Effect of Long-Term Inactivity on Railcar Bearing Lubricant Performance

Exhibit D

Recipient/Grant (Contract) Number: University of Texas Rio Grande Valley (UTRGV)/Grant No. 69A3552348340

Center Name: University Transportation Center for Railway Safety (UTCRS)

Research Priority: Promoting Safety

Principal Investigator(s): Robert Jones (PI, UTRGV), Constantine Tarawneh (Co-PI, UTRGV), Jose Taha Tijerina (Co-PI, UTRGV), and Heinrich Foltz (Co-PI, UTRGV)

Project Partners: CSX Transportation, MxV Rail, and National Transportation Safety Board (NTSB)

Research Project Funding: $78,230 (Federal), $76,957 (Non-Federal Cost Share)

Project Start and End Date: 06/01/2024 to 08/31/2025

Project Description: The performance of railroad bearings that sit idle in railyards, large industrial plants, or shipping ports has only recently been explored. Some of the bearings, with documented periods of inactivity exceeding 18 months, have been associated with major derailments. This provides a basis for concerns that the inactive periods contributed to early failure, possibly through degradation of the grease properties brought on by moisture intake or grease separation leading to uneven protection of the metal components. The proposed work builds on prior efforts conducted in collaboration with CSX Transportation, MxV Rail, and the National Transportation Safety Board (NTSB), and seeks to improve our understanding of the effects of long-term inactivity on lubricant properties.

The proposed work will consist of (a) preparation of two test bearings which will be placed outdoors in a position to receive direct sunlight, (b) placement of grease samples in the same location in a simulated bearing housing to mimic the thermal cycle of a sun-exposed bearing, (c) regular sampling from the simulated bearing housing to monitor long-term changes in lubricant performance and condition, (d) at 23 weeks and 48 weeks, bearings will be retrieved and installed on a laboratory test rig and run for 15,000 simulated miles with continuous performance monitoring of temperature rise, vibration spectra, and power consumption, (e) post-test inspection including disassembly, teardown, and visual inspection of all bearing components, and (f) analysis of the grease composition at all stages with specific focus on loss of oxidation inhibitors and changes in tribological performance.

US DOT Priorities: The proposed work in this project is aligned with five of the six USDOT strategic goals: **(a) Safety:** The project directly investigates a potential safety concern that has been identified by NTSB. **(b) Economic Strength:** Unscheduled stoppages and field repairs cause serious economic losses for rail companies and their customers, and other users of the track. **(c) Equity:** UTRGV is a minority serving institution with an established record of training students from underrepresented groups and placing them in professional positions in the transportation industry. This project will directly employ two students, and indirectly support the employment of several others. **(d) Sustainability:** By enabling proactive preventive maintenance, this project will extend the useful lifetime of rolling stock, and thus amortize the carbon footprint of manufacturing a railcar over a longer period. It will reduce the number of environmentally significant derailments. **(e) Transformation:** The results of this study will provide invaluable information to the rail industry and federal agencies that can recommend policy changes leading to safety guidelines defining acceptable periods of bearing inactivity.

Outputs: The expected products include:

1. Completed laboratory testing of bearings.

2. Logs of temperature, vibration, and power data acquired throughout each test.
3. Results of Thermogravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC) analysis of lubricants before and at various aging times.
4. Results of Tribological evaluations: Coefficient of Friction (COF), Wear Scar Diameter (WSD), and friction torque.
5. Results of Rheological evaluations: viscosity, storage/loss modulus.
6. Final report with findings.
7. One or more conference or journal publications. At a minimum, we will submit a paper to the ASME Joint Rail Conference (JRC) at the first conference after results are available.

Outcomes/Impacts: The primary impact of the research is answering the question of what effects long periods of inactivity have on lubricant properties and bearing performance, reliability, and service life. However, the research will have impacts beyond this specific question. **Industry Impact:** The results could lead to recommendations for industry best practices; for example, a recommendation to move inactive railcars by a short distance at given intervals, or a recommendation to take weighted inactive time into account when predicting bearing mileage. **Educational Impact:** The UTCRS portions of the project will be carried out by students working under the supervision of the PIs. As a minority serving institution in a rapidly growing metropolitan area, we anticipate that most of the students will be from underrepresented groups. The students will gain invaluable experience in operating lubricant test equipment, bearing test equipment and in conducting tests according to AAR and ASTM standards. We anticipate that at least four undergraduate and graduate students will participate in the various aspects of the project.

Final Research Report: Upon completion of the project, a URL link to the final report will be provided.