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WMSC Commissioner Brief: W-0152 – Collision – Greenbelt Yard – November 16, 2021

Prepared for Washington Metrorail Safety Commission meeting on March 8, 2022

Safety event summary:

The Train Operator of Train ID 503 accelerated rather than applying braking on approach to the end of a track in the Greenbelt Rail Yard on November 16, 2021. The train collided with a bump post, causing substantial damage.

At approximately 12:56 a.m., Train ID 503 Train Operator entered Greenbelt Yard with no passengers aboard. The operator received permission under an absolute block to travel toward Track 13 and was instructed to make all required safety stops along the way. An absolute block is a section of the track that can only be occupied by one train at a time.

Vehicle Monitoring System (VMS) download and analysis determined the train stopped twice in approach to the bump post, which is designed to absorb the shock of a collision and protect against railcar intrusion. The Train Operator stopped once, 232 feet away and again, 155 feet away from the post, activating the train horn both times. The Train Operator did not perform all safety stops in accordance with WMATA MSRPH Operating Rules 3.88 and 3.89, which requires four stops to be made at: three car lengths (225 feet), two car lengths (150 feet), 50 feet and 10 feet.

At approximately 67 feet from the bump post, operating at 10 mph, the Train Operator moved the master controller to P1 propulsion mode instead of entering braking mode. After traveling another 25 feet, the Train Operator placed the master controller in B4 and then B5 braking mode in an attempt to slow the train, however the train made contact with the bump post at 6 mph.

The Train Operator reported the collision to the Interlocking Operator, who then notified an Office of Rail Transportation (RTRA) Supervisor. The Rail Operations Control Center (ROCC) notified SAFE of the collision, and it was initially reported to the WMSC as a minor collision. After further investigation, the event was correctly reclassified as a major collision.

The Train Operator was removed from service by an RTRA Supervisor for post-event toxicology testing.

During the interview, the Train Operator indicated they inadvertently kept the master controller (throttle) in propulsion mode instead of braking mode as they approached the bump post. On Metrorail's legacy fleet, including the 3000 Series railcars, the master controller clicks into each position (B5-P5). On Metrorail's 7000 Series cars, strong physical feedback occurs when the master controller transitions between a power mode and coast or braking mode. The operator stated that they felt the physical feedback when they changed from what vehicle data shows was P2 power mode to P1 power mode approximately 36 feet from the bump post.

The Train Operator said they "felt out of themselves" just prior to the event.

During the investigation, VMS data showed the collision time as 1:03 a.m. The event was reported over the radio at 1:18 a.m. (Note: these are separate systems, so the clocks are not synced). There was no video available due to a lack of camera views in the bump post area. Office of Chief Mechanical Officer (CMOR) Incident Investigation Team (IIT) data analysis found no faults to the propulsion and braking systems.

Extensive damage was discovered including coupler head damage, drawbar damage and broken shear bolts. Shear bolts are emergency release bolts that help minimize the damage to the coupler system and reduce impact. The Office

of Car Maintenance (CMNT) Supervisor established blue flag protection, a safeguard against movement of the train, while investigators who had arrived at approximately 3:30 a.m. were on scene, and investigators departed the scene. When investigators returned at approximately 1:00 p.m., SAFE discovered the consist was no longer under blue flag protection. This was immediately reported, and the track behind the incident train was placed under blue flag protection until the Incident Management Officer (IMO) received Event Scene Release (ESR) authorization from the WMSC.

Probable Cause:

The probable cause of this event is ineffective training and certification for personnel authorized to operate trains on all active railcar fleets.

Corrective Actions:

The Train Operator underwent refresher training and an RTRA Supervisor ride check.
Metrorail developed 'lessons learned' document regarding this event to Rail Transportation personnel.

WMSC staff observations:

The WMSC transmitted a draft Rail Operations Audit to Metrorail last month for technical review. This includes an assessment of Metrorail's training for operations personnel. The WMSC expects to issue a final report in the coming weeks.

Fatigue-related discussions in the Train Operator interview, and the statement that the operator "felt out of themselves," suggest a possibility that fatigue contributed to this event. However, available documentation could not confirm this. Metrorail is implementing corrective action plans related to its fatigue policies.

Staff recommendation: Adopt final report.

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

FINAL REPORT OF INVESTIGATION A&I E21583

Date of Event:	11/16/2021
Type of Event:	Collision
Incident Time:	01:18 hours
Location:	Greenbelt Yard, Track #13
Time and How received by SAFE:	01:23 hours, SAFE IMO
WMSC Notification Time:	01:51 hours
Responding Safety Officers:	WMATA SAFE: Yes WMSC: No Other: N/A
Rail Vehicle:	Train ID 503, L3275-3274 X 3067-3066 X 3200-3201T
Injuries:	None
Damage:	Anti-climber damage and broken shear bolts on multiple cars
Emergency Responders:	None
SMS I/A Incident Number:	20211116#96850MX

Table of Contents

Abbreviations and Acronyms

ARS	Audio Recording System
CMOR	Office of Chief Mechanical Officer
ER	Event Recorder
IIT	Incident Investigation Team
IMO	Incident Management Officer
MC	Master Controller
MSRPH	Metro Safety Rules Procedures Handbook
NOAA	National Oceanic and Atmospheric Administration
ROCC	Rail Operations Control Center
ROQT	Rail Operations Quality Training
RTRA	Office of Rail Transportation
SOP	Standard Operating Procedure
VMS	Vehicle Monitoring System
WMSC	Washington Metrorail Safety Commission

Executive Summary

On Tuesday, November 16, 2021, at approximately 01:23 hours, the Rail Operations Control Center (ROCC) notified SAFE of a collision event at Greenbelt Yard occurring at approximately 01:18 hours. The Train Operator of Train ID 503, lead car 3275, entered the yard with no passengers aboard at approximately 00:56 hours. Train ID 503 traveled at approximately 14 mph towards track 13 after receiving permission from Greenbelt Yard Interlocking Operator to proceed under an absolute block, making all required safety stops. The Train Operator only made three of the required four stops on approach to track 13.

According to the Office of Chief Mechanical Officer (CMOR) Incident Investigation Team (IIT) Vehicle Monitoring System (VMS) download and analysis, Train ID 503 first stopped approximately 232 feet away from track 13's bump post, followed by a second stop approximately 155 feet from the bump post. Train ID 503 activated their train horn on both stops.

Approximately 67 feet from the bump post, Train ID 503 reached a speed of 10 mph. The Train Operator then moved the Master Controller (MC) to P1 Propulsion Mode and continued for an additional 25 feet at the same rate. The Train Operator then placed the MC into a B4 Braking mode and B5 braking, with the train speed of at 8 mph 10 feet from the bump post. Train ID 503 contacted the bump post at 6 mph at approximately 01:18 hours. The bump post operated as designed, depressing approximately three feet, then the train came to rest. The emergency braking push button was activated subsequently de-energizing the emergency relay after R3275 made contact with the bump post.

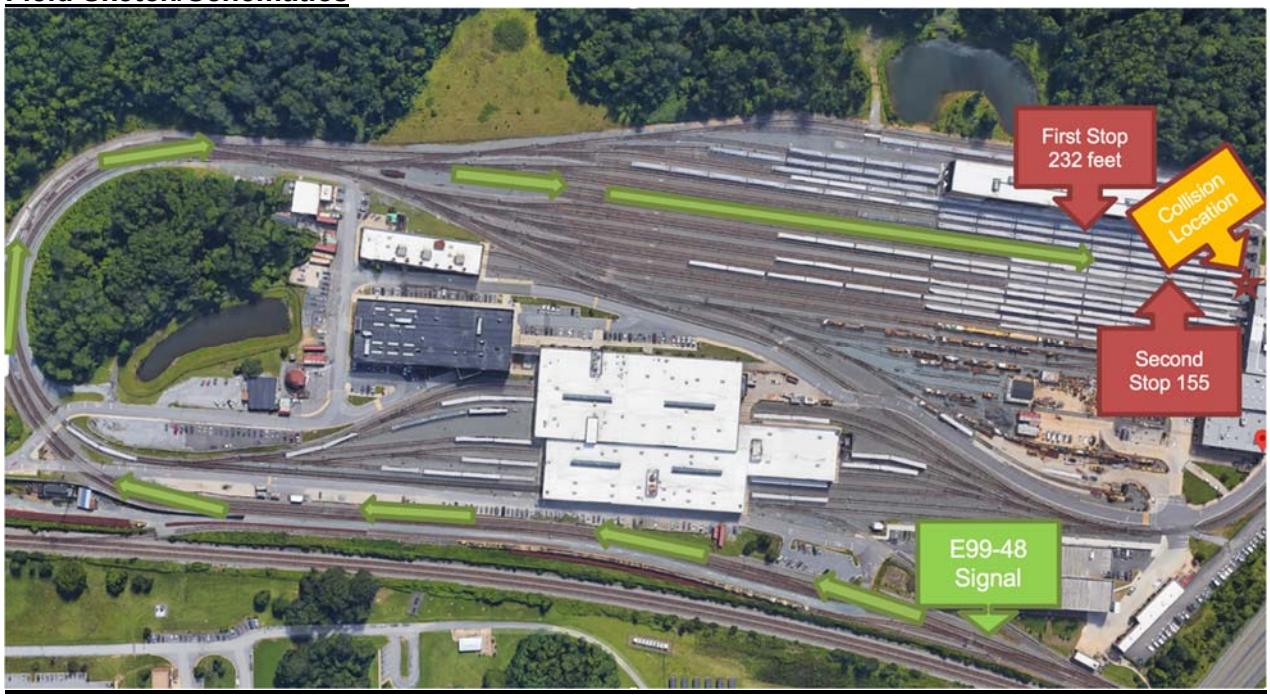
The event was initially reported as a Minor Collision (I-3 Event Code) to the WMSC based on initial reports from the field. After further investigation and damage assessment, it was reclassified as a Major Collision (A-3 Event Code) and assigned to an investigator. An Event Scene Release was received from the WMSC at approximately 14:57 hours on November 16, 2021.

The probable cause for November 16, 2021, Collision event at Greenbelt yard was a human factors error. The Train Operator lost situational awareness, entering a propulsion mode instead of a braking mode on approach to the bump post, for an undetermined reason.

Incident Site

Greenbelt Yard, Track 13 Bump Post

Field Sketch/Schematics



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 notification of a Collision at the Greenbelt Yard on November 16, 2021, 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:

Initial scene response and Follow-on Assessment performed by On-call Safety Officer and Transit Safety Investigator, respectively.

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

- 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

- System Data Recording Review – A collection of information in Metro Data Recording Systems. This data includes:
    - Audio Recording System (ARS) playback [Radio and Ambient]
    - Network Video Recording (NVR) playback

Investigation

On Tuesday, November 16, 2021, at 01:23 approximately hours, the ROCC notified SAFE of a minor collision at Greenbelt Yard occurring at 01:18 hours. The Train Operator of Train ID 503, lead car 3275, entered the yard with no passengers aboard at approximately 00:56 hours. Train ID 503 traveled at approximately 14 mph towards track 13 after receiving permission from the Greenbelt Yard Interlocking Operator to proceed under an absolute block, making all safety stops. Communications between the Train Operator and the Terminal Supervisor and Interlocking Operator did not utilize the required 100 percent repeat back. However, the repeated instructions by the Train Operator were not substantially different nor presented a conflict with the Interlocking Operator's instruction.

According to the CMOR IIT VMS download and analysis, Train ID 503 Train Operator made two stops approaching the track 13 bump post. Train ID 503 activated their train horn on both stops. Data showed Train ID 503 first stopped approximately 232 feet away from track 13 bump post and then approximately 155 feet from the bump post.

Approximately 67 feet from the bump post, Train ID 503 reached a speed of 10 mph. The Train Operator then moved the MC to P1 and continued at the same speed for an additional 25 feet. The Train Operator then placed the MC into a B4 Braking mode and subsequently in B5 braking, with a train speed of 8 mph, 10 feet away from the bump post.

Train ID 503 made contact with the bump post at 6 mph. The train pushed the bump post in 3 feet, then came to rest. The emergency brake push button was activated subsequently de-energizing the emergency relay after R3275 made contact with the bump post at approximately 01:03 hours according to the VMS, however ARS playback indicates an incident time of approximately 01:18 hours. Video playback of the event was not available due to a lack of camera views of the bump post area.

Scene Photographs

Figure 1 - Car 3275 and bump post Collision with spring-loaded barrier pushed into the housing.

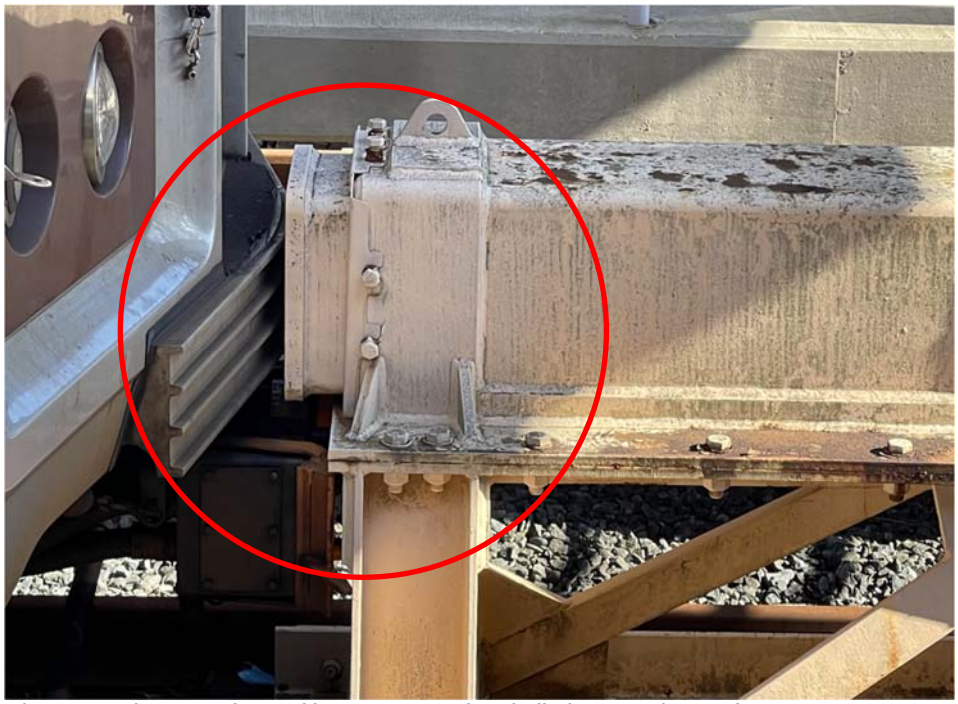


Figure 2 - Close-up photo of bump post and anti-climbers mating surface.

Figure 3 - Shows Track 13 and a comparison of an uncompressed spring-loaded bumping post to the left.

After the collision, the Train Operator reported the event to the Interlocking Operator via phone. The interlocking Operator then contacted an RTRA Supervisor via radio and requested they give them a landline.

SAFE Response

SAFE conducted an on-site yard inspection with the Office of Car Maintenance (CMNT) and CMOR IIT and identified married pair [3275-3274] lead car 3275 coupler head damage and shear bolts broken. Car 3274 Drawbar damage and all cap screws came off; both A-car and B-car shock absorbers joined together. Car 3067 shear bolts broken with cap screws came off. CMOR IIT found Cars 3066, 3067, 3275, and 3275 front and rear floorboards not dislodged from their original orientation on the train.

Figure 4 - Car 3275 rear bulkhead door heading into car 3274.


Figure 5 – Cars 3275 and 3274 showing anti-climbers touching, which indicates shear bolts are broken.

Shear bolts [emergency release bolts] are installed on the body of the semi-permanent drawbars and front couplers shaft housing. These bolts shear as a safety function at approximately 125,000 lbs. of force to help minimize the damage to the coupler system and reduce impact.

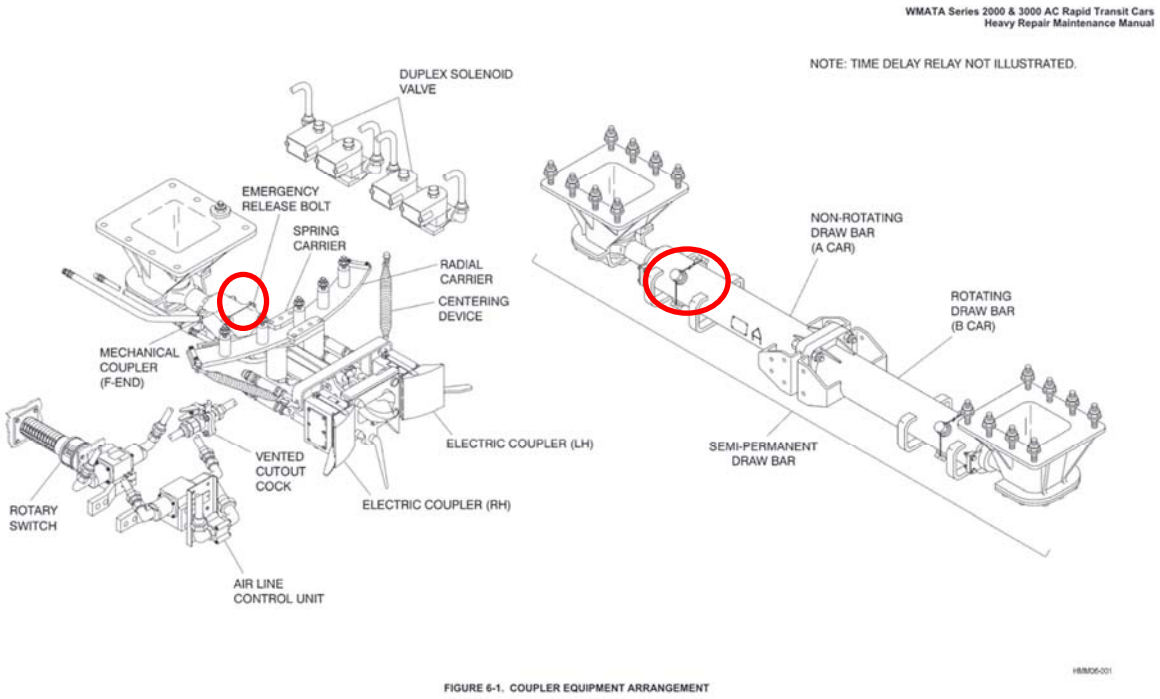


Figure 6 - Diagram of Front Coupler and Semi-Permanent Drawbar.

The Train Operator was not present upon SAFE's arrival due to being transported for post-incident testing. The CMNT Supervisor established blue flag protection to prevent movement of train consist until further notice.

SAFE Investigations personnel returned to the Greenbelt Yard site later that day around 13:00 hours and responded to the out-of-service consist involved in the bump post-collision on Track 13 to complete an initial assessment and data gathering. SAFE determined that the consist was no longer under blue flag protection. SAFE immediately reported this issue to an RTRA Assistant Superintendent, CMNT, and instructed the Interlocking Operator to contact the CMNT shop and blue flag the track behind the incident train, which CMNT completed until IMO received the ESR from the WMSC.

Chronological Event Timeline

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

Time	Description
00:56 hours	• Train ID 503: "This is Train ID 503 lead car 3275 six cars." • Terminal Supervisor: "3275 come on with it Echo 10, stand by central got the board. One to two eight-car marker operate doors platform side train will be out of service walk through it make sure it clear of customers let me know when you are clear then I'll give you a block down." [Yard 1 Radio]
00:57 hours	• Train ID 503: "That is a good copy for 503. Lunar approaching one to two eight-car marker this train is out of service walk-through verify customer are clear and notify over." • Terminal Supervisor: Affirm. [Yard 1 Radio]
01:02 hours	• Train ID 503: Notified the Terminal Supervisor train was clear of customers. • Terminal Supervisor: "Roger that all clear of customers block down to Echo 99 48 contact greenbelt tower, have a good one. Get home safe over." • Train ID 503: "Train ID 503 has a block down to 48 at Echo 99." [Yard 1 Radio]
01:04 hours	• Train ID 503: Contacted Greenbelt Yard Interlocking Operator and stated, "good morning, Greenbelt tower, this is 503 lead car 3275, six cars clear of customers." • Interlocking Operator: "Correct alignment 48 lunar absolute block to track 13. All safety to the bump post." • Train ID 503: "Train ID 503 verify lunar E99 48. I have absolute block to secure six over." [Yard 2 Radio]
01:18 hours	• Train ID 503: Notified the Interlocking Operator that they made contact with the bump post via phone. • Interlocking Operator: Gave the Train ID 503 Train Operator an incident time of 01:18 hours and instructed them to see the RTRA Supervisor in the Admin. [Ambient]
01:19 hours	• Interlocking Operator: Reported the incident to the RTRA Supervisor. [Ambient]
01:25 hours	• RTRA Supervisor: Notified the Superintendent of Greenbelt yard of the incident. [RTRA Managerial Incident report and Ambient]
02:02 hours	• Train ID 503 Train Operator: Transported by RTRA Supervisor for post-incident testing. [RTRA Managerial Incident report]
03:30 hours	• SAFE: Responded to Greenbelt Yard to investigate the event. [RTRA Managerial Incident report]

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

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

Based on the CMOR IIT data analysis, there was no fault with Train ID 503 that would have contributed to this incident. Propulsion and braking systems operated as designed.

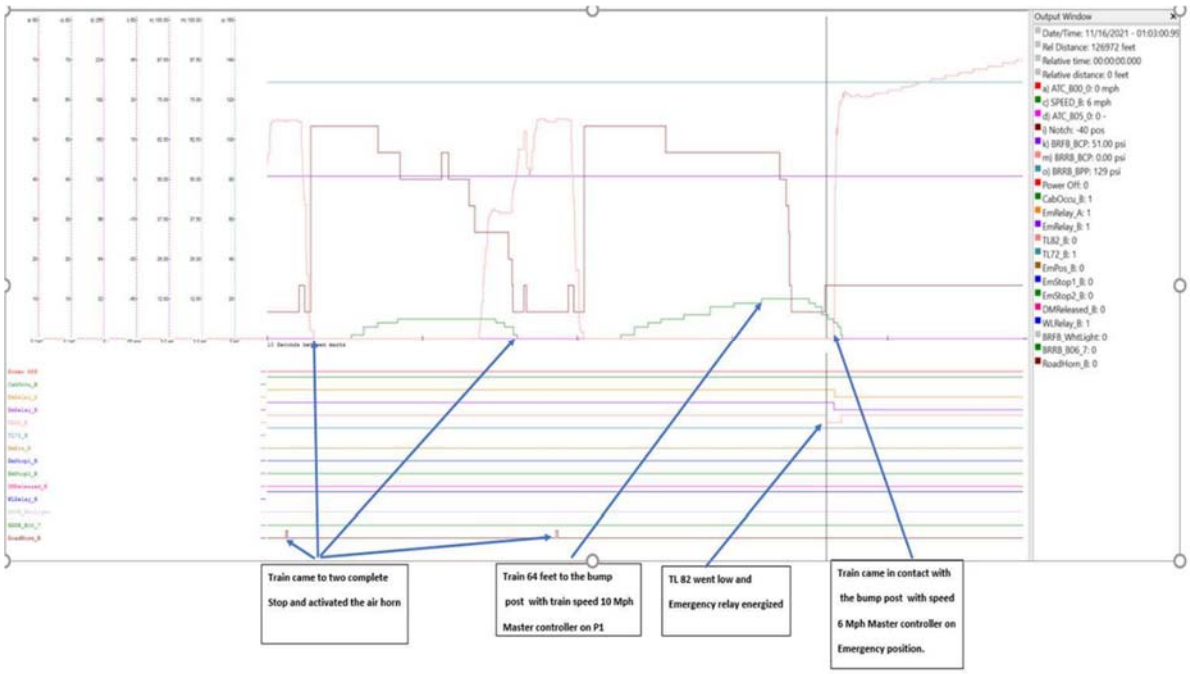
Adopted from IIT Report:
"Based on a walk-around inspection upon arrival to the yard, the train collision was on track 13 bump post. The consist "Lead 3275/74X 3067/66X 3200/3201 T" ran into the bump post and pressed the post-spring into the housing. As a result, the following car consist damages were observed:

- Car 3275 coupler head damage and shear bolts broken.
- Car 3274 Drawbar damage and all cap screws came off. Both A-car and B-car shock absorbers joined together.
- Car 3067 shear bolts broken with cap screws came off.
- Cars 3066, 3067, 3275, and 3275 front and rear floorboards bumped up.

The ROCS SPOTS Report shows that at 00:58:15 hours train left E10 track 2 (Greenbelt station), heading towards E99 Greenbelt Yard. Rail Performance Monitor Yard Activity report time shows the train arrived at Greenbelt Yard Track #13. See ROCS SPOTS and RPM pictures below.

Per the VMS data collected for this train incident, the last two stops were 232 feet and 155 feet away from the bump post. The Train Operator activated the train's Road horn on both stops. 67 feet from the Bump Post, the train reached a speed of 10 mph, then the MC was placed on P1 and continued at the same speed for an additional 25 feet. Then, the Train Operator moved the MC to B4 Braking. The MC was placed on B5, with a train speed of 8 mph, 10 feet to the bump post. The train made contact with the bump post at 6 mph. The emergency relay de-energizes after R3275 made contact with the bump post. The train pushed the bump post in 3 feet, where it then came to rest. Refer to the detailed incident timeline below for more details."

<u>R3275 VMS Graphical Display</u>



Incident Timeline

Time	Description of Events
00:55:15.9 hours	Car 3275 Keyed up on the Track #2 at Greenbelt Station.
00:55:32.7 hours	MC Placed in B4.
00:55:35.3 hours	The train moved towards GB Yard at speeds no greater than 23 mph.
00:55:58.2 hours	MC moved to B4.
00:56:03.7 hours	The train comes to a stop after traveling 584 feet in the direction of Greenbelt Yard
00:56:04.7 hours	Yard Horn signal goes high.
00:56:06.3 hours	MC Placed in B2.
00:56.09.2 hours	The train moved towards GB Yard at speeds no greater than 14 mph.
00:56:25.0 hours	MC Placed in B5 at a speed of 13 mph.
00:57:14.1 hours	Yard Horn signal goes high.
00:57:16.2 hours	Yard Horn signal goes high.
00:57:38.5 hours	The train comes to a stop after traveling another 1,462 feet in the direction of Greenbelt Yard.
00:57:40.2 hours	Yard Horn signal goes high.
00:57:45.0 hours	MC Placed in a P3 Power Mode.
00:57:44.4 hours	The train Begins to move towards GB Yard.
00:59:09.8 hours	MC Placed in B5, at a speed of 4 mph.
00:59:11.1 hours	The train comes to a stop after traveling another 1,504 feet in the direction of GB Yard
00:59:12.3 hours	Yard Horn signal goes high.
00:59:14.4 hours	MC Placed in a P3 Power Mode.
00:59:16.6 hours	The train begins to move towards GB Yard at speeds no greater than 8 mph.
00:59:29.3 hours	MC Placed in B5, at a speed of 3 mph.
00:59:30.0 hours	The train came to a stop after traveling another 123 feet in the direction of GB Yard.
00:59:31.8 hours	Yard Horn signal goes high.
00:59:33.5 hours	MC Placed in a P4 Power Mode.
00:59:35.8 hours	The train again begins to move towards Greenbelt Yard.
00:59:35.8 - 01:02:22.7 hours	MC cycled back and forth between P5 and B3 at speeds no greater than 14 mph.
01:02:24.0 hours	The train came to a stop after traveling another 2,680 feet., 232 feet from Track #13 Bump Post.
01:02:26.2 hours	Yard Horn signal goes high.
01:02:27.8 hours	MC Placed in a P2 Power Mode.
01:02:30.5 hours	The train again begins to move towards GB Yard at speeds no greater than 5 mph.

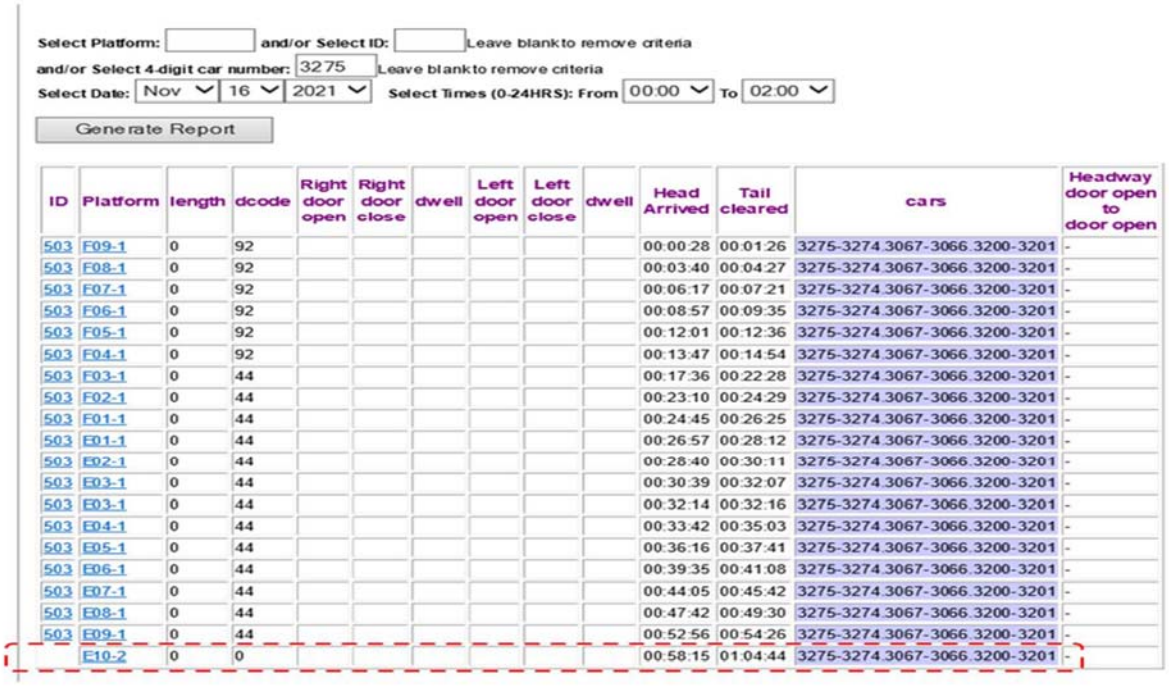
Time	Description of Events
01:02:40.8 hours	MC Placed in B5, at a speed of 2 mph.
01:02:41.1 hours	The train came to a stop, 155 feet from Track #13 Bump Post.
01:02:43.6 hours	Yard Horn signal goes high.
01:02:45.4 hours	MC Placed in a P2 Power Mode.
01:02:58.4 hours	Again, the train began to move towards GB Yard, Track #13 Bump Post.
01:03:01.3 hours	Car 3275 made Contact with Bump Post, Track #13 at 6 mph.
01:03:01.5 hours	Emergency Relay De-energized and caused the Brake Pipe to Dump.
01:03:02.1 hours	The train came to a complete stop after collapsing the Bump post 3 feet.

**Note: Clock settings were inconsistent with other systems of record. SAFE adopted timestamps verified by ARS, AIMS and general CCTV review.*

Recommendations for the whole consist:

- Perform detailed floor and under-car inspections for any possible hidden damages
- Re-establish ATC communications
- Reset all Brake systems since three of them were not communicating
- Inspect both front and rear coupler assemblies

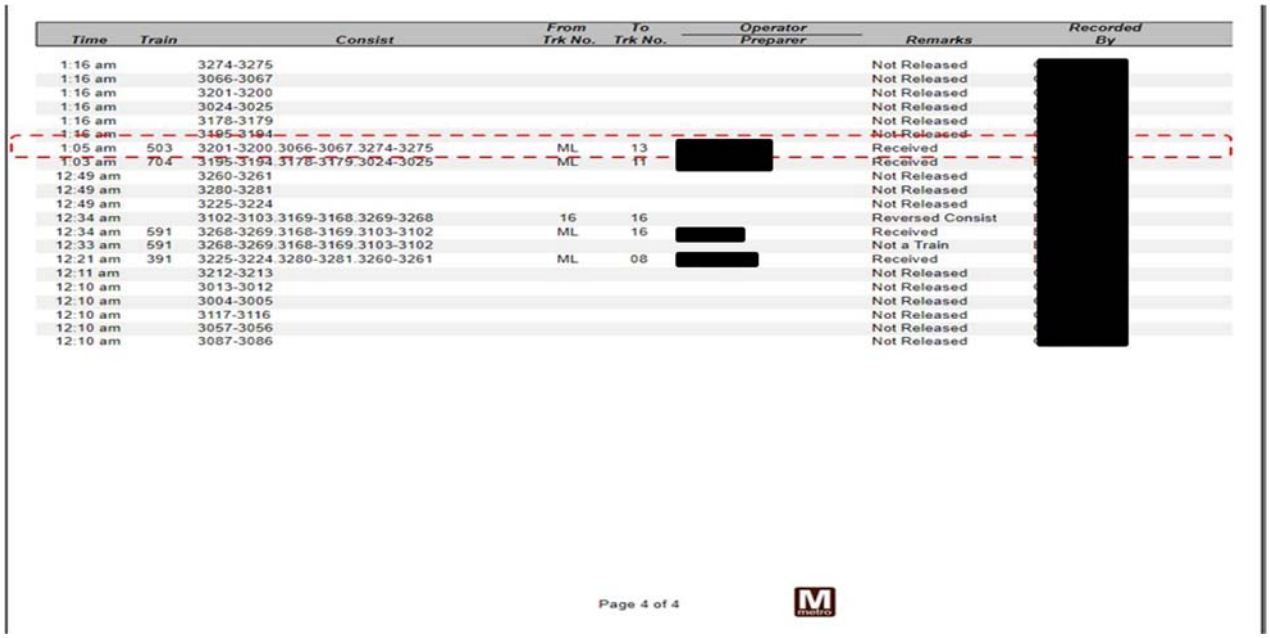
ROCS SPOTS R**eport**



Select Platform: and/or Select ID: Leave blank to remove criteria
and/or Select 4-digit car number: 3275 Leave blank to remove criteria
Select Date: Nov 16 2021 Select Times (0-24HRS): From 00:00 To 02:00
Generate Report

ID	Platform	length	dcode	Right door open	Right door close	dwell	Left door open	Left door close	dwell	Head Arrived	Tail cleared	cars	Headway door open to door open
503	F09-1	0	92							00:00:28	00:01:26	3275-3274.3067-3066.3200-3201	-
503	F08-1	0	92							00:03:40	00:04:27	3275-3274.3067-3066.3200-3201	-
503	F07-1	0	92							00:06:17	00:07:21	3275-3274.3067-3066.3200-3201	-
503	F06-1	0	92							00:08:57	00:09:35	3275-3274.3067-3066.3200-3201	-
503	F05-1	0	92							00:12:01	00:12:36	3275-3274.3067-3066.3200-3201	-
503	F04-1	0	92							00:13:47	00:14:54	3275-3274.3067-3066.3200-3201	-
503	F03-1	0	44							00:17:36	00:22:28	3275-3274.3067-3066.3200-3201	-
503	F02-1	0	44							00:23:10	00:24:29	3275-3274.3067-3066.3200-3201	-
503	F01-1	0	44							00:24:45	00:26:25	3275-3274.3067-3066.3200-3201	-
503	E01-1	0	44							00:26:57	00:28:12	3275-3274.3067-3066.3200-3201	-
503	E02-1	0	44							00:28:40	00:30:11	3275-3274.3067-3066.3200-3201	-
503	E03-1	0	44							00:30:39	00:32:07	3275-3274.3067-3066.3200-3201	-
503	E03-1	0	44							00:32:14	00:32:16	3275-3274.3067-3066.3200-3201	-
503	E04-1	0	44							00:33:42	00:35:03	3275-3274.3067-3066.3200-3201	-
503	E05-1	0	44							00:36:16	00:37:41	3275-3274.3067-3066.3200-3201	-
503	E06-1	0	44							00:39:35	00:41:08	3275-3274.3067-3066.3200-3201	-
503	E07-1	0	44							00:44:05	00:45:42	3275-3274.3067-3066.3200-3201	-
503	E08-1	0	44							00:47:42	00:49:30	3275-3274.3067-3066.3200-3201	-
503	E09-1	0	44							00:52:56	00:54:26	3275-3274.3067-3066.3200-3201	-
	E10-2	0	0							00:58:15	01:04:44	3275-3274.3067-3066.3200-3201	-

RPM Yard Activity



Time	Train	Consist	From Trk No.	To Trk No.	Operator Preparer	Remarks	Recorded By
1:16 am		3274-3275				Not Released	[redacted]
1:16 am		3066-3067				Not Released	
1:16 am		3201-3200				Not Released	
1:16 am		3024-3025				Not Released	
1:16 am		3178-3179				Not Released	
1:16 am		3195-3194				Not Released	
1:05 am	503	3201-3200.3066-3067.3274-3275	ML	13	[redacted]	Received	
1:03 am	704	3195-3194.3178-3179.3024-3025	ML	11		Received	
12:49 am		3260-3261				Not Released	
12:49 am		3280-3281				Not Released	
12:49 am		3225-3224				Not Released	
12:34 am		3102-3103.3169-3168.3269-3268	16	16		Reversed Consist	
12:34 am	591	3268-3269.3168-3169.3103-3102	ML	16	[redacted]	Received	
12:33 am	591	3268-3269.3168-3169.3103-3102				Not a Train	
12:21 am	391	3225-3224.3280-3281.3260-3261	ML	08	[redacted]	Received	
12:11 am		3212-3213				Not Released	
12:10 am		3013-3012				Not Released	
12:10 am		3004-3005				Not Released	
12:10 am		3117-3116				Not Released	
12:10 am		3057-3056				Not Released	
12:10 am		3087-3086				Not Released	

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Office of Rail Transportation (RTRA)

According to the RTRA final managerial incident investigation, the Train Operator failed to make the appropriate safety stops and failed to maintain attention to their operating duties. RTRA removed the Train Operator from service for post-incident testing.

Office of Track and Structure (TRST)

TRST evaluated the incident area and did not report any damage to the bump post on track 13 or any wayside track components.

Vehicle Program Services (CENV)

"On 11/16/21 at 01:30 hours, train consist "L3275/74X 3067/66X 3200/3201T" was moving on Greenbelt yard track # 13 when leading car 3275 contacted the bump post. When the train came to a stop, the bump post was fully compressed due to the impact. VMS data analysis indicates the train operator did not perform the safety stops per the Operating Rules 3.88 and 3.89 established in the MSRPH (Metrorail Safety Rules and Procedures Handbook) document.

Safety stops must be made three (3) car lengths, then two (2) car lengths, then fifty (50) feet, then ten (10) feet, and then proceed at a speed not to exceed three (3) mph when approaching another rail vehicle, bumping post, or obstruction. The VMS data shows the train, after two stops, was moving at approximately 10 mph, decreased speed to 9 mph, then 6 mph until the train finally stopped upon contact with the bumping post.

"Conclusion"

VMS data analysis indicates the train operator did not perform all the required safety stops per the MSRPH Operating Rules 3.88 and 3.89. The VMS data shows the train, after two stops, was

moving at about 10 mph, then decreased speed to 6mph before coming to a stop compressing the bump post-spring. The train data did not indicate any train malfunction that could have contributed to this incident. The protrusions and deterioration observed in the floor surfaces of cars 3274-3274 and 3066-3067 appear to be caused by water intrusion and corroded hardware. Flooring deformation was also observed in non-contact cars, which most likely is a result of moisture and deterioration of the ply metal." See Appendix C

Office of Car Maintenance (CMNT)

Based data within the system of record, CMNT conducted the following inspections and repairs on the cars listed below.

Inspection Findings

Car 3067

- CMNT performed an under-car inspection. TWC antenna was broken, the TWC antenna mounting brackets were bent down, and the front and rear couplers' shear bolts were activated.
- Inspected under cars structure and equipment's brackets, no anomalies were found.
- Inspected car interior flooring and noticed bumps over the cab area's floor surface that requires inspection and evaluation.

Car 3066

- CMNT personnel performed an under-car inspection, and CMNT identified that the Front and Rear couplers' shear bolts were broken.
- Inspected under cars structure and equipment's brackets, no anomalies were found.
- Inspected car interior flooring and noticed bumps over the cab area's floor surface that requires inspection and evaluation.

Car 3275 (Car impacted the Bump Post)

- CMNT performed under-car inspection. and CMNT identified that the Front and Rear couplers' shear bolts were broken.
- Under car visual inspection did not reveal structural damage, the under-car equipment's mounting brackets did not show damage.
- Rail car interior flooring has bumps in the cab area from the bulkhead door to the passenger doors 1-2 and 6-7 section, requiring more inspection to verify and evaluate subfloor integrity. CENV requested CMNT to remove pieces of Nora flooring to inspect under and verify if uneven flooring is caused by the bump post-impact incident.

Car 3274

- The front and rear couplers shear bolts were activated
- Under car visual inspection did not reveal structural damage, the under-car equipment's mounting brackets did not show damage
- Interior flooring has bumps in the cab area section that requires more assessment to verify and evaluate subfloor integrity

Repairs

- 3274 - CMNT replaced front coupler and drawbar; sub-flooring pass inspection--car good for service
- 3275 - CMNT replaced front coupler and drawbar; sub-flooring replaced --car good for service

- 3067 - CMNT replaced subfloors
- 3066 – CMNT removed and replace front and rear buckled floorboards

- 3200 – CMNT removed and replaced shear bolts on the front coupler and rear drawbar.

Cost Analysis

CMNT Incident Cost Estimate

Incident#:	8570886
Failure:	Operator came in contact with the bump post track 13, 0/0, E99, RTR, COLL, 503
Date:	11/16/21
Shop:	GBL INSP.
Prepared by:	WMATA
Rate:	$76.00

Car(s)	*Defect*	*Total Parts*	*Hours*	*Rate*	*Total Labor*	*Total Cost*
3200	HARDWARE	$1,143.12	25.5	$76.00	$1,938.00	$3,081.12
3201	HARDWARE	$1,143.12	25.5	$76.00	$1,938.00	$3,081.12
3067	HARDWARE	$23,130.07	532.5	$76.00	$40,470.00	$63,600.07
3066	HARDWARE	$16,704.93	414	$76.00	$31,464.00	$48,177.93
3274	HARDWARE	$15,098.82	82	$76.00	$6,232.00	$21,330.82
3275	HARDWARE	$15,090.02	413	$76.00	$31,388.00	$46,478.02
Totals		$72,310.08	1492.5		$113,430.00	$185,749.08

Applicable Rules and Procedures

Communication

Train Operator, Terminal Supervisor, and Interlocking Operator

MSPRH 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."

Operation

Operating Rule 3.91: "Rail vehicles shall not be operated so as to collide with another vehicle, bumping post, or obstruction. Train Operators shall report any couplings that may have resulted in equipment damage to either the ROCC or the Interlocking Operator. Train Operators shall activate the emergency stop pushbutton (mushroom) any time a train must be stopped to prevent a collision with any object or when the train fails to respond to a call for normal braking from the Master Controller. All activations of the mushroom shall be reported to the Rail Operations Control Center."

Operating Rule 3.22: Mode 2 - Level 2 is the normal operating mode in yards. On the mainline, vehicles shall not be operated in Mode 2-Level 2 unless specifically authorized by ROCC to "operate in Mode 2 with zero speed commands", except as stated in 3.79. Operators shall move vehicles in either P1 or P2 while moving in the yards or with zero speed commands on the mainline unless directed otherwise by the Interlocking Operator in the yard or by ROCC while on the mainline.

Operating Rule 3.89: Safety stops, when required, must be made three (3) car lengths, then two (2) car lengths, then fifty (50) feet, then ten (10) feet and then proceed at a speed not to exceed three (3) mph until final stop is made. Speeds into shop are not to exceed three (3) mph.

Interview Findings

Based on the investigation launched into the Greenbelt Yard Collision Accident, SAFE conducted one interview via Microsoft Teams, including the investigation team and the WMSC, and collected two incident reports. The interview was conducted two days after the event and identified the following key findings associated with this event. Findings detailed below include reported information from interviews and may conflict with other data sources contained in the report.

Train Operator

The Train Operator was the only person in the cab and reportedly made three safety stops. The Train Operator stated that safety stops should occur at 225 feet, 150 feet, and 50 feet. The Train Operator noted they had moved the MC to a Power mode rather than braking during the close-in procedures. The Train Operator stressed that they were not fatigued and unsure why they moved the MC to a power mode.

The Train Operator stated they typically use P1 – P2, the standard operating speed for the yard, and noted that P3 would activate the Overspeed alarm and send the train into braking mode. After the collision, the Train Operator stated that no one was near the accident area when it occurred. The Train Operator said they "felt out of themselves" just prior to the event.

Interlocking Operator Incident Report

"Interlocking Operator reported that they were involved in an incident. Interlocking Operator stated that they struck the bumping post on track thirteen. All proper personnel was notified in regard to this incident."

RTRA Supervisor Incident Report

"At approximately 01:19 hours, I was contacted by the Interlocking Operator and informed that a Train Operator had made contact with the bumping post of storage track #13. 01:20 hours contacted ROCC and spoke with the Operations Manager. 01:25 hours, I contacted Greenbelt Superintendent and informed them of the incident. The Train Operator stated that as they approached the bumping post, they shifted to a point of power instead of braking and made contact with the bumping post. 02:02 hours, I transported the Train Operator downtown for post-incident testing."

Weather

At the time of the incident, National Oceanic and Atmospheric Administration (NOAA) recorded the temperature as 41°F, Mostly Cloudy with winds SW at 6.214 mph and no precipitation. The relative humidity was 57% with ten-mile visibility. SAFE has concluded that weather was not a contributing factor in this incident (Weather source: NOAA – Location: Greenbelt, Md.)

Human Factors

Fatigue

Evidence of fatigue:

Conditions at the time of the incident were evaluated to distinguish whether evidence of fatigue was present. Video of the involved person was not available to ascertain whether evidence of fatigue was present. The Train Operator reported feeling Moderately 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:

Incident data was evaluated for fatigue risk factors. Although the incident time of day (1:03 hours) suggests an increased risk of fatigue-related impairment, no other significant risk factors were identified. The employee worked mid-day shifts 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 and 20 minutes in the sleep period preceding the incident and reported 7.5 hours of sleep in the 24 hours preceding the incident. Given that the waketime of the 2-hour nap period preceding the incident could not be confirmed, the length of time that the employee was awake at the time of the incident could not be determined. The off-duty period preceding the incident was 13.9 hours long, which provides the opportunity for 7-9 hours of sleep. The employee reported usual workday sleep durations of 6.5 hours and 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 one safety violation within the past three years; a station overrun on April 16, 2019.
- An RSDAR spot check revealed that on March 21, 2021, the Train Operator was observed cutting off the automated train announcements on the 7000 series rail cars.
- The Train Operator failed certification in October 2018 with a QL 3, but passed on their reattempt.

"Each Primary Qualification Proficiency Practicum is graded using a system based on three "Quality Levels". Quality Level 1 (QL-1) is reserved for Train Operators whose exam performance demonstrates that no additional training or instruction is required. Quality Level 2 (QL-2) is assigned for performance that is weak in certain areas, but not so inadequate as to preclude continued independent, unescorted operation while retraining is being administered. Quality Level 3 (QL-3) is assigned for performance that demonstrates a substantial weakness which must be corrected before the Operator can be allowed to operate a train unescorted."

Immediate Mitigation to Prevent Recurrence

- CMNT removed the collision consist from service to evaluate the damage and make necessary repairs.
- The Train Operator was sent for post-incident testing
- RTRA supervisors will conduct random Safety Audits at Greenbelt Yard on OR 3.89.

Investigative Findings

- MC cycled back and forth between P5 and B3 at speeds no greater than 14 mph while in the yard.
- The Train Operator made two stops at 232 feet and 155 feet before contacting Track #13 bump post.
- Car 3275 made Contact with Bump Post, Track #13 at 6 mph.
- CMOR IIT did not identify any anomalous [friction brake package or propulsion system] failures that may have contributed to the collision.
- Train ID 503 Train Operator was ending their tour of duty after storing the Train ID 503 on Track #13.
- The Train Operator failed certification in October 2018 with a QL 3, but passed on their reattempt.

Probable Cause

The probable cause for November 16, 2021, Collision event at Greenbelt yard was a human factors error. The Train Operator lost situational awareness, entering a propulsion mode instead of a braking mode on approach to the bump post, for an undetermined reason.

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, 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	Due Date
96850_ SAFECAPS_ RTRA_001	(RC-1, CF-2) Train Operator shall undergo Refresher Training.	RTRA SRC	Completed
96850_ SAFECAPS_ RTRA_002	(RC-1) RTRA shall develop lessons learned to expound on the events surrounding the collision.	RTRA SRC	Completed
96850_ SAFECAPS_ RTRA_003	(RC-1) The Train Operator will undergo an RTRA Supervisor ride check within 30-days of the incident date.	RTRA SRC	Completed

Appendices

Appendix A – Interview Summaries

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.

Train Operator

WMATA employee with five years of experience as a Train Operator. The Train Operator has 7.5 years of seniority with the Authority; their previous role was a Bus Operator. The Train Operator's last certification was on October 2, 2020. The Train Operator had one previous incident for a Station Overrun on August 16, 2019.

SAFE asked the Train Operator to describe the events surrounding the collision in the Greenbelt Yard, and the Train Operator said, "My last trip from Branch Avenue to Greenbelt Station was operating the meet train. I checked the train for passengers. The Terminal Supervisor permitted me to move the train into the yard. When I got to the yard by the signal, the Interlocking Operator permitted me to enter the yard with a block to Track #13. I repeated the instructions. I proceeded towards the roadway, stopped, and three to five minutes later, I had the accident.

I called the Interlocking Operator and reported the accident. The Interlocking Operator advised me to see the RTRA Supervisor, and the RTRA Supervisor came and did an investigation and transported [me] downtown for post-incident testing."

Interview follow-up questions revealed, the Train Operator was the only one in the cab and reportedly made three safety stops. The Train Operator stated that safety stops should occur at 225 feet, 150 feet, and 50 feet. The Train Operator noted they had moved the MC to a Power mode rather than braking during the close-in procedures. The Train Operator stressed they were not fatigued and unsure why they moved the MC to a power mode.

The Train Operator stated they typically use P1 – P2, the standard operating speed for the yard, and P3 will activate the Overspeed alarm and send the train into braking mode. After the collision, the Train Operator stated, there was no one near the accident area when it occurred. The Train Operator said they felt out of themselves.

Interlocking Operator Incident Report

"Interlocking Operator reported that they were involved in an incident. Interlocking Operator stated that they struck the bumping post on track thirteen. All proper personnel was notified in regards to this incident."

RTRA Supervisor Incident Report

"At approximately 01:19 hours, I was contacted by the Interlocking Operator and informed that a Train Operator had made contact with the bumping post of storage Track #13. 01:20 hours contacted ROCC and spoke with the Operations Manager. 01:25 hours, I contacted Greenbelt Superintendent and informed them of the incident. Train Operator stated that as they approached the bumping post, they shifted to a point of power instead of braking and made contact with the bumping post. 02:02 hours, I transported the Train Operator downtown for post-incident testing."

Appendix B – RTRA's Managerial Report

Washington Metropolitan Area Transit Authority

Office of Rail Transportation: Managerial Incident Investigation Report

Incident Status: FINAL

GENERAL INCIDENT INFORMATION

Incident Type:	Train made contact with fixed object (Bumping Post)	Delay (Minutes):	N/A
Incident Date:	Tuesday, November 16, 2021	Vehicles Involved:	Car #3275
Incident Time:	01:18 am	First Reported By:	Interlocking Operator [redacted]
Location:	Greenbelt Yard		

BRIEF DESCRIPTION:

At approximately 01:18 am, Greenbelt Train Operator [redacted] reported to Interlocking Operator [redacted], that while attempting to store 6 cars on track #13, when his train made contact with the Bumping Post.

A request was made at 03:58 am, to ROCC Superintendent [redacted] to pull the recording of the communication between Interlocking Operator [redacted] and Operator [redacted].

Key Employees Involved & Employee Statements:

1. **Interlocking Operator** [redacted] stated that," Operator [redacted] reported that he struck the Bumping Post on track #13. All appropriate personnel were notified in regard to this incident.

2. **Train Operator** [redacted] stated that, "I had an accident taking the train into the yard. The time to stop the train I shifted the Master Controller forward and made contact with the Bumping Post. I contacted the tower for direction and advice.

Post Incident Testing & Employee History:

Train Operator [redacted] was removed from service for Post Incident Testing. Results were negative.

Train Operator [redacted] has been a WMATA employee since October 14, 2014.

Train Operator [redacted] has been on the Rail since December 14, 2016

Attachment 1 – RTRA Managerial Report Page 1of 3.

Washington Metropolitan Area Transit Authority

Office of Rail Transportation: Managerial Incident Investigation Report

SIGNIFICANT INCIDENT TIMELINE:

01:04 Train Operator [redacted], was given permission to enter E99 yard verifying a lunar at E99/48 signal and correct rail alignment. Operator [redacted] was to secure 6 cars on track #13.
01:05 Train Operator [redacted] provided 100 % repeat back of all instructions given by Interlocking Operator [redacted].
01:18 Train Operator [redacted] reported to E99 Tower that he made contact with the Bumping Post on Track #13.
01:19 Interlocking Operator [redacted] reported the incident to Rail Operations Supervisor [redacted] and ROCC Superintendent [redacted].
01:21 Rail Operations Supervisor [redacted] went to investigate the incident train and incident location.
01:25 Rail Operations Supervisor [redacted] notified Superintendent [redacted] of the incident.
02:02 Train Operator [redacted] was removed from service and transported by Supervisor [redacted] for post incident testing.
03:00 Superintendent [redacted] arrived at E99 to complete the necessary reports.
03:30 Safety Officer [redacted] was notified, and Safety Personnel responded to E99 yard to investigate the incident.

SIGNIFICANT FINDINGS & PENDING ISSUES:

1. Train Operator [redacted] failed to maintain attention to operation duties.
2. Failure to perform safety stops.
3. Significant damage to multiple cars in the consist.

CORRECTIVE ACTIONS:

The employee was sent to Refresher Training with ROQT one (1) day. A RTRA Supervisor will conduct a Supervisor Ride with [redacted] within 30-days of the incident date. A lesson learned will be created and shared with all departments. Greenbelt Tower Supervisor will conduct random Safety Audits at Greenbelt Yard on OR 3.89. Disciplinary Action was assessed.

Attachment 1 – RTRA Managerial Report Page 2 of 3.

Washington Metropolitan Area Transit Authority

Office of Rail Transportation: Managerial Incident Investigation Report

INCIDENT PHOTOS: ATTACH ANY SIGNIFICANT PHOTOS BASED ON THE INITIAL INCIDENT INVESTIGATION.


Report Prepared by: [redacted] 11/16/2021

Report Reviewed by:

Attachment 1 – RTRA Managerial Report Page 3 of 3.

Washington Metropolitan Area Transit Authority

CENV

Incident Report

Incident Description
Train Made Contact with Bump Post in E99 Yard, Track # 13

Date
11/16/21

CENV Form 41.008

Attachment 1 - CENV Incident Report Page 1 of 16

Table of Contents

LOCATION: Greenbelt Yard E99
INCIDENT #: N/A
DATE: 11/16/2021
TIME: 01:30 AM

Investigation Team Members

[redacted]

Report Prepared By:
[redacted]

Report Approved By:

_____
[redacted] – Deputy Chief Engineer - CENV

Executive Summary

On 11/16/21 at 1:30am, train consist "L3275/74X 3067/66X 3200/3201T" was moving on Greenbelt yard track # 13 when leading car 3275 contacted the bump post. When the train came to a stop, the bump post was fully compressed due to the impact. VMS data analysis indicates the train operator did not perform the safety stops in accordance with the Operating Rules 3.88 and 3.89 established in the MSRPH (Metrorail Safety Rules and Procedures Handbook) document. Safety stops must be made three (3) car lengths, then two (2) car lengths, then fifty (50) feet, then ten (10) feet and then proceed at a speed not to exceed three (3) mph when approaching another rail vehicle, bumping post, or obstruction. The VMS data shows the train, after 2 stops, was moving at approximately 10 mph, decreased speed to 9 mph, then 6 mph until the train finally stopped upon contact with the bumping post.

Investigation

Figures 1 and 2 below show car 3275 contacting the bumping post at Greenbelt yard track 13. The train consist was inspected in the yard to ensure cars were able to move safely to the workshop. All cars were moved from the yard to the workshop to start the incident investigation and perform further inspections on all cars of the train consist.

Figure 1. Car 3275 on yard track 13

Attachment 1 - CENV Incident Report Page 4 of 16

Figure 2. Car 3275 contacting the Bump Post

VMS Analysis

The VMS data was downloaded from the lead pair 3274-3275. A summary of the critical timeline events is presented below:

- The train made two (2) safety stops at 232 feet and 156 feet from the bump post respectively. The road horn was activated during both safety stops.
- Approximately 63 feet from the bump post, the train speed was recorded as 10 mph at P1 Power rate
- Approximately 36 feet from the bump post, the master controller was placed in B5 brake rate
- The train speed decreased to 6 mph, the emergency brake relays, and emergency stop train lines (A car and B car) were deenergized to activate maximum friction brake rate
- The train came to rest after contacting the bump post
- There is no indication of Car Wash Train Line activation during this incident
- There is no indication of Push Button Emergency Valve activation during this incident

A detailed timeline of events is presented below.

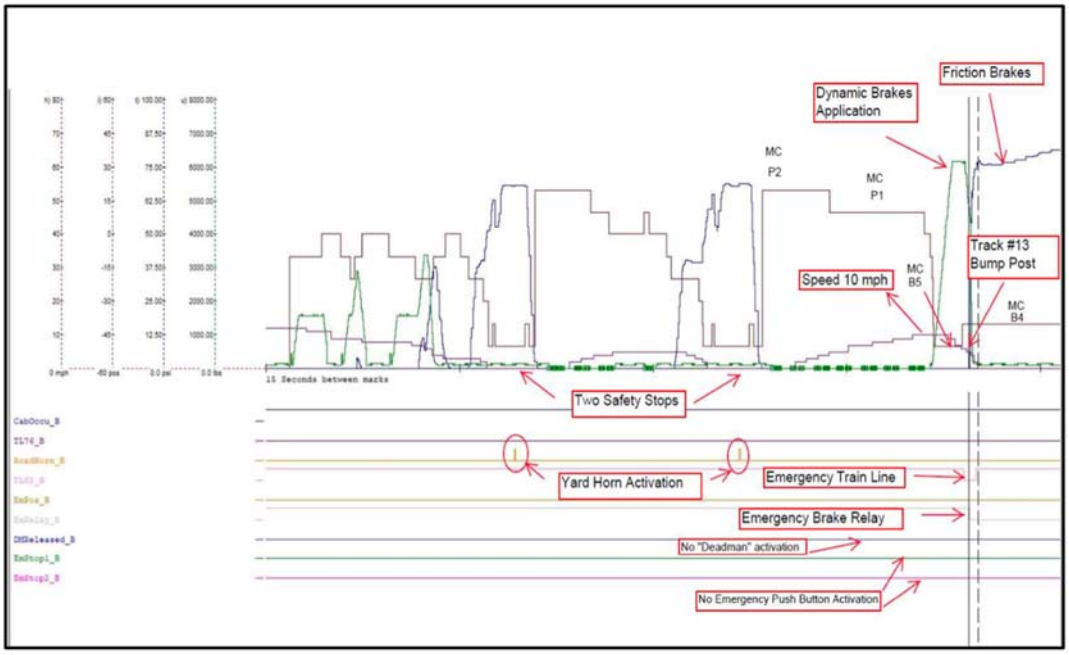

Figure 3. VMS Graph

Incident Timeline:
Note: VMS clock was 8 minutes behind real time clock

Time	Description of Events
00:55:15	Car 3275 Keyed up on the Track #2 at Greenbelt Station.
00:55:35	Train began to move towards GB Yard recording maximum speed of 23 Mph
00:55:58	Then the train stopped at B4 rate
00:56:09	The train began to move again through Greenbelt yard at average speed of 13 mph
01:02:24	The train was commanded to make one safety stop at approximately 232 feet from the track #13 Bump Post (final stop).
01:02:26	The Yard Horn was activated
01:02:30	The train began to move at about 5 mph and traveled about 76 feet
01:02:41	After traveled about 76 feet, the train was commanded to make a second stop with B5 brake rate
01:02: 43	The Yard Horn was activated
01:02:47	At about 156 feet from the bump post, the train began to move again with P2 power rate, then changed to P1 power rate to reach about 10 mph

01:02:58	At same speed of 10 mph, the Power/Brake rate changed from P1 to B5 (about 36 feet from final stop)
01:03:00	The train decreased speed from 10 mph to 6 mph
01:03:01	At the same speed of 6 mph, the emergency brake relays, and emergency stop train lines (A car and B car) were deenergized to activate maximum friction brake rate
01:03:02	Train comes to a complete stop upon collapsing the Bump Post.

Overhaul Shop Inspection and Testing

Car 3067

1. Performed under car inspection. TWC antenna was broken. The TWC antenna mounting brackets were deformed and the front and rear coupler shear bolts were activated. Refer to Figures 4 and 5 below.

Figure 4. Car 3067 TWC antenna and bracket

Figure 5. Coupler Shear Bolts

2. Inspected under car structure and equipment brackets. No anomalies found.
3. Inspected car interior flooring. Minor floor deformation along the surface at the cab area observed requiring evaluation for future replacement as needed. Refer to Figures 6 and 7 below.

Figure 6. Car 3067 Nora Flooring

Figure 7. Car 3067 flooring deformations

Car 3066

1. Performed under car inspection. The front and rear coupler shear bolts were activated.
2. Inspected under car structure and equipment brackets. No anomalies found.
3. Inspected car interior flooring. Floor deformation along the surface at the cab area observed requiring evaluation for future replacement. Refer to Figure 8 below.

Figure 8. Car 3066 Flooring

Car 3275 (Car impacted the Bump Post)

1. Performed under car inspection. The front and rear coupler shear bolts were activated.
2. Under car visual inspection did not reveal structural damage. No damage observed on under car equipment mounting brackets.
3. Rail car interior flooring deformed in the cab area from bulkhead door to the passenger doors 1-2 and 6-7 sections requiring inspection for evaluation of subfloor integrity. CENV requested that CMNT remove pieces of Nora flooring for inspection of flooring. Refer to Figure 9 below.

Figure 9. Car 3275 Flooring

Car 3274

1. The front and rear coupler shear bolts were activated.
2. Under car visual inspection did not reveal structural damage. No damage observed on undercar equipment mounting brackets.
3. Interior flooring deformed in the cab area section requiring inspection for evaluation of subfloor integrity. Refer to Figure 10 below.

Figure 10. Car 3274 Interior Flooring

Cars 3200 and 3201

1. No anomalies observed during undercar inspection.

Additional Findings (not related to the incident)

Car 3067

1. Under car inspections revealed brake discs with heat cracks and worn surface on brake discs 1 and 4. Refer to Figure 11 below.

Figure 11. Brake Discs from car 3067 trucks (F/R)

2. Rear Truck, on the left side, securing cable is contacting leveling valve air pipe as shown in Figure 12. Correction of securing cable routing required to prevent chafing.

Figure 12. Truck securing cable

Car 3066

1. All brake discs of this car (Front and Rear Trucks) have heat crack and worn surfaces. An example of the condemned brake disc is shown in Figure 13 below.

Figure 13. Worn Brake discs with evidence of heat cracks

Car 3275

1. The right hand (RH) front end electric coupler head contacts were found with corrosion and some contact pins pushed in. No physical damage to coupler case structure, door, insulation block or gasket was found. See Figure 14 as illustration.

Figure 14. RH Front-end electric coupler head

2. Rear Propulsion Common Case cover missing securing bolt as shown in Figure 15 below.

Figure 15. Rear PCC unit

3. Rear Truck, parking brake bracket is broken. Refer to Figure 16 below. Refer to Figure 16 below.

Figure 16. Rear Truck bracket broken

4. During Interior inspection, cracked glass in divider panel at doors 3 and 4 was found.
5. The Plymetal Panels were removed from car 3275 as requested for inspection. Visual inspection has been performed at the carbody underframe, F-end Cross Member, Central Element, and Front-End Bolster. No damage or deformations were observed; however, inspection on removed plymetal panels showed material deterioration such as, rotten wood, floorboard rusted mounting hardware, and plymetal delamination. Bulky floor areas in married pair 3275/76 were also observed.

Car 3274

1. Front Propulsion Common Case Unit, HV Cover Plate has missing securing bolt. Refer to Figure 17 below.

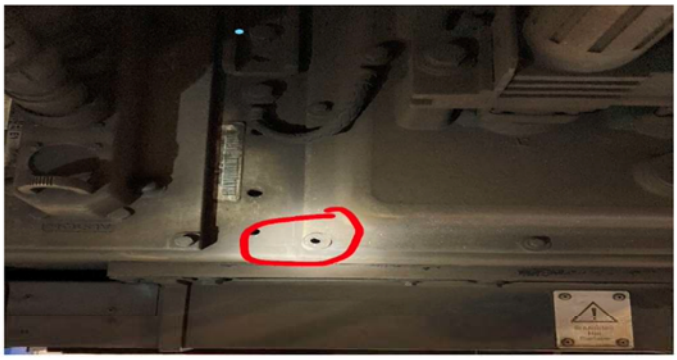

Figure 17. HV Cover Plate

Attachment 1 - CENV Incident Report Page 14 of 16

2. Front and Rear Propulsion Common Case blower covers missing one securing bolt each. Refer to Figure 18 below as an example.

Figure 18. PCC Blower Cover

3. The RH and LH front coupler electrical head pins were found with mild corrosion and worn pins.

Recommendations/Actions Taken

1. Replace TWC antenna and mounting hardware in car 3067.
2. Overhaul or replace Front and Rear Couplers from cars 3274-3275 and 3066-3067.
3. Inspect brake discs for heat cracks and worn surface conditions, recondition or remove and replace all brake discs of car 3067 as required.
4. Replace or adjust orientation of securing cable in rear truck (left side) of car 3067 to prevent chafing against leveling valve air pipe.
5. Inspect brake discs for heat cracks and worn surface conditions, recondition or remove and replace all Brake discs of car 3066 as required.
6. Check the front and rear propulsion common case units and install missing securing hardware in the covers of cars 3274 and 3275.
7. Repair broken bracket on the rear truck of car 3275.
8. Replace cracked glass in divider panel at doors 3 and 4 of car 3275.
9. Replace all floorboards and all hardware removed from car 3275 for the inspection.
10. During interior inspections, swollen flooring in the walkway area between doors 1-2 and 7-8 of car 3066 (belly position during incident) was observed. Further evaluation for future floorboards replacement is recommended.
11. For all 4 cars (3274-3275 and 3066-3067) after repairs are done:
    - Open the KA boxes and perform inside inspection to ensure the EMR relay is secured and check expiration date
    - Dump the BP using left/right mushrooms and Deadman
    - Drain the water from the main reservoirs as needed
    - Run H1-A self-test
    - Perform the brake rate test
    - Reestablish communication between brake system and VMS

Conclusion

VMS data analysis indicates the train operator did not perform all the required safety stops in accordance with the MSRPH Operating Rules 3.88 and 3.89. The VMS data shows the train, after 2 stops, was moving at about 10 mph, then decreased speed to 6mph before coming to a stop compressing the bump post spring.

The train data does not indicate any train malfunction that could contribute to the incident occurrence.

The protrusions and deterioration observed in the floor surfaces of cars 3274-3274 and 3066-3067 appear to be caused by water intrusion and corroded hardware. Flooring deformation was also observed in non-contact cars which most likely is a result of moisture and deterioration of the plymetal.

Attachment 1 - CENV Incident Report Page 16 of 16

Appendix D – Lessons Learned

Office of Rail Transportation

OFFICE OF RAIL TRANSPORTATION

Looking back, to effectively move forward

Lessons Learned

November 16, 2021
Number: 2021-006

Greenbelt Division (E99) Failure to follow procedures leads to collision

INCIDENT SUMMARY

On Monday, November 16, 2021 at approximately 1:04am the Rail Operations Control Center received notification of a collision involving a rail vehicle the Bumping Post on track 13. All appropriate notifications were made, support personnel were dispatched to the incident location. The collision caused substantial damage to multiple cars in the consist. There were no reported injuries.

ROOT CAUSE

Disregard for established rules and Standard Operating Procedures demonstrated by the train operator lead to the collision. Not only did the operator fail to complete the required safety stops as outlined in OR 3.89, the train speed exceeded the 3-mph maximum limit while in approach to the bumping post. This action caused the bumping post to collapse 3 feet inwards.

MSRPH RULES VIOLATED

OR 3.88 Safety Stops shall be made as prescribed in Rule 3.89 when approaching another rail vehicle, bumping post or obstruction.

OR 3.89 Safety Stops, when required, must be made three (3) car lengths, then two (2) car lengths, then fifty (50)ft, then ten (10) ft and then proceed at a speed not to exceed three (3) mph until the final stop is made. Speeds into the shop are not to exceed three (3) mph.

OR 3.91 Rail vehicles shall not be operated so as to collide with another vehicle, bumping post or obstruction

What happened…	*What should have happened…*
The Train Operator failed to follow all Yard Procedures as instructed by the Interlocking Operator.	The operator should have completed all required Safety Stops, and safely secured the train consist at the bumping post.
After completing two (2) of the four (4) Safety Stops, the Train Operator placed the Master Controller in a P2 Power Mode increasing the train speed to 6 mph and making contact with the bumping post on track #13.	The Train Operators speed should not have exceeded 3 mph until the final stop was made.

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RECOMMENDATIONS

- ✓ Train Operators, and all operations personnel, must always be vigilant and aware of their surroundings.
- ✓ Safety Stops, when required, must be made three (3) car lengths, then two (2) car lengths, then fifty (50)ft, then ten (10) ft and then proceed at a speed not to exceed three (3) mph until the final stop is made. Speeds into the shop are not to exceed three (3) mph.
- ✓ Emphasize that all operational personnel abide by Operating Rule 3.89 and 3.91 when operating trains.
- ✓ Ensure that all operational personnel comply with all Operating Rules, especially Cardinal Operating Rules.
- ✓ Always follow Rules/Procedures outlined in WMATA's MSRPH.

Print Name_____Date_____

Signature_____Payroll_____

Attachment 1 – RTRA Lessons Learned page 2 of 2

Appendix E – Root Cause