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WMSC Commissioner Brief: W-0133 – Improper Roadway Worker Protection – near Forest Glen Station – August 6, 2021

Prepared for Washington Metrorail Safety Commission meeting on December 7, 2021

Safety event summary:

Rail Traffic Controllers in the Rail Operations Control Center (ROCC) permitted the Equipment Operator of a Roadway Maintenance Machine (RMM) to move through an area where a Traction Power Maintenance (TRPM) crew was on the roadway just north of Forest Glen Station with foul time protection that they had not relinquished, creating a near-miss of a collision with workers on the tracks.

The controllers had incorrectly removed foul time protection indicators – red signals, blue block and human form on the Advanced Information Management (AIM) system screen – after a different Traction Power Maintenance crew relinquished their foul time near Wheaton Station. When the crew near Wheaton Station relinquished foul time and the blue block and human form indications were removed in that area, the Radio Controller also told the Button Controller that the crew at Forest Glen Station had relinquished their foul time. The Button Controller then also removed the red signals, blue block and human form indications for the crew near Forest Glen Station.

The Radio Controller then gave permission for the Equipment Operator of Prime Mover (PM) 60 to travel under an absolute block from Forest Glen Station to Wheaton Station. The Equipment Operator of JR-02, who had traveled with PM 60 in a convoy block to Forest Glen Station, asked over the radio whether personnel were clear of the roadway. Someone responded “that’s a negative”, however it is not clear who that person was. PM 60 moved to Wheaton Station.

The work crew reported that they saw PM 60 approaching while they were on the roadway and quickly moved to a place of safety on the stairs between Track 1 and Track 2.

The crew on the roadway contacted ROCC to report that the vehicle had moved through their work area that was protected under foul time. ROCC controllers then re-established human form on the AIM screen.

Probable Cause:

The probable cause of this event was a lack of redundancy in Metrorail’s foul time relinquishing process to ensure that details are confirmed prior to removing protections.

Corrective Actions:

Metrorail re-trained the ROCC controllers involved and conducted a ROCC safety standdown focused on foul time procedures and improper roadway worker protection (RWP) events.

ROCC is reviewing the process of documenting and tracking foul time protection. This will include enhancements to the foul time checklist sheet used to document work crews working under foul time protection on the roadway.

Metrorail is required to address fatigue management through open Corrective Action Plans.

WMSC staff observations:

Following this and other events, Metrorail implemented additional interim reviews in September 2021 for the granting of foul time. This investigation identified gaps in the relinquishing of foul time.

The Radio Controller's RWP certification had expired at the time of this event. Metrorail had issued extensions as it catches up on training following the COVID-19 public health emergency. This expired certification did not contribute to this event.

Staff recommendation: Adopt final report.

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

FINAL REPORT OF INVESTIGATION A&I E21345

Date of Event:	08/06/2021
Type of Event:	Improper Roadway Worker Protection
Incident Time:	01:37 Hours
Location:	Forest Glen Station, Track 1
Time and How received by SAFE:	01:55 Hours; SAFE/IMO
WMSC Notification Time:	03:24 Hours; Email
Responding Safety Officers:	WMATA: None WMSC: None Other: None
Rail Vehicle:	Track Unit – PM-60
Injuries:	None
Damage:	None
Emergency Responders:	None
SMS Incident/Accident Report Number	20211012#96111

Forest Glen – Improper Roadway Worker Protection

August 6, 2021

Table of Contents

Abbreviations and Acronyms

AIMS	Advanced Information Management System
ARS	Audio Recording System
B09	Forest Glen Station
CAP	Corrective Action Plan
CCTV	Closed-Circuit Television
COMM	Office Systems Maintenance Communication Section
CM	Chain Maker
JGB	Jackson Graham Building
MSRPH	Metrorail Safety Rules and Procedures Handbook
NOAA	National Oceanic and Atmospheric Administration
RMM	Roadway Maintenance Machine
RTC	Rail Traffic Controller
RTRA	Office of Rail Transportation
ROCC	Rail Operations Control Center
SAFE	Department of Safety and Environmental Management
SMS	Safety Measurement System
TRPM	Traction Power Maintenance
TRST	Office of Track & Structures
WMATA	Washington Metropolitan Area Transit Authority
WMSC	Washington Metrorail Safety Commission

Executive Summary

On Friday, August 6, 2021, at approximately 01:37 hours, a Traction Power Maintenance (TRPM) Crew contacted the Rail Operations Control Center (ROCC) and reported to the ROCC Rail Traffic Controller (RTC) that an Office of Track & Structure (TRST) Rail Maintenance Machine (RMM) traversed their protected work area that was covered under Foul Time protection between Chain Markers (CM) B1 547+00 and 564+00, outside of Forest Glen Station (B09). At the same time, RMM PM-60 and JR-02 were given permission to travel under a convoy block from Silver Spring Station to Forest Glen Station. At the end of the convoy block, ROCC RTC authorized RMM PM-60 to continue as a single unit to Wheaton Station, track 1 traversing the Foul Time area that was occupied by the TRPM Crew. After passing through the Foul Time area, RMM PM-60 continued to Wheaton Station, track, 1 as a single unit. RMM JR-02 remained at Forest Glen Station, track 1. There were no injuries or damage as a result of this incident.

The Audio Recording System (ARS) playback revealed that at approximately 01:13 hours, Track Units PM-60 and JR-02 were traveling under a convoy block to their respective work locations from Brentwood Rail Yard. The Track Units were given permission to travel to Silver Spring Station, track 1. Prior to the Track Units arriving at Silver Spring Station, at approximately 01:18 hours, a Power Maintenance Crew contacted ROCC from Forest Glen Station and requested foul time to enter the roadway for switching and hot sticking at CM B1 547+00 to 564+00. The Radio RTC granted permission, with 100% repeat-back, to the Power Maintenance Crew after setting up foul time protection in the requested work area. At approximately 01:28 hours, the Track Units contacted ROCC when they arrived at the end of the convoy block, Silver Spring Station, track 1. The Track Units were instructed to hold due to another work crew performing work under foul time just ahead of the Track Units.

At approximately 01:26 hours, a second TRPM crew reported clear of the roadway and relinquished foul time between CM B1 637+00 and B1 632+00, which is in the area of Wheaton Station (B10). The human forms for the TRPM crew at Wheaton Station were removed from the Advanced Information Management System (AIMS) display. Approximately one minute later, the human forms for the TRPM crew at Forest Glen Station were removed from the AIMS display. At approximately, 01:29 hours, the Radio RTC gave permission to the Track Units to continue as a convoy block to Forest Glen Station, track 1. After arriving at Forest Glen Station, at approximately 01:33 hours, the Radio RTC gave permission to RMM PM-60 to travel under an absolute block to Wheaton Station to set up their work location. At approximately the same time, JR-02 questioned if personnel were clear of the roadway, however there was no response.

At approximately 01:37 hours the Power Maintenance Crew contacted ROCC via phone and reported that a Track Unit traveled through their work area that was protected under foul time. At approximately 01:42 hours, ROCC reestablished human forms of the TRPM Work Crew at Forest Glen.

After reviewing the Audio Recording System (ARS) playback, there did not appear to be any communication deficiencies with the radio system.

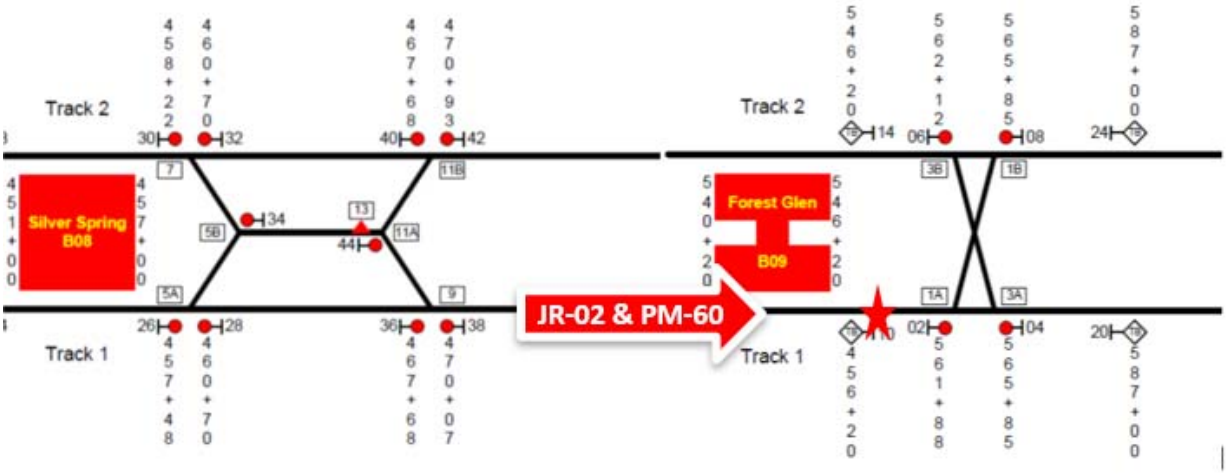
The probable cause of the Improper RWP event was a human factors failure of the Radio RTC to track and document the number and call ID of work crews under Foul Time protection. This resulted in confusing the work crew at Wheaton Station with the work crew at Forest Glen Station.

A contributing factor to the event was a miscommunication by the Radio RTC, providing inaccurate information to the Buttons RTC, caused the removal of the human forms from the AIMS display. This action subsequently caused the Radio RTC to give permission to the Track Unit to move through the area under Foul Time protection.

Incident Site

Forest Glen Station, Track 1 at CM B1 547+00

Field Sketch/Schematics



Purpose and Scope

The purpose of this accident 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.

Investigative Methods

The investigative methodologies included the following:

- Site Assessment through document review

- Formal Interviews – SAFE interviewed four individuals as part of this investigation, including the
  - ROCC Radio RTC
  - TRPM RWIC
  - TRPM Helpers (two personnel)

- Informal Interviews – Collected through conversations with individuals during the investigation to provide background and supporting information.

- Documentation Review – A collection of relevant work history information and process documentation contained in Metro systems of record. These records include:
  - Employee Training Procedures & Records
  - Metro Safety Rules and Procedures handbook (MSRPH)
  - National Oceanic and Atmospheric Administration (NOAA) data

- Certifications
- 30-Day work history
- Office of Systems Maintenance Communication Section (COMM)

- System Data Recording Review – A collection of information contained in Metro Data Recording Systems. This data includes:
  - Audio Recording System (ARS) playback including OPS 1 Radio, Phones and Ambient Microphone

Investigation

On Friday, August 6, 2021, at approximately 01:37 hours, a Traction Power Maintenance (TRPM) Crew contacted the Rail Operations Control Center (ROCC) and reported to the Button Rail Traffic Controller (RTC) that a Track Unit passed through their protected work area that was covered under foul time protection between Chain Markers (CM) B1 547+00 and 564+00. ARS review indicated that at approximately 01:33 hours, Track Unit PM-60 was given permission to travel under an absolute block from Forest Glen Station to Wheaton Station, track 1 traversing an area that was occupied by a Power Maintenance Crew who was given prior authorization to enter into the roadway under foul time protection from the Radio RTC on Radio Ops (Ops) 1.

At approximately 01:19 hours, a Power Maintenance Crew requested permission to enter the roadway under foul time between CM B1 547+00 and B1 564+00. The AIMS display verified that signals B08-44, B08-36 were red, and B08-38 signal was prohibited, and human form was in place at Forest Glen Interlocking. The Radio RTC granted the Power Maintenance Crew personnel foul time to enter track one at Forest Glen Station to perform switching and hot sticking.

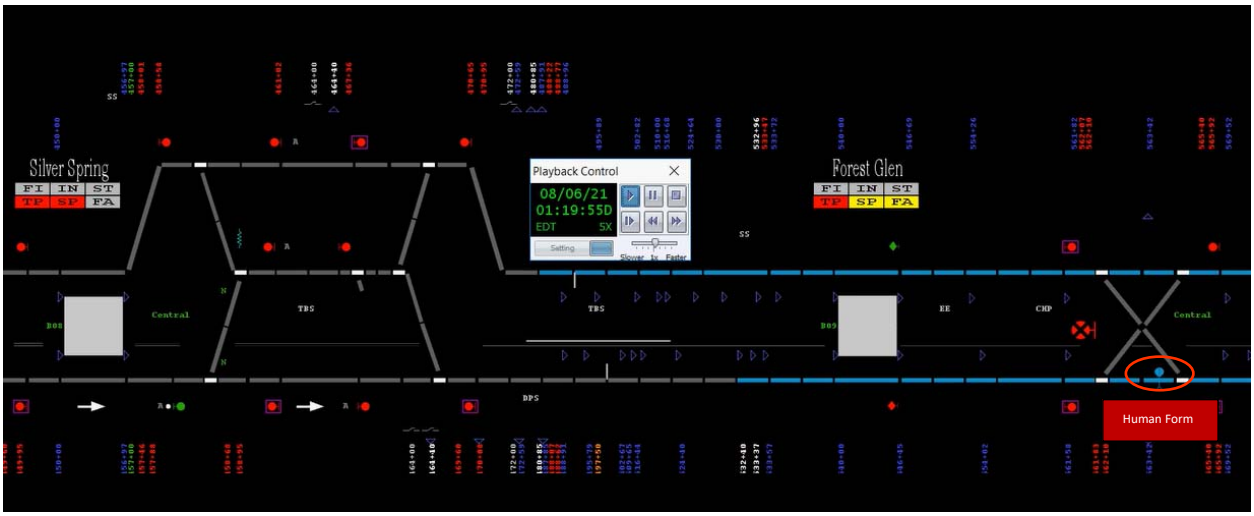


Image 1 – Human Form in place at Forest Glen Station Interlocking.

At approximately 01:26 hours, a different Power Maintenance Crew located at Wheaton Station, also operating under foul time protection, relinquished their protection with the Radio RTC between CM B1 637+00 and B1 632+00. At approximately 01:27 the foul time protection in human from was removed from the AIMS Display at Forest Glen Interlocking.

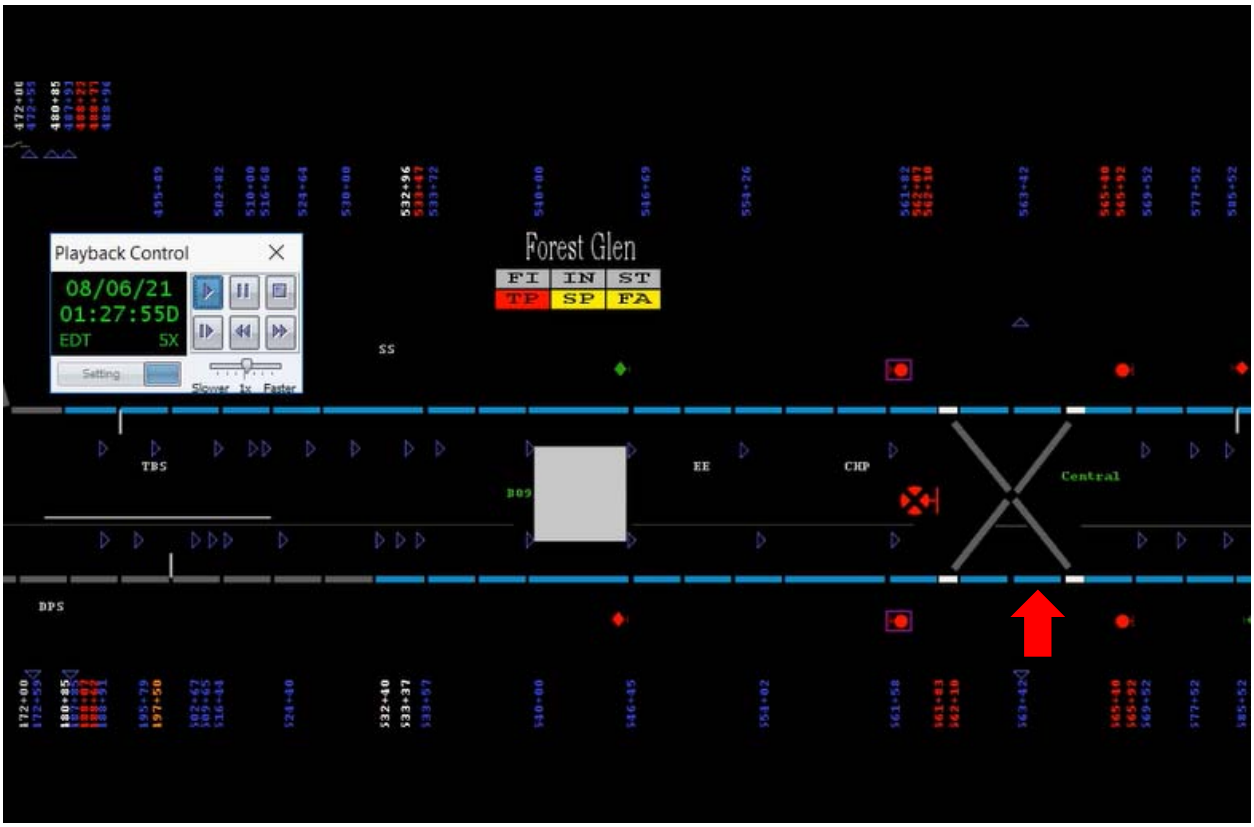


Image 2 – Human Form removed while Power Maintenance Crew are still under foul time protection.

It was at this time that the Radio RTC confused the two Power Maintenance Crews that were working at Forest Glen Station and Wheaton Station. The Power Unit located at Forest Glen Station had not relinquished their foul time. The Radio RTC confirmed during the interview that they advised the Buttons RTC that the Power Maintenance Crew that was located at Forest Glen Station had relinquished their foul time causing the Buttons RTC to remove the human form protection from the AIMS Display at Forest Glen as well. This action was a violation of MSRPH Section 5 – RWP, 5.13.5 Foul Time Protection.

At approximately 01:28, the Radio RTC instructed Track Units RMM PM-60 and JR-02, located at Silver Spring Station, to standby due to a Power Maintenance Crew ahead that had just relinquished their foul time. At approximately 01:28 hours, signal B08-36 was set for a normal route. At approximately 01:29 hours, the Radio RTC instructed Track Units RMM PM-60 and JR-02 to move under a permissive block to Forest Glen Station, track 1. The RTC corrected themselves during the same transmission to say convoy block.

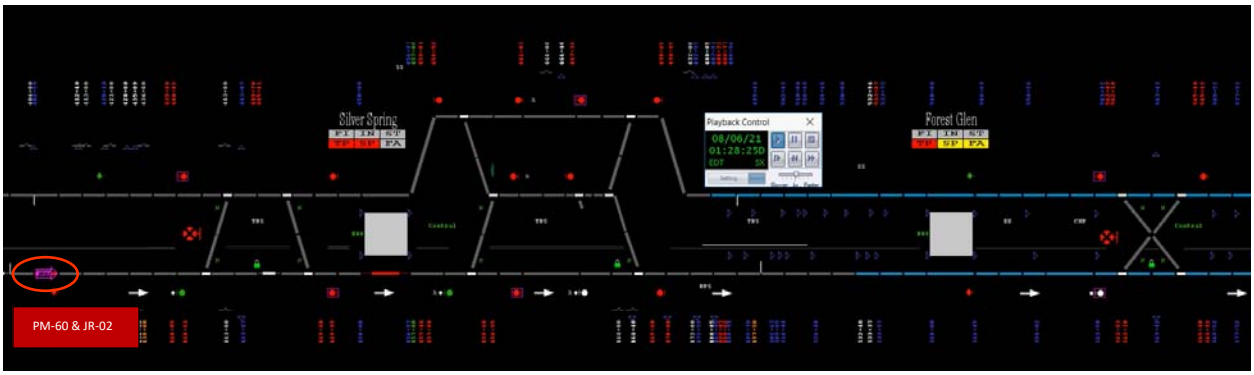


Image 3 – Signal B08-36 set to normal as Track Unit PM-60 approaches Silver Spring Station.

At approximately 01:32 hours, RMM PM-60 and JR-02 cleared signal B08-38 at Silver Spring Station.

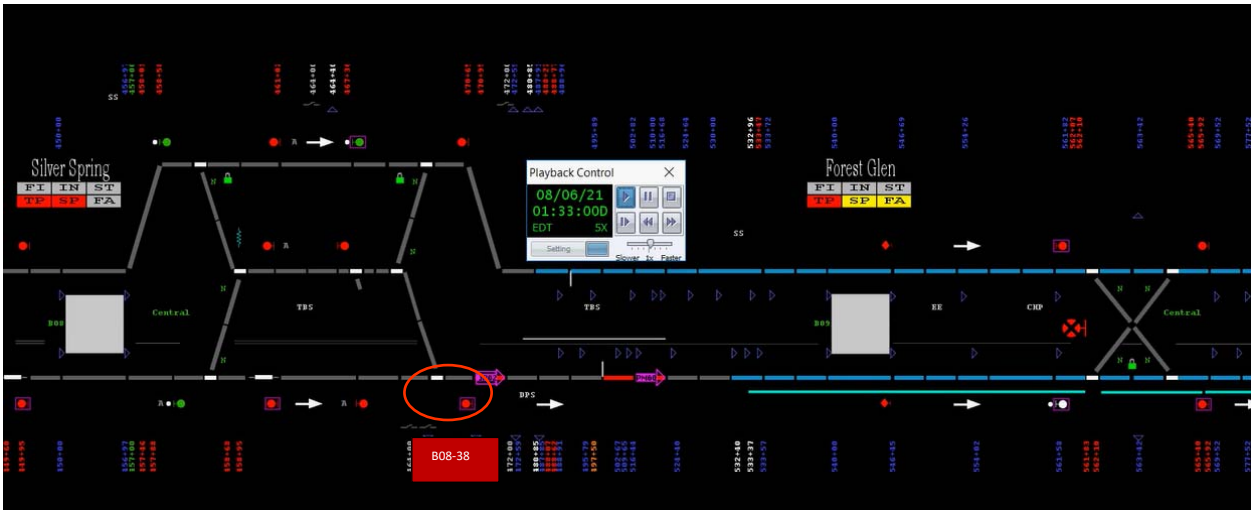


Image 4 – Track Units PM-60 & JR-02 clear signal B08-38.

After arriving at the end of their Absolute Block at Forest Glen Station, track 1, the Radio RTC extended RMM PM-60's absolute block to Wheaton Station, track one causing the rail vehicle to traverse the protected area.

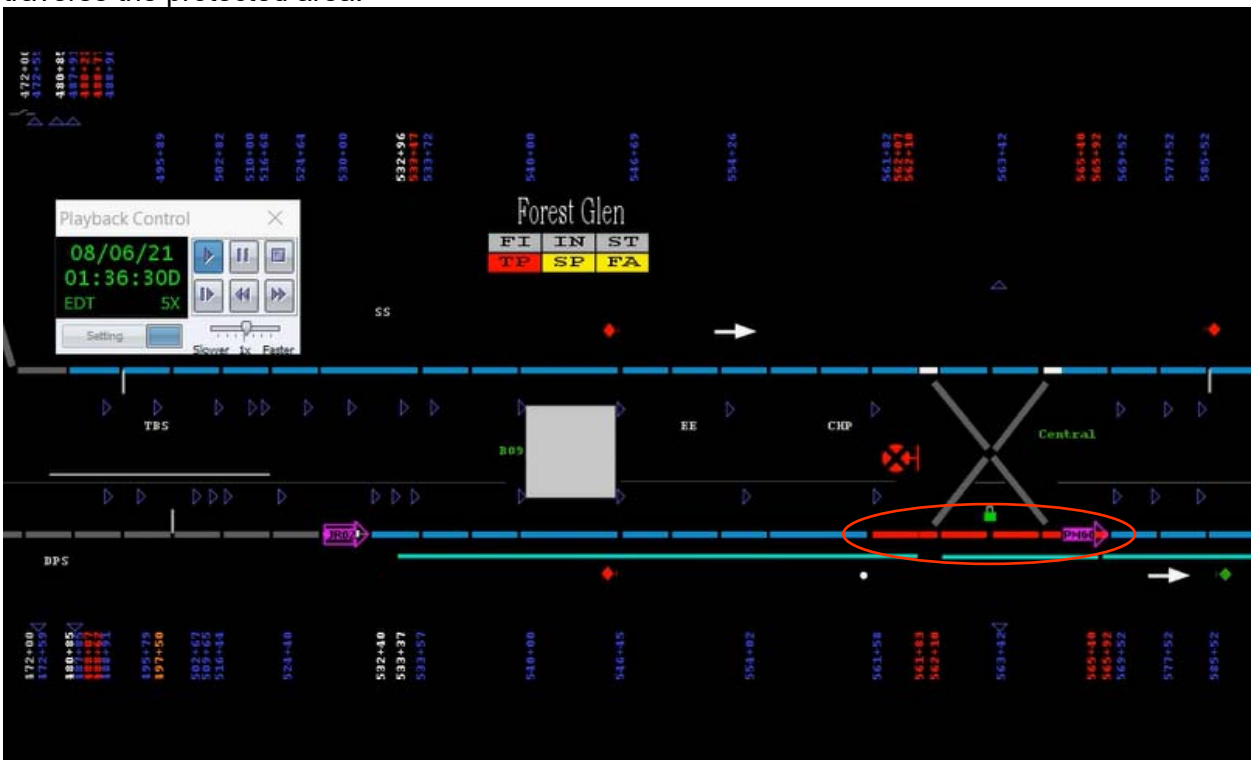


Image 5 – Track Unit PM-60 traversing foul time area.

The Power Maintenance Crew contacted the Button RTC via landline and reported that the work crew was still under foul time protection when Track Unit PM-60 traversed through the area. The Radio RTC contacted all Track Units in the area to confirm that they were not moving and instructed the Track Units to secure in their locations. The Radio RTC again granted the Power Maintenance Crew foul time at Forest Glen Station track one tie breaker. The Power Maintenance Crew personnel relinquished their foul time on track one at Forest Glen Station platform.

Chronological Event Timeline

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

Time	Description
1:13:51 hours	Track Unit PM-60: Reported, Clear B06-04. ROCC Radio RTC: JR-02 are you holding at B06-02? Track Unit JR-02: Responded, Affirmative. ROCC Radio RTC: Instructed, PM-60 + 1, convoy block to Silver Spring, track 1. Track Unit PM-60: Acknowledged and repeated. [Ops 1 Radio]
1:18:55 hours	TRPM RWIC 1: Requesting foul time to enter the roadway at B09, track 1 for switching and hot sticking at CM B1 547+00 to 564+00. ROCC Radio RTC: Acknowledged and repeated. [Ops 1 Radio]

Time	Description
1:19:43 hours	TRPM RWIC 1: Responded, affirmative. ROCC Radio RTC: Instructed, standby and stand clear, setting up your protection. TRPM RWIC 1: Responded, standing by standing clear. [Ops 1 Radio]
1:20:15 hours	ROCC Radio RTC: B08-44 and B08-36 signal red, all prohibits in place, blue block human form in place, track 1, CM 547+00 to 564+00, you have permission to enter the roadway under foul time. Notify ROCC when you relinquish in a place of safety. TRPM RWIC 1: Acknowledged and repeated. [Ops 1 Radio]
1:25:30 hours	Track Unit PM-60: Reported, PM-60 + 1, clear Takoma Park, track 1. ROCC Radio RTC: Acknowledged and repeated. [Ops 1 Radio]
1:26:06 hours	TRPM RWIC 2: Relinquished FT protection between B1 637+00 and B1 632+00. [Ops 1 Radio] ROCC Radio RTC: Acknowledged and repeated. [Ops 1 Radio]
1:28:29 hours	Track Unit PM-60: Reported, PM-60 + 1 lead unit holding at Silver Spring, track 1. ROCC Radio RTC: Responded, PM-60 + 1 lead unit holding at Silver Spring, track 1. They are just relinquishing their foul time ahead of you, standby. Track Unit PM-60: Acknowledged. [Ops 1 Radio]
1:29:09 hours	ROCC Radio RTC: Instructed, PM-60 + 1, providing all personnel and equipment are safe and clear of the unit you have a permissive block at B08-26 correct rail alignment, convoy block to Forest Glen, track 1. Track Unit PM-60: Acknowledged and repeated. [Ops 1 Radio]
1:32:43 hours	Track Unit JR-02: Reported, PM-60 +1 clear B08-38. ROCC Radio RTC: Acknowledged, PM-60 +1 clear B08-38. PM-60 you will be traveling as a single unit to Wheaton from Forest Glen, your absolute block has been changed to Wheaton, track 1 verifying your work location; B10-02 will be red. [Ops 1 Radio]
1:33:24 hours	Track Unit PM-60: Responded, traveling as a single unit to Wheaton work location. ROCC Radio RTC: Responded, B10-02 will be red. [Ops 1 Radio]
1:33:45 hours	Track Unit PM-60: Responded, B10-02 will be red. ROCC Radio RTC: Acknowledged. JR-02 your convoy block will end at Forest Glen, track 1 work location. Track Unit JR-02: Acknowledged, convoy block will end at Forest Glen, track 1 work location. Central, did you clear the personnel? Unknown: Responded, that's a negative. [Ops 1 Radio] ***Note:*** *ROCC RTC did not respond.*
1:34:49 hours	Track Unit PM-60: Reported, Clear Forest Glen. [Ops 1 Radio]
1:37:05 hours	TRPM RWIC 1: Contacted the ROCC RTC on the landline phone and reported that they were still under foul time as the Track Unit came through the area. [Phone]
1:41:46 hours	ROCC Radio RTC: PM-60, are you holding track 1 secure? Track Unit PM-60: Responded, Holding Wheaton track 1 work location. ROCC Radio RTC: JR-02 are you holding at Forest Glen track 1 work location? Track Unit JR-02: Responded, Holding secure track 1. ROCC Radio RTC: Instructed TRPM RWIC to contact ROCC. [Ops 1 Radio]

Time	Description
1:42:09 hours	TRPM RWIC 1: Acknowledged ROCC. ROCC Radio RTC: B08-44 and B08-36 signal red, all prohibits in place, blue block human form in place, track 1, CM 547+00 to 564+00, you have permission to enter the roadway under foul time. JR-02 is secure on track 1 Forest Glen and PM-60 is secure track 1 Wheaton. Notify ROCC when you relinquish in a place of safety. TRPM RWIC 1: Acknowledged and repeated. ROCC Radio RTC: Responded, I appreciate your help as always. [Ops 1 Radio]
1:55:19 hours	TRPM RWIC 1: Contacts ROCC. ROCC Radio RTC: Acknowledges TRPM RWIC 1. TRPM RWIC 1: Responded, Clear of the roadway; relinquishing foul time. ROCC Radio RTC: Acknowledged, TRPM RWIC 1 clear of the roadway and relinquishing foul time at 01:55 hours. [Ops 1 Radio]

***Note: Times above may vary from other system's timelines based on clock settings.*

Advanced Information Management System (AIMS)

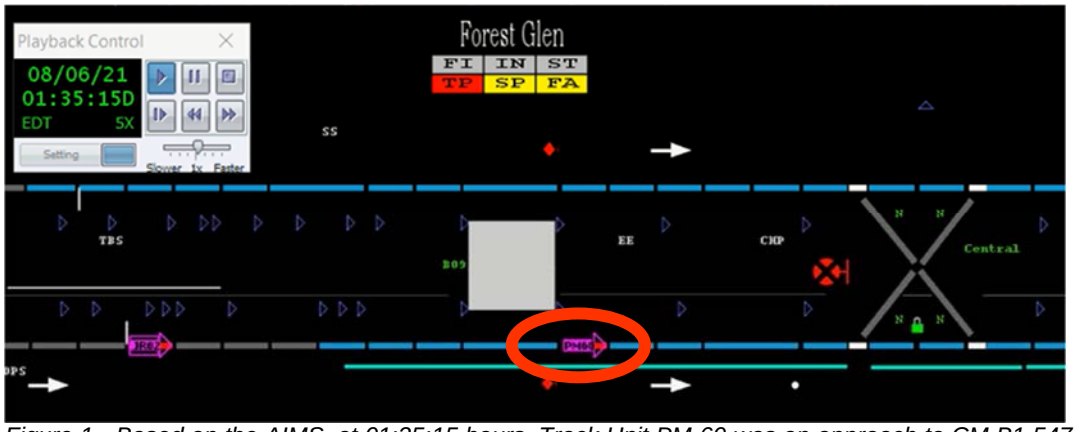


*Figure 1 - Based on the AIMS, at 01:35:15 hours, Track Unit PM-60 was on approach to CM B1 547+00, Forest Glen Station, Track 1. *Note lack of human form icon*

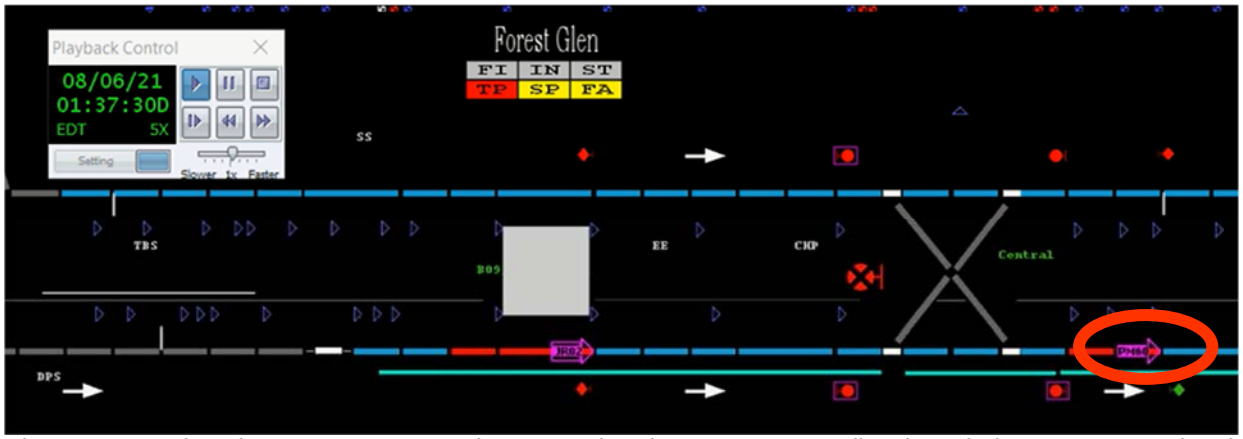


*Figure 2 - Based on the AIMS, at 01:37:30 hours, Track Unit PM-60 was traveling through the area protected under foul time on approach to CM B1 564+00, Forest Glen Station, Track 1. *Note lack of human form icon*

Office of System Maintenance Communication Section (COMM)

After reviewing the Audio Recording System (ARS) playback, there did not appear to be any communication deficiencies over the radio.

Interview Findings

The Radio RTC stated that there were two crews requesting red tags that needed foul time protection to hot stick, one at Forest Glen Station and one at Wheaton Station. The Radio RTC stated that they were mistaken between the two crews as to which crew was clearing up. The Radio RTC stated that the Button RTC asked if the power crew at Forest Glen Station had cleared up and they told their RTC partner yes and gave them a time according to the foul time checklist sheet. The RTC stated that they looked at the foul time checklist sheet and got the numbers and locations mixed up, then gave their partner the wrong time. The RTC stated that they were feeling normal prior to the event and that the atmosphere wasn't hectic or not too busy. The Radio RTC stated that they were located at the Jackson Graham Building (JGB) on the date of the event and noted that the location is in a more confined space. They did not feel that it impacted their ability to perform their role and responsibilities.

The TRPM Roadway Worker in Charge One (RWIC) stated that there were two helpers in the work crew completing switching and hot sticking (total of three crew members). A roadway job safety briefing was conducted before entering the roadway. There were two locations scheduled for switching and the first location was at Forest Glen Station tie breaker located on the roadway. The RWIC stated that they requested and received foul time to go to the tie breaker between B1 547+00 to 564+00 for switching and hot sticking. After switching operations inside the room, they went to the track to hot stick. While they were hot sticking, the crew noticed Track Unit PM-60 coming towards them. The RWIC stated that the work crew quickly moved to a place of safety on the stairs near the tie breaker room and called ROCC to ask what was happening. The RWIC stated that the RTC that answered the phone and responded that they [the RWIC] had cleared and relinquished their foul time. The RWIC informed the RTC that they never called clear and were still on the roadway. The RWIC stated that the RTC instructed the work crew to stand by and clear of the roadway and they will receive another foul time, and after a few minutes ROCC gave the work crew another foul time. After receiving the second foul time the work crew went back to hot sticking. The RWIC stated that PM-60 did not stop or blow the horn and they did not believe the Unit Operator noticed the crew on the roadway. They believed that the headlights on the Track Unit and the work crew's location on the stairs away from the roadway may have obscured them. The RWIC stated that after the work was completed, they went back to the platform and called clear and relinquished the foul time.

The TRPM Mechanical Helper #1 stated that a roadway job safety briefing was conducted before calling for foul time. The work crew was working on a switching order, and everything was going smoothly. The Mechanical Helper stated that the work crew was walking down the steps and while walking towards the third rail to hot stick and as they were grabbing their hot stick, the two helpers stepped on the track. The Mechanical Helper stated that their partner saw the lights of a vehicle and told them to get off the track. The Mechanical Helper stated the RWIC went to the tie breaker room and called ROCC to find out what was going on. The Mechanical Helper reported they exited the roadway back to the steps for a place of safety, they went to a space on the steps that separated tracks 1 and 2. The Mechanical Helper stated they did not hear a horn from the RMM before the vehicle passed their location. The Mechanical Helper stated that they are new to the position, everything is going smoothly, everyone is always talking about safety, and proper

procedures. The Mechanical Helper stated that there was a discussion that was conducted with the department midnight crew regarding the event on the next day.
The TRPM Mechanical Helper #2 stated that they clocked in on duty at Shady Grove Yard, then attended a safety meeting and a Supervisor's meeting for work assignments. The work crew conducted a pre-trip inspection on the work vehicle (service vehicle), then headed to the location and waited to be called for switching. The TRPM Mechanical Helper stated they attended a roadway job safety briefing, and the RWIC requested foul time to enter the track and received permission from ROCC. The TRPM Mechanical Helper stated that it was hard to hear in the work area due to the exhaust fans. The work crew got to the tie breaker room to perform switching and then went to hot stick. The TRPM Mechanical Helper stated that the work crew went down the steps to hot stick and their partner was attempting to hot stick. The Mechanical Helper stated that they are usually nervous about trains moving so they are always looking around. The TRPM Mechanical Helper stated they told their partner to move from the roadway when they noticed the lights of a vehicle. The Mechanical Helper stated that the RWIC asked them why they were exiting the roadway and they told them that there was a vehicle coming. The TRPM Mechanical Helper stated the RWIC went upstairs and called ROCC. The Mechanical Helper stated that approximately 30 seconds passed before the RMM passed by the work crew and the RMM was moving very slowly. The TRPM Mechanical Helper stated the work crew was under foul time for approximately 15-30 minutes before the event occurred. The Mechanical Helper stated that after the event, the work crew went to the tiebreaker room and requested foul time again and then walked back to the platform.

Weather

On August 6, 2021, at the time of the incident, NOAA recorded the temperature as °73 F, with passing clouds. The incident occurred within a tunnel section of the roadway. SAFE has concluded that weather was not a contributing factor in this incident (Weather source: NOAA) – Location: Forest Glen, MD)

Human Factors

Fatigue

Signs and Symptoms of Fatigue

Rail Traffic Controller (RTC)
Conditions at the time of the incident were evaluated to distinguish whether evidence of fatigue was present. No evidence of fatigue was indicated by the available data. No video of the involved person was available to ascertain whether evidence of fatigue was present. The RTC 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.

TRPM Roadway Worker in Charge (RWIC)
Conditions at the time of the incident were evaluated to distinguish whether evidence of fatigue was present. No evidence of fatigue was indicated by the available data. No video of the involved person was available to ascertain whether evidence of fatigue was present. The PWR Technician 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.

TRPM Mechanical Helper #1

Conditions at the time of the incident were evaluated to distinguish whether evidence of fatigue was present. No evidence of fatigue was indicated by the available data. No video of the involved person was available to ascertain whether evidence of fatigue was present. The Mechanical Helper 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.

TRPM Mechanical Helper #2
Conditions at the time of the incident were evaluated to distinguish whether evidence of fatigue was present. No evidence of fatigue was indicated by the available data. No video of the involved person was available to ascertain whether evidence of fatigue was present. The PWR Technician 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

Rail Traffic Controller (RTC)
Incident data was evaluated for fatigue risk factors. Risk factors for fatigue were identified. The incident time of day (01:33 hours) suggests an increased risk of fatigue-related impairment. The employee worked evening/overnight shifts (21:00 – 05:00) in the days leading up to the incident. Based on the employee's reported bed and wake times the day before the incident, the employee slept a total of 5 hours in the sleep period (daytime) preceding the incident and was awake for 9.5 hours at the time of the incident. The off-duty period preceding the incident was 64.4 hours long, which provided the opportunity for 7-9 hours of sleep. The employee reported usual workday sleep durations of 7 hours and no issues with sleep.

TRPM Roadway Worker in Charge (RWIC)
Incident data was evaluated for fatigue risk factors. Risk factors for fatigue were identified. The incident time of day (01:33 hours) suggests an increased risk of fatigue-related impairment. The employee worked evening/overnight shifts in the week leading up to the incident. Based on the employee's reported bed and wake times the day before the incident, the employee slept a total of 5 hours in the sleep period preceding the incident and was awake for 5.5 hours at the time of the incident. The off-duty period preceding the incident was 15.4 hours long, which provided the opportunity for 7-9 hours of sleep. The employee reported usual workday sleep durations of 8 hours and no issues with sleep.

TRPM Mechanical Helper #1
Incident data was evaluated for fatigue risk factors. Risk factors for fatigue were identified. The incident time of day (01:33 hours) suggests an increased risk of fatigue-related impairment. The employee worked evening/overnight shifts (e.g. approx. 22:00 – 06:00) in the week leading up to the incident. Based on the employee's reported bed and wake times the day before the incident, the employee slept a total of 5 hours in the sleep period preceding the incident and was awake for 6.05 hours at the time of the incident. The off-duty period preceding the incident was 15.5 hours long, which provided the opportunity for 7-9 hours of sleep. The employee reported usual workday sleep durations of 6.5 hours and no issues with sleep.

TRPM Mechanical Helper #2
Incident data was evaluated for fatigue risk factors. Risk factors for fatigue were identified. The incident time of day (01:33 hours) suggests an increased risk of fatigue-related impairment. The employee worked evening/overnight shifts (e.g. approx. 22:00 – 06:00) in the week leading up to the incident. Based on the employee's reported bed and wake times the day before the incident, the employee slept a total of 10 hours in the sleep period preceding the incident and was awake

for 6.5 hours at the time of the incident. The off-duty period preceding the incident was 15.5 hours long, which provided the opportunity for 7-9 hours of sleep. The employee reported usual workday sleep durations of 8 hours and no issues with sleep.

Biomathematical Fatigue Model - SAFTE-FAST WebSFC

Rail Traffic Controller (RTC)

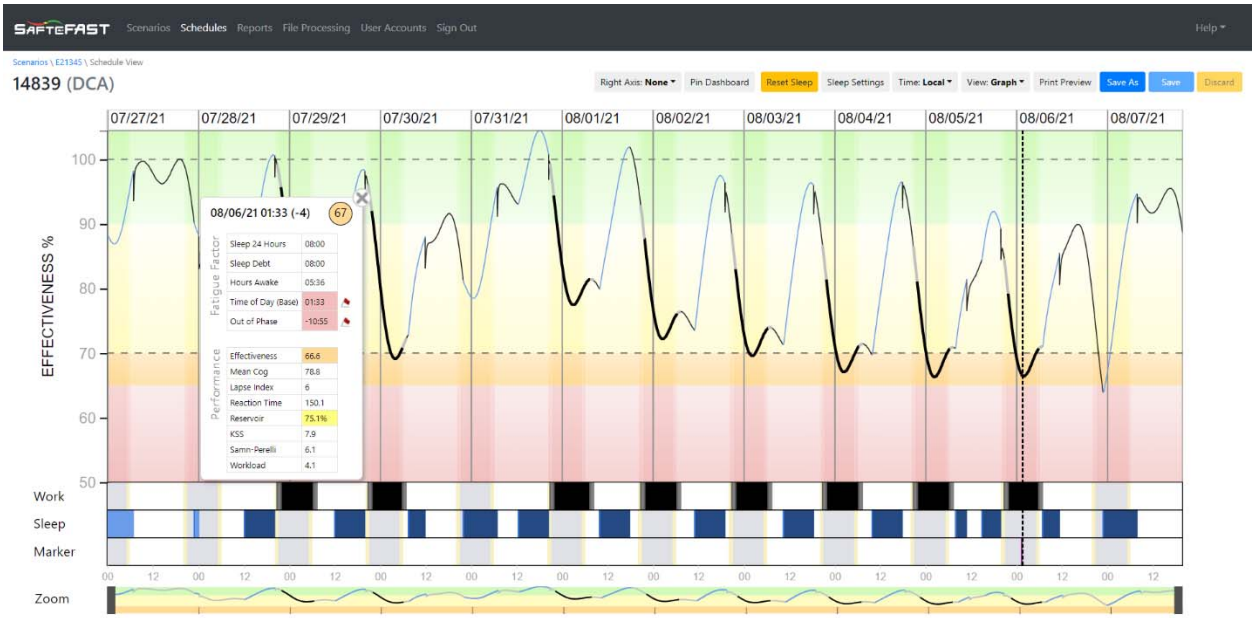
A biomathematical fatigue modelling application (SAFTE-FAST WebSFC) was used to further evaluate fatigue risk factors that may have been present in the RTC's schedule. The analysis was based on the RTC's work schedule, bed, and wake times from the day before the incident and reported habitual sleep durations. Estimated performance effectiveness at the time of the incident was 85.1%. Specifically, the analysis identified the circadian effects of night work as a factor contributing to an increased risk of fatigue at the time of the incident.

Modeling analysis output shows estimated performance effectiveness during the incident work shift (top), and for the week leading up to the work shift (bottom) based on the employee work and reported sleep schedule. Estimates were based on the RTC's work schedule, bed, and wake times from the day before the incident and reported habitual sleep durations (7 hours a day). The employee was off-duty in the days preceding the incident and reported sleeping a total 7 hours in the 24 hours leading up to the incident (as well as bed times for a 5-hour sleep period immediately preceding the incident). Bold portions of the modeled curve show work (in black) and sleep times (in blue). Effectiveness is shown on the vertical axis, with colored fields in the chart background signifying ranges of effectiveness scores including high effectiveness (>90%) in green, and low effectiveness (<65%) in red. Time is shown on the horizontal axis. Markers for work and sleep times are shown in the lanes above the time of day on the horizontal axis.

TRPM Roadway Worker in Charge (RWIC)

SAFTE-FAST WebSFC was used to further evaluate fatigue risk factors that may have been present in the Mechanical Helper's schedule. The analysis was based on the PWR Technician's work schedule, bed, and wake times from the day before the incident and reported habitual sleep durations. Estimated performance effectiveness at the time of the incident was 66.6%. Specifically, the analysis identified the circadian effects of night work as a factor contributing to an increased risk of fatigue at the time of the incident.

Modeling analysis output shows estimated performance effectiveness during the incident work shift (top), and for the



week leading up to the work shift (bottom) based on the employee work and reported sleep schedule. Estimates were based on the PWR Technician's work schedule, bed, and wake times from the day before the incident and reported habitual sleep durations (8 hours a day). The employee reported bedtimes for a 5-hour sleep period and 8 hours of total sleep in the 24 hours preceding the incident. Sleep periods were adjusted in the analyses to accurately depict the employee report. Bold portions of the modeled curve show work (in black) and sleep times (in blue). Effectiveness is shown on the vertical axis, with colored fields in the chart background signifying ranges of effectiveness scores including high effectiveness (>90%) in green, and low effectiveness (<65%) in red. Time is shown on the horizontal axis. Markers for work and sleep times are shown in the lanes above the time of day on the horizontal axis.

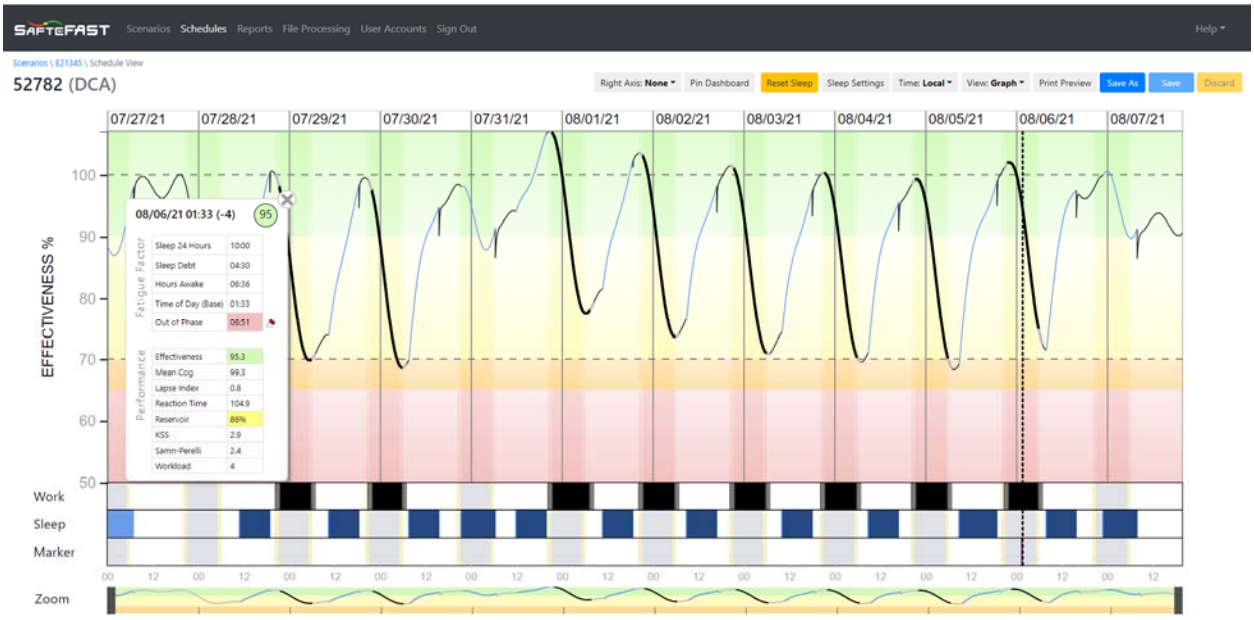
TRPM Mechanical Helper #1

SAFTE-FAST WebSFC was used to further evaluate fatigue risk factors that may have been present in the Mechanical Helper's schedule. The analysis was based on the Mechanical Helper's work schedule, bed, and wake times from the day before the incident and reported habitual sleep durations. Estimated performance effectiveness at the time of the incident was 60.5%. Specifically, the analysis identified short sleep duration in the last 24 hours, the circadian effects of night work, and sleep debt (inferring accumulated sleep loss of more than 8 hours) as factors contributing to an increased risk of fatigue at the time of the incident.

Modeling analysis output shows estimated performance effectiveness during the incident work shift (top), and for the week leading up to the work shift (bottom) based on the employee work and reported sleep schedule. Estimates were based on the Mechanical Helper's work schedule, bed, and wake times from the day before the incident and reported habitual sleep durations (6.5 hours a day). The employee reported bedtimes for a 5-hour sleep period and 6.5 hours of total sleep in the 24 hours preceding the incident. Sleep periods were adjusted in the analyses to accurately depict the employee report. Bold portions of the modeled curve show work (in black) and sleep times (in blue). Effectiveness is shown on the vertical axis, with colored fields in the chart background signifying ranges of effectiveness scores including high effectiveness (>90%) in green, and low effectiveness (<65%) in red. Time is shown on the horizontal axis. Markers for work and sleep times are shown in the lanes above the time of day on the horizontal axis.

TRPM Mechanical Helper #2

SAFTE-FAST WebSFC was used to further evaluate fatigue risk factors that may have been present in the Mechanical Helper's schedule. The analysis was based on the PWR Technician's work schedule, bed, and wake times from the day before the incident and reported habitual sleep durations. Estimated performance effectiveness at the time of the incident was 95.3%. Specifically, the analysis identified the circadian effects of night work as a factor contributing to an increased risk of fatigue at the time of the incident.



Modeling analysis output shows estimated performance effectiveness during the incident work shift (top), and for the week leading up to the work shift (bottom) based on the employee work and reported sleep schedule. Estimates were based on the PWR Technician's work schedule, bed, and wake times from the day before the incident and reported habitual sleep durations (8 hours a day). Bold portions of the modeled curve show work (in black) and sleep times (in blue). Effectiveness is shown on the vertical axis, with colored fields in the chart background signifying ranges of effectiveness scores including high effectiveness (>90%) in green, and low effectiveness (<65%) in red. Time is shown on the horizontal axis. Markers for work and sleep times are shown in the lanes above the time of day on the horizontal axis.

Post-Incident Toxicology Testing

WMATA's Drug and Alcohol Program determined that the Radio RTC and Buttons Controller tested in relation to this event were not in violation of the Drug and Alcohol Policy and Testing Program 7.7.3/6.

Findings

- TRPM RWIC One requested and received Foul Time Protection from the ROCC RTC approximately thirteen minutes prior to the arrival of the Roadway Maintenance Machines. Human Forms were added to the AIMS display by ROCC Personnel.
- TRPM RWIC One's Human Form was removed from the AIMS display by ROCC Personnel at approximately 01:27 hours, after removing TRPM RWIC Two from the AIMS display at an adjacent work location.
- The Radio RTC instructed the Track Unit to travel into the protected work area where TRPM RWIC One's crew was present. The ROCC Radio RTC's action was not in

compliance with MSRPH Section 5 RWP, Rule 5.13.5 Foul Time Protection, *ROCC confirms over the radio to the Requestor that FT has been relinquished at their stated location and advises the Requestor to be on the lookout for rail vehicle movement*.
- Track Unit PM-60 traversed the Foul Time area while TRPM RWIC One was under Foul Time Protection.

Immediate Mitigation to Prevent Recurrence

- ROCC removed the Radio RTC from service for post-incident toxicology testing.
- On September 9, 2021, ROCC added an additional layer of review for all Foul Time Protection requests. The Assistant Operations Manager must be notified and observe the process prior to granting Foul Time.
- In September 2021, all ROCC personnel completed a Safety Stand Down that emphasized Foul Time Procedures and reviewed recent Improper RWP incidents.

Probable Cause Statement

The probable cause of the Improper RWP event was a human factors failure of the Radio RTC to track and document the number and call ID of work crews under Foul Time protection. This resulted in confusing the work crew at Wheaton Station with the work crew at Forest Glen Station. A contributing factor to the event was a miscommunication by the Radio RTC, providing inaccurate information to the Buttons RTC, caused the removal of the human forms from the AIMS display. This action subsequently caused the Radio RTC to give permission to the Track Unit to move through the area under Foul Time protection.

SAFE Recommendations/Corrective Actions

The following are the recommendations and corrective actions identified as a result of this investigation. These 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. Refer to the SMS I/A module for additional information.

Corrective Action Code	Description	Responsible Party	Due Date
96111_SAFECAPS_ROCC_001	(CF-1) Involved personnel shall undergo re-training with an emphasis on Radio Communication. Training should reinforce required procedures regarding MSRPH Section 5 – RWP, 5.13.5 Foul Time Protection.	ROCC	Completed
96111_SAFECAPS_ROCC_002	(RC-1) ROCC shall review the process of documenting and tracking foul time protection. Develop enhancements to the Foul Time Checklist Sheet used to document work crews working under foul time protection on the roadway.	ROCC	02/06/2022

Corrective Action Code	Description	Responsible Party	Due Date
96111_SAFECAPS_ROCC_003	(CF-1) Conduct a Stand-down with all RWP-qualified personnel that emphasizes the importance of proper communications, knowledge of system characteristics, and Personal Protective Equipment (PPE)	OPMS SRC	11/30/2021

Rail Operation Control Center (ROCC)
The Rail Operations Control Center (ROCC) reviewed this event and has provided the following:

The RTC identified in this event has completed the recommended re-training and Lessons Learned were developed and distributed.

Appendices

Appendix A – Interview Summaries

ROCC

RTC

The Rail Traffic Controller (RTC) is a WMATA employee with 3 years of service and experience. The RTC Roadway Worker Protection Level 2 certification expired July 2021.

The RTC stated that there were two crews requesting red tags that needed foul time protection to hot stick, one at Forest Glen Station and one at Wheaton Station. The RTC stated that they were mistaken between the two crews as to which crew was clearing up. The RTC stated that their partner asked if the power crew at Forest Glen Station had cleared up and they told their partner yes and gave a time according the foul time checklist sheet. The RTC stated that they looked at the foul time checklist sheet and got the numbers and locations mixed up, then gave their partner the wrong time. The RTC stated that they were feeling normal prior to the event and that it wasn't too hectic and not too busy. The RTC stated that they were located at the Jackson Graham Building (JGB) on the date of the event and the location is in a more confined space.

TRPM

RWIC

TRPM RWIC One (RWIC) is a WMATA employee with 8.5 years of service, and 3.5 years as years as a Power Technician. The RWIC holds a Roadway Worker Protection (RWP) Level 4 certification that expires in December 2021.

The RWIC stated that there were two helpers in the work crew completing switching and hot sticking. A roadway job safety briefing was conducted before entering the roadway. There were two locations scheduled for switching and the first location was at Forest Glen Station tie breaker located on the roadway. The stated that they requested foul time to go to the tie breaker between B1 547+00 to 564+00 for switching and hot sticking. After switching they went to the track to hot stick and while they were hot sticking the crew noticed Track Unit PM-60 coming towards them. The RWIC stated that the work crew quickly moved to a place of safety on the stairs near the tie breaker room and called ROCC to ask what was happening. The RWIC stated that the RTC that answered the phone and responded that they had cleared and relinquished their foul time. The RWIC informed the RTC that they never called clear and were still on the roadway. The RWIC stated that the RTC instructed the work crew to stand by and clear of the roadway and they will receive another foul time, and after a few minutes ROCC gave the work crew another foul time. After receiving the second foul time the work crew went back to hot sticking. The RWIC stated that PM-60 did not stop or blow the horn and the Unit Operator didn't notice the crew on the roadway possibly because of the lights on the Track Unit and the work crew was on the stairs away from the roadway. The RWIC stated that after the work was completed, they went back to the platform and called clear and relinquished the foul time.

TRPM

Mechanical Helper #1

The TRPM Mechanical Helper is a WMATA employee with less than 1 year of service. The Mechanical Helper holds a Roadway Worker Protection (RWP) Level 2 certification that expires in May 2022.

The TRPM Mechanical Helper stated that a roadway job safety briefing was conducted before calling for foul time. The work crew was working on a switching order, and everything was going smoothly. The Mechanical Helper stated that the work crew was walking down the steps and while walking towards the third rail to hot stick and as they were grabbing their hot stick, the two helpers stepped on the track. The Mechanical Helper stated that their partner saw the lights of a vehicle and told them to get off the track. The Mechanical Helper stated the RWIC went to the tie breaker room and called ROCC to find out what was going on. The Mechanical Helper reported they exited the roadway back to the steps for a place of safety, they went to a space on the steps that separated tracks 1 and 2. The Mechanical Helper stated they did not hear a horn from the RMM before the vehicle passed their location. The Mechanical Helper stated that they are new to the position, everything is going smoothly, everyone is always talking about safety, and proper procedures. The Mechanical Helper stated that there was a discussion that was conducted with the department midnight crew regarding the event on the next day.

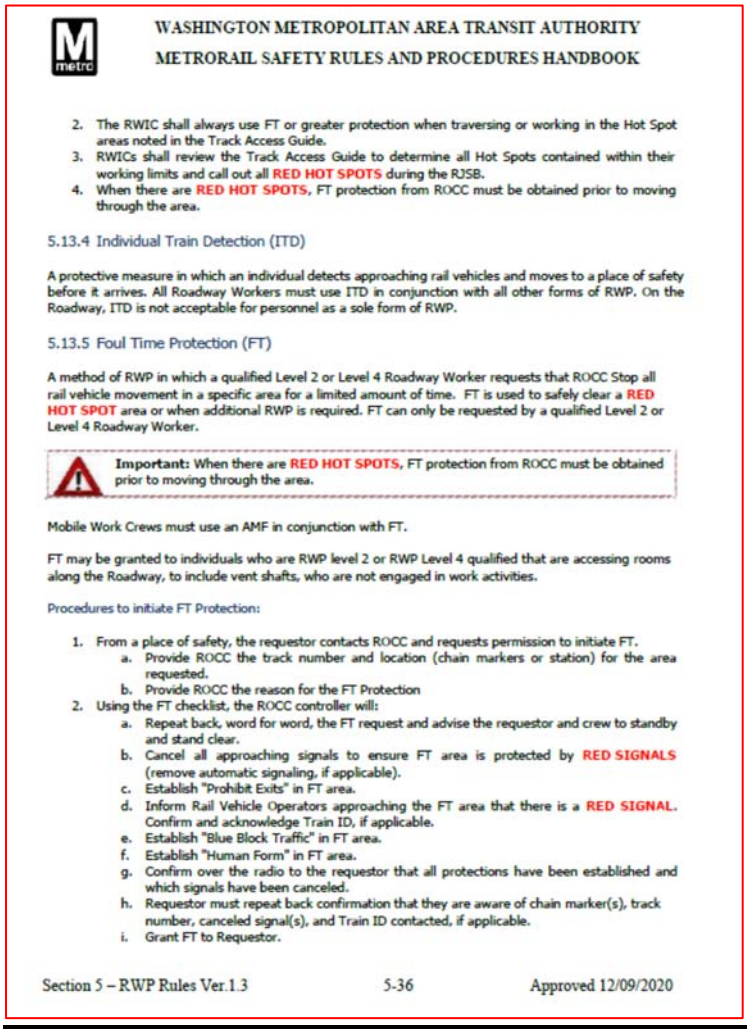
TRPM

Mechanical Helper #2

The TRPM Mechanical Helper is a WMATA employee with less than 1 year of service. The Mechanical Helper holds a Roadway Worker Protection (RWP) Level 2 certification that expires in March 2022.

The TRPM Mechanical Helper stated that they clocked in on duty at Shady Grove Yard, then attended a safety meeting and a Supervisor's meeting for work assignments. The work crew conducted a vehicle inspection, then headed to the location and waited to be called for switching. The TRPM Mechanical stated they attended a roadway job safety briefing, and the RWIC requested foul time to enter the track and received permission from ROCC. The TRPM Mechanical Helper stated that it was hard to hear in the work area due to the exhaust fans. The work crew got to the tie breaker room to perform switching and then went to hot stick. The TRPM Mechanical Helper stated that the work crew went down the steps to hot stick and their partner was attempting to hot stick. The Mechanical Helper stated that they are usually nervous about trains moving so they are always looking around. The TRPM Mechanical Helper stated they told their partner to move from the roadway when they noticed the lights of a vehicle. The Mechanical Helper stated that the RWIC asked them why they were exiting the roadway and they told them that there was a vehicle coming. The TRPM Mechanical Helper stated the RWIC went upstairs and called ROCC. The Mechanic al Helper stated that approximately 30 seconds passed before the RMM passed by the work crew and the RMM was moving very slowly. The TRPM Mechanical Helper stated the work crew was under foul time for approximately 15-30 minutes before the event occurred. The Mechanical Helper stated that after the event, the work crew went to the tiebreaker room and requested foul time again and then walked back to the platform.

Appendix B –Foul Time Protection – Metrorail Safety Rules and Procedures Handbook (MSRPH), Section 5 RWP 5.13.5



WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
METRORAIL SAFETY RULES AND PROCEDURES HANDBOOK

2. The RWIC shall always use FT or greater protection when traversing or working in the Hot Spot areas noted in the Track Access Guide.
3. RWICs shall review the Track Access Guide to determine all Hot Spots contained within their working limits and call out all **RED HOT SPOTS** during the RJSB.
4. When there are **RED HOT SPOTS**, FT protection from ROCC must be obtained prior to moving through the area.

5.13.4 Individual Train Detection (ITD)

A protective measure in which an individual detects approaching rail vehicles and moves to a place of safety before it arrives. All Roadway Workers must use ITD in conjunction with all other forms of RWP. On the Roadway, ITD is not acceptable for personnel as a sole form of RWP.

5.13.5 Foul Time Protection (FT)

A method of RWP in which a qualified Level 2 or Level 4 Roadway Worker requests that ROCC Stop all rail vehicle movement in a specific area for a limited amount of time. FT is used to safely clear a **RED HOT SPOT** area or when additional RWP is required. FT can only be requested by a qualified Level 2 or Level 4 Roadway Worker.

Important: When there are **RED HOT SPOTS**, FT protection from ROCC must be obtained prior to moving through the area.

Mobile Work Crews must use an AMF in conjunction with FT.

FT may be granted to individuals who are RWP level 2 or RWP Level 4 qualified that are accessing rooms along the Roadway, to include vent shafts, who are not engaged in work activities.

Procedures to initiate FT Protection:

1. From a place of safety, the requestor contacts ROCC and requests permission to initiate FT.
   a. Provide ROCC the track number and location (chain markers or station) for the area requested.
   b. Provide ROCC the reason for the FT Protection
2. Using the FT checklist, the ROCC controller will:
   a. Repeat back, word for word, the FT request and advise the requestor and crew to standby and stand clear.
   b. Cancel all approaching signals to ensure FT area is protected by **RED SIGNALS** (remove automatic signaling, if applicable).
   c. Establish "Prohibit Exits" in FT area.
   d. Inform Rail Vehicle Operators approaching the FT area that there is a **RED SIGNAL**. Confirm and acknowledge Train ID, if applicable.
   e. Establish "Blue Block Traffic" in FT area.
   f. Establish "Human Form" in FT area.
   g. Confirm over the radio to the requestor that all protections have been established and which signals have been canceled.
   h. Requestor must repeat back confirmation that they are aware of chain marker(s), track number, canceled signal(s), and Train ID contacted, if applicable.
   i. Grant FT to Requestor.

Section 5 – RWP Rules Ver.1.3 5-36 Approved 12/09/2020

Attachment 1- Page 1 of 1

For personnel being dropped off or picked up on the Roadway, only the following FT checklist items shall be required:

1. Repeat the FT request and advise the Requestor and crew to standby and stand clear.
2. Grant FT to the Requestor.

Important: The Rail Vehicle will be held until the personnel are in a place of safety and FT is relinquished.

When the Requestor has determined that FT is no longer necessary, they shall relinquish it through the following process:

1. From a place of safety, the requestor contacts ROCC and states the following:
   - Radio ID
   - They are relinquishing FT at the granted FT location
   - Their current chain marker, station, and/or physical location
2. ROCC confirms over the radio to the Requestor that FT has been relinquished at their stated location and advises the Requestor to be on the lookout for rail vehicle movement.
3. ROCC must document the time that FT was relinquished.

Important: Although WMATA personnel may request FT any time they feel it is warranted to ensure their safety, FT is required for all **RED HOT SPOTS.**

5.13.6 Advanced Mobile Flagging (AMF) – Mobile Work Crew

AMF protection is the use of Watchman/Lookouts assigned to a Mobile Work Crew in conjunction with an additional flagger positioned at the station in advance of the Mobile Work Crews. A Watchman/Lookout must be a minimum of 50 feet in advance of the Mobile Work Crew. The Advance Mobile Flagger (AMF) is an assigned Roadway Worker positioned at the end of a platform (8 car marker or end gate) in the direction of normal travel for Class 1 or 2 Rail Vehicle. RWICs are to use the Need vs. Speed Chart to determine sight distance vs Rail Vehicle speeds to provide Ample Time/Warning. If proper sighting distance cannot be achieved for the work crew to reach a place of safety in Ample Time/Warning, then a higher form of protection (e.g. FT, ETO, or IT) must be used.

Advanced Mobile Flagging Procedures:

1. The RWIC will conduct a RJSB prior to entering the Roadway and assign the AMF(s) and Watchman/Lookout(s).
2. The RWIC will contact ROCC and perform a radio check establishing positive communication.
3. The AMF is required to follow PPE guidelines per the Minimum PPE Standard for On-Track Safety in the MSRPH Section 5 - RWP.
4. In addition to the PPE required, the following equipment is also required when performing the duties of an AMF (reference 5.12.2 of the MSRPH for designated safety equipment and devices for AMF):
   - WMATA Approved Flashing Amber Lantern/E-Flare and Orange Flag
   - WMATA Approved and Certified Working Radio
   - WMATA Approved Air Horn and Whistle
5. Under the direction of the RWIC, the AMF will position themselves at the next station ahead (in the direction the Mobile Crew will be walking). The AMF will take their position at the end of the platform (8 car marker or end gate) in the direction the train is traveling, and on the track the Mobile Work Crew is inspecting.

Attachment 2- Page 2 of 2

Appendix C – ROCC Foul Time Checklist

FOUL TIME (FT) CHECKLIST

PAGE OF

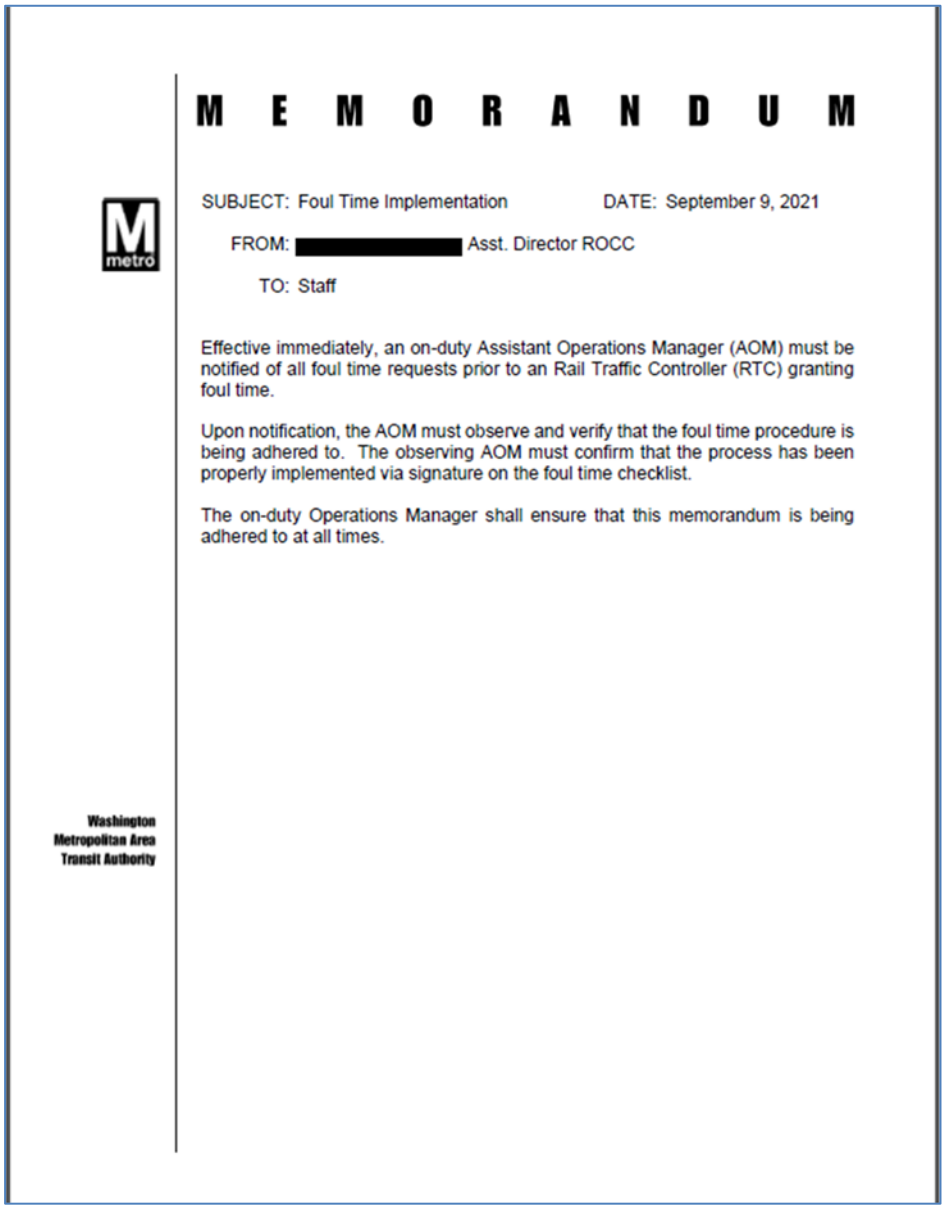
DATE_____

RADIO CALL NUMBER	REQUEST TIME	LOCATION	RADIO CALL NUMBER	REQUEST TIME	LOCATION	RADIO CALL NUMBER	REQUEST TIME	LOCATION

☐ Repeat request. Have RWIC & crew standby and stand clear.	☐ Repeat request. Have RWIC & crew standby and stand clear.	☐ Repeat request. Have RWIC & crew standby and stand clear.
☐ Cancel all approaching signals to ensure FT area is protected by RED SIGNALS (remove automatic signaling, if applicable). **Cancelled Signal(s)**_____	☐ Cancel all approaching signals to ensure FT area is protected by RED SIGNALS (remove automatic signaling, if applicable). **Cancelled Signal(s)**_____	☐ Cancel all approaching signals to ensure FT area is protected by RED SIGNALS (remove automatic signaling, if applicable). **Cancelled Signal(s)**_____
☐ Establish "Prohibit Exits" in FT area. **Prohibited Signal(s)**_____	☐ Establish "Prohibit Exits" in FT area. **Prohibited Signal(s)**_____	☐ Establish "Prohibit Exits" in FT area. **Prohibited Signal(s)**_____
☐ Inform Train Operators in approach to FT area that there is a RED SIGNAL ahead where they must hold. Train ID(s) contacted: _____	☐ Inform Train Operators in approach to FT area that there is a RED SIGNAL ahead where they must hold. Train ID(s) contacted: _____	☐ Inform Train Operators in approach to FT area that there is a RED SIGNAL ahead where they must hold. Train ID(s) contacted: _____
☐ Establish "Blue Block Traffic" in FT area.	☐ Establish "Blue Block Traffic" in FT area.	☐ Establish "Blue Block Traffic" in FT area.
☐ Establish "Human Form in FT area.	☐ Establish "Human Form in FT area.	☐ Establish "Human Form in FT area.
☐ Confirm over radio to the RWIC that all protections have been established and which signals have been cancelled. Grant FT to Roadway Worker.	☐ Confirm over radio to the RWIC that all protections have been established and which signals have been cancelled. Grant FT to Roadway Worker.	☐ Confirm over radio to the RWIC that all protections have been established and which signals have been cancelled. Grant FT to Roadway Worker.
Foul Time Relinquished:_____	Foul Time Relinquished:_____	Foul Time Relinquished:_____
Controller Initials:	Controller Initials:	Controller Initials:
Notes:		

Attachment 3 – Page 1 of 1

Appendix D – Foul Time Procedure Enhancement Memorandum



M E M O R A N D U M

SUBJECT: Foul Time Implementation DATE: September 9, 2021

FROM: [redacted] Asst. Director ROCC

TO: Staff

Effective immediately, an on-duty Assistant Operations Manager (AOM) must be notified of all foul time requests prior to an Rail Traffic Controller (RTC) granting foul time.

Upon notification, the AOM must observe and verify that the foul time procedure is being adhered to. The observing AOM must confirm that the process has been properly implemented via signature on the foul time checklist.

The on-duty Operations Manager shall ensure that this memorandum is being adhered to at all times.

Washington Metropolitan Area Transit Authority

Attachment 4 – Page 1 of 1

Appendix E – Root Cause/Why Tree