

Effect of Long-Term Inactivity on Railcar Bearings

Deliverables and Reporting Requirements for UTC Grants Awarded in 2023 (June 2023)

Exhibit D

Research Project Requirement Template

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): Constantine Tarawneh (PI, UTRGV), Robert Jones (Co-PI, UTRGV), Heinrich Foltz (Co-PI, UTRGV)

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

Research Project Funding: \$88,899 (Federal), \$38,962 (Non-Federal Cost Share)

Project Start and End Date: 09/01/2023 to 08/31/2024

Project Description: The performance of railroad bearings that sit idle in railyards, large industrial plants, or shipping ports has not been previously explored. Some of the bearings, with documented periods of inactivity exceeding 18 months, have been associated with major derailments. The aforementioned has led to concerns in whether 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, to be conducted in collaboration with CSX Transportation and in consultation with the National Transportation Safety Board (NTSB), aims to answer the question of whether long-term inactivity has significant effect on bearing performance and service life, and whether these are tied to changes in the lubricant.

The proposed work would consist of (a) identification of installed bearings on railcars that have not moved for periods of six months or longer, (b) removal of the bearings with minimum disruption to the lubricant, (c) pre-test inspection of the still-assembled bearings, (d) installation and service life testing on a laboratory test rig, 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 with specific focus on loss of oxidation inhibitors and evidence of lubricant separation.

US DOT Priorities: The proposed work in this project is aligned with four of the six USDOT strategic goals, which are listed hereafter: **(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:** Identifying causes of early bearing failure will reduce the number of environmentally significant derailments.

Outputs: The expected products and deliverables will include:

- a. Completed laboratory testing of bearings.

- b. Documentation of all pre- and post-test mechanical measurements, including photographs.
- c. Logs of temperature, vibration, and power data acquired throughout each test.
- d. Results of TGA and DSC analysis of lubricants.
- e. Final report with findings.
- f. 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 whether long periods of inactivity have a significant impact on 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 remaining bearing mileage. **Educational Impact:** The UTCRS portions of the project will be conducted 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 and that some fraction of them may have the chance to work with CSX engineers. The students will gain invaluable experience in operating bearing test equipment and in conducting tests according to AAR standards. We anticipate that at least six 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.