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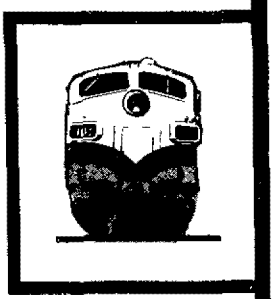

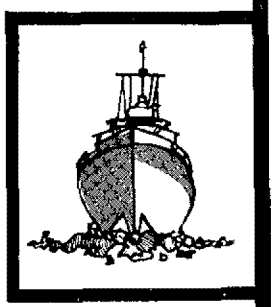

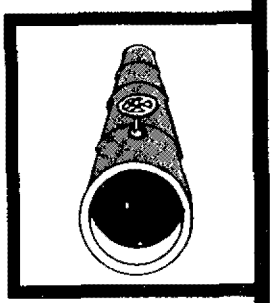

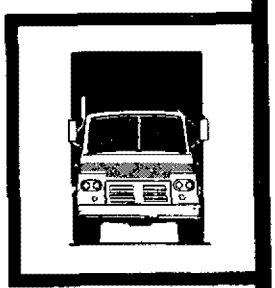

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

DERAILMENT OF
BURLINGTON NORTHERN RAILROAD COMPANY
FREIGHT TRAIN NO. MTC-0718
NEAR CRYSTAL CITY, MISSOURI
JULY 18, 1983

NTSB/RAR-84/01

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

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16. Abstract About 4:35 p.m. on July 18, 1983, 58 cars of Burlington Northern Railroad Company freight train No. MTC-0718, moving about 52 mph, were derailed on the main track near Crystal City, Missouri. Two of the derailed cars came to rest in the Mississippi River. Within the train's 94 cars were 17 maintenance-of-way, ballast-laden hopper cars being transported to maintenance-of-way work locations north of St. Louis, Missouri. The train was being operated in revenue service without restriction. No one was injured in this accident, and no hazardous materials were involved. Damage was estimated to be about $1,058,330.

The National Transportation Safety Board determines that the probable cause of this accident was the displacement of the outer rail in a curve by a truck on a maintenance-of-way car, which could not slue to the track curvature because of a cracked and displaced centerplate. Contributing to the accident was the Burlington Northern Railroad Company's failure to enforce its inspection and maintenance procedures for maintenance-of-way cars or to impose restrictions on their movement in revenue freight trains. Also contributing to the accident was the Federal Railroad Administration's failure to establish car safety standards or operating restrictions for maintenance-of-way cars in revenue freight trains.

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CONTENTS

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: February 7, 1984

DERAILMENT OF BURLINGTON NORTHERN RAILROAD COMPANY FREIGHT TRAIN NO. MTC-0718 NEAR CRYSTAL CITY, MISSOURI JULY 18, 1983

SYNOPSIS

About 4:35 p.m. on July 18, 1983, 58 cars of Burlington Northern Railroad Company freight train No. MTC-0718, moving about 52 mph, were derailed on the main track near Crystal City, Missouri. Two of the derailed cars came to rest in the Mississippi River. Within the train's 94 cars were 17 maintenance-of-way, ballast-laden hopper cars being transported to maintenance-of-way work locations north of St. Louis, Missouri. The train was being operated in revenue service without restriction. No one was injured in this accident, and no hazardous materials were involved. Damage was estimated to be about $1,058,330.

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INVESTIGATION

The Accident

Burlington Northern Railroad Company (BN) train No. MTC-0718, a regularly scheduled freight train, originated at Memphis, Tennessee, on July 18, 1983, at about 6:05 a.m. 1/ After receiving an initial terminal inspection, the train proceeded to Turrell, Arkansas, where at about 11 a.m. 18 hopper cars of crushed rock ballast for use by the BN Maintenance-of-Way (MW) Department were added to the train. (See figure 1.) The brakeman stated that a brake test at Turrell on the hopper cars revealed that the brakes on one of the hopper cars were not functioning properly. The hopper car with defective brakes was then set out of the train. The remaining 17 hopper cars were placed near the head of the train, beginning 5 cars behind the three-unit locomotive. The hopper cars are not required to be inspected by BN Car Department inspectors at Turrell.

1/ All times hereinafter referred to are Central Daylight Time.

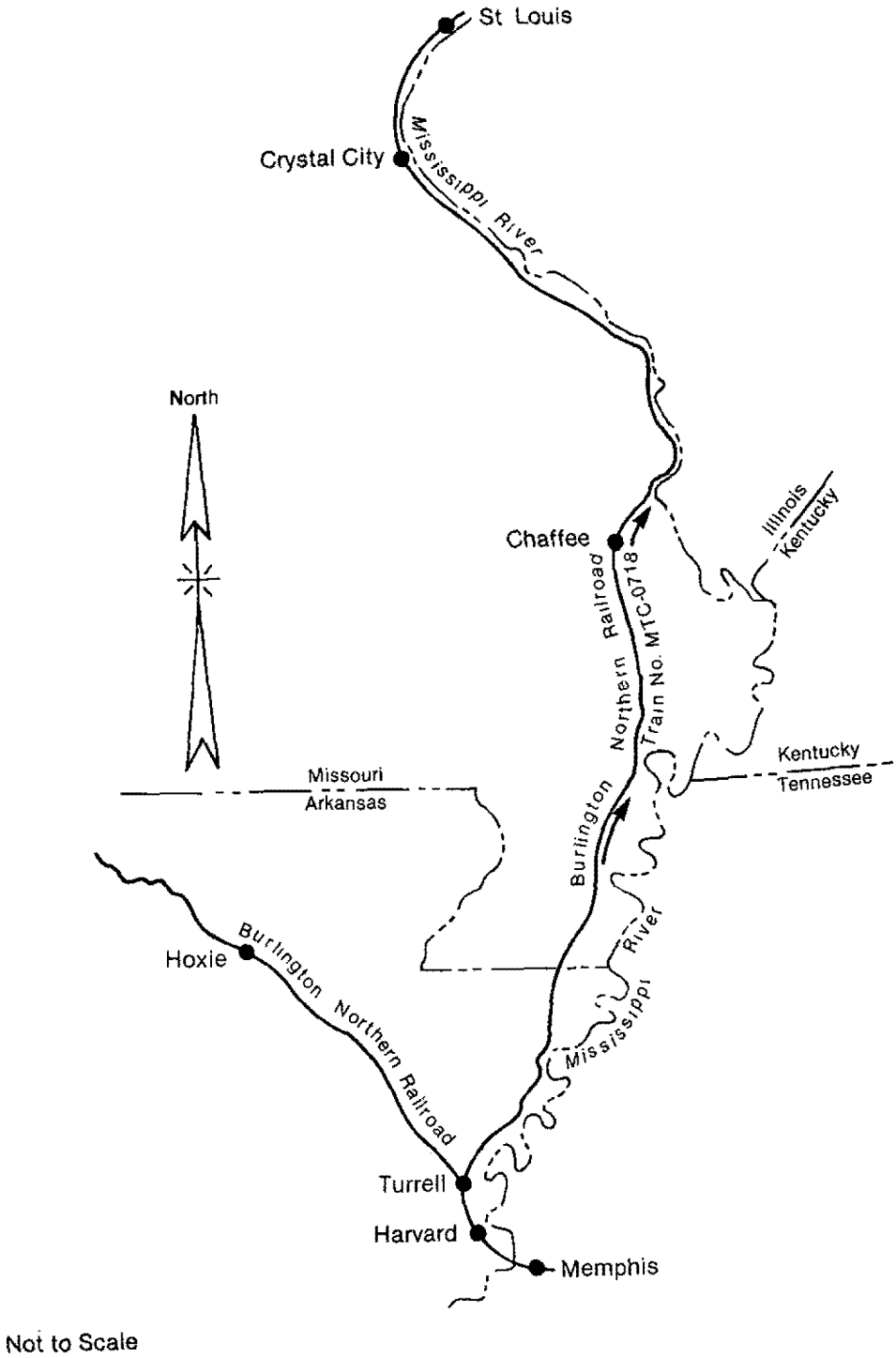


Figure 1.--Train No. MTC-0718 route diagram.

About 44 miles north of Turrell, the train was stopped to set out the first 4 cars as scheduled, leaving the 17 hopper cars directly behind the locomotive. The train then proceeded to Chaffee, Missouri, where a relief crew took over the train. The incoming engineer made a full service brake application and stopped the train, the outbound engineer released the brake, and the train's rear end crew (a conductor and a rear brakeman) performed a roll-by inspection of the train's running gear. The rear end crew took no exception to the condition of the train during the roll-by inspection. They boarded the caboose, and the train proceeded north.

About 4:35 p.m., train No. MTC-0718 was approaching Crystal City, Missouri, about 42 miles south of St. Louis, Missouri, at which point there was a 2-degree curve to the left, an intervening 544 feet of tangent track, and then a 3-degree curve to the right. The tracks at this location are situated on a side-hill cut with bluffs rising to the west and the Mississippi River below and to the east. The engineer and head brakeman stated that about the time the locomotive was passing over a timber trestle over Selma Creek in the tangent portion of the track and nearing a left-hand turnout leading to a passing siding on the west side of the main track (see figure 2), they felt a lateral motion on the locomotive. The engineer stated that the speed of the train was about 50 mph at that time, and that he had just begun to reduce the speed of the train for a 20-mph speed restriction through Crystal City, about 3 miles distant, by placing the locomotive into dynamic braking.

Immediately afterward, when the locomotive had just passed over the turnout to the passing siding, the train's automatic air brake unexpectedly applied in emergency. The three-unit locomotive and the first four hopper cars remained coupled and came to a stop with the rear truck of the fourth car derailed but remaining in line and upright. The following 58 cars derailed. Cars 5 through 19 (15 cars), including the remaining 13 hopper cars, came to rest in various positions along the main and siding tracks north of the timber trestle. Cars 20 through 30 (11 cars) came to rest in the creekbed or on the destroyed timber trestle. Cars 31 through 42 (12 cars) came to rest upright, while the following 19 cars (cars 43 through 61) came to rest in jackknifed positions along the track structure. Two of these cars, both of which were empty, came to rest in the Mississippi River. The rear 33 cars and the caboose did not derail.

No one was injured, and there was no fire in any of the derailed equipment. No hazardous materials were involved.

Damage

A total of 58 cars were involved in the derailment; 21 cars were destroyed, 20 cars sustained extensive damage, and the remaining 17 cars sustained only minor damage.

About 1,530 feet of track were damaged in the accident. A 110-foot-long, eight bent 2/ wooden trestle supporting the track structure across Selma Creek was destroyed in the accident. (See figure 3.) Also destroyed were the power-operated switch leading to the siding north of the trestle and a 140-foot-high microwave transmission tower situated just to the west of the switch.

2/ According to the Manual For Railway Engineering of the American Railway Engineering Association (AREA), a "bent" is defined as: The group of members forming a single vertical support of a trestle, designated as pile bent where the principal members are piles, and as framed bent where of framed timbers.

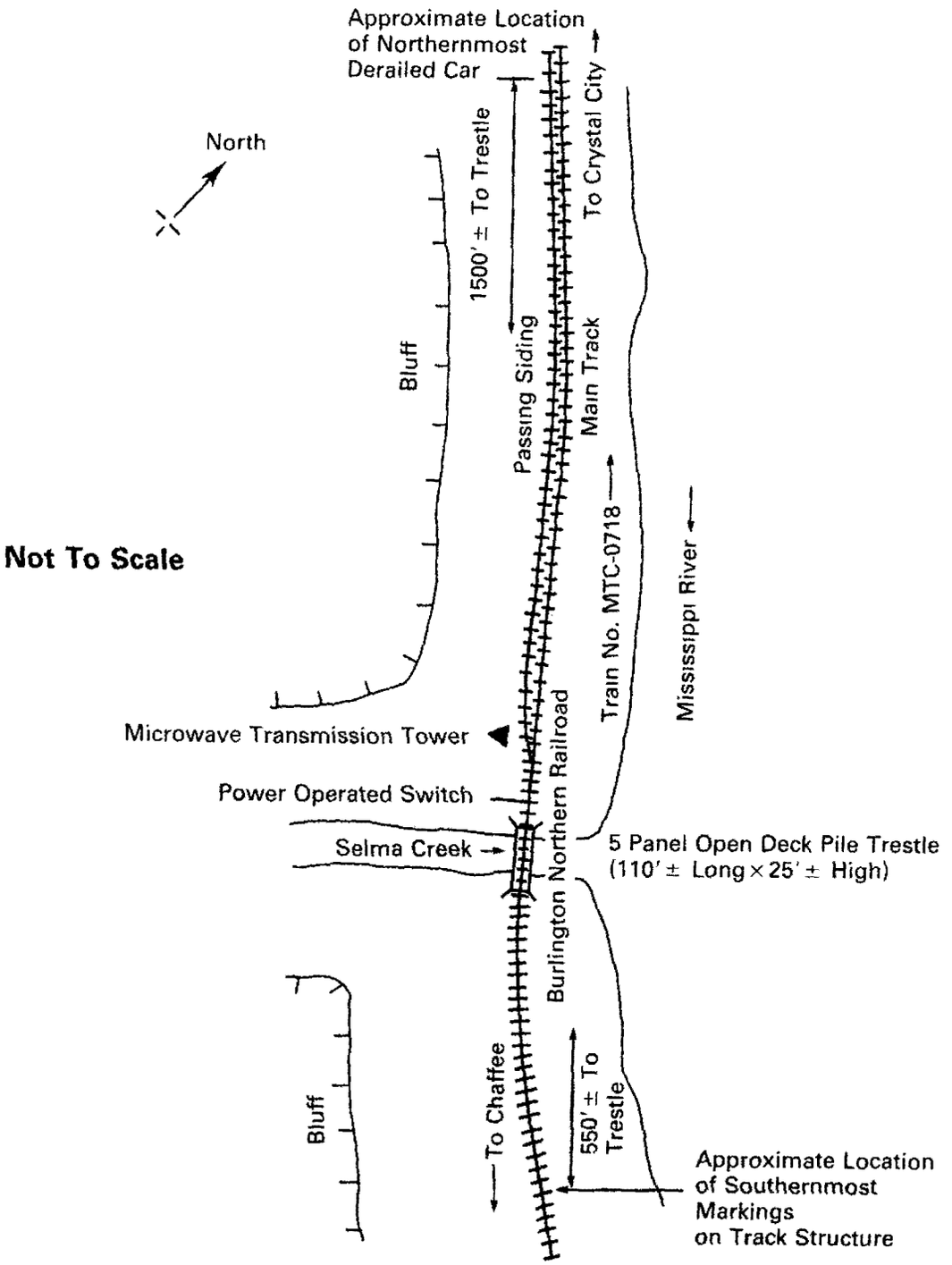


Figure 2.—Plan view of derailment site.

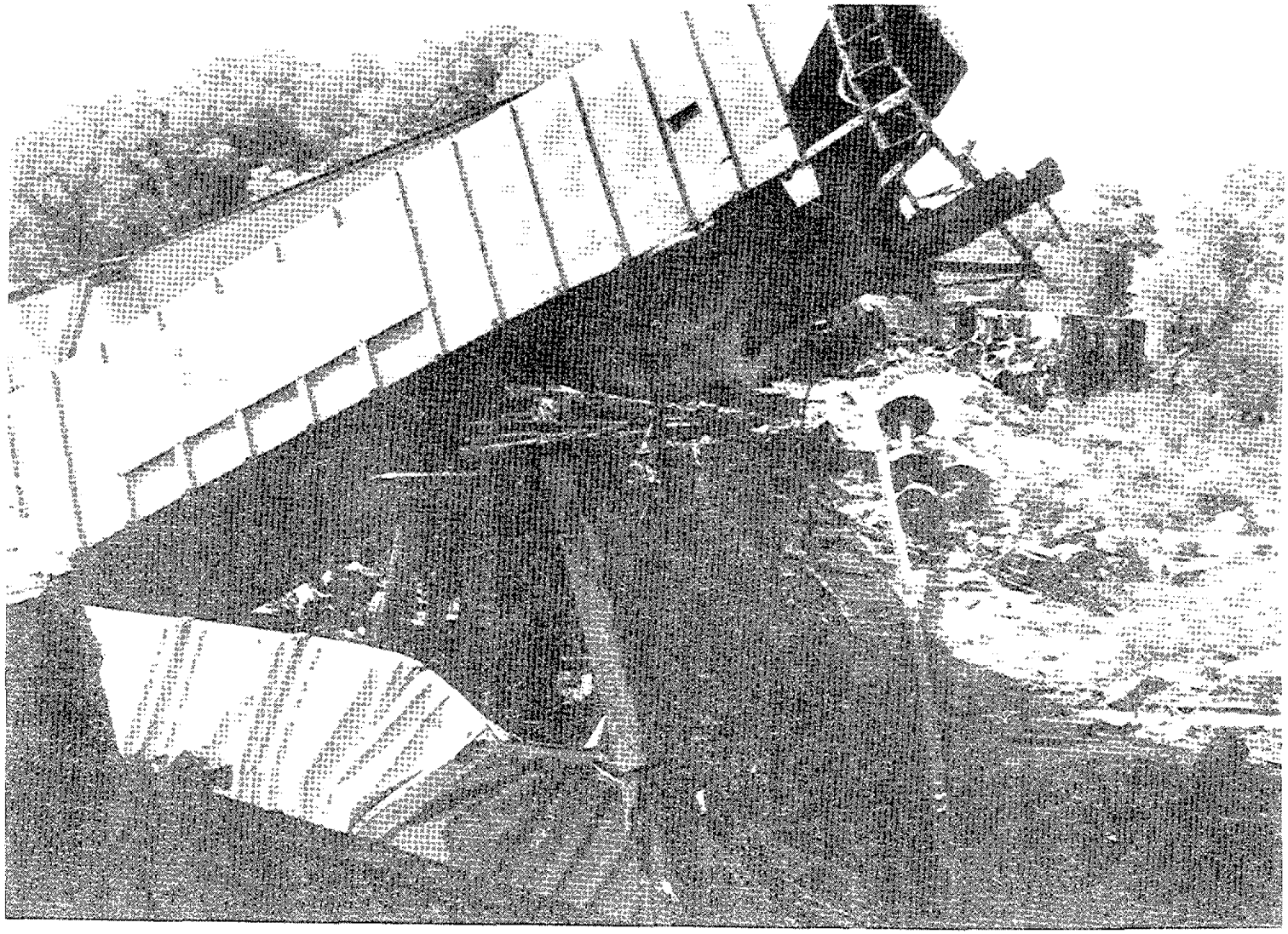


Figure 3.—Derailed cars and destroyed wooden trestle at derailment site.

Damage was estimated as follows:

Equipment	$ 532,716
Lading	200,500
Track	22,700
Bridge	98,500
Signals	150,000
Wreckclearing	53,914
	$1,058,330

Personnel Information

The engineer, head brakeman, conductor, and rear brakeman were all qualified for their positions in accordance with BN requirements (see appendix B). All crewmembers were current on operating rules.

Train Information

The locomotive of train No. MTC-0718 consisted of three diesel-electric units: BN 6334, BN 4016, and BN 8143. The first and third units were model SD-40-2, 3,000-horsepower, 6-axle units, manufactured by the Electromotive Division of General Motors Corporation. The second unit was a model B30-7A, 3,000 horsepower, 4-axle unit, manufactured by the General Electric Company. The locomotive weighed about 1,026,000 pounds. All the units were equipped with operable radios, 26-L air brake systems, dynamic brakes, speed indicators, and event recorders. 3/ The caboose was equipped with an operable radio.

At the time of the accident, the train contained 55 loaded cars, 39 empty cars, and 1 caboose, and had a trailing tonnage of about 7,061 tons. The train contained general merchandise but no hazardous materials.

The train received an initial terminal inspection before its departure from Memphis on July 18, 1983. Inspections of the train equipment and air brakes were neither required nor conducted at Chaffee, the point at which the relief crew took over train No. MTC-0718.

Track Information

The main track at the accident location is constructed of 115-lb RE section 4/ continuous welded rail (CWR). The rails are laid on double-shouldered tie plates atop treated hardwood crossties. The crossties are laid on crushed limestone ballast with compacted full tie cribs. The shoulder ballast section extends more than 12 inches beyond the outer crosstie end.

3/ The event recorder records elapsed time, speed in miles per hour, load in amps, travel direction, automatic brake pipe reduction, locomotive brake and throttle setting, and dynamic brake application.

4/ 115-lb RE section refers to rail which nominally weighs 115 pounds per lineal yard and is a standard rail section recommended for use by the AREA.

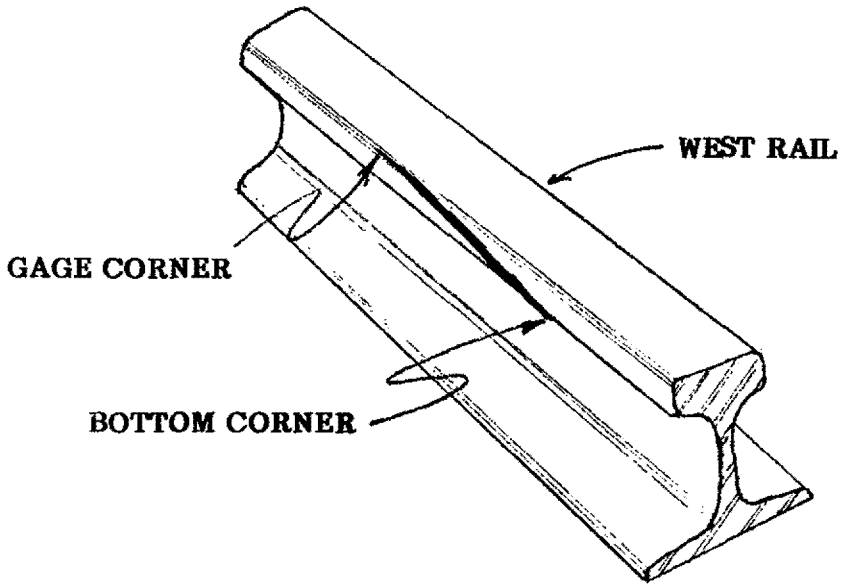


Figure 4.--Sketch of southernmost derailment marking at transition from tangent track into 3-degree curve.

The power-operated main track switch, which leads to the siding, is constructed of 115-lb RE rail. The switch is located about 56 feet north of the north end of the wooden trestle. The siding is constructed of 112-lb RE section jointed rail. The main track, which is at a generally level river grade, descends northward for about 1,350 feet approaching the trestle at a 0.12 grade, and ascends for about 800 feet north of the trestle at a 0.14 grade. The main track meets or exceeds the minimum standards of the Federal Railroad Administration (FRA) track safety standards for class 4 track, and the siding meets or exceeds the FRA track safety standards for class 2 track. 5/

Investigation of the track structure within the derailment site indicated that the first set of derailment markings (southernmost) occurred at about the transition from the tangent track into the 3-degree curve to the right, south of the trestle. (See figure 2.) The mark extended downward from the gage corner of the west rail to the bottom corner of the rail head. (See figure 4.) The west rail is the outside rail in the curve at this location. The crossties at this location met FRA track safety standards, but there were wheel flange markings near the east rail. The track spikes had been elevated on the gage side and bent over to the west on the field side of the west rail. From this point northward to the trestle, the east rail was displaced to the east and the west rail was displaced to the west. Examination of the component structural members of the wooden trestle did not disclose any defects that would have contributed to the accident.

Method of Operation

Trains are operated through Crystal City by timetable, train orders, special instructions, and signal indications of the automatic wayside signals of a centralized traffic control (CTC) system. The maximum allowable speed at the location of the accident is 50 mph with a speed restriction of 20 mph through the limits of Crystal City. No passenger trains are operated over this portion of the BN. One scheduled northward and one scheduled southward freight train are operated daily.

The BN uses a stone quarry near Hoxie, Arkansas, (see figure 1) as a major source of supply for the crushed rock ballast for its track structures. The ballast-laden hopper cars that were involved in this accident originated at Hoxie. The cars were transported from Hoxie to Turrell and set out at Turrell before being added to northbound train No. MTC-0718. The ballast was destined for a trackwork location on the BN north of St. Louis. BN traincrew members told Safety Board investigators that they routinely pick up loaded ballast cars at Harvard, Arkansas, or Turrell on northbound trains and set out the empty ballast cars from southbound trains at those locations. They further stated that they routinely pick up ". . . anywhere from 10 to 40 . . ." ballast cars on northbound trains.

Special instructions within the BN timetable restrict ". . . loaded unit ore, ballast and potash trains . . ." to a maximum speed of 40 mph. However, no restriction is placed on the operation of trains containing ballast cars if the train is not a unit train. Train No. MTC-0718 was subject to a "heat order" that was issued to the crew in Memphis on the day of the accident. Heat orders are issued to lower train-induced stresses on track with CWR during periods of high ambient temperatures. Under a BN heat order a train must be operated at a speed not to exceed 10 mph less than the normal maximum allowable speed when the ambient temperature reaches or exceeds 90° F. The heat order further instructs the engineer not to use the train's dynamic brake to slow or stop his train. The heat order issued to train No. MTC-0718 did not specify the ambient temperature at the time the heat order was issued or what the expected high temperature was for July 18, 1983.

The FRA sets forth certain minimum safety standards for railroad freight cars in Title 49 Code of Federal Regulations (CFR) Part 215, Railroad Freight Car Safety Standards. However, 49 CFR 215.3(c)(3) excludes from the application of that part ". . . Maintenance-of-way equipment . . . if that equipment is not used in revenue service and is stenciled in accordance with section 215.305 of this part." The term "revenue service" is not defined in the CFR. 6/ Section 215.305 states:

5/ Title 49 CFR 213.9, "Classes of Track: operating speed limits," prescribes for Class 2 track a maximum allowable operating speed of 25 mph for freight trains, and prescribes for Class 4 track a maximum allowable operating speed of 60 mph for freight trains.

6/ According to the Statistical Manual of the Association of American Railroads, the terms Revenue and Non-Revenue Freight are:

> Revenue Freight—A local or interline shipment for which earnings accrue to the carrier upon the basis of tariff rates.
>
> Non-Revenue Freight--Company material and supplies transported without charges in freight trains of a particular railroad for its own use.

(a) Maintenance-of-way equipment (including self-propelled maintenance-of-way equipment) described in §215.3(c)(3) shall be stenciled, or marked—
  (1) In clearly legible letters; and
  (2) In accordance with paragraph (b) of this section.
(b) The letters "MW" must be—
  (1) At least 2 inches high; and
  (2) Placed on each side of the car.

Hopper car BN 958200, the seventh car in the train, was stenciled in accordance with 49 CFR 215.305, and it was restricted to ballast hauling service by the BN. Therefore, it was not required to conform to Part 215. Section 215.121 states:

> A railroad may not place or continue in service a car, if:
> (a) Any portion of the car body, truck, or their appurtenances (except wheels) has less than a 2 1/2 inch clearance from the top of rail;
> (b) The car center sill is:
> (1) Broken;
> (2) Cracked more than 6 inches; or
> (3) Permanently bent or buckled more than 2 1/2 inches in any six foot length;
> (c) The car has a coupler carrier that is:
> (1) Broken;
> (2) Missing;
> (3) Non-resilient and the coupler has a type F head.
> (d) After November 1, 1982, the car is a box car and its side doors are not equipped with operative safety hangers, or the equivalent, to prevent the doors from becoming disengaged;
> (e) The car has a center plate;
> (1) That is not properly secured;
> (2) Any portion of which is missing; or
> (3) That is broken; or
> (4) That has two or more cracks through its cross section (thickness) at the edge of the plate that extend to the portion of the plate that is obstructed from view while the truck is in place; or
> (f) The car has a broken sidesill, crossbearer, or body bolster.

BN officials stated to Safety Board investigators after the accident that it was BN policy to give, and that they were giving, MW cars the same maintenance inspections given to freight cars used in revenue service. They further stated that BN policy was to continue operating MW cars in revenue trains without imposing any additional restrictions to the operation of those revenue trains containing MW cars.

Meteorological Information

At the time of the accident, visibility was good, the temperature was about 95° F, the relative humidity was about 44 percent, and the winds were from the west-northwest at about 8 knots. There was no precipitation.

Tests and Research

An examination of the event recorder tape determined that the locomotive was moving about 52 mph at the time of the accident. (See appendix C.) There was a heat order in effect that required 40 mph.

Postaccident examination of the derailed equipment disclosed that the body centerplate from the "A" end 7/ of hopper car BN 958200 had separated from the car body during the accident (see figures 5, 6, and 7) and had multiple fractures with rust-covered surfaces. The examination also disclosed that two other of the ballast-laden hopper cars that were derailed in the accident, BN 958104 and NP 85412, had fractured body centerplates with rusted surfaces. The cars were not overloaded. All three of the ballast cars were stenciled "MW" in accordance with 49 CFR 215.305 and were dedicated to ballast hauling services.

Safety Board investigators noted that MW hopper car BN 958200 had been repaired at the BN's repair track facility at Galesburg, Illinois, on July 2, 1983. The repairs consisted of air brake hose replacement, side bearing weldment, spring replacement, end sill weldment, and brake shoe replacement (see appendix D). The record of that work does not note the condition of the body centerplate on BN 958200. The car was returned to ballast hauling service after the repairs of July 2, 1983, were completed. The car had been ordered to be repaired because of defective truck springs found during a routine train yard inspection at Galesburg on June 30, 1983, while the car was en route from Hoxie to Clinton, Iowa (see appendix D). After the repair, in which the car body is lifted or tilted from the truck bolster to facilitate replacement of the springs, thus exposing the centerplate, the car proceeded to Clinton for unloading on July 7, 1983, and subsequently was returned to Hoxie for ballast loading on July 14, 1983.

After the accident, the body centerplate from the "A" end of MW hopper car BN 958200 was taken to a BN facility for metallurgical analysis. (See appendix E.) The examination disclosed (1) the presence of weldment repair that had been performed at some undetermined time prior to the accident, (2) indications that the centerplate may have been displaced prior to the accident, (3) center pin elongation without any crack initiation in that area, and (4) multiple heavily rusted fracture surfaces.

Other Information

Railroad freight cars used in revenue interchange service are subject to the provisions of the interchange rules of the Association of American Railroads (AAR) as set forth in the AAR Field Manual. Rule 60 of the interchange rules states that, "Body center plates must be replaced with new or reclaimed secondhand plates. . .", and permits weldment repair of centerplates ". . . on loaded car or on car with unusual design center plate, in which case repair weld may be made as a temporary repair to allow car to be forwarded to destination and to home shop." (See appendix F.) MW cars are not subject to the interchange rules as long as they are not interchanged to any other railroad.

7/ The "A" end of a car is that end of the car opposite the end of that car at which the hand brake is located. The "B" end of a car is that end of the car at which the hand brake is located.

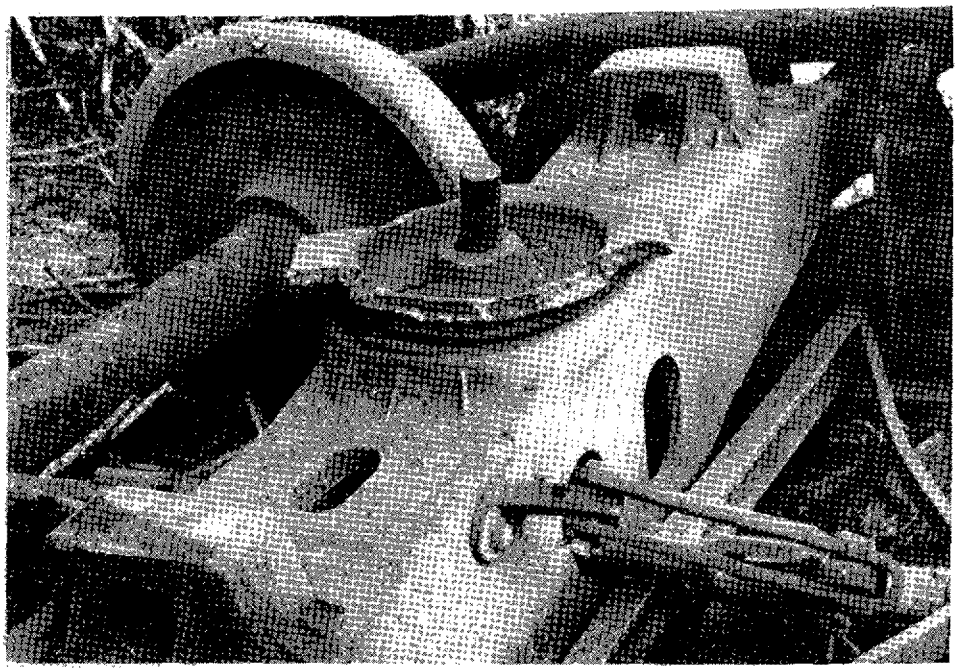


Figure 5.—Car body centerplate from BN 958200 shown separated from car body and resting in place on "A" end truck bolster.

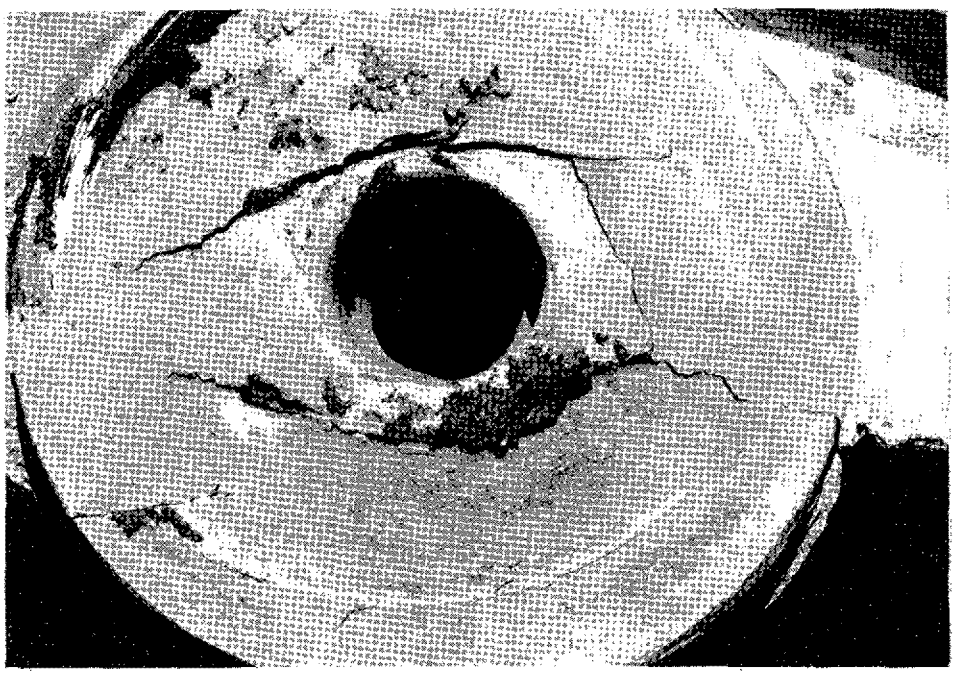


Figure 6.—View of the underside of car body centerplate from "A" end of BN 958200 showing multiple rust-covered fracture surfaces.

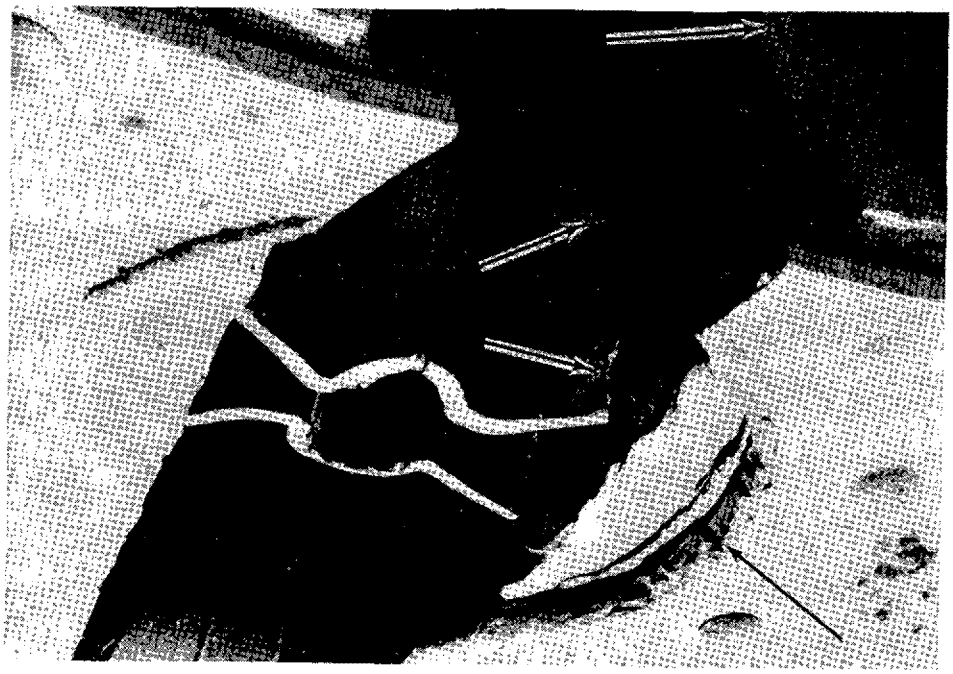


Figure 7.--Underside view of car body center casting at "A" end of BN 958200 with centerplate displaced. Note rust-covered fractures indicated by arrows.

On July 22, 1983, two Safety Board investigators went to the stone quarry near Hoxie where the ballast cars involved in the accident had been loaded. They examined 21 hopper cars at that location that were loaded with ballast and ready for movement. Of the 21 cars, 2 cars were found to have fractured centerplates. Car GN 78206 was found to have fractured centerplates at both ends of the car (see figures 8 and 9). Car BN 958123 was found to have a fractured centerplate at the "B" end of the car. (See figure 10.) These conditions were brought to the attention of BN officials who then ordered the two cars to be transferred to the repair track at Memphis. Car GN 78206 received extensive repairs and was returned to service; car BN 958123 was later condemned and scrapped.

Correlating Information

The Safety Board has investigated other accidents involving MW cars being moved in revenue trains. On Conrail at Hughes, Ohio, on June 7, 1976, the chain securements on a load of prefabricated panels of track loosened on an MW car, and the load of track panels shifted because of being improperly fastened. The panels struck an oncoming train on the adjacent main track. A locomotive engineer was killed, and a fireman and a brakeman were injured. Damage was estimated to be about $57,000. (See appendix G). 8/ The MW

8/ For more detailed information see National Transportation Safety Board Report of Railroad Accident Investigation, Consolidated Rail Corporation Freight Train Collision at Hughes, Ohio, June, 7, 1976 (ATL-76-F-R-086).

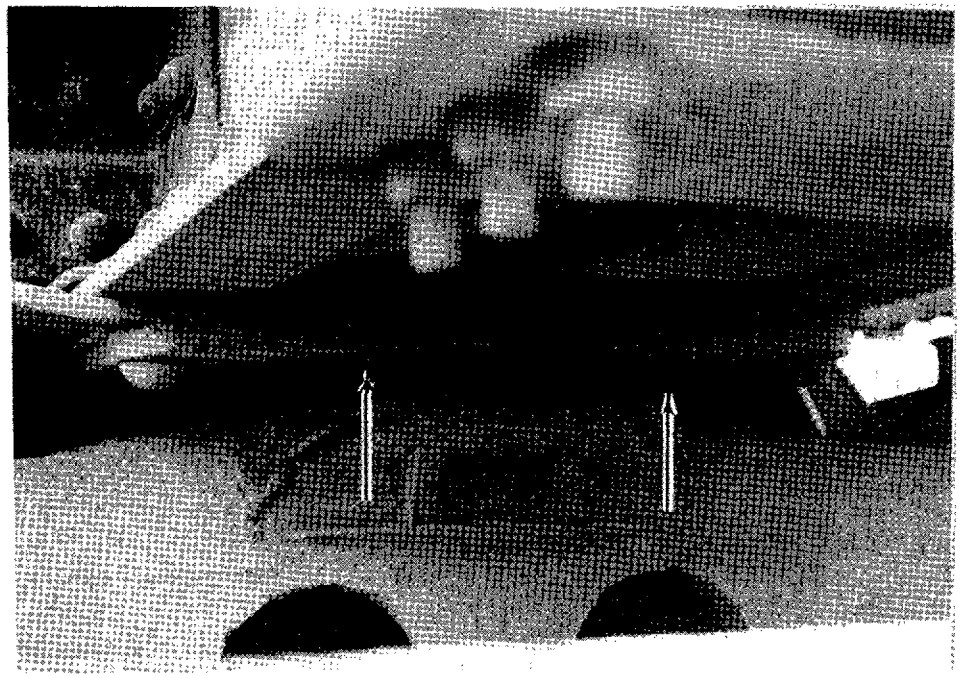


Figure 8.—Fractured centerplate at "A" end of GN 78206.

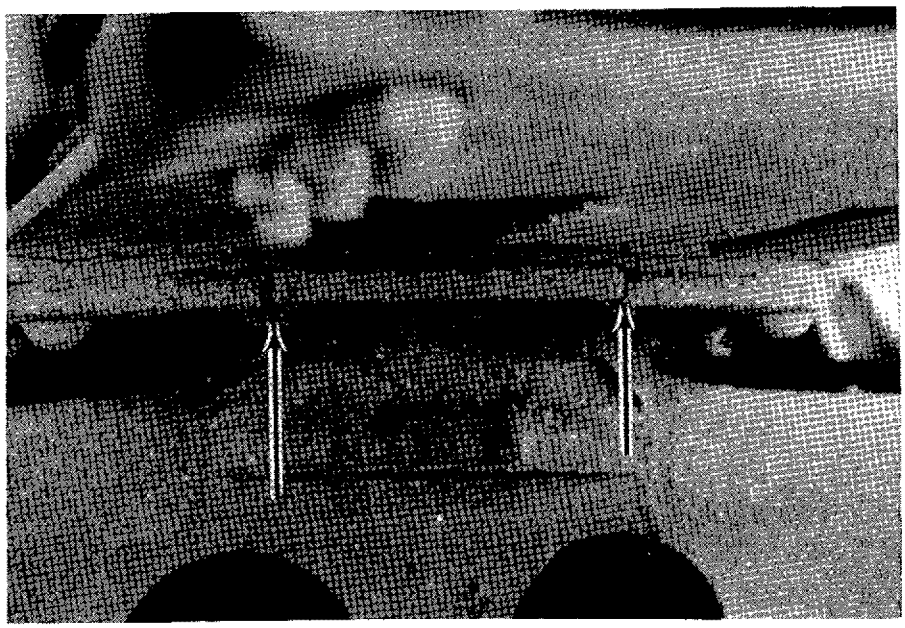


Figure 9.—Fractured centerplate at "B" end of GN 78206.

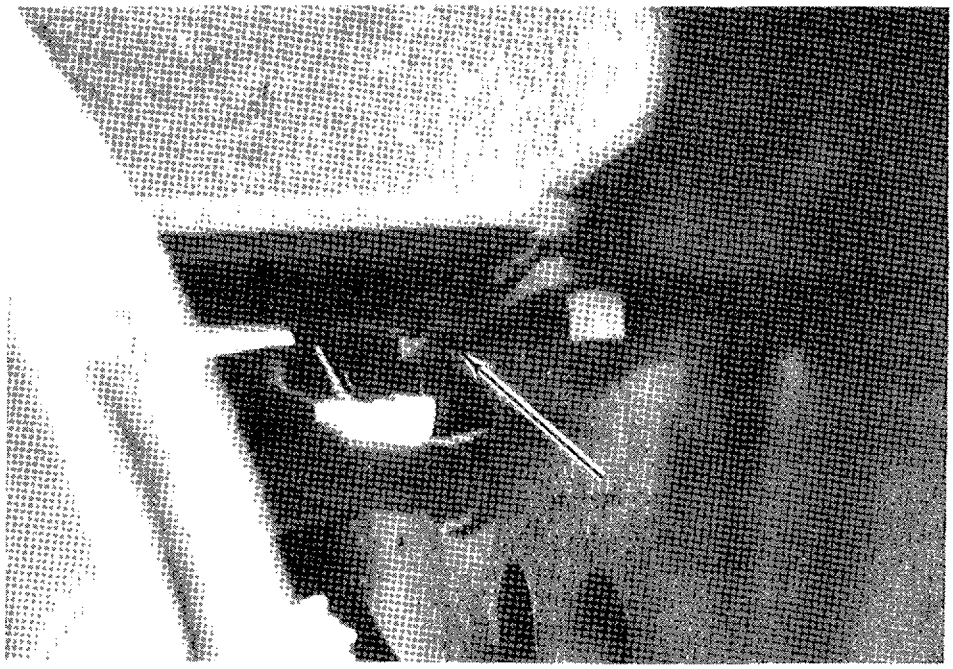


Figure 10.—Fractured centerplate at "B" end of BN 958123.

car carrying the panels was being moved in a revenue train to a repair facility despite the fact that the draft assembly on the MW car had failed while the MW car was being moved in another revenue train. The draft assembly was of a type that had been restricted from revenue service because of a high rate of failure.

In a derailment on the Seaboard Coastline Railroad at Auburndale, Florida, on November 17, 1979, an MW car in ballast hauling service, and thus exempt from the periodic inspection provisions of the freight car safety standards, caused the derailment of 38 cars in a revenue train when a dragging fractured truck bolster on the MW car struck a main track switch. Although there were no injuries, hazardous materials that were being transported in the train were spilled, and damage amounted to about $834,333. (See appendix H). 9/

ANALYSIS

The Accident

The crewmembers of train No. MTC-0718 were qualified for their respective positions in accordance with BN requirements. A postaccident examination of the track structure and trestle disclosed no defects that contributed to the accident.

When the engineer of train No. MTC-0718 placed his locomotive into dynamic braking to slow his train for an upcoming speed restriction, he was not following the requirement of the heat order, which stated not to use dynamic braking. The restriction

9/ For more detailed information see National Transportation Safety Board Report of Railroad Accident Investigation, Seaboard Coastline Railroad Freight Train Derailment at Auburndale, Florida, November 17, 1979 (ATL-80-F-R-009).

was intended to prevent possible track damage. However, this braking action did initiate a run-in adjustment of the slack 10/ that had accumulated in the train. Such slack adjustment is acceptable within the parameters of well-maintained railroad equipment and track structure and is normal and occurs commonly. However, in this case, the compressive action of slack adjustment incurred in the braking of train No. MTC-0718 probably resulted in or increased an off-center movement of the defective centerplate at the "A" end of MW car BN 958200, the seventh car in the train. An off-center position severely restricts the ability of a truck to slue to the curvature of the track. When a truck does not slue freely in a curve, excessive force is placed on the outer rail in a curve. In this case, markings on the track structure at the transition from tangent to curved track south of the trestle indicate that an excessive force at that location probably caused the outer rail in the curve to tip outward and be displaced. Once the rail had been forced from its proper location, the general derailment followed. The lateral motion the engineer and head brakeman felt on the locomotive was probably the result of cars derailing behind them and impacting onto the roadbed and the trestle.

Maintenance-of-Way Cars

MW cars, especially those which are used in ballast hauling service, generally are subjected to severe operating practices. This is particularly true during periods of seasonally intensive railroad MW work, such as major ballasting and track-surfacing operations. During these periods MW cars often are subject to quick turnaround and extended use, hauling ballast between source sites and various work project locations. Further, MW cars used in ballast service often are subject to rough handling while being unloaded. MW crews unload such cars using chains and/or timbers affixed to the bottom outlet doors so as to regulate the flow of ballast onto the track while the car is moved at a slow pace. Often the ballast becomes obstructed and the flow slows unacceptably or stops prematurely. A common practice to restart the flow of unloading ballast is to rapidly gather and stretch the slack in the work train, thereby inducing a shock to dislodge the obstructed ballast. These induced shocks place severe stresses on the component members of the cars.

Most MW cars are older railroad freight cars which have been removed from revenue service and relegated to MW service. The Safety Board concludes that the severe stresses placed on equipment which has already deteriorated substantially in years of revenue service hastens component failures in MW cars. These component failures, such as the failed car body centerplates found on MW cars BN 958200, BN 958104, and NP 85412 at Crystal City, and on cars GN 78206 and BN 958123 at Hoxie, normally would be detected through routine periodic inspections if the cars were being used in revenue service. However, MW cars are exempt from the periodic inspection and mechanical requirements of the FRA's freight car safety standards.

The FRA issued a Notice of Proposed Rulemaking (NPRM) on January 5, 1979, to revise its Railroad Freight Car Safety Standards, in which it proposed that MW cars (except those used exclusively in work train service) be required to comply with the safety standards. The Safety Board supported making the MW cars subject to the safety standards. However, when the FRA issued its revised standards on March 1, 1980, MW

10/ According to "Management of Train Operation and Train Handling" of The Air Brake Association, slack is defined as follows: "There are two kinds of slack: One is termed "Free Slack" and is the accumulation of clearances and wear in the associated parts of the couplers. The other type of slack is often called "Spring Slack" and results from compression of the draft gears."

cars were exempted from compliance with the standards, provided those cars were stenciled "MW" and were not used in revenue service. The standards do not address the placement of MW cars into revenue freight trains.

On May 27, 1980, the Safety Board recommended that the FRA:

> Amend 49 CFR Part 215 to prohibit any car which does not comply with the Railroad Freight Car Safety Standards from being operated in a revenue train unless adequate restrictions are provided for its safe operation. (R-80-21)

The FRA responded that it had,

> . . . concluded that the substantial cost of either replacing maintenance-of-way cars which do not comply with the Freight Car Safety Standards or restricting their movement to work trains cannot be justified. Railroads impose restrictions on the use of these cars to assure safe operation. Maintenance-of-way cars are limited to slow speeds and local trains. . . . FRA will continue to exempt maintenance-of-way cars from compliance with the Railroad Freight Car Safety Standards since these cars are not used in revenue service. There is no intent to allow maintenance-of-way cars to be used as revenue cars which operate at timetable speeds in free interchange service.

Because of the FRA's response, the Safety Board placed Recommendation R-80-21 in a "Closed—Unacceptable Action" status on March 22, 1982.

The Safety Board recognizes that many railroads may restrict MW cars to local train service when it is available. However, as in the cases of the accidents at Crystal City, Hughes, and Auburndale, MW cars often are moved within revenue freight trains at maximum authorized track speeds. Thus, MW cars regularly are moved in trains which may be carrying hazardous materials and operating without restrictions or operating in proximity to passenger-carrying trains. From the standpoint of operational safety, there is no practical difference whether a defective car is carrying revenue freight or a defective MW car is carrying company material in a revenue train operating at maximum authorized speeds. Since the BN does not operate scheduled local train service over the route on which this accident occurred, it regularly moves MW cars in its scheduled revenue freight trains contrary to FRA beliefs, as stated in the FRA's response to the Safety Board's Safety Recommendation R-80-21.

The FRA's stated position of exempting MW cars being operated in revenue freight trains from the Railroad Freight Car Safety Standards constitutes a tacit condonation of a continuing hazard to the safety of railroad employees as well as the general public. The Safety Board holds that the FRA should correct the hazards of operating exempt MW cars in revenue freight trains without restrictions.

Operating Practices

Although the BN stated that its policy is to provide MW cars with the same inspections given to freight cars used in revenue service, it is apparent that the stated policy is not in fact a working practice. MW car BN 958200 had been on the Galesburg repair track about 2 weeks prior to the accident, and the inspection of the car while under repair should have detected the multiple fractures in the centerplate. The accident could have been prevented if the defective car body centerplate had been replaced at that time.

The centerplate from MW car BN 958200 evidenced previous weldment repair. Although weldment repair of the body centerplate on MW cars is permissible because MW cars are not subject to the FRA's freight car safety standards or the AAR's interchange rules, such weldment repairs are not considered a safe practice, and are, in fact, banned from interchange and revenue service. The reliance on weldment repairs for MW cars suggests a fundamental deficiency in the BN's policy concerning the safety of train operations in placing such MW cars in high-speed freight trains.

The Government/Industry Track Train Dynamics Research Program has determined that the greatest forces exerted on the drawbars of freight cars, whether in compressive or tensile state, generally occur in the cars closest to the locomotive and decrease in magnitude toward the cars farthest from the locomotive. While the Track Train Dynamics studies do not specifically refer to the placement of MW cars in revenue freight trains, the Safety Board believes that these studies point out the danger of placing marginal equipment at the front end of revenue freight trains. The placement of the ballast-laden hopper cars at the head end of train No. MTC-0718 facilitated the pickup and scheduled set-out of those cars and was thus an operationally efficient procedure. However, this procedure placed those MW cars in a position in the train in which they were subject to the greatest impacts of slack run-in adjustment upon the most deteriorated cars. The Safety Board concludes that the operation of revenue freight trains containing MW cars with potentially dangerous defects at maximum authorized speeds constitutes an unacceptable risk to railroad employees as well as to the general public. This is especially true in the cases where such trains contain hazardous materials or are operated on tracks adjacent to tracks on which passenger trains are operated.

Although train No. MTC-0718 was being operated in excess of the reduced rate of speed prescribed by the heat order, the Safety Board believes that this was not a significant factor in the events culminating in this accident. The Safety Board concludes that the severely degraded condition of MW car BN 958200 would have resulted in an in-service failure even if the failure had occurred at the restricted speed. However, the severity of the accident might have been lessened somewhat had the derailment occurred at a 10-mph slower speed. The heat order stipulated that trains be operated 10 mph less than maximum speed when the temperature exceeded 90° F. The temperature at the time of the accident was about 95° F. Compliance with the heat order requires a train's engineer to know the ambient temperature over his entire operating district during his entire tour of duty, and to be able to recognize a wide variety of environmental factors affecting ambient temperature. It is apparent that BN management has set an unreasonable requirement for an engineer, because the engineer does not have a means to monitor ambient temperature. A more reasonable approach might be to issue train orders specifically restricting speeds at those times when the ambient temperature exceeds or is expected to exceed a predetermined level, and cancelling those specific orders when the ambient temperature falls below the predetermined level. Such specific train orders would remove the need for an individual judgment by each engineer as to whether the heat order is applicable.

CONCLUSIONS

Findings

1. The Federal Railroad Administration has established minimum safety standards for railroad freight cars in its Railroad Freight Car Safety Standards; however, railroad cars not used in revenue service and stenciled "MW" (maintenance-of-way) are permitted to be exempt from these minimum safety standards as well as prescribed periodic inspections.

2. Maintenance-of-way cars used in ballast hauling service generally are subjected to severe operating practices and rough handling; this is particularly so when seasonal conditions are favorable to intensive railroad maintenance-of-way work and maintenance-of-way cars are heavily used.

3. Maintenance-of-way car BN 958200, dedicated to ballast service and owned by the Burlington Northern Railroad Company, underwent car body, brake, and truck repairs on a repair track on July 2, 1983; the record of repair did not note any deficiencies in the condition of the body centerplate.

4. A competent inspection of maintenance-of-way car BN 958200 while it was on the Burlington Northern Railroad Company's repair track on July 2, 1983, should have disclosed the multiple fractures in the centerplate.

5. Postaccident inspection of the body centerplate from the "A" end of BN 958200 indicated that (1) weldment repair had been performed at some time prior to the accident and the July 2, 1983, repairs, (2) multiple heavily rusted fracture surfaces existed, (3) there was center pin elongation, and (4) the centerplate may have been displaced prior to the accident.

6. Burlington Northern Railroad Company maintenance-of-way cars often are moved within revenue freight trains at maximum authorized track speeds without restrictions and without regard to the fact that freight trains may be carrying hazardous materials or that they may be operated on tracks adjacent to tracks carrying passenger trains.

7. The Burlington Northern Railroad Company's stated policy of subjecting maintenance-of-way cars to the same inspections as freight cars used in revenue service is not in fact a working practice.

8. The engineer's use of the dynamic brake to slow train No. MTC-0718 initiated a slack run-in adjustment just prior to the derailment, which probably resulted in or increased an off-center displacement of the defective centerplate at the "A" end of maintenance-of-way car BN 958200.

9. The off-center condition of the defective centerplate on car BN 958200 severely restricted the ability of the truck at the "A" end of that car to slue to the curvature of the track, creating an excessive force which probably caused a displacement of the outer rail of the track in the curve.

10. The operation of train No. MTC-0718 at a speed in excess of that stipulated by a restricting heat order was not a significant factor in the causal events culminating in this accident because the severely degraded condition of maintenance-of-way car BN 958200 probably would have resulted in an in-service failure even at the restricted speed; however, the severity of the ensuing derailment damage may have been less at the prescribed speed.

11. Compliance with Burlington Northern Railroad Company's restricting heat order requires the train's engineer to know the ambient temperature over his entire operating district during his entire tour of duty, and to be able to recognize a wide variety of environmental factors affecting ambient temperature while the railroad company does not provide any means of determining temperature.

12. Burlington Northern Railroad Company's operation of revenue freight trains containing maintenance-of-way cars which may have potentially dangerous defects at maximum authorized speeds constitutes an unacceptable risk to railroad employees and the general public.

13. The Federal Railroad Administration's stated position of exempting maintenance-of-way cars from the Railroad Freight Car Safety Standards constitutes a condonation of a continuing hazard to the safety of railroad employees and the general public.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the displacement of the outer rail in a curve by a truck on a maintenance-of-way car, which could not slue to the track curvature because of a cracked and displaced centerplate. Contributing to the accident was the Burlington Northern Railroad Company's failure to enforce its inspection and maintenance procedures for maintenance-of-way cars or to impose restrictions on their movement in revenue freight trains. Also contributing to the accident was the Federal Railroad Administration's failure to establish car safety standards or operating restrictions for maintenance-of-way cars in revenue freight trains.

RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board made the following recommendations:

—to the Burlington Northern Railroad Company:

Revise and enforce inspection and maintenance requirements for maintenance-of-way cars to be moved in revenue freight trains to make the cars suitable for safe operation up to the maximum speeds at which the cars will be operated. (Class II, Priority Action) (R-84-8)

Revise the procedure for the issuance and cancellation of a restricting train order due to high ambient temperatures to require that the order be issued for a specific restricting speed and be cancelled by the dispatcher when the ambient temperature falls below a predetermined level. (Class II, Priority Action) (R-84-9)

—to the Federal Railroad Administration:

Require that maintenance-of-way cars meet the Railroad Freight Car Safety Standards or, in the alternative, impose operating restrictions on maintenance-of-way cars being moved in revenue freight trains to compensate for the actual mechanical condition of the cars. (Class II, Priority Action) (R-84-10)

--to the Association of American Railroads:

Urge its member railroads to review and revise as necessary their procedures for inspecting, maintaining, and operating maintenance-of-way cars to be moved in revenue freight trains so as to prevent accidents similar to that which occurred near Crystal City, Missouri, on July 18, 1983. (Class II, Priority Action) (R-84-11)

Notify the Safety Board of the results of the reviews by its member railroads of their procedures for inspecting, maintaining, and operating maintenance-of-way cars to be moved in revenue freight trains. (Class II, Priority Action) (R-84-12)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ G. H. PATRICK BURSLEY
Member

/s/ DONALD D. ENGEN
Member

/s/ VERNON D. GROSE
Member

PATRICIA A. GOLDMAN, Vice Chairman, did not participate.

February 7, 1984

APPENDIXES

APPENDIX A

INVESTIGATION

The National Transportation Safety Board was notified of the accident at 1:20 a.m. on July 19, 1983. The Safety Board immediately dispatched an investigator from its Denver, Colorado, field office and the investigator-in-charge from Washington, D.C., to the accident site.

Groups were formed to investigate the mechanical, operational, and track aspects of the accident. The groups were comprised of personnel from the Burlington Northern Railroad Company and the Safety Board, under the direction of a Safety Board employee. The Federal Railroad Administration declined to participate in the Safety Board's investigation of this accident.

APPENDIX B

PERSONNEL INFORMATION

Engineer

John H. Freeze, 60, was first employed by the St. Louis-San Francisco (SL-SF) Railway Company, a predecessor company of the Burlington Northern Railroad Company, as a fireman on October 27, 1949. He was promoted to engineer on June 23, 1961. He last attended a class of instruction on operating rules on June 30, 1983. He passed a medical examination on September 15, 1982.

Conductor

Stirling H. Boyts, 61, was first employed by the SL-SF as a brakeman on February 9, 1947. He became a switchman on July 30, 1949, and was promoted to conductor on November 21, 1955. He last attended a class of instruction on operating rules on May 23, 1983. He passed a medical examination on November 24, 1982.

Head Brakeman

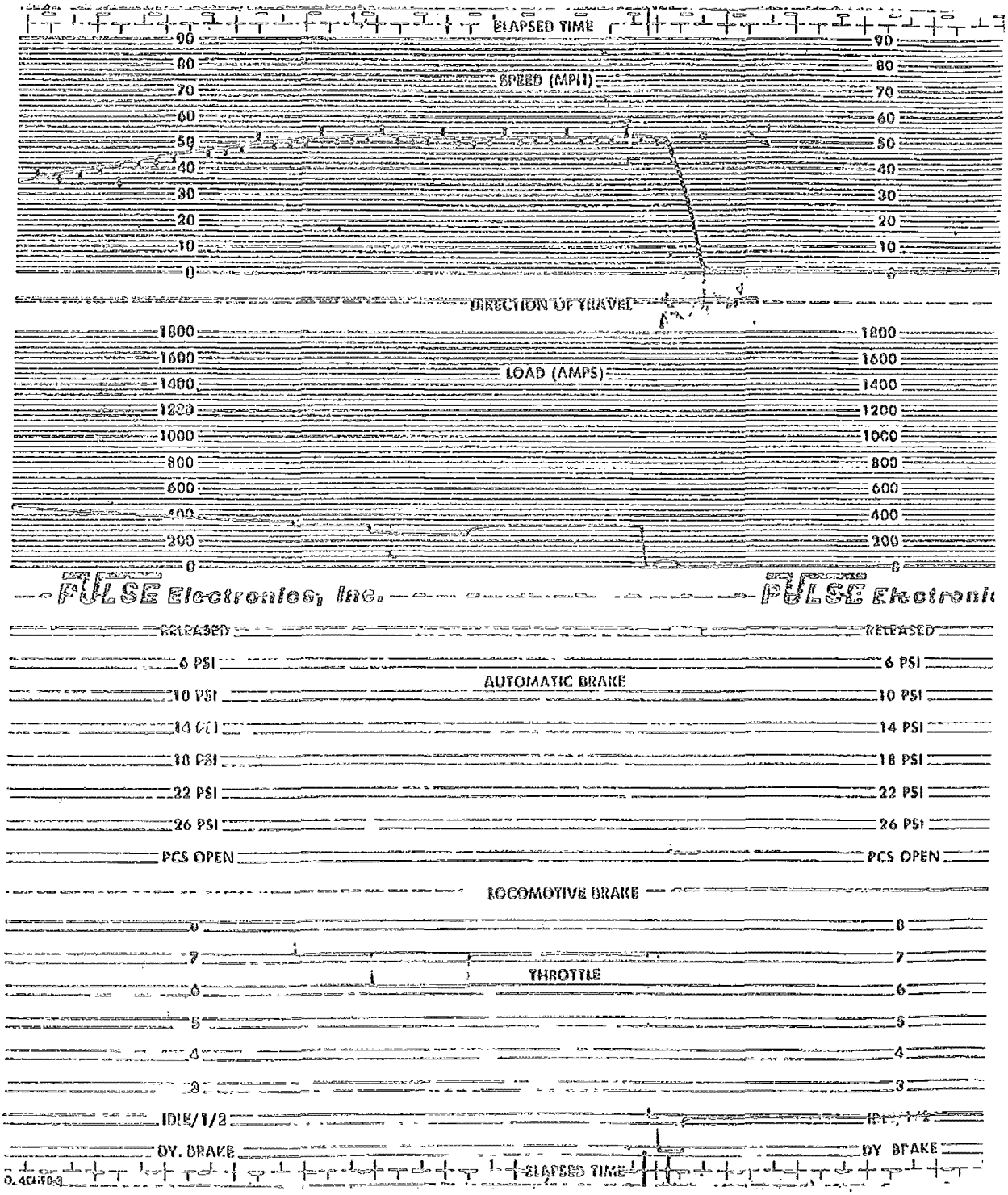
James W. Cassout, 36, was first employed by the SL-SF as a brakeman on October 29, 1966. He was promoted to conductor on May 1, 1971. He last attended a class of instruction on operating rules on June 22, 1983. He passed a medical examination on May 26, 1982.

Rear Brakeman

Herbert D. Scheetz, 58, was first employed by the SL-SF as a brakeman on November 15, 1946. He was promoted to conductor on December 14, 1959, but subsequently relinquished conductor rights and reverted to the position of brakeman. He last attended a class of instruction on operating rules on June 22, 1983. He passed a medical examination on June 24, 1982.

APPENDIX C

EVENT RECORDER TAPE



APPENDIX D

REPAIR AND INSPECTION INFORMATION ON MW CAR BN 958200

STA ST 1 BN 958200 LHS — HEADER

ORIGINAL RECORD OF REPAIRS

HEADER FORM

PAY LOCATION SHOP	REPAIR DATE MO	DY	YR	INITIAL	NUMBER	KIND	AXLES
22942	07	02	3	BN	958200	H	4

REPAIR STATUS CODE: 1 REPAIR TRACK; 2 ROAD; 3 YARD; 4 HEAVY SHOP

REPAIR STATUS	L-LOAD E-EMPTY	W.S.	D	SPECIAL PROJECT	DEFECT CARD INITIAL	MO	DY	YR	COT & S MO	DY	YR	LUB MO	DY	YR
1	L	7	1						01	00	6	12	00	1

KIND EQUIP. CODES: B BOX; R RFGR; S STOCK; T TANK; G GON; H HOPPER; L COV-HOP; F FLAT; P PSGR; K RACK; M OTHER

WHY SHOP CODES: 1 YARD (NOT SHOP); 2 RULE 95 DAMAGE; 7 REPAIRS; 8 HEAVY REPAIRS; 9 PROGRAM/PROJECT

DISPOSITION CODES: 1 REL. REPAIRED; 2 REL. WITH D/C; 3 HELD

DESCRIPTION OF REPAIRS MADE	LOCATION	QUANTITY	COND	WHY MADE	JOB APPLIED CODE	QUAL	JOB REMOVED CODE	QUAL	R
A - Air Hose	A	0001	1	04	1628		1628		1
B - Air Hose	B	0001	1	04	1628		1628		1
Top side bearing welded BR,L AR,L		0060	0	02	4800	FW	4800	FW	1
O.C. Springs D2 A R&L B R&L		0007	1	02	3900		3900		1
I.C. Spring D2 " " " "		0007	1	02	3916		3916		1
-A- End Sill welded		0024	0	02	4800	GV	4800	GV	1
-B- End Sill welded		0024	0	02	4800	GV	4800	GV	1
-L2- Brake shoe comp.		0001	1	01	1838		1830		

Repaired By LCC. RFK Entered By W.J.M. Repairs Verified Correct W.J.M. (Signature)

FORM 15914 7 82

BURLINGTON NORTHERN

ORIGINAL

CAR INSPECTOR'S ORIGINAL RECORD

DATE 6/30/85

TERMINAL	YARD	TRACK	TOTAL CARS
22442	SYR	4	79
TFR NAME/TRAIN NO	**ENGINE**	**REC'D FROM**	**TIME**
108	8007		M
TOTAL NO. OF INSPECTORS	**INSPECTOR(S)**		
4	KLH - JKS		

[x] INBOUND INSPECTION
[ ] OUTBOUND AIR TEST

CONDITION		HOUR	MIN	A/P
BLUE FLAG	APPLIED	4	49	A M
	REMOVED	6	22	A M
ARRIVAL		4	14	A M
DEPARTURE				M

OUTBOUND AIR TEST

CONDITION	HOUR	MIN.	A/P
ENGINE ON TRAIN			M
CABOOSE ON TRAIN 10079	[illegible]		M
AIR SET			M
AIR RELEASED			M

EXPLAIN TRAIN DELAY (HERE OR BELOW)

INITIAL	NUMBER	LD/✓	CLEAN (1)	FLOOR OR BOTTOM DOORS (2)	BOX LINING GON SIDES AND ENDS (3)	BOX DOOR POST & END BOW (4)	REMARKS
ICG	245036	L G	Air	Brakes		9	J C Z.
BN	958200		Truck	Springs			J 10
			Rept 248				
	79059		70	9582	UD -	7 DH	
	87736		—	10079	[illegible]	[illegible]	

FORM 15265 10/77

APPENDIX E

METALLURGICAL ANALYSIS

BURLINGTON NORTHERN RAILROAD

Burlington Northern Railroad Company

RESEARCH & DEVELOPMENT DEPARTMENT

UPON FUTURE REFERENCE REFER TO REPORT NUMBER

Material FAILED BODY CENTER PLATE Test Report No D-1042

Manufacturer _____ Address _____

Purchase Order No _____ Specification _____

Date Sample Submitted _____ Date Sample Received _____

Failure Analysis of Body Center Plate

A broken body center plate was submitted to Springfield Laboratory for failure analysis. This plate was removed from BN car 458200, a former NP 87155 car built January 7, 1943 and converted to the present BN number on April 1, 1972 This car was involved in a derailment at Crystal City, Missouri on July 18, 1983. The only marking on the plate was the former Northern Pacific pattern number DF-705 stamped on the corner of the plate. Photograph G-4516 shows the top view of plate and fracture locations. The following steps were taken in failure analysis of the plate. The examination was performed in the presence of Mr. Robert Utterback of the National Transportation Safety Board.

1. Visual Inspection

   The overall plate and fracture surfaces were inspected visually,

   a. The plate had been repair welded at some time previously in its history. The old weld repair is shown on the bottom view of plate in Photograph G-4517. Part of the fracture parallels the old repair weld.

   b. Markings on center plate indicate it may have been displaced from the truck prior to derailment.

   c. The center hole of the plate was elongated from friction against the center pin. No crack was initiated from this area.

   d. Fracture surfaces had indication of sudden break but no definite origin was found. All fracture surfaces were heavily rusted, indicating cracks were present at time of derailment. The fracture surfaces were derusted with 10% oxalic acid solution (in water) and photographed. Several cuts were made to break open the cracks on the center of the plate. All these old cracks showed sudden break also but again with no indication of a defined origin. Small cracks were observed on the cut surfaces near the welded region but no relationship was found between these cracks and the main fracture areas when samples were etched with 10% nital.

2. Microstructural Examination

   Two specimens were taken from fracture area and weld region. Specimens were ground, polished, then etched with 2% nital. Microstructure was typical of forged steel on the base metal with some decomposed pearlite around weld and heat affected zone. No large flaws nor cracks were detected on these regions. Steel was relatively clean.

Material — AUG 18 1983 — Date — (Signed) W H Mill — Manager, Springfield Laboratory

FORM 51055 6-82 Printed In U S A

APPENDIX E

BURLINGTON NORTHERN RAILROAD

Test Report No. D-1042 Page 2

Material FAILED BODY CENTER PLATE

3. Hardness Measurements
Rockwell (B) indentations were made on base metal, weld, and heat affected zone and are shown below:

	Minimum	Maximum
Base metal----------	67	71
Weld metal----------	88	90
Heat affected zone------	90	90

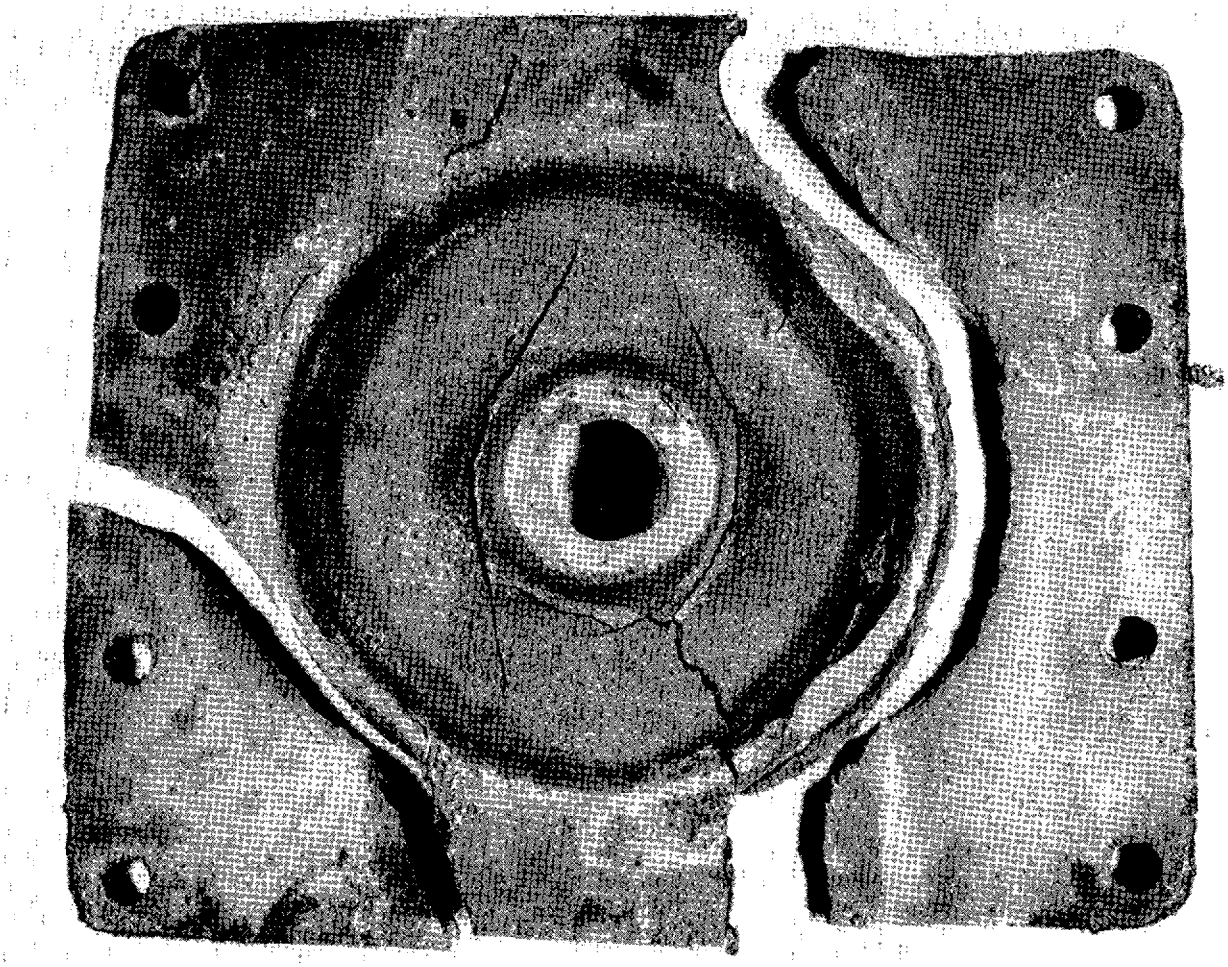
4. Chemical Analysis
Spectrographic analysis is as follows:

	Body Center Plate	AAR M-126 Grade B Forged Steel
Carbon----------	0.220%	0.15-0.25%
Manganese----------	0.488	0.30-0.60%
Phosphorus---------	0.014	0.045% max.
Sulfur----------	0.026	0.050% max.
Silicon----------	0.196	-----

Conclusion
The failure of body center plate is not a material related problem. The type of fracture indicates an impact or overload condition. Since the fracture surfaces showed all old crack (not progressive), this indicates that the center plate had been cracked in a previous incident with a final separation immediately before or in the derailment.

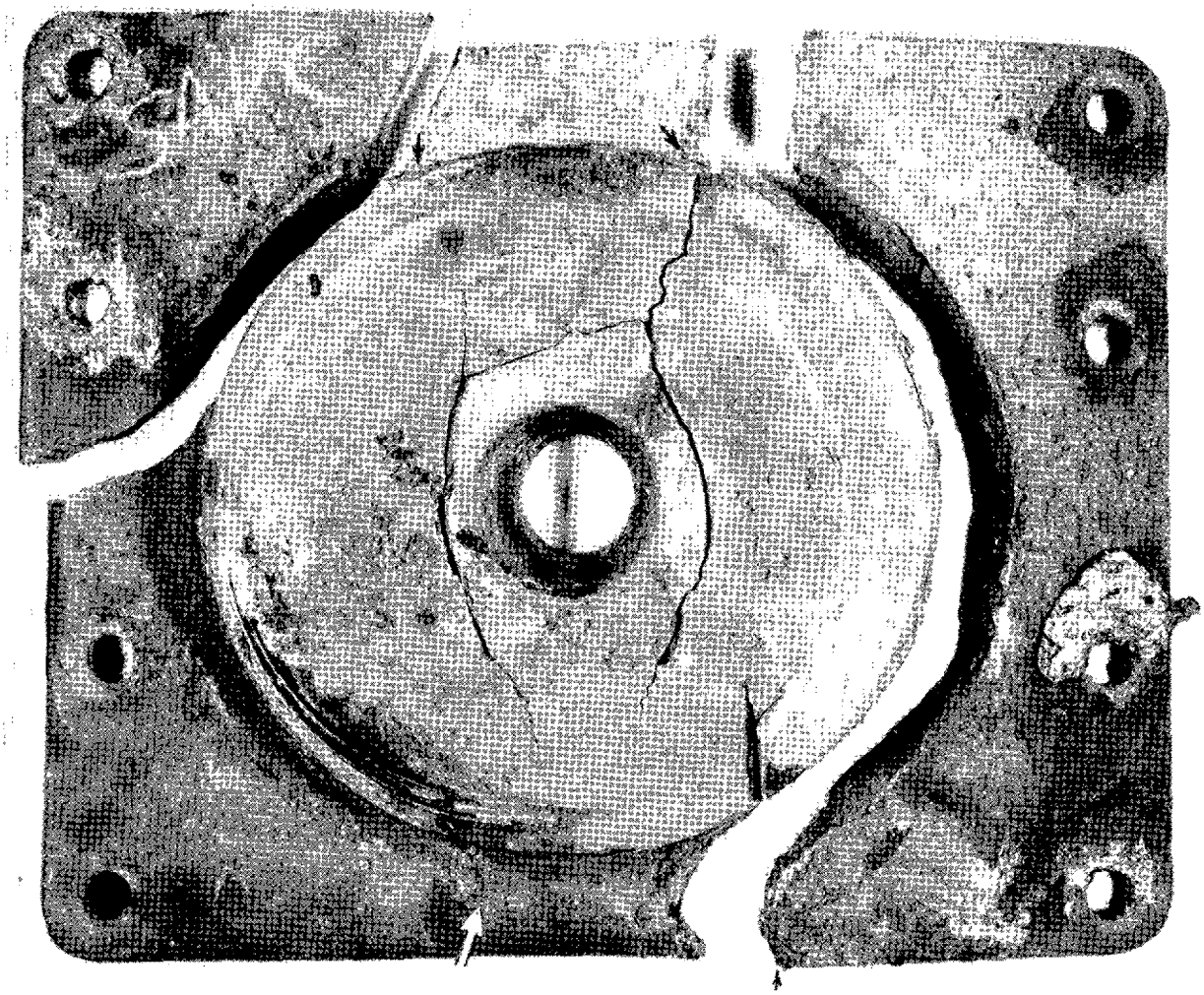
cc: B. L. Boyer
R. E. Taylor
R. L. Coulter
R. J. Utterback
W. M. Reed

FORM 51055 8-81



Photograph G-4516

Top view of failed body center plate from BN 958200, Crystal City, MO derailment.



Photograph G-4517

Bottom view of failed body center plate. Note previous repair welds present in plate (ends of welds indicated by arrows) and markings on center plate indicating it may have been displaced from truck prior to derailment.

APPENDIX F

EXCERPTS FROM INTERCHANGE RULES OF THE ASSOCIATION OF AMERICAN RAILROADS FIELD MANUAL 1983

RULE 60—BODY CENTER PLATES AND SIDE BEARINGS

A. Wear Limits, Gaging, Cause for Renewal
   1. Cracked, broken, missing or bent.
   2. Worn:
      a. Bowl diameter reduced by 7/8" at any point.
      b. Bowl height reduced more than 3/8".

B. Correct Repairs
   1. Body center plates must be replaced with new or reclaimed secondhand plates of latest design shown in Section C, AAR Manual of Standards. Center plates of special design must be replaced with new or reclaimed secondhand plates of same special design.
   2. When bolts are used in securement of body center plates or body side bearings, bolts must be high tensile steel.

C. Reconditioned Requirements
   1. Worn center plates may have wear surface built up by welding and then machined or ground smooth to proper contour, without removal from car.

D. Welding Requirements
   1. See Rule 82 for general regulations governing welding except that for building up of worn center plate on the car no heat treatment is required.

E. General Information
   1. Cracked or broken separable center plates must not be repaired by welding unless on loaded car or on car with unusual design center plate, in which case repair weld may be made as a temporary repair to allow car to be forwarded to destination and to home shop. Cars with center plate so welded must be home shopped and the owner so notified. Charge for temporary repair is permissible.

* * * * *

RULE 82—WELDING AND ASSOCIATED HEAT TREATMENT

* * * * *

E. General Information

1. Tack or fillet welding will be measured and reported on the basis of lineal inches (fraction of inch will be treated as full inch), regardless of depth or width of bead or number of welding passes performed.
2. Fracture or butt welding will be measured and reported by using the average thickness of part(s) welded as being the thickness of weld and the length will be the total lineal inches (fraction of inch will be treated as a full inch), of weld applied.
3. Building up worn surfaces will be measured and reported by using the average thickness of the built-up section as being the thickness of weld and each square inch of area of the built-up section as being equal to one lineal inch of weld.
4. Removal of all types of old welding will be measured and reported on the basis of lineal inches (fraction of inch will be treated as a full inch).
5. Annealing, normalizing or stress relieving when properly performed will be reported on the basis of weight of part welded.
6. Job Codes covered by this Rule include labor and material for preparation of parts, all welding material, gas and electric current.
7. Welding is not permitted on the following items:
   a. Center sills and side sills, unless properly spliced in accordance with Rules 57 and 58.
   b. Truck equalizers, except for building up worn surfaces.
   c. Other car parts restricted by Section D, "Welding Requirements," of a specific Rule.
   d. Cast steel side frames or bolsters repaired or reconditioned by fabrication of components taken from other castings.
8. Aluminum welding will be charged on actual time and material basis.

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D.C. 20594

Reported by: Consolidated Rail Corporation Brief of Railroad No.: 76-086

Location:	Time:	Date:	Weather:	Visibility:
Hughes, Ohio	0250 EDT	6-7-76	Clear - Dark	Unlimited

Train:	Railroad:	Class:	Direction:	Operating Phase:	Track No.:
1	Consolidated Rail Corporation	Freight	East	Enroute	Main
2	Consolidated Rail Corporation	Freight	West	Enroute	
3					

Accident Description: Train 1 struck cargo Train 2 resulting in fatality
Speed of train 1 was 10 mph. Engineer aware of accident
Speed of train 2 was 40 mph. Engineer not aware of accident
Visibility not affected by track alignment

Probable Cause:
1. Lack of or inadequate compliance with industry standards
2.
3.

Other Factors:
1.
2.
3.

Fatalities:	Number:	Description:	Injuries:	Number:	Description:
	1	Employee on duty		2	Employee on duty

Probable Cause of Casualty:
1. Collapse of structure
2.
3.

Property Losses:
Railroad: $57,000
Non-Railroad:

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

80-0045

BRIEF OF RAILROAD ACCIDENT #ATL80FR009

REPORTED BY:
UNKNOWN

1979, 4TH QTR

LOCATION	TIME	DATE	WEATHER	VISIBILITY
AUBURNDALE, FLORIDA	1101 EST	11/17/79	CLEAR	DAY/2000 FT

TRAIN	RAILROAD	CLASS	DIRECTION	OPERATING PHASE	TRACK/NO
1	SEABOARD COAST LINE RR	FREIGHT	SOUTH	EN ROUTE	MAIN 001

ACCIDENT DESCRIPTION

TRAIN 1 DERAILED, RESULTING IN DERAILED CARS, RELEASE OF TOXIC AGENTS.
SPEED OF TRAIN 1 WAS 045 MPH; ENGINEER WAS NOT AWARE OF IMPENDING ACCIDENT.

PROBABLE CAUSES

1. FAILURE OF TRUCK BOLSTER DUE TO NORMAL DETERIORATION/WEAR

CASUALTIES

NONE

PROPERTY LOSSES

RAILROAD	NON-RAILROAD
$ 831,000	$ 2,000