NTSB | National Transportation Safety Board

Date: September 22, 2023

To: Robert Hall, Director, RPH

Through: Robert Gordon, Branch Chief, RPH-120

From: James Southworth, IIC, RPH-120

Subject: RRD23LR006- Springfield, OH- Safety Performance of Wheelsets Investigation Closeout Memo

Synopsis:

On March 4, 2023, at about 4:54 p.m. local time, westbound Norfolk Southern Railway (NS) mixed freight train 179LC04 derailed 28 railcars at NS milepost 178.85 on the NS Dayton District near Springfield, Ohio. Twenty-one of the derailed railcars were loaded and seven were empty; none were carrying hazardous materials. The train comprised three head-end locomotives, two mid-train distributed power units, and 212 railcars. The train was 13,470 feet long and weighed about 17,966 tons.

During the derailment, three wheelsets exhibited movement on their axles. One axle had a wheel dislodged from its axle seat, one axle had a wheel dislodged outboard, and a third axle had a wheel dislodged inboard.

Initial Investigation and Industry Response:

After this derailment, on March 8, 2023, NS began removing 517 railcars built by National Steel Car from service until their wheelsets could be replaced and examined. Additionally, the Association of American Railroads (AAR) issued an equipment inspection order (EI-0033) on March 9, 2023, advising railroads to inspect and remove from service wheelsets mounted on railcars by National Steel Car between August 2022 and March 2023.

AAR Wheel Mounting Standards:

AAR develops and publishes rules governing wheel shop practices, including axle and wheel bore machining and mounting practices. These rules are included in AAR's

Safety and Operations Manual of Standards and Recommended Practices Section G-II Wheel and Axle Manual, Effective October 2022 (MSRP G-II). NTSB investigators reviewed these standards to determine those sections applicable for use in examinations.

Wheelsets Held for Investigation:

The National Transportation Safety Board (NTSB) initiated an investigation focusing on the safety performance of wheelsets involved in the derailment. NTSB placed an investigative hold on twelve wheelsets that moved on their axle seats from three coil railcars of the derailed train. Each of wheelsets held were mounted by National Steel Car (NSC). NTSB also placed an investigative hold on additional wheelsets that were mounted by NSC around the same time as those held from the derailed train. All wheel sets were shipped to an NS facility in Altoona, Pennsylvania. This examination began on March 15, 2023, and was performed before all parties.

Inspections included dismounting five wheels and performing detailed visual inspections and measurements of the wheel bores and axle seats. Additionally, on March 21 and 22, 2023, a portable coordinate measurement machine was used to gather additional data from the dismounted wheels at the NS Juniata Shop in Altoona, PA, and wheel 05544, which completely dislodged in the derailment.

The five wheelsets from the derailed cars NS 162581 and NS 162582 that did not visually appear to dislodge their wheels during the derailment were measured for wheel back-to-back spacing in three locations approximately evenly spaced around the wheels. Each of these wheelsets' back-to-back measurements was within the AAR MSRP G-II specifications for back-to-back measurements. They did not exhibit evidence of the wheels moving on their axles nor of conditions that would lead to such movement. Additional wheelsets were examined that were manufactured by National Steel Car around the same time as those that exhibited movement of wheels on their axles in the derailment. These wheelsets were obtained from two cars in Elkhart, IN (4 wheelsets each from car NS 162438 and car NKLX 400172). These wheelsets were examined in the same manner. None of these wheelsets exhibited evidence of wheels moving on their axles or of conditions that would lead to such movement.

The axle containing wheel 05544 that was completely dislodged in the derailment was cut to remove the completely dislodged wheel. The mate wheel to wheel 05544 (wheel 05508) was pressed from the axle, and the wheel bore and axle seat of each wheel from that axle were visually examined for evidence of movement on the axle, along with conditions that could lead to such movement, such as fretting. No evidence of movement on the axle prior to the derailment was identified.

Wheel Dismounts and Measurements:

The remaining two wheelsets that had wheels dislodged from their seat during the derailment from cars NS 162581 and NS 162592 were examined. The two axles with a wheel partially dislodged from its seat had each wheel pressed from the axle, recording the required force to break the wheel free from its seat and the force required to slide the wheel off its seat. There are no AAR or other industry standards for wheel dismount forces.

After dismounting the diameter, taper, and rotundity of all four wheel bores and their corresponding axle seats were measured. Axle seat surface roughness was also measured.

The bore of wheel 07340 exhibited anomalies in its bore diameter regarding the bore taper and maximum deviation in bore measurements. As a result of this anomaly, additional investigative actions were performed using 3D scans of wheelset axle seats and wheel bores. A portable coordinate laser measuring machine was used to gather precise three-dimensional data of wheel bore profiles. Six-wheel bores from three axles were examined with the equipment: the three wheels that exhibited movement on their axles in the derailment and each of these wheels' axle mates, which exhibited no movement before being dismounted as part of the investigation.

Using the scan data, the wheel bore machining profile was compared to nominal parameters and to those of a new, unmounted wheel produced on March 28, 2023, at National Steel Car.

The results show that the machining profiles of each wheel was close to the nominal and new wheel bore machining profile, although it should be noted that there are no AAR requirements for wheel bore finish on dismounted wheels.

The machined bore profiles of each wheel were examined to determine the number of machine grooves per bore, the machining groove depth, and the radius within groove cross sections. Table 4 below provides the values produced from the scans, including the nominal machining parameters and those of a new, unmounted wheel. When comparing a new, unmounted wheel to a wheel that has been mounted and dismounted, it is expected to have changes such as a reduction in groove depth due to the mounting and dismounting processes. As stated, there are no AAR requirements for wheel bore finish on dismounted wheels.

No AAR or other industry standards exist for post-dismount axle or wheel dimensions. However, all measurements indicated the axles and wheel bores were manufactured and mounted within specifications, with one exception.

AAR Cancels Equipment Instructions:

On April 13, 2023, the AAR Wheels, Axles, Bearings and Lubrication committee voted to cancel EI-0033 that it issued on March 9, 2023, which had advised railroads to inspect and remove from service wheelsets that were mounted by National Steel Car between August 2022 and March 2023. Equipment Instruction EI-0033 Supplement 01 removed all cars from the advisory and informed car owners that they may request to have wheelsets quarantined by EI-0033 placed back under their own cars. The NS also cancelled their equipment intercept instructions and completed inspections on May 3, 2023.

Conclusion:

As a result of the physical evidence and results of examinations, NTSB staff has determined that all wheelset inspected were found to be in compliance with AAR's Safety and Operations Manual of Standards and Recommended Practices Section G-II Wheel and Axle Manual, Effective October 2022. Therefore, NTSB staff recommends that this investigation be closed.

I concur:

ROBERT HALL

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Robert Hall, Director
Office of Railroad, Pipeline and
Hazardous Materials Investigations