Derailment of Amtrak Train No. 58, *City of New Orleans*, Near Flora, Mississippi April 6, 2004

Railroad Accident Report

NTSB/RAR-05/02

PB2005-916302
Notation 7642A

National Transportation Safety Board
Washington, D.C.

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Adopted July 26, 2005

National Transportation Safety Board
490 L'Enfant Plaza, S.W.
Washington, D.C. 20594

National Transportation Safety Board. 2005. *Derailment of Amtrak Train No. 58, City of New Orleans, Near Flora, Mississippi, April 6, 2004.* Railroad Accident Report NTSB/RAR-05/02. Washington, DC.

Abstract: About 6:33 p.m. central daylight time on April 6, 2004, northbound National Railroad Passenger Corporation (Amtrak) train No. 58 (*City of New Orleans*), derailed on Canadian National Railway Company railroad track near Flora, Mississippi. The entire train, consisting of one locomotive, one baggage car, and eight passenger cars, derailed near milepost 196.5 while traveling about 78 mph. The train was carrying 61 passengers and 12 Amtrak employees. The derailment resulted in 1 fatality, 3 serious injuries, and 43 minor injuries. The equipment costs associated with the accident totaled about $7 million.

As a result of its investigation of the accident, the Safety Board identified the following safety issues: the Canadian National Railway Company's continuous welded rail maintenance and inspection procedures and standards, Amtrak's emergency response training of its employees, and the Federal Railroad Administration's oversight of continuous welded rail maintenance programs and Amtrak's emergency response training of its employees.

As a result of its investigation of this accident, the Safety Board makes safety recommendations to the Federal Railroad Administration, the Canadian National Railway Company, and Amtrak.

Contents

Executive Summary

About 6:33 p.m. central daylight time on April 6, 2004, northbound National Railroad Passenger Corporation (Amtrak) train No. 58 (*City of New Orleans*) derailed on Canadian National Railway Company railroad track near Flora, Mississippi. The entire train, consisting of one locomotive, one baggage car, and eight passenger cars, derailed near milepost 196.5 while traveling about 78 mph. The train was carrying 61 passengers and 12 Amtrak employees. The derailment resulted in 1 fatality, 3 serious injuries, and 43 minor injuries. The equipment costs associated with the accident totaled about $7 million.

The National Transportation Safety Board determines that the probable cause of Amtrak's *City of New Orleans* accident on April 6, 2004, near Flora, Mississippi, was the failure of the Canadian National Railway Company to properly maintain and inspect its track, resulting in a rail shift and the subsequent derailment of the train, and the Federal Railroad Administration's ineffective oversight to ensure the proper maintenance of the track by the railroad.

The safety issues addressed in this report are:

- The Canadian National Railway Company's continuous welded rail maintenance and inspection procedures and standards,
- Amtrak's emergency response training of its employees, and
- The Federal Railroad Administration's oversight of continuous welded rail maintenance programs and Amtrak's emergency response training of its employees.

Other items discussed in this report include:

- Establishment of incident command during emergency response and
- Operation of handles to remove emergency windows to allow egress from damaged cars.

As a result of its investigation of this accident, the Safety Board makes safety recommendations to the Federal Railroad Administration, the Canadian National Railway Company, and Amtrak.

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Factual Information

Accident Synopsis

About 6:33 p.m. central daylight time[1] on April 6, 2004, northbound National Railroad Passenger Corporation (Amtrak) train No. 58 (*City of New Orleans*) derailed on Canadian National Railway Company (CN) track near Flora, Mississippi. The entire train, consisting of one locomotive, one baggage car, and eight passenger cars, derailed near milepost (MP) 196.5 while traveling about 78 mph. Six of the passenger cars rolled onto their right sides, and three of those cars came to rest on a hill that sloped down below the tracks. The last two cars were almost upright. The train was carrying 61 passengers and 12 Amtrak employees. The derailment resulted in 1 fatality, 3 serious injuries, and 43 minor injuries (including injuries to 2 emergency responders). The equipment costs associated with the accident totaled about $7 million.

Accident Narrative

Northbound Amtrak train No. 58, *City of New Orleans*, originated at New Orleans, Louisiana, on April 6, 2004, bound for Chicago, Illinois. (See figure 1 for a map showing the train's route and the accident location.) The train consisted of a locomotive, a baggage car, and eight Superliner passenger cars.[2]

According to the conductor, the train had successfully completed the required air brake test before departure. Train No. 58 departed New Orleans about 1:55 p.m. The trip from New Orleans to Jackson, Mississippi, was uneventful. At Jackson, which is a passenger stop, a crew change for engineers occurred. The inbound and outbound engineers discussed the condition of the train. The inbound engineer said that "everything was fine" and the braking and power were good.

The train departed Jackson, Mississippi, at 6:02 p.m., with the new engineer. After the train left Jackson, the engineer performed a running air brake test, which he said was successful. The conductor recalled making a safety announcement before the train left Jackson.

[1] All times are central daylight time.

[2] The Superliner cars on the train were one sleeper car, one dining car, one lounge car, one crew dormitory car, and four coach cars.

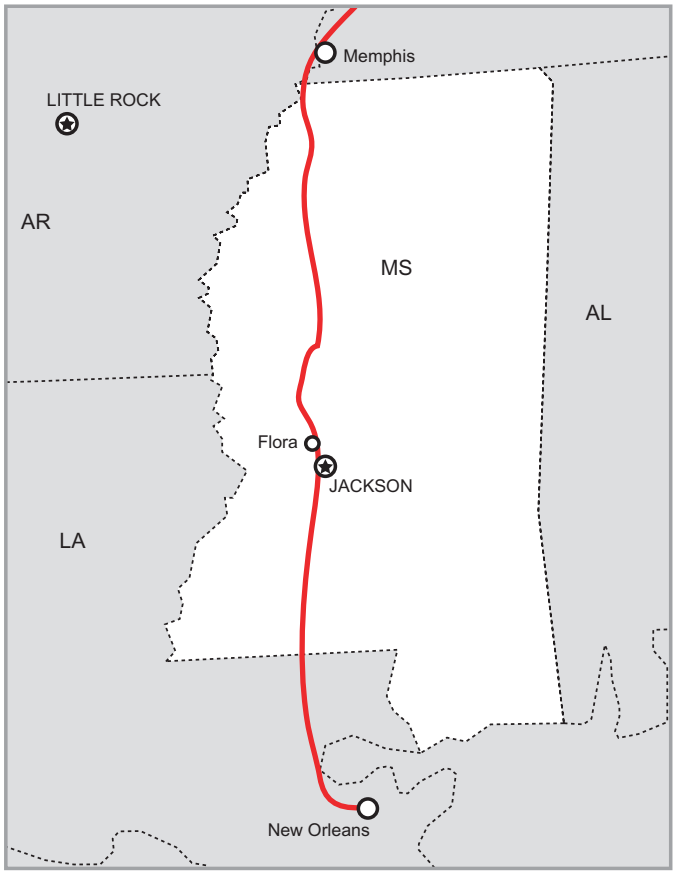

Figure 1. Map showing train route and accident location.

According to the conductor, after leaving Jackson the train passed a wayside train defect detector at MP 209.2, and no defects were detected. He also recalled that a railroad employee observing the passing Amtrak train notified him that the portable marker at the rear of the train was functioning, although he did not remember the employee or the employee's location at the time of the observation.

Near MP 197, while the train passed a block signal displaying a *clear* indication (green aspect), the engineer said he looked at the track ahead of the train and observed something that was "not right." (The train was traveling about 78 mph at the time.) Ahead of the train were two bridges over the Big Black River flood plain, with a filled levee between the bridges. According to the engineer, the track between the bridges looked "pretty bad." He immediately started a service application of the brakes. The engineer described what happened next as follows:

> I get up to it and I can see that the rail is kinked, and my engine goes through. I think the baggage car went through it too, and I started to feel everything moving and shaking. I knew something wasn't right. And my engine is already through it, and I'm not looking in the mirror, I'm looking ahead and I can see the right, or east rail rolling over, [so] I shot it.[3]

[3] *Shot it* is railroad jargon for applying the air brakes in emergency.

About 30 minutes after departing Jackson (6:33 p.m.) the conductor felt the train start to derail, and then, he said, "… things got worse and worse." He stated that the car he was in turned over on its side. Once the car came to rest, he became aware that he was still breathing, and then he heard a lot of moaning from the passengers.

The entire train derailed beginning on the filled levee about halfway between the two bridges over the Big Black River. The locomotive and the baggage car reached the second bridge and came to rest upright, although the rear of the baggage car hung over the right side of the bridge. The remaining eight cars derailed to the right of the track. (See figure 2 for a photograph of the derailed train and figure 3 for a diagram of the accident aftermath.) The first passenger car, a transition sleeper car,[4] separated from the baggage car and went off the fill to the right of the track before it reached the second bridge. The transition sleeper and the seven cars following it remained coupled. The transition sleeper, the dining car, the lounge, and the first coach car rolled to the right 90° and came to rest on their sides on the flood plain below the bridge. The last four cars in the train did not reach the second bridge and were on the filled area of the track between the bridges when they derailed. The first of these cars rolled on its side on the downward slope of the raised fill and came to rest at about a 110° angle from upright. The second car tipped over 90°, the third car leaned at about a 45° angle, and the last car came to rest near the tracks in an upright position.

Figure 2. Wreckage of derailed train.

[4] Part of this car is a rest area and dormitory for the on-board crewmembers, and part of the car is a sleeper for passengers. This car is always coupled to the baggage car with the rest of the passenger cars behind.

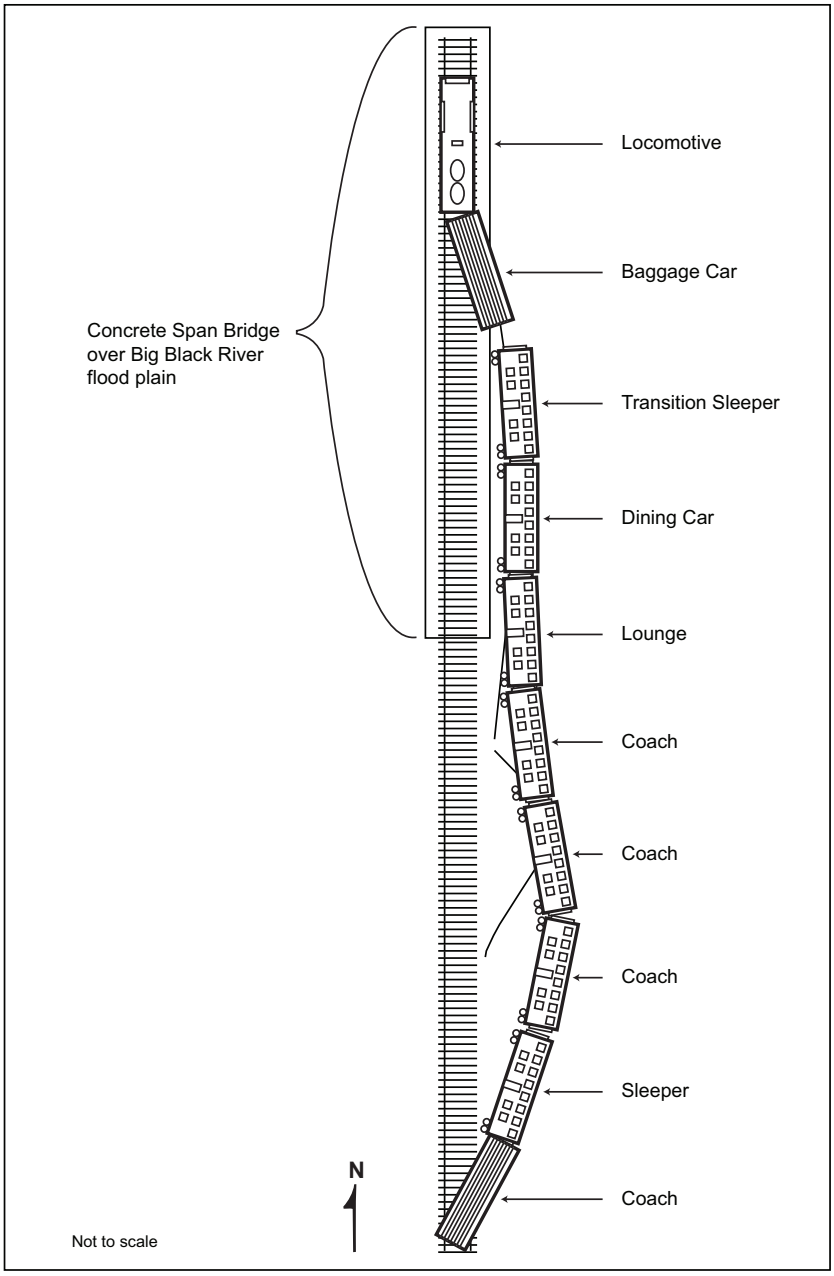

Figure 3. Diagram of wreckage.

The engineer told investigators that after the locomotive stopped he looked back and all he could see was dust on both sides of the train. He announced "emergency" on the radio three times. He then contacted the train dispatcher and requested help for the passengers and crew of the train. The engineer shut down the electrical system that provides high voltage electricity through the train. Then he walked back through the locomotive toward the derailed cars.

The conductor could hear the engineer talking on the radio to the CN train dispatcher. He also heard a car attendant calling 911. The conductor heard the train

dispatcher on the radio say that emergency responders had been notified and were on the way. He then contacted Amtrak's Consolidated National Operations Center.[5]

The evacuation process started, and the conductor remembered someone opening an emergency window exit. Then he left the train with the rest of the passengers and crew.

Emergency Response

Local Emergency Response

The first 911 call was made from the train by an Amtrak employee at 6:37 p.m. At 6:52 p.m., the first firefighter, the Flora Volunteer Fire Department chief, arrived on scene near Ratliff Road. (The map in figure 4 shows the derailment area, including the location of the command post, the triage area, the staging area, the helicopter landing area, and Ratliff Road.) The road crossed the tracks at MP 196.85, but there were no roads between this point and the accident site, so the only access to the derailed cars was by the railroad tracks and across the Big Black River railroad bridge.

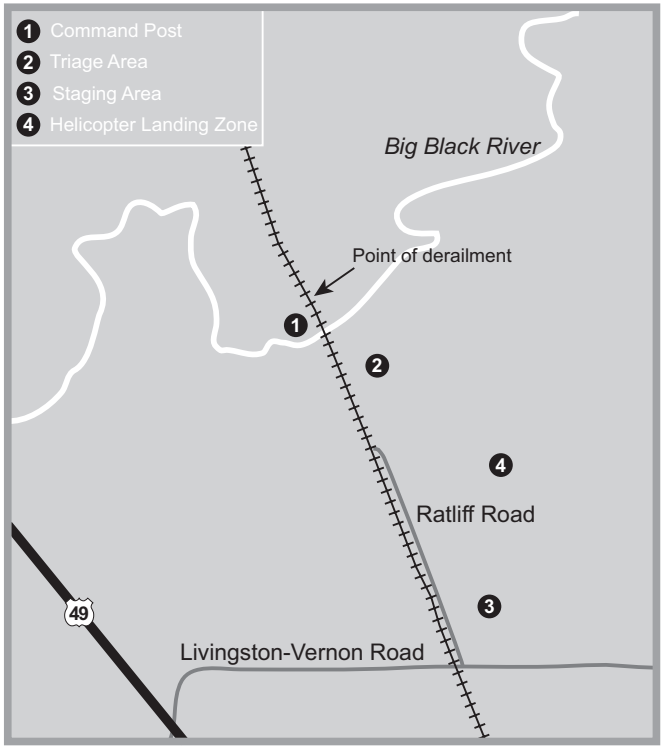

Figure 4. Map of derailment area.

[5] The Consolidated National Operations Center, in Wilmington, Delaware, is Amtrak's 24-hour operations center. It handles many functions, including train crew assignments, nationwide locomotive and rail car deployment, and coordination of train operations with host railroads when trains are operating on freight railroads.

According to the Flora Volunteer Fire Department chief, when he arrived on scene he went to the derailment location and began to assess the passenger cars and to triage the injured passengers. Approximately 21 minutes after the accident, the Kearney Park Volunteer Fire Department requested the assistance of the Madison Fire Department. Five minutes later, the Madison County Sheriff's Office officially requested the Madison Fire Department to respond to the scene. At 6:55 p.m., the chief requested mutual assistance from the Gluckstadt Volunteer Fire Department. The chief told investigators that although he did not officially establish a command post or assume incident command, he did direct firefighters during the initial passenger extrication and triage. He stated that he assigned several 3-person crews from the Flora, Kearny Park, and Gluckstadt Volunteer Fire Departments to search all the cars and gather the passengers at a collection point south of the derailment location.

At 7:05 p.m., the Madison County sheriff arrived on scene and began to direct the emergency response. The conductor told National Transportation Safety Board investigators that he informed the sheriff that there were about 61 passengers on board the train. The passenger manifest was lost on the train when the derailment occurred, but it was later located in the dining car by city of Madison[6] Fire Department firefighters.

The Madison Fire Department was not notified of the accident during the initial dispatch of emergency responders, but approximately 52 minutes after the derailment, the emergency medical services (EMS) director for the Madison Fire Department arrived on scene after traveling more than 20 miles from Madison. He immediately began to look for the command post and the incident commander in order to find out what resources were needed. Approximately 15 minutes later, he approached the Madison County sheriff, assuming that the sheriff was the incident commander. During this meeting with the sheriff, the EMS director learned that there was no command post or incident commander. At 7:45 p.m., he established a command post south of the derailment. The EMS director assumed incident command under the Unified Command System with the assistance of the Madison County sheriff. A representative from CN was present at the command post. Once the command post was established, the EMS director began to assign emergency response activities, including extricating and triaging passengers and moving them to a collection point. About 7:50 p.m., a CN representative offered the use of CN's hy-rail[7] vehicles to transport injured passengers from the accident scene, across the Big Black River, and up to Ratliff Road. Emergency responders reached the accident site by driving for 1 mile on a dirt road that paralleled the railroad right-of-way followed by walking approximately 1/2 mile on the railroad tracks across the Big Black River.

The EMS director then tasked the operations manager for American Medical Response (a private medical transportation company) with setting up a triage area at the north end of Ratliff Road and a helicopter landing zone south of the triage area. The EMS director wanted to direct all the people from the accident scene to the triage area to ensure an accurate accounting of persons and to organize the transport of the injured from the

[6] Throughout this report the city of Madison will be referred to as "Madison," and Madison County will be referred to as "Madison County."

[7] A *hy-rail* vehicle, or hy-rail, is a truck that has flanged wheels attached to the front and rear so it can travel over railroad tracks and easily get on or off the track at a road crossing.

scene. The EMS director had ambulances waiting at the staging area located at Ratliff Road and Livingston-Vernon Road. As the injured were transported off hy-rail vehicles, the ambulances were dispatched to the triage area to transport the injured to area hospitals.

By 7:57 p.m. it was estimated that 50 persons were injured but could walk, 1 or 2 were moderately[8] injured, 1 needed immediate transportation by helicopter, and 1 had been fatally injured.

By 8:12 p.m. all persons had been evacuated from the train. Between 8:34 p.m. and 10:24 p.m., 58 persons were transported to hospitals. Uninjured passengers were transported to a shelter. A final search of the train was conducted at 9:50 p.m., and by 10:25 p.m. all persons had been located and counted.

A total of 21 agencies (fire, police, and municipal and private ambulance companies) responded to the derailment. Appendix B contains a list of those agencies.

CN Emergency Response

At 6:35 p.m., the CN dispatcher received an emergency broadcast from the engineer of Amtrak train No. 58. The CN dispatcher immediately notified the CN police dispatcher that Amtrak train No. 58 had derailed on the Yazoo Subdivision near MP 196.2. The engineer had requested police, ambulance, and fire department response. The CN police dispatcher immediately notified the Madison County Sheriff's Office and the Yazoo County Sheriff's Department.

A CN assistant superintendent who overheard the emergency radio broadcast knew that the accident site was not accessible by road. He therefore requested all engineering employees in the area to respond. Two CN employees with hy-rail trucks responded immediately. The assistant superintendent radioed them and asked them to direct emergency responders to the accident scene from the south across the Big Black River.

About 7:00 p.m., the assistant superintendent arrived at the accident scene. He noticed emergency responders arriving at the scene on foot and in all-terrain vehicles (sometimes referred to as quads). He told the ambulance personnel that since ambulances would not be able to reach the site, the CN hy-rail vehicles could be used to transport injured passengers from the accident site to the staging area and the ambulances. The Madison County sheriff agreed with this plan for transporting the injured passengers.

Amtrak Emergency Response

At 6:50 p.m., the CN train director in Homewood, Illinois, notified Amtrak's operations center that Amtrak train No. 58 had derailed at MP 195.6,[9] north of Jackson,

[8] As patients are triaged, they are usually assigned a color code based on the severity of their injuries. In this case, the emergency responders used green to signify those persons that were injured, but still able to walk; yellow was used to signify those persons who were moderately injured; red was used to signify a critical injury; and black was used to signify a confirmed fatality.

[9] The derailment actually occurred at MP 196.5.

Mississippi, at 6:35 p.m. The notification further stated that some derailed cars were on their sides, injuries were reported, and local police and rescue personnel and CN representatives were en route to the accident scene. At 6:51 p.m., the operations center notified the Amtrak police about the derailment. Between 6:51 p.m. and 7:00 p.m., the operations center dispatchers continued internal notifications.

Amtrak's Customer Services Group provided assistance to passengers after the accident. On the day of the accident, group representatives went to a shelter the Red Cross had established for passengers in the Flora accident. The group arranged for hotel accommodations, needed clothing and medicine, and continuing transportation. Counselors from Amtrak's Employee Assistance Program arrived on site the day after the accident to provide mental health services for passengers and Amtrak employees.

Injuries

A total of 58 persons (passengers and crew) were transported to six Jackson, Mississippi, area hospitals.[10] One Amtrak employee was subsequently transferred to North Oaks Medical Center in Hammond, Louisiana. Two emergency responders transported themselves to area hospitals where they were treated and released.

The derailment resulted in 1 passenger fatality, due to a traumatic impact injury, 1 passenger with serious injuries, and 34 passengers with minor injuries. Amtrak employees sustained two serious and seven minor injuries. Two emergency responders received minor injuries. (See table 1.)

Table 1. Injuries.

Injury Type[a]	Train Crew	Emergency Responders	Passengers	Total
Fatal	0	0	1	1
Serious	2	0	1	3
Minor	7	2	34	43
Total	9	2	36	47

[a] 49 *Code of Federal Regulations* (CFR) 830.2 defines *fatal injury* as "any injury which results in death within 30 days of the accident" and *serious injury* as "an injury which: (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) causes severe hemorrhages, nerve, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns, or any burn affecting more than 5 percent of the body surface."

[10] Not all persons transported to hospitals were injured.

Damage

As a result of the derailment, about 273 feet of the main track were destroyed, which required the installation of 7 track panels[11] and about 1,100 feet of rail. A multispan concrete bridge spanning the Big Black River flood plain sustained damage to the concrete structure on the east side wall. The track damage was approximately $100,000.

Two cars, the transition sleeper and the dining car, were damaged beyond repair. Amtrak estimated monetary damage to the equipment as shown in table 2.

Table 2. Estimated damage to rail equipment.

Car Number	Car Type	Damage Estimate
82	Locomotive	$50,000
1223	Baggage	$55,000
32036	Transition Sleeper	$2,000,000
38009	Dining	$2,000,000
33013	Lounge	$700,000
31592	Coach	$700,000
34069	Coach	$650,000
34087	Coach	$350,000
32005	Sleeper	$215,000
34135	Coach	$176,000
Total		$6,896,000

Personnel Information

Amtrak Train-Operating Crew

Engineer. The engineer was hired by Amtrak on December 22, 1998. He was promoted to engineer after he completed the Amtrak engineer class on March 10, 2000. He was assigned to on-the-job training as a student engineer from March 11, 2000, to January 30, 2001, when he was certified as a train service engineer. He was recertified as a train service engineer on January 23, 2003. He qualified on the CN operating rules and territorial characteristics in 2003. During the month before the accident he had transited the accident territory about 21 times. He received Amtrak's PREPARE (Passenger Railroad Emergency Preparedness and Response Education) training on January 7, 2001.

[11] Track panels are generally 39 feet long. They are preconstructed sections of two rails affixed to crossties.

Conductor. The conductor was hired by Amtrak on April 13, 1993. He had previously been employed as a conductor by the Illinois Central (IC) Railroad in 1973, and worked the same territory on which the accident occurred. He was qualified on the CN operating rules on January 30, 2004, and completed air brake instruction on March 21, 2002. He received Amtrak's PREPARE training on September 11, 2002.

Assistant Conductor. The assistant conductor was hired by Amtrak in April 1999. On June 18, 2002, he began his current assistant conductor position. He was qualified on the operating rules on February 6, 2004, and on the territorial characteristics on July 7, 2003. He received air brake instruction on July 23, 2002, and Amtrak's PREPARE training on April 25, 2002.

CN Track Maintenance Personnel

Track Supervisor. The track supervisor was hired in 1963 by the IC Railroad. He was promoted to general foreman in 1976. He became the supervisor for the Yazoo Subdivision in 1997.

Track Inspector. The track inspector was hired by the IC Railroad in 1971 and worked for 5 years on a bridge gang. He later transferred to the track department and was promoted to track inspector in 1978. He has spent most of his career inspecting track throughout the Yazoo Subdivision. He regularly attended annual training on the operating rules and Federal Railroad Administration (FRA) regulatory guidelines covering track standards, which allowed him to maintain his qualifications as a track inspector.

Track Foreman. The track foreman went to work for the IC Railroad as a laborer in 1969. He was promoted to track foreman in 1972, and 5 years later he became a track inspector. He worked various jobs before he began his current track foreman position in 1999. He was responsible for the portion of the Yazoo Subdivision from MP 144 to MP 217. [12]

The track foreman attended a required 1-day on-track safety training class annually, annual operating rules training, FRA training in 2002, and a 2-day training session on standard practices circulars that included CN's continuous welded rail (CWR) engineering policies.

Track Welder. The track welder was hired by the IC Railroad in August 1996. In July 1999, he took a welder helper position, and in August 2000, a welder position. He had worked on the Yazoo Subdivision since 2002, and was currently assigned to Yazoo City, Mississippi, along with a welder helper.

The welder had attended periodic annual training, which included welding instruction, CN's practices and procedures contained in the standard practices circulars, and the operating rules. He had been trained on the FRA regulatory guidelines covering track standards, which allowed him to inspect track and supervise remedial actions.

[12] The operating timetable designated the Yazoo Subdivision from MP 5.4 to MP 218.6.

FRA Inspection Personnel

Track Inspector. The track inspector went to work for the IC Railroad as a track laborer in 1972. Over the next 30 years he worked as a track foreman, a machine operator, a track inspector, a track supervisor, and a road master for the Kansas City Southern Railroad. He was hired by the FRA in January 2003.

The inspector received classroom training covering 49 CFR Part 213, "Track Safety Standards," and Part 214, "Railroad Workplace Safety," of 1 week each. These classes also covered the use of the "Track Safety Standards Compliance Manual." His other training included a 1-week orientation class, accident investigation, photography, report writing, and computer classes. Since starting with the FRA, he had attended two regional workshops that lasted several days and included various classes. He also had had 5 months of on-the-job training with senior inspectors, and he said, "I do have a mentor, and [on-the-job training] is the largest part of it …."

Toxicological Information

The Amtrak engineer, conductor, and assistant conductor provided blood and urine specimens for toxicological testing as required by 49 CFR Part 219, Subpart C. Northwest Toxicology, Inc., Salt Lake City, Utah, conducted the tests. Specimens were screened for cannabinoids, cocaine, opiates, amphetamines, methamphetamines, phencyclidine, barbiturates, and benzodiazapines. All results were negative for the presence of alcohol and cited drugs.

Meteorological Information

In the Flora, Mississippi, area on April 6, 2004, the lowest overnight temperature was 45° Fahrenheit (F) about 4:00 a.m. The temperature rose to about 79° F in the afternoon. At the time of the accident, the weather was clear with a few broken clouds, there was a light breeze less than 10 mph, and the temperature was about 77° F. Before the accident there had been several weeks of little or no precipitation.

The weather on dates related to this accident is described in table 3. The weather data were recorded at Jackson, Mississippi, about 40 miles southeast of Flora, Mississippi. On April 9, 2004, 3 days after the accident, the rail temperature near the point of derailment was measured at 114° F at 5:45 p.m. April 9 was sunny with a few clouds, and the maximum ambient temperature was 82.9° F.

Table 3. Weather conditions in accident area (Jackson, MS) on selected dates.[a]

Date	Max. / Min. Temp. (°F)	Avg. Wind Speed (mph)	Visibility (miles)	Sky Cover	Precip-itation (inches)
January 29[b]	56 / 24	2.1	9–10	Clear to 9 a.m. Overcast 9 a.m. to midnight.	0.00
March 6[c]	73 / 50	5.1	10	Clear all day.	0.00
March 9[d]	67 / 45	12.7	10	Clear with a few clouds 3–6 p.m.	0.00
March 10[d]	62 / 36	4.4	9–10	Clear all day.	0.00
April 6	80.6 / 39.2	0–6.91, avg. 2.3	10	Clear with a few broken clouds 4–9 a.m.	0.00
April 7	80.6 / 51.8	0–9.21	10	Partly cloudy all day.	Trace
April 8	80.6 / 51.8	0–12.7	0.25–10	Partly cloudy.	0.00
April 9	82.9 / 50	0–8.06	5–10	Clear with few clouds 1–5 p.m.	0.00

[a] Source: National Climatic Data Center, Asheville, North Carolina.
[b] Date rail plug was installed.
[c] Date track condition was inspected and reported.
[d] Dates crossties were installed and area of repaired rail was tamped.

Operations Information

Train movements on the CN Central Division, Yazoo Subdivision, are governed by the CN/IC Railroad *U.S. Operating Rules*, Second Edition, the August 10, 2003, revision. The trains were authorized by signals using a centralized traffic control system operated by a train dispatcher in Homewood, Illinois.

CN train crews used the *Central Division Timetable/Special Instructions*, effective August 10, 2003, for specific instructions about the territory. The timetable/special instructions indicated that the maximum speed for passenger trains in the area of the accident was 79 mph.

Signal Information

The derailment occurred on a single main track in centralized traffic control system territory that was signaled for movement in both directions, between the north end of control point Ragin, MP 198.0, and the south end of control point South Anding, MP 191.8. The traffic control system consisted of color-light wayside signals, power operated switch machines, and coded electronic track circuits controlled by the train dispatcher in Homewood, Illinois.

Event Recorder Information

According to the data from the event recorder, at 6:32:00 p.m. (event recorder time),[13] the train was traveling 77 mph with the locomotive throttle in notch T3. The automatic brake pressure and the brake cylinder pressure indicated that the brakes were released and fully charged. At 6:32:13, the horn was sounded, and 1 second later the bell was activated. At 6:32:46 and 6:33:07, the alerter was acknowledged while the train speed and throttle remained unchanged. The throttle position was increased to notch T4 at 6:33:24. One second later the train speed increased to 78 mph. At 6:33:26, the horn was again sounded. At 6:33:27, the automatic brake handle was moved from the release position to the suppression position. One second later, the automatic brake pipe pressure began to decrease.

The automatic brake handle was moved from suppression to emergency at 6:33:33 p.m. The event recorder indicated that the pneumatic control switch[14] had opened and the brakes had an engineer-initiated emergency. With the throttle indicating "idle," the train speed dropped and brake cylinder pressure increased until the speed decreased to 0 mph, 13 seconds later. The data further indicated that the locomotive traveled approximately 398 feet during those 13 seconds.

Site Description

The derailment occurred near Flora, Mississippi, at MP 196.5. The single track was oriented north and south. The train was traveling north when the derailment occurred. The milepost numbers decreased northward.

Between MP 197.0 and MP 196.5, the track was straight with a very slight descending grade of 0.13 percent. The Big Black River Bridge was between MP 196.7 and MP 196.6. From MP 196.5 to MP 194.75 the track was level as it crossed the flood plain of the Big Black River. Part of the track through the flood plain was on a 6- to 8-foot fill area, or levee, between the bridges. At the end of the fill was a multispan concrete bridge over the remainder of the Big Black River flood plain. Beyond the flood plain from MP 194.75 to MP 194 there was an ascending grade of 0.34 percent. From MP 194 to near MP 192.9 there was an ascending grade of 0.14 percent reaching a flat area for approximately 1/2 mile. A train traveling in this area in either direction descends on a slight grade to the flood plain.

Between 22 and 24 trains operated through the territory daily. Two of those trains were the northbound and southbound *City of New Orleans* passenger trains. The reported annual tonnage was about 44.4 million gross tons.

[13] All times in this section are from the event recorder. The event recorder's independent clock may indicate a time that differs from the correct time if the clock has not been calibrated recently.

[14] The pneumatic control switch is activated by the emergency application of the brakes and translates this pneumatic activity into an electrical signal to drop the engine to idle and disable the power.

CN designated the track as FRA Class 4 track, which permitted a maximum authorized speed of 60 mph for freight trains and 80 mph for passenger trains, according to 49 CFR Part 213, "Track Safety Standards."

Track Information

The track in the accident area was CWR on wooden ties secured with tie plates[15] and cut spikes. The rail was 136-pound rail manufactured by Tennessee-USA in October 1979. CN did not maintain records of track installation dates, and railroads are not required to keep such records.

Postaccident Track Condition

The first point of derailment was identified as MP 196.5, on the fill between the bridges. In January 2004, a 12-foot 11 1/2-inch portion of the east rail in this location was replaced with a replacement rail plug and bolted into place. The postaccident inspection of the gage side of the east rail revealed gouge marks 19.6 feet north of the rail plug. The west rail on the gage side opposite these marks exhibited similar gouge marks. The east rail was rolled over and spread east off the multispan bridge. The bolts of the north joint of the replacement rail plug had been sheared off, and the joint bars, bolts, and rail were separated. The south joint had strike marks on the joint bars on the gage side. The west rail was intact and resting in its original prederailment position.

The intact west rail at the derailment site showed abrasion marks between the rail spikes and the inside base of the rail that indicated longitudinal movement of the rail. (See figure 5.) This rail movement was 2 inches. The east rail showed very little sign of longitudinal rail movement.

Just south of the derailment site, the rail was box anchored[16] at every tie on the 200-foot approach to the Big Black River Bridge. The rail on the open deck portion of the Big Black River Bridge was anchored on every tie with elastic metal clip fasteners.[17] (See figure 6.) The anchor applies pressure on the top of the base of the rail. If a rail moves longitudinally, shiny areas appear where the anchor contacts the rail. No shiny areas were found on the open deck portion of the bridge.

[15] *Tie plates* are rectangular pieces of steel placed under the rail to distribute the weight of a train over a greater area of the tie than the base of the rail alone.

[16] *Box anchoring* places rail anchors on both rails across from each other against each side of a tie.

[17] This type of fastener replaces both spikes and rail base anchors; it fastens the rail to the crosstie and also retards rail movement.

Figure 5. Abrasion marks on west rail.

Figure 6. Elastic metal clip anchors.

North of the 200-foot approach to the Big Black River Bridge, in the direction of the derailment site, was evidence that rail anchors had been applied to every other tie from the gage side. (See figure 7.) Investigators found 281 crossties in the area and 295 anchors placed against the sides of the ties. If the ties were box anchored on every other tie, that is, two anchors on each rail on every other tie, there would have been 281 anchors on each rail. The west rail had 144 anchors (51.25 percent), and the east rail had 151 anchors (53.74 percent). Additional anchors were lying on the ballast near by or away from the sides of the crossties.

Figure 7. Ties with few anchors, indicated by arrows.

Ballast. The crossties were surrounded by limestone ballast approximately 24 inches deep and 12 inches wide on the outside for shoulder support. The areas between the ties (the tie cribs) were filled with ballast. Near MP 196.6 at the north approach to the Big Black River Bridge were signs of improper drainage from fouled ballast.[18] (See figure 8.) Title 49 CFR 213.103, the FRA regulation regarding ballast, states that

> all track shall be supported by material which will restrain the track laterally, longitudinally, and vertically under dynamic loads imposed by railroad rolling equipment and thermal stress exerted by the rails, provide adequate drainage for the track, and maintain proper track crosslevel, surface, and alignment.

Tie Plates. The CWR was seated in 14- by 7 3/4-inch double-shoulder tie plates.[19] The tie plates were designed with eight holes punched to accommodate two rail-holding spikes on both the field and the gage sides of the rails and two holes to secure the plate to the ties on each side of the rails. The rails were fastened to the crossties with 6-inch cut track spikes. Each tie plate had at least two spikes: a rail-holding spike on both the gage side and the field side. Additional spikes anchoring the plates to the ties were present at irregular intervals, particularly on the gage side.

[18] *Fouled ballast* refers to dirt intermixed with ballast.

[19] A *tie plate shoulder* is a small raised portion of metal that forms a ridge next to the base of a rail to help properly position the tie plate and prevent the rail from shifting laterally.

Figure 8. Fouled ballast.

Crossties. The wooden crossties, or ties, were 8 feet 6 inches long with an average spacing of 19 1/2 inches between the centerlines of the crossties. Federal regulations, at 49 CFR 213.109, specify the condition of crossties required to provide support for the rail: they must not be "… broken through, split or otherwise impaired to the extent the crossties will allow the ballast to work through, or will not hold spikes or rail fasteners." Each class of track requires a minimum number of ties that do not display the above defects for each 39-foot section of track. Class 4 track must have a minimum of 12 crossties in good condition for each 39 feet of rail on tangent (straight) rail and curves of equal to or less than 2°.

Several crossties near the point of derailment were broken through and split and showed signs of not holding the spikes. (See figure 9.) Neither the number nor the pattern of defective ties exceeded those allowed by the regulations. The crossties and track surface had been rehabilitated in 1998. CN had planned to do the next rehabilitation project for this area in the first quarter of 2005, but after the Flora accident, it accelerated the schedule. (See *Postaccident Actions* in the *Other Information* section of this report.)

Continuous Welded Rail

CWR is subject to mechanically induced outside forces when loaded and to thermally induced internal forces from expansion or contraction. CWR must be longitudinally restrained to prevent rail movement caused by these mechanical and thermal forces. Longitudinal restraint in CWR generally takes the form of additional rail anchors, solid crossties, and compacted ballast.

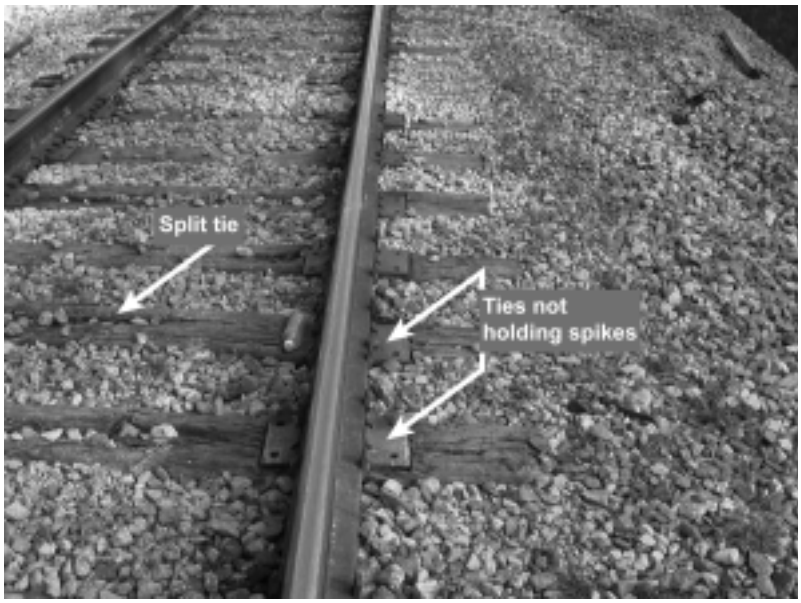

Figure 9. Ties that are broken and not holding spikes.

According to the American Railway Engineering and Maintenance-of-Way Association (AREMA),[20] the magnitude of force that may be developed within CWR, independent of its length, is directly proportional to the difference in temperature between the "neutral rail temperature"[21] and the current rail temperature. On a sunny, cloudless day, rail temperature can increase up to 50° F above the ambient temperature.

Neutral rail temperature is the temperature at which there are no thermally induced forces in the rail. When the temperature of rail is different from the neutral temperature, internal forces develop within the rail. Rail anchors are an integral part of the track restraint system for CWR. Rail anchors prevent or restrict the longitudinal movement of the rail, localizing the compressive or expansive forces in the rail and allowing these localized forces to be uniformly distributed throughout the whole track structure. Without the restraint of sufficient, effective, and evenly distributed rail anchors, if temperatures are higher than the neutral temperature, the rail will expand. The expected amount of expansion or contraction of an unrestrained rail can be calculated using a standard formula that multiplies the rail length by the change in temperature and by the standard coefficient of expansion for steel rail.[22] For example, a 1-mile section of unrestrained CWR can expand as much as 18.5 inches if it experiences a 45° F change in temperature. CN's CWR program contains a CWR thermal expansion table that lists for given lengths of CWR how

[20] AREMA is an independent industry association that sets recommended standards of practice for railroad construction and maintenance. AREMA's stated purpose is "The development and advancement of both technical and practical knowledge and recommended practices pertaining to the design, construction and maintenance of railway infrastructure."

[21] This is the same as the anchoring temperature, when the rail is free of any internal longitudinal forces.

[22] The internal stress of restrained rail is the product of the coefficient of expansion and the modulus of elasticity of the steel multiplied by the change in temperature.

much the length of the rail changes at various changes in temperature. (An abbreviated portion of CN's thermal expansion table is in table 4.) In the absence of proper anchoring, compressive forces within the rail may build up and overcome the lateral restraint at the weakest point in the track, which may create a track buckle. These forces may lift the rail out of the tie plates. Because "rail tends to expand in the direction of least resistance, it often expands upward sufficiently to free it from lateral restraint," which allows the rail to move laterally.[23] To prevent such problems, rail anchors must be in good condition and properly placed. They must also retain their clamping strength and be tight against the side of the tie.

Table 4. CN CWR Thermal Expansion Table.

Temp. Change (°F)	200 (ft.)	400 (ft.)	600 (ft.)	800 (ft.)	1000 (ft.)	1200 (ft.)	1400 (ft.)	1600 (ft.)
35	5/8 in.	1 1/8 in.	1 3/4 in.	2 1/4 in.	2 7/ in.8	3 3/8 in.	4 in.	4 1/2 in.
40	5/8 in.	1 1/4 in.	1 7/8 in.	2 5/8 in.	3 1/4 in.	3 7/8 in.	4 1/2 in.	5 1/8 in.
45	3/4 in.	1 1/2 in.	2 1/8 in.	2 7/8 in.	3 5/8 in.	4 3/8 in.	5 1/8 in.	5 3/4 in.
50	3/4 in.	1 5/8 in.	2 3/8 in.	3 1/4 in.	4 in.	4 7/8 in.	5 5/8 in.	6 3/8 in.
55	7/8 in.	1 3/4 in.	2 5/8 in.	3 1/2 in.	4 3/8 in.	5 1/4 in.	6 1/4 in.	7 1/8 in.
55	1 in.	1 7/8 in.	2 7/8 in.	3 7/8 in.	4 7/8 in.	5 3/4 in.	6 7/8 in.	7 3/4 in.

Railroads determine the temperature at which CWR will be under the least amount of stress throughout seasonal temperature changes, and this temperature is a railroad's preferred rail laying temperature. The intent is to lay rail at a temperature at which the rail is subject to no internal forces and that closely matches the rail temperatures found for the rail for the majority of the year. For example, CN's preferred rail laying temperature for most of Canada is 90° F, and the preferred rail laying temperature for the Central Division is 105°. In CN's "Policy on Continuous Welded Rail," dated April 2003, the preferred rail laying temperature is defined as the target temperature for CWR installation and anchoring.

Track Maintenance History

Since the beginning of 2004, several track maintenance procedures had been performed in the area near the point of derailment (MP 196.5). On January 29, welders cut out a 12-foot 11 1/2-inch portion of the east rail with a crushed rail head. When the piece of rail was cut out, the remaining rail pulled apart, and the replacement rail plug had to be 2 1/2 inches longer to fill the opening. The replacement rail plug was 13 feet 2 inches long. At that time, the rail plug was bolted rather than welded into place. The welder told investigators that the temperature was cold when the rail was repaired. The meteorological report for that day showed overcast conditions with a high of 56° F. After using a rail thermometer on the rail plug, the welder entered 60° F on the repair record, called a Non-

[23] W.W. Hay, *Railroad Engineering*, 2nd ed., p. 588 (New York, NY: John Wiley and Sons, 1982).

Compliance Work Report. The work report was submitted to the track supervisor to report the condition of the anchor pattern and ballast; the rail adjustment amount; the location, weight, and temperature of the rail; and the type of repair.

The work report also had an entry for how the rail temperature of the rail plug related to the preferred rail laying temperature of 105° F. The welder said that he had not filled in that section of the report. Further, he explained that he did not know the formula to make those calculations and indicated that he would need guidance or training to do the calculations and complete that part of the form.

The welder also explained that the dispatcher had allotted him 1 hour to make the repair because of the amount of train traffic in the area. The time allotted was not enough to weld the joints or to heat and expand the CWR, so he inserted a plug using joint bars at both ends. Because the rail pulled apart, or contracted, when the piece of rail was cut out, as noted above, and the welder had to add a longer piece of rail to fill the space, he was required to fill out a Non-Compliance Work Report.

According to CN instructions, the welder was required to assess the status of the rail anchors for 200 feet from the repair site in each direction. On the Non-Compliance Work Report submitted for January 29, 2004, he had circled "Yes" to indicate that "Anchoring Pattern [was] in Accord With IC Policy." He also added the word "Corrected" at the bottom of the page. He told investigators that he wrote this so that the supervisor would know that he had corrected the crushed head and replaced it with a good piece of rail. There were no records to indicate that the plug had been adjusted or shortened to the length of the rail replaced before the derailment.

CN's rail insert procedure required the welder to mark on the rail the difference in length between the piece of rail removed and the replacement rail. The welder could not recall whether he had marked or written on the rail. No markings were found on the rail plug after the derailment.

One month before the accident, on March 6, 2004, an operating crew reported a track problem near MP 196.5. The conductor on the local train said that the track appeared to bow out on the east rail. The local track inspector found two locations near the derailment site with irregularities. He corrected a 1-inch-wide gage condition at the plug inserted in January but was unable to repair a profile[24] problem at the north end of the multispan bridge over the flood plain. He opted to reduce the train speed through the area to 25 mph for freight trains and 30 mph for passenger trains.

The track inspector told investigators that he remembered that some anchors were missing around the rail plug, but he did not remember seeing any rail movement to indicate that the rail was beginning to buckle. The inspection records submitted by the track inspector did not indicate that any action was necessary in connection with the rail anchor conditions.

[24] *Profile* is the relative elevation of the two rails along the track. A profile condition is when the track structure dips or heaves. The dip normally occurs under the load of a train. The profile measurement is the deviation (up or down) at the mid-ordinate of a 62-foot chord.

A few days later, the track foreman returned to the area to replace ties. Inserting the ties in two locations reinforced the correction of the gage problem and repaired the profile problem at the north end of the bridge. According to testimony by the track foreman, he "put the [existing] anchors back on" the area where the plug was inserted. As shown in figure 10, the new ties were not box anchored on every other tie. He maintained the speed restriction set earlier by the track inspector.

Figure 10. New ties with few anchors. Bracket indicates new ties. Arrows indicate anchors.

The track supervisor visited the area where the inspector and the foreman had performed the track work. He told investigators that he thought it was around March 16. He noted that "they had left a couple anchors out on a tie." Other than the missing anchors, however, he said, "… everything was to my satisfaction that day …."

CN had a table depicting the number of trains and the tonnage necessary to compact the track area that had been disturbed by the track work. Following CN railroad guidance for the number of trains and tonnage necessary to compact track after track work, train speeds were restricted to 25 mph for freight trains and 30 mph for passenger trains between MP 196.6 and MP 196.2 from March 6 to March 24. On March 24, the track supervisor determined that the necessary number of trains and tonnage had traversed the track, and he increased the train speeds to 60 mph for freight trains and 79 mph for passenger trains.

The track supervisor told investigators that he entered the data from the Non-Compliance Work Report into a computerized rail defect tracking system (RDTS). He stated that the RDTS does not have a function that highlights anything that needs immediate attention when he accesses the system. He said that he believed that a system that alerted him to conditions that needed to be addressed would be an improvement.

The CN engineering superintendent stated that the RDTS was primarily used for tracking defective rails and that he does not use the system a lot. He added that the RDTS does not provide an overview of rail defects and that it could be improved.

The CN division engineer said that the track supervisor handles the data from the Non-Compliance Work Report that are entered into the RDTS. He stated that the engineering superintendent audits some of the forms or checks field conditions, but not for every rail plug. According to the CN regional engineer, the RDTS has two functions: to store data about defective rail that has been replaced and to track corrective actions. He stated that he was not aware of a feature to alert the system user to locations where rail length has been changed, but that the system has the ability to sort the data by subdivision or by location where rail has been replaced.

CN CWR Program

CN's CWR program in effect in 2004 was its "Policy on Continuous Welded Rail," dated April 2003. This document superseded the IC railroad's CWR program, which had been submitted to the FRA in February 1999. However, one employee told investigators that he had not received the latest CWR policy until after the derailment.

The introduction to CN's April 2003 CWR program regarding rail expansion states that "the distance that rail expands and contracts is directly proportional to the change in the temperature of the rail." CN's instructions (CN Standard Practices Circular (SPC) No. 3205, "Continuous Welded Rail," revision 2, January 2003) to the maintenance-of-way employees identified the preferred rail laying temperature range of 105° F to 130° F. The instructions, under "General," continue as follows:

> CWR will be installed and anchored within the [preferred rail laying temperature range] without further adjustment. CWR installed below the [preferred rail laying temperature] must be de-stressed[25] as soon as possible after laying. De-stressing must be completed before any seasonal increase in temperature.

The more specific instructions under "Maintenance" were as follows:

> Precautions must be taken to monitor the length of rail installed during rail changes.
>
> c) … the amount of rail added or removed will be marked on the rail and [reported] to the Track Supervisor.
>
> d) Track Supervisor will be responsible for the locations and amounts of rail added or removed. These locations, must, if required, have correct length plug installed and welded prior to the onset of warm weather.

[25] *De-stressing* is the procedure used to readjust a rail's temperature to the desired value. It typically consists of cutting the rail and removing rail anchoring devices, allowing for the necessary expansion and contraction, and then reassembling the track.

From interviews with the local maintenance-of-way employees, the consensus was that adjusting for the seasonal increase in temperature was to be completed before May 1. The track supervisor stated, however, that when the accident occurred, he had 15 other locations where 2 to 3 inches of rail had been added during the winter that were on the priority list for welding before the warm weather.

Federal Regulations

Title 49 CFR 213.119(b) requires that railroads with CWR have in their CWR programs "rail anchoring or fastening requirements that will provide sufficient restraint to limit longitudinal rail and crosstie movement to the extent practical." The CWR regulations further state that railroads shall have in effect:

> Procedures which specifically address maintaining a desired rail installation temperature range when cutting CWR including rail repairs, in-track welding, and in conjunction with adjustments made in the area of tight track, a track buckle, or a pull-apart. Rail repair practices shall take into consideration existing rail temperature so that—
>
> (1) When rail is removed, the length installed shall be determined by taking into consideration the existing rail temperature and the desired rail installation temperature range; and
>
> (2) Under no circumstances should rail be added when the rail temperature is below [the desired rail installation temperature range designated by the railroad],[26] without provisions for later adjustment.[27]

CN Track Inspections and Testing

Hy-Rail. The tracks were inspected from a hy-rail vehicle in the derailment site on April 4, 2004, 2 days before the accident, by a CN employee qualified under 49 CFR 213.7, "Designation of qualified persons to supervise certain renewals and inspect track." The record of this inspection showed no track defects. However, the same track inspector had entered a crosslevel variance of 1 1/4 inches at MP 196.6 on the inspection reports from the previous week.

Ultrasonic Rail Testing. CN tests its rail ultrasonically four to five times annually. The last seven tests were conducted on April 3, July 18, September 12, September 15, and December 8, 2003, and January 15 and April 2, 2004. Sperry Rail Service conducted the most recent ultrasonic rail test on April 2. The defect closest to the derailment that was found during this test, and repaired the same day, was a transverse detail fracture of 30 percent at MP 197.06, about 0.6 of a mile south of the derailment location.

[26] CN's range is 105° F to 130° F.

[27] Title 49 CFR 213.119(c).

Track Geometry Measurements. CN had tested the track geometry on the Yazoo Subdivision with its geometry test car.[28] The most recent tests were performed on February 19, 2004, and December 5, July 10, and February 26, 2003. These four tests measured 22 separate locations that produced data indicating 20 locations of profile (crosslevel) deviations and 2 locations of wide gage between MP 196.0 and MP 197.0. The regulation allows profile variances for Class 4 track not to exceed 2 inches and wide gage not to exceed 1 inch. None of the nonstandard measurements exceeded the allowed variance specified by the regulations for Class 4 track.

The number of noted variances also increased from February 2003 to February 2004. In February 2003, the geometry tests had two notations of variances between MP 196.0 and MP 197.0. For this same mile, 10 variations were found with the geometry test car in February 2004.

CN Track Maintenance Procedures

CN's track maintenance procedures were assembled in its Standard Practices Circulars (SPCs). SPC 3601 addresses application and maintenance of rail anchors. The SPC that addresses general CWR maintenance is SPC 3205, "Continuous Welded Rail." Following are relevant excerpts from that SPC discussing track buckling and the importance of rail temperature:

> 39. When practicable, rail will not be added to CWR track. In the event that replacement rail of the same length cannot be installed and additional rail must be added the following guidelines will be met: when repairing a rail failure and rail ends have pulled apart, the distance separation of the two rail ends will be noted. If rail heaters or expanders are not available to assist in bringing the rail back to its original length, the length of the replacement rail, installed with a joint gap not exceeding 1/2 inch, plus the distance of separation will be marked on the rail and reported to the Track Supervisor.
>
> Locations of track buckle susceptibility are at bottoms of grades, track abutting immovable objects (switches, crossing frogs, road crossings, etc.), areas of recently disturbed track, marginal tie or anchor condition, fouled ballast, light ballast section or locations where heavy train braking or accelerating occurs.
>
> Indications of tight rail are bunched or pushing ties which are plowing ballast, rail running whether through rail anchors or with the anchors, rail lifting up under the spike heads, rail pushing against both shoulders of the tie plates, canting rail on curves, gaps at the ends of the ties indicating lateral movement of the track or track having a kinky alignment.
>
> When these signs are apparent, immediate remedial action will be taken by either placing a speed restriction or adjusting the rail.

[28] This car takes dynamic measurements of the track geometry, which, among other things, includes degree of curves, gage, and rail elevation.

> 44. When it is evident that the neutral temperature of a section of rail has been decreased to a level that a track buckle may occur, the neutral temperature should be adjusted back to the Preferred Rail Laying Temperature. The method of de-stressing involves removing rail anchors, cutting the rail and removing rail to achieve the correct rail laying temperature.

Regulatory Oversight of CWR

FRA Track Safety Program and CWR

The FRA regulations covering CWR are at 49 CFR 213.119, "Continuous Welded Rail, General," which states, in part:

> Each track owner with track constructed of CWR shall have in effect and comply with written procedures which address the installation, adjustment, maintenance and inspection of CWR, and a training program for the application of those procedures, which shall be submitted to the FRA by March 22, 1999.

The FRA headquarters staff is responsible for reviewing the plans submitted by railroads in accordance with the regulation, as noted above. The plans are reviewed for CWR installation, adjustment, anchoring, rail temperatures (during installation, repair, and maintenance), monitoring, appropriate speeds, inspection, training for employees working on CWR, and record-keeping. The FRA enforces a railroad's own CWR program, as detailed in the railroad's written CWR plan and standards (if any). A CWR defect noted by the FRA generally reflects the failure of a railroad to comply with its own CWR standards.

CN's former owner, the IC, submitted its first CWR policy, dated February 1999, to the FRA. In 2003 CN submitted an updated version of its CWR policy. Before the accident, FRA headquarters staff had not reviewed either of the CWR programs submitted. After the accident, the FRA headquarters staff reviewed CN's CWR program. (See *Postaccident Actions* in the *Other Information* section of this report.)

FRA Track Inspections

The FRA "Track Safety Standards Compliance Manual" cross-references sections of the Track Safety Standards with instructions and codes for defects found. Selected sections contain information for FRA inspectors regarding what they should look for during an inspection and how to code defects that are found. The Manual states the following regarding the identification and documentation of instances of noncompliance:

> A defect is a condition that is not in compliance with the Track Safety Standards. Defects are noted on inspection reports, which serve as notification to the railroad of FRA's awareness of the defect's existence …. An FRA inspector may choose to also take a violation for the defect, and so note the decision on the inspection form. …

> In many cases, documenting conditions of noncompliance is sufficient to achieve compliance with the Track Safety Standards. However, there are many instances where a condition warrants a violation. When recommending a violation, the inspector must prepare a well-documented narrative report describing the seriousness of the condition. …
>
> A non-complying condition under one set of circumstances may warrant a defect, while the same condition under a different set of circumstances may warrant a violation. The enforcement discretion considerations in Part 209, Appendix A require the Inspector to consider the inherent seriousness of the condition.

The Manual is available on the Internet. This access to the Manual gives railroads the opportunity to learn what FRA inspectors look for during inspections based on the different sections of the Track Safety Standards from 49 CFR Part 213.

The section of the Manual covering 49 CFR 213.119 contains instructions to FRA inspectors concerning the CWR programs submitted by railroads:

> Inspectors must be aware of the procedures in effect before inspecting each railroad. When conducting inspections, the Inspector must make observations to determine if the railroad is following its basic safety procedures.

Further, the Manual explains that there are procedures for a railroad to perform maintenance work on the track without complying specifically with the guidelines of its CWR program. However, a railroad must have a method of recording this work and a process through which the work is later corrected to comply with the railroad's CWR program. The Manual stresses the point that just recording the noncompliance situation is not enough; the followup work to correct the noncompliance is necessary to avoid a track defect violation.

The FRA inspector based in Petal, Mississippi, was responsible for a territory covering north central Mississippi south to the Gulf Coast, which includes the area around Flora. The inspector had copies of CN's two CWR programs (February 1999 and April 2003), and he stated that he used them to check CN's compliance with its own CWR maintenance instructions. He said he used the FRA "Track Safety Standards Compliance Manual" to guide his inspections. He said that during his inspections he specifically checks an employee's awareness "… of what's in [the railroad's] program and [the employee's] noticing the conditions … in the field."

This FRA inspector, accompanied by CN's track inspector, had conducted two recent track inspections before the derailment: for 3 days in June 2003 and 3 days in February 2004. These inspections were not identified as followup inspections, and even though several defects were noted, no violations were filed. The FRA inspector stated that two of the inspection reports from June 2003 contained comment items. He explained that information about upcoming program maintenance work schedules for a particular portion of a territory guided his decision whether to write in the comment section. His goal was to inspect the Amtrak and hazardous materials routes twice a year.

From the June 2003 track inspection, the inspector's comment on June 10 pertained to the area between MP 145 and MP 180. The comment was "… [at] numerous locations tie distribution is marginal, rail anchors are ineffective against longitudinal displacement." The inspector's comment on June 11, 2003, pertained to the area between MP 180 and MP 217. The comment was "… numerous locations [have] marginal effective ties and the rail anchors are not controlling longitudinal displacement."

The FRA track inspector stated that the CN inspector who was with him during the inspections agreed with the conditions noted in the comments, but the FRA inspector did not expect the railroad to "follow through with the repairs" on those items, and he noted that the railroad was not required to make the repairs because they were not entered as defects. In interviews, the FRA track specialist, who was the FRA inspector's technical advisor, said he also did not expect the railroad to make repairs based on comment items.

Postaccident FRA Inspections

The FRA conducted a walking inspection of the track on either side of the derailment on April 8, 2004. The report from that inspection noted 4 fouled ballast locations and identified 28 loose rigid rail braces at the turnouts at a nearby siding. The four fouled ballast locations were at MPs 197.6, 196.3, 196.1, and 195.8. The fouled ballast locations also had profile deviations of 1/2 to 3/4 inch. The regulation allows for a 2-inch profile deviation in Class 4 track.

The FRA performed a focused inspection on the entire Yazoo Subdivision[29] April 26–28, 2004. The report from this inspection included 7 record-keeping defects and 130 track defects that required remedial action by CN. In addition, the FRA found 24 occurrences of failure to comply with CN's written CWR procedures (insufficient anchors), 5 locations with insufficient anchorage to restrain rail movement in turnouts, and 1 location where the crosstie condition was unacceptable, at MP 188.0.

Equipment

Maintenance, inspection, and repair records for the locomotives and all cars in the train were reviewed. Additionally, the locomotives and all cars on the train were mechanically inspected and evaluated after the accident. The results of those inspections are detailed below.

Preaccident Inspections

Each car in the train was mechanically inspected prior to departure. There were no unrepaired defects at the time of departure. Additionally, all the cars were up to date in Amtrak's ongoing preventative maintenance program.

[29] The Yazoo Subdivision includes the territory inspected by the FRA before the accident, but it is larger than that territory.

The locomotive was within all required inspection parameters, and the required information was recorded and maintained on the locomotive unit.

Postaccident Inspections

The foundation brake rigging, wheels, and underframe were inspected on the locomotive unit and each car after the accident. The overturned cars were inspected in both the horizontal and vertical positions. Each car and the locomotive unit had friction burns from metal-to-metal contact. Those marks were lighter under the locomotive unit and baggage car than under the rest of the train.

A significant impact mark was noted on the number 7 wheel and brake disk of the transition sleeper, and a similar mark was noted on the number 5 brake disk of the dining car. The connecting rods and lateral guide links were deformed rearward, beginning at the trailing end of the transition sleeper and continuing toward the rear of the train. Those components on the leading end of the transition sleeper were not bent.

Inspection of the wheels, brake disks, and brake pads of the trailing car (an unoccupied coach car) indicated normal contact and wear patterns. The wheels and brake disks were worn smooth and were shiny, but were within their respective tolerances. All the brake pads were worn, but none had reached its condemning limit, or the point at which it required repair.

A postaccident air brake test equivalent to an initial terminal air brake test was performed on the locomotive unit and baggage car, and they successfully completed it. Because the passenger cars had damaged components, a postaccident air brake test could not be performed on them. However, brake pipe pressure was maintained on the rear car for 2 days after the accident. Each passenger car in the train displayed normal contact and wear patterns similar to those on the trailing car. The locomotive engineer stated that the brakes had handled as expected throughout the trip.

Emergency Preparedness

Amtrak Personnel Emergency Preparedness Training

Amtrak has developed an emergency preparedness training program for its crewmembers as required by 49 CFR Part 239. The purpose of Amtrak's 8-hour Passenger Railroad Emergency Preparedness and Response Education (PREPARE) is to prepare operating crewmembers and on-board employees to respond to train emergencies. Amtrak had until January 29, 2001, to ensure that all current crewmembers received the initial PREPARE training.[30] The regulation requires refresher training once every 2 years after the initial training has been completed.

[30] Title 49 CFR 239.101.

In the weeks following the accident, Amtrak provided Safety Board investigators with the emergency preparedness training records for all the Amtrak employees on the accident train. According to the training records provided by Amtrak from its database after the accident, 8 of the 12 crewmembers on board the train had attended a PREPARE training course in the 2 years before the accident. For the remaining four crewmembers, Amtrak's records indicated that one crewmember had never received PREPARE training, and three were not current because they had gone more than 2 years without the required training. More than a year after Amtrak provided its training records, Amtrak located additional records that were not in the database. These records show that three more crewmembers were current with PREPARE training, bringing to 11 the number of crewmembers who had received the required training.

On March 14, 2003, Amtrak officials told Safety Board investigators that Amtrak is "currently improving … technological resources to afford [Amtrak] the opportunity to better track PREPARE training for all active on-board service personnel." Amtrak hopes that these improvements will allow it "to better monitor the status of all active employees' PREPARE training."

Amtrak Emergency Preparedness Training for Communities

On June 9, 1999, an Amtrak emergency preparedness manager provided training to approximately 21 members of the Yazoo City Fire Department, the Bentonia Volunteer Fire Department, the Benton Volunteer Fire Department, and the Tri-Community Volunteer Fire Department in Yazoo, Mississippi. The training course was Amtrak's Passenger Train Emergency Response course, known as SAFE 015.[31] The same Amtrak emergency preparedness manager conducted another SAFE 015 course in Meridian, Mississippi, on February 23, 2004. A Ridgeland Fire Department captain attended the training in Meridian. According to records provided by Amtrak, no firefighters from 8 of the 10 fire departments that responded to the Flora accident have attended any training provided by Amtrak. (See appendix B.)

CN Emergency Preparedness Training

According to CN, since November 2003 it has provided nine training opportunities for emergency responders from Madison and Yazoo Counties. This training included CN 911 Tank Car/TRANSCAER/Emergency Responder and Grade Crossing Collision Investigation presentations. State, local, and volunteer firefighters, paramedics, and emergency management agencies were invited to attend these training opportunities.

A 2-day training session was conducted in Canton, Mississippi, (Madison County) February 11–12, 2004. The first day was for emergency responders, and the second day was for law enforcement responders. Two 2-hour sessions were offered on February 11 for all emergency management and fire department personnel within a 1 1/2-hour drive of the Canton area. CN sent a notice for the February 11 training to representatives from 40

[31] *SAFE 015* includes instruction on safety on railroad property and equipment, contacts for the region's railroads, familiarization with Amtrak's equipment and crew, and emergency access to the passenger cars and locomotives, among other subjects.

emergency response agencies in the Canton area. According to records provided by CN, the notice was not sent to the following agencies that responded to the derailment on April 6, 2004: Madison County Emergency Management Agency, Madison Fire Department, Flora Volunteer Fire Department, Kearney Park Volunteer Fire Department, Gluckstadt Volunteer Fire Department, Southwest Madison Volunteer Fire Department, Bentonia Volunteer Fire Department, Camden Volunteer Fire Department, and Farmhaven Volunteer Fire Department. A total of 6 firefighters from the Flowood Fire Department, 18 firefighters from the Canton Fire Department, and 1 firefighter from the Jackson Fire Department attended the training on February 11. None of these departments responded to the derailment.

Madison County Emergency Preparedness Training

The Madison County Emergency Management Agency director told investigators that the Madison County emergency plan was not implemented as a result of this accident. In addition, according to the director, there had not been any countywide disaster drills before the accident.

Survival Factors

Superliner Passenger Car Emergency Windows

During an on scene inspection of the sleeper car, Safety Board investigators noted an emergency window handle that had been partially pulled free from the rubber grommet surrounding the window. One screw had pulled right through the rubber grommet. The window handle is normally attached to the grommet with two steel screws that are about 1 1/4 inch long and have a head diameter of 1/4 inch. When investigators attempted to open the window, the second screw also pulled right through the rubber grommet, leaving the grommet and window in place, preventing removal of the window for emergency egress. (See figure 11 for a photograph of the emergency window handle.) The grommet was not marked with a date of manufacture.

Title 49 CFR 239.107 requires that a representative sample of emergency windows be tested at least once every 180 days and that the window inspection and maintenance records be kept for 2 calendar years. Prior to the accident, Amtrak's Preventive Maintenance and Standard Maintenance Procedures outlined requirements to test and remove only one emergency window during each maintenance cycle (typically every 3 months). These procedures did not require documentation of which emergency window was removed and inspected.

Title 49 CFR 238.113 requires that each main level of a passenger rail car have a minimum of four emergency windows and that the windows allow rapid and easy removal without the use of tools. All windows on the Superliner passenger cars are emergency windows. Each is equipped with a handle to remove a rubber grommet that surrounds the window and holds it in place. Once the rubber grommet is removed from the window assembly, the window itself can be moved.

Figure 11. Emergency window handle that partially pulled free from rubber grommet.

Since the accident, Amtrak has informed Safety Board investigators that it will increase to four the minimum number of emergency windows tested per car during each 3-month cycle for all Superliner, Surfliner, and Viewliner passenger cars. If a failure is detected during the inspection, the same number of additional windows will be tested to ensure compliance and operability.

Amtrak has stated that it will also record in its maintenance database the location of each window tested on each car, and its Standards and Compliance Group will randomly audit the database. According to Amtrak, this new procedure will ensure that every emergency window on each passenger car will be tested at least once every 4 years. Additionally, at Amtrak's request, as of July 2004, both emergency window handle manufacturers began stamping the date of manufacture on the handle area of the window gasket assembly.

Other Information

The last train over the accident location before the arrival of train No. 58 was a southbound freight train, CN G89291-04, at 4:30 p.m. on April 6. It consisted of 2 locomotive units, 132 loaded freight cars, and 3 empty freight cars. The empty cars were the 21st, 24th, and 30th from the head end. The train weighed 17,118 tons and was 8,200 feet long. Thirty-two cars were set out at Jackson, Mississippi. After the derailment, those 32 cars were mechanically inspected at Jackson, and the remainder of the train was inspected at Collins, Mississippi. No defective cars were found during those inspections.

Previous Derailment

On July 18, 1997, the IC Railroad (the previous owners of the railroad) had a derailment at MP 196.8. According to the FRA database, 12 cars of a 125-car train derailed. Two hazardous materials cars released their product, and 4,000 local residents were evacuated. There were no deaths or injuries. The database indicates that the cause of the derailment was "track alignment irregularity (buckled/sunkink)."[32]

Postaccident Actions

CN. CN has started the track structure rehabilitation program that was planned for the first quarter of 2005. The local engineering superintendent stated that since May 2004, crews have replaced 52,322 defective ties, about one-third of the existing ties, reapplied rail anchors, added ballast, and tamped the ballast around and under the ties between MP 164 and MP 217. CN also installed 34,853 new ties, which accounted for about a third of the ties, and surfaced the track between MP 92.7 and MP 124.0.

FRA. After the accident, the FRA headquarters staff reviewed CN's CWR program. The results of that review were sent to CN in a June 22, 2004, letter that recommended that CN clarify several terms and phrases used in the CWR program. One of the phrases CN was asked to clarify was "onset of warm weather." As of July 26, 2005, the FRA had not received a response to its request for clarification.

After the accident, Safety Board investigators asked the FRA whether it had audited Amtrak's records of employee training. The FRA had no record of this type of audit for the region in which the Flora accident occurred. However, between April 26 and 29, 2004, the FRA reviewed employee training records as part of an audit of Amtrak's passenger train emergency preparedness program (49 CFR Part 239) for the Northwest Region of the Pacific Division, which includes Amtrak's operations in Oregon, Washington, Idaho, and Montana. For one group of employees, one-third (10 out of 30) had not received the PREPARE training within 2 calendar years. For a second group of employees, two-thirds (four out of six) did not have the PREPARE training within 2 calendar years. The FRA filed two violations based on these findings.

Mississippi Emergency Management Agency Emergency Preparedness Training. Since the accident, the Mississippi Emergency Management Agency has conducted incident command system training in Madison and Yazoo Counties. The 16-hour course was conducted in Madison County on April 28 and 29, 2004, and in Yazoo County on May 17 and 18, 2004. The purpose of this course was to provide the necessary training for all agencies in every county to be familiar with the National Interagency Incident Management System that was standardized for all responses by the Mississippi governor's Executive Order 851 in October 2001. Attendees of these courses included emergency responders from agencies that responded to the April 6, 2004, derailment: fire departments (including volunteer agencies), emergency medical services, law enforcement, emergency management, the American Red Cross, and the Mississippi Department of Health.

[32] *Sunkink* refers to a heat induced expansion of the rail that results in misalignment of the rail.

Analysis

The Accident

The Amtrak *City of New Orleans* passenger train derailed on April 6, 2004, at approximately 6:33 p.m. between two bridges near Flora, Mississippi. The engineer noted that the rail ahead of the train and between the bridges was "kinked," and he attempted to slow the train from 78 mph. Before he could stop, the train reached the irregularity, and the train started derailing. The engineer applied the emergency brakes while the train continued to derail. The derailing train stripped the east rail out from under the locomotive; the engineer said he could see the right hand rail roll over in front of the locomotive. The derailed locomotive continued rolling onto the second bridge before it stopped. The train broke away from the baggage car (directly behind the locomotive) and tipped over to the right. Most of the passenger cars slid to a stop on their sides at the bottom of the flood plain of the Big Black River. Only the locomotive, the baggage car, and the unoccupied last car remained upright.

Exclusions

None of the Amtrak on-board personnel reported any significant problems or unusual events involving the equipment during the train's preaccident journey. The engineer said that the train had handled as expected and he did not recall any signal or train control problems. Postaccident inspections of the train, subsequent tests of the braking systems, and a review of vehicle maintenance records did not indicate any problems with the train equipment. Therefore, the Safety Board concludes that Amtrak train No. 58 and its related equipment functioned as intended and did not cause the derailment.

A review of the event recorder data with respect to train handling showed that before the locomotive passed over the track irregularity, the engineer handled the train in accordance with accepted practices and procedures. Postaccident drug and alcohol testing results for the train operating crewmembers were negative. The work-rest histories of the train-operating crewmembers indicated that fatigue had no role in the accident. Therefore, the Safety Board concludes that the operation of the train was not a factor in the accident.

The postaccident testing of CN signal equipment and the train control system demonstrated that they worked as intended. No communications problems were reported among the train-operating crewmembers or between the train crew and the dispatcher.

Track Condition

The conditions leading to the rail shift at the point of derailment had developed over time since the plug had been inserted in the rail in January 2004. When the welder installed the plug, he had three options for adjusting the CWR correctly: cut the plug to the same dimensions as the original piece of rail and heat the rail on both sides of the plug before installation; secure the existing rail with additional anchors before cutting out the defective piece to prevent the cold rail from shrinking away from the cut; or insert a plug longer than the original piece of rail and return later, before the onset of warm weather, to adjust the rail to the proper length. The welder chose the third option and marked the correction form to note that this plug needed adjusting before the "onset of warm weather." Because an increase in temperature can increase the potential for track failure in CWR, the phrase "before the onset of warm weather" is inadequate for specifying when an adjustment needs to be made. Adjusting CWR correctly in relation to temperature changes requires monitoring of actual temperatures.

According to the testimony of the track maintenance employees, informal policy set May 1 as the date for the onset of warm weather. On the day of the accident, April 6, the air temperature was approximately 80° F with broken clouds. Three days later, a similar day with a temperature of 82.9° F and a few clouds, the rail temperature was measured to be 114° F. Rail temperatures can be much greater than the ambient temperature, depending on the amount of radiant heating by the sun. The rail plug was inserted at a temperature of 60° F in January. The standard neutral rail temperature for the surrounding rail should have been the same as the preferred rail laying temperature of 105° F. When the plug was inserted at the lower temperature and fitted against the existing rail, it changed the neutral rail temperature of the existing rail to well below the original neutral rail temperature. When the weather changed, the entire rail, including the rail insert with the lower neutral temperature and the rail on both sides of the insert, heated up and expanded, creating internal compression forces in both the existing rail and the new plug, which was tight against the existing rail.

Three critical components of the track structure that help secure the rail and counter the forces during an increase in temperature that causes the rail to expand are the number and pattern of effective anchors applied tightly against the sides of the crossties, the effectiveness of the ties in holding the spikes to prevent the rail from lifting from the compressive forces, and the presence of ballast tamped around the tie and applied to the shoulders to prevent the ties from moving.

Approximately 50 percent of the anchors were ineffective. There were split ties and ties in marginal condition with reduced spike-holding ability. Even though several locations had fouled ballast, there appeared to be enough shoulder ballast to prevent the track from moving laterally. The ineffective anchoring and the marginal tie condition were the weakest of the three rail restraints.

When the rail expanded in the heat and tried to "run" longitudinally, it moved northward away from the Big Black River Bridge. Exacerbating that movement was the

speed reduction through the derailment site between March 6 and March 24, 2004. As a train approached the speed reduction from either direction, the train brakes were applied. Because of the frictional forces between the wheels and the rail during deceleration, the rail was pushed ahead of the train. At the bridge the rail was anchored solidly with elastic clips, and the rail could not move longitudinally in that area. However, because the rail was not anchored effectively in the area away from the bridge, its ability to move longitudinally increased the compressive forces within the rail between the bridge structures. With the adequate shoulder support from the ballast preventing the track structure's lateral movement between the bridges, the east rail could move only upward to relieve the forces within it. The east rail started to bow, and the spikes were lifted out of the ties because the ties were split and could not hold the spikes effectively. The rail is designed to rest in a metal tie plate with raised portions against the outside and inside of the rail that help prevent lateral movement when secured to ties imbedded in well-tamped ballast. Once the rail bowed high enough to clear the raised portions on the tie plates, the rail moved more easily outward. At MP 196.5, the east rail moved enough laterally to widen the gage of the rail and allow the wheels of train No. 58 to drop between the rails. The west rail remained intact, resting on the tie plates, and appeared to be moderately secure. The Safety Board concludes that the inadequately restrained east rail lifted out of the tie plates because of expansion caused by warm temperatures resulting in the rail shifting and the gage widening, causing the wheels of the train to drop between the rails.

Track Maintenance

CN CWR Maintenance and Inspection

CN's instructions for the maintenance of CWR addressed the installation of rail plugs and the adjustment required before the onset of warm weather if a plug is installed during cold weather. Because he did not use rail heaters or expanders to achieve the desired CWR adjustment at the time the rail plug was installed in January 2004, the welder was required to mark the rail for later adjustment and make a report to the supervisor. Many of the conditions that can cause rail to be susceptible to buckles and compression forces, as noted in CN's CWR maintenance instructions, existed at the accident location. These include location at the bottom of a grade, abutting an immovable object (the Big Black River Bridge), location in an area of recently disturbed track (ties were inserted in March), marginal tie or anchor condition, and heavy train braking. The track welder installed the plug in January 2004. He entered both the temperature of the inserted piece of rail and the number of inches of added rail into the repair form. He was also required to mark the rail plug with the amount of rail added. However, no markings were found on the plug after the accident, so it is unlikely that the rail had been marked. The track welder also noted on the repair form that he had checked the anchor pattern for 200 feet from the insert in both directions and the proper number of anchors were there. However, postaccident observations found that only about half of the anchors were in functioning positions against the sides of the ties, and those anchors were not enough to retard or restrain the longitudinal rail movement. It is unlikely that the condition of the anchors had changed much between January and the time of the accident.

Further, on March 6, 2004, the track inspector made repairs at the location of the rail insert. He remembered seeing that some of the anchors were missing but since he did not see any rail movement (longitudinally) he considered their absence to be inconsequential. A few days later, the track foreman put some new ties under the rail plug. The foreman recalled that the rail anchors that were removed from the old ties were put on the new ties. The postaccident examination showed that anchors were not applied box style on every other tie of the new ties as required by the CWR program. Following these 2 separate days of work by the track inspector and the track foreman, the track supervisor visited the site to evaluate the work performed by them and the welder. He told investigators that the work was satisfactory but noted that a couple of anchors had been left off.

Between January and March 2004, four maintenance employees (welder, track inspector, track foreman, and track supervisor) had been at or near MP 196.5 on four different occasions, and all four employees said they had examined the condition of the anchors. However, even though CN's standard for anchors in CWR was full box anchoring on every other tie, none of the four employees adjusted or added anchors although half of the anchors were missing or not against the sides of the ties. Further, CN did not have an adequate system to alert key personnel of critical maintenance activities, such as followup rail adjustments before the onset of warm weather. The Safety Board concludes that although CN had written instructions for maintaining CWR and preventing track buckling, track employees at multiple levels did not follow or ensure adherence to these instructions. The Safety Board also concludes that had the employees who maintained the track at the accident site followed the written procedures the rail shift condition likely would not have occurred. Therefore, the Safety Board believes that CN should establish an audit program to verify that employees follow the current written track maintenance and inspection procedures, including rail anchoring requirements and specifically maintaining the preferred rail laying temperature.

FRA Oversight

The FRA is responsible for determining the adequacy of a railroad's CWR program, but the FRA did not review either the old IC program or the CN program before the accident. This type of oversight deficiency was identified by the Safety Board during its investigation of a January 18, 2002, derailment near Minot, North Dakota.[33] The FRA's failure to evaluate rail carriers' CWR programs until after serious rail accidents is particularly disturbing given the movement of trains carrying passengers and hazardous material over rail routes throughout the country and the serious consequences that can result when a derailment occurs. Since the Flora accident, the FRA has reviewed CN's CWR program and has asked the railroad to clarify certain details within the program. One of the details the FRA has asked CN to clarify is the specific meaning of the phrase, "onset of warm weather." This is important in connection with the Flora accident because the CWR where the oversized rail plug was inserted near the derailment site needed to be adjusted before it was affected by the increasing temperature.

[33] National Transportation Safety Board, *Derailment of Canadian Pacific Railway Freight Train 292-16 and Subsequent Release of Anhydrous Ammonia Near Minot, North Dakota, January 18, 2002*, Railroad Accident Report NTSB/RAR-04/01 (Washington, DC: NTSB, 2004).

Before the Flora accident, although the FRA inspector had the railroad's CWR program and he found areas in which the ties were marginal and the rail anchors were ineffective against longitudinal displacement, he did not write up any defects, nor did he identify instances where anchors were not applied box style on every other tie. However, such instances were found and identified as defects after the accident prompted a more focused FRA inspection.

The FRA inspector had several methods available to inform the railroad of corrections necessary to improve the track conditions. The most severe was to note a defect and file a violation on that defect. An alternative was for the inspector to note a defect, but not file a violation, which gives the railroad time to correct the problem. A third method, which he used, was to write comments to the railroad, although this method has no enforcement element. Later, the FRA inspector and the FRA track specialist agreed that the railroad was not required to respond to written comments and they did not expect the railroad to make repairs based on comment items.

In his written inspection comments to CN in June 2003, the FRA inspector characterized the anchoring as "ineffective against longitudinal displacement," indicating that the rail could move because of changes in temperature. However, in a February 2004 return visit to the same territory, the FRA inspector did not comment on the condition of the anchors, and no records were found to indicate that anchors had been applied between June 2003 and February 2004 to meet CN's CWR program requirement that anchors be applied box style on every other tie. An inspection after the derailment found that approximately 50 percent of the anchors in the area of the accident were missing or not properly positioned. Although the FRA inspector had brought the anchor deficiencies to CN's attention about 10 months before the accident, he did not link this deficiency to CN's CWR program and communicate the problem in a formal way—as a defect—that would have likely prompted corrective action by CN. The Safety Board concludes that although an FRA preaccident inspection identified track deficiencies, the FRA's oversight was not effective in ensuring corrective action by CN. The Safety Board believes that the FRA should emphasize to its track inspectors the importance of enforcing a railroad's CWR program as a part of the Federal Track Safety Standards, and verify that inspectors are documenting noncompliance with the railroad's program.

Emergency Response

Immediately following the derailment, an Amtrak crewmember in the dining car of the accident train called the Madison County Sheriff's Office (911) on his cellular telephone to report the accident. He was able to provide the 911 dispatcher with detailed information about the number of passenger cars derailed, the number of passengers, and the location of the derailment.

The Madison County 911 dispatcher immediately dispatched people from the Madison County Sheriff's Office, the Kearney Park Volunteer Fire Department, and the Flora Volunteer Fire Department. Within 16 minutes of the derailment, the Madison

County Sheriff's Office arrived on scene. Approximately 3 minutes later, the first firefighter (the chief of the Flora Volunteer Fire Department) arrived on scene. The location of the derailment was approximately 1 1/2 miles from the nearest paved road. Although the derailment occurred in a remote area, emergency responders were able to find the derailment site and respond quickly.

When the chief of the Flora Volunteer Fire Department arrived on scene, he immediately began to triage the injured passengers on the train. As the first responding firefighter (and most senior responder on the scene), the chief should have established a command post, declared himself incident commander, and initiated the formal management of the emergency response. If he had established command, the resources needed for the emergency response could have been better managed at the beginning of the response.

During the period in which there was no official command post or incident commander, emergency responders were responding to the scene and assisting with injured passengers. The emergency responders were gathering the passengers together to ensure that everyone was either evacuated or in the process of receiving medical treatment. The establishment of the command post and the staging and triage areas by the EMS director organized the emergency response operations already in progress. The establishment of incident command made it easier to allocate proper resources to the search for and triage of passengers and the extrication and medical transport of injured passengers.

The survival of victims of a mass disaster may be directly attributable to the decisions made by medical and fire rescue personnel at the scene. These critical decisions include the allocation of resources, such as medical, fire, and rescue personnel and equipment. The purpose of the incident command system at the scene of a disaster is to methodically allocate resources and objectively make important decisions in an emotionally charged atmosphere with potentially life or death consequences.

The Madison County Emergency Management Agency director told investigators that there had not been any countywide disaster drills before the accident. Such drills provide emergency response agencies the opportunity to test their response, communication, and coordination with each other. A disaster drill also provides an opportunity to test the effectiveness of the incident command system in managing an emergency. Madison County emergency responders at the Flora accident were able to work well and effectively together even though they had not practiced or drilled together before the accident. However, the lack of an established incident command during the early stages of the response could have had a serious negative effect on the overall response.

Since the accident, the Mississippi Emergency Management Agency has conducted incident command system training for emergency responders in Madison and Yazoo Counties. The 16-hour course was conducted in Madison County in April 2004 and in Yazoo County in May 2004.

Emergency Preparedness

Amtrak Crewmember Emergency Preparedness Training

During emergency situations, particularly those involving passenger evacuations, the train crew and on-board service personnel are responsible for managing and directing the safe evacuation of passengers. Passengers rely on the training, experience, and leadership of the on-board service personnel. Required periodic emergency situation training should prepare the train crewmembers to perform their duties confidently when emergency situations occur. This periodic training is important because policies and procedures change over time, both skills and memory erode unless exercised and emergencies are rare, and the training is required by Federal regulation. Although Amtrak is required to train current and new employees in emergency procedures, of the 12 crewmembers on train No. 58, 1 had gone more than 2 years without retraining. Title 49 CFR Part 239 has been in effect since January 1, 1999; therefore, Amtrak has had ample time to train all of its crewmembers.[34]

The Safety Board has long been concerned with the emergency preparedness training of Amtrak crewmembers and has previously made six recommendations (Safety Recommendations R-79-36, R-83-24, R-83-72, R-89-35, R-93-23, and R-98-59) to Amtrak regarding this issue. (Appendix C has a list of previous Safety Board recommendations relating to the issues addressed in this accident.) Safety Recommendation R-79-36,[35] which asked Amtrak to establish a program to train crewmembers in the proper procedures for care of passengers in derailment and emergency situations, was classified "Closed—Acceptable Action" on October 8, 1980, after Amtrak said that all employees had received training and that an ongoing training program was in place. In response to Safety Recommendations R-83-24[36] and R-83-72,[37] Amtrak developed an advanced 4-hour course on emergency procedures for on-board crewmembers and supervisory personnel.[38] Safety Recommendation R-89-35[39] asked Amtrak to develop procedures and equipment for evacuation of passenger cars involved in

[34] Title 49 CFR 239.101 provided a 2-year grace period commencing on January 29, 1999, for completing the initial training for current employees and training within 90 days of hire for new employees. After the initial training, periodic training is then to occur at least once every 2 years.

[35] National Transportation Safety Board, *Rear End Collision of Conrail Commuter Train No. 400 and Amtrak Passenger Train No. 60, Seabrook, Maryland, June 9, 1978*, Railroad Accident Report NTSB/RAR-79/03 (Washington, DC: NTSB, 1979).

[36] National Transportation Safety Board, *Derailment of Amtrak Train No. 5 (the San Francisco Zephyr) on the Burlington Northern Railroad, Emerson, Iowa, June 15, 1982*, Railroad Accident Report NTSB/RAR-83/02 (Washington, DC: NTSB, 1983).

[37] National Transportation Safety Board, *Fire Onboard Amtrak Passenger Train No. 11, Coast Starlight, Gibson, California, June 23, 1982*, Railroad Accident Report NTSB/RAR-83/03 (Washington, DC: NTSB, 1983).

[38] Safety Recommendation R-83-24 was classified "Closed—Acceptable Action" on October 12, 1984, and Safety Recommendation R-83-72 was classified "Closed—Acceptable Action" on June 3, 1986.

[39] National Transportation Safety Board, *Derailment of National Railroad Passenger Corporation Train 7, on Burlington Northern Railroad near Saco, Montana, August 5, 1988*, Railroad Accident Report NTSB/RAR-89/03 (Washington, DC: NTSB, 1989).

an accident and train employees in those procedures and equipment. Amtrak updated its emergency evacuation procedures manual and provided annual refresher training to all train and engineering and on-board crews. Safety Recommendation R-89-35 was classified "Closed—Acceptable Action" on January 16, 1990. In response to Safety Recommendation R-93-23, Amtrak now provides all on-board service personnel with comprehensive training in first aid, cardiopulmonary resuscitation, and the use of the public address system.[40, 41] Safety Recommendation R-98-59 asked Amtrak to implement effective controls to monitor and ensure that all train crews and on-board service personnel receive the necessary initial and recurrent emergency training to provide for passenger safety.[42, 43] In response, Amtrak established a computerized database that tracks the attendance of all on-board crewmembers in initial and recurrent training in passenger emergency preparedness and response education. However, Amtrak had difficulty locating accurate training records for 4 of the 12 crewmembers after this accident because the database had not been updated. Amtrak also centralized the training records into a single database for compliance monitoring by Amtrak's human resources office.

Despite the existence of an employee training database, an Amtrak on-board employee in this accident had not had training as required by Federal regulation. Amtrak's continued failure to provide passenger emergency training to its crews has the potential to put the traveling public at risk should an emergency occur on an Amtrak train. Although it was not a factor in this accident, the Safety Board concludes that Amtrak was not assuring that all of its crewmembers received emergency preparedness training.

For almost 2 years, Amtrak officials have been telling Safety Board investigators that Amtrak is "currently improving … technological resources to afford us the opportunity to better track PREPARE training for all active on-board service personnel." Amtrak hopes that these improvements will allow it "to better monitor the status of all active employees' PREPARE training." However, because of the importance of this issue and Amtrak's continued failure to ensure all employees receive PREPARE training, the Safety Board believes that Amtrak should report to the Board within 90 days a schedule for training its employees who have not received emergency preparedness training as required by 49 CFR Part 239.

According to the regulation all Amtrak employees that worked on trains had to be trained for emergency response by January 29, 2001, and retrained every 2 years thereafter. However, Amtrak has failed to meet this requirement. The FRA is

[40] National Transportation Safety Board, *Derailment and Subsequent Collision of Amtrak Train 82 with Rail Cars on Dupont Siding of CSX Transportation Inc. at Lugoff, South Carolina, July 31, 1991*, Railroad Accident Report NTSB/RAR-93/02 (Washington, DC: NTSB, 1993).

[41] Safety Recommendation R-93-23 was classified "Closed—Acceptable Action" on December 5, 2000.

[42] National Transportation Safety Board, *Derailment of Amtrak Train 4, Southwest Chief, on the Burlington Northern Santa Fe Railway near Kingman, Arizona, on August 9, 1997*, Railroad Accident Report NTSB/RAR-98/03 (Washington, DC: NTSB, 1998).

[43] Safety Recommendation R-98-59 was classified "Closed—Acceptable Action" on December 5, 2000.

responsible for ensuring that Amtrak is in compliance with this regulation, but Safety Board investigators identified only one FRA audit of Amtrak's emergency preparedness training. Moreover, that audit occurred after the accident and in one location in a different region. Before the Part 239 regulation was in effect, this issue had surfaced in six Amtrak accident investigations over 18 years, resulting in recommendations to improve emergency training. Further, since Amtrak's failure to ensure such training surfaced in another accident after the regulation required the training, the Safety Board concludes that the FRA was not conducting periodic audits of Amtrak's passenger train emergency preparedness plan to ensure that all crewmembers were receiving the required emergency preparedness training. Therefore, the Safety Board believes that the FRA should establish an audit and enforcement program to verify that Amtrak complies with initial and periodic emergency preparedness training for all crewmembers systemwide, as required by 49 CFR Part 239.

Emergency Responder Training Provided by Amtrak

Amtrak has provided its "Passenger Train Emergency Response" course to emergency responders in Yazoo County. However, very few responders from Yazoo County responded to the accident, and most of their formal training from Amtrak occurred approximately 5 years before the accident. Amtrak is required by 49 CFR 239.101(a)(5) to provide training to emergency responders along passenger rail routes. According to records provided by Amtrak, no firefighters from Madison County (the Flora Volunteer Fire Department, the Kearney Park Volunteer Fire Department, the Gluckstadt Volunteer Fire Department, the Madison Fire Department, the Southwest Madison Volunteer Fire Department, the Camden Volunteer Fire Department, the Canton Volunteer Fire Department, and the Farmhaven Volunteer Fire Department) have attended any training provided by Amtrak. The lack of the training was demonstrated by the delayed implementation of an incident command system. However, these problems stem more from a lack of preparedness among the volunteer fire departments than from a lack of training provided by Amtrak.

Passenger Train Equipment

Emergency Window Handles

An emergency window on the sleeper car had a handle that partially pulled free from the rubber grommet around the window, preventing removal of the window for emergency egress. Therefore, the Safety Board concludes that the handle on an emergency window on the sleeper car was found to have failed. Without knowing the date of manufacture of the gasket, investigators were unable to determine how the age of the rubber may have affected the failure of the screws to remain attached to the grommet.

Prior to the accident, Amtrak's Preventive Maintenance and Standard Maintenance Procedures outlined requirements to test and remove only one emergency window during each maintenance cycle (typically every 3 months). These procedures did not require documentation of which emergency window was removed and inspected.

Since the accident, Amtrak has informed the Safety Board that it will increase the number of emergency windows tested on all Superliner, Surfliner, and Viewliner passenger cars from one to a minimum of four during each 3-month cycle. The new requirement for number of windows tested will increase the total number of emergency windows tested and inspected to 16 annually. According to Amtrak, this new procedure will ensure that every emergency window will be tested on each passenger car at least once every 4 years.

Amtrak has stated that it will also record the location of each window tested on each car in its electronic maintenance database. According to Amtrak, its Standards and Compliance Group will randomly audit this database. Additionally, Amtrak has asked both of its emergency window handle manufacturers to begin adding a date of manufacture stamp to the handle area of the window gasket assembly.

Because Amtrak appears to be taking an appropriate approach to testing, maintaining, and documenting the emergency windows on the entire fleet, a safety recommendation to address the failed emergency window handles in this accident is not necessary. However, the Safety Board will continue to monitor and document this issue in future accident investigations to ensure that the emergency window handles function as designed.

Conclusions

Findings

1. Amtrak train No. 58 and its related equipment functioned as intended and did not cause the derailment.

2. The operation of the train was not a factor in the accident.

3. The inadequately restrained east rail lifted out of the tie plates because of expansion caused by warm temperatures resulting in the rail shifting and the gage widening, causing the wheels of the train to drop between the rails.

4. Although the Canadian National Railway Company had written instructions for maintaining continuous welded rail and preventing track buckling, track employees at multiple levels did not follow or ensure adherence to these instructions.

5. Had the employees who maintained the track at the accident site followed the written procedures the rail shift condition likely would not have occurred.

6. Although a Federal Railroad Administration preaccident inspection identified track deficiencies, the Federal Railroad Administration's oversight was not effective in ensuring corrective action by the Canadian National Railway Company.

7. Although it was not a factor in this accident, Amtrak was not assuring that all of its crewmembers received emergency preparedness training.

8. The Federal Railroad Administration was not conducting periodic audits of Amtrak's passenger train emergency preparedness plan to ensure that all crewmembers were receiving the required emergency preparedness training.

9. The handle on an emergency window on the sleeper car was found to have failed.

Probable Cause

The National Transportation Safety Board determines that the probable cause of Amtrak's *City of New Orleans* accident on April 6, 2004, near Flora, Mississippi, was the failure of the Canadian National Railway Company to properly maintain and inspect its track, resulting in a rail shift and the subsequent derailment of the train, and the Federal Railroad Administration's ineffective oversight to ensure the proper maintenance of the track by the railroad.

Recommendations

As a result of its investigation of the April 6, 2004, derailment of Amtrak's train No. 58, the *City of New Orleans,* near Flora, Mississippi, the National Transportation Safety Board makes the following safety recommendations:

To the Federal Railroad Administration:

Emphasize to your track inspectors the importance of enforcing a railroad's continuous welded rail program as a part of the Federal Track Safety Standards, and verify that inspectors are documenting noncompliance with the railroad's program. (R-05-05)

Establish an audit and enforcement program to verify that Amtrak complies with initial and periodic emergency preparedness training for all crewmembers systemwide, as required by 49 *Code of Federal Regulations* Part 239. (R-05-06)

To the Canadian National Railway Company:

Establish an audit program to verify that employees follow the current written track maintenance and inspection procedures, including rail anchoring requirements and specifically maintaining the preferred rail laying temperature. (R-05-07)

To the National Railroad Passenger Corporation (Amtrak):

Report to the Board within 90 days a schedule for training your employees who have not received emergency preparedness training as required by 49 *Code of Federal Regulations* Part 239. (R-05-08)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

MARK V. ROSENKER
Acting Chairman

RICHARD F. HEALING
Member

ELLEN ENGLEMAN CONNERS
Member

DEBORAH A. P. HERSMAN
Member

Adopted: July 26, 2005

Deborah A. P. Hersman, Member, filed the following dissenting opinion on July 28, 2005.

Notation 7642A

Member HERSMAN, dissenting:

I voted against the recommendations made in this report because I believe we have missed the mark -- the probable cause of this accident has to do with CN's lack of compliance with their own CWR program. In order to make a positive change, we must rely on the actions of the railroad and appropriate FRA oversight to prevent similar accidents from occurring in the future. What did not contribute to the cause or the severity of this accident was the currency of Amtrak crew's PREPARE training.

RECS #2 and #4 - Emergency preparedness training

I cannot reconcile the fact that 50% of the recommendations issued in the report are focused on the emergency preparedness training of the Amtrak crew whose actions were appropriate during the accident. Moreover, there is no finding in the report that such training or lack of training was causal to the accident or even a contributing factor. Nor is there any discussion in the report about any inappropriate action or inaction by the Amtrak crew during the accident sequence. Amtrak crew members notified CN dispatch, Amtrak's CNOC, and local 911 via radio or cell phones as soon as possible after the derailment. A call made to local 911 by a member of the crew provided detailed information about the train's location, the number of passengers aboard and the general conditions of the accident. The fact that local responders arrived on scene within 16 minutes of the derailment is a testament to the accurate information provided, even though the crew member called from his cell phone in the overturned dining car and the derailed train was approximately 1 1/2 miles from a paved road. I agree that Amtrak was not in compliance with the emergency preparedness provisions of 49 CFR Part 239. However, FRA has the responsibility to enforce this regulation. Our role is to identify the probable cause and make recommendations to prevent similar accidents from occurring. Neither the training of the crew nor their actions post accident were a factor in this accident; in fact, their actions were entirely appropriate. However, by devoting two of four recommendations to the issue of Amtrak's emergency preparedness training, the report implies otherwise.

RECS #1 and #3 - Continuous Welded Rail (CWR)

The two recommendations to FRA and CN regarding CWR are consistent with the probable cause, but I would have preferred to see more specificity with respect to certain areas of CWR programs. With only 119 track inspectors at the state and federal level overseeing the safety of more than 200,000 miles of track, we must rely on the railroads to develop robust CWR programs and follow through on implementing them.

While we ask FRA to enforce CWR programs and verify that inspectors are documenting noncompliance, we do not ask FRA to review all CWR programs to

ensure that railroads have in effect (as per the CWR regulations) procedures which specifically address maintaining a desired rail installation temperature range when making rail repairs (49 CFR 213.119). It is unacceptable that CN has not responded to FRA's request from over a year ago to clarify what it means by the "onset of warm weather" in its CWR program.

As early as 1971, the FRA recognized that installation temperature and anchoring were fundamental CWR issues. Disturbing CWR beyond the installation temperature is widely understood to affect the rail. The failure of CN to effect a more permanent repair to the CWR in the vicinity of the accident is identified in our findings as a factor in this accident. Furthermore, it was not an isolated occurrence on the CN, according to the track supervisor who stated that there were 15 other locations where 2 to 3 inches of rail had been added during the winter but had not yet been welded at the time of the accident.

I believe that there are other areas that we might have addressed to improve the safety of CWR. For example, we could ask FRA to: 1) review best practices (several Class I railroads have not had any reportable accidents caused by buckled rail in a year) and draft a model CWR program; or 2) compare submitted proposals to the AREMA manual's section on CWR (1988) which provides basic guidance. These recommendations could constitute improvements to the existing program without being overly prescriptive.

Additionally, I remain concerned about the many situations in which "temporary" repairs become long-term or permanent. We could recommended that, in light of this accident and others involving derailments due to temporary repairs of CWR, FRA review the nature and duration of "temporary" repairs to CWR and determine when delays in making such temporary repairs more permanent is acceptable. (One Class I railroad achieves permanent repairs on CWR in a much more expedited fashion because it makes temporary repairs operationally inconvenient).

Finally, in the report, there is some discussion of a CN computerized rail defect tracking system (RDTS) which appears to be underutilized or ineffective. Yet another major Class I railroad uses a rail tracking program that readily identifies those locations in CWR that may be vulnerable to buckling because more permanent repairs have not been made to rail cuts or plugs inserted and may be subjected to excessive longitudinal forces. Why wouldn't we recommend that CN improve their data collection and tracking systems?

The draft report was timely and thorough, and I commend the staff and the parties on their work. However, I believe we missed an opportunity to address the root cause of derailment through our recommendations. We shouldn't wait for another accident to develop a more complete record of weaknesses in CWR maintenance. We already possess enough information to make needed recommendations to improve the safety of CWR.

Appendix A

Investigation

The National Transportation Safety Board was notified about 8:30 p.m. eastern daylight time on April 6, 2004, that an Amtrak train had derailed near Flora, Mississippi. The Safety Board launched a railroad accident investigation team to the site. The team included Vice Chairman Mark Rosenker (accompanied by a public affairs representative and a family affairs representative) and investigative groups for operations, track, signals, mechanical, human performance, and survival factors/crashworthiness factors.

Parties to the investigation included the Federal Railroad Administration, the Canadian National Railway Company, Amtrak, the Madison County sheriff, United Transportation Union, and the Brotherhood of Locomotive Engineers and Trainmen.

Appendix B

Emergency Responders

The agencies in the following list responded to the Flora accident:

1. Flora Volunteer Fire Department
2. Gluckstadt Volunteer Fire Department
3. Ridgeland Fire Department
4. Bentonia Volunteer Fire Department
5. Canton Volunteer Fire Department
6. Madison County Sheriff's Office
7. Madison Police Department
8. Yazoo County Emergency Management Agency
9. American Medical Response
10. Acadian Ambulance Service
11. University of Mississippi Medical Center – Air Care
12. Kearney Park Volunteer Fire Department
13. Madison Fire Department
14. Southwest Madison Volunteer Fire Department
15. Camden Volunteer Fire Department
16. Farmhaven Volunteer Fire Department
17. Madison County Emergency Management Agency
18. Yazoo County Sheriff's Office
19. Mississippi Emergency Management Agency
20. EmergyStat Ambulance Service
21. University Hospital and Clinics – Holmes

Appendix C

Previous Safety Board Recommendations

The Safety Board has issued numerous recommendations to Amtrak to improve the emergency response and emergency training of its employees and emergency responders in communities through which Amtrak trains travel; and to the FRA to improve exit window and CWR maintenance and inspection procedures and intervals.

Listed below are 10 recommendations issued from 1979 through 2004. Eight recommendations asked Amtrak to upgrade training in emergency response. One recommendation to the FRA asked for improvements in maintenance and inspection of all emergency window exits, and another recommendation to the FRA requested compliance with correct CWR inspection procedures.

Emergency Preparedness and Passenger Safety Training

Accident. On June 8, 1978, a Conrail commuter train, consisting of 4 self-propelled cars, struck the rear of an Amtrak passenger train consisting of 1 locomotive and 14 cars at Seabrook, Maryland. The impact caused eight cars of the Conrail train and eight cars of the Amtrak train to derail, injuring 16 crewmembers and 160 passengers.

Relevant findings. Emergency personnel were unfamiliar with the train's emergency equipment because Amtrak and Conrail had not provided training and familiarization for railroad emergencies to local rescue organizations. Passengers on both trains had little or no guidance in evacuating the trains and obtaining medical assistance. Crewmembers lacked knowledge of emergency procedures, including how to manually open doors.

Relevant recommendations.

R-79-35 to Amtrak
Arrange for a program along passenger train routes for training and familiarizing emergency rescue organizations in the type of equipment being used.

Issued 3/21/1979; Closed—Acceptable Alternate Action, 10/8/1980

Amtrak said it prepared an emergency procedures manual and distributed it to fire departments and rescue squads along Amtrak routes. The manual covered the entry to Amtrak equipment and evacuation of passengers and crewmembers during emergencies. Amtrak said it did not have funding to undertake a training program throughout the system and that the booklet was designed to be self-instructive.

R-79-36 to Amtrak
Establish a program to train crewmembers in the proper procedures for care of passengers in derailment and emergency situations.

Issued 3/21/1979; Closed—Acceptable Action, 10/8/1980

Amtrak said newly hired and existing on-board service crewmembers had been trained in a standard Red Cross multi-media first aid training program by fully qualified instructors since early 1978. Amtrak said the training program was ongoing for newly hired and existing employees and said it trained 1,173 on-board service personnel in fiscal year 1979 and expected to train an additional 1,200 employees in fiscal year 1980. All new employees receive, as part of their regular training, detailed training in emergency procedures. Amtrak said it trained 636 employees in fiscal year 1979 and expected to train 600 in fiscal year 1980.

Accident. On June 15, 1982, an Amtrak passenger train with 315 persons on board derailed near Emerson, Iowa, while traveling 74 mph when it encountered flood waters over the top of washed-out rails. The accident resulted in 1 passenger fatality and 27 injuries.

Relevant findings. Emergency personnel were not aware, prior to the accident, of Amtrak's emergency evacuation procedures booklet, and thus were not informed of the proper procedures to be used in entering and evacuating passenger cars. Amtrak's training program in emergency procedures for its on-board employees was not effective in providing adequate assistance to passengers involved in the accident.

Relevant recommendations.

R-83-23 to Amtrak
Provide copies of Amtrak's emergency evacuation procedures booklet to all emergency response organizations not possessing those procedures from the original distribution, along all designated passenger train routes.

Issued 2/28/1983; Closed—Acceptable Action, 10/12/1984

Through the National Safety Council, Amtrak said it distributed 2,140 emergency evacuation manuals to emergency medical service units throughout the country, and planned to distribute 1,000 more copies. Amtrak said 15,000 copies had already been distributed in the previous 2 years. It also said instructional meetings with emergency medical services and fire departments groups were held in Arkansas, Nebraska, and California, and more meetings would be held on request.

R-83-24 to Amtrak
Review and revise, where necessary, the training and retraining programs for on-board employees in emergency procedures, including the operation of emergency exits, to improve on-board employee competence to render effective assistance to passengers in emergency situations.

Issued 2/28/1983; Closed—Acceptable Action, 1/11/1985

Amtrak said it developed and distributed to its field offices an updated, advanced 4-hour course on emergency procedures. The course contained instructions pertaining to several train types and was expanded to include transfer of passengers from stalled trains and evacuation from tunnels. The course uses lecture, discussion, and role play techniques to teach proper response to an emergency as well as hands-on experience in extinguishing a fire under controlled conditions.

Accident. On June 23, 1982, an Amtrak 10-car passenger train with 307 persons on board stopped at Gibson, California, after fire and dense smoke were discovered in a sleeping car. Two passengers died, 2 passengers were injured, and 57 passengers and 2 train crewmembers were treated for smoke inhalation.

Relevant finding. Amtrak and railroad operating personnel should be given hands-on training in procedures for emergency evacuation from passenger equipment.

Relevant recommendation.

R-83-72 to Amtrak
Include both Amtrak supervisory personnel and on-board service personnel in refresher training programs covering the changes in Amtrak emergency procedures. Arrange with all railroads, over which Amtrak trains are operated, emergency training for train crew employees qualified for assignment to passenger service.

Issued 7/8/1983; Closed—Acceptable Action, 8/20/1986

Amtrak said it developed emergency procedures refresher training for supervisors and on-board service employees and a course for front-end train crews and contract railroad crews. It also said that new crews and contract crews must take a 3-day course that includes emergency procedures.

Accident. On August 5, 1988, an Amtrak passenger train derailed near Saco, Montana. Five passengers and 1 Amtrak service crewmember were seriously injured, and 87 passengers and 13 Amtrak service employees received minor injuries.

Relevant finding. Difficulties were experienced by crewmembers and emergency responders in extricating passengers from the overturned cars, including a passenger from a designated handicapped sleeping compartment that was not equipped with an emergency window.

Relevant recommendation.

R-89-35 to Amtrak
Develop procedures and equipment for evacuation of passenger cars involved in an accident, and train employees in those procedures and equipment.

Issued 5/31/1989; Closed—Acceptable Action, 1/16/1990

Amtrak said it had previously distributed 50,000 copies of its emergency evacuation procedures manual. The manual was updated in 1989, and distributed. Amtrak said initial and refresher emergency situation training was being given to all train crews annually, and its new training programs were being presented to police, fire, and medical response personnel. Amtrak said its evacuation procedures were effective and it did not plan to institute additional procedures.

Accident. On July 31, 1991, an Amtrak passenger train, consisting of 2 locomotives, 3 baggage cars, and 15 passenger cars, derailed 6 cars in Lugoff, South Carolina. The derailed passenger cars collided with freight train hopper cars stored at a nearby siding. Eight passengers were killed, 12 passengers were seriously injured, and 12 on-board service personnel and 53 passengers sustained minor injuries.

Relevant finding. On-board service crewmembers were not required to attend periodic training in first aid or emergency procedures and failed to follow appropriate established emergency procedures, such as using the public address system to inform passengers about the emergency, and give related instructions or to locate passengers who had medical expertise and might have been able to render assistance.

Relevant recommendation.

R-93-23 to Amtrak
Require that all on-board service personnel periodically take training in the emergency operating rules in first aid, cardiopulmonary resuscitation, and the use of the public address system during train emergencies.

Issued 11/30/1993; Closed—Acceptable Action, 12/5/2000

Amtrak said that it provides all on-board crewmembers with comprehensive training called PREPARE (Passenger Railroad Emergency Preparedness and Response Education). It contains training in the following: cardiopulmonary resuscitation, emergency first aid, prevention of disease transmission, communications procedures, situational awareness, passenger evacuation, and rail equipment familiarization. The course is required every 2 years.

Accident. On August 9, 1997, an Amtrak passenger train with 294 passengers and 18 Amtrak employees on board derailed near Kingman, Arizona. Traveling at 89 mph, the

train derailed after it encountered a hump in the tracks and crossed a bridge that had been damaged by a flash flood. Ten Amtrak employees and 173 passengers were injured.

Relevant finding. Amtrak's current system for providing emergency training for train crews and on-board service personnel has not been effective, which has resulted in personnel being provided differing levels of emergency situation training.

Relevant recommendation.

R-98-59 to Amtrak
Implement effective controls to monitor and ensure that all train crews and on-board service personnel received the necessary initial and recurrent emergency training to provide for passenger safety.

Issued 9/16/1998; Closed—Acceptable Action, 12/5/2000

Amtrak said its human resources division developed guidance for training Amtrak employees and established a central repository of training information and accurate record-keeping procedures. When an employee completes an internal or external course, Amtrak said the information is recorded in a database and checked periodically.

Emergency Window Exit Maintenance and Inspection

Accident. On February 16, 1996, a Maryland Rail Commuter (MARC) train collided with an Amtrak passenger train near Silver Spring, Maryland. The MARC train consisted of one locomotive and three cars. The Amtrak train had 2 locomotives and 15 cars. All three operating crewmembers and eight passengers on the MARC train were killed in the derailment and subsequent fire. Eleven passengers on MARC and 15 of the 182 crewmembers and passengers on the Amtrak train were injured.

Relevant finding. Prescribed inspection and maintenance test cycles are needed to ensure reliable operation of emergency windows in all long-distance and commuter rail passenger cars.

Relevant recommendation.

R-97-18 to the Federal Railroad Administration:
Provide promptly a prescribed inspection and maintenance test cycle to ensure the proper operation of all emergency exit windows as well as provide that the 180-day inspection and maintenance test schedule is prescribed in the final rule.

Issued 8/28/1997; Closed—Acceptable Alternate Action, 7/27/2001

The FRA issued a final rule, effective July 12, 1999, that included significant passenger safety upgrades. It included a requirement for mechanical inspection every 3 months of a representative sample of emergency window exits for proper operation. The

rule requires the FRA to notify railroads of inspection results and require railroads to correct deficiencies. Before the rule became effective, the FRA issued an emergency order on April 20, 1996, requiring window exit inspections and repair of deficiencies.

Welded Rail Inspections

Accident. On January 18, 2002, a Canadian Pacific Railway freight train derailed 31 of its 112 cars near Minot, North Dakota. Five tank cars carrying anhydrous ammonia ruptured, resulting in a vapor plume covering the derailment site and surrounding area. One resident was killed and about 60 area residents were rescued. As a result of the accident, 11 people sustained serious injuries and 322 people, including 2 train crewmembers, sustained minor injuries.

Relevant finding. FRA's oversight of Canadian Pacific Railway's CWR program was ineffective because the agency neither reviewed the program nor ensured that its track inspectors had copies of the program to determine if the railroad was in compliance with it.

Relevant recommendation.

R-04-03 to the Federal Railroad Administration
Instruct Federal Railroad Administration track inspectors to obtain copies of the most recent continuous welded rail programs of the railroads that fall within the inspectors' areas of responsibility and require that inspectors use those programs when conducting track inspections.

Issued 3/15/2004; Closed—Acceptable Action, 6/22/2005

The FRA said it would issue a technical bulletin, which will be a rewrite of its track compliance manual, to emphasize the requirement that

> inspectors must be aware of the procedures in effect before inspecting each railroad. When conducting inspections, the inspector must make observations to determine if the railroad is following its basic safety procedures.

The FRA also said that inspectors were reminded of this requirement during technical workshops in 2004.