Federal Railroad Administration
Highway-Rail Grade Crossing Safety
Business Plan

November 2019

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Executive Summary

Safety is the highest priority of the U.S. Department of Transportation (USDOT) and the Federal Railroad Administration (FRA).

With this plan, the FRA focuses on safety at or near highway-rail grade crossings and describes actions the agency will take over the next three years to support the implementation of technology to improve grade crossing safety. This plan complements the FRA's National Strategy to Prevent Trespassing on Railroad Property Report to Congress submitted in October 2018. Together, highway-rail grade crossing and trespasser accidents account for **97 percent** of all fatalities along the nation's railroad rights-of-way.

The number of grade crossing incidents and accidents has remained steady for the past ten years, and the FRA believes that new approaches must be applied to this resistant and pervasive problem. Specifically, we seek new technologies and methods to augment our time-tested strategies to achieve a reduction in the number of these preventable accidents.

We seek to join and empower our stakeholders to work together to identify, develop, and implement these ideas to improve grade crossing safety in our communities and reduce the number of incidents by 5 percent year after year.

Together, we made a start toward this goal in 2019 during FRA-hosted listening sessions that captured some initial innovative ideas involving both low- and high-tech solutions and identified barriers to implementing these new technologies. The FRA is committed to helping remove these barriers.

We recognize the costs to communities to implement technologies at grade crossings, and are making information about funding opportunities available to remove one more obstacle to our collective progress.

The FRA is also intensifying our efforts to support the implementation of new solutions:

We will enhance our **partnerships and outreach** efforts to increase the numbers of eyes that can see the problem, the minds that can envision the solution, and the hands that can fashion it. We will seek to educate the public about the dangers posed by inattentive or risky behaviors around trains and tracks.

We will **leverage data** to apply our resources more effectively. By continually challenging the accuracy of our data, finding creative ways to visualize this data, using tools to analyze our data from multiple angles for a more complete picture of an issue, and by seeking new data sources, we can be more confident of our decisions and our direction.

We will use our **regulatory oversight and enforcement** processes to maintain safe rail operations near accident-prone areas, and we will engage those partners in the rail industry, state and local governments, and law enforcement to solicit their support.

We have a long history of **supporting research** to address the problems of rail safety, and are currently engaged in several research initiatives to support the implementation of technology to promote grade crossing safety. We consider research vital to validating our pilot programs and to unearthing new knowledge to feed us constantly with fresh ideas.

The FRA believes that most accidents at grade crossings are preventable. We also believe the factors that lead to these accidents are discoverable and solvable.

"We look forward to working with our partners so that everyone may safely reach the other side of the tracks." – Ronald L. Batory, FRA Administrator

Agency Overview

Our Agency

The Federal Railroad Administration (FRA) was created by the Department of Transportation Act of 1966. It is one of ten agencies within the U.S. Department of Transportation (USDOT). We have broad regulatory authority over all areas of railroad safety.

FRA's Office of Railroad Safety (RRS) promotes and regulates safety throughout the nation's railroad industry. The office executes its regulatory and oversight responsibilities through a diverse staff of nearly 700 federal safety professionals.

Our Mission

The FRA mission is *to enable the safe, reliable, and efficient movement of people and goods for a strong America, now and in the future.* This plan supports that mission by seeking to eliminate preventable vehicle-train collisions at highway-rail grade crossings.

Our Team and Partners

The FRA's Highway-Rail Grade Crossing and Trespasser Programs Division (Division) was created in 1993. The headquarters staff is supported by teams of regional grade crossing specialists, managers, and inspectors. Together they develop programs to work with states and local communities to improve safety at highway-rail grade crossings by closing crossings, planning corridor programs, advancing public education and awareness, and promoting law enforcement. The FRA recently increased its emphasis on grade crossing safety as a technical discipline and formalized its guidance for inspections and violations reporting. The Division also works closing with the RRS Signal and Train Control team that provides oversight to the critical systems that enhance grade crossing safety. To date, there have been very few incidents that are the result of malfunctioning equipment.

The FRA works closely with **our partners** to reduce accidents at grade crossings. The Division works closely with the **FRA's Office of Railroad Policy and Development** to identify and study problematic human behavior, test new technologies, and to research the use of conventional technologies that may have a beneficial application for grade crossing safety.

We work with **other USDOT modes** that have a vested interest in highway-rail grade crossing safety through the ONEDOT Team. Together, we seek to enhance grade crossing safety by capturing common perspectives and challenges of each mode and formulating collaborative solutions.

The FRA and our modal partners provide funding to **Operation Lifesaver, Inc.** (OLI) for outreach and education. OLI promotes awareness of emergency notification signs; educates news media on safe reporting near tracks and trains; and encourages pedestrian safety around railroad tracks.

The FRA recognizes **law enforcement** officers as the front line at grade crossings to protect our citizens, uphold the law, and hold violators to account. We seek to find technologies to aid them in these tasks.

The FRA participates in **committees** such as the Transportation Research Board Committee on Highway/Rail Grade Crossings to support research into innovative devices and better data analysis.

We've worked with our **state partners** to develop practical and effective highway-rail grade crossing State Action Plans. FRA developed a model State Action Plan that outlines best practices from the existing plans and other noteworthy practices that could be included for use by state departments of transportation along with cities, counties, towns, tribal governments, and railroad companies.

The Grade Crossing Safety Environment

There are approximately **209,000** at-grade railroad crossings in the United States.

Grade crossing remains the second leading cause of railroad fatalities. Together with the leading cause, trespassing, it accounts for **97 percent** of all railroad fatalities.

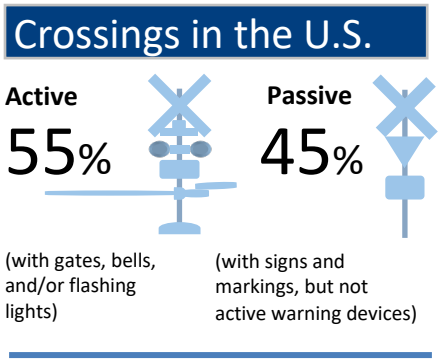
In the past ten years, the total number of accidents at public and private railroad crossings have remained relatively constant, averaging approximately **2,100 per year.**

2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1,933	2,052	2,064	1,988	2,104	2,296	2,080	2,049	2,123	2,216

Source: FRA SafetyData website, as of July 31, 2019 (https://safetydata.fra.dot.gov).

Many factors contribute to the dangers inherent when two modes of transportation intersect.

Human behavior plays a primary role in the number of accidents at grade crossings. When a driver chooses to maneuver around lowered gates at an active crossing, he or she increases the risk of a grade crossing incident or accident. We must also account for those who use passing trains to deliberately end their lives. Human Factors (HF) research seeks to understand the underlying causes and human behaviors that result in pedestrians and vehicles struck by oncoming trains at grade crossings. In the last ten years, FRA safety data shows that human behavior accounts for up to **93 percent** of vehicle crossing accidents for the U.S. railroad system. HF research ideas and pilot projects address variables such as human perception, decision making, distraction, and human fatigue.



About half of the public at-grade crossings are passive and have no train-activated warning devices. Drivers must scan for oncoming trains and judge the speed and distance to determine if it is safe to cross.

The ability of drivers and pedestrians to navigate a grade crossing safely can be hindered when the **sight distance is obstructed** by vegetation or by buildings.

Crossings may be located near signalized roadway intersections. A highway **signal preemption** installation may be necessary and must be properly inspected and maintained to ensure that vehicles that could become queued and stopped on the tracks will be able to clear before a train arrives.

About 38% of grade crossings are private crossings where the roadway is owned by a private entity. There are **no federal laws and regulations** for these crossings, and the standards for signs and pavement markings are not the same as for public crossings. Because of these factors, these crossings are often less equipped than public crossings and may pose a greater risk, especially if a larger volume of vehicles use them.

A Technological Approach

The FRA embraces a cutting-edge approach to address the long-standing issue of grade crossing safety. We encourage the development and implementation of new and revitalized technology to multiply the effectiveness of traditional approaches through meaningful partnerships and leveraging of data systems.

Traction through Recent Accomplishments

In October 2018, FRA submitted its National Strategy to Prevent Trespassing on Railroad Property Report to Congress, and hosted the Trespasser and Grade Crossing Fatality Prevention Summit at its headquarters in Washington, D.C. The summit focused in part on discovering new and innovative ways to use technology to mitigate and eliminate grade crossing collisions.

Then, in March through May of 2019, FRA hosted six grade-crossing technology listening sessions at USDOT headquarters. The sessions engaged Class I and commuter railroads; communication and signal experts; signal equipment manufactures; technology companies and automobile manufacturers; trade and advocacy groups, law enforcement agencies and federal, state and local governments, and USDOT modal experts. The participants discussed emerging grade crossing technologies, use of effective conventional technologies, barriers to implementation of new technologies, and ideas for regulatory changes needed to allow for greater flexibility. The FRA captured several ideas for improvements at grade crossings, evaluated each idea, and prioritized them based on viability. These ideas ranged from low-tech to high-tech and included pilots already underway. For the complete list, see Appendix A. Examples include:

Low-Tech	Pilot	High-Tech
North Carolina DOT **Low-Cost Corridor Improvement Strategies** Use of large pots to "narrow" crossings and force large trucks to use a nearby grade separation, thereby eliminating the instances of hung up and slow-moving, heavy vehicles blocking the crossing and being hit.	***Island Radar*** **Fouled/Blocked Crossing Detection & Notification System** Allows a railroad signal maintainer, or other railroad personnel, to receive an instant alert with an image of the situation. An embedded link allows real-time access to the crossing over a cellular channel to view status. Costs approximately $12,000 per crossing location.	***BNSF*** **Wireless Train Detection Capability** Can reduce light train speed restrictions, loss of shunt, and conventional and electrified track capability. Overcomes poor track conditions and allows more off-track maintenance to occur. Allows for remote health monitoring checks to issue immediate speed restrictions.

During the FRA Grade Crossing Symposium to be held November 19, 2019 in Washington, D.C., we will share what was learned during the listening sessions with all participants and other stakeholders, and provide tools and guidance to enhance safety and facilitate relationships among the other USDOT modes with a vested interest in grade crossing safety. Additionally, over the next three years, the FRA will:

- Identify and communicate information about high- and low-tech solutions during our outreach efforts
- Work with implementers to determine consistently the effectiveness of technical solutions
- Hold annual local and national symposia to grow ideas and momentum for technical solutions

Funding Opportunities

The FRA recognizes that new technologies come with a price tag that is out of reach for many communities. We will support them by providing information about that available funding that may help them offset the cost of expensive safety upgrades.

FRA programs accepting applications (https://www.fra.dot.gov/Page/P0997)

- **Federal-State Partnership for State of Good Repair (SOGR)**
  State governments, localities, public agencies, and Amtrak are eligible for this grant that assists in funding capital projects to repair, replace, or rehabilitate qualified railroad assets to reduce the state of good repair backlog and improve intercity passenger rail performance. Eligible projects include those that replace existing assets in-kind and bring existing assets into a SOGR. Highway-rail grade crossing safety and grade-separation projects are encouraged. Applications are due December 9, 2019, and information is at https://www.federalregister.gov/documents/2019/10/08/2019-21866/notice-of-funding-opportunity-for-the-federal-state-partnership-for-state-of-good-repair-program

- **Railroad Trespassing Enforcement Grant Program**
  State, county, municipal, local, and regional law enforcement agencies with FRA-regulated track within their jurisdiction can take advantage of this program for hourly wages for law enforcement officials to enforce trespassing laws at rail trespass hot spots or problem areas. Activities may include investigating trespassing and providing warnings and citations to the trespassers. Applications are due December 23, 2019, and information is at https://www.federalregister.gov/documents/2019/10/22/2019-22925/notice-of-funding-opportunity-for-railroad-trespassing-enforcement-grant-program

Available FRA/DOT programs pending future funding (https://www.fra.dot.gov/Page/P0997)

- **Consolidated Rail Infrastructure and Safety Improvements (CRISI) Grants.**
  States, local governments, Class II and III railroads, and university transportation centers can apply for a wide range of capital and safety improvement projects for intercity and freight rail, including grade crossing and grade separation projects.

- **Better Utilizing Investments to Leverage Development (BUILD) Grants.**
  State and local governmental entities can apply for a broad range of surface transportation projects including safety improvements to eliminate unsafe grade crossings.

- **Infrastructure for Rebuilding America (INFRA) Grants**
  State, local, and tribal governmental entities and federal land management agencies jointly with a State can apply for railway-highway grade crossing or grade separation projects.

Select Federal Highway Administration (FHWA) programs administered by States.

- **23 USC 130 (Section 130) Program**
  Apportioned to the States and targeted to eliminate hazards at railway-highway crossings. https://safety.fhwa.dot.gov/hsip/xings/

- **23 USC 148 Highway Safety Improvement Program (HSIP)**
  If States undertake a rail-highway crossing project they must have it in their State Strategic Highway Safety Plan (SHSP). https://www.fhwa.dot.gov/fastact/factsheets/hsipfs.cfm

- **National Highway Freight Program**
  Various freight transportation enhancement activities which can include railway-highway grade separation. https://www.fhwa.dot.gov/fastact/factsheets/nhfpfs.cfm

- **National Highway Performance Plan (NHPP)**
  For various National Highway System (NHS) route projects which can include highway safety improvements on the NHS. https://www.fhwa.dot.gov/fastact/factsheets/nhppfs.cfm

- **Surface Transportation Block Grant Program (STBG)**
  For various transportation projects for almost any route, which can include highway and transit safety infrastructure improvements and railway-highway grade crossings hazard elimination. https://www.fhwa.dot.gov/fastact/factsheets/stbgfs.cfm

In addition, the FRA will develop a standard method to determine the return-on-investment of technology and implementation funded by FRA grants.

Removing Barriers to Implementation

Many new technologies, including positive train control (PTC), forward-facing cameras, automated track testing equipment, machine vision, drones, and other technological advances currently being implemented by railroads are enablers for further advancements in grade crossing solutions. To capitalize on these opportunities, the FRA recognizes that barriers need to be overcome in our regulatory framework, and opportunities to fund research and development need to be identified. In support of this plan, the FRA is:

- Streamlining methods and processes within FRA regulations for proof of concept, testing, and approvals of new grade crossing solutions.
- Evaluation of standards and analytical frameworks to be used to evaluate and approve commercially off the shelf (COTS) technology in grade crossing solutions.
- Assessing how existing grant and loan programs, and reimbursable federal aid highway programs such as the Section 130 Program, may be used to fund new grade crossing technology developments.
- Identifying opportunities to use the Transportation Technology Center in Pueblo, CO to assess the reliability and performance of new grade crossing components.

FRA is also working with other USDOT modes to update and expand existing guidance and handbooks to embrace future advancements in grade crossing technology.

Navigating the Process

States, local governments, and other entities who wish to test a new technology need to know how to get the process started. The FRA wants to ensure that these entities have a clear path through what can at first appear to be a complicated process.

We recommend for anyone interested in testing a new technology to send a request to the Federal Highway Administration (FHWA), Office of Operations MUTCD team. The FHWA reviews the proposals, approves tests and sets conditions, and reviews regular reports from the requesting agency on the results of the test. More information including a quick-reference flowchart on this process can be found in Section 1A.10 of the MUTCD and at https://mutcd.fhwa.dot.gov/condexper.htm

In the next year, the FRA will:

- Publish sample requests for approval
- Publish a process flowchart for technology approval applications

Supplemental Efforts

Over the next three years, in support of technology implementation initiatives, the FRA plans to enhance key partnerships, improve and leverage data, improve our regulatory oversight, and support quality research. This plan will be reviewed annually.

Enhancing Outreach and Partnerships

The successes in reducing grade crossing accidents that have been achieved are, in part, the result of the commitment of the FRA to engage with its partners to share what they know with each other and the public. The FRA plans to continue this approach with our current partners and to engage new partners to grow the opportunity to discover additional technologies and create more avenues for raising awareness about grade crossing safety.

Some specific activities include:

In FY 2020, hosting dialogue sessions in the six states that are home to the ten counties that have the largest number of incidents for both grade crossing and trespassing. These FRA-led sessions will focus on mitigating strategies within and near the communities where the event will be held.

Continuing to communicate with stakeholder organizations including AASHTO, AAR, APTA, ASLRRA, Lifesavers, NSA, OLI and others to capture the best practices, technology, and policies among each entity. This relationship also provides the opportunity for regulatory and legislative requirements to be advanced with minimal discord.

Continuing our collaboration with our ONEDOT Crossing Team counterparts. As part of this team, the FRA leads the effort to identify and addresses issues related to technologies that will reduce the number and severity of highway-rail grade crossing collisions. This group recently collaborated on a *Grade Crossing Handbook*, a best practices guide for public authorities working to improve safety at grade crossings.

Establishing a relationship with organizations, such as the trucking industry, state policy program managers, and advocacy groups, that are transportation stakeholders, but who have typically not been formally approached.

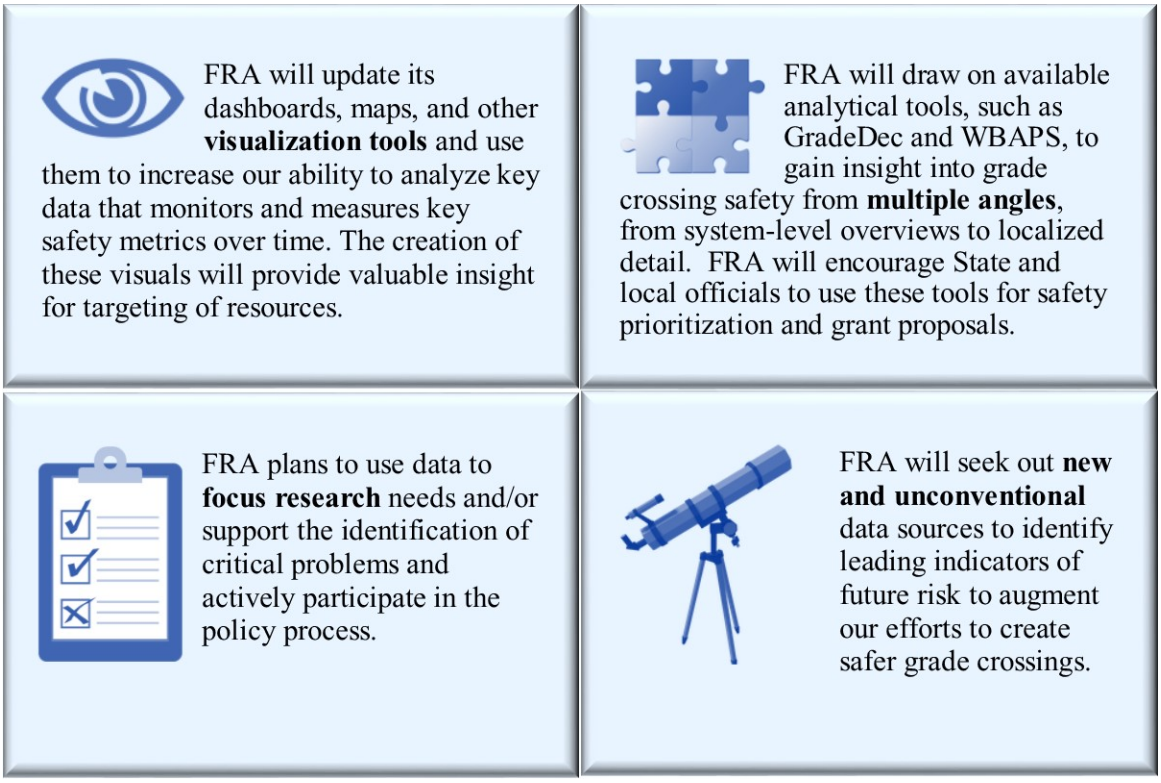
Continuing to work with state regulators to educate drivers properly about the use of emergency notification signs and to warn them about the dangers of humped crossings.

Continuing to host, sponsor, support and participate in key events including national and regional stakeholder crossing conferences and symposia; FRA Research Needs Workshop and Right-of-Way Fatality and Trespass Prevention Workshop; Lifesavers National Conference on Highway Safety Priorities; National Council of State Legislators; and the National Sheriffs' Association.

Communicating with the public through our increased presence on social media platforms. The FRA will also provide information through the crossing locator app, blocked crossing reporting, correspondence and web inquiries. We will continue to develop and execute public service campaigns with support from the National Highway Transportation Safety Administration to include television, radio, and print and social media advertisements. These ads will be distributed nationally and focused in areas where there are high numbers of crossing incidents and accidents.

Leveraging Data

The FRA places a premium on the value of accurate and useful data. We intend to continue using this data to improve the effectiveness of our decisions and to share this data with our stakeholders to improve the effectiveness of our partnerships.



The *Highway-Rail Crossing Handbook* is co-published by FRA and FHWA, and acts as a best practices and resource guide on highway-rail crossings. It will be electronically stored and accessible and regularly updated to ensure accuracy for readers.

Improving Regulatory Oversight and Enforcement

The FRA is continually refining its internal processes to better exercise its regulatory authority to ensure consistent compliance with federal, state, and local regulations related to grade crossing safety. Our staff will inspect crossings to determine compliance with:

- Sounding of Locomotive Horns (49 CFR 222)
- Quiet Zones (49 CFR 222)
- State Action Plans (49 CFR 234.11)
- Emergency Notification Systems (49 CFR 234, Subpart E)
- Grade Crossing Inventory (49 CFR 234, Subpart F)

Additionally, we will continue to:

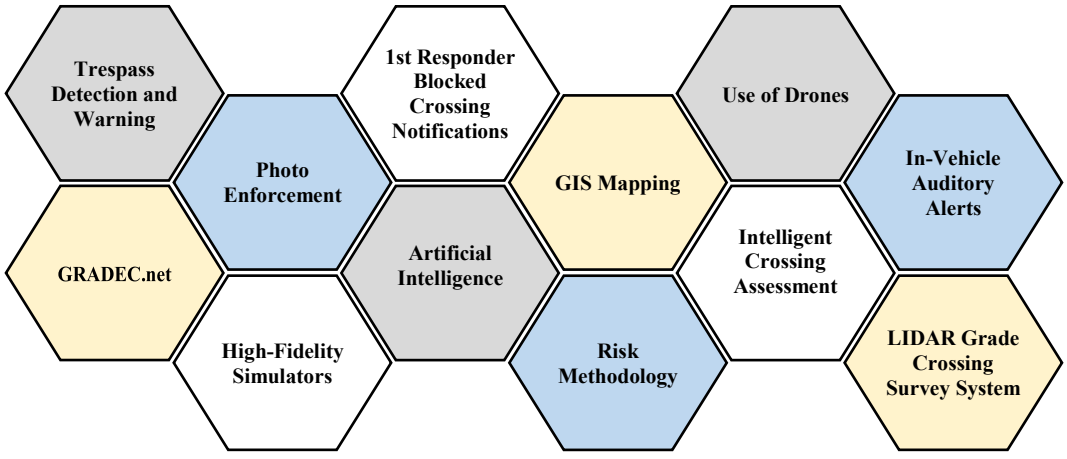
- Track deficient crossings, and notify the appropriate authorities of non-compliance.
- Implement and update our Grade Crossing Compliance Manual that guides regional and headquarters staff on enforcement and outreach efforts related to highway-rail crossing and trespass prevention. This manual is available to the public.
- Continually refine our Focused Inspection Program to guide inspector activities and outreach based on risk and the quiet zone inspection plan schedule.
- Assess the establishment and maintenance of quiet zones.

Supporting Research and Development

The Grade Crossing Safety and Trespass Prevention research program conducts research to improve safety at highway-rail grade crossings and along the railroad rights -of-way to reduce collisions and incidents. The program develops, tests, and evaluates technologies and engineering solutions, and collects and analyzes data to measure the effectiveness in improving grade crossing safety. The research outcomes, reports, and best practices are published on the FRA website and presented at industry related conferences and workshops. FRA currently uses an online research repository to store and maintain research reports and will introduce a search engine to facilitate access to these reports.

Over the past 10 years, the Office of Research and Development funded about 60 research projects focused on grade crossing safety producing numerous research reports, papers, evaluations, and prototype engineering solutions.

The FRA is currently supporting research in several technologies that have the potential to reduce grade crossing accidents.



Conclusion

For their relatively small size when compared to the railways and roadways they support, grade crossings loom large as important points where multiple modes of transportation – including trains, vehicles of all sizes, and pedestrians – intersect.

When all of these modes can navigate the crossings safely, the nation prospers. Trains, trucks, and buses can carry goods and people wherever needed, and our citizens can travel to places of work, educational institutions, medical facilities, shopping centers, and recreational venues.

In the future, we expect the number of vehicles and people traversing grade crossings to increase, making it all the more critical that we act together now to find ways to meet the challenge of maintaining safety and saving lives.

The FRA believes technology can help us do more. We recognize that a technological solution can be simple or complex – there is room for both. We want these ideas to be have the chance to be explored, tested, and if effective, put to use quickly. We want these ideas to be supported by adequate funding and by the removal of regulatory and administrative barriers.

We look forward to continuing to work with our partners to gather and share data to focus to our efforts. We will add to our knowledge base by supporting new research that gives us the insights we need to understand human behavior around crossings and help us find engineering solutions to deter unsafe behaviors.

The FRA is proud of the work that has already been done by our own talented and dedicated team and by all of our partners who have shared our commitment to keeping grade crossings safe.

We also believe that the future of grade crossing safety – and achieving our goal to reducing incidents and accidents at grade crossing through the use of technology – starts now.

Appendix A – Listening Session Technology-Based Solutions

Low-Tech Solutions

Blocked Crossing Monitoring System (TRAINFO)
Solar-powered wayside equipment that detects trains arriving into a metropolis area and allows dispatchers in municipalities with a dedicated Transportation Management Center City to adjust traffic flow patterns around affected crossing(s), send alerts to motorists via electronic roadside signs. The signal from the equipment predicts occupancy duration and traffic delay when the train approaches the crossing(s). Notification of a blocked crossing could be received by legacy vehicles, connected vehicles and automated vehicles.

Waze's Connected Citizen Program (CCP)
Municipalities receive real-time incident information faster than other reporting methods through this two-way data exchange program. The information accurately pinpoints where incidents occur, creating faster response and clearing times and potentially saving lives. Los Angeles METRO used ads at 23 rail crossings along the Blue, Gold, and Expo Lines and experienced a 15 percent decrease in collisions. Long Island Rail Road used CCP at 20 rail crossings and in 2018, experienced a significant decrease in cars turning onto tracks; 0 thus far in 2019.

Effective Traffic Control Devices
The use of tubular markers and pavement markings, pavement markings and supplemental signing, and concrete planter boxes in the median (NC DOT) has significantly reduced the number of vehicles stalling and/or turning on the tracks.

Track Circuit Monitoring System (CTC)
Able to dynamically monitor track circuit conditions where unreliable train detection and shunting have become a challenge. Use of AC, DC, or coded track circuits can be dynamically monitored to collect data for predictive failure analysis.

Dynamic Crossing Queuing Warning System (Island Radar)
Using radar units to detect vehicles in the dynamic envelope of the grade crossing. An LED, solar-powered 'Do Not Stop On Tracks' sign lights up to inform the driver queuing at or near the danger zone.

Active Stopped on Tracks Warning (ASTW) (CTC)
Activated by the motorist stalled on the crossing area, not by the railroad. Not a train-control warning device, independent of the crossing controller. Received FHWA Experimentation Approval 8(09)-22 Speech Warning Messages at Highway-Rail Grade Crossings. Alerts a sound-oriented and visual message toward a motorist to emphasize the warning of being stopped on the tracks — whether or not a train is approaching.

Advanced Remote Monitoring System (Island Radar)
Using radar units to detect the health status of its radar zones remotely via video footage.

Obstacle Detection System (Progress Rail)
Used in Mira, Italy (40 installations and counting in Italy). Gives an overlay detection video feed to alert Dispatch and the Train Operator to take action. CENELEC Sil4 certified and uses the 76 GHz spectrum.

Pilot Programs

Turned on Tracks & Trespassing Monitoring System – Real-Time Monitoring Applications (CTC)
Able to dynamically monitor track circuit conditions where unreliable train detection and shunting have become a challenge. Turned on Tracks monitoring provides a means to ultimately slow or stop a train prior to a collision when an errant motorist turns onto the tracks. Can also incorporate instances when a motorist has stopped on the tracks for a pre-set period and slow or stop a train. Can detect trespassers and generate intrusion alarm messages. Can monitor traffic signal preemption operation.

Blocked Crossing Detection and Notification System (Island Radar)
A Railroad Signal Maintainer or any number of railroad personnel receive an instant alert with an image of the situation. An embedded link allows real-time access to the crossing over a cellular channel to view status. Blocked crossing alert on a smartphone with confirmation image, along with a real-time video confirmation image. Costs approximately $12,000 per crossing location.

An Enhanced Microprocessor-Based 8-Wire Preemption Unit (CTC)
Resolves design deficiencies that commonly plague railroad preemption design. Has shown a decrease in system-wide crashes over 10 months. A specialized loop added detects fail-safe health of inductive loop.

Crossing Warning Enhancement (CWE) System (METROM Rail)
Overlay to supplement existing grade crossing predictor units. Detects approaching trains, measures the train speed, and calculates the time before the train reaches the crossing. Uses axle wheel counters. Meets CENELEC requirements. Inherently solves loss-of-shunt issue.

Magnetic Train Detection (Central Signal)
Magnetic speed sensor devices placed at the approaches. No on-board train equipment required. Requires no data input from remote processors or train devices. Detects approaching trains and measures the train speed. Sensor performance is not affected by rusty rail, contaminated rail, track ballast conditions or harsh track environments; Train length, train weight, and train speed. Solves loss-of-shunt issues. In addition, the technology can be used to activate the traffic preemption phasing.

High-Tech Solutions

Predictive Crossing Activation Technology (Island Radar)
Consolidates upcoming crossing activation information from multiple railroads' PTC databases. Local vehicular interaction can be accomplished without direct railroad participation through information from a modified 'listen-only' PTC broadcast message. Makes information, filtered by geographical location, available to potentially-affected crossings. Infrastructure to Vehicle messaging via Dedicated Short-Range Communications, 5.9 GHz or 5G (allows automatic braking); Radio Data Service to GPS Networks. Estimated time of arrival and crossing activation duration data consumed by automotive navigation systems and municipal emergency vehicle dispatch system for route optimization.

Crossing Proximity and Train-On-Approach Alert System (Island Radar)
Using the PTC Network from the Train-On-Approach On-Board Database. Incorporating the Grade Crossing Geolocation Correlation. Alert would be activated via a fixed network or cellular channel from the Centralized PTC database. Ideal for both passive and active crossings.

Wireless train detection capability (BNSF)
Can reduce light train speed restrictions, loss of shunt, and conventional and electrified track capability. Overcomes poor track conditions and allows more off-track maintenance to occur. Allows for RHM checks to issue immediate speed restrictions.