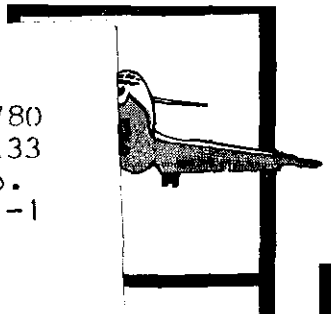

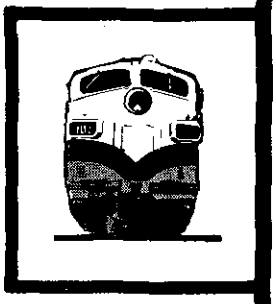

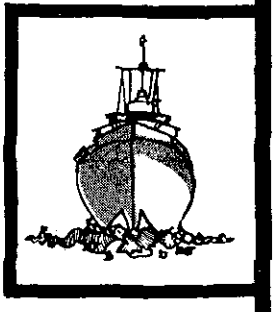

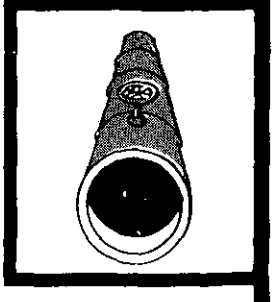

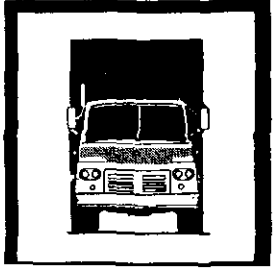

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

**ILLINOIS CENTRAL GULF
RAILROAD COMPANY
FREIGHT TRAIN DERAILMENT
HAZARDOUS MATERIAL RELEASE
AND EVACUATION
MULDRAUGH, KENTUCKY
JULY 26, 1980**

NTSB-RAR-81-1

UNITED STATES GOVERNMENT

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16 Abstract

About 7:58 a.m., on July 26, 1980, 4 locomotive units and 17 cars, including 7 placarded tank cars containing hazardous materials, of Illinois Central Gulf Railroad Company freight train No. 64 were derailed while moving at a calculated speed of about 35 mph around a 6° curve in Muldraugh, Kentucky. Two tank cars of vinyl chloride were punctured and their contents burned. Flames impinged two other tank cars of vinyl chloride, causing one to vent toxic fumes, but neither car ruptured. About 6,500 persons were evacuated from Muldraugh and the U.S. Army installation at Fort Knox. Four train crewmembers were injured during the derailment, and property damage was estimated at $1,348,394.

The National Transportation Safety Board determines that the probable cause of the accident was the tipping of the outside rail and widening of track gage in the 6° curve because of the combined effects of defective crossties, excessively worn rail, irregular alignment and gage, and the lateral forces produced by the train's speed. Inadequate maintenance and inspection practices of the Illinois Central Gulf Railroad allowed these conditions to remain uncorrected. Contributing to the accident was the inadequate Federal Track Safety Standards which failed to provide for a track structure commensurate with the permitted train speeds.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: February 3, 1981

ILLINOIS CENTRAL GULF RAILROAD COMPANY FREIGHT TRAIN DERAILMENT HAZARDOUS MATERIAL RELEASE AND EVACUATION MULDRAUGH, KENTUCKY JULY 26, 1980

SYNOPSIS

About 7:58 a.m., on July 26, 1980, 4 locomotive units and 17 cars, including 7 placarded tank cars containing hazardous materials, of Illinois Central Gulf Railroad Company freight train No. 64 were derailed while moving at a calculated speed of about 35 mph around a 6° curve in Muldraugh, Kentucky. Two tank cars of vinyl chloride were punctured and their contents burned. Flames impinged two other tank cars of vinyl chloride, causing one to vent toxic fumes, but neither car ruptured. About 6,500 persons were evacuated from Muldraugh and the U.S. Army installation at Fort Knox. Four train crewmembers were injured during the derailment, and property damage was estimated at $1,348,394.

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INVESTIGATION

The Accident

Illinois Central Gulf (ICG) northbound freight train No. 64, consisting of 4 locomotive units and 38 cars, departed Central City, Kentucky, about 2:20 a.m. on July 26, 1980, for Louisville, Kentucky. Transfer reports did not specifv any defects and a roll-by inspection of the train equipment at Central City revealed no defects.

As the train traveled between Central City and Cecilia, Kentucky, it passed two hot-box detectors which indicated no defects. The fireman, a qualified locomotive engineer, was operating the train; the engineer and head brakeman were seated opposite him on the left side of the control compartment in the lead locomotive unit.

After traveling 18.7 miles from Cecilia, the train started down a 1.1 percent grade in Muldraugh, Kentucky, which is surrounded by the U. S. Army's Fort Knox. To maintain a constant descending speed and to prevent train slack from running in, the fireman made a 12-pound brakepipe reduction and kept the throttle in the No. 5 position. The train left the descending grade and entered a 101-foot-long straight section of track approaching a 6° curve to the right, 216 feet north of signal No. 27.2. About 7:58 a.m. as the locomotive entered the curve, at an indicated speed of 26 to 30 mph according to the fireman, the crewmembers on the locomotive heard a "popping" sound from the front of the lead unit and felt the lead unit "fishtail" as the rear of the lead unit derailed. The fireman immediately placed the train brakes in emergency and held onto the control stand to keep from being thrown about the cab. The other two crewmembers braced themselves at the left side of the locomotive. The three trailing locomotive units overturned to the left pulling the coupled lead unit over. All of the locomotive units remained coupled. The lead end of the locomotive came to rest about 645 feet north of the point of derailment.

The following 17 cars were derailed. (See figure 1.) Seven were tank cars containing hazardous materials. Six of the tank cars carried vinyl chloride and one contained chlorine. Both vinyl chloride and chlorine produce toxic fumes when released to the atmosphere. Two of the tank cars of vinyl chloride were breached. The pressurized compressed gas escaped and formed a gas cloud around the derailed equipment.

The engineer got out of the lead unit via the right-side window opening. He saw a white cloud forming about 6 inches above the ground near the rear locomotive unit. Knowing that hazardous materials were being carried in the seven tank cars, the first being six cars behind the locomotive consist, the engineer quickly assisted the fireman and brakeman through the same window exit.

While standing beside the lead unit, the crewmembers heard what they identified as electrical arcing coming from the battery area of the rear unit. They ran from the wreckage area as the gas cloud ignited. Although not burned, the crewmembers felt a heat wave and a subsequent concussion. They went to a highway that paralleled the track and advised a local police officer there of the derailment and of the hazardous contents of the tank cars, and recommended that the area be evacuated immediately.

After the train stopped, the crewmembers in the caboose had attempted to call the locomotive crewmembers by radio. Because of the violent stop, the crewmembers in the caboose assumed that the train had derailed. Unable to establish communication with the other crewmembers, the flagman and conductor left the caboose. The conductor went to check the track behind the train and the flagman went ahead to check the cars in the train. The conductor saw the gas cloud shortly after he left the caboose, and he advised military personnel at Fort Knox of the derailment. The flagman who was walking from the caboose toward the derailed equipment felt the heat of the burning gas cloud and radioed the train dispatcher and requested emergency aid. He then went to the highway and was escorted to safety by military personnel.

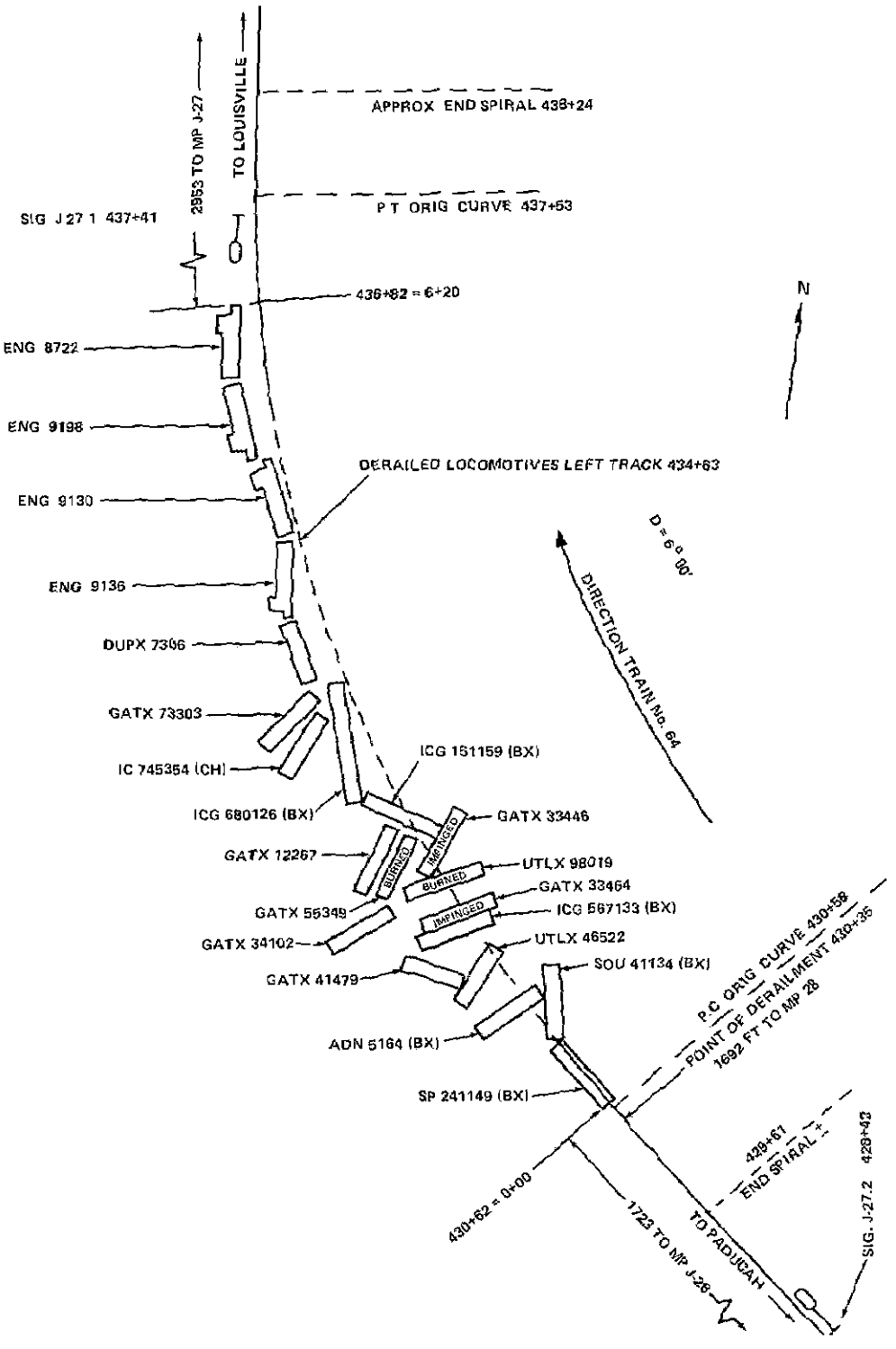


Figure 1.—Plan View of Accident

Injuries to Persons

Injuries	Crewmembers	Passengers	Others	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	4	0	0	4
None	1	0	0	1
Total	5	0	0	5

Damage

The tank car loaded with chlorine was not breached. Two tank cars loaded with vinyl chloride which were punctured were destroyed. One of the other four tank cars that was not punctured lost about 30 percent of its vinyl chloride lading through the safety valve because of overpressure resulting from the heat of the fire.

Of the other 10 derailed cars, which did not carry hazardous materials, 3 sustained light damage, 2 were moderately damaged, 3 were heavily damaged, and 2 were destroyed.

The running gear and car bodies of the first three locomotive units were damaged by the derailment. The fourth unit was destroyed by the fire from the burning vinyl chloride and the spilled fuel oil from the ruptured locomotive fuel tank.

The derailment destroyed or damaged about 645 feet of track. Broken rails and joint bars were found on both sides of the track. The estimated cost of the damage is listed below:

Locomotive equipment	$ 860,000
Car equipment	275,500
Track and signals	11,200
Lading	93,254
Removal of Wreckage	108,440
Total	$1,348,394

Crewmember Information

All of the crewmembers were qualified according to ICG operating rules. (See appendix B.)

Train Information

Train No. 64, consisting of 28 loaded freight cars, 9 empty freight cars, and a caboose, was 2,528 feet long and had 2,841 trailing tons. The locomotive consisted of four diesel-electric, four-axle units manufactured by the Electro-Motive Division of General Motors.

The lead unit was a model GP-11 and the three other units were model GP-9's. The lead unit was equipped with No. 26-L-type airbrakes, speed indicator,

wheel slip-slide indicator, and an operative radio. The locomotive was not equipped with speed-recording or event-recording equipment.

Immediately behind the locomotive were two empty tank cars, an empty covered hopper, an empty boxcar, and an empty refrigerator car. The 6th through the 11th cars were tank cars containing vinyl chloride. Five of the tank cars had been provided with insulation, head shields, and top-and-bottom shelf couplers that met U. S. Department of Transportation (DOT) specification 112J 340W. One tank car was outfitted to DOT specification 105 A 300W. The 12th car, outfitted to DOT specification 105 A 500W, was loaded with chlorine. All of the tank cars were placarded properly.

Track Information

The track was constructed of 39-foot-long, 115-pound rails connected by 6-hole, 36-inch joint bars. The east rail was laid in 1951 and the west rail in 1977. The rails were placed on 7 3/4-inch by 13-inch, double-shoulder tieplates on an average of 23 hardwood crossties per 39-foot rail length. The track was ballasted with slag and crushed limestone to an average depth of 18 inches. Each rail was secured to the crossties with an average of one spike on the gage side, one spike on the field side, and one plate-holding spike.

The track where the derailment occurred was an 863-foot-long, 6° curve to the right. Spirals were provided at each end. The curve had a 2 1/2-inch superelevation. Approaching this curve from the south, the track was straight for 101 feet. Northbound trains moved on a descending grade of about 1.1 percent approaching the straight track and on a level grade through the curve.

The track was supposed to be maintained to meet the Federal Railroad Administration's (FRA) track safety standards for Class 3 track. (See appendix C.) An FRA geometry car was last operated over the track on December 14, 1979. The survey (see appendix D) found that at the midpoint of the 6° curve, the track gage at a joint was 57.6 inches, which is 1.1 inches wider than standard gage of 56.5 inches. In the next curve, at milepost 27.9, the gage at a joint was 57.8 inches. According to the ICG, the excess gage locations were repaired to meet the standards for Class 3 track, which allow a maximum gage of 57.75 inches. However, there is no record of the repair. The survey also found that the curvature deviated from the designed 6° between 5°30' to 7°, that the superelevation of the curve deviated from the planned 2 1/2 inches up to 3 3/4 inches, and that the profile of the track ranged from 1/2 inch to 1 inch high and low through the curve. The curvature, superelevation, and profile deviations were within the tolerances established by the standards for Class 3 track.

During routine ICG track inspections between June 6, 1980, and July 21, 1980, 15 track defects were recorded between mileposts 16 and 32. The track supervisor reported that the defects were repaired. Among the defects were a number of stripped joints and buckled tracks. As a result of the buckled track, caused by daytime heat, ICG General Order No. 116 was issued on July 18, 1980, limiting the maximum speed of all trains to 30 mph between mileposts 5 and 125 from 10:01 a.m. until 7:01 p.m. Class 3 track permits a maximum of 40 mph for freight trains on straight track and 36 mph through a 6° curve with a 2 1/2-inch superelevation.

A 42-mile section of track that included the accident site was checked twice a week by an ICG track inspector on a motor car moving at speeds of 15 to 20 mph. On July 22, 1980, an FRA track safety inspector and an ICG track supervisor made a visual inspection of the accident curve, and they did not report any defects. However, at mileposts 20.7 and 28.5, the FRA inspector found crosstie defects on each side of the area where the derailment later occurred. There were no other exceptions noted at that location. The FRA inspector cautioned the ICG track supervisor that the rail was flaking metal on the high side of the curve each time a train traversed the track, causing wear and curve-worn rail. He told the ICG inspector that, because of the curve-worn rail, the track gage should be carefully checked. An ICG track inspector inspected the track again on July 24, 1980, and found no reportable defects.

A postaccident inspection revealed that the gage side of the head of the outside rail of the 6° curve was reduced between 28 to 44 percent of its surface. (See appendix E.) The ICG inspector who made the July 24, 1980, inspection said he noticed flange marks on the top of joint bars at milepost 27.5. He said he attributed the flange marks to railhead wear and curve-worn rail on the high side of the curve which would permit the flanges of the wheels to contact the joint bars. He did not note these conditions on the inspection report.

The ICG track supervisor said that he inspected the curve again on July 25, 1980, and took no exceptions to the curve. However, he had scheduled a maintenance-of-way gang to resurface the curve beginning on July 28, 1980. The gang was scheduled to spike crossties left unspiked previously and to replace defective crossties. The ICG had replaced crossties through this area in December 1979 and because of ICG maintenance techniques, about 1 in 10 of the new crossties was left unspiked. The curve-worn rail was scheduled to be replaced later. Since the accident, the ICG has replaced about 600 defective crossties per mile in the 42-mile section. There are about 3,000 crossties per mile in this area.

The track in the accident area was last ultrasonically tested for internal rail defects on November 9, 1979. There were no defects noted in the immediate area of the accident.

Method of Operation

Trains are operated over the Louisville District of the Kentucky Division by an automatic block signal system. The train dispatcher, who is located in Chicago, Illinois, has direct radio communication with trains moving through the accident area. An average of 45 trains per week are operated over the single main track. The trains carry an estimated 7 million gross tons of freight annually.

Efficiency checks were made on trains operating over the Louisville District. In the 6 months prior to the derailment about 150 efficiency checks were reported, including 9 radar speed checks of train No. 64's operation, with no exceptions noted.

Timetable special instructions and several slow orders had reduced the original maximum authorized track speed of 50 mph to as low as 10 mph in some areas. However, on the day of the accident, ICG General Order No. 116 had

reduced the speed of all Louisville District trains to a maximum of 30 mph. This made the minimum running-time between Cecilia and Muldraugh 1 hour 21 minutes.

Meteorological Information

At the time of derailment, it was daylight, the weather was clear, the wind was calm, and the temperature was about 72° F as reported by the Army Weather Service Station at Fort Knox's Godman Field located about 1.8 miles from the derailment site.

Medical and Pathological Information

Of the four injured crewmembers, only the rear brakeman was immediately hospitalized. He had been exposed to the vaporized vinyl chloride for a short time, and he was treated for inhalation of toxic fumes. The engineer, fireman, and head brakeman received emergency treatment. The fireman entered a hospital for observation several days after the occurrence. Although the conductor escaped injury, he did not work for several days because of a nervous condition that reportedly resulted from the accident.

Because of previous experience with accidents involving hazardous chemicals and on the advice of emergency response officials, the wreck-clearing workers waited until most of the gases and smoke had dissipated before attempting major cleanup operations. No injuries were reported by those involved in these activities.

Survival Aspects

Shortly after the derailment, crewmembers informed the Muldraugh Police and Fort Knox military personnel of the leaking and burning hazardous chemicals. The properties of the materials involved and the potential for explosion caused authorities to immediately order the evacuation of about 6,500 persons. About 4,000 of the evacuees were military personnel from Fort Knox.

At about 8:25 a.m., the Kentucky Division of Disaster and Emergency Services (DES) was called in by local authorities to implement an emergency response plan which had been previously established by the State of Kentucky. This plan was immediately put into effect, thereby alerting all State and local emergency services. In addition, the ICG had notified appropriate Federal agencies and shippers about the accident. (see Appendix F). A temporary command post with the DES in charge was established about 3/4 mile from the site and was later moved to an operations building on the Fort Knox base.

In addition to the immediate evacuation of the affected area, three highways (U.S. 31W, U.S. 60, and S.R. 1638) near the derailment site were closed to prevent highway traffic from moving into the hazardous zone. The air space to a 10,000-foot ceiling and for a 3-mile radius surrounding the derailment was closed to all air traffic.

Personnel from the U.S. Environmental Protection Agency (EPA) and representatives from a vinyl chloride shipper tested air samples at the accident site. No traces of vinyl chloride were found in locations away from the immediate vicinity of the derailment. As the hazard subsided, the evacuation area during the

following day was reduced from 2 to 1 1/4 miles. The burning tank cars were intentionally detonated by explosive experts 4 days following the derailment, the fires were extinguished, and the remainder of the evacuees were permitted to return to their homes. Expeditious and efficient emergency actions resulted in no postderailment injuries.

The United States Army provided assistance throughout the emergency. It helped with the evacuation by furnishing personnel, equipment, security, helicopters, and a command post location.

Other Information

Postaccident Inspection of Train Equipment.--A test of the speed indicator installed on the lead locomotive unit revealed that the indicator read 21 mph at an actual speed of 25 mph, 26 mph at 31.4 mph, and 34 mph at 39.3 mph. The engineer and the conductor of train No. 64 said that the speed indicator was checked for accuracy between measured mileposts 118 and 119 in accordance with existing instructions, but because of the slow order in the vicinity, they did not detect the inaccuracies. There were no other measured mileposts before the accident site. Recorded train times by the dispatcher and operators indicated that train No. 64 had operated between Cecilia and Muldraugh in 1 hour 6 minutes.

Inspection of the locomotive wheels disclosed rail abrasions on the outside of the rims.

Even though many of the coupler shanks of the tank cars had broken or the cars had become uncoupled during the derailment sequence, all but two remained coupled during the initial run-in until the cars started jackknifing, breaking the couplers. The two tank car breaches found were both in the sides of the tanks. The 7th car was punctured as the result of a broken rail piercing the jacket and tearing the side of the tank. The mechanism causing the puncture of the 10th car could not be determined, but the car was punctured in the side. There were no head punctures.

After the accident, an inspection of the 7th car disclosed a tear about 2-1/2 inches long and 1/2-inch wide at the center of the tank on the right side about two-thirds of the way down the side from the dome. An inspection of the 10th car disclosed a hole about 1 3/4 inches by 1 1/2 inches about 60 inches from the middle of the tank towards the A-end at the bottom. Fire burned at the punctures on these cars until the cars were detonated.

A large burned area was noted on the 8th car. The burn area was located where the car was directly fire-impinged for more than 72 hours. About 30 percent of the contents of the car was vented through the safety valve. Although the 11th car was fire-impinged over a period of time, no loss of its chemical contents occurred.

Postaccident Inspection of Track.--Track measurements of the undisturbed track for a distance of 859.5 feet south and 232.5 feet north of the derailment site disclosed many deviations from the designated curvature, superelevation, and gage. (See appendix G.) The alignment of a curve located about 400 feet south of the point of derailment varied from 5°7'30" to 5°52'30" for the designed 5° curve. The

superelevation of the 5° curve varied from 2 inches to 2 1/2 inches. Because of the derailment damage, only one measurement--a superelevation of 2 1/2 inches--could be made in the 6° curve. Track gage varied from 56.5 to 57.5 inches. However, all of these deviations in track geometry were within the tolerances allowed by the standards for Class 3 track. Broken rails and angle bars found at the accident site were determined to have been broken in the derailment.

Postderailment inspection disclosed defects in crossties, tie plates, and spiking in the approach to and beyond the point of derailment. (See figures 2, 3, 4, and 5.) A defective crosstie, marked by the ICG with a yellow dot prior to the December 14, 1979, FRA geometry car inspection, was found in the middle location at a supported insulated joint on the east rail about 216 feet south of the point of derailment. (See figure 2.) The ICG joint was supported by three crossties. The track safety standards (49 CFR 213.109(d)) require a minimum of one nondefective crosstie at each joint of Class 3 track, and a nondefective crosstie in a supported joint must be in the middle location. The yellow dot on the crosstie is a carrier-used method of indicating that the crosstie must be removed. A tie plate was also missing at this joint.

An unspiked new crosstie was found at a location about 300 feet south of the point of derailment. (See figure 3.) Because of the absence of spikes in a number of the new crossties, many tie plates were not properly positioned under the rail base. (See figure 4.) Federal regulations require that tie plates having shoulders must be placed so that no part of the shoulder is under the base of the rail.

Four adjacent defective crossties--two were split and two were missing spikes--were found at the accident site, leaving a space of 109 inches between nondefective crossties. (See figure 5.) This exceeded the 70 inches maximum for nondefective crosstie spacing for Class 3 track allowed by the track safety standards (49 CFR 213.109(c)).

Five days after the derailment, the FRA issued violation notices on the two defects at mileposts 20.7 and 28.5 that had been reported to the ICG on July 22, 1980, and which had not been repaired in accordance with the track safety standards (49 CFR 213.233(d)).

After the accident, the disturbed rails were reassembled by ICG personnel. However, a 20-foot-long piece of rail that had been originally positioned as a part of the outside rail near the middle of the curve body could not be found. All other rails were carefully examined and found to be free of internal defects. Derailed wheel markings were found on the gage side of the outside rail about 74 feet from the beginning of the curve or about 216 feet north of signal 27.2.

Train Speed.--Several days after the accident, ICG personnel programmed the train makeup and routing data of train No. 64 into a company-owned computer and simulated runs from Cecilia to Muldraugh. Allowing for slow orders and other known conditions, they concluded that train No. 64 had been operated on the accident date at speeds averaging 6 mph over the authorized speed of 30 mph. A company supervising locomotive engineer who assisted in the testing said that the speed of the simulated movement increased by 4 mph in descending the 1.1 percent grade at the derailment site. A 12-pound brakepipe reduction as reported by the engineer of train No. 64 was used in the simulated descent.

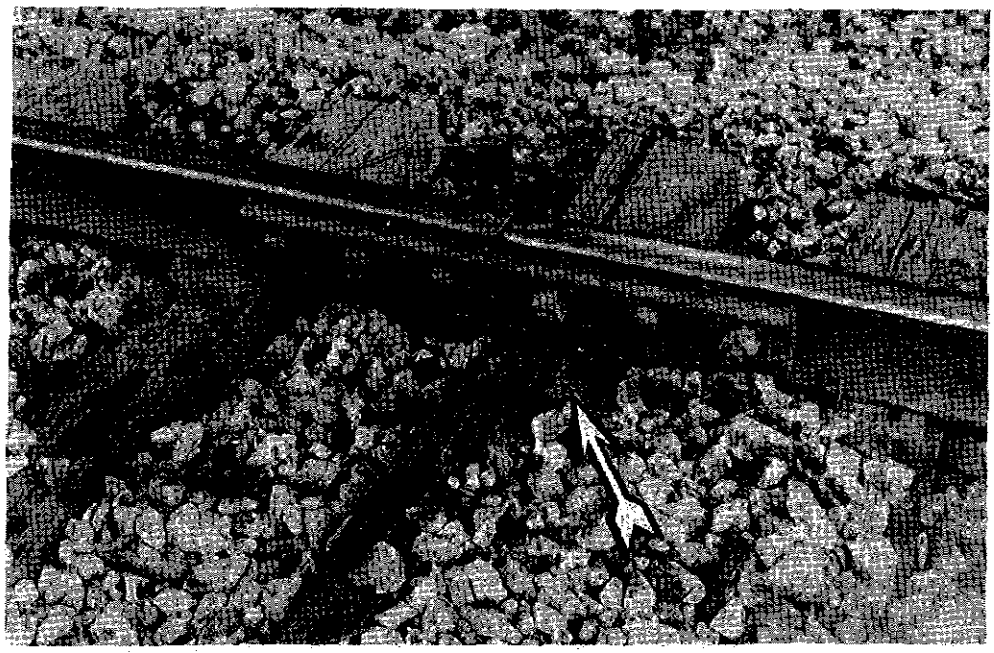


Figure 2.—Defective crosstie marked by yellow dot (arrow) 216 feet before the point of derailment.

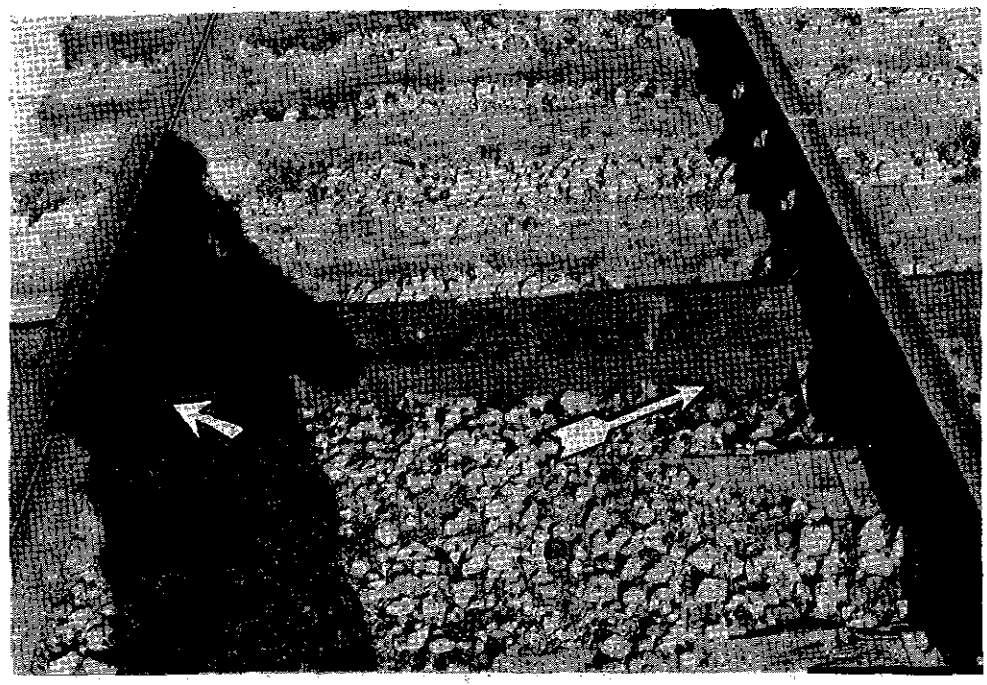


Figure 3.—Unspiked new crosstie about 300 feet south of the point of derailment.

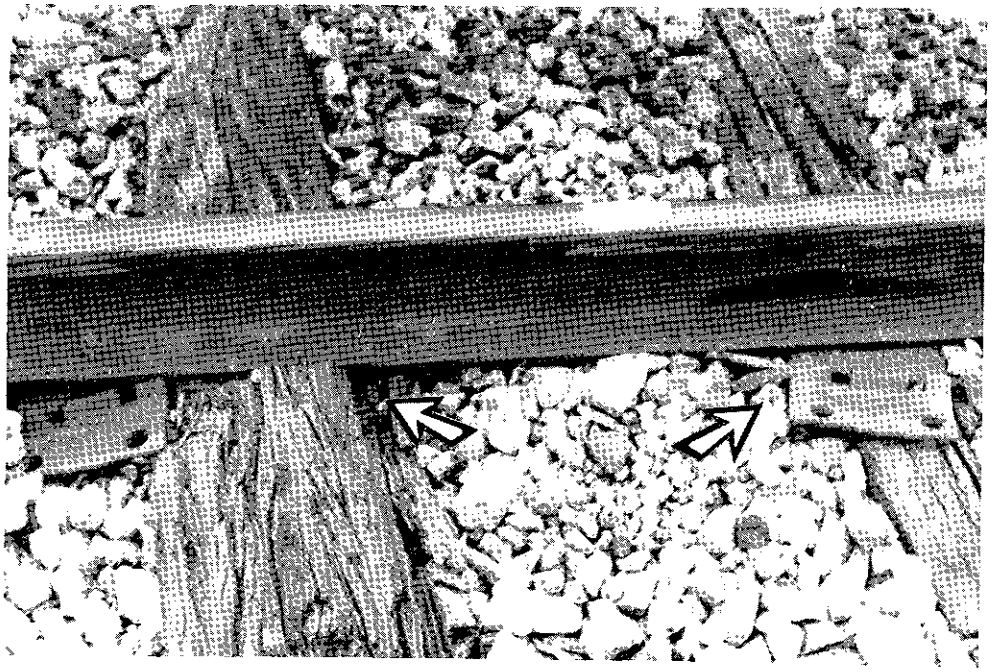


Figure 4.--Improperly installed and unspiked tieplates in derailment area.

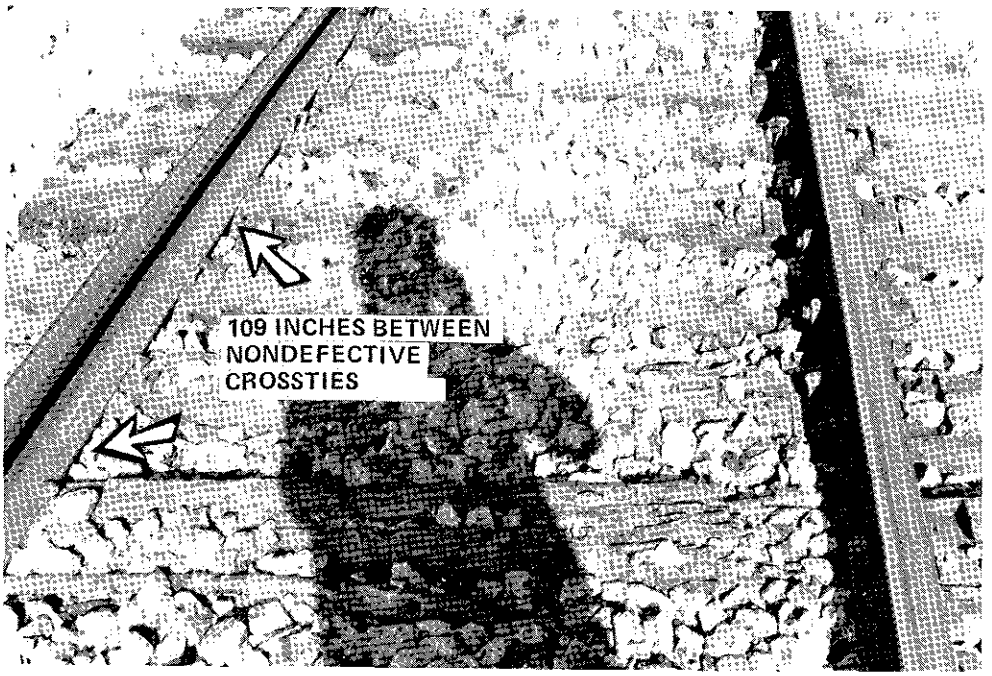


Figure 5.--Four adjacent defective crossties at the accident site.

ANALYSIS

The Accident

It is apparent from the marks on the track structure and from the location of the derailed equipment that train No. 64 derailed within the track gage at Muldraugh. The outside rail of the curve was tipped outward as the trailing truck of the lead locomotive unit entered the spiral of the 6° curve. This was evident from the rail abrasions seen on the wheels of this locomotive unit. The "popping" sound and a subsequent "fishtailing" of the lead unit described by the crewmembers resulted as the lead unit derailed at a point about 216 feet north of signal No. 27.2. The location where the crewmembers heard the popping sound coincided with the location of derailment markings on the rails. Therefore, the Safety Board concludes that the initial point of derailment was about 1,700 feet north of milepost 28.

The momentum of the derailed four-unit locomotive caused it to move on the track structure a distance of 428 feet, breaking rails, joint bars, and tie plates as the rails were forced outward by the wheels as they moved within the track gage. This destruction of the track structure then caused the locomotive to swing to the west as it left the track structure. After traveling an additional 219 feet, the four locomotive units overturned to the west.

Tank Car Structural Integrity

Tank head shields, top-and-bottom shelf couplers, and additional insulation previously recommended by the Safety Board 1/ were provided on the tank cars containing vinyl chloride. These components greatly enhanced the crashworthiness of the chemically laden tank cars during and after the derailment. Physical markings seen on the derailed equipment demonstrated that the path of metal-piercing projectiles had been diverted from the tank heads by the head shields. The postcrash equipment inspection indicated that top-and-bottom shelf couplers had performed within the limits of their designed functions. The J-type retrofit modifications which included metal jackets and insulation limited the flame impingement experienced by the vinyl chloride-filled tank cars to the outer jackets. Insulation further restricted the introduction of heat to the inner tank shells and their contents, preventing hot spots and allowing a controlled safety valve release of the gas. Catastrophic releases of hazardous materials did not occur.

Track Irregularities

Because of the extensive damage caused by the derailment, a complete assessment of the disturbed trackage was not possible. However, it is reasonable to assume that the conditions observed on the track in approach to and beyond the derailment area during a postaccident inspection were representative of the precrash conditions of the accident-damaged track. Also, the December 1979

1/ Safety Effectiveness Evaluation, "Analysis of Proceedings of the National Transportation Safety Board into Derailments and Hazardous Materials, April 4-6, 1978" (NTSB-SEE-78-2).

measurements of the track made by the FRA geometry car revealed abrupt changes in curvature and superelevation for a distance of about 84 feet at the beginning of the 6° curve. The variations of the 6° curve alignment from 5°30' to as much as 7° would have produced additional lateral forces on the outside rail of the curve as a train moved around the curve. Abrupt changes in the superelevation also would have produced unequal lateral forces. Even though these measurements were made about 6 months before the accident, there is no record that the repairs were made to correct these conditions before the accident occurred. Separately, these defects were not in violation of the standards for Class 3 track. However, constant traffic would, in all likelihood, have made the deviations greater than when originally measured. The increased possibility of derailment because of the combination of these deteriorating track conditions should have been recognized by inspectors.

As a result of its safety effectiveness evaluation of FRA track safety programs, 2/ the Safety Board recommended on March 20, 1979, that the FRA:

> Immediately revise the track safety standards to eliminate the subjectivity, incompatibility, vagueness, and unenforceability. The requirements should be made more explicit so as to insure the detection and correction of all combinations of track conditions which cause derailments. (R-79-19)

The FRA replied that it had undertaken, beginning in May 1978, a complete review of the track safety standards in an effort to reduce the number of, and to strengthen and clarify, those portions remaining as requirements. However, the review and revision of the standards has not yet been completed. The Safety Board is holding this recommendation in an "Open--Acceptable Action" status.

Over 90 percent of the Louisville District trackage had been downgraded by the carrier from FRA Class 4 to Class 3. At the accident site, deteriorated track conditions indicate the carrier had apparently maintained the Class 3-designated trackage at no more than a minimum level of compliance. However, certain defects found on the track structure near the derailment site, such as excessive spacing between nondefective crossties, improper tie plate positioning, and an improperly supported joint, were in violation of the standards prescribed for Class 3 tracks. Although most of the other track irregularities observed near the site were permitted by FRA standards for Class 3 track, collectively all these irregularities, with other system stresses, most likely caused the track to fail.

The Board's 1979 safety effectiveness evaluation also discussed the problems associated with lowering a track classification in lieu of making necessary repairs to maintain the track's higher classification. As a result, the Safety Board recommended that the FRA:

> Determine the ultimate safety effect of allowing the indiscriminate lowering of main track classifications instead of maintaining the track at original intended class. (R-79-25)

2/ "Safety Effectiveness Evaluation of the Federal Railroad Administration's Hazardous Materials and Track Safety Programs, March 8, 1979" (NTSB-SEE-79-2)

The FRA replied that safety should not be affected by lowering of main track classification. It said that a study of the relationship between train loading, train speeds, and track conditions is reflected in the revised track safety standards published in a notice of proposed rulemaking on September 6, 1979. In the notice of proposed rulemaking, the FRA stated in the section "Classes of Track: Operating Speed Limits" that consideration of axle loads in determining maximum permissible operating speeds was being postponed until further technical information provided sufficient safety justification for this step, or future investigation revealed significant cost reductions. The Safety Board is holding this recommendation in an "Open—Unacceptable Action" status.

Section 213.9 of the proposed rule prescribes maximum permissible speeds that are correlated to the strength or weight of the rail in the track. Since dynamic forces generated by passage of both freight and passenger trains increase as train speed increases, with rail support conditions remaining constant, the stresses developed in the rail will likewise increase. Heavier rail is needed to sustain these higher forces. Thus, the FRA proposes to lower many of the present maximum permissible speeds over the various classes of track that have rail weighing less than 112 pounds per yard and to increase the maximum permissible speeds over track with rail that weighs more than 131 pounds per yard. The maximum permissible speeds over track with rails that weigh between 112 and 131 pounds per yard would remain essentially the same. The Safety Board on January 10, 1980, in its comments on the proposed rulemaking stated that in revising section 213.9, speed limits should not be raised solely on the basis of weight of rail. The Board said that there are other criteria, such as crosstie condition, cross level, and gage, which should be considered. The Board stated its concern that the proposal could effectively raise many train speeds without compensating changes in track geometry requirements.

Many excessively curve-worn rails were found throughout the derailment area. The approximate 28- to 44-percent reduction in the cross section of the rail would have substantially lowered the rail's ability to withstand bending stresses. 3/ This worn condition would have made the rail more prone to breakage under the strain of the increasingly heavy loads carried by today's trains. 4/ A 44-percent reduction of cross section also would have made the rail more prone to tipping because the resultant force of the vertical and lateral component forces of the wheel on the rail could have been beyond the outside edge of the rail base. The use of such curve-worn rails is left to the discretion of the carrier. Neither the ICG nor the FRA have promulgated rules or regulations to limit wear for rails that are used in mainline trackage. The Safety Board believes that the use of such excessively worn rails should not be used on main or side tracks.

3/ "Track Structures for Heavy Wheel Loads," William W. Hay, 1975 Railroad Engineering Conference.

4/ National Transportation Safety Board, Atlanta Field Office, Field Report of Railroad Accident Investigation--Louisville and Nashville Railroad Company Freight Train Derailment at Acworth, Georgia, January 25, 1980 (ATL-80-FR-002).

An inspection of the rail and crossties as a result of the 1-inch-wide gage recorded on the 6° curve by the FRA geometry car on December 14, 1979 indicated a problem with the track holding proper gage. Additionally, the FRA track safety inspector on July 22, 1980, cautioned the ICG track supervisor that excessive gage-widening was possible because of the wear condition seen on the curved rails. Allowing the excessively curve-worn rails to remain in the mainline track significantly increased the risk of derailment and of possible injurious consequences from hazardous materials to the Muldraugh/Fort Knox communities. If there were either a responsible policy by the ICG or if there had been Federal regulations limiting the use of such badly worn rails in mainline track, the accident may have been prevented by correction of the worn rail condition and other existing track irregularities at the same time.

Many of the crossties in the derailment area were defective and were scheduled for replacement by the carrier shortly after the date of this accident. The crossties were split and spike-worn to the extent that they would not provide sufficient securement for the rails. In addition, the rails had not been spiked to some of the new crossties which had been put in place 6 months before the accident. In advance of the derailment area, crossties were missing in several places, thus allowing excessive spacing between crossties. This deteriorated crosstie condition along with an excessively worn rail condition could have created a track condition which would have been unable to sustain the normal lateral forces of a passing train such as train No. 64. These normal forces would probably have caused the outside rail in the curve to tip under the locomotive.

FRA Track Safety Standards

The Safety Board has addressed the deficiencies of the FRA track safety standards in other accident reports. 5/ This accident, involving a hazardous materials release, emphasizes the urgent need to revise the existing standards to provide for a safe track. Many of the track irregularities found at the time of this derailment were acceptable deviations under the established Federal standards. Other irregularities, such as the condition and location of the crossties under supported joints, either were not subject to regulation or were subject to a difference in interpretation or a combination of conditions. The lack of clear and specific regulations and the failure of the regulations to take into account the cumulative effect of a combination of deficiencies prompts judgmental safety decisions to be made by those who otherwise might rigidly adhere to restrictions imposed by Federal regulation.

Under the current FRA track safety standards, specified civil penalties are established for noncompliance with the minimum safety requirements. However, before such penalties can be imposed, it must be demonstrated that the carrier had prior knowledge of the track conditions that are in noncompliance. In its special study of the proposed track standards prior to their effective date, 6/ the Safety

5/ "Railroad Accident Report--Derailment of Amtrak Train on Illinois Central Gulf Railroad, Goodman, Mississippi, June 30, 1976" (NTSB-RAR-77-3), and "Railroad Accident Report--Derailment of Amtrak Train on Burlington Northern Railroad, near Ralston, Nebraska, December 16, 1976" (NTSB-RAR-77-8).

6/ "Railroad Special Study--Proposed Track Safety Standards, August 26, 1971" (NTSB-RSS-71-2).

Board discussed the inadequacy of section 213.5, which does not require that all substandard or defective conditions actually be searched out and corrected. This loophole allows, and may even promote, the practice of deferring track maintenance to the point where it becomes unsafe. The safety regulations neither encourage carriers to improve track above the regulatory minimums nor discourage violations of regulations by the prospect of effective enforcement. When an FRA track safety inspector finds noncompliance with the regulations, he must inform a carrier representative of the infraction. At that time, several options are permitted by the regulations which allow the carrier to bring the track into compliance before a penalty is imposed. In most cases, the carrier merely elects to downgrade the affected track to the next lower class until repairs are made or the carrier may even defer repair indefinitely. Because of the thousands of miles of trackage for which each of the few FRA track safety inspectors is responsible, a railroad's track maintenance procedures which allow irregularities to exist will be continued by some carriers without a real threat of Federally imposed penalties.

The circumstances of the Muldraugh derailment show the need for closer FRA monitoring of current ICG track inspection and maintenance practices. Additionally, this accident indicates that beyond the revisions of the FRA track safety standards suggested by the Safety Board in the past, revision should be made to include (1) new regulations that define and restrict certain combinations of track irregularities that create unacceptable risks to safe train operations, (2) establishment of rail limits of wear that will exclude the use of excessively worn rails in mainline tracks subject to use by trains carrying passengers or hazardous materials, and (3) an elimination of the "need to know" requirement of defective conditions as a basis for penalty. There should also be a tightening of the civil penalty regulations to influence carriers to adhere more rigidly to Federal track maintenance requirements.

Train Speed

When train No. 64's locomotive crew assumed control of the locomotive consist at Central City, there was nothing in the transfer reports to suggest that the speed indicator was inaccurate. The speed indicator was checked in accordance with existing instructions, and the crew assumed that the indicator was performing accurately. Since there were no other measured-mile stations prior to the accident site, the crew was unable to make additional tests. However, postaccident tests indicated that the actual train speed was faster than that shown by the speed indicator. Train No. 64 traveled the 19 miles between Cecilia and Muldraugh in 1 hour 6 minutes. Complying with the maximum speeds allowed for this trackage, the trip should have taken 1 hour 21 minutes. The fireman who was operating the train had relied completely on the inaccurate speed indicator reading of about 5 mph slower than actual to comply with the authorized track speeds. Therefore, the speed at the time of the derailment could have been as much as 35 mph since the fireman thought he was operating the train between 26 and 30 mph as the train entered the curve. The 35-mph speed of train No. 64 at the time of the accident could have been an additional contributing factor, particularly with the track in a deteriorated condition.

Postderailment Activities

The Safety Board commends the manner in which the State of Kentucky, the U.S. Army, various Federal agencies, surrounding communities, and the ICG conducted emergency on-site activities. Through their coordinated efforts, the threat of serious injuries to the public was minimized. If the derailment had produced more catastrophic consequences, its location relative to the Fort Knox military installation could have caused significant evacuation and security problems.

CONCLUSIONS

Findings

1. The lead unit of train No. 64's locomotive was the first to derail.

2. The initial point of derailment was about 1,700 feet north of milepost 28.

3. Broken rails, joint bars, and tie plates at the accident site resulted from the derailment.

4. The locomotive speed indicator used by the fireman to control the train's speed indicated as much as 5.1 mph less than actual train speed.

5. At the time of the derailment, train No. 64 was moving at about 35 mph in a 30-mph speed restriction location. This speed should not have affected an adequate track structure.

6. The combination of track irregularities in alignment, profile, cross level, and curve-worn rail conditions combined with train speed to produce sufficient lateral forces to tip the high rail and widen the track gage.

7. The current FRA track safety standards do not take into consideration the cumulative effect of combinations of otherwise acceptable track irregularities on safe train operations.

8. The FRA track safety standards do not restrict the use of curve-worn rails, except through those regulations regarding proper track gage.

9. The ICG elected to downgrade the track classification of the Louisville subdivision rather than to repair and maintain it as a Class 4 track.

10. After receiving notice of noncompliance from an FRA inspector, ICG personnel failed to repair the two track defects in the Muldraugh area prior to the derailment.

11. Many deviations from the FRA track safety standards were overlooked during an FRA safety inspection of the trackage near Muldraugh 4 days before the accident.

12. Track conditions at the accident site indicated that the ICG's prederailment maintenance practices did not produce a track condition which met the minimum requirements for Class 3 track.

13. Postaccident emergency activities were carried out in a coordinated and effective manner by all participants.

14. Top-and-bottom shelf couplers, tank head shields, and tank shell insulation performed within design limits as intended and prevented head punctures in all of the derailed tank cars.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the tipping of the outside rail and widening of track gage in the 6° curve because of the combined effects of defective crossties, excessively worn rail, irregular alignment and gage, and the lateral forces produced by the train's speed. Inadequate maintenance and inspection practices of the Illinois Central Gulf Railroad allowed these conditions to remain uncorrected. Contributing to the accident was the inadequate Federal Track Safety Standards which failed to provide for a track structure commensurate with the permitted train speeds.

RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board recommends that:

-the Illinois Central Gulf Railroad Company:

Establish and implement procedures to maintain mainline tracks and sidings to a level of safety not less than that which is prescribed by Federal regulations governing carrier-designated track classes. (Class II, Priority Action) (R-81-32)

Establish and implement track maintenance standards which designate the limit of acceptable rail wear and which require rail removal when worn beyond the acceptable limits. (Class II, Priority Action) (R-81-33)

-the Federal Railroad Administration:

Institute surveillance of the maintenance of Louisville District trackage of the Illinois Central Gulf Railroad Company until it is brought into conformance with the requirements of the FRA track safety standards. (Class II, Priority Action) (R-81-34)

Promulgate regulations which designate the limit of acceptable rail wear and which require railroads to remove from active tracks rails that are worn beyond the acceptable limits. (Class II, Priority Action) (R-81-35)

In addition, the National Transportation Safety Board reiterates the following recommendations previously made to the Federal Railroad Administration as a result of other train accident investigations:

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. (R-77-6) (Open—Response Received)

Amend track geometry standard 49 CFR 213.63, Track Surface, so that it defines "uniform profile," establishes maximum rate-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. (R-77-7) (Open—Response Received)

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 for the maximum allowable speed for each class. (R-77-8) (Open—Acceptable Action)

Immediately revise the track safety standards to eliminate the subjectivity, incompatibility, vagueness, and unenforceability. The requirements should be made more explicit so as to insure the detection and correction of all combinations of track conditions which cause derailments. (R-79-19) (Open—Acceptable Action)

Determine the ultimate safety effect of allowing the indiscriminate lowering of main track classifications instead of maintaining the track at original intended class. (R-79-25) (Open--Acceptable Action)

Amend track safety standards 49 CFR 213.241, Inspection Records, to require railroad inspectors to list on their inspection records the location of rails which exhibit the external conditions listed in subpart (b) of 49 CFR 213.113, Defective Rails, and the remedial action they have taken. (R-80-32) (Open—Response Received)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

February 3, 1981

APPENDIXES

APPENDIX A
INVESTIGATION

Investigation

The National Transportation Safety Board was notified of the accident about 11:30 a.m., on July 26, 1980. The Safety Board immediately dispatched an investigative team from its field office in Atlanta, Georgia, to the scene. On August 20, 1980, statements about the accident were taken in Louisville, Kentucky, from ICG employees.

APPENDIX B
CREWMEMBER INFORMATION

C. S. Wheat, Locomotive Engineer

Mr. Wheat, age 31, was employed as a fireman on October 30, 1969. He was promoted to locomotive engineer on September 11, 1970. He passed a medical examination on May 13, 1970, and passed the ICG operating rules examination last held in 1978. He was sitting in the fireman's seat when the accident occurred.

William L. Hunt, Fireman

Mr. Hunt, age 37, was employed as a switchman on March 25, 1970. He transferred to brakeman on March 25, 1971, and transferred to fireman on July 10, 1973. On July 31, 1973, he was promoted to conductor. On June 25, 1974, he was examined on the operating rules as a student engineer and was promoted to locomotive engineer on July 1, 1974. He passed a medical examination on July 10, 1980, to return to work from a personal injury. He passed the ICG operating rules examination last held in 1978. He was operating the locomotive when the accident occurred.

Jerry L. Tucker, Head Brakeman

Mr. Tucker, age 27, was employed as a brakeman on May 13, 1972, and was promoted to conductor on May 18, 1974. He passed the ICG operating rules examination last held in 1978. When the derailment occurred, he was seated in the left-front seat of the locomotive.

C. L. Gregory, Conductor

Mr. Gregory, age 58, was employed as a brakeman on December 4, 1941. He took a 3-year military leave and returned to work on December 28, 1945. He was promoted to conductor on March 27, 1950. He passed a medical examination on September 24, 1974, and was required to wear eyeglasses while on duty. He passed the ICG operating rules examination last held in 1978. He was on the caboose when the train derailed.

John O. Randolph, Rear Brakeman

Mr. Randolph, age 31, was employed as a brakeman on May 21, 1969, and was promoted to conductor on September 23, 1973. He passed the ICG operating rules examination last held in 1978. He was riding on the caboose when the derailment occurred.

APPENDIX C
EXCERPTS FROM TRACK SAFETY STANDARDS
49 CFR 213

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

*****

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—*		*The gage of curved track must be—*	
	At least—	*But not more than—*	*At least—*	*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

APPENDIX C

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"	5/8"

*****

§ 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 . . .	3/4"	5/8"
6 .	1/2"	3/8"

[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

*****

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,

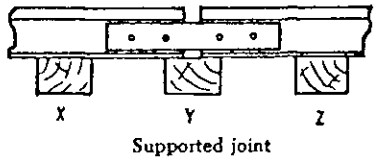
(4) Cut by the tie plate through more than 40 percent of its thickness, or

(5) Not spiked as required by § 213 127

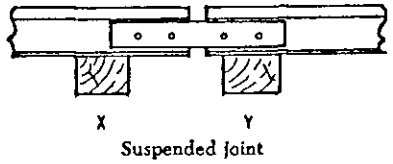
(c) If timber crossties are used, each 39 feet of track must be supported by nondefective ties as set forth in the following table

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

§ 213 123 Tie plates

(a) In classes 3 through 6 track where timber crossties are in use there must be tie plates under the running rails on at least eight of any 10 consecutive ties

(b) Tie plates having shoulders must be placed so that no part of the shoulder is under the base of the rail

§ 213 125 Rail anchoring

Longitudinal rail movement must be effectively controlled If rail anchors which bear on the sides of ties are used for this purpose, they must be on the same side of the tie on both rails

§ 213 127 Track spikes

(a) When conventional track is used with timber ties and cut track spikes, the rails must be spiked to the ties with at least one line-holding spike on the gage side and one line-holding spike on the field side The total number of track spikes per rail per tie, including plateholding spikes, must be at least the number prescribed in the following table

Subpart F—Inspection

§ 213 231 Scope

This subpart prescribes requirements for the frequency and manner of inspecting track to detect deviations from the standards prescribed in this part

§ 213 233 Track inspections

(a) All track must be inspected in accordance with the schedule prescribed in paragraph (c) of this section by a person designated under § 213 7

(b) Each inspection must be made on foot or by riding over the track in a vehicle at a speed that allows the person making the inspection to visually inspect the track structure for compliance with this part However, mechanical, electrical and other track inspection devices may be used to supplement visual inspection If a vehicle is used for visual inspection, the speed of the vehicle may not be more than 5 miles per hour when passing over track crossings, highway crossings, or switches

(c) Each track inspection must be made in accordance with the following schedule

APPENDIX C

Class of track	Type of track	Required frequency
1, 2, 3	Main track and sidings	*Weekly* with at least 3 calendar days interval between inspections or *before use* if the track is used less than once a week or *twice weekly* with at least 1 calendar day interval between inspections if the track carries passenger trains or more than 10 million gross tons of traffic during the preceding calendar year
1, 2, 3	Other than main track and sidings	*Monthly* with at least 20 calendar days interval between inspections
4, 5, 6		*Twice weekly* with at least 1 calendar day interval between inspections

(d) If the person making the inspection finds a deviation from the requirements of this part, he shall immediately initiate remedial action.

§ 213.235 Switch and track crossing inspections

(a) Except as provided in paragraph (b) of this section, each switch and track crossing must be inspected on foot at least monthly

(b) In the case of track that is used less than once a month, each switch and track crossing must be inspected on foot before it is used.

§ 213.237 Inspection of rail

(a) In addition to the track inspections required by § 213.233, at least once a year a continuous search for internal defects must be made of all jointed and welded rails in Classes 4 through 6 track, and Class 3 track over which passenger trains operate. However, in the case of a new rail, if before installation or within 6 months thereafter, it is inductively or ultrasonically inspected over its entire length and all defects are removed, the next continuous search for internal defects need not be made until 3 years after that inspection

(b) Inspection equipment must be capable of detecting defects between joint bars, in the area enclosed by joint bars

(c) Each defective rail must be marked with a highly visible marking on both sides of the web and base.

§ 213.239 Special inspections.

In the event of fire, flood, severe storm, or other occurrence which might have damaged track structure, a special inspection must be made of the track involved as soon as possible after the occurrence.

§ 213.241 Inspection records

(a) Each owner of track to which this part applies shall keep a record of each inspection required to be performed on that track under this subpart

(b) Each record of an inspection under §§ 213.233 and 213.235 shall be prepared on the day the inspection is made and signed by the person making the inspection Records must specify the track inspected, date of inspection, location and nature of any deviation from the requirements of this part, and the remedial action taken by the person making the inspection The owner shall retain each record at its division headquarters for at least 1 year after the inspection covered by the record

(c) Rail inspection records must specify the date of inspection, the location, and nature of any internal rail defects found, and the remedial action taken and the date thereof The owner shall retain a rail inspection record for at least 2 years after the inspection and for 1 year after remedial action is taken.

(d) Each owner required to keep inspection records under this section shall make those records available for inspection and copying by the Federal Railroad Administrator

APPENDIX C

APPENDIX A—MAXIMUM ALLOWABLE OPERATING SPEEDS FOR CURVED TRACK

Degree of Curvature	Elevation of outer rail (inches)												
	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
	Maximum allowable operating speed (mph)												
0 30	93	100	107										
0 40	80	87	93	98	103	109							
0 50	72	78	83	88	93	97	101	106	110				
1 00	66	71	76	80	85	89	93	96	100	104	107	110	
1 15	59	63	68	72	76	79	83	86	89	93	96	99	101
1 30	54	58	62	66	69	72	76	79	82	85	87	90	93
1 45	50	54	57	61	64	67	70	73	76	78	81	83	86
2 00	46	50	54	57	60	63	66	68	71	73	76	78	80
2 15	44	47	50	54	56	59	62	64	67	69	71	74	76
2 30	41	45	48	51	54	56	59	61	63	66	68	70	72
2 45	40	43	46	48	51	54	56	58	60	62	65	66	68
3 00	38	41	44	46	49	51	54	56	58	60	62	64	66
3 15	36	39	42	45	47	49	51	54	56	57	59	61	63
3 30	35	38	40	43	45	47	50	52	54	55	57	59	61
3 45	34	37	39	41	44	46	48	50	52	54	55	57	59
4 00	33	35	38	40	42	44	46	48	50	52	54	55	57
4 30	31	33	36	38	40	42	44	45	47	49	50	52	54
5 00	29	32	34	36	38	40	41	43	45	46	48	49	51
5 30	28	30	32	34	36	38	40	41	43	44	46	47	48
6 00	27	29	31	33	35	36	38	39	41	42	44	45	46
6 30	26	28	30	31	33	35	36	38	39	41	42	43	45
7 00	25	27	29	30	32	34	35	36	38	39	40	42	43
8 00	23	25	27	28	30	31	33	34	35	37	38	39	40
9 00	22	24	25	27	28	30	31	32	33	35	36	37	38
10 00	21	22	24	25	27	28	29	31	32	33	34	35	36
11 00	20	21	23	24	26	27	28	29	30	31	32	33	34
12 00	19	20	22	23	24	26	27	28	29	30	31	32	33

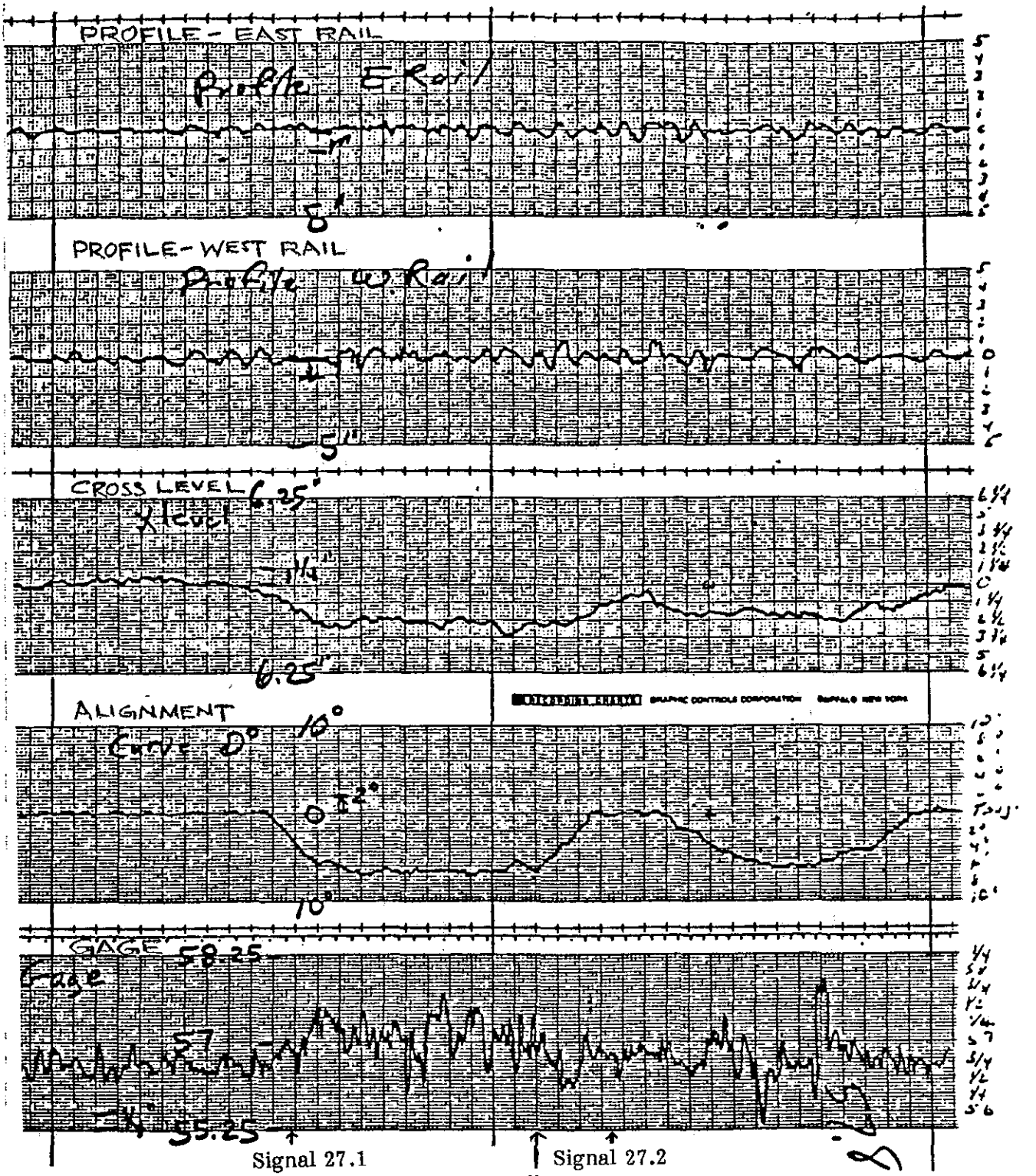
[36 FR 20336 Oct 20, 1971, as amended at 38 FR 876 Jan 5, 1973]

APPENDIX B—SCHEDULE OF CIVIL PENALTIES

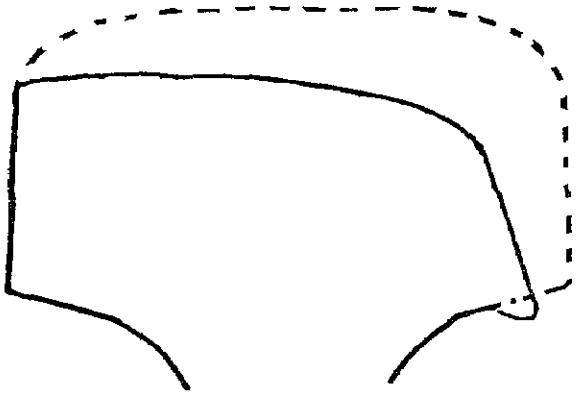
Appendix B reflects a statement of policy by the Federal Railroad Administration in making applicable to Part 213 a specific civil penalty for a violation of particular sections of this part

		Violation	Haz viol [1]
Subpart A—General			
213 5	Responsibility of track owners	$1 000	$2 000
213 7	Designation of qualified persons to supervise certain renewals and inspect track	500	1 000
Subpart A—General—Continued			
213 9	Classes of track operating speed limits	1 000	2 000
213 11	Restoration or renewal of track under traffic conditions	1 000	1 000
213 13	Measuring track not under load	500	1 000
Subpart B—Roadbed			
213 33	Drainage	500	1 000
213 37	Vegetation	500	1 000
Subpart C—Track geometry:			
213 53	Gage	750	1 500
213 55	Alinement	750	1 500

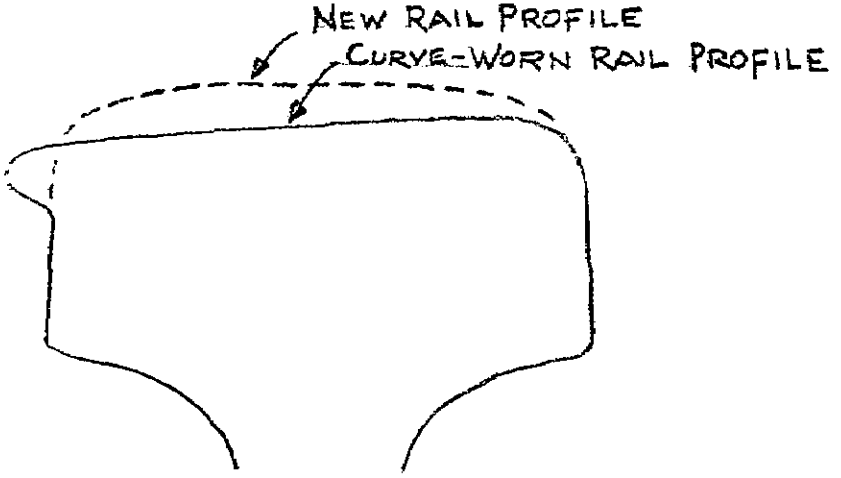
APPENDIX D
FRA GEOMETRY TAPE,
DECEMBER 14, 1979
ICG TRACK, MP 27 TO 28



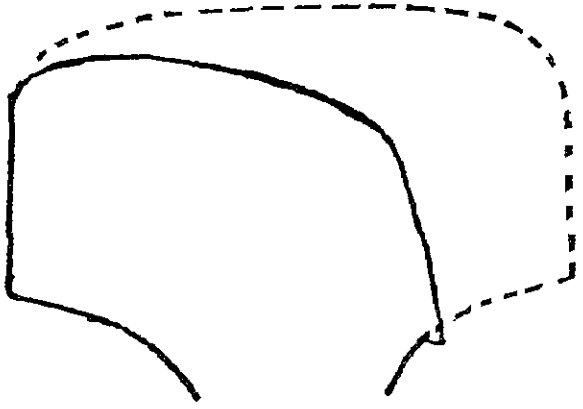
APPENDIX E
PROFILE OF CURVE-WORN RAIL



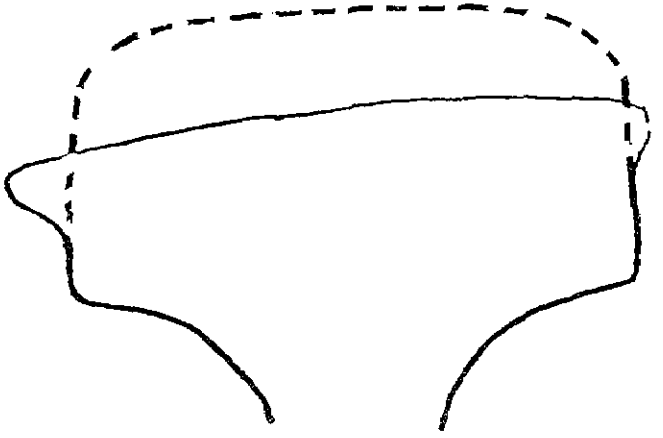
WEST RAIL, STA 30+71
28% WEAR



EAST RAIL, STA 31+27



WEST RAIL, STA 34+27
44% WEAR



EAST RAIL, STA 34+12

APPENDIX F
AGENCIES RESPONDING TO ACCIDENT

State Agencies of Kentucky

Department of Military Affairs

Division of Disaster and Emergency Services (DES)

- Area 5 Coordinator
- Area 6 Coordinator
- Area 3 Coordinator
- Executive Director
- Public Information Officers
- Two Communications Officers
- Army National Guard-Helicopters

Department of Natural Resources and Environmental Protection

- Division of Air Pollution Control
- Division of Hazardous Materials and Waste Management
- Division of Water Quality

Department of Agriculture

- Division of Food Distribution

Department of Justice

- Bureau of the State Police

Department of Housing, Buildings, and Construction

- Office of the State Fire Marshal - Hazardous Materials Division

Department of Education

- Bureau of Vocational Education-Public Service Occupations Unit
  - Fire Services

Department of Human Resources

- Bureau for Social Services
  - Social Workers
- Bureau for Health Services
  - Health Environmentalists

Federal Agencies

U.S. Environmental Protection Agency

Environmental Emergencies Branch

National Transportation Safety Board

U.S. Army - Fort Knox

Military Police
Explosives Ordnance Detachment

U.S. Air Force

Weather Detachment

Department of Transportation

Federal Railroad Administration

Department of Justice

U.S. Marshals Service

Independent

Haz Tec
Illinois Central Gulf Railroad
Hulcher Emergency Services
Stauffer Chemical Company - Shipper
B. F. Goodrich - Shipper
Association of American Railroads, Bureau of Explosives
Valley Station High School - Louisville School System
American Red Cross
Salvation Army

Local Agencies

Hardin County DES
Hardin County DES Rescue
Louisville Fire Department
County Judge/Executive-Meade County
Meade County DES
Larue County DES
Louisville-Jeffersonville County Civil Preparedness
Muldraugh Police Department
Lebanon Junction Fire Department
Meade County Sheriff's Office
Mayor - Muldraugh
Muldraugh Fire Department
Grayson County DES

APPENDIX G
POSTACCIDENT TRACK MEASUREMENTS
JULY 28, 1980

STATION	ELEVATION	GAGE	ORDINATE
421+13.5	3/4"	56 1/2"	0"
+34.0	7/8"	56 1/2"	0"
+49.5	1"	56 5/8"	1/9"
+65.0	1"	56 3/8"	1/2"
+80.5	1 1/4"	56 3/4"	1/2"
+96.0	1 1/2"	56 1/2"	1/4"
422+11.5	1 1/2"	56 5/8"	5/8"
+27	1 7/8"	57"	1 1/2" Bent Rail
+42.5	1 3/4"	56 1/2"	1 3/4"
+58.0	1 3/4"	57"	2"
+73.5	1 1/2"	56 3/4"	3 1/8"
+89.0	1 1/2"	56 1/2"	4 1/8"
423+04.5	1 3/4"	56 3/4"	4 1/4"
+20.0	1 7/8"	56 1/2"	4 1/8"
+35.5	2 1/8"	56 3/4"	4 1/16"
+51.0	2 1/2"	56 5/8"	4 1/4"
+66.5	2 1/2"	56 5/8"	4 1/2"
+82.0	2 1/2"	57"	4 3/4"
+97.5	2 1/2"	56 3/4"	4 7/8"
424+13.0	2 1/2"	57 1/8"	5 3/8"
+28.5	2 1/4"	57 3/8"	5 7/8"
+44.0	2"	56 1/2"	5 3/4"
+59.5	2 1/4"	56 3/8"	5 3/4"
+75.0	2 1/8"	56 1/2"	5 3/4"
+90.5	2"	56 3/4"	5 7/8"
425+06.0	2 1/4"	56 3/4"	5 7/8"
+21.5	2"	56 7/8"	5 7/8"
+37.0	2"	56 1/2"	5 7/8"
+52.5	2"	56 1/2"	5 7/8"
+68.0	1 7/8"	56 5/8"	5 5/8"
+83.5	1 5/8"	56 1/8"	5 1/4"
+99.0	1 3/8"	56 3/4"	5 3/8"
426+14.5	1 1/2"	56 3/4"	5 1/2"
+30.0	1 1/2"	57"	5 1/8"
+45.5	1 7/8"	56 1/2"	4 7/8"
+61.0	1 7/8"	56 3/4"	4 1/2"
+76.5	1 7/8"	57"	4 1/4"
+92.0	1 3/4"	57"	4 1/4"
427+07.5	1 7/8"	57"	3 7/8"
+23.0	2 1/4"	56 1/2"	3"
+38.6	2 1/8"	56 1/2"	2 1/8"
+54.0	2 1/4"	56 1/2"	1 3/4"
+69.5	2"	56 3/8"	1 3/8"
+85.0	1 7/8"	56 1/2"	1 3/8"

APPENDIX G

Station	Elevation	Gage	Ordinate
428+00.5	1 3/4"	56 1/2"	1 3/8"
+16.0	1 5/8"	56 3/4"	1 1/4"
+31.5	1 3/4"	57"	3/8"
+47.0	5/8"	56 1/2"	-1/4"
428+78.0	7/8"	56 5/8"	+1/8"
+93.5	3/4"	56 3/4"	———
429+09.0	1"	56 5/8"	———
+24.5	1 1/4"	56 5/8"	———
+40.0	1 1/2"	57 1/2"	———
436+82.0	2 1/2"	57 1/2"	6 7/8"
+97.5	2 3/8"	57 1/2"	5 1/8"
437+13.0	2"	57 1/4"	4 3/4"
+28.5	1 7/8"	56 7/8"	4 3/8"
+44.0	1 5/8"	56 7/8"	3 5/8"
+59.5	1 1/8"	57"	2 1/2"
+75.0	1"	57"	1 3/4"
+90.5	5/8"	56 7/8"	1 1/16"
438+06.0	5/8"	56 3/4"	3/4"
+21.5	5/8"	56 3/4"	1/2"
+37.0	3/8"	56 3/4"	1/4"
+52.5	1/4"	57"	1/4"
+68.0	0"	56 5/8"	1/4"
+83.5	0"	56 5/8"	1/4"
+99.0	1/8"	56 3/4"	1/4"
439+14.5	1/4"	56 7/8"	1/4"

*U S GOVERNMENT PRINTING OFFICE: 1981-0-341-828 6