to the rail and rail anchors were made as a result of the maintenance performed during this period. The Safety Board believes that such followup adjustments were not made. The Safety Board concludes that the maintenance activities on the middle track (surfacing and tie replacement) and the increasing ambient temperatures created conditions that, in effect, altered the initial rail-laying temperature, resulting in rail that was no longer adjusted to resist the higher temperatures to which it was going to be exposed. Thus, increasing temperatures created greater longitudinal forces in the rail than would have been created had the rail

^{1/} For more detailed information, read Railroad Accident Report—"Derailment of Steam Excursion Train Norfolk and Western Railway Company Train Extra 611 West, Suffolk, Virginia, May 18, 1986" (NTSB/RAR-87/05).

been properly adjusted. Because of these increased forces, the rail tended to elongate and eventually the turnout could not resist elongation.

The physical evidence and the testimony of the crew and passengers suggest strongly that as the train approached a turnout on the westbound track, it passed over track that was already laterally displaced. Lateral displacement of track occurs more often in the early spring and early summer months as ambient temperatures increase and as daily temperatures vary widely. In May 1986, the CWR on the middle and westbound main tracks was subject to variations in temperature, which could have produced tensile and compressive rail stresses that could have readily produced a lateral track displacement. The wide variations in ambient temperatures from the high of 91° F on May 7 to a low of 46° F on May 11 followed by the high temperatures on the day of the derailment were significant because the changes in temperature created increases in the rail stresses that had to be resisted by the turnout.

Compressive rail stresses normally are contained by properly maintained rail anchors and ballast section. Train operation creates additional compressive stresses in the rail, and combined with the effects of increased temperature and disturbed track conditions, the train exacerbates the effects with the possible result of laterally displaced track. The issuance of a "heat wave" order is one method to reduce the effects of the train on the track. A slow moving train is less likely to contribute to the displacement of track than one that is moving rapidly; further, if a track problem develops, the consequences will be lessened.

On May 6, 1986, a prototype shoulder ballast cleaner was being operated on the westbound main track when it struck the turnout at the east end of the accident site and damaged eight adjustable brace plate bolts. The Safety Board believes that during the repair process the track was jacked up significantly to cause the tie/ballast interface to be disturbed. This reduced the ability of the track structure at the turnout to resist the forces in the rail created by the increasing temperature on that day. On the following day, when the section foreman realigned the track and removed a slow order placed on the track because of the track condition, the ambient temperature recorded by the National Weather Service (NWS) at Norfolk was 79° F. However, a "heat wave" order effectively reducing the effects of a train on the track was issued by the dispatcher about 2:44 p.m. on the same day, after the temperature went above 90° F, the threshold for issuing "heat wave" orders on that track section.

On the day of the accident, the dispatcher at Crewe reported a temperature of 86° F to the conductor of the train between the time the conductor reported for duty at 12:15 p.m. and the time the train departed at 1:31 p.m. At 1:50 p.m., the NWS at Norfolk recorded a temperature of 89° F. N&W officials testified that the threshold limit for issuing "heat wave" orders was not uniform throughout the Norfolk Southern Corporation (NS) system before the derailment, but in June 1986 the threshold was standardized at 85° F. The Safety Board believes that had the threshold limitation been standardized at 85° F earlier, a "heat wave" order would have been issued on May 18, 1986, and may have prevented or lessened the effects of the accident.

The N&W's method of obtaining ambient temperatures at midnight, 6 a.m., noon, and 6 p.m. is a standard procedure throughout the railroad industry. Wayside operators normally report the weather conditions at their location to the dispatcher at these time intervals. However, 6 a.m., midnight, and 6 p.m. are not periods of maximum temperatures. On May 7, 1986, the maximum temperature occurred at 1:50 p.m. On the day of the accident, the maximum temperature occurred between the hours of 2 p.m. and 4 p.m. The Safety Board believes that the effects of temperature changes on CWR

requires that the times for monitoring temperatures be modified to include the occurrences of maximum temperatures.

The Safety Board has noted in other accidents the problems with the installation, maintenance, and inspection practices of CWR. 2/ The Safety Board believes that the railroad industry needs to promote the importance of proper procedures to the employees responsible for these areas for CWR.

The track foreman responsible for repairing the westbound main track on May 6 failed to notify the Signal and Communications Department that track work was being performed in the area of the shunt wires of the turnout track shunt circuit switch protection. Although no failure of the signal system was noted during the regular monthly test 8 days after the repairs, the Signal and Communications Department should have been notified of the track work because it could have affected the signal system. The track foreman's work did not do so, but it could have resulted in the failure of the signal system to provide a correct aspect, thereby causing an accident.

On November 28, 1981, an N&W freight train, after receiving a clear signal indicating a clear main track route, entered a misaligned crossover and sideswiped coal-laden hopper cars and then caromed into a freight train on the adjacent track. 3/ The Safety Board investigation of the accident indicated that:

... the west switch of the crossover revealed that the right-hand switch point and its mating stock rail had been recently renewed. The Safety Board also noted that the stock rail had not been drilled to accept the rail connectors for the shunt wires leading to the switch circuit controller. The shunt wires and rail connectors were found lying unconnected in the ballast under the stock rail. The rail connector studs were bent over and the stud ends exhibited fracture surfaces which were covered with rust. Even though the Safety Board believes that the section foreman may have requested the services of a signal maintainer, the Board believes that a signal maintainer was not present during the replacement of the switch point and stock rail. A qualified and experienced signal maintainer would not have broken off the connector studs in a manner that rendered them unfit for reuse and would not have left the shunt wires unconnected to the new stock rail.

As a result of the investigation, the Safety Board recommended that the N&W:

R-82-44

Establish effective coordination procedures in the Maintenance of Way and Signal and Communications Department, to make certain that Maintenance of Way work which involves the signal system will not result in improper functioning of the signal system.

2/ Railroad Accident Reports--"Derailment of Amtrak Train No. 21 (The Eagle) on the Missouri Pacific Railroad, Woodlawn, Texas, November 12, 1983" (NTSB/RAR-85/01); and "Derailment of St. Louis Southwestern Railway Company (Cotton Belt) Freight Train Extra 4835 North and Release of Hazardous Materials near Pine Bluff, Arkansas, June 9, 1985" (NTSB/RAR-86/04).

3/ Railroad Accident Report--"Side Collision and Derailment of Norfolk and Western Railway Company Trains Nos. 6BS78, Yard Shifter, and 67HNP, Crewe, Virginia, November 28, 1981" (NTSB-RAR-82-3).

The N&W responded that instructions were reissued to N&W's Maintenance of Way and Signal and Communications Department employees that any work involving the signal system must be performed as a joint effort and/or with full protection of signal apparatus. On August 18, 1983, the Safety Board placed the recommendation in a "Closed-Acceptable Action" status.

The Safety Board believes that a track foreman's judgment is not an adequate substitute for a signal maintainer's expertise in signal system appliances. In the Suffolk accident, the roadmaster, who was aware of the N&W's policy resulting from the Safety Board's recommendation, said that he would have called for a signal maintainer; however, he did not become aware of the track work until the following day. The differing opinions of the roadmaster, the assistant roadmaster, and the division engineer indicates that the N&W should review its written procedures on when compliance with the policy of notifying the Signal Department is necessary, and then make these procedures clear to all pertinent employees.

The Safety Board is aware that much of the modification and restoration of historic equipment is performed by members of railroad historical societies and associations who take pride in restoring the equipment to its original condition. However, the Safety Board believes that when this historic equipment is used on the general railroad system, the public has a right to expect that the historic equipment will not jeopardize the public's safety. It was no coincidence that, of the 14 cars to derail, the cars that jackknifed and/or overturned were not equipped with tightlock couplers. The railroad industry has long recognized that tightlock couplers prevent vertical disengagement of couplers during derailments, thus resisting cars overturning and telescoping in collisions. Tightlock couplers have been a mandatory standard of the AAR on railroad passenger equipment built since 1956. The N&W management had the responsibility and authority to accept or reject equipment or to impose restrictions as necessary. The Safety Board believes that the N&W management should not have permitted passenger equipment without tightlock couplers to be used in a train.

The Federal Railroad Administration (FRA) exempts historic or older equipment used for excursions on the general railroad system from complying with Federal requirements for safety glazing standards and emergency exits. However, in this accident, windows in the derailed passenger cars were broken either as a result of the derailment or by evacuation of passengers. More injuries, possibly even fatal injuries, could have resulted had car NW 1069, which had no glazing in the window openings to keep occupants from being ejected from the car, overturned and slid, like cars SOU 1087 and SOU 4061. The Safety Board believes that with the increasing number of excursion trips on the general railroad system, no passenger car should be exempt from compliance with the recognized safety standards that are intended to provide the safest equipment for the public.

In evaluating the interiors of the jackknifed and/or overturned cars, it is apparent that the conversions and modifications were done with little consideration for crashworthiness. Service counters in car SOU 4061 were inadequately fastened to the floor and separated from the floor when the car overturned, trapping one passenger. The loose, free-standing appliances, furniture, and other objects became missiles during the derailment and may well have caused some of the more serious injuries. Protruding objects, such as light switches, junction boxes, bare bolt ends, and nails in the walls should be relocated or eliminated.

Although there was no evidence to suggest that alcohol and drugs were involved in the accident, the Safety Board believes that toxicological testing should consistently and

routinely be performed following all major railroad accidents. Toxicological testing can eliminate doubts and speculation or confirm use of intoxicants.

Toxicological testing was not performed following the derailment because, according to NS, the criteria for testing were not met. As it turned out, it appears that this accident did not meet the FRA criteria for toxicological testing. A decision to not conduct toxicological testing was made by the president of the N&W who was not on the scene. The railroad superintendent on the scene did not decide to not conduct toxicological testing until 4 hours after the derailment. Also, when the various NS investigators and officials arrived at the accident site, there was confusion as to the identity of the appropriate senior official entrusted with the decision on whether or not to test. Under other circumstances, for instance when testing criteria are met, such confusion may result in a failure to test or a delay in testing. The delay in deciding whether or not to test would seriously compromise the value of tests. The value of the NS testing program ultimately depends on its consistent application, as a matter of standard and routine practice.

The Safety Board approves of the NS' effort to develop a comprehensive syllabus for instruction of management supervisory personnel on the control of alcohol and drug use. However, as demonstrated by the confusion that arose at the accident site, clarification of duties of senior officials responding to an accident is needed. Also, the program needs to address the instance when a member of management or the executive division becomes the "covered employee."

Title 49 CFR Part 219, Subpart C states that the determination to conduct toxicological testing is left to the railroad representative responding to the scene of the accident/incident. This representative is responsible for making reasonable inquiry into the facts as necessary to make a decision. The regulations state that the railroad representative satisfies the requirements if, after making a reasonable inquiry, he exercises good faith judgment in making his decision. The Safety Board believes that the senior officers of the N&W failed to take advantage of an excellent opportunity to demonstrate to its employees the importance it places on its toxicological testing program and the FRA's toxicological testing program and that the N&W management not only supported such training, but would participate in such testing if they were involved in an accident.

Therefore, the National Transportation Safety Board recommends that the Norfolk and Western Railway Company, a subsidiary of the Norfolk Southern Corporation:

Develop and implement a program to provide maintenance-of-way forces and supervisory personnel with technical training for identifying and correcting track maintenance problems associated with continuous-welded rail. (Class II, Priority Action) (R-87-24)

Review the written procedures in the Maintenance of Way Department and instruct all pertinent employees of the requirement to notify the Signal and Communications Department when maintenance-of-way work involves the signal system. (Class II, Priority Action) (R-87-25)

Require that all cars in the consist of a passenger-carrying train be equipped with interlocking (tightlock) couplers and certified window glazing. (Class II, Priority Action) (R-87-26)

Require that the interior fixtures and appliances of any passenger-carrying car be secure and that the interiors of cars do not have the injury-producing features identified in the accident involving train Extra 611 West at Suffolk, Virginia, on May 18, 1986. (Class II, Priority Action) (R-87-27)

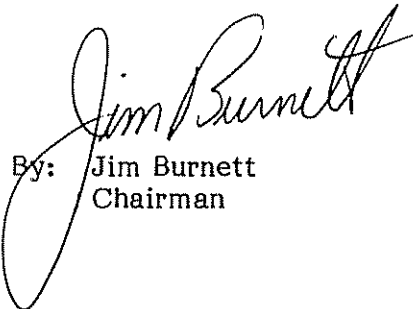
Review the toxicology training program and revise, as necessary, to clarify the duties of company officials responding to the scene of an accident. (Class II, Priority Action) (R-87-28)

Revise, to reflect the occurrences of the maximum changes in ambient temperatures, the times at which such temperatures are obtained for the purpose of placing slow orders on continuous-welded rail track. (Class II, Priority Action) (R-87-29)

The Safety Board also issued Safety Recommendations R-87-30 and -31 to the National Railroad Historical Society, the American Association of Private Railroad Car Owners, Inc., the American Short Line Railroad Association, and the Association of American Railroads; R-87-32 to the American Short Line Railroad Association and the Association of American Railroads; and R-87-33 through -37 to the Federal Railroad Administration.

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-87-24 through -29 in your reply.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and NALL and KOLSTAD, Members, concurred in these recommendations. LAUBER, Member, did not participate.


By: Jim Burnett
Chairman