

Passenger Fatality

Massachusetts Bay Transportation Authority

Boston, Massachusetts
April 10, 2022

1 Factual Information

1.1 Accident Description

On April 10, 2022, about 12:30 a.m. local time, a Massachusetts Bay Transportation Authority (MBTA) passenger was dragged and killed as northbound MBTA Red Line train 1034 departed Broadway Station in Boston, Massachusetts.¹ About 12:29 a.m., train 1034 arrived at Broadway Station, and the accident passenger and several others boarded the train. Station surveillance video reviewed by National Transportation Safety Board (NTSB) investigators showed that, as the train was departing, the accident passenger attempted to exit the train using the middle passenger doors of railcar 1510, the second railcar of the six-car train. According to the video, the doors closed on the accident passenger’s upper body on his right side as he stepped back onto the platform. As the train accelerated to depart the station, the passenger ran alongside the train with his upper body pinched between the doors. The train did not stop, and the passenger collided with a wall at the end of the platform and was killed. Figure 1 provides a diagram of the accident location.

¹ (a) Visit www.nts.gov to find additional information in the [public docket](#) for this NTSB accident investigation (case number RRD22LR008). Use the [CAROL Query](#) to search safety recommendations and investigations. (b) All times in this report are local time unless otherwise noted.

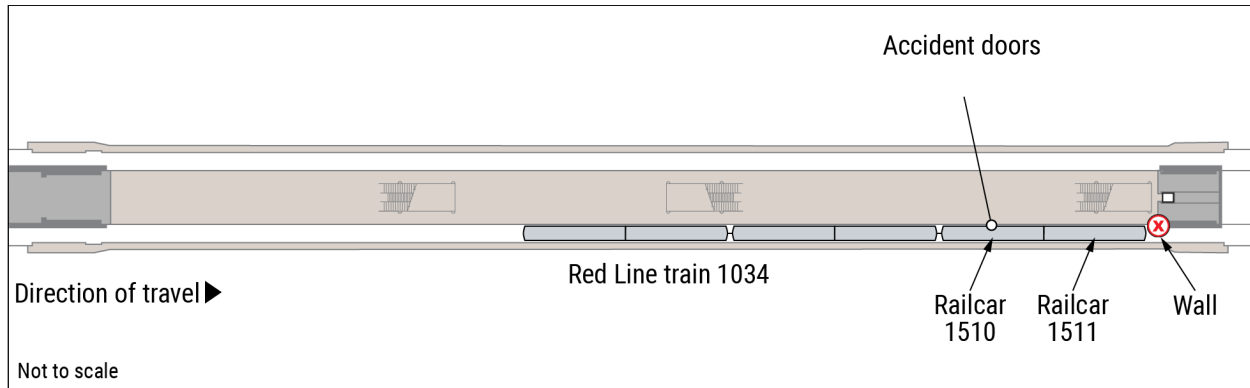


Figure 1. Diagram of the Broadway Station platform.

1.2 Before the Accident

The operator of train 1034 began work at 6:22 p.m. on April 9, 2022. In a postaccident interview with NTSB investigators, the operator stated that the train departed Ashmont Station northbound to Harvard Station a little after midnight.²

Surveillance video showed that when the train stopped at the Broadway Station platform, the operator looked at the platform with her head out of the operating cab window. The video then showed the passenger doors on the train open; the red pilot light on the side of the railcar was illuminated.³ The operator closed the doors and pulled her head back into the operating cab. The pilot lights remained illuminated.

1.3 Train Operator

The operator of train 1034 was hired by MBTA on October 1, 2018. NTSB investigators reviewed the operator's work history from March 9, 2022, to April 9, 2022. Work history records indicated the operator had worked a total of 16 times in the 32 days before the accident and on 4 consecutive days before the accident. NTSB investigators did not identify any violations of the MBTA work policy.⁴

1.3.1 Disciplinary Actions

NTSB investigators reviewed the train operator's employment records with MBTA. The records showed that on December 30, 2019, the operator received disciplinary action for an incident that involved a previous door failure. On July 17,

² On April 9 and 10, 2022, Harvard Station was the northernmost point of the Red Line.

³ *Pilot lights* illuminate when railcar doors are open and turn off when they close.

⁴ *MBTA Rules for Operations Employees*, August 1, 2018.

2020, and December 24, 2020, the operator received written warnings for attendance issues.

On October 17, 2021, the operator received disciplinary action for failing to stop for a double red signal. The operator completed reinstruction training on the proper procedure to stop on November 8, 2021.

1.3.2 Toxicology

Postaccident toxicological testing of the train operator for alcohol and other drugs did not identify any tested-for substances.⁵

1.4 MBTA 1500 Series Railcars

The MBTA Red Line train 1034 consisted of three married railcar pairs; the lead (1511) and accident (1510) railcars were MBTA 1500 series railcars. MBTA 1500 series railcars had a passenger door interlock circuit designed such that if any passenger door was open, the circuit would not complete (would remain open) and train propulsion (movement) would be disabled. When all passenger doors were closed, the circuit would complete (close) and train propulsion would be enabled.

The MBTA 1500 series railcars were also equipped with an automatic door starting button, which when pressed by the operator would sound a buzzer to confirm that all doors were closed, and a passenger door recycle feature. The passenger door recycle feature caused the passenger doors to cycle open and closed when an obstruction was detected until the train speed reached 3 mph. When the train speed reached 3 mph, the obstructed doors would close as far as the obstruction would allow and then would be held in that position by the pneumatic cylinder that operated the doors. This feature was designed to prevent passengers from opening railcar doors while the train was in motion. The average acceleration rate for train 1034 and other MBTA trains was 2.5 mph per second.

1.5 Postaccident Examination, Testing, and Observations

1.5.1 Passenger Door Interlock Circuit

NTSB investigators reviewed MBTA maintenance and inspection records and did not identify any previous train operator reports of door malfunctions involving railcar 1511, the railcar that controlled door operation on train 1034 at the time of the

⁵ In accordance with Title 49 *Code of Federal Regulations (CFR)* Part 655, and as detailed in 49 *CFR* Part 40, the train operator underwent a postaccident urine drug test for marijuana metabolites, cocaine metabolites, amphetamines, opioids, and phencyclidine, as well as a postaccident alcohol breath test.

accident. Maintenance records showed the Cineston master controller on railcar 1511 was rebuilt in January 2017 at MBTA facilities.⁶

On April 11, 2022, on MBTA property, NTSB investigators tested the propulsion system on train 1034 and observed that trainline propulsion was enabled even if the passenger door interlock circuit was open (that is, if there was an open door). Further testing of each railcar in train 1034 showed that a short circuit in railcar 1511 bypassed the functionality of the passenger door interlock circuit.⁷ A review of the passenger door interlock circuit schematics indicated the short circuit was located in the electromechanical contact connections, specifically the terminal contacts and finger contacts located on the wire terminal board under the Cineston master controller in railcar 1511.⁸

NTSB investigators then examined the Cineston master controller and observed wire strands protruding from the terminal contact of one of the wires. These protruding wire strands were touching a mounting screw close to the contact, completing the short circuit. (See figure 2.)

⁶ *Cineston* was a model of master controller for railcars or trains; *Cineston* is sometimes used as a generic term for master controllers.

⁷ A *short circuit*, or short, is an unintended electrical connection between two conductors that causes an electrical current to bypass its intended path.

⁸ (a) *Terminal contacts* and *finger contacts* are types of connectors used with wires to make electrical circuits. (b) A *terminal board* is an insulating slab on which terminal contacts and finger contacts are mounted.

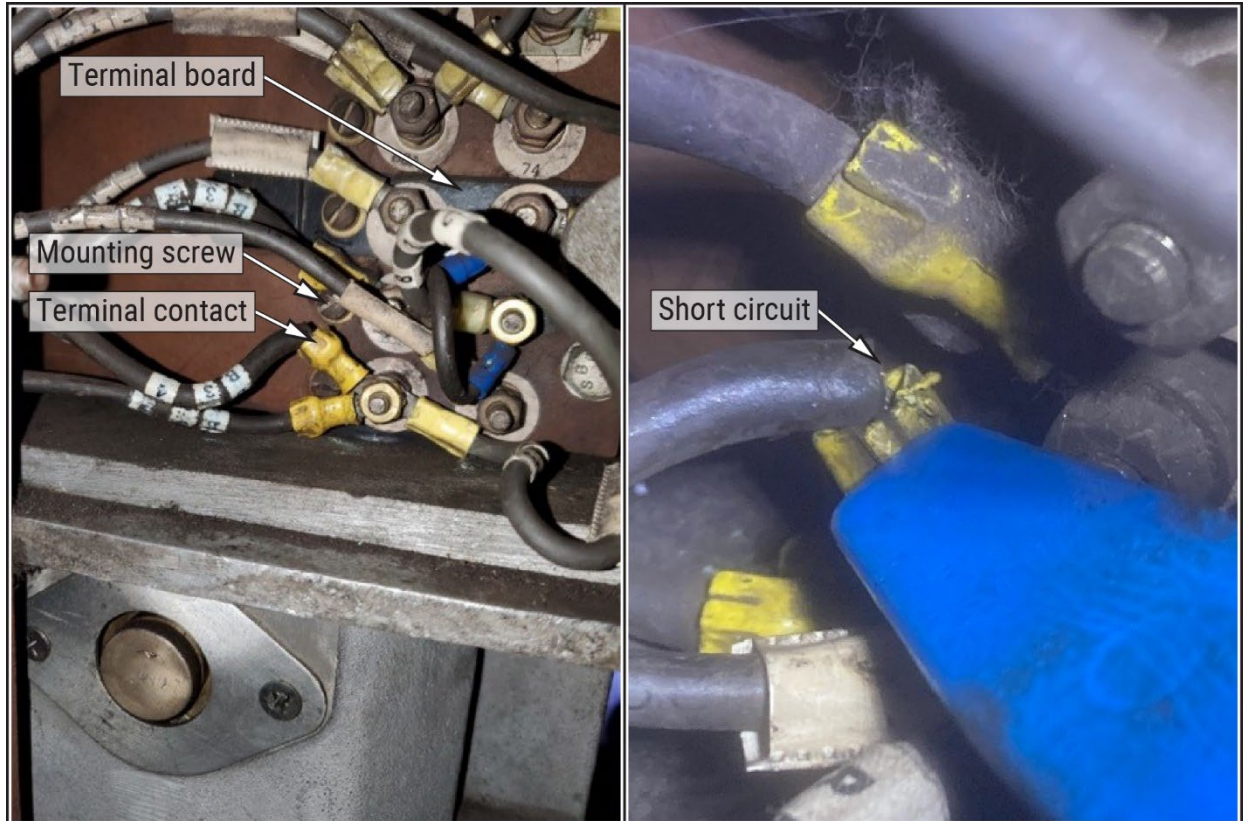


Figure 2. View (*left*) and close-up (*right*) of the short circuit.

1.5.2 Automatic Door Starting Button

NTSB investigators examined, tested, and inspected the automatic door starting button circuitry on train 1034. The button functioned as designed and was not compromised by the short circuit in railcar 1511 that bypassed the passenger door interlock circuit.⁹

NTSB investigators reviewed MBTA maintenance and inspection records. The records did not identify any defects related to the automatic door starting button on train 1034, nor did the records reveal any previous reports of the button malfunctioning or not working.

⁹ In a postaccident interview with investigators, the train operator stated that just before departing Broadway Station, she pressed the automatic door starting button to check if the doors were closed. The operator stated that she heard the buzz sound.

1.5.3 Passenger Door Recycle Feature

NTSB investigators tested the passenger door recycle feature of train 1034 while the train was moving; the feature functioned as designed.

1.6 Sight Distance Observations

On April 12, 2022, NTSB investigators conducted sight distance observations on an exemplar MBTA Red Line train at Broadway Station. During the sight distance observations, investigators viewed a single-person train operation (SPTO) camera monitor mounted on the wall of the platform across from the operator cab window. The monitor showed a view of the station platform, except for a 19-foot blind spot. The blind spot included the exemplar doors that would have been used by the accident passenger at the time of the accident as well as the exemplar pilot light on the same railcar.

Investigators also conducted line-of-sight observations from the operating cab window, recreating the view of the train operator at the platform during a station stop. NTSB investigators saw no obstructions in the line of sight from the operating cab window to the exemplar doors.¹⁰

1.7 MBTA Procedures

1.7.1 Departure Procedures

NTSB investigators reviewed MBTA departure procedures, which state that operators must stop the train in the station and use platform mirrors, SPTO cameras, and line-of-sight observations with their head outside of the operating cab to determine when the platform is clear and when it is safe to move the train to the next station.¹¹ Procedures also state that the operator must then close train doors using controls located in the operating cab and must make sure all pilot lights on the train are extinguished before they pull their head back into the cab.

¹⁰ The exemplar doors were the same location as the doors used by the accident passenger (the middle doors of the second railcar in the consist) and were measured to be approximately 105 feet from the operating cab window.

¹¹ *MBTA Rules for Operations Employees: HR17–Operation of Doors*, August 1, 2018.

1.7.2 MBTA Maintenance Procedures

NTSB investigators reviewed MBTA's fleet preventative maintenance inspection (PMI) procedures for door operations and door obstructions.¹² These procedures did not provide an inspection procedure for the functionality of the door interlock circuit.

1.8 Postaccident Actions

1.8.1 MBTA

After the accident, MBTA updated its PMI procedures for door obstruction testing and door interlock testing to include manipulating the Cineston master controller to verify that train propulsion would not initiate while doors were open. Using these updated PMI procedures, MBTA tested its Red Line railcar fleet within 72 hours of the accident to detect any other railcars with the same issues identified in the investigation and found none.

MBTA implemented a method of electrical isolation between wire terminal contacts and mounting screws on the Cineston terminal board so that protruding wires do not unintentionally complete a short circuit.

MBTA now conducts twice-daily audits of SPTO monitors for functionality and clarity, and MBTA performed follow-up audits on placement and alignment of SPTO cameras.

MBTA expects to retire the 1500 series of railcars from service by March 2024.

1.8.2 Federal Transit Administration

On April 13, 2022, following the accident at Broadway Station, the Federal Transit Administration (FTA) notified MBTA that it would immediately assume an increased safety oversight role of the MBTA system. The FTA further notified MBTA that FTA Transit Safety Oversight would conduct a safety management inspection of transit operations and maintenance programs and would assess the effectiveness and role of the Massachusetts Department of Public Utilities (DPU), the state agency responsible for safety oversight of the MBTA's rail transit operations.

¹² MBTA. *Preventative Maintenance Inspection Policy, Red Line #1 and #2 Heavy Rail Car*, December 2, 2020.

On June 15, 2022, the FTA issued special directives to MBTA and the DPU to address interim findings of patterns of safety incidents uncovered during the safety management inspection.¹³

The FTA also issued Safety Advisory 22-1, titled *Rail Car Passenger Door Inspection and Function Testing*, on October 13, 2022.¹⁴ The FTA recommended that state safety oversight agencies direct rail transit agencies operating rail fixed guideway public transportation systems to evaluate the sufficiency of railcar passenger door inspection and function testing procedures.

2 Analysis

In this accident, an MBTA passenger was dragged and killed when the passenger doors of railcar 1510 of MBTA Red Line train 1034 closed on his upper body and the train departed Boston's Broadway Station. Postaccident examinations and testing found a short circuit in the electromechanical contact connections under the Cineston master controller in the lead railcar.

Under normal operating conditions, the passenger door interlock circuit would have prevented train propulsion if a door obstruction was detected or the doors were open. However, the short circuit that bypassed the passenger door interlock circuit allowed the train to proceed even with the passenger's upper body obstructing the accident railcar doors. The railcar passenger doors were designed to become secure in their positions at a train speed of 3 mph or higher. When train 1034 accelerated to leave the station, it quickly reached 3 mph, and the doors became secure in their positions, leaving the passenger unable to free himself.

NTSB investigators determined that the short circuit bypassing the passenger door interlock circuit occurred sometime after the 2017 Cineston master controller rebuild. As a result of the accident, MBTA implemented a method to electrically isolate wire terminal contacts and mounting screws on the Cineston terminal board and updated its door obstruction and door interlock testing procedures. The FTA assumed an increased safety oversight role of the MBTA system and began conducting safety management inspections of MBTA transit operations and maintenance programs.

NTSB investigators examined surveillance video footage and found that, after conducting a visual inspection of the station platform, the operator pulled her head back into the operating cab before the pilot lights above the doors had turned off.

¹³ *Special Directives to the Massachusetts Bay Transportation Authority and the Massachusetts Department of Public Utilities*, June 15, 2022.

¹⁴ *Federal Transit Administration Safety Advisory 22-1: Rail Car Passenger Door Inspection and Function Testing*, October 13, 2022.

This was contrary to MBTA departure procedures, which required operators to make sure all pilot lights on railcars have turned off before they pull their head back into the cab.

Investigators also identified a 19-foot blind spot in the SPTO camera view that included the middle doors of the second railcar in the train consist. The NTSB determined that, had the train operator been using the SPTO monitor to check whether the platform was clear before departing the station, it was unlikely that she would have seen the accident passenger stuck in the doors. After the accident, MBTA began conducting regular audits of SPTO monitors and cameras.

MBTA plans to retire its 1500 series railcars from service by March 2024.

3 Probable Cause

The National Transportation Safety Board determines that the probable cause of the April 10, 2022, passenger fatality was a short circuit in the passenger door interlock circuit on the accident railcar that enabled propulsion on train 1034 with the door obstructed by a passenger, causing the passenger to be dragged along the platform.

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable cause of the accidents and events we investigate and issue safety recommendations aimed at preventing future occurrences. We also conduct safety research studies and offer information and other assistance to family members and survivors for any accident investigated by the agency. Additionally, we serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)).

For more detailed background information on this report, visit the NTSB investigations website and search for NTSB accident ID RRD22LR008. Recent

publications are available in their entirety on the NTSB website. Other information about available publications also may be obtained from the website or by contacting—

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