

National Transportation Safety Board

Office of Railroad, Pipeline and Hazardous Materials

Washington, DC 20594



RRD23FR014

INVESTIGATIVE GROUP

Group Chair's Factual Report

January 26, 2024

TABLE OF CONTENTS

A	ACCIDENT.....	4
B	INVESTIGATIVE GROUP	4
C	SUMMARY	5
D	FACTUAL INFORMATION.....	5
1.0	THE VEHICLE.....	5
1.1.1	Details of the braking systems	6
1.1.2	Pneumatic Air Supply	7
2.0	INFRASTRUCTURE AND FACILITIES	7
2.1.1	Elmwood Maintenance Facility and Yard	7
2.1.2	Island and Woodland Avenues.....	8
2.1.3	Blue Bell Inn.....	9
3.0	SEPTA RULES, PROCEDURES, AND SOPS.....	10
3.1	Safety Awareness for Yard and Shops Manual	10
3.2	Maintenance Procedures.....	10
3.2.1	Light Rail Transit Car Running Maintenance and Service Manual	10
3.2.2	Heavy Repair Maintenance Manual Light Rail Transit Car	11
3.3	LRV Operation Training.....	11
3.4	Engineering Change Notice.....	12
3.5	Turn Over Process, Generally.....	13
3.5.1	Turnover for Trolley Number 9107	14
4.0	TROLLEY 9107 MAINTENANCE.....	15
4.1	Work Order Number 3567000	15
4.1.1	Work Completed on July 27	15
4.2	Details on the movement from Track 5.....	17
5.0	PUBLIC TRANSPORTATION AGENCY SAFETY PLAN	17
5.1	Recent Single-Ended Light Rail Vehicle (LRV) Audits.....	18
5.1.1	SEPTA System Safety.....	18
5.1.2	Pennsylvania Department of Transportation	18
6.0	POST ACCIDENT SAFETY ACTIONS.....	19
6.1	Maintenance Procedures.....	19

6.2	Training	19
E	APPENDIX A- LIST OF INTERVIEWEES	21
F	APPENDIX B- DOCUMENT REQUEST	22

A ACCIDENT

Location: Philadelphia, Pennsylvania
Date: July 27, 2023
Time: 10:18 p.m.
Trolley: 9107

B INVESTIGATIVE GROUP

IIC	John Manutes National Transportation Safety Board Denver, Colorado
Assistant IIC	Ben Strot National Transportation Safety Board Denver, Colorado
Party Coordinator/ Group Member	Phil Herbert ¹ Federal Transit Administration Accident Investigators
Party Coordinator	Elizabeth Bonini Pennsylvania DOT State Safety Oversight Chief
Party Coordinator/ Group Member	Ron Keele SEPTA Chief Safety Officer
Party Coordinator	Ron Newman TWU 234 Business Agent
Group Member	J Michael McLaughlin Pennsylvania DOT State Safety Oversight Regional Manager

¹ Investigator George Good initially responded on scene, but retired from Federal service shortly thereafter. Investigator Herbert is the Primary Party Coordinator for FTA for this accident.

Group Member	Mark Jansen Transportation Resource Associates (Supporting PennDOT SSO) Senior Analyst
Group Member	Edward Carruthers SEPTA Senior Director Metro Rail Equipment Maintenance
Group Member	Paul Southard TWU Local 234 Business Agent

C SUMMARY

For a summary of this accident, please see the IIC summary in the docket.

D FACTUAL INFORMATION

1.0 The Vehicle

The trolley involved in the accident was Trolley Number 9107, manufactured by Kawasaki Heavy Industries in 1981 for SEPTA (Southeastern Pennsylvania Transportation Authority) and rebuilt in 1997. The trolley has a maximum passenger capacity of 101 people with seating for 51 people and is operated by one operator. Under normal circumstances, the trolley is operated as a single vehicle, but it can be coupled to another trolley for multiple-unit operations. There is a single control compartment in the trolley for normal operations with a backup controller on the rear folded out of its storage position when in use. The back controller position contains no gauges or readouts of systems on the car. The only control on the back up controller is an operating handle that combines the control of the braking and propulsion systems into one handle.

The trolley has two trucks with 2 powered axles on each truck for 4 powered axles. The trolley is powered by a 600 VDC overhead line connected to it by a single trolley pole. The traction motors are rated at 100 hp each and produce a maximum tractive effort of 3100 lbs. The maximum speed of the trolley as delivered is 47 mph.

Braking is accomplished through 3 different and separate systems on the Trolley; dynamic brake, magnetic track brakes, and pneumatically applied friction brakes on each axle. The operator can apply these different braking systems using various pedals and switches on the forward control stand as well as the rear reverse controller.

1.1.1 Details of the braking systems

There are three braking systems on the car (dynamic, disc, and track) which may be applied to give service and emergency braking rates.

A. Dynamic brakes provide the main braking force for the trolley under normal operating circumstances. The dynamic brakes are blended with the pneumatic brakes when the brake pedal is depressed and are effective down to 3 mph.

B. Disc brakes are mounted on each axle and provide normal service braking and emergency braking effort as needed. Pneumatic service brakes are blended with the dynamic brakes and provide all braking effort after the dynamic brakes become ineffective at 3 mph.

Service braking is applied using the brake pedal, door interlock or release of the safety pedal while in RUN. When the disc brakes are applied the disc brake applied light will illuminate and the red brake cylinder pressure needle will show 40-70 psi.

When emergency braking is called for, the pneumatic disc brakes will apply at any speed. Emergency braking is initiated by applying the brake pedal past the detent and into emergency position, the red console emergency button, or by putting the car into storage. When emergency braking is applied, and the trolley is in run the disc brake applied light will illuminate and the red brake cylinder gauge will register 65-70 psi with the white needle dropping to zero.

C. Track Brakes are mounted on each truck and used to supplement the pneumatic disc brakes in emergency braking situations. Four articulated electromagnetic track brake units are suspended from the trucks, one mounted between each pair of wheels directly over the rail's head. The track brake shoes are held off the rail by spring pressure. Energizing the coils in each of the shoes allows them to be pulled down to the rails by their own magnetism. The track brake system is powered by the battery circuit. Track brakes are applied either full on or off, there is no feathering of the application. Track brakes are activated when the brake pedal is pushed down into emergency and held, emergency plunger is depressed on the console, the safety pedal is released with the trolley in run, if the backup controller handle is put into emergency, or the console toggle switch is activated.

The pneumatic brake cylinders on the trucks can be released and isolated from the pneumatic system manually by closing ball cock valves at the brake cylinders. The brake cylinders can also be cut out and isolated from the system via disc brake cutouts located in the trolley cut out box.

1.1.2 Pneumatic Air Supply

Air is supplied to the trolley for operation of the disc brakes, horn, windshield wipers, suspension, doors, sanders, and coupler by an air compressor unit mounted under the rear left side of the trolley behind a hinged skirt. The air compressor unit consists of a compressor section, electric motor, flexible drive coupling, pneumatic conditioning and pressure regulating control, and isolation valves. The compressor is a two stage, two-cylinder, 120-degree, single acting reciprocating unit with a displacement of 21.8 cubic feet at 1740 rpm.

Compressed air is stored in two reservoirs, the main reservoir supplies air to all the items in the pneumatic system and the brake supply reservoir is charged from the main reservoir and supplies air to the brake system. Air flows through piping from the reservoirs to the servotrol unit where the air is metered to the brake cylinders depending on input from the operator.

2.0 Infrastructure and Facilities

2.1.1 Elmwood Maintenance Facility and Yard

The Elmwood District is a SEPTA subway-surface trolley car house constructed in 1981 to house the current Kawasaki LRV's that run on subway-surface routes. SEPTA defines an area where day-to-day running maintenance is performed as a car house. The Elmwood car house has indoor maintenance facilities used to perform vehicle cleaning, running repairs, and inspections. The maintenance facility is staffed by 54 technicians managed by 6 Maintenance Managers, an assistant director and director of rail equipment maintenance.

The Elmwood District combines the car house with transportation facilities and a storage yard for the LRV's. The storage yard has a capacity of 120 LRV's as well as loop tracks and service tracks.

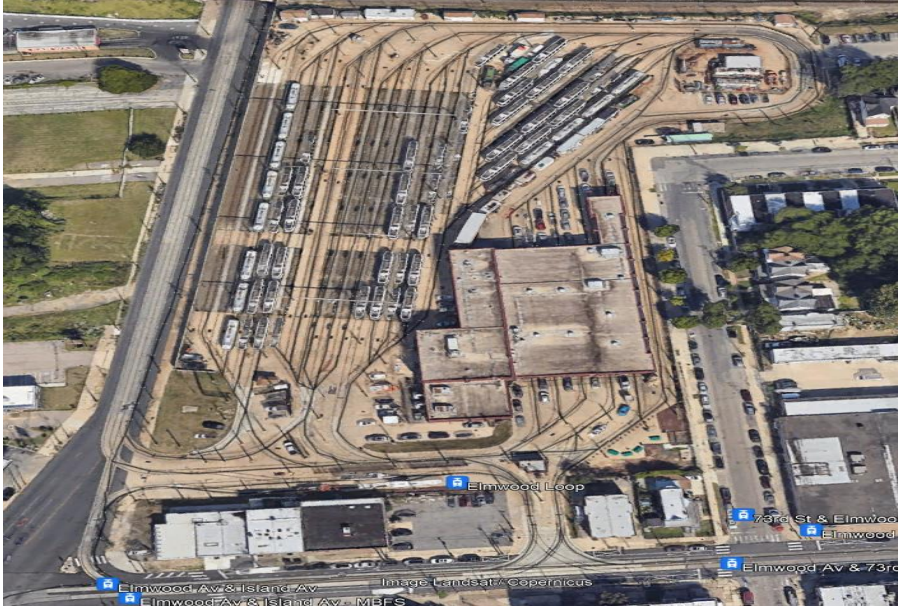


Figure 1. Overhead view of Elmwood facility. Source: Google maps

2.1.2 Island and Woodland Avenues

Island Avenue is a four lane to two lane roadway that runs Northwest to Southeast from the intersection of Woodland Avenue to the airport. Double trolley tracks run the length of the avenue with some street running and some running on private right of way.

Woodland Avenue is a four-lane roadway running Northeast to Southwest from the intersection with Island Avenue to the University City neighborhood. Double trolley tracks run the length of the avenue operating in street running traffic the entire route.

The intersection of Island Avenue and Woodland Avenue is a 4-way intersection controlled by overhead highway traffic signals. The roads at each quadrant of the intersection start here. To the northwest Cobb Creek Parkway begins, to the southwest Main Street begins, to the southeast Island Avenue begins and to the northeast Woodland Avenue begins.

Trolley tracks make a T at the intersection with the tracks continually running northeast to southwest from Woodland Avenue to Main Street. The tracks from the southeast on Island Avenue end at the intersection with all trolleys entering the perpendicular track through switches in the roadway.

2.1.3 Blue Bell Inn

The Blue Bell Inn is a historic structure on the northwest corner of the Island and Woodland Avenue intersection. The portion of the building standing was built in 1776 along one of the major stage roads between Philadelphia and the southern colonies.

Trolley Number 9107 stopped when it impacted the south side of the Blue Bell Inn. At the time of the accident a caretaker for the property resided in the building. The caretaker did not report any injuries, but the building sustained substantial damage.



Figure 2. Intersection of Island and Woodland Aves., with the Blue Bell Inn in the top right corner.

3.0 SEPTA Rules, Procedures, and SOPs

Employees and managers at Elmwood maintenance facility are governed by multiple SEPTA rule books, maintenance manuals and SOP's. These rule books can be broken down into operating procedures, maintenance procedures, and safety rule books. Employees access up-to-date rule books through the SEPTA Vehicle Technical Information Library (VTIL) system. During interviews and on-scene visits, employees also stated that some of these rule books are stored in print in the office of the facility, in employee's personal toolboxes, and their automobiles.

3.1 Safety Awareness for Yard and Shops Manual

Safety rules for mechanical employees are contained in the Safety Awareness for Yard and Shops.²

This rule book contains rules on:

- Elmwood Specific blue signal protection
- Identification of defective equipment that prohibits use in revenue service.

3.2 Maintenance Procedures

Maintenance procedures for SEPTA Light rail vehicle mechanics are covered by two maintenance manuals provided by the vehicle manufacturer, Kawasaki. These manuals are broken down into servicing/light running repair and heavy maintenance.^{3,4} SEPTA has an internal change process to update these manuals for procedures specific to SEPTA and its locations. Once these changes are processed and approved, an Engineering Change Notice (ECN) is issued to supersede sections of the manuals. The most up to date versions of the rule books, with ECN updates, can be found in the VTIL system.

3.2.1 Light Rail Transit Car Running Maintenance and Service Manual

The Light Rail Transit Car (LRTC) Running Maintenance and Service Manual contains daily servicing, inspection, and repair items. The manual provided by SEPTA is a 350-page document that only pertains to the single ended vehicles. The manual is broken down into 12 sections:

1. Introduction

² The current revision for the Safety Awareness for Yard and Shops document is July 25, 2018.

³ The Light Rail Transit Car Running Maintenance and Service Manual is dated September 1981, Revised November 1982.

⁴ The Heavy Repair Maintenance Manual, Section 6 - Brake and Piping System Revised March 15, 2016 was used in this report.

2. Car body
3. Truck system
4. Propulsion system
5. Electrical system
6. Air supply and braking system
7. Coupler and draft gear
8. Door system
9. Air comfort system
10. Lighting system
11. Communication system
12. Miscellaneous system

Each section is broken down into sub paragraphs covering system description, component description, inspection tasks, servicing and lubrication, and removal and installation.

This manual contains no sections covering movement of light rail vehicles. The functional checkout procedure for brake operation starts on page 1-41. Section 6 describes the air/braking system on the vehicle and how to service it. There are descriptions, inspection procedures, and servicing/lubrication for the air compressor but no removal and installation process for the air compressor is contained in this manual.

3.2.2 Heavy Repair Maintenance Manual Light Rail Transit Car

The Heavy Repair Maintenance Manual Light Rail Transit Car (LRV HRMM) is an in-depth manual that breaks systems down to components and contains procedures to repair and rebuild these components. NTSB reviewed Section 6 -Brake and Piping Systems. This section of the manual contains detailed descriptions of systems and repair procedures for the air and braking systems of the LRV.

This section details multiple ways to cut out the brake system on an LRV and system start up procedures. The sections on the air compressor detail how to disassemble each individual component but do not include procedures for removal of the compressor from the LRV.

3.3 LRV Operation Training

Maintenance employees are trained on how to operate the Kawasaki LRV's by the operation training department employees. This training is a 5-day course broken down into 1 day of classroom training, 3 days hands-on training with the Kawasaki LRV, and 1 day of hands-on training with the PCC II cars. Hands-on training involves

moving the vehicles in the shop as well as operating the vehicles on the street from shop to shop. According to training staff interviewed by investigators, mechanical employees are not trained the same as operations personnel and are not allowed to carry passengers.

According to SEPTA's Suburban Light Rail Transit Instructor, during operations training for mechanical department employees, mechanical personnel are provided with a handout with rules extracted from the Rail Operations Rules Manual for reference.⁵ Investigators were provided with a copy of the document for review. This document does not contain pre-movement inspection criteria or instructions on brake tests procedures when operating from the rear controller. Investigators learned that mechanical employees are given this handout of rules but they are not personally given an operating manual to refer to during or after class. Full-time LRV operators are given a personal copy of the operating manual. According to SEPTA representatives, a copy of the manual is available in the manager's office, but it is not clear if employees are aware of or encouraged to reference this document.

3.4 Engineering Change Notice

SEPTA uses an internal change management process to update procedures for specific locations or to modify manufacturers processes. This process is called an Engineering Change Notice (ECN.) SEPTA explains the ECN process in internal document REE 3.0, which states:

Following expiration of the Carbuilder warranty, Vehicle Engineering becomes responsible for railcar configuration management via the ECN program. Configuration control is to be maintained and enforced by requiring that any and all hardware and software changes, permanent or temporary, be made with an approved ECN authorizing the change(s). ECNs are to be used to authorize all Supplier design, system, software, hardware, or material changes. Approved ECNs are also to be used to authorize all tests, (as well as) all evaluations of components, equipment, and systems.

Approved ECN's that also change maintenance, repair, parts, operators, or inspection manuals (or procedures) content must also include the approved revised manuals" pages along with distribution of the ECN to assure distribution of changed pages to the Manual Holders. The most recent ECN's are shared with employees through the VTIL system and supplement the manuals and polices contained within.

⁵ Interview of Suburban Light Rail Transit Instructor, August 1, 2023, Page 26, Line 1
INVESTIGATIVE GROUP
GROUP CHAIR'S FACTUAL REPORT

ECN 4391-1 contains the steps for performing an LRV leakage test. A portion of this ECN was used in the making of the D5 compressor change out leakage test form. This form does not contain all the steps included in the ECN but only the steps needed for a whole system decay test and a spot to document the results.

3.5 Turn Over Process, Generally

Employees at Elmwood turn over from shift to shift through two different processes. First, shop employees who do not complete a task in their shift use the Vehicle Maintenance Information System (VMIS) system to add notes in the work order showing what was completed on a job or what needs to be done to complete a task.⁶ Second, apart from the VMIS system, the maintenance managers at Elmwood use an excel spreadsheet-based form to turn over the status of vehicles at the shop level. This spreadsheet is updated though out the shift and printed out at the end of each shift for review in turn over.

The Maintenance Manager's Standard Operating Procedures book states that each shift the manager should review the turnover excel spreadsheet provided by the previous shift's manager. They should then prioritize work according to that turnover. The document does not expand further regarding the turnover process.⁷

In an interview with the Assistant Director at Elmwood Maintenance Facility, investigators asked, "Is there a formalized process on what managers should put in the turnover sheet? Is there a checklist, "don't forget", or an instruction, you know, a paragraph that tells them how to fill out that sheet or is it more on-the-job, we know what to do?" The Assistant Director's reply was, "There is no formalized process, it's more when a newer manager starts, they work with the senior managers and they pass that information along. When I get newer managers, I try to pass on information and knowledge to them on how I like to see things done, but ultimately, they're running the shift so I try to encourage them to make their own decisions as long as it's not an unsafe decision."⁸

The Assistant Director was also asked, "Where would you see information on safety related defects to the vehicles, brakes cut out, you know, something of that nature, where would you normally expect to see that listed, or, you know, where an employee would know that's been done to the car"? The Assistant Director's reply

⁶ According to the Vehicle Equipment Maintenance Standard Operating Procedures, Maintenance Managers document approved January 17, 2020, the VMIS system is, "a fully automated, real-time system used to manage and standardize maintenance activities on the shop floor and at an administrative level. VMIS is an Oracle database application which is capable of being accessed by individual PC's or Winterm terminals over a network.

⁷ Vehicle Equipment Maintenance Standard Operating Procedures, Maintenance Managers document approved January 17, 2020, Pages 5-7

⁸ Interview of Elmwood Assistant Director Vehicle Maintenance, July 27, 2023, Page 17, Lines 1 - 14.

was, “If there was a serious safety issue, that would be noted (in VMIS). In the case of 9107, it wouldn’t be assumed from the manager’s perspective that the brakes would have still been cut out because the car was moved back into position to be worked on , so the assumption would be that they are cut in, but if there was one, they would note on the turnover. And the mechanics, I encourage them to use VMIS because they can put notes under their ID. I encourage them to put notes in like that, even though in this case it didn’t happen. There was VMIS training at one point, I don’t know nowadays, I don’t know that it has been done in a while so I would say in the current situation, it would be best practice.”⁹

3.5.1 Turnover for Trolley Number 9107

For Trolley Number 9107, employees recorded notes in the VMIS system beginning on June 14 when Work Order 3567000 was opened. These notes are summarized in Table 2, below.

NTSB reviewed the revision history for the excel spreadsheet used by managers for shift turn over. The information related to Trolley Number 9107 is summarized in the following table.

Table 1. Summary of Elmwood Manager's Turnover Document for Trolley 9107

July 7, 2023, 5:30 a.m.	Trolley 9107 is shown on “25 Rail” under the column for “Deferred Repairs” – “CBTC NPR Needed Compressor Problem” ^{10,11}
July 7, 2023, 7:15 a.m.	Trolley 9107 is shown on “25 Rail” under the column for “Deferred Repairs” – “CBTC NPR Needed Compressor Problem”
July 7, 2023, 1:40 p.m.	Trolley 9107 is shown on “5 Rail” with the comment, “D5 Compressor – WND (Needs wiring & leak test CBTC (Cradle missing))” ¹²
July 7, 2023, 10:00 p.m.	Trolley 9107 is shown on “5 Rail” with the comment, “CBTC (Cradle missing)”

⁹ Interview of Elmwood Assistant Director Vehicle Maintenance, July 27, 2023, Pages 31-32

¹⁰ CBTC is Communication Based Train Control

¹¹ NPR is a Norming Point Reader

¹² In interviews with employees, it was stated that “needs wiring” was a typing mistake while discussing the status of the vehicle. Trolley 9107 was electrically wired at this point and only needed the leak-down test performed.

4.0 Trolley 9107 Maintenance

4.1 Work Order Number 3567000

Work order 3567000 for Trolley Number 9107 was initially opened in the VMIS system on June 14, 2023. An operator reported that the vehicle keeps losing air. The work order contains several parts. The first part is the initial write up for the vehicle losing air and the associated troubleshooting. The second part of the work order is a 10-day inspection that shows to be waiting for assignment. The third part of the work order is to house clean the vehicle; this shows done. The fourth part of the work order pertains to the defective air compressor diagnosis and leakage test.

The following is the sequence of events pertaining to this work order according to the VMIS system:

Table 2. Employee turnover notes through the VMIS system.

June 14, 2023	Work order 3567000 is opened. Operator reported vehicle keeps losing air
June 15, 2023	Notes: Checked CBTC system and found issue with NPR. Adjustments did not work; needs replacing. (Parts on Order)
July 20, 2023	Notes: (Worked on building the CBTC cradle, good, will let it burn in overnight)
July 27, 2023	(CBTC Cradle is complete. Mechanic finds air compressor issue when trying to move the vehicle to the shop)
July 27, 2023	Notes: Diagnosed and contactor was stuck got the contactor to work compressor running loud replaced compressor still needs to be electrically wired and leak tested
July 27, 2023	Notes: Did compressor leak test, stop all leaks system passed

4.1.1 Work Completed on July 27

On July 27th, the CBTC cradle was ready to be installed in the 9107. When the mechanic went out to the yard to move the vehicle into the shop, he found that the air system was not working properly. The vehicle was subsequently M/U'd with another vehicle and brought into the shop. Once in the shop the mechanic began to troubleshoot the air issue, finding the air compressor contactor stuck. Once the mechanic freed the contactor the compressor began to operate. The mechanic determined from the sound of the compressor that it would need to be changed.

The 3rd shift mechanic that diagnosed the compressor was finishing his regular shift and starting 4 hours of overtime when he was assigned the compressor change. The mechanic discussed with his manager that he could not complete the task in the

4 hours he had remaining. He was told to do what he could and someone else would finish.

The 3rd shift mechanic then set out to change the air compressor. In this process the mechanic cut the brakes out at the trucks and moved the car manually. The car had to be moved to lower the air compressor with a forklift because the Elmwood shops lacked a means to lower and raise the compressor in the pit. When the mechanic finished his overtime, he told investigators that the compressor needed to be electrically tested and a leakage test needed to be performed.¹³

In an interview with investigators, an Electronics Specialist stated that he was assigned to do a leak test on Trolley 9107 on July 27, 2023, at around 7:00 p.m. He stated that he was given a form to fill out, performed the air leak test, and started and stopped the air compressor. He stated he recorded the information needed for the form and returned it to the maintenance manager.¹⁴ He stated that he was not sure if the vehicle had chocks and that he did not change the position of the brake cut out valves.¹⁵

Investigators interviewed both an experienced electronics specialist and the assistant director of Elmwood. In these interviews both interviewees were asked if there is a procedure outlining how to change an air compressor at Elmwood yard.

The electronics specialist stated that there was not a process followed and that junior mechanics were taught by more senior personnel. He also stated that every mechanic performed the task differently both in how they perform the compressor change and how they perform the leakage test. The electronic specialist stated that the form given to employees to complete the compressor leakage test was missing the process outlined in the ECN for the leakage test. Specifically, the part that stated that the vehicle must be ready for revenue service. The SEPTA Electronics Specialist was asked where he would go to find information if he had a question regarding a procedure or a job. He responded that he has personal copies of some books, and there are manuals in the manager's office. When asked how often he looks for that information, he responded, "Every time I feel I need to".¹⁶

In interviews with investigators the assistant director at Elmwood was asked if there was a written process for air compressor change out. The assistant director replied that at one time it was in a maintenance manual but that it was not typically used, typically the process was learned through observing a more experienced mechanic. He also stated that the manager on duty would "assume" that the brakes on the vehicle were cut in unless he was informed otherwise by the employee working on the vehicle.

¹³ Interview of SEPTA First Class Mechanic, July 30, 2023, Page 11, Lines 8 - 16.

¹⁴ Interview of Alvin McCollin, Electronics Specialist, July 29,2023, Page 9, Lines 5 - 12

¹⁵ Interview of Alvin McCollin, Electronics Specialist, July 29,2023, Page 10, Lines 6 - 18

¹⁶ Interview of Rail Vehicle Electronics Specialist, July 31, 2023, Page 31, Line 12

4.2 Details on the movement from Track 5

After the leakage test was performed the 3rd shift maintenance manager tasked a 3rd shift specialist with moving vehicle 9107 from track 5 to track 11 for temporary storage. To perform this movement, the vehicle would need to back out of the carhouse up a slight incline to line a switch and come back towards the carhouse. The 3rd shift specialist boarded the vehicle to move it from the rear, back up, controller. As he approached the top of the grade to stop for the switch, he realized the car had no pneumatic brakes. The following is a timeline of the movements gathered from onboard image recorders, building security cameras, and the vehicle event recorder:

Time	Event
2218:04	Movement of the vehicle starts inside the carhouse
2218:29	Vehicle has exited the carhouse
2219:17	Vehicle enters the street
2219:41	Mechanic jumps from the vehicle
2220:09	Vehicle impacts SUV and Blue Bell Inn

5.0 Public Transportation Agency Safety Plan

Investigators reviewed the Pennsylvania Department of Transportation (PennDOT) State Safety Oversight Agency Program Standard, dated July 2023. PennDOT is the designated agency (49 C.F.R. Part 674.13) for fixed guideway safety and security oversight in the Commonwealth of Pennsylvania. The PennDOT SSOA has been approved and certified by the Federal Transit Administration (FTA) in accordance with the requirements of Federal public transportation safety law (49 U.S.C. § 5329 (e)) and FTA's SSO regulation (49 C.F.R. § 674) on April 23, 2018. Accordingly, the PennDOT SSOA has the authority to oversee and enforce both state and federal safety requirements. The PennDOT SSOA Program Standard is the governing document for rail safety and security oversight specifying the requirements that rail fixed guideway public transportation systems within the Commonwealth of Pennsylvania must meet to comply with federal and state safety laws and rules including 49 U.S.C § 5329, Public Transportation Safety Program / Fixing America's Surface Transportation Act of 2015, as amended by the Infrastructure Investment and Jobs Act of 2021 and the associated regulations, 49 C.F.R. Part 672, Public Transportation Safety Certification Training Program; 49 C.F.R. Part 674, State Safety Oversight; and 49 C.F.R. Part 673, Public Transportation Agency Safety Plan (PTASP).

On July 19, 2018, the FTA released the PTASP Final Rule, 49 C.F.R. § 673. This rule requires all transit agencies that receive funding under 49 U.S.C. Chapter 53 to develop and maintain a PTASP.

SEPTA, as a covered Rail Transit Agency (RTA), must review and update their PTASP once each calendar year and submit the plan to the PennDOT SSOA. The PennDOT SSOA reviews the plan to ensure it complies with both their Program Standard and 49 C.F.R. Part 673 before either approving or requiring amendment of the plan.

The PennDOT SSOA requires SEPTA to develop and document a process for the performance of ongoing internal safety audits to assess compliance, implementation, and effectiveness of the PTASP.

The PennDOT SSOA must also conduct a complete audit of SEPTA's compliance with its PTASP at least every three years (or, alternatively, on an ongoing basis over a three-year period).

5.1 Recent Single-Ended Light Rail Vehicle (LRV) Audits

5.1.1 SEPTA System Safety

Between July 19 and 22, 2022, the SEPTA System Safety Department conducted an internal audit of the Elmwood Single-Ended Light Rail Vehicle (LRV) Inspection and Maintenance Process. Investigators reviewed the report, dated August 30, 2022. The purpose of the audit was to verify that the current inspection activity was being administered and documented properly and following established SEPTA standards and practices. The following findings were all determined to be "compliant"; availability of written procedures, availability of written worksheets, a hard-copy review of documents for a sample of vehicles, the frequency of inspections, VMIS records completeness, vehicle history record availability, adequacy of training provided, and criteria for vehicles returning to service. No recommendations were made as a result of the audit. One suggested improvement was made for the use of safety inspection cards in the process.¹⁷

5.1.2 Pennsylvania Department of Transportation

On July 20 and 21, 2021, the PennDOT SSOA conducted an audit of the Single End Light Rail Vehicle (SELRV) maintenance and inspection programs at the SEPTA. The audit assessed SEPTA's compliance with its plans, policies, and procedures; the RTSRP Procedures and Standards; federal requirements; and industry best practices and standards. During this audit, PennDOT reviewed SEPTA's implementation of the

¹⁷ *Suggested Improvements are proposed enhancements to any observed activity determined to be "compliant" - but in which auditors believe further changes will improve existing protocols and/or facilitate consistency with similar activities in other departments, and/or comply with industry best practices.*

Rail Transit Public Transportation Agency Safety Plan (PTASP) and its Safety Management System (SMS) program. One Finding of Non-Compliance and three Observations were identified in the audit. A Corrective Action Plan was developed by SEPTA to address the Finding of Non-Compliance.

6.0 Post Accident Safety Actions

SEPTA put together a list of short term and long-term corrective actions. These range from safety conversations to complete overhauls of the process to change air compressors on LRV's.

6.1 Maintenance Procedures

SEPTA vehicle engineering and maintenance initiated an ECN to formalize a process for removing and installing air compressors on the Kawasaki LRV. When enacted, this process would eliminate the need to cut out the brakes at Elmwood to allow the vehicle to be moved in the work bay. SEPTA temporarily ceased air compressor changes at Elmwood pending the acceptance of the new ECN. Air compressor changes are now done at Woodland, where it is not necessary to cut out the brakes. SEPTA also changed the leakage test documents to include ensuring all brakes are cut back in prior to releasing the car.

6.2 Training

SEPTA training department made several changes to training documents and processes to give mechanical operators more training as well as documents they can refer to as they are performing tasks.

- The document that is given to mechanical operators in training was changed to add brake test steps and MU operations.
- A pre-movement checklist was created for mechanical operators to follow and refer to in daily operations.
- Back up controller use was added to the training syllabus.

Below is the memo sent outlining the safety initiatives, supporting documents for each item completed will be uploaded to the accident docket.



MEMORANDUM

TO: Sachit Kakkar **CC:** M

FROM: Edward F. Carruthers

DATE: August 14th, 2023

SUBJECT: Metro Rail Safety initiatives

In response to the SEPTA wide safety initiative, Metro Rail Maintenance has done and will continue to do the following:

Two-week lookback:

1. Held Emergency stand down meetings at all Metro Rail Maintenance locations.
2. Held emergency LSC meetings to address current safety concerns.
3. Continued location blue flag refresher training.
4. Established a "safety rule of the day" for all managers during meetings prior to the start of hourly shifts.
5. Held toolbox talks to review the electronic policy, blue flag and VTIL usage.
6. The Yard Safety Committee conducted an independent investigation into the roll event.
7. Penn-Dot, System Safety, Engineering, and the Office of Process Improvement observed the LRV air compressor change out, a work standard draft was created to ensure vehicles are not left with the brakes cut out. This new standard includes moving the vehicle with a forklift and tow bar instead of "barring" the vehicle.
8. A premovement check list was created to ensure a vehicle is functioning properly prior to movement.
9. Procurement is purchasing a "Bakes cut out: Sign that will be placed on the cab and rear controller whenever brakes are cut out.
10. The Yard Safety committee performed a yard audit with Penn-Dot at Fern Rock on 8-3-2023.
11. LRV leak-down test paperwork has been updated to include employee and manager signature and includes ensuring all brakes are cut back in prior to releasing the car.
12. A "moving vehicles with defective brakes" memo has been distributed to all Metro Rail locations.

Moving forward:

13. The Office of process improvement will continue to evaluate work performed that involves a safety device at all locations.
14. Engineering will evaluate ways to replace LRV compressors without having to move a vehicle.
15. Maintenance will be scheduling additional interviews with the NTSB.
16. Compliance audits will continue to be performed.
17. During staff meetings, each Maintenance Director will provide a Safety topic or Improvement that they have implemented.
18. A draft report from the YSC will be submitted for review.
19. A revised work Standard will be issued that includes the Engineering improvements for compressor change out.
20. Location Safety Committees will gather monthly and perform audits under their responsibility.

10-4-2023 update:

Bullets have been changed to numbers. Each number will correlate to a supporting document found in the NTSB Kiteworks folder named 'SEPTA safety efforts supporting documentation.'

E APPENDIX A- LIST OF INTERVIEWEES

Below is a list of all individuals interviewed, copies of the interview transcripts will be in the accident docket.

- Steve Cooke- Assistant Director Maintenance, Elmwood
- Ameer Rone- SEPTA Maintenance Manager, Elmwood District
- Kevin Talbert- SEPTA Maintenance Manager, Elmwood District
- John Baumgartner- SEPTA Maintenance Manager, Elmwood District
- Lawrence Horne- SEPTA Suburban Light Rail Transit Instructor
- Mohammed Bouanani- SEPTA Rail Vehicle Electronics Specialist
- Alvin McCollin- SEPTA Rail Vehicle Electronics Specialist
- Ali Sokri- SEPTA Rail Vehicle Electronics Specialist
- David Weihe- SEPTA Rail Vehicle First Class Mechanic

F APPENDIX B- DOCUMENT REQUEST

Action Item	Responsible Organization	Status
System Safety paragraph on traffic control characteristics for subway surface line	SEPTA	Closed
System Safety to collect and report monetary value of damage to 9107 Trolley	SEPTA	Closed
SEPTA to locate point of contact for the building struck by 9107 Trolley to connect NTSB. NTSB seeking monetary cost for damage to the building.	SEPTA	Closed
Contact Presbyterian Hospital to obtain release date/time, along with confirmation of no serious injuries.	SEPTA	Closed
Copy of employee safety promotion done post event to employees and managers. Report is Ops, Board, and Maintenance may have emailed something.	SEPTA	Closed
SEPTA to provide posters developed by Safety to promote safety at hot spots	SEPTA	Closed
SEPTA to provide sketch of scene of the event.	SEPTA	Closed
SSOA to provide breakdown of events leading up to the derailment	SSOA	Closed
SEPTA to send list of any emergency CAPs associated with the immediate actions following the event	SEPTA	Open
Gather elmwood statistics for events	SSOA	Closed
SSOA overview	SSOA	Closed
Pictures from the event	SSOA	Closed
SEPTA Internal Audit Reports and Inspection Reports <ul style="list-style-type: none"> o Conducted at Elmwood o Directly related to reverse moves o Training o VIMIS o Lockout tag out o Yards o Maintenance 	SSOA	Closed
SEPTA Hazard logs and follow-up documentation related to the above	SSOA	Closed

All Events o Elmwood o Involve reverse moves o Runaway trains	SSOA	Closed
OSIC Safety Committee Meeting Minutes and Hazard Logs o Yard Safety o Accident Reduction	SSOA	Closed
LSC Meeting Minutes from Elmwood Yard	SSOA	Closed
JHSC Meeting Minutes	SSOA	Closed
Open or closed CAPs o Elmwood Yard o Training o Reverse Moves o Runaway Trains	SSOA	Closed
SSOA Audits that can be related	SSOA	Closed
SSOA Inspections that can be related	SSOA	Closed
SEPTA's Comprehensive Yard Inspection Report at Elmwood	SSOA	Closed
Consolidated Interview Summaries	SSOA	Closed
Field Notes - Interviews (seven total)	SSOA	Closed
2020, 2021, and 2022 Annual SEPTA Safety Certification	SSOA	Closed
2022 SEPTA PTASP	SSOA	Closed
2023 Elmwood Yard Inspection	SSOA	Closed
SSOA Program Standard	SSOA	Closed
Inspection of SEPTA LOTO/Blue Signal Program	SSOA	Closed
Shop Awareness Manual	SEPTA	Closed
General Orders	SEPTA	Open
Maintenance Manager Manual	SEPTA	Closed
General Order update process	SEPTA	Open
Engineering Change Notice (ECN) process	SEPTA	Open
Shop Personnel Rule Handout 10-17-166	SEPTA	Closed
SEPTA internal accident report	SEPTA	Open
SEPTA internal injury report	SEPTA	Closed
Trolley 9107 On-board Video from July 27	SEPTA	closed

Security camera video from inside and outside the maintenance facility	SEPTA	closed
Diagrams and photos of accident scene	SEPTA	Closed
Timetable in affect for accident territory	SEPTA	Open
SEPTA interview records and/or written statements from supervisors and employees	SEPTA	Closed
Video from City of Philadelphia Streets Dept. (From Island and Woodland Ave, 10:00 pm – midnight)	SEPTA	Closed
OCC communications regarding the event	SEPTA	Closed
Police report from STPD	SEPTA	Open
Philadelphia Police CAD report from the event	SEPTA	Closed
SEPTA internal audit program plan for the maintenance facility	SEPTA	Closed
SEPTA infrastructure, environmental and fire, life, safety inspection reports (1-year) for Elmwood yard	SEPTA	Closed
System Safety initial investigation report	SEPTA	Closed
Maintenance Rule Book	SEPTA	Open
Any Audits or inspections related to the maintenance rule book	SEPTA	Closed
Policy or instructions related to the safe movement of vehicles by mechanical employees in the shop and yard environment	SEPTA	Open
Information on the Kawasaki single ended LRV (Description of equipment, specifications, etc.)	SEPTA	Closed
Leakage Test Procedures (full procedure) ECN	SEPTA	Closed
Additional procedures in place for air compressor change out at Elmwood yard using forklift to lower the compressor	SEPTA	Open
Shop Safety Rule Book	SEPTA	Open

For Trolley Number 9107: <ul style="list-style-type: none"> • 180-Work history • Work Order 3567000 • Shift turnover documentation from July 27, 2023 • Event recorder data for the accident sequence • Records related to the last 10-day inspection performed 	SEPTA	Closed
Staffing levels and vacancies within Maintenance Department at Elmwood	SEPTA	Closed
Kawasaki maintenance manuals	SEPTA	Closed
Daily out of service report from June 14-27th	SEPTA	Open
Copy of Turnover from Jonathan Baumgartner to Kevin Talbert (morning of 7/27)	SEPTA	Closed
Copy of Turnover from Kevin Talbert to Ameer Rone (afternoon of 7/27)	SEPTA	Closed
Training course for new mechanics who are certified to move equipment.	SEPTA	Open
Training course for new operators who are certified to operate revenue trolleys	SEPTA	Open
Procedures for manually moving cars with brakes cutout	SEPTA	Closed
Copy of written tests taken at the end of operator training for:	SEPTA	Open
Emails concerning post-accident safety stand downs	SEPTA	Closed
Emails communications to employees about recent incidents	SEPTA	Closed

<p>For the following people:</p> <ul style="list-style-type: none"> • Ameer Rone • Jonathan Baumgartner • Alvin McCollin • Kevin Talbert • David Weihe • Ali Sokri <p>Provide the following information:</p> <ul style="list-style-type: none"> • Complete employment history • Training and certification records (Past 2-years as applicable) • Time sheets last 30 days • Previous incident/accident history • Discipline history • Awards and commendations • Most recent company physical / medical examination/ fitness for duty (if applicable) • Post-accident drug/alcohol test records & results (if applicable) 	SEPTA	Open
Track diagrams (grade, track designations, etc.)	SEPTA	Open
Discipline and/or decertification records for employees related to this accident	SEPTA	Closed
Description of the track along the accident route	SEPTA	Closed
Description of the traffic control/signals in the area of the accident	SEPTA	Closed

Document request for [Third Shift Maintenance Manager] a) Quest Diagnostics Laboratory Report b) pre-employment drug/alcohol testing records c) random drug/alcohol testing records d) pre-employment fitness for duty records, if applicable e) Confirm if Mr. Baumgartner was tested for alcohol post-accident f) 14-day work history (hours/jobs worked)	SEPTA	Open
Post-accident testing results for Ali, and any other employee that may have been post-accident tested as a result of this accident.	SEPTA	Open
The FTA regulations or policy for random drug testing that covers Elmwood employees (Mechanics and Supervisors)	FTA	Closed
The FTA regulations or policy for post-accident drug testing that covers Elmwood employees (Mechanics and Supervisors)	FTA	Closed
The SEPTA policy for random drug testing that covers Elmwood employees (Mechanics and Supervisors)	SEPTA	Open
The SEPTA policy for post-accident drug testing that covers Elmwood employees (Mechanics and Supervisors)	SEPTA	Open
The results of the most recent audit regarding drug testing for Elmwood employees	SEPTA	Open
An overview document of random testing for one year for the pool of employees that includes Elmwood mechanics and supervisors	SEPTA	Open

<p>Document request for Ali Sokri</p> <ul style="list-style-type: none"> a) Quest Diagnostics Laboratory Report b) pre-employment drug/alcohol testing records c) random drug/alcohol testing records d) pre-employment fitness for duty records, if applicable e) Confirm if Mr. Baumgartner was tested for alcohol post-accident f) 14-day work history (hours/jobs worked) 	SEPTA	Open
<p>Document request for David Weihe</p> <ul style="list-style-type: none"> a) Quest Diagnostics Laboratory Report b) pre-employment drug/alcohol testing records c) random drug/alcohol testing records d) pre-employment fitness for duty records, if applicable e) Confirm if Mr. Baumgartner was tested for alcohol post-accident f) 14-day work history (hours/jobs worked) 	SEPTA	Open
<p>Medical Review Officer - Full Report for tests performed for Baumgartner, Sokri, and Weihe</p>	SEPTA	Open

Submitted by:
Benjmain Strot
Assistant IIC