



National Transportation Safety Board

Washington, D.C. 20594

Railroad Accident Brief

Accident No.: DCA-04-FR-007
Location: Queens, New York
Date of Accident: March 10, 2004
Time: 2:18 p.m. eastern standard time¹
Railroads: Long Island Rail Road and New York & Atlantic Railway
Accident Type: Multiple highway/railroad grade crossing collisions
Injuries: 4
Damages: \$83,000

Synopsis

On March 10, 2004, about 2:18 p.m., the crew of a Long Island Rail Road (LIRR) train, assigned to reposition equipment in various locations, left a locomotive (LIRR 160) unattended with only its air brakes applied. The locomotive was left on a descending grade in the Fresh Pond yard of the New York & Atlantic Railway (NYAR)² in Queens, New York. The locomotive rolled away and traveled through the yard and onto the Bushwick Branch of the NYAR, where it passed over seven passive grade crossings³ and struck numerous vehicles before coming to a stop. Four occupants of three struck vehicles were seriously injured. A fire occurred when the locomotive came to a stop, after its collision with the last two vehicles. The LIRR estimated equipment damages of \$83,000⁴; the NYAR estimated minimal damages.

The Accident

The LIRR train crew, assigned to reposition equipment, reported to work at Penn Station, New York, at 8:00 a.m. on March 10, 2004. The crew consisted of an apprentice engineer, an engineer, a conductor, and an assistant conductor/brakeman. The apprentice

¹ All times in this brief are eastern standard time.

² The NYAR is owned by the Anacostia & Pacific Company, Inc., which also owns the Louisville & Indiana Railroad, the Pacific Harbor Line, and the Chicago Southshore & South Bend Railroad.

³ A *passive grade crossing* is not equipped with train-activated devices, such as flashing lights, bells, or gates. The crossing has grade crossing signs and pavement markings.

⁴ This damage is for railroad equipment and track appurtenances. No estimate was available for vehicular damage.

engineer operated the train the entire day under the engineer's supervision. All crewmembers told investigators that they were well rested for the day's assignments.

The crew completed its first assignment of the day without event. The crew's second assignment was to go to the Morris Park, New York, engine house and take LIRR 508, an out-of-revenue-service locomotive, to the NYAR yard in Fresh Pond. LIRR 508 was to be interchanged to the Canadian Pacific Railway (CPR) for shipment to Altoona, Pennsylvania, for warranty/maintenance work.

The crew arrived at Morris Park at 10:30 a.m. LIRR 508 was to be moved "dead in tow" (unpowered) in the middle of a group of three locomotives. Locomotives LIRR 160 and LIRR 164 were to be the lead and trailing locomotives of the three-locomotive train, depending on the train's direction of movement. Because LIRR 508 was a different type of locomotive,⁵ the usual electrical cable connections between the locomotives could not be made. Therefore, whenever a movement took place, only the lead locomotive provided tractive power as the controlling locomotive. The train-line air brake and main reservoir hoses were connected between the three locomotives; the connection permitted the operation of the air brakes on all the locomotives.

LIRR Morris Park mechanical personnel coupled the three-locomotive train (LIRR 160, 508, and 164) and performed the required air tests. The mechanical personnel gave the crew a completed LIRR brake test slip that indicated that the air brakes were in working order. The crew told investigators that they also performed a brake test before leaving the engine house and a running brake test after they left the engine house. They did not note any exceptions to the air brake system operation.

At 12:00 noon, the crew moved the three-locomotive train from Morris Park to Jamaica Station, New York, with LIRR 164 as the controlling locomotive. At Jamaica, the train changed direction, and LIRR 160 became the controlling locomotive for the move to Long Island City, New York. At Long Island City, the crew changed ends again, making LIRR 164 the controlling locomotive. The crew told investigators that each time they changed ends, they tested the air brakes without noting any exceptions. The locomotive event recorder showed an air brake application each time the operating direction was changed.

⁵ LIRR 508 was a DM30AC locomotive, which uses a 36-pin connection for multiple unit operation. LIRR 160 and 164 were MP15AC locomotives, which use a 27-pin connection for multiple unit operation.

Once the crew received permission from the yardmaster at Fresh Pond yard to enter the NYAR property, a NYAR pilot⁶ joined the LIRR crew. The pilot instructed the crew to move onto the west leg of the wye⁷ track and then proceed to the CPR interchange track, so they could put LIRR 508 on a train being prepared for movement.

To facilitate this operation, the crew had to separate LIRR 160 from the train, thus leaving LIRR 160 on the wye track. The conductor and assistant conductor stated that they closed the brake pipe angle cock⁸ on LIRR 508 and left the angle cock open on LIRR 160. They stated that they did not apply the locomotive hand brake on LIRR 160. They further stated that they heard a “whoosh” of air as LIRR 164 and LIRR 508 pulled away from LIRR 160 and the air hose parted. They believed the sound indicated that the emergency brakes on LIRR 160 had applied. The assistant conductor said that he saw LIRR 160’s brake shoes against the wheels. The locomotive event recorder on LIRR 160 recorded the loss of air brake pressure when LIRR 508 separated from LIRR 160, but it did not record an emergency application of the brakes.

The crew then took LIRR 164 and LIRR 508 to the CPR interchange track, so they could couple LIRR 508 to the last car of a train that was being prepared for movement. The engineer stated that when they reached the interchange track, he got off the train and saw that LIRR 160 was not where the crew had left it.

They had left the unattended LIRR 160 on a 1 percent descending grade. According to the LIRR 160 event recorder, after about 2 minutes 32 seconds, the locomotive’s brake cylinder air pressure had decreased to 0 pounds per square inch (psi). Twelve seconds later, LIRR 160 began to move. It traveled about 1 mile, gaining speed through the yard, and dislodged a temporary rail-mounted derail⁹ at the entrance to the Bushwick Branch. A split-point derail there had been previously damaged; and, because replacement parts were not immediately available, a hinged derail had been installed temporarily between the damaged split-point derail and the entrance to the Bushwick Branch. The locomotive event recorder on LIRR 160 recorded the speed of the runaway locomotive as ranging between 6 and 8 mph as it approached the derail.

LIRR 160 traveled about 1.2 miles on the Bushwick Branch, passing over seven passive highway/railroad grade crossings. The event recorder indicated that the locomotive traveled the total distance of about 11,692 feet (2.2 miles) in 16 minutes 9 seconds and reached a maximum speed of about 31 mph.

⁶ A *pilot* is an employee qualified on the physical characteristics and rules of the portion of a railroad over which movement is to be made. A pilot is assigned to a train when either the engineer or conductor is not qualified for that area.

⁷ A *wye track* is shaped like the letter “Y” and has a connector between the two arms of the Y. It is used to reverse the direction of trains or cars. A train pulls completely over one arm of the wye and then the switch is thrown; the train reverses direction, moving back along the arm of the wye, then crossing over to the other arm, and then moving through it with the other end of the train leading.

⁸ *Angle cocks* are valves at the ends of locomotives and cars that, when open, allow the air in the brake system to flow from car to car. When the angle cock is closed, air stays in the brake system.

⁹ A *derail* is a track safety device attached to one side of a siding or storage track; it is designed to cause a car or locomotive to be derailed if it rolls free toward a main track.

During the runaway, LIRR 160 struck an automobile at one grade crossing and pushed it several hundred feet. The two occupants of this vehicle sustained serious injuries and required hospitalization. At another grade crossing, the locomotive struck two more automobiles, resulting in serious injuries to their drivers, who also required hospitalization. Two trucks were parked along the tracks near another grade crossing. The locomotive struck the trucks and pushed them about 800 feet westward beyond the crossing before it stopped. One of the trucks was carrying welding supplies, including acetylene and oxygen cylinders; the cylinders were damaged during the accident and caused a fire. The trucks were unoccupied; however, employees of the trucks' owner had to jump away from the track to avoid injury.

As LIRR 160 collided with the automobiles and trucks, the struck vehicles were propelled in different directions and struck other vehicles. As a result, the accident damaged five other vehicles and a backhoe.¹⁰ (See figure 1.)

The LIRR required postaccident toxicological testing of the four LIRR employees who had crewed the three-locomotive train. The test results were negative for drugs and alcohol.



Figure 1. Locomotive after collisions.

Train Operations on NYAR

All LIRR train movements on the NYAR are governed by the LIRR *Rules of the Operating Department* (effective June 18, 2001) and the LIRR *Train Handling and*

¹⁰ In total, 10 vehicles and a backhoe were damaged or destroyed.

Equipment Manual (effective January 1, 2002). NYAR *Timetable No. 4* (effective September 19, 2003) governs train movements within the Fresh Pond yard and on the Bushwick Branch.

Securing Unattended Locomotives

Item 1.22 (a)(8,9), “Locomotives Unattended,” in the LIRR *Train Handling and Equipment Manual* states that a locomotive left unattended must be secured with its hand brakes applied, air brakes must never be depended upon to hold equipment left standing and unattended, and both sides of one wheel must be chocked. A June 16, 2000, LIRR memo to all train and engine personnel addressed securing a “lite¹¹ locomotive” by setting the hand brake or parking brake. Rule 961, “Securing of Trains,” in the LIRR *Rules of the Operating Department* states, “a sufficient number of hand brakes... must be applied on all trains... left standing or yarded on any track to make them secure....”

According to Title 49 *Code of Federal Regulations* (CFR) 232.103(n), which addresses securing unattended equipment, including locomotives, the “air brake shall not be depended upon to hold equipment standing unattended on a grade.” The regulation further states that hand brakes are to be applied to secure unattended equipment.

The crew did not apply the hand brake to secure LIRR 160 when they left it unattended, and they did not chock one of its wheels. When the conductor and assistant conductor were asked why they did not set the hand brake or chock a wheel, they responded that it was a “fast switch operation,” during which they would leave the locomotive unattended for only a short period and that they were following a “standard practice” that was “done all the time.”

Operating Restrictions

Train operations on the NYAR are authorized at “restricted speed,” defined in the LIRR operating rules as

A speed, not exceeding 15 miles per hour, at which a train can be stopped within one half the range of vision, short of the next signal, another train, obstruction, or a switch improperly lined, looking out for broken rail or crossing protection not functioning.

The NYAR timetable further limits the maximum authorized speed for the Bushwick Branch to restricted speed not to exceed 10 mph with the same attributes as above, between Fresh Pond yard and Bushwick Branch and not to exceed 5 mph through turnouts, sidings, grade crossings, and the English Kills drawbridge.

¹¹ *Lite* means without cars.

Postaccident Inspection of LIRR 160

LIRR 160 did not derail. The fire following the collision with the two trucks damaged the front of the locomotive.

Investigators attempted to document the position of the control devices in the LIRR 160 cab.¹² Investigators found the control devices in the following positions: the power was off (the knife switch was in the open position, and the generator field switch was in the down position); the automatic brake valve handle was in the off position; the automatic brake valve cut-out was set for trailing; the independent brake valve handle was in the released position; the independent brake valve cut-out was in the open “lead or dead” position; the throttle was set to idle; and the reverser handle was set in the center/middle position and had been removed.

An inspection of the LIRR 160 trucks and air brake system connections found the MU (multiple unit) connections as follows: the brake pipe angle cock was open at the rear of LIRR 160, where LIRR 508 had been uncoupled; and the main reservoir MU hose at the rear of LIRR 160 was curled up and resting in the locomotive coupler. The end cock¹³ associated with the main reservoir MU hose was open. All other air brake end cock MU connections were closed.

Investigators were able to restart LIRR 160 and determine that the air compressor was in working order. The brake valve handles were set up to charge the brake pipe, but the brake pipe could not be charged. Some air brake components were damaged; there was leakage in the vicinity of the front truck and from the automatic drain valve on the No. 1 main reservoir. The brake cylinders on the front truck were cut out, and the automatic drain valve was plugged. Leakage tests were performed at varying levels of brake pipe pressure, and no leakage was noted for the first minute for the fully charged brake pipe and for 5 psi, 10 psi, 15 psi, and full service reductions. Investigators performed several tests to simulate an emergency application of the brakes with the angle cock being rapidly opened. All tests showed similar results. One test showed that brake cylinder pressure after 1 minute was 86 psi, but it decreased to 3 psi after 18 minutes. Another test with a normal emergency brake application using the locomotive’s 26L automatic brake handle showed brake cylinder pressure of 94 psi in 8 seconds and no leakage for 5 minutes.

Safety Board investigators inspected two check valves on the LIRR 160 air brake system. (Check valves affect a locomotive’s ability to retain air pressure and maintain the application of the brakes.) Investigators found that the check valve on the No. 1 main reservoir had been bypassed when an air dryer had been installed with new direct piping.

¹² A New York City firefighter was reported to have entered the cab and altered control device positions while attempting to shut down the diesel engine; the control devices the firefighter reportedly adjusted were not identified.

¹³ An *end cock* is a valve that opens and closes the air connections between locomotives when they are coupled for MU operation.

With this check valve inoperative, the air pressure from the No. 1 main reservoir would be lost if the main reservoir MU connection were left open to atmosphere.

Investigators found that the check valve on the No. 2 main reservoir had been installed upside down and was discolored at the bottom of the check valve seat. The purpose of this check valve was to protect against the loss of air pressure in the No. 1 main reservoir from either a broken pipe or a failed air compressor. Normally, air is pumped into the No. 2 main reservoir, and the check valve stops the air from escaping. The No. 2 main reservoir provides the air pressure for the air brake system on the locomotive and the brake cylinders.

The inside of the check valve is made so that the moveable valve does not rest evenly with the bottom of the pipe. When correctly installed, the piping is almost horizontal; any sludge or foreign matter in the air system flows to the lowest point in the piping. When the check valve is installed correctly, the moveable part of the check valve and the check valve seat do not line up with the bottom of the pipe, and the flange of the check valve creates a small “dam” against the debris flowing in the bottom of the horizontal pipe. Thus, the check valve sits high in the pipe to avoid contamination. Because the check valve on LIRR 160 was upside down and the moveable part of the check valve and the check valve seat were even with the bottom of the piping, the check valve was more likely to stick open due to debris in the pipe.

The main reservoir MU connection at the rear of LIRR 160 had been left open. Normally, a choke is present to allow the air compressor to maintain pressure in the No. 1 reservoir in this situation. However, the choke was missing from LIRR 160. Consequently, once LIRR 508 and LIRR 160 were separated, the initial pressure in the reservoir was exhausted, and the air compressor could not maintain pressure in the system.

Normally, the pressure in the No. 2 reservoir is protected by a check valve that does not allow the air to flow back toward the open MU connection. In this case, the check valve was installed upside down. During postaccident testing, the check valve was deliberately stuck open, and the loss of pressure nearly matched the recorded loss of pressure on the day of the accident. Given the valve’s position, which would have allowed debris to enter the check valve seat intermittently, this check valve probably stuck in the open position on the day of the accident resulting in the air brake system’s failure to hold the standing locomotive.

Investigators simulated the separation of the locomotives on the day of the accident using the air pressures from the event recorder readout. The main reservoir supply was dropped to 45 psi and the brake cylinder pressure was recorded when the locomotives were separated. When the brake pipe pressure dropped to 25 psi, an emergency brake application was initiated. The main reservoir MU end cock was then opened to the atmosphere, and the brake cylinder and main reservoir pressure dropped to 0 psi in 3 minutes.

Railroads do not typically test check valves during periodic air brake inspections. During normal use, a check valve failure is not noticed, and a valve's intermittent obstruction by debris is difficult to detect. No backup exists for an inoperative check valve. If a locomotive compressor fails, a pipe cracks, or an MU end cock is left open (as happened in this accident), the check valve is the only protection for preserving the air pressure required to operate the brakes.

Although the conductor and the assistant conductor/brakeman were convinced that the "whoosh" sound they heard as they uncoupled LIRR 508 was an emergency application of the train brakes on LIRR 160, the event recorder on LIRR 160 did not record an emergency brake application. The recorder indicated that as the crew uncoupled LIRR 160, the brake cylinder pressure briefly increased from 40 to 45 psi and then started to decrease. The brake cylinder pressure decreased to 0 psi in about 2 minutes 32 seconds. When the brake cylinder pressure reached 0 psi, the air brake system no longer provided a braking force to keep the brake shoes applied against the locomotive wheels.

The air brake system and the hand brake were the only available braking systems on LIRR 160. With the air brakes released and no hand brake applied, the locomotive had no working braking system when the crew left it unattended.

Crew Efficiency Testing

The LIRR has an efficiency testing program to monitor crew compliance with the operating rules. The disciplinary record for the conductor of the accident crew showed that in May 2001, he had failed¹⁴ the efficiency program test for the LIRR *Rules of the Operating Department* Rule 961, "Securing Equipment." In 2002, the LIRR refined its efficiency testing program and renamed it the Situational Awareness For Efficient Railroading, or SAFER program. The SAFER program was designed to cause face-to-face interaction between the manager and the employee, thus preventing train accidents/incidents and personal injuries by improving employee operating and safety habits. The program requires managers to submit SAFER observations, including hand brake observations. From January 2001 to March 10, 2004, the LIRR conducted 918 SAFER evaluations that specifically addressed the securing of equipment.¹⁵ These evaluations identified 24 instances of noncompliance.

The NYAR conducts operational tests and inspections in accordance with the LIRR and NYAR timetables, special instructions, and safety and operating rules. Before the March 10, 2004, accident, no joint efficiency testing was conducted while LIRR crews were operating on NYAR property.

¹⁴ The conductor was suspended for 2 days as a result of failing the test.

¹⁵ As established in LIRR operating rules 13, 803, and 961.

Highway/Railroad Grade Crossings

When LIRR 160 rolled away and traveled about 2.2 miles, it traversed seven highway/railroad grade crossings on the Bushwick Branch. None of the grade crossings had active warning devices. Several years ago, the crossings had such devices, but by March 1990, the devices had been removed. The representatives for the New York State Department of Transportation (NYSDOT), the LIRR, and the NYAR could not provide any reason for the removal of the active devices.

After the active devices at the seven crossings had been removed, both the LIRR and the NYAR required that train movements over the highway/railroad grade crossings (1) be made at 5 mph, (2) be preceded by the sounding of the locomotive's bell and horn, and (3) at the train crew's discretion, be preceded by a flagman providing a visible warning to vehicular traffic.

Numerous deficiencies and/or irregularities were found in the passive warning devices, the pavement markings, and the advance warning signs at the seven crossings. The NYSDOT stated that under New York Railroad law and the *Manual for Uniform Traffic Control Devices*¹⁶ (MUTCD), the railroad is responsible for the installation and maintenance of crossbucks at all public crossings. Also, under the MUTCD, local municipalities are responsible for the installation and maintenance of pavement markings and advance warning signs.

Postaccident Actions

LIRR

The LIRR developed an action plan with two goals: (1) to address potential organizational, human factor, mechanical, and infrastructure causes of unsecured equipment, and (2) to study the incident to determine whether it indicated other potential or actual lapses of operational safety. The LIRR took the following steps immediately after the accident: LIRR managers met with all affected employees to discuss the potential causes of unsecured equipment; the LIRR increased focused operational efficiency checks to measure compliance with the rules and procedures for unattended locomotives; the LIRR established a management team to develop best practices; and the LIRR inspected the main reservoir systems of all 1,500- and 1,000-horsepower diesel locomotives for improperly installed check valves.

The LIRR also reported that it is developing systems for overseeing LIRR employees operating on the NYAR, enhancing the qualifications of LIRR operating crews on NYAR territory, and reviewing operating rules and instructions to determine

¹⁶ U.S. Department of Transportation, Federal Highway Administration, *Manual on Uniform Traffic Control Devices* (Washington, DC: FHWA, 1988). This document defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets and highways.

whether revisions are needed. In addition, the LIRR issued instructions to all LIRR train crews to coordinate with the NYAR when they are operating in the Fresh Pond yard. The LIRR also reminded the crews to apply hand brakes on “all unattended cars and engines and cuts of cars and engines.” The split-point derail at the entrance to the Brunswick Branch was repaired and returned to service.

FRA

On March 11, 2004, the Federal Railroad Administration (FRA) advised the NYAR by telephone to protect all train movements on the Bushwick Branch with flagmen. On March 12, 2004, the NYAR issued General Notice No. 402, which stated, “Effective immediately, all crossings on the Bushwick Branch must be flagged and protected.”

The FRA held a community meeting on April 7, 2004, with Community Boards 1 and 5, the NYAR, the New York City Department of Transportation (NYC DOT), and the NYSDOT to discuss the highway/railroad grade crossings in Queens and to facilitate any future actions. The LIRR was invited, but did not attend the meeting. At the meeting, the FRA suggested that the signage for the highway/railroad grade crossings involved in this accident be improved. The NYAR subsequently replaced the missing crossbuck signs at the crossings. The NYC DOT agreed to reconstruct the pavement at the crossings, update the standard advance warning crossing signs that were already in place, and repaint the advance warning pavement signs.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the multiple highway/railroad grade crossing collisions in Queens, New York, on March 10, 2004, was the failure of the Long Island Rail Road conductor and assistant conductor/brakeman to secure the locomotive when they left it unattended on a descending grade.

Adopted: April 18, 2005