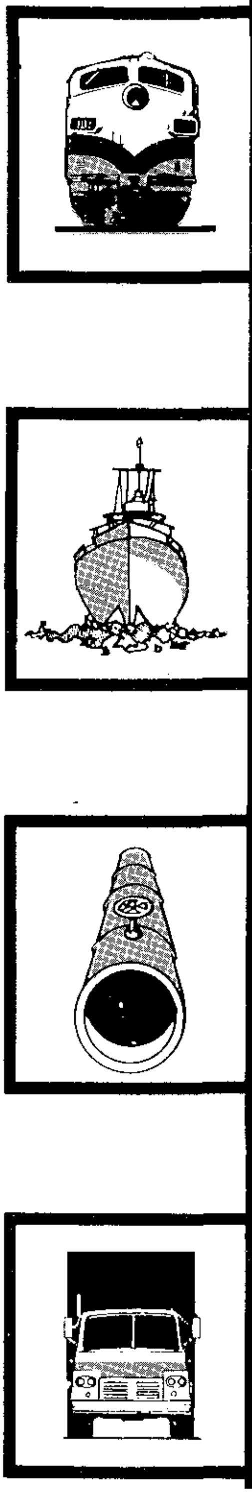

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

DERAILMENT OF AMTRAK TRAIN ON ILLINOIS CENTRAL GULF RAILROAD

GOODMAN, MISSISSIPPI

JUNE 30, 1976

REPORT NUMBER: NTSB-RAR-77-3

UNITED STATES GOVERNMENT

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16 Abstract

About 8:17 a.m., on June 30, 1976, 2 locomotive units and 11 cars of Amtrak Train No. 59 derailed on the Illinois Central Gulf Railroad Company's track near Goodman, Mississippi. Thirty-four of the 145 passengers on the train were injured, 11 crewmembers were injured, 6 trackmen were injured, and 1 trackman was killed. Property damage amounted to about $453,100.

The National Transportation Safety Board determines that the probable cause of this accident was the tipping of the east rail and widening of track gage when the track structure was unable to withstand the lateral forces generated by excessive oscillations of the locomotive trucks due to irregularities in the track alignment and cross level, the wet ballast and subgrade, and the train's excessive speed. The excessive oscillations occurred even though track alignment, track surface, and cross-tie spiking complied with the minimum requirements for FRA Class 4 track, indicating that these FRA requirements are inadequate.

As a result of its investigation of the accident, the National Transportation Safety Board submitted three recommendations to the Federal Railroad Administration concerning its track safety standards.

17 Key Words Amtrak; derailment; turned-over rail; track standards; track alignment; track profile; track gage; track surface.		18 Distribution Statement This document is available to the public through the National Technical Information Service, Springfield, Virginia 22151	
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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: April 7, 1977

DERAILMENT OF AMTRAK TRAIN ON ILLINOIS CENTRAL GULF RAILROAD, GOODMAN, MISSISSIPPI JUNE 30, 1976

SYNOPSIS

About 8:17 a.m., on June 30, 1976, 2 locomotive units and 11 cars of Amtrak train No. 59 derailed on the Illinois Central Gulf Railroad Company's track near Goodman, Mississippi. Thirty-four of the 145 passengers on the train were injured, 11 crewmembers were injured, 6 trackmen were injured, and 1 trackman was killed. Property damage amounted to about $453,100.

The National Transportation Safety Board determines that the probable cause of this accident was the tipping of the east rail and widening of track gage when the track structure was unable to withstand the lateral forces generated by excessive oscillations of the locomotive trucks due to irregularities in the track alignment and cross level, the wet ballast and subgrade, and the train's excessive speed. The excessive oscillations occurred even though track alignment, track surface, and crosstie spiking complied with the minimum requirements for FRA Class 4 track, indicating that these FRA requirements are inadequate.

INVESTIGATION

The Accident

At 5:20 a.m., on June 30, 1976, southbound Amtrak train No. 59, consisting of two P-30-CH-type diesel-electric locomotive units and 12 cars, departed Memphis, Tennessee, en route to New Orleans, Louisiana. Except for the Illinois Central Gulf (ICG) crewmembers, all service personnel were Amtrak employees.

At Durant, Mississippi, the rear car was removed and the conductor inspected the cars of the train and took no exceptions to their condition. The train departed Durant at 8:07 a.m.

When train No. 59 was 3.9 miles south of Goodman, Mississippi, the speed recorder on the locomotive recorded its speed at 88 mph. Both the engineer and the fireman saw trackmen standing along both sides of the right-of-way. When the lead locomotive unit passed the trackmen, the engineer felt his locomotive derail and immediately applied the brakes in emergency. The fireman also felt the lead unit derail, begin to vibrate, and move toward the right.

An ICG electrician, who was in the second locomotive unit, felt the locomotive suddenly start to bounce. He was facing forward and was on the same side of the cab as the engineer. Looking ahead, he saw that his unit was leaning to the right of the lead unit. He could not identify the location where he felt the derailment because his view of the track ahead was obscured by the lead unit.

Neither the engineer, fireman, nor electrician looked back or into rearview mirrors at the time of the derailment. None heard unusual noises or felt unusual motions in the locomotive before the derailment.

The foreman and five members of the trackcrew were standing on the west side of the track. The foreman saw sparks coming from the third or fourth car of the train as the lead unit passed him. He stated that the lead unit's wheels were still on the rails when it passed him. He then saw rocks and dirt being thrown up from the track in the area of the third or fourth car. The foreman and the five trackmen began to climb a small bank to escape the flying debris. Three of the trackmen were unable to escape and were trapped under the derailed seventh car; one was killed and the other two were seriously injured.

A trackman on the east side of the track also watched the approach of train No. 59. He said that the second locomotive unit began to bounce and sway near a road crossing about 900 feet north of him. He saw sparks coming from under the third or fourth cars when they were about 400 feet north of him. He stated that the lead unit's wheels were still on the rails as it passed him, but he could not recall if the second unit or following cars were derailed.

When the train stopped at 8:17 a.m., the engineer immediately radioed the railroad agent at Durant, Mississippi, to report the derailment. The entire train derailed. The diner was the only car to turn on its side.

The track is straight for more than a mile on each side of the derailment site. (See figure 1.) The grade descends southward and varies from 0.2 to 0.4 percent. The track was constructed on a fill section up to the point of derailment and in a cut section at the point of derailment. Drainage ditches on each side of the track were filled with water and weeds at the time of the derailment. The roadbed and track were wet and muddy from recent rains.

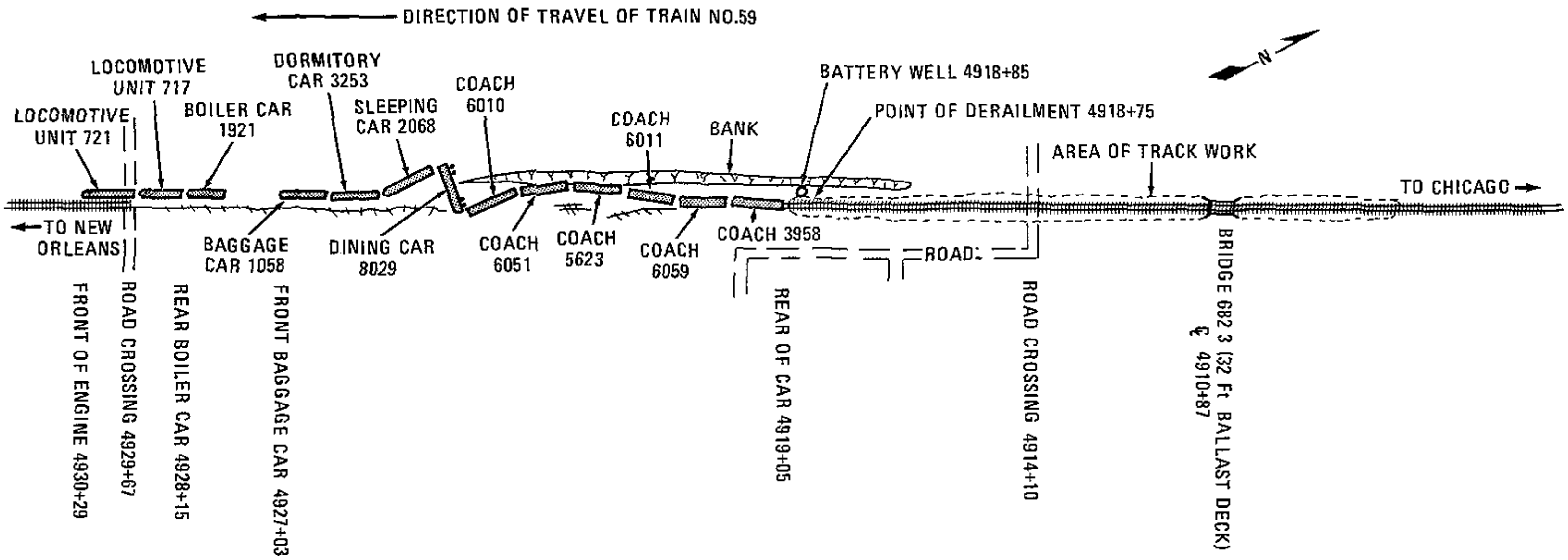


Figure 1. Plan of accident site.

The track was constructed of 112-pound, 39-foot rails connected with 6-hole, 36-inch joint bars. Each rail had 8 to 12 rail anchors. The rails rested on 7 3/4-inch by 13-inch, doubleshoulder tie plates, which were laid on an average of twenty-three 6-inch by 8-inch by 8 1/2-foot wood crossties per each 39-foot rail. The crossties rested on 6 to 12 inches of 1 1/2-inch slag ballast and were covered with about 3 inches of 3 1/2-inch slag ballast. The rail was held with two track spikes per tie plate.

The track was last surfaced and lined in December 1975. The last extensive crosstie replacements were made in 1973.

During the 4 workdays before the accident, the trackmen had been replacing defective crossties and regaging the track. They began working about 1,500 feet north of the point of derailment.

The maximum wide gage correction required within the 1,500 feet was from one-fourth inch to one-half inch. Many crossties were being replaced because they were unable to hold proper gage and not because they were broken, split, or plate cut. Tie plugs were not used in the existing crossties when respiking the track to proper gage. Instead, the track spikes were driven into adjacent spike holes.

It was estimated that about 150 crossties per mile--one in every 34 feet of track--would be replaced. However, the actual number of crossties installed averaged about 8 in every 34 feet of track. They were installed in groups of two to seven in a row for about each 19 1/2 feet of track. These crossties were installed and tamped by hand. Old slag ballast and some new 3 1/2-inch slag ballast was used during the tamping.

On the day of the derailment, work on an adjacent 585 feet of track had begun about 45 minutes before the accident. The foreman checked the track gage in this area and estimated it was one-fourth of an inch wider than the standard gage measurement of 4 feet 8 1/2 inches. The trackmen raked the ballast from both sides of the west rail in this 585 feet to expose the tie plates and track spikes for regaging. Also, a trackman raked and picked the ballast at the end of some crossties that were to be replaced. The trackmen stated that they did not remove any track spikes, loosen any track bolts, or place any track jacks under the rail.

The track is classified as Federal Railroad Administration (FRA) Class 4, which permits a maximum passenger train speed of 80 mph without regard to locomotive characteristics. (See appendix.) At the end of each workday, the foreman, who was qualified by the ICG to inspect the completed track work, determined that the track gage, line, surface, cross level, and ballast compaction at the new crossties was satisfactory for Class 4 track. Slow orders were not issued to reduce the operating speed of trains traveling through the work area. On the day of the accident, the disturbed track area, which had increased approximately 300 to 400 feet each day, was about 1,500 feet.

The supervisor of track had inspected the track in the derailment area on June 28, 1976, and noted no discrepancies. The track foreman responsible for the area also inspected the track on June 28. He noted one defective crosstie which was replaced the same day.

On June 14, 1976, the rails through the area of the accident were tested with a rail detector car and no defects were noted. In 1975 the U.S. Department of Transportation track geometry car was used to inspect the track, and it was determined that it met FRA Class 4 geometric requirements.

After the trackmen completed work on June 29, 1976, four trains moved through the derailment area before train No. 59.

The maximum speeds of these trains were allegedly 79 mph and 50 mph. The traincrews did not report any irregularities in track appearance or in the riding quality of their equipment.

Injuries to Persons

Injuries	Crewmembers	Passengers	Other
Fatal	0	0	1
Nonfatal	11	34	6
None	4	111	0

Damage

The trucks and traction motors of the two locomotive units were damaged and the right bottom section of each unit's pilot above the west rail was dented. The second unit's dent was about 1-foot high and was about the width of the rail. The cars sustained mostly truck damage. There was little damage to the interiors of the cars. The dining car was the most extensively damaged.

The derailment damaged 1,056 feet of track. The west rail was broken in many places and several joint bars were stripped from the rail. Cost of damages was estimated as follows:

Locomotives	$236,000
Cars	148,500
Track	30,800
Removal of Wreck	37,800
Total	$453,100

Train Information

The train had two locomotive units, a boiler car, baggage car, dormitory car, sleeping car, dining car, and six coaches. The passenger cars were constructed of stainless steel and were equipped with tightlock couplers. The P-30-CH-type diesel-electric locomotive units were manufactured by the General Electric Company. They each weighed 386,000 pounds and had two 3-axle trucks and snowplow-type pilots. Each unit was equipped with an alertor, speedometer, speedrecorder (with overspeed detection set for 97 mph), and wheel slip-slide detection.

Method of Operation

Trains are operated over this line by an automatic block system supervised by the dispatcher in Chicago, Illinois. The maximum ICG authorized speed for passenger trains in this automatic block territory is 79 mph.

Current ICG rules for the maintenance of way and structures, lists the same track standards as those contained in the FRA Track Safety Standards. Rule 749-Inspection states that "when on or about the property constant observation of condition of facilities must be maintained [by the foreman] and when track, signal bridge or other defects are noted which might affect the safe operation of the railroad, corrective action must be taken." Rule 98-Slow Orders states: "Where conditions require a speed restriction, if practical, trains should be warned by train order or bulletin..."

Meteorological Information

The accident occurred in daylight. The weather was cloudy, visibility was about 10 miles, and the temperature was 76° F. During the previous 4 days, it had rained more than 2 inches in the area. When the trackmen reported to work at 7:00 a.m. it had just finished raining but was still misting.

Tests and Research

The lead locomotive unit stopped 1,144 feet beyond the first marks of the derailment, which were wheel marks on the inside web of the west rail near an insulated track joint about 465 feet south of the road crossing. The north end of the insulated joint was battered. The east rail at this point was tipped outward.

Several of the rails were broken through the bolthole area but were not battered on the ends. The Association of American Railroads Technical Center examined the rails and determined that they were broken by a high lateral torsional loading.

Inspection of the track in the recently worked area north of the derailment site disclosed variations in gage, irregularities in line and cross level, and tie plate movement. Gage varied from 1/4-inch less than standard to 1/2-inch more than standard. Alignment of the east rail in one 19 1/2-foot section varied from three-fourths of an inch to the east of three-fourths of an inch to the west when measurements were taken from the center of a 62-foot stringline. Cross level varied from 3/4-inch high to 3/4-inch low in a 19 1/2-foot section. Tie plate movement on the older crossties, in addition to wide gage, was one-half inch. None of these gage, alignment, cross level, and tie plate movement measurements were taken under the static loading of a train. (See figure 2.)

All locomotive truck measurements were within the design specifications and tolerances. No mechanical defects were found.

The speed recorders on the locomotive units were checked for accuracy and were found to be functioning properly. The speed recorder tapes, which indicated a train speed of 88 mph at the time of derailment and for the preceding 4 miles, were evaluated for accuracy. It was found that the speeds shown on the tapes for the 137 miles from Memphis to the derailment site were accurate when the equipment was tested by the manufacturer and railroad. No mechanical defects were found on any of the cars. Part of a cast-iron steam connector with a hole in its elbow was found 2 weeks after the accident at the site. No marks were found on the elbow or adjoining section of the connector to indicate that the connector had been dragging. Laboratory analysis indicated that the connector was broken by a hard blow. Examination of the fractured surfaces did not reveal the presence of any metal fatigue fracture or extreme heat.

ANALYSIS

It is always difficult to maintain proper alignment and track surface when installing a large group of crossties in consecutive rails by hand. When such work is done, a slow order is normally placed on the section of track until the work is completed and the track has regained stability.

During the 4 days before the accident, the trackmen installed more crossties per rail than anticipated. The installation of from two to seven new crossties in a row, in a number of rail joint locations, necessitated disturbing much of the existing alignment and surface. Because of the number of crossties that were installed and hand tamped and the amount of track that was regaged, only a small section of track was completed between trains. Since the work progressed in small completed segments, the foreman believed that no condition existed that required the issuance of a slow order according to ICG maintenance rule 98.

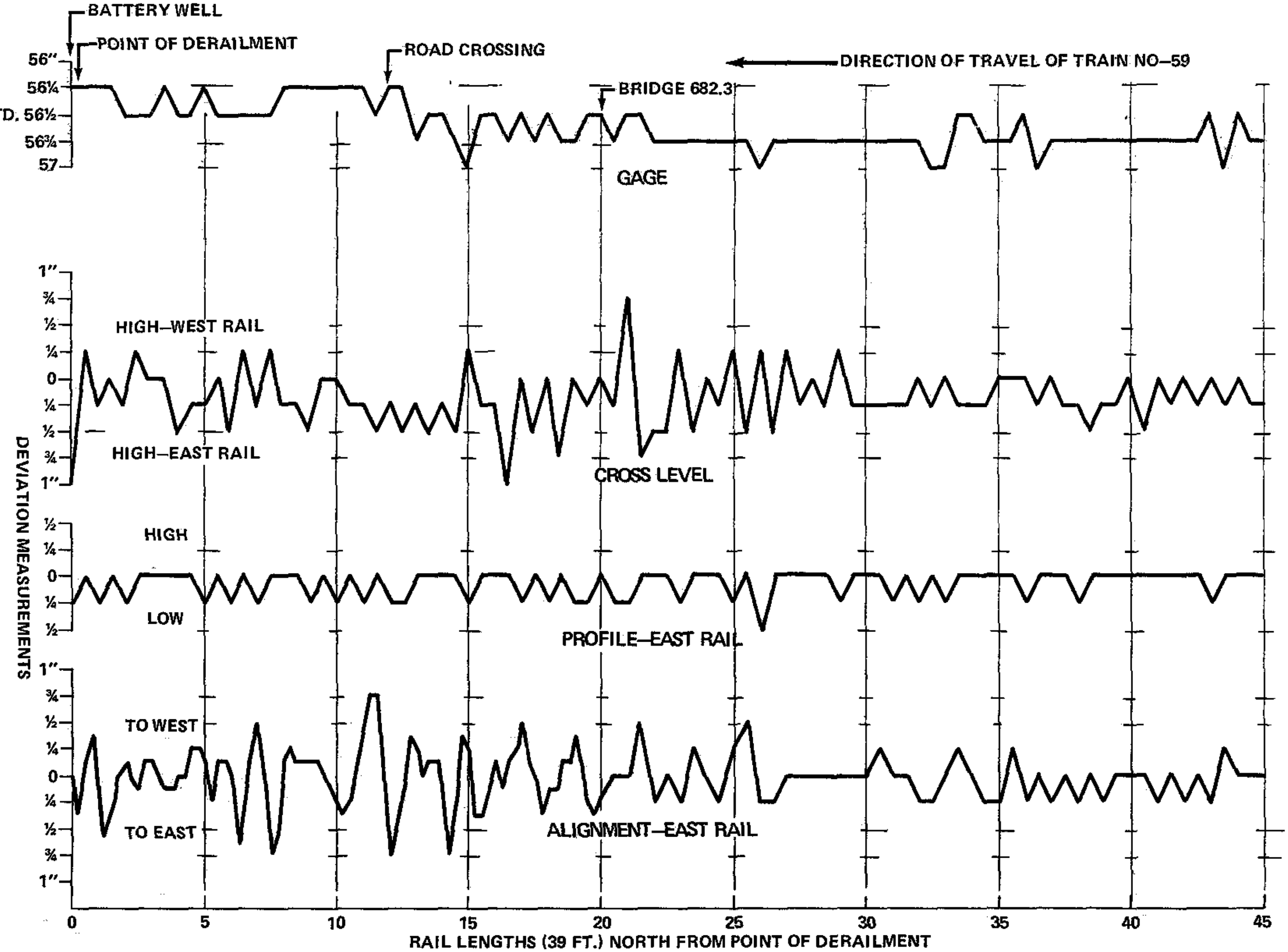


Figure 2. ICG RAILROAD COMPANY TRACK GEOMETRY MEASUREMENTS

Each day, as the trackmen completed work on an additional 300 to 400 feet of track, more of the original track alignment, surface, and stability was disturbed. As passenger and freight trains continued movement over these areas, at alleged maximum speeds of 79 mph and 50 mph, respectively, the unstable track alignment and surface progressively deteriorated. These conditions increasingly affected truck oscillation. During the trackwork, the 2 inches of rainfall also affected the stability of the disturbed track.

Examination of some old crossties in the track north of the derailment area indicated that some of their spikeholding ability had deteriorated. Consequently, their ability to hold adequate track gage was uncertain. Leaving crossties in the track that have lost some spikeholding ability and changing spikeholes without using tie plugs while regaging track is a questionable practice. When crossties are 5 to 15 years old, the amount of deterioration in the unused spikehole is unknown. There is also the possibility that the supposedly unused spikeholes in these old crossties have actually been used previously.

The current ICG "Rules for the Maintenance of Way and Structures" do not explain tie plug use, crosstie respiking, crosstie installation, or track regaging procedures. The trackmen stated that they were unaware of any other rule books or special instructions in effect about the maintenance of track that might have explained these procedures.

The track, ballast, and subgrade were wet from the previous 4 days of rain as southbound train No. 59 approached the accident area at a speed of 88 mph. Because of the irregularities in the track alignment and cross level, the wet ballast and subgrade, and the train's high speed, the trucks of the locomotive units and cars began to oscillate excessively. Greater track misalignment and irregularity in cross level near the road crossing further increased the oscillations, which were noticed by the trackman standing 900 feet south of the road crossing on the east side of the track. The oscillations and speed of the train caused the wheels of the locomotive to exert lateral force against the east rail near an insulated joint 475 feet south of the road crossing. The lateral force caused the east rail to tip outward which then allowed the west wheels of the lead truck of the second locomotive unit to drop inside of the rail. The second unit's westward tilt, which the electrician noticed, and the large dent in the pilot above the west rail indicate that the east wheels were still on the rail as the west wheels derailed.

As the train continued southward about 400 feet to where the trackmen were standing, only the west wheels of the second unit and those of the two or three following cars were derailed. By the time the third or fourth car reached the point at which the second unit derailed, the track gage had been widened enough to allow both the east and west wheels of the third or fourth car and all following cars to drop inside of the rails. The sparks that the trackmen saw coming from under the derailed cars were caused by the wheels and trucks scraping the rails and running on the roadbed.

As the locomotive passed the trackmen, the derailed second unit tipped the west rail out from under the wheels of the lead unit. The engineer and fireman felt the lead unit derail at this location. Because the lead unit stayed on the rails for about 500 feet after the second unit derailed, it kept the train stretched. When the baggage car uncoupled from the boiler car, however, the trailing cars began to collide. The run-in caused the diner to jackknife and overturn and caused the seventh and eighth cars to run against the west bank where the trackmen were running from the site.

The track conditions generated excessive locomotive truck oscillations in spite of the fact that the track met the minimum standards for FRA Class 4 track. This raises the question of whether the methods used for measuring and evaluating geometric track conditions under the FRA Track Safety Standards are adequate.

For example, the Class 4 Track Safety Standards allow an alignment deviation "from uniformity" of 1 1/2 inches from the mid-offset of a 62-foot stringline without any loading on the track. The track at the derailment site met the FRA alignment standards because the greatest mid-offset in any 62-foot section measured was only three-fourths of an inch. However, to obtain the mid-offset measurement this way, and then to relate this measurement to uniformity is misleading because any chord measurement made in this manner does not indicate the actual position of the rail or its actual amount of misalignment from track uniformity. The Track Safety Standards neither define uniformity nor stipulate a method by which uniformity shall be established. Without a geometrically correct uniform line to use as a reference line when plotting the deviation measurements, the true amount of deviation cannot be determined. The standards also do not state how often a measurement shall be taken or an allowable rate of change in uniformity. Mid-offset measurements made with a 62-foot stringline after the accident show that the track directly north of the derailment site geometrically deviated about 2 inches in 19 1/2 feet from a uniform tangent line such as that established with a transit surveying instrument. (See figure 3.) This 2-inch deviation exceeds the 1 1/2-inch deviation allowed by the Class 4 Track Safety Standard.

The same problem exists when using the stringline method to determine the deviation from uniform profile and cross level. The FRA standards allow a 2-inch deviation in profile and a 1 1/4-inch deviation in cross level. The profile measurements at most rail joints where new crossties were installed north of the derailment site were found to be only 1/4-inch to 1/2-inch low but cross level at these locations was as much as 3/4-inch to 1-inch out of level at opposite points on the rails within 19 1/2-feet.

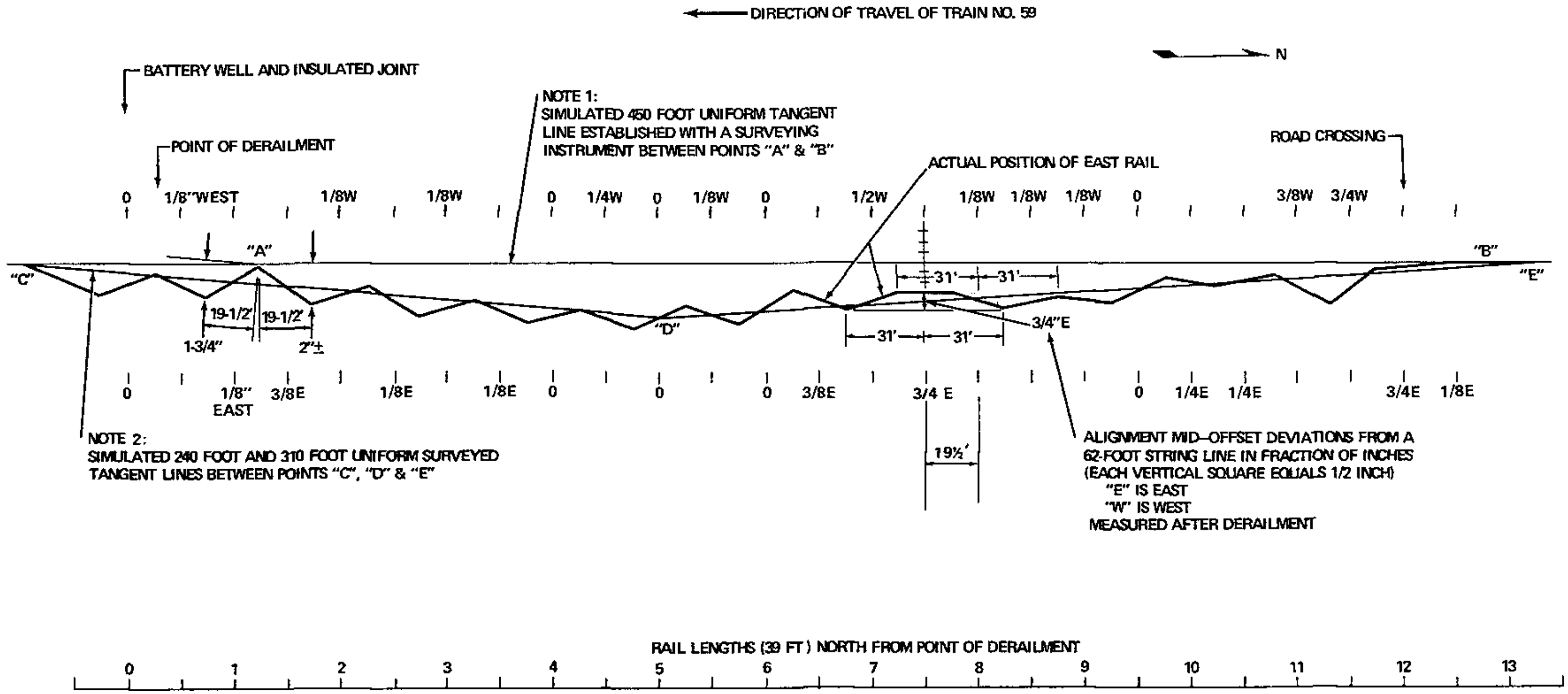


Figure 3. Plot of alignment measurements.

Since the difference in cross level between any two points is related to the profile of each rail, and opposite irregularities within a short distance create an unsafe track condition known as "warp," it is essential to take both measurements at any one point under investigation. Therefore, differences in profile and cross level, which are both plus or minus at the same location, should be added to obtain the total difference in cross level between any two points less than 62 feet apart. This method of evaluation revealed a noncomplying 1 1/2-inch deviation in cross level in 19 1/2 feet of track near the derailment point. (See figure 4A.) Cross level measurements taken in the track revealed that 10 feet south of the point of derailment the east rail was 1 inch higher than the west rail. This section of track may have been disturbed in the derailment. However, the east rail at this point was one-fourth inch lower than the east rail at a point 19 1/2 feet farther north. At the point 19 1/2 feet farther north, the west rail was one-fourth inch higher than the east rail. The measurements were not taken under train static or dynamic loading.

The cross level, in combination with rail profile, is at or near the maximum allowable 1 1/4-inch deviation at several locations north of the road crossing. Just north of bridge 682.3 the difference in cross level changes from three-fourths of an inch to the east, to 1 1/4 inches to the west, to 1 inch to the east in 39 feet of track. However, the maximum single-field measurement taken was three-fourths of an inch which is within FRA standards. (See figure 4B.) This extreme rate of change in cross-level, along with the irregular alignment would have precipitated the oscillation of the locomotive that the trackman saw. The poor cross level would also have caused the track to move farther out of line under train movement.

An examination of the crossties in the 1,500 feet of track north of the derailment point revealed 1/4-inch to 1/2-inch tie plate movement. This movement in conjunction with a 1/4-inch to 1/2-inch wider-than-standard gage deviation found in the regaged track indicates that the track was unable to restrain the lateral force against the rails. At the point of derailment no existing crossties had been replaced and the east and west rails were tipped outward.

Of the four trains that went through the area before train No. 59, the three northbound did not overturn the rail apparently because by entering the disturbed track area from the south, they encountered the most recently worked track before the poorly aligned and surfaced track area. The one southbound train did not overturn the rail apparently because its speed was only 50 mph or less.

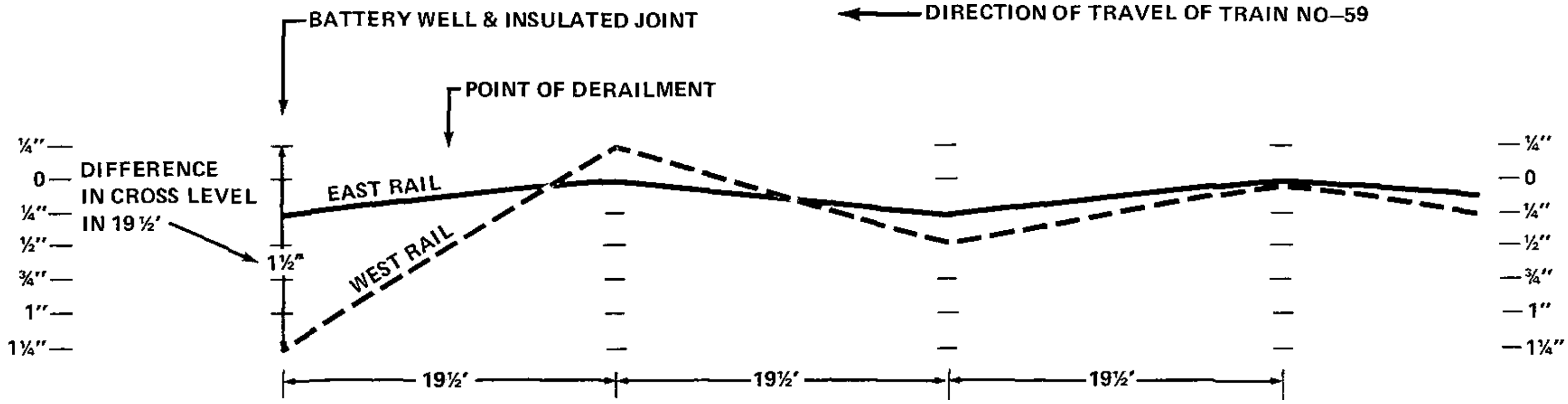


Figure 4A

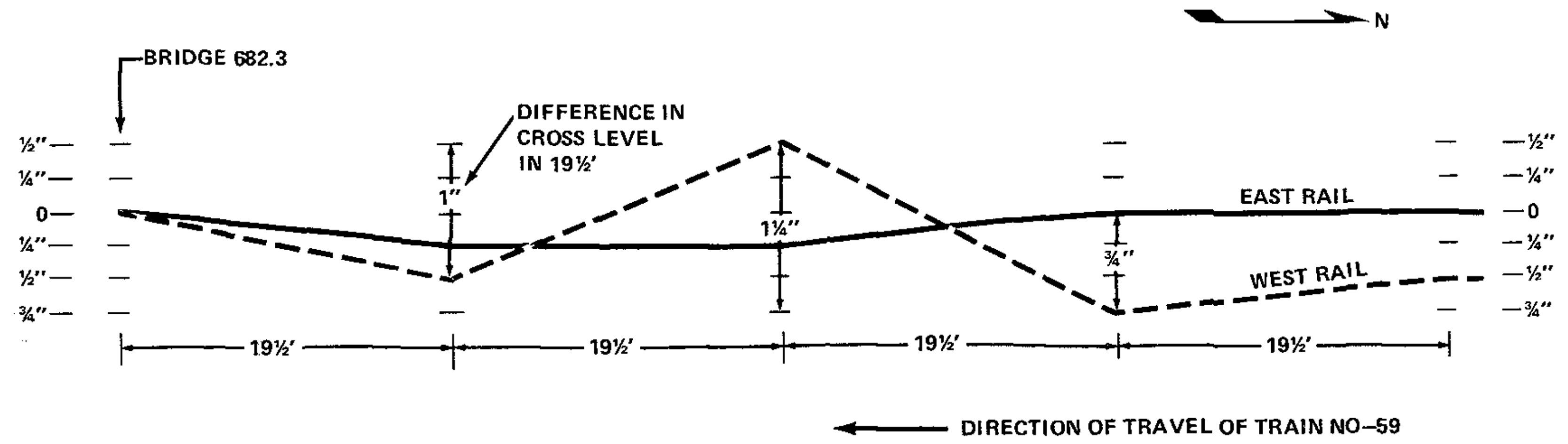


Figure 4B
PLOT OF PROFILE AND CROSS LEVEL MEASUREMENTS

CONCLUSIONS

Findings

1. The train was moving at a recorded speed of 88 mph, 9 mph over the maximum allowable speed of 79 mph at the time of derailment.

2. The variations in track alignment, profile, and cross level caused locomotive oscillations which developed lateral forces that exceeded rail resistance.

3. The lead truck of the second locomotive unit tipped the rail and increased the track gage because the track structure was unable to withstand the lateral force that the locomotive trucks generated.

4. The broken rails found at the site after the derailment were broken during the derailment.

5. The broken steam connector found at the site after the derailment was broken during the derailment by contact with the track structure.

6. The track in the 1,500 feet north of the derailment point had critical conditions that were not ascertained by using procedures in the FRA Track Safety Standards. The standards' methods of measuring and evaluating track geometric conditions are inadequate.

7. Sharp rate of change in track alignment, which contributed to the locomotive truck oscillations, is not adequately covered in the FRA standard on track alignment.

8. The short, undulating rates of change in cross level and profile, which created track warp that also contributed to the locomotive truck oscillations, is not adequately covered in the FRA standard on track surface.

9. Even though the track in the 1,500 feet north of the derailment point met the minimum FRA Class 4 track standards, the derailment of the train indicates that further investigation of irregular and deteriorated track conditions in relation to train speed is required.

10. The track in the 1,500 feet north of the derailment point became increasingly unstable and irregular with the passage of trains at maximum allowable speeds within a short period of time after track work was completed.

11. The track area under repair was not covered with a slow order.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the tipping of the east rail and widening of track gage when the track structure was unable to withstand the lateral forces generated by excessive oscillations of the locomotive trucks due to irregularities in the track alignment and cross level, the wet ballast and subgrade, and the train's excessive speed. The excessive oscillations occurred even though track alignment, track surface, and crosstie spiking complied with the minimum requirements for FRA Class 4 track, indicating that these FRA requirements are inadequate.

RECOMMENDATIONS

As a result of this investigation, the National Transportation Safety Board submitted the following recommendations to the Federal Railroad Administration:

> "Amend track geometry standard 49 CFR 213.55, Alignment, so that it defines "uniformity," establishes a maximum rate-of-change in alignment deviation, and establishes the maximum number of feet between which each alignment mid-offset measurement shall be taken. (Class II, Priority Followup)(R-77-6)
>
> "Amend track geometry standard 49 CFR 213.63, Track Surface, so that it defines "uniform profile," establishes maximum rates-of-change in profile and cross level deviations, and establishes the maximum number of feet between which each profile midordinate measurement and each cross level measurement shall be taken. (Class II, Priority Followup)(R-77-7)
>
> "Include in review of the current FRA track safety regulations, investigation and testing to determine if the minimum track conditions that are required for the FRA classes of track by 49 CFR 213.9 are adequate for all types of trains and for the maximum allowable speed for each class." (Class II, Priority Followup)(R-77-8)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ WEBSTER B. TODD, JR.
Chairman

/s/ KAY BAILEY
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PHILIP A. HOGUE
Member

/s/ WILLIAM R. HALEY
Member

April 7, 1977

APPENDIX

EXCERPTS FROM

TRACK SAFETY STANDARDS

FEDERAL RAILROAD ADMINISTRATION

DEPARTMENT OF TRANSPORTATION

*****

SUBPART A–GENERAL

§ 213 1 SCOPE OF PART

This part prescribes initial minimum safety requirements for railroad track that is part of the general railroad system of transportation. The requirements prescribed in this part apply to specific track conditions existing in isolation Therefore, a combination of track conditions, none of which individually amounts to a deviation from the requirements in this part, may require remedial action to provide for safe operations over that track.

*****

§ 213 9 CLASSES OF TRACK OPERATING SPEED LIMITS

(a) Except as provided in paragraph (b) of *this section and* § § 213 57(b), 213.59(a), 213.105, 213.113 (a) and (b), and 213 137 (b) and (c), the following maximum allowable operating speeds apply

[In miles per hour]

Over track that meets all of the requirements prescribed in this part for –	*The maximum allowable operating speed for freight trains is –*	*The maximum allowable operating speed for passenger trains is –*
Class 1 track	10	15
Class 2 track	25	30
Class 3 track	40	60
Class 4 track	60	80
Class 5 track	80	90
Class 6 track	110	110

(b) If a segment of track does not meet all of the requirements for its intended class, it is *reclassified to the next lowest class of track for* which it does meet all of the requirements of this part However, if it does not at least meet the requirements for class 1 track, no operations may be conducted over that segment *except as provided in § 213.11.*

*****

§ 213 11 RESTORATION OR RENEWAL OF TRACK UNDER TRAFFIC CONDITIONS.

If, during a period of restoration or renewal, track is under traffic conditions and does not meet all of the requirements prescribed in this part, the work and operations on the track must be under the continuous supervision of a person designated under § 213 7(a)

§ 213.13 MEASURING TRACK NOT UNDER LOAD

When unloaded track is measured to determine compliance with requirements of this part, the amount of rail movement, if any, that occurs while the track is loaded must be added to the measurement of the unloaded track.

*****

APPENDIX

SUBPART C–TRACK GEOMETRY

§ 213.51 SCOPE.

This subpart prescribes requirements for the gage, alinement, and surface of track, and the elevation of outer rails and speed limitations for curved track.

§ 213.53 GAGE.

(a) Gage is measured between the heads of the rails at right angles to the rails in a plane five-eighths of an inch below the top of the rail head

(b) Gage must be within the limits prescribed in the following table:

Class of track	*The gage of tangent track must be– At least–*	*The gage of tangent track must be– But not more than–*	*The gage of curved track must be– At least–*	*The gage of curved track must be– But not more than–*
1	4'8"	4'9¾"	4'8"	4'9¾"
2 and 3	4'8"	4'9½"	4'8"	4'9¾"
4	4'8"	4'9¼"	4'8"	4'9½"
5	4'8"	4'9"	4'8"	4'9½"
6	4'8"	4'8¾"	4'8"	4'9"

*****

§ 213.63 TRACK SURFACE.

Each owner of track to which this part applies shall maintain the surface of its track within the limits prescribed in the following table:

*****

§ 213.55 ALINEMENT.

Alinement may not deviate from uniformity more than the amount prescribed in the following table:

Class of track	*Tangent track* The deviation of the mid-offset from 62-foot line[1] may not be more than–	*Curved track* The deviation of the mid-ordinate from 62-foot chord[2] may not be more than–
1	5"	5"
2	3"	3"
3	1¾"	1¾"
4	1½"	1½"
5	¾"	⅝"
6	½"	⅜"

[1] The ends of the line must be at points on the gage side of the line rail, five-eighths of an inch below the top of the railhead. Either rail may be used as the line rail, however, the same rail must be used for the full length of that tangential segment of track

[2] The ends of the chord must be at points on the gage side of the outer rail, five-eighths of an inch below the top of the railhead.

*****

Track Surface	*Class of track* 1	2	3	4	5	6
The runoff in any 31 feet of rail at the end of a raise may not be more than	3½"	3"	2"	1½"	1"	½"
The deviation from uniform profile on either rail at the midordinate of a 62-foot chord may not be more than	3"	2¾"	2¼"	2"	1¼"	½"
Deviation from designated elevation on spirals may not be more than	1¾"	1½"	1¼"	1"	¾"	½"
Variations in cross level on spirals in any 31 feet may not be more than	2"	1¾"	1¼"	1"	¾"	½"
Deviation from zero cross level at any point on tangent or from designated elevation on curves between spirals may not be more than	3"	2"	1¾"	1¼"	1"	½"
The difference in cross level between any two points less than 62 feet apart on tangents and curves between spirals may not be more than	3"	2"	1¾"	1¼"	1"	⅝"

APPENDIX

SUBPART D—TRACK STRUCTURE

§ 213.101 SCOPE.

This subpart prescribes minimum requirements for ballast, crossties, track assembly fittings, and the physical condition of rails.

§ 213.105 BALLAST, DISTURBED TRACK

If track is disturbed, a person designated under §213.7 shall examine the track to determine whether or not the ballast is sufficiently compacted to perform the functions described in § 213.103 If the person making the examination considers it to be necessary in the interest of safety, operating speed over the disturbed segment of track must be reduced to a speed that he considers safe

§ 213 109 CROSSTIES

(a) Crossties may be made of any material to which rails can be securely fastened. The material must be capable of holding the rails to gage within the limits prescribed in § 213 53 (b) and distributing the load from the rails to the ballast section

(b) A timber crosstie is considered to be defective when it is—

(1) Broken through,

(2) Split or otherwise impaired to the extent it will not hold spikes or will allow the ballast to work through,

(3) So deteriorated that the tie plate or base of rail can move laterally more than one-half inch relative to the crosstie;

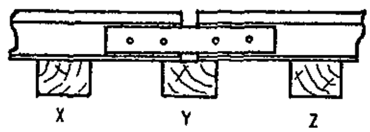
(4) Cut by the tie plate through more than 40 percent of its thickness, or

(5) Not spiked as required by § 213 127

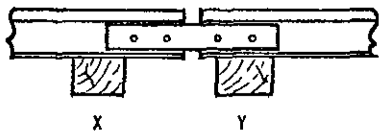
(c) If timber crossties are used, each 39 feet of track must be supported by nondefective ties as set forth in the following table

Class of track	*Minimum number of nondefective ties per 39 feet of track*	*Maximum distance between nondefective ties (center to center) (inches)*
1	5	100
2, 3	8	70
4, 5	12	48
6	14	48

(d) If timber ties are used, the minimum number of nondefective ties under a rail joint and their relative positions under the joint are described in the following chart The letters in the chart correspond to letter underneath the ties for each type of joint depicted.



Supported joint



Suspended joint

Class of Track	*Minimum number of nondefective ties under a joint*	*Required position of nondefective ties*	
		Supported Joint	*Suspended Joint*
1	One	X, Y, or Z	X or Y
2, 3	One	Y	X or Y
4, 5, 6	Two	X and Y, or Y and Z	X and Y

(e) Except in an emergency or for a temporary installation of not more than 6 months duration, crossties may not be interlaced to take the place of switch ties

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