

National Transportation Safety Board

Office of Railroad, Pipeline and Hazardous Materials

Washington, DC 20594



RRD23FR011

MECHANICAL

Group Chair's Factual Report

June 22, 2023

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A. ACCIDENT

Location: New Castle, Pennsylvania

Date: May 10, 2023

Time: 10:57 p.m. Local Time

Train: Norfolk Southern (NS) Train 14M.10

B. MECHANICAL GROUP MEMBERS

Group Chair Matt Thompson
National Transportation Safety Board
Federal Way, WA

Specialist Adrienne Lamm
National Transportation Safety Board
Washington, DC

Specialist Nancy McAtee
National Transportation Safety Board
Washington, DC

Group Member Ervin White
Federal Railroad Administration
Pittsburgh, PA

Group Member John Hancock
Pennsylvania Public Utilities Commission
Harrisburg, PA

Group Member Geoff Craker
Norfolk Southern Railway
Chicago, IL

C. SYNOPSIS

On May 10, 2023, about 10:57 p.m. local time in New Castle, Pennsylvania, a northbound Norfolk Southern Railway (NS) train 14M.10 derailed. The derailment occurred on the main track on the Youngstown Line of the Keystone Division in New Castle, Pennsylvania. NS train 14M.10 consisted of three locomotives and 213 mixed

manifest cars. Nine cars derailed, cars 164-172¹ at the Montgomery Avenue railroad crossing. There were no reported fatalities or injuries. The derailed equipment included one hazardous material tank car, which was not breached that contained paraffin wax. The weather at the time of the accident, visibility conditions were dark and clear; the temperature was 52°F with no precipitation.

D. DETAILS OF THE INVESTIGATION

1.0 Train Consist

The train consisted of three locomotives and 213 mixed freight rail cars. One locomotive was on the head end, and two were located mid train (126 & 127). Train 14M.10 had 144 loads and 69 empties. The train weighed 19,993 tons (including locomotives) and was 12,724 feet long.

Lead	NS 4342	GE AC44C6M	4400hp	Remanufactured 2020
DPU	NS 3642	GE ET44AC	4400hp	Built 2016
DPU	NS 4689	GE AC44C6M	4400hp	Remanufactured 2023

2.0 Post Derailment Equipment Examination

Cars 1-163 were positioned at the Youngstown, Ohio, yard west of the derailment for inspection. Cars 164-171 were derailed and in the pile up at the derailment site. Car position 172 was rerailed and moved with cars 173-213 just south of the derailment site. Locomotives NS 4342, NS 3642 and NS 4689 were with cars 1-163 at the Youngstown, Ohio, yard.

Cars 1-163 were inspected at the Youngstown Yard, and cars 172-213 were inspected just east of the derailment site. 45 of 213 cars were found with air brake, safety appliance and truck FRA defects that did not affect the performance of the cars.

Lead locomotive NS 4342, DPU's NS 3642 and NS 4689 were inspected with no critical defects.

Rolling stock equipment damage is estimated by NS at approximately \$601,227.

Leading axle 1 of car CRDX 3017 the first car to derail was found underneath the car with the L1 journal burnt off located just approx. 2 ½ car lengths north of the

¹ Car positions referenced throughout the report that omit locomotives.

bridge at YG 74.9. The burnt off journal and bearing segments were located near the POD at YG 76.56 on main 1 track.



Figure 1 - Car CRDX 3017 - L1 Journal bearing.



Figure 2 - Car CRDX 3017 - #1 Wheel set showing L1 wheel.

3.0 Wheel Set and Bearing Details

Car Number	CRDX3017	CRDX3017	CRDX3017	CRDX3017	CRDX3017	CRDX3017
Component Type	Wheelset	Axle	Bearing	Wheel	Bearing	Wheel
Truck	B	B	Bearing	B	B	B
Wheelset	1	1	1	1	1	1
Sub-Component Location		1	1	1	2	2
Component ID Number	8RIC0001804815	8RIC0001804815	8RIC0001804815	8RIC0001804815	8RIC0001804815	8RIC0001804815
Axel Nominal Journal Diameter		6.5				
Axel Nominal Journal Length		12				
Axle AAR Type		RWS - Raised Wheel Set				
Axle Body Design		F				
Axle AAR Condition Code		2 - Second Hand				
Wheel Stamped Month Year				2/8		2/8
Wheel Stamped Manufacture Code				SW - Standard Steel LLC		SW - Standard Steel LLC
Wheel Stamped Heat Treatment Class				C - Heat Treated Wheels		C - Heat Treated Wheels
Wheel Rim Thickness Side Scale Reading				36		36
Wheel Design Code (CH)				H-36		H-36
Wheel New or Turned				New		New
Bearing Reconditioned Classification			R - Reconditioned		R - Reconditioned	
Bearing Certificate			5 - Brenco (Green)		5 - Brenco (Green)	
Bearing Size Description			6.5		6.5	
Bearing Backing Ring Type			8TIM003 - Timken Sur-Fit		8TIM003 - Timken Sur-Fit	
Bearing Condition			R - Reconditioned		R - Reconditioned	
Mileage						
Mileage From Date						
Mileage to Date						

Figure 3 - Table depicting wheelset assembly. (Information provided by NS)

Wheel set 1: L1 burnt off journal, R1 bearing cap missing.
 #1 Wheel set applied 3/23/2008 - 99731 miles
 Reconditioned Brenco bearing dated 03/2008
 PCX-K- A. Stucki Company KY Elizabethtown - Bearing reconditioner (previously Precision Roller Bearing at the time of reconditioning).
 MWSI - Greenbriar Rail Services, Chicago Heights, IL - Bearing mounting shop.

4.0 Car Movement CRDX 3017 From Origin

Car CRDX 3017 originated on the NS on train C54.09 from Mingo Junction, Ohio, and traveled to Conway, Pennsylvania. A Conway Yard mechanical employee performed the Class 1 and Pre-departure inspection before departing. A review of the last 10 years of movement history of car CRDX 3017 indicates that it was

stationary twice over 6 months. From January 8, 2015, until October 3, 2015, the car showed no movement for 268 days, and from November 27, 2020, until July 29, 2021, the car showed no movement for 244 days. Although movement is only recorded when equipment moves past a reader on the mainline, cars can be moved within facilities or yards without being recorded.

5.0 Wheel Set and Bearing Examination

The separation of the L1 journal of axle 1 on car CRDX 3017 resulted in the derailment of the train in New Castle, Pennsylvania, on May 10, 2023. While on-scene investigators located and secured, for further analysis, the separated axle journal, the wheelset, and the following mating components: outer seal and outer seal wear ring, outer cone, bearing cup, inner cone, inner seal and inner seal wear ring, backing ring, and 12 rollers. The NTSB put out an open call for bid and ultimately selected Engineering Systems, Inc. (ESi) in Omaha, Nebraska, to perform teardown and documentation of the collected components and the remainder of the axle 1 wheel set. The teardown of the wheel set occurred on September 12, 2023, in the presence of NTSB investigators, technical advisors, and representatives of party members to the investigation.

During the examination, all legible part markings were recorded from the components. The markings showed the axle had been manufactured in March 1994 by Standard Forged Products - Johnstown, Pennsylvania. Markings on the wheels indicated they were cast wheels manufactured in February 2008 by Standard Steel LLC - Burnham, Pennsylvania. The R1 bearing cup had markings indicating it was manufactured by Brencos in 1980. The L1 bearing cup had damage that obscured most of the part markings, but a distinct "CO" was observed after indiscernible prior letters, likely indicating Brencos as the manufacturer; the year of manufacture of the L1 bearing cup could not be determined. The locking plates showed the bearings were reconditioned by A Stucki - Elizabethtown, Kentucky, in March 2008. Markings on the wheelset indicated the bearings had been mounted at Greenbriar Rail Services - Chicago Heights, Illinois, in March 2008.

The L1 bearing journal portion of the axle still had the end cap and locking plate installed, which were removed to expose manufacturer identification numbers on the axle. The reconditioned L1 bearing that failed had extensive thermal damage, and no traces of the polymer seals remained. The steel components within the reconditioned bearing had evidence of melting, portions of components galled and melted together, and extensive rub damage and plastic deformation. The rollers still assembled within the bearing were flattened and fused to the mating components.

The cages for both the inner and outer roller assemblies were comprised of steel. Spalling damage (imperfections on the surface due to cyclical loading resulting

in component fatigue damage) that occurred prior to the accident was observed on some areas of the bearing cup.

The mate R1 bearing was still installed on the axle and typical disassembly procedures outlined by Brenco, a bearing industry expert that the NTSB invited to serve as a technical advisor for this investigation, were performed using a 90-ton capacity bearing puller. Impact damage was observed on the cap screws and endcap resulting from the derailment, though the cap screw torques were only hand tight and the disassembly of the mate bearing proceeded smoothly without the need for destructive methods.

During disassembly, a sample of grease was collected for further evaluation. After disassembly, the mate R1 bearing parts were examined. The cages for both the inner and outer roller assemblies were comprised of steel. Markings on the outer cone indicated it had been reconditioned by Timken - Mascot, Tennessee in August 1993. Markings on the cup indicated it had been reconditioned by A Stucki - Elizabethtown, Kentucky, in March 2008. The rollers, cone race surfaces, and cup were cleaned and inspected. Marks consistent with hard particle damage were observed on several rollers and in some locations on the cup. Minor spalling damage was observed on the inboard cone. No signs of spalling or flat spots were observed on the rollers.

A full report of the teardown, attendees, and activities is attached in Appendix A.

The sample of grease collected from the mate R1 bearing was analyzed by SGS North America in Vallejo, California. The sample was tested for compliance with AAR M-942. Due to the sample size, the testing was limited to the following tests: ASTM D6304: Standard Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fisher Titration; ASTM D2265: Standard Test Method for Dropping Point of Lubricating Grease Over Wide Temperature Range; ASTM D1403: Standard test method for cone penetration of lubricating grease using one-quarter and one-half cone penetration equipment.

The results of these tests met the listed acceptance criteria for AAR M-942 for dropping point and cone penetration. Water content did not exceed the maximum under the accepted criteria.

In addition to the specification testing, the sample was tested for the presence of metals and other foreign materials using ASTM D7303: Standard Test Method for Determination for Metals and Lubricating Grease by Inductively Coupled Plasma, (ICP) Atomic Emission Spectroscopy. The presence of silicon indicated that there may have been dirt in the lubricant. Evidence of bushing/bearing wear was also found.

The sample was also analyzed using Fourier-transform infrared spectroscopy (FTIR). The resulting spectrum was consistent with a mineral oil/lithium-based grease.

A full report of the grease analysis is attached in Appendix B.

Submitted by:

Matthew C. Thompson
Railroad Accident Investigator