

## **METRO PRIORITY REPLACEMENT INSPECTION REPORT**

Maryland Transit Administration (MTA) tasked the services of HNTB to review contract T-1464-0440 Metro -- Rail and Insulated Joints (IJ) replacement, Tamping, Resurfacing, Bridge End Alignment, and Rehabilitation Work Bridges 506, 550, 569, 656, 696, and Sudbrook Tunnel for the track areas west of the portal. The document was prepared by another consulting firm previously tasked to inspect and identify track sections to be repaired or replaced. The following items were identified in their report to be repaired or replaced.

- 1) Insulation Joints (Factory or Field installed);
- 2) Rail Replacement (high or outer rail only);
- 3) Bridge End Approach Repairs including replacing concrete ties with timber ties, removing fouled ballast and surfacing and aligning existing track;
- 4) Concrete Tie replacement; and
- 5) Hixson Fastener replacement at select locations.

HNTB was asked to field verify the items listed above and determine which items should be categorized for replacement during a scheduled construction outage in the Summer of 2018.

Prior to inspecting the track (Monday, January 22, 2018), the HNTB inspector reported to the Old Court Metro maintenance facility to gather information. The information gathered included a list of areas Metro MOW crews had recently replaced rail. In addition, he reviewed Maximo Work Orders/inspection reports, and scheduled an escort for a Tuesday morning inspection effort.

On Tuesday, January 23, 2018, the HNTB inspector and MTA escorts began inspecting Mainline 1 and 2 from Old Court to Reisterstown Plaza and observed the following:

- 1) Bridge approaches for Bridge 506 had fouled ballast that should be removed and replaced and the track required alignment, surfacing and tamping but not critical for Summer 2018 construction.
- 2) Curves 56, 57, and 58 – Wear was observed on the high rail but not confirmed until the Holland data was accessed. In reviewing the data, these curves showed a gauge face angle (GFA) exceeding 26 degrees in 2016, placing these curves in a black condition (See Figure 1).
- 3) The fasteners approaching Sudbrook Tunnel and within Sudbrook Tunnel will need to be replaced. Additionally, the approaches to the tunnel require tamping, aligning and surfacing. This item was not critical for Summer 2018 construction.
- 4) Rail defects (water damage from bridge) were observed along Track 1, left rail.
- 5) All Insulated Joints listed in the contract to be replaced were confirmed and documented to be replaced. The I.J.'s were functioning properly.

On Wednesday, January 24, 2018, the HNTB inspector and MTA escort inspected Main line 1 and 2 from Reisterstown Plaza to Cold Spring. The following was observed:

- 1) Concrete ties with the wedge fasteners were listed to be replaced. It was observed that the ties should be replaced but this item is not critical for Summer 2018 construction.
- 2) Insulation Joints were confirmed to have been replaced at the Reisterstown Plaza and Rogers Avenue interlocking and removed from the contract.
- 3) Curves 32 and 31 -- Wear was observed on the high rail but not confirmed until the Holland data was accessed. In reviewing the data, these curves showed a gauge face angle (GFA) exceeding 26 degrees in 2016 placing these curves in a black condition (See Figure 1).

On Thursday, January 25, 2018, the HNTB inspector and MTA escorts inspected Mainline 1 and 2 from West Cold Spring to the Portal. The following was observed:

- 1) Curves 30, 29, 27, 25 and 23 – Wear was observed on the high rail. These curves were field verified and it was confirmed that the GFA was above 26 degrees placing these curves in a black condition. The Holland data confirmed the field measurements. (See Figure 1).
- 2) Curve 28 -- Wear was observed on the high rail but not confirmed until the Holland data was accessed. In reviewing the data, these curves showed a gauge face angle (GFA) exceeding 26 degrees in 2016 placing these curves in a black condition (See Figure 1).

On Friday, January 26, 2018, the HNTB inspector and escort inspected Mainline 1 and 2 from Old Court to Owings Mills. The following was observed:

- 1) Insulation Joints listed in the contract to be replaced were confirmed and documented to be replaced. The I.J.'s were functioning properly.
- 2) Curves 59, 64, 63, and 65 – Wear was observed on the high rail. These curves were field verified and it was confirmed that the GFA was above 26 degrees placing these curves in a black condition. The Holland data confirmed the field measurements. (See Figure 1)
- 3) Curves 60, 66, 67, and 68 – Wear was observed on the high rail but not confirmed until the Holland data was accessed. In reviewing the data, these curves showed a gauge face angle (GFA) exceeding 26 degrees in 2016 placing these curves in a black condition (See Figure 1).
- 4) Bridge Ends for Bridge 696, 656, 569, 550 - Fouled ballast was observed that should be removed and replaced, aligned, surfaced and tamped. Bridge 656 and Bridge 550 will need to be addressed during the Summer 2018 construction; the remaining bridge approaches are not critical.
- 5) Fasteners on Bridge 656 will need to be replaced.

On Monday, January 29, 2018, the HNTB track inspector gained access to the MTA computer to review the Holland range cam data. The November 2016 Holland data was reviewed as the 2017 data was not available until a later date.

The wear of the rail was reviewed on the rail profile using the 2016 Holland data. The curves within the contract were showing gauge face angle (GFA) exceeding MTA's track standard

guidelines of 26 degrees. Based on MTA’s latest standard, curves with a GFA exceeding 26 degrees are listed as a Black condition. All the curves in the contract were reviewed and all 19 curves listed in the contract had GFA in excess or nearing the 26-degree limit. See Figure 1 below:

**Figure 1 – MTA Table 4-1 Rail Wear Limits for 115# Rail**

Condition		Level	Deviation
Top Wear		(G)	up to 1/2 inch
		(Y)	1/2 inch to 5/8 inch
		(R)	more than 5/8 inch
		(B)	more than 3/4 inch
Side Wear		(G)	up to 1/2 inch
		(Y)	1/2 inch to 5/8 inch
		(R)	more than 5/8 inch
		(B)	more than 3/4 inch
Restraining Rail		(G)	Up to 7/16 inch
		(Y)	7/16 inch to 5/8 inch
		(R)	more than 5/8 inch
		(B)	more than 3/4 inch
Maximum Gauge Wear Angle		(G)	26 degrees
		(B)	more than 26 degrees

# Cautionary reduction in speed to 40 mph. until problem is corrected.  
 \*Supervise operations not exceeding 12 mph.

The Holland data confirmed the HNTB inspector’s field measurements obtained using an angle cube.

The findings of the inspection were presented to the MTA engineering Department. Table 1 includes a summary of the gauge face angles for all curves within the contract.

**Table 1 – Summary of Gauge Face Angle**

	High Rail Replacement Limits		Curve #	11/2016 Gauge Face Angle <sup>1</sup>	2/2018 Field Verification Angle
<b>ML 1</b>	698+50	688+50	#68	27.1	verified *
<b>ML 2</b>	697+34	687+34	#67	25.2	verified *
<b>ML 1</b>	681+97	633+45	#66	25.5	verified *
<b>ML 2</b>	682+17	633+44	#65	26.1	26.8
<b>ML 1</b>	624+10	601+46	#64	28.2	28.2
<b>ML 2</b>	624+24	601+60	#63	28.9	28.5
<b>ML 1</b>	561+78	532+54	#60	27.4	verified *
<b>ML 2</b>	561+81	535+30	#59	28.1	28.8
<b>ML 1</b>	519+20	502+26	#58	28.2	verified *
<b>ML 2</b>	518+33	501+78	#57	29.3	verified *
<b>ML 1</b>	490+07	465+62	#56	26.5	verified *
<b>ML 1</b>	276+12	272+75	#32	28.0	verified *
<b>ML 2</b>	279+44	275+80	#31	28.1	verified *
<b>ML 1</b>	267+01	260+95	#30	28.7	28.4
<b>ML 2</b>	266+81	260+00	#29	28.1	27.0
<b>ML 1</b>	258+29	245+77	#28	27.3	verified *
<b>ML 2</b>	258+41	245+76	#27	26.9	28.0
<b>ML2</b>	243+51	237+28	#25	26.6	27.5
<b>ML2</b>	226+50	220+52	#23	26.3	27.1

ML 1 – Mainline Track 1

ML 2 – Mainline Track 2

\* Visual wear was confirmed on the tracks but not manually measured.

Note 1 - The values included in the table were compiled in January 2018 from the original raw data.

**Conclusions:**

Based on MTA's Baltimore Light and Heavy Rail Systems, Field Guide for Track Inspectors, Effective April 2017, "Through proper inspection of the track by qualified inspectors, these track conditions or dimensions are evaluated, measured, and verified with respect to the standards of the Maryland Transit Administration (MTA). If the conditions of the track is below acceptable levels, as defined by the MTA standards, corrective or protective action is required".

According to MTA's Baltimore Light and Heavy Rail Systems, Field Guide for Track Inspectors, Effective April 2017 and FTA's Pocket Guide: Compilation of Rail Transit Industry Best Practices for Track Inspection Maintenance, a Black or "Out of Service" condition of serviceability exists when a section of track has deteriorated to the point where no train movement is allowed. Additionally, the manuals indicate that ".....The qualified person(s) detecting such condition should make every effort to correct the condition immediately".

Based on MTA's criteria, a gauge face angle exceeding 26 degrees falls within a black condition. FTA's criteria specify the maximum allowable angle of side wear be limited to 26 degrees. According to the 2016 Holland data, the curves listed in Table 1 either exceed 26 degrees or are close to the 26-degree threshold. As stated above, based on the MTA and FTA criteria, a black condition is where no train movement is allowed.

**Recommendations:**

- MTA should take immediate action to enact emergency repairs to their tracks to be consistent with MTA's Baltimore Light and Heavy Rail Systems, Field Guide for Track Inspectors.
- MTA develop a SOP to address third party geometry and UT data collection reviews on a regular basis, field verify exceptions as soon after testing as possible. They should either train MTA staff or obtain outside services to conduct the reviews. Maintenance Staff should partner with Internal engineering staff to develop a program to plan, schedule and correct defects as soon as possible.
- Consider obtaining rail wear measurement tools such as the Mini-Prof instrument and software (or alternative products) to accurately field measure rail profiles and include these measurement verifications as part of the SOP previously mentioned.
- Evaluate their current training practice for Track Inspection and consider expanding their program to include an extensive classroom/field training program; include a mentoring activity similar to an On-The Job Training effort with a focus on effective field measuring activities.
- MTA should review their rail lubrication policy.