



Issued: October 22, 2024

Railroad Investigation Report: RIR-24-11

Southeastern Pennsylvania Transportation Authority Trolley Derailment

Philadelphia, Pennsylvania
July 27, 2023

1 Factual Information

1.1 Accident Description

On July 27, 2023, about 10:18 p.m. local time, Southeastern Pennsylvania Transportation Authority (SEPTA) trolley 9107 derailed at the intersection of Island Avenue and Woodland Avenue in Philadelphia, Pennsylvania, and struck a sport utility vehicle and the Blue Bell Inn.¹ (See figure 1.) Shortly before the derailment, an electronics specialist began operating trolley 9107 from SEPTA's Elmwood maintenance facility toward an adjoining yard for storage.² As the trolley left the facility, the electronics specialist attempted to apply the air brakes to stop the trolley from moving downhill into Island Avenue, but the brakes had been rendered inoperable during maintenance and did not activate. The electronics specialist jumped out of the trolley before the derailment and collision with the sport utility vehicle and Blue Bell Inn. He sustained minor injuries. The sport utility vehicle was occupied by four people, two of whom were transported to a local hospital with minor injuries. The Blue Bell Inn was occupied by one resident, who was not injured. Visibility conditions were dark, but the area was illuminated by ambient and street lighting; the temperature was 84°F with light wind and

¹ Visit www.nts.gov to find additional information in the public docket for this NTSB accident investigation (case number RRD23FR014). Use the [CAROL Query](#) to search safety recommendations and investigations. (b) All times in this report are local time.

² The electronics specialist was a maintenance employee at SEPTA's Elmwood maintenance facility.

no precipitation. SEPTA estimated equipment damage to be about \$500,000. Longcare Appraisal & Adjustment estimated damage to the Blue Bell Inn to be about \$300,000.

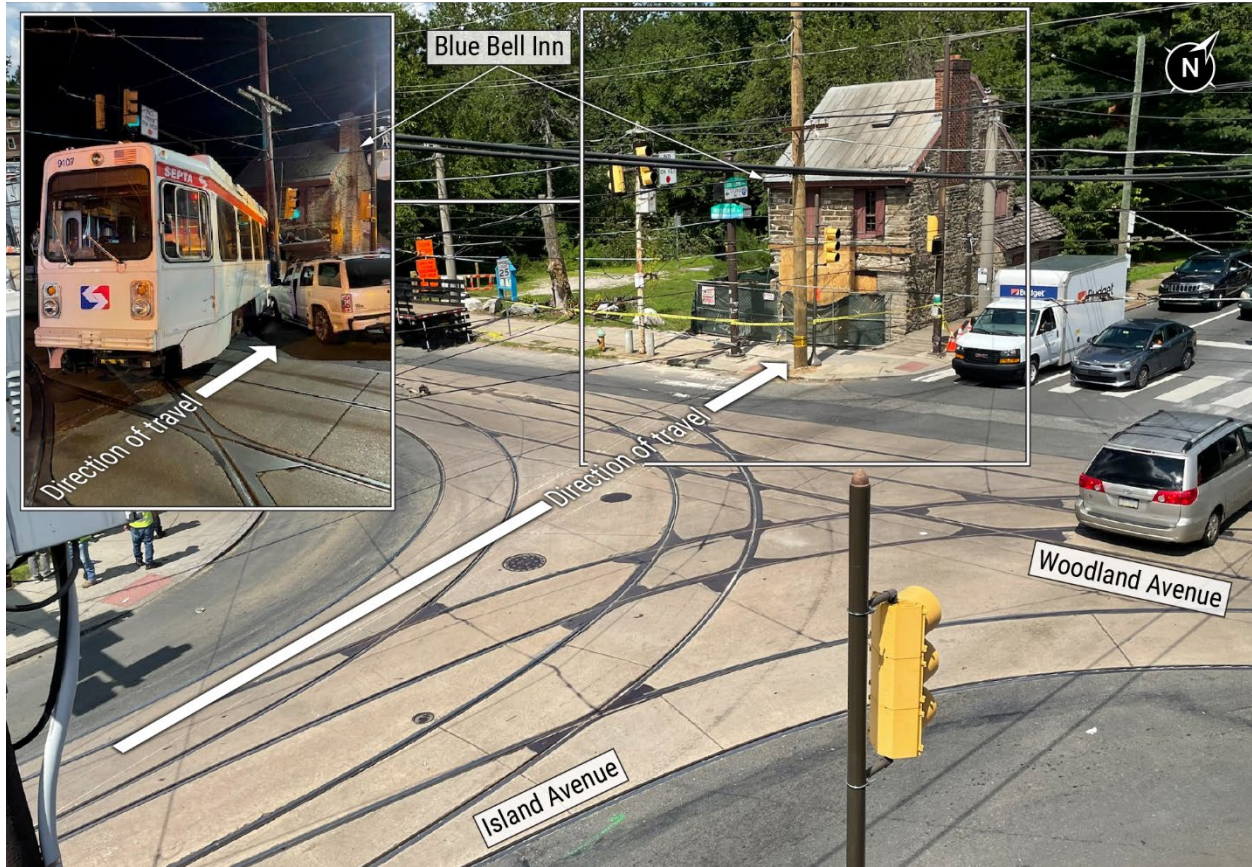


Figure 1. Overview of the accident area.

On the day of the accident, trolley 9107, a Kawasaki light rail vehicle, was undergoing an air compressor replacement at the Elmwood maintenance facility. The replacement spanned three shifts throughout the day and involved multiple maintenance employees and maintenance managers. A mechanic working on the first shift disconnected the trolley's air brakes to manually move the trolley to the edge of the maintenance facility to allow a forklift to lower the air compressor. The mechanic replaced the air compressor and manually repositioned the trolley within the maintenance facility but did not reconnect the brakes. Another mechanic working on the second shift checked the air compressor and performed a leak test but did not reconnect the brakes. Neither the first shift mechanic nor the second shift mechanic placed a tag on the trolley to indicate that the brakes had been disconnected.

The electronics specialist, a SEPTA employee with 4 months of experience, was working on the third shift. A maintenance manager instructed him to reposition the trolley in the adjoining yard for temporary storage. The electronics specialist began this move under the trolley's own power. He operated the trolley out of the Elmwood

maintenance facility on an uphill grade toward a switch to change direction and move into the storage yard.³ When he attempted to apply the brakes and change direction, the trolley failed to stop and continued on a downhill grade from the switch toward Island Avenue. The trolley made a right turn onto Island Avenue and continued downhill. The trolley derailed as it was traversing the curve at the intersection of Island Avenue and Woodland Avenue about 20 mph. (See figure 2.)



Figure 2. The movement of the trolley from the Elmwood maintenance facility to the intersection of Island Avenue and Woodland Avenue.

1.2 Postaccident Examinations

NTSB investigators examined the accident area and identified the location on Island Avenue where the trolley derailed. Wheel marks were clearly visible on the concrete roadway. Investigators did not find any defects or visual obstructions on the tracks along Island Avenue. Investigators also tested the trolley's air brake system after the brakes were reconnected and did not find any defects.

³ To reach the yard, the operator would have traversed the switch, lined the switch toward the yard, and then reversed through it.

1.3 SEPTA Maintenance Procedures and Training

NTSB investigators reviewed maintenance and operations manuals and procedures for Kawasaki light rail vehicles. Investigators found documents in the operations manual that contained guidelines for inspecting a trolley's brakes and conducting brake tests before operating a trolley. SEPTA's manual for operating trolleys, *Light Rail Transit Car Operations Manual: Single End Car*, has instructions for checking the trolley's "cut out box" to ensure that the brakes have not been cut out.⁴ The *Callowhill and Elmwood District's Special Instructions* has guidelines for conducting brake tests before operating a trolley.⁵ Investigators did not find evidence that maintenance employees at the Elmwood maintenance facility referred to these documents or followed these guidelines while working on trolley 9107. The NTSB did not find any written procedures for replacing air compressors at the Elmwood maintenance facility.

Investigators also examined SEPTA's training documents and certification records. Maintenance employees were trained to operate trolleys for movement from the Elmwood maintenance facility to the adjoining yard as well as for movement on the street. At the end of the training, employees had to pass a written examination and received a *Shop Personnel Rules Handout* containing selections from the *Light Rail Transit Car Operations Manual: Single End Car*, but not the entire operations manual. Investigators found that the section "Preparing Cars for Service," which contained a pre-movement checklist, including checking the brakes before any movement, was not included in the handout.

Investigators also reviewed SEPTA's turnover process of maintenance employees between shifts. There were two levels of turnovers, the mechanic's turnover and the manager's turnover. The mechanic's turnover used online work orders and updates in the Vehicle Maintenance Information System, a database for work orders. The manager's turnover used a shared Excel spreadsheet that was updated and printed at the end of each shift for the next manager to review. This document was kept in a shared folder that all managers could access. Neither the mechanic's turnover nor the manager's turnover used specific guidelines for the information that should be included in the turnover notes and passed on to the maintenance employees in the next shift. The Vehicle Maintenance Information System entries for trolley 9107 as well as the manager's Excel spreadsheet did not mention that the brakes were disconnected.

⁴ SEPTA. "Preparing Car for Service." *Light Rail Transit Car Operations Manual: Single End Car*. 1990, pages 91-94.

⁵ SEPTA. "Pre-Departure Brake Test for Kawasaki Vehicles." *Surface Transportation City Rail: Callowhill and Elmwood District's Special Instructions*. November 6, 2022, pages GL27-GL28.

1.4 Toxicology Testing

The electronics specialist and the maintenance manager underwent postaccident alcohol breath tests and urine drug tests.⁶ The electronics specialist tested negative for all tested-for substances. The third shift maintenance manager tested positive for cocaine.

1.5 Postaccident Actions

After the accident, SEPTA stopped performing air compressor replacements at the Elmwood maintenance facility. This procedure was moved to SEPTA's Woodland maintenance facility, which is configured to allow air compressor replacements without disconnecting the trolley's air brakes. SEPTA's training department made changes to the *Shop Personnel Rules Handout* given to maintenance employees at the Elmwood maintenance facility and added the section "Preparing Car for Service," which contains a pre-movement checklist that includes checking the brakes before moving a trolley.

2 Analysis

In this accident, a maintenance manager instructed an electronics specialist to move trolley 9107 from the Elmwood maintenance facility to the adjoining yard for storage. The trolley failed to stop and derailed while traversing a curve because the air brakes on the trolley had been disconnected during an air compressor change, and neither the maintenance manager nor the electronics specialist operating the trolley had any indication that the air brakes were disabled. Although the maintenance manager tested positive for cocaine, the NTSB's investigation did not find any evidence that his possible impairment contributed to the accident.

The NTSB's review of SEPTA's maintenance procedures found that they were insufficient. Investigators did not find any written procedures for replacing air compressors at the Elmwood maintenance facility. As a result, there was no consistency among maintenance employees about when the air brakes were to be disconnected and reconnected during the replacement process. If there had been a written procedure for replacing air compressors, maintenance employees would have known when to disconnect and then reconnect the brakes, and when to expect a trolley's brakes to be inoperable.

⁶ Tested-for substances included marijuana metabolites, cocaine metabolites, amphetamines, opioids, and phencyclidine, in accordance with Title 49 *Code of Federal Regulations* 40.82 and as detailed in Title 49 *Code of Federal Regulations* 40.85.

The NTSB's review of SEPTA's shift turnovers at the Elmwood maintenance facility found that the process lacked clear communication between maintenance employees. As mechanics worked on a job, they entered notes into the Vehicle Maintenance Information System on their progress and on the condition of the vehicle they were working on. These notes were not based on any specific guidelines for including certain safety information, such as the condition of the brakes. The turnover documents from trolley 9107 did not mention that the brakes were disabled at the end of the first or the second shift. To eliminate the risk of brakes being disabled during air compressor maintenance, following the accident, SEPTA stopped performing air compressor changes at the Elmwood maintenance facility, shifting this procedure to the Woodland maintenance facility, where maintenance employees could perform the procedure without disconnecting the trolley's air brakes.

The NTSB's investigation also revealed gaps in the training SEPTA provided to maintenance employees at the Elmwood maintenance facility. SEPTA's training manual for operators, *Light Rail Transit Car Operations Manual: Single End Car*, was not provided in its entirety to maintenance employees even though they were expected to operate trolleys. Instead, they were given the *Shop Personnel Rules Handout*, which contained only selected sections of the manual. The handout did not include the section "Preparing Car for Service," which contains a pre-movement checklist that includes checking the brakes before moving a trolley. After the accident, SEPTA added this checklist to the handout.

3 Probable Cause

The National Transportation Safety Board determines that the probable cause of the derailment of Southeastern Pennsylvania Transportation Authority trolley 9107 was the trolley's movement with inoperable brakes; the electronics specialist operating the trolley was unaware that the brakes were disconnected because of insufficiently documented maintenance procedures. Contributing to the likelihood of the accident were inadequate training resources for maintenance employees and a maintenance shift turnover process that lacked clear communication about the condition of the brakes.

The NTSB is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in the other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also 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 Case Analysis and Reporting Online \(CAROL\) website](#) and search for NTSB accident ID [RRD23FR014]. 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 –

National Transportation Safety Board
Records Management Division, CIO-40
490 L’Enfant Plaza, SW
Washington, DC 20594
(800) 877-6799 or (202) 314-6551