Issued: August 24, 2026 Railroad Investigation Report: RIR-26-13

Southeastern Pennsylvania Transportation Authority Pantograph Separation From Trolley Car

Location	Springfield, Pennsylvania
Date	September 25, 2025
Accident type	Pantograph separation with injuries
Train	Southeastern Pennsylvania Transportation Authority Trolley 111
Line	D1 Trolley Line
Crew and passengers	One crewmember and nine passengers onboard
Track	Non-signalized main track 2
Hazardous materials	None
Fatalities	None
Injuries	One crewmember and three passengers
Property damage	$254,000

Factual Information

On September 25, 2025, about 6:58 a.m., westbound Southeastern Pennsylvania Transportation Authority (SEPTA) Trolley 111 was operating on main track 2 of the D1 Line at milepost 3.97 with nine passengers and an operator onboard in Springfield, Pennsylvania, when its pantograph became entangled with the overhead catenary system (OCS).[1] A portion of the pantograph separated from the trolley car, and components of the pantograph penetrated the trolley's roof and entered its passenger compartment. (See figure 1.) The trolley operator and three passengers requested transport to a hospital for minor injuries. SEPTA estimated damages to be about

[1] (a) Visit ntsb.gov to find additional information in the public docket for this NTSB accident investigation (case number RRD25FR024), including detailed factual reports about the circumstances of the accident. (b) All times in this report are local. (c) A *pantograph* is a collapsible, articulated device mounted on the roof of an electric vehicle, such as a tram or trolley, that collects electric current from overhead lines to power the vehicle's motor. (d) An *overhead catenary system* uses an overhead wire to supply electricity to vehicles, such as light rail trains and streetcars, as part of a broader traction power supply system.

$254,000. The weather was 74°F and cloudy with no precipitation; visibility was unobstructed.

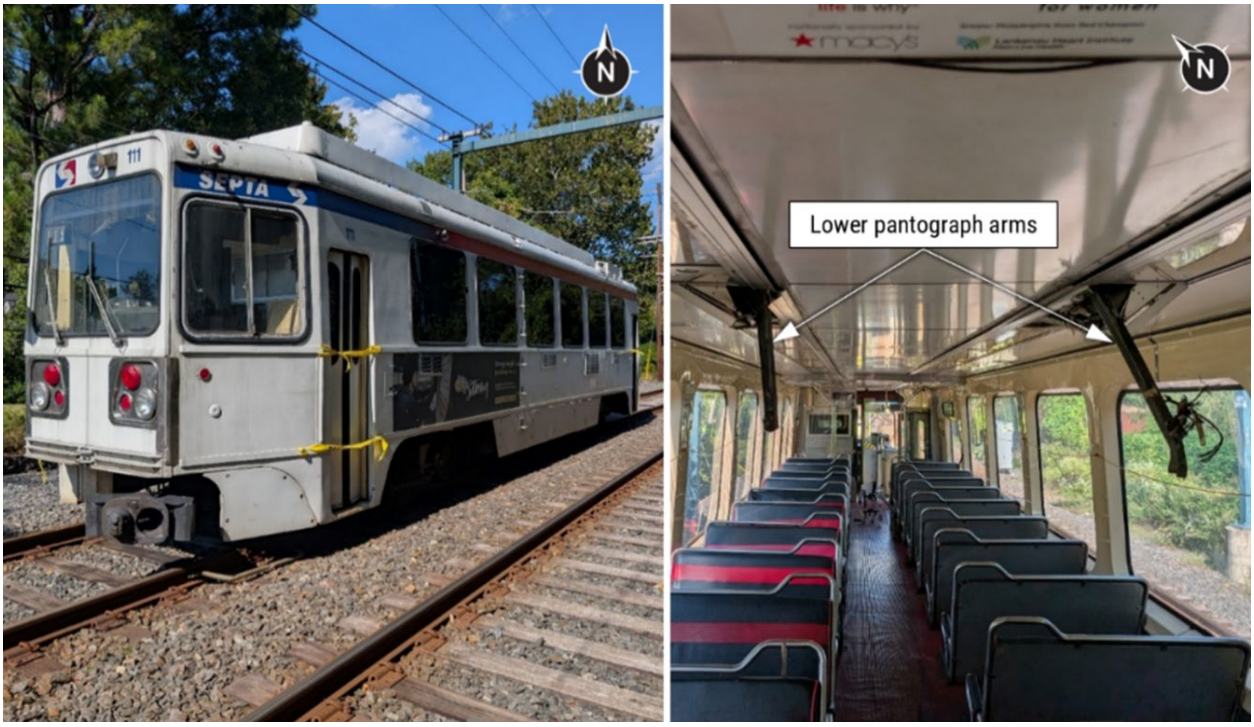

Figure 1: Trolley 111 postaccident (*left*) and passenger compartment of Trolley 111 (*right*).

Trolley 111, a single light rail vehicle, was traveling about 38 mph at the time of the accident, en route to Media, Pennsylvania.[2] The D Line's OCS provided direct current via a trolley wire—a single, uninsulated overhead contact wire—suspended directly over and parallel to the tracks and spanning between vertical supports spaced about 100 feet apart on the D Line.[3] The trolley wire is energized to provide power to the trolley's traction motors. The trolley pantograph first became entangled with the OCS within the east crossover of the Scenic Road interlocking, where the wire that provided power through the crossover intersected with the wire for the main track.[4] After becoming

[2] The maximum authorized speed at the accident location was 50 mph.

[3] (a) A *contact wire* is the solid overhead wire of an OCS which makes direct contact with a vehicle-mounted pantograph or trolley pole to supply electrical power from the OCS to the vehicle. (b) A *trolley wire* differs from a simple catenary, which suspends the contact wire from a tensioned messenger wire with hangers, and a compound catenary, which includes auxiliary wires in addition to a messenger wire.

[4] (a) An *interlocking* is an arrangement of signal equipment and switches designed to prevent conflicting movements through turnouts, crossings, and other places where tracks converge. (b) A *crossover* is a connection track between two adjacent (not necessarily parallel) tracks that allows trains to cross from one track to the other.

entangled, parts of the pantograph assembly disconnected from the trolley and were subsequently found adjacent to the track. The entanglement also caused the two lower pantograph arms to penetrate the passenger compartment of the trolley.

The incident severed the contact wires and tore them from their supports; responding personnel later found the downed wires on the ground. The incident also tripped the circuit breakers at both traction power substations supplying power to the OCS at the location, interrupting power to the contact wire and de-energizing the OCS in the vicinity.

After the accident, SEPTA halted passenger service on the D Line to perform inspections and repairs to the OCS. During this shutdown, which lasted 18 days, SEPTA identified 46 conditions across the 11.9-mile line that required repairs before the line could be reopened, including multiple crossovers with sagging contact wires.

Safety Oversight

The Federal Transit Administration (FTA) has authority to regulate light rail transit operations, but delegates direct safety oversight to the states by certifying state safety oversight agencies (SSOAs) to perform the regulatory work. The Pennsylvania Department of Transportation (PennDOT) SSOA performs this oversight of SEPTA's rail transit operations, including the D Line. The FTA does not have regulations that directly govern the inspection and maintenance of traction power supply systems like the D Line's OCS. However, the FTA does require SSOAs to complete triennial audits of each rail transit agency's compliance with its Public Transportation Agency Safety Plan.[5]

During its triennial audits of SEPTA in the years preceding the accident, PennDOT SSOA documented several findings related to SEPTA's traction power system on the D Line:

- 2016: SEPTA's traction power maintenance department did not have a compiled maintenance plan that included specific maintenance and inspection procedures and details of its power infrastructure or the current condition of the traction power system.
- 2019: SEPTA's traction power maintenance department's inspection and maintenance frequencies were not consistent with information provided in

[5] Each transit agency is required by Title 49 *Code of Federal Regulations (CFR)* Part 673 to have a *Public Transportation Agency Safety Plan* that details the agency's safety policies, objectives, and responsibilities utilizing an active safety management system framework.

its System Safety Program Plan.[6] SEPTA's suburban transit district, which was responsible for the D Line, was in the process of creating an OCS inspection plan at the time of the audit, while another district had no written plans in place. Furthermore, the audit found several instances in which inspections and maintenance activities were not performed and that some records of annual inspections on the D Line were missing.

- 2023: No findings related to SEPTA's traction power system.

In response to the audit findings, SEPTA initiated corrective action plans (CAPs), completed actions intended to fix the shortcomings found, and closed the CAPs. PennDOT SSOA approved the CAPs upon initiation and then approved closure of the CAPs by SEPTA.[7] CAPs should have addressed the underlying safety issues of missing and inconsistent OCS inspection plans and maintenance procedures that had been identified during the audits. After the accident, however, when the National Transportation Safety Board (NTSB) requested copies of SEPTA's written procedures that governed the inspection and maintenance of the OCS on the D Line, SEPTA was initially unable to locate any such written procedures. SEPTA's system safety department concluded that SEPTA did not have written OCS inspection and maintenance procedures for its rail transit lines.

Six months after the initial NTSB request, SEPTA located and provided the NTSB with a two-page document from 2009 titled "Standards for Track Power AC and DC Overhead Distribution System Inspection and Maintenance."[8] These standards included lists of checks to be performed during walking inspections and aerial inspections that are performed with a catenary maintenance car (CMC).[9] However, these standards were not referenced during interviews of SEPTA traction power maintenance employees and did

[6] A *System Safety Program Plan* was a comprehensive safety management tool, historically mandated under 49 *CFR* Part 659, that detailed a rail transit agency's safety policies, objectives, and responsibilities. This was later superseded by the safety management system–based frameworks required under 49 *CFR* Part 673.

[7] *Corrective action plans,* detailed in 49 *CFR* 674.37, are initiated by a rail transit agency (in this case, SEPTA) to address identified safety concerns. Either an SSOA or the FTA may require a rail transit agency to develop and carry out a CAP. When requiring a CAP, the SSOA must approve the proposed CAP or require revisions if the proposed CAP is insufficient. After the rail transit agency completes the planned corrective actions, they notify the SSOA to request closure of the CAP. The SSOA either concurs and the CAP is closed, requests additional evidence, or reopens specific action items of the CAP.

[8] *AC* and *DC* are types of electrical current. AC means alternating current; DC means direct current.

[9] A *catenary maintenance car* is a specialized rail-bound vehicle used to inspect and repair overhead catenary systems. It features an electrically insulated aerial lift to elevate workers to perform their work on the overhead wires. An *aerial inspection* of the OCS is performed from the elevated platform of a CMC.

not include any required inspection frequencies, defined defective conditions, or required remedial actions for defective conditions. The standards also did not include procedures for monitoring the effectiveness of, and employee compliance with, the program.

Inspection History and Pantograph Incident Trends

SEPTA's traction power maintenance department had performed annual walking inspections of the D Line OCS. In interviews with the NTSB, employees said the department also had a goal of performing monthly aerial inspections from a CMC, though records of these monthly aerial inspections were not kept. Of note, SEPTA power department employees told the NTSB that these monthly inspections often were not performed, including multiple occasions of missed consecutive aerial inspections. The power department employees attributed most of the missed monthly aerial inspections in the year before the accident to the CMC being out of service from maintenance issues.

For over a year before the accident, SEPTA's vehicle maintenance department had been tracking an uptick in incidents on the D Line involving trolley pantographs being damaged while in service, including other pantograph separations like the one that occurred in this accident. SEPTA's maintenance records showed that on 47 occasions in the 14 months preceding the accident, a trolley experienced pantograph damage that required it to be removed from service for repairs; a dozen of these incidents resulted in a partial or complete pantograph separation. Maintenance records showed that, before this 14-month period, the D Line fleet averaged about 10 such occurrences per year. The vehicle maintenance department shared these data with SEPTA's traction power maintenance department, but the traction power maintenance department did not conduct extensive inspections and repairs of the D Line OCS. Because of the increase in damage occurring to the pantographs from striking OCS components, SEPTA's vehicle maintenance department increased inspections of vehicle pantographs and lowered thresholds for repair.

Analysis

Trolley 111's pantograph became entangled with sagging contact wires at the Scenic Road crossover, damaging the pantograph and contact wires and causing portions of the pantograph assembly to penetrate the trolley's passenger compartment.

A trolley's pantograph usually touches a single contact wire of the OCS. When tracks come together at a crossover, there is a contact wire for the main track, and a contact wire for the crossover that passes above the main track contact wire. (See figure 2.) If contact wires are not properly tensioned, they will sag excessively. Sagging wires, or crossover wires that are too low, can cause the wires and the pantograph to bounce

vertically as a trolley passes. At a crossover, this bouncing action creates a dangerous condition as the pantograph navigates the multiple contact wires and could become entangled.

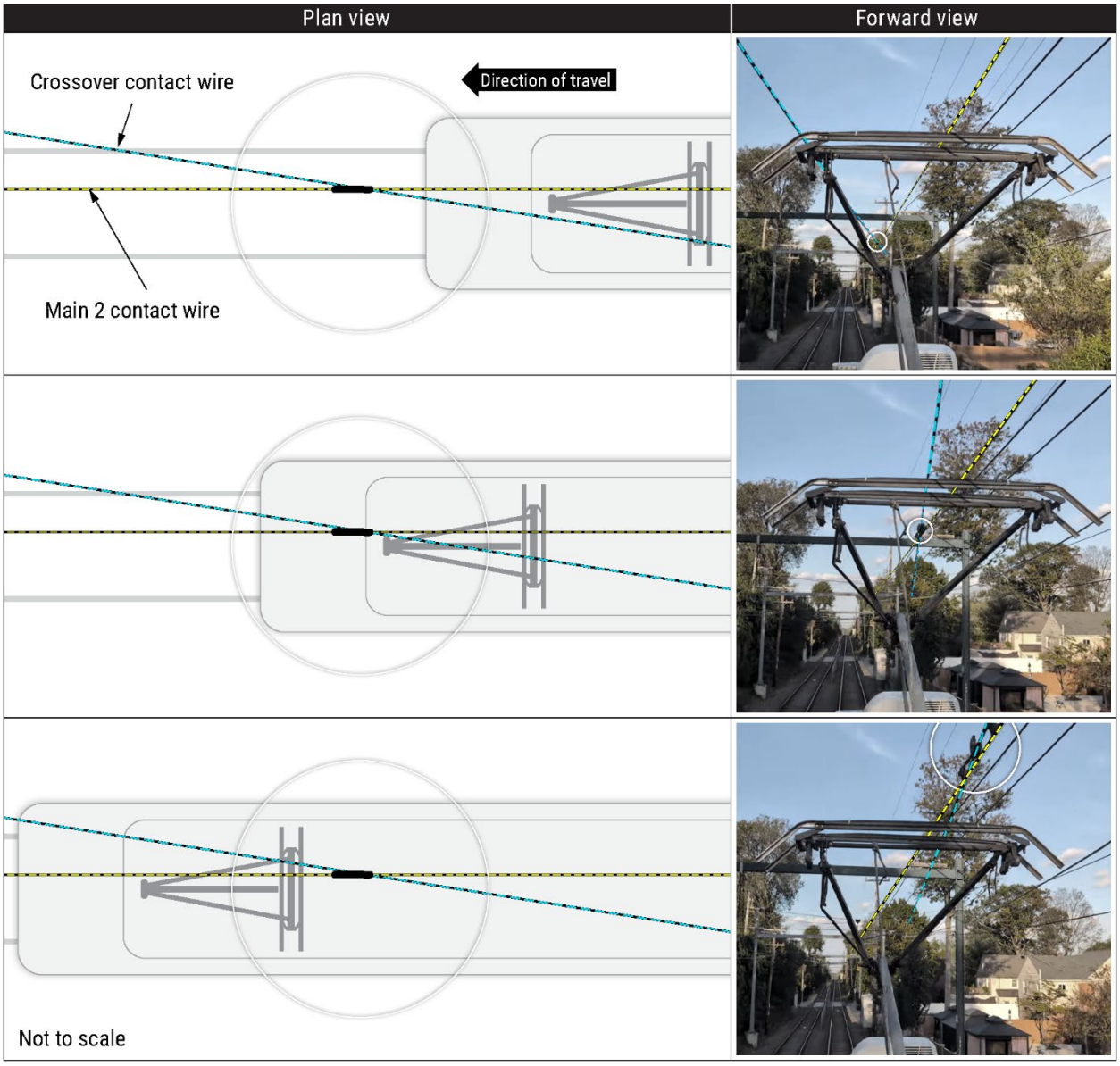

Figure 2. Diagrams and photos of an exemplar pantograph and catenary wire arrangement as a trolley passes through a crossover.

In this accident, the pantograph first became entangled with the OCS where the two contact wires—which were likely sagging from inadequate tension or improper configuration—crossed at the east crossover on main track 2 at the Scenic Road interlocking. SEPTA's postaccident inspections identified 17 other locations where OCS wires were sagging or too low, six of which were at crossovers. However, because the D Line trolley fleet was not equipped with roof-mounted video cameras that record the

interaction between the pantograph and OCS, investigators were unable to determine exactly how the pantograph and contact wires became entangled. After the accident, SEPTA began installing roof-mounted video cameras to the D Line trolley fleet that will record the interaction between the pantograph and OCS. These cameras will allow maintenance employees to observe the interaction of the pantograph with the suspended powerlines and help identify unsafe conditions before they cause an accident. Additionally, these cameras allow investigators to quickly determine the root cause of damaged pantographs when accidents do occur.

SEPTA did not have a formal OCS inspection and maintenance program at the time of the accident. An effective inspection and maintenance program would include the following elements:

- Required inspection frequencies for specific OCS components;
- Defined limits of acceptable (and therefore unacceptable) conditions, including measurements and specifications;
- Specific required remedial actions for each defective condition; and
- Procedures for monitoring the effectiveness of, and employee compliance with, the program.[10]

Without strict adherence to formal procedures and a process to ensure the procedures are both effective and continually complied with, organizations often undergo a normalization of deviance (otherwise known as a practical or procedural drift)—a process by which a lack of controls allows a slow, gradual drift toward progressively unsafe practices and acceptance of risk.[11] Because a negative consequence is not immediately experienced at each step along this drift, each new step of degraded operations becomes the new accepted baseline of normal operations.

Evidence showed that SEPTA's traction power maintenance department likely experienced a normalization of deviance regarding its OCS inspection and maintenance since at least 2016, when PennDOT SSOA's audit found that SEPTA did not have specific inspection and maintenance procedures. By 2024, vehicle maintenance records showed that SEPTA was experiencing incidents in which trolley pantographs were damaged during service about four times as often as the long-term average during the previous 14 years of available data. During the year before the accident, this increase of pantograph incidents became normalized and, therefore, did not raise sufficient concerns within the

[10] See APTA Standard APTA-RT-FS-S-006-02, *Traction Electrification Distribution System Inspection, Maintenance and Testing* and 49 *CFR* 673.27, Safety Assurance.

[11] Vaughan, Diane. 1996. *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*. Chicago, IL: University of Chicago Press.

traction power maintenance department. Employees became accustomed to frequent incidents of pantograph damage and to maintenance issues on the CMC car that prevented regular aerial inspections. Because these small incidents did not result in significant negative consequences, employees came to accept both missed aerial inspections and regular incidents of pantograph damage as the baseline for normal operations.

Additionally, because SEPTA did not have a written OCS inspection and maintenance program, its missed monthly aerial inspections were not identified by SEPTA's management as inducing increased risk and cause for concern. Management did not intervene, even when consecutive months of inspections were missed, and the CMC used for these inspections was itself often out of service for maintenance issues. The inability to perform monthly aerial inspections on the D Line was normalized within SEPTA. In the end, SEPTA's normalization of deviance led to the degraded OCS condition that caused this accident and the additional 46 critical conditions on the D Line that were identified postaccident, which required repair before passenger service could be resumed.

PennDOT SSOA's oversight failed to correct SEPTA's unsafe practices and lack of OCS procedures, even though PennDOT SSOA identified the inadequate inspection and maintenance activities in the 2016 and 2019 triennial audits. The actions taken by SEPTA in response to the audit findings did not address their root causes or the lack of a formal OCS inspection and maintenance program. Nonetheless, PennDOT approved closure of each CAP created and executed by SEPTA. For example, in response to PennDOT's 2019 finding that annual OCS walking inspection records were missing, SEPTA performed new inspections for the locations that were missing records but did not create a process to ensure these inspections would continue. Had PennDOT SSOA ensured SEPTA implemented an effective OCS inspection and maintenance program in 2016, when it identified SEPTA lacked a compiled OCS program, the accident may have been prevented, as unsafe OCS conditions would have been identified and corrected.

SEPTA initiated six CAPs after the accident concerning OCS inspection and maintenance on its light rail transit lines, including the D Line. After the accident, the FTA determined that "unsafe conditions or practices exist[ed]" regarding SEPTA's OCS and that these shortcomings "present[ed] a substantial risk of death or personal injury." The FTA then issued Special Directive 25-1 to SEPTA, which, in part, required SEPTA to develop and implement a formal OCS inspection and maintenance program.[12] The FTA also issued Special Directive 25-2 to PennDOT SSOA, requiring it to strengthen its

[12] The FTA may issue a special directive when it is necessary to eliminate or mitigate an unsafe condition or practice, as outlined in 49 United States Code § 5329 and 49 *CFR* 670.27.

oversight of SEPTA's OCS inspection and maintenance program, which included an independent engineering review of SEPTA's new OCS program and active, ongoing field oversight of OCS related activities. SEPTA's new formal OCS inspection and maintenance program was approved by PennDOT SSOA and the FTA and went into effect on April 28, 2026.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the September 25, 2025, accident was Southeastern Pennsylvania Transportation Authority's (SEPTA) lack of a formal inspection and maintenance program for its overhead catenary system (OCS), which led to SEPTA failing to identify and correct unsafe catenary conditions that caused the pantograph on Trolley 111 to become entangled in the catenary wires and separate from the trolley, and caused pantograph components to penetrate the trolley's passenger compartment. Contributing to the accident was Pennsylvania Department of Transportation State Safety Oversight Agency's failure to require SEPTA to implement a formal and enduring OCS inspection and maintenance program after they identified SEPTA's inadequate OCS inspection and maintenance activities.

Lessons Learned

Rail transit agencies are required by Title 49 *Code of Federal Regulations* Part 673 to have safety assurance processes that ensure maintenance procedures are sufficient and being complied with.[13] To prevent similar accidents in the future, rail transit agencies and state-safety oversight agencies should ensure that formal inspection and maintenance programs for all infrastructure and rolling stock assets, including traction power systems such as overhead catenary and third rail systems, are sufficient and that adherence to those programs is maintained. Effective inspection and maintenance programs include explicit inspection frequencies, defined defective conditions, and required remedial actions for each defective condition. To ensure these programs continually meet organizational safety goals, adapt to new technologies and operational changes, and avoid a normalization of deviance, it is critical that they include procedures for monitoring the program's effectiveness and verifying employee compliance with it.

In addition to rail transit agencies, electrified heavy-rail passenger railroads should similarly ensure that formal inspection and maintenance programs are in place for all infrastructure and rolling stock assets, including traction power systems like overhead

[13] 49 *CFR* 673.27 states, in part, that "a transit agency must establish activities to: (1) Monitor its system for compliance with, and sufficiency of, the transit agency's procedures for operations and maintenance."

catenary and third rail systems. To call attention to risks posed by aging electric propulsion power systems in both rail transit and heavy rail, in March 2026 the NTSB published a safety alert encouraging railroads to review and address deficiencies in traction power electrical system procedures and maintenance and to incorporate electrical hazards into system safety programs.[14]

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For more detailed background information on this report, visit the NTSB Case Analysis and Reporting Online (CAROL) website and search for NTSB accident ID RRD25FR024. 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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[14] NTSB. 2026. *Electric Propulsion Power Systems – Finding Risks in Aging Rail Infrastructure.* Safety Alert SA-105. Washington, DC: NTSB.