Effects of Long-Term Inactivity on Railcar Bearings Performance

M. Adame, K. Lopez, M.Abrego, C. Tarawneh, R. Jones, and H. Foltz
University Transportation Center for Railway Safety (UTCRS)
University of Texas Rio Grande Valley (UTRGV)
Edinburg, TX, USA

IHHA 2025
13TH INTERNATIONAL HEAVY HAUL ASSOCIATION CONFERENCE 2025
November 17-21, 2025 | The Broadmoor, Colorado Springs, CO, USA

Introduction

The National Transportation Safety Board (NTSB) investigation into the East Palestine, OH, derailment indicated that the failed bearing that caused the accident had two extended periods of inactivity (565 and 216 days). This observation raised the question whether prolonged inactivity could cause lubricant degradation leading to grease separation and compromised bearing performance. To address this, UTCRS, in collaboration with the NTSB, MxV Rail, and CSX Transportation, has undertaken a project to study the effects of long-term inactivity on bearing performance and service life. The preliminary findings are presented here. Note that the sample size is not significant for broad generalizations.

Methodology

CSX removed ten bearings from freight cars that had sat idle for three years. The bearings were pulled and shipped using special protocols to avoid any rotation that could redistribute the grease inside before they reached the test labs at UTCRS. Some bearings were opened immediately at UTCRS for inspection and lubricant sampling, while others were left assembled for performance testing on a laboratory test rig. During testing, both bearing temperature and vibration were monitored.

The performance tests were initially planned for 100,000 miles (161,000 km) with the speed and load gradually increased to 66 mph (106 km/h) and 34,400 lbs. (153 kN) per bearing, respectively. The test axle setup consisted of two inactive bearings plus two freshly assembled, healthy (defect-free) bearings that served as controls. The average operating temperature of each bearing, along with the temperature difference between the control average and the inactive bearings are shown in Table 1. The lubricant loss for inactive and control bearings is shown in Table 2.

Experiment	Bearing	Avg. Temp [°C]	Temperature Above Control Avg. [°C]
277A	B1 - Control	52	7 (B2 - R7) 14 (B3 – L7)
	B4 - Control	52	
	B2 - R7	59	
	B3 - L7	66	
282A	B1 - Control	50	15 (B2 – L4) 17 (B3 – R4)
	B4 - Control	50	
	B2 - L4	65	
	B3 - R4	67	
283A	B1 - Control	45	16 (B2 – L2) 25 (B3 – R2)
	B4 - Control	47	
	B2 - L2	62	
	B3 - R2	71	

Table 1: Temperature Differences

Experiment	Bearing	Grease Loss		
		[oz]	[g]	% Loss
277A	B1 - Control	0.32	9.07	1.5
	B2 - R7	3.84	108.86	17.5
	B3 - L7	0.96	27.22	4.4
	B4 - Control	0	0	0
282A	B1 - Control	0.32	9.07	1.5
	B2 – R4	0.48	13.61	2.2
	B3 – L4	0.48	13.61	2.2
	B4 - Control	0.32	9.07	1.5
283A	B1 - Control	N/A	N/A	N/A
	B2 – R2	3.2	90.72	14.5
	B3 – L2	2.4	68.04	10.9
	B4 - Control	N/A	N/A	N/A

Table 2: Lubricant Loss

Results

- Higher than normal torque was required to initiate rotation at the start of the test runs.
- Bearing R7 emitted sparks from the seal after 163 mi (262 km) and the seal dislodged after 6,731 mi (10,832 km).
- Test with Bearings R7 and L7 terminated early at 93,554 miles (150,561 km) due to impending failure as Bearing R7 began indexing under full railcar load. Figures 3-5 show damage found in post-test inspection.
- Bearings R4 and L4 ran with no notable incident other than losing 2.2% of their initial grease content. See Figure 5.
- Bearings R2 and L2 ran with no notable incident other than losing 14.5% and 10.9% of their initial grease content, respectively.
- A small spall with an area of 3.87 mm^2 (0.006 in^2) was found on the inboard cone of Bearing R2. This spall is within the AAR allowable spall size.

The test bearings typically operated at less than 50°C (90°F) above ambient, and about 7-25°C (13-45°F) hotter than the control bearings. However, they remained well below the 94°C (170°F) above ambient threshold recommended by the AAR for hot bearing detectors (HBDs). See Figure 7.

Figure 3: Cup Damage, Bearing R7

Figure 4: Cone Damage, Bearing R7

Figure 5: Cracked Cone, Bearing R7

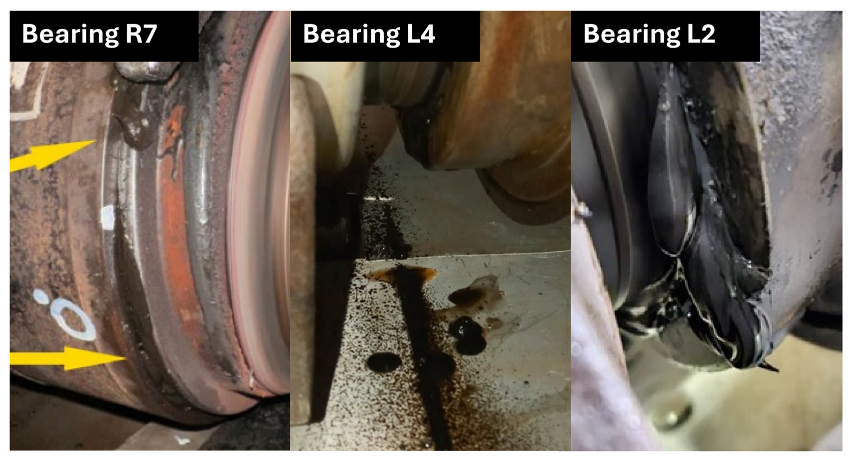

Figure 6: Grease Release, R7, L4, L2

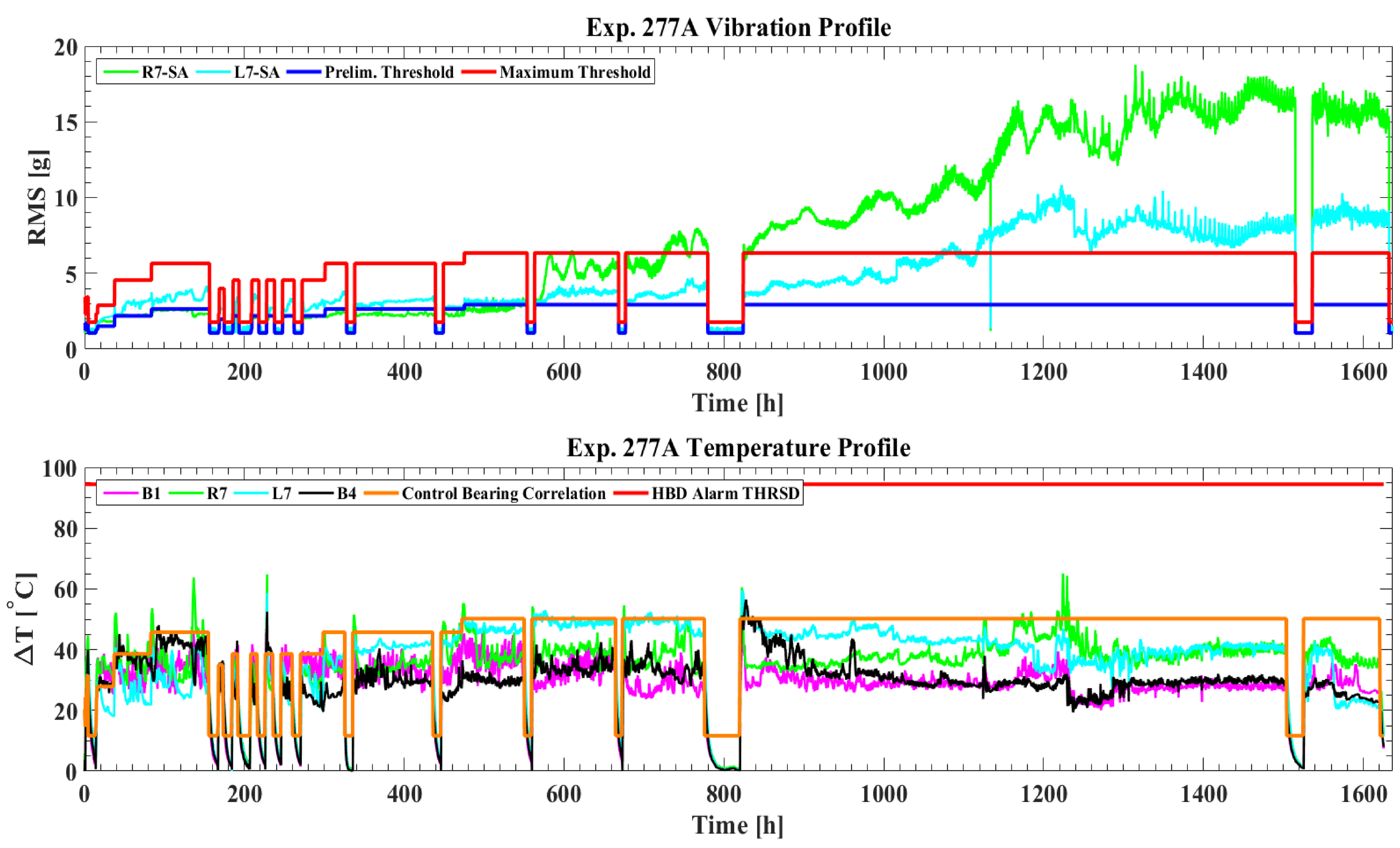

Figure 7: Vibration and Temperature for R7 and L7. Temperatures remain well below the AAR HBD thresholds, but vibration shows progressing damage.

Conclusions

The preliminary results demonstrate some impacts of extended inactivity on the degradation of railcar bearings. While bearings exposed to long-term inactivity may still operate within safe limits for a significant distance, they are prone to developing defects, such as spalling or grease leakage, which can compromise their performance over time. Temperature monitoring alone does not adequately detect early signs of bearing failure; however, vibration monitoring can identify mechanical damage before it leads to catastrophic failure. This underscores the importance of proactive condition monitoring of rolling stock through both temperature and vibration to prevent accidents caused by bearing failures in freight railcars. More testing is still needed to provide a meaningful statistical analysis for broad generalizations.

Acknowledgments

The authors acknowledge the University Transportation Center for Railway Safety (UTCRS) at UTRGV for support of this study through USDOT UTC Grant No. 69A3552348340.

For further information please contact:
Constantine Tarawneh, UTCRS
Constantine.Tarawneh@utrgv.edu