FEDERAL RAILROAD ADMINISTRATION

RAIL
MOVING AMERICA FORWARD

FRA OFFICE OF RESEARCH, DEVELOPMENT & TECHNOLOGY

CURRENT RESEARCH PROJECTS

U.S. Department of Transportation
Federal Railroad Administration

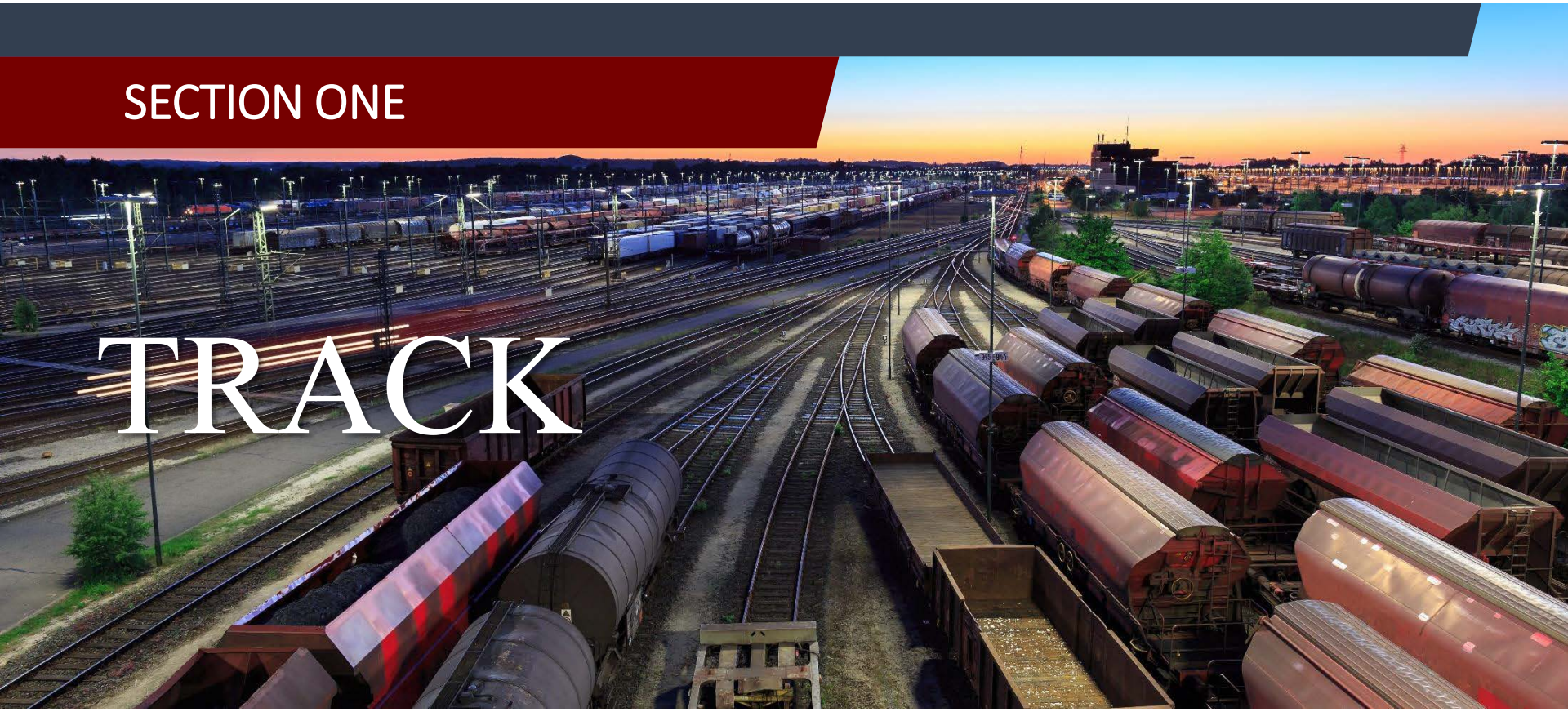
2019 TRB Annual Conference

RESEARCH SECTIONS

1. Track
2. Rolling Stock
3. Train Control & Communications
4. Human Factors

SECTION ONE

TRACK

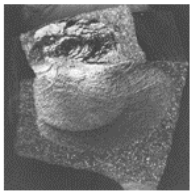


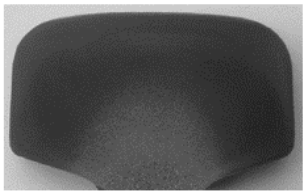
U.S. Department of Transportation
Federal Railroad Administration

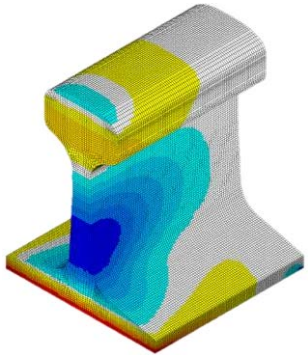
Defect Growth Characterization in Modern Rail Steel

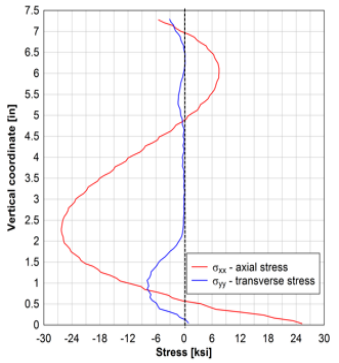
PROJECT DESCRIPTION

- Process and analyze all the data generated in Phase I in reference to existing data for legacy rails, including a comparative study.
- Perform detailed crack growth analyses, accounting for both internal (i.e., residual) and external stresses in the rails.
- Determine the safe inspection interval for modern rails based on the above analyses.









RAILROAD IMPACT

- Detailed experimental characterization of microstructural gradient and residual stress effects in head-hardened rails.
- Framework for modern rail characterization with a consistent testing protocol applicable to variety of rail grades and types.
- Modular/ building block development framework that considers previously collected data and expertise, and allows multiple extensions to account for advancements in material science and rail manufacturing technology – paradigm shift.
- Process developed could be applied to determine optimal inspection intervals or even the remaining life of the rail, given the flaw detected during routine inspection. This could aid repair scheduling as well as analysis of the delayed remedial action scenarios.

PROJECT PARTNER(S)

- Weidlinger Associates, Inc.
- Harvard University
- Lehigh University
- ArcelorMittal
- National Institute of Standards and Technology (NIST)

COST & SCHEDULE

- Funding: $697,016
- Project Duration: January 2016 – June 2019

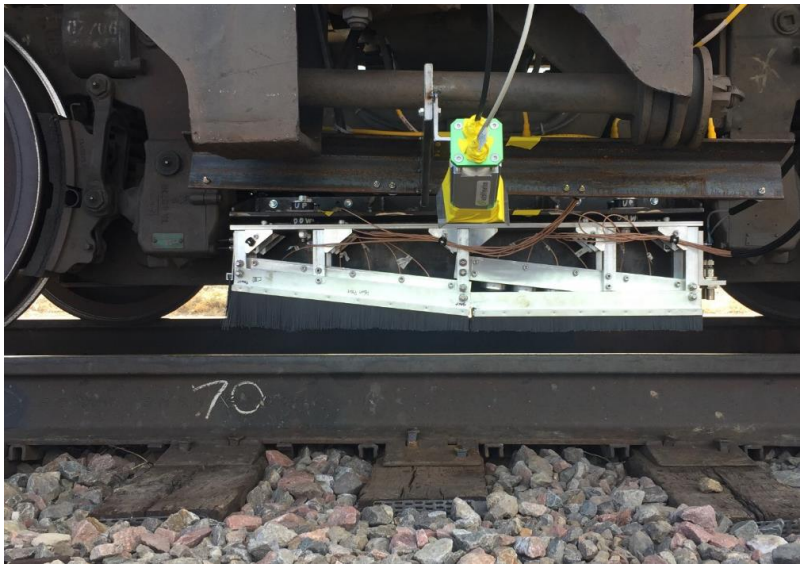
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Robert Wilson, PhD • (617) 494-2265 • robert.wilson@dot.gov

Non-Contact Rail Inspection Prototype (Passive-Only System for High-Speed Rail Inspection)

PROJECT DESCRIPTION

- Evaluate a new technique that uses non-contact acoustic sensors and special signal processing algorithms to detect internal defects in rails by exploiting the acoustic excitations naturally induced in the rail by the wheels of a running train.
- Develop new inspection concept based on the application of special signal processing algorithms aimed at extracting a "stable" acoustic Transfer Function between two points of the rail despite the "random" acoustic excitation by the rolling train wheels.
- Perform successful feasibility tests of the "passive" Transfer Function extraction were conducted in September 2016 at the Transportation Technology Center (TTC) by using a prototype designed by UCSD to speeds of 80 mph.
- Complete and test second generation prototype at the TTC High Tonnage Loop (first tests completed November 2018).



PROJECT PARTNER(S)

- University of California, San Diego (UCSD) – grantee
- ENSCO, Inc. – test support
- Transportation Technology Center, Inc. (TTCI) – test support

COST & SCHEDULE

- Funding: $561,323
- Project Duration: May 2016 – May 2019

RAILROAD IMPACT

- Passive rail inspection technology that exploits the natural train wheel excitations would enable extremely high testing speeds, well beyond the ~ 25 mph maximum speed currently allowed by conventional (e.g., RSU-based) rail inspection cars.
- Inspecting the rail at regular train speeds would simplify scheduling of rail inspections around normal traffic.
- "Smart train" approach: this technology could be used on regular trains to enable multiple redundant inspections of the same track, thereby improving the inspection reliability and, ultimately, the safety of transportation.

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Robert Wilson, PhD • (617) 494-2265 • robert.wilson@dot.gov

Robust Railway Track Crack Detection System Using Thermal Signatures

PROJECT DESCRIPTION

Develop a prototype sensor with low-power microprocessor, InfraRed (IR) camera, GPS and gyro to detect rail breaks from the back of a train.

Our Phase II objectives are:

- Construct smaller second generation sensor platform.
- Use a higher resolution IR camera for broken rail detection application.
- Employ various image processing and enhancement techniques to increase the likelihood of break detection.
- Better discriminate between true cracks and background clutters.
- Incorporate feedback from MBTA.

PROJECT PARTNER(S)

- Migma Systems, Inc.
- Massachusetts Bay Transportation Authority (MBTA)

COST & SCHEDULE

- Funding: Approx. $300,000 (cost to date)
- Project Duration: May 2017 – May 2019

RAILROAD IMPACT

- Automated railway inspection is critical for ensuring the safety of public transportation. Rails often break under trains but do not lead to immediate derailment until further damage occurs at the fracture, causing catastrophic derailment.
- Video cameras have been used to detect the rail cracks with limited success as the video image quality is highly impacted by the environment such as alignment of light source and weather conditions. The system developed under this Small Business Innovation Research (SBIR) Phase II project utilizes an IR camera for the detection of rail cracks through their unique thermal signatures. It can be mounted on the back of trains and detect cracks in real time as trains are in service.

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Robert Wilson, PhD • (617) 494-2265 • robert.wilson@dot.gov

High-Speed Broken Rail Detection

PROJECT DESCRIPTION

- Demonstrate a second generation prototype detection system.
- Automated detection of broken rails.
- Real-time imaging of rail morphology allows breaks to be differentiated from rail joints.
- Novel high-speed detector enables detection of broken rails from trains at normal operational speeds (does not require dedicated metrology/inspection).
- Field tests being conducted on Vermont Rail System.

RAILROAD IMPACT

- Broken rails or welds are a common cause of Class I mainline derailments. Rails often break under trains but do not cause immediate derailment until further damage leads to catastrophic failure.
- Current inspection methods are periodic and may miss the critical period during which initial damage progresses to complete failure.
- Detection of early-stage rail defects from normal service revenue trains enables repair before catastrophic failure and derailment.

PROJECT PARTNER(S)

- Creare, LLC
- Vermont Rail System

COST & SCHEDULE

- Funding: $299,000
- Project Duration: May 2017 – May 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Robert Wilson, PhD • (617) 494-2265 • robert.wilson@dot.gov

Quantification and Evaluation of Rail Flaw Inspection Practices and Technologies

PROJECT DESCRIPTION

Rail Flaw Library of Associated Defects (RF-LOAD)

- Collect naturally occurring flaws from revenue service operations. These rail flaw samples will be used for training of inspectors using hand-held Non-Destructive Evaluation (NDE) instruments, Probability of Detection (POD) method development, and initial development of advanced inspection technologies.

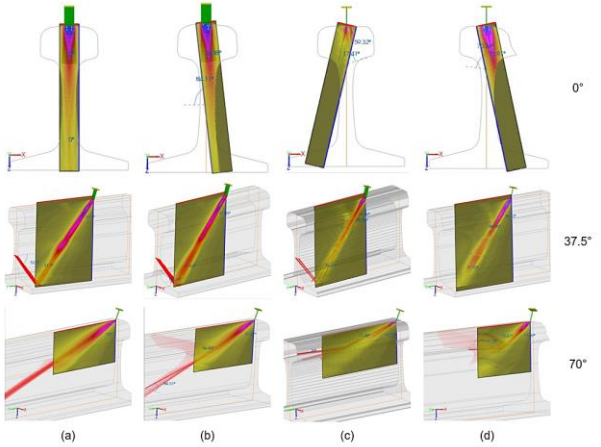
Ultrasonic Beam Modeling & Inspection Simulations

- Conduct Ultrasonic Testing (UT) simulations to better understand ultrasonic beam and probe responses for commonly missed flaws (shape, size, orientations) in revenue service under different inspection scenarios.

Flash Infrared Thermography (IRT)

- Assess the feasibility of using this technology at track speed for non-contact in motion rail base inspection

Rail Flaw Library



Ultrasonic beam field computation (transmission) of ultrasonic transducers for different 136 RE rail head profiles. (a) Virgin rail profile; (b) Normal used profile; (c) Surface damaged profile; (d) Gage wear profile.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: $449,000
- Project Duration: July 2016 – May 2019

RAILROAD IMPACT

- Support future research directed towards evaluating and improving the performance of current and future rail inspection technologies for use in detecting rail flaws as well as the methods for quantifying them.
- Rail flaw library will serve other researchers to allow them direct access to the realistic rail flaw samples for validating their work on rail inspection technologies.
- Achieve higher reliability of Ultrasonic NDE inspection for rail flaw detection and characterization.
- Optimized ultrasonic parameters and inspection angles for improved detection of missed flaws in revenue service.

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Robert Wilson, PhD • (617) 494-2265 • robert.wilson@dot.gov

Rail Neutral Temperature (RNT) and Longitudinal Force Management

PROJECT DESCRIPTION

- **RNT Data Mining and Analysis**
- **Monitoring RNT and Curve Movement under Heavy Axle Loads**
- **Evaluation of Potential Curve Monitoring Technologies**
- **RNT Workshop**
  - Develop a workshop to document the best RNT management practices from industry and FRA.
- **RNT Test Bed Design**
  - This task will develop an RNT and Track Buckling Test Bed design concept and performance requirements. The potential exists for installation of a track segment that can have independent rail force loading capability while still being part of an operating track, such as the High Tonnage Loop at the Transportation Technology Center.
- **Track Maintenance Effects on RNT**

RAILROAD IMPACT

- Characterization of RNT changes in revenue service track.
- Characterization of rail force at the time of weld and rail failure under “real world” conditions.
- Evaluation of new methods to monitor curve movement.
- Understand how curves breathe with and without train traffic.
- Measure rail movement and RNT changes simultaneously in curves at the FAST Facility.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: Approx. $524,000
- Project Duration: July 2016 – December 2019

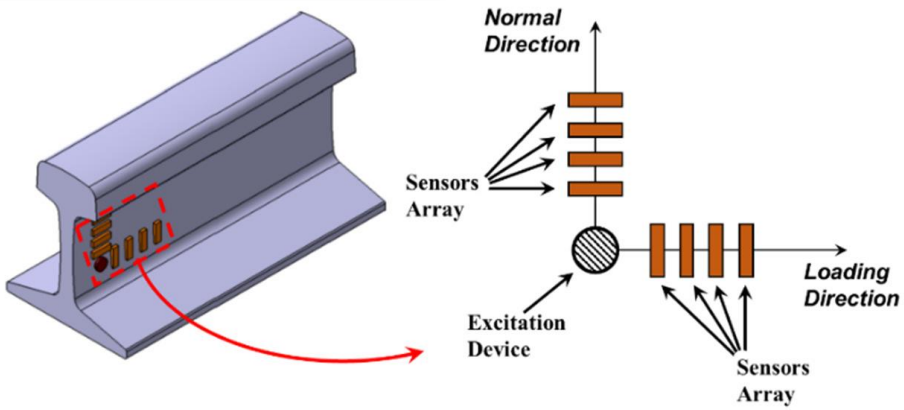
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Robert Wilson, PhD • (617) 494-2265 • robert.wilson@dot.gov

Rail Neutral Temperature (RNT) Measurement by Virginia Tech

PROJECT DESCRIPTION

- The primary goal of this research effort is to develop, validate, and implement a novel acoustoelastic-based approach for longitudinal rail stress and neutral temperature measurement.
- The proposed approach has two fundamentally distinctive features compared to current ultrasonic practices, these are:
    1. The utilization of *low-frequency* flexural waves to calculate the state-of-stress, which offers enhanced sensitivity and robustness.
    2. The utilization of the vertical (normal-to-loading) direction as a reference, which further enhances the robustness of the technique and allows compensating for uncertainties in rail characteristics.



RAILROAD IMPACT

- Potential to provide reliable, *reference-free* measurements of longitudinal rail stress and neutral temperature.
- Better understanding and management of RNT through regular measurements.
- Ability to spot-check RNT on any given rail.
- Potential to reduce track buckles and pull-a-parts.

PROJECT PARTNER(S)

- Virginia Tech
- Norfolk Southern

COST & SCHEDULE

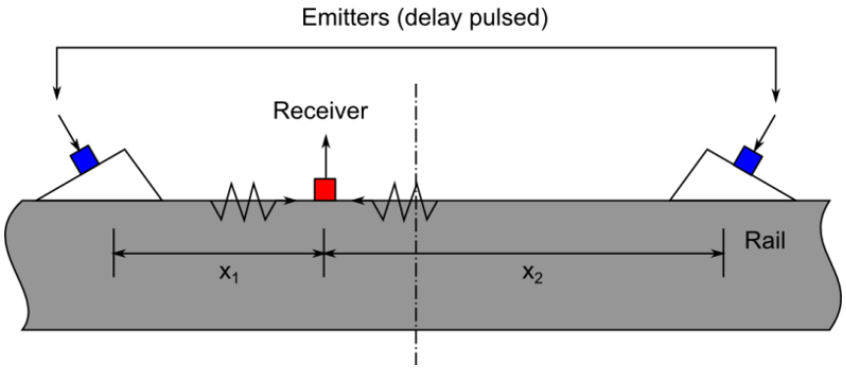
- Funding: $141,000
- Project Duration: July 2018 – July 2020

FRA PROJECT MANAGER: Robert Wilson, PhD • (617) 494-2265 • robert.wilson@dot.gov

Rail Neutral Temperature (RNT) Measurement (University of Sheffield)

PROJECT DESCRIPTION

- Apply an ultrasonic interferometry approach to the problem of longitudinal rail stress, and develop and demonstrate a prototype measurement device which overcomes current measurement limitations. The system will be tested on track with the assistance of FRA staff who will ensure safe and suitable trials are performed.
- The proposed ultrasonic measurement system will consist of data acquisition hardware, processing software mounting clamp and sensors. It will offer a way of measuring the stress state of the rail non-destructively and in-situ without the need to unpin or modify the rail. Fast measurements (<5 min), of high resolution could be carried out by a single person. Neutral temperature (NT) predictions with a confidence band of ±5°F or better are targeted.



RAILROAD IMPACT

- Potential to provide reliable, *reference-free* measurements of longitudinal rail stress and neutral temperature.
- Better understanding and management of RNT through regular measurements.
- Ability to spot-check RNT on any given rail.
- Potential to reduce track buckles and pull-a-parts.

PROJECT PARTNER(S)

- The University of Sheffield
- Transportation Technology Center, Inc. (TTCI) – test support

COST & SCHEDULE

- Funding: $150,000
- Project Duration: November 2018 – November 2019

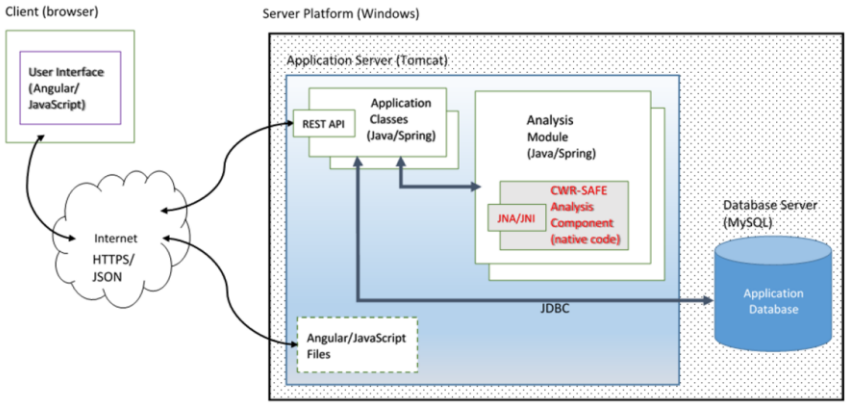
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Robert Wilson, PhD • (617) 494-2265 • robert.wilson@dot.gov

Upgrade of CWR-SAFE Software

PROJECT DESCRIPTION

- Upgrade CWR-SAFE, a computational model for track buckling safety analyses, to run on modern computer operating systems and mobile platforms.
- Promote FRA and industry use of the CWR-SAFE application through provision of the utility via secure website.



RAILROAD IMPACT

- Provide industry with a tool for a deterministic evaluation of buckling strength and safety.
- Prevent or minimize consequences of track buckling related derailments.
- Establish better awareness of buckling danger for track personnel.

PROJECT PARTNER(S)

- ENSCO, Inc.

COST & SCHEDULE

- Funding: $150,000
- Project Duration: September 2018 – September 2019

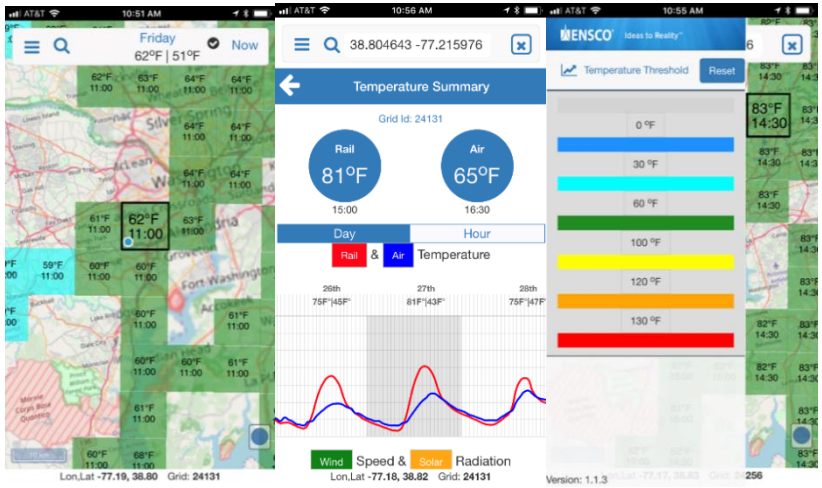
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Robert Wilson, PhD • (617) 494-2265 • robert.wilson@dot.gov

Rail Temperature and Buckling Risk Prediction

PROJECT DESCRIPTION

- Expand the functionality of FRA's existing Rail Temperature and Buckling Risk Prediction web-mobile application.
- Support training for use of the application including user documentation and training webinars.



RAILROAD IMPACT

- Provide industry with a tool to issue heat slow orders in a more effective and targeted way.
- Prevent or minimize consequences of track buckling related derailments by improved heat slow order management process.
- Establish better awareness of rail temperature for track personnel through use of a utility that provides information in near real time.

PROJECT PARTNER(S)

- ENSCO, Inc.
- Amtrak
- Norfolk Southern

COST & SCHEDULE

- Funding: $39,942
- Project Duration: September 2018 – December 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Robert Wilson, PhD • (617) 494-2265 • robert.wilson@dot.gov

Ballast Waiver Support

PROJECT DESCRIPTION

- Better define the performance, degradation, variability, and safety of “reduced performance” ballast through a better understanding of its long-term behavior.
- Collect and analyze pertinent information using track inspection vehicles, long-term track instrumentation, Ground Penetrating Radar and other available data.
- Continue stakeholder support for the operations under the fouled ballast waiver and the activities related to concurrent joint Association of American Railroads-FRA research effort.

RAILROAD IMPACT

- Better understanding of “reduced performance” or “fouled” ballast under a range of weather conditions, and its affect on track performance and safety critical conditions.
- Development of objective criteria for both railroads and FRA inspectors to use for identifying and managing “fouled” ballast conditions.
- Production of information for potential data driven recommendations related to enforcement of §213.103 of the Track Safety Standards.
- Improved railroad safety and maintenance operations.

PROJECT PARTNER(S)

- ENSCO, Inc.
- Association of American Railroads (AAR)
- BNSF
- University of Illinois, Urbana-Champaign
- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: $404,455
- Project Duration: August 2018 – July 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Hugh Thompson • (202) 493-6383 • hugh.thompson@dot.gov

Quantification of Track Instabilities Due to Ballast Movement at Special Locations Using Integrated Sensor Networks

PROJECT DESCRIPTION

- Develop a platform of hardware and software to: (1) quantify in the field ballast failure mechanism and criteria; and (2) offer a platform for the future "real-time ballast stability evaluation and monitoring program."
- Develop advanced sensors with: (a) onboard programmable ballast failure mechanism and criteria algorithm; and, (b) advanced communication protocols such as "iBeacon."
- Install field instrumentation of the advanced sensor networks at different locations under different traffic and maintenance conditions.
- Initiate the "real-time ballast stability evaluation and monitoring program" based on validated ballast failure mechanism and criteria.

RAILROAD IMPACT

- Real-time data collection and integrated analysis system allows railroad companies to more accurately identify the instantaneous condition of their ballast and track-bed and proactively assign maintenance windows to ensure safe and efficient train operation with the least amount of train delay due to maintenance outages.
- Allow railroads to identify an objective threshold by which they can establish a window or opportunity for ideal track maintenance.
- Technology is "moving platform ready" with "iBeacon" technology because sensor data can not only be sent to the engineers in real time but can also be stored and "picked up" by geometry cars passing by, with which track engineers will have significant higher resolution and real-time images of their track in terms of safety and serviceability.

PROJECT PARTNER(S)

- Penn. State
- HyGround
- Amtrak
- Railroad Technology & Services (RTS)

COST & SCHEDULE

- FRA BAA Funding: $322,842 – Scheduled for 24 months (two phases)
- Granted In-kind Support from:
  - RTS – 50 "SmartRocks" free of charge and other technical support (equivalent to a cash value of $48,600)
  - Amtrak – site access and protection, technical support, etc.
- Project Duration: September 2018– August 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Hugh Thompson • (202) 493-6383 • hugh.thompson@dot.gov

Innovative Track Inspection Technologies

PROJECT DESCRIPTION

- Support for the introduction of new track inspection approaches and advancement of existing track inspection technologies with focus on data interpretation and analysis.
- Research into assessment of FRA's Vertical Track Deflection Measurement System (VTDMS) and alternative approaches to directly measure vertical defection under given loads.
- Provide engineering and data analysis support for Gage Restraint Measurement System (GRMS), Ground Penetrating Radar (GPR), VTDMS, and similar track evaluation technologies.
- Support field activities for FRA track research.

RAILROAD IMPACT

- Broaden the application of innovative technologies to detect degraded track conditions.
- Improve the understanding of track behavior through characterization of various track components and parameters.
- Provide practical uses of technology to improve railroad safety and maintenance practices.

PROJECT PARTNER(S)

- ENSCO, Inc.

COST & SCHEDULE

- Funding: $112,486
- Project Duration: August 2018 – April 2019

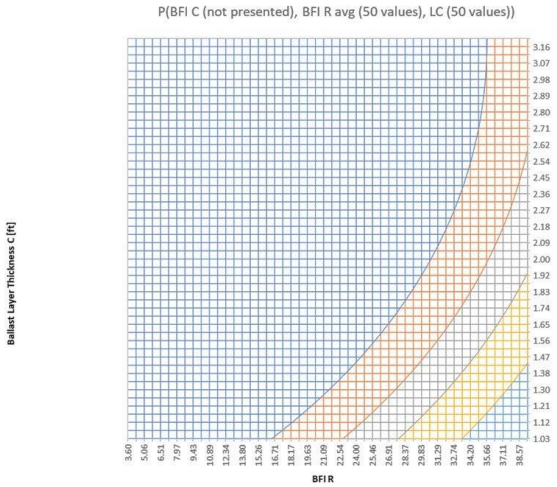
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Hugh Thompson • (202) 493-6383 • hugh.thompson@dot.gov

Relationship Between Track Geometry Defects and Measured Track Subsurface Conditions

PROJECT DESCRIPTION

- Develop engineering and/or statistical relationships between track substructure inspection parameters and track geometry defects.
- Specific focus on the relationship between ballast condition as defined by Ground Penetrating Radar (GPR) and development of track geometry defects.
- Provide identification of track locations with potential for development of track geometry defects that will grow to unsafe levels.
- Develop analysis algorithm(s) to correlate key GPR inspection parameters, with track geometry defects



RAILROAD IMPACT

- GPR is being used on an increasing basis by railroads to identify ballast condition.
  - Key GPR parameters include Ballast Fouling index and Ballast Layer Thickness.
- The ability to use GPR inspection to identify potential track geometry initiation/development sites would be a valuable tool for railroads.
  - Provides information on where high-risk track geometry could develop.

PROJECT PARTNER(S)

- University of Delaware (Railroad Engineering and Safety Program)
- GREX

COST & SCHEDULE

- Funding: $289,842 overall cost
- Project Duration: August 2016 – December 2018
  - Report to be issued in 2018
  - 24-month schedule included data collection and preparation, development of engineering relationships, statistical analysis, development of analysis algorithms
  - Partner participation for data collection and analysis (labor).

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Hugh Thompson • (202) 493-6383 • hugh.thompson@dot.gov

Near Real-Time Processing of Targeted Ground Penetrating Radar (GPR) Data for Ballast Condition

PROJECT DESCRIPTION

- Support introduction of new track inspection approaches and advancement of existing track inspection technologies with focus on data interpretation and analysis.
- Research into assessment of FRA's Vertical Track Deflection Measurement System (VTDMS) and alternative approaches to directly measure vertical defection under given loads.
- Provide engineering and data analysis support for Gage Restraint Measurement System (GRMS), Ground Penetrating Radar (GPR), VTDMS, and similar track evaluation technologies.
- Support field activities for FRA track research.

RAILROAD IMPACT

- Broaden the application of innovative technologies to detect degraded track conditions.
- Improve the understanding of track behavior through characterization of various track components and parameters.
- Provide practical uses of technology to improve railroad safety and maintenance practices.

PROJECT PARTNER(S)

- Balfour Beatty
- Zetica Rail

COST & SCHEDULE

- Funding: $378,782
- Project Duration: September 2018 – August 2019

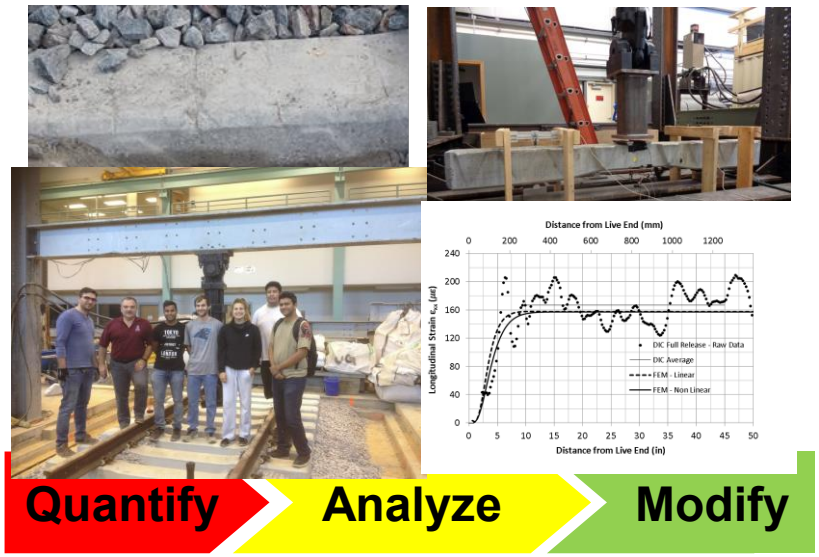
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGERS: Hugh Thompson • (202) 493-6383 • hugh.thompson@dot.gov
James Payne • (202) 493-6005 • james.payne@dot.gov

Concrete Tie Design and Performance Research

PROJECT DESCRIPTION

- Basic research to quantify the stress state of the track superstructure.
- Review and revise FRA regulations pertaining to concrete ties.
- Advanced computer modeling of ties and track systems.
- Research new materials for improved concrete tie performance.
- Improve testing standards for concrete ties.
- Study the operating environment of concrete ties, especially areas that foster tie abrasion and poor support conditions.
- Create new technologies to assess the internal stress state of concrete ties.



RAILROAD IMPACT

- Basic and applied research to establish sound design, construction, and testing practices for concrete crossties.
- Advance the state of science in the area of concrete ties for high-speed rail and freight applications.
- Develop industry recommended practices and testing standards for design and production of concrete ties.
- Create useful tools and techniques for improving concrete tie quality and performance.
- Study the operating environment and understand the effects of this environment on the performance of concrete ties.

PROJECT PARTNER(S)

- Universities
  - University of Illinois, Kansas State, University of South Carolina, Western New England University, University of Florida
- Class I Railroads (all)
  - Rocla, CXT, GIC and other suppliers

COST & SCHEDULE

- Funding: Total program – Approx. $1,000,000/year
- Project Duration: June 2011 – June 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Cameron Stuart • (202) 493-6384 • cameron.stuart@dot.gov

Automated Frog Repair Technology

PROJECT DESCRIPTION

- Phase 2 project includes field testing of repaired frogs on Class I railroads.
- Development of metal cored electrode to reduce weld slag and eliminate inter-pass cleaning.
- Develop conceptual framework for field-deployable automated repair system.

RAILROAD IMPACT

- Automated, improved repair process for Austenitic Manganese Steel (AMS) frogs.
- Eliminates errors and inconsistencies in field repairs.
- Controlled process ensure high quality and extend life for repaired frogs.
- Automated process allows for off track rehabilitation, thus reducing time on track.

PROJECT PARTNER(S)

- Edison Welding Institute
- CSX
- Norfolk Southern

COST & SCHEDULE

- Funding: $300,000
- Project Duration: March 2016 – September 2019

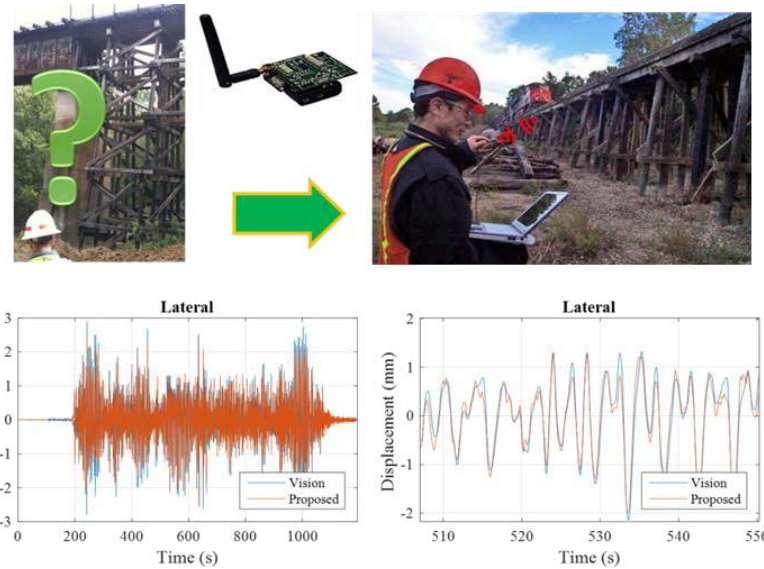
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Cameron Stuart • (202) 493-6384 • cameron.stuart@dot.gov

Bridge Condition Assessment Using Smart Sensors

PROJECT DESCRIPTION

- Phase 2 development effort.
- Field trials of equipment on multiple bridges in the Midwest of the US.
- Establish service limit thresholds based on measured data.
- Test the reference-free displacement estimation algorithms and user interface.



RAILROAD IMPACT

- Accurate, reference-free bridge displacement estimations under revenue traffic.
- Dynamic bridge safety limit thresholds.
- Wireless technology – no fixed installation required.
- Quantitative data for railroad use in prioritization of bridge maintenance and replacement.

PROJECT PARTNER(S)

- University of Illinois at Urbana-Champaign (UIUC)
- FRA Office of Railroad Safety
- Class I - CN, multiple short line railroads

COST & SCHEDULE

- Funding: $350,000
- Project Duration: January 2017 – June 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Cameron Stuart • (202) 493-6384 • cameron.stuart@dot.gov

Investigation of Timber Crosstie Spike Fastener Failures

PROJECT DESCRIPTION

- Identify and quantify the extent of spike failures in the field.
- Collect data on operating conditions, environmental characteristics, track construction, maintenance, and age.
- Develop and test failure cause hypotheses.
- Make recommendations to eliminate failures.

RAILROAD IMPACT

- Improve system safety and reliability, and reduce life cycle infrastructure costs.
- Improve spike design and system arrangements.
- Reduce risk of derailments due to fastener failures.

PROJECT PARTNER(S)

- University of Illinois at Urbana-Champaign (UIUC)
- Class I railroads: Norfolk Southern, BNSF, CSX, UP, CN
- Suppliers: Pandrol

COST & SCHEDULE

- Funding: FY18 – FY19 Approx. $300,000
- Project Duration: April 2018 – April 2019

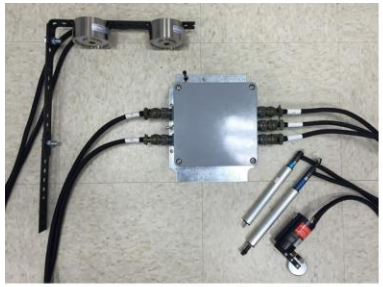
U.S. Department of Transportation
Federal Railroad Administration

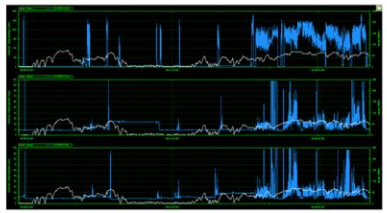
FRA PROJECT MANAGER: Cameron Stuart • (202) 493-6384 • cameron.stuart@dot.gov

Portable Rail Suspension Displacement Monitoring System

PROJECT DESCRIPTION

- System will have the capability to measure the displacement of any two points on the vehicle suspension, including, axle box to truck frame, truck frame to car body, and truck rotation.
- System will incorporate detachable mounting mechanisms and wireless sensors to facilitate displacement measurements on any rail vehicle at any time.
- System will integrate with existing portable acceleration monitoring systems to determine correlations between vehicle/track interaction data and displacement data.





RAILROAD IMPACT

- Current rail suspension displacement monitoring systems are costly and unwieldy to install, configure, and operate.
- The portable rail suspension displacement monitoring system addresses these detriments to allow railroad companies to easily monitor rail suspension displacement with advanced wireless sensors.
- The displacement data will be beneficial in determining vehicle suspension problems and for model validation and qualification testing.

PROJECT PARTNER(S)

- dFuzion, Inc.

COST & SCHEDULE

- Funding: $300,000, cost to date
- Project Duration: December 2016 – December 2018

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Track Geometry Measurement System (TGMS) Evaluations

PROJECT DESCRIPTION

- Develop procedures for testing and evaluating Track Geometry Measurement Systems (TGMS) under controlled conditions to verify accuracy and repeatability.
- Known vertical and lateral track perturbations on TTC's High-Speed Adjustable Perturbation Slab (HS-APS) track including "blind tests."
- Tests of DOTX 216 at speeds 15 to 105 mph in 2015 and 2016
  - Combinations of perturbation vertical and lateral wavelengths and amplitudes.
- FRA and Volpe Center: develop procedures and analyze test data.
- TTCI: assist with developing/reviewing procedures, install, measure perturbations, provide wayside measurements, operations support and improvements to HS-APS based on testing experience.
- ENSCO: test planning, operate DOTX 216 and collect TGMS data.

RAILROAD IMPACT

- Consistent method for evaluating and benchmarking TGMS cars.
- Reduce TGMS measurement error.
- Verify accuracy and repeatability, including effects of measurement speed and repeated/multiple deviations.
- Identify potential issues for measurement/analysis of certain types of track geometry (TG) perturbations.
- Increased confidence in TG data and exception reports.
- Improved TG data for input to vehicle-track dynamic interaction computer simulation models.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)
- Volpe National Transportation Systems Center
- ENSCO, Inc.

COST & SCHEDULE

- Funding: $1,225,151
- Project Duration: May 2015 – December 2018
- Phase 1 and 2 testing completed in 2016, with test report delivered to FRA September 2017
- Report on improvements to HS-APS December 2018 including:
  - Track stiffness & damping characterization tests.
  - Additional wayside strain gages & instrumentation shed.
  - Improved lateral alignment and permanent benchmarks.
  - Cost estimate for design and construction of Curved HS-APS in 50 minute high speed curve at the Transportation Technology Center.

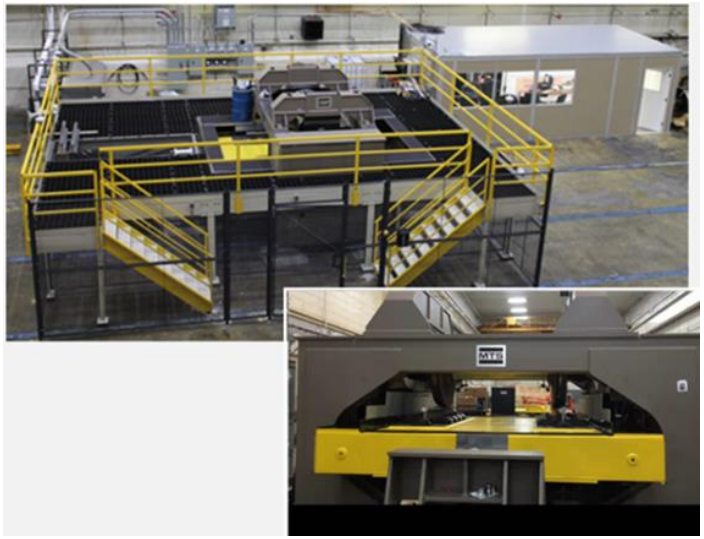
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Steering Traction on Wheel and Rail Damage – Full Scale Testing with Rolling Contact Fatigue Simulator (RCFS)

PROJECT DESCRIPTION

- The RCFS was developed and installed in the Rail Dynamics Laboratory at FRA's Transportation Technology Center (TTC) in Pueblo, Colorado.
- RCFS is capable of testing full scale, freight and passenger wheelsets and rails under current and anticipated future load conditions with precisely controlled variables.
- Testing at various traction forces under 36-ton axle load shows plastic flow dominant, combination of plastic flow and wear, and wear dominant damage modes.
- RCF and wear performance of different class wheels and rails are investigated: wheel/rail contact forces, creep force, creepage characteristic measurement, lubrication and rail grinding effect on RCF, tribology study



RAILROAD IMPACT

- Reduction of RCF through optimization of wheel and rail materials, profiles, and maintenance procedures.
  - Rails with RCF may lead to derailment.
  - RCF may contribute to shattered and vertical split rims of wheels; it may also mask deeper seated cracks in rail from ultrasonic detection.
- Lowered stresses and lowered crack growth in rail.
- Measured wheel/rail contact creep characteristics provide valuable information for developing maintenance strategy and safety limits.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)
- Jointly funded by FRA and Association of American Railroads

COST & SCHEDULE

- FRA Funding: $2,176,253
- Project Duration: September 2013 – October 2019
- The RCFS was commissioned in March 2015
- Low traction ratio RCF tests completed in 2017
- Second Phase testing and measurement improvement continued in 2018

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Evaluation of Wheel/Rail Contact Mechanics and Dynamics

PROJECT DESCRIPTION

- Complete the commissioning of the state-of-the-art Virginia Tech-FRA roller rig intended for more advanced evaluation of the wheel-rail interface (WRI).
- Conduct a series of experiments for scientifically determining the effect of third body layers on traction coefficients simulating conditions during field operations.
- Evaluate the effect of wheel load and creepage force on conditions that can lead to wheel-rail accelerated wear.
- Evaluate the effect of wheel-rail angle of attack (AoA) on wheel wear and potentially offer recommendations for reducing such wear.

RAILROAD IMPACT

- Understanding the complex mechanics and dynamics that occur at the WRI is critical for improving railway operational safety and efficiency.
- Introducing a new level of accuracy for measuring a multitude of contact parameters that are critical in WRI modeling and technology advancement for both passenger and freight trains, far beyond the means currently available to FRA and rail industry.
- Scientifically evaluating parameters and conditions that affect wheel-rail wear, but cannot be evaluated accurately in the field due to the naturally-varied conditions.

PROJECT PARTNER(S)

- Virginia Tech
- Norfolk Southern
- Standard Steel

COST & SCHEDULE

- Funding: $300,000
- Project Duration: September 2017 – February 2019 (Phase II)

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Ground Truth Measurement of Track Geometry on FRA Test Track

PROJECT DESCRIPTION

- FRA's adjustable test track at the Transportation Technology Center (TTC) can be configured with known geometry deviations for vehicle testing as well as measurement system assessment.
- The objective of this task is to design, build, and demonstrate a measurement device that accurately and quickly establishes the ground truth track geometry following modification of the test track.

RAILROAD IMPACT

- FRA's adjustable test track is an important tool for research related to vehicle-track interactions, validation of dynamic simulations, vehicle safety testing, and the assessment of track measurement technology.
- The results of this effort will be vital to these activities by allowing researchers and test engineers to accurately determine the configuration of the test track.

PROJECT PARTNER(S)

- ENSCO, Inc.

COST & SCHEDULE

- Funding: $480,000
- Project Duration: September 2018 – September 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Vehicle-Track Interaction Testing, Modeling and Analyses

PROJECT DESCRIPTION

- Modeling, simulation, testing, data collection and analyses of vehicle-track interaction related issues.
- Efforts include evaluating current track geometry standards and exploring influence of track geometry characteristics and speeds on vehicle dynamic forces.

RAILROAD IMPACT

- Studies in this area can reduce derailment risk, track degradation, vehicle wear or damage, lading damage, and passenger discomfort.
- Research considers performance-based track geometry tolerances and vehicle design parameters that ensure safety, and maximize effective and efficient use of maintenance resources.

PROJECT PARTNER(S)

- ENSCO, Inc.

COST & SCHEDULE

- Funding: $231,000
- Project Duration: September 2018 – September 2019

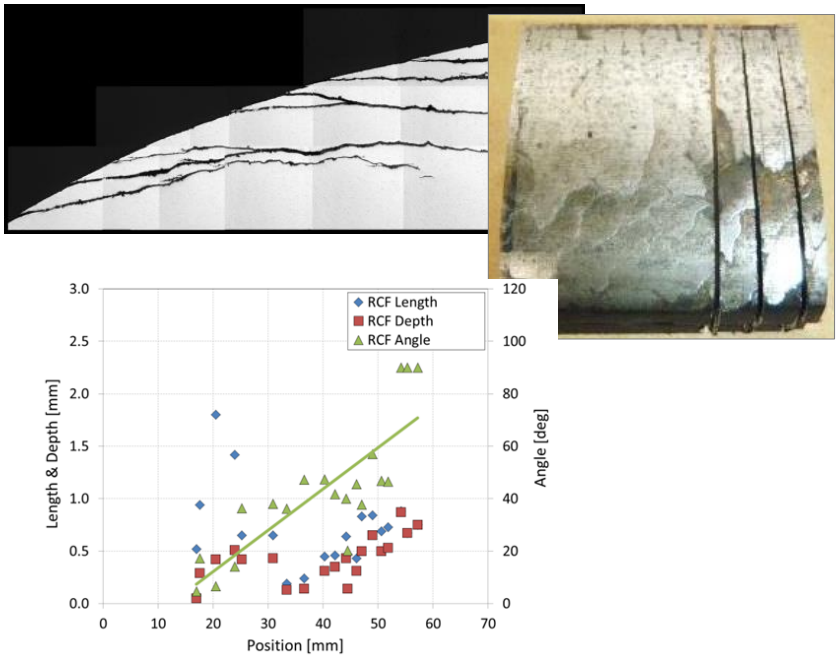
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Rolling Contact Fatigue (RCF) Qualification

PROJECT DESCRIPTION

- Measuring RCF severity on rail to improve railroad safety and reliability. RCF impacts railroad safety and reliability, having information on RCF's severity on a given rail is crucial.
- Over the last year, 15 rail samples were analyzed metallurgically to determine the extent of RCF and its correlation with visible surface damage.
- Relationships are being developed between surface damage appearance and subsurface crack propagation angles and depths using Eddy Current (EC) measurement techniques.
- These same relationships can be applied to surface photographs being collected by imaging systems.
- All inspection results are being placed in an 'RCF Matrix' for public use, while many different combinations of steel type, curvature, and tonnage remain to be analyzed.



RAILROAD IMPACT

- **Safety:** Understanding rail subsurface RCF damage as a function of track curvature and million gross ton (MGT) accumulation will allow railroads to more safely manage RCF.
- **Economic competitiveness:** Accurate mapping of RCF is useful to railways for making grinding and rail replacement decisions, and to RCF modelling experts for predicting rail life under variable conditions.

PROJECT PARTNER(S)

- National Research Council (NRC) of the Government of Canada

COST & SCHEDULE

- Funding: $90,000 annually
- Project Duration: 2017 –2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Track Geometry Measurement System (TGMS) Evaluation Procedures

PROJECT DESCRIPTION

- Plan and coordinate testing on FRA adjustable test track at the Transportation Technology Center (TTC) with FRA's High-Speed Geometry Car DOTX 216.
- Support analysis and documentation efforts comparing DOTX 216-collected geometry data with ground truth measurements.
- Analyze and document data collected with DOTX 216's Instrumented Wheel Sets.
- Write a procedure for testing and measuring ground truth and testing Track Geometry Measurement Systems.

RAILROAD IMPACT

- Current TGMS verification methods rely on a statistical measure of precision and periodic verifications of accuracy by comparing static and dynamic measurements.
- FRA can introduce precise geometry into a test track at the Transportation Technology Center (TTC) to provide controlled comparison to measured track geometry data.
- This project is first of several steps in establishing a procedure by which track assessment technology can be objectively evaluated.

PROJECT PARTNER(S)

- ENSCO, Inc.
- Transportation Technology Center, Inc. (TTCI)
- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: $800,000
- Project Duration: April 2015 – March 2019
  - DOTX 216 TTC Testing – 2015, 2016

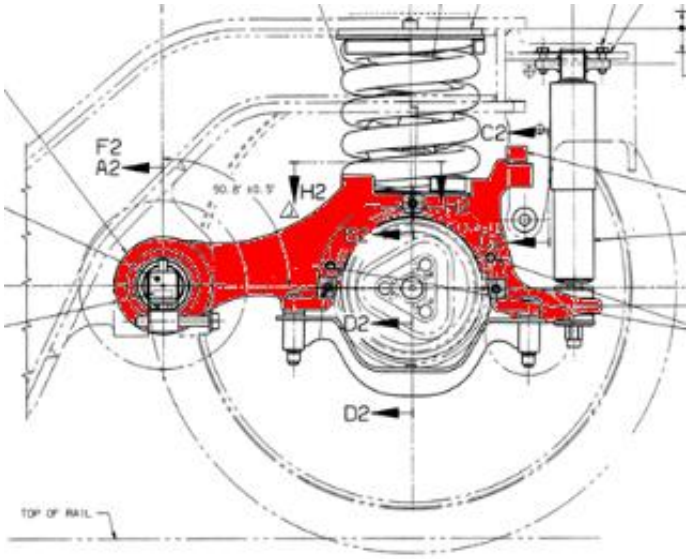
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Coil Spring Characterization and Modeling

PROJECT DESCRIPTION

- Procure a multiaxial test machine to test suspension springs under various loading conditions.
- First phase is to procure the test machine.
- Measure the axial, shear, and torsional stiffness of the spring.
- Study the best practice for modeling suspension springs in the trucks.
- Investigate the need for modifications in the methods that the springs are modeled in multibody simulation programs.



RAILROAD IMPACT

- Provide guidelines how to measure spring properties.
- Provide information on how to model springs in multibody simulation program.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Zwick

COST & SCHEDULE

- Funding:
  - Phase I – Procure the test machine: $500,000
  - Phase II – Perform testing to characterize springs: $200,000
- Project Duration: 2014 – 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Influence of Track Irregularities on Derailment Safety

PROJECT DESCRIPTION

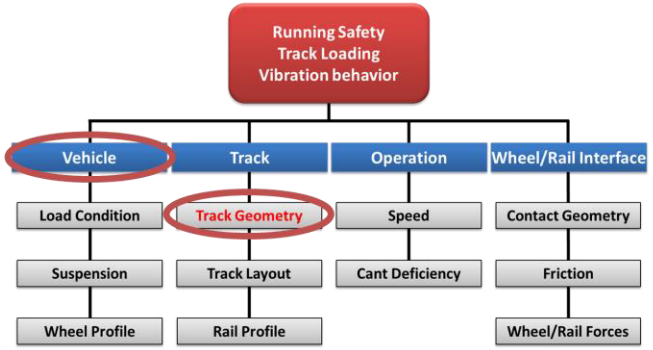
- Develop validated computer models of freight and passenger rail vehicles to study dynamic response for speeds up to 220 mph.
- Currently working on developing validated tank car computer model including the effects of liquid slosh on vehicle dynamics on Track Classes 1 through 5.
- Perform parametric studies using computer modeling to study the relationship between vehicle performance, track geometry, and derailment safety.
- Use model results to identify safe operating speeds, maximum allowable track geometry deviations, and other operating conditions needed to minimize the risk of derailment.

RAILROAD IMPACT

- Help provide an infrastructure that supports a variety of vehicles for speeds up to 220 mph.
- Address derailment safety concerns and support industry's needs in terms of identifying safe track geometry limits and procedures used for assessing the performance of new rail vehicles from a derailment safety standpoint.
- Working with industry to develop a tank car model suitable for examining the response of tank cars to track geometry deviations with the inclusion of sloshing effects to examine effects of combined track geometry deviation on vehicle performance.

VTI Safety – Track Geometry

- Safety limits - maximum allowable track geometry variations
- Identify conditions that require immediate attention
- Help provide an infrastructure that supports a variety of vehicles



PROJECT PARTNER(S)

- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: $400,000
- Project Duration: June 2018 – May 2020

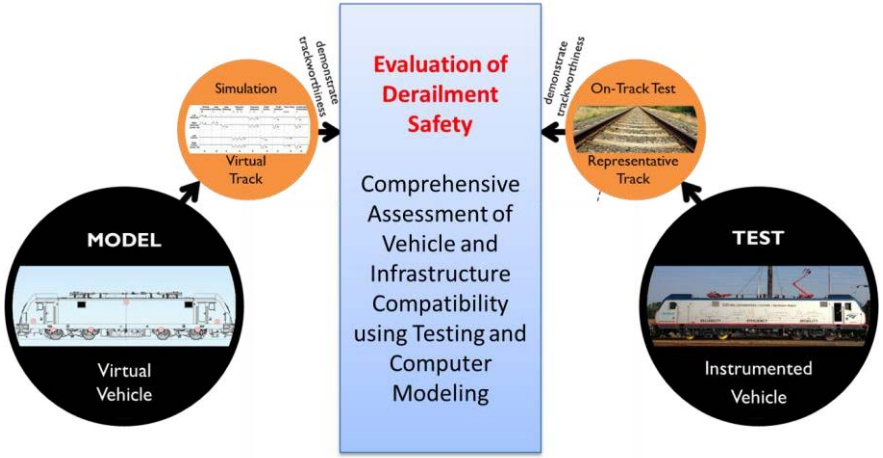
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Support of FRA Office of Railroad Safety

PROJECT DESCRIPTION

- Review test plans submitted for qualification testing and pre-revenue service acceptance testing.
- Develop and update new procedures for assessing safety of rail vehicles, including existing designs imported to North America, prior to usage in revenue service and taking advantage of state-of-the-art computer modeling and testing.
- Analyze data collected during physical testing as well as data from simulations from vehicle qualification process.
- Assist in derailment investigations.



RAILROAD IMPACT

- Review of qualification testing results identifies potential safety concerns which can be addressed before revenue service.
- Simulations included in qualification process provide a standardized procedure for vehicle manufacturers to examine the dynamics of a new design intended for the North American railroad operating environment.
- Derailment investigation can identify root causes of accident and potentially prevent future accidents.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: $400,000
- Project Duration: June 2018 – May 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Modeling of Wheel/Rail Friction Modifier

PROJECT DESCRIPTION

- To develop a wheel/rail creep force model that incorporates the effects of the third body layer or top of the rail (TOR).
- Develop a wheel/rail creep force model that incorporates effects of the third body layer or top of the rail (TOR) friction modifier
    - Collect data on TOR products, operating practices, contact and surface conditions.
    - Conduct tribological tests to determine creep stress relationships for a range friction modifiers and contact and surface conditions for inputting to model.
    - Develop the model and its parameters.

RAILROAD IMPACT

- With integration of model into Vehicle-Track Interaction simulations, a tool that can help define TOR product choice and application protocols.
- Provide more accurate force prediction that will improve vehicle dynamics, wear and rolling contact fatigue (RCF) assessments.
- Experimental tests for benchmarking TOR products performance.

PROJECT PARTNER(S)

- University of Sheffield
- L.B. Foster Rail Technologies, Corp. (LBF)
- Virtual Vehicle Research Center (ViF)

COST & SCHEDULE

- Funding: Phase I (12 months) – Approx. $300,000
- Project Duration: September 2017 – December 2018

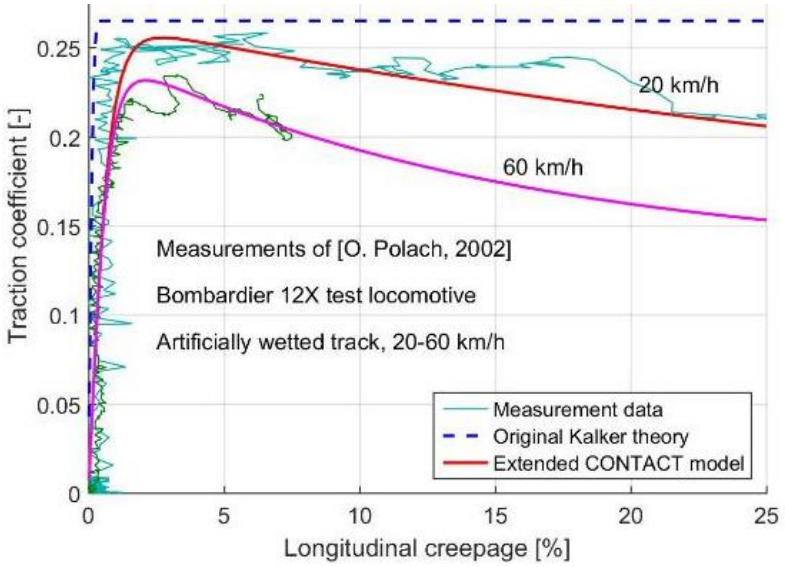
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Advanced Modeling of Wheel/Rail Friction Phenomena

PROJECT DESCRIPTION

- Improve the friction modeling approach in the Extended CONTACT model.
- Validate the model against available measurements.
- Improve physics-based modeling.
- Integrate the model in the main Vehicle-Track Interaction (VTI) simulation packages.



RAILROAD IMPACT

- Our simulation technology will improve computer simulation of:
  - Influence the humidity on vehicle stability.
  - Influence falling friction on flange climb derailment.
  - Influence the friction modifiers on curving behavior, traction control and energy efficiency.
  - The loads exerted on the track, in a wide range of circumstances.

PROJECT PARTNER(S)

- VORtech BV

COST & SCHEDULE

- Funding: $225,000
- Project Duration: March 2017 – March 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Track Geometry and Vehicle Performance

PROJECT DESCRIPTION

- To improve tank car model, FRA purchased tank car DOT-117A100W1 for performing vehicle characterization and on-track tests.
- Conduct full-scale tank car tests on the Transportation Technology Center's (TTC's) test tracks, including High Tonnage Loop (HTL), Precision Test Track (PTT) and Wheel/Rail Mechanism (WRM) loop and Railroad Test Track (RTT). For the loaded condition, crude oil is to be used as lading choice. Data acquired from the various tests will be utilized for tank car model improvement.

RAILROAD IMPACT

- On-track testing for empty and loaded conditions of a DOT-117 tank car to better understand its dynamic behavior and to provide critical data for improving the NUCARS® tank car model developed under Phase I of the project.
- Use of crude oil as the lading choice for the loaded condition testing helps determine the sloshing effects of crude oil.
- The improved tank car model can be reliably deployed to enhance applicable track geometry limits for safer tank car performance.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: $962,862
- Project Duration: September 2016 – March 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

Adjustable Precision Curved Track Anomaly Test Section

PROJECT DESCRIPTION

- Track geometry measurement validation and vehicle-track interaction testing are critical functions for safety and operations of railroads, especially for high-speed passenger trains.
- This project will design a curved test track section on the high-speed test track at the Transportation Technology Center (TTC) where geometric track anomalies can be installed and adjusted.
- Curved test track section will supplement the existing tangent test track section previously built at TTC.

RAILROAD IMPACT

- Track geometry testing is a critical function for safety and operations of railroads, especially for high-speed passenger trains.
- For high-speed passenger rail, the track anomaly test section will provide a unique testing platform where vehicle-track interaction modeling simulations can be validated, and existing and new technologies can be tested.
- This track section can be used to validate a track geometry measurement system.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: FY19 $441,000
- Project Duration: October 2018 – January 2020
  - Conceptual design and 30% design plans
  - 60% and 90% design and final construction bid document preparation

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Ali Tajaddini • (202) 493-6483 • ali.tajaddini@dot.gov

US – China Railway Technology Exchange

PROJECT DESCRIPTION

- Facilitate communication with Chinese counterparts in organizing and participating in the annual Transportation Forum held in the US and China.
- Facilitate technical exchanges with China in the areas of track inspection and maintenance standards, track structure for high-speed rail (HSR), use of risk analysis for safety assurance, transportation capacity simulation for HSR networks, and vehicle qualification.
- Organize rail technology and standards exchange meetings and technical visits.

RAILROAD IMPACT

- Enable technical exchanges especially on high-speed rail infrastructure and equipment inspection and maintenance.
- Enhance FRA's presence at the US – China Forum.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: FY18 $30,000
- Project Duration: 2012 – 2019

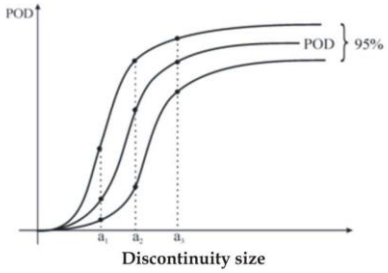
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Luis Maal • (719) 584-0551 • luis.maal@dot.gov

Evaluation of Track Inspection Technology Effectiveness

PROJECT DESCRIPTION

- Focus on the development of a general approach to quantify the effectiveness of track inspection technology.
- Conduct a comprehensive literature survey to identify available performance measures or evaluation methods employed in other fields and applicable to existing and emerging inspection technologies.
- Formulate the requirements for evaluation methods to address the gathered data, ground truth, sample sizes and acceptance criteria.
- Characterize effectiveness of Track Geometry Measurement Systems (TGMS) to illustrate the selected evaluation procedure.



Actual Class \ Predicted class	P	N
P	True Positives (TP)	False Negatives (FN)
N	False Positives (FP)	True Negatives (TN)

RAILROAD IMPACT

- Establish confidence in the effectiveness of new inspection technologies, thereby facilitating its adoption for regular use in safety assurance.
- Lay the groundwork to standardize the evaluation of effectiveness of existing and emerging track inspection technologies.

PROJECT PARTNER(S)

- ENSCO, Inc.

COST & SCHEDULE

- Funding: $124,000
- Project Duration: July 2018 – May 2019

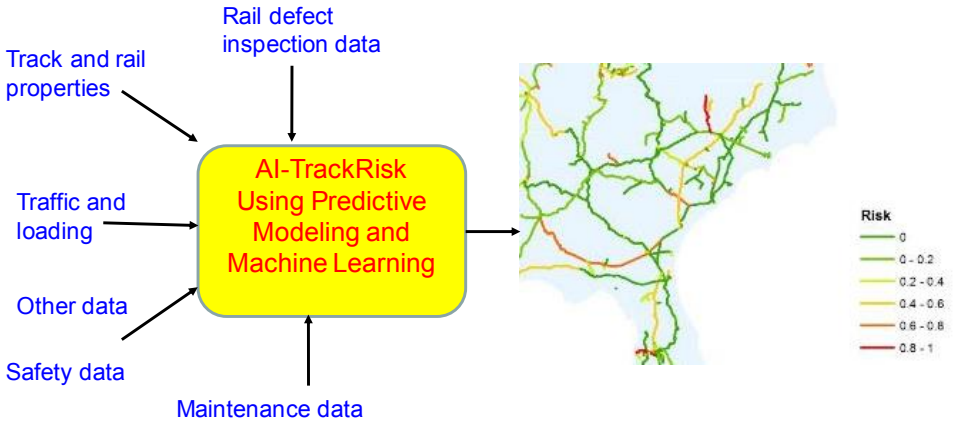
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jay Baillargeon • (719) 584-7155 • jay.baillargeon@dot.gov

Artificial Intelligence Aided Track Risk Analysis (AI-TrackRisk)

PROJECT DESCRIPTION

- Develop an Artificial Intelligence (AI) Aided Track Risk Analysis (AI-TrackRisk) tool, focusing on rail failures at this stage.
- AI-TrackRisk is an intelligent computer system that can automate track data modeling, predictive analytics, and risk analysis, ultimately supporting optimal track inspection and maintenance decisions.
- AI-TrackRisk can be a "brain" of a "virtual risk analyst" to automatically turn volumes of track-related data directly into risk predictions and decision-making.



RAILROAD IMPACT

- Provide the industry with an innovative map-based decision-making tool to perform track data integration, statistical modeling, and risk prediction automatically, enabled by machine learning techniques.
- Acquire new knowledge and tools pertaining to how AI can be used to support track data analysis and risk management.

PROJECT PARTNER(S)

- Rutgers, The State University of New Jersey
  - Civil & Environmental Engineering Department
  - Computer Science Department
- CSX

COST & SCHEDULE

- Funding: $345,651
- Project Duration: August 2018 – August 2020

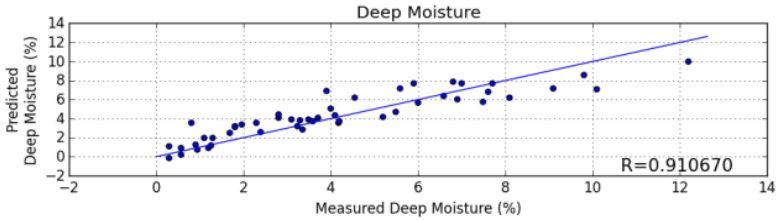
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jay Baillargeon • (719) 584-7155 • jay.baillargeon@dot.gov

Moisture-Sensitive Ballast Fouling Measurement Tool

PROJECT DESCRIPTION

- Develop a man-portable, automated instrument to non-invasively determine fouling condition (i.e., "RABIT", or **RA**dar **B**allast **I**nspection **T**ool).
- Collect field data on outdoor test track and revenue service track.
- Compare ground-penetrating radar (GPR) results with geotechnical laboratory analysis results to show validity of the technique.
- Investigate relationship between ballast condition and ballast performance (i.e., strength).



RAILROAD IMPACT

- Provide real-time fouling measurement; no post-processing required, which eliminates the need for highly trained personnel to interpret the results.
- Plan maintenance based on fouling measurement and relationship between ballast condition and ballast performance (i.e., strength).
- Provide railroad personnel with an automated solution that allows for track to be inspected on their schedule and to spot-check problem areas.

PROJECT PARTNER(S)

- Earth Science Systems, LLC
- BNSF
- University of Massachusetts at Amherst
- Volpe National Transportation Systems Center
- FRA Office of Railroad Safety (Region 7)

COST & SCHEDULE

- Funding: $468,625
- Project Duration: July 2016 – January 2019
  - ASTM Ballast Testing Symposium: January 2018
  - Live-Track Testing with BNSF: January – March 2018
  - Additional Field Testing at the Transportation Technology Center (TTC): September 2018
  - Field Evaluation with FRA Track Inspector: December 2018
  - Final Report: 2019

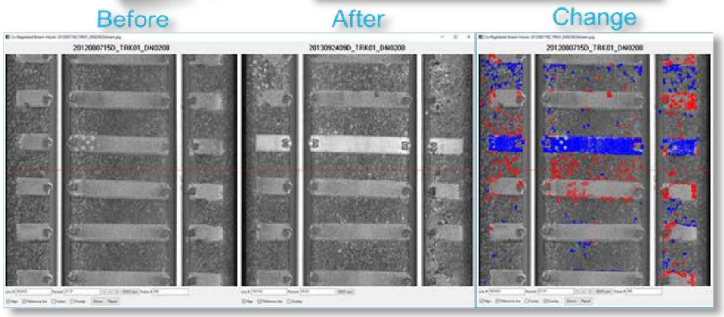
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jay Baillargeon • (719) 584-7155 • jay.baillargeon@dot.gov

Automated Change Detection Technology for Track Inspection

PROJECT DESCRIPTION

- Leverage commercial hardware and software to create an automated change detection system applicable to the railroad track environment, capable of evaluating images against a baseline for relevant changes in the track structure automatically.
- Develop the technological framework for advancing change detection technology to a practical application for track safety assurance inspections.
- Explore alternative data collection methods for change detection, including unmanned aircraft systems (UAS).
- Results will be compiled and presented in reports and presentations to industry at large.



RAILROAD IMPACT

- Further development of automated vision- and laser-based inspection technologies that can automatically isolate areas of the track structure that have changed since the previous inspection.
- Investigation into and implementation of deep learning and artificial intelligence techniques that can accurately process associated data and report on areas of relevant change to railroad decision makers.
- Development of technologies that will supplement traditional walking or hi-rail track inspection activities for safety assurance.

PROJECT PARTNER(S)

- Pavemetrics Systems, Inc.
- ENSCO, Inc.
- Harris Geospatial Solutions, Inc.
- Noble Drone Services, LLC
- Amtrak

COST & SCHEDULE

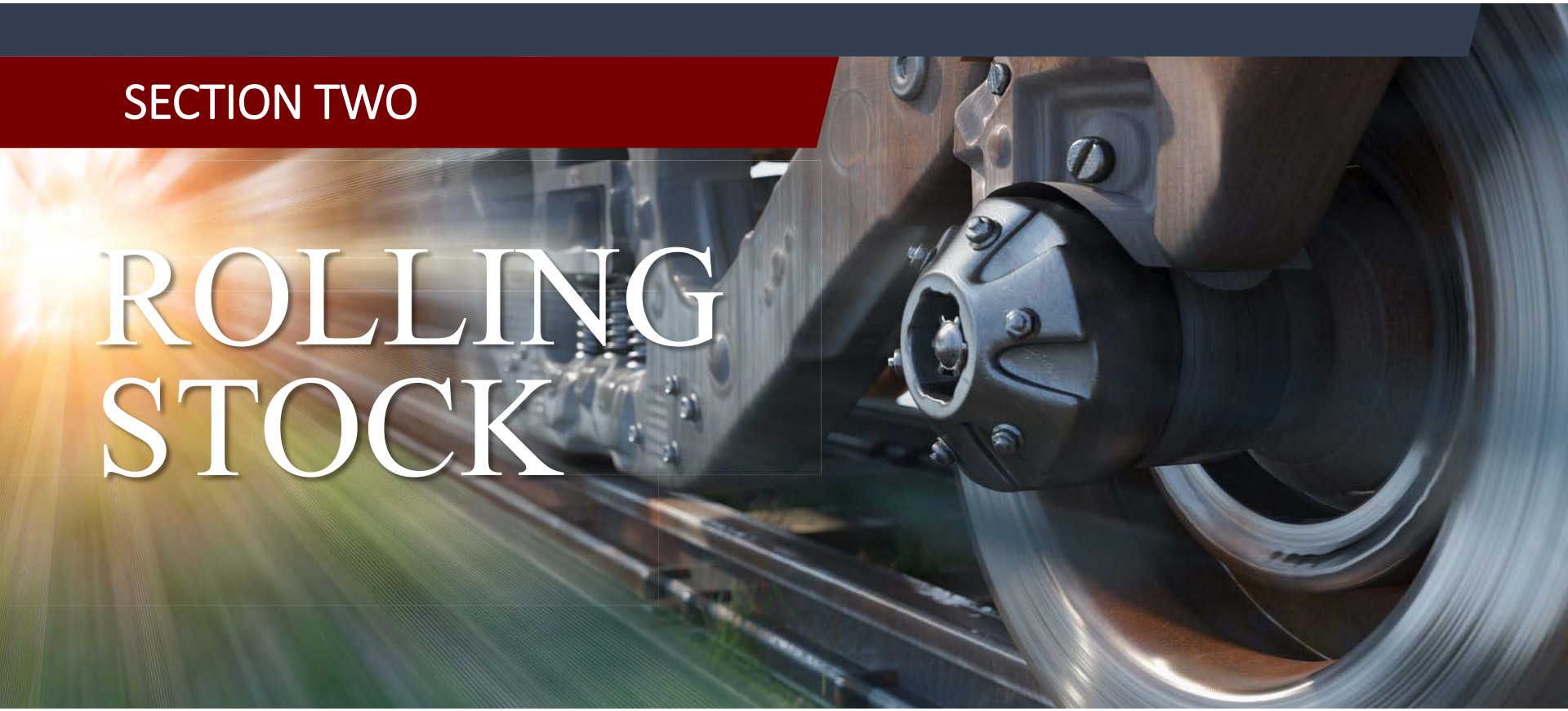
- Funding: $345,651
- Project Duration: August 2018 – August 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGERS: Jay Baillargeon • (719) 584-7155 • jay.baillargeon@dot.gov
Cameron Stuart • (202) 493-6384 • cameron.stuart@dot.gov

SECTION TWO

ROLLING STOCK



U.S. Department of Transportation
Federal Railroad Administration

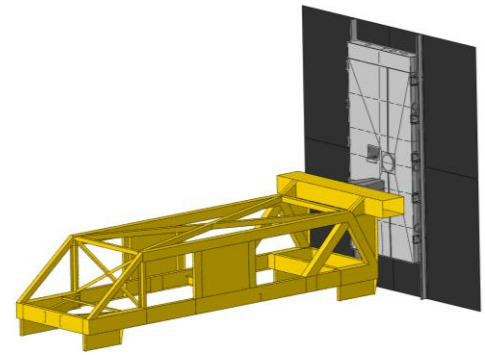
Raking Impact Testing of Diesel Multiple Unit (DMU) Fuel Tanks

PROJECT DESCRIPTION

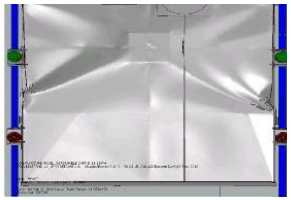
- Develop the test method.
- Design and construct the test fixture.
- Prepare and test two diesel multiple unit (DMU) fuel tanks.
- Analyze and provide the data for model validation.

RAILROAD IMPACT

- Development of performance-based scenarios intended to be used to evaluate the puncture resistance of modern fuel tank designs, such as those on DMU locomotives.
- Evaluation of the crashworthiness of passenger fuel tank designs.
- Evaluation of performance under dynamic loading conditions, and recommendations for improved fuel tank protection strategies.



Post-test Photo



Pre-test FEA
11.1 mph Deformable Impactor

Post-test Photograph
DMU Tank

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)
- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: FY19 – TBD
- Project Duration: September 2017 – March 2019

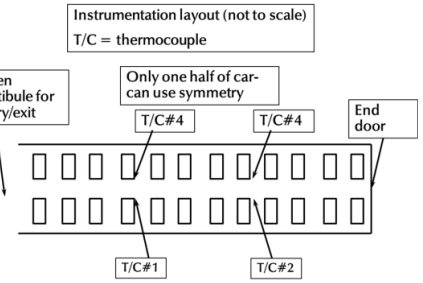
U.S. Department of Transportation
Federal Railroad Administration

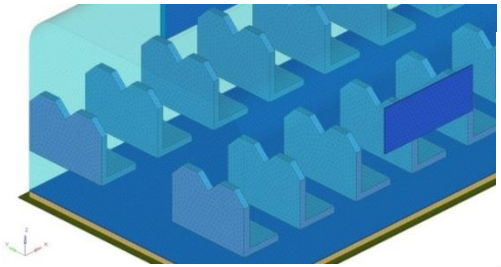
FRA PROJECT MANAGER: Melissa Shurland • (202) 493-1316 • melissa.shurland@dot.gov

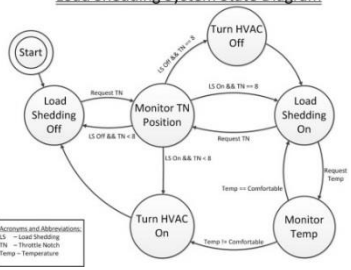
Load Shedding - Phase III, Concept Development & Prototype

PROJECT DESCRIPTION

- Hotel power for passenger comfort on running commuter/ passenger trains is provided from the Head End Power (HEP) system that is located on the operating locomotive. The overall traction power of the locomotive is de-rated about 10% when coupled to a HEP system; therefore, a 4,000 HP locomotive is able to supply about 3,600 HP for tractive effort, a reduction in the amount of energy available for achieving higher speeds.
- This phase work focuses on:
  - Thermal model validation and economic model update
  - Hardware and software architectural layout for the load shedding implementation
  - Communication and control hardware and software development







RAILROAD IMPACT

- Peak Traction, Auxiliary, and HEP needs are/can be separated in time (temporal separation of power peaks), such that peak needs are unlikely to be simultaneous.
- HEP needs can be temporarily minimized, at times of peak traction need, through an automatic (or controlled) load shedding process.
- Improved energy efficiency on commuter locomotives.

PROJECT PARTNER(S)

- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: FY19 $65,700
- Project Duration: July 2017 – June 2019

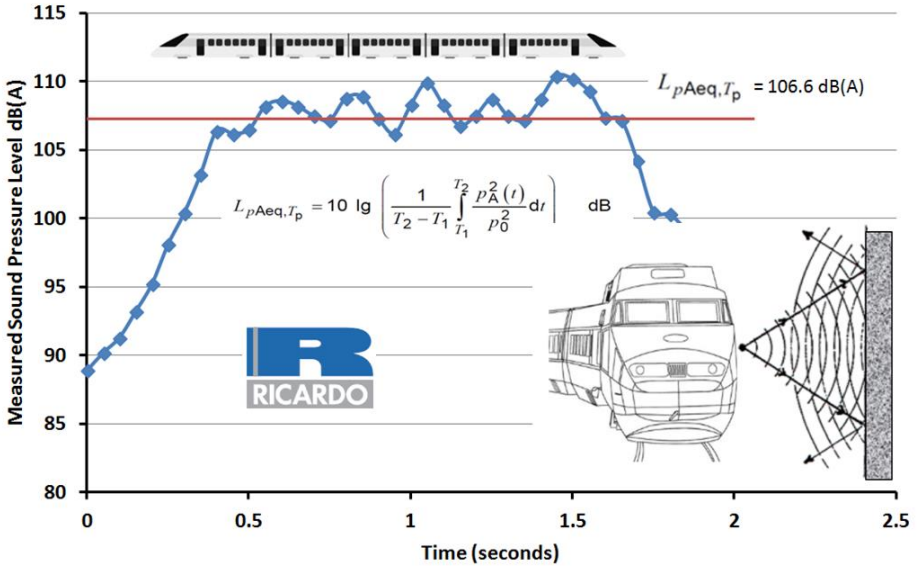
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Melissa Shurland • (202) 493-1316 • melissa.shurland@dot.gov

Cost of Compliance for High-Speed Rail Noise

PROJECT DESCRIPTION

- Develop an analytical tool to allow global noise standards and regulations to be compared on a common basis.
- Will be applied to the rules and metrics identified in the recently completed FRA study of high-speed rail noise.
- Assess the cost of compliance for the three categories of noise emission reduction procedures (rolling stock, path to receiver, and at receiver).
- Rank costs as $/dB(A) reduction and $/dB(A) per impacted resident.
- Allow the various procedures to be cost ranked individually or as a combination to achieve an overall noise emission reduction.



RAILROAD IMPACT

- Provide tool that allows US rail industry to compare global rules on a common reference.
- Understand the costs associated with compliance.

PROJECT PARTNER(S)

- Ricardo, Inc.
- California High-Speed Rail Authority
- Amtrak
- WSP Rail Vehicles Division

COST & SCHEDULE

- Funding: FY19 $260,000
- Project Duration: September 2018 – July 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Melissa Shurland • (202) 493-1316 • melissa.shurland@dot.gov

Electronically Controlled Pneumatic (ECP) Brake Device with Pneumatic Emulation – Field Demo

PROJECT DESCRIPTION

- The safety and economic benefits of Electronically Controlled Pneumatic (ECP) brakes are well-known, and yet the technology has not been widely adopted by North American railroads. ECP brake technology benefits can only be realized when the entire train consist is equipped with the technology. This project will develop pneumatic emulation technology to overcome the need for the entire train consist to be ECP-equipped.
- Focus on understanding the barriers to ECP brake system implementation.
- Current focus is on:
  - Upgrading and enhancement of ECP emulation technology as alternative to overlay ECP
  - Field demonstration of the selected emulator technology for interoperability per the industry standards S-4200 requirements.

PROJECT PARTNER(S)

- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: FY19 $43,500
- Project Duration: March 2017 – March 2019

RAILROAD IMPACT

- Increased railroad operating safety due to inherently more reliable and effective braking.
- An alternative to overlay ECP.
- Increased line-haul speeds due to reduced terminal and in-service train delays.
- Improved safety for both crew and public due to better performing equipment.
- Increased utility of cars equipped with ECP compared to stand-alone ECP system.

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Melissa Shurland • (202) 493-1316 • melissa.shurland@dot.gov

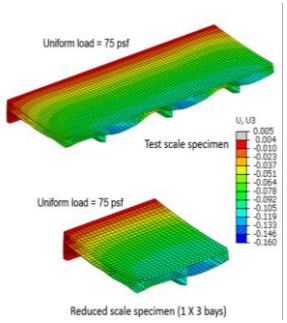
Fire Safety Research

PROJECT DESCRIPTION

- Evaluate and develop alternative fire performance criteria for passenger rail cars.
- Develop models and scaling laws to reduce test article size for quantifying fully-developed rail car fire heat release rate.
- Conduct testing and modeling to demonstrate reduced-scale floor assembly fire resistance compliance testing.
- Perform literature review to quantify smoke toxicity contribution to passenger injury/deaths and create material toxicity database.

RAILROAD IMPACT

- Provide validated computer models to predict fully-developed rail car fire heat release rate to support fire hazard assessments and smoke control design.
- Determine reduced-scale rail car fire test to quantify fully-developed fire heat release rate for cost-effective testing of rail car designs.
- Recommend a reduced-scale floor assembly for fire resistance testing to save cost on compliance testing.
- Demonstrate use of computer models for predicting rail car floor assembly thermal and structural response to support design.
- Evaluate the historic impact of fire smoke toxicity on passenger injuries / deaths to assess problem.
- Provide a consolidated database of material smoke toxicity for use in assessing and developing material smoke toxicity requirements.



PROJECT PARTNER(S)

- Jensen Hughes
- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: FY19 $423,000
- Project Duration: September 2018 – September 2019

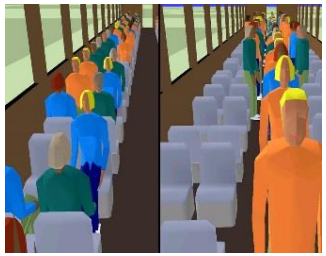
U.S. Department of Transportation
Federal Railroad Administration

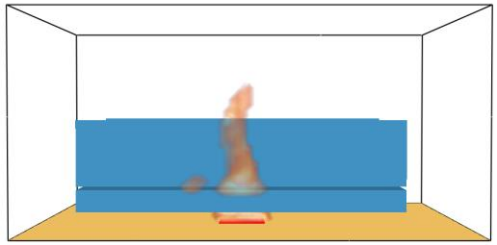
FRA PROJECT MANAGER: Melissa Shurland • (202) 493-1316 • melissa.shurland@dot.gov

Fire Safety and Emergency Preparedness Research Support

PROJECT DESCRIPTION

- Develop heat release rate requirements for interior finishes as an alternative method for evaluating passenger rail car interior materials.
- Address questions on developing alternative floor assembly fire test requirements, including:
  - Appropriateness of fire exposure severity and duration;
  - Potential for reducing size of floor assembly test article.
- Assess the need for smoke toxicity test procedures and performance requirements.
- Interface with industry through the National Fire Protection Association 130 Committee to revise and update standards.
- Compare egress modeling software, the application to passenger rail cars, and the capability to predict fire growth.
- Evaluate evacuation concepts, strategies, and techniques for applicability to US rail passenger cars.





PROJECT PARTNER(S)

- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: FY19 $75,000
- Project Duration: September 2018– September 2019

RAILROAD IMPACT

- Provide a better understanding of the fire hazard threat of materials inside passenger rail cars by establishing heat release rate performance requirements.
- Potential for reduced size and cost of the test article for passenger rail car floor assembly fire resistance tests.
- Update industry standards to include material toxicity requirements.
- Recommendations for applying simulation models in fire hazard analyses.

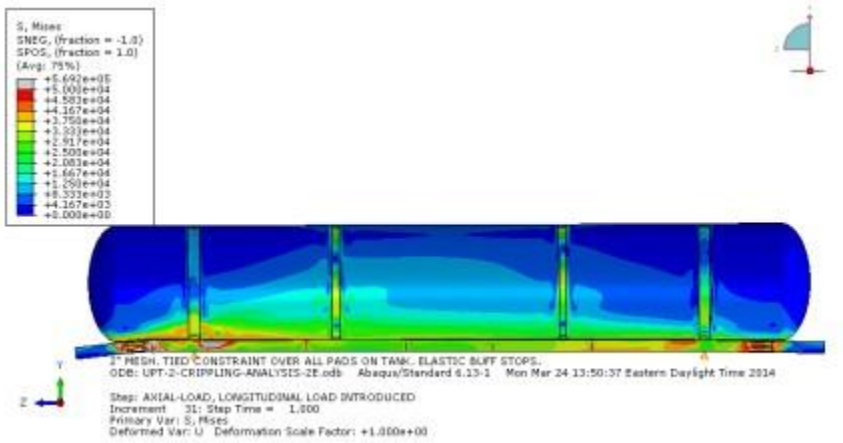
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Melissa Shurland • (202) 493-1316 • melissa.shurland@dot.gov

Evaluation of the Structural Integrity of Natural Gas Fuel Storage Equipment for Locomotives

PROJECT DESCRIPTION

- Develop crashworthiness standards for compressed natural gas (CNG) fuel tenders.
- Evaluate structural performance, puncture resistance, and fitting integrity with simplified analyses of legacy natural gas fuel tender.
- Apply results of simplified analyses to estimate performance in scenarios.
- Evaluate safe speeds in scenarios.
- Impact testing.



RAILROAD IMPACT

- Improve the state-of-the-art knowledge on natural gas fuel tenders and other storage equipment.
- Assess crashworthiness of legacy natural gas fuel tenders.
- Develop strategies for structural analyses of next generation of natural gas fuel tenders.
- Collaborate with railroad industry in development of specifications for next generation of natural gas fuel tender.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: FY19 – TBD
- Project Duration: May 2013 – April 2020

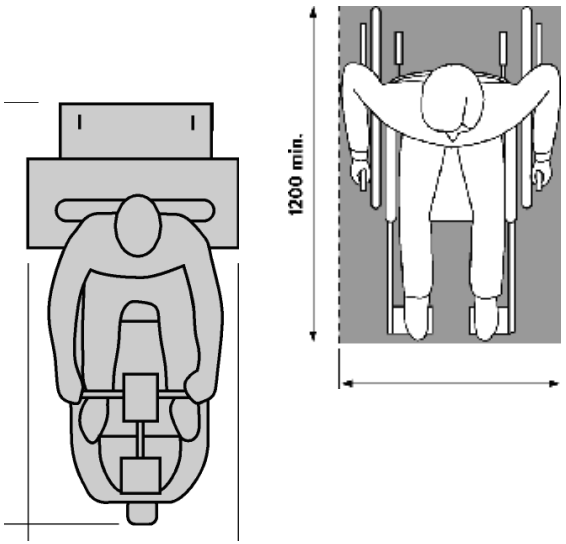
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Melissa Shurland • (202) 493-1316 • melissa.shurland@dot.gov

Universal and Inclusive Accessibility for Next Generation of Passenger Rail Equipment

PROJECT DESCRIPTION

- Develop recommendations for improved accessibility on passenger rail equipment:
  - Larger accessible space to accommodate powered wheeled mobility devices.
  - Improved maneuverability in accessible restroom.
  - Automatic controls in accessible restrooms.
  - Dual-mode passenger information system to ensure communication with passengers who are deaf or have hearing loss.
- Investigate Rail Vehicle Access Advisory Committee recommendations for feasibility and cost as measured by revenue seat loss.
- Investigate containment issues accommodating two or more wheeled mobility devices on passenger rail car.
- Study use of elevator on bi-level cars.



PROJECT PARTNER(S)

- Oregon State University
- Volpe National Transportation System
- Next Generation Equipment Committee established by Section 305 of the Passenger Rail Investment and Improvement Act of 2008 (PRIIA)

COST & SCHEDULE

- Funding: FY19 – TBD

RAILROAD IMPACT

- Inclusion of enhanced accessibility requirements on PRIIA bi-level equipment.
- Enhanced train travel for all passengers with improved communication during normal and emergency operations.
- Establishment of US Access Board's Rail Vehicle Access Advisory Committee to develop guidance for new regulations to improve accessibility on passenger rail vehicles.
- Study of occupant protection for passengers who remain seated in wheeled mobility devices.

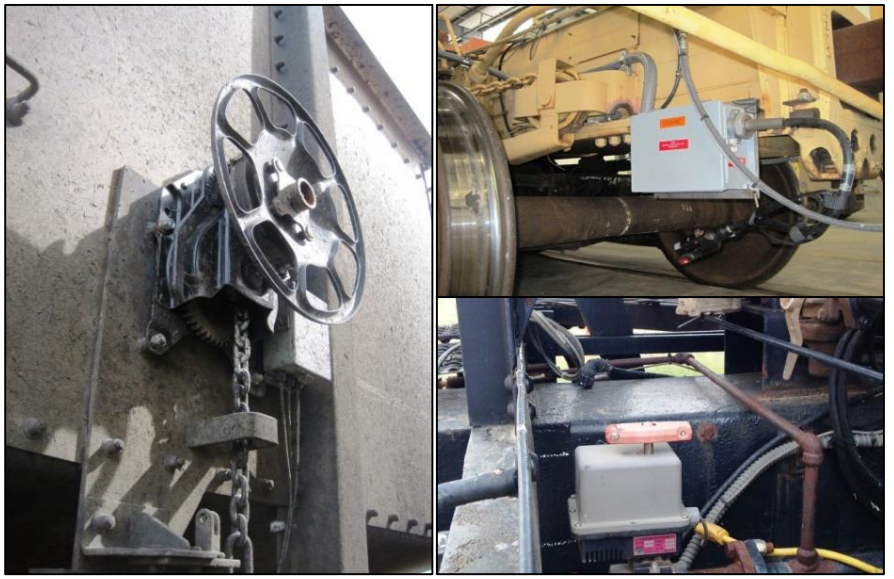
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Melissa Shurland • (202) 493-1316 • melissa.shurland@dot.gov

Advanced Devices Train and Test Bed

PROJECT DESCRIPTION

- Facilitate the development of an Advanced Devices Train and Test Bed (ADT&TB) in order to test advanced devices; either developed or under development for functionality and ergonomics.
- Advanced devices include Electrically Driven Hand Brake (EDHB), Tri-Couplers (air, electrical, and mechanical coupling systems), remote controlled angle cocks, and remote controlled cut-levers.
- Conduct evaluations and demonstrations of advanced devices and the advanced device network.
- Advanced devices can be operated either on the side of the car or remotely from within the locomotive.



RAILROAD IMPACT

- Improve safety of train operations by minimizing human interaction with cars and car devices.
- Improve reliability of newly developed devices through testing.
- Increase train capacity and reduce costs by decreasing the time needed during stops due to functionality of devices.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)
- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: $224,000
- Project Duration: July 2014 – July 2019

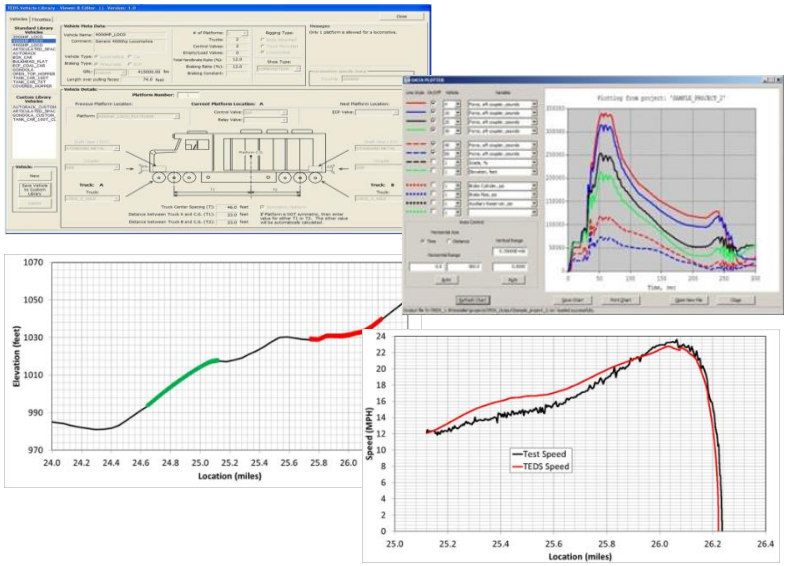
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Train Energy and Dynamics Simulator (TEDS)

PROJECT DESCRIPTION

- Train Energy and Dynamics Simulator (TEDS) is a computer program developed by FRA for conducting longitudinal train dynamics simulations.
- May be used to assist development of guidelines and recommendations to improve train operating safety.
- Capable of simulating train handling, train makeup, head-end and distributed power, Electrically Controlled Pneumatic (ECP) and automatic brake applications for speed control, stopping distances, and emergency stops.
- Published validation detail can be found in the FRA eLibrary in a report titled: Validation of the Train Energy and Dynamics Simulator (TEDS)
- Used successfully for several simulations to assist FRA's Office of Railroad Safety in various investigations.
- Available for public use under a service agreement with FRA and Sharma & Associates, Inc.



PROJECT PARTNER(S)

- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: FY19 $140,000
- Project Duration: September 2015 – September 2020

RAILROAD IMPACT

TEDS facilitates identification and quantification of safety risk in train operations affected by :

- Equipment
- Train makeup, including free slack between couplers.
- Train handling
- Track conditions, including presence of lubricators.
- Operating practices
- Environmental conditions
- Certain types of malfunctioning equipment, such as locomotive power drop
- Derailment/incidence investigation

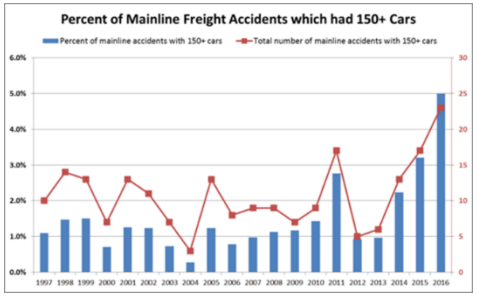
U.S. Department of Transportation
Federal Railroad Administration

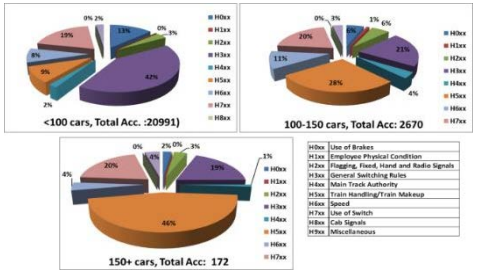
FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Risk Reduction for Very Long Trains (VLT)

PROJECT DESCRIPTION

- With the railroad industry's increase of the length and weight of trains operated over the rail network, accepted practices for both train makeup and train handling developed in the past may not be appropriate for very long trains (such as 200 car trains), possibly leading to excessive coupler forces and derailments.





- This project seeks to address the following:
  - How does the increase in air brake signal propagation time impact application and release, and how does the air brake system leakage on such long trains affect the brake pipe pressure on cars near the tail end of train?
  - What train handling and train strategies may help reduce adverse effects of train length on operational safety?
  - Are there potential crew attention issues during potentially lengthy terminal tests and train dispatch inspections (are they likely to have fatigue/attention issues towards the tail end of a long train)?
  - How are the potentially high buff and draft forces under undulating territories likely to pose challenges to the engineer in handling a 200 car train or longer?
  - How do the increased buff and draft forces impact individual car dynamic behavior and safety during curve negotiation?

RAILROAD IMPACT

- Improved train makeup.
- Improved motive power assignment.
- Reduced incidents/derailments.
- Improved operational safety.
- Reduced risk exposure to public.

PROJECT PARTNER(S)

- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: FY19 $257,000
- Project Duration: July 2017 – June 2021

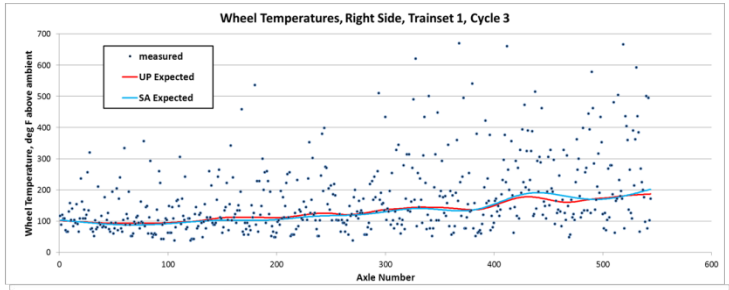
U.S. Department of Transportation
Federal Railroad Administration

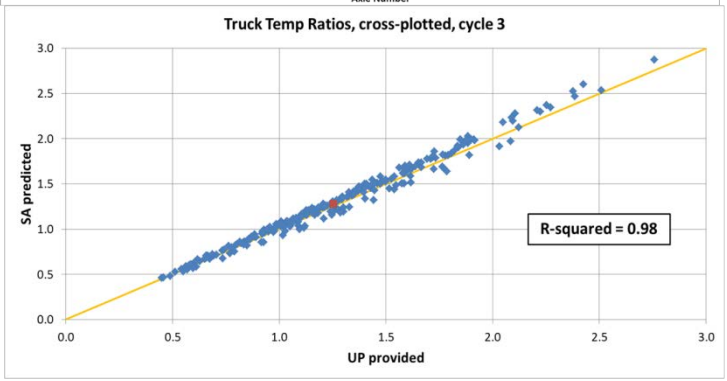
FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Wheel Temperature Detector (WTD) Waiver Support

PROJECT DESCRIPTION

- Identify brake systems that are not functioning properly by detecting wheels that are inappropriately hot or cold.
- Assess the implementation of Wheel Temperature Detector (WTD) technology and its effectiveness in improving the safety of train operations and detection of air brake system defects on moving trains.
- Develop database for maintaining the pilot study data supplied by the railroad for the WTD system and the car maintenance.
- Develop methodology for data analysis to support the test committee.
- Conduct data analysis to support the evaluation of the performance of the pilot study as it relates to meeting the success criteria established for the pilot study.





RAILROAD IMPACT

- Automate detection of hot and cold wheels.
- Preventive maintenance of fleet's air brake systems.
- Improve train braking performance.
- Improve operational safety.
- Reduce risk exposure to public from air brake related incidences.

PROJECT PARTNER(S)

- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: FY19 $140,000
- Project Duration: August 2017 – July 2022

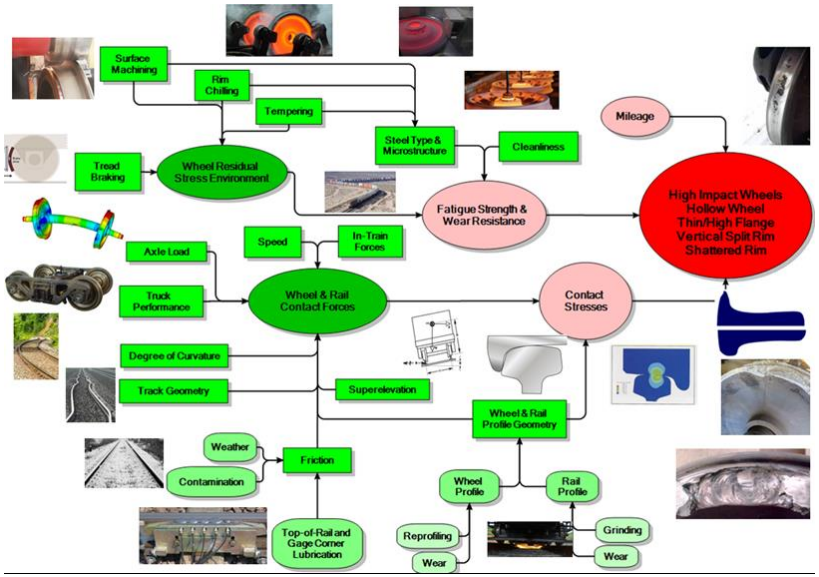
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Framework for the Development of Wheel Life Model

PROJECT DESCRIPTION

- Railway vehicles, using steel wheels rolling on steel rails, constitute the most fuel-efficient transportation system for moving large volumes of goods over long distances. Over time, the tonnage carried per wheel has progressively increased thus subjecting the wheel-rail contact area to much higher stresses. These higher stresses have accelerated the problem of rolling contact fatigue (RCF).
- The project will carry out the following:
  - Conduct literature review to document damage resistance models of freight wheels, contact stress environment and residual stress analysis for manufacturing processes to validate against any published data.
  - Identify contact load environment based on field tests and revenue service grouped by degree of curvature.
  - Develop wheel and rail contact model using boundary element method (CONTACT©) and embed preliminary transient thermal Finite Element Analysis (FEA) model simulating tread braking.
  - Investigate new shakedown and ratcheting areas for a framework for a wheel life model.



RAILROAD IMPACT

- Improve methodology and analysis for wheel fatigue life evaluation.
- Reduce risk to public attributed to wheel failure by use of reliable analysis tools for predicting failure mechanisms.
- Improve railroad operational safety against wheel failure related derailments.

PROJECT PARTNER(S)

- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: FY19 $149,800
- Project Duration: September 2018 – March 2020

FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

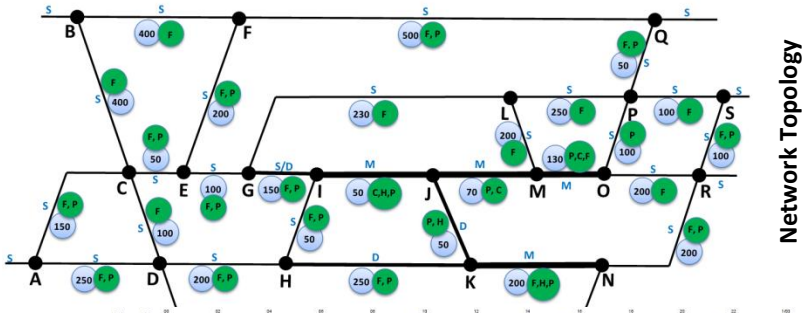
Effects of Technology Implementations on Network Operations

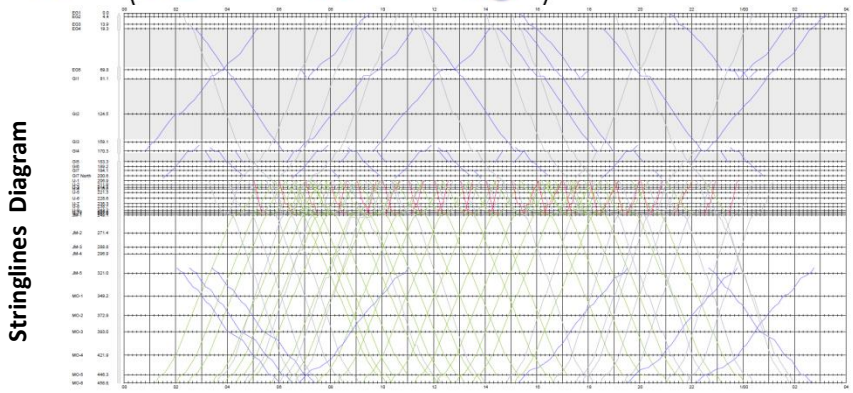
PROJECT DESCRIPTION

- Develop a methodology to quantify network level benefits for train operations resulting from the implementation of new technologies.
- Use network simulations software OpenTrack® for various network operational characteristics as follows:
  - Different types of corridors: single track, double track, and multiple track corridors
  - Types of traffic: dedicated vs. shared-use corridors
  - New technology implementation

RAILROAD IMPACT

- Improve traffic congestion analysis.
- Objective evaluation of operating with new technologies.
- Capabilities to analyze the network related parameters of operating trains under PTC systems.
- Quantify network benefits due to new technologies.





PROJECT PARTNER(S)

- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: FY19 $149,000
- Project Duration: September 2018 – September 2021

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Wheel Failure Research Program

PROJECT DESCRIPTION

- Reduce wheel failures including vertical split rims (VSRs) and shattered rims.
- Participate in an industry-wide stakeholder working group focused on evaluating current failure modes and characteristics.
- Develop research strategies, including analysis of historical data and testing failed wheels, to mitigate failures and reduce risks to achieve overall safety improvement.

RAILROAD IMPACT

- Increase understanding of current wheel failure mechanisms and facilitate mitigation.
- Reduce derailments causing severe equipment and track damage.
- Reduce public safety risks and costs associated with such incidents.

PROJECT PARTNER(S)

- ENSCO, Inc.
- Association of American Railroads (AAR)
- Wheel Manufacturers

COST & SCHEDULE

- Funding: $500,000 – Phase II
- Project Duration: September 2017 – March 2019

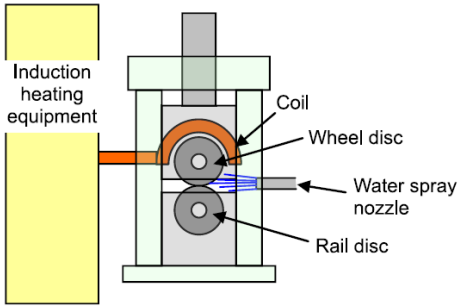
U.S. Department of Transportation
Federal Railroad Administration

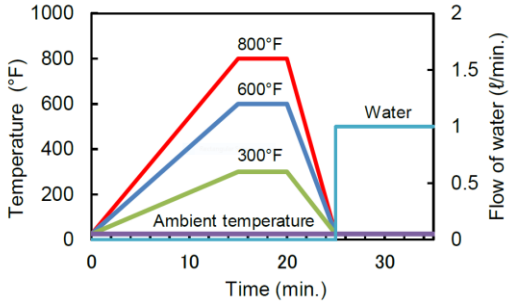
FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Effects of Temperature on Wheel Spalling

PROJECT DESCRIPTION

- Use a twin disc roller test machine to study the effects of contact pressure, slip ratio, lubrication and temperature on the development of rolling contact fatigue (RCF) cracks on wheels.
- Induction heating coil will control the temperature of the "wheel" disc up to a maximum of approximately 1,000° F.
- Investigate how temperature at the wheel-rail interface can affect wheel surface performance.





RAILROAD IMPACT

- Reduce occurrence of high impact wheels, and thus improve safety and reduce the effects of high impact forces on degradation of roller bearings, rail, and track structure.
- High impact wheels are often a result of wheel RCF, in which cracks initiate at or near the tread surface of the wheel and propagate until pieces of the wheel tread surface break out.
- Yield strength and residual stress are both important factors in a wheel's ability to resist damage from RCF. Both of these properties can be affected by changes in temperature.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)
- Nippon Steel and Sumitomo Metal Corporation

COST & SCHEDULE

- Funding: $279,350
- Project Duration: August 2017 – April 2019

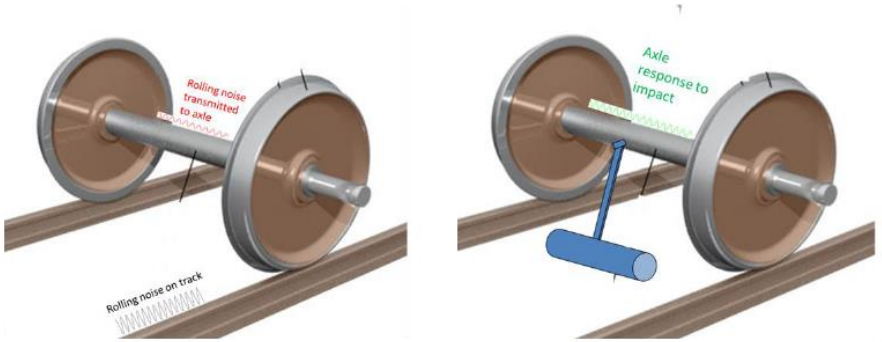
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Resonant Acoustic Wayside Cracked Axle Detection (RAWCAD)

PROJECT DESCRIPTION

- A four phased project aimed at developing and demonstrating a wayside automated cracked axle detection system for moving trains.
- Use of the fact that axles are periodically loaded due to rotation.
- Develop novel methods for measuring and identifying the vibration response on moving axles.
- First phase will confirm the effect on a static axle.



RAILROAD IMPACT

- Rail cars must currently be removed from service to detect axle defects.
- Automated axle inspection on moving trains can lead to improved capacity and efficiency for the railroads while simultaneously improving safety.
- Automated cracked axle detection will reduce in-service defects and proactively improve safety.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)
- Vibroacoustic Concepts, LLC

COST & SCHEDULE

- FRA Funding: $343,820 – approved for Phases 1 & 2
- Project Duration: September 2018 – July 2021
  - Phase 1 – semi-static testing has begun

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Diagnosis and Detection of Bearing Grease Degradation and Defects

PROJECT DESCRIPTION

- Investigate the properties of grease degradation related to bearing performance, across all bearing types and grease types over the life-cycle of in-service bearings.
- Determine if it is possible to identify the grease metrics associated with bearing failure modes based on grease sampling and analysis.
- Determine the best location in the bearing to sample bearing grease, as determined by the worst grease condition.

RAILROAD IMPACT

- Improve safety by investigating the properties of grease degradation from bearings at the end of service life, focusing on defect related lubrication degradation.
- Reduce accidents by proposing methods to diagnose bearing defects through grease analysis.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: FY19 $100,000
- Project Duration: September 2018 – June 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Technologies and Testing to Prevent Water Ingress to Railroad Bearings

PROJECT DESCRIPTION

- Test the ability of the current baseline bearing rubbing lip seals versus the frictionless seals to prevent water ingress over the life of the bearing.
- Determine if water ingress will occur in revenue service bearing seals through environmental fluctuations.

RAILROAD IMPACT

- The primary objective of this research is to improve safety and reduce accidents from bearing defects. This will be done in two parts:
  1. Research how water ingress causes bearing degradation.
  2. Recommend solutions to prevent water ingress.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: FY19 $150,000
- Project Duration: September 2018 – November 2019

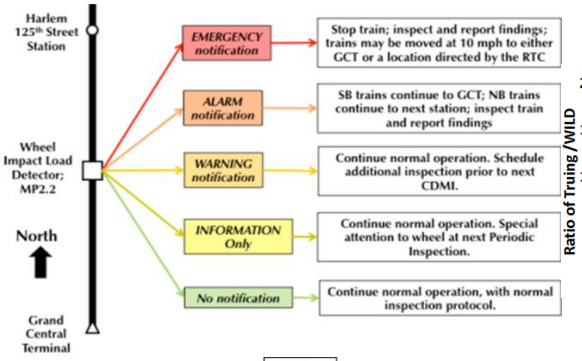
U.S. Department of Transportation
Federal Railroad Administration

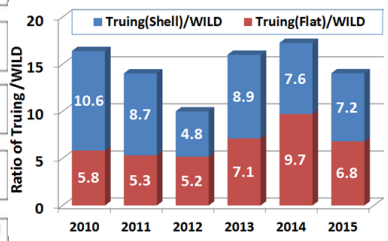
FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

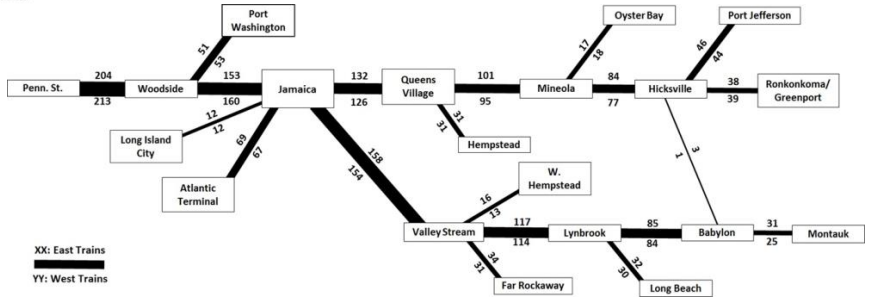
Wayside Advanced Technology Systems (WATS)

PROJECT DESCRIPTION

- Partner with Metro-North Railroad (MNR), Long Island Rail Road (LIRR) and New York Atlantic Railway (NYA) to assist with pilot demonstrations of new wayside technology systems to detect defects and precursors to safety critical defects in railroad rolling stock.
- Review and document existing and new/proposed wayside detector installations.
- Evaluate corresponding performance monitoring control protocols.
- Review the detection data alerts and maintenance practices.
- Develop recommendations for wayside system enhancements and further research/study.







RAILROAD IMPACT

- Improve the process for demonstrating and implementing new technology.
- Establish a standard process for wayside technology pilot demonstrations.
- Wayside technology systems will reduce the number of incidents and accidents through proactive maintenance driven by monitored performance of rolling stock equipment and components.

PROJECT PARTNER(S)

- Sharma & Associates, Inc.
- Metro-North Railroad (MNR)
- Long Island Rail Road (LIRR)
- New York & Atlantic Railway (NYA)

COST & SCHEDULE

- Funding: FY19 $89,850
- Project Duration: September 2018 – September 2021

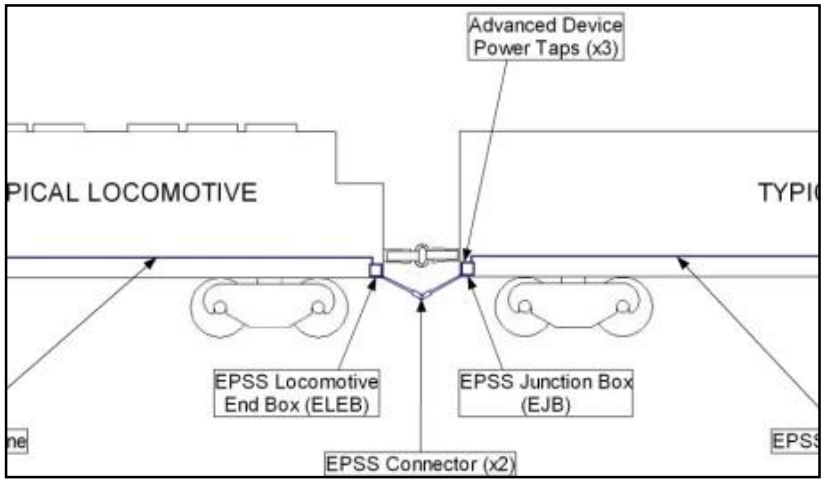
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Test Rack Hardening of Electrical Power Supply System (EPSS) for Freight Cars

PROJECT DESCRIPTION

- Electrical Power Supply System (EPSS) takes electrical power from locomotives and distributes it along adjoining freight cars in a train.
- Successful initial test of the prototype EPSS system at the Transportation Technology Center (TTC) in Pueblo, Colorado, included one locomotive and two freight cars that utilized advanced devices including Electrically Driven Handbrakes (EDHBs).
- Design, prototype and test an EPSS DC access / battery charger. The interface/charger is powered by the EPSS AC power line and provides a standard 24 volts DC interface to safety and security devices where desired.
- Completed a full-scale field test of the EPSS on a one locomotive and eight freight car train. The system worked without any issues and the power line losses insignificant.
- 50-car simulator in-lab EPSS test rack: Built and currently in use for test hardening of the EPSS design and collection of performance data for EPSS model calibration for use in extrapolating to much longer trains.



PROJECT PARTNER(S)

- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: $299,000 – Phase II
- Project Duration: September 2016 – September 2020

RAILROAD IMPACT

- Electrical power available on freight cars would increase safety, security and efficiency in freight railroad operations. It would allow for the implementation of safety and efficiency improvement devices, including remote controlled actuators and passive sensors for use with car switching mechanisms and intrusion detection, and many other opportunities.
- The EPSS DC access/battery charger development allows future developers of safety, security, and efficiency improvement devices a 24 VDC interface with which to connect.

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Optimization of Electrically Driven (Set and Release) Hand Brake (EDHB)

PROJECT DESCRIPTION

- Electrically Driven Hand Brake (EDHB) is a remotely controlled, electrically driven, set and release, vertical wheel hand brake that keeps all normal manual AAR Group N and related Groups' specified functions and requirements.
- Following successful prototype development:
  - Developed a draft performance specification template for Association of American Railroads' (AAR's) review.
  - Completed prototype testing and validation.
  - Completed long-term field exposure testing on three prototype EDHBs installed on freight cars at the Facility for Accelerated Service Testing (FAST), at the Transportation Technology Center (TTC).
  - Optimized the controller/motor interface design and efficiency, and implemented an improved means of feedback from chain load of communications, and control of application and release functions.
- Currently developing a wireless communications and control interface.

PROJECT PARTNER(S)

- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: $348,000
- Project Duration: April 2014 – September 2019

RAILROAD IMPACT

- Reduce risk of operator injuries and the need to go in between/climb rail cars.
- Reduce the potential for runaway trains by allowing more straightforward and effective hand-brake application and release.
- Reduce damage to hand brakes due to controlled application and release forces.
- Mitigate slid flat and out-of-round damage to wheels.
- Mitigate damage to lading, track, vehicles and bridges due to damaged wheels.
- Reduce railroad operating costs.

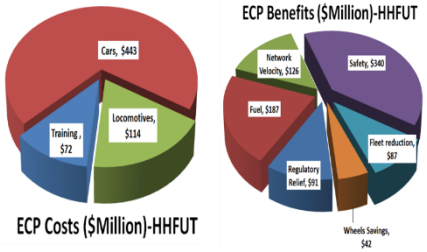
U.S. Department of Transportation
Federal Railroad Administration

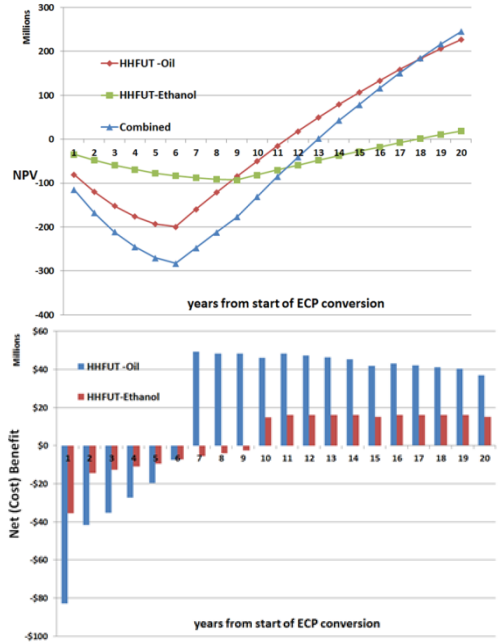
FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Electronically Controlled Pneumatic (ECP) Brakes Implementation and Pilot Demo

PROJECT DESCRIPTION

- This project focuses on a roadmap for ECP implementation.
  - Review technical and financial concerns from industry stakeholders.
  - Prepare a roadmap brief for internal review at FRA.
  - Support FRA in setting up a stakeholder Technology Implementation Advisory Group (TIAG) to guide the ECP implementation.
  - Develop analysis tools to support TIAG in an ECP pilot.





RAILROAD IMPACT

- Improve train control with effective and reliable air brakes.
- Shorter stopping distance to reduce over-speed and collision incidents.
- Improved network capacity through increased train speeds and train performance.
- Improved operational safety and reduced risk exposure to public.

PROJECT PARTNER(S)

- Sharma & Associates, Inc.

COST & SCHEDULE

- Funding: FY19 $98,900
- Project Duration: July 2017 – June 2021

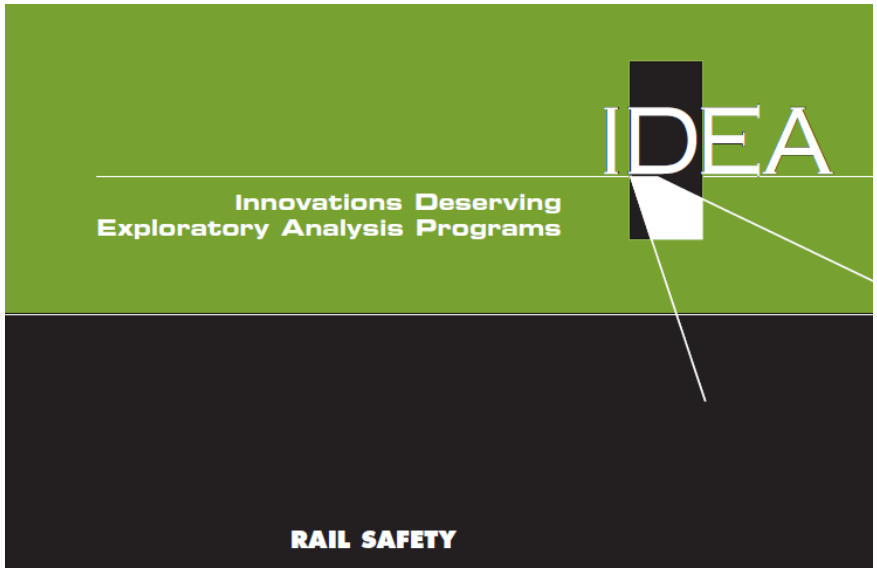
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Monique Stewart • (202) 493-6358 • monique.stewart@dot.gov

Rail Safety Innovations Deserving Exploratory Analysis (IDEA) Program

PROJECT DESCRIPTION

- The National Academy of Sciences (NAS) carries out the Rail Safety IDEA program through the Transportation Research Board (TRB).
- IDEA programs differ from traditional research programs since such projects are initiated by researchers, inventors, universities, or companies, both within and outside the usual transportation research community rather than by a request for proposals.
- Each year, three proposals are selected and funded for up to $100,000 each.



RAILROAD IMPACT

- Capture unexpected concepts that challenge conventional thinking.
- Explore promising but unproven concepts with the potential to advance railroad safety and performance.
- Support universities' research centers and small companies to improve their railroad research capabilities and expertise.

PROJECT PARTNER(S)

- Transportation Research Board (TRB)

COST & SCHEDULE

- Funding: FY19 $400,000
- Project Duration: January 2019 – June 2021

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Tarek Omar • (202) 493-6189 • tarek.omar@dot.gov

Non-Destructive Evaluation (NDE) of Railroad Tank Cars

PROJECT DESCRIPTION

- Disseminate prior NDE probability of detection (POD) results/findings with the tank car industry and other stakeholders.
- Conduct a feasibility study to identify the capabilities/limitations of new and advanced NDE methods for tank car inspections.
- Investigate the effects of corrosion on railroad tank car structures, and the potential use of state-of-the-art NDE methodologies for remaining tank car shell thickness measurement.
- Gather information on the newer types of tank cars and the common failure modes and determine if newer weld test panels are needed for future POD studies.

RAILROAD IMPACT

- Providing inspection reliability is a key consideration in the safety and operations of tank cars.
- Increases safety through technological development
- Addresses industry needs in the areas of maintenance, inspection, and damage tolerance.
- Quantification of the NDE methods through POD metrics provides direction and insight into the current capabilities of the industry when using the allowed NDE methods.
- Provides for operator and procedure qualifications.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)
- Tank car industry and other stakeholders
- NDE equipment Original Equipment Manufactures (OEMs)

COST & SCHEDULE

- Funding: FY19 $100,000
- Project Duration: October 2018 – September 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francisco González • (202) 493-6076 • francisco.gonzalez@dot.gov

Tank Car Impact Tests

PROJECT DESCRIPTION

- Continuation of FRA and industry tank car impact research programs.
- Develop and improve test methods.
- Provide data for improving modeling methods.
- Design and construct test fixtures.
- Prepare and test various tank car designs:
  - April 27, 2016 – DOT 105A-500W
  - September 28, 2016 – DOT 117J-100W
  - July 26, 2017 – DOT 105
  - August 1, 2018 – DOT 105
  - October 30, 2018 – DOT 111
  - 2019: car and date TBD, possibly a cryogenic tank car
- Analyze and provide the data for validation of finite element models.
- Issue reports on test and model results.

RAILROAD IMPACT

- Development of performance-based testing requirements.
- Development of methods to evaluate the crashworthiness and structural integrity of different tank car designs.
- Evaluation of crashworthiness performance of tank cars used in the transportation of hazardous materials.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)
- Volpe National Transportation Systems Center
- Tank car donors:
  - Trinity Rail
  - Shell
  - Axial

COST & SCHEDULE

- Funding: $2,522,063
- Project Duration: July 2015 – July 2019

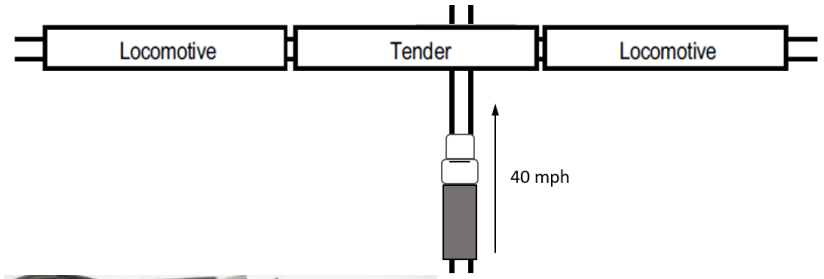
U.S. Department of Transportation
Federal Railroad Administration

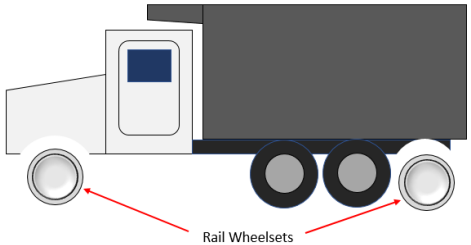
FRA PROJECT MANAGER: Francisco González • (202) 493-6076 • francisco.gonzalez@dot.gov

Structural Crashworthiness of Tender for Liquefied Natural Gas

PROJECT DESCRIPTION

- Provide data to help evaluate the survivability of the valve functions to cut off supply and shut off any liquefied natural gas (LNG) or gas flow under certain grade crossing accident conditions.
- Testing will be performed according to the proposed draft Association of American Railroads (AAR) standard: AAR Natural Gas Fuel Tender Specifications, M-1004.





RAILROAD IMPACT

- Will allow use of LNG as a locomotive fuel.
- Potential fuel cost savings.
- Potential clean fuel technology.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)
- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: $441,000
- Project Duration: August 2017 – May 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francisco González • (202) 493-6076 • francisco.gonzalez@dot.gov

Tank Car Operating Environment

PROJECT DESCRIPTION

- High magnitude coupling forces that occur in yard operations have the potential to exceed yield limits of mild steel.
- Recently completed comprehensive test program to characterize tank car load environments at Amsted Rail's test facility in Camp Hill, Pennsylvania.
- Focus on comprehensive analysis of the collected impact test data to arrive at limiting conditions for coupling speed and impacting mass.
- Additional testing will focus on brake system performance in revenue service operations.

RAILROAD IMPACT

- Create better understanding of the operational environment and root cause of fractures on tank cars.
- Develop speed and mass combination curves to mitigate tank car stub sill failures.
- Conduct over the road brake testing to target a variety of issues being faced by the industry.

PROJECT PARTNER(S)

- ENSCO, Inc.
- Union Tank Car Company
- Amsted Rail

COST & SCHEDULE

- Funding: $310,000
- Project Duration: September 2018 – September 2020

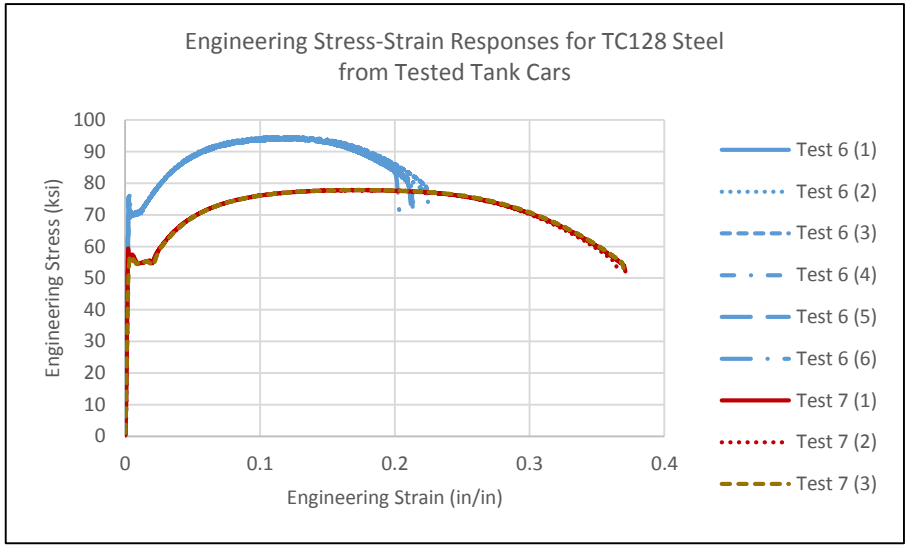
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francisco González • (202) 493-6076 • francisco.gonzalez@dot.gov

Structural Behavior of Tank Cars Under Operating Conditions

PROJECT DESCRIPTION

- Conduct engineering analyses and develop computational tools to evaluate structural performance of railroad tank cars under normal operating conditions.
- Conduct material testing to determine mechanical properties and fracture behavior of tank car steels.
- Conduct study on fabrication techniques affecting material properties.
- Develop computational models of tank car steels.



RAILROAD IMPACT

- Previous industry and FRA-sponsored research has revealed a wide range of material properties found in tank car fleet.
- Additional data has become available since that previous research was conducted.
- Understanding the range of material behaviors in tank car fleet needed to determine “baseline” tank car fleet structural performance.
- Developing computational models of these materials supports parametric studies of material variations.
- Understanding the effects of fabrication techniques on mechanical properties in “as-built” cars can identify potential benefits to tank car performance.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: FY19 $150,000
- Project Duration: August 2018 – April 2020

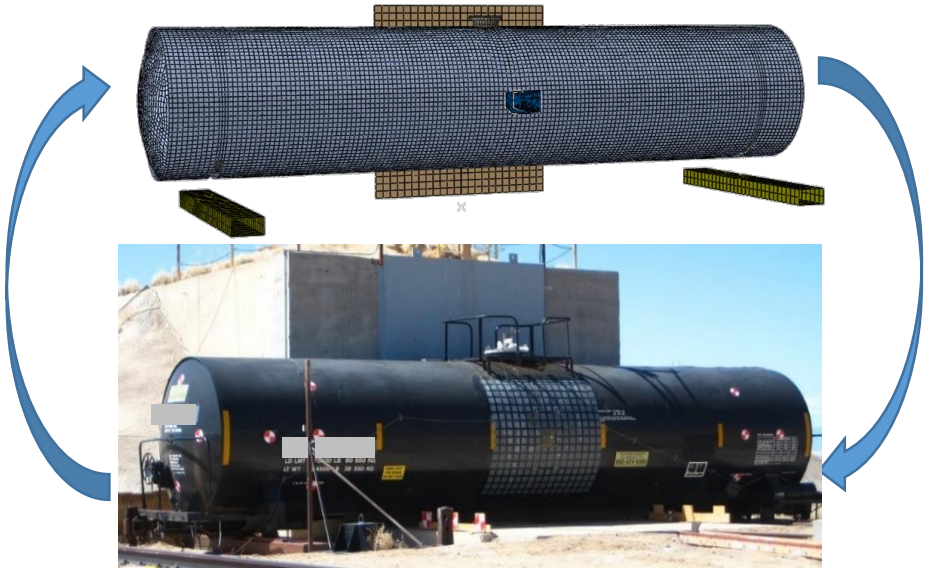
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francisco González • (202) 493-6076 • francisco.gonzalez@dot.gov

Structural Behavior of Tank Cars under Accident Conditions

PROJECT DESCRIPTION

- Evaluate puncture resistance of various tank car designs (e.g., DOT-105, DOT-111, DOT-117, etc.) in standardized shell impact scenarios.
- Examine effects of parameters such as support conditions, impactor size, etc., on shell puncture.
- Develop computational models of tank car designs under impact conditions.
- Compare test data with model results to validate models.



RAILROAD IMPACT

- Development of performance-based evaluation requirements.
- Development of methods to evaluate and compare the crashworthiness and structural integrity of different tank car designs.
- Evaluation of crashworthiness performance of tank cars used in the transportation of hazardous materials.
- Development of objective methods for demonstrating validation of computational models.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: FY19 $150,000
- Project Duration: August 2018 – April 2020

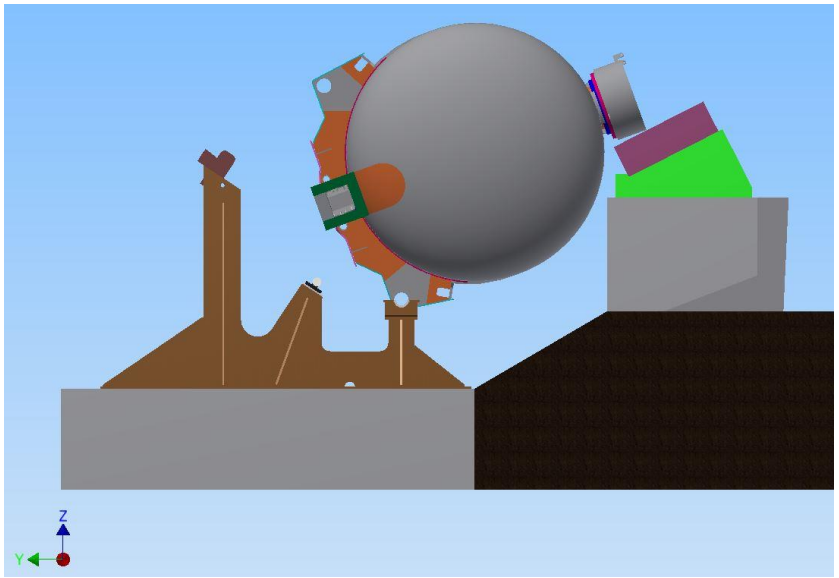
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francisco González • (202) 493-6076 • francisco.gonzalez@dot.gov

Improving Safety of Tank Car Fittings in Hazardous Materials (Hazmat) Service

PROJECT DESCRIPTION

- Evaluate the performance of top fittings protection used on current design tank cars, particularly those used in unit trains carrying flammable materials under rollover conditions.
- Conducted through a series of analytical simulations and full-scale rollover tests
- Designs considered include:
  - CPC-1232 style designs
  - Innovative, industry proposed options
- Calibrate analytical models to test results.
- Develop criteria and protocols for future industry research.



RAILROAD IMPACT

- Improve overall safety of tank car operations by mitigating the release of hazardous material (hazmat) in tank car rollover derailments.
- Help develop performance information that can be used by the industry for standards development.
- Develop recommendations for future design and testing of fittings for industry use.

PROJECT PARTNER(S)

- Sharma & Associates, Inc.
- Tank car manufacturers
- Railroads (CSX, UP, BNF, CP, Norfolk Southern)

COST & SCHEDULE

- Funding: FY19 – TBD
- Project Duration: May 2016 – December 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francisco González • (202) 493-6076 • francisco.gonzalez@dot.gov

Performance of Pressure Relief Devices (PRDs) Under Fire Conditions

PROJECT DESCRIPTION

- Tank cars are required to have pressure relief devices (PRDs) to protect tank cars under derailment fire conditions.
- However, the performance of PRDs under fire conditions has not previously been evaluated/confirmed.
- The intent of this project is to document by scale testing under nominal fire conditions, PRD performance with respect to opening pressure, reclosing, and evacuating the tank.
- Initial tests planned with water as lading; subsequent tests conducted with flammable lading.
- Results will be used to validate detailed analytical models being developed by agencies like Transport Canada.

RAILROAD IMPACT

- Helps the industry better understand the risks associated with hazardous materials transportation, as PRD performance under derailment fire conditions is critical to safety.
- Quantification of PRD performance will help industry with designs and standards of PRDs that are appropriate for flammable liquid service.

PROJECT PARTNER(S)

- Sharma & Associates, Inc.
- Transport Canada
- Underwriters Laboratories
- TransQuip
- Fort Vale
- Bundesanstalt für Materialforschung und -prüfung (BAM)

COST & SCHEDULE

- Funding: FY19 – TBD
- Project Duration: 2018 – 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francisco González • (202) 493-6076 • francisco.gonzalez@dot.gov

Fire Performance of a Cryogenic ISO UN-T75 Tank

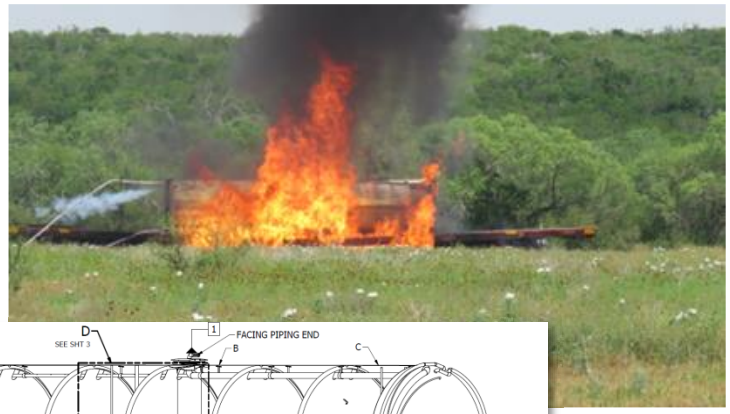
PROJECT DESCRIPTION

PHASE I:

- Conduct a full-scale fire test on an ISO UN-T75 tank (see photograph to the right).
- Obtain experimental data.
- Provide a realistic fire exposure of the ISO tank on a flat car, simulating a fire exposure in an accident conditions.
- Conduct a computer simulation of the experiment data.
- Use nitrogen as a commodity and a diesel fire.

PHASE II:

- Repeat Phase I test with liquefied natural gas (LNG) in test tank, instead of liquid nitrogen.
- Make improvements to internal instrumentation, including several floating temperature measurements (see schematic to the right), which will be used for future computer model validation.
- Phase II test scheduled for Spring 2019.



RAILROAD IMPACT

- Improve the survivability of the ISO tank in fire conditions.
- Improve the performance of the pressure relief device.
- Obtain important data for future design improvements.
- Improvements to crashworthiness of tender.

PROJECT PARTNER(S)

- Southwest Research Institute
- Sharma & Associates, Inc.
- Florida East Coast Railroad (FECR)
- Friedman Research Corporation
- Transport Canada
- Pipeline and Hazardous Materials Safety Administration (PHMSA)
- Taylor-Wharton (formerly CVA)

COST & SCHEDULE

- Funding:
  - FY19 – Phase II: $230,000
  - FY18 – Phase II: $400,000
  - FY17 – Phase I: $300,000
- Project Duration: September 2017 – September 2019

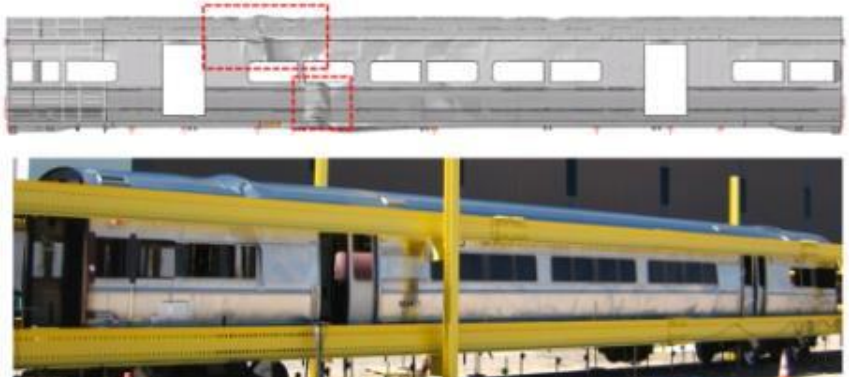
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francisco González • (202) 493-6076 • francisco.gonzalez@dot.gov

Passenger Equipment Structural Crashworthiness

PROJECT DESCRIPTION

- Develop design strategies for improving the structural crashworthiness of passenger rail cars relative to existing designs.
- Develop specifications and regulations, and to support various waiver requests and evaluations of compliance with FRA regulations.
- Previous work focused on Occupied Volume Integrity (OVI) or the ability of a passenger rail car to support a large longitudinal load without compromising the space occupied by passengers and crew.
- Current focus on side structure integrity criteria. Side strength requirements for various passenger equipment designs are being investigated in response to a National Transportation Safety Board (NTSB) recommendation to FRA.



COST & SCHEDULE

- Funding: FY19 – $0
- Project Duration: August 2018 – April 2020
  - Paper and presentation at The American Society of Mechanical Engineers International Mechanical Engineering Congress & Exposition (ASME IMECE), November 2018
  - Results of parametric study, June 2019
  - Comprehensive report on side structure integrity, June 2019

RAILROAD IMPACT

- Current longitudinal loading requirement for passenger cars requires the structure to experience no permanent deformation while an 800,000 pound load is placed along the line of draft.
- New passenger equipment rule contains alternative OVI requirements that are applicable to passenger cars designed to alternate standards which move the evaluation load from the line of draft to the collision load path.
- Similar to OVI, side strength plays a role in accident survivability.
- Modeling performed to assess structural performance under a variety of loading conditions and the tendency for rollover when vehicles are subjected to side impacts.
- Development of techniques for demonstrating compliance with the requirements and conducting assessments of the results of those analyses assist FRA in ensuring that passenger vehicles achieve sufficient occupied volume strength.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jeff Gordon • (617) 494-2303 • jeffrey.gordon@dot.gov

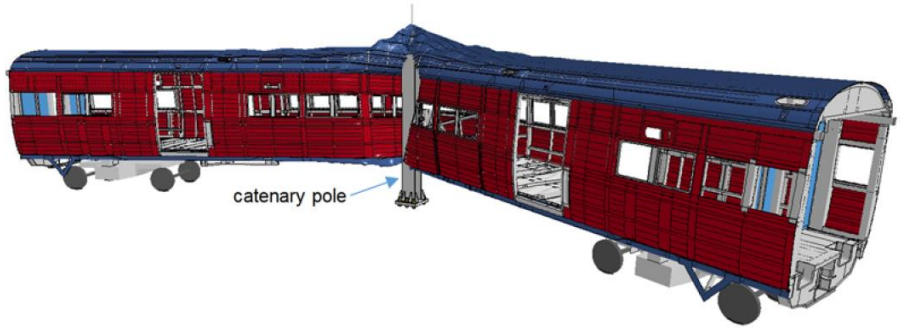
Resilient Wayside Structures and Passenger Car Survivability

PROJECT DESCRIPTION

- Passenger fatalities and injuries can occur during derailments due to interaction with wayside structures, such as catenary poles, bridge abutments, and discontinuities in third rail.
- Apply design considerations for roadside (highway) structures to railroad wayside structures to reduce stiffness and strength, incorporate energy absorbing mechanisms, and allow failure to occur in a controlled and predictable manner.
- Develop a proof-of-concept breakaway base connection design to reduce the hazards presented by catenary poles to demonstrate design practicality through experimental testing and additional high-fidelity numerical modeling.
- Experimental test program will involve static friction tests, static lateral load tests, and dynamic impact tests.
- Roadmap for market delivery will also be identified through the development of a robust commercialization strategy.

COST & SCHEDULE

- Funding: FY19 – $0
- Project Duration: July 2018 – January 2020
  - Development of Experimental Test Plan, completed
  - Experimental Characterization of Breakaway Mechanism, February 2019
  - Proof-of-Concept Pendulum Impact Testing, August 2019
  - Numerical Analysis of OLE Support Structure, October 2019
  - Commercialization Planning, throughout project
  - Final report to be issued in 2019



RAILROAD IMPACT

- Damage mitigation concept that modifies existing anchor bolt base connection designs would be both effective in enhancing passenger safety and likely attractive to passenger railroads.
- Commercialization planning will also involve the development of a preliminary connection design package, including drawings/sketches, material specifications, and recommended design guidance.
- Design package will serve to facilitate discussions with industry on market delivery/integration and practical use on projects.

PROJECT PARTNER(S)

- Protection Engineering Consultants
- Arup
- Southwest Research Institute

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jeff Gordon • (617) 494-2303 • jeffrey.gordon@dot.gov

Locomotive Structural Crashworthiness

PROJECT DESCRIPTION

- Demonstrate effectiveness of crashworthy components in preventing override in collisions involving locomotives.
- Evaluate performance of the combination of a push-back coupler and deformable anti-climber under full-scale dynamic impact scenarios.
- Design crashworthy components as a retrofit to existing locomotives.
- Perform individual component testing to demonstrate performance and develop technical information to inform finite element modeling.
- Perform routine coupling tests to develop range of expected impact forces and to demonstrate designed behavior.
- Plan for full-scale impact tests in January 2019 and beyond to assess the performance of the retrofit components in a moderate-speed collision for a range of impacted equipment.
- Activities to also include a full-scale train-to-train impact test, as well as development of locomotive crashworthiness standards.

RAILROAD IMPACT

- Locomotives, because of their great longitudinal strength and stiffness, are particularly susceptible to override when they collide with another vehicle, and the consequences can be catastrophic.
- Research has shown that conventional anti-climbing structures can deform on impact and form a ramp, increasing the likelihood of override.
- Such behavior was exhibited in a 23-mph collision that occurred in Red Oak, Iowa, on April 17, 2011 (see photo above).
- Research has also shown that the addition of modest structural features to the forward end of a locomotive can greatly reduce the propensity for override.

COST & SCHEDULE

- Funding: FY19 $1,000,000
- Project Duration: August 2018 – April 2020
  - FRA report on conventional coupling tests, December 2018
  - Presentation on vehicle-to-vehicle (V2V) test results, February 2019
  - Joint Rail Conference paper on V2V test plans, April 2019
  - The American Society of Mechanical Engineers International Mechanical Engineering Congress & Exposition (ASME IMECE) paper on V2V test results, November 2019

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- TIAX
- Transportation Technology Center, Inc. (TTCI)
- CANARAIL

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jeff Gordon • (617) 494-2303 • jeffrey.gordon@dot.gov

Interior Occupant Protection

PROJECT DESCRIPTION

- Research to inform development and revision of American Public Transportation Association (APTA) safety standards to address the crashworthiness of passenger seats and workstation tables in passenger rail cars.
- Preferred option (Option A) in the table safety standard requires dynamic sled testing with an advanced anthropomorphic test devices (ATDs) to evaluate abdominal injuries.
- The H3RS ATD was developed in the UK specifically to assess abdominal injuries due to impacts with tables in trains.
- Conduct research, development, and testing to improve the biofidelity, reliability, and repeatability of the performance of the H3RS ATD.
- Additional activities include further development of a simulation model representative of the H3RS ATD and a study to identify additional table force-crush behavior and geometry prone to cause occupant injury.

COST & SCHEDULE

- Funding: FY19 $250,000
- Project Duration: August 2018 – April 2020
  - Facilitate revisions to APTA Workstation Table Standard, early 2019.
  - Prepare proposal for revised APTA Seat Standard, December 2018.
  - Two The American Society of Mechanical Engineers International Mechanical Engineering Congress & Exposition (ASME IMECE) papers on validated Mathematical Dynamic Modeling (MADYMO) model of H3RS ATD and workstation tables, November 2018.
  - Presentations to industry working group on analyses to evaluate the crash pulse developed over a range of collisions speeds, late 2019.

RAILROAD IMPACT

- Impacts with fixed workstation tables can cause significant abdominal injuries to passengers.
- UK and U.S. have safety standards for workstation tables that involve use of ATDs capable of assessing abdominal injuries.
- In partnership with UK researchers, costs to improve the fidelity of the H3RS ATD can be shared.
- A globally acceptable test device which would present an opportunity to exploit advances in ATD instrumentation since the H3RS ATD was first developed in 2002.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Rail Safety and Standards Board (UK)
- Transportation Research Laboratory (UK)

FRA PROJECT MANAGER: Jeff Gordon • (617) 494-2303 • jeffrey.gordon@dot.gov

Field Investigations

PROJECT DESCRIPTION

- Activities include documenting the damage to the equipment (both interior and exterior), reconstructing the sequence of events and identifying causal mechanisms for injury and fatality.
- Findings serve to assess the current performance of rail equipment, interiors, emergency egress/access, fuel tank integrity and other safety features.
- Produce technical presentation of the field investigation from the preliminary findings.
- Issue report or paper describing the findings from the field investigations and the accident reconstruction.

COST & SCHEDULE

- Funding: FY19 – $0
- Project Duration: August 2018 – April 2020
  - Accident investigations have been performed for: Lake City, SC, in August 2000; Nodaway, IA, in March 2001; Crescent City, FL, in April 2002; Placentia, CA, in April 2002; Kensington, MD, in July 2002; Flora, MS, in April 2004; Glendale, CA, in January 2005; Chicago, IL, in September 2005; Chicago, IL, in November 2007; Chatsworth, CA, in 2008; Red Oak, IA, in April 2011; Lovelock, NV, in 2011; Goodwell, OK, in June 2012; Bridgeport, CT, in May 2013; Spuyten Duyvil, NY, in December 2013; Philadelphia, PA, in 2015; Hoboken, NJ, in September, 2016; Dupont, WA, in December 2017; Cayce, SC, in February, 2018.

RAILROAD IMPACT

- Derive passenger equipment safety research program areas from information gleaned from real-world conditions.
- Identify deficiencies related to equipment performance and operating practices, and inform changes to regulations and industry standards.
- Tune program direction based on the findings of the field investigations to ensure maximum application and effectiveness of research results.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Owners/operators of equipment involved in investigated accidents

FRA PROJECT MANAGER: Jeff Gordon • (617) 494-2303 • jeffrey.gordon@dot.gov

Passenger Equipment Glazing Integrity

PROJECT DESCRIPTION

- Develop engineering strategies for improved occupant containment by glazing systems, while meeting all other existing safety, service, and manufacturing requirements.
- Glazing system functions as windows and expected to be impact resistant, provide emergency egress, provide emergency access, be fire resistant, and provide occupant containment.
- Develop detailed plans for drafting, analyzing, and testing engineering strategies for glazing systems.
- Define all safety and operational requirements placed on glazing systems; assess the performance of current glazing systems in meeting those requirements; develop modifications for improving occupant containment; and, conduct analysis and testing to compare the performance of conventional and modified glazing systems.

COST & SCHEDULE

- Funding: FY19 $137,000
- Project Duration: August 2018 – April 2020
  - Present research findings to APTA or RSAC to facilitate rule-making, April 2020
  - Issue report describing project and results

RAILROAD IMPACT

- At least 25 fatalities attributed to glazing malfunction in the last 44 years.
- Subsequent to the commuter train derailment in Spuyten Duyvil, New York, on December 1, 2013, the National Transportation Safety Board (NTSB) issued a recommendation for more effective passenger containment by glazing systems in derailments.
- NTSB re-iterated its recommendation after the derailment in Philadelphia, Pennsylvania, on May 12, 2015.
- Currently, no FRA regulations related to passenger containment by glazing systems.
- Outcomes of this research include strategies for improving the survivability of glazing in rollover accidents to improve occupant containment.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Sharma & Associates, Inc.

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jeff Gordon • (617) 494-2303 • jeffrey.gordon@dot.gov

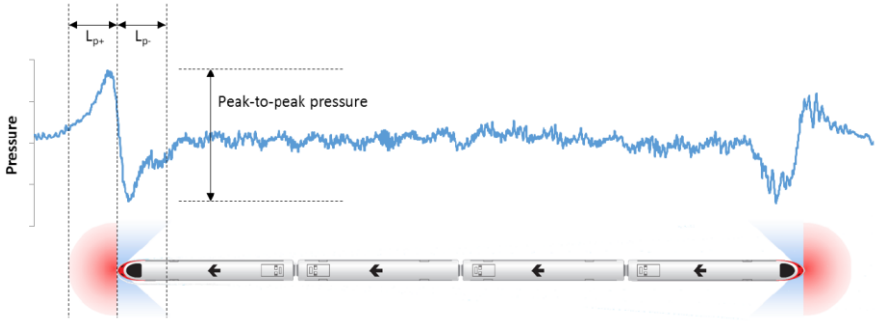
Aerodynamic Assessment and Design Guidance Manual for High-Speed Rail (HSR)

PROJECT DESCRIPTION

- Proposed work follows on FRA's publication of the Arup team's Phase 1 report entitled "High-Speed Rail Aerodynamic Assessment and Mitigation Report" in December 2015.
- Previous work defined numerous national and international criteria, guidelines, studies, practices, and mitigation measures for components of the aerodynamic effects of high-speed rail relative to passed trains, track work personnel, waiting platform passengers, adjacent structures, and equipment.
- Information was limited in scope and/or not readily transferrable to the development of a design guidance manual that would be flexible to accommodate varying train types and operational conditions, and, could be used specifically by the North American railway industry.
- Need exists to bring the results of these studies together so issues can be evaluated and mitigated relative to the aerodynamic effects with the potential to cause harm to passengers, track workers, equipment and adjacent structures.
- Manual will encompass both the open and tunnel environments for high-speed rail.

COST & SCHEDULE

- Funding: FY19 $73,400
- Project Duration: June 2017 – March 2019
    - Issue report describing project and results



RAILROAD IMPACT

- Implement safe high-speed rail services, preventing injuries to railway track workers and the traveling public, and reducing damage to equipment, cargo, and structures in close proximity to high-speed railway tracks.
- Probability is very high that the rail industry will adopt the Aerodynamic Assessment and Mitigation Design Guidance Manual for High-Speed Trains based on the importance of safety, future reduction of facilities' modifications costs, and development of appropriate operational procedures.

PROJECT PARTNER(S)

- Arup
- Transportation Technology Center, Inc. (TTCI)
- Birmingham University (UK)
- Central Japan Railway Company
- Central South University of China

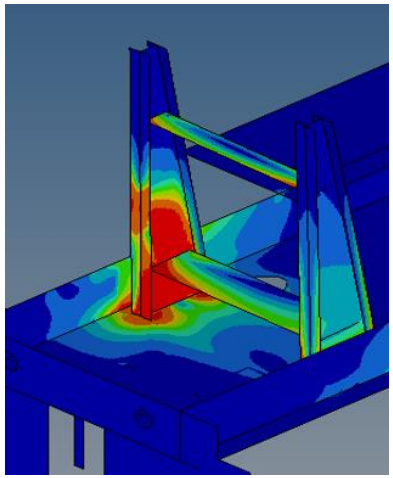
U.S. Department of Transportation
Federal Railroad Administration

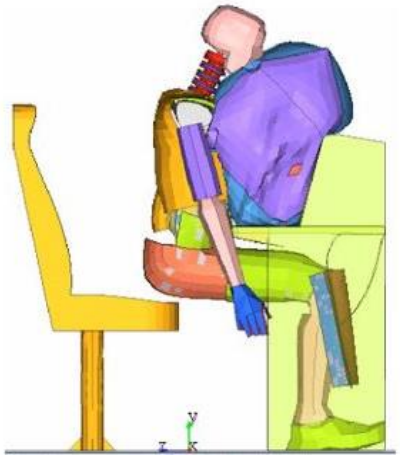
FRA PROJECT MANAGER: Jeff Gordon • (617) 494-2303 • jeffrey.gordon@dot.gov

Improving Survivability for Locomotive Crews

PROJECT DESCRIPTION

- Modern locomotives are built to crashworthiness standards that are defined in in Title 49 of the Code of Federal Regulations (CFR), Part 229 and Association of American Railroads (AAR) S-580 standards.
- Locomotives manufactured before 1990, specifically the narrow-nose locomotives, were not designed to crashworthiness standards and lack the crew protection in case of train collisions.
- Collision post design alternatives compliant with current standards and amenable to a retrofit with no impact on locomotive functionality will be developed and tested in the next phase of work.
- Locomotives compliant with existing standards can preserve the space occupied by an engineer in the leading cab in a train collision up to moderate speeds, but do not provide protection against injuries resulting from secondary impacts resulting from abrupt locomotive deceleration.
- Novel combination airbag/knee bolster arrangement can be adapted to existing engineer desk geometry will be tested as part of this program to mitigate secondary impacts.





RAILROAD IMPACT

- Will have no impact on locomotive functionality, and bring legacy locomotives into compliance with crashworthiness requirements, and minimize the injury and fatality risk to crew in a collision.
- Secondary Impact Protection System (SIPS) will be shown to limit forces and accelerations imparted to cab occupants due to secondary impacts to industry-acceptable levels in the event of a moderate to severe collision scenario.

COST & SCHEDULE

- Funding: FY19 $378,000
- Project Duration: August 2013 – May 2020
  - Issue report on collision post-tests, 2020
  - Issue report on SIPS tests with improved airbag, 2020

PROJECT PARTNER(S)

- Sharma & Associates, Inc.

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jeff Gordon • (617) 494-2303 • jeffrey.gordon@dot.gov

Regulatory Development, Waiver Support and Technology Transfer

PROJECT DESCRIPTION

- Support development and revision of regulations and safety standards for:
  - High-speed passenger trains
  - Conventional speed passenger trains
  - High-speed passenger trains used in mixed service
- Activities include:
  - Definition of accident scenarios of concern and assessment of likelihood and loss from accidents.
  - Identification of technologies for improved occupied volume protection, injury prevention, fuel containment, and glazing impact resistance.
  - Application of information derived to support policy decisions, regulations and standards development, and verification of required performance.

COST & SCHEDULE

- Funding: FY19 – $0
- Project Duration: August 2018 – April 2020
  - Presentations and briefings for the National Transportation Safety Board (NTSB), American Public Transportation Association (APTA), and the Railroad Safety Advisory Committee (and its task forces) as requested/needed, TBD
  - Reviews of technical documentation submitted by railroads to demonstrate compliance with FRA regulations as requested, TBD

RAILROAD IMPACT

- FRA support for rail equipment standards development since the advancement of Amtrak's technical specification for the Acela in 1993, which evolved into FRA's Tier II equipment standards, the first national standards requiring Crash Energy Management.
- Publication of first rule addressing crashworthiness and other features of Tier III passenger equipment on November 21, 2018.
- Additional standards supported include the Passenger Equipment Safety Standards, Locomotive Crashworthiness Standards, and Cab Car End Frame Standards.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Passenger equipment manufacturers, operators, suppliers and consultants

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jeff Gordon • (617) 494-2303 • jeffrey.gordon@dot.gov

SECTION THREE

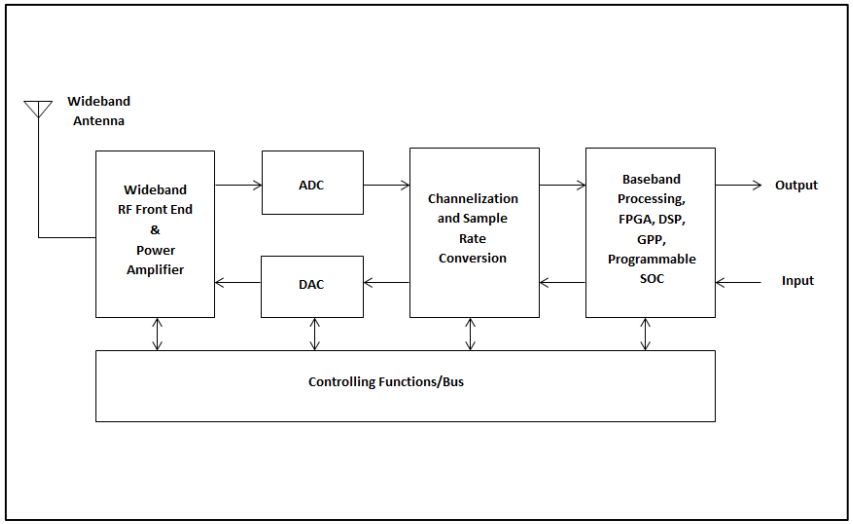
TRAIN CONTROL & COMMUNICATIONS

U.S. Department of Transportation
Federal Railroad Administration

Rail Software-Defined Radio (SDR)

PROJECT DECSCRIPTION

- Define overall requirements for an industry-standard SDR.
- Perform trade studies to select best type of solution for each major component (e.g., power amplifier, antenna, front end, modem), including high-level reliability analysis.
- Generate specifications for each major component to support development.
- Develop and test prototypes of the major components.



RAILROAD IMPACT

- Reduced hardware count – one SDR substitutes for multiple radios, reducing hardware and support required.
- Migration support – when migrating an application to a new protocol, waveform, or frequency band.
- Dynamic adaptability – ability to adapt to changing environment and/or availability of spectrum.
- Upgradeability and flexibility for future expansion – expand capabilities and support changing or new requirements without replacing hardware.
- Sparing – one SDR spares for many other radio types in the event of a radio failure.
- Availability – Increase availability by adding one hot spare radio in cases where several required previously.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)
- MeteorComm, LLC (MCC)

COST & SCHEDULE

- Funding: $518,188
- Project Duration: August 2016 – December 2018

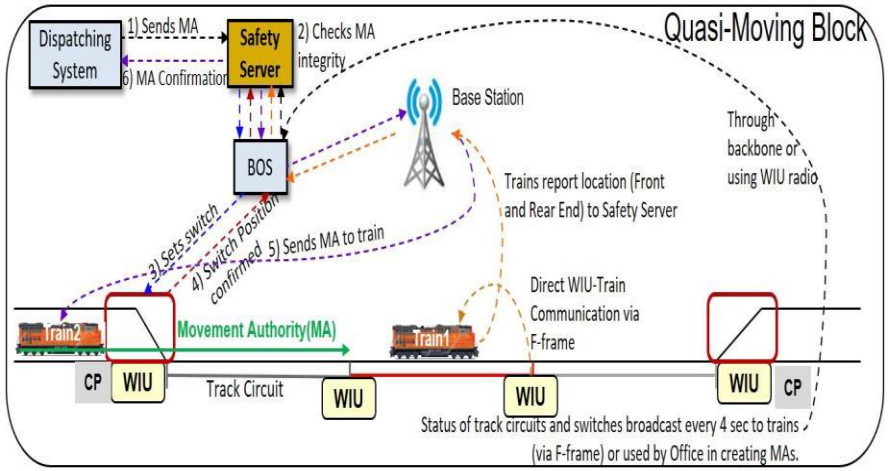
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jared Withers • (202) 493-6362 • jared.withers@dot.gov

Quasi-Moving Block Train Control

PROJECT DECSCRIPTION

- Develop a Concept of Operations (CONOPS), with industry input and review, describing the technical approach for implementing quasi-moving block train control.
- Identify new functions, key design details, interfaces, and issues requiring resolution.
- Analyze communication, hardware, and software needs and identify potential technology gaps.
- Develop safety analysis and draft implementation plan.



RAILROAD IMPACT

- Improve operational efficiency and network capacity by safely reducing train headways.
- Improve safety by preventing train collisions under restricted speed operation.
- Test and evaluate remote sensing suite that will influence the feasibility of automated train operation in the future.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: $400,013
- Project Duration: September 2017 – September 2019

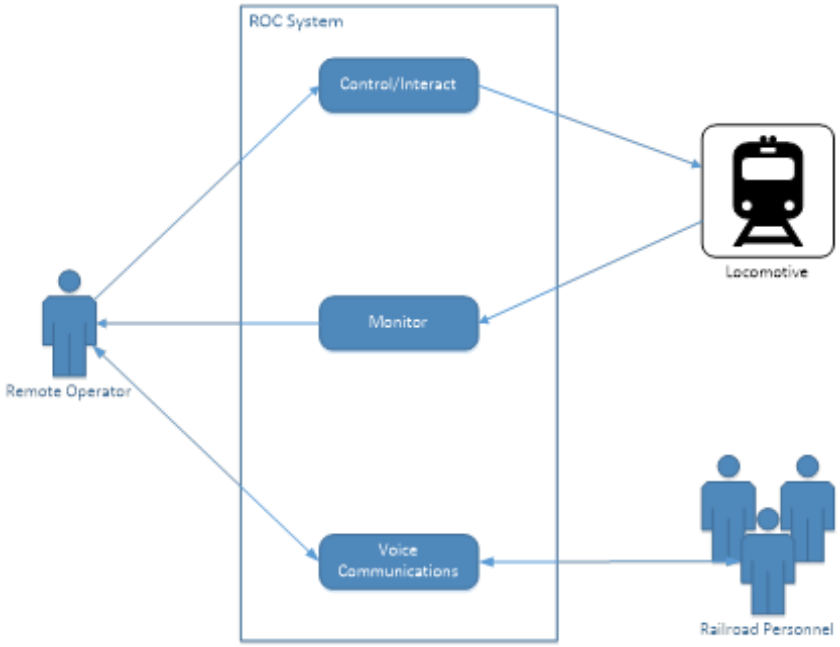
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jared Withers • (202) 493-6362 • jared.withers@dot.gov

Flexible Operator Location Feasibility Analysis

PROJECT DECSCRIPTION

- Develop a Concept of Operations (CONOPS), with industry input and review, describing the technical approach for implementing automated train operations (ATO).
- Research, develop and evaluate sensor platforms and technologies for support of ATO.
- Develop and analyze safety cases for ATO.



RAILROAD IMPACT

- Improve operational efficiencies and network capacity.
- Improve safety by reducing human error.
- Test and evaluate remote sensing suite that will influence the feasibility of automated train operation in the future.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: $1,105,414
- Project Duration: September 2015 – December 2020

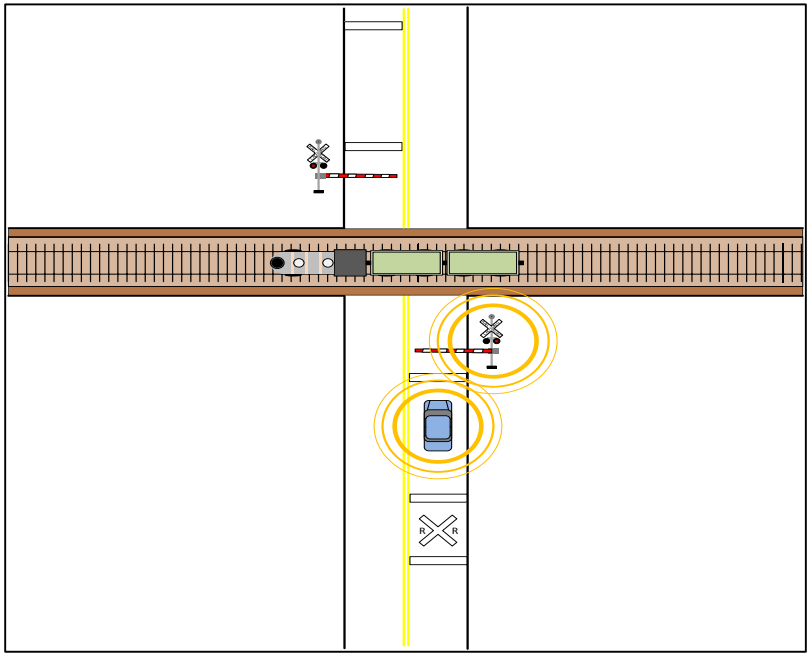
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jared Withers • (202) 493-6362 • jared.withers@dot.gov

Rail Crossing Violation Warning

PROJECT DECSCRIPTION

- Develop a connected vehicles reference application for in-vehicle driver warning of immanent violation of a grade crossing protection system.
- Suitable for retrofitting existing infrastructure.
- Evaluate the technical feasibility of implementing the proposed system.
- Provide recommendations and data for future analyses.



RAILROAD IMPACT

- Mitigation of many grade crossing accidents.
- Rail side integration with connected and automated vehicle systems being deployed by the automotive industry.
- Test platform for evaluating the effectiveness of connected vehicle safety systems for grade crossing scenarios.

PROJECT PARTNER(S)

- Battelle
- Honda R&D America
- CTC, Inc.
- Transportation Technology Research Center

COST & SCHEDULE

- Funding: $853,156
- Project Duration: September 2015 – March 2020

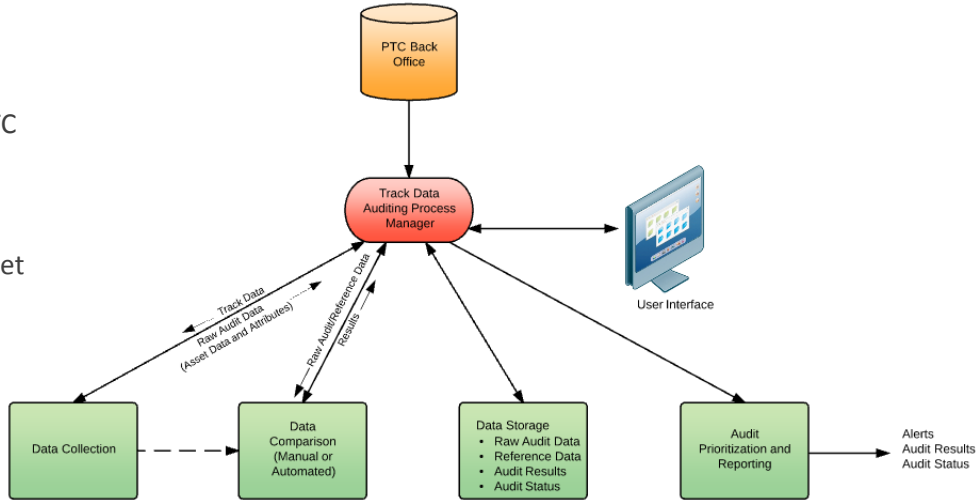
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jared Withers • (202) 493-6362 • jared.withers@dot.gov

Positive Train Control (PTC) Critical Asset Track Data Auditing System

PROJECT DECSCRIPTION

- Facilitate and document a railroad consensus for the functionality and requirements for a system to support PTC track map auditing.
- Develop system specification documentation based on stakeholder engagement and railroad need.
- Survey/evaluate technologies and concepts that could meet the documented requirements.
- Identify any significant gaps between requirements and available technology.



RAILROAD IMPACT

- Supports implementation of PTC and other safety-related systems that depend on accurate up-to-date track information.
- Supports automation of track database auditing for enhanced safety and efficiency.
- Supports development of a system to scan for PTC-critical track assets and detect and report discrepancies from the reference database.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: $946,641 total project cost
- Project Duration: September 2015 – January 2019

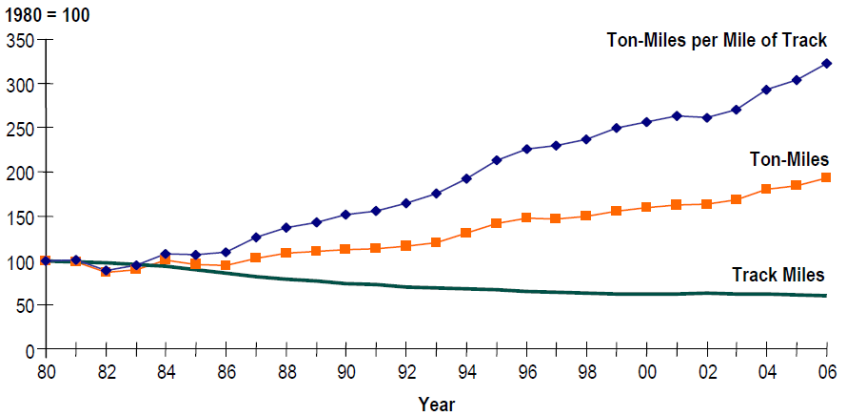
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jared Withers • (202) 493-6362 • jared.withers@dot.gov

Higher Reliability and Capacity Train Control

PROJECT DECSCRIPTION

- Understand the observed and potential operational and safety impacts of Positive Train Control (PTC), particularly as related to effects on railroad capacity and system availability.
- Develop an Advanced Train Control and Management System (ATCAMS) concept and migration plan that would address the operation and safety issue discussed above.
- Analyze communication, hardware, and software needs and identify potential technology gaps.
- Develop an approach that will allow for staged implementation of identified train control methods and, where appropriate, migration to these methods with incremental return on investment.



RAILROAD IMPACT

- Improve operational efficiency and network capacity.
- Mitigate train delays due to PTC system or component reliability or availability.

PROJECT PARTNER(S)

- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: $757,951
- Project Duration: September 2017 – September 2019

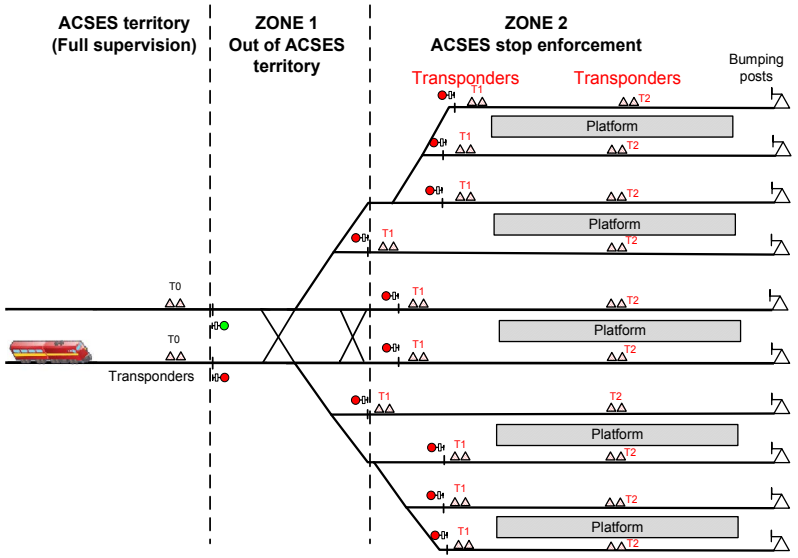
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Jared Withers • (202) 493-6362 • jared.withers@dot.gov

Restricted Speed Enforcement for Positive Train Control (PTC) Systems

PROJECT DESCRIPTION

- Evaluation safety of PTC-preventable accidents below restricted speeds, particularly end-of-track collisions in passenger terminals.
- Develop Concept of Operations (ConOps) for PTC enforcement to prevent end-of-track collisions.
- Estimate the cost-effectiveness and operational impact of PTC enforcement on terminating tracks in terminals.
- Develop field testing to verify and validate the research concept and method.



RAILROAD IMPACT

- Evaluation of the safety, cost, and operational implications of PTC enforcement to prevent end-of-track collisions in passenger terminals.
- High-level operational concept for modifying positive train control systems to function below restricted speeds.
- Field testing to verify the technical feasibility of PTC enforcement under restricted speeds.

PROJECT PARTNER(S)

- Rutgers, The State University of New Jersey
- HNTB
- Amtrak

COST & SCHEDULE

- FRA Funding: $400,550
- Project Duration: February 2017 – May 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Pilot Grant Program — Law Enforcement Strategies for Reducing Trespassing

PROJECT DESCRIPTION

- The objective of this program is to evaluate the effectiveness of funding local law enforcement activities intended to reduce trespassing on the rail right-of-way (ROW).
- The funded agencies will perform rail trespassing enforcement related activities and report those activities and associated benefits to FRA.
- The research team will evaluate the effectiveness of dedicated funding in reducing rail trespassing incidents and risk factors based on the data obtained from the activities performed in this grant program.

RAILROAD IMPACT

- Document the effectiveness of the presence of law enforcement officers in reducing railway trespassing.
- Provide further information and education to trespassers.
- Supported analysis for potential legislative processes.
- Increase public safety.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- City of North Tonawanda, New York
- City of Worcester, Massachusetts
- Palm Beach County Sheriff's Office, Florida
- Town of Brighton, New York

COST & SCHEDULE

- Funding: $196,357 overall award
- Project Duration: October 2018 – December 2019

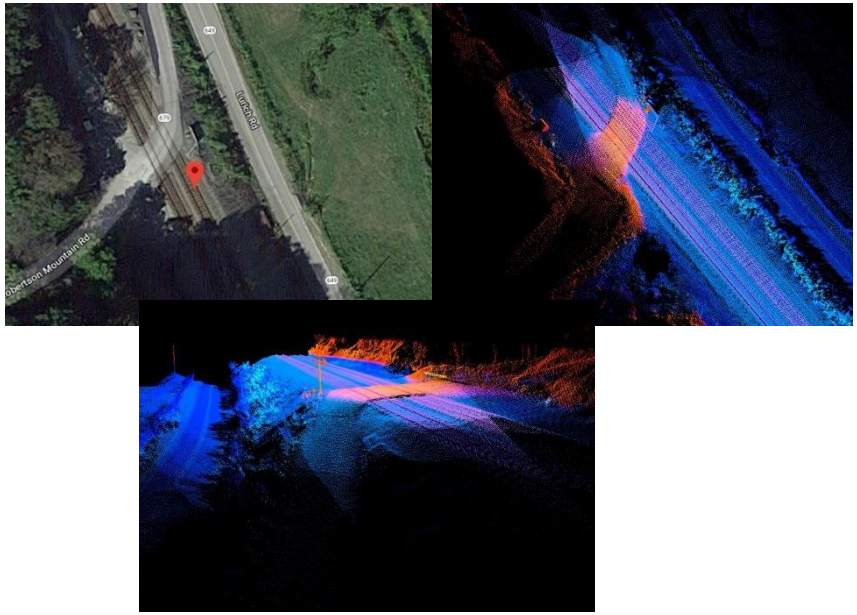
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Enhanced Humped Crossing Database Using LiDAR

PROJECT DESCRIPTION

- Enhance FRA's National Grade Crossing Inventory database by including LiDAR point clouds of those humped crossings that have a history of accidents.
- Study the feasibility of implementing a portable LiDAR system (e.g., UAV) for grade crossing scanning.
- Develop and test a quasi real-time alerting system if a humped crossing is detected and not reported as such.



RAILROAD IMPACT

- Consistent verification to what is currently reported to the National Grade Crossing Inventory database.
- Provide a new tool for the public to further analyze and study the crossing profiles.
- Improve efficiency in documenting the state of a grade crossing profile.
- Increase public safety.

PROJECT PARTNER(S)

- ENSCO, Rail

COST & SCHEDULE

- Funding: $299,804
- Project Duration: October 2018 – April 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

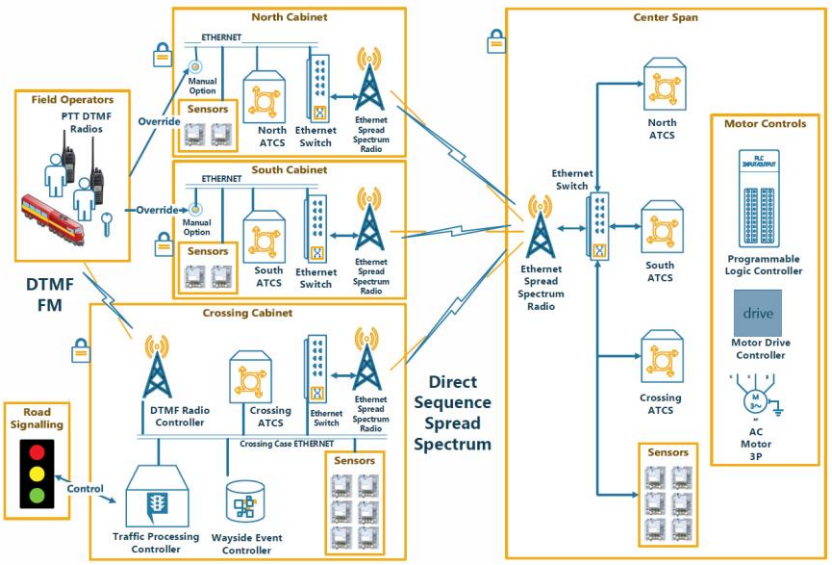
Cybersecurity Risk Management for Connected Railroads

PROJECT DESCRIPTION

- Develop a cybersecurity risk management framework specific to railroads.
- Focus on understanding the communications-related cybersecurity risks for connected railroad technologies.
- Implement the risk methodology for selected use cases, such as advanced train control systems (ATCS) and remote control of movable bridges.
- Provide recommendations and identify future research needs for mitigating railroad cybersecurity risks.

RAILROAD IMPACT

- Description of selected connected railroad technologies and use cases.
- Assessment of cybersecurity risk profiles (scenario and hazard source, vulnerability, capability of attack, impact of an attack).
- Implementation issues of cybersecurity risk management and research needs.



PROJECT PARTNER(S)

- Rutgers, The State University of New Jersey
- George Mason University
- HNTB
- Industry partners (e.g., Conrail, Belt Railway of Chicago, Amtrak, PATH, CSX)

COST & SCHEDULE

- FRA Funding: $799,713
- Project Duration: September 2017 – November 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Trespass Detection and Warning – Drone System

PROJECT DESCRIPTION

- Test the effectiveness of drone technology to detect trespassers on railroad property.
- The mobile camera will be deployed on a remote-controlled aerial vehicle (drone) by the police and provide coverage over a significant amount of right-of-way (ROW) when in use. It will be used to identify and track trespassers in areas of the ROW that are difficult to access by the police, and be an integral part of the police department's trespass and suicide prevention efforts.
- Once properly trained, officers will fly over rail property using both standard HD cameras and FLIR cameras to detect trespassers. Officers will then provide education to trespassers on rail safety.

RAILROAD IMPACT

- Reduce trespass frequency on the Brunswick, Maine, corridor, through detection and education of trespassers on the ROW.
- Demonstrate potential benefits, including documenting best practices and lessons learned, of implementation and evaluation of drone technology to detect trespassers on railroad property. Application could be nationwide.
- An aerial mobile camera will increase coverage and safety along the entire ROW.
- Reduce trespass deaths; there were 509 ROW trespass fatalities and 508 injuries in 2017.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Brunswick, Maine, Police Department

COST & SCHEDULE

- Funding: $150,000
- Project Duration: January 2018 – December 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Photo Enforcement-Based Education at Crossings

PROJECT DESCRIPTION

- Study the effectiveness of photo enforcement technologies to detect and enforce highway-rail grade crossing violations.
- Collaborate with the City of Orlando, FL on its red light running program by implementing cameras at a grade crossing.
- City funded the installation of cameras at one grade crossing on East Princeton Street (Crossing ID 622173H) and provided grade crossing safety education materials to violating drivers.
- Signage installed by the City on June 23, 2016. Photo enforcement system operational in August 2016.
- Research team collected and analyzed vehicle data before and after the cameras were installed.
- Short-term results under internal review.
- Long-term (2 years after installation) evaluation underway.

RAILROAD IMPACT

- Develop, implement, and evaluate techniques or technologies that reduce violations of grade crossing traffic control devices that may lead to incidents and casualties.
- Provide driver education on safety at grade crossings.
- Provide best practices for successful implementation of grade crossing photo enforcement systems.
- Supported analysis for rulemaking and legislative processes.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- City of Orlando, Florida
- SunRail

COST & SCHEDULE

- Funding: $250,000
- Project Duration: March 2016 – June 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Gate Skirts Research

PROJECT DESCRIPTION

- To evaluate a specific type of pedestrian gate enhancement, commonly known as gate skirts, designed to prevent pedestrians from violating the grade crossing while the grade crossing protection systems are activated.
- Current research in Ramsey, New Jersey, (grade crossing at East Main Street - Crossing ID 263186S) builds on the lessons learned from previous research on gate skirt prototypes in Matawan, New Jersey, and New Britain, Connecticut.
- Gate skirts installed at Ramsey crossing on September 5, 2017.
- Before/after data collected and analyzed and results under internal review.
- Pedestrian channelization to be installed and evaluated in 2019.

RAILROAD IMPACT

- Demonstrate and evaluate new technologies and strategies that increase pedestrian safety at grade crossings; there were 172 pedestrian incidents at grade crossings in 2017 (about 9% of the total crossing incidents).
- Partnerships with State DOTs and railroads.
- Information exchange with rail safety partners on cutting-edge technologies and/or strategies.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- New Jersey DOT
- New Jersey Transit
- Borough of Ramsey, New Jersey

COST & SCHEDULE

- Funding: $50,000
- Project Duration: May 2017 – September 2019

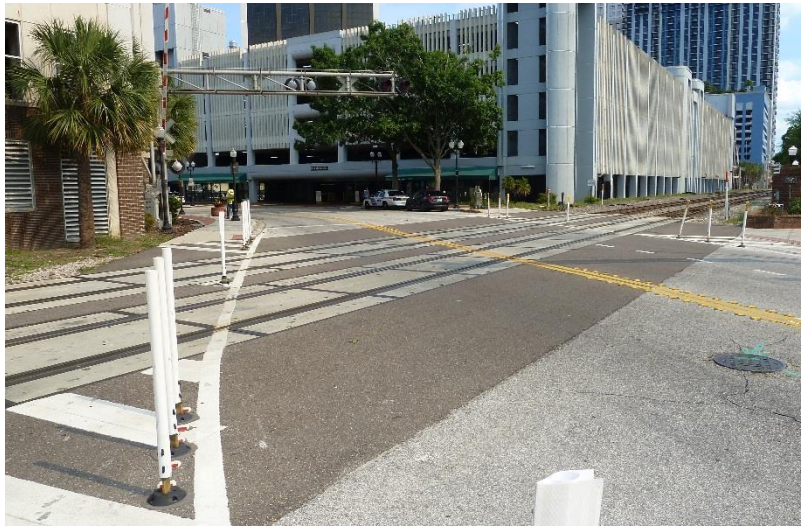
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Vehicle Railroad Right-of-Way (ROW) Incursion Prevention

PROJECT DESCRIPTION

- Study to evaluate the effectiveness of engineering treatments to deter vehicles from turning onto the rail ROW.
- Partnered with SunRail and the City of Orlando to develop vehicle ROW incursion prevention engineering treatments, identify suitable grade crossings for implementation, collect before and after data, and evaluate the results.
- Treatments installed at two crossings in the City, in December 2016: West Washington Street (Crossing ID 622188X) and West Jefferson Street (Crossing ID 622187R).
- Treatments consist of the extension of pavement markings through the crossing, and addition of reflective markers and flexible delineators on both sides and in-between the tracks.
- Results of year-over-year comparison published in August 2018.
- Additional data being collected for two-year comparison.



RAILROAD IMPACT

- Develop strategies to reduce the number of vehicles that mistakenly enter the ROW, thus reducing the possibility of an incident with a train (such as the one on February 14, 2015, in Oxnard, California, where a vehicle was struck by a Metrolink train, resulting in 1 fatality and 27 injuries).
- Develop low-cost solutions to increase safety at crossings.
- Information exchange on cutting edge technologies and/or strategies.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- City of Orlando, Florida
- SunRail

COST & SCHEDULE

- Funding: $165,000
- Project Duration: October 2016 – March 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Vehicle Blocked Crossing Research

PROJECT DESCRIPTION

- To develop, install, and evaluate low-cost treatments to increase driver awareness of the tracks at crossings.
- The MBTA indicated interest in collaborating on developing a system to warn drivers of the dangers of stopping on the tracks, and identified crossing #052315W on Brighton Street in Belmont, Massachusetts, for the study.
- A video data collection system was installed at crossing on March 9, 2017.
- Town of Belmont installed pavement markings on November 12, 2017.
- Before/after data was analyzed to determine potential benefit of markings.
- Research team obtained LED-enhanced R8-8 signage and scheduled to install in Spring 2019.

RAILROAD IMPACT

- Provide effectiveness estimates for different engineering treatments to deter drivers from stopping on the tracks.
- Provide additional warning opportunity where signs may be obstructed or vehicle operator is distracted.
- Contribute to reduction of casualties at highway-rail grade crossings.
- Potential to save multiple lives/injuries per incident and $5M+/yr in accident related costs per incident.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Massachusetts Bay Transportation Authority (MBTA)
- Town of Belmont, Massachusetts

COST & SCHEDULE

- Funding: $150,000
- Project Duration: March 2017 – June 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Rail Right-of-Way (ROW) Trespass Mitigation Treatments

PROJECT DESCRIPTION

- To review, select, and evaluate emerging technologies and strategies for railroad ROW trespass applications, specifically anti-trespass guards and landscaping rock treatments.
- New technologies or approaches to mitigate the trespass problems will be investigated for possible demonstration at trespass prone locations.
- Anti-trespass guard panels installed in June 2015 on ROW adjacent to the West Dickson Street crossing (ID 667195J) in Fayetteville, Arkansas.
- Before/after data collected and analyzed, with final results currently under internal review.
- Rock treatments currently being investigated.

RAILROAD IMPACT

- Develop low-cost solutions to increase safety around rail ROW.
- Reduce the number of pedestrians that trespass onto rail ROW.
- Information exchange on cutting-edge technologies and/or strategies.
- Leveraged through Public-Private-Partnership (P3).

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Arkansas and Missouri Railroad
- Florida DOT
- SunRail
- CTC, Inc.

COST & SCHEDULE

- Funding: $300,000
- Project Duration: October 2014 – September 2019

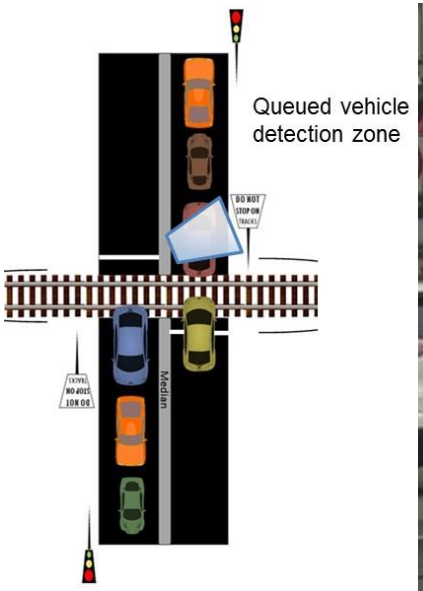
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

LED-Enhanced “Do Not Stop On Tracks” Sign Research

PROJECT DESCRIPTION

- Evaluate the effectiveness of flashing light-emitting diode (LED) enhanced “Do Not Stop on Tracks” (R8-8) signs on reducing traffic queuing at highway-rail grade crossings.
- Perform tradeoff analysis of applicable sensor technologies for stopped vehicle detection.
- Perform a before/after analysis of LED R8-8 sign triggered by laser-based queue detection system.
- Location: Katonah, New York, on Metro-North Commuter Railroad (MNCR) Harlem Line (Jay Street, Crossing ID 529896U).
- System installed in October 2018.
- Evaluation currently underway.



RAILROAD IMPACT

- Develop techniques or technologies that reduce instances of vehicles queuing over and stopping on rail tracks, which may lead to incidents and casualties (such as the 2015 crash in Valhalla, New York, that killed 6 and injured 15).
- Facilitate implementation and evaluation of innovative safety technologies.
- Information exchange on cutting-edge technologies and/or strategies for grade crossing safety.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Town of Bedford, New York
- Metropolitan Transportation Authority/ Metro-North Railroad (MTA/MNR)

COST & SCHEDULE

- Funding: $185,000
- Project Duration: June 2017 – June 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Emergency Notification System (ENS) Sign Study

PROJECT DESCRIPTION

- To learn more about drivers' awareness and understanding of the Emergency Notification System (ENS) signs posted at highway-rail grade crossings.
- Shed light on how drivers react when crossing infrastructure that appears to be malfunctioning or when they get stuck on the crossing.
- Focus on whether drivers look for or attempt to make use of the information on the ENS sign.
- This experiment will be conducted in the Volpe driving simulator.

RAILROAD IMPACT

- Identify possible trends in vehicle driver behavior at and approaching grade crossings.
- Identify potential driver education/awareness strategies regarding presence and use of ENS signs.
- Provide guidance on most effective location and orientation of ENS signs.
- Support analysis for potential legislative processes.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: $150,000
- Project Duration: June 2018 – November 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

National Trespass Workshop

PROJECT DESCRIPTION

- Plan, coordinate, and execute a follow-on workshop on railroad trespassing similar to the previous one held in 2015.
- The goal of the workshop is to identify and share existing industry leading practices and explore new strategies that the rail industry could pursue to reduce the number of right-of-way (ROW) and trespasser incidents and fatalities.
- Compile a list of stakeholder-generated research needs in this area.

RAILROAD IMPACT

- Foster an exchange of information on research priorities on trespassing mitigation.
- Provide FRA's partners with information on recent and upcoming research topics.
- Provide railroads and industry stakeholders with a concise message of FRA's strategic plan.
- Encourage future partnerships on shared research topics of interest.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Railroads
- State DOTs
- Industry stakeholders

COST & SCHEDULE

- Funding: $150,000
- Project Duration: January 2019 – December 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

In-Pavement Grade Crossing Lights

PROJECT DESCRIPTION

- Review past and current of LED in-pavement warning lights prototypes and conduct a demonstration at a flashing lights only crossing.
- Include an evaluation of the potential applicability and effectiveness of this type of crossing enhancement technology.
- A technology was selected and field-tested in an operational environment (Crossing ID 597456M, in Elk City, Oklahoma).
- Baseline data collection system installed on September 15, 2016.
- In-pavement lights installed the week of September 11, 2017.
  The system became operational on September 19, 2017.
- Data on vehicle compliance, both before and after the implementation of the selected technology, was collected and analyzed.
- Final report under internal review.

RAILROAD IMPACT

- Decrease driver and pedestrian risky behavior at grade crossings by increasing compliance with traffic control devices; 272 crossing deaths in 2017.
- Partnerships with State DOTs and railroads.
- Technology transfer/implementation in the US.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Oklahoma DOT
- City of Elk City, Oklahoma
- Farmrail

COST & SCHEDULE

- Funding: $190,000
- Project Duration: September 2016 – September 2018

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Effect of Grade Separation on Trespassing

PROJECT DESCRIPTION

- Evaluate a grade separation at a highway-rail intersection, and determine what effects, if any, it has on pedestrian trespass activity at the crossing.
- The study took place in Birmingham, Alabama, in the community of Collegeville.
- Alabama DOT closed and replaced the Fred L. Shuttlesworth Drive grade crossing (Crossing ID 352514C) with an overpass bridge. The bridge opened in June 2017.
- Video data was collected before and after construction, and trespass activity was compared between the two time periods. The results are a characterization of the impact of grade separation on trespassing.
- Final report under internal review.

RAILROAD IMPACT

- Study real-world rail trespass behavior.
- Reduce trespass fatalities on Collegeville corridor.
- Demonstrate potential rail safety benefits, including documenting best practices and lessons learned, of implementation and evaluation of a grade separation project.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Alabama DOT
- CSX
- Birmingham Housing Authority

COST & SCHEDULE

- Funding: $175,000
- Project Duration: October 2014 – September 2018

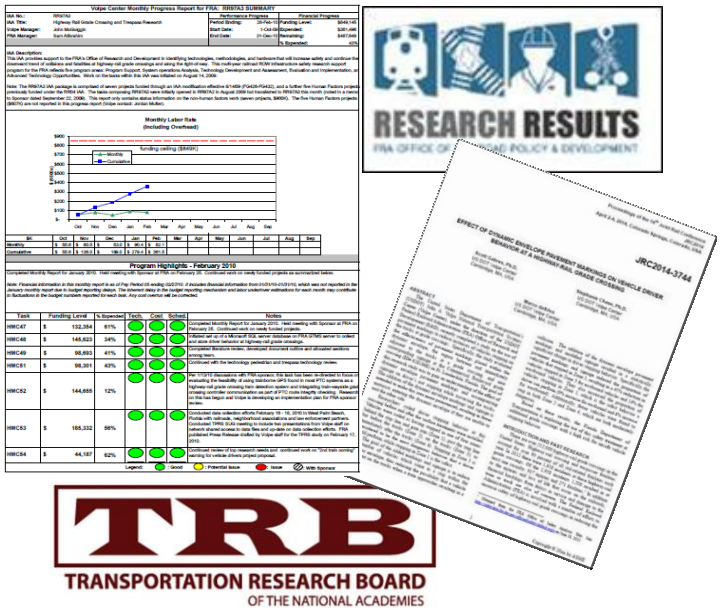
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Grade Crossing and Trespass Research Program Support

PROJECT DESCRIPTION

- Participate in professional activities within the scope of research topic that are not specifically funded under another task (e.g., TRB AHB60 Committee, technical papers).
- Exchange information on cutting-edge technologies and/or strategies for grade crossing safety and trespass prevention (including outreach to FRA grade crossing managers).
- Provide reports on a periodic basis to define and track key activities in support of the research program.



RAILROAD IMPACT

- Information exchange with State DOTs and railroads on cutting-edge technologies and/or strategies for grade crossing safety and trespass prevention.
- Quick response capability in support of FRA Office of Research, Development & Technology (RD&T).
- Support FRA RD&T on studies requiring immediate action that is not covered in any existing task.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: $210,000
- Project Duration: November 2016 – March 2019

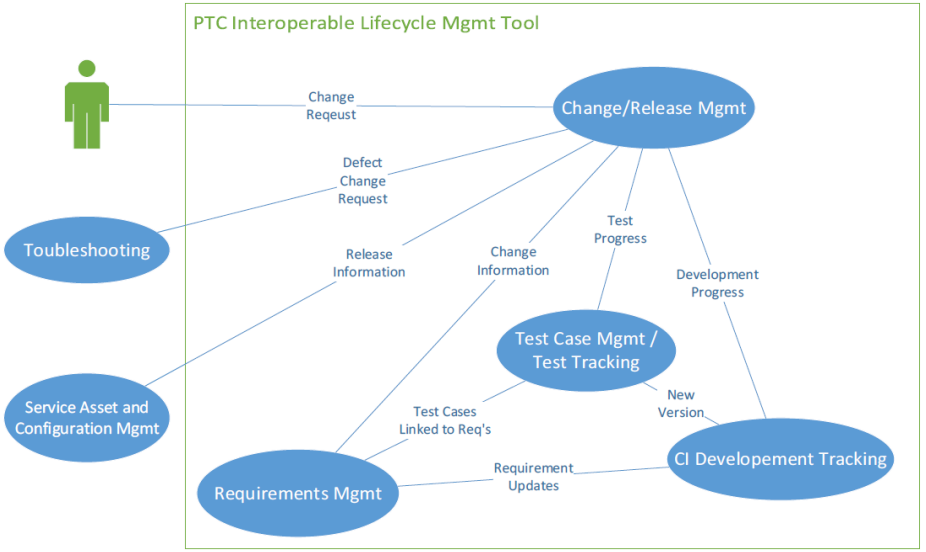
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Francesco Bedini Jacobini • (202) 493-0800 • Francesco.Bedini@dot.gov

Positive Train Control (PTC) Interoperability

PROJECT DESCRIPTION

- Organize industry stakeholder advisory group.
- Develop operational concepts/system description documentation.
- Develop requirements for the PTC Interoperable Lifecycle Management System.
- Research existing commercially available tools options.
- Support the Interoperable Train Control (ITC) Change and Configuration Management Team.



RAILROAD IMPACT

- Support implementation of PTC systems that depend on accurate configuration information between railroads.
- Support automation of PTC Compatibility Database.
- Improve operational safety and network capacity by reducing the manpower and time to verify inter-railroad operations.
- Migration support for new/updated software and hardware releases.
- Support multiple and unique PTC applications and installations.
- Expandable to support future upgrades / versions of PTC.

PROJECT PARTNER(S)

- Association of American Railroads (AAR)
- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: $886,000
- Project Duration: March 2017 – March 2020

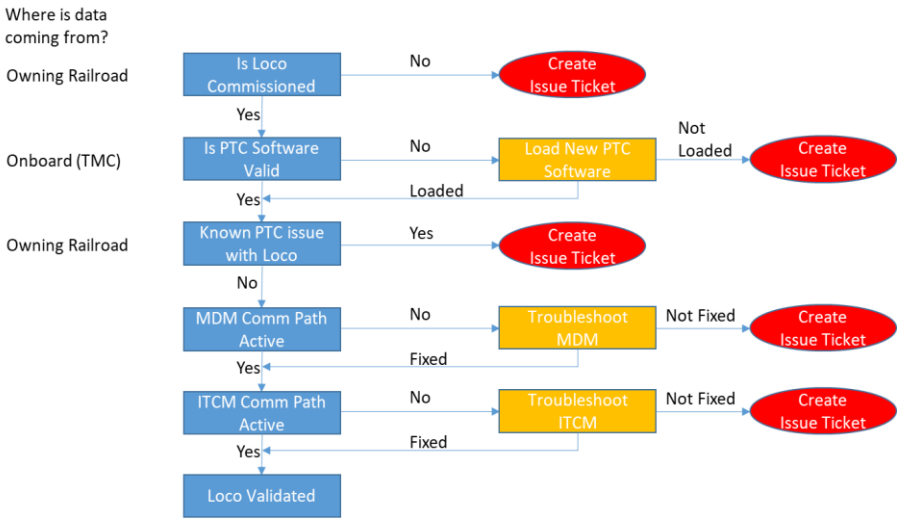
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Rick Orcutt • (719) 584-0507 • richard.orcutt@dot.gov

Monitoring and Analysis of the Integrated Network (MAIN)

PROJECT DESCRIPTION

- Collaborate with Technical Advisory Group made up of members from FRA, AAR and TTCI.
- Determine data collection needs, analytic methods, and feasibility of Monitoring and Analysis of the Integrated Network (MAIN).
- Develop analytic tools to quickly identify and alert users of problems; provide key information for diagnosing problems; and, automatically diagnose problems when possible.



RAILROAD IMPACT

- Provide real-time alerts/alarms, health and status information, diagnostics support, and Key Performance Indicators for Positive Train Control (PTC) help desks, railroad signal and locomotive troubleshooters, network operation centers, dispatchers, urban area coordinators, PTC220 LLC, and PTC maintainers.
- Deploy an industry standard technological platform for railroads to exchange data.
- Provide ongoing message statistics and frequency of instances where locomotives are unable to obtain a communication timeslot (or are delayed in doing so).

PROJECT PARTNER(S)

- Association of American Railroads (AAR)
- Transportation Technology Center, Inc. (TTCI)
- Railinc, Inc.

COST & SCHEDULE

- Funding: $1,489,300
- Project Duration: August 2016 – May 2020

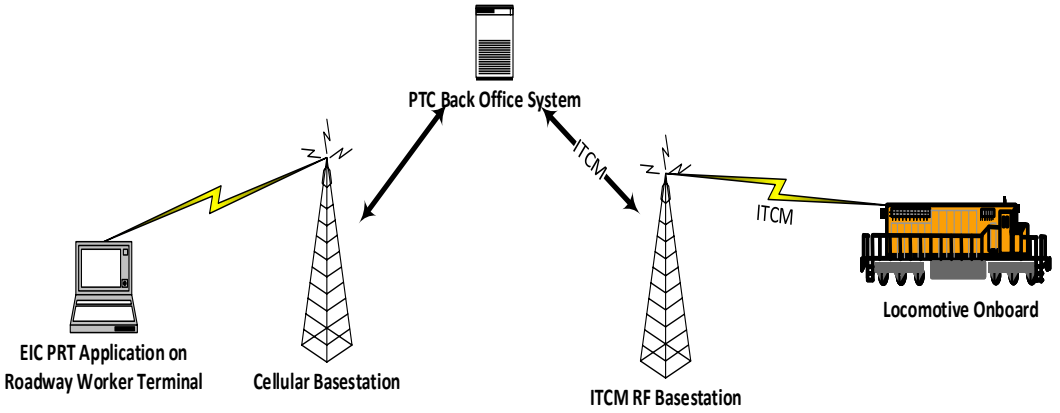
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Rick Orcutt • (719) 584-0507 • richard.orcutt@dot.gov

Employee in Charge Portable Remote Terminal (EICPRT)

PROJECT DESCRIPTION

- Transmitted electronically from an EIC Terminal through the Back Office Server to the On-Board Computer.
- Allows an Employee In Charge (EIC) to grant permissions for train crews to enter a work zone.
- Provides enforcement of Positive Train Control (PTC) instructions (i.e., speed limits).
- Use of the EIC Terminal application for electronic control of Working Limits does not supersede the Maintenance of Way Operating Rules or required verbal communication.



RAILROAD IMPACT

- PTC enforcement of EIC instructions, thereby protection is maintained.
- Mitigates EIC working outside of maintenance-of-way protected time.
- Prevents instructions to the locomotive by 3rd party (spoofing) through the EICPRT interface.

PROJECT PARTNER(S)

- Association of American Railroads (AAR)
- Transportation Technology Center, Inc. (TTCI)

COST & SCHEDULE

- Funding: $3,200,400 project cost
- Project Duration: September 2012 – December 2020

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Rick Orcutt • (719) 584-0507 • richard.orcutt@dot.gov

SECTION FOUR

HUMAN FACTORS

The Impact of Commute Times on the Fatigue and Safety of Locomotive Engineers

PROJECT DESCRIPTION

- Commute times are not currently recognized or acknowledged as a contributing factor to fatigue by FRA.
- The extent to which commute times impact the fatigue and safety of locomotive engineers is unknown.
- Leverage surveys and focus groups to identify and assess various aspects of fatigue, including commute times, and the impact they have on safety.
- Assess the issue of commute times and determine if further investigation is necessary.

RAILROAD IMPACT

- Identify existing gaps in research related to fatigue in the railroad industry.
- Gain a better understanding of the contributors to fatigue.
- Assess the impact of commute times on fatigue and safety in the railroad industry.
- Provide recommendations on best practices for combating fatigue in the railroad industry.

PROJECT PARTNER(S)

- Virginia Tech Transportation Institute

COST & SCHEDULE

- Funding: Approx. $180,000
- Project Duration: May 2018 – December 2020
    - *Data collection phase*

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Rachel Grice • (202) 493-8005 • rachel.grice@dot.gov

New Jersey Transit Run-Through Switch Project

PROJECT DESCRIPTION

- The goal is to identify factors that contribute to train crews running through switches at New Jersey Transit.
- New Jersey Transit requested assistance from FRA to learn why train crews continue to run through switches.
- A number of system and environmental conditions can contribute to these events, such as diverted attention, the level of expertise of workers, the design of switches, organizational constraints, safety culture, and training standards. Identifying the contributing conditions can lead to corrective actions that reduce these unwanted events.

RAILROAD IMPACT

- Identification of contributing factors leading to switch violations.
- Corrective action development.
- Less damage to infrastructure and equipment.

PROJECT PARTNER(S)

- FRA-sponsored research
- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: Approx. $200,000
- Project Duration: October 2016 – June 2019
  - *Research completed: Final report in editing*

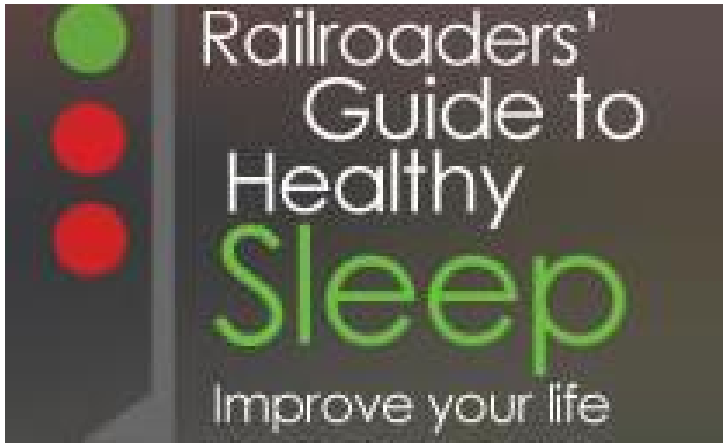
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Rachel Grice • (202) 493-8005 • rachel.grice@dot.gov

Railroaders' Guide to Healthy Sleep Website
www.railroadersleep.org

PROJECT DESCRIPTION

- In 2012, the Volpe Center (in conjunction with Harvard Medical School) launched an interactive, multimedia educational website tailored towards providing train crews and other railroad employees:
  - Scientifically-valid information about the importance of sleep.
  - An anonymous self-assessment sleep disorder screening tool.
  - Proven, practical strategies for improving sleep health.
- Current key project efforts include a comprehensive redesign (to reflect current web standards), reorganization of existing website content to better meet target user needs, and creation of new content to address balancing work/life challenges.



RAILROAD IMPACT

- Fatigue in the transportation industry has been a top priority of the National Transportation Safety Board (NTSB) starting in 1990. The Rail Safety Improvement Act of 2008 includes a requirement for carrier fatigue education and training.
- The website can help carriers in their efforts to meet this upcoming requirement.
- This educational website intended for railroaders focuses on the causes of sleepiness and key mitigation strategies under an operator's control that can help reduce sleepiness and fatigue-related incidents.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Association of American Railroads (AAR)
- American Short Line and Regional Railroad Association (ASLRRA)
- Harvard Medical School Division of Sleep Science
- Brotherhood of Locomotive Engineers and Trainmen (BLET)
- SMART Transportation Division (SMART-TD)
- Rail carriers

COST & SCHEDULE

- Funding: Project Lifecycle – Approx. $600,000 (including project evaluation effort)
- Project Duration: April 2015 – March 2020
- Updating website

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Rachel Grice • (202) 493-8005 • rachel.grice@dot.gov

Maintenance-of-Way (MOW) Worker Fatigue

PROJECT DESCRIPTION

- There is a high prevalence of human factors-related safety accidents among maintenance-of-way (MOW) workers.
- Because shift work and other irregular schedules can disrupt the circadian rhythm and introduce challenges to human performance, such as fatigue, work schedules for MOW workers should be optimized to mitigate these challenges.
- This project will analyze MOW employee accidents and incidents, and the corresponding schedule data for the employees to determine whether there is a correlation between fatigue and accidents or incidents.

RAILROAD IMPACT

- Educate industry and MOW workers concerning fatigue and accident patterns of MOW workers.
- May be used to determine optimal MOW worker schedules that reduce fatigue and related human performance errors.
- This effort may support changes to safety standards regarding regulations for MOW worker work/rest periods to be consistent with other railroad employee work/ rest regulations.

PROJECT PARTNER(S)

- FRA-sponsored research
- 10 major passenger railroads

COST & SCHEDULE

- Funding: Approx. $150,000
- Project Duration: May 2016 – June 2019
  - *Report in progress*

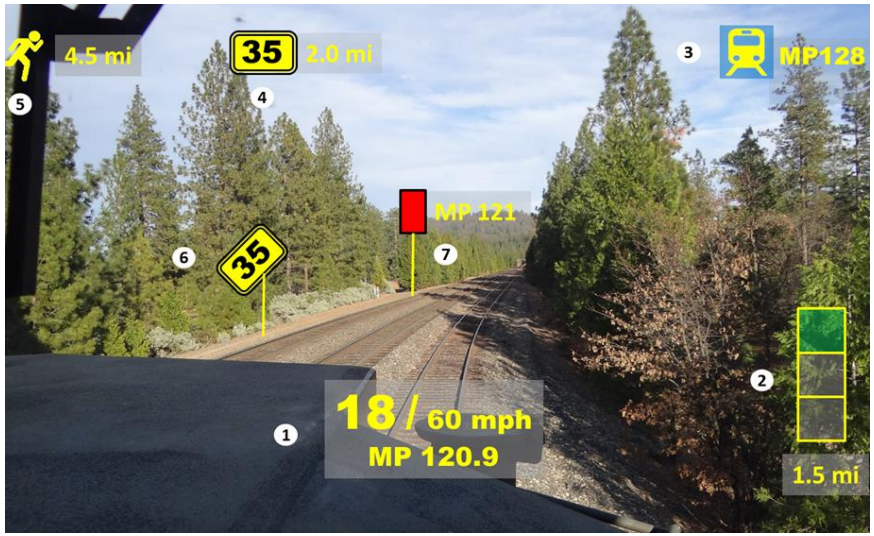
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Rachel Grice • (202) 493-8005 • rachel.grice@dot.gov

Head-Up Display (HUD) Alternative for Locomotives

PROJECT DESCRIPTION

- Distraction is a common problem in locomotive cabs and preliminary research suggests that the dispatch radio may have significant effects on crew workload and performance.
- FRA seeks to develop an understanding of how the dispatch radio communications could potentially lead to human-performance degradation in the railroad engineer, and whether a Head-Up Display (HUD) would be an alternative and superior technology to communicating information usually conveyed over the dispatch radio.
- Variables to be examined include time spent looking at the forward track, workload, and system usability.



RAILROAD IMPACT

- Increase time engineers are looking at the forward track.
- Reduce workload of engineer.
- Improve safety of rail operations by decreasing distraction from the dispatch radio.

PROJECT PARTNER(S)

- FRA-sponsored and led research
- Massachusetts Institute of Technology's (MIT) Human Systems Laboratory
- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding: Approx. $150,000
  ($48,000 for MIT production of HUD)
- Project Duration: June 2016 – June 2019

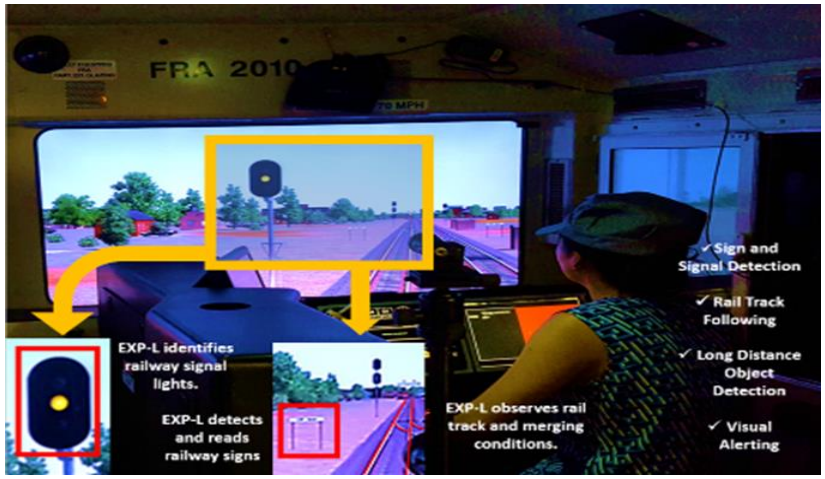
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Rachel Grice • (202) 493-8005 • rachel.grice@dot.gov

External Perception for Locomotives (ExPL)

PROJECT DESCRIPTION

- Via machine-learning, machine vision technologies develop an in-situ perception system for locomotives that detects and interprets the state of railway signals and signs, and detects objects on the track. Specific examples include rail grade crossings and speed restrictions.
- Leverage extensive Rail Human Factors expertise with MIT Man Vehicle Laboratory.
- Show feasibility and proof of concept in the Volpe Center Cab Technology Integration Laboratory (CTIL) using realistic test cases such as adverse weather or recreated accidents.



RAILROAD IMPACT

- A real-time, automated second set of eyes will be developed to compensate for loss of situational awareness in the train cab.
- A novel framework will be developed for a machine vision/machine learning system that goes beyond human capability for real-time railway signal and sign detection, and obstacle detection in day/night conditions.
- Path toward standards for system design and human factors will be developed and presented.

PROJECT PARTNER(S)

- Aurora Flight Sciences
- MIT Human Systems Laboratory

COST & SCHEDULE

- Funding:
  - Phase I — System Design: $156,000
    - System will be implemented into the Volpe CTIL train simulator. Initial data collection.
  - Phase II — Development: $161,000
    - Machine vision and machine learning algorithm development.
    - Software prototype with datasets delivered.
  - Phase III — Maturation and Refinement: $120,000
- Project Duration: April 2018 – April 2019

U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Mike Jones • (202) 493-6106 • michael.e.jones@dot.gov

Monitoring Engineer Fatigue (MEFA)

PROJECT DESCRIPTION

- Via machine learning technology, develop an in-cab passive monitoring system that detects and intervenes when a locomotive engineer is less vigilant due to fatigue.
- Measure fatigue without relying on traditional, brittle eye tracking systems.

RAILROAD IMPACT

- Supply a critical fail-safe monitoring system that fills an area not currently addressed with existing Alerter systems by detecting engineer's behavior.
- Provide information that can be used by existing automation systems or new methods to re-engage the engineer.
- Path toward maturation of comprehensive fatigue monitoring systems to be used with Alerter or third-party systems.
- Future phases for further development and testing in actual locomotive.

PROJECT PARTNER(S):

- Aurora Flight Sciences
- MIT Human Systems Laboratory

COST & SCHEDULE

- Funding:
  - Phase 1 — Sensor Selection and Acquisition: $100, 567
  - Phase 2 — Classification Development and Data: $179,580
  - Phase 3 — Model Validation: $114,471
- Project Duration: September 2018 – September 2019

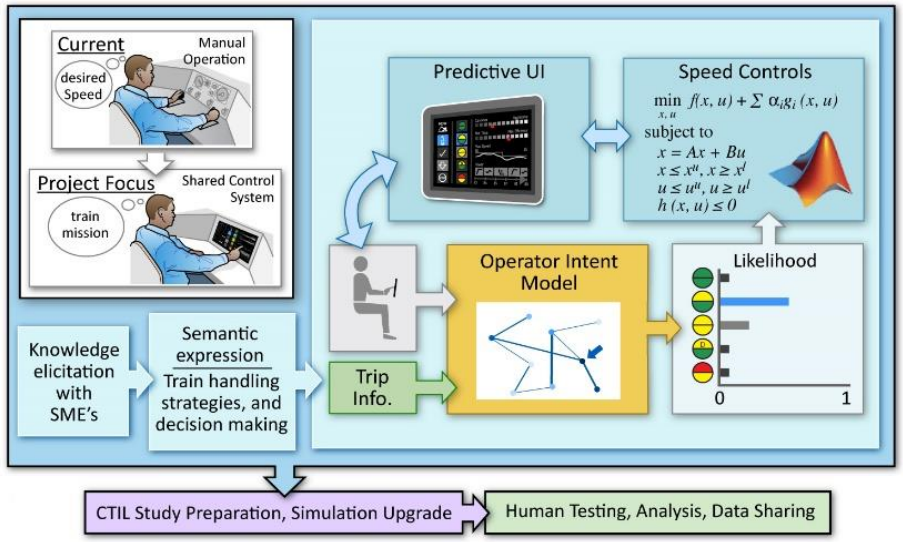
U.S. Department of Transportation
Federal Railroad Administration

FRA PROJECT MANAGER: Mike Jones • (202) 493-6106 • michael.e.jones@dot.gov

Design of a Robust Locomotive Operating Mode

PROJECT DESCRIPTION

- Explore the performance impact of new user interface for manual operating mode which directs automated systems to carry out sequences of tasks and incorporates higher orders of operator interactions (mission/speed input vs. notch input to locomotive).



RAILROAD IMPACT

- Foundational research for future operational concepts.
- Understand impact of advanced automation with less experienced crew on train safety and system performance.
- Improve rail safety by identifying critical deviations through real-time mismatch between operator behavior and modeled intent.
- Enable new automation system and adaptive display.

PROJECT PARTNER(S):

- GE Global Research
- MIT Human Systems Laboratory

COST & SCHEDULE

- Funding:
  - General Electric (GE) 20% cost share
  - Year 1 — Phase 1: $489,304
  - Year 2 — Phase 2: $500,908
- Project Duration: October 2018 – September 2020

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Federal Railroad Administration

FRA PROJECT MANAGER: Mike Jones • (202) 493-6106 • michael.e.jones@dot.gov

MIT Augmented Reality Head-Up Display (HUD)

PROJECT DESCRIPTION

- Design, develop, and evaluate prototype Head-up Display (HUD).
- Conduct quantitative evaluation of HUD design with human-in-the-loop experiments in CTIL.

RAILROAD IMPACT

- HUD supports enhanced situation awareness and detection of critical external events.
- HUD enables smooth transitions between automated and manual control of the locomotive.

PROJECT PARTNER(S)

- MIT Human Systems Laboratory
- General Electric (GE) Global Research

COST & SCHEDULE

- Funding:
  - Year 1 — Phase 1: $500,000
  - Year 2 — Phase 2: $500,000
  - Optional Phase — Actual locomotive testing
- Project Duration: September 2018 – September 2020

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Federal Railroad Administration

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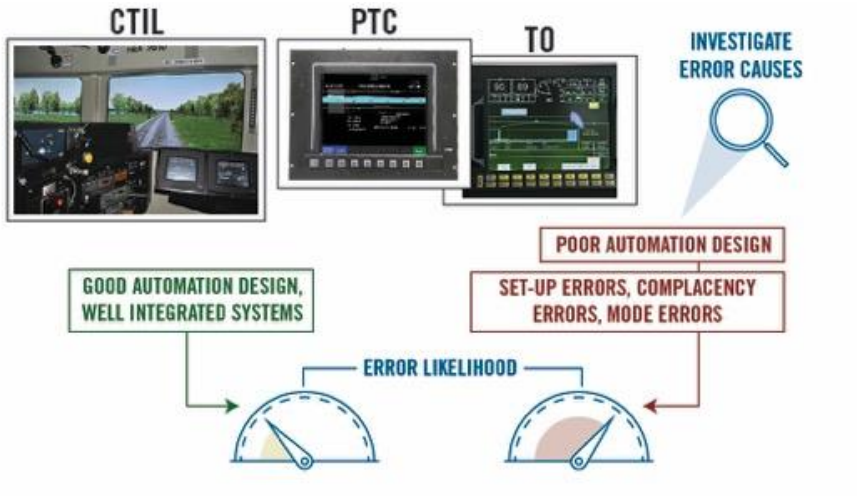
Human Error Potential in Human-Automation Interaction

PROJECT DESCRIPTION

- Human-in-the-loop research investigating human-automation interaction (HAI) with positive train control (PTC) and trip optimizer (TO).
- Compare crew performance in low and high workload automated scenarios with crew performance in low and high workload manual scenarios.
- Investigate the potential for automation set-up errors, complacency errors, and mode errors.
- Investigate effects of distraction and workload on error potential.
- Identify design and training recommendations to improve HAI and reduce error likelihood.



RAILROAD IMPACT

- Identify factors that contribute to error in the locomotive cab with automated system use.
- Reduce error potential by up to an order of magnitude through HAI design and training recommendations.
- Improve the safety of rail operations by reducing risk of human error.

PROJECT PARTNER(S)

- Tier 1 Performance Solutions LLC

COST & SCHEDULE

- Funding: $397,276
- Project Duration: September 2018 – December 2019

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Federal Railroad Administration

FRA PROJECT MANAGER: Mike Jones • (202) 493-6106 • michael.e.jones@dot.gov

Suicide Countermeasures

PROJECT DESCRIPTION

- Work with railroad carriers to implement pilot tests of various countermeasures to understand which countermeasures could mitigate suicides on the rights-of-way (ROW).
- Develop rail specific guidelines for reporting on suicides on ROW.
- Track suicide and trespass rates and identify potential regions of concern (e.g., hotspots) using Geographic Information Systems (GIS) mapping.
- Continue to gather information about the prevalence of suicides on ROW, as well as demographic characteristics of individuals involved and characteristics of time and location that may impact countermeasure development.

PROJECT PARTNER(S)

- Volpe National Transportation Systems Center
- Various railroad carriers

COST & SCHEDULE

- Funding: $160,000
- Project Duration: October 2018 – September 2019

RAILROAD IMPACT

- Reduction in the number of suicide casualties that occur on the railroad rights-of-way (ROW).
- Reduction in service disruption and employee time-off due to suicide incidents.
- Better understanding of potential countermeasures and improved understanding of feasibility of implementing countermeasures to mitigate suicides.
- Improvement in the quality of data being collected on suicide and trespass casualties by railroad carriers.
- Involvement of other groups who may be able to share countermeasure costs.

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Short Line Safety Institute (SLSI)

PROJECT DESCRIPTION

- Partner with the SLSI to help short line and regional railroads enhance and improve safety practices, and to increase their commitment to safety.
- Work with the SLSI to develop and test safety culture assessment tools and provide on-going program improvements.

PROJECT PARTNER(S)

- SLSI
- University of Connecticut (UConn)
- Volpe National Transportation Systems Center

COST & SCHEDULE

- Funding:

  FY18: September 2018 – December 2019
  - $2.4 million grant to SLSI
  - $100,000 to Volpe

  FY19: September 2019 – December 2020

RAILROAD IMPACT

- The Short Line Safety Institute (SLSI) was formed to improve safety practices and to provide safety training for Class II and Class III freight railroads to build a stronger, sustainable safety culture.
- The SLSI:
  - Conducts safety culture assessments and provides recommendations on how to improve safety culture.
  - Provides training and education about safety culture.
  - Serves as a research center that compiles and disseminates information on safety needs and trends.
  - Communicates to stakeholders about safety culture improvement efforts.

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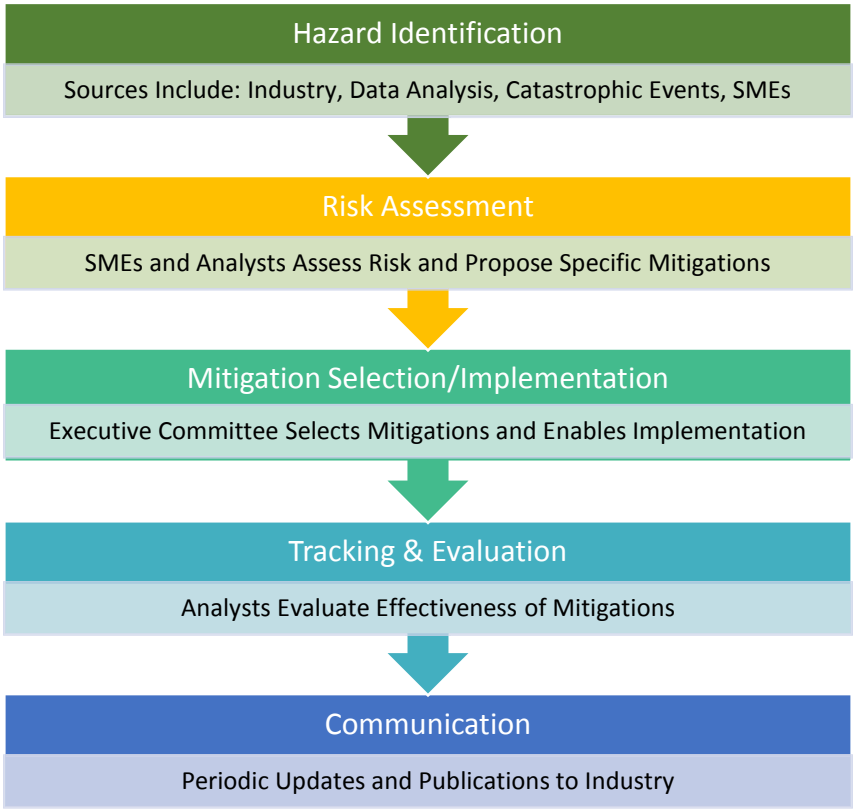
Railroad Information-Sharing Environment (RISE)

PROJECT DESCRIPTION

- Objective: Build a non-regulatory safety collaborative combining data, information, and subject matter expertise from government and industry sources to evaluate railroad safety risks and enable the industry to manage those risks.
- RISE follows the example of successful programs in other transportation modes:
  - Federal Aviation Administration (FAA) – Aviation Safety Information Analysis and Sharing (ASIAS)
  - National Highway Traffic Safety Administration (NHTSA) – Partnership for Analytics Research in Traffic Safety (PARTS) program for vehicle manufacturers
- Participation is entirely voluntary and will never be required by regulation.

RAILROAD IMPACT

- Reduce the numbers and rates of railroad accidents, incidents, injuries, and fatalities.
- Focus on issues not addressed by existing regulations.
- Address issues spanning multiple disciplines, multiple railroads, or multiple geographic regions.
- Develop consensus-based mitigations to railroad safety issues.



PROJECT PARTNER(S)

- TBD

COST & SCHEDULE

- TBD

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