# National Transportation Safety Board
**Washington, D.C. 20594**

## Railroad Accident Brief

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| **Accident No.:** | DCA-07-MR-009 |
| **Location:** | Oneida, New York |
| **Date:** | March 12, 2007 |
| **Time:** | 6:58 a.m., eastern daylight time[1] |
| **Railroad** | CSX Transportation |
| **Property Damage:** | $2.07 million |
| **Environmental Cleanup:** | $4.66 million |
| **Injuries:** | None |
| **Fatalities:** | None |
| **Type of Accident:** | Derailment |

# Synopsis

On Monday, March 12, 2007, about 6:58 a.m., CSX Transportation (CSX) train No. Q39010, a mixed freight train, derailed near Oneida, New York. The train was en route from Buffalo, New York, to Selkirk, New York. At the time of the derailment, the train was traveling about 47 mph. The train consisted of 3 locomotives and 78 cars. Twenty-nine cars derailed. Six tank cars were breached, including four carrying liquefied petroleum gas, one carrying toluene, and one carrying ferric chloride. An explosion and fire followed that led local emergency response officials to close two elementary schools and evacuate a 1-mile area around the derailment site. Four firefighters were taken to a hospital for observation as a precaution because they had stepped in a pool of ferric chloride. There were no fatalities. Estimated damages and environmental cleanup costs were $6.73 million.

# The Accident

The engineer and conductor went on duty at CSX's Frontier Yard in Buffalo, New York, at 2:30 a.m. to relieve the inbound crew on train No. Q39010. They said that after leaving Buffalo the trip was uneventful until the derailment and that the train had responded normally to the operating conditions.

Near control point 266, about 6:58 a.m., while the train was traveling at 47 mph and the locomotives were pulling the train in throttle position No. 2,[2] both crewmembers heard a loud

[1] All times in this brief are eastern daylight time.

[2] The throttle has eight positions, and position No. 8 has the highest power output.

“pop” from under the locomotive. Immediately, the engineer looked in the rearview mirror and could see sparks at the spot in the track where the crew had heard the noise, then the brakes applied with an emergency application. The event recorder indicated that the engineer had kept the locomotive brakes released in response to the emergency application.[3]

The engineer said that he saw a fire near the middle of the train. The crew contacted the train dispatcher and reported that the train was on fire. After coming to a stop, they exited the locomotive and walked ahead of the train. The conductor made contact with the arriving emergency responders and gave them the written consist of the train.

## Investigation

The investigation revealed that the train crew was qualified and trained to perform their duties correctly. Testing and a review of records showed that the signal system had functioned as designed. Postaccident equipment inspections and air brake tests showed that the locomotives and cars had no defects that would have caused or contributed to the collision. The only item noted was marks on the wheels of the front portion of the train that did not derail that passed over the point where a broken rail was found. (See *Postaccident Testing.)*

## Emergency Response

On the morning of March 12, 2007, the Oneida Fire Department chief[4] was driving north on Broad Street to his station located at 109 North Main Street. (See figure 1.) He noticed a large fire in the distance and began driving in that direction. After he arrived on West Elm Street, he drove along a dirt access road between West Elm Street and the railroad. From this road, he saw a large fire and rail cars near the track. He went back to West Elm Street and established a command post there. He radioed his station and requested that one engine (Engine 2) respond to the north side of the railroad. A deputy fire chief responded with this engine. Two engines (Engines 1 and 3) responded to the south side of the railroad at West Elm Street. The fire chief also requested a tanker from the Canastota Fire Department, a tanker from the Wampsville Fire Department, and the Oneida County Hazmat Team. An ambulance was also dispatched to the scene to stand by.

[3] The CSX train-handling guidelines instruct engineers to keep the locomotive brakes released after an emergency application of the brakes when the locomotives are in power before the application. Because the brakes on the locomotives can be more effective than those on the train, keeping the locomotive brakes released prevents the cars on the train from running into the locomotives.

[4] The chief of the Oneida Fire Department later became the incident commander.

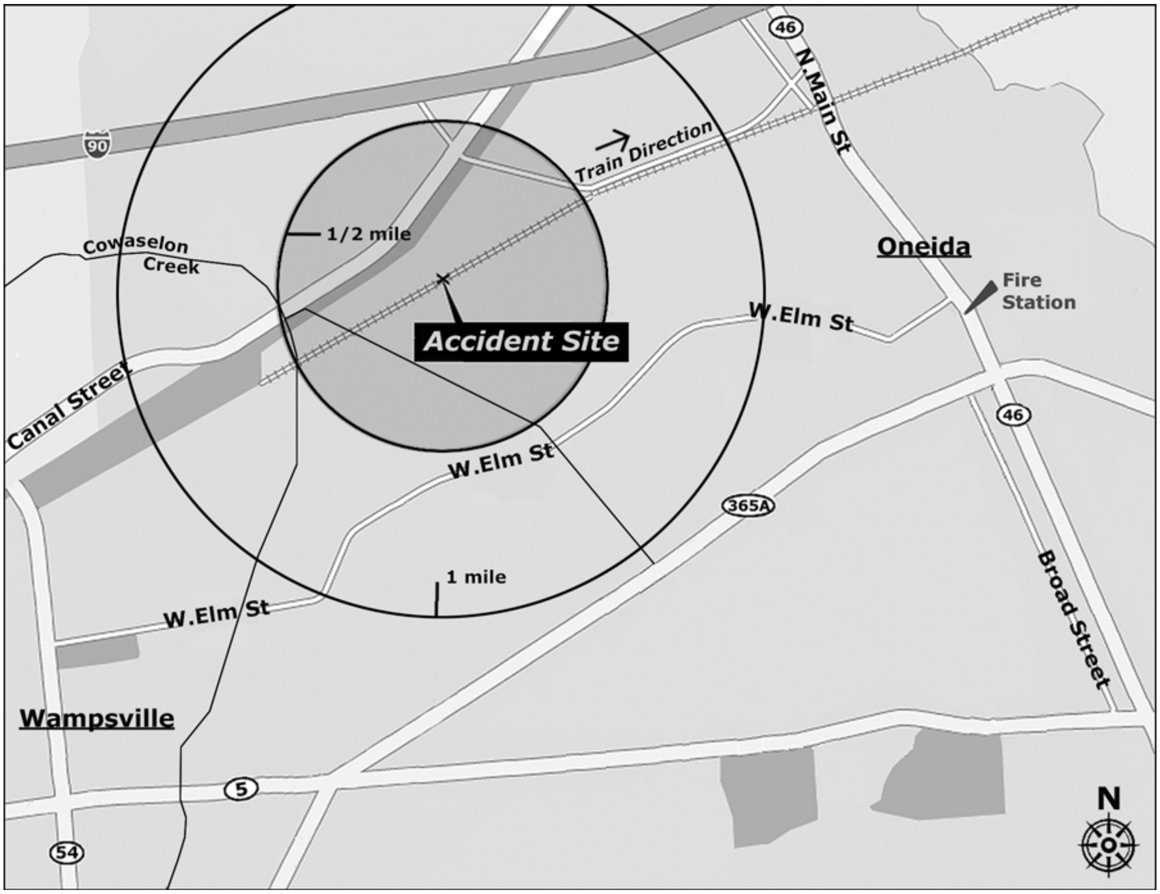


**Figure 1.** Map of accident area. (The 1/2-mile and 1-mile radii circles indicate evacuation areas around the accident site.)

The Madison County Communications Center operates the 911 and emergency communications for the county. The first 911 call was received about 7:03 a.m. The caller reported that a train had exploded on the train tracks on Canal Street in Oneida.

According to the fire chief, the deputy fire chief met the train crew on the north side of the track. The crew gave the deputy fire chief the train consist. The fire chief estimated that he received this information within about 30 minutes of his arrival on scene.

The initial evacuation area was a 1-mile radius around the accident site. After a further assessment, the evacuation area was reduced to a 1/2-mile radius that included eight houses. The mayor of Oneida declared a state of emergency that made this evacuation mandatory. The Oneida Police Department, the Madison County Sheriff, and the New York State Police conducted the evacuation. A school bus and an ambulance were used to assist those without transportation. The Oneida City School District bus garage was used as a shelter for evacuated residents. Two elementary schools (Durhamville and North Board Street) were closed, and students were taken to Oneida High School.

Throughout the morning, local and railroad responders began to assess the accident scene and develop action plans. Based on observations from a New York State police helicopter that flew over the accident site with a CSX representative on board, it was estimated that cars 19 through 53[5] were involved in the derailment; two propane cars were breached; one propane car was burning; and the toluene car was burning and venting. Because the toluene car was venting, responders planned defensive actions. No fire suppression was conducted for the tank car fires; however, unmanned water monitors were used to cool the cars.

During the afternoon and evening, local railroad responders began to assess the damage to the derailed cars and tested the pressure of the derailed cars. Based on these assessments, they made plans for transferring the contents of the damaged cars to either tanker trucks or empty rail tank cars brought from other locations. They also decided which cars had limited damage and could be re-railed.

The state of emergency was lifted at 3:00 p.m. on March 15, 2007, 3 days after the derailment, and evacuated residents were allowed to return to their homes.

## Description of Derailment and Damage

The first 24 cars of the train did not derail. The 25th car was still attached to the train, and the front part of the car was not derailed. The rear of the car was off the tracks to the south side, and the truck assembly[6] was no longer under the rear of the car. Approximately 1,284 feet behind the 25th car, the 26th car lay on its side off the tracks to the south, and both truck assemblies from this car were missing. A truck assembly was found 240 feet west of the 26th car, and it matched the partially derailed 25th car. Approximately 500 feet from this single truck assembly was a pileup of 27 derailed cars. The two truck assemblies matching the 26th car were located within the pileup. The rear 25 cars of the train did not derail. In total, 29 cars derailed.

The intact truck assembly on the front of the 25th car was inspected, and no unusual wear or measurements were found. The detached truck assembly from the 25th car also was inspected, and the areas that normally contact the car did not have unusual wear patterns. The northern side frame of the 25th car showed rail burns[7] on the underside. (See figure 2.) This type of rail burn occurs when the wheels drop between the rails and the side frame of a derailed railroad car moves along the top of the rail. The rail burn damage had scoured and disfigured the surface of the underside of the side frame of the rear truck.

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[5] The cars that derailed were the 25th through the 52nd.

[6] A *truck assembly* consists of two axles and wheel sets, two side frames, and a cross piece (bolster) with the necessary braking and spring assemblies.

[7] A *rail burn* is a type of long dent, oriented more or less longitudinally, that is caused by friction from a car (not the wheel) moving along a rail.

At milepost QC 266.0, a section of the south rail was recovered that had a portion of the head of the rail broken out. (See figure 3.) The break in the rail was 55.5 inches west of the tip of the adjacent switch point of the crossover. The track was destroyed from milepost QC 266.0 to 700 feet east of the milepost. The next 1,000 feet of track were moderately damaged. The signal equipment case and the power crossover switches at control point 266 were destroyed. Estimated equipment, track, and signal damage was $2.07 million.

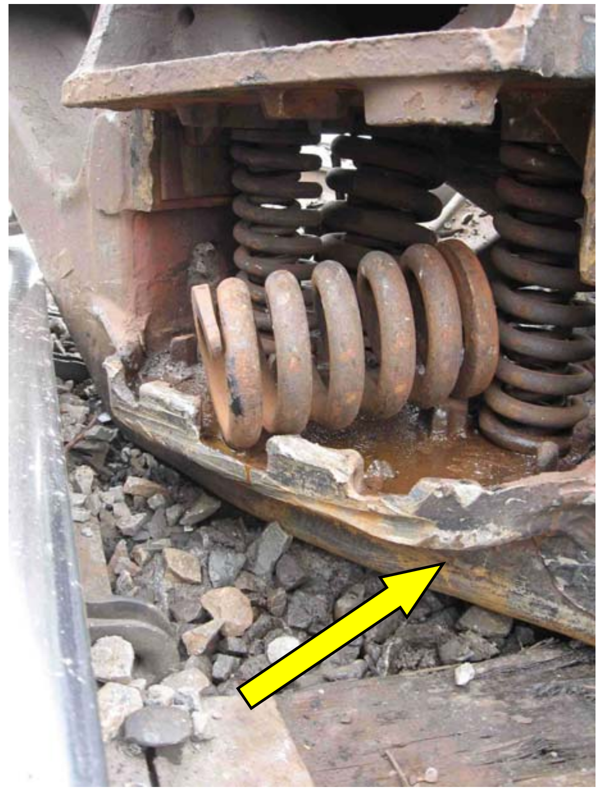

**Figure 2.** Rail burn on underside of northern side frame of 25th car.

**Figure 3.** Section of south rail with portion of rail head broken out.

## Hazardous Materials Information

Of the 29 derailed cars, 22 were tank cars loaded with hazardous materials. Six of these tank cars were breached and released hazardous materials.

Derailed cars (numbered from the front of the train) 30, 31, 32, and 42 were pressurized tank cars carrying liquefied petroleum gas. During the derailment, all four of these tank cars were punctured and they released their entire contents, which subsequently burned. When emergency response personnel arrived, they prevented access to the area and allowed the product to burn off. Additional air was pumped into the tanks of cars 30 and 31 to purge and burn the entire contents. The other 16 derailed tank cars containing liquefied petroleum gas had their loads vented and flared or transferred.

Derailed cars 34 and 40 were nonpressurized tank cars. Car 34 carried toluene (a flammable liquid that is unhealthy when its vapors are inhaled or it is absorbed by the skin) and sustained a small leak on the bottom outlet valve. The car released about 500 gallons, some of which was consumed by fire. Car 40 contained ferric chloride, a corrosive liquid. This tank car sustained a large tear on one side and lost its entire contents, approximately 17,000 gallons. Lime was used to neutralize the ferric chloride in the contaminated soil.

Within 12 hours after the derailment, AMEC Earth and Environmental, Inc. (AMEC), which was contracted by CSX to monitor and perform environmental remediation of the accident site, began monitoring and sampling the surface water near the derailment site. AMEC also took pH readings of the water several times daily for the next 3 days. The monitoring and sampling was reduced to once daily at four locations until March 17, 2007. Periodic sampling continued until April 20, 2007. In addition, samples from tap water at homes within a 1/2-mile radius of the derailment also were tested.

Interim remedial measures to stop the spilled materials from entering the water system included installing absorbent booms and pads in the nearby unnamed tributary and Cowaselon Creek. AMEC dug interceptor trenches parallel and perpendicular to the tributary to capture the released product before it entered the tributary. AMEC also constructed a limestone berm around the tributary to buffer surface water and shallow groundwater entering the tributary and applied lime and soda ash to lowland areas where there was evidence of ferric chloride impact. Initially, AMEC removed from the trenches 10,560 gallons of water contaminated with ferric chloride and sent the water for disposal. Later, because of heavy rains, AMEC removed and sent for disposal about 90,000 gallons of water.

AMEC removed 7,128 tons of contaminated soil from the track bed and adjacent access road. This remediated the ferric chloride hazard; however, after treatment, 3,729 tons of the soil still were moderately contaminated with toluene, and the soil was sent to a local waste disposal site. Another 358 tons of soil were highly contaminated with toluene, which required the soil to be sent to a specialized waste disposal site. The soil from the two burn pits also was excavated and sent for disposal. According to CSX, environmental cleanup costs totaled $4.66 million.

## Operations Information

The CSX Operating Rules, effective October 1, 2004, governed train movements on the Mohawk Subdivision of the CSX Albany Division. The trains were authorized by signals in a traffic control system operated by a train dispatcher in Selkirk, New York. CSX train crews used the Albany Division Timetable/Special Instructions, effective November 1, 2004, for specific instructions about the territory.

## Event Recorder Information

According to the data from the locomotive event recorder, at 6:58:37 a.m. the train was traveling at 47 mph with the throttle handle in position No. 2 and the brake pipe charged to 88 pounds per square inch (psi). One second later, the brake pressure indicated 69 psi. At 6:58:39, the event recorder data indicated that the train speed was 45 mph, the throttle handle was still in position No. 2, and the train line emergency brake application was recorded. At 6:58:40, with the train speed at 44 mph, the throttle handle indicated idle. The end-of-train device also indicated that the emergency application had reached the rear of the train. By 6:59:36, the train speed had dropped to 0 mph. The locomotives traveled approximately 2,018 feet after the initiation of the emergency brake application.

## Meteorological Information

The nearest meteorological station was at Syracuse, New York, approximately 30 miles west of the derailment. On March 12, 2007, at 6:54 a.m. the temperature was 19° F, and the weather was partly cloudy with winds from the southeast at 5 mph.

## Track Information

Two tracks at the derailment location ran approximately east and west. Track No. 1 was the northernmost track. Trains could operate on either track in either direction. However, eastbound trains heading toward Selkirk predominately operated on track No. 2, and the westbound trains heading toward Syracuse operated on track No. 1. The track gradient in the derailment area ranged from 0.00 to -0.25 percent. The alignment was tangent (straight) from milepost 268.6 to milepost 265.5.

The derailment occurred at milepost 265.98 while the train was moving at 47 mph on track No. 2. The train was trailing through the eastern switch of a crossover that connected track No. 1 with track No. 2.

The main tracks in the area of the derailment were classified as class 4 track under the Federal Railroad Administration (FRA) guidelines of 49 *Code of Federal Regulations* (CFR) Part 213. Maximum authorized speed for freight trains on class 4 track is 60 mph. However, because the train was a key train as defined by the Association of American Railroads Circular No. OT-55-I, "Recommended Railroad Operating Practices for Transportation of Hazardous Materials," the authorized maximum speed for the train was 50 mph. Annually, the two tracks carried 103.44 million gross tons (MGT), with an estimate of 51.72 MGT each.

The most recent major maintenance performed on the track was in 2004. At that time, replacement crossties were installed, and the track bed was resurfaced.

According to CSX records, a track inspector visually inspected the derailment site on March 8, 2007, and no exceptions were noted. Track records for the previous 90 days also showed that inspection frequency was consistent with FRA requirements.

On January 18 and March 24, 2006, the FRA conducted routine inspections, which included the area through the derailment site, and noted no defects.

## CSX Internal Rail Inspection History

As a contractor to CSX, Sperry Rail Services had recently inspected the track ultrasonically for internal defects, on July 12 and November 9, 2006. The July 12, 2006, inspection had a loss of bottom signal at the location where the broken rail was found, indicating that the ultrasonic signal was unable to reach the bottom of the rail and echo back to provide an internal image of the rail. The operator had recorded this finding.

The most recent ultrasonic inspection, on November 9, 2006, also had a loss of bottom signal in the same location. However, in this instance the operator decided to use a hand-held ultrasonic device because of visual evidence of shelling[8] on the top of the rail. Shelling can impede both the transfer of ultrasonic signals into the rail and the reflection of the signals back to the detector, reducing the effectiveness of the inspection. A hand inspection may be more likely to detect internal defects because the operator has some control over the orientation of the ultrasonic signal. The operator recorded the results of the hand screening as “negative hand test,” indicating that no defects had been found.

## Postaccident Testing

Sections of the broken rail found on scene were secured and sent to the Safety Board’s Materials Laboratory in Washington, D.C., for testing. The rail was identified and labeled as shown in figure 4.

[8] *Shelling* is surface cracking by metal fatigue near the gage corner caused by repetitive stresses. It is a progressive separation that may crack out at any level on the gage side of the rail but generally at the gage corner.

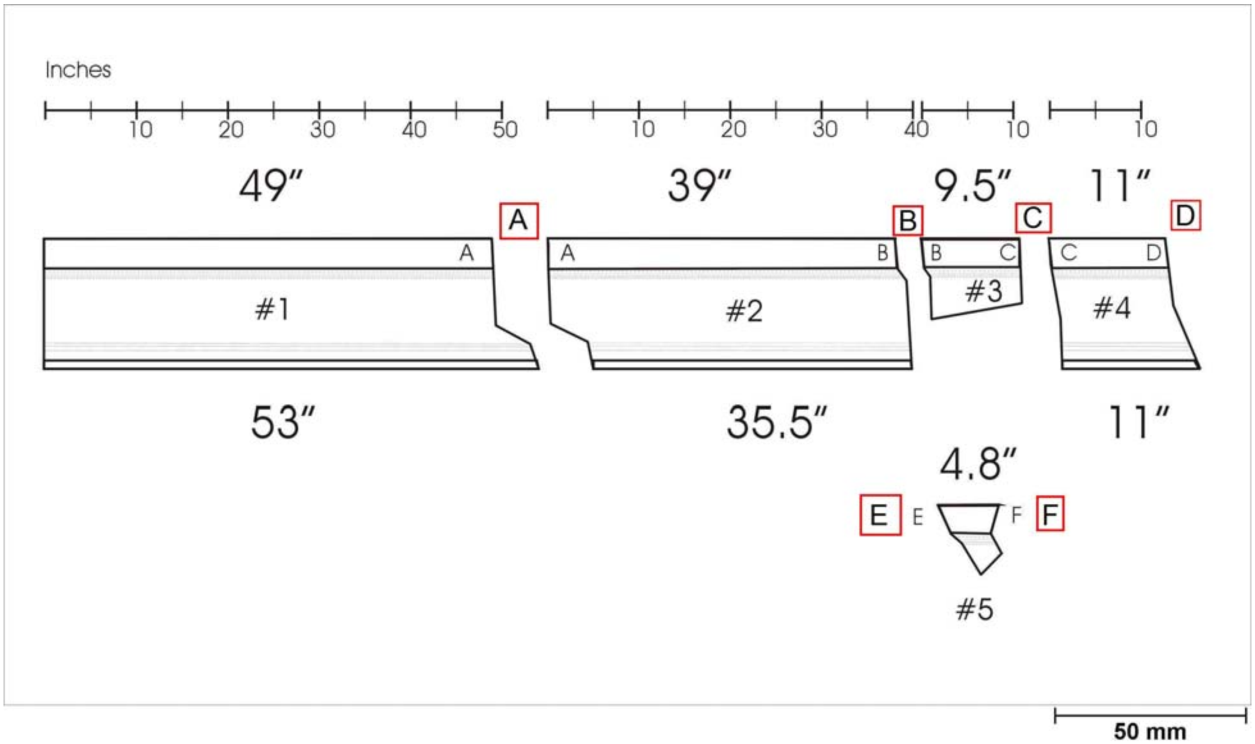


**Figure 4.** Broken rail sections. (Fractures labeled A through F.)

The running surfaces of each piece were examined visually. Extensive surface cracks and flat spots (smooth local depressions) were noted. All pieces showed shell cracks intersecting the running surface near the upper gage corner. Pieces 3 and 4 had a nearly continuous series of shell cracks along the length of each piece. The entire length of piece 5 displayed shell cracking. All pieces exhibited areas of shell cracks on the gage side of the running surface. Typical flat spots were 1 to 2 inches long. Measurements showed that most of the flat spots were depressed less than 0.010 inches below the adjacent surfaces. The flat spot adjacent to the east end of piece 4 measured 0.025 inch at its deepest. Cross sections of the rail were cut through pieces 1 and 2. No noticeable wear of the rail head was noted when the rail profiles were compared to each other and to profiles contained in the American Railway Engineering and Maintenance-of-Way Association *Manual for Railway Engineering*.

The six fractures between the sections of rail were inspected and labeled A through F. Fractures A, C, D, E, and F, although showing some signs of internal defects, contained primarily features typical of an overstress separation.[9]

Fracture B was dominated by a large detail fracture in the rail head that most likely was the primary fracture. (See figure 5.) A longitudinal shelling crack propagated below the running surface of the rail and turned downward to form the detail fracture. This fracture propagated in fatigue until it penetrated more than 70 percent of the existing head cross section. The detail fracture region was darkly oxidized with alternating bands of fine fatigue arrest lines and areas of

[9] An *overstress separation* of the rail is often caused by the forces of a derailment.

coarse fracture. The detail fracture measured 2.2 inches wide and 2 inches deep and extended into the web of the rail.

Both faces of fracture B were heavily damaged at and adjacent to the running surface of the rail. (See figure 6.) The damage appeared to be consistent with rail damage from wheel contact that occurs after the rail has fractured. Also, the rail damage correlated with the damage to the wheel treads of the cars at the front of the train that did not derail.

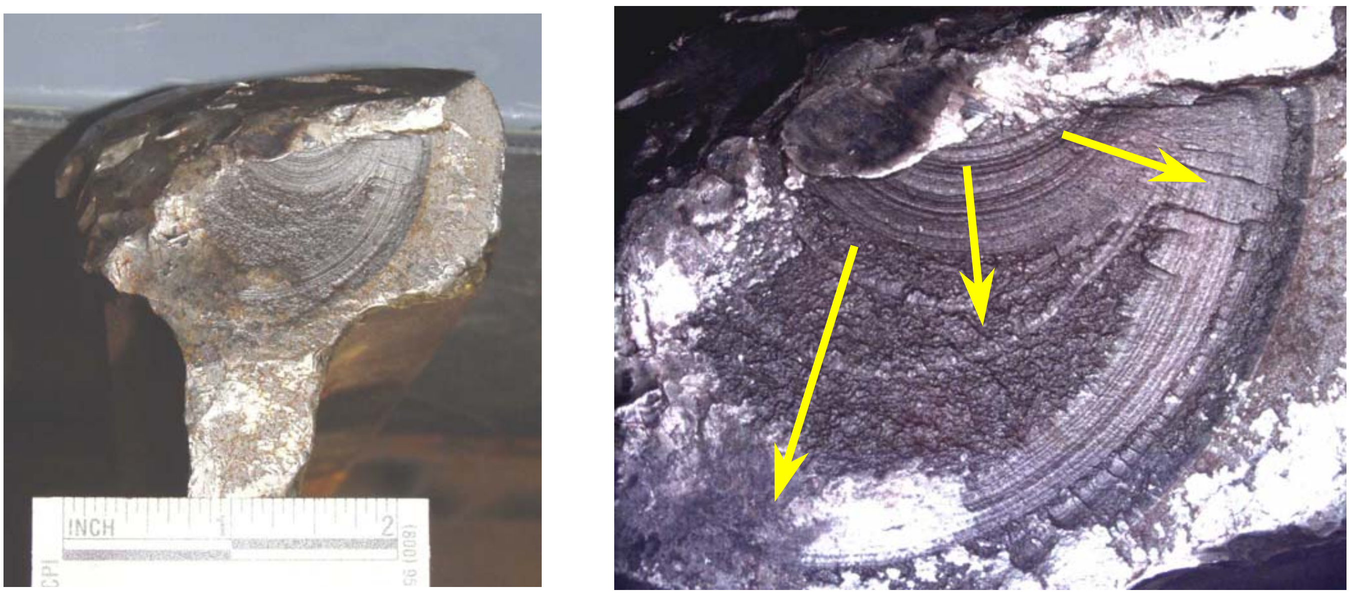


**Figure 5.** Rail fracture B. (Photographs taken with different lighting and magnification.)


**Figure 6.** Damage to both faces of rail fracture B.

## Internal Rail Inspection

FRA regulations regarding rail inspection at 49 CFR 213.237 require that a continuous search for internal defects be made of all rail in Classes 4 through 5 track, and class 3 track over which passenger trains operate, at least once every 40 MGT or once a year, whichever interval is shorter. CSX reported that it was inspecting the accident rail in accordance with these intervals. When the test was performed on November 9, 2006, the ultrasonic sensor on the hy-rail[10] vehicle had difficulty reading through the rail to the base; however, the operator performed a hand test to look for internal defects and noted that nothing was found. The FRA regulation required the next ultrasonic test of the rail to be performed before 1 year had passed. Using average tonnage, CSX determined that 40 MGT would have passed in August 2007, and the next ultrasonic inspection was to be performed at that time.

Estimates of rail defect growth rates indicate that the size of the internal defect that initiated the rail failure was likely large enough to have been detected during the prior ultrasonic inspection; however, the presence of shelling cracks on the railhead can obscure internal defects during ultrasonic inspections. As noted earlier in this report, shelling can also initiate a detail fracture into the head of the rail.

The Safety Board investigated a derailment of a Burlington Northern freight train that occurred in Superior, Wisconsin, on June 30, 1992.[11] An ultrasonic inspection had been performed in the month before the derailment, on May 13, 1992. The report described the inspection activity as follows:

> … the ultrasonic inspection car operator recognized that the rail contained shelling but did not consider the conditions severe enough to warrant an exception report. However, because of the surface condition, he conducted additional ultrasonic inspections using hand held equipment. The operator considered the rail to be free from internal defects based on his evaluation of the tests and his experience.

The circumstances of the inspection activity in the Superior accident are similar to those in the Oneida accident. The National Transportation Safety Board determined that the probable cause of the derailment at Superior was the failure of the rail from an undetected preexisting detail fracture that had initiated from shelling and had reached critical size. As a result of its investigation of the Superior accident, the Safety Board issued recommendations that addressed the effectiveness of internal rail inspections. New provisions were added to the Track Safety Standards through paragraphs (d) and (e) of 49 CFR 213.237 that were responsive to the Board's recommendations. These provisions appear to ensure that railroads are required to conduct valid continuous searches for internal defects and that no segments of rail are to remain in service without being inspected. In both the Superior and Oneida accidents, the rail inspection operators

[10] 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.

[11] National Transportation Safety Board, *Derailment of Burlington Northern Freight Train No. 01-142-30 and Release of Hazardous Materials in the Town of Superior, Wisconsin, June 30, 1992*, Hazardous Materials Accident Report NTSB HZM-94/01 (Washington, DC: NTSB, 1994). Excerpt is from page 73.

saw shelling conditions and conducted additional ultrasonic inspections but failed to find internal defects that subsequently caused derailments.

In its report of the derailment of a Norfolk Southern Railway Company freight train on October 20, 2006, near New Brighton, Pennsylvania, the Safety Board addressed the need to improve the effectiveness of internal rail inspections:[12]

> A damage-tolerance approach would establish an inspection frequency that allows internal rail defects to be identified before they reach critical size. The term *damage tolerance* means the ability of a structure to withstand damage without failure, including damage such as fatigue cracking or wear, which can develop from undetected manufacturing defects or from use in service. For most engineered structural components, including rail, an inspection and maintenance program to detect and repair damage in any component before it reaches critical size is integral to the damage tolerance of the structure. A damage-tolerance approach should (1) identify areas of rail that are prone to failure from high stress and fatigue and (2) determine appropriate inspection intervals based on the defect size detectable by the inspection method being used, the stress level, and defect (crack) propagation characteristics in the structure. Such an approach would consider all the factors that can affect defect growth rates, including rail head wear, accumulated tonnage, rail surface conditions, track geometry, track support, steel specifications, temperature differentials, and residual stresses in the rail. The capabilities and limitations of the inspection methods used to detect defects are a major factor in determining appropriate inspection intervals in a damage-tolerance approach.

The rail at Oneida, New Brighton, and Superior had met or exceeded the minimum ultrasonic inspection frequency required by the FRA. Nevertheless, in each accident, an internal defect grew to critical size and resulted in a rail failure. As a result of the New Brighton investigation, on May 13, 2008, the Safety Board made the following recommendation to the FRA:

> <u>R-08-10</u>
>
> Require railroads to develop rail inspection and maintenance programs based on damage-tolerance principles, and approve those programs. Include in the requirement that railroads demonstrate how their programs will identify and remove internal defects before they reach critical size and result in catastrophic rail failures. Each program should take into account, at a minimum, accumulated tonnage, track geometry, rail surface conditions, rail head wear, rail steel specifications, track support, residual stresses in the rail, rail defect growth rates, and temperature differentials.

[12] National Transportation Safety Board, *Derailment of Norfolk Southern Railway Company Train 68QB119 with Release of Hazardous Materials and Fire, New Brighton, Pennsylvania, October 20, 2006,* Railroad Accident Report NTSB RAR-08/02 (Washington, DC: NTSB, 2008). Excerpts are from pages 36–37 and 42.

The current status of Safety Recommendation R-08-10 is “Open—Response Received,” and the Safety Board is evaluating the FRA’s response.

## Probable Cause

The National Transportation Safety Board determines that the probable cause of the March 12, 2007, derailment of CSX train No. Q39010 and subsequent release of hazardous material near Oneida, New York, was the failure of the rail from an undetected detail fracture that initiated from an area of shelling on the rail.

### Adopted: September 30, 2008