U.S. Department of Transportation

Federal Railroad Administration

Office of Research and Development (R&D) Current Projects

January 2012

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Track and Infrastructure Research Division Projects

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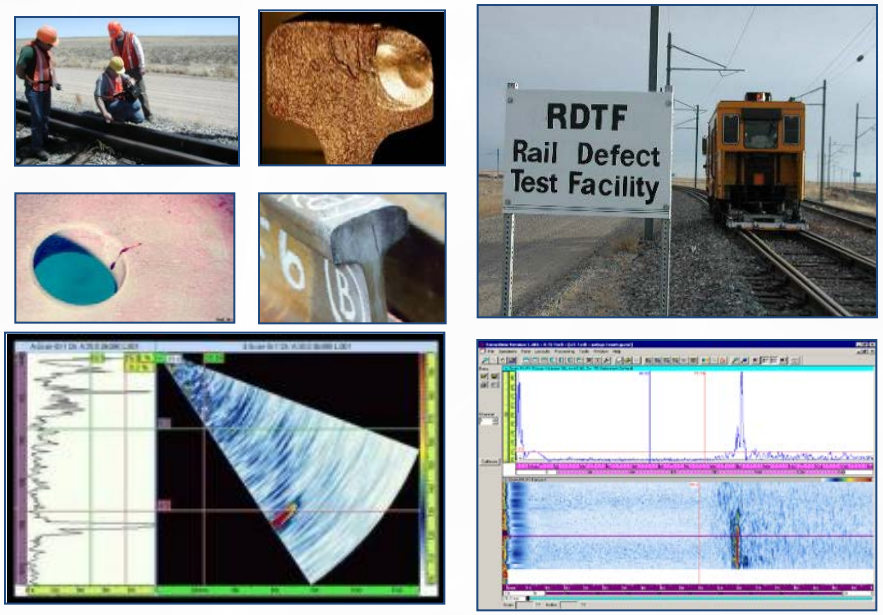
Rail Integrity
Phased Array Approach to Flaw Sizing



Project Description:

- Identify and team with three to four portable UPA equipment manufacturers/suppliers and adapt their systems towards rapid sizing of rail flaws in the field
- Develop rail flaw master gauges for use in quantifying rail flaw sizing capability
- Perform UPA on various types and sizes of rail flaws to identify applicable approaches to flaw sizing
- **End Product:** Develop a portable, hand-held, ultrasonic phased array rail flaw inspection approach and/or inspection system

Railroad Impact:

- Annual Problem Size - $476M
- Safety – A reduction in rail flaw related derailments, accidents and service failures
- Reliability - Reduction in service failures and train delays
- Success in identifying and developing an Ultrasonic Phased Array (UPA) approach for flaw sizing is expected to increase safety and efficiency thus increasing reliability of rail operations and maintenance of track due to rail flaws

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Project Partner: TTCI (Greg Garcia)

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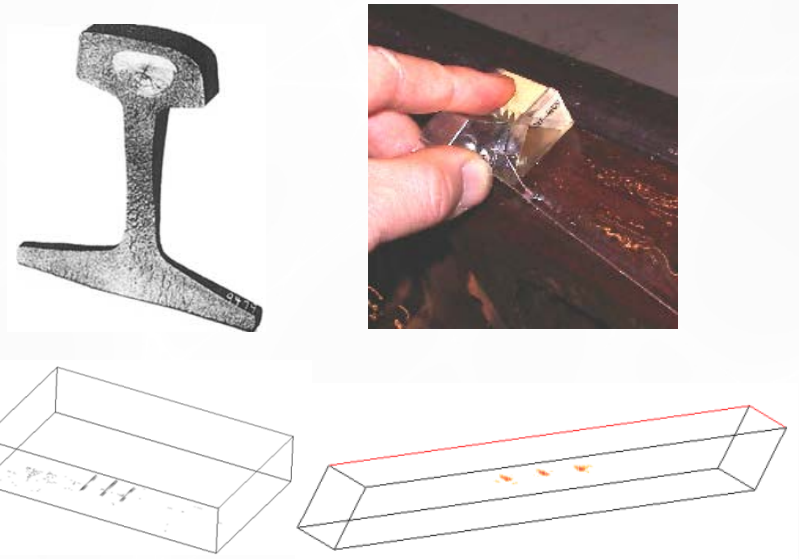
Handheld Rail Flaw Tomographic Imaging System



Images Courtesy of Olympus NDT

Railroad Impact:

- Following the identification of a potential internal rail defect by an inspection vehicle, detailed inspections of suspect areas are conducted to confirm the presence of the defect prior to the removal of the affected area;
- Follow-up inspections are often conducted with portable ultrasonic devices that require a significant amount of experience to operate;
- This proposed task focuses on the development of instrumentation that yield easily interpreted results that could eventually lead to automatic detection and imaging of internal rail flaws.

Project Description:

- Proposed task intends to develop advanced means to visualize the results of manual inspections of suspected internal rail flaws;
- Initial phase of study would employ a technology survey to determine the state-of-the-art in inspection technology;
- Efforts will then focus on the use of signal processing practices used in other fields, such as tomography, or alternative approaches, to process data collected with the final goal of creating a user interface that displays a 3-D image of the rail defect being interrogated.
- Performs rapid sizing, type and location of rail flaws in the field.

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Project Partner: ENSCO Inc.

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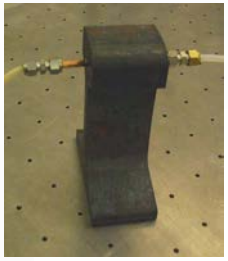
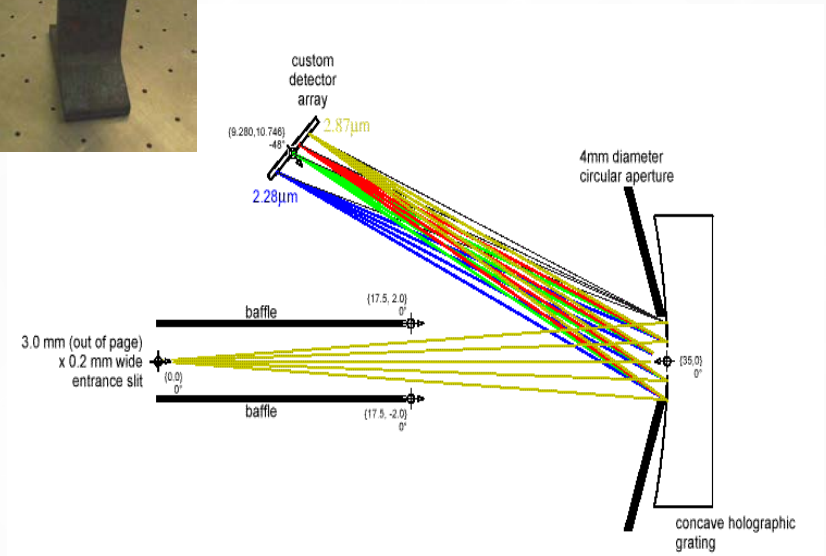
In-Motion Rail Temperature Measurement System





Project Description:

- A rail temperature measurement system will be developed capable of being installed on an in-service rail vehicle
- Multiple sensors will detect the surface temperature of the head and web of both rails
- Software with real-time display of rail temperature data is constantly streaming.
- An integrated GPS location capability is included in the system.

Railroad Impact:

- Allow real-time monitoring of rail temperature
- Potential to immediately alter operations and reduce speed if high rail temperatures are detected
- Data will allow for validation of rail temperature prediction model which is currently being developed

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Project Partner: En'Urga

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Ultra-Portable Ride Quality Meter (UPRQM)

Project Description:

- Develop a compact, portable ride quality meter with GPS data integration.
- The UPRQM will allow for real-time display of data channels and real-time GIS-based mapping of current location.
- The UPRQM will be designed to work in conjunction with a laptop and will receive its power through a USB connection to the laptop.

Railroad Impact:

- Presently, track inspectors evaluate the ride quality of a train in a subjective manner by riding the train and feeling the “bumpiness” of the ride.
- The UPRQM will quantify this process, thereby allowing for collection, analysis, and recording of data.
- The collected data will be beneficial in addressing immediate safety concerns, as well as long-term track degradation and statistical studies.

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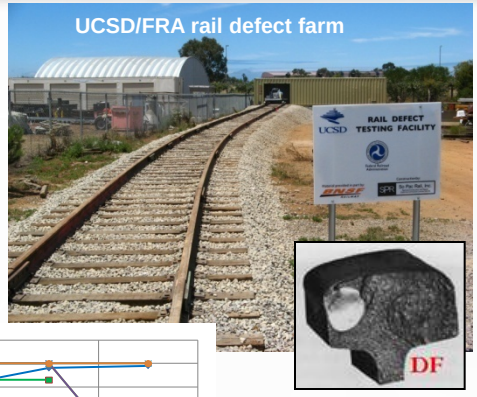
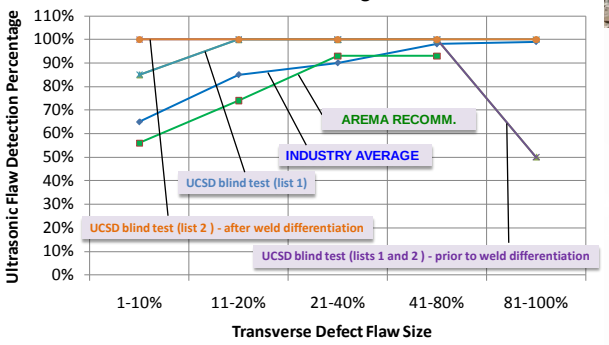
Non-contact Rail Inspection Prototype Improvement



Blind test results at Herzog



Railroad Impact:

- Current rail inspection technologies fail to find all critical flaws in rails. Transverse Defects, Vertical Split Head Defects and Defective Welds are among the flaws that are not fully addressed by current inspections.
- NTSB Safety Reports addressed disastrous train derailments in Superior, WI in 1992 (BNSF) and Oneida, NY in 2007 (CSX) caused by undetected internal head defects under shelling.

Project Description:

- Prototype uses laser, air-coupled sensors and unique statistical pattern recognition to perform ultrasonic inspection of rails.
- Prototype field tested at defect farm of Herzog, Inc. Blind tests resulted in defect detection performance that exceeded both AREMA Standards and Industry Average.
- Prototype shows good detection performance of TD under shelling in laboratory testing.
- Guided Wave Rail, LLC will commercialize the technology to rail inspection providers (discussions underway with Herzog, Sperry and Dapco/Nordco)
- Current efforts aimed at adding rail surface characterization for use in grinding operations. Discussions under way with Loram, Inc. to commercialize surface characterization part.

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Project Partners: UCSD, ENSCO, Volpe, Herzog, BNSF;
PI: Dr. Lanza di Scalea

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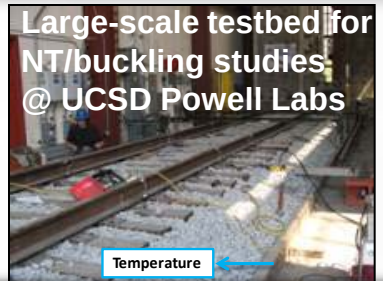
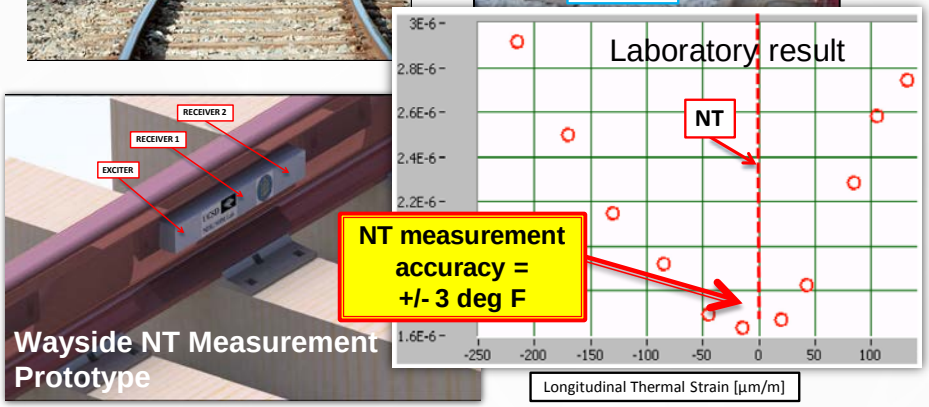
Neutral Temperature & Incipient Buckling Detection System for CWR





Railroad Impact:

- Knowledge of NT in CWR is critical to avoid breakage in cold weather and buckling/instability in hot weather. This need is ever more stringent with increasing train tonnage and speeds.
- Current methods to determine rail NT today either require unfastening of rail or are very sensitive to rail fastening/support conditions.
- Railroads would benefit greatly from a system able to measure thermal stress and/or imminent buckling of CWR without need for unfastening and without tie-to-tie variations.

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Project Description:

- Developing a new approach for monitoring stress levels (NT) and incipient buckling in CWR by using special non-linear features of ultrasonic guided waves

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- A unique large-scale testbed of CWR (70-ft long) constructed at UCSD's Powell Structural Laboratories with BNSF for simulating rail thermal stresses.
- Results from the large-scale testbed show measurement of NT to within +/- 3 deg F using nonlinear ultrasonic guided waves.
- Based on these results, a prototype has been developed for wayside measurements of rail thermal stresses. Prototype field testing will be scheduled for the beginning of 2012 in collaboration with BNSF and UP.
- Provisional patent application No. 61/558,353 filed on 11/10/2011 by the University of California.

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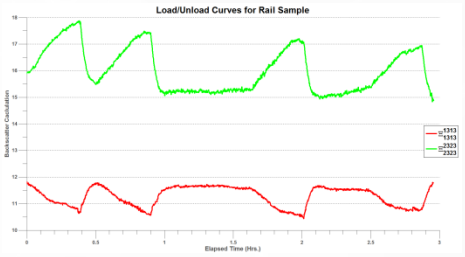
Measurement of Longitudinal Rail Stress



Laboratory diffuse ultrasonic measurements on rail (4 cycles)

Preliminary field tests on UPRR and BNSF track show feasibility of measurements on active track

Project Description:

- Developing robust models that predict the change in ultrasonic scattering due to applied stress in metals
- Developing a hand-held unit for measuring diffuse ultrasonic backscatter (DUB) on rail for both laboratory and field-testing
- Developing necessary software and algorithms for fitting measurements to scattering models for extracting stress information
- Exploiting UNL experience with ultrasound research for materials characterization

Railroad Impact:

- Rail stress is possibly the most challenging research issue facing the rail industry and currently, there are few options for measurement
- Direct cost of rail stress-associated issues are tens of millions of dollars annually
- Entire rail industry would benefit substantially from new developments in reliable and efficient rail stress monitoring

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Project Partners: University of Nebraska, Lincoln, University of California, San Diego, BNSF, UPRR, OPPD, OL&B; **PI:** Dr. Joseph Turner

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Real-Time Measurement of Track Modulus from a Moving Car

Project Description:

- The objective of this project is to design a system that will provide autonomous real-time measurements of track modulus from a moving railcar operating in revenue service (like no existing system).
- Continuous modulus for large sections of track.
- Currently working on commercial implementation.

Railroad Impact:

- Significant support from both UPRR & BNSF including over 10,000 miles of BNSF & UPRR coal lines in 2009-10
- Technology licensed to a privately funded start up company, MRail, to commercialize results of this research
- MRail using private funds to prepare technology and push into marketplace
- Testing planned on CN/CP during Q1 2012
- Will implement technology on FRA's T-18 in 2012-13

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Project Partners: University of Nebraksa, Lincoln (UNL)- , BNSF, UPRR, OPPD; **PI**: Dr. Shane Farritor

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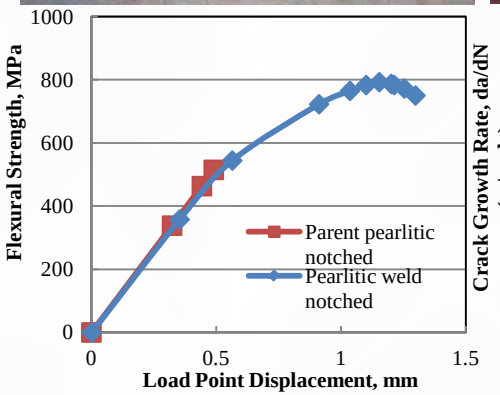
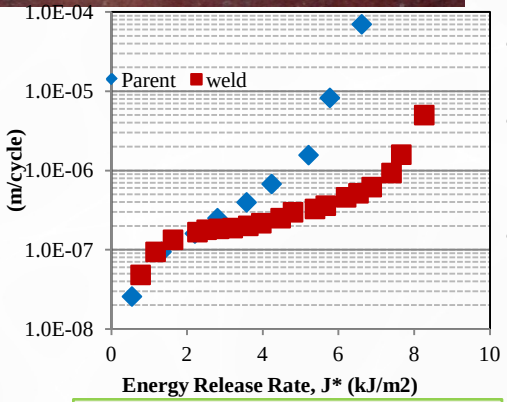
Fracture and Fatigue Evaluation of Slot-Welded Railhead Repair


Rail before welding


Rail after welding and grinding



Fracture resistance of the welded & parent Pearlitic rail steels



Fatigue resistance of the welded & parent Pearlitic rail steels

Project Description:

- Design and develop a welding process for repair of railhead defects.
- Finite Element Analysis was successfully performed to establish the temperature profiles before and during welding to optimize the welding parameters.
- Flexural strength of the developed slot welded pearlitic rail steel is found to be comparable to the parent rail steel.
- The fracture resistance of the welded pearlitic rail steel was found to be higher than the parent rail steel.
- The fatigue crack growth rate of the slot welded pearlitic rail steel shows better performance than the parent rail steel.
- The fatigue damage tolerance of the slot welded steels showed equal or higher value than the parent rail steels indicative of high durability in-service, reduction in maintenance and thus increased safety of the railroad tracks.

Railroad Impact:

- Improves the quality of welded railhead repair
- Enhances the fatigue damage tolerance of welded rails
- Reduces the time and cost of rail repair
- Improves rail safety

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Project Partners: Tuskegee Univ.; Nucor Steels; UP &TTCI; **PI:** Dr. H. Aglan

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Development and Evaluation of FRP Composite Strengthened Railroad Crossties

Tie with FRP shell (static bending test)

Wrapped pile (left) and infrared image (right)

Spike Pullout Tests

Field (TTCI) Installation

Project Description:

- Manufacturing of multi-axial fabric strengthened recycled FRP crossties with energy absorbent core (wood/rubber) & wrapping of bridge members
- Static and fatigue load (18 million cycles) evaluation – ties & wrapped members.
- Field installation including rail seat and spike integrity evaluation under fatigue loads.
- Rehabilitation and monitoring of wrapped RR bridge members
- Evaluation of FRP panel use for railroad crossings
- Collaboration with SBVR, WVDOH and others

Railroad Impact:

- Thermoplastic/thermoset composite crossties with high fatigue endurance under fatigue and abrasive rail loads.
- Crossties that are stronger, stiffer, durable, safe, easy to install and/or replace.
- Lower maintenance and replacements
- Recyclable materials (thermoplastics and discarded tires) save trees and wood treating chemicals, thus benefiting environment by reducing greenhouse effects and saving energy.

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Project Partners: WVU, SBVR-WVDOH

PI: Dr. Hota GangRao

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Plastic Ties Safety Performance Evaluation

Railroad Impact:

- Consensus: Conduct/coordinate laboratory, field studies, and workshops to address priority performance and safety issues of plastic ties.
- Technical Guides: New Part 5 on Engineered Composite Ties now included in AREMA Railway Engineering Manual, Chapter 30, Ties.
- Guidance better assures safe use of these new class of tie products in heavy axle service conditions.

Project Description:

- Plastic composite ties have seen increased use over the last 15 years. A variety of material compositions and designs are available – safety concerns raised due to unknown failure modes and unproven long-term durability in heavy axle service.
- Fracture under construction loads and fire resistance are current focus of research. Coordinating and monitoring work at TTCI regarding tie failures during handling and installation in track.
- Developing test method to evaluate fire resistance of engineered composite ties and to compare performance to treated wood ties.
- Monitor performance concerning testing and use of plastic composite ties by Class 1 railroads.
- New Section on Engineered Composite Ties for Open Deck Bridges approved to be included in the 2012 Edition of AREMA Chapter 30, Part 5.

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Project Partners: USACE, UP, BNSF, CSX, CTA, Rutgers Univ., CTL, TTCI & Manufacturers; **PI:** Richard Lampo

U.S. Department of Transportation
Federal Railroad Administration

Bridge Failure Modes and Intelligent Bridge Monitoring

Project Description:

- Use results of Phase 1 report on bridge service interruptions
- Develop methodologies for targeting bridges for most effective monitoring.
- Develop inspection strategies and methodologies to cover likely failure modes.
- Development / demonstration of monitoring technologies
- Investigate integration with existing bridge management programs

Railroad Impact:

- Characterization of bridge types and risk factors determining appropriate inspection and maintenance procedures.
- Enables predictive maintenance on an aging bridge population
- Reduces the occurrence of bridge failures by warning of bridge distress prior to failure
- Warns bridge owners of possible bridge collisions or structural damage

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Project Partner: TTCI (Richard Joy)

U.S. Department of Transportation
Federal Railroad Administration

Heavy Axle Load Revenue Service Testing at Mega Sites

Project Description:

- Eastern mega site has timber ties, sharp curves, steep grade, open deck steel bridges under HAL coal traffic
- Western mega site has concrete ties, shallow curves, ballast deck concrete bridges, higher operating speed and high annual HAL tonnage
- Establish and conduct various experiments based on inputs from member railroads to address HAL operation issues (safety and track component lives)
- Complement and supplement FAST program with a wider range of track, operation and environmental conditions
- Monitor performance long term, quantify load environment and failure mechanisms through field measurements and testing, as well as lab testing and modeling if necessary

Railroad Impact:

- Understanding of root causes of track safety and maintenance issues under HAL operations
- New technologies, improved track maintenance procedures and new designs to improve train operation safety and to mitigate track degradation from HAL operations

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Project Partner: TTCI (Dingqing Li)

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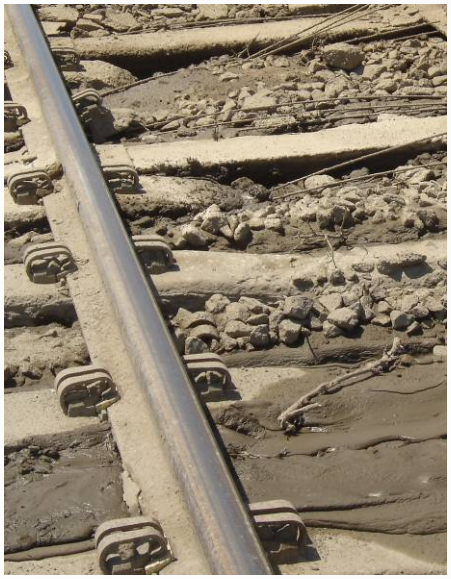
Federal Railroad Administration

Diagnostics and Remediation of Mud Holes on Heavy Haul Coal Lines



Railroad Impact:

- Derailments and slow orders caused by mud holes in heavy haul coal lines in past several years have caused significant safety, reliability and customer satisfaction problems. Mud holes have also caused broken rails, broken ties and rough track geometry
- Effective diagnostics provides the basis for effective remediation and prevention

Project Description:

- Investigate HAL routes where there are on-going mud hole problems:
  - Field measurements to fully characterize the effects of mud holes on track performance
  - Collect samples to determine the main source of fouling materials (ballast breakdown, coal fine or subgrade soil)
- Conduct controlled tests at FAST regarding coal fouled ballast
- Conduct modeling work to further quantify the effects of mud holes on the lives of other track components (rails and ties)
- In conjunction with Univ. of Illinois, conduct lab tests to quantify various conditions on ballast strength and deformation
- Develop remediation and maintenance procedure to prevent or delay occurrence of mud holes
- Install and evaluate remedial procedures at problems sites

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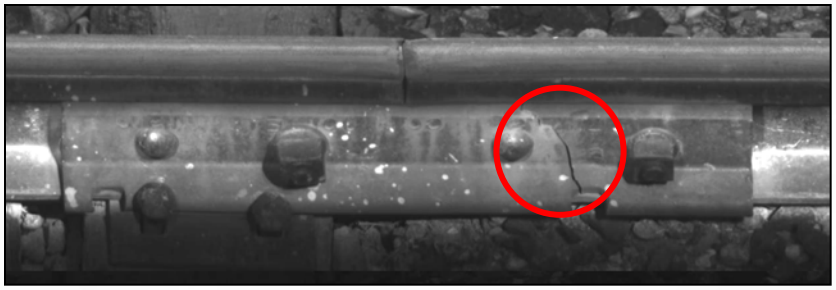
Federal Railroad Administration

Joint Bar Service Failure Prevention



Project Description:

- Develop recommended guidelines for improved joint bars and materials
  - Complete fatigue and crack growth of joint bars using data being currently collected
  - Perform FEA to investigate joint bar cracking at top center of bars
  - Conduct inspections and lab tests and summarize five top failure modes of joint bars
- Recommend methods to match joint stiffness to rail
  - Develop resilient foundations for joints
- Propose measures to reduce safety concerns of joint bars currently in the system

Railroad Impact:

- Joint bar failures cause a significant number of accidents every year
- On going FRA funded study will provide information needed to help railways:
  - Develop inspection technologies and schedules to minimize service failures
  - Design new joint bars with better mechanical and fatigue resistance properties
- Research will help railroads to develop a strategy to reduce failures of joint bars already in the system

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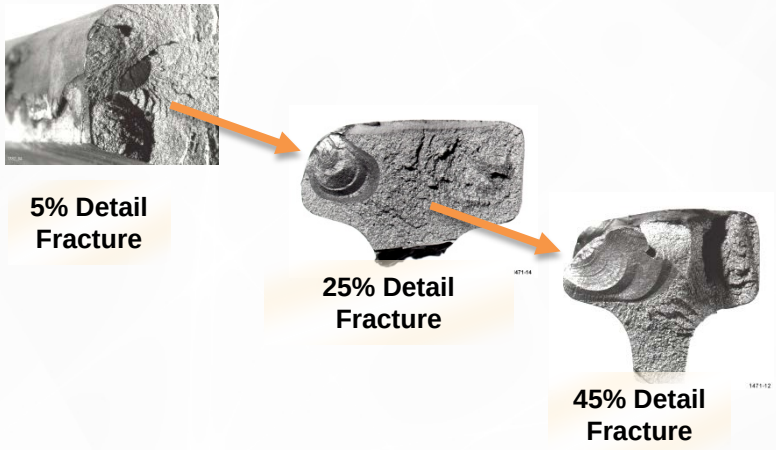
Investigation of Crack Growth Rates in Modern rail Steels

Modern Rail Crack Growth



Railroad Impact:

- Greatly improves safety against broken rails
- Cost Effective- The cost of rail maintenance is reduced.
- Overall, the life of the rail is improved.

Project Description:

- Identify rail defects that can be cut out and transported to TTCI
- Document operating and support conditions of track where defects are found
- Install in facility to access growth rate in safe manner if under traffic consider loose bars to protect train
- Map growth as a function of traffic, monitor operating and support conditions
- Identify conditions that allow rapid crack growth and develop special test locations that include as many features as reasonable.
- Calibrate models

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Project Partner: TTCI (Daniel Gutscher)

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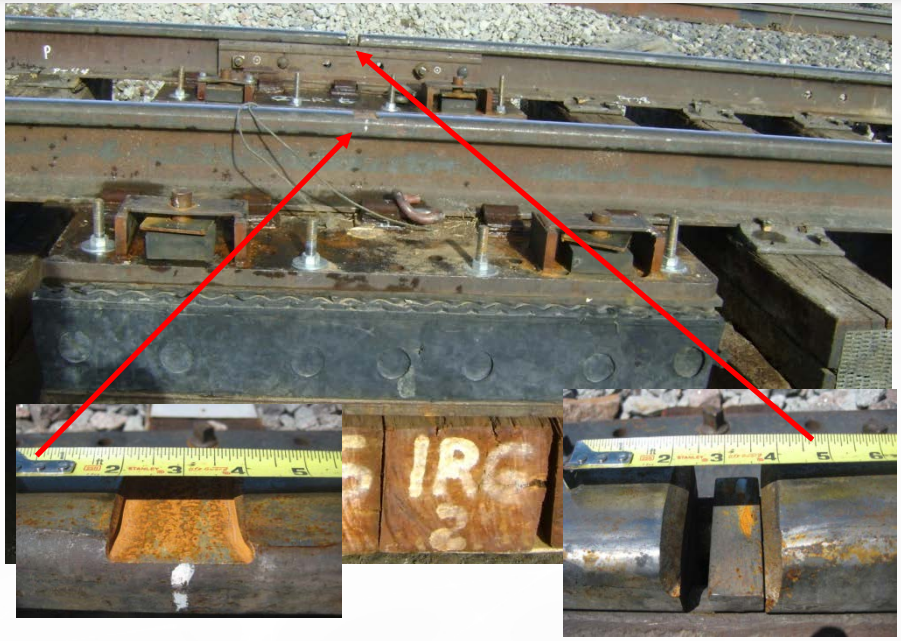
Next Generation Foundations for Special Track Work



Railroad Impact:

- Vertical and lateral impacts on special track work are very high, and are the major cause of lower service life of Special Trackwork (STW) components.
- About 20 percent of all track related accidents and derailments are due to STW.
- Next generation foundations and special track structure are likely to reduce impacts significantly, increasing the ride quality and service life of STW components.

Project Description:

- Investigate effects of track structures on wheel/rail impact caused by rail discontinuities (gaps):
  - Rigid gap (one piece of rail with milled gap)
  - Flexible gap (two pieces of rail connect by bars)
- Conduct test and modeling study of foundation design parameters:
  - To quantify the extent of reduction in impacts on track and vehicle.
  - To identify and recommend material specifications to be used with prototype foundations.
- Perform lab & field tests to verify material properties
- Determine economic feasibility of prototypes
- Phase II: Design, build and test prototype foundation

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Project Partner: TTCI (David Davis)

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Federal Railroad Administration

Autonomous Track Geometry Measurement System (ATGMS)

Railroad Impact:

- Continuous, un-manned geometry data collection provides critical track data in real-time wherever the system(s) are deployed.
- No impact on rail traffic operations. The system can be installed on normal revenue railcars or locomotives and run in consist.
- Track testing is automatically scheduled based on normal operation of the vehicle.
- ATGMS provides a reduction in complexity, size and cost of traditional geometry systems without compromising performance.

Project Description:

- Research and development program to adapt service-proven track geometry measurement technology to autonomous operation. Objectives:
  - Reduce capital and operating costs of geometry inspection systems
  - Provide routine and frequent data for safety assurance activities and track degradation analysis
- Pilot system currently in service and performing well. Technology refinements currently in development to obtain 90 day maintenance interval, improve automatic geo-location performance, and to perform automatic track degradation and reporting functions.
- Second system currently in development for deployment on Amtrak NE Corridor.

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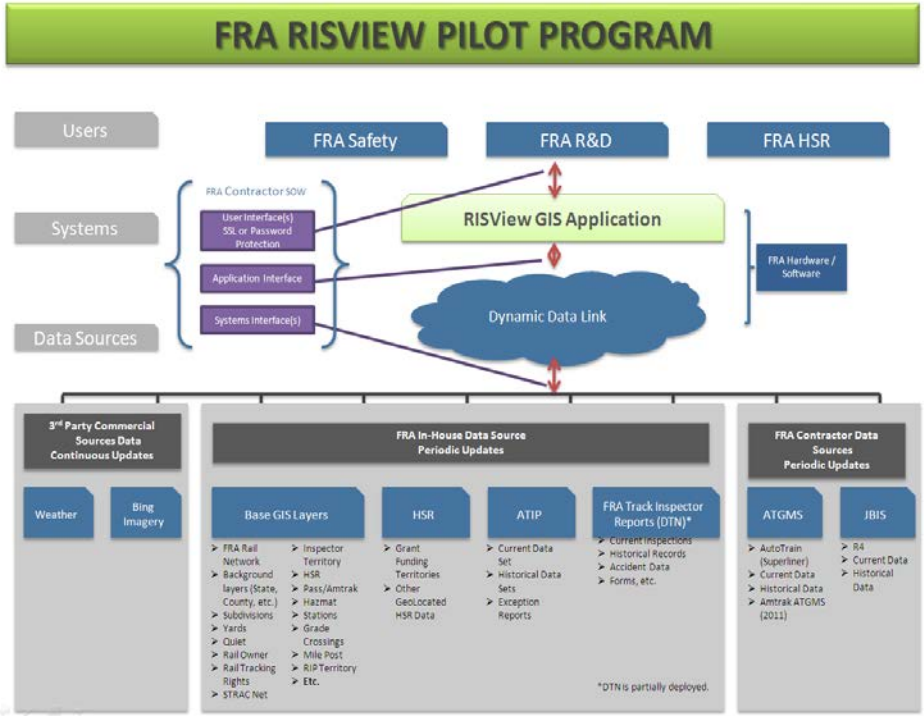
Rail Interactive Safety View (RisView)



Project Description:

- Pilot program, currently in procurement phase, to develop internal and external data interfaces and integrate these data into the FRA's existing GIS tool
- Test and evaluation activities
- Requirements definition for full-scale deployment.

Railroad Impact:

- Desktop access to local and remote data sources via a geographical interface.
- Provides synthesis of data sets for detailed analysis and reporting activities
- Provides single-point access for high volume data sets, including autonomous data collection systems

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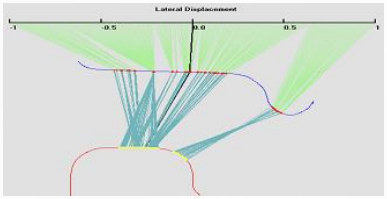
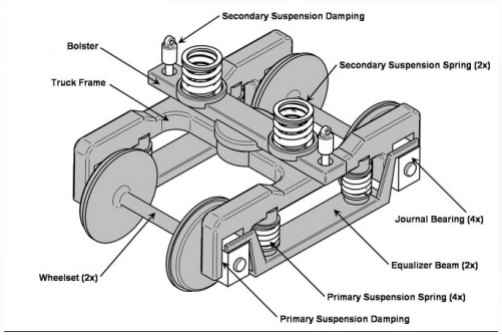
Vehicle-Track Interaction (VTI) Testing, Modeling and Analysis





Project Description:

- Assist FRA OR&D in modeling, simulation, test, data collection and analyses of VTI related issues; understand the mechanics, evaluate current track geometry standards, and improve and verify the accuracy of vehicle dynamics modeling in predicting forces and accelerations exerted on wheel and rail;
- Determine the influence of track geometry characteristics and vehicle speeds on extreme lateral and vertical dynamic forces and accelerations that can potentially lead to derailment or compromise passenger safety.

Railroad Impact:

- Reduce derailment risk, track degradation, vehicle wear or damage, lading damage and passenger discomfort;
- Establish performance-based track geometry tolerances and vehicle design parameters that ensure safety and maximize effective and efficient use of maintenance resources;
- Move goods and passengers at higher speeds and more efficiently.

Point of Contact Information:

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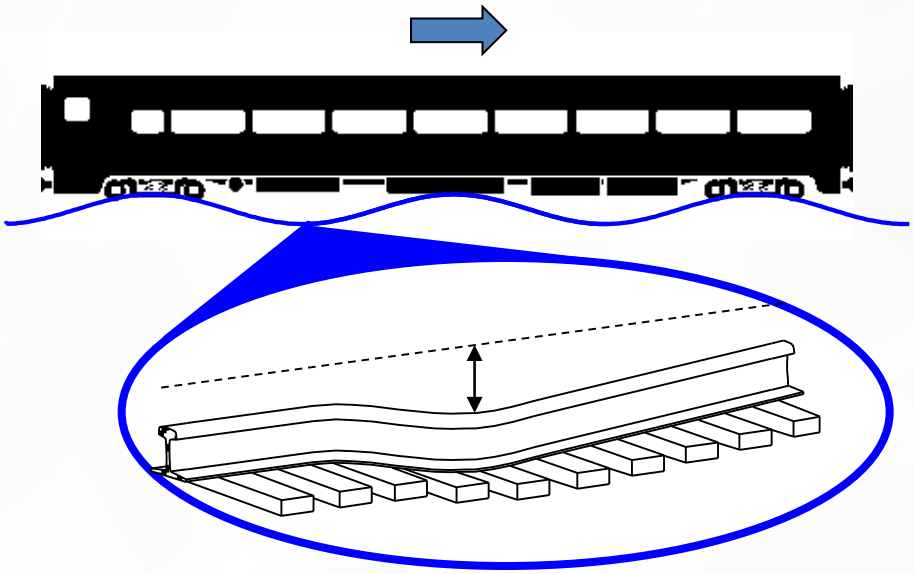
Project Partner: ENSCO Inc.

U.S. Department of Transportation
Federal Railroad Administration

Revise Track Geometry Safety Standards



Project Description:

- Establish consensus on vehicle dynamics safety limits which define adverse vehicle responses and severe loading of track structure
- Apply analysis tools and simulation programs to define largest amplitude of geometry signatures that would not exceed safety limits (focus only on high speed & high cant deficiency operations)
- Develop effective inspection techniques to identify critical track geometry signatures so that track/vehicle system operates within established safety limits

Railroad Impact:

- Track Geometry has been identified as one of the major causes of main line derailments in US (15% are Track Caused Derailments).
- Improved railroad safety via reduction of track geometry related derailments
- More economic, understandable and enforceable standards
- New standards for combined geometry

Point of Contact Information:

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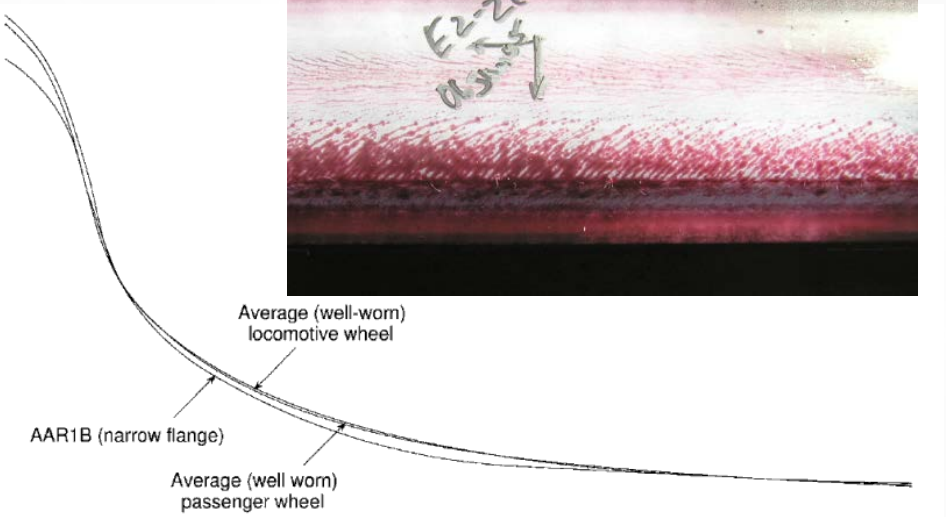
Project Partner: Volpe

U.S. Department of Transportation
Federal Railroad Administration

Wheel Rail Profile, Lubrication and Grinding Practices



Railroad Impact:

- An improved wheel profile demonstrates the ability to nearly double wheel life.
- Optimized rail shapes and improved rail grinding patterns maximizes the effectiveness of the grinding effort
- Testing of friction management proves dramatic reduction of lateral forces and reduced wheel-climb risk

Project Description:

- Completion of ongoing wheel/rail projects at Amtrak.
- Completion of and reporting on field testing of an optimized wheel profile
- Analysis of IWS data to determine the potential of wayside friction management on Amtrak
- Delivering a rail grinding best practices document
- Support efforts to trial vehicle-based friction management
- Study the Rolling Contact Fatigue (RCF) on North East Corridor (NEC) rail and Acela Wheels
- Test the developed wheel and rail profile for commuters in a commuter system

Point of Contact Information:

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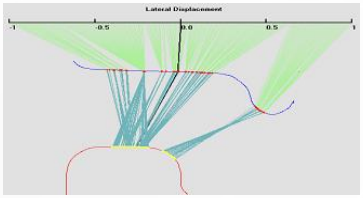
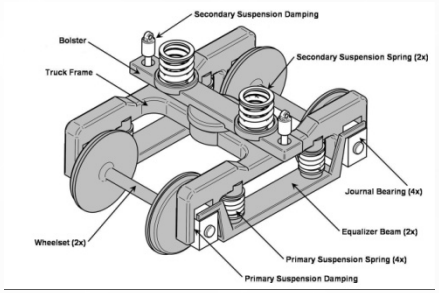
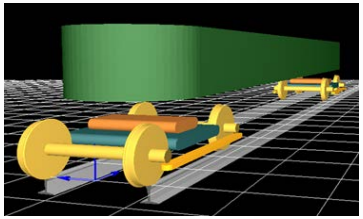
Project Partner: National Research Council (NRC)

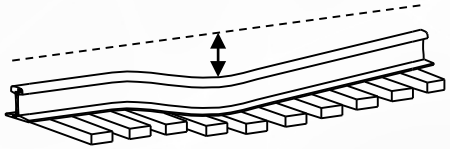
U.S. Department of Transportation
Federal Railroad Administration

Vehicle/Track Dynamic Simulation Tool









Project Description:

- Predicts wheel/rail forces from measured track geometry using either measured wheel forces or SAMRAIL simulated forces;
- Implemented in real-time on track inspection vehicles or offline;
- Currently have models for Metroliner, Tank Car (Loaded and Empty), AEM-7 & Loaded Hopper Car;
- Predicts vehicle track interaction vehicle safety exceptions to help identify unsafe track conditions;
- Propose to implement 2 - 3 additional vehicle models (“problem cars”) and deploy all models on FRA cars for real-time performance-based evaluations.

Railroad Impact:

- Reduces derailment risk, track degradation, vehicle wear or damage, lading damage and passenger discomfort.
- Establishes performance-based track geometry tolerances and vehicle design parameters that ensure safety and maximize effective and efficient use of maintenance resources.
- Provides a tool to be used for derailment investigation or vehicle qualifications.

Point of Contact Information:

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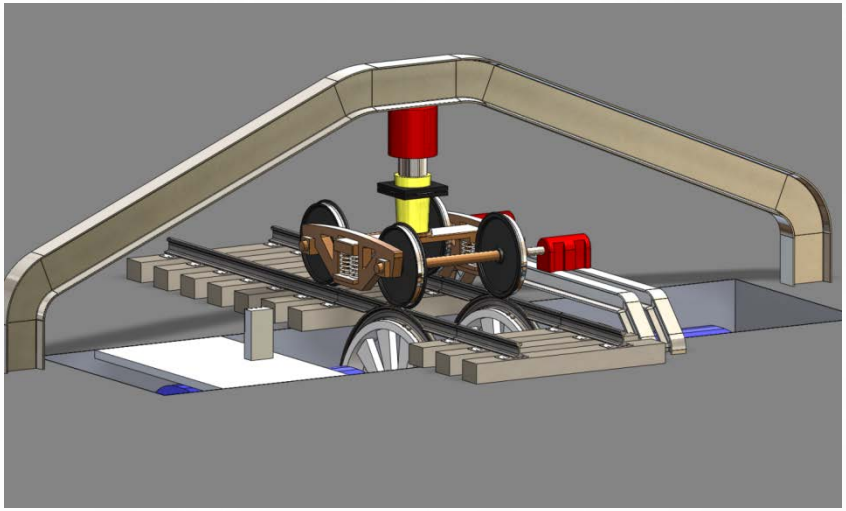
Project Partner: University of Illinois

U.S. Department of Transportation
Federal Railroad Administration

Evaluation of Wheel/Rail Contact Mechanics



Project Description:

- Design a wheel/rail contact mechanics evaluation test rig that can be used for the needs of both freight and high-speed intercity trains
- Provide the means for thorough understanding of the mechanics and dynamics associated with the wheel/rail interaction, under conditions that can be scientifically related to train operation
- Provide the means for measuring the parameters that are necessary for practical evaluations that are of interest to the FRA and U.S. rail industry

Railroad Impact:

- Understanding the complex mechanics and dynamics that occur at the wheel-rail interface is critical for improving railway equipment operation safety and efficiency
- Provides the capability to more accurately measure the critical forces, moments, and displacements that are necessary for rail vehicle modeling and engineering analysis for both passenger and freight trains, far beyond the means currently available to the FRA and rail industry

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Project Partner: Virginia Tech
Norfolk Southern

U.S. Department of Transportation
Federal Railroad Administration

Evaluation of GPR Inspection Technologies for Track Substructure

Railroad Impact:

- Track substructure has a profound effect on track performance
- Main root cause of track geometry defects and degradation
- Affects performance and lives of other track components such as rails and ties
- Ground penetrating radar (GPR) is a non-destructive testing method for track substructure
- Proactive planning of maintenance before problems become visible and severe

Project Description:

- Conduct evaluation tests at FAST and in revenue service:
  - Ballast layer thickness
  - Ballast layer fouling
  - Ballast layer moisture content
  - Subgrade analysis
  - Hot mix asphalt layer, road crossing, bridge approaches, etc
- Develop performance requirements and evaluation criteria
- Develop guidelines for implementation in North America
- Recommend additional GPR R&D needs

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Project Partner: TTCI (David Read)

U.S. Department of Transportation
Federal Railroad Administration

Concrete Tie Rail Seat Abrasion Mechanisms

Project Description:

- Root cause analysis of rail seat abrasion through literature review, field evaluation and modeling
- Builds on initial survey of rail seat abrasion detection methods by AAR in 2008 showing wide range of measured rail cant from different inspection methods.
- With the cooperation of AAR and member railroads improve correlation of actual cant to measured.
    - Measure actual RSA and resulting cant.
    - Determine acceptable cant limits.

Railroad Impact:

- Railseat abrasion has been identified as a cause in several recent high profile derailments
- RSA is difficult to detect when in early stages, leaving little opportunity for repair before failure
- Detection of RSA in its early stages will allow time remediation and prevent derailments
- Current methods utilize visual inspection (slow) and cant measurements (cant not unique to RSA)

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Project Partner: TTCI (Russ Walker)

U.S. Department of Transportation
Federal Railroad Administration

Portable Track Loading Fixture

Project Description:

- A modification of the PTLF design would be conducted and two prototype PTLFs would be produced
- Analyses and design improvements to the PTLF would be conducted to improve the consistency of the PTLF measurement.
- PTLF standards would be evaluated and issues addressed for greater acceptance in the industry.

Railroad Impact:

- A redesigned PTLF with four (4) times the repeatability of the current PTLF would be available for use by the industry.
- An electronic PTLF capable of using the return method would be produced.
- Greater acceptance in the industry of the PTLF as a more consistent and repetitive tool.
- Ease of measurement would result in further acceptance in the industry.

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Project Partner: TTCI (Russ Walker)

U.S. Department of Transportation
Federal Railroad Administration

Gage Widening Studies

Project Description:

- Evaluate gage widening due to rail roll and seat translation to identify locations exhibiting signs of rail seat deterioration on concrete ties
- Support the development of class-based GRMS standards, especially for higher track classes
- Demonstrate the usefulness of track strength assessment to corridor rehabilitation efforts
- Improve the state of the art of GRMS technology

Railroad Impact:

- Research in this task has allowed for the improvement of performance based track strength evaluation
- Methods accessed through this task are targeting the identification of rail seat deterioration for concrete ties to minimize the risk of rail rollover derailments
- Approaches for the overall assessment of track developed through this task will have direct bearing on the evaluation of track rehabilitation projects

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Project Partner: **ENSCO Inc.**

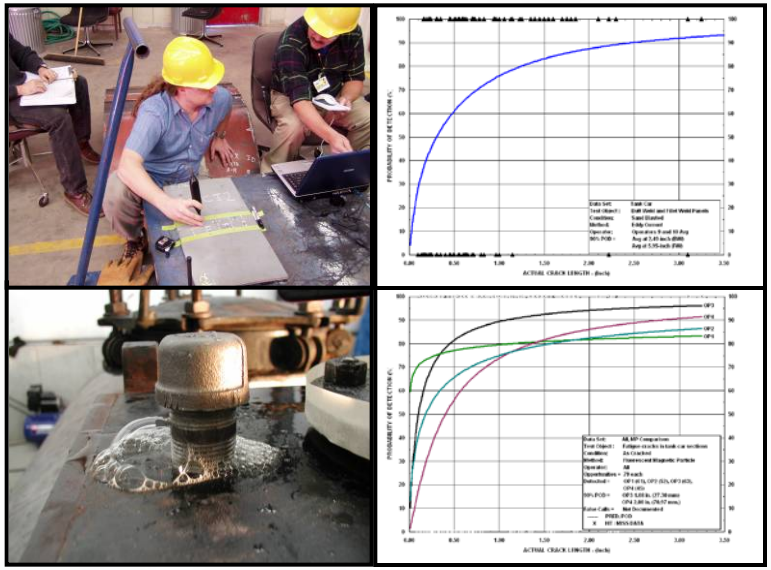
U.S. Department of Transportation

Federal Railroad Administration

Rolling Stock Division Projects

U.S. Department of Transportation
Federal Railroad Administration

Non-Destructive Evaluation in Lieu Of Hydrostatic Testing of DOT Specification Tank Cars



Project Description:

- Evaluate and quantify Non-Destructive Testing methods authorized under 49 Code of Federal Regulations Section 180.509 for use in replacing the hydrostatic pressure test in the qualification or re-qualification of railroad tank cars
- Quantify NDT methods using the probability of detection (POD) approach
- Development and maintenance of the Tank Re-qualification and Inspection Center (TRIC)

Railroad Impact:

- Increased safety through technology development
- Addresses industry needs in the areas of maintenance, inspection, and damage tolerance
- Increased reliability of inspections
- Provides for operator and procedure qualification

Point of Contact Information:

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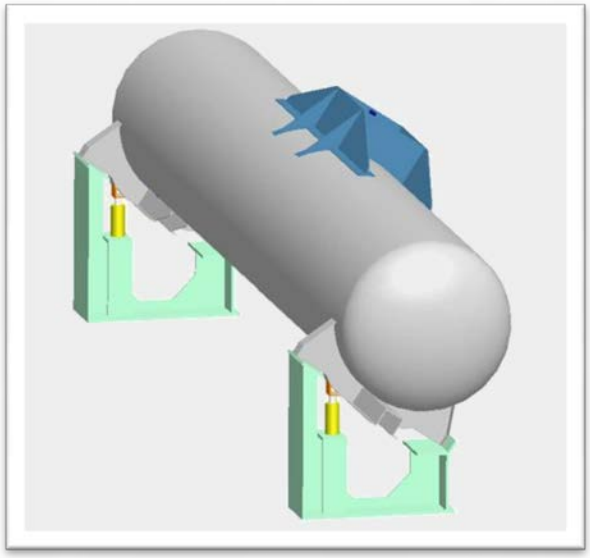
Project Partner: TTCI

U.S. Department of Transportation
Federal Railroad Administration

Improving Safety of Tank Car Fittings in HazMat Service



Project Description:

- Perform full scale static and dynamic testing of tank car fittings under rollover conditions.
- Evaluate effectiveness of three types of protective devices: base case, top skid, and reinforced protective housing.
- 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 hazardous material release in tank car rollover derailments
- Develop recommendations for industry use for future design and testing of fittings

Point of Contact Information:

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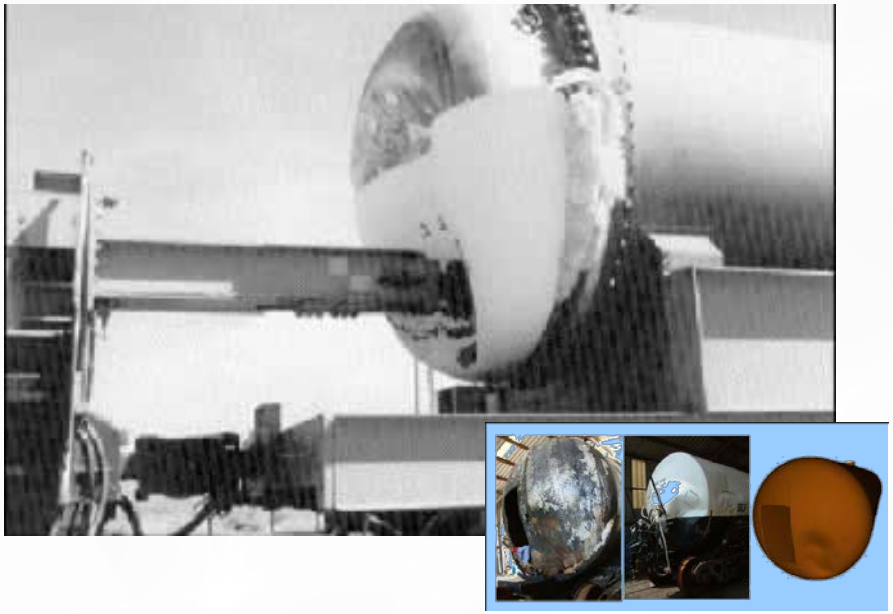
Project Partner: Sharma and Associates

U.S. Department of Transportation
Federal Railroad Administration

Tank Car Structural Integrity: Impact Resistance and Fracture Toughness



Project Description:

- Modeling of dynamic forces acting on tank cars in derailments
- Material testing to determine fraction behavior
- Risk ranking to prioritize tank cars most vulnerable to catastrophic failure

Railroad Impact:

- There are 28,116 pre-1989 pressurized tank cars in service today.
- National Rail Safety Action Plan calls for accelerated tank car structural integrity research, May 2005.
- Address safety concerns arising from Minot, North Dakota train derailment and tank car rupture on January 2002:
    - Answers NTSB recommendation resulting from Minot investigation 18-Oct-06

Point of Contact Information:

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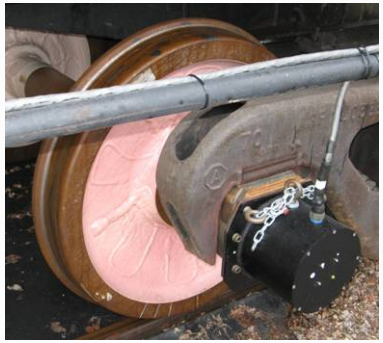
Project Partners: Volpe
CMI

U.S. Department of Transportation
Federal Railroad Administration

Instrumented Tank Car



Project Description:

- To determine the cause of fractures in the stub sills of tank cars
- Instrument tank car with strain gauges, accelerometers, instrumented couplers, instrumented wheelsets, etc. and couple to T-16 for 2,000 miles
- Using similar instrumentation, add remote monitor equipment for autonomous data collection without T-16 for 15,000 miles

Railroad Impact:

- Creates better understanding of the operational environment and forces exerted on tank cars in the creation of fractures
- Confirms the industry's current understanding of fracture initiation and propagation
- Potentially reveals additional factors that are critical to the understanding of the phenomena

Point of Contact Information:

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Project Partner: ENSCO Inc.

U.S. Department of Transportation
Federal Railroad Administration

Renewable Fuels Non-Accident Releases Research

Project Description:

- The objective of this task is to reduce the number of product releases in the renewable fuels industry as a result of failures in the assembly of bolted joints and threaded connections.
- The project will focus on people, processes, and equipment in the bolted and threaded assembly joint process.

Railroad Impact:

- Reduces the Non-Accident releases.
- Reduce the exposure of railroad employees to chemical releases.

Point of Contact Information:

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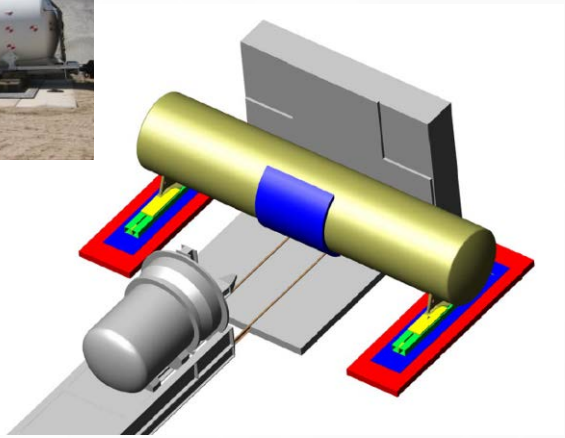
Project Partner: Renewals Fuels Foundation

U.S. Department of Transportation
Federal Railroad Administration

Full-Scale Tank Car Impact Testing



Project Desciprtion:

- To support FRA's continuing a research program to provide the technical basis for rule-making on enhanced and alternative performance standards for tank cars.
- This includes a review of new and innovative designs that are developed by the industry and other countries as well as full scale testing

Railroad Impact:

- Evaluate crashworthiness performance of tank cars used in the transportation of Toxic by Inhalation materials (TIH)
- Evaluate a new design protective panel to increase the crashworthiness of the tank car
- Improve tank car design in order to improve hazardous materials transportation safety.

Point of Contact Information:

FRA Task Monitor: Francisco Gonzalez

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Project Partner: TTCI

U.S. Department of Transportation
Federal Railroad Administration

Assessment of Small Tank Thermal Protection Defects

Project Description:

- Thermal protection is used to protect dangerous goods/hazardous materials tank cars from the effects of fire impingement.
- This work is part of a research program to establish what level of defect is acceptable from a safety standpoint and to collect data for the development and validation of computer models.

Railroad Impact:

- DOT requires that these tank car safety systems are designed so that they will protect the tank car from rupture for 100 minutes in a defined engulfing fire, 30 minutes in a defined torching fire.

Point of Contact Information:

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Project Partners: Transport Canada
RSI

U.S. Department of Transportation
Federal Railroad Administration

HazMat (HM) Risk Assessment

Project Description:

- FRA is interested in:
  - (1) Identifying and characterizing the baseline risks and metrics associated with the operation and transportation of HM by rail under current conditions;
  - (2) Determining the effect of the various regulatory changes will have on the identified risks (i.e., enhanced tank cars, PTC, Rail Routing, ECP brakes, speed reduction)
  - (3) Identify research needed to support industry or governmental efforts to further reduce the risk.

Railroad Impact:

- Understand the risk involved with all aspects of transportation of Hm in tank cars.
- Evaluates the impact of the different conditions and action taken to reduce the risk of release of HM during transportation

Point of Contact Information:

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Project Partners: ICF Consulting
BHA

U.S. Department of Transportation
Federal Railroad Administration

Liquid Flow Test for Valves

Project Description:

- Thermal protection is used to protect dangerous goods/hazardous materials tank cars from the effects of fire impingement.
- Computer models are used to simulate the effects of areas of thermal protection degradation
- AFFTAC model is designed to generate such analysis quickly on a computer, in lieu of expensive and complicated destructive tests.
- The work to be performed under this project is aimed at providing a better understanding of the parameters to be used in the models describing the liquid flow rate through the PRV.

Railroad Impact:

- DOT requires that these tank car safety systems are designed so that they will protect the tank car from rupture for 100 minutes in a defined engulfing fire, or 30 minutes in a defined torching fire.
- Improves the computer model use by the tank car builders and manufacturers.

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Project Partners: CEESi
Midland

U.S. Department of Transportation
Federal Railroad Administration

Analysis of Different Impactor Threats and Impact Conditions

Project Description:

- Evaluate the puncture behaviors of tanks under a more general range of impact conditions. This includes analyses using three different impactor sizes (such as: 3x3, 6x6, 12x12) and real impactor shapes (such as: a coupler, a coupler shank, and a section of rail)

- Task 1: Analysis of Different Sized Impactors
- Task 2: Analysis of Real World Impactors Extend Task 1 to include different complex impactors (e.g. coupler head, broken rail, etc.)
- Task 3: Analysis of real world impacts
- Task 4: Analysis of real world Threats

- Coordinate with DHS and FRA to evaluate protection system concepts under Tasks 1 and 2 impact conditions

Railroad Impact:

- This research is in cooperation with Advance Tank Car Collaborative Research Program (ATCCRP)
- These analyses will help to better understand the damaged caused by the different impactors on different tank cars and should provide us with conclusions/recommendations for performance tests for tank head and shell for each impactor.

Point of Contact Information:

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Project Partner: Applied Research Associates

U.S. Department of Transportation
Federal Railroad Administration

Crashworthiness and Occupant Volume Integrity

Project Description:

- Accidents are investigated to estimate the sequence of events leading to injury and fatality.
- Scenarios, simplified from actual accident conditions, are developed and analyzed.
- Alternative strategies to improve occupant protection and reduce the potential for injury are engineered.
- Conventional and improved designs are tested, and the results compared to determine the potential degree of improvement.

Railroad Impact:

- The results of the research are applied to develop industry standards and FRA regulations.
- Improved equipment is designed according to the evolving standards, and introduced into service.
- Represents an evolutionary cycle, in which continuous research leads to constantly improving standards and designs.
- Results applied intercity and commuter rail passenger equipment, as well as freight locomotives.

Point of Contact Information:

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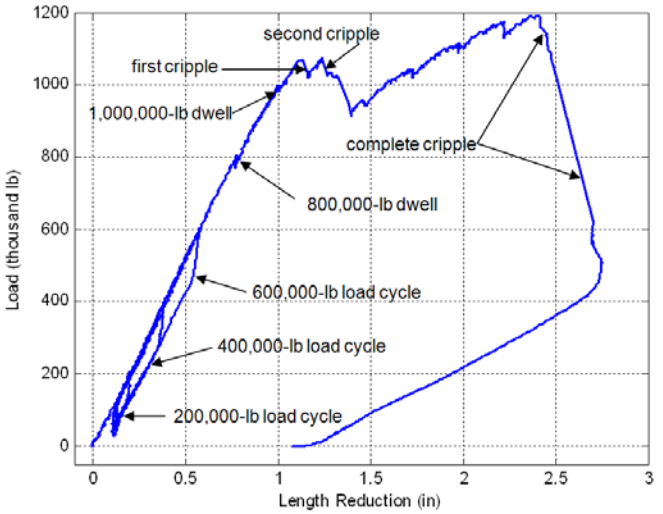
E-Mail: Jeffrey.Gordon@dot.gov

Project Partner: Volpe Center (David Tyrell)
Sharma & Associates (Anand Prabhakaran)
TIAX (Rich Stringfellow)

U.S. Department of Transportation
Federal Railroad Administration

Full Scale Passenger Car Crashworthiness Improvement



Project Description:

- Support FRA's continuing research program to provide technical basis for rule making on alternatively designed passenger equipment in areas that may include
  - Crashworthiness improvements
  - Crash energy management systems
  - Quasi-static and dynamic impact testing
  - Interior fixture testing
  - Occupant protection enhancements
- Prepare test vehicles and conduct instrumented tests
- Publish technical reports documenting results
- Tests conducted
  - 800,000-pound compression load on line of draft
  - Crippling load applied at CEM pockets, 1,200,000-pound load, alternatively designed passenger equipment.
- Crippling load analysis and test on CEM-equipped car in progress as mock demonstration of the waiver process

Railroad Impact:

- Improve crashworthiness and safety of passenger equipment
- Assist in providing guidelines and regulations for qualifying passenger equipment
- Assist in providing methods and facilities to qualify novel designs and equipment built to alternative structural standards.

Point of Contact Information:

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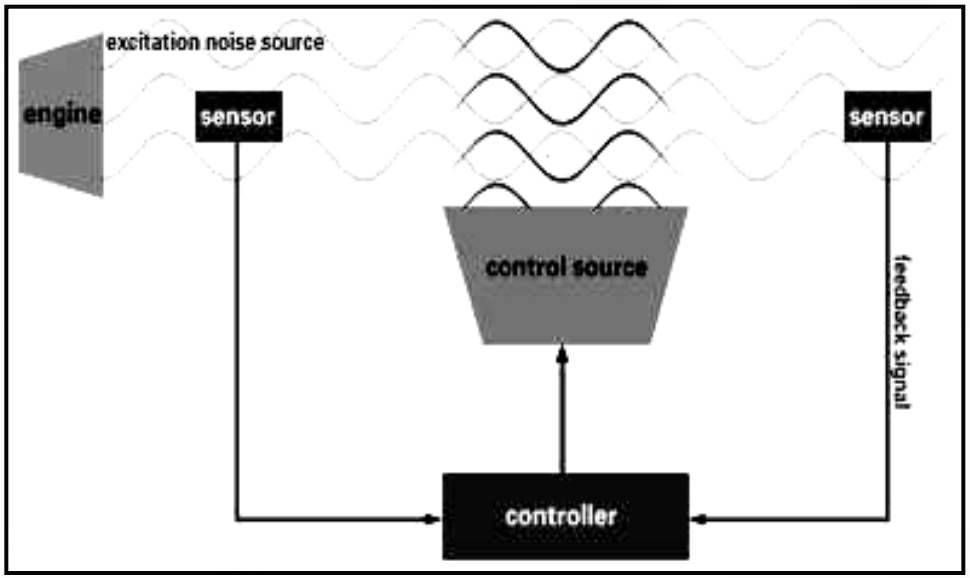
Project Partner: TTCI (Robert Fries)

U.S. Department of Transportation
Federal Railroad Administration

Active Noise Cancellation Demonstration



Shown here: Active Noise Cancellation Schematic

Project Description:

- Project initiated in 2010 to explore the potential for Locomotive Cab noise reduction with new technologies
- Current level noise levels are compared with reduced noise levels obtainable with Active Noise Cancellation (ANC) Systems
- Plans are to demonstrate noise reduction in the most commonly used new locomotive designs in revenue service
- An updated noise standard may result from this work

Railroad Impact :

- Improves situational awareness, resulting in increased safety
- The ANC system have been installed in the U.K. for short test periods and is currently in use.
- A 7db reduction in noise levels was noted in a GP40-2

Point of Contact Information:

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U.S. Department of Transportation
Federal Railroad Administration

Whole Body Vibration

Shown here: PBC Model 356B41 Seat Pad Accelerometer

Project Description:

- Determine ride quality on North American locomotives
- Determine health effects, if any
- Engineer / Conductor fatigue
- Compare ride quality with ISO standards

Railroad Impact:

- Reduce lost time injuries (i.e. back injuries) and engineer fatigue
- Establish new ride quality standards
- Optimize seat configuration for comfort and ergonomics
- Reduce strain on crew from ride quality levels

Point of Contact Information:

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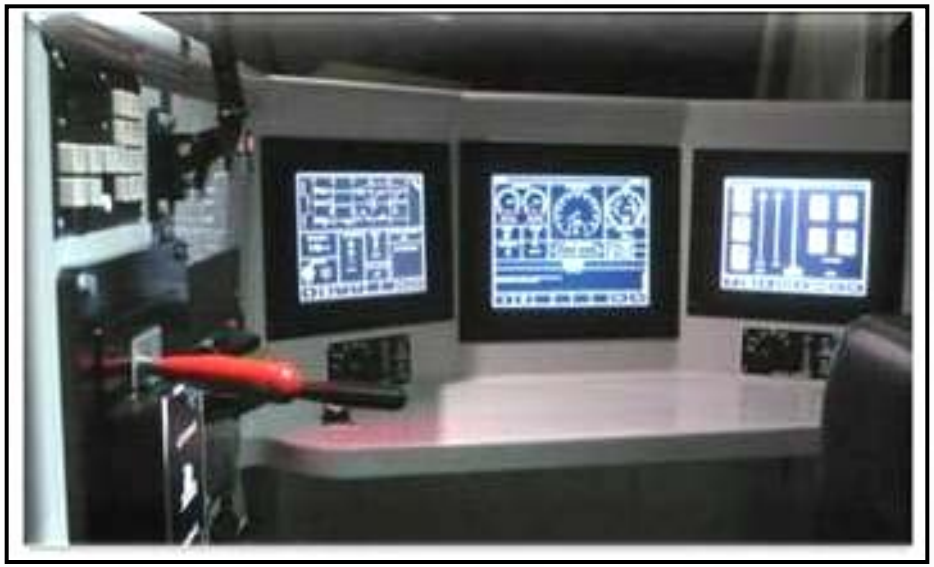
U.S. Department of Transportation
Federal Railroad Administration

Next Generation Locomotive Cab



Shown here: Displays and Controls

Project Description:

- To integrate current displays with new technologies (PTC, LEADER)
- To evaluate displays in CTIL
- To solicit engineer feedback from new displays
- To improve noise and vibration environment
- To include ergonomic seat placement and control stand with improved interior lighting
- Develop Next Generation Cab for safety and comfort

Railroad Impact:

- Industry common di cab displays standard
- Integrate engineer-friendly in-cab displays
- Reduce engineer fatigue
- Reduce accident risk
- Improve operating safety

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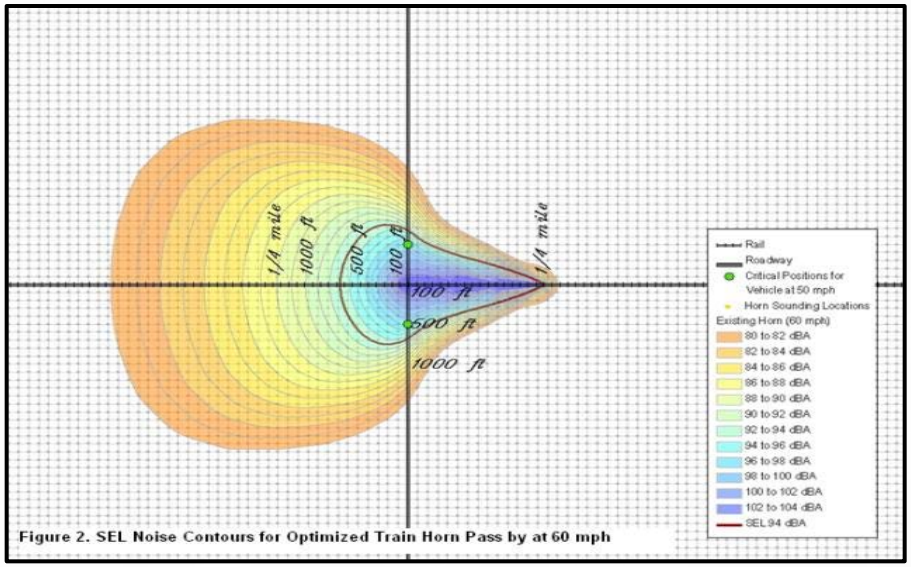
U.S. Department of Transportation
Federal Railroad Administration

Long Range Acoustic Device



Shown here: Long Range Acoustic Sound Wave

Project Description:

- To conduct a feasibility study examining the potential benefits of using LRAD devices on trains
- To perform static tests of LRAD acoustical performance
- To perform a moving test of LRAD acoustical performance on a locomotive at TTC
- To compare LRAD warning device to a train horn with respect to range, effectiveness, life cycle cost expected , and durability and public acceptance

Railroad Impact:

- Sufficient decrease in horn noise level
- Focuses noise beam more effectively
- Reduce accident risk at crossings
- Reduce the number of hearing impairment accidents

Point of Contact Information:

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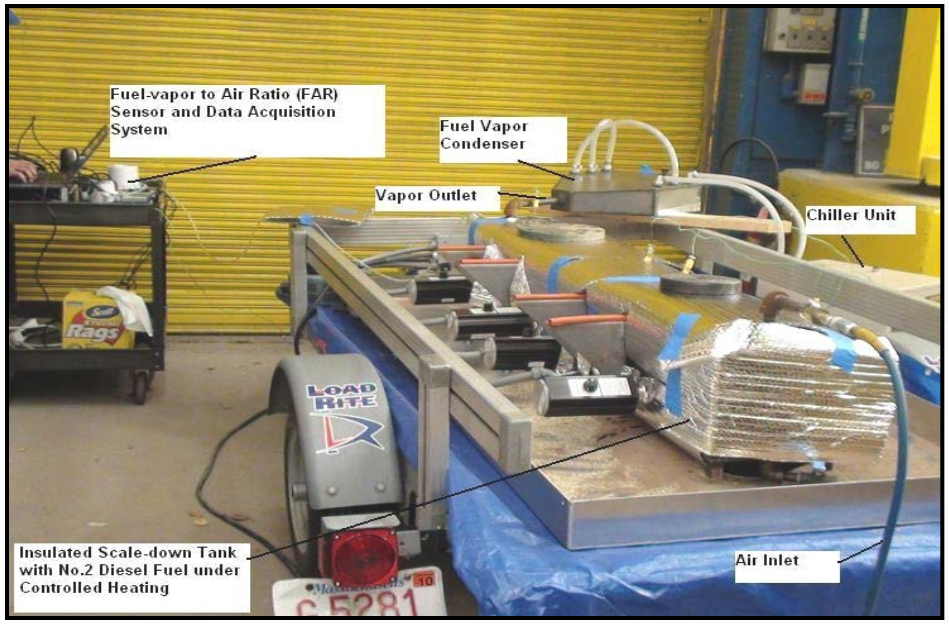
U.S. Department of Transportation
Federal Railroad Administration

Fire Safety / Vapor Reclamation



Shown here: Quarter Scale Vapor Reclamation Testing Setup

Project Description:

- To evaluate the benefits of fuel vapor reclamation as a method for fire risk mitigation
- To improve safety by reducing fire hazards by reducing vapor content inside tank
- To improve fuel efficiency by recovering the vapor and liquefying it to feed back into the tank which will provide substantial savings over the current practice of releasing the vapors into the environment
- To reduce emissions

Railroad Impact:

- Fuel tank leaks, caused by collision, derailment, or foreign object penetration are major fire hazards in locomotive accidents that can be prevented with the reclamation of fuel vapor
- 2% to 5% fuel savings are anticipated

Point of Contact Information:

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U.S. Department of Transportation
Federal Railroad Administration

Operating Practices Research to Reduce Derailment / Optimize Fuel Use

Shown here: Train Derailment

Project Description:

- Review significant derailments caused by train make up and train handling
- Using TEDS and other simulators establish train make up rules / guidelines
- Route specific train handling for difficult territory and train types will be researched in an proactive manner to reduce risks
- ECP braking advantages for train operation will be evaluated
- Industry exchange of accident cause and prevention of derailments

Railroad Impact:

- Significant reduction in train derailments
- Reduced fuel consumption and emissions
- Operator assist software may result, making the engineer job less stressful

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U.S. Department of Transportation
Federal Railroad Administration

Crashworthiness of Equipment

Shown here: Two train car head-on collision

Project Description:

- Crashworthiness of freight and passenger locomotives
- Safety of inter-city and commuter cars
- Review of recent collisions to evaluate FRA Regulation adopted in 2007
- Assistance to Office of Safety in regulatory implementation for crashworthiness, fuel tanks

Railroad Impact:

- Mitigate effects of collisions and derailments
- Crew protection within cab compartment
- Passenger car safety and comfort enhancements
- Reduce incidents of accidents and cost of repair

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U.S. Department of Transportation
Federal Railroad Administration

Locomotive Emergency Egress and Responder Training

Shown here: CSX fatal wreck at Carlisle, OH 2/17/2001

Project Description:

- Emergency rear window escape, as recommended by NTSB in the Chatsworth, CA train to train collision
- Emergency Responders Training Course, initiated by public request in response to a training video

Railroad Impact:

- Accident mitigation in collisions and derailments
- 30 major accidents requiring emergency egress in the last five years have occurred
- Responders have lacked adequate training and appropriate tools

Point of Contact Information:

FRA Task Monitor: John Punwani

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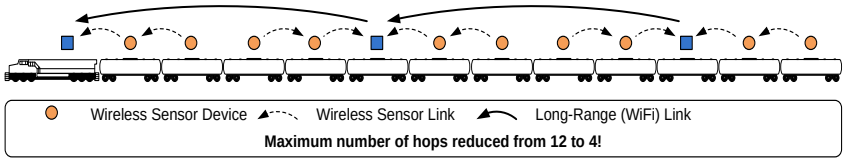
U.S. Department of Transportation
Federal Railroad Administration

Wireless Sensors Network



Shown here: Hybrid Sensor Network on Train

Project Description:

- Study wireless communications on-board a train for the purpose of real time monitoring and control of sensors and advanced components. (i.e., bearings and handbrake set/release)
- Hybrid WSN network is being developed at the Advanced Telecommunications Lab University of Nebraska
- Open architecture standard will allow sensors to be networked on a train
- Head end communication with remote locomotives may be integrated

Railroad Impact:

- Reduction in switching operations injuries an fatalities, currently 3000 injuries and average of 3 to 4 fatalities per year
- Real time monitoring of bearings, security breach alarms, wheel condition monitoring
- Train delay reductions and savings from derailments and program in-time maintenance of equipment
- Open new opportunities for rain traffic

Point of Contact Information:

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U.S. Department of Transportation
Federal Railroad Administration

Fire Safety

Project Description:

- Support rulemaking activities associated with Fire Safety and emergency preparedness
  - The research project is currently aimed at developing fire growth model that will interface with time-based performance egress standards.
  - Future work will focus on developing alternative fire safety standards based on the heat release rate (HRR) of the various materials used in design of passenger rail cars
- Investigate and evaluate alternative strategies and technologies relating to evaluating passenger rail car fire safety performance.
- Provide sound technical basis for revising the content of FRA passenger train fire safety requirements.
- Interface with industry standards (APTA, NFPA)

Railroad Impact:

- Provide objective minimum criteria for meeting FRA regulations and industry standards for new and existing passenger equipment
- Continue to expand systems approach for passenger rail car design to evaluate fire safety beyond current emphasis on materials
- Provide cost-effective test alternative based on Heat Release Rate to existing flammability and smoke emissions requirements

Point of Contact Information:

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Project Partner: Volpe National Transportation Center

U.S. Department of Transportation
Federal Railroad Administration

Emergency Preparedness




Railroad Impact:

- Provides objective minimum criteria for meeting FRA regulations and industry standards for new and existing passenger equipment
- Use systems approach for rail car emergency design to locate, reach, and operate emergency exits
- Provides cost-effective alternative to electrical powered emergency lighting, signs and path marking
- Reorganizes CFR to consolidate all emergency equipment to 238 to assist RR in following all regulations.

Project Description:

- Support the development of new regulations relating to emergency lighting, signage, and egress
- Investigate and evaluate alternative strategies and technologies relating to passenger rail system emergency preparedness
- Provide sound technical basis for revising the content of FRA passenger train emergency preparedness / equipment requirements
- Interface with industry to develop and revise APTA passenger rail equipment safety standards
- Determine feasibility of time-based performance based egress standards
- Determine impact of Amtrak Conductors on passenger safety

Point of Contact Information:

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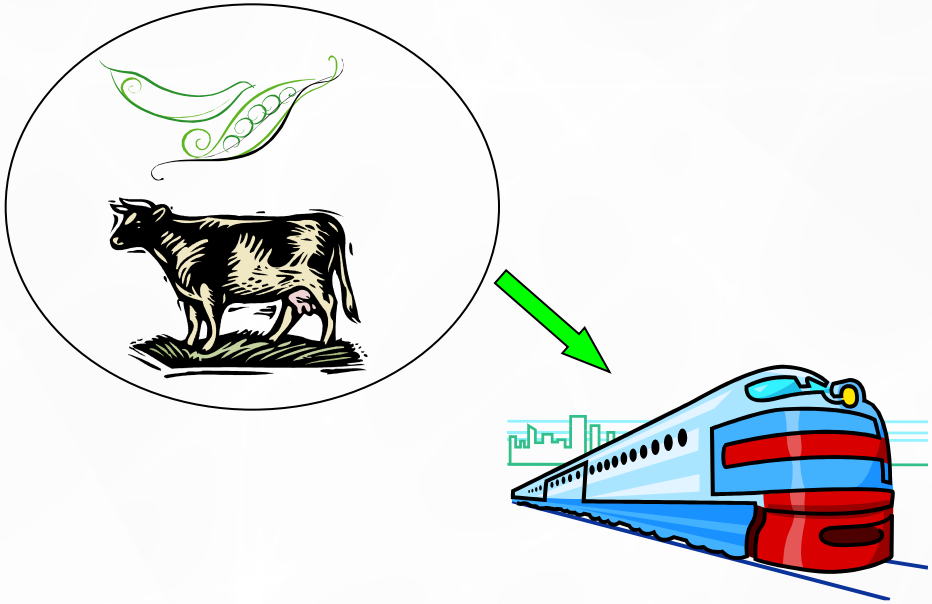
Project Partner: Volpe National Transportation Center

U.S. Department of Transportation
Federal Railroad Administration

Revenue Service Trial of Biodiesel



Project Description:

- Revenue service test of B20 in Amtrak Heartland Flyer Passenger Train:
  - Daily Roundtrip Oklahoma City, OK to Fort Worth, TX
  - Engine Emissions Testing [following revenue service test]
  - Engine Power Assembly Inspection and Measurement
  - Fuel Consumption Data Collection

Railroad & Environmental Impact:

- Newly proposed US EPA regulation will require railroad to reduce the amount of Green House Gases emitted from locomotive engines: Nitrogen Oxides (NOx), Carbon Monoxide (CO), Hydrocarbons (HC) and Particle Matter (PM)
- Railroads are be interested in alternative fuel and their capabilities
- Renewable source of fuel

Point of Contact Information:

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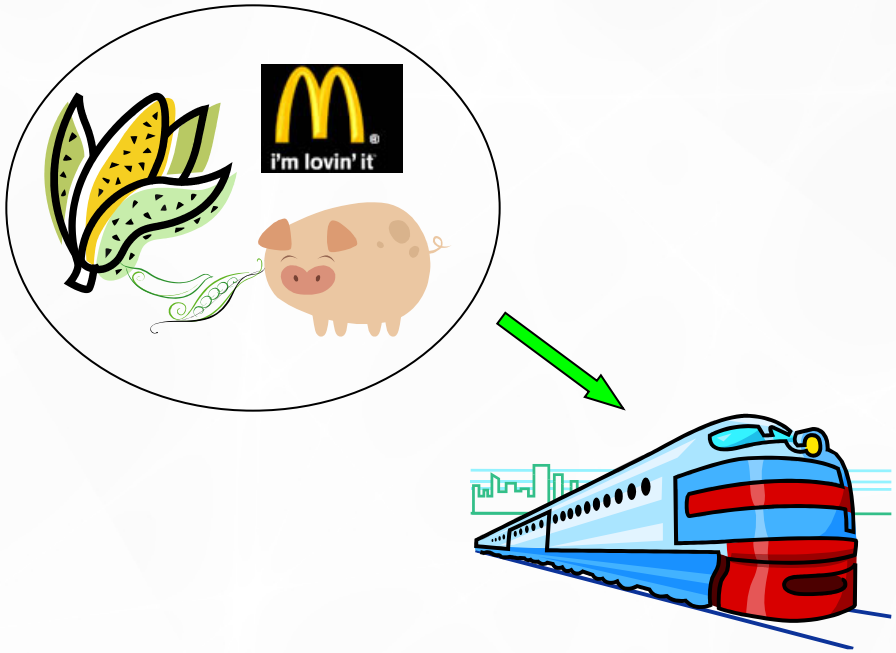
Project Partners: Amtrak
Oklahoma DOT
GE Transportation
Chevron-Oronite Inc.

U.S. Department of Transportation
Federal Railroad Administration

Biodiesel In Railroad Applications



Project Description:

- This project focuses on determining the long term effects of using biodiesel in railroad equipment.
- The research is separated into the following subtasks:
  - Emissions testing of B5 and B20 biodiesel fuel in various models of locomotive engines
  - Engine Durability Assessment of B5 and B20 biodiesel in various models of locomotive engines

Railroad & Environmental Impact:

- Newly proposed US EPA regulation will require railroad to reduce the amount of Green House Gases emitted from locomotive engines: Nitrogen Oxides (NOx), Carbon Monoxide (CO), Hydrocarbons (HC) and Particle Matter (PM)
- Railroads are be interested in alternative fuel and their capabilities
- Renewable source of fuel

Point of Contact Information:

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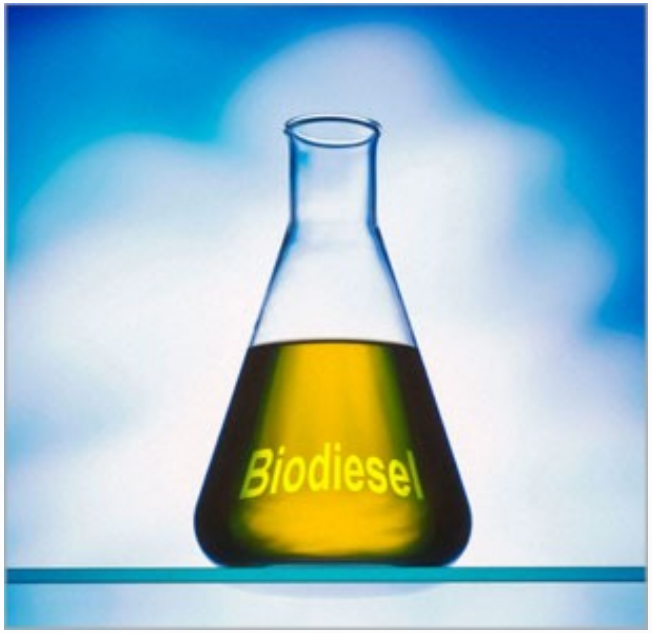
Project Partners: SAE TC7Subcommittee
Southwest Research Inc.

U.S. Department of Transportation
Federal Railroad Administration

Locomotive Biofuel Study



Railroad & Environmental Impact:

- Newly proposed US EPA regulation will require railroad to reduce the amount of Green House Gases emitted from locomotive engines: Nitrogen Oxides (NOx), Carbon Monoxide (CO), Hydrocarbons (HC) and Particle Matter (PM)
- Railroads are interested in alternative fuel and their capabilities
- Renewable source of fuel

Project Description:

- This project's intent is to determine the extent to which freights railroads, Amtrak and other passenger rail operators could use biofuel blends to power locomotives and other vehicles that currently operate on diesel fuel, and to determine a "premium" blend of biofuel for rail vehicles.
- The project will focus on the following research tasks to assess the viability of using biodiesel in railroad vehicles:
    - The energy intensity of various biofuel blends compared to diesel fuel;
    - Environmental effects of using various biofuel blends compared to diesel fuel, including emission effects;
    - Cost of purchasing biofuel blends;
    - Whether sufficient biofuel is readily available;
    - Any public benefits derived from the use of such fuels; and
- the effect of biofuel use on locomotive and other vehicle performance and warranty specifications.

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Project Partner: North Carolina State

U.S. Department of Transportation
Federal Railroad Administration

Study of the Use of Bio-based Lubricant Technology

Project Description:

- The intent of this project is to test the feasibility of using readily biodegradable lubricants and greases in locomotive, rolling stock and other equipment. Tasks will include the following:
  - An analysis of the potential use of soy-based and other readily biodegradable grease and hydraulic fluids to perform according to railroad industry standards;
  - A comparison of the health and safety of petroleum-based lubricants with readily biodegradable lubricants and greases, which shall include an analysis of fire safety;
  - A comparison of the environmental impact of petroleum-based lubricants with readily biodegradable lubricants and greases, which shall include the rate and effects of biodegradability ;
  - A comparison of the performance of the readily biodegradable lubricant and grease in comparison to petroleum-based lubricants; and
  - A study of the effects of the readily biodegradable lubricants and greases on railroad equipment components in comparison to petroleum-based lubricants

Railroad Impact:

- Lubricants and greases that are used in rail equipment can come from biodegradable sources that may be:
  - renewable,
  - cost effective, and
  - environmentally benign.

Point of Contact Information:

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Project Partners: University of Northern Iowa
National Agriculture-based Lubricant Center

U.S. Department of Transportation
Federal Railroad Administration

Advanced Component Testing

Project Description:

- Supporting further testing of the Advanced Tri-Coupler, Electrically Driven Hand Brake (EDHB), Remote Controlled Angle Cock, and Remote Controlled Cut Lever to determine their functionality and durability as well as conduct testing of the advanced component network.
- The advanced components can be operated either on the side of the car or remotely from within the locomotive.

Railroad Impact:

- Increases crew safety by eliminating need to go between cars and manually operate cut levers and angle cocks
- Reduces track, lading, vehicle and wheel damage due to feedback indicator readily seen at the side of the car or in the locomotive cab
- Reduces cost due to fewer injuries and wheel change-outs

Point of Contact Information:

FRA Task Monitor: Monique Stewart, John Punwani

Phone Number: (202) 493-6358

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Project Partner: Sharma & Associates Inc.

TTCI

U.S. Department of Transportation
Federal Railroad Administration

Advanced Tri-Coupler

Project Description:

- ADFT includes:
  - Field testing of the Hand Brake Release Sensor,
  - Remote Controlled Angle Cock and,
  - Remote Controlled Cut Lever

  …to obtain industry feedback on the devices' ability to improve operational safety and efficiency.

Railroad Impact:

- Increases crew safety by eliminating the need to go between cars and manually operate cut levers and angle cocks
- Reduces track, lading, vehicle and wheel damage due to feedback indicator readily seen at the side of the car or in the locomotive cab
- Reduces cost due to fewer injuries and wheel change-outs

Point of Contact Information:

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Project Partner: Sharma & Associates Inc.

U.S. Department of Transportation
Federal Railroad Administration

Electrically Driven Hand Brake (EDHB)

Project Description:

- EDHB is an electrically driven, fully functioning, set and release vertical wheel hand brake that keeps all normal manual AAR Group N specified functions and requirements.

Railroad Impact:

- Reduces risk of operator injuries and the need to go in-between/climb rail cars
- Reduces damage to hand brakes due to controlled application and release forces
- Mitigates slid flat and out-of-round damage to wheels
- Mitigates damage to lading, track, vehicles and bridges
- Reduces railroad operating costs

Point of Contact Information:

FRA Task Monitor: Monique Stewart

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E-Mail: monique.stewart@dot.gov

Project Partner: Sharma & Associates Inc.

U.S. Department of Transportation
Federal Railroad Administration

Improved Quality Truck Castings

Project Description:

- Over $11 million is spent yearly due to failed/broken truck castings.
- This project focuses on improving the safety of train operations by reducing the number of in-service failures and derailments due to broken truck components.

Railroad Impact:

- Reduction in failure rates related to truck component castings
- Improved specifications for higher quality castings
- Implementation of newer more efficient castings processes
- Improvements in surface finish and nondestructive inspection methods

Point of Contact Information:

FRA Task Monitor: Monique Stewart

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Project Partner: TTCI

U.S. Department of Transportation
Federal Railroad Administration

Locomotive Security System (LSS)

Project Description:

- LSS utilizes biometric and electronic ID advanced technology to both locally and remotely prevent unauthorized operation of locomotives.
- The FRA is supporting a full service field evaluation and demonstration of the LSS in an effort to evaluate fuel sensing capabilities and system performance.

Railroad Impact:

- Prevents unauthorized locomotive movement
- Automatically logs crew authentication
- Automates crew on-duty time accounting
- Potential use for crew time monitoring and route authorization
- Reports locomotive fuel level and Event Recorder data

Point of Contact Information:

FRA Task Monitor: Monique Stewart

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Project Partner: WiTronix, LLC

Iowa Northern Railway Company

U.S. Department of Transportation
Federal Railroad Administration

Machine Vision Based Inspection Systems Evaluation & Implementation

Project Description:

- The FRA is supporting research to determine the effectiveness of machine vision technology in meeting the inspection requirements of CFR Title 49 Part 231, Railroad Safety Appliance Standards as applied to coal cars.

Railroad Impact:

- Objective repeatable inspections
- Ability to provide historical records of car safety appliance conditions
- Reduce inspector exposure to train yard hazards

Point of Contact Information:

FRA Task Monitor: Monique Stewart

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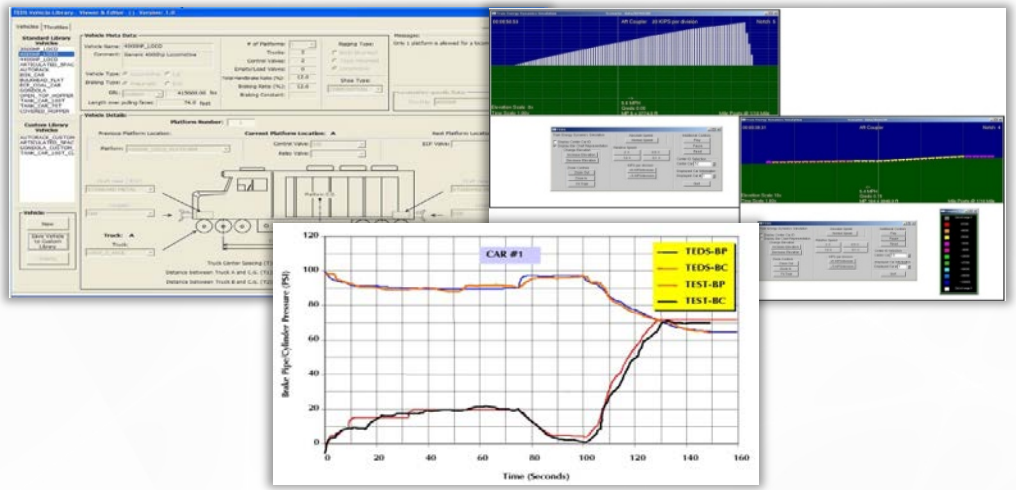
Project Partner: TTCI

U.S. Department of Transportation
Federal Railroad Administration

Train Energy & Dynamics Simulator (TEDS)



Project Description:

- The Train Energy and Dynamics Simulator (TEDS) is a computer program used to conduct longitudinal train dynamics simulations in an effort to assist in the development of guidelines and recommendations to improve train operation safety.
- It is capable of simulating train handling, head-end and distributed power, train makeup, ECP and automatic brake applications for speed control, stopping distances, and emergency stops.

Railroad Impact:

TEDS facilitates the identification and quantification of improper train operations affected by :

- Equipment,
- Train makeup,
- Train handling,
- Track conditions,
- Operating practices and,
- Environmental conditions.

Point of Contact Information:

FRA Task Monitor: Monique Stewart

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Project Partner: Sharma & Associates, Inc.

U.S. Department of Transportation
Federal Railroad Administration

Wayside Advanced Technology Systems (WATS)

Data Analysis & Pilot Demonstration

Project Description:

- Wayside detection systems promote rail safety and performance through appropriate and optimal application of automated inspection technology to detect defects and precursors to safety critical defects in railway rolling stock.
- The FRA is working with various stakeholders to quantify and validate these systems.

Railroad Impact:

- Implementation of wayside technology will enhance existing manual inspection procedures to facilitate early detection of rail defects.
- Reduces the number of incidents and accidents caused by rolling stock equipment and component failures.

Point of Contact Information:

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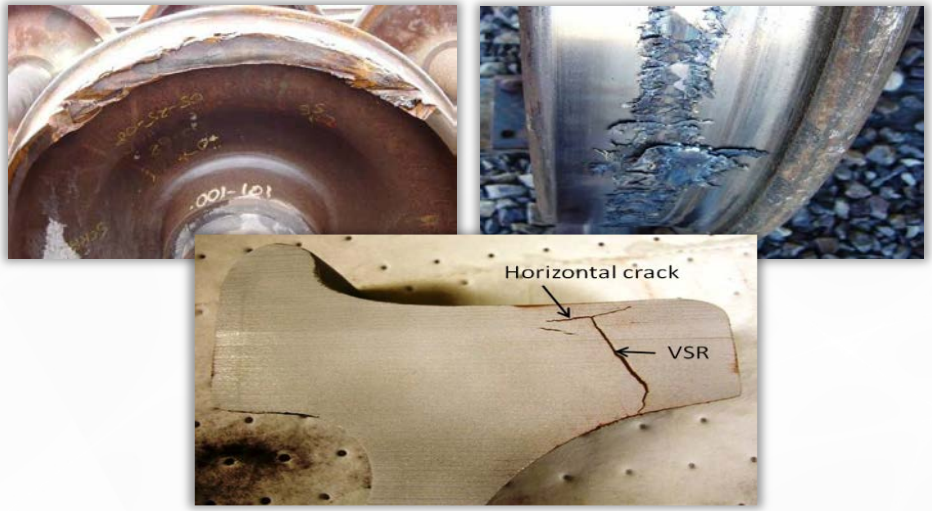
Project Partner: Sharma & Associates, Inc.

Norfolk Southern (NS)

U.S. Department of Transportation
Federal Railroad Administration

Wheel Research



Project Description:

- The FRA is supporting research to identify measures for improved wheel performance by gaining a solid understanding of the root causes of broken wheel rims and wheel tread build-up.
- The effort is being conducted in co-operation with the AAR Wheel Strategic Research Initiative.

Railroad Impact:

- Demonstration of solid understanding of wheel failure root causes
- Development of prevention guidelines for broken rim and tread build-up failure mode avoidance

Point of Contact Information:

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Project Partner: TTCI

U.S. Department of Transportation
Federal Railroad Administration

Wheel Temperature Detector Technology

Project Description:

- The FRA is supporting research to determine the effectiveness of wheel temperature detector technology to provide an objective assessment of brake effectiveness and to improve train braking through better testing methodology.

Railroad Impact:

- Objective measurement of applied force
- Ability to determine brake effectiveness in dynamic rather than static conditions
- Ability to trend and plan maintenance proactively

Point of Contact Information:

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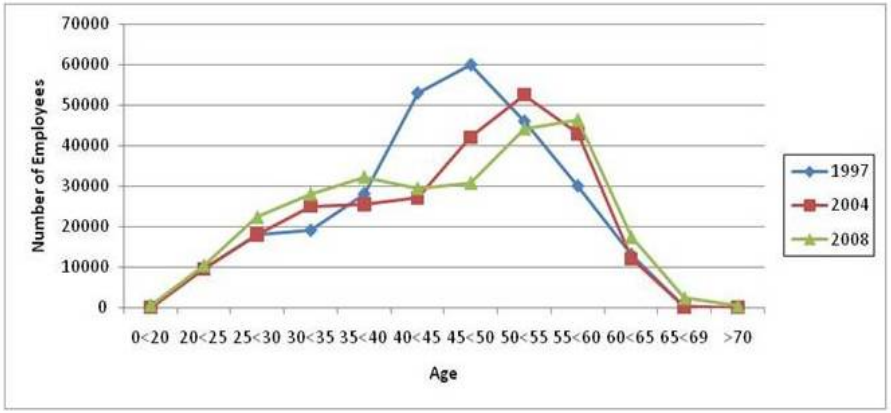
Project Partner: TTCI

U.S. Department of Transportation
Federal Railroad Administration

Workforce Development

Railroad Employee Age Distribution



Railroad Employee Age Distribution Shift, 1997-2008
(SOURCE: Railroad Retirement Board (RRB)

Project Description:

- In support of the DOT National Transportation Workforce Development Strategy Initiative, the FRA Workforce Development Team (FRA-WDT) has developed a comprehensive review of rail industry workforce trends and has developed a plan for engaging the rail industry to collaboratively address the industry's workforce challenges.
- Additionally, the team is preparing for the National Transportation Workforce Summit in April of 2012.

Railroad Impact:

•Identify synergies in workforce development approaches across the rail industry and DOT.

• Create a national platform to identify and address transportation workforce issues, specifically, within the rail industry segment

Point of Contact Information:

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Project Partner: T. White Parker

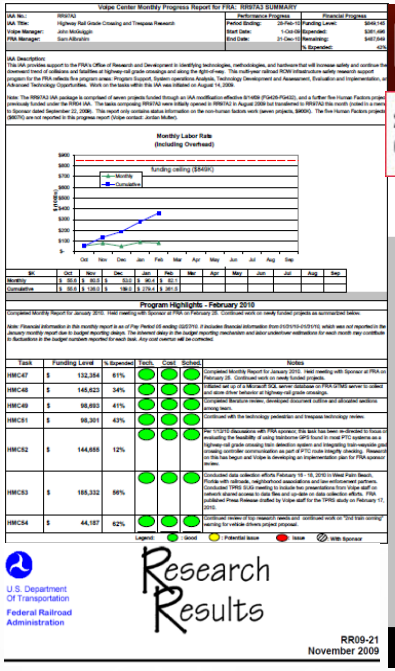
U.S. Department of Transportation

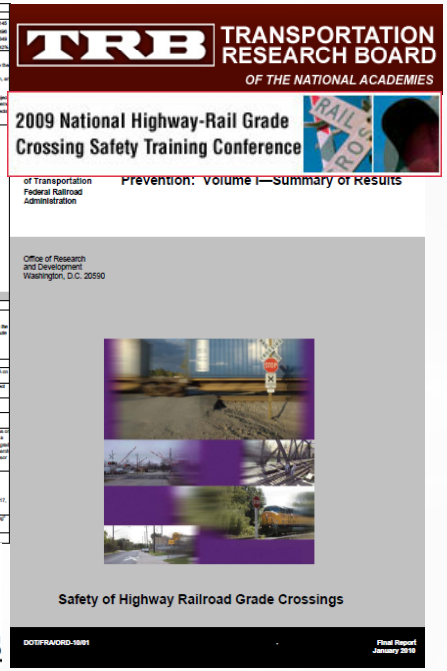
Federal Railroad Administration

Train Control and Communication Division Projects

U.S. Department of Transportation
Federal Railroad Administration

Grade Crossing and Trespass Prevention Program Management, Quick Response, and Special Studies





Project Description:

- Provide support for any requests from the FRA Office of R&D requiring immediate attention or any studies not covered in any existing task.
- Participate in professional activities such as conferences and meetings.
- Provide outreach to the FRA Grade Crossing Managers.
- Provide reports to define and track key activities in support of the program.
- Provide technical assistance in the development and implementation of cooperative research agreements with FRA traditional and non-traditional transportation partners (national and international) that have active and complimentary programs that target research, development and implementation.

Railroad Impact:

- Information exchange on cutting edge technologies and /or strategies for grade crossing safety and trespass prevention
- Quick response capability in support of FRA R&D

Point of Contact Information:

FRA Task Monitor: Leonard W. Allen III

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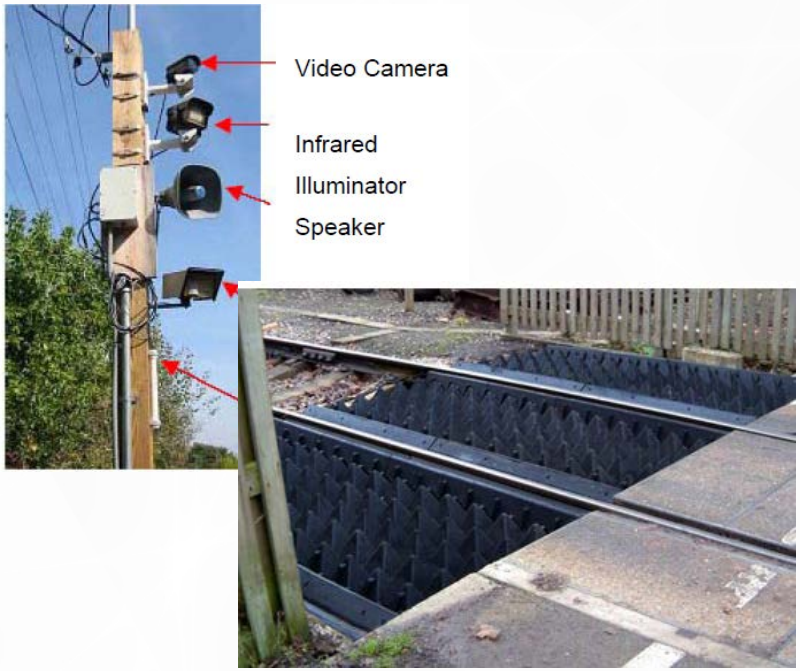
U.S. Department of Transportation
Federal Railroad Administration

Anti-Trespass Technology Demonstrations



Project Description:

- Review, select, and evaluate emerging technologies and applications for rail right-of-way trespass applications
- Analyze operational systems (i.e. HoldFast Anti-Trespass Guards currently operational in Europe) and prototypes (i.e. Pittsford bridge trespass deterrent system)
- Conduct field operational test and evaluation of one or more systems/technologies, possibly on the TriRail and/or FEC tracks in West Palm Beach, FL, or Sun-Rail in Orlando, FL.

Railroad Impact:

- Reduce trespass fatalities (433 in 2009)
- Fatality reduction would in turn reduce occurrences of Post-Traumatic Stress Disorder (PTSD)
- Benefits from emerging technologies
- Leveraged through Public-Private-Partnership

Point of Contact Information:

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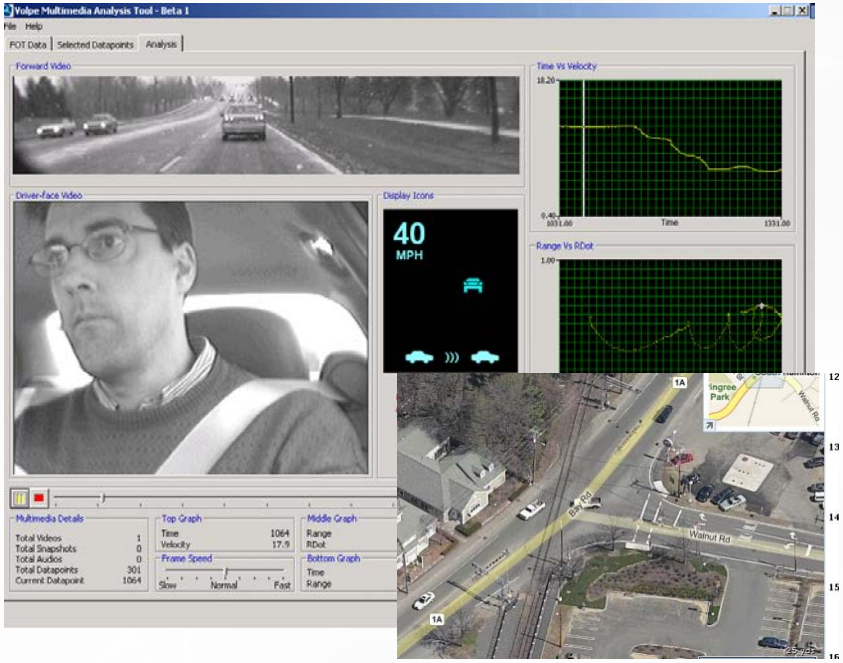
U.S. Department of Transportation
Federal Railroad Administration

Driver Behavior Analysis Using Field Operational Test Data



Project Description:

- Study driver behavior at grade crossings by analyzing Field Operational Test (FOT) data obtained from National Highway Traffic Safety Administration (NHTSA) evaluations of Integrated Vehicle-Based Safety Systems (IVBSS) heavy trucks
- Volpe was the independent FOT evaluator and retains the FOT data, which consists of a multitude of vehicle numerical data (including GPS) as well as driver and scene video data.

Railroad Impact:

- Study of real-world driver behavior using data already collected. (NHTSA has already completed multiple FOTs)
- Identify potential driver education/awareness strategies that would best mitigate risky driver behavior at grade crossings.
- Relevant to Strategic Plan Topic “Traffic Patterns” and Sec. 208 of the RSIA of 2008.

Point of Contact Information:

FRA Task Monitor: Leonard W. Allen III

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U.S. Department of Transportation
Federal Railroad Administration

Evaluation of Education and Outreach Strategies and Methods

Project Description:

- Conduct a pilot study evaluating education and outreach methods used to educate the public of the hazards of grade crossings (Operation Lifesaver, Inc.)
- One recent study, involving analysis of the effectiveness of education and enforcement strategies in two communities in the state of Illinois (PEERS), revealed different effectiveness results that could be partly associated with the methods the two different communities used to reach out to their citizens.

Railroad Impact:

- Provide effectiveness estimates for different education and outreach methods
- Relevant to Strategic Plan Topic “Education and Public Awareness” and Sec. 201, 206, 207, and 208 of the RSIA of 2008.

Point of Contact Information:

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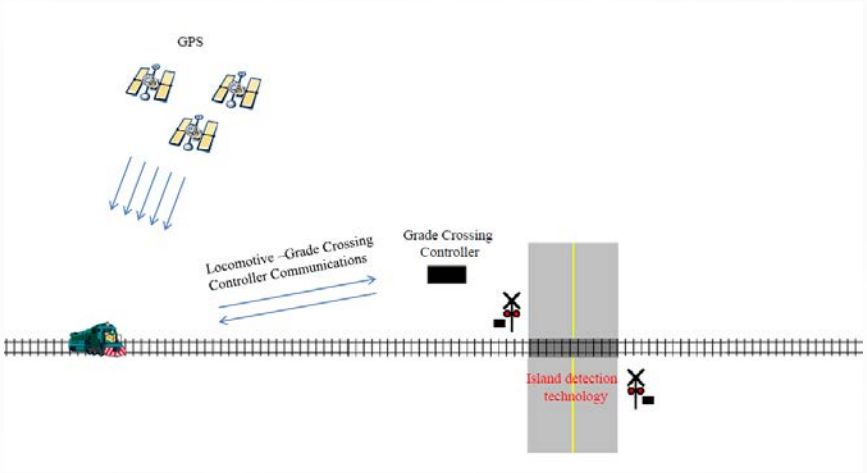
U.S. Department of Transportation
Federal Railroad Administration

Positive Train Control (PTC)-Based Grade Crossing Train Detection and Warning System



Project Description:

- Development of a low-cost train detection and warning system for passive grade crossings.
- Research feasibility of Positive Train Control (PTC) GPS-based train location technology.
- Explore contracting opportunities
- Conduct testing at Transportation Technology Center or elsewhere
- Conduct technology assessment relevant to use as component of an in-vehicle crossing approach system
- Analyze prototype feasibility and publish assessment results in an FRA report

Railroad Impact:

- Develop a low-cost solution to increase safety at passive crossings
- Benefits from Technology Transfer from PTC
- Enhanced rail and road infrastructure safety
- Relevant to Strategic Plan Topic “Grade Crossing Modernization” and “New Technology Opportunities” and Sec. 208 and 210 of the RSIA of 2008.

Point of Contact Information:

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U.S. Department of Transportation
Federal Railroad Administration

Second Train Warning for Motor Vehicle Drivers

Project Description:

- Review past and current prototype and demonstration of this technology. Maryland Mass Transit Administration and the LA County Metropolitan Transportation Authority have tested a technology.
- Evaluate potential applicability and effectiveness of 2nd train warning signs for motor vehicle drivers. Review incident data and determine possible impacts on reduction of incidents.
- Select technology and test location, and conduct a field-test of a 2nd train warning sign, driver behavior data collection (pre/post), and documenting results.

Railroad Impact:

- Decrease driver risky behavior at grade crossings
- Preliminary data analyses reveal that there have been 249 fatal events related to vehicle collisions with 2nd trains in the past 20 years.

Point of Contact Information:

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U.S. Department of Transportation
Federal Railroad Administration

Trespass Prevention Research Study

Railroad Impact:

- Reduce trespass fatalities within the rail networks in West Palm Beach, Florida.
- Demonstrate potential benefits, including documenting best practices and lessons learned of implementation and evaluations conducted within the study area.
- Relevant to Strategic Plan Topic “Education and Public Awareness” and Sec. 201 and 208 of the RSIA of 2008.

Project Description:

- Create and facilitate a Trespass Prevention Stakeholders User Group including all stakeholders within the West Palm Beach Florida geographical area. Conduct site visits. Develop plan for acquiring locomotive video information in line with South Florida Rapid Transit Administration (SFRTA).
- Work with stakeholder partnership to review the implementation of signs, barriers and education efforts. Evaluate potential benefits of the lessons learned from local activities. Develop strategies for further reduction of trespass events within the study area.
- Evaluate additional strategies through before and after data collection efforts.
- Document results via research results and reports and support the development of a US Guidance document on Trespass Reduction Strategies.

Point of Contact Information:

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U.S. Department of Transportation
Federal Railroad Administration

High Accuracy GPS Site at Transportation Technology Center (TTC)

Project Description:

- Install prototype High Accuracy Global Positioning System (HA-GPS) site at Transportation Technology Center (TTC)
- Conduct demonstrations & tests to evaluate potential benefits for railroad applications
- Evolve to be the first fully operational High Accuracy Nationwide Differential Global Positioning System (HA-NDGPS) site in North America

Railroad Impact:

- Improved positional accuracy over basic Global Positioning System (GPS) and integrity monitoring of GPS satellites for safety critical applications like Positive Train Control (PTC)
- Automated Asset Mapping of track and wayside equipment
- Automated Track Defect Location system
- Locomotive location and end of train location for PTC

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U.S. Department of Transportation
Federal Railroad Administration

High Accuracy Nationwide Differential Global Positioning System (HA-NDGPS)

Railroad Impact:

- Improve accuracy of GPS-based position data transmitted from Pueblo NDGPS site
- Determine relative accuracy of GPS, NDGPS, & HA-NDGPS data in a railroad environment
- Demonstrate usefulness of HA-NDGPS accuracy in railroad applications
- Verify ability of HA-NDGPS equipped locomotives to resolve track occupancy with confidence necessary for fail-safe train control applications

Project Description:

- Follow-on task to High Accuracy Global Positioning System (HA-GPS) prototype system test at Transportation Technology Center (TTC)
- Preparation of Pueblo NDGPS site for upgrade to HA-NDGPS.
- Perform upgrade of Pueblo NDGPS site to HA-NDGPS.
- Demonstrate potential benefits of HA-NDGPS for train control applications with testing at TTC and long baseline tests of up to 200 miles.
- Evaluate the accuracy and integrity capabilities of a fully operational HA-NDGPS site.

Point of Contact Information:

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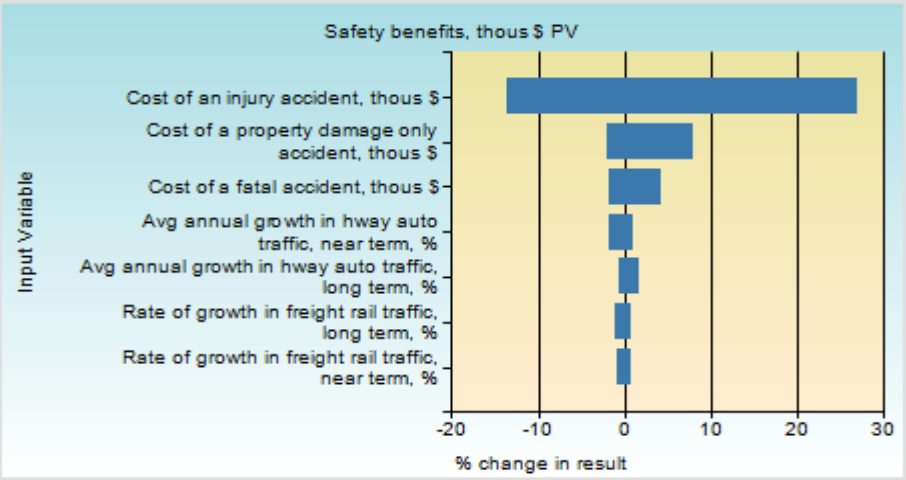
U.S. Department of Transportation
Federal Railroad Administration

GradeDec Highway-Rail Benefit Cost Analysis Tool



Project Description:

- Online tool to evaluate highway rail grade crossing investment alternatives.
- Meets Office of Management and Budget and US DOT requirements for benefit cost analysis of infrastructure investments.
- Quantifies improvements in safety, highway travel time, and highway-related vehicle emission.
- Allows users to allocate daily highway and rail traffic to four 6-hour periods to improve estimates of the likelihood that these vehicles will occupy the crossing simultaneously.
- Ranks investment risk by input metric.
- Generates output charts, graphs, and reports to facilitate public debate, especially for grade crossing closure and separation.

Railroad Impact:

- Optimizes grade crossing safety by identifying the riskiest crossings at the regional or rail corridor level. Includes aggravating risk factors, like line-of-sight, alignment, grade, and curvature when assessing safety risk.
- Promotes alternative safety measures, like 4-quad gates and photo enforcement.
- Provides a standardize method to work with public agencies to facilitate public-private partnerships.

Point of Contact Information:

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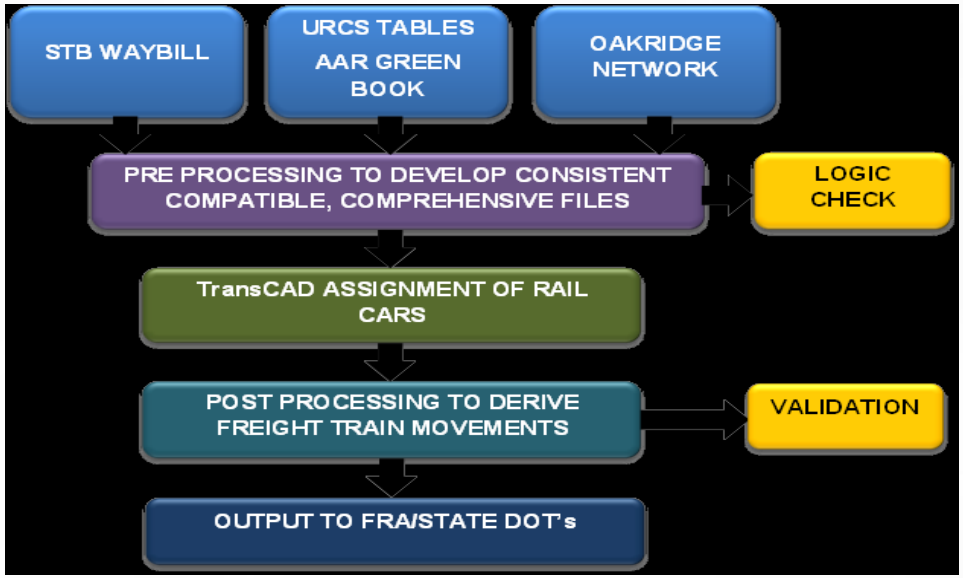
U.S. Department of Transportation
Federal Railroad Administration

Rail Waybill Traffic Assignment Software



Project Description:

- Flows STB Waybill data over a rail network to estimate daily freight traffic by train type (bulk, intermodal, general cargo, auto, and empty).
- Develops train speed and impedance factors by rail link and node for accurate traffic assignment between origin and destination points.
- Quantifies statistical variation in rail traffic by any aggregation of daily traffic for more efficient design and safety mitigation strategies.
- Provide users with a tool to query traffic assignment by any grouping of STB Waybill input metrics.

Railroad Impact:

- Facilitates preliminary statewide rail investment planning especially on shared-use corridors without tying up private sector resources .
- Coordinates Federal and State DOT's understanding of freight rail traffic and its seasonal variability,
- Improves initial public and private partnership discussions and reduce costs for both parties (time, money, and manpower).

Point of Contact Information:

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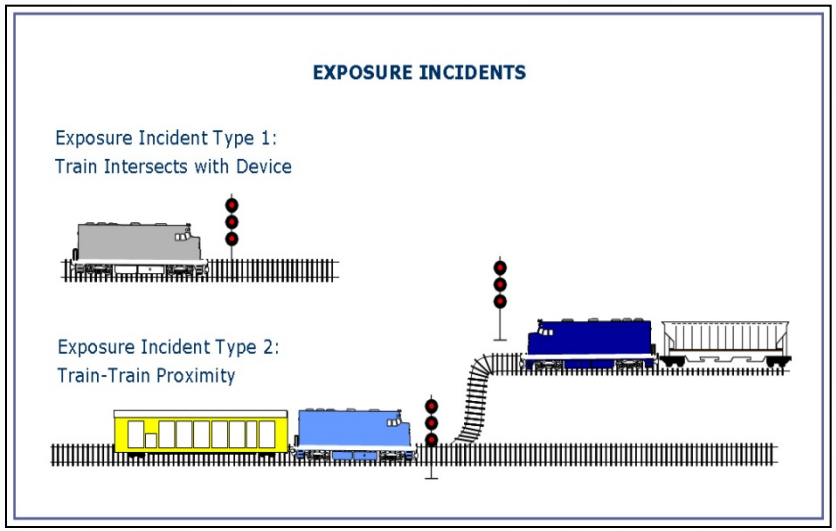
U.S. Department of Transportation
Federal Railroad Administration

Generalized Train Movement Model



Project Description:

- A simulation model to replicate a rail line operation over a well-defined track infrastructure with a specific train control method.
- Simulates the dispatchers' decision on prevention of deadlock, meet and pass planning and preset train priorities.
- Generates metrics of risk exposures to interface with risk assessment.
- Provides capacity/rail performance output.

Railroad Impact:

- Improves on risk assessment and risk mitigation analysis.
- Expedient preparation of Product Safety Plan of new train control system.
- Optimizes railroad line usage by increasing capacity with minimal investment.
- Promotes wider deployment of Positive Train Control System.
- Provides preliminary cost estimates of adding passenger rail service to freight rail lines.

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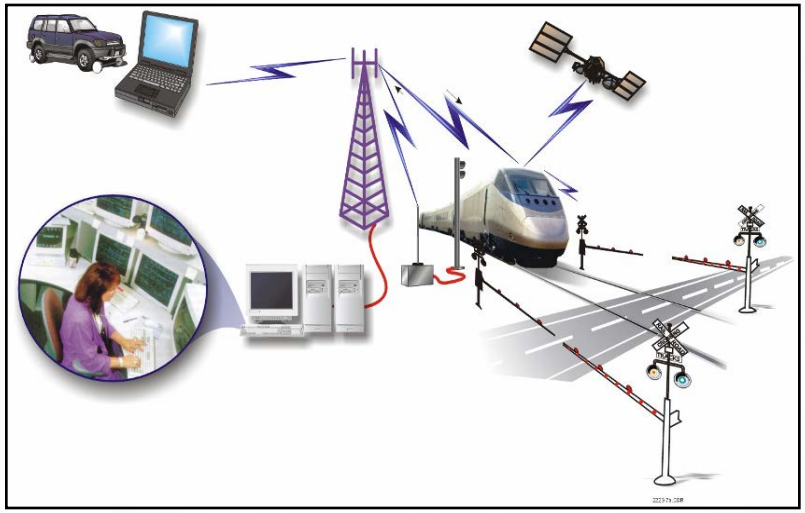
U.S. Department of Transportation
Federal Railroad Administration

Caltrain Communication Based Overlay Signal System (CBOSS)/Positive Train Control (PTC) System Development



Project Description:

- Communication Based Overlay Signal System (CBOSS).
- PTC system designed to meet the guidelines.
- CBOSS/PTC will be designed to differentiate between the unique operating characteristics of both commuter and high speed trains running on Caltrain tracks.
- All passenger trains operating on the Caltrain corridor will be provided with in-cab equipment that will continuously supervise the train speed and automatically intervene with a penalty brake whenever there is a speed violation.

Railroad Impact:

- Enable optimal performance for the different types of train technologies that will operate in the Peninsula Corridor.
- Prevent train collisions and over-speed derailments
- Provide enhanced protection for trackside workers and on-track equipment by protecting the work zones

Point of Contact Information:

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U.S. Department of Transportation
Federal Railroad Administration

Lidar Upgrade and Automated Extraction of Grade Crossing Parameters

Project Description:

- Installation of a Lidar-based system on a full-sized rail vehicle in order to achieve FRA's goals of comprehensive grade crossing scanning and assessment in an expedited fashion
- Development of tools required to automatically extract grade crossing features from the Lidar data collected from the surroundings around grade crossings for a comprehensive assessment of crossing conditions.

Railroad Impact:

- Reduce hang-ups at grade crossings
- A step forward toward the FRA's need to identify high profile grade crossings throughout the country
- Improve the safety features/warnings at grade crossings

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U.S. Department of Transportation
Federal Railroad Administration

Federal Railroad Administration (FRA) Support for Transportation Research Board's (TRB) Core Program Activities

U.S. Department of Transportation
Federal Railroad Administration

RESEARCH RESULTS

RR 11-23 | November 2011

PASSENGER RAIL CAR EGRESS – TRB WORKSHOP

SUMMARY

The Federal Railroad Administration's (FRA) Office of Railroad Policy and Development is exploring how to enhance regulations that address the safe, timely, and effective emergency evacuation of occupants from passenger rail vehicles in various emergency scenarios. Several evacuation concepts, strategies, and techniques are currently being investigated and evaluated for applicability to U.S. passenger rail cars.

FRA sponsored a Human Factors Workshop related to passenger train emergency egress on January 9, 2010, as part of the Transportation Research Board (TRB) Annual Meeting, in Washington, DC. The workshop featured two areas: 1) findings from recent research regarding emergency evacuation from transportation vehicles; and 2) a field trip for participants to experience the challenges of egress for an overturned commuter rail car and a crash-damaged rail transit car in a subway tunnel environment.

A Roll-Over Rig (ROR) Simulator was used to demonstrate commuter rail car egress during the TRB Workshop.

FRA funded the construction of the ROR, which is located at the Washington Metropolitan Area Transit Authority (WMATA) Carmen E. Turner Maintenance and Training Facility in Landover, MD. The ROR Simulator is capable of "rolling" a rail car "over," in place, at various angles to simulate rail car positions after derailments or other rail accidents. The ROR Simulator is used as a training tool by WMATA for emergency response organizations and has been used to demonstrate different types of emergency evacuation-related equipment to government agencies and industry groups.

Passenger Rail Car ROR Rig

Subway Tunnel

Figure 1. WMATA Emergency Evacuation Training Facility

Project Description:

- This is an ongoing annual program between FRA and the Transportation Research Board (TRB) that has been in place for many years.
- TRB will continue to provide services in support of a Technical Assistance and Information Dissemination to the Public Transportation Community.

Railroad Impact:

- The National Academy of Sciences (NAS)/TRB ongoing services and materials will assist the FRA to carry out and fulfill its various missions and obligations.

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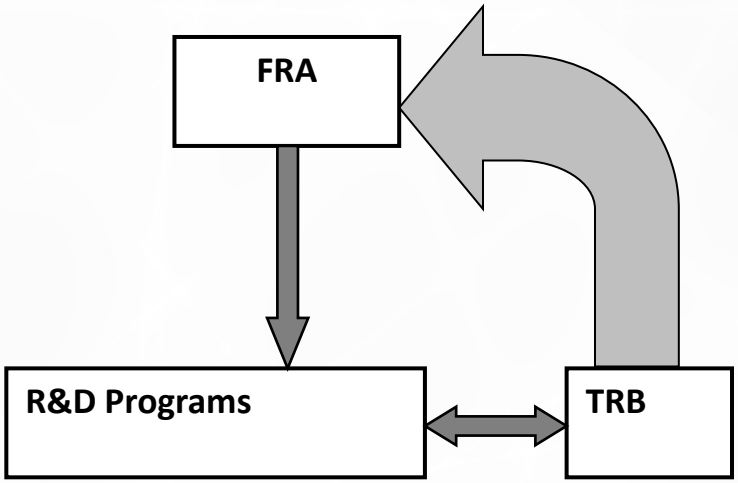
U.S. Department of Transportation
Federal Railroad Administration

Annual Review of FRA's Research and Development Program Area



Project Description:

- The TRB committee appointed for this study conducts a review and evaluation of major program areas in the research and development (R&D) program of the FRA.

Railroad Impact:

- Provide recommendations and constructive comments to FRA on how to improve its processes for selecting, executing, and delivering value from its R&D program.
- Suggest future directions for the FRA R&D program.

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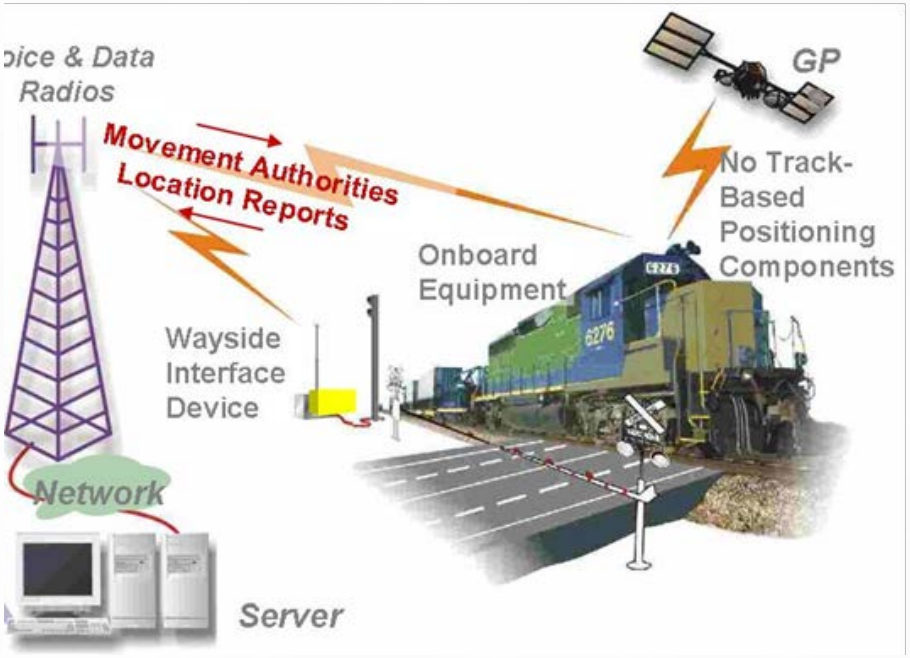
U.S. Department of Transportation
Federal Railroad Administration

Positive Train Control (PTC) Security Study



Project Description:

- Perform an independent assessment of the security mechanisms built into the overall Meterocomm Positive Train Control (PTC) network infrastructure, which include wireline network elements and data radio elements.

Railroad Impact:

- Improve the Positive Train Control (PTC) radio communication accuracy, reliability and effectiveness.

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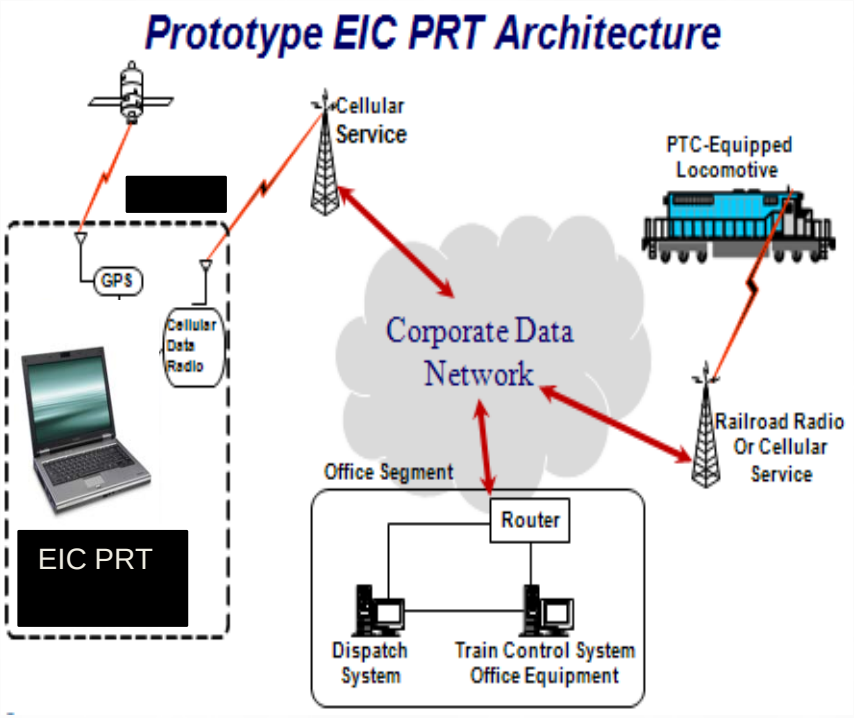
U.S. Department of Transportation
Federal Railroad Administration

Employee-In-Charge (EIC) Portable Remote Terminal



Project Description:

- Develop a safety-critical, wireless, handheld device used by the employee-in-charge (EIC) of roadway workers to communicate with a CBTC system to:
  - Request and release work zones
  - Control entry and speed restrictions of trains allowed into the work zones

Railroad Impact:

- OBC enforcement and thereby protection is maintained through MWP with EIC specified movement parameters
- Mitigates EIC working outside of MWP protected time
- Prevents instructions to the locomotive by 3rd party (spoofing) through the EIC PRT communications interface.

Point of Contact Information:

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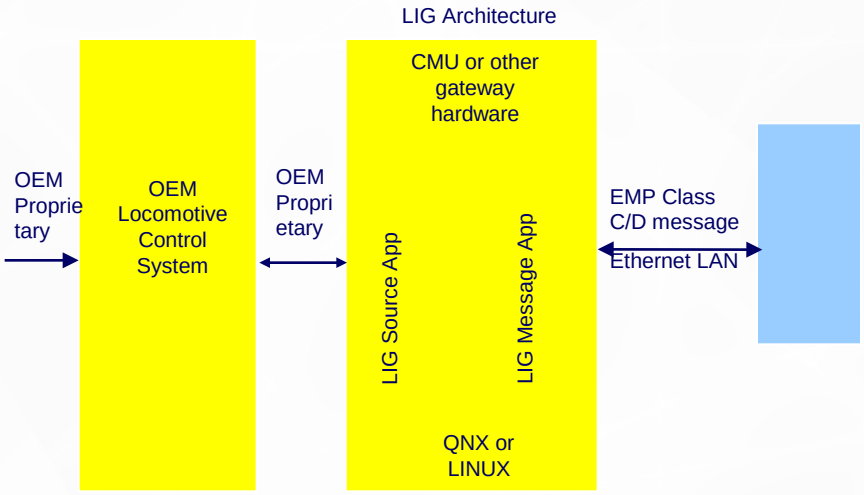
Project Partner: TTCI

U.S. Department of Transportation
Federal Railroad Administration

Locomotive Interface Gateway



Yellow background is proprietary developed
and Green background is non-proprietary (CA sponsored)

Project Description:

- Develops a Locomotive Interface Gateway (LIG) which can provide a common gateway for any PTC or other application.
- Provides an open interface so any new PTC Train Control System can be Incorporated
- Utilizes a common message set for commands and instructions among modules
- Utilizes a standard communication link protocol for internal communication

Railroad Impact:

- Enables efficient integration of onboard applications like PTC in new and after market locomotives
- Ensures backward compatibility with cab signal equipment
- Ensures ease of interoperability among different PTC systems
- Cost effective solution to minimize capital investment for universal adaptability

Point of Contact Information:

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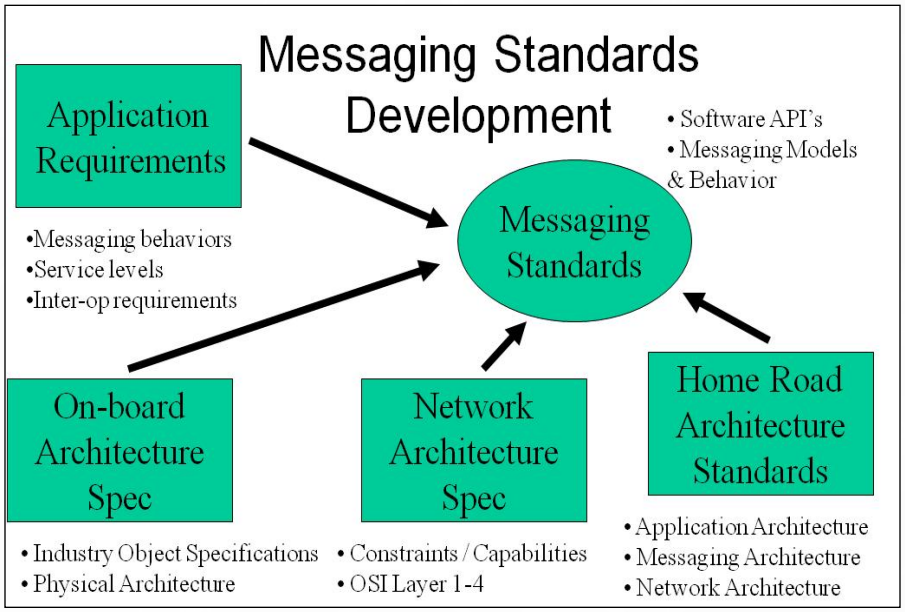
U.S. Department of Transportation
Federal Railroad Administration

Interoperable Train Control Proof of Concept



Project Description:

- Develop the plans for and execute the testing of an interoperable train control proof of concept, and
- The development of a comprehensive set of verified standards and reference implementations for the Association of American Railroads (AAR) through the RRF.

Railroad Impact:

- Provide a specification on messaging standard and protocols for interoperable train control
- Insure smooth operation for run-through trains in US operation
- Reduce overall cost of PTC implementation and deployment

Point of Contact Information:

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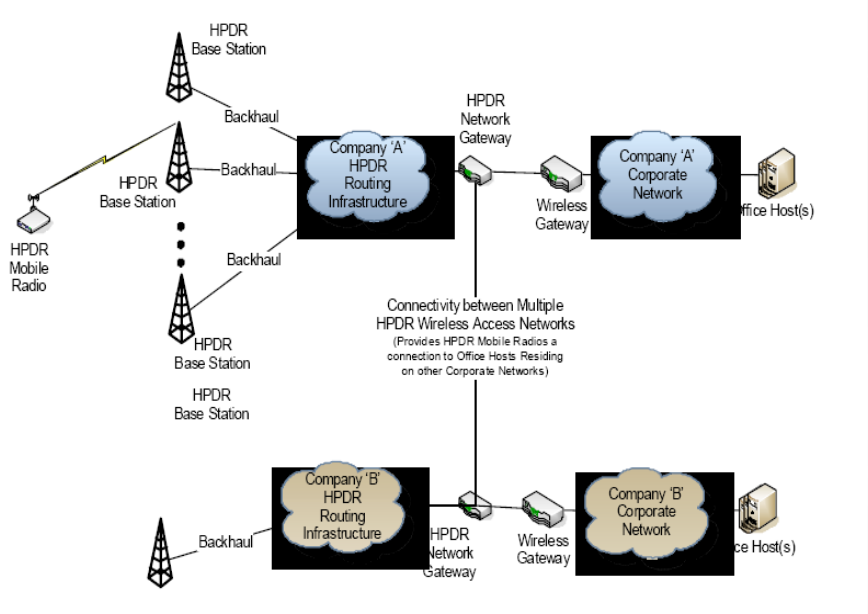
U.S. Department of Transportation
Federal Railroad Administration

Higher Performance Data Radio



Project Description:

- To develop a next generation communication network to support PTC/business applications
- To assist in the migration to narrow banding of 160 MHz radios-integrate voice and data
- To require robustness and throughput for railroad safety critical applications
- To establish 220 MHz communication standards and protocols to support interoperability

Railroad Impact:

- An integrated digital communication network
- Adoption of narrow-banding 160 MHz insures interoperability
- Upgraded communication network in compliance with FCC ruling
- Supporting train control, existing digital applications and foreseeable expansions

Point of Contact Information:

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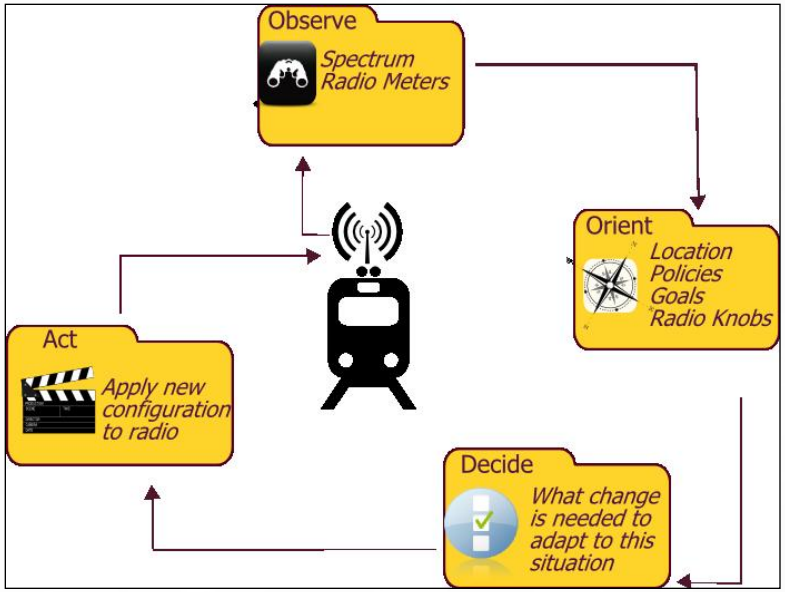
U.S. Department of Transportation
Federal Railroad Administration

Railway Cognitive Radio



Project Description:

- Improve robustness, reliability, and potential for interoperability of wireless communications for PTC
- Develop a Cognitive Radio (Rail CR) engine and integrate it with a Software Defined Radio (SDR)
- Sense spectrum and performance changes, decide on radio mitigation strategies, implement changes, and learn from past decisions.
- Develop Rail-CR concept of operations, functional requirements, and test case scenarios in simulation and SDR hardware platform

Railroad Impact:

- Enhanced communications with…
  - Other companies, Base Stations, Signal Switches
- Protection against…
  - Interference (multipath, attenuation)
  - Intentional jamming
- Improved…
  - Radio link performance, spectrum efficiency

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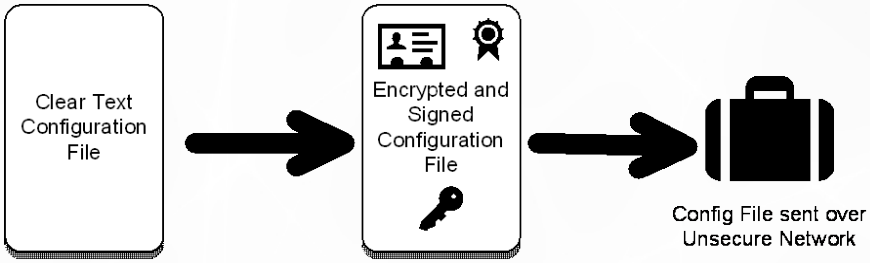
U.S. Department of Transportation
Federal Railroad Administration

Positive Train Control (PTC) Security Mechanism



Project Description:

- Analyze critical security aspects of industry Interoperable Train Control (ITC) Messaging (ITCM) framework.
- Investigate the affect of the wayside device security posture on interoperable PTC systems.
- Analyze the methods of configuration, monitoring updates, patch management and maintenance to ensure secure procedures and identify potential security issues.

Railroad Impact:

- Improve overall security for PTC wayside devices
- Provide the due-diligence regarding requirements needed to ensure the security of device maintenance and updates
- Provide to the industry an independent security effectiveness evaluation
- Insure data security for the 2015 PTC deployment

Point of Contact Information:

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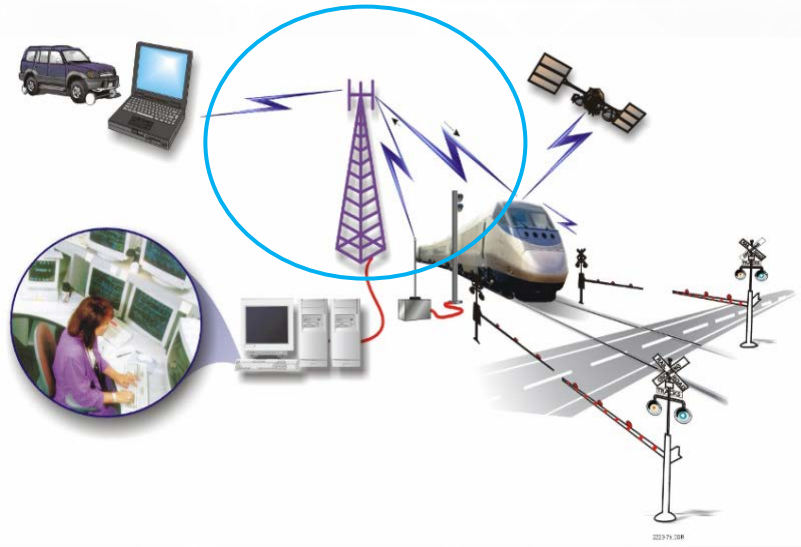
U.S. Department of Transportation
Federal Railroad Administration

PTC/Communication Test Bed

PTC Architecture – 220 MHz Comm Links



Railroad Impact:

- To meet PTC communications demands, the Industry has purchased 220 MHz frequency and is specifying a new PTC 220 MHz data radio. Communications among all PTC system elements will be via the 220 MHz network using these new radios.
- A venue for field testing of PTC communications using the new radios will be needed in 2011
- Full implementation of PTC is contingent upon successful testing of ITC-Compliant 220 MHz radios

Project Description:

- Upgrade communications & testing capabilities of PTC Test Bed at TTC to support field testing of ITC-Compliant PTC 220 MHz radios.
- Provide equipment for field testing 220 MHz radios
  - ITC-Compliant WIUs & radios for 10 WIU reporting locations, including 4 remotely controlled switches
  - 2 ITC-compliant base stations to support hand-off testing
  - 2 V/ETMS-equipped locomotives
  - Wabtec TMDS CAD system & ETMS BOS
- Install required equipment
- Integrate, test, and commission upgrade equipment
- Perform check-out of enhanced Test Bed communications capabilities
- Ensure upgrades support potential for future Test Bed expansions to provide test environments for full blown deployment testing with the communications density of a major metropolitan area

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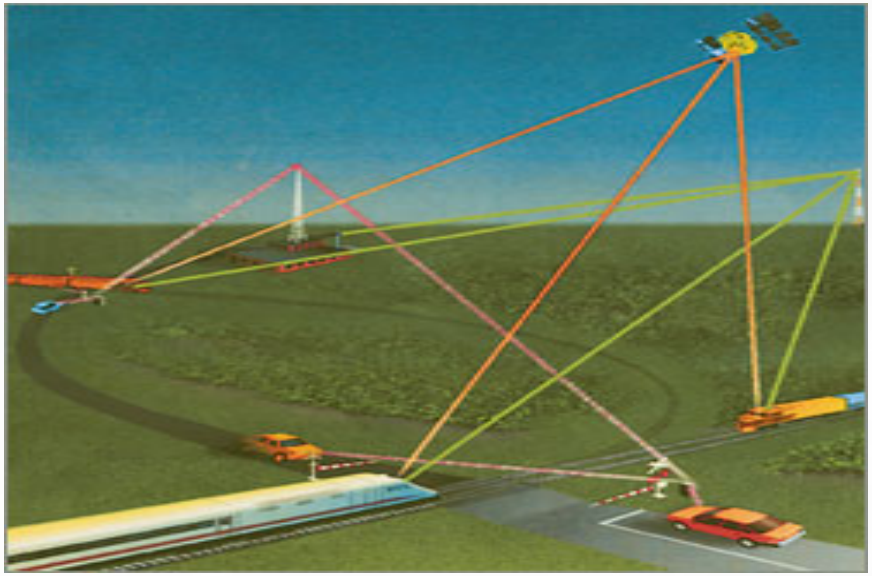
Project Partner: TTCI

U.S. Department of Transportation
Federal Railroad Administration

ITS V2I Highway-Rail Safety System



1. Approaching train communicates to crossing gates.
2. Activated gates transmit a warning signal via DSRC radio.
3. Drivers approaching the crossing receive an in-car warning.

Project Description:

- Integrate current Digital Short Range Communications (DSRC) into active crossing protection systems to enable in-car warning of an active crossing.
- Prototype a working solution in cooperation with RITA, VOLPE, and the ITS JPO.
- Conduct a field demonstration and proof of concept.

Railroad Impact:

- Provides increased safety for vehicles approaching an active rail crossing.
- Enables route calculation to avoid occupied crossings for emergency vehicles.
- A lower cost solution for protecting un-signaled grade crossings.

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Project Partner: TTCI

U.S. Department of Transportation

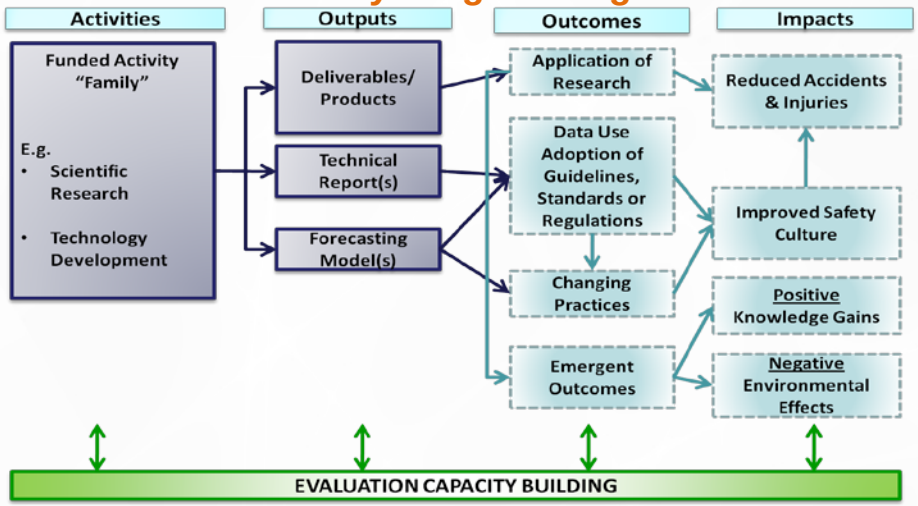
Federal Railroad Administration

Human Factors Division Projects

U.S. Department of Transportation
Federal Railroad Administration

Program Evaluation Capacity Building: Implementation, Utilization, and Impact Assessment Support for FRA RPD and Safety Programs

RPD and Safety Program Logic Model



Railroad Impact:

- Collaborative results-oriented safety programs
- Improved capacity to implement and evaluate innovative safety programs for utilization, effectiveness and impact

FRA Impact:

- Systematic, rigorous evaluations appropriate for programs being evaluated with improved understanding of real impacts
- Valid, accurate information to support evidence-based budgeting and decision-making
- Guidance documents for structuring and improving agency safety programs and their impact on safety in transportation
- Useful, relevant, high impact R&D and Safety programs
- Prioritized and cost effective R&D and Safety programs
- Improved capacity to conduct rigorous, independent evaluations in response to Congress and OMB requests

Project Description:

- Develop: a) a program evaluation infrastructure that complements and strengthens efforts to improve program performance measurement and management, b) an evidence-based approach to program development, implementation planning, results monitoring, and resource allocation, and c) program evaluation and impact assessment tools and methods that support the implementation and evaluation of on-going FRA and industry safety programs such as Clear Signal for Action, C3RS, ISROP, and FRA's Risk Reduction Program; and to better facilitate the utilization, effectiveness, and impact of RPD and Safety programs overall, including:
- Program logic models with causal linkages between activities, outputs, outcomes, and intended impacts
- Program implementation and evaluation plans
- Program outcome measures and leading safety indicators
- Stakeholder buy-in and commitment strategies
- Models for knowledge transfer, information diffusion, and translation of research for impact
- Strategies for evaluation sustainability

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Email: michael.coplen@dot.gov

U.S. Department of Transportation
Federal Railroad Administration

Railroader Sleep Health and Safety Website

Project Description:

- This project will develop a tailored, interactive, multi-media, web-based education program geared towards providing train crews and other railroad employees with:
- Scientifically-valid information on the importance of sleep,
- A tailored tool to assess personal risk for sleep disorders, and
- Proven, practical strategies for improving sleep health.

Railroad Impact:

- Fatigue in the Transportation Industry is a pressing problem that has been singled out by the National Transportation Safety Board (NTSB) as a high priority for education and research since 1990.
- The major underlying cause of fatigue-related rail accidents is sleepiness. An educational website for railroaders focusing on the causes of sleepiness and mitigation strategies under an operator's control should reduce sleepiness and fatigue-related accidents.
- The planned website can be used by individual railroad employees and as an education component of a railroad carrier's fatigue management plan, as required per the Rail Safety Improvement Act of 2008.

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U.S. Department of Transportation
Federal Railroad Administration

Critical Incident Intervention Program

Railroad Impact:

- Nearly 1,000 fatalities occur every year in this country from trains striking motor vehicles at grade crossings and individual trespassers along the track, often resulting in psychological trauma to train crews.
- Railroad work, due to the inherent nature of the industry's environment, carries the risk of exposure to the sort of situations known to trigger severe emotional and psychological distress, including Post Traumatic Stress Disorder (PTSD) and the more immediate Acute Distress Disorder (ASD), which can result in increased risk of accident and injury.

Project Description:

- The purpose of this program is to develop an intervention program that will control the risks associated with traumatic exposure to critical incidents in the railroad setting, including developing one or more program designs suitable for implementation by rail carriers in partnership with their respective unions and researchers.
- FRA plans to award a competitive grant early in fiscal year (FY) 2011 for development of an intervention plan to reduce the effects of traumatic exposure to grade crossing and trespasser incidents in particular. Additional funding may be available in future years for expansion and implementation of one or more interventions.
- FRA will then implement one or more pilot interventions to document its effectiveness and impact for possible adoption

Point of Contact Information:

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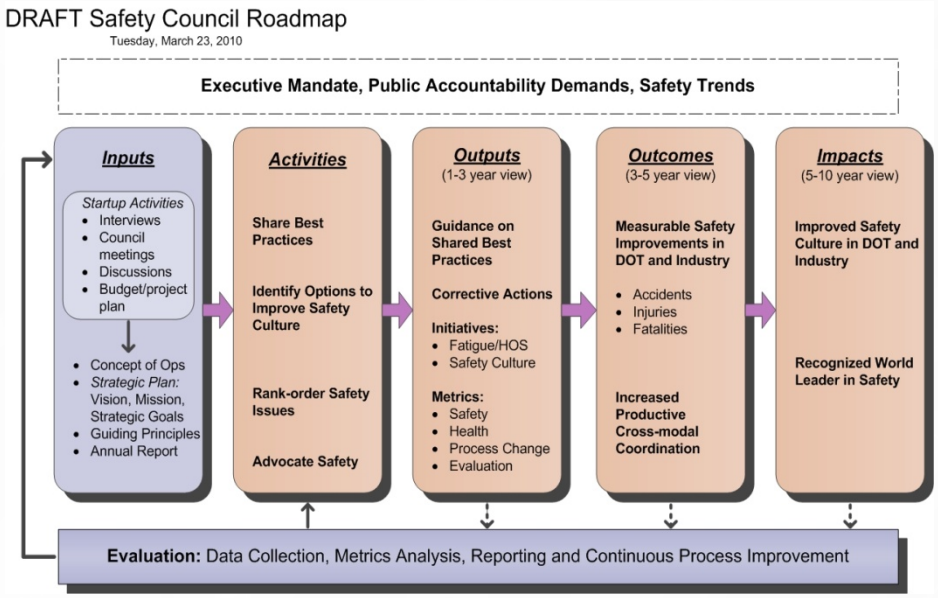
U.S. Department of Transportation
Federal Railroad Administration

Department of Transportation Safety Council Support



Project Description:

- This project will provide cross modal funding, research, implementation, and evaluation support for top DOT Safety Council safety initiatives and other on-going activities of the Council and safety action teams, including Safety Culture, Fatigue/HOS and SMS.

Railroad Impact:

- Improved information sharing across modes
- Improved safety data collection and management practices
- Greater collaboration and coordination of top priority safety programs and projects
- Greater collaboration with industry stakeholders as a result of lessons learned from other modes
- Cost/resource efficiencies on safety initiatives launched jointly with other modes
- Enhanced safety culture awareness
- Improved safety programs

Point of Contact Information:

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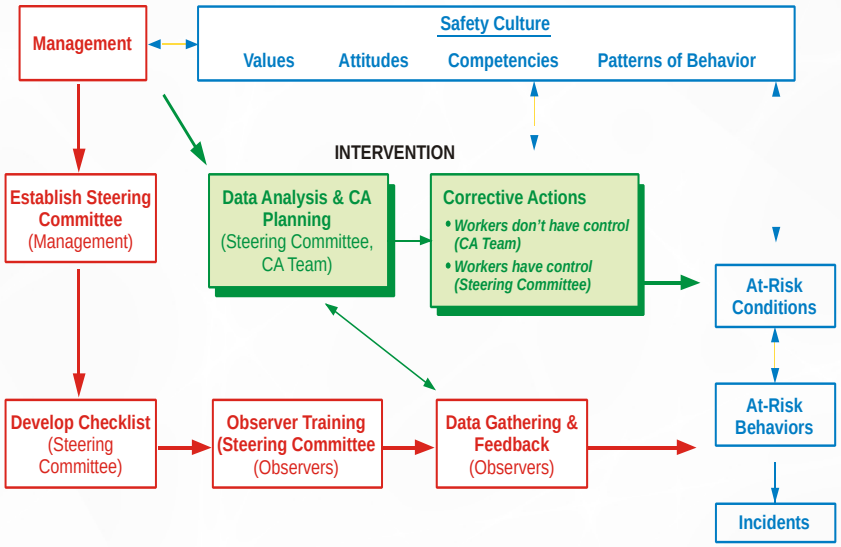
U.S. Department of Transportation
Federal Railroad Administration

Safety Culture, Organizational Development and Safety Program Performance

CSA Program Theory of Change



Pilot Programs	Dept	Outcomes
Rules Revision	All Operating	**51%** reduction in reportable injuries Drop in *liability claims*
EAGLES*	Station Services	**80%** drop in *injury rates* **76%** drop in reportable injuries
ISROP	Mechanical	**50%** drop in injury rates (all injuries)
CAB*	Road	**72%** drop in L.E. *decertification rates* **69%** drop in HF *derailment rates*
STEEL*	Switching	**62%** drop in yard derailment rates
C3RS	Road & Yard	Reduced accidents Improved safety culture
*** CSA Projects**		

Project Description:

- This effort will reduce accidents and injuries, and build strong safety cultures, by developing innovative methods, processes, and technologies to identify and correct individual and systemic safety risk factors using "upstream" predictive data.
- Numerous R&D pilot projects have already been initiated: Rules Revision, ISROP, Clear Signal for Action (CSA), and Confidential Close Call Reporting (C3RS) systems.
- CSA is a risk-based safety management system that includes behavioral-observations and feedback, continuous improvement processes, leadership development, and corrective actions.
- In collaboration with the Office of Safety and industry stakeholders, this effort will design, implement, and evaluate innovative safety culture change approaches, internally at FRA and externally in industry, to demonstrate measureable outcomes and recommend approaches for broader industry-wide adoption.

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U.S. Department of Transportation
Federal Railroad Administration

Countermeasures to Reduce Suicides on Railway Rights of Way

Railroad Impact:

- Addresses National Strategy for Suicide Prevention (U.S. Surgeon General, 2001) to "Promote efforts to reduce access to lethal means and methods of self-harm."
- Suicide accounts for 30 – 50% of trespasser-related serious injuries/fatalities on railroads
- In 2004, suicide was the leading cause of rail-related fatalities in Illinois, with 30 probable suicide deaths and 3 additional attempts involving trains in Chicago alone.

Project Description:

- This project is currently in the fourth year of a five year study, led by an Industry Steering Committee, to:
  - Determine the prevalence of and underlying causal factors for rail-related suicides
  - Develop effective measures to reduce the incidence of suicide along railway rights of way (including crossings)
  - Establish pilot programs for testing countermeasures
  - Develop standard protocol for documenting suicides and provide baseline data for monitoring trends
- Retrospective and prospective assessments of the prevalence of suicide has been completed and comprehensive psychological autopsy data collected from 60 suicide cases. A pilot program has been initiated to evaluate use of signs as suicide prevention strategy. Data analysis is ongoing and will inform the development of additional suicide countermeasure pilot programs.

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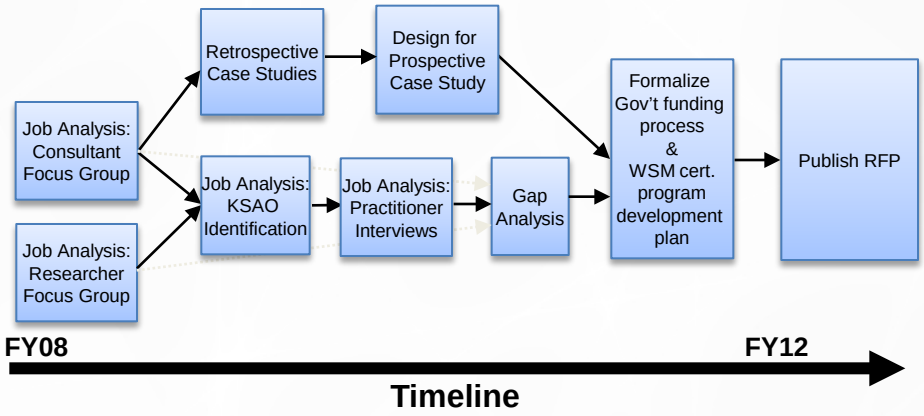
U.S. Department of Transportation
Federal Railroad Administration

Work Schedule Manager (WSM) Certification – Phase II: Program Development and Cross Government Collaboration

Phase I Overview: Job Analysis of Work Schedule Manager



Project Description:

- The majority of those who manage work schedule (WS) operations have little or no formal training in staffing analysis, schedule design, fatigue, or the human factors of shiftwork, often leading to significant operational or safety problems.
- The nature of the problem, and the KSAO's needed to effectively manage WS operations, appears similar across occupational classifications.

Railroad Impact:

- **Vision:** Professionalize the job of managing work schedules in the around-the-clock operations, especially the railroad industry, to support broad scale development and institutionalization of fatigue risk management systems.
- **Goal**: To develop a cross-governmental partnership to implement an effective work schedule manager certification program.

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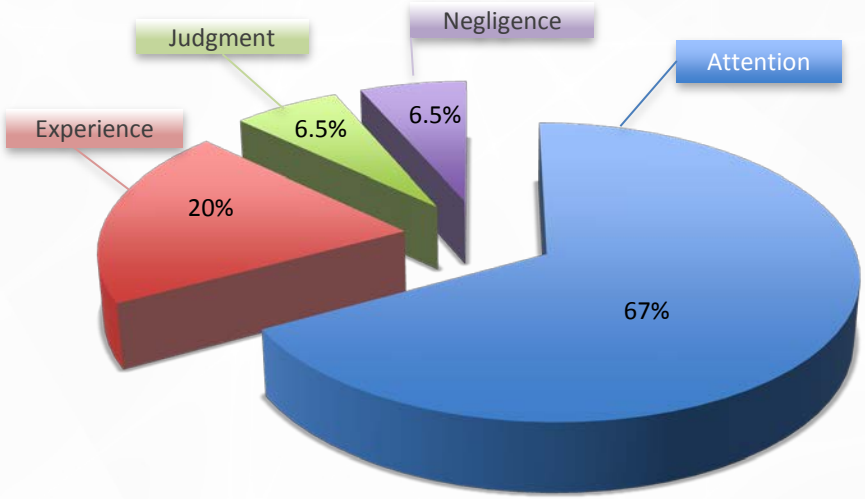
U.S. Department of Transportation
Federal Railroad Administration

Sustained Attention and Error: A Scientific Approach to Reducing Major Rule Violations



Veolia Transportation Services Inc. Study

Project Description:

- Applies scientific literature to investigate attention related errors in train operations
- Analyzes operator attention using CTIL
- Develops a Sustained Attention Training program
- Evaluates training program utilizing CTIL
- Outreach/shares knowledge with industry.

Railroad Impact:

- A truly collaborative effort with industry to address sustained attention and human error related rule violations
- Contribute to the effectiveness of accident investigation techniques and root cause analysis processes.

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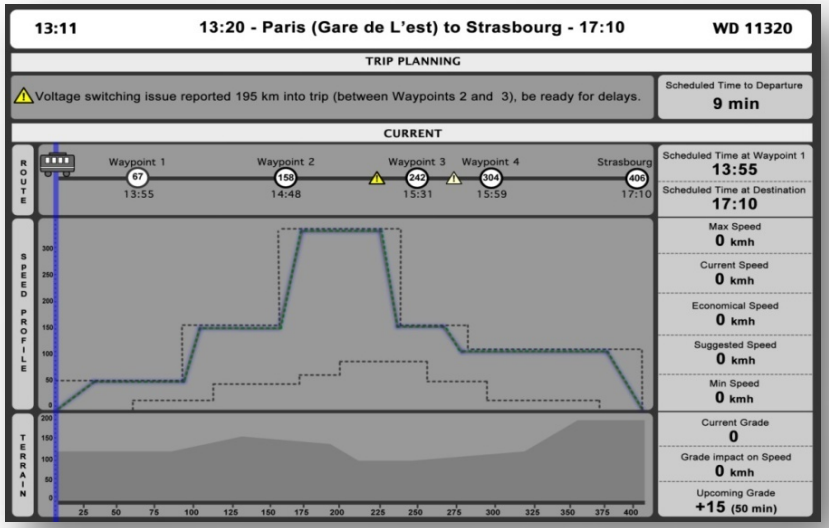
Project Partner: Veolia Transportation Services Inc. and George Mason University

U.S. Department of Transportation
Federal Railroad Administration

Development and Evaluation of a High Speed Rail Scheduling Display and a Virtual Head-Up



Project Description:

- Using CTIL, a real-time interactive planning and scheduling display is developed for U.S. high speed rail operators that reduces operator workload.
- Demonstrates human and system performance advantages, including cost and safety improvements.
- Head-Up Display in virtual environment helps determine HUD human requirements.

Railroad Impact:

- Preliminary usability evaluations show display is easy to learn, operators are confident in their use after just two hours of interaction, and the display was consistent with expectations
- Reduces crew workload
- Improves crew situation awareness
- Manages fuel more efficiently
- Customer satisfaction was increased with better adherence to published schedules

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U.S. Department of Transportation
Federal Railroad Administration

Locomotive Moving Map-Display

Project Description:

- Examines the scope of implementation and usability of locomotive moving map displays.
- Examines the use of the display on locomotive crew performance.
- Develops human factors guidance to support the design and evaluation of the displays through simulations using CTIL.
- Determines needed functionality

Railroad Impact:

- Enhances crew situational awareness
- Improves crew operational effectiveness

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Project Partner: Volpe Center Human Factors

U.S. Department of Transportation
Federal Railroad Administration

Robust Engineer's Workstation Design (REWD)

Project Description:

•The REWD will have baseline seat and locomotive engineer's workstation that meets locomotive crew (or engineer's) requirements.

•Integrates the seat with locomotive controls and displays to meet crew task requirements for bi-directional operation.

•The REWD Workstation will serve as a control/display testing platform and serve as an initial configuration or experimental locomotive engineer's workstation.

• Will be integrated in CTIL for T&E

Railroad Impact:

- Addresses concerns about crew health, safety, and performance related to current workstation designs
- Demonstrates an approach to workstation design to meet requirements for bi-directional locomotive operations

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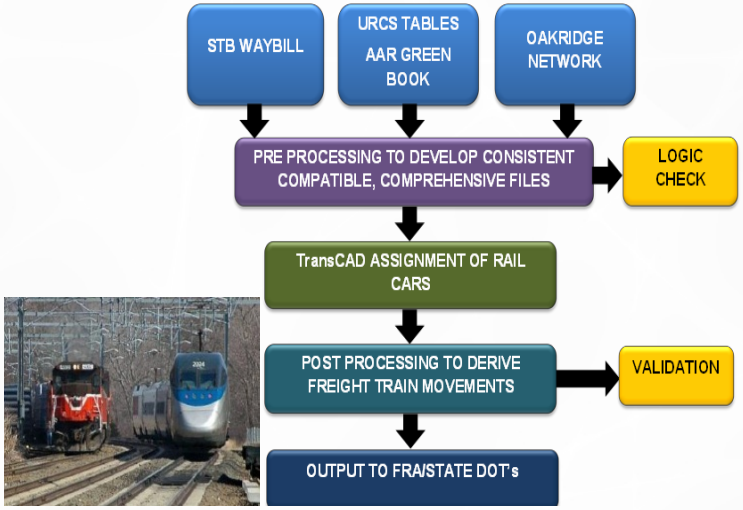
U.S. Department of Transportation

Federal Railroad Administration

High-Speed Rail R&D Broad Agency Announcement (BAA) Projects

U.S. Department of Transportation
Federal Railroad Administration

RAIL Waybill Traffic Assignment



Project Description:

- Flow STB Waybill data over the rail network by departure date to estimate daily freight traffic and its variability by train type (bulk, intermodal, general cargo, and auto).
- Develop train speed and impedance factors by rail link and node for accurate traffic assignment between origin and destination points.
- Quantify statistical variation in rail traffic for more efficient infrastructure design and safety mitigation strategies.

Railroad Impact:

- Facilitate preliminary statewide investment planning especially on shared-use corridors without tying up private sector resources.
- Improve and coordinate Federal and State DOT's understanding of freight railroad traffic and its variability.
- Improve initial public and private partnership discussions and reduce associated costs fro both parties (time, money, manpower).

Point of Contact Information:

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Project Partner: TEMS, Inc.
Caliper Corp.

U.S. Department of Transportation
Federal Railroad Administration

Technology Assessment and Field Demonstration of Automated Switch Inspection

Project Description:

- Define turnout inspection areas and requirements
- Identify current and future inspection technologies for each area
- Demonstrate new generation rail profile inspection system for switch points, frogs and other key turnout rail component areas
- Demonstrate 3-D analysis capability of turnout rail components to include accuracy and effectiveness
- Identify short, medium and long term needs for inspection of other turnout components and areas.

Railroad Impact:

- Turnouts are complex and expensive track components
  - 10 times more expensive to maintain than conventional track
- One of the largest track caused derailment areas
- Current inspections are visual using walking inspector
  - Inefficient and limited
- Automated inspection will improve safety and reduce turnout maintenance cost
- Significant for all rail systems

Point of Contact Information:

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Project Partners: Zeta Tech
New Jersey Transit

U.S. Department of Transportation
Federal Railroad Administration

High Speed Rail Turnouts for the U.S.A.

Project Description:

- Review and Analyses of HSR turnout technologies
  - Lit review
  - Development of alternatives
  - Software modeling of prototype geometry
  - Research Report and Recommendations
- Design of the HSR turnouts and siding track on RTT.
  - Detailed HSR track, civil and systems design
  - Contract documents preparation

Railroad Impact:

- High Speed (110/220) turnout design specifically designed for the US service environment – US spec components.
  - Kinematic gauge optimization
  - Assymetric switch points
  - Tangential geometry
  - Moving point frog
- Research – slab track and concrete tie installation – TTC. (Phase 2)

Point of Contact Information:

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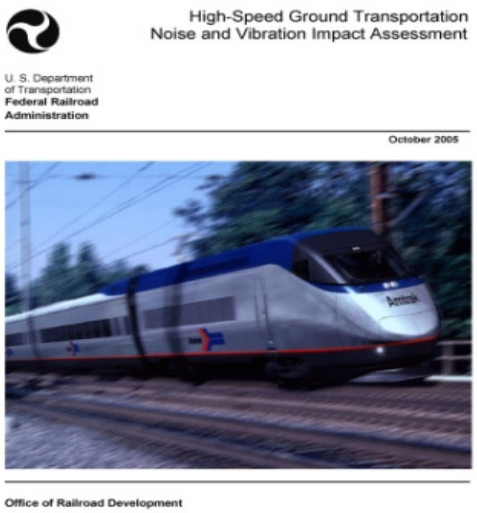
Project Partners: Notrak
TTCI, suppliers

U.S. Department of Transportation
Federal Railroad Administration

Update of FRA's High speed Rail Noise/Vibration Guidance Manual



Railroad Impact:

- FRA guidance manual, "High-Speed Ground Transportation Noise and Vibration Impact Assessment" is used on all HSR EIR/EIS documents in United States.
- FRA's guidelines on noise emissions (2005) are based on measurements made in 1996.
- Research in Europe and Asia has resulted in greater understanding of HSR noise sources since 1996.
- Specifications for new high speed passenger operations will benefit from updated guidelines that take account of recent developments in noise suppression.

Project Description:

1. The work would be performed by HMMH who prepared FRA's HSR guidance manual (2006)
2. A survey of current noise emission levels and suppression methods will be conducted through HMMH contacts in Europe and TTCI and FRA contacts in Japan and China.
3. Data will be analyzed for use in the FRA HSR noise model which will be upgraded as necessary.
4. The FRA guidelines will be updated.
5. Two options are proposed: 1) Update the FRA HSRNOISE spreadsheet program; 2) Recommendations for further research.

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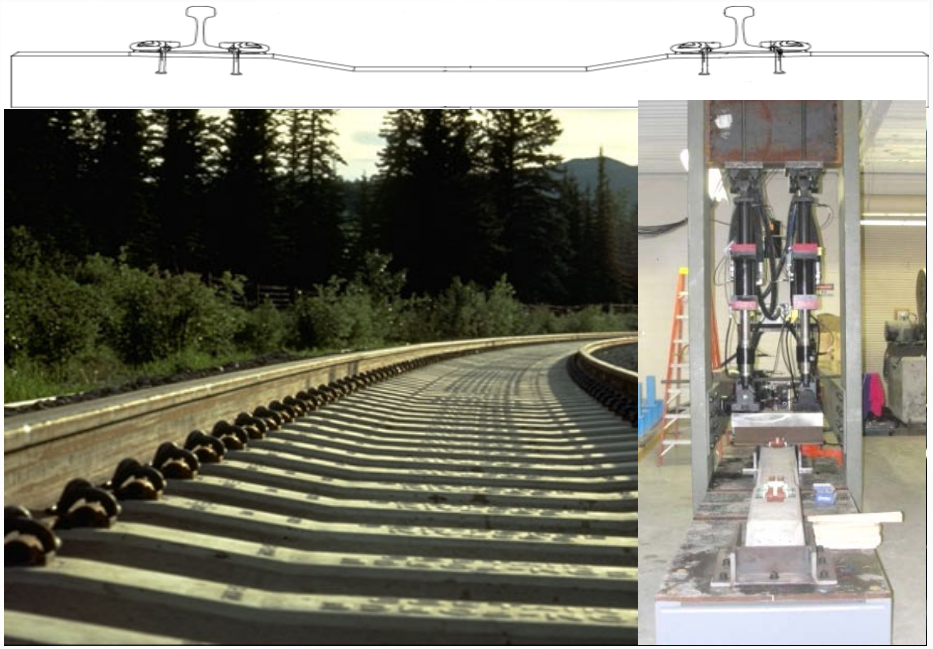
Project Partner: Harris, Miller, Miller & Hanson

U.S. Department of Transportation
Federal Railroad Administration

Improved Concrete Crossties and Fastening Systems for HS and Joint Corridors



Project Description:

- Research, Quantify, and/or Develop:
  - Provide state-of-the-art assessment for the design and performance of concrete ties and fastening systems
  - Rail to Tie Loading Path Analysis and Load Distribution Quantification
  - Concrete Mix Design and Materials Selection Requirements
  - Optimal Materials Qualities for Ties
  - Performance-based design recommendations for ties and fasteners

Railroad Impact:

- Improved infrastructure safety on high speed passenger and joint passenger/freight lines throughout the US (e.g. enhanced rail restraint)
- Enhanced performance of concrete crossties and fastening systems under demanding loading conditions in the US

Point of Contact Information:

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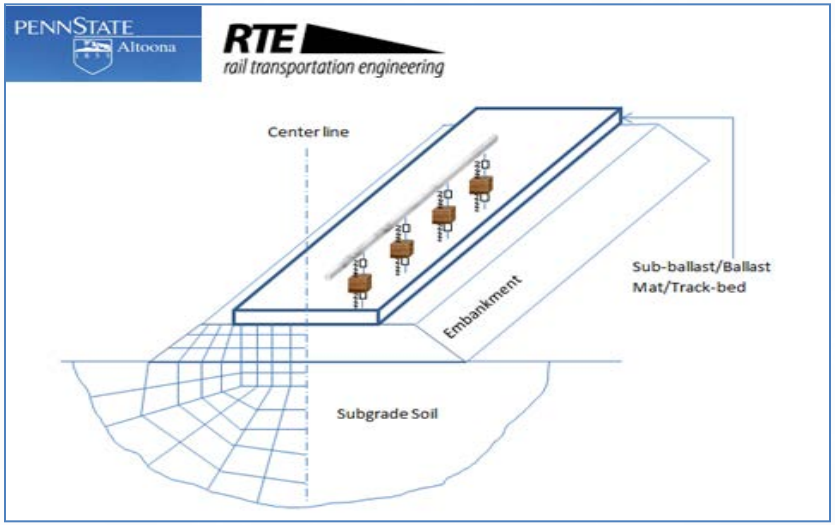
Project Partners: University of Illinois, Urbana-Champaign, CXT Concrete Ties, Inc. (Tie Manufacturer), Unit Rail, Inc. (Fastener Manufacturer), Union Pacific, BNSF, Amtrak, Hanson Prof. Services, Inc., GIC Inc.

U.S. Department of Transportation
Federal Railroad Administration

Development of Dynamic Track Model Under Mixed Traffic – High Speed Passenger and Freight



Project Description:

- A dynamic track model will be formulated, implemented, and calibrated to investigate the "Critical Speed" effect and the track responses under mixed traffic i.e. freight and high speed passenger train.

Railroad Impact:

- Railroad will benefit from this research in:
  - A safer high speed rail infrastructure network
  - Successful in track performances prediction under mixed traffic (freight and high speed passenger train)
  - Better track design, current track evaluation, and optimization methodology
  - Eventually efficient development of high speed rail.

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Project Partners: Penn State, Altoona

U.S. Department of Transportation
Federal Railroad Administration

Quantifying the Effect of Pre-stressing Steel and Concrete Variables on the Transfer Length in Pre-tensioned Concrete Crossties

Project Description:

- Quantify the parameters that affect the bond (transfer length) in pretensioned concrete crossties. This project will focus on the following parameters:
  1. Reinforcing type (indented strands of indented wires)
  2. Indent geometry (shape, depth, angle of inclination)
  3. Concrete Strength at release of prestress force
  4. Concrete consistency (slump)
- Determine the variations in transfer length that occur in production for the different reinforcing types.
- Develop a wire-bond test so that a minimum bond quality can be specified by tie manufacturers at the time of wire purchase.

Railroad Impact:

- Improve understanding of key parameters required to ensure integrity of pre-stressed concrete crossties.
- Reduce the risk of tie failure in track by ensuring pre-stress force is properly transferred to ties.
- Enable rapid detection of bond quality degradation in production using automated transfer-length measurement device.
- Enable possible reduction in overall crosstie length with economic and environmental benefit.

Point of Contact Information:

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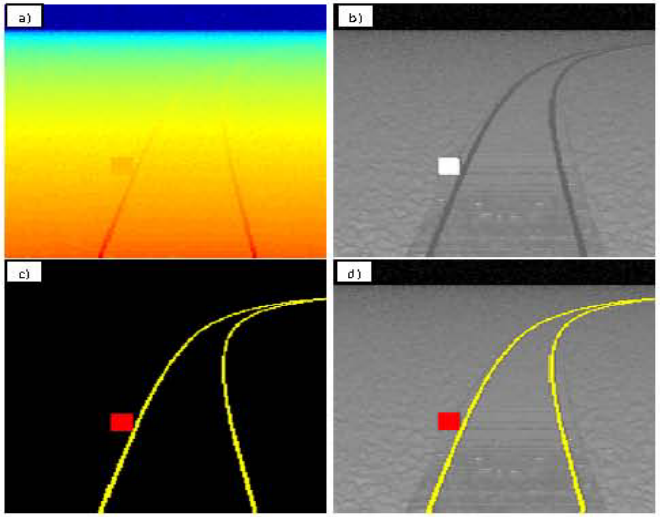
Project Partners: Kansas State University
CXT Concrete Ties, Inc.

U.S. Department of Transportation
Federal Railroad Administration

Scanning LIDAR for Obstacle Detection



Automated real-time processing of simulated data: (a) range colormap (red ->blue, short->far); (b) intensity grayscale (SWIR band); (c) rail detection (yellow) and potential obstacles (red) through data processing; (d) GUI for train operator highlights rail path and obstacle. Here the center of the field of view is at a range of 1.6 km, and the obstacle is at a range of 1.0 km.

Railroad Impact:

- Provide steerable "Intelligent Headlight" LIDAR system to detect and classify obstruction on the track with enough advance notice to respond effectively, even for high speed trains.

• Penetrates fog & drizzle

•Accurately locate obstructions with respect to current tracks, even with curves and grade changes.

•Enable significant improvement in the operating safety of railroad systems for current train speeds as well as future high speed trains.

Project Description:

- "Intelligent Headlight" LIDAR system provides and processes 3-D Images well down the tracks from current position.
- "Track following" capability located obstruction with respect to track; Classification capability automatically tags likely type of obstruction.
- Complete deployable scanning LIDAR system will be developed at program end. Aerius Photonics will address hardware development aspects and Toyon Research will address software development. Aerius will have overall program management responsibility.
- Phase I advances proven technology solutions from technology readiness level (TRL) 3 for this application TRL through logical, systematic risk reduction. Phase II advances solutions to TRL 7

Point of Contact Information:

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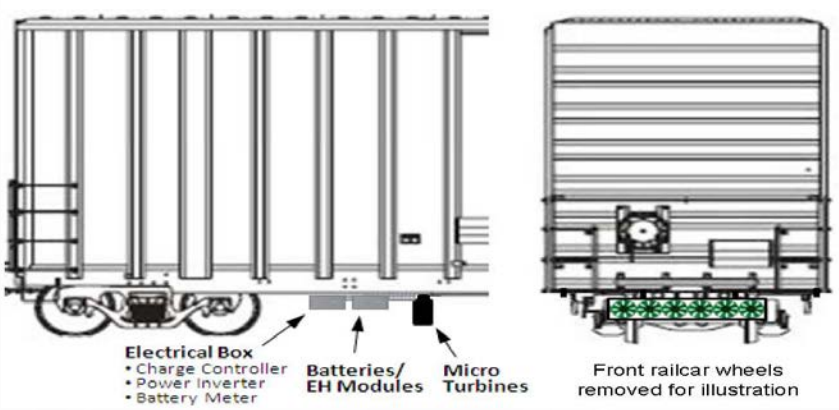
Project Partners: Aerius Photonics
Toyon Research

U.S. Department of Transportation
Federal Railroad Administration

Self-Contained Energy Harvesting Powerplant to Power Railway Systems



Project Description:

- Develop self-contained “Powerplant” combining multiple energy harvesting technologies.
- Utilize wind (air flow created by moving railcar) motion, and vibration energy harvesting
- Provide continuous, controlled power while railcar is in motion.
- Supply power for track inspection systems or other powered railway applications.
- Rapid-prototype demonstration integrating current and emerging technologies.

Railroad Impact:

- Provide an independent vehicle power generation system to power autonomous inspection systems.
- Offer reliable, cost-effective means to power on-board wireless communication systems and wayside communications
- Improve track and structure safety by allowing unlimited operation of railway safety systems.
- Support reduction in track inspection time
- Allow wider deployment and utilization of powered safety systems.

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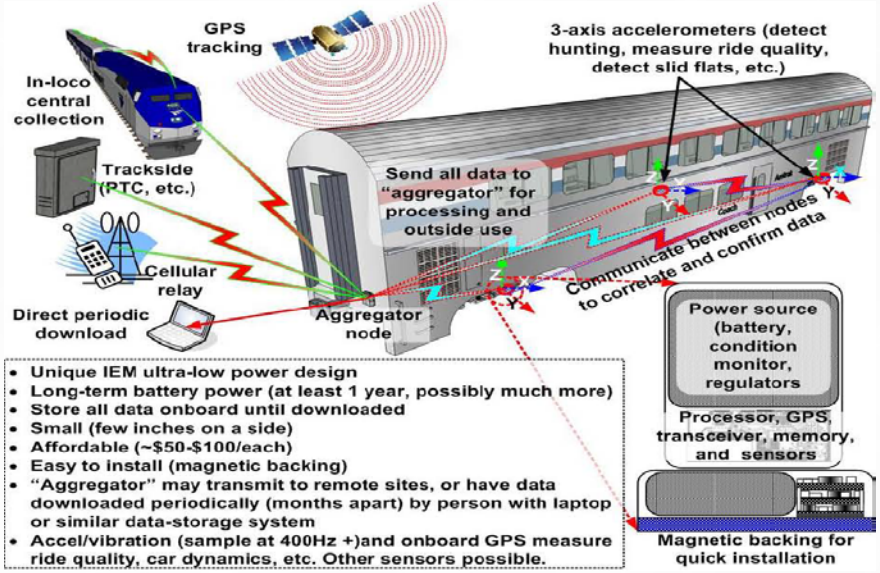
Project Partners: New Way Solutions, LLC

U.S. Department of Transportation
Federal Railroad Administration

Self-Powered Sensor Node for Smart Car Systems



Project Description:

- Low-cost miniature wireless sensor node with onboard GPS, a three-axis accelerometer, on-board data storage, and wireless connectivity
  - Accelerometer sampled at 400+Hz
  - Memory holds at least 1 year of data
  - Monitor ride quality, vehicle dynamics, etc.
  - Many other sensors possible
  - Affordable, easily deployed/removed
- Aggregator node for each car (may be dedicated device or portable laptop, etc.)
  - Gathers data from all car nodes
  - Acts as communication gateway
- Battery lasts at least one year possible more

Railroad Impact:

- Detect/analyze safety and efficiency related conditions
  - Wireless ride quality measurement
  - Vehicle dynamics
  - Truck behavior (hunting monitoring required by FRA HSR regulations)
  - Other conditions (bearing heating, slide flats, etc) with additional sensor
- Increase safety, reduce maintenance costs

Point of Contact Information:

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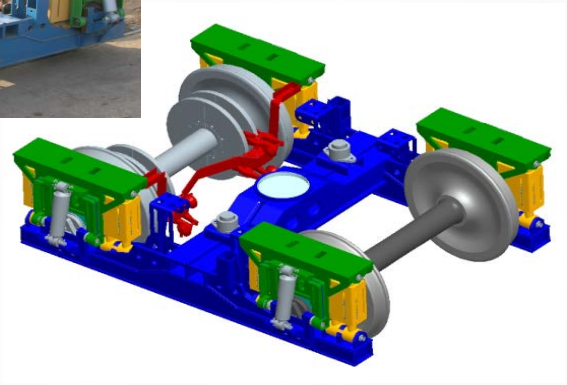
Project Partners: IEMC

U.S. Department of Transportation
Federal Railroad Administration

125 mph Freight Truck Performance Requirements and Analysis



Project Description:

- Validation of the performance of a prototype freight truck designed for 125 mph operation

Phase 1

- Define performance requirements for a 70-ton freight truck for 125-mph service
- Perform due diligence market analysis
- Perform dynamic simulations and structural FE analysis to assess performance against newly defined requirements

Future Phase (s)

- Complete high speed on-track testing to validate the truck's dynamic performance

Railroad Impact:

- Higher speed freight operations
  - 100% improvement in empty car top speeds (approx. 60 mph to 125 mph)
  - 58% improvement in loaded car top speeds (approx. 80 mph to 125 mph)
- Improved infrastructure capacity
  - Increased line-haul speeds to allow sharing of routes with higher speed passenger service
- Reduced rolling stock & track damage with improved dynamics

Point of Contact Information:

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Project Partners: Sharma & Associates, Inc.

U.S. Department of Transportation
Federal Railroad Administration

Radar Vehicle Detection System for Four Quadrant Gage Warning Systems

Railroad Impact:

- Eliminate buried loop sensors:
  - Increased safety through redundant sensors, with continuous self-checking and cross checking
  - Eliminate train delays caused by installation and maintenance of buried sensors.
  - Decreased Total Cost of Ownership, through lower cost, low maintenance, longer life sensors
- Advance warning of potential crossing obstructions over cellular and PTC communication infrastructure
  - Detect vehicles that are stores, disable or deliberately places in the crossing island.

Project Description:

- Develop and validate a non-embedded Vehicle detection radar for railroad crossing applications:
  - Exit gate management for four quadrant gate warning systems used in high speed rail.
  - Dual sensors, each with 16 separate microwave radars
- Develop a blocked crossing detection system for advance warning in high speed rail applications
  - Detection of candidate obstructions
  - Event notification and image data delivered to centralized dispatch or locomotive on-board system

Point of Contact Information:

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Project Partners: ByStep, LLC
Wavetronix, LLC

U.S. Department of Transportation
Federal Railroad Administration

Technical Challenges and Research Needs Related to Shared Corridors

Project Description:

- New high speed rail (HSR) developments in the U.S. need to address:
  - how to safely and effectively accommodate new passenger service,
  - while sustaining ongoing rail freight transportation efficiency and growth
- This project will identify and prioritize technical challenges, knowledge gaps and research needs associated with shared rail corridors

Railroad Impact:

- Identification of critical areas to address in planning new HSR systems
- Better prioritization of resources in HSR design, construction, operations and maintenance
- Supporting development of design, construction, operations, maintenance and safety standards

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Project Partners: University of Illinois, Urbana-Champaign

U.S. Department of Transportation
Federal Railroad Administration

Inclusive and Universal Design Guidelines for HSR passenger Cars: Beyond the ADA

Railroad Impact:

- HSR cars are the Intercity Public Transportation mode of the future
- HSR cars that are accessible to All passengers, including the elderly, disabled and those with strollers, and obese persons
- Set an International standard for inclusive and universal design and leverage expertise in accessible design
- Provide a new level of access and safety that coincides with operating environment of HSR

Project Description

- New Accessible Passenger Design Guidelines Handbook for HSR and stakeholder groups that:
  - Incorporates inclusive and universal designs beyond ADA regulations
  - Optimizes seat capacity and train consist access
  - Responds to changes in population demographics
  - Responds to market forces and seat revenues
  - Involves stakeholders and is based on consensus

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Project Partners: Oregon State University

U.S. Department of Transportation
Federal Railroad Administration

Field Demonstration of GeoCell Track Substructure Support System Under High Speed Passenger Railroad Operations

Railroad Impact:

- High geometry degradation locations such as weak subgrade zones expensive to maintain
- Reduction in rate of degradation will require fewer and less frequent surfacing intervention cycles.
- Lower cost of maintenance of track geometry
- Significant for all rail systems, especially high speed passenger
- Cost of track geometry maintenance is major track maintenance cost

Project Description:

•Address high track geometry maintenance areas with high maintenance intervention (surfacing) costs

•Particularly important for high speed passenger rail operations

•Demonstrate effectiveness of new generation of three-dimensional cellular confinement systems (geocells) in reducing the rate of track geometry degradation

•Comparison of geocell applications with conventional (control) section on a high speed rail line on Northeast Corridor

•Measure the improvement in extension of surfacing cycles using geocell materials

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Project Partners: Zeta-Tech. Columbia University Department of Civil Engineering, Amtrak, PRS Mediterranean

U.S. Department of Transportation
Federal Railroad Administration

Concrete Tie Degradation Study Using Machine Vision Technology

Project Description:

- The mission of this research effort is to improve the understanding of concrete tie cracking and degradation rates to facilitate the improvement of concrete tie inspection practices for high speed applications.
- Machine-vision data will be collected over test zones within Amtrak's Northeast Corridor at pre-determined intervals using existing concrete tie inspection system developed and operated by ENSCO.
- Project will focus on relating operating conditions to changing tie conditions to evaluate influence of these parameters on observed degradation/crack growth.

Railroad Impact:

- Concrete tie inspection has primarily been conducted by walking inspectors using simplified rating scales.
- Recently, machine vision based technology has been introduced to provide automated, objective assessment of concrete ties.
- Results of this study will lead to means for the railroad industry assess factors contributing to concrete tie failure, eventually leading to viable guidelines for replacement.
- Project will advance current capabilities to capture and monitor rate at which the cracks propagates to the point where the tie is considered failed.

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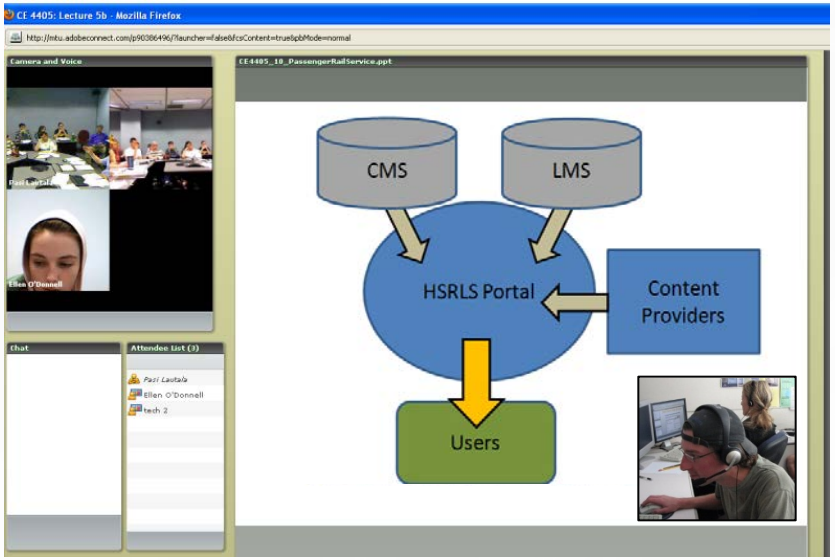
Project Partners: ENSCO, Inc.
Amtrak

U.S. Department of Transportation
Federal Railroad Administration

High-Speed Rail Workforce Development through Education and Training



Project Description

- Assessment of HSR education and training needs in the US
- HSR workforce symposium execution
- Implementation of web based proof-of-concept High Speed Rail Learning System (HSRLS)
- HSRLS system testing and evaluation

Railroad Impact

- Removal of geographical barriers to access education and training
- Increased learning opportunities to facilitate HSR expertise and culture development
- Increased HSR safety and productivity through qualified employees
- Better HSR knowledge base for domestic manufacturing development

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Project Partners: Michigan Tech. Univeristy
Mineta Transportation Institute (MTI)

U.S. Department of Transportation
Federal Railroad Administration

Developing a Reliable Method for Attaching Signal Wires to Rail

Railroad Impact:

- Signal Failures account for a number of train accidents (57)
- 22,500 broken connection reports collected as trouble code yearly. Estimated cost is $1k per incident
- Loss of signal may cause reduction of train speed and require further inspection to verify problem
- Broken stud or wire connection compromises PTC

Project Description:

- Signal Wire Stud attachment methods are currently unreliable
  - Research and develop a repeatable high integrity stud attachment process that doesn't affect the rail
  - Welded to guarantee high strength
  - Design for easy replacement
  - Ensure solution does not create a corrosion issue
  - Equipment – portable and operator independent
- Test solutions of resonant fatigue stand to rapidly accrue loading cycles

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Project Partners: Edison Welding Institute (EWI)

U.S. Department of Transportation
Federal Railroad Administration

Mitigation of Differential Movement at Railway Transitions

Uzarski (2010)

Hyslip et al. (2009)

Project Description

- Field investigations, instrumentation, monitoring of selected sites to isolate root cause(s) of differential movement. Amtrak, UP, N-S.
- Modeling of sites and development of alternative design and construction techniques for mitigating differential movement at new transitions

Railroad Impact:

•Developing innovative approaches to track design and repair that improves high speed ride quality, mitigates differential movement, and reduces vehicle/track interaction forces

• Evaluating alternative techniques such, as slab track, ballast-less track, and other designs that may reduce capital and/or maintenance costs or better manage mixed use track demands

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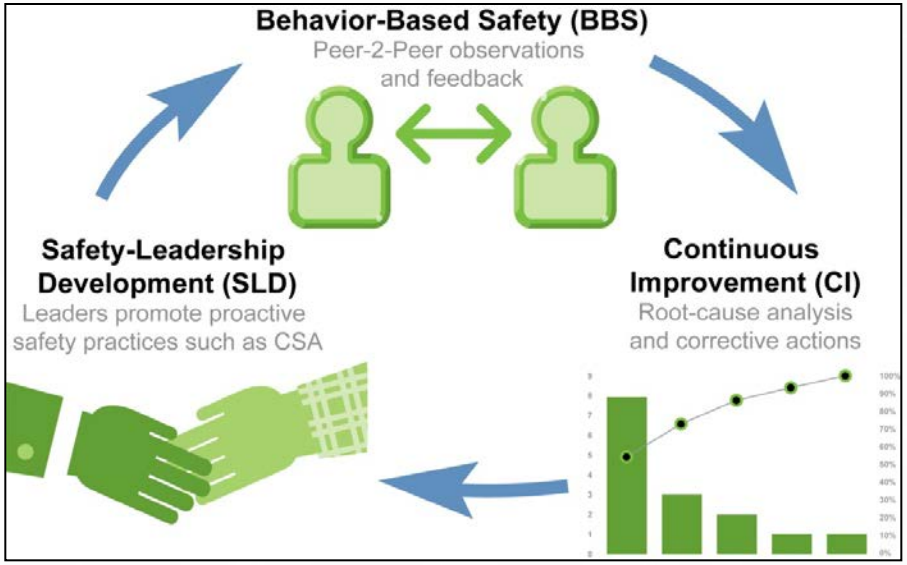
Project Partners: University of Illinois, Urbana-Champaign, Amtrak, UP, NS, Hyground Engineering, GeoPier Foundation Company, Nicholson Construction, Tensar International, Inc.

U.S. Department of Transportation
Federal Railroad Administration

Improving Safety Culture in Intercity Railroads



Railroad Impact:

- If applied, 30-80% improvement in HF incidents
- Improved safety, safety culture, and overall reduced transportation costs
- Reduced distraction
- Improved situation awareness
- Improved safety culture
- Non-proprietary materials reduces cost of implementation, encouraging use
- Broad application and potential use for all high-speed and intercity railroads

Program Description

- Design, develop, and implement safety culture training program for high-speed and/or intercity rail , building on highly successful safety culture program for freight operations
- Use *non-proprietary,* low cost safety materials
  - Scalable, transferable for broad industry-wide applications. Includes training materials and software application (root-cause analysis problem solving)
- Industry Steering Committee guides program development
- Pilot the program in high speed or intercity railroad, evaluate
- Compile lessons learned and revise training materials
- Plan for launch across all intercity railroads , and expand to high speed operations

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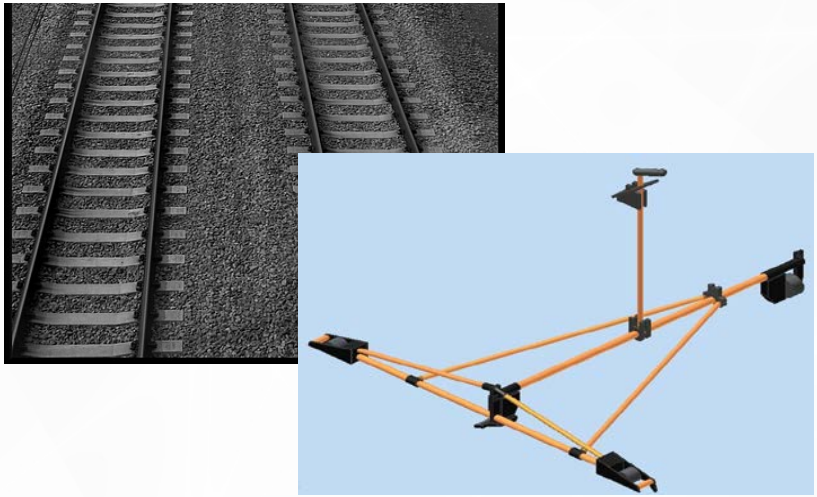
Project Partner: Volpe

U.S. Department of Transportation
Federal Railroad Administration

Long Chord Length Portable Track Geometry Measurement System for High-Speed Rail



Railroad Impact:

- Current portable geometry measurement systems cannot provide MCO information at chord lengths applicable to high speed operations.
- Proposed effort would advance state-of-the-art of portable geometry measurement platforms to facilitate assessment of maintenance/construction activities related to high speed and passenger route improvements.
- Resulting technology would also benefit derailment investigations.
- End user product cost estimated to be $70K.

Project Description:

- Under this project, a new Portable Track Geometry Measurement System (PTGMS) will be developed, constructed and demonstrated.
- Trolley-based system would measure gage, cross-level, profile and alignment mid-chord offsets (MCO) for chords up to 124 feet in length as well as half rail profile contours
- The system will be capable of collecting measurements over short measurement bases and extrapolating results to longer chords lengths to provide geometry parameters associated with high speed applications.
- System would include GPS to provide accurate location information.
- System would be designed to facilitate convenient shipment for use throughout the country.

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Project Partners: ENSCO, Inc.