

**NATIONAL TRANSPORTATION SAFETY BOARD**  
Vehicle Recorder Division  
Washington, DC 20594

July 10, 2017

## **Onboard Image Recorder**

**Group Chairman's Factual Report**  
**By Bill Tuccio, Ph.D.**

### **1. EVENT**

Location: Philadelphia, Pennsylvania  
Date: January 4, 2017  
Trollies: 9101 Struck; 9085 Striking  
Operator: SEPTA  
NTSB Number: DCA17FR003

For a summary of the accident, refer to the *Accident Summary* report, within this docket.

### **2. GROUP**

An onboard image recorder group convened on January 30, 2017.

Chairman: Dr. Bill Tuccio  
Aerospace Engineer  
National Transportation Safety Board (NTSB)

Member: Dr. Michael Hoepf  
Human Performance Group Chairman  
NTSB

Member: Ryan Frigo  
Operations Group Chairman  
NTSB

Member: Troy Lloyd  
Lead Accident Investigator  
Federal Transit Administration

Member: Elizabeth Bonini  
State Safety Oversight Manager  
Pennsylvania Department of Transportation

Member: Scott Sauer  
Assistant General Manager System Safety Division  
Southeastern Pennsylvania Transportation Authority (SEPTA)

Member: Ronald Newman  
Business Agent  
Transport Workers Union of Philadelphia, AFL-CIO Local 234

### **3. DETAILS OF INVESTIGATION**

The NTSB Vehicle Recorder Division received two DVDs containing video footage from the struck trolley, Trolley 9101, and the striking trolley, Trolley 9085.

#### **3.1. Recorder Description**

The SEPTA video recording system installed on trollies 9101 and 9085 simultaneously recorded 8 video cameras in color at 10 frames per second, and some parametric data, such as speed and latitude/longitude. No audio was recorded. The camera vantage point names assigned by the recording system were:

- Front door
- Forward Aisle
- Center Aisle
- Rear Door
- Rear Deck
- Operator
- Forward Facing (external only)
- Curbside (external only)

#### **3.2. Video Files**

Video files from trollies 9101 and 9085 were 52 minutes in duration, starting 22 minutes before the collision and ending 30 minutes after the collision.

#### **3.3. Timing and Correlation**

Times in this report are expressed in local time, eastern standard time (EST). In agreement with the Investigator-in-Charge (IIC), SEPTA control center times were considered authoritative times for this investigation. Accordingly, video recorder times were offset as follows.

##### **3.3.1. Trolley 9101**

At 1247:46 EST, the SEPTA control center recorded that Trolley 9101's priority button was pushed. Video review showed 9101 operator's hand near the radio controls between 1247:52 and 1248:20 (9101 video clock time). SEPTA's control center also logged that a SEPTA controller answered the priority button at 1248:17 EST, and video review showed 9101's operator answering a call at 1248:26 (9101 video clock time). Given ambiguities of the available information, the following relationship was used as an appropriate estimate:

1247:46 EST = 1247:55 (9101 video clock time)

Accordingly, 9 seconds were subtracted from 9101 video clock time to convert to EST time.

### **3.3.2. Trolley 9085**

Video from trollies 9101 and 9085 were reviewed to find a common event. Trolley 9101's Curbside camera recorded 9101's operator outside the trolley at 1249:34.6 EST (corrected as explained in the prior section of this report); the same event was recorded by trolley 9085's Forward Facing camera at 1249:35.2 (9085 video clock time). This common event created the following relationship:

1249:34.6 EST = 1249:35.2 (9085 video clock time)

Accordingly, 0.6 seconds were subtracted from 9085 video clock time to convert to EST time.

## **3.4. Summary of Recording Contents**

In agreement with the IIC, the video group transcribed events starting at the 30<sup>th</sup> Street Westbound Platform and continued to transcribe until the end of the recording. The level of detail transcribed varied throughout the recording, with greater emphasis applied near the time of the collision. All transcript details were created by viewing all eight camera angles installed in the trollies.

As part of the Safety Board's accident investigation process, the trolley operators were invited to review this report and suggest corrections or additions. They declined the invitation.

### **3.4.1. Trolley 9101**

At 1237:13 EST, Trolley 9101 was stopped at the 30<sup>th</sup> Street Westbound Platform inside a tunnel and people were boarding and alighting. The operator was seated in the operator cab. The trolley had about 28 passengers on board, with about 2 standing.<sup>1</sup>

By 1238:36 EST, Trolley 9101 had slowed and passed by the 33<sup>rd</sup> Street Westbound Platform (without stopping). During transit from the 30<sup>th</sup> Street Westbound Platform, the operator was seated mostly with his arms crossed and passed a green (proceed) signal.

About 1239:18 EST, Trolley 9101 came to a stop at a red over red (stop) R2 signal. During the transit from the 33<sup>rd</sup> Street Westbound Platform, the operator changed

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<sup>1</sup> Throughout this report, "about" is used when video angles or resolution necessitated a qualification of information, such as but not limited to number of passengers.

his hand positions from crossed to resting his right hand on the fare box, and putting his left hand in his pants pocket.

At 1239:24 EST, the R2 signal switched to yellow over green aspect (approach left) signal. At 1239:26 EST, Trolley 9101 began to move forward again. The operator's right hand was on the fare box, his left hand was at his side (due to lighting, the precise position could not be determined).

About 1240:13 EST, Trolley 9101 began to exit the portal at 36<sup>th</sup> Street between Market and Chestnut Streets. During the transit from the R2 signal, the operator moved his hand positions, but generally returned to having his right hand on the fare box and his left hand on his left thigh.

About 1240:30 EST, Trolley 9101 stopped just outside the Portal at the 36<sup>th</sup> Street Portal Transit Stop. The operator did the following: moved the Mode Switch to Standby and the Direction Switch to Neutral, removed the Anti-Theft Key and transfer papers, and then exited the trolley. The operator then walked towards the portal and exited the field of view towards a restroom. The doors to the trolley remained open while the operator was not in the trolley. Passengers were boarding and alighting. During this stop, two exterior center door red indicator lights (Motorist Warning Lights) were alternating flashing (up and down), consistent with a door open indication.

About 1242:09 EST, the operator returned to Trolley 9101 and did the following: placed the Anti-Theft key back into the Key Switch, put transfers back on the console, moved the Mode Switch to Run and the Direction Switch to Forward, and closed the doors. When the doors shut, the exterior center door red indicator lights (Motorist Warning Lights) extinguished. At this point there were about 37 seated passengers and 3 standing passengers. At 1242:22 EST, Trolley 9101 began to move forward.

About 1242:31 EST, Trolley 9101 turned right onto 36<sup>th</sup> Street, north towards Market Street.

Between 1242:31 and 1245:28 EST, Trolley 9101 proceeded on Route #10 and stopped at traffic lights and/or for vehicle traffic and/or to board/alight passengers. During this time, the operator's hands moved from various positions including: at his side, on his thighs, on the console operating switches for the doors, on his chin, on the console (not operating switches), and receiving fare media. The street was dry, sky was clear, and visibility was good.

At 1245:28 EST, Trolley 9101 came to a stop at the Facing Point Switch at 36<sup>th</sup> Street and Lancaster Avenue. The traffic light facing Trolley 9101 was red. Trolley 9101 boarded and alighted passengers.

At 1245:35 EST, the traffic light changed from red to green.

At 1245:44 EST, Trolley 9101 began to move forward/left onto Lancaster Avenue. The operator's hands were on his thighs.

At 1245:51 EST, Trolley 9101's operator moved his right hand to the silver bar, and his left hand remained on his left thigh.

At 1246:00 EST, Trolley 9101's operator moved his right hand and touched (scratched) his face, then moved his right hand to his right thigh.

At 1246:04 EST, Trolley 9101's operator crossed his hands centered between his thighs.

At 1246:09 EST, Trolley 9101's operator moved both hands to the silver bar.

At 1246:12 EST, Trolley 9101's operator crossed both his hands on the console and leaned forward in his seat.

At 1246:17 EST, Trolley 9101 stopped before a pedestrian crosswalk at a red light at the intersection of Powelton Avenue and Lancaster Avenue. The operator moved his left hand to his head and his right hand remained over the console.

At 1246:18 EST, Trolley 9101's operator rested his elbows on the silver bar and placed his hands together just below his chin, and then crossed his arms while still resting his elbows on the silver bar.

At 1246:35 EST, Trolley 9101's operator looked right in the direction of a passenger near the front (#2) door. The passenger remained standing near the front (#2) door until the trolley was struck.

At 1246:43 EST, Trolley 9101 began to move forward.

At 1246:47 EST, the traffic light changed from red to green, as Trolley 9101 was in the middle of the pedestrian crosswalk. Trolley 9101's operator turned his head to the right.

At 1246:49 EST, Trolley 9101's operator clutched the fingers on his right hand.

At 1246:56 EST, Trolley 9101's operator moved his hands forward over the console, while resting his elbows on the silver bar.

At 1247:00 EST, Trolley 9101 began to slow. A brown UPS truck was parked ahead and to the right of the trolley, in the pedestrian crosswalk; however, the UPS truck was not blocking the travel of the trolley. There was a pedestrian standing at the right side of the crosswalk, just ahead of the UPS truck.

At 1247:01 EST, Trolley 9101's operator raised his right hand, extending all his fingers while looking forward. He moved his left hand to the console near the Door Toggle Switch. He waved his extended hand and fingers forward and back

(consistent with non-verbal communication with someone/thing outside the trolley) until Trolley 9101 was struck by Trolley 9085.

At 1247:03 EST, Trolley 9101 came to a stop about 20 feet before the Stop Line. The operator used his left hand to activate the Door Toggle Switch and the front (#1) door began to open. By this time, Trolley 9085 was visible in the rearmost interior camera approaching Trolley 9101.

At 1247:04 EST, Trolley 9101's front doors (#1 and #2) were open. The operator momentarily put his right hand on the Gong Toggle Switch, then re-raised his hand and continued the waving motion previously initiated. A passenger standing near the front door (#1) began to step towards the open door. The two exterior center door red indicator lights (Motorist Warning Lights) began alternately flashing (up and down), consistent with a door open indication

At 1247:05.6 EST, Trolley 9085 struck Trolley 9101. No passenger had boarded or alighted the trolley at this stop before the collision. At the time of the collision, there were about 43 seated passengers and 4 standing passengers. At this time, the white needle on the analogue gauge (Emergency Brake Pipe Pressure Gauge) in the upper left-hand corner of the console, began to rotate counterclockwise towards 0 (the red needle was not visible).

Over about the next 1.5 seconds, Trolley 9101's passengers were initially thrust backward, and then forward towards the end of the 1.5 seconds. Some passengers' hats fell off their heads. The operator was thrust backwards in his seat and then forward over a 0.5 second period.

By 1247:06 EST, Trolley 9101's operator turned his head towards the right (towards front doors (#1 and #2) and a previously standing passenger near the door who fell). The operator continued to turn his head towards the rear of the trolley.

By 1247:07 EST, Trolley 9101's operator began to stand, as did a few of the previously seated passengers.

At 1247:11 EST, Trolley 9101's operator sat down in his seat and touched his head with his right hand.

By 1247:16 EST, Trolley 9101's operator held the top of his head with two hands while seated.

At 1247:19 EST, Trolley 9101's operator moved the Mode Switch to Standby and the Direction Switch to Neutral. The operator then remained in his seat while holding his head and looking around (mostly in the direction of the passenger near the front doors (doors #1 and #2). The passenger near the front door attempted to stand.

At 1247:23 EST, Trolley 9101's operator turned to the right, and assisted the passenger near the front door to stand.

At 1247:42 EST, Trolley 9101's operator reached his left hand up towards the radio (Computer Aided Radio Dispatch System (CARD)) and pressed/manipulated controls on the radio.

At 1248:08 EST, a passenger exited Trolley 9085.

At 1248:16 EST, Trolley 9101's operator sat back in his seat and looked upwards.

Between the collision at 1247:05.6 EST and 1248:22 EDT, passengers re-oriented themselves in various ways, including: moving their hands and feet, crouching in their seats, leaning forward, putting their hands on their heads or other body parts.

At 1248:17 EST, Trolley 9101's operator picked up the radio handset and held it to his ear.

At 1248:33 EST, Trolley 9085's operator first leaned out of Trolley 9085 looking towards Trolley 9101. At 1248:37 EST, Trolley 9085's operator returned into Trolley 9085 (out of view of 9101's curbside camera).

At 1248:40 EST, a male passenger exited Trolley 9101 through the front door (door #2).

At 1248:58 EST, Trolley 9085's operator again leaned out of Trolley 9085 looking towards Trolley 9101 and then exited Trolley 9085.

At 1249:05 EST, Trolley 9101's operator hung up the radio handset.

At 1249:11 EST, Trolley 9085's operator re-boarded Trolley 9085. Trolley 9101's operator got up from his seat and exited the trolley through the front door (door #2).

At 1249:19 EST, Trolley 9101's operator walked outside the trolley towards Trolley 9085.

At 1249:23 EST, a second male passenger exited Trolley 9101, as 9085's operator exited his trolley, and 9101's operator approached 9085's operator.

At 1249:26 EST, operators from 9101 and 9085 talked to each other with various hand gestures.

At 1249:36 EST, Trolley 9101's operator began walking towards Trolley 9101. Trolley 9085's operator was bending over, holding his knees, outside Trolley 9085.

At 1249:46 EST, Trolley 9101 and 9085's operators re-entered their respective trolleys through a front door.

At 1249:52 EST, the male passenger who exited the trolley at 1249:23 EST, re-entered the trolley. At this time, Trolley 9101's operator faced the passengers in his Trolley while holding his head.

By 1250:04 EST, Trolley 9101's operator was standing in his cab area.

By 1250:28 EST, Trolley 9101's operator turned and stood facing the passengers in his trolley. Some passengers were holding the backs of their heads and necks.

At 1250:47 EST, Trolley 9101's operator walked inside to the rear of the trolley, consistent with checking on passenger conditions. At 1251:03 EST, Trolley 9101's operator began walking inside from the rear towards the front of his trolley.

At 1251:24 EST, Trolley 9101's operator reached the front of the trolley, stopped, and talked to a passenger seated in the front of the trolley and then stood in the cab area.

At 1251:40 EST, Trolley 9101's operator exited the trolley through the front door (door #1) and walked towards Trolley 9085. While walking, Trolley 9101's operator was holding the back of his neck. Trolley 9101's operator stood half-way inside the front door of Trolley 9085.

At 1252:03 EST, Trolley 9101's operator started walking back towards Trolley 9101.

At 1252:18 EST, Trolley 9101's operator re-entered his trolley through the front door (door #1), and stood in the cab area looking forward.

At 1252:21 EST, the brown UPS truck that was parked ahead and to the right of Trolley 9101, departed his parking spot and exited the scene. Trolley 9101's operator sat down in the cab.

At 1252:30 EST, a Philadelphia fire department, red SUV-type vehicle, with emergency lights activated, first appeared in the forward-facing view of Trolley 9101. A Philadelphia police car also arrived on scene.

From 1252:41 until 1317:19 EST the following events occurred:

- Police and firefighters spoke with Trolley 9101's operator.
- A white, gray-haired male entered Trolley 9101 and exited with the female passenger who had been standing near the front door during the collision. This male and female ultimately returned to the trolley and spoke with emergency service personnel.
- Multiple emergency services personnel and vehicles arrived on scene.
- Emergency services personnel entered trollies 9101 and 9085.



- Emergency services personnel attended to passengers on Trolley 9101, consistent with triaging activity.
- SEPTA Transportation Manager arrived on scene.
- Emergency personnel put yellow caution tape around the scene.
- Emergency personnel talked to various passengers and took notes.
- Emergency personnel removed passengers from Trolley 9101.

### **3.4.2. Trolley 9085**

At 1239:39 EST, Trolley 9085 was stopped at the 30th Street Westbound Platform inside a tunnel and people were alighting. The operator was seated in the operator cab. The trolley had about 7 passengers on board, with 1 standing.

At 1239:50 EST, Trolley 9085 began to exit the 30th Street Westbound Platform. The operator had both his hands on his thighs.

Between 1239:50 and 1240:49 EST, Trolley 9085's operator moved his hand position, to include: hands on thighs, hands on chest, hand to mouth, hands on console. Trolley 9085's operator rocked from side to side, as the trolley transited the tunnel, and moved his head back and forth from time to time.

At 1240:44 EST, Trolley 9085 passed through the 33rd Street Westbound Platform, without stopping (there were no people on the platform).

At 1240:54 EST, a passenger standing near the center door (#3) pulled the stop request cord; at this time, a light (Stop Requested LED) illuminated on Trolley 9085 operator's console.

At 1241:22 EST, Trolley 9085 passed a yellow approach signal.

At 1241:39 EST, Trolley 9085 stopped at a red over red stop (R2) signal. The track was set to the Route 10 position.

At 1241:43 EST, the R2 signal switched to a yellow over green aspect (approach left) signal. Trolley 9085's operator looked up momentarily.

At 1241:49 EST, Trolley 9085's operator looked forward and the trolley moved, proceeding on the leftmost route.

Between 1241:49 and 1242:08 EST, Trolley 9085's operator had his left hand on the console, his right elbow on the silver bar, and was resting his chin on his right hand.

At 1242:41 EST, Trolley 9085 began to exit the portal at 36th Street between Market and Chestnut Streets; at this point, Trolley 9101 was not in view. Trolley 9085's operator had both hands on the console, with his elbows resting on the silver bar.

At 1242:52 EST, Trolley 9085 came to a stop just outside the Portal at the 36th Street Portal Transit Stop. At this time, Trolley 9101 was in view on 36th Street. The operator did the following: moved the Mode Switch to Standby and the Direction Switch to Neutral. All doors were closed; a passenger standing on the step at the center door (#3) looked towards the operator, consistent with the passenger asking the operator to open the door. The operator pushed a button on his console, door #3 opened, and the passenger alighted.

At 1243:10 EST, Trolley 9101 began to move out of the field of view of Trolley 9085.

At 1243:34 EST, Trolley 9085's operator moved the Mode Switch to Run and the Direction Switch to Forward.

At 1243:39 EST, Trolley 9085 began to move forward and then turned right onto 36th Street.

At 1243:54 EST, Trolley 9085 stopped behind a small FedEx van. Trolley 9101 was visible ahead of the FedEx van.

At 1243:58 EST, Trolley 9085's operator moved the Mode Switch to Standby and the Direction Switch to Neutral. The operator leaned back and attempted to adjust his seat. The operator then rested his right hand on the fare box.

At 1244:36 EST, Trolley 9101 and the FedEx van both began to move forward.

At 1244:41 EST, Trolley 9085's operator moved the Mode Switch to Run and the Direction Switch to Forward.

At 1244:44 EST, Trolley 9085 began to move forward.

At 1244:52 EST, Trolley 9085 slowed as it approached the intersection of 36th Street and Market Street. While the traffic signal was green, the FedEx van was blocking the forward movement of Trolley 9085 (the FedEx van was waiting for a pedestrian to cross Market Street). At 1244:53 EST, the FedEx van turned right on Market Street.

At 1244:56 EST, Trolley 9085 began to accelerate through the intersection of 36th Street and Market Street. Trolley 9101 was about 1 block ahead of Trolley 9085.

At 1244:58 EST, as Trolley 9085 was passing the center of the intersection of 36th Street and Market Street, the traffic light changed from green to yellow. At 1245:03 EST, the traffic light changed to red.

By 1245:28 EST, Trolley 9085 was closing on Trolley 9101.

At 1245:43 EST, Trolley 9085 came to a stop about 20 feet behind Trolley 9101 (the switch at the intersection of 36th Street and Lancaster Avenue was not

visible). Trolley 9101 was stopped. Between 1245:03 and 1245:43 EST, Trolley 9085 operator's left hand was holding his right wrist, over the console, with his elbows resting on the silver bar.

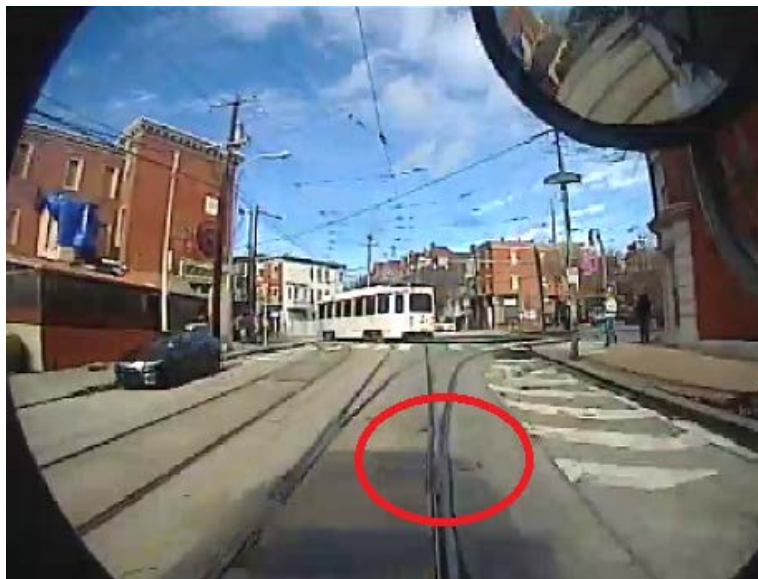
At 1245:44 EST, Trolley 9101 began to move forward. Trolley 9085's operator moved his left hand to the Direction Switch, did not move the switch, and then positioned left hand on top of his right hand, over the console, with his elbows resting on the silver bar. He maintained this position until 1246:16 EST.

At 1245:49 EST, Trolley 9085 began to move.

At 1245:52 EST, Trolley 9101 began to turn left onto Lancaster Avenue.

At 1245:54 EST, Trolley 9085 passed through the Facing Point Switch at 36th Street and Lancaster Avenue, without stopping. The Facing Point Switch is circled in red in figure 1, as recorded by Trolley 9085 at 1245:54 EST.

**Figure 1. Trolley 9085, Forward Facing image at 1245:54 EST.**



At 1245:59 EST, Trolley 9085 turned left onto Lancaster Avenue. The traffic light was green. After rounding the corner onto Lancaster Avenue, Trolley 9101 was visible.

By 1246:16 EST, Trolley 9085 began closing on Trolley 9101.

By 1246:19 EST, the alternating, flashing red brake lights, and the steady, red tail lights of Trolley 9101 became visible in the video. At this time, Trolley 9101 was at the intersection of Powelton Avenue and Lancaster Avenue; Trolley 9085 was at the intersection of 37th Street and Lancaster Avenue.

At 1246:27 EST, Trolley 9085's operator moved his right hand up to his face.

At 1246:35 EST, Trolley 9085 stopped behind Trolley 9101 (about a Trolley length behind Trolley 9101). Trolley 9085's operator moved both hands forward onto the console, with elbows on the silver bar.

At 1246:41 EST, the alternating, flashing red brake lights on Trolley 9101 extinguished.

At 1246:43 EST, Trolley 9101 began to move forward through the Powelton Avenue and Lancaster Avenue intersection.

At 1246:46 EST, Trolley 9085's operator moved his right hand up to his face. He maintained this position until 1247:02.4 EST.

At 1246:49 EST, Trolley 9085 began to move forward through the Powelton Avenue and Lancaster Avenue intersection; the traffic light was green. The distance between 9085 and 9101 was increasing.

At 1246:57 EST, the alternating, flashing red brake lights of Trolley 9101 became visible in the video.

About 1246:59 EST, the distance between Trolley 9085 and 9101 began to close. Until the collision, none of the passengers appeared to shift in their seats.

At 1247:02.5 EST, Trolley 9085's operator began to shift his position.

At 1247:02.6 EST, Trolley 9085's operator began to move slightly backward.

At 1247:02.7 EST, Trolley 9085's operator moved his left hand up off the console, his right elbow off the silver bar, and his right hand away from his face.

At 1247:02.8 EST, Trolley 9085's operator began to move both his hands towards the silver bar.

At 1247:03.0 EST, Trolley 9085's operator put his right hand on the silver bar, deflecting the silver bar slightly forward.

At 1247:03.4 EST, Trolley 9085's operator had his right hand on the silver bar, and his left hand over the console, in the vicinity of the Track Brake Toggle.

At 1247:03.5 EST, Trolley 9085's white needle on the analog gauge (Emergency Brake Pipe Pressure Gauge) in the upper left-hand corner of the console, began to rotate counterclockwise towards 0 (the red needle was not visible).

At 1247:03.6 EST, Trolley 9085's operator moved his left hand to the silver bar.

At 1247:04.0 EST, Trolley 9085's white needle on the analog gauge (Emergency Brake Pipe Pressure Gauge) in the upper left-hand corner of the console, reached its full counterclockwise position (zero).

By 1247:04.1 EST, Trolley 9085 operator's back was fully against the operator's seatback, consistent with a bracing position.

At 1247:04.2 EST, Trolley 9085's operator put his left index finger and thumb on the Track Brake Toggle Switch on the console.

At 1247:04.6 EST, Trolley 9085's operator moved his left hand to the silver bar (now both his hands were on the silver bar).

At 1247:05.5 EST, Trolley 9085 struck Trolley 9101. At the time of the collision there were 6 passengers on the trolley and all were seated. Passengers on Trolley 9085 began to shift forward. Trolley 9101's red alternating/flashing lights continued operating until the end of the recording.

Between 1247:05.6 and 1247:06.5 EST, passengers shifted forward and then backwards. Some passengers had their head/neck area bent forward over the seat in front of them, others moved forward into a partition.

By 1247:07 EST, Trolley 9101 had moved forward and stopped (as a result of the impact). Two passengers on Trolley 9085, seated towards the front of the trolley, moved to the right, towards the aisle, and leaned their torso over their knees.

At 1247:08 EST, Trolley 9085's operator used his right hand to adjust the rearview mirror.

By 1247:12 EST, Trolley 9085's passengers began to re-orient themselves.

Between 1247:12 and 1247:30 EST, Trolley 9085's operator remained in his seat and did the following: moved a Door Toggle Switch (though a door did not open) and turned his head to the right and back (out of the field of view of any camera).

At 1247:30 EST, Trolley 9085's operator moved the Mode Switch to Standby and the Direction Switch to Neutral.

By 1247:35 EST, one passenger moved and sat in Trolley 9085's front door (#2) stairwell.

By 1247:44 EST, Trolley 9085's operator reached his hand towards the radio (CARD).

By 1247:56 EST, Trolley 9085's operator again reached his hand towards the radio.

At 1248:04 EST, Trolley 9085's operator pushed the Recharge Toggle. The white needle on the analogue gauge (Emergency Brake Pipe Pressure Gauge) in the upper left-hand corner of the console, rotated clockwise towards the 2 o'clock position, consistent with recharging the system.

At 1248:05 EST, Trolley 9085's front doors (#1 and #2) opened. Some passengers were assisting each other in the trolley.

At 1248:07 EST, a female passenger exited the center door (#4) of Trolley 9085.

At 1248:12 EST, Trolley 9085's operator stood up and walked backwards down the stairs through the forward door (#1). He then walked back up into the trolley (without fully exiting).

At 1248:18 EST, Trolley 9085's operator manipulated the radio; however, by this point he had not picked up the handset.

At 1248:33 EST, Trolley 9085's operator leaned out of the front door (#1).

At 1248:41 EST, Trolley 9085's operator leaned back into the trolley, standing in the stairwell of the front door (#1).

At 1248:45 EST, Trolley 9085's operator re-entered the cab and picked up the handset (which was on the floor) and placed the handset back in the holder.

At 1248:55 EST, Trolley 9085's operator retrieved his cellphone from a location behind and above the operator's seat, out of the field of view of any camera, consistent with removing the cellphone from his personal bag. The cellphone was off when it first appeared in the field of view and the operator turned the phone on. The operator then exited the front door (#1) of the trolley.

At 1249:13 EST, Trolley 9085's operator stood in the front door stairway (#1), facing into the trolley, with his left foot on the third step with his left knee bent at a 90 degree angle, and his right foot was on the street with his right leg extended. He was resting his left elbow on his left knee, his head was resting on his left hand, his right hand was resting on his left knee, and his right hand was holding his cellphone. He remained in this position until 1249:21 EST. A previously mentioned female passenger was also sitting in the front door stairway (#2), facing the street.

At 1249:17 EST, Trolley 9101's operator appeared in the field of view of Trolley 9085's forward-facing camera and was walking on the street towards Trolley 9085.

At 1249:21 EST, Trolley 9085's operator raised his head and turned to his right, in the direction of Trolley 9101's operator, who was approaching Trolley 9085. Trolley 9101's operator's hands were both raised at about his head level.

At 1249:23 EST, Trolley 9085's operator stepped back into the street with his left leg, lost his balance, and then moved an additional two steps backwards into the street, while facing Trolley 9101's operator.

Between 1249:24 and 1249:33 EST, Trolley 9085's operator and Trolley 9101's operator were facing each other and conversing. Trolley 9085's operator took a

few, wide steps, with his back hunched over, with his arms swinging at his side, towards Trolley 9101. Trolley 9101's operator had his left hand on his forehead and was pointing with his outstretched right arm towards Trolley 9101.

At 1249:34 EST, Trolley 9101's operator began to walk toward the front door of Trolley 9101.

At 1249:48 EST, Trolley 9085's operator returned to the front door and spoke with the female passenger sitting on the front door stairway (#2).

By 1249:59 EST, Trolley 9085's operator had sat down in Trolley 9085's operator cab.

Between 1249:59 and 1250:14 EST, Trolley 9085's operator sat sideways in his seat, holding his head.

Between 1250:17 and 1253:21 EST, Trolley 9085's operator crossed his arms on the farebox and rested his head on his crossed arms, with occasional, slight adjustments.

At 1251:48 EST, Trolley 9101's operator walked to Trolley 9085.

At 1251:57 EST, Trolley 9101's operator stood outside the front door (#1) of Trolley 9085 and spoke to Trolley 9085's operator. Trolley 9101's operator had his left hand on the back of his head. Trolley 9085's operator maintained his position with his arms on the farebox, while raising his head and looking at Trolley 9101's operator.

At 1252:01 EST, Trolley 9101's operator began to walk towards Trolley 9101, and Trolley 9085's operator put his head back down on his arms (which were on the farebox).

At 1252:37 EST, a police car passed Trolley 9085.

At 1252:48 EST, another police car passed Trolley 9085.

At 1252:55 EST, a fire truck arrived on 38th Street.

At 1253:14 EST, a Philadelphia firefighter appeared in view, and approached Trolley 9085.

At 1253:21 EST, Trolley 9085's operator leaned forward (from his seated position, leaning on the farebox), moving his head towards the Philadelphia firefighter who was standing in the front door (#1) of Trolley 9085.

By 1253:35 EST, the Philadelphia firefighter had entered the Trolley, and while standing near the front door, gestured to passengers and spoke. Some passengers raised their hands.

From 1253:35 until 1317 EST the following events occurred:

- Additional police and firefighters (first responders) arrived on scene.
- Trolley 9085's operator interacted with first responders, and changed his seated position to upright.
- First responders entered Trolley 9085.
- Trolley 9085's operator received a call on the radio, picking up the handset.
- First responders assisted passengers exiting Trolley 9085.
- First responders tagged Trolley 9085's operator, consistent with triage activities.
- The SEPTA supervisor entered Trolley 9085 and spoke with Trolley 9085's operator. Trolley 9085's operator opened a bag, pulled out cards (similar to Incident Cards), and handed them to the SEPTA supervisor.
- The last passenger exited Trolley 9085, with assistance from first responders, at 1310 EST.
- Trolley 9085's operator exited (walked off) Trolley 9085, with assistance from first responders, at 1313 EST, and sat in a Stair Chair and then exited the scene with first responder assistance.