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Federal Railroad Administration

2017 Grade Crossing Research Needs Workshop

Office of Research,
Development
and Technology
Washington, DC 20590

DOT/FRA/ORD-19/05

Final Report
March 2019

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13. ABSTRACT (Maximum 200 words)

In August of 2017, the Federal Railroad Administration (FRA) held the fourth Highway-Rail Grade Crossing Safety Workshop in St. Louis, MO. The workshop brought together national and international subject matter experts to collaborate, identify, and prioritize specific research needs. The attendees included representatives of Federal, State, and local governments as well as railroad, labor unions, academia, non-profit organizations and consultants. Workshop participants identified and shared existing best practices and explored new strategies that the rail industry can adopt to reduce the number of highway-rail grade crossing incidents and fatalities. The conference agenda covered five topic areas: Engineering/Technologies, Human Factors, Community Outreach/Education, Enforcement, and Hazard Management. The workshop format consisted of a general session with informative presentations and breakout sessions for each topic area. The ideas generated were shared with the entire group of attendees in a wrap-up session. This report documents the results. This workshop continued the conversation from the 2009 Third Research Needs Workshop on Highway-Rail Grade Crossing Safety and Trespass Prevention.

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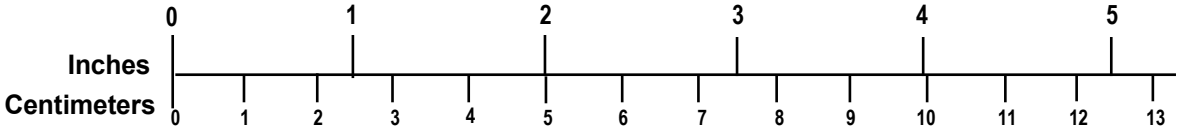

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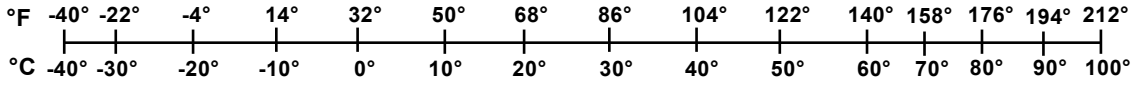

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The authors also wish to extend special thanks to the Steering Committee members for their partnering contributions to the successful planning and conduct of this research-needs workshop. The Steering Committee members are as follows:

Staff Members	Agency/Organization
Debra Chappell	FRA
Marco daSilva	Volpe Center
Frank Frey	FRA
Michail Grizkewitsch	FRA
Ryan Gustin	CSXT
Starr Kidda	FRA
Tarek Omar	FRA
Ron Ries	FRA
Robert Rohauer	CSXT

The authors also wish to thank the team of FRA and the Volpe Center staff assigned to the Workshop Support Group. They provide back up if needed, and to help the Steering Committee implement the workshop.

Staff Members	Agency/Organization
Leonard Allen	Volpe Center
Carolyn Cook	FRA
Lou Frangella	FRA
Scott Gabree	Volpe Center
Norma Griffiths	FRA
Mirna Gustave	Volpe Center/iBiz
James Harrison	Volpe Center
Suzanne Horton	Volpe Center
Bernard Kennedy	Volpe Center
Tiffany Lindemann	FRA

Staff Members	Agency/Organization
Kelly Morton	Federal Highway Administration
Tashi Ngamdung	Volpe Center

Leonard Allen, Chief, Systems Safety and Engineering Division, DOT's Office of Assistant Secretary of Research and Technology (OST-R) at the John A. Volpe National Transportation Systems Center (Volpe Center), provided managerial direction and support for the workshop. Marco daSilva, Highway-Rail Grade Crossing and Trespass Research Program Manager, Systems Safety and Engineering Division, Volpe Center, provided overall direction for the workshop. James Harrison, Senior Transportation Industry Analyst, Systems Safety and Engineering Division, Volpe Center, provided project management and implementation oversight.

The authors also wish to thank and acknowledge the contributions of all participants for their part in the successful development of new or expanded initiatives, strategies, programs, and new research projects.

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Executive Summary

From August 15–17, 2017, the Federal Railroad Administration (FRA) sponsored the fourth Grade Crossing Research Needs Workshop in St. Louis, MO, with the U.S. Department of Transportation's (DOT) Office of Research and Technology (OST-R), and the John A. Volpe National Transportation Systems Center (Volpe Center) personnel in attendance.

The 2009 Third Research Needs Workshop on Highway-Rail Grade Crossing Safety and Trespass Prevention [1] was the format used for this report, as well as written to retain the interest of the public and the railroad industry.

The workshop had two main goals:

1. Provide FRA and key stakeholders with an update of current and future activities in grade crossing incident prevention.
2. Solicit new ideas from the workshop attendees on prospective new or expanded initiatives, strategies, programs, and research projects.

These goals were achieved by bringing together subject matter experts (SMEs) to share information, collaborate, identify, and prioritize specific recommended actions related to education, engineering, and enforcement (Three Es) to facilitate the reduction of railroad and transit right-of-way (ROW) grade crossing incidents and fatalities.

To assist with the planning and direction of the workshop, the formation of a Steering Committee, based on FRA nominations of leaders of various DOT agencies and their key partnering organizations (both public and private), addressed different perspectives of highway-rail grade crossing safety.

The Steering Committee developed the technical agenda and identified five topic areas, selected appropriate speakers, and actively participated in the execution of the workshop. The five topic areas were:

- Engineering/Technologies
- Human Factors
- Community Outreach and Education
- Enforcement
- Hazard Management

A total of 149 delegates attended the 2½-day workshop. They included representatives from Federal, State, and local governments, as well as railroads, transit agencies, law enforcement (railroad and non-railroad), academia, nongovernmental organizations, and consultants.

The workshop commenced with a welcome address by Heath Hall, former Deputy Administrator of FRA and he thanked all the participants for attending on behalf of the DOT Secretary Elaine

[1] Third Research Needs Workshop on Highway-Rail Grade Crossing Safety and Trespass Prevention, accessed on January 29, 2018.

Chao. He challenged workshop participants to make the next decade the safest ever by embracing innovation that leads to new technologies, greater knowledge and increased public awareness to reduce and eliminate potential injuries and deaths. For the full keynote address, visit FRA's website.

On the first day, speakers made presentations on the first three of the five research areas identified by the Steering Committee: Session 1, Engineering/Technologies; Session 2, Human Factors; and Session 3, Community Outreach and Education. Speakers delivered nine technical presentations covering these three topic areas.

On day two, the remaining two topic areas: Session 4, Enforcement; and Session 5, Hazard Management were covered in seven presentations.

The second day also concluded with five working group breakout sessions. The work groups were asked to come up with ideas including new or expanded initiatives, strategies and programs, in addition to new research projects.

In effect, the work groups were asked by the Steering Committee to "think out of the box," and produce outcomes based on:

- Consideration of alternatives based on public interest
- Focusing on ideas that are not necessarily based on current and/or potential conventions or standards, needs, and perceptions
- Consideration of possible research projects with different procedures, innovative technologies, new participants, and a shift in responsibilities

The participants developed more than 100 ideas during the 5 breakout sessions. Each group brainstormed many potential project ideas for each topic area. A discussion of proposals and as a result, the creation of flip charts occurred. Each group identified the top three to five project proposals. This vetting process resulted in the identification of the top 22 recommended actions across the 5 topic areas. A presentation to the entire group occurred in the "Working Group Summaries of Top Research Needs" session and Table 1 shows this.

The remaining 80 potential actions that did not make the short list nevertheless provided some valuable discussions and considerations of the full spectrum of issues. Table 9 presents these additional recommendations.

Table 1. Top 22 Recommended Actions Developed

TOPIC AREA	ACTION	TITLE
1. Engineering/Technologies	1	Wireless Technology for Crossing Aviation
	2	Research and Develop V2V and V2I to Inform, Warn, and Force Stop Motor Vehicles
	3	Research Alternative RR Warning Devices
	4	Intelligent Traffic System Application for More Vehicles
	5	Research Vehicle Activated Enhanced Advanced Warning Sign
2. Human Factors	1	Improve Close Call/Near Miss Reporting (People or Vehicle Strike)
	2	Integration of Rail Safety Messages into Driver Education and Licensing
	3	Incorporating Rail Safety People into Development/Planning Process
	4	Educate Youth to Educate Adults
3. Community Outreach and Education	1	Trespasser Identification, Motivation and Messaging
	2	Research into the Efficacy of Social Media Platforms and Messages
	3	Driver Education (General and Commercial Drive License)
	1	Technology Opportunities for Law Enforcement
4. Enforcement	2	Funding Opportunities for Law Enforcement
	3	Uniformity of Highway-Railroad Grade Crossing Laws
	4	Development of National Highway-Railroad Grade Crossing Law Enforcement Campaign
	5	Closure of Highway-Railroad Grade Crossings
5. Hazard Management	1	Additional Train Approaching Warning System
	2	Grade Crossing Hazard Matrix
	3	Model Communication Process
	4	Enhanced Data Exchange Between Vehicle Control
	5	Updating Evaluation Tools for Rail/Highway Grade

FRA hopes that DOT modal administrations and their stakeholders to enhance safety on the Nation's rail transportation network will use this workshop. Given the track record of the previous workshops, this is certain to be the case.

The workshop was successful, based on evaluations and comments made during the sessions. A total of 87 out of the 149 total attendees (58 percent) responded to the survey (included in Appendix B) which was issued after the workshop. The results were as follows:

- 94% very or extremely satisfied with registration process
- 88% very or extremely satisfied with the presentations
- 95% very or extremely satisfied with the session structure
- 94% very or extremely satisfied with breakout session/discussion (81% at the 2015 trespass workshop)
- 99% very or extremely satisfied with workshop staff (the other 1% left this blank)
- 86% very or extremely satisfied with conference location and facilities
- 99% very or extremely satisfied with overall quality of the workshop
- 98% responded yes to "workshop met your expectations"
- 49% recommended these types of workshops be held at least every 2–3 years (44% every year, 6% every 5 years)

Presentations and ancillary documents from the workshop are available on FRA's website.

1. Introduction

In 2009, the Federal Railroad Administration (FRA) sponsored the Third Research Needs Workshop on Highway-Rail Grade Crossing Safety and Trespass Prevention[2] by bringing together multiple rail constituents from transit, freight, and commuter rail to focus on common problems and solutions surrounding grade crossing safety. Delegates from various organizations and government agencies attended. Based on the success of FRA's 2009 workshop, FRA sponsored the fourth 2017 Grade Crossing Research Needs Workshop held on August 15–17, 2017, in St. Louis, MO. Figure 1 shows a snapshot of the workshop in action.

Figure 1. Technical Panel and Attendees at a Workshop Session

As with the 2009 sessions, the 2017 workshop consisted of a varied program presented by rail and transit experts and other safety professionals who shared their ideas on key issues; best practices; technical developments; human behavior; law enforcement; public education awareness outreach methods; and techniques related to rail grade crossing safety. The workshop encouraged the 149 attendees (representing Federal, State, and local governments, freight and passenger railroads, transit agencies, labor unions, academia, nonprofit organizations, and consultants) to discuss advances, accomplishments, challenges, and approaches related to rail grade crossing issues. The result was an open exchange of ideas, an opportunity to network with peers, a showcase of the newest and best safety-related applications, and a discussion of future recommended actions. The participants concluded by developing a list of 22 high-priority recommended actions across 5 topic areas discussed in Section 3.3: Engineering/Technologies, Human Factors, Community Outreach and Education, Enforcement, and Hazard Management.

[2] The 2009 Third Research Needs Workshop on Highway-Rail Grade Crossing Safety and Trespass Prevention.

The first 2 days of the workshop included technical presentations by representatives of various organizations on railroad and transit right-of-way (ROW) trespass issues corresponding to the five topic areas identified above.

On day two, five working group breakout sessions identified potential new or expanded initiatives, strategies, and programs across the range of the topic areas to reduce highway/rail grade crossing incidents and fatalities.

Following the breakout sessions, session leaders compiled the top 22 recommendations; workshop support staff then created a master presentation detailing all the recommendations.

Day three consisted of a session reporting out on each working group's top recommendations, followed by one final presentation, and capped by closing statements.

This report documents the purpose, process, analyses, and results of the workshop. FRA's website provides additional supporting information on the workshop agenda, discussions, presentations, correspondence, and forms.

1.1 Background

Highway-rail grade crossing incidents are the second-leading cause of rail-related deaths in the U.S. In 2016, over 2,000 grade crossing incidents resulted in 263 fatalities and 832 injuries across the nation's roughly 212,000 grade crossings.[3]

1.2 Project Objectives/Goals

The purpose of the 2017 workshop was to:

1. Identify and share existing industry-leading practices and explore new strategies that the rail industry could pursue to reduce the number of rail grade crossing incidents and fatalities.
2. Bring together subject matter experts (SMEs) to share information, collaborate, identify, and prioritize specific recommended actions to facilitate the reduction of rail grade crossing incidents and fatalities.

The session resulted in a collaborative effort to identify and prioritize specific research needs related to engineering/technologies, human factors, community outreach and education, enforcement, and hazard management for incorporation into the strategic vision of FRA, other U.S. Department of Transportation (DOT) modes, and their stakeholders.

1.3 Overall Approach

The formation of a Steering Committee occurred to develop the technical agenda, including the identification of five topic areas, selecting appropriate speakers, and actively participating in the execution of the workshop.

On the first day, speakers made presentations on the first three of the five research areas identified by the Steering Committee: Session 1, Engineering/Technologies; Session 2, Human

[3] FRA's Office of Safety Analysis website.

Factors; and Session 3, Community Outreach and Education. Speakers provided nine presentations covering these three topic areas. During the second day of the workshop, seven presentations covered the remaining two topic areasSession 4, Enforcement and Session 5, Hazard Management. The second day concluded with five working group breakout sessions. The work groups produced ideas on new or expanded initiatives, strategies and programs, and new research projects. The third day focused on reporting the top recommendations from the breakout groups.

1.4 Scope

The scope of this workshop covers highway-rail grade crossing safety and trespass prevention research.

1.5 Organization of the Report

- Section 2 presents information about the workshop structure.
- Section 3 describes the breakout group sessions and recommended actions derived from those sessions.
- Section 4 describes the final day of the workshop.
- Section 5 provides the final thoughts of the workshop.

2. 2017 Grade Crossing Research Needs Workshop

The 2 ½-day workshop brought together national and international SMEs to collaborate with participants to identify and prioritize specific research needs. The attendees included representatives of Federal, State and local governments, as well as railroad, labor unions, academia, non-profit organizations and consultants. Workshop participants identified and shared existing best practices and explored new strategies that the rail industry can adopt to reduce the number of highway-rail grade crossing incidents and fatalities.

2.1 Overall Workshop Structure

To assist in determining the structure and direction of the workshop, FRA nominated a Steering Committee to address different perspectives of highway-rail grade crossing safety. Members of the committee included leaders of various DOT agencies and their key partnering organizations (both public and private), as indicated in Table 2.

Table 2. Steering Committee Members

Name	Agency/Organization
Debra Chappell	FRA
Marco DaSilva	Volpe Center
Frank Frey	FRA
Michail Grizkewitsch	FRA
Ryan Gustin	CSXT
Starr Kidda	FRA
Tarek Omar	FRA
Ron Ries	FRA
Robert Rohauer	CSXT

The Steering Committee's goal were to bring together a wide range of views from a diverse pool of experts that included Federal researchers; representatives of highway safety; law enforcement; the rail and transit industry; management and labor; academia; and consultants. They were asked to aim for outcomes based on:

- Considering alternatives based on public interest
- Focusing on ideas not necessarily based on current and/or potential conventions or standards, needs, and perceptions
- Considering possible research projects with different procedures, innovative technologies, new participants, and changed responsibilities

The committee identified the following five topical or research needs areas:

Engineering/Technologies (Yellow Team)

This session brought together three engineering elements that presented challenges for further enhancements to grade crossing safety: regulatory change, the willingness to pursue technology, and the investment needed to implement innovative engineering designs.

Human Factors (Green Team)

Human error accounts for most of the accidents and fatalities at grade crossings. This session focused on understanding driver behavior at grade crossings and around railroad tracks.

Community Outreach & Education (Orange Team)

This session highlighted three unique public safety outreach efforts that employed non-traditional tactics to further educate the public on making smart decisions on or near highway-rail grade crossings. Highlights included a successful targeted social media campaign, the use of peer developed videos, and enhancing partnerships to effectively reach an audience.

Enforcement (Blue Team)

This session presented several safety/security initiatives that are currently in place and being effectively implemented to identify, apprehend, and prosecute violators of highway-rail grade crossing laws.

Hazard Management (Purple Team)

This session discussed the mitigating strategies and/or programs related to problem-solving processes aimed at defining problems (identifying hazards), gathering information about them (assessing the risks) and solving them (controlling the risks).

The Steering Committee next designated five topic area leaders to moderate the technical sessions and guide delegates in the analysis and discussion of the recommended actions developed individually by the five working groups. Table 3 listed these leaders. The committee nominated 18 speakers and presenters to provide up-to-date research information and research progress on the 5 topic areas, detailed in Table 4.

The basis of the assembly of the breakout groups were the following: attendee preference, size, and a representative mix of participants from different modes, roles, and responsibilities. The design of the formula was to stimulate as much discussion as possible, and facilitate the cross-disciplinary and cross-modal sharing of ideas.

Table 3. Workshop Research Needs Areas

Topic Areas	Team Leader	Organization
Engineering/Technologies	Frank Frey	FRA
Human Factors	Starr Kidda	FRA
Community Outreach and Education	Robert Rohauer	CSXT
Enforcement	Ryan Gustin	CSXT
Hazard Management	Debra Chappell	FRA

Table 4. Workshop Speakers – Topic Areas

Topic Areas	Speaker	Title	Organization
Engineering/Technologies	Bud Zaouk and Kelly Ozdemir	President and Director of Human Factors	KEA Technologies
	Ralph Young	General Director, Signal Engineering	BNSF Railway
	David Baldwin	Owner	Central Signal, LLC
Human Factors	David Nelson	Senior Research Engineer	Michigan Technological University
	Anand Prabhakaran	VP, Engineering	Sharma and Associates
	Scott Gabree	Engineering Psychologist	Volpe Center
Community Outreach/Education	Tom Lange	AVP, Corporate Communications	Union Pacific Railroad (UP)
	David Sloan & Tahir Juba	Wide Angle Youth Media	Wide Angle Youth Media
	David Reich	President	Reich Communications
Enforcement	Louis Jogmen	Deputy Chief	Park Ridge Police Department
	Raymond Rodriguez	Operations Manager	City of Orlando
	Carlos Löfstedt	President	Sensys America
	Richard Gent	President	Hot Rail Group
Hazard Management	Michael Long	Senior Safety and Operations Manager	Short Line Safety Institute
	Garreth Rempel	CEO	TRAINFO
	Brent Ogden	Vice President	Kimley-Horn

Table 5 illustrates the range of participants from Federal, State, and local governments, as well as railroads, transit agencies, labor unions, academia, nonprofit organizations, and consultants.

The featured topic area presentations given to the entire group were on days one and two of the workshop. Near the end of day two, the breakout groups assembled to deliver three to five

recommendations concerning new or expanded initiatives and strategies within their topic area. The idea was to compile the ideas listed on flip charts. After that, voting took place as the attendees used the flip charts to place one of the adhesive dots provided to them next to the potential recommendations of their choice. Each attendee selected the three to five recommendations with the most votes.

The working groups developed a total of 100+ ideas. Each group then identified up to five top recommended actions for their respective research needs area. This vetting process resulted in the identification of 22 top needs.

To retain ideas that did not make the vote but still provided insight into the topic in question, the groups submitted all flip charts and notes taken during the breakout session to the Workshop Support Group, a back-up group to the Steering Committee. The notes included many other discussions of ideas not chosen for the top three to five recommendations.[4]

Table 6 shows the number of participants assigned to each of the workshop working groups.

[4] These ideas are nevertheless very important. See Section 3.2, Other Recommendations Discussed and Recorded at Breakout Sessions, Table 9.

Table 5. Distribution of Participants by Organization Type

Organization Type	Number of Participants
Federal Government	27
Highway Agencies/DOTs	24
Railroads	34
Transit Agencies	3
Industry	18
Consultants	22
Enforcement	5
University/Academia	8
Non-government Organizations	7
Volpe Center Onsite Contractor Staff	1
Total	149

Table 6. Distribution of Participants by Topic Area

Topic Area	Number of Participants
Engineering/Technologies	37
Human Factors	26
Community Outreach and Education	30
Enforcement	29
Hazard Management	27
TOTAL	149

2.2 Main Session Presentations by Topic Area

Appendix C documents the agenda outlined below. The conference homepage holds all presentations and all documents.

Day One

Opening Remarks

- Michail Grizkewitsch, FRA and Marco daSilva, Volpe Center

Welcome Address

- Eric Curtit, Rail Administrator, MODOT Multimodal Ops Rail Section

Keynote Address

- Heath Hall, former Deputy Administrator, FRA

General Address, FRA Accomplishments

- Sam Alibrahim, Chief of Train Control and Communications Division, FRA Office of Research, Development and Technology (RD&T)

SESSION 1: Engineering/Technologies

Moderator: Frank Frey, FRA

- Bud Zaouk and Kelly Ozdemir, KEA Technologies – *Implementing Connected Vehicle and Autonomous Vehicle Technologies at Highway-Rail Grade Crossings*
- Ralph Young, BNSF Railroad – *Wireless Crossing, Next Generation Technology, Highway/Rail Interconnection Design*
- David Baldwin, Central Signal LLC – *Engineering Solutions to Mitigate/Eliminate Incidents of Loss of Shunt at Highway-Rail Grade Crossings*

SESSION 2: Human Factors

Moderator: Starr Kidda, FRA

- David Nelson, Michigan Technological University – *Investigating Driver Behavior at Highway-Rail Grade Crossing Using NDS and Driving Simulators*
- Anand Prabhakaran, Sharma and Associates – *Analysis and Modeling of Grade Crossing Accidents*
- Scott Gabree, Volpe Center – *Opportunities to Reduce Crossing Fatalities, Gaps in the Current Safety Trends*

SESSION 3: Community Outreach and Education

Moderator: Robert Rohauer, CSX Transportation (CXT)

- Tom Lange, Union Pacific Railroad – *Using Social and Digital Media to Promote Public Safety*
- David Sloan and Tahir Juba, Wide Angle Youth Media – *Peer to Peer Messaging; Steps Taken from Development to Execution*
- David Reich, The National Road Safety Foundation – *Developing Partnerships; Broaden Your Messaging Reach Locally, Regionally, and Nationally*

Day Two

SESSION 4: Enforcement

Moderator: Ryan Gustin, CSX Transportation

- Louis Jogmen, Park Ridge Police Department - *Illinois Rail Safety Week*
- Raymond Rodriguez, City of Orlando – *Orlando Stops, City of Orlando Railroad Crossing Safety Initiative*
- Carlos Löfstedt, Sensys America – *The Next Generation of Photo Enforcement, Automated Traffic Enforcement*
- Richard Gent, Hot Rail Group – *Drone Use in Law Enforcement, "A Tool in your Toolbox"*

SESSION 5: Hazard Management

Moderators: Debra Chappell, FRA; Kelly Morton, Federal Highway Administration (FHWA)

- Michael Long, Short Line Safety Institute – *The Importance of Safety Culture in Risk Management*
- Garreth Rempel, TRAINFO – *TRAINFO, The Source of Live and Predictive Railway Crossing Information*
- Brent Ogden, Kimley-Horn – *Another/Second Train Coming Sign*

Organization of Working Groups/Introduction of Teams (Marco daSilva, Volpe Center)

Day Three

Working Group Summaries of Top Research Needs (Team Leaders)

FRA's Highway-Rail Grade Crossing Task Force (Debra Chappell, FRA)

Final Thoughts and Workshop Closeout (Ronald Ries, FRA)

2.3 Opening Remarks

The opening session, moderated by FRA's Staff Director Ronald Ries, included remarks by former the FRA Deputy Administrator Heath Hall and the Missouri Department of Transportation (MODOT) Rail Administrator Eric Curtit, and a research update from FRA's RD&T Chief of Train Control and Communications Sam Alibrahim. Figure 2 shows the opening session panel during Mr. Hall's remarks.

Figure 2. Remarks by Former FRA Deputy Administrator Hall During Opening Session

Keynote Speaker—Heath Hall, Former Deputy Administrator, FRA

On behalf of DOT's Secretary Elaine Chao, the former Deputy Administrator Heath Hall kicked off the workshop with words of encouragement and recognition of the importance of rail safety, along with innovation and other commonsense policies.

Mr. Hall underscored the importance of railroads to the economy and jobs, for example, rail moves 40 percent of U.S. freight. However, Mr. Hall also emphasized that safety is of the greatest importance. In fact, 60 percent of Federal dollars and labor expended by FRA goes to safety initiatives. FRA's website provides the entirety of Mr. Hall's keynote speech, but here are a few highlights:

> *We have been successful in improving safety. Over time, we have driven the number of incidents and fatalities down. However, this has leveled out over the past few years. This means that the number is poised to spike either up or down. Our job is to make sure this number goes down. This is made all the more challenging due to the distractions out there: hand held computing devices, alcohol, substance abuse (especially opioids), and evolving technologies. These factors make this workshop the most important one yet.*
>
> *Regarding demographics, we can characterize the average grade crossing violators. They are males aged 42. We know who they are and what time of day that most violations occur. We may need to consider beefing up efforts to reach this demographic. The challenges are daunting, with more than 212,000 highway*

grade crossings, there is a continuing need to educate millions of drivers to exercise caution.

We have some of the brightest minds from all facets of the railroad industry assembled in one room for this workshop. We are certain that we can come up with some great ideas that can be adopted by the industry.

We never want to say, "Did we do enough?"

This is why we are gathered here together—to ask the tough questions, share ideas and challenge assumptions, to explore new and innovative approaches for addressing longstanding challenges.

General Address, FRA Accomplishments—Sam Alibrahim, Chief of Train Control and Communications Division, FRA RD&T

FRA's research project portfolio is determined by various means and in collaboration with many government, non-governmental organizations, industry, and academia entities. Volpe Center accomplished about 80 percent of the research.

Workshops such as this on grade crossing research needs, along with workshops dealing with trespassing, drives the suite of FRA research initiatives. In fact, of the 33 research projects identified in the 2009 workshop, FRA conducted research on 10 of them. Representative examples of this are in the areas of LED-enhanced signs, photo enforcement practices, gate skirts and other pedestrian safety treatments, law enforcement strategies and suicide media reporting, and research on identifying and classifying humped crossings. Many of the efforts span years using data analysis and connected vehicle research.

Table 7 shows the workshop's five key areas, and the corresponded research areas currently spearheaded by FRA.

Table 7. FRA Research Areas

Area of Research	Objective	Active Research Projects
Engineering/Technologies	Provide up-to-date engineering standards and best practices for safety improvements at grade crossings.	Gate skirts, dynamic envelope zone pavement markings, in-pavement lights, and low ground clearance vehicle detection.
Human Factors	Better understand grade crossing accidents, fatalities, and injuries to develop countermeasures and focus future research.	FRA internal data analysis, correlation and causal analysis, predictive modelling, and highway-rail grade crossing driver behavior.
Community Outreach/Education	Educate partners, stakeholders, and the public about grade crossing safety to improve awareness, understanding and safe behavior.	Motorist outreach, grade crossing training aid, website improvements, continued support of Operation Lifesaver.
Enforcement	Develop enforcement strategies for improving grade crossing safety through enhanced law enforcement and regulatory compliance.	National Working Group, photo enforcement at crossings, law enforcement strategies, and first responder videos.
Hazard Management	Develop mitigating strategies and/or programs related to hazard identification, risk assessment and risk control.	Pedestrian overpass evaluation, blocked crossing driver awareness, GradeDec, and connected vehicle standards and protocols (FRA/FHWA/JPO)

Before adjournment of the opening session, Mr. Ries noted that a new application showing grade crossing incident data would soon be available on the FRA website.[5] This tool provides a visual presentation of grade crossing data and allows for zooming in on State, county and city levels. It contains information on when grade crossing collisions happen, types of warning devices, etc. Also, a Geographic Information System (GIS)/Global Positioning System (GPS) application with information on specific crossings is also available.

[5] The new application has since been released and can be accessed through the FRA website. The GIS/GPS application can be accessed through the FRA website.

3. Identification of Top Recommended Actions

On the afternoon of day two, attendees broke into the five working groups. The purpose of the working group sessions was to:

- Update FRA and all workshop stakeholders on activities and research in their area of railroad ROW trespasser incidents and fatalities.
- Formulate, by consensus, an updated set of initiatives, strategies, programs, and research.
- Prepare these needs in a prioritized action item format.

3.1 Working Group Top Recommended Actions

The general format for the working groups consisted of a 3-hour block of time, facilitated by the team leader or moderator, with assistance provided by support staff, as depicted in Figure 3.

Figure 3. Community Outreach and Education Working Group in Action

After brainstorming initiatives, strategies, programs, and research projects, each group then prioritized recommendations for their team leader to report to the general session on the last day of the workshop.

The brainstorming produced many vetted and consolidated ideas added to flip charts. The groups then voted to select the three to five top recommendations in their topic areas. Figure 4 shows an example of ideas drafted through brainstorming during one of the breakout sessions (left) and an example of the voting procedure using voting dots by the participants (right).

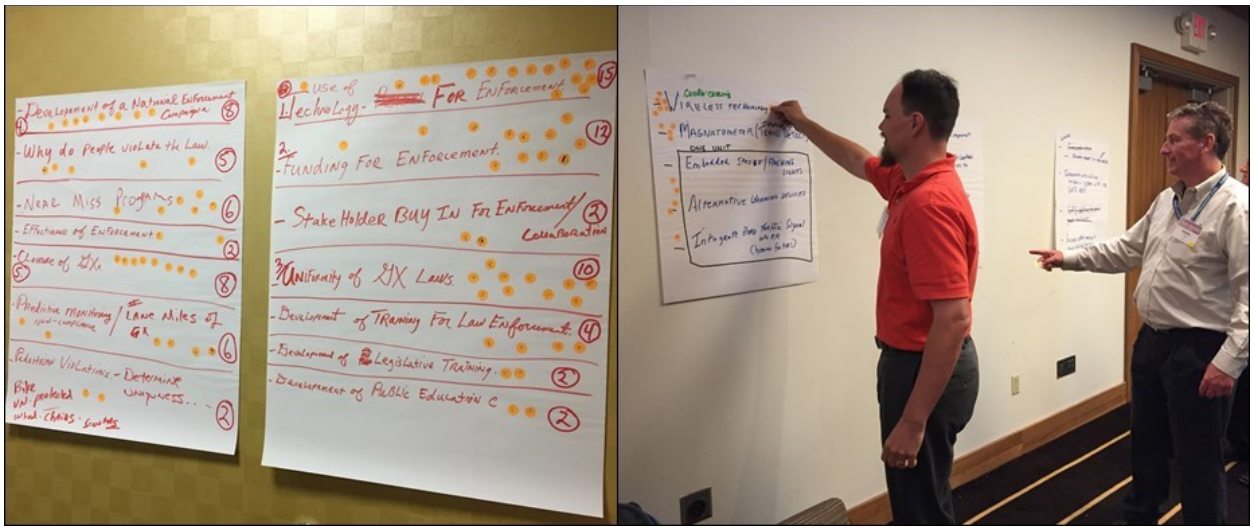

Figure 4. Example of Generated Ideas and Voting During a Breakout Session

This vetting process resulted in the identification of the top 22 recommended actions out of more than 100 suggestions across the 5 topic areas. Table 8 shows the resulting distribution of the 22 recommended actions by topic area.

Note that there were slight variations in the voting procedures, level of detail, and reports between the breakout groups. The moderator/facilitator team for each working group was free to employ his or her individualized approach and strategies for garnering the requested information.

Table 8. Distribution of the Top 22 Recommended Actions by Topic Area

Topic Area	Team Leader	Number of Recommendations
Engineering/Technologies	Frank Frey	5
Human Factors	Starr Kidda	4
Design, Technology, and Infrastructure	Robert Rohauer	3
Enforcement	Ryan Gustin	5
Hazard Management	Debra Chappell	5

Below are the top recommendations by each working group, also provided in Table 1. The groups developed this information below (with very slight editorial modifications for readability). Table 16 shows the distribution of participant votes per affiliation for each of the top recommended actions (found in Appendix D). FRA collected this demographic information to justify and support future requests for funding on high-priority research generated from this workshop.

Engineering/Technologies

1. *Wireless Technology for Crossing Activation*: Leverage the existing Positive Train Control (PTC) network for activating grade crossings.
2. *Research and Develop Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) to Inform, Warn, and Force Stop Motor Vehicle*: Research the in-vehicle warning using connected vehicle infrastructure with the ability to enforce stopping.
3. *Research Alternative Railroad Warning Devices*: Research into enhanced warning devices to grab motorist attention (e.g., embedded strobe lights, different color lights, and different frequency pattern).
4. *Intelligent Traffic System Application for Motor Vehicles*: Enhance pre-emption techniques and queue cutting/traffic management.
5. *Research Vehicle Activated Enhanced Advanced Warning Sign*: Research vehicle triggered advanced pre-warning to alert motorist on approach to grade crossing.

Human Factors

1. *Improve Close Call/Near Miss Reporting (People or Vehicle Strike)*: Phase 1: Develop a process to systematically collect and categorize vehicle and person near miss events. Phase 2: Extract more detailed information from near miss events (e.g., behaviors).
2. *Integration of Rail Safety Messages into Driver Education and Licensing*: Expand both commercial and private driver education and testing to more accurately reflect the interaction of railroads in driving environment.
3. *Incorporate Rail Safety Professionals into Development/Planning Process*: Incorporate rail safety input into community development or planning processes to identify potential increases in rail safety hazards, possibly in the environmental assessment.
4. *Educate Youth to Educate Adults*: Similar to the National Highway Traffic Safety Administration (NHTSA) model on seat belts. Change the culture of how kids and families see railroads.

Community Outreach and Education

1. *Trespasser Identification, Motivation and Messaging*: Identify types and reasons for trespassing and develop modes and methods to test messaging aimed at trespassers.
2. *Research into the Efficacy of Social Media Platforms and Messages*: Research appropriate social media platforms based on target audiences. Examine existing social media content and determine the effectiveness versus new content.
3. *Driver Education (General and Commercial Driver License)*: Evaluate driver education programs for grade crossing safety content and investigate effective distribution of crossing safety messaging to drivers.

Enforcement

1. *Technology Opportunities for Law Enforcement*: Identify technologies that law enforcement can use to be more effective in identifying and enforcing grade crossing laws.
2. *Funding Opportunities for Law Enforcement*: Earmark funding sources for law enforcement that is specific to crossing enforcement.
3. *Uniformity of Highway-Railroad Grade Crossing Laws*: Push for legislation requiring States to have uniform grade crossing laws (sanctions).
4. *Development of National Grade Crossing Law Enforcement Campaign*: Develop national safety/enforcement campaign to garner national attention and buy-in from both the public and the law enforcement community.
5. *Closure of Highway-Railroad Grade Crossings*: Research effective strategies to close highway-railroad grade crossings that have higher rates of "noncompliance," especially when viable alternate access exists.

Hazard Management

1. *Additional Train Approaching Warning System*: Identify and evaluate potential solutions to alert road users of the approach of a second train.
2. *Grade Crossing Hazard Matrix*: Develop a matrix that shows the annual number of incidents, types of hazards, injuries and deaths, and indicate which treatment will prevent or mitigate the hazard.
3. *Model Communication Process*: Improve communication and coordination between various agencies and railroads.
4. *Enhanced Data Exchange between Vehicle Control Systems and Train Control Systems*: Determine the list and type of information (in addition to preemption) required by vehicle control systems from train control systems and vice versa.
5. *Updating Evaluation Tools for Rail/Highway Grade Crossing Improvements*: Modernize both the Accident Prediction and Severity model and GradeDec.

3.2 Other Recommendations Discussed and Recorded at Breakout Sessions

The 22 recommendations listed above were the top vote-getters, but many other important ideas were also proposed. Many participants felt that assigning the top five was difficult because the other suggestions were just as well. Table 9 presents other ideas below. Note that some similar ideas developed independently between groups are included in this table.

Table 9. Other Ideas/Recommendations Not Selected for the Top 22

TOPIC AREA	TITLE
Engineering/Technologies	Innovative train detection (magnetometer, sonic, etc.)
	Research alternative warning devices to provide better warning
	Look at integrating road traffic signal into railroad
	Model to enhance and augment vital and non-vital components to enhance detection
	Study to detects non-motorized vehicles to release exit gate for 4-quad gate
	Research incorporating steel plate with gates to discourage drivers from breaking gate
	Electromagnet to stop motor vehicles
	Integrate warning system into GPS navigation system (built in to avoid grade crossing as an option)
	Leverage social media to avoid block crossings
	Research to provide audio/visual warning for vehicles stopped within Dynamic Envelope zone
	Study on deterrence to prevent vehicles from going around gate arm
	Constant monitoring (live)—research alternate testing for gate operation
	Research retractable speed hump at congested crossing to prevent vehicles from following other cars (connect with pre-emption/gate)
	Better measure of motor vehicle exposure at crossing and technologies to measure exposure
	Study changing cross bucks color to brighter color (neon)
	Optimizing advanced preemption
	Gate down logic at crossing adjacent to station
	Research vehicle clearance methodology for preemption
	Revise/update/augment to Title 49 Code of Federal Regulations 236 subpart H
Human Factors	How can we use technology at the crossings (e.g., geo fence, loud audio) to engage with trespasser (including suicides)
	Laser detection at risk areas (radar detection-perimeter detects objects that are not supposed to be there like they use in Europe. Fiber optic

TOPIC AREA	TITLE
	Use of head-end camera to automate near miss reports (e.g., through machine learning)
	Negative about detection-pathways through communities going to school, malls, etc.—so many people will be detected that suicides won't be detected
	Education—outreach to community to identify high risk areas
	FRA—signs and symptoms for train crews to watch for—suicide detection
	Outreach to communities—data driven—like our focused inspections at FRA—Safety with a Team (SWAT) approach
	Campaign for older people—use materials for places they hang out—bars, restaurants, restrooms, etc.—clear channel, use operations lifesavers materials
	Building permits—look at to target outreach—new risk areas
	Bring safety people into building/planning process for construction near rail lines. Education. Engage with planning commission. New requirements—build next to railroad—engineer or mitigate for grade crossing separation
	Change the culture that drives people to consider beating the train
	Human factors related to in-vehicle alternatives/technology (e.g., WAZE integration
	Red light camera in Richmond, CA, at high risk crossing—put light as soon as gates activity—train approaching—sign red light violation—mandate crossing safety class—in lieu of fine—safety education mandatory
	Use bright visuals for pedestrians (not audio—because of head phones) Maybe in-ground lights for pedestrians
	Better understand what drives behaviors in time-pressure situations—how to use this for engineering or education
	How to build respect into society (e.g., of rail or enforcement)
	Monetary fines—how can we use this more to change behavior? Use this new $ for engineering safety enhancements

TOPIC AREA	TITLE
	What physical measures can be effective for encouraging people to go to official crossings?
	Identify potential hotspots through analysis of where schools/housing/areas of interest
	Proactive research
	Ways to engage with non-rail folks (e.g., NHTSA/FHWA). Maybe Vision Zero first
	What non-incident data can be used to track safety?
	Button in train cab to activate video to capture problems (e.g., trespassing, grade crossing near miss
	Consider Federal recommendations (or regulations) for pedestrians at crossings
	Expand on crossing research to understand drivers' behavior using SHRP2 data.
Design, Technology, and Infrastructure	Judicial/Law enforcement education, partnerships and strategies
	Determining the effectiveness of current and innovative signage
	Community engagement best practices for the 3Es
	Research youth education
	Suicide outreach, partnerships and messaging
Enforcement	Determine why people violate the laws at grade
	Development of 'near miss" programs
	Study the effectiveness of enforcement
	Predictive monitoring of noncompliance/lane miles of grade crossings
	Pedestrian/bicyclist/unprotected/wheelchairs/scooters violations and their uniqueness
	Stakeholder buy-in for enforcement/collaboration
	Development of training for law enforcement
	Development of legislative training
	Development of public education
	The effect of blocked crossings on grade crossing violations
	Jurisdictional issues relating to grade crossing enforcement
	Enforcement issues related to poorly engineered grade crossings

TOPIC AREA	TITLE
Hazard Management	Wireless device train horn—connected to cell phone and activates similar to Amber Alert/Emergency Notifications
	Second Train Approaching—wireless signal to alternate pitch of second approaching train. Pedestrian walk/don't walk signal (similar in design)
	Highway/Grade Crossing Reroute—protocols for rerouting traffic in construction
	Agency communication for new project development to contact railroad (e.g., unaware of policies—especially for smaller agencies)
	Incorporate pedestrian/bicycle community into crossing development process
	Collecting data on pedestrian/bicycle usage of crossings such as getting counts
	Crash modification factor (CMF) development for countermeasures at crossings and greater integration with HSM (FHWA CMF Site—CMF Clearinghouse).
	Humped crossing information on commercial vehicle app—capture real time conditions and research to identify low clearance and truck dimensions
	Algorithms that allow more green light time, when trains at crossings proactively in area wide traffic signal control devices
	Queue disruption for long blocked crossings
	Challenges in hazard identification and determining responsibility, e.g., any geometric issue and human behaviors
	Research to identify to low clearance and truck dimensions
	Blocked crossing detection system tied into PTC
	Sight distance issues related to crossings hazard
	Universal reporting number for public to report hazard. It's impossible for railroads/State partners to know all the "dangerous" crossings and need the public to tell us something easy (e.g., 411, 911, etc.)
	Effectiveness of low-cost safety treatments
	GPS—Apps like WAZE can add information by user, railroads and DOT

TOPIC AREA	TITLE
	Part of accident are because people are not paying attention (text, music with means to get their attention.) Example: put LED in the pavement for the pedestrians looking at their feet. For pedestrians with headphones, possibly use a strobe light to get their attention
	In quiet zones or no bell areas, consider a chirper for visually impaired people or appropriate audible alternatives

3.3 Presentation of Final Results

On day three, the work group leaders presented their findings from the previous day's breakout sessions to the entire workshop.

Results for each of the working groups are as follows in sequence:

1. Team members with facilitators and moderators identified
2. A list of the top three to five recommendations
3. For each recommendation (which is the working groups' deliverable to the workshop):
    a. Project identification
    b. Description
    c. Rationale
    d. Perceived benefits
    e. Key implementation issues
4. Working group presentation to the entire group

Note that the language presented in this subsection is as agreed upon by the workshop groups, with minor edits for readability.

3.3.1 Engineering/Technologies

This session brought together three engineering elements that presented challenging hurdles to overcome to further enhance grade crossing safety: regulatory change, the willingness to pursue technology, and the investment needed to implement innovative engineering designs. Table 10 lists the registrants assigned to the Engineering/Technologies breakout session. Note that not all registrants attended the breakout sessions. The breakout group summarized the top five recommended actions.

Table 10. Engineering/Technologies Breakout Group Registrant Assignments

Name	Agency/Organization
Sam Alibrahim	FRA
Kurt Anderson	Campbell Technology Corporation

Name	Agency/Organization
Chris Ashley	Kansas City Southern
Sid Bakker	ARMS
David Baldwin	Central Signal
Peter Bartek	Protran Technology
Bryce Brayman	Canadian Pacific
Kim Chan	SCRRA
Richard Cranfill	Tavla Solutions
Eric Curtit	MODOT
Tim Doddo	Long Island Railroad
Jason Field	Moffatt & Nichol, Inc.
Frank Frey	FRA
James Harrison	Volpe Center
Tom Hilleary	Island Radar Company
Aemal Khattak	University Nebraska/Lincoln
Stephen Klinger	Norfolk Southern Corporation
Steve Laffey	IL Commerce Commission
Danny Lites	Kansas City Southern Railway
Aaron Marx	HNTD Corporation
Christopher Michael	East/West Gateway COG
Richard Mullinax	North Carolina (NC) DOT Rail Division
Tashi Ngamdung	Volpe Center
Maxim Nikiforov	Siemens Industry
Toby Onyekonwu	UP
Jason Orthner	NC DOT Rail Division
David Peterson	UP
Bill Pearsall	Illinois (IL) DOT
Gerard Reminiskey	HDR
Larry Scheperle	MODOT
James Sottle	RR Safety Consultant
French Thompson	BNSF Railway

Name	Agency/Organization
Marc Villenes	Bartlett and West
Steve Wells	BNSF
Scott Willis	CSXT
Jack Wright	MODOT
Ralph Young	BNSF
Bud Zaouk	KEA Technologies

Recommended Actions for Topic Area 1: Engineering/Technologies

- **Project 1. Wireless Technology for Crossing Activation**
- **Project 2. Research and Develop V2V and V2I to Inform, Warn, and Force Stop Motor Vehicles**
- **Project 3. Research Alternate Railroad Warning Devices**
- **Project 4. Intelligent Traffic System Application for Motor Vehicles**
- **Project 5. Research Vehicle Activated Enhanced Advanced Warning Sign**

Project 1: Wireless Technology for Crossing Activation

- Description: Leverage existing PTC network for activating highway-rail grade crossing.
- Rationale: To establish more reliable train detection and crossing warning times.
- Benefits: To mitigate loss of shunt and activation of failure crossing disabling and improve station stop warning times.
- Key Implementation Issues: Interoperability, standardize safety criteria

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Project 2: Research and Develop V2V and V2I to Inform, Warn, and Force Stop Motor Vehicles

- Description: In-vehicle warning using connected vehicle infrastructure with the ability to enforce stopping
- Rationale: Piggy backing on existing technologies/infrastructure (cost-efficient implementation).
- Benefits: Improve grade crossing safety.
- Key Implementation Issues: Auto industries adoption, regulatory issues, liability issues

Project 3: Research Alternative Railroad Warning Devices

- Description: Enhanced warning devices to grab motorist' attention (embedded strobe lights, different color lights, different frequency pattern) – Human Factors
- Rationale: To grab motorist attention by varying operation of warning devices
- Benefits: Keep attention grabbing
- Key Implementation Issues: National Committee on Uniform Traffic Control Devices (NCUTCD) endorsement, cost

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Project 4: Intelligent Traffic System Application for Motor Vehicles

- Description: Enhance pre-emption technique and queue cutting/traffic management.
- Rationale: To decrease vehicles stopped at a crossing.
- Benefits: Decrease accidents due to vehicles stopped on dynamic envelope, better traffic flow through the crossing.
- Key Implementation Issues: City/county issues, cost

Project 5: Research Vehicle Activated Enhanced Advanced Warning Sign

- Description: Vehicle triggered advanced pre-warning to alert motorist on approach to highway-rail grade crossing.
- Rationale: To provide motorist additional warning time and distance.
- Benefits: To improve safety, especially at passive crossings.
- Key Implementation Issues: City/county issues, absence of infrastructure (power, communication)

3.3.2 Human Factors

Human error accounts for a large percentage of accidents and fatalities at grade crossings. This breakout session focused on understanding and recommending actions for driver behavior at grade crossings and around railroad tracks. Table 11 lists the registrants assigned to the Human Factors breakout session. The breakout group summarized the top four recommended actions.

Table 11. Human Factors Breakout Group Registrant Assignments

Name	Agency/Organization
Andrea Armstrong	FRA
Jon Broadway	Siemens Mobility
Chris Brownell	MODOT
Martin Cocker	Utah Transit Authority
Scott Gabree	Volpe Center
Norma Jean Griffiths	FRA

Name	Agency/Organization
Mike Hendley	Capitol Corridor Joint Powers Authority (CCJPA)
Alan Ho	FHWA-IL
Thomas Jacques	HDR
Chris Keckeisen	UP
Starr Kidda	FRA
Jacob Mathew	University of IL Urbana-Champaign
Modeste Muhire	Michigan Tech
Dave Nelson	Michigan Tech
Kelly Ozdemir	KEA Technologies
Gregory Orrell	MITRE
Marty Palazzolo	Keolis Commuter Rail
Jason Pike	Arizona Corporation Commission
Anand Prabhakaran	Sharma and Associates
Larry Smith	Creekside Limited
Paul Smith	Telephonics Corporation
Shawn Stokes	Terminal RR of St. Louis
Phil Thomas	Maryland Transit Administration
John Weston	HMMH, Inc.
Trefor Williams	Rutgers University

Recommended Actions for Topic Area 2: Human Factors

- **Project 1. Improve Close Call/Near Miss Reporting (People or Vehicle Strike)**
- **Project 2. Integration of Rail Safety Messages into Driver Education and Licensing**
- **Project 3. Incorporating Rail Safety People into Development/Planning Process**
- **Project 4. Educate Youth to Educate Adults**

Project 1: Improve Close Call/Near Miss Reporting (People or Vehicle Strike)

- Description: Phase 1: Develop a process to systematically collect and categorize vehicle and person near miss events (e.g., simplify the process-forms-narrative and potential to use automate and time-stamp the process using technology such as cameras). Phase 2: Pull out more detailed information, such as behaviors.
- Rationale: We do not have an understanding of the whole population of unsafe behaviors (i.e., where risky behaviors occur).
- Benefits: More accurate data; reduction in unsafe acts; proactive safety through analysis for better resource management; and cost reduction
- Key Implementation Issues: Obtaining carrier buy-in, confidentiality

Project 2: Integration of Rail Safety Messages into Driver Education and Licensing

- Description: Expand both commercial and private driver education and testing to accurately reflect the interaction of railroads in driving environment. In areas, such as driver re-education and traffic schools, State driver education manuals and other high traffic areas such as bars, restaurant, public restrooms, etc. Possibly utilize social media to drive down publication costs for general education materials.
- Rationale: This is currently an education gap.
- Benefits: More compliance by drivers in rail settings.
- Key Implementation Issues: Requires partnership and buy in with States

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Project 3: Incorporating Rail Safety People into Development/Planning Process

- Description: Incorporate rail safety input into development or planning processes to identify potential increases in rail safety hazards, possibly in the environmental assessment.
- Rationale: Proactive strategy for identifying potential safety hazards (i.e., bring safety into the planning process)
- Benefits: Incorporated as part of the existing railroad safety certification program (Safety and Security Certification) and environmental assessment.
- Key Implementation Issues: Requires partnerships with states and localities

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Project 4: Educate Youth to Educate Adults

- Description: Similar to the NHTSA model on seat belts, change culture of how kids and families see railroads (trespassing and crossing violations).
- Rationale: It worked with seat belts.
- Benefits: Increase in safety awareness, personalized understanding and reduction in unsafety behaviors
- Key Implementation Issues: Determining the most effective way to disseminate the message.

3.3.3 Community Outreach and Education

This breakout session highlighted three unique public safety outreach efforts that employ non-traditional tactics to further educate the public on making smart decisions on or near highway-rail grade crossings. Highlights included a successful targeted social media campaign, the use of peer developed videos, and enhancing partnerships to effectively reach an audience. Table 12 lists the registrants assigned to the Community Outreach and Education breakout session. The breakout group summarized the top three recommended actions.

Table 12. Community Outreach and Education Breakout Group Registrant Assignments

Name	Agency/Organization
Clyde Armstrong	Metro-North Railroad
Ray Benekohal	University of Illinois
Matthew Chrapek	Thouvenot, Wade & Moerchen, Inc. (TWN)
Carolyn Cook	FRA
Greg Deibler	Virginia Rail Express
Louis Farley	Virginia State Corporation Commission
Jessica Feder	IN Operation Lifesaver
Denise Gauthier	BNSF Railway
Karen Hankinson	RailPros
Suzanne Horton	Volpe Center
Tahir Juba	Wide Angle Youth Media
Tom Lange	UP
Sandy Kelley	Florida East Coast Railway
Tim Leon	Geile Leon Marketing Communications
Tiffany Lindemann	FRA
Susan Madigan	San Joaquin Joint Powers Authority (SJJPA)
Karl Meyer	LIRR
Terry Morris	UP
Bonnie Murphy	OLI
John Plebanek	UP

Name	Agency/Organization
David Rabinowitz	MITRE
David Reich	Reich Communications
Ronald Ries	FRA
Jim Ruiz	Texas DOT (TxDOT)
Don Richardson	VA State Corporation Commission
Bob Rohauer	CSXT
Nancy Sheehan	CA Operation Lifesaver
David Sloan	Wide Angle Youth Media
Eric Struss	Indiana Harbor Belt Railroad
Michelle Teel	MODOT

Recommended Actions for Topic Area 3: Community Outreach and Education

- **Project 1. Trespasser Identification, Motivation and Messaging**
- **Project 2. Research into Efficacy of Social Media Platforms and Messages**
- **Project 3. Driver Education (General and Commercial Driver License)**

Project 1: Trespasser Identification, Motivation, and Messaging

- Description: Identify types and reasons for trespassing and develop modes and methods to test messaging aimed at trespassers.
- Rationale: This will provide communities tools for deterring trespassing.
- Benefits: Better targeting of messaging based on demographics, geography and reasons for trespassing
- Key Implementation Issues: Significant research project with a large data collection effort

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Project 2: Research into the Efficacy of Social Media Platforms and Messages

- Description: Research appropriate social media platforms based on target audience. Examine existing social media content and determine the effectiveness versus new content.

- Rationale: Assist stakeholders in choosing the most effective social media platform and offer messaging which is more effective based on target audiences.
- Benefits: Reach more people using social media.
- Key Implementation Issues: Technology is rapidly changing, so this project should be implemented quickly.

Project 3. Driver Education (General and Commercial Driver License)

- Description: Evaluate driver education programs for grade crossing safety content and investigate effective distribution of grade crossing safety messaging to drivers.
- Rationale: Human factor (drivers) is a key contributor to grade crossing incidents.
- Benefits: Better driver understanding of safe crossing procedures, resulting in fewer incidents.
- Key Implementation Issues: Collaboration with and across many different State agencies that conduct driver education

3.3.4 Enforcement

This breakout session brainstormed several safety/security initiatives that could be implemented to identify, apprehend, and prosecute violators of highway rail grade crossing laws. Table 13 lists the registrants assigned to the Enforcement breakout session. The breakout group summarized the top five recommended actions.

Table 13. Enforcement Breakout Group Registrant Assignments

Name	Agency/Organization
Michael Allen	WR Allen Associates
Francesco Bedini	IL DOT
Kim Chan	SCRRA
Bill Cleveland	FRA
John Danyluk	Frauscher
Lou Frangella	FRA
Tom Garrepy	Brunswick Police Department
Rich Gent	Hot Rail Security
Mike Grizkewitsch	FRA
Ryan Gustin	CSXT
Heath Hall	FRA
Chris Hess	FRA
Cory Hoffman	Cedar Rapids and Iowa City Railway
Patrick Howley	Redflex Traffic Systems
Marcus Landy	SC Office of Regulatory Staff
Bob Ledoux	Florida East Coast Railway
Carlos Löfstedt	CEO
Aaron Marx	HNTB Corporation

Name	Agency/Organization
Charlie Mathewson	Indiana Harbor Belt Railway
Phil Meraz	Iowa DOT
LaKenya Rapley	Georgia (GA) DOT
Robert Reustle	FRA
Ray Rodriguez	Orlando Stops
Jeff Schmid	BSNF (retired)
Mark Sexton	Oklahoma City Police Department
Brian Stanley	BSNF
Brett Walker	Siemens Rail
Rodney Whaley	FRA
Lyle J Wehr	Cedar Rapids and Illinois City Railway

Recommended Actions for Topic Area 4: Enforcement

- **Project 1. Technology Opportunities for Law Enforcement**
- **Project 2. Funding Opportunities for Law Enforcement**
- **Project 3. Uniformity of Highway-Railroad Grade Crossing Laws**
- **Project 4. Development of National Highway-Railroad Grade Crossing Law Enforcement Campaign**
- **Project 5. Closure of Highway-Railroad Grade Crossings**

Project 1: Technology Opportunities for Law Enforcement

- Description: Identify technology opportunities that law enforcement can use to be more effective in identifying and enforcing grade crossing laws. This could include unmanned aerial vehicles (UAV)/drones, portable detection equipment, etc.
- Rationale: Law enforcement, as it relates to enforcement of railroad related issues, must have the ability to use technology.
- Benefits: Decrease violations and "noncompliant" behavior.
- Key Implementation Issues: Funding for technology can be expensive. Specific training, maintenance, and installation of equipment might be required.

Project 2: Funding Opportunities for Law Enforcement

- Description: Earmark funding sources for law enforcement that is specific to grade crossing enforcement.
- Rationale: Often the simplest of ideas require funding sources, whether for manpower, equipment, training, etc. Create mechanisms that allow for law enforcement agencies to apply for funds to focus their efforts on grade crossing enforcement.

- Benefits: When competing against many other law enforcement related issues and their respective campaigns, law enforcement agencies might choose to focus their efforts on grade crossing issues if monies exist. Decrease violations and "noncompliant" behavior.
- Key Implementation Issues: Funding is an ongoing concern. Will often have to appropriate existing funds from some other source.

Project 3: Uniformity of Highway-Railroad Grade Crossing Laws

- Description: Move beyond offering "model" guidance and push for legislation requiring states to have uniform grade crossing laws (sanctions).
- Rationale: Currently, there is inconsistency among the various States when it pertains to highway-railroad grade crossing laws.
- Benefits: Uniformity creates an understanding of how drivers should approach and negotiate grade crossings, regardless of location. This supports law enforcement's ability to address railroad-specific issues.
- Key Implementation Issues: Getting all 50 States to adopt uniform law might prove difficult.

Project 4: Development of National Grade Crossing Law Enforcement Campaign

- Description: Develop national safety/enforcement campaign to garner national attention and buy-in from both the public and the law enforcement community.
- Rationale: Work to get recognized by those associations that often manage funding (Governor's Highway Safety Office) for support/funding. National 'roll-out' with Federal/State/local partners, with the goal of annual recurrence. Develop program marketing, resources materials, tracking methods, and related incentives.
- Benefits: Garner buy-in from state/local law enforcement focused on grade crossing enforcement. Decrease violations and 'noncompliant' behavior. Gain national exposure on an issue that is otherwise kept in the shadows.
- Key Implementation Issues: Competing against other law enforcement campaigns might make implementation more difficult.

Project 5: Closure of Highway-Railroad Grade Crossings

- Description: Research effective strategies to close highway-railroad grade crossings that have higher rates of driver "noncompliance," especially when viable alternate access exists.
- Rationale: Standardized matrix to identify and incent communities to address problem or redundant crossings does not really exist (e.g., FHWA, Section 130 application).

- Benefits: Create funding sources used to encourage grade crossing closures. Closure of grade crossings eliminates the need for enforcement. The safest crossing is the one that does not exist. Decrease violations and "noncompliant" behavior.
- Key implementation issues: Funding is an ongoing concern for this topic as well. Communities need financial support to be a willing partner in crossing closures and consolidations.

3.3.5 Hazard Management

This session discussed mitigation strategies and/or programs related to defining problems (identifying hazards), gathering information about them (assessing the risks) and solving them (controlling the risks). Table 14 lists the registrants assigned to the Hazard Management breakout session. The breakout groups summarized the top five recommended actions.

Table 14. Hazard Management Breakout Group Registrant Assignments

Name	Agency/Organization
Leonard Allen	Volpe Center
Pascal Baran	Keolis Commuter Services
Michael Blackshear	TXDOT
Debra Chappell	FRA
Andrei Edelman	Siemens Mobility
Julie Finnegan	Ohio Rail Development Commission
Kevin Fitzgerald	FRA
Tracy Hamer	Tri-Met
Sheryl Harley	National Transportation Safety Board
Evelyn Hendricks	FRA
Bernard Kennedy	Volpe Center
Mike Long	Short Line Safety Institute
Megan McIntyre	BNSF
John H.E. Miller	Delaware City Fire Company
Jeff Moller	Association of American Railroads
Kelly Morton	FHWA
Brent Ogden	Kimley-Horn
Garreth Rempel	TRAINFO
Gary Rosin	CP Railroad
Ben Sperry	Ohio University
Jeff Stewart	FRA Region 8
Matt Talkin	MODOT
Carmen Wallace	Kansas City Southern Railway
Jeff Warner	TX A&M Transportation Institute
Brent Weatherford	Genesee and Wyoming
Cayela Wimberly	Norfolk Southern Corporation
Betty Young	WA Utilities and Transportation Comm.

Recommended Actions for Topic Area 5: Hazard Management

- **Project 1. Additional Train Approaching Warning System**
- **Project 2. Grade Crossing Hazard Matrix**
- **Project 3. Model Communication Process**
- **Project 4. Enhanced Data Exchange between Vehicle Control Systems and Train Control Systems**
- **Project 5. Updating Evaluation Tools for Rail/Highway Grade Crossing Improvements**

Project 1: Additional Train Approaching Warning System

- Description: Identify and evaluate a wide range of potential solutions as a means to alert road users of the approach of a second train.
- Rationale: There is consideration to include Another/Second Train Coming sign within the MUTCD. This effort has been researched in the past, but further analysis on various traffic control device concepts may be warranted.
- Benefits: Expected to reduce frequent cause of pedestrian collisions usually resulting in fatalities.
- Key Implementation Issues: Lab testing, followed by prototype in-field testing

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Project 2: Grade Crossing Hazard Matrix

- Description: Develop a matrix that shows the annual number of incidents, hazards, injuries, and deaths, and indicate which treatment will prevent or mitigate the hazard.
- Rationale: A "deep dive" data-trend analysis should be considered to potentially mitigate and/or eliminate crossing incidents.
- Benefits: Develop standard operating procedures; long term planning; improved coordination and seamless project completion.
- Key Implementation Issues: Availability of information, data gaps, variability/accuracy of data

---

Project 3: Model Communication Process

- Description: Improve communication and coordination between various agencies and railroads.
- Rationale: Effort would assist with project development, long-term planning efforts, engineering design coordination and long-term budgeting for big projects (e.g., grade separations).
- Benefits: Provides standard operating practices, improved coordination and seamless project completion

- Key Implementation Issues: Stakeholder coordination and commitment

---

Project 4: Enhanced Data Exchange between Vehicle Control Systems and Train Control Systems

- Description: Determine the list and type of information (in addition to preemption) required by vehicle control systems from train control systems and vice versa.
- Rationale: Safety and efficiency improvements of both systems
- Benefits: Increased and long-term safety of highway crossing, improvement of highway traffic flow
- Key Implementation Issues: None provided.

Project 5: Updating Evaluation Tools for Rail/Highway Grade Crossing Improvements

- Description: Modernize both Accident Prediction and Severity model and GradeDec.
- Rationale: The current models focus on the benefits associated with upgrading from crossing treatment when the APS model was created 30+ years ago. Grade crossing technology and the railroad operating environment and available data has changed.
- Benefits: Help ensure that the direction of the grade crossing resources are driven to the areas of the greatest benefit and risk reduction, thereby saving as many lives as possible, they could also justify an increase in spending on crossing improvements.
- Key Implementation Issues: None identified.

4. Day Three Wrap-Up

4.1 Working Group Summaries of Top Research Needs

Each of the breakout group leaders presented their group's recommendations to the entire audience on the morning of the third day of the workshop. As was observed, each group used a different strategy, but each obtained excellent results. As the groups went through their recommendations, it became clear that some suggestions overlapped or were similar to those from other groups. For instance, the Human Factors group recommended the integration of rail safety messages into driver education and licensing, which resembled what was put forth in Community Outreach and Education. In another instance, the Engineering and Technologies group recommended researching and developing V2V and V2I to inform, warn, and force stop motor vehicles–similar to the Hazard Management group's recommendation to explore enhanced data exchange between vehicle control systems and train control systems. The concept of Human Factors cut across the groups. For example, the Engineering Technology recommendation to research alternate railroad warning devices suggested the installation of strobe lights to grab motorist attention by varying the operation of the warning devices; likewise, several recommendations involved human factors. This was true also for emerging technologies, including social media, and enhanced data collection and data processing.

The conference staff had remaining steps to compile upon completion of the presentations, as well as to release a summary of the results and a final report on the overall workshop. The results from this research and technical presentations delivered are available on the FRA website.

4.2 FRA's Highway-Rail Grade Crossing Task Force—Debra Chappell, FRA

After the delivery of the working group summaries, Debra Chappell delivered a presentation on FRA's Highway-Rail Grade Crossing Task Force (GXTF). The GXTF was established soon after the Valhalla, NY, accident of February 3, 2015. FRA leadership established the task force to provide the extra time and human resources to provide advanced thinking and leadership regarding grade crossing safety and trespass prevention programs. The GXTF has a cadre of SMEs to manage efforts from a project level and provide programmatic guidance. GXTF members welcomed all ideas. Several of the initiatives involve collaboration with FRA's external stakeholders, such as NHTSA and Federal Motor Carrier Safety Administration (FMCSA).

The work of the GXTF is broken down into five categories: Data, Analysis and Research; Engineering; Education; Enforcement; and Program Improvement. Table 15 presented the objectives and key initiatives for each category.

FRA is committed to continuing to build on the success of the GXTF.

Table 15. Grade Crossing Task Force Initiatives

GXTF Focus Area	Objective of Focus Area	Key Initiatives
Data, Analysis and Research	Better understand grade crossing accidents, fatalities, and injuries to ensure development of appropriate countermeasures and focus for future research and outreach.	Grade Crossing Location Clean-Up, Tech Company Coordination, Data Analysis Predictive Modelling, In-Depth Data Analysis of Grade Crossing Accidents Resulting in Injuries and Fatalities
Engineering	Provide up-to-date improved engineering standards and best practices for safety improvements at grade crossings.	Traffic Preemption, Blocked Crossing Study, Grade Crossing Handbook Update
Education	Educate partners, stakeholders, and the wider public about grade crossing safety to improve awareness, understanding, and safer behavior.	Motorist/Pedestrian Outreach, Continued Support of Operation Lifesaver, Web Site Improvements
Enforcement	Develop enforcement strategies for improving grade crossing safety through enhanced law enforcement and regulatory compliance.	National Working Group, First Responder Videos, “Take 10” Campaign
Program Improvement	Improve safety at high-risk grade crossings through grant management and collaborative efforts with other agencies and organizations.	Project Selection for Grants, Stakeholder Engagement, Section 130 Coordination, State Action Plans

5. Final Thoughts and Workshop Closeout

FRA Staff Director Ronald Ries delivered final thoughts and the workshop closeout, excerpted below:

> *Thanks for coming, and also for participating and sharing ideas, asking the honing questions and pushing the envelope.*
>
> *Many thanks go to the speakers and moderators, the planning committee and staff who made this workshop possible. In addition, a workshop like this cannot happen without funding. Kudos go to FRA's Office of Railroad Policy and Development and Office of Research, Development and Technology staff who put up the funding for this workshop, allowing for participant attendance at a low cost.*
>
> *Research formulation does not happen in a vacuum. We need partners such as cities or state DOTs to step up with new and innovative approaches, new ways of putting an emphasis on safety. Working together, we can come up with new ideas.*
>
> *This is not a dead topic; conversations are going to continue. You are encouraged to look for opportunities and innovative ways of doing things. If you know of universities or organizations looking to do research, FRA would love to know about it and potentially assisting in the analysis of the research question. Keep on pushing the envelope. Thanks for helping make grade crossings safer for the good people of this country.*

Appendix A. Workshop Materials

A word about the dissemination of workshop materials via Internet:

FRA established a website for summary materials, presentations, history, and contact information pertaining to the 2017 Grade Crossing Research Needs Workshop. Figure 5 provides a snapshot.

FRA intends to keep this site up to date as other resources become available.

This workshop does not need to stop on August 17, 2017. It can continue using the internet and social media—Facebook, Twitter—where further discussion and sharing of information can take place.

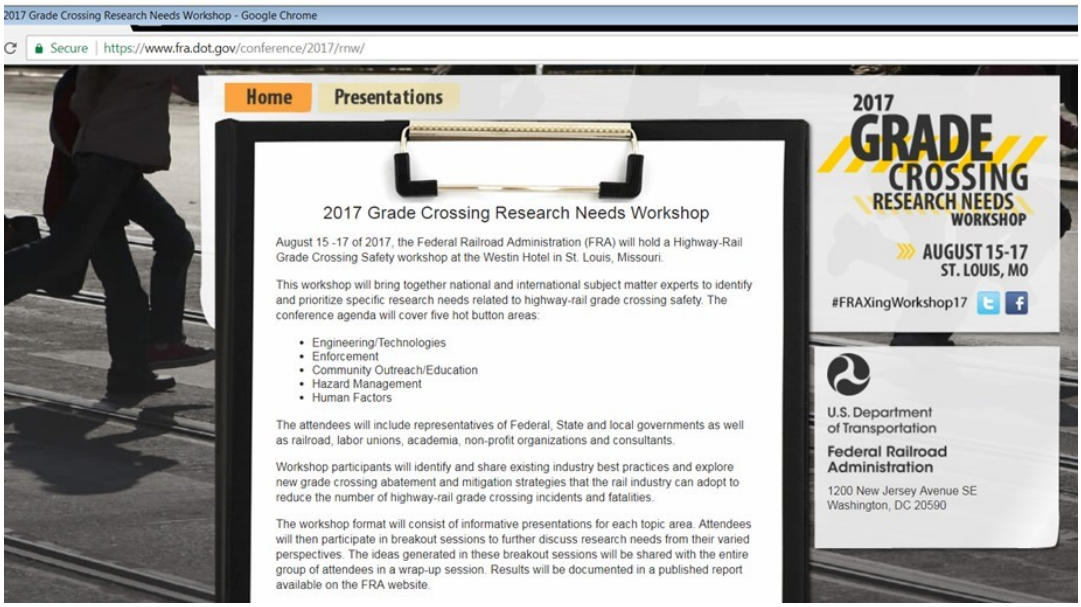

Figure 5. 2017 ROW Fatality and Trespass Prevention Workshop Homepage

Appendix B. Post-Workshop Survey Results

Below is a summary of the workshop feedback received through the evaluation form circulated to the workshop participants on the morning of day three. A total of 87 out of the 149 total attendees (58 percent) responded to the survey. Based on evaluations and comments made during the sessions, the overwhelming consensus was that the workshop was a success.

Highlights:

- 94% very or extremely satisfied with registration process
- 88% very or extremely satisfied with the presentations
- 95% very or extremely satisfied with the session structure
- 94% very or extremely satisfied with breakout session/discussion (this rating was 81% at the 2015 trespass workshop)
- 99% very or extremely satisfied with workshop staff (the other 1% left this blank)
- 86% very or extremely satisfied with conference location and facilities
- 99% very or extremely satisfied with overall quality of the workshop
- 98% responded yes to "workshop met your expectations"
- 49% recommended these types of workshops be held at least every 2–3 years (44% every year)

The survey as handed out to the participants and response summary are on the following pages.

2017 Grade Crossing Research Needs Workshop

St. Louis, MO – August 15-17, 2017

Evaluation

Workshop Evaluation: Please take a moment to complete this evaluation of the 2017 Grade Crossing Research Needs Workshop. Your responses will be valuable in planning future Workshops. Thank you.

Which of the following best describes the industry you belong to?

- ☐ Federal agency
- ☐ State or Local agency
- ☐ Transit agency
- ☐ Railroad
- ☐ Consultant
- ☐ Union Rep
- ☐ Association or organizations representing the railroad community
- ☐ Academic or University
- ☐ Education and Public Awareness
- ☐ Other _____

Please rate your satisfaction level for the following.

Category	Extremely	Very	Somewhat	Not at all	Comments
Registration process					
Workshop presentations					
Workshop session structure					
Breakout session discussions/results					
Courtesy and helpfulness of workshop staff					
Conference location and facilities					
Overall quality of the Workshop					

How did you hear about the workshop?
☐ Email ☐ From colleague ☐ Website ☐ Other: _____

Did the Workshop meet your expectations? ☐ YES ☐ NO
Comments:

How often should this type of workshop be held? ☐ Yearly ☐ Every 2-3 yrs ☐ Every 5 yrs ☐ No Preference

What did you like most about this Workshop? _____

What did you like least about this Workshop? _____

What kinds of topics would you like to see included at future Workshops? _____

General comments: _____

Figure 6. Workshop Attendee Survey

1. Which of the following best describes the industry you belong to?

Industry	Response Count	Response Percent
Federal agency	12	13.8%
State or Local agency	18	20.7%
Transit agency	4	4.6%
Railroad	24	27.6%
Consultant	12	13.8%
Union Rep	0	0.0%
Association or organizations representing the railroad community	1	1.1%
Academic or University	3	3.4%
Education and Public Awareness	2	2.3%
Other	9	10.3%
Blank	2	2.3%
Total	87	100.0%

Other: Supplier, Media Vendor, Fire Service, Did Not Specify (4), Manufacturer, Research Federal Firm

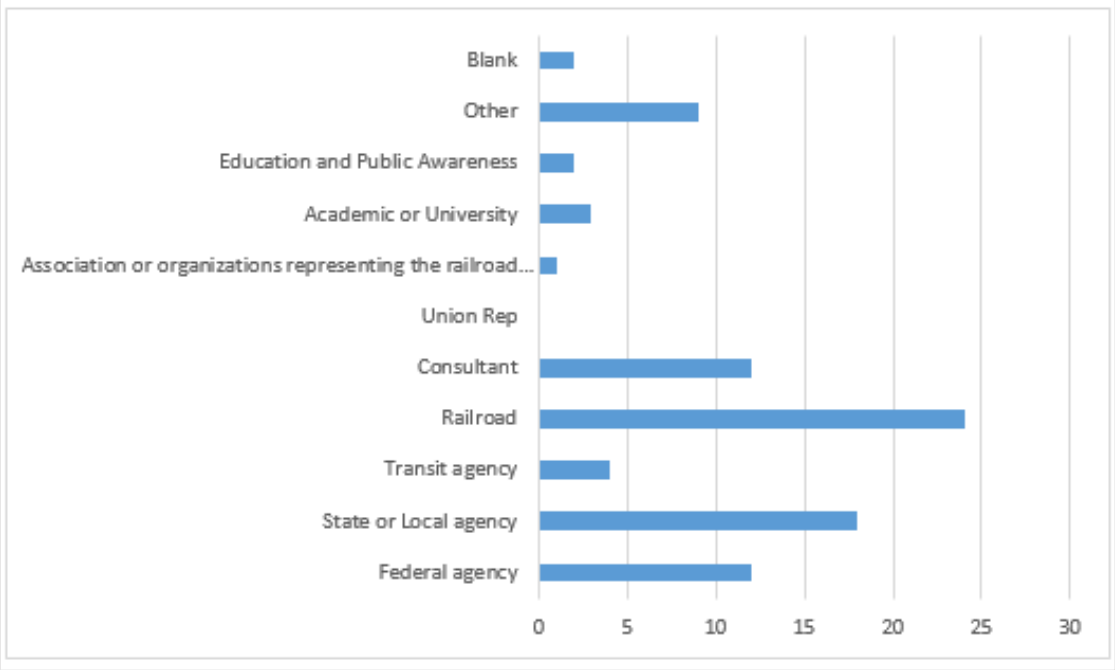

Figure 7. Industry Representation

2. Please rate your satisfaction level for the registration process.

Satisfaction Level	Response Count	Response Percent
Extremely	68	78%
Very	14	16%
Somewhat	3	3%
Not at all	0	0%
Not rated	2	2%
Total	87	100%

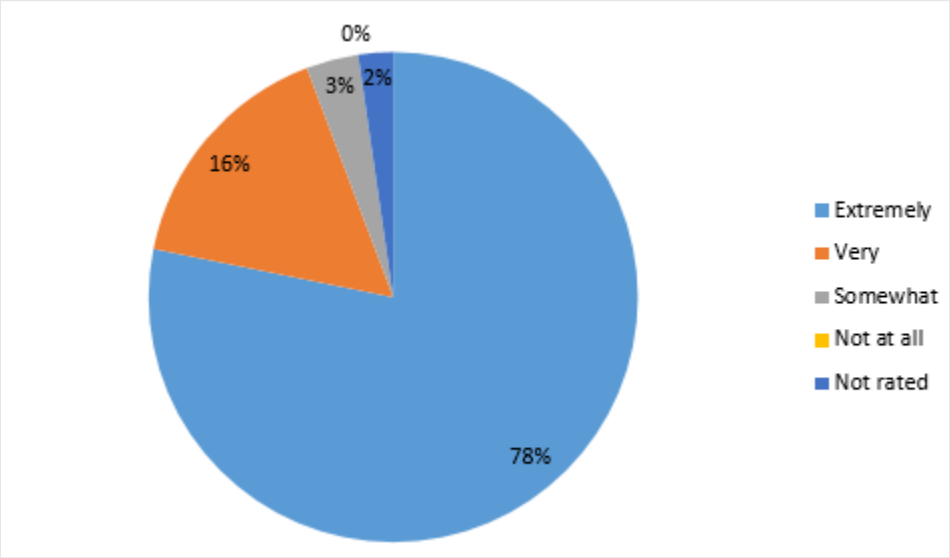

Figure 8. Registration Satisfaction Level

Comments:

Extremely

- Provide attendee list at the beginning
- Very simple
- Very easy

Somewhat

- For some reason our firewall prevents your link
- No confirmation sent, unclear it was free

3. Please rate your satisfaction level for the workshop presentations.

Satisfaction Level	Response Count	Response Percent
Extremely	46	53%
Very	39	45%
Somewhat	2	2%
Not at all	0	0%
Not rated	0	0%
Total	87	100%

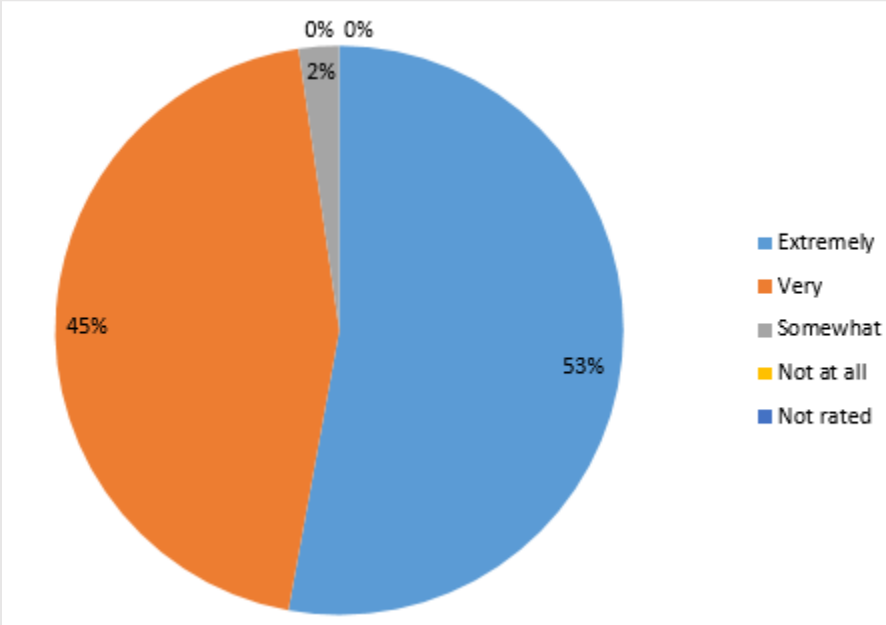

Figure 9. Workshop Presentations Satisfaction Level

Comments:

Extremely

- Great presentations
- I learned a ton

Very

- Some topics are repeated considering this is generally the same audience as other FRA-hosted conferences
- Excellent

4. Please rate your satisfaction level for the workshop session structure.

Satisfaction Level	Response Count	Response Percent
Extremely	51	59%
Very	32	37%
Somewhat	4	5%
Not at all	0	0%
Not rated	0	0%
Total	87	100%

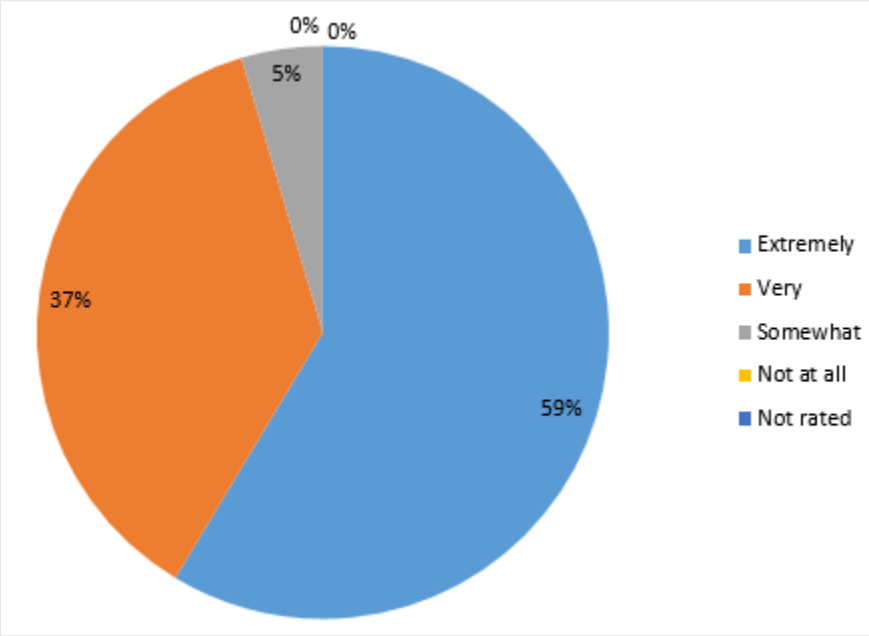

Figure 10. Workshop Session Structure Satisfaction Level

Comments:

Very

- Well organized

5. Please rate your satisfaction level for the breakout session discussions/results.

Satisfaction Level	Response Count	Response Percent
Extremely	55	63%
Very	27	31%
Somewhat	5	6%
Not at all	0	0%
Not rated	0	0%
Total	87	100%

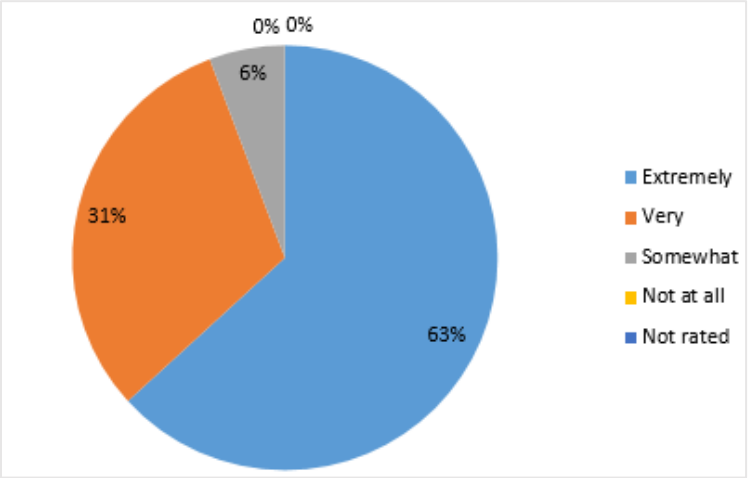

Figure 11. Breakout Session Discussions/Results Satisfaction Level

Comments:

Extremely

- It is important to keep the ideas and progress moving to accomplish the task, but more discussion at large would be nice
- Best part was the breakout session
- Lots of great ideas for facilitator

Very

- Needed better intro and initial discussion, unfocused idea sharing, unstructured

Somewhat

- This was good, although a lot of attendees did not know what they were talking about
- Too much over talking by some members

6. Please rate your satisfaction level for the courtesy and helpfulness of the workshop staff.

Satisfaction Level	Response Count	Response Percent
Extremely	71	82%
Very	15	17%
Somewhat	0	0%
Not at all	0	0%
Not rated	1	1%
Total	87	100%

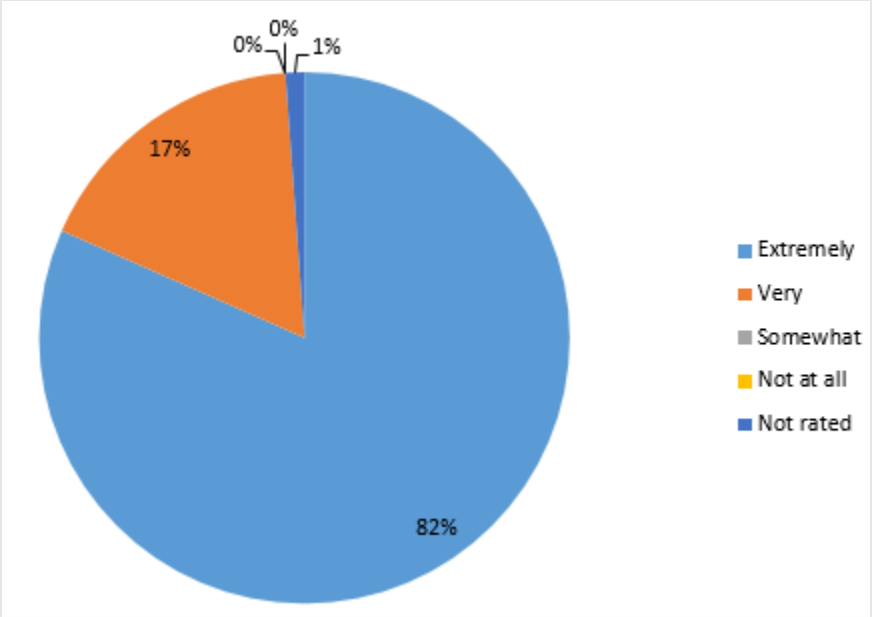

Figure 12. Workshop Staff Courtesy and Helpfulness Satisfaction Level

Comments:

Extremely

- Great availability
- Great group of people

7. Please rate your satisfaction level for the conference location and facilities.

Satisfaction Level	Response Count	Response Percent
Extremely	47	54%
Very	28	32%
Somewhat	11	13%
Not at all	0	0%
Not rated	1	1%
Total	87	100%

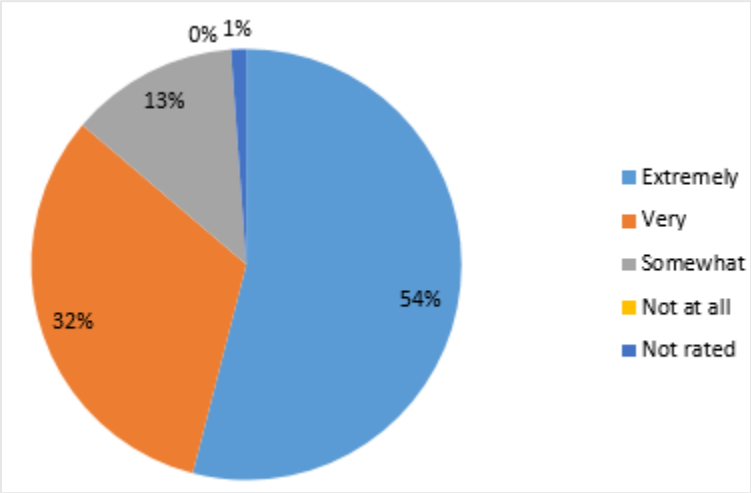

Figure 13. Conference Location and Facilities Satisfaction Level

Comments:

Extremely

- Very easy to get to, the train system is the best
- Great hotel facility

Very

- Place had character, but I liked it
- Columns were an issue with view
- The room for the main conference had bad angle to view screen

Somewhat

- Better sight lines in main room
- Room block limited, no communications on it

Not Rated

- Columns are in the way in the room

8. Please rate your satisfaction level for the overall quality of the workshop.

Satisfaction Level	Response Count	Response Percent
Extremely	58	67%
Very	28	32%
Somewhat	0	0%
Not at all	0	0%
Not rated	1	1%
Total	87	100%

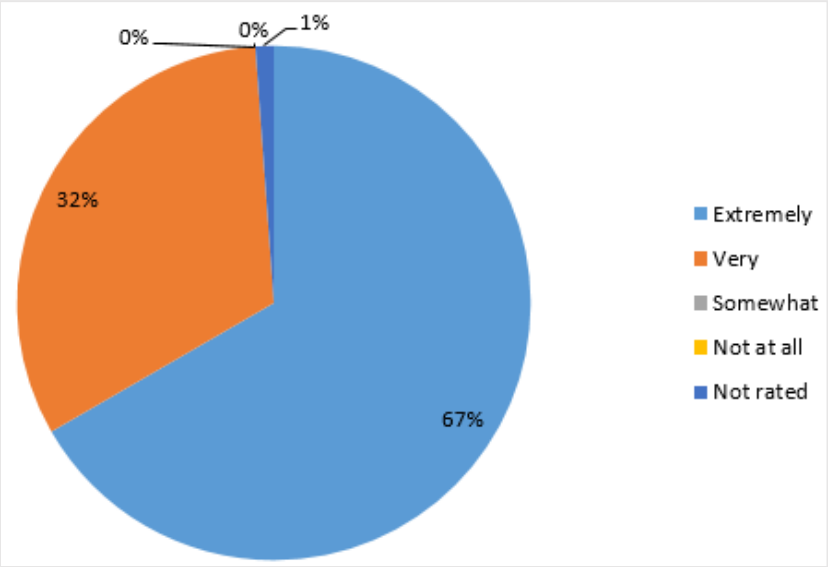

Figure 14. Overall Workshop Quality Satisfaction Level

Comments:

Extremely

- Hotel facilities (i.e., the breakfast discount)
- A+

9. How did you hear about the workshop?

Resource	Response Count	Response Percent
Email	38	44%

Resource	Response Count	Response Percent
From colleague	31	36%
Website	12	14%
Other	5	6%
No response	1	1%
Total	87	100%

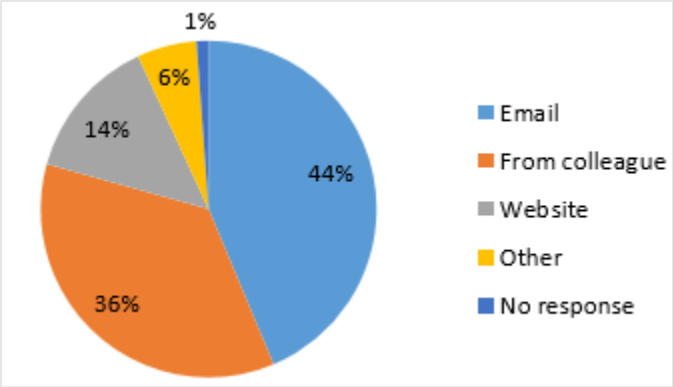

Figure 15. How Did Attendees Hear About the Workshop?

10. Did the workshop meet your expectations?

Expectations Met	Response Count	Response Percent
Yes	85	98%
No	0	0%
Not rated	2	2%
Total	87	100%

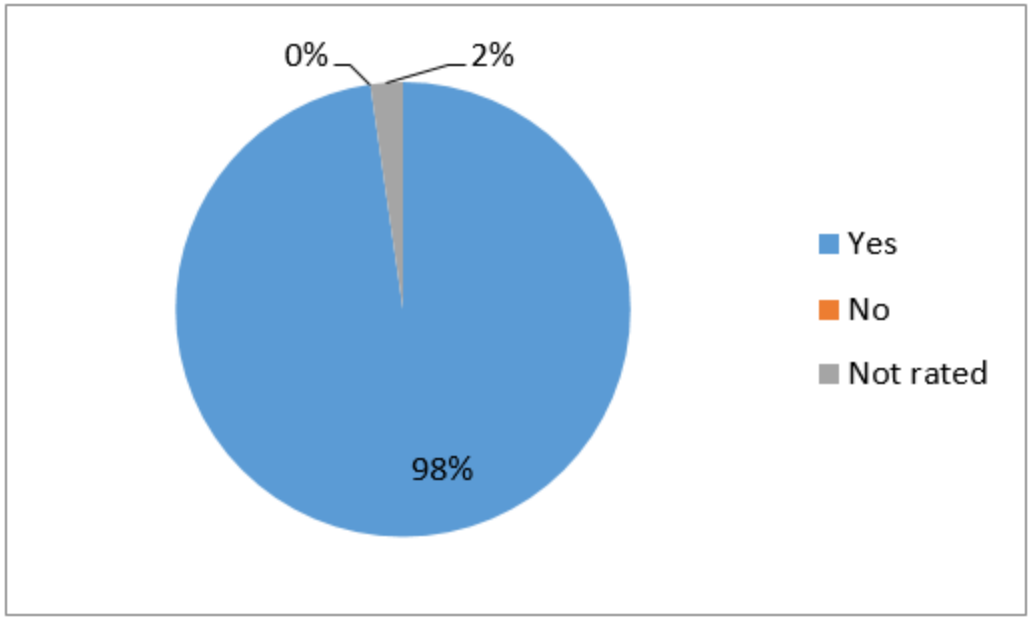

Figure 16. Did the Workshop Meet Expectations?

11. How often should this type of workshop be held?

Recommended Timeframe to Hold Workshop	Response Count	Response Percent
Yearly	38	44%
Every 2–3 yrs	43	49%
Every 5 yrs	5	6%
No Preference	0	0%
Blank	1	1%
Total	87	100%

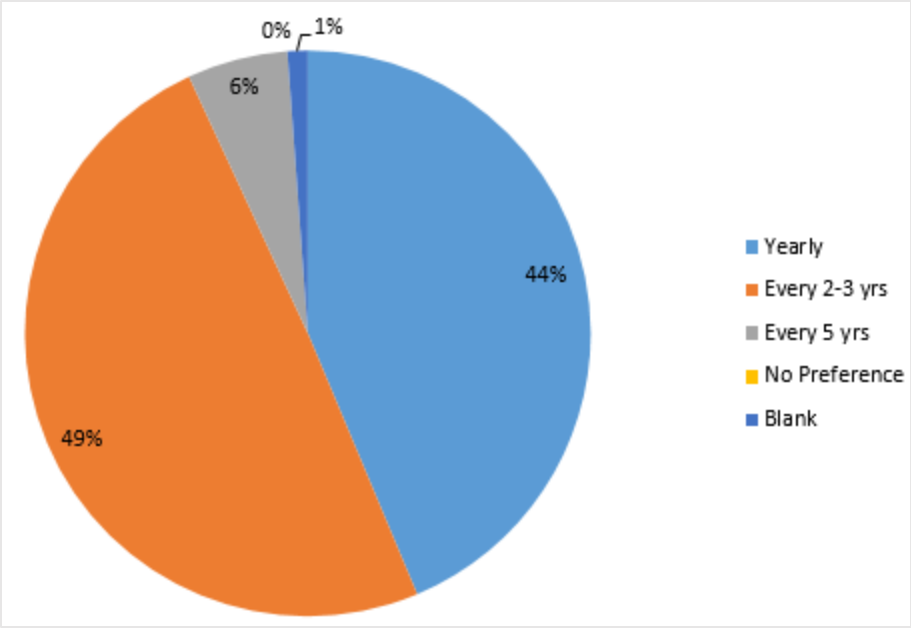

Figure 17. How Often Should this Type of Workshop be Held?

12. What did you like <u>most</u> about this workshop?

- Community outreach and education
- Variety of presentations & backgrounds
- Breakouts session
- Free, wide group of professionals
- Forward thinking well researched presentations
- Presentations and breakout sessions
- Open discussion and networking
- Interactive discussions—broad cross section
- Technology breakout
- Breakout session
- Frank Frey
- Presentations and breakout sessions
- Exchange of ideas
- Presentations
- Networking
- Presentations were excellent
- Opportunity to learn new tech under review for potential implementation
- Break out discussion
- Varied topics
- Amount of the time for discussions
- Breath of information areas
- Workshop interaction
- Lots of good information & examples

- Breakout sessions, certain speakers, technology
- The topics
- New/emerging technology
- Presentations
- Information reviewed in presentation is used during break away sessions to form more useful idea
- Interaction
- Variety of subjects and always like the breakout sessions
- Community outreach/education and human factor
- Information exchange/ sharing best practices
- Excellent sessions
- The variety of ideas and contacts made for follow-up
- Location and topics
- The engineering/technology session
- Best practices/new technologies
- Getting current data on issues related to grade crossing safety
- Excellent presenters
- The interaction
- Wide angle youth media
- Multiple speakers per subject
- Networking, presentation, discussion
- Pulling together of stakeholder/free
- Technical presentation and breakout session to develop research needs
- Quality of presentations/professional
- The variety of information provided
- Presentation
- Well informed speakers, capable of speaking
- Opportunity to do business
- Open sharing of ideas; welcoming new technologies
- Collaboration
- Making connections
- Collaboration
- Exchange of ideas
- Breakout session to develop ideas for update
- New technology in railroad
- Learning new ideas
- Camera technology
- The innovative ideas presented regarding new technology
- Collaboration and networking
- Learned stuff
- I like the variety of materials covered from all areas
- Exchange of ideas
- The breakout session was a good brainstorm session
- Presentations and down time between them

- The data that came in from presenters
- Provided great "lens" for current/future technologies/research information
- Presentations
- Great presentations
- Workshop presentations
- Industry interaction, positive sharing of project that improves safety at crossings
- Networking/idea sharing

13. What did you like <u>least</u> about this workshop?

- Midday Thursday with limited airline flights available
- Lack of Wi-Fi if you didn't stay at the hotel
- Too many welcomes, keynote speaker was "interesting"
- Poor researched presentation
- N/A
- Transparency of existing DOT research
- Some of the presentations were poor quality
- Plethora of ideas
- Talks that did not pertain to grade crossing
- The magnetometer and drone presentation
- Breakout: Rude attendees
- Need current FRA research going on, would save on discussion
- More participating from other disciplines included such as pedestrian, bicycle, traffic engineers
- Seems engineering solutions are limited in immediate practicality
- Some presentation material not relevant
- Non-electronic voting
- Discussion too general
- Need snacks/soft drinks available between meetings
- Length of sessions
- Everything was good
- No meet and greet session
- Lengthy, boring presentations, not engaging
- Would like about 10–15 min longer at lunch or have at least a lunch at 1 hr. 15 min
- Breakout "decisions by committee"
- Condense the workshop 2 days
- The pillars in the room
- No introductions/need to meet new people
- I thought the general session room was a little small
- Did not have a good sense of who my fellow attendees were; would be good to have a list of attendees with conference on day 1
- Limited hotel rooms in the room blocks
- Nothing
- The columns in the main room, no breakfast/snacks, cold air in main room
- No guided networking

- Former Deputy Administrator lengthy comments, shorter would have been better
- Needed longer time for workshops
- Lack of actions presented most presentation only discuss research, not solutions
- The sightlines during the presentation (not a big deal)
- Sight line in main room
- Not enough government rate rooms, had to stay at another hotel
- Time of year (buy time period)
- Cannot think of a negative
- Sales pitch
- Maybe have coffee
- Lack of food
- All great
- The service at the restaurant was slow and it affected some of the schedule
- Material sharing (last time/this time)
- No grocery stores near the hotel
- Did not get the correct breakout
- PowerPoint equipment not working properly

14. What kinds of topics would you like to see included at future workshops?

- Pedestrian factors
- Ongoing research at Volpe and FRA
- Better coordination between FHWA and FRA on implementation, funding
- Legal perspective
- Expand on future tech and what FRA is researching
- Real examples of research or tests—sample population
- Presentation of current projects that resulted from workshops
- A list of everything FRA is working on
- Results of prior recommendation
- 130 funding
- Suicide prevention, improving safety culture
- Solutions from other parts of the world
- Big data
- GIS applications
- Follow up this year's max goals discussed in breakout, trending ways to reach public
- Current initiatives
- Trespass/ENS education
- More trespass issues-solutions
- These five were fine
- Assessment of existing practices/regulations
- High security fencing trespassing
- Possibly design considerate
- Rail safety
- Effective solutions (engineering education enforcement)

- Results of research engaged since last conference
- More of same-cutting edge info on grade crossings
- Preemption pedestrian/bike treatments, quiet zones - administration, implementation
- Cannot think of any at the moment
- Policy issues
- Current available systems, i.e., GPS that can provide warnings related to crossings already available in current mapping/GPS/GIS software
- Continuous improvement
- More enforcement presence
- New technology
- More breakout sessions
- More law enforcement topics
- Safety for first responders
- Pedestrians
- A physical person is needed
- Continued follow-up on existing workshop
- Results from other workshops
- Success stories from around the world that are applicable to the situation in the US
- How if information shared? What is the feedback loops between groups?
- Data analysis
- Weather conditions
- Funding/coordination efforts
- Solutions to suicide trespass and crossing behavior

15. General comments:

- Could this be a joint FHWA/FRA conference? Some of the issues are relevant to highway/traffic
- Good job
- Thank you
- Great venue for producing new ideas and making the industry safer
- Annual conference should talk about research
- Thank you, excellent experience
- Great workshop, super informative
- Great job
- Enjoyed it, very interested in coming to the next workshop
- Nice location, schedule next workshop when the cardinals are playing at home
- Thank you to all who put this together
- Thank you! Good job
- Great events - highly effective
- Two-day program
- Would like there to be a display of the various RR/s, agencies, etc. TRS products (ask them to bring products to share; distribute the attend list - if want to
- Very well organized
- Nicely done!

- I am very satisfied and very glad I came
- I loved this class
- Agree with the structure of the presentations and use of breakouts
- Great location and material
- There seemed to be limited number of State DOT section 130-type people. Could be I just missed them
- Pleasantly surprised by the mindset and how advanced developments are
- Would prefer location w/ access to subway, fast food options. Free breakfast would be good too. Cool location—love stadium and access to light rail
- Very informative
- It would be nice to have FRA present on initiatives or do a roundtable for their partners to ask questions
- It is desirable to get presentation and workshop outputs to participate as quickly as possible. Also, demonstrate progress with the proposals prior to any future meeting
- Great event!
- Enjoyed it
- Great work
- Very good organization and planning
- From political branch
- Have session broken in smaller groups and groups rotate - more time for question and answer following sessions
- Great job with the workshop, I learned a lot
- Great information presented. Please make presentations available soon
- Outstanding
- Great workshop and wonderful way to connect with all types of people from various backgrounds and work areas and professions dedicated to grade crossing safety
- I love this conference
- Trespass - pedestrian - walker: It will be hard for us to communicate with the pedestrians while we thinking of them as abstractions, they need to be considered walkers
- Great job overall! Keep partnering!
- Great workshops
- Great conference
- Great job. Need more
- More technical sessions please
- Very interesting workshop would like to be back next year

Appendix C. Workshop Agenda

Monday, August 14

5:00–8:00 pm Registration

Tuesday, August 15

7:30–8:30 am Registration

8:30 – 10:00 am Opening Session

Opening Remarks:

- M. Grizkewitsch, FRA & Marco daSilva, Volpe National Transportation Systems Center

Moderator/MC:

- Ronald Ries, FRA

Welcome DOT Address:

- Eric Curtit, Rail Administrator, MODOT Multimodal Ops Rail Section

Keynote Speaker:

- Heath Hall, Former Deputy Administrator, FRA

General Address, FRA Accomplishments:

- Maryam Allahyar-Wyrick, Director of Research, Development & Technology, FRA (acting Director of RD&T since the drafting of this report)

10:00–10:15 am Break

10:15 am – 12:00 pm Session 1: *Engineering/Technologies*

Moderator: Frank Frey, FRA

- Kelly Ozdemir & Bud Zaouk, KEA Technologies *Implementing Connected Vehicle and Autonomous Vehicle Technologies at Highway-Rail Grade Crossings*
- Ralph Young, BNSF Railway
  Wireless Crossing Technology, Next Generation Technology, and Highway-Rail Interconnection Design
- David Baldwin, Central Signal, LLC
  Engineering Solutions to Mitigate/Eliminate Incidents of Loss of Shunt at Highway-Rail Grade Crossings

12:00 – 1:00 pm Lunch (On Your Own)

1:00 – 2:30 pm Session 2: *Human Factors*

Moderator: Starr Kidda, FRA

- David Nelson, Michigan Technological University *Investigating Driver Behavior at Grade Crossings Using Driving Data & Simulators*
- Anand Prabhakaran, Sharma & Associates
  Analysis and Modeling of Grade Crossing Accidents
- Scott Gabree, Volpe Center
  Pedestrians' Behavior at Grade Crossings and Suicide Prevention

2:30–3:00 pm Break

3:00 – 4:30 pm Session 3: *Community Outreach & Education*

Moderators: Robert Rohauer, CSX Transportation; Suzanne Horton, Volpe Center

- Tom Lange, Union Pacific Railroad
  Your Life is Worth the Wait—
  Social Media Aspects of a Safety Campaign; Successfully Reaching Targeted Audiences
- David Sloan & Tahir Juba, Wide Angle Youth Media *Peer to Peer Messaging; Steps Taken From Development to Execution*
- David Reich, The National Road Safety Foundation
  Developing Partnerships; Broaden Your
  Messaging Reach Locally, Regionally, and Nationally

4:30–4:45 pm Adjournment

- Ronald Ries, FRA

Wednesday, August 16

7:30–8:15 am Registration

8:15 –8:30 am Welcome, *General Address:*
- Ronald Ries, FRA

8:30–10:00 am Session 4: *Enforcement*
Moderators: Ryan Gustin, CSX Transportation; Michail Grizkewitsch, FRA
- Louis Jogmen, Park Ridge Police Department
  Illinois Grade Crossing Safety Week
- Raymond Rodriguez, City of Orlando
  Orlando Stops Program
- Carlos Löfstedt, Sensys America
  Photo Enforcement Technology
- Richard Gent, Hot Rail Group
  Drone Detection Technology

10:00–10:15 am Break

10:15 am – 12:00 pm Session 5: *Hazard Management*
Moderators: Debra Chappell, FRA; Kelly Morton, FHWA
- Michael Long, Short Line Safety Institute *The Importance of Safety Culture & Risk Management*
- Garreth Rempel, TRAINFO
  The Use of TRAINFO to Predict Blocked Highway-Rail Grade Crossings
- Brent Ogden, Kimley-Horn
  "Second Train Coming" Sign Research

12:00 –12:15 pm Organization of Working Groups/Intro of Teams

12:15 –1:15 pm Lunch (On Your Own)

1:15 –2:45 pm Working Group Breakouts
- *Engineering/Technology* (YellowTeam)
- *Human Factors* (Green Team)
- *Community Outreach & Education* (Orange Team)
- *Enforcement* (Blue Team)
- *Hazard Management* (PurpleTeam)

2:45–3:00 pm Break

3:00 –4:30 pm Working Group Breakouts

4:30–4:45 pm Adjournment

Thursday, August 17

8:00 – 9:15 am *Optional Working Group Session Meeting*

9:15 –9:30 am *Welcome Address:*
- Ronald Ries, FRA

9:30 –11:00 am Working Group Summaries of Top Research Needs

11:00 –11:30 am *FRA's Highway-Rail Grade Crossing Task Force*
Moderator: Debra Chappell, FRA

11:30 am – 12:00 pm *Final Thoughts and Workshop Closeout*

Appendix D. Voting Distribution for Top 22 Recommended Actions

Table 16 contains the distribution of the votes for the top recommended actions developed within each breakout group. Participants in each breakout session developed ideas and then voted to arrive at a short list of top recommended actions within their group. Each participant was given up to five voting dots (exact number was based on the number of ideas the group were to vote on and determined by the session leader), which they affixed to their preferred ideas. The votes documented in Table 16 are broken down per participant affiliation, defined as follows:

F = Federal Agency

S = State or Local Government Agency

R = Railroad

T = Transit Agency

C = Consultant

A = Academia

B = Association or organization representing the railroad community

O = Other

FRA collected this demographic information to justify and support future requests for funding to conduct high-priority research generated from this workshop.

Table 16. Voting Distribution for Top 22 Recommended Actions

TOPIC AREA	ACTION	TITLE	F	S	R	T	C	A	B	O	Total
1. Engineering/ Technologies	1	Wireless Technology for Crossing Activation	2	6	6		5	1	1	1	22
	2	Research and Develop V2V and V2I to Inform, Warn, and Force Stop Motor Vehicles	1	5	8		5	1			20
	3	Research Alternative RR Warning Devices	2	3	7		7				19
	4	Intelligent Traffic System Application for Motor Vehicles	1	3	3		6				13
	5	Research Vehicle Activated Enhanced Advanced Warning Sign	3	3	2		3				11
2. Human Factors	1	Improve Close Call/Near Miss Reporting (People or Vehicle Strike)	3	3	1	1	1	1		2	12
	2	Integration of Rail Safety Messages into Driver Education and Licensing	2	2	2	2	1	1		1	11
	3	Incorporating Rail Safety People into Development/Planning Process	2	1	2	2	1	1		1	10
	4	Educate Youth to Educate Adults	2	2	2		1			1	8
3. Community Outreach and Education	1	Trespasser Identification, Motivation and Messaging	1	2	5		4		2		14
	2	Research into the Efficacy of Social Media Platforms and Messages		3	3		4		2		12
	3	Driver Education (General and Commercial Drive License)	1	2	3		2			2	10
4. Enforcement	1	Technology Opportunities for Law Enforcement	4	4	3		2			2	15
	2	Funding Opportunities for Law Enforcement	2	3	4		2			1	12
	3	Uniformity of Highway-Railroad Grade Crossing Laws	1	3	2		2			2	10
	4	Development of National Highway-Railroad Grade Crossing Law Enforcement Campaign	1	2	2	1	2				8
	5	Closure of Highway-Railroad Grade Crossings	3	1	3		1				8
5. Hazard Management	1	Additional Train Approaching Warning System	6	2	4	1	1	1		2	17
	2	Grade Crossing Hazard Matrix	5	1	3	1		1	1		12
	3	Model Communication Process	5	1	3			1	1		11
	4	Enhanced Data Exchange Between Vehicle Control Systems and Train Control Systems	2	1	3		1		1	1	9
	5	Updating Evaluation Tools for Rail/Highway Grade Crossing Improvements	3	1	1	1		1		1	8

Abbreviations and Acronyms

Abbreviations & Acronyms	Names
CN	Canadian National Railway
CP	Canadian Pacific Railway
CMF	Crash Modification Factor
CSXT	CSX Transportation
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
GIS	Geographic Information System
GPS	Global Positioning System
GXTF	Grade Crossing Task Force
JPO	Joint Program Office
KCS	Kansas City Southern Railway
LED	Light Emitting Diode
LIRR	Long Island Railroad
MUTCD	Manual on Uniform Traffic Control Devices
MODOT	Missouri Department of Transportation
NCUTCD	National Committee on Uniform Traffic Control Devices
NHTSA	National Highway Traffic Safety Administration
OST-R	Office of Assistant Secretary of Research and Technology
PTC	Positive Train Control
RD&T	Research, Development and Technology
ROW	Right-of-Way
RRS	Office of Railroad Safety
SMEs	Subject Matter Experts
Three Es	Education, Engineering, and Enforcement

Abbreviations & Acronyms	Names
UP	Union Pacific Railroad
DOT	U.S. Department of Transportation
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
Volpe Center	John A. Volpe National Transportation Systems Center