

FRA/Volpe Center Highway-Rail Grade Crossing Safety and Trespass Prevention Research Program

*Sponsored by the FRA Office of Research, Development, and Technology
Train Control & Communications Division*

**2015 National Highway-Rail Grade
Crossing Safety Training Conference**



November 4, 2015



FRA/Volpe Center Highway-Rail Grade Crossing Safety and Trespass Prevention Research Program

Goal

- ❑ Partner with FRA to analyze crash causation and develop safety countermeasures, programs, and guidance to reduce the number of casualties at grade crossings and along railroad rights-of-way.
- ❑ Contribute to reduction of casualties on railroad rights-of-way by developing, demonstrating and evaluating new technologies and strategies that increase safety along rail rights-of-way.

Research Method

- ❑ Research the root cause of incidents and fatalities
- ❑ Engage Stakeholders
- ❑ Identify corrective actions
 - Engineering, Enforcement, Education
- ❑ Deploy and evaluate solutions



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Grade Crossing Research Projects

Project	Status
<i>LED-enhanced Grade Crossing Traffic Signs</i>	Completed
<i>Engineering Design for Pedestrian Safety</i>	Completed
<i>Dynamic Envelope Zone Research</i>	Ongoing
<i>Pedestrian Gate Skirts</i>	Ongoing
<i>Development of Training Aids</i>	Ongoing
<i>Active Train Detection at Dark Crossings</i>	New (initiated 2015)
<i>In-pavement Grade Crossing Lights</i>	New (initiated 2015)
<i>Law Enforcement Strategies for Grade Crossing Safety</i>	New (initiated 2015)
<i>Vehicle ROW Incursion Prevention</i>	New (initiated 2015)
<i>Motorist Behavior Modeling</i>	New (initiated 2015)

LED-Enhanced Grade Crossing Traffic Signs

Project Description:

- Conduct research into effectiveness of LED enhanced grade crossing signs – currently being used by BNSF and explored for use by Vermont DOT.
 - Potential to be a low-cost safety enhancement to increase driver awareness at passive crossings
- Review current technology, assess potential safety benefits, conduct demonstration and evaluate effectiveness.
 - Proposed replacement of W10-1 and R15-1 signs with LED-enhanced versions



<http://www.campbelltech.net/company/>

Current Status:

- Research has been completed. Final report currently under FRA review.
- Technical presentation available at <http://railtec.illinois.edu/GLXS/presentations/B/11B3-GLXS2014-1083-HELLMAN.pdf>



Location: Lakewood Dr, Swanton, VT
Source: Volpe Center

Project Partners: FRA/Volpe Center, Vermont Department of Transportation, New England Central Railroad (NECR), Town of Swanton, VT

LED-Enhanced Grade Crossing Traffic Signs

Effect of Centerline on Nighttime Speeds

Baseline VS LED Crossbuck Sign- Nighttime							
Detector Name	Distance from Crossing (feet)	Baseline Mean Speed (mph)	LED XBuck Mean Speed (mph)	$\bar{x}_{BL} - \bar{x}_{XB}$	t-value	p-value	Significant*
Detector 1	202.5	32.97	30.02	2.95	3.651	< 0.001	YES
Detector 2	137.5	30.55	27.46	3.09	4.003	< 0.001	YES
Detector 3	72.5	27.56	24.24	3.32	4.242	< 0.001	YES
Detector 4	12.5	24.92	22.03	2.89	3.786	< 0.001	YES

*Significant at 95% Confidence Level

LED Crossbuck Sign Before and After Centerline (CL) - Nighttime							
Detector Name	Distance from Crossing (feet)	Pre-CL Speed (mph)	Post CL-Mean Speed (mph)	$\bar{x}_{Pre-CL} - \bar{x}_{Post-CL}$	t-value	p-value	Significant*
Detector 1	202.5	30.02	31.97	-1.95	-1.915	> 0.05	NO
Detector 2	137.5	27.46	29.38	-1.92	-1.960	0.05	YES
Detector 3	72.5	24.24	26.62	-2.37	-2.406	< 0.02	YES
Detector 4	12.5	22.03	24.79	-2.76	-2.913	< 0.01	YES

*Significant at 95% Confidence Level

Engineering Design for Pedestrian Safety

Project Description:

- Research on practical and cost-effective engineering design solutions such as pedestrian channelization techniques currently employed on the rail system that will enable railroads to mitigate pedestrian crossing hazards.
- The result will be the development of recommendations or guidelines on the use of such solutions.

Current Status:

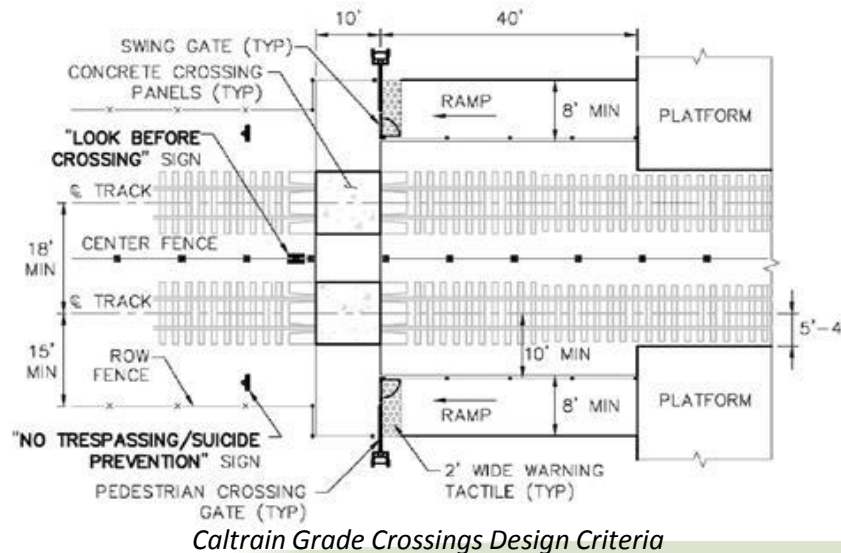
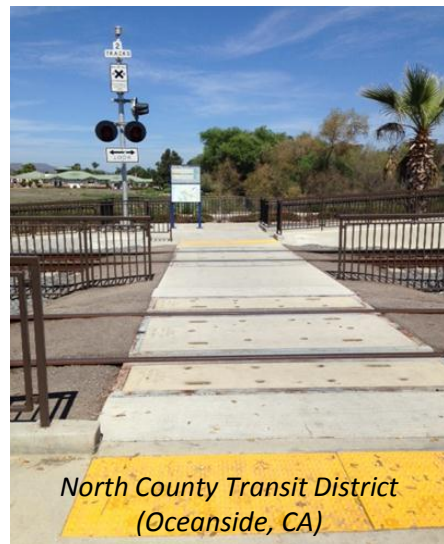
- Research has been completed. Final report currently under FRA review.

Project Partners: FRA/Volpe Center



Engineering Design for Pedestrian Safety

- Literature Review
 - Individual treatments are used alone or in combination as determined by engineering site analysis.
 - Little is known about the efficacy of any individual treatment.
- Recommendations Report
 - Research needed for before and after data of installation of individual or combinations of treatments for measure effectiveness of treatments or combinations of treatments.



Dynamic Envelope Zone Research - Pavement Markings

Commercial Blvd, Ft Lauderdale, FL

Project Description:

- Evaluate effectiveness of pavement markings in reducing instances of stopped vehicles within the grade crossing dynamic envelope zone.
- Select pavement markings pattern and test location. Field-test, driver behavior data collection (pre/post), and document results.
 - Pattern and test location pre-selected by FL DOT
- Follow-on research funds for large-scale implementation and evaluation.



Project Partners:



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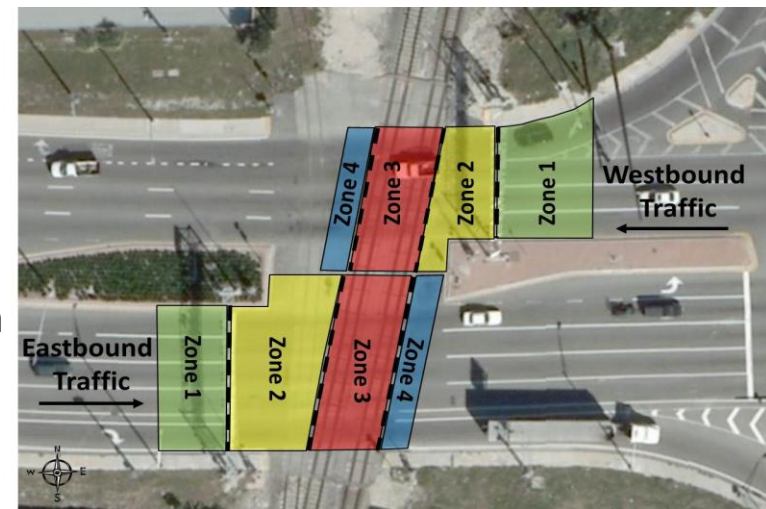
Project History/Status

- Project initiated in July 2013
- Site selected: grade crossing on Commercial Boulevard in Ft. Lauderdale, FL
 - Pre-installation data May 23-June 5, 2012
 - Markings Installed week of December 9, 2012
 - Post-Installation data Jan 6-19, 2013 (short-term evaluation)
 - Post-Installation data Feb-Mar 2015 (long-term evaluation)
- Short-term effectiveness study completed in 2014 – Final Report available at <https://www.fra.dot.gov/eLib/details/L04994>



Findings

- A 45% reduction in the number of vehicles stopped in Zone 3 (on tracks) eastbound and 15% reduction for westbound after installation
 - An increase in vehicles stopping in Zone 1 (behind the stop line) after installation
 - A reduction in the number of gate violations (both descending and horizontal) after installation
-
- Long-term evaluation currently underway, and results expected in Fall 2015



Pedestrian Gate Skirts

Project Description:

- To evaluate a specific type of pedestrian gate enhancement, commonly known as gate skirts and designed to prevent pedestrians from violating the grade crossing while the grade crossing protection systems are activated.
- This new task in New Britain, CT (grade crossing at Robert Loughery Way, New Britain, CT - Crossing ID 500950A) will build on the lessons learned from the previous task that evaluated a gate skirt installation on New Jersey Transit (NJT) in Matawan, NJ.

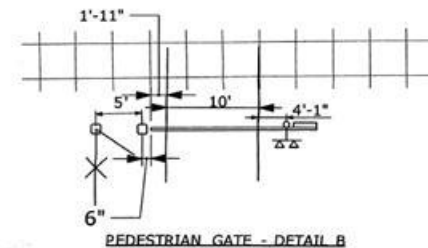
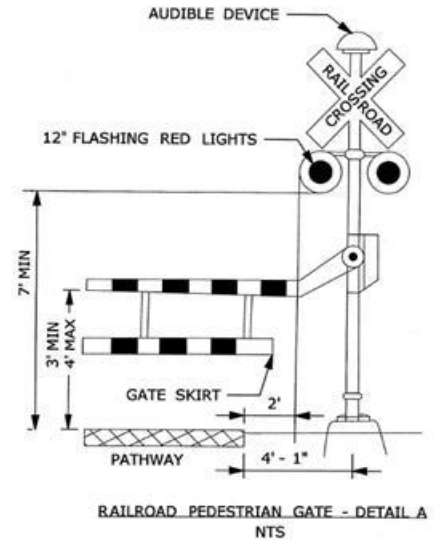
Current Status:

- Baseline Data collection (March 2015 – September 2015)
- Material Installation (October 2015)
- Post data collection (November 2015 -)

Upcoming Milestones/Deliverables:

- Final analysis & technical report (Spring/Summer 2016)

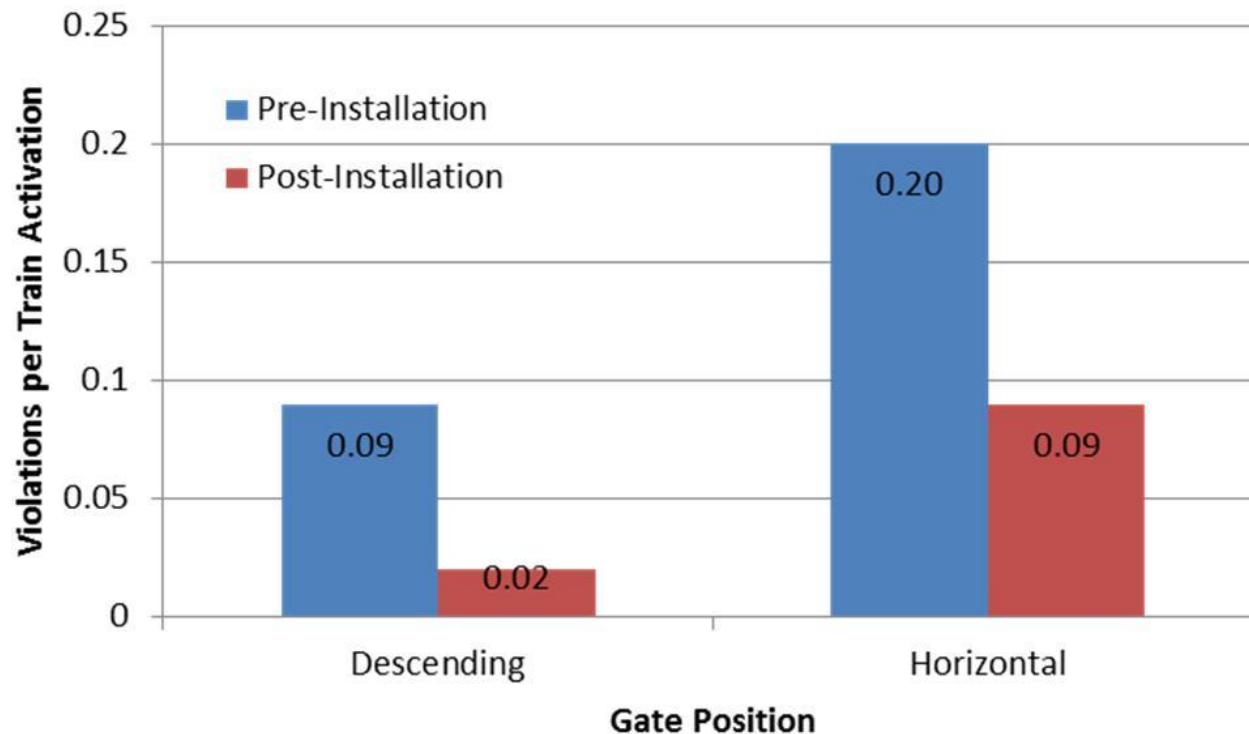
Project Partners: FRA/Volpe Center, ConnDOT, Pan Am Railways



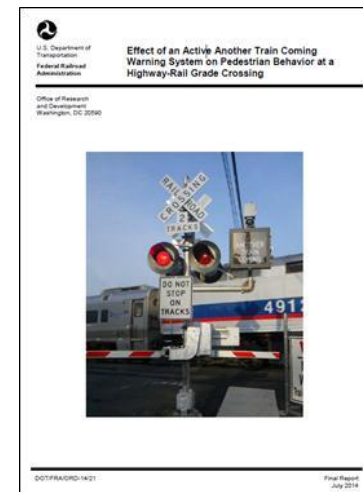
Pedestrian Gate Skirts – Results from NJT Installation

Violation Rate Per Activation Pre- and Post-Installation

55% reduction in horizontal gate violations



Final report available at <http://www.fra.dot.gov/eLib/details/L04898>



Development of Training Aids

Project Description:

- To identify and research current best practices and effective initiatives used by law enforcement organizations in areas where there exists a high degree of public awareness and compliance with railway trespassing laws.
- This study will identify areas where public compliance with rail safety laws is high and research enforcement factors that may have contributed to the success. The results will be disseminated to rail safety stakeholders.

Current Status:

- Steering Committee established and meeting periodically
- Preliminary training requirements and target audience identified: 10th to 12th graders; address grade crossing and trespasser sub-modules; preliminary list of scenarios; gamification; need to run on mobile devices and computers.
- Gamification: Modeled on OLI Railroad Safety for Professional Drivers, OLI Railroad Safety for School Bus Drivers, E-learning Challenge
- Statement of Work (SOW); received committee review and concurrence
- App Development Contract awarded

Upcoming Deliverables:

- Develop education module (Summer 2016)

Project Partners: FRA/Volpe Center/Operation Lifesaver (OLI)



Active Train Detection in Dark Territories (new)

Project Description:

- For research to develop (or evaluate) a cost-effective active train detection and grade crossing warning system for the dark territory corridors. The focus of this research is the passive grade crossings in dark territory corridors owned by Class I railroads that are designated for PTC.
- A detailed analysis of these crossings will be performed to determine the magnitude of parameters such as rail traffic, highway traffic, and accident risk. Since the deployment of PTC in dark territory may increase the capacity of these corridors, many of these currently passive grade crossings may experience an increase in risk and require more protection than offered by current warning systems.

Current Status:

- Passive public grade crossings analysis initiated. This project was initiated in February 2015.

Project Partners: FRA/Volpe Center



Law Enforcement Strategies/Recommendations to Improve Highway-Rail Grade Crossing Safety (new)

Project Description:

- To identify communities and organizations implementing successful initiatives that are focused on the enforcement of traffic safety laws and precautions at highway-rail grade crossings.
- The researchers will document examples of law enforcement efforts to improve highway-rail grade crossing safety through a literature review and outreach to stakeholders. In an effort to have the strategies and initiatives accepted by the law enforcement community, a working group will be constructed that will include members of law enforcement and rail safety stakeholders. The working group will be responsible for reviewing project artifacts and contributing to the task deliverables.
- Research team will also explore opportunity for a grant pilot program with law enforcement agencies.

Current Status:

- This project was initiated in May 2015. Currently working on development of law enforcement working group.

Project Partners: FRA/Volpe Center



Vehicle ROW Incursion Prevention (new)

Project Description:

- To perform a comprehensive literature review of relevant research and implementation studies of interventions to prevent vehicle incursions into railroad rights-of-way. In the same time, researchers will perform an in-depth analysis of recent relevant incidents and attempt to characterize the typical incident, if possible. There may be an opportunity to partner with a State DOT, major transit agency, and/or other DOT modal administrations to implement and evaluate a specific intervention.

Current Status:

- This project was initiated in May 2015. Currently conducting literature review and incident data analyses.

Project Partners: FRA/Volpe Center



In-pavement Grade Crossing Lights (new)

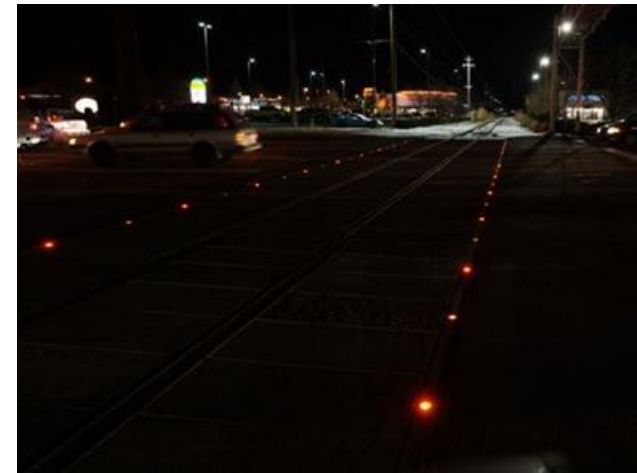
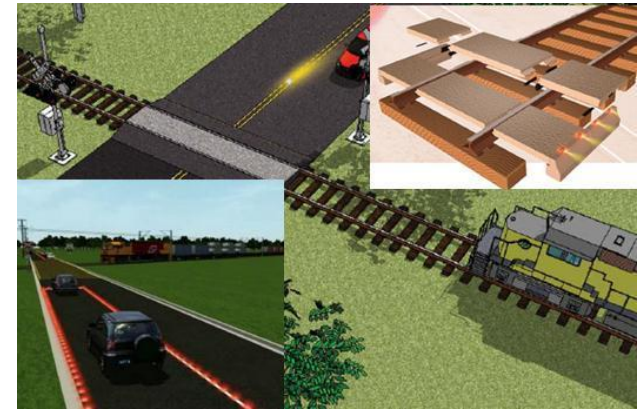
Project Description:

- For research to review past and current prototype and demonstration of LED in-pavement warning lights, and include an evaluation of the potential applicability and effectiveness of this type of crossing enhancement technology. A technology will be selected and field-tested in an operational environment. Data on vehicle compliance, both before and after the implementation of the selected technology, will be collected and analyzed.

Current Status:

- This project was initiated in March 2015. Literature review and vendor outreach underway. Continued efforts to identify/select technology for evaluation.

Project Partners: FRA/Volpe Center



Anti-Trespass Guards Evaluation

Project Description:

- To review, select, and evaluate emerging technologies and application for railroad right-of-way trespass application, specifically anti-trespass guards or landscaping rock treatments. New technologies or approach to mitigate the trespass problems, such as anti-trespass guards currently operational in Europe and the use of rock ballast at the ends of platform and at grade crossings, will be investigated for possible demonstration at trespass prone locations.



Current Status:

- Data collection and analysis complete at 3 locations on A&M Railroad (Arkansas)
- Site selected (Dixon St Crossing, Fayetteville, AR)
- Baseline data collected, material obtained by RR and installed on 6/2/15

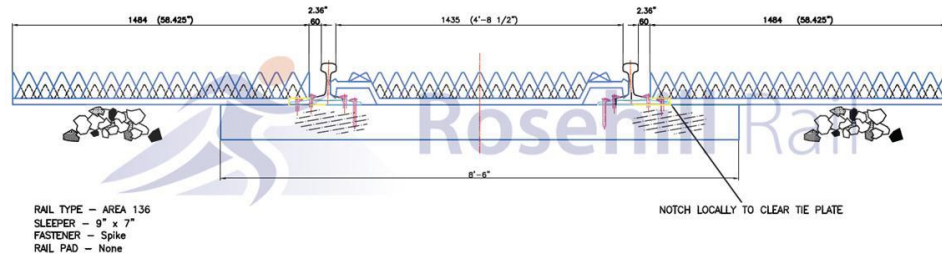
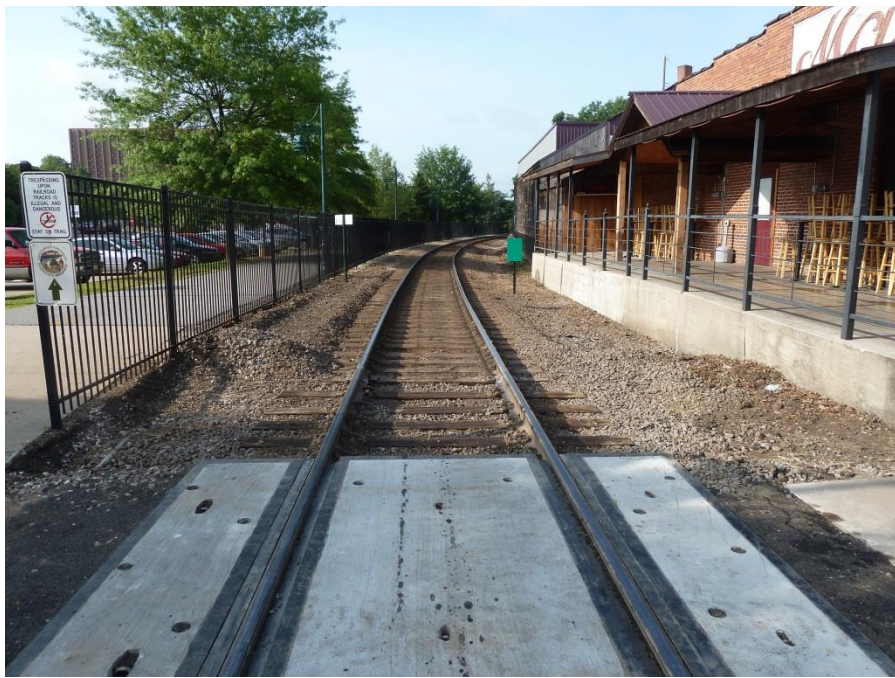
Upcoming Deliverables:

- Post data collection (December 2015)

Project Partners: FRA/Volpe Center, A&M Railroad, CTC Inc.



Installation for Dickson Street Crossing - South



Grade Crossing Simulator Efforts



Project Description:

- Empirically test FRA's model of motorist behavior at grade crossings regarding violations and train arrival time (Raslear, 2015)
- Use the Volpe driving simulator to test the theory that motorist stopping behavior depends critically on the variability of the expected train arrival time rather than mean expected train arrival time.

Railroad Impact:

- Improved understanding of why motorists may choose to violate active warning devices at grade crossings; which can then be used to develop more effective countermeasures

Current Status:

- Pilot test design completed
- Piloting participants now
- Preparing OMB paperwork for complete study

Suicide Mitigation Efforts



Project Description:

- Developed report detailing current evidence about the effectiveness of proposed rail suicide countermeasures (DOT/FRA/ORD-14/36)
- Use report findings to explore pilot projects with interested rail carriers. These projects will provide real world evidence of the impact of these countermeasures
- Develop recommendations to improve the media's reporting of rail trespass and suicide incidents to mitigate potential copycat incidents
- Analyze available rail suicide data to understand the population most at risk to tailor mitigation strategies to be most effective
- Coordinate with international community through the Global Railway Alliance for Suicide Prevention (GRASP) to improve best practices in the US

RECOMMENDATIONS FOR REPORTING ON SUICIDE®

Developed in collaboration with: American Association of Suicidology, American Foundation for Suicide Prevention, Annenberg Public Policy Center, Associated Press Managing Editors, Canterbury Suicide Project • University of Otago, Christchurch, New Zealand, Columbia University Department of Psychiatry, ConnectSafely.org, Emotion Technology, International Association for Suicide Prevention Task Force on Media and Suicide, Medical University of Vienna, National Alliance on Mental Illness, National Institute of Mental Health, National Press Photographers Association, New York State Psychiatric Institute, Substance Abuse and Mental Health Services Administration, Suicide Awareness Voices of Education, Suicide Prevention Resource Center, The Centers for Disease Control and Prevention (CDC) and UCLA School of Public Health, Community Health Sciences.

IMPORTANT POINTS FOR COVERING SUICIDE

- More than 50 research studies worldwide have found that certain types of news coverage can increase the likelihood of suicide in vulnerable individuals. The magnitude of the increase is related to the amount, duration and prominence of coverage.
- Risk of additional suicides increases when the story explicitly describes the suicide method, uses dramatic/graphic headlines or images, and repeated/extensive coverage sensationalizes or glamorizes a death.
- Covering suicide carefully, even briefly, can change public misperceptions and correct myths, which can encourage those who are vulnerable or at risk to seek help.

Current Status:

- Various pilot efforts underway (e.g., signage evaluation) and others planned
- Analysis of current media reporting practices underway – recommendations document will be developed based on results
- Review and analysis of demographics and characteristics surrounding reported rail suicides underway

Project Partners: FRA, Volpe, AAR, George Washington University (GWU), Metrolink, Caltrain, Keolis, Metra

Current Program Partners



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U.S. Department of Transportation
Federal Highway Administration



U.S. Department of Transportation
Federal Motor Carrier Safety Administration



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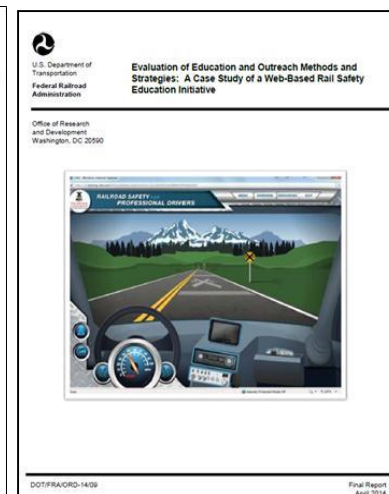
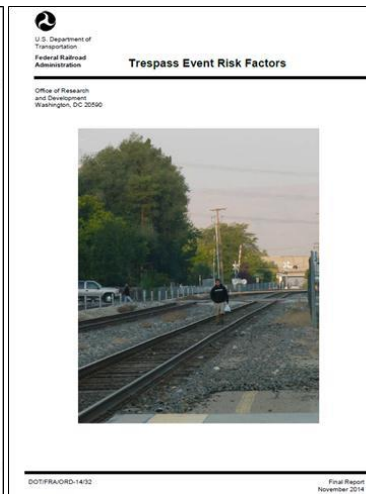
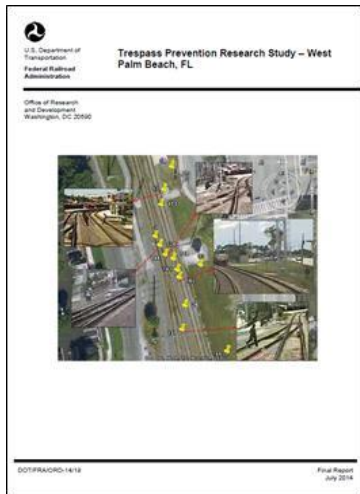


NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY



Published Reports (April 2014-April 2015)

- **Evaluation of Education and Outreach Methods and Strategies – A Case Study of a Web-Based Rail Safety Education Initiative** (DOT/FRA/ORD-14/09), April 2014
- **Effect of Dynamic Envelope Pavement Markings on Vehicle Driver Behavior at a Highway-Rail Grade Crossing** (DOT/FRA/ORD-14/04), April 2014
- **Trespass Prevention Research Study – West Palm Beach, FL** (DOT/FRA/ORD-14/19), July 2014
- **Effect of an Active Another Train Coming Warning System on Pedestrian Behavior at a Highway-Rail Grade Crossing** (DOT/FRA/ORD-14/21), July 2014
- **Trespass Event Risk Factors** (DOT/FRA/ORD-14/32), November 2014





Highway-Rail Grade Crossing and Trespass Prevention Research Program

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