Advanced Model for Predicting Buckling in Rails

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

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): Dr. David H. Allen (PI, Texas A&M University (TAMU))

Project Partners: MxV Rail and BNSF

Research Project Funding: $179,514 (Federal), $87,028 (Non-Federal Cost Share)

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

Project Description: It is well-known that track buckling is one of the most commonplace causes of train derailments. Accordingly, with partial funding provided by our previous USDOT UTC and the Technology Transportation Center, Inc. (TTCI, now MxV Rail), we are continuing to develop a track buckling model for deployment by MxV Rail as a tool for predicting track buckling, A significant advancement over currently deployed track buckling models, our technology includes an open-source nonlinear finite element algorithm that is user-friendly. Briefly, our track buckling model accounts for the effects of the following on track buckling: both longitudinal and lateral track walk; rail neutral temperature (RNT); both lateral and longitudinal crosstie-aggregate interfacial friction; track modulus; nonlinear track liftoff; and broken spikes. In addition, it is sufficiently robust to be capable for additional environmental causes to be described herein and in a companion proposal. Given these advanced capabilities, track engineers will be able to dramatically improve track safety.

US DOT Priorities: This research aligns with the following U.S. DoT goals: safety, economic strength and global competitiveness, climate and sustainability, and transformation.

Outputs: The expected products include:

1. Further predictions of the effects of longitudinal and lateral friction on track buckling.
2. Continued predictions of the range of buckling loads caused by variations in experimentally determined values of track modulus and ballast-crosstie coefficients of friction.
3. The development of a Beta version of our buckling model applicable to track on curves.
4. Dissemination of our results via conference presentations, workshops, conference articles, and journal articles, as well as meetings with BNSF and MxV Rail.

Outcomes/Impacts: The broader impact of this research is that it will significantly impact railway safety via the development of more scientifically based track failure models that will significantly mitigate the probability of future environmentally and socially impactful train derailment incidents.

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