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WMSC Commissioner Brief: W-0161 – Improper Door Operation and Station Overruns at Twinbrook Station – January 19, 2022

Prepared for Washington Metrorail Safety Commission meeting on May 24, 2022

Safety event summary:

On January 19, 2021, two trains overran the platform at Twinbrook Station. The operator of one of the trains improperly opened the doors off the platform.

First overrun and improper door operation

The first event occurred at 4:11 p.m. when Train 102 experienced slip-slide conditions while entering the station on Track 1. This location is sloped downward. The Train Operator of Train 102 attempted to slow the train by braking, including activating of emergency braking, but the train passed the eight-car marker at 18 mph. The front of the train stopped 130 feet beyond the end of the platform.

The Train Operator incorrectly reported to the Rail Operations Control Center (ROCC) Rail Traffic Controller that the train had only overrun the platform by half a car length (two doors). Closed-circuit television (CCTV) playback shows that the overrun was actually by more than one and a half car lengths. Each Metrorail car is 75 feet long.

Based on the report from the Train Operator, the Rail Controller instructed the Train Operator to drop associated door breakers so that the door open command would only open doors on the trailing five cars (not the first car), verify the length of the overrun, and walk customers needing to exit from the first car through the bulkhead of the first car into the second car to service the station. The Train Operator and Controller did not follow procedures requiring 100 percent repeat back of radio transmissions.

After servicing the station and improperly opening doors off of the platform, the train operator continued in service to Grosvenor-Strathmore Station where they were removed from service by an Office of Rail of Transportation (RTRA) Supervisor for post-event toxicology testing. This removal from service was due to the station overrun reported by the operator. The improper door operation was identified and reported later during review of CCTV video conducted as part of the station overrun investigation. The third (last) set of doors of the second car were the first doors on the platform. Therefore, when the train operator opened the train doors, the first two doors on the second car opened off of the station platform. No riders fell from or stepped out of these improperly opened doors. CCTV does not clearly show the open doors directly, but shows the door open indication light active on the second car. The doors on the first car did not open.

Metrorail's Safety Department (SAFE) properly updated the safety event reporting code to include the improper door operation.

The Train Operator's certification was scheduled to expire September 26, 2021. The Train Operator was still operating a train nearly four months later under a waiver that the Department of Rail Transportation (RTRA) had given itself from these safety training processes.

Second station overrun

The second event, at 10:35 p.m., involved a different train consist. While entering Twinbrook Station on Track 1 at 21 mph, the train experienced similar slip-slide conditions to those in the earlier station overrun event. The Train Operator moved the Master Controller (MC) into emergency position, but the train's speed continued to increase. When the train was moving 23 mph, the Train Operator depressed the emergency mushroom. The front of the train stopped 40 feet beyond the end of the platform. Station Overrun length verification and procedures were followed during this event and only doors on the platform were opened for riders.

At the time of these overruns, there had been warming temperatures that caused snow that had accumulated around the running rails from a storm approximately two weeks earlier to begin to melt. The temperature changes and melting snow likely contributed to condensation on the rails, resulting in low rail adhesion. The day after these overruns, a rainstorm washed away most of the snow, limiting specific detailed evaluation of the precise conditions at the time of each overrun.

Metrorail's Office of Track and Structures (TRST) personnel identified no structural conditions that would have contributed to the overrun events.

Probable Cause:

The probable cause of the station overruns was the low rail adhesion likely caused by condensation on the rails caused by weather conditions and temperature changes.

The probable cause of the improper door operation following the station overrun was that elements of Metrorail have a culture that accepts noncompliance with written operational rules, instructions, and manuals.

Corrective Actions:

Metrorail implemented a medium speed restriction for five days, which was lifted based on improved weather conditions.

Metrorail is establishing a process to verify station overrun events and details. In addition, Metrorail is changing station overrun response procedures due to this investigation and investigation W-0163 related to a station overrun and improper movement near Suitland Station on December 7, 2021.

WMSC staff observations:

Due to the WMSC's Rail Operations Audit (final report April 2022), Metrorail is required to develop and implement corrective action plans (CAPs) including a CAP to address the finding that elements of Metrorail have a culture that accepts noncompliance with written operational rules, instructions, and manuals. This CAP development process has already begun. Expected actions include the implementation for Rail Transportation (RTRA) personnel of the safety management system (SMS) that Metrorail has committed to in its Public Transportation Agency Safety Plan (PTASP).

These events demonstrate that Metrorail should consider determining what locations and what weather conditions warrant the proactive placement of speed restrictions to prevent station overruns and other safety events caused by trains not remaining in the full control of their operators.

Washington Metro Area Transit Authority
Department of Safety and Environmental Management (SAFE)

FINAL REPORT OF INVESTIGATION A&I E22040

Date of Event:	01/19/2022
Type of Event:	Improper Door Operation and Station Overrun
Incident Time:	16:11 hours
Location:	Twinbrook, Track #1
Time and How received by SAFE:	16:11 hours, SAFE IMO
WMSC Notification Time:	17:10 hours
Event Scene Release:	16:15 hours, IMO
Responding Safety Officers:	WMATA SAFE: No WMSC: No Other: N/A
Rail Vehicle:	Train ID 102, L6173-6172.6059-6058.6067-6066T Train ID 108, L6103-6102.6091-6090.6117-6116T
Injuries:	None
Damage:	None
Emergency Responders:	None
SMS I/A Incident Number:	20220119#97958MX

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Abbreviations and Acronyms

ARS	Audio Recording System
BIE	Brakes in Emergency
CCTV	Closed Circuit Television
CMOR	Office of Chief Mechanical Officer
COMR	Office of Radio Communications
EBCU	Electronic Brake Control Unit
ER	Event Recorder
IIT	Incident Investigation Team
IMO	Incident Management Officer
MC	Master Controller
MSRPH	Metrorail Safety Rules Procedures Handbook
NOAA	National Oceanic and Atmospheric Administration
ROC	Rail Operations Control
ROCC	Rail Operations Control Center
ROQT	Rail Operations Quality Training
RTC	Rail Traffic Controller
RTRA	Office of Rail Transportation
TRST	Office of Track and Structure
SOP	Standard Operating Procedure
VMS	Vehicle Monitoring System
WMSC	Washington Metrorail Safety Commission

FINAL REPORT OF INVESTIGATION A&I E22040

Executive Summary

On Wednesday, January 19, 2022, two Train Operators experienced Station Overruns at Twinbrook Station, approximately four hours apart. Both trains experienced identical slip-slide conditions. Train ID 102 overran Twinbrook Station by 130 feet, and Train ID 108 overran the Station by 30 feet, respectively. A rail car is approximately 75 feet long, equating the first overrun to one and three-quarter rail cars and the second to nearly half of a rail car.

First Station Overrun (ID 102)

At approximately 16:11 hours, inbound Red Line Train ID 102 entered Twinbrook Station at 37 mph and experienced a slip-slide condition on Track 1 beginning nine feet into the platform limits. Train ID 102 subsequently overran Twinbrook Station after exhausting braking modes, including emergency braking activation, which occurred 274 feet into the platform limits.

Train ID 102 passed the eight-car marker at 18 mph while in emergency braking with slide conditions present and came to a complete stop approximately 130 feet outside of the platform limits. Video playback showed the third (last) set of doors on the second car within the platform limits. The Train Operator reported the event to the Rail Operations Control Center (ROCC) as a Station Overrun by half a car length (two doors).

The ROCC Radio Rail Traffic Controller (RTC) instructed the Train Operator to drop associated door breakers on the lead car, verify the length of the overrun (half-a-car), walk any customers through the bulkhead door to the second car, and service the station. RTRA removed the Train Operator from service at Grosvenor Station for post-incident toxicology testing. The Radio RTC dispatched CMNT personnel to inspect the incident consist due to the Train Operator's report of a braking problem.

Upon receiving the ROCC Alert of a Station Overrun, SAFE reviewed Twinbrook Station Closed Circuit Television (CCTV) and observed the discrepancy between the reported length of the overrun and the actual length. During the door operation, CCTV appeared to show five of the six cars with a “Door Open” indication light active. On the second car of the consist, two of the three doors were positioned outside the platform limits beyond the eight-car marker, however it could not be immediately determined from the CCTV whether the two doors were open.

CMNT personnel boarded the incident consist as instructed by ROCC and reported no trouble found. The incident train remained in revenue service from Twinbrook to Glenmont Station before being taken out of service.

This event was initially reported as a Station Overrun (O-12a Event Code) to the Washington Metrorail Safety Commission (WMSC) based on initial reports from the field. After confirmation of off-platform door operation, it was reclassified as an Improper Door Operation (O-15 Event Code) and assigned to an investigator. The Incident Management Officer (IMO) issued an Event Scene Release (ESR) at approximately 16:15 hours on January 19, 2022, for the Station Overrun.

The probable cause for the Station Overrun and subsequent Improper Door Operation on January 19, 2022, was low rail adhesion event that degraded the train's stop within the platform limits. After the Station Overrun, the Train Operator experienced a human factors failure, possibly due to the pressure of experiencing the Station Overrun and failed to complete the overrun length verification prior to exercising the door operation. A Contributing Factor to the incident was an improper 100% repeat-back by the Train Operator that was not enforced by the Radio RTC.

Second Station Overrun (ID 108, different consist)

On Wednesday, January 19, 2022, at approximately 22:35 hours, inbound Red Line Train ID 108 Train Operator experienced a slip-slide condition on Track 1 before entering the Twinbrook Station platform limits at 21 mph. The Train Operator moved the Master Controller (MC) into Emergency Position. The train speed was 22 mph 543 feet from the Eight-Car Marker. Train ID 108 continued experiencing slide conditions. The Train Operator depressed the emergency mushroom when the train speed was 23 mph and the slip-slide indication disabled 34 feet from the end of the platform limits. Train ID 108 passed the Eight-Car Marker at a speed of 21 mph while in Emergency Braking. The train came to a complete stop 40 feet beyond the eight-car marker at Twinbrook Station on Track 1. Station Overrun length verification and procedures were completed during the second event. No Improper Door Operation occurred with Train ID 108.

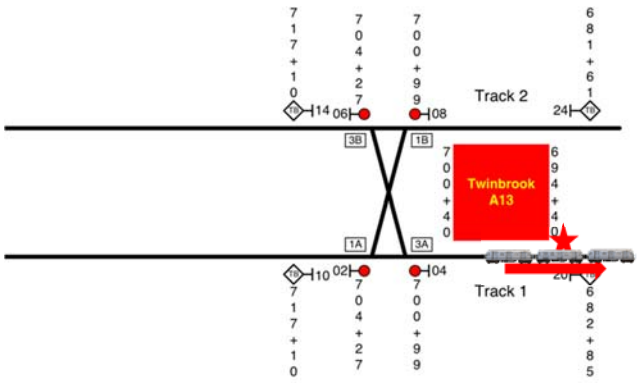
There were no significant weather events on the day of the two station overruns. Most recently, a storm system on January 3, 2022, dropped a significant snow total [8-11 inches] in the Washington Metropolitan area. A 10-day artic air cold front prevented rising temperatures to mitigate snow melting. A review of CCTV identified snow accumulation around the running rails that may have contributed to condensation, resulting in low rail adhesion. A rainstorm occurred the day following this incident (January 20), which precluded a more detailed evaluation of the rail conditions at the time of the event.

On January 20, 2022, the Office of Track and Structure (TRST) responded and evaluated the incident area. The team found no conditions that might have contributed to the event. However, TRST implemented a medium speed restriction as a precautionary measure.

Incident Site

Twinbrook Station, Track #1
Ballast Track
Elevation Change of 1.20 downgrade
Outside Station
Previous snowfall accumulations near running rail

Field Sketch/Schematics



Field Sketch not to scale

Purpose and Scope

The purpose of this incident investigation and candid self-evaluation is to collect and analyze available facts, determine the probable cause(s) of the incident, identify contributing factors, and make recommendations to prevent a recurrence.

Investigation Process and Methods

Upon receiving the Improper Door Operation notification at the Twinbrook Station on January 19, 2022, SAFE launched an investigation into this event. SAFE team members worked with relevant Washington Metropolitan Area Transit Authority (WMATA) subject matter experts to review the incident's facts and data.

Investigation Methods

The investigative methodologies included the following:

Formal Interview – SAFE interviewed one individual as part of this investigation with participation from the WMSC.

- SAFE conducted one interview as part of this investigation:
    - Train Operator ID 102

- Documentation Review – A collection of relevant work history information and process documentation contained in Metro systems of record. These records include:
    - Training Procedures & Records
    - Certification
    - The 30-Day work history review
    - Incident Investigation Report review
    - Metrorail Safety Rules and Procedures Handbook (MSRPH)
    - National Oceanic and Atmospheric Administration (NOAA)
    - Office of Rail Transportation (RTRA) Managerial Report
    - Rail Operations Control (ROC) Report

- System Data Recording Review – A collection of information in Metro Data Recording Systems. This data includes:
    - Audio Recording System (ARS) playback [Radio]
    - Closed Circuit Television (CCTV)
    - Vehicle Monitoring System data (VMS)

Investigation

On Wednesday, January 19, 2022, at approximately 16:11 hours, inbound Red Line Train ID 102 Train Operator entered Twinbrook Station on track 1 at 37 mph, and experienced a slip-slide condition nine feet within the platform limits according to the VMS download and analysis performed by CMOR IIT. Train ID 102 subsequently overran Twinbrook Station after exhausting brake applications options, including emergency braking activation 274 feet within the platform limits.

Train ID 102 passed the Eight-Car Marker at 18 mph in emergency braking with slide conditions still present and came to a complete stop 130 feet beyond the station platform limits. The

emergency brake rate is 3.2 miles per hour per second (mphps) at speeds below 50 mph and the instantaneous rate is 2.5 to 3.6 mphps at speeds between 50 and 75 mph. Wheel slide control function activates when a slide condition is detected unless initiated by the emergency stop valve.

The Train Operator of Train ID 102 reported this event to the ROCC as a Station Overrun by half a car.

The ROCC Radio RTC instructed the Train Operator to drop associated door breakers on the lead car, verify the overrun length (half-a-car), walk the customers through the bulkhead door, and to service the station. Enforcement of 100% repeat-back during these communications was not observed during a review of radio transmissions by both the Radio RTC and Train Operator. This action likely contributed to the failed verification instruction from the Radio RTC to “confirm half a car only.”

RTRA removed the Train ID 102 Train Operator from service at Grosvenor Station for post-incident toxicology testing. The Radio RTC dispatched CMNT personnel to inspect the incident consist for the Train Operator's report of a braking problem.

SAFE reviewed Twinbrook Station CCTV after the reported Station Overrun and discovered the Train Operator overran the Station by approximately one car and three quarters and performed a left side door operation. This was later confirmed through VMS analysis by CMOR IIT.

Figure 1 - Lead Car 6066 passing 8-Car Marker and continuing. This would be half of a car Station Overrun if the train stopped here.

CCTV showed five railcars with active “Door Open” indicator lights illuminated, including railcar 6067, the second car in the consist. Railcar 6067’s stopped position resulted in two of the three doors being outside the platform limits.

Figure 2 – Train ID 102 stopped outside of Twinbrook Station limits. Railcars 6067 and 6068’s door indication lights illuminated. 6066’s (lead car) door light did not illuminate—no platform with guard rail observed near car 6067 doors 3,4,5 and 6.

Passengers were observed alighting from railcar 6067 using the third set of doors.

Figure 3 – Railcar 6067 of Train ID 102's last set of doors opened within the platform limits. Passengers alighted through this door.

The event was initially reported as a Station Overrun (O-12a Event Code) based on reports from the field. After further investigation and confirmation of train data, it was reclassified as an Improper Door Operation (O-15 Event Code) and assigned to an Investigator. As the event was not discovered immediately, the Train Operator did not conduct a ground walk-around in accordance with an Improper Door Operation procedures.

Audio Recording Services (ARS) playback revealed that the Train ID 102 Train Operator requested the train be evaluated for a braking problem. CMNT personnel boarded the incident consist and reported no trouble found. The incident train remained in revenue service until it reached Glenmont Station.

Second Station Overrun Occurrence (ID 108)

On Wednesday, January 19, 2022, at approximately 22:35 hours, inbound Red Line Train ID 108 Train Operator on approach to Twinbrook Station on Track 1, experienced a wheel slip-slide condition before entering the platform limits at 21 mph. The Train Operator moved the MC into Emergency Position. The train speed was 22 mph at 543 feet from the Eight-Car Marker. Train ID 108 continued experiencing slip-slide conditions. When the Train Operator depressed the emergency mushroom, the train speed was 23 mph. The wheel slide control function disabled 34 feet from the end of the platform limits after the emergency mushroom was depressed. Train ID 108 passed the Eight-Car Marker at Twinbrook at a speed of 21 mph while in Emergency Braking. The train came to a complete stop 40 feet beyond the Eight-Car Marker at Twinbrook on Track 1. Train ID 108 Train Operator reported the train had "no brakes," referring to the slide condition.

Station Overrun length verification and procedures were completed during the second event. No Improper Door Operation occurred with Train ID 108.

There were no significant weather events on the day of the two station overruns. Most recently, a storm system on January 3, 2022, dropped a significant snow total [8-11 inches] in the Washington metropolitan area. A subsequent 10-day arctic air cold front prevented rising temperatures and snow melting. At the time of the incident on January 19, 2022, NOAA recorded the air temperature as 52°F. A review of CCTV identified snow accumulation around the running rails that may have contributed to condensation, resulting in low rail adhesion. A rainstorm occurred the day following this incident, which precluded a more detailed evaluation of the rail conditions at the time of the event.

On January 20, 2022, the Office of Track and Structure (TRST) responded and evaluated the incident area. The team found no conditions that might have contributed to the event. However, TRST implemented a medium speed restriction as a precautionary measure.

Chronological Event Timeline

A review of ARS playback, i.e., radio communications, revealed the following:

Time	Description
16:11:14 hours	Train ID 102 entered Twinbrook Station, track #1; Train Speed was 37 MPH, MC was in the B5 Braking Mode. [VMS Data]
16:11:41hours	The train began to experience Wheel Slide conditions 9 feet within Twinbrook Platform limits at 37 mph, with the MC in B5 Braking Mode. [VMS Data]
16:11:46 hours	Emergency Braking initiated, causing Brake Pipe to Dump; Train speed was 23 MPH, 274 feet from 8-Car Marker [VMS Data]
16:11:00 hours	Train ID 102 Train Operator: "Track #1 Twinbrook overrun half a car off, no braking over." Radio RTC: "Copy that. You said you have a Station Overrun by half a car over?" [Ops 1 Red Line Radio]
16:12:00 hours	Radio RTC: "What is your lead car over? Go ahead and drop your left and right over. Radio RTC: Train ID 102 communicate with me? Radio RTC: Train ID 102 come into central over. Train ID 102 Train Operator: This is 102 central, dropped my left and right. Would you like me to secure my cab and walk any customer out? Radio RTC: That's affirmative, verify half a car only, Walk your passengers through the bulkhead door and service the station." [Ops 1 Red Line Radio]
16:13:00 hours	Radio RTC: Instructed an RTRA Supervisor to check Train ID 102 for flats. RTRA Supervisor: Confirmed the transmission. [Ops 1 Red Line Radio]
16:14:00 hours	Radio RTC: Train ID 102. "Did we service Twinbrook Station? Train ID 102 Train Operator: "I copy station serviced, have them check this train out it ran all the way through over. "[Ops 1 Red Line Radio]
16:15:09 hours	Left Door Open Trainline Goes High indicating Door Open Pushbutton was depressed, opening Left Side Doors [VMS Data]

Time	Description
16:15:29 hours	Left Door Close Trainline Goes High indicating Door Closed Pushbutton was depressed, Closing Left Side Doors. [VMS Data]
16:15:44 hours	MC placed in P5, and Train continues to the next station towards Glenmont. [VMS Data]
16:16:00 hours	Radio RTC: "Check the train out on track #1. Check the braking modes. The train operator claims they lost brakes coming through Twinbrook; that's why they had a station overrun. Check those brakes out for me." CMNT Road Mechanic: "I am going to check out Train 102 on track #1. I did not hear some of your message, it came through distorted, but I heard something about brakes over." [Ops 1 Red Line Radio] Note: CMNT Road Mechanic was located at Grosvenor Station when notified by RTC.
16:17:00 hours	Radio RTC: I need you to check the brake system over. The Train Operator said brakes did not allow them to stop at the 8-car maker." CMNT Road Mechanic: "I copy that central over." [Ops 1 Red Line Radio]
16:18:00 hours	Radio RTC: "Instructed the RTRA Supervisor to take over operations of Train ID 102 at Grosvenor and keep the operator with them." RTRA Supervisor: Confirmed the transmission. [Ops 1 Red Line Radio]
16:29:00 hours	CMNT Road Mechanic: "Central, Train ID 102 is operating fine." Radio RTC: "Copy that, [Radio traffic unclear and distorted] we will let the train run to the end of the line." [Ops 1 Red Line Radio]

Note: Times above may vary from other systems' timelines based on clock settings.

Office of Chief Mechanical Officer (CMOR) Incident Investigation Team (IIT)

CMOR IIT completed an analysis of data retrieved from the consist. According to VMS data, Train ID 102 entered Twinbrook Station, track #1 at 37 MPH in a B5 Braking Mode. When the train was 9 feet within the platform limits, the train began experiencing slide conditions on the entire consist while in a braking mode. Emergency braking was initiated 274 feet within the Twinbrook Station platform. In emergency braking, the train passed the 8-Car Marker at 18 MPH, with slide conditions still present, coming to a complete stop 130 feet beyond the 8-Car Marker.

After coming to a complete stop, the Left Side doors were opened to service the station, then closed. The train then continued to the next station. When experiencing slide conditions, the train's friction brake slip/slide feature was initiated and performed as designed. Based on the VMS' calculated stop location of the train and platform video, the doors on the 2nd car were opened while not properly berthed on the platform. There was no fault observed with the VMS data that may have contributed to the cause of this incident.

Adopted from IIT Report:
Additional Findings unrelated to the event:

Upon Arrival, the VMS had a blue screen Fault Screen, and power had to be cycled to establish connectivity; upon reboot, the VMS failed Self-Test. CMOR IIT attempted to download both EXT and FRA data. EXT data was empty during the reported incident and had ceased recording at 13:34 hours. The FRA files were unable to download.

The data from other cars in the consist were used to determine information noted in this incident. Unfortunately, due to the inability to review data from the lead pair, there was no way to determine if the door operator circuit breakers were dropped.

Recommendations:

- MC checks and Brake Rates on operating car on ID 102 (6066).
- Comply with CMOR SI #G2, Station Overrun Inspection Requirements.
- Verify proper function and communication with the VMS on car 6066 and its respective subsystems.
- Document all inspections, findings, and corrective actions in Maximo.

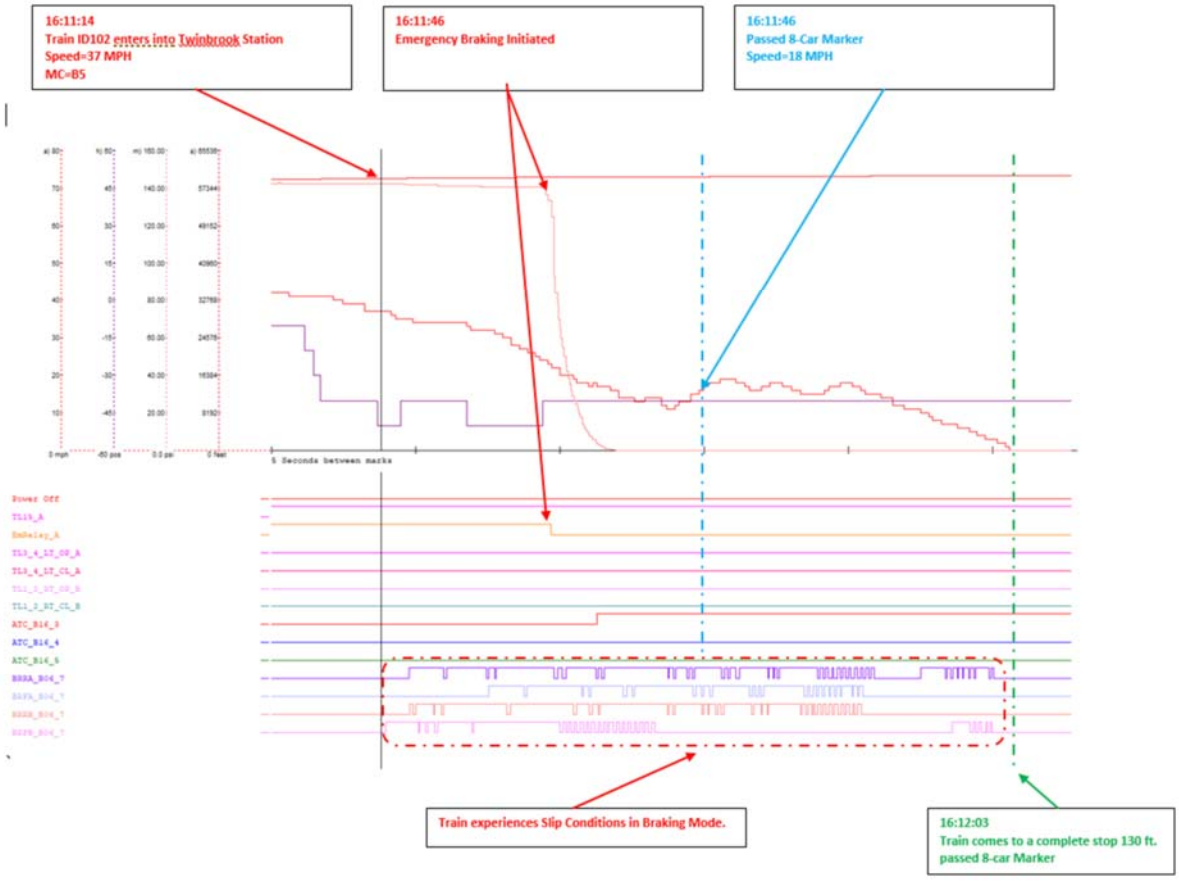


Figure 4 - Train ID 102 data sketch.

Train ID 102 Incident Timeline

Time	Description of Events
16:11:14.020 hours	Train ID 102 entered Twinbrook Station, track #1; Train Speed was 37 mph, MC was in the B5 Braking Mode.
16:11:41.180 hours	Train began to experience Wheel Slide conditions 9 feet within Twinbrook Platform limits at 37 mph, with the MC in B5 Braking Mode.
16:11:46.904 hours	Emergency Braking initiated, causing Brake Pipe to Dump; Train speed was 23 mph, 274 feet 8-Car Marker
16:11:52.400 hours	Train Passes 8-Car Marker at Twinbrook at a speed of 18 mph while in Emergency Braking.
16:12:02.759 hours	The train comes to a complete stop 130 feet beyond the 8-Car Marker at Twinbrook, track #1.

Time	Description of Events
16:15:09.848 hours	Left Door Open Trainline Goes High indicating Door Open Pushbutton was depressed, opening Left Side Doors
16:15:29.348 hours	Left Door Close Trainline Goes High indicating Door Closed Pushbutton was depressed, Closing Left Side Doors.
16:15:44.212 hours	MC placed in P5, and Train continues to the next station towards Glenmont.

Note: Times above may vary from other systems' timelines based on clock settings.

Second Station Overrun Occurrence

Train ID 108 Incident Timeline

Time	Description of Events
22:35:33 hours	Train ID 108, lead car 6030, Entered Twinbrook Station, track #1, Train Speed was 21 mph, MC was in the B5 Braking Mode. Wheel slide conditions can be seen before entering platform limits.
22:35:35 hours	MC is placed in an Emergency Position. Emergency Braking was initiated, causing Brake Pipe to Dump; Train speed was 22 mph, 543 feet from 8-Car Marker. The train continues experiencing slide conditions.
22:35:49 hours	Emergency Mushroom one (Operator side) is pressed—train speed 32Mph. Slip/slide correction is disabled. TL/72 de-energized 34 feet from the 8-Car Marker.
22:35:57 hours	The train comes to a complete stop 40 feet beyond the 8-Car Marker at Twinbrook, Track #1.
22:40.06 hours	Left Door Open Pushbutton was depressed, opening Left Side Doors
22:42.49 hours	Train 6130 is keyed down.

Note: Times above may vary from other systems' timelines based on clock settings.

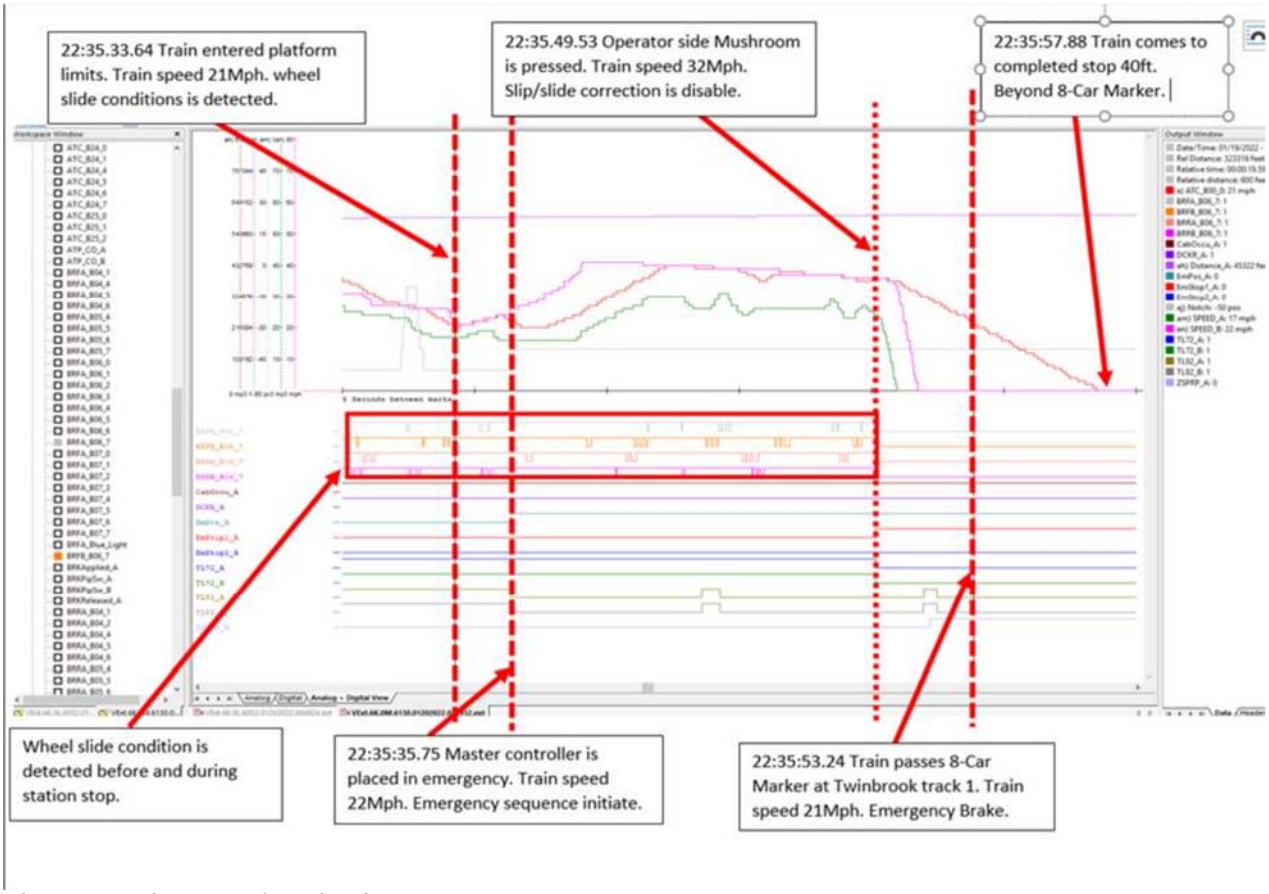


Figure 5 - Train ID 108 data sketch.

Office of Rail Transportation (RTRA)

According to the RTRA incident report, the Train Operator was removed from service for post-incident testing and scheduled for reinstruction.

Office of Track and Structure (TRST)

TRST responded and evaluated the incident area on January 20 and did not identify findings of any track conditions that might have contributed to the event. However, TRST implemented a medium speed restriction as a precautionary measure for Twinbrook Station, Track 1.

Office of Car Maintenance (CMNT)

CMNT personnel replaced the front Friction Brake Electronic Control Unit (FBECU) on car 6066 due to failed MB03 and MB04 boards failures. The remainder of the cars' control boards and brake rates were found to in proper working order and the entire consist experienced the slip-slide condition. These facts support that the MB03 and MB04 board failures were not a contributing factor to the Station Overrun.

CMNT technicians inspected the incident consist for flats; no wheel flats were found on the consist. CMNT technicians performed MC operational checks on the consist and did not find any abnormal conditions with the MC. CMNT personnel performed brake rate testing and determined the readings were within acceptable ranges.

A 30-day Maximo history review of the cars involved did not yield any findings for brake anomalies. Car 6066-67 underwent CMNT 2/3/6k Return to Service Mainline Track Test on October 7, 2021, from Greenbelt to Brentwood Yard.

There are two ECUs per car. The ECU interprets the train signals for the brake level commanded by the MC or Automatic Train Control (ATC). It provides the control signals to the friction braking equipment. The ECU also interfaces with the propulsion system, which provides a feedback signal to the friction brake ECU of the achieved braking effort. The ECU then controls the friction braking to supplement the electric braking required to meet the overall braking demand. The ECU also provides real-time monitoring and diagnostics of the friction brake and pneumatic systems and communicates with the VMS via the car communications network.

Wheel slip control is a Friction brake slide control provided by the FBECU. Each FBECU uses four-speed sensors on each car to detect wheel slide. Sensors are wired so that axle one goes to input one on the FBECU. This allows the wheel slide algorithm to know which axle it must control to prevent wheel slide. The FBECU monitors the slide condition independent of propulsion. When a slide occurs above the fade speed, propulsion first attempts to correct the slide if propulsion is unsuccessful in its attempt after 200 milliseconds.

The FBECU inhibits the propulsion wheel slide correction by setting the L (Wheel Slide Protection) L_WSPx train-line to a low state and then proceeds to finish correcting the slide. When the slide has been corrected, the FB.ECU sets the L_WSPx train-line to a high state. The FBECU uses the apply and release dump valve to correct the wheel slide. The FBECU monitors the LO_WSPx train-line (TL 72) and inhibits WSP when this train-line is in a low state. If power is lost to the FBECU, the wheel slide dump valve allows full emergency braking. The friction brake and ED-Brake system response times are sufficiently short to permit the vehicle to achieve the specified performance requirements.

The MB04B board controls brake cylinder pressure, and the MB03B board provides wheel slide protection. Each FBECU containing these boards works independently on each truck on a rail vehicle.

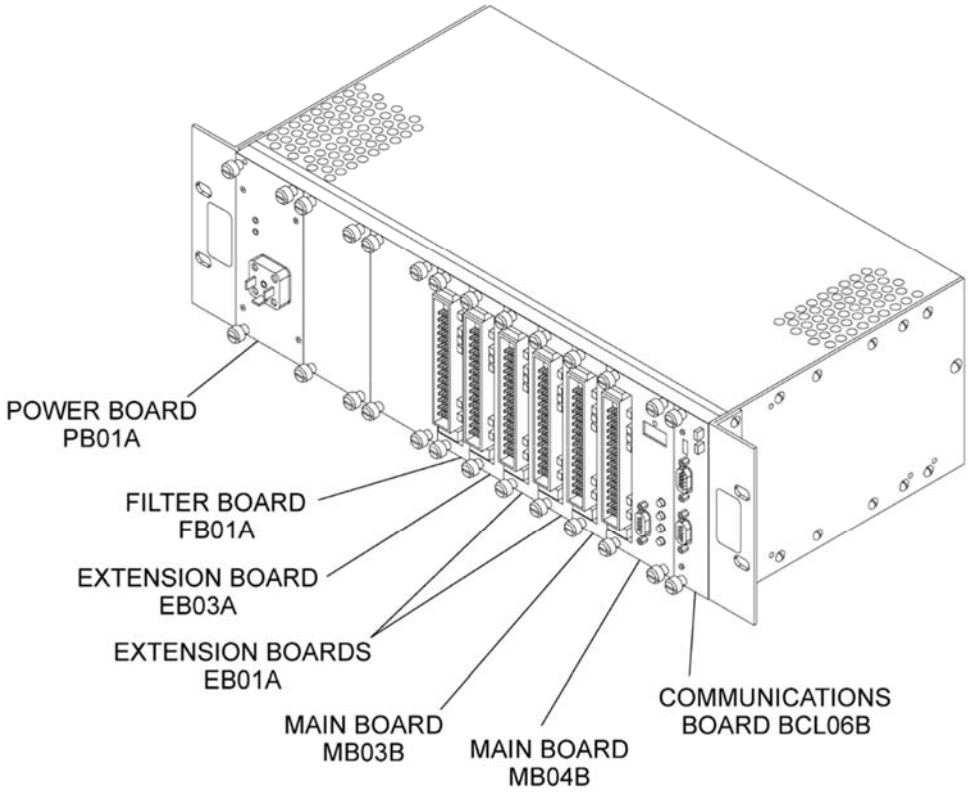


Figure 6 - Picture of an FBECU and location of boards.

Office of Radio Communication (COMR)

COMR conducted a comprehensive radio check on tracks #1 and #2 at Twinbrook and Grosvenor Station and did not identify any issues with the communication system. The communication system was operating as designed.

Applicable Rules and Procedures

MSRPH Cardinal Rule 1.79 - Personnel shall not take any action until they are positive that all radio transmissions or receptions are heard, fully understood, and acknowledged. Individual radio transmissions shall, at all times, be repeated by the receiver so the transmitter can confirm the message was received completely and by the intended receiver. Whenever the transmitter has completed their transmission and is turning the airtime over to the receiving party for acknowledgment or reply, they are to end their communication with the word "over." Speed restrictions must always be acknowledged by each Rail Vehicle Operator, even when a blanket message is sent out from Central Control, through 100 percent word for word repeat-back from the Rail Vehicle Operators to Central Control or the Tower."

MSRPH Operating Rule 3.91: "All activations of the mushroom shall be reported to the Rail Operations Control Center."

MSRPH 40.5.4.1. C (2): "After disabling control to doors on the lead car and opening doors on the platform side, make two (2) PA announcements advising customers on the lead car that they must use the emergency bulkhead doors at the rear of the first car to enter next car and exit train."

Interview Findings

As part of the investigation launched into the Twinbrook Station Improper Door Operation Incident, SAFE conducted one interview via Microsoft Teams, including the investigations team and the WMSC. The interview was conducted one day after the event and identified the following key findings associated with this event. The findings detailed below include reported information from interviews and may conflict with other data sources contained in the report.

Train Operator of ID 102

Upon entering Twinbrook Station, track #1, "the train seemed not to have any brakes or was sliding. Once I got approximately two cars on the platform, I came out of a braking mode into coast and back into a braking mode; the train was still not slowing down."

The Train Operator said they entered Brakes in Emergency (BIE) approximately halfway onto the platform and the train still did not stop until a half to a car off the platform. The Train Operator notified the ROCC. ROCC instructed the Train Operator to drop their right and left circuit breakers; the Train Operator serviced the station and continued. ROCC sent CMNT to check for flats with none found.

The Train Operator stated an RTRA Supervisor removed them at Grosvenor Station for post-incident toxicology testing. The Train Operator stated, "I think I notified ROCC I BIE'd the train." The Train Operator said they usually go to B5 when entering the station and then proceed to different braking pressures, such as B3. The Train Operator said they advised ROCC they were about half a car or a car beyond the platform. They reported looking out of the non-operating window (platform side) and it appeared they were a half to one railcar off the platform.

The Train Operator said, "I may have misjudged the distance. I was looking at the [Door Open Indicator] lights on the car." The Train Operator noted the Chain Markers are 100 feet apart, and they did not think about looking for signage for distance reference. The Train Operator spoke with customers on the lead car from the operator cab door to determine if anyone needed to alight. When no passengers stated that they needed to exit the train, the Train Operator returned to the cab without verifying the overrun length.

The Train Operator stated that when looking out of the non-operating cab window, the station building and railing were not visible directly in front of them. The Train Operator had to look back towards the station and railing.

Weather

A storm system from January 3, 2022, dropped a significant snow total [8-11 inches] in the Washington Metropolitan area. A subsequent 10-day arctic air cold front prevented rising temperatures and snow melting. At the time of the first incident on January 19, 2022, NOAA recorded the air temperature as 52°F, mostly cloudy with winds from the South at 15 mph with no precipitation in the last 24 hours. The relative humidity was 37% with ten-mile visibility.

At the time of the second incident (Train ID 108) NOAA recorded the air temperature as 50°F, with winds from the SSW at 18 mph. Weather conditions and accumulated snow around the running rails may have contributed to this incident, however a thorough evaluation of the conditions were not conducted before another precipitation event occurred. This determination was made based on the elimination of other factors, such as vehicle performance, fatigue and speed of the railcar. (Weather source: NOAA – Location: Washington DC.)

Human Factors

Fatigue

Evidence of fatigue – Train Operator

Conditions at the time of the incident were evaluated to distinguish whether evidence of fatigue was present. No video of the involved person was available to ascertain whether evidence of fatigue was present. The employee reported feeling fully alert at the time of the incident. The employee reported experiencing no symptoms of fatigue in the time leading up to the incident.

Fatigue Risk – Train Operator

Incident data was evaluated for fatigue risk factors. No significant risk was identified. The incident time of day did not suggest an increased risk of fatigue-related impairment. The employee reported keeping a regular sleep schedule in the days leading up to the incident. The employee worked evenings in the days leading up to the incident. The employee was awake for 8.18 hours at the time of the incident. The employee reported 10 hours of sleep in the 24 hours preceding the incident. The off-duty period was 60.28 hours, which provides an opportunity for 7-9 hours of sleep. This was a comparable amount of the employee's usual workday sleep durations. The employee reported no issues with sleep.

Post-Incident Toxicology Testing

WMATA's Drug and Alcohol Program determined that the Train Operator was not in violation of the Drug and Alcohol Policy and Testing Program 7.7.3/6.

Work History

Train Operator

- The Train Operator has no safety violations within the past three years.

Findings

- Train ID 102 entered Twinbrook Station on track 1 within recommended speed limit for manual operations. The train speed was 37 mph and the MC was in the B5 Braking Mode.
- Train ID 102 experienced wheel slip-slide conditions nine feet into the Twinbrook platform limits at 37 mph, with the MC in B5 Braking Mode.
- Emergency Braking was initiated with the train speed at 23 mph, approximately 274 feet from the eight-car marker.
- Train ID 102 passed the eight-car marker at 18 mph while in Emergency Braking.
- Train ID came to a complete stop 130 feet beyond the eight-car marker at Twinbrook Station on Track 1.
- A review of established procedures and rules did not identify a specific method documented to verify a train's resting position after experiencing a Station Overrun.
- Train Operator failed to perform 100% repeat-back of instructions from the Radio RTC following the Station Overrun prior to taking action to service the station. The Radio RTC did not require the Train Operator to repeat the instruction.
- Train ID 102 Train Operator performed a left side door operation with cars outside the platform limits.
- Two trains experienced wheel slip-slide conditions within several hours of each other on the same track (Track 1).

Probable Cause

The probable cause for the Station Overrun and subsequent Improper Door Operation on January 19, 2022, was an undetermined low rail adhesion that degraded its stopping performance while traversing Twinbrook Station, resulting in Train ID 102 Train Operator overrunning the station by 130 feet. After the Station Overrun, Train ID Train Operator experienced a human factors failure, possibly due to pressure of the Station Overrun and failed to complete the overrun length verification prior to exercising the door operation. A Contributing Factor to the incident was an improper repeat-back by the Train Operator that was not enforced by the Radio RTC.

Immediate Mitigation to Prevent Recurrence

- TRST implemented a medium speed restriction as a precautionary measure for Twinbrook Station Track 1, on January 20, 2022. Conditions were reevaluated and the speed restriction was lifted on January 25, 2022.

Recommendations/Corrective Actions

The following are the recommendations and corrective actions preliminarily identified as a result of this investigation. Additional recommendations may be identified as the investigation continues and will be included in the final report.

Recommendations and corrective actions are tracked using WMATA's Safety Measurement System Incidents/Accidents (SMS I/A) Module and are verified by SAFE upon completion. The responsible department is identified in the corrective action code, and the respective departmental Safety Risk Coordinator (SRC) will manage the mitigation. Refer to the SMS I/A module for additional information.

Corrective Action Code	Description	Responsible Party	Target Completion Date
96850_ SAFECAPS_ RTRA_001	(RC-1) Train Operator to undergo Refresher Training on Station Overrun procedures and radio communications.	RTRA SRC	Completed
97233_SAFECAPS_ ROQT_002	(CF-1) Development of Train Operator Station Overrun Prevention Strategies Computer-Based Training (CBT).	ROQT	10/01/2022
97233_SAFECAPS_ RSSC_001	(CF-1) Development of Standard Operating Procedures relating to Station Overruns response.	OOP/RSSC	10/01/2022

Appendices

Appendix A – Interview Summaries

Train Operator

The below narrative summarizes the interview with SAFE and represents the statements made by the involved individual. As such, times and details may conflict with the data contained in systems of record.

WMATA employee with four years of experience as a Train Operator. The Train Operator has 7.5 years of seniority with authority; their previous role was a Bus Operator. The Train Operator's last certification was on September 2019.

The Train Operator said their first trip on January 19, 2022, was from Glenmont Station, Track #2, inbound towards Shady Grove Station. Upon arriving, the Train Operator switched operating ends and headed back in Glenmont Station's direction on Track #1.

Upon entering Twinbrook Station, track #1, "the train seemed not to have any brakes or was sliding. Once I got approximately two cars on the platform, I came out of a braking mode into coast and back into a braking mode; the train was still not slowing down."

The Train Operator said they entered BIE with the train halfway on the platform and the train still did not stop until a half to a car off the platform. The Train Operator notified the ROCC. ROCC instructed the Train Operator to drop their right and left circuit breakers. The Train Operator serviced the station and continued. ROCC sent CMNT to check for flats with none found.

The Train Operator stated an RTRA Supervisor removed them at Grosvenor Station for post-incident toxicology testing. The Train Operator stated, " I think I notified ROCC I BIE'd the train." The Train Operator said they usually go to B5 when entering the station and then proceed to different braking pressures, such as B3. The Train Operator said they advised ROCC they were about half a car or a car beyond the platform. They reported looking out of the non-operating window (platform side) and it appeared they were a half to one railcar off the platform.

The Train Operator said, "I may have misjudged the distance. I was looking at the lights on the car." The Train Operator noted the Chain Markers are 100 feet apart, and they did not think about looking for signage for distance reference. The Train Operator spoke with customers on the lead car from the operator cab door to determine if anyone needed to alight. When no passengers stated that they needed to exit the train, the Train Operator returned to the cab without verifying the overrun length.

The Train Operator stated that when looking out of the non-operating cab window, the station structure and railing were not visible directly at the window. The Train Operator had to look back towards the station to see the railing.

Appendix B – RTRA's Managerial Report

RTRA DIVISION MANAGER
STATION OVERRUN REPORT

Please ensure this report is submitted to the Line Directors and RTRA Managing Director within 24 hours (weekdays); 48 hours (weekends) of reported overrun

INCIDENT DATE & TIME	OPERATOR'S DIVISION
Wednesday, January 19, 2022 @1611	**Glenmont**
OPERATOR'S NAME & PAYROLL	**INCIDENT LOCATION & TRACK NUMBER**
[redacted]	*Twinbrook Station Track #2*
TRAIN ID	**CONSIST NUMBERS**
102	*6173 x 6059 x 6067*

STOV TRENDS for *Insert Station Name (Insert Alphanumeric Code)*

There have been approximately 0 station overruns reported at this location in 2022.

OPERATOR HISTORY & FITNESS

- Train Operator [redacted] *has* been on the rail as a Train Operator *since October 29,2017*. He has been employed with the Authority since *May 31, 2015*
- Today, he was working Glenmont *Run #508, and* this was his 1st trip, for the day.
- Train Operator [redacted] worked a total of 51 hours within the last seven (7) days. There were no recorded instances of overtime and/or 8-hour rule violations noted within Trapeze.
- **Previous Station Overruns:** 0
- **Safety Violations:** 0
- **Last Certification Date** 9/26/2016
- There were no reported discrepancies with the employee's performance and/or fitness for duty

REFRESHER TRAINING/DISCIPLINARY ACTION

Refresher will be schedule once Operator [redacted] *Clear Drug and Alcohol testing. Disciplinary action to follow investigation.*

SMS NUMBER	REPORT COMPLETED BY
	[redacted]

Attachment 1 – RTRA Managerial Report Page 1 of 1.

Appendix C – ROC Report

View Approved Incident Report

INCIDENT ID: 2022019RED3

DATE	TIME	LINE	ITEM
2022-01-19	1611	Red	3

LOCATION (STATION/YARD)
Twinbrook (A13)

LOCATION/CHAIN MARKER (If Applicable)

REPORTED BY
Train Operator [redacted]

TRAIN ID	DIRECTION	TRACK NUMBER	DEPTS NOTIFIED
102	I/B	1	Everbridge Alert/Messaging

CAR NUMBERS (XXXX-XXXX)
Lead Car

6066-6067	6058-6059	6172-6173	-
Caused Issue ☑	Caused Issue ☐	Caused Issue ☐	Caused Issue ☐

TRBL CODE
STOV-
STATION
OVERRUN

RESP CODE
RTR

TYPE INCIDENT
Station Overrun

ACTION PLAN
Dispatch RTRA Supervisor, CMNT/ Remove Operator From Service

DELAYS IN MINUTES

LINE	INCIDENT	TRAIN	TOTAL DURATION
3	3	3	0

TRIPS MODIFIED

PARTIAL	GAP TRAIN	LATE DISPATCHES	REROUTED	NOT DISPATCHED	OFFLOADS
0	0	0	0	0	0

FIVE PRIMARY CONSOLE INDICATIONS

BCP	BRAKES ON ILLUMINATED	ALL DOORS CLOSED ILLUMINATED	AUTO\MANUAL ILLUMINATED	BPP
Yes	Yes	Yes	MANUAL	Yes

Attachment 1 – ROC Report Page 1 of 2

View Approved Incident Report

INCIDENT CHRONOLOGY	
TIME	**DESCRIPTION**
1611	Train 102 Operator [redacted], Twinbrook track one, reported a station overrun by one half car. ROCC instructed Train 102 operator to verify only one half car and trip right and left door control circuit breakers to service the station. Unit [redacted] RTRA Supervisor [redacted] and CMNT [redacted] were dispatched. ROIC, CMNT, Assistant Operation Manager and all concerned personnel were notified.
1614	Train 102 Operator reported Twinbrook station serviced and continued normal revenue service to Glenmont. Unit [redacted], CMNT [redacted] intercept Train 102 operator who was removed from service at Grosvenor track one.
1655	Unit 18 RTRA Supervisor [redacted] transported Operator [redacted] for a post incident analysis .Normal service resumed.

MAXIMO TICKET#
8583149

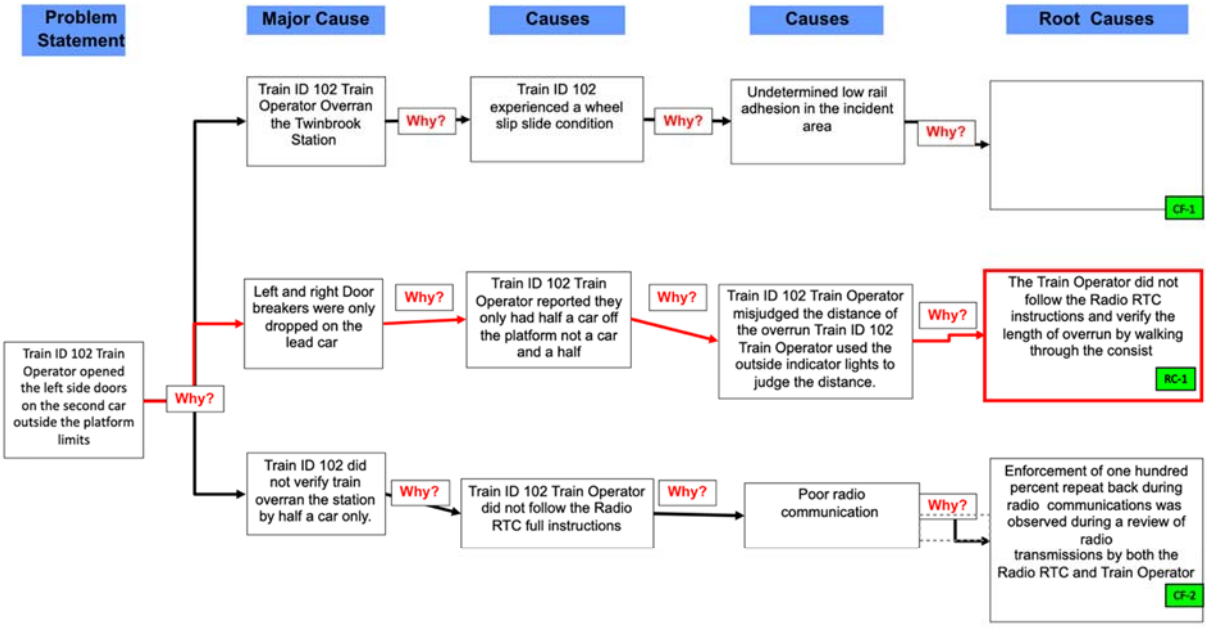
REPORT PREPARED BY	NAME	CLICK TO SIGN
RADIO CONTROLLER 1	[redacted]	✓
BUTTON CONTROLLER 1	[redacted]	✓
RADIO CONTROLLER 2		
BUTTON CONTROLLER 2		

SUPERINTENDENTS OR ASSISTANTS SECTION	
ADDITIONAL FOLLOW-UP CORRECTIVE ACTIONS OR REMARKS	
FOLLOW-UP INFORMATION OBTAINED FROM SUPPORT DEPARTMENTS	
NOTIFICATIONS/PAGE GROUPS	#1/CEO ☐ #2/DGM &BELOW ■
ADDITIONAL NOTIFICATIONS MADE BY PHONE	

APPROVED BY	NAME	CLICK TO SIGN
REPORT APPROVED BY SUPT. OR ASST SUPT.	[redacted]	✓

Attachment 1 – ROC Report Page 2 of 2

Appendix D – Root Cause



Root Cause Analysis

Attachment 1 – Root Cause page 1 of 1.