Highway-Rail Grade Crossings

Florida's State Action Plan

FDOT

FREIGHT & MULTIMODAL OPERATIONS

January 2022

U.S. Department
of Transportation

**Federal Railroad
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

January 29, 2026

Kelli D. Phillips, CPM
Rail Safety and Operations Administrator
Florida Department of Transportation
605 Suwannee Street, MS 25
Tallahassee, FL 32399-0450

Dear Ms. Phillips:

As you are aware, Section 11401 of the Rail Safety Improvement Act of 2008 (FAST Act, Public Law 114-94), included a mandate that the Federal Railroad (FRA) Administrator promulgate a rule regarding the ten States previously identified in FRA's regulations implementing section 202 of the Rail Safety Improvement Act of 2008 (RSIA, Public Law 110-432). These ten States, including Florida, must provide FRA an updated state highway-rail grade crossing action plan (SAP) and a report describing what the State did to implement its previous SAP and how the State will continue to reduce highway-rail grade crossing and pathway crossing safety risks. On December 14, 2020, FRA published a final rule in the Federal Register implementing this statutory mandate.

FRA has completed its review of the January 2022 Florida SAP (which contains the required implementation report) and appreciates all efforts to comply with this Congressional requirement and Federal regulations. FRA has determined that the January 2022 Florida SAP complies with FRA's regulatory requirements on state highway-rail grade crossing action plans. In making this determination, FRA notes that the January 2022 Florida SAP discusses specific strategies in its current and future plans related to highway-rail grade crossing safety. In addition, the January 2022 Florida SAP contains an implementation timeline for the strategies discussed. FRA is also pleased that the January 2022 Florida SAP provides additional information on the State's efforts to demonstrate its holistic approach to enhance safety at or near highway-rail grade crossings. Therefore, FRA approves the January 2022 Florida SAP, with the understanding that the SAP may be subject to adjustments, based on issues such as, but not limited to, context-sensitive data, incident trends, and regulatory and legislative requirements.

As you are probably aware, section 22403 of the Bipartisan Infrastructure Law (BIL, Public Law 117-58) requires the FRA to submit a report that summarizes the State SAPs. FRA may reach out to your State to assist with the development of this report. We ask you to please continue to update your SAP point of contact to assist with this effort.

Thank you for Florida's ongoing efforts to improve highway-rail grade crossing safety. FRA looks forward to the implementation of this SAP. If you need additional information, please feel free to contact me at James.Payne@dot.gov or (202) 493-6005.

Sincerely,

James Payne

James Payne
Staff Director
Grade Crossing and Trespasser Outreach Division

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Executive Summary

The Freight and Multimodal Operations (FMO) Office leads the development of Florida's passenger and freight rail systems, and champions Florida's multimodal freight programs. The office guides Florida Department of Transportation's (FDOT) Freight and Rail functional areas to ensure a well-connected, reliable, and safe multimodal network.

To achieve this aim, the FMO office has several programs that contribute to rail safety including a rail inspection program, a rail crossing safety improvement program, a grade crossing opening/closure program, a Rail System Plan, and rail capacity programs; this compilation of programs helps address rail and highway network safety statewide.

The purpose of this Highway-Railroad Grade Crossing Action Plan is to advance the efforts of those programs and plans. The document starts by laying out the rail safety components of other state plans and discussing the outreach involved in the plan creation. It follows with data analysis and risk assessment components which analyze existing conditions at railroad crossings statewide, and detail where risks are the highest. The data analysis and risk assessment lead into a discussion of the highest-priority safety challenges, which are found to be:

- driver and pedestrian behavior,
- humped crossings,
- traffic queuing on tracks, and
- blocked crossings.

Through the lenses of engineering, education, enforcement, and emergency response, this document uses the last section to provide direction for implementing safety improvements to address the four safety challenges. Goals, objectives, and entities responsible for actions are summarized in **Figure 23: Responsibilities Matrix** to help guide implementation.

Introduction

About This Plan

The State of Florida consistently promotes a safe, economical, and efficient transportation system in the best public interest. This is accomplished through the Mission[1] of the Florida Department of Transportation (FDOT) and the Strategic Focus[2] of the Freight and Multimodal Operations (FMO) Office. A key factor of the Strategic Focus is to guide the Department's Freight and Rail functional areas to ensure a well-connected, reliable, and safe multimodal network. The Mission and Strategic Focus guide FMO to achieve an effective rail safety program through implementing education, engineering, enforcement, and emergency response strategies.

In 2009, the Federal Rail Administration (FRA) mandated that the top 10 states with the most at-grade crossing collisions on average, produce a Highway-Rail Grade Crossing State Action Plan (SAP). FDOT developed that plan and delivered it on August 24, 2011. Concurrently, FDOT continued to implement its Statewide Highway-Rail Grade Crossing Safety Improvement Program, which is the principal statewide program for rail grade crossing hazard elimination. The SAP played a significant role in further strengthening the program.

Recently, the FAST Act mandated a new requirement to have an SAP completed by all states; additionally, the previously noted top 10 states were required to update their SAPs with a report describing results of the State's previous plan implementation. The FRA and FHWA developed a model to aid the states in the development of their SAPs; Florida's 2011 SAP was a named reference within this model. On December 14, 2020, the FRA issued new SAP regulations in a final rule published in the Federal Register. Florida has updated the SAP and prepared **Appendix A: Implementation Report** to meet these requirements.

[1] The FDOT mission is to provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity and preserves the quality of our environment and communities. The FDOT vision is to serve the people of Florida by delivering a transportation system that is fatality and congestion free. https://www.fdot.gov/info/moredot/mvv.shtm

[2] The FDOT Freight and Multimodal Operations Office strategic focus is to achieve success through teamwork and efficiency, by means of removing institutional, Infrastructure and funding bottlenecks to build a well-connected, reliable, and safe multimodal network.

Purpose

The purpose of this Highway-Rail Grade Crossing State Action Plan (SAP) is to address the safety core elements of FDOT's mission and the Freight and Multimodal Operations (FMO) Office's Strategic Focus by eliminating rail safety hazards throughout Florida's rail network.

Scope

This SAP will evaluate current conditions, leverage key indicators from data analysis and risk assessment including qualitative input from stakeholders, and provide direction to implement safety improvements in the short term (5 years). The SAP focuses on the highest priority safety challenges of:

- Driver and pedestrian behavior
- Humped crossings
- Traffic queuing on tracks
- Blocked crossings

The following general strategies will be used to implement safety improvements:

- Engineering
- Education
- Enforcement
- Emergency response

Goals and Objectives

The elimination of rail safety hazards starts with SMART goals, objectives, and actions; these are defined as Specific, Measurable, Action-Orientated, Realistic, and Time-based. This document will explore how each safety challenge was selected and will follow with proactive measures for eliminating hazards in the short term to create positive future impacts. The outline of goals and objectives to address the highest priority safety challenges is included in **Figure 1** on the next page.

The goals and objectives outlined in this introductory section will be reiterated later in the document, with a focus on the data and risk assessment that brought the safety challenges to light. The next section explores FDOT planning documents and efforts relevant to rail safety. This SAP and the associated goals and objectives will complement the planning efforts that are already in place.

Figure 1: Goals & Objectives

SAFETY CHALLENGES	GOALS		OBJECTIVES
Driver and pedestrian behavior	Reduce hazards based on driver/pedestrian behavior	1	Identify locations of highest trespassing incidents and develop recommendations to solve challenges
		2	Create the "Next Generation Project" to share the importance of rail safety and the significant impact freight and passenger rail service has on improved quality of life
Humped crossings	Eliminate humped crossings	3	Define humped crossings and identify humped crossings in Florida
		4	Identify methods to fix or mitigate humped crossings and work with partners to implement solutions
Traffic queuing on tracks	Reduce redundant crossings	5	Aim to close five crossings a year while reducing net crossing openings to zero
		6	Address preemption issues in FDOT standards and manuals
	Reduce the number of vehicles stopping on the tracks or in the foul zone	7	Implement clearer signals, signage, and pavement markings at railroad crossings
	Eliminate incorrect turns onto tracks	8	Identify methods to fix or mitigate incorrect turns onto railroad tracks and develop or revise FDOT standards to solve challenges
		9	Educate the public about the incorrect turns onto the tracks issue
Blocked crossings	Reduce the number of blocked crossings due to railroad operations	10	Identify areas with blocked crossing issues and work with railroads to resolve
	Rapidly notify the public of blocked crossings and provide alternate route options	11	Identify opportunities to leverage emerging technology to avoid traffic congestion

Statewide Highway-Rail Grade Crossing Safety Efforts

With safety as a core part of FDOT's mission, there are various planning documents and efforts related to rail and/or safety at the statewide level. This section references the plans and programs that have relevant rail safety improvement components. This SAP integrates and expands upon other Florida planning efforts.

Plans

Florida Transportation Plan, 2020

The Florida Transportation Plan (FTP) is the single overarching statewide plan guiding Florida's transportation direction. Its policy, performance, and vision elements provide direction to FDOT and all statewide, regional, and local partners that plan and manage Florida's transportation system. As passenger rail continues to have a more significant presence in the state, indicators like rail trespassing events and rail crashes are becoming a more prominent component of this high-level document. Additionally, the goals of the FTP cross over to all the other adjacent Florida transportation plans.

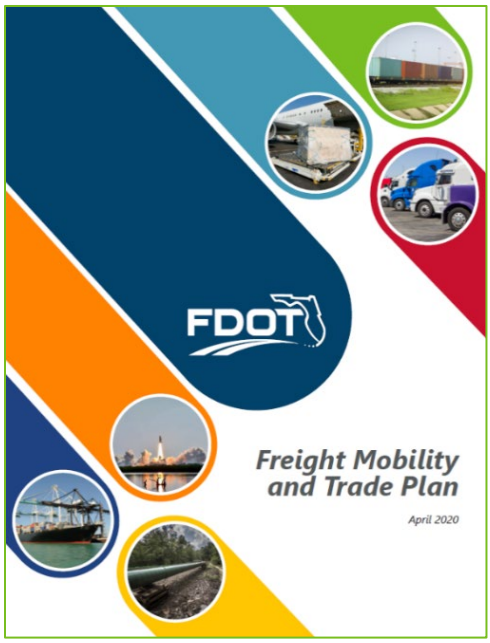
These goals are:

- Safety and security for residents, visitors, and businesses
- Agile, resilient, and quality transportation infrastructure
- Connected, efficient and reliable mobility for people and freight
- Transportation choices that improve accessibility and equity
- Transportation solutions that strengthen Florida's economy
- Transportation solutions that enhance Florida's communities
- Transportation solutions that enhance Florida's environment

Freight Mobility and Trade Plan, 2020

The Freight and Mobility Trade Plan (FMTP) is the state's comprehensive freight plan that focuses on the movement of goods in, out, and around Florida. It provides an integrated analysis to examine needs and solutions in a cross-cutting, multi-functional approach.

The FMTP takes stock of Florida's rail assets and shows rail tonnage and commodity data. It notes the trend of increased highway-rail crossing incidents between 2008 and 2017 and addresses the need for new technologies at railroad grade crossings to address safety.



Rail System Plan, 2018

The Florida Rail System Plan is one of the various statewide modal planning efforts of the Florida Department of Transportation. By law, the Florida Rail System Plan includes an identification of priorities, programs, and funding levels required to meet statewide needs.

The plan, created in 2015 and amended in 2018, establishes a vision for passenger and freight rail transportation in Florida and a policy framework of goals, policies, and strategies to guide future state rail investments and decisions. It touches on several highway-railroad related programs, train incidents as defined by the Federal Railroad Administration (FRA), overpass needs, and identifies necessary funding. The Rail System Plan is being updated in 2022.

Strategic Highway Safety Plan, 2021

The Strategic Highway Safety Plan (SHSP) is the statewide plan focused on accomplishing the vision of eliminating fatalities, serious injuries, and property damage on all public roads. The SHSP is focused on the roadway component of transportation safety. The plan utilizes the 4-E approach (engineering, enforcement, education, and emergency response) to focus resources where opportunities for safety improvements are the greatest based on the best available data and trends.

The high-level plan mentions Florida's 3,500+ public railroad crossings and that the majority (78 percent) are equipped with active warning devices. It points out that between 2015 and 2019, 40 people died and 69 were seriously injured in railway-highway crossing crashes in Florida – almost a doubling of fatalities from the prior five years. This plan also highlights that FDOT implemented Operation STRIDE (Statewide Traffic and Railroad Initiative Using Dynamic Envelopes) in 2019 to augment other rail safety initiatives.

Programs

In addition to these plans, the Opening and Closure Program, Highway-Railroad Grade Crossing Safety Improvement Program, Highway-Railroad Grade Crossing Construction Program, State Rail Safety Participation Program, and Operation Lifesaver promote the Freight and Multimodal Operations (FMO) Office Strategic Focus of building a well-connected, reliable, and safe multimodal network.

Opening and Closure Program

In accordance with *Section 335.141, Florida Statutes,* the Department has regulatory authority over all public highway-railroad grade crossings in the state, including the authority to issue permits which shall be required prior to the opening and closing of highway-rail grade crossings. With an emphasis on identifying and eliminating hazardous and redundant crossings, the Department manages the process in conjunction with railroad companies, local governments, and citizens. The risk of train/vehicle collisions is reduced by the elimination of redundant crossings; therefore, it is in the best interest of all

parties involved to eliminate unnecessary crossings. Between 2016 and 2020, 261 public crossings were closed in Florida[3].

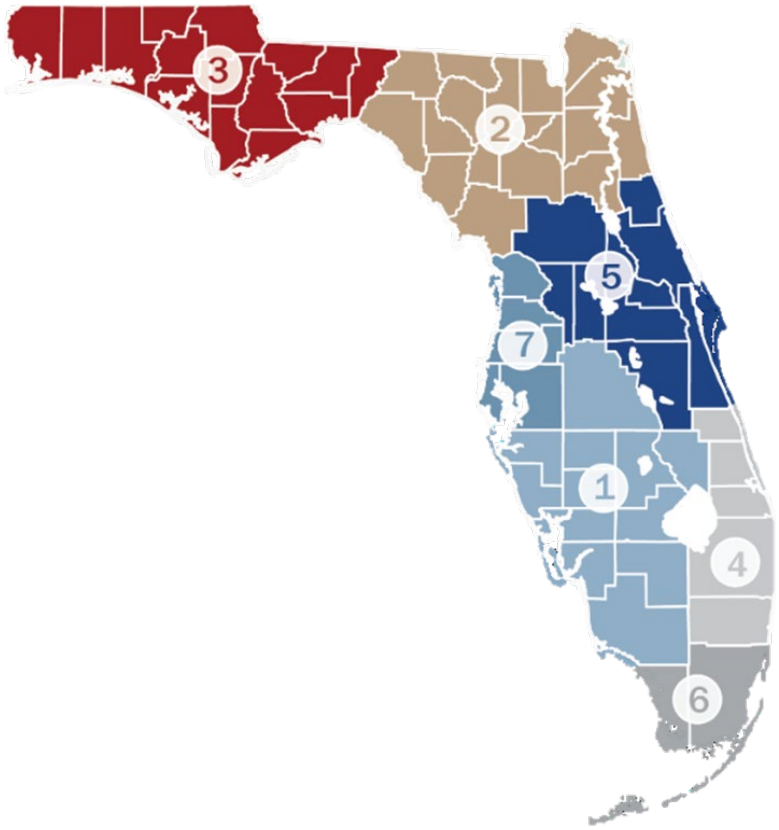
Highway-Railroad Grade Crossing Safety Improvement Program

The Highway-Rail Grade Crossing Safety (HRGCS) Improvement Program is a statewide program for rail grade crossing hazard elimination. *23 USC 130* authorizes the HRGCS Improvement Program to use federal funds for the construction costs of projects that eliminate hazards at railway-highway crossings, and *Section 335.141(2)(a) F.S* authorizes the function of the Highway-Railroad Grade Crossing Safety Improvement Program.

How Projects are Identified and Selected

Each of FDOT's seven geographic Districts have a Rail Coordinator or Administrator who is responsible for implementation of highway-railroad grade crossing safety projects in their District, with technical and policy support from FDOT Central Office.

Figure 2: FDOT Districts



Source: FDOT Freight and Multimodal Operations Office, 2021

[3] Source: FRA Crossing Inventory Data – FL State Crossing Data, 2021. Not all crossing closures were facilitated by FDOT. Includes rail line abandonments.

Every year, the FMO Office runs the crash prediction algorithm using the FDOT Rail Highway Crossing Inventory (RHCI) database to create an annual Crossing Safety Index Report. The report ranks crossings annually with the highest to lowest crash potential (number 1 ranking being the crossing with the highest crash potential).

Crossings considered for funding have a Safety Index Ranking from 1 to 1600. Using the report, potential project candidates are determined for each District. The candidate list obtained through RHCI may be adjusted by removing or adding crossings based on factors not currently in RHCI, such as recent crashes, changes in traffic volumes, near incident misses, and requests for safety improvements from local governmental agencies.

Diagnostic Reviews

Each District coordinates diagnostic locations review scheduling with the railroad companies and local agencies. Diagnostic review teams can include personnel from the FDOT District Rail Offices, FDOT Freight and Multimodal Operations Office, FDOT Safety Office, FDOT Traffic Engineering and Operations Office, the railroad, the FRA, and local government. The team recommends safety improvements based on the diagnostic review and Department Standards.

How Federal Funds Are Applied

After diagnostic reviews are completed and FDOT receives submittal of project estimates from railroad companies, FDOT Central Office staff reviews eligible candidate crossings and selects safety improvement projects based on Diagnostic Team recommendations, reasonable distribution, and the maximum available funding for the year. FDOT Central Office will notify each District of their annual program allocations. Projects are programmed by the District in accordance with their project allocations and Work Program Instructions. Prior to the beginning of the Federal Fiscal Year, FDOT will submit a listing of all next year's approved projects by District including project location, work description and cost, right-of-way and NEPA status as well as Categorical Exclusion date to the Federal Aid Office for Federal Authorization. Each District will encumber funds for each of their respective safety improvement projects prior to executing contracts for the construction of the projects.

Program Evaluation

By July 1 of each year, the Central Office will submit the Before and After Report to FHWA via their Information System located at https://fhwaapps.fhwa.dot.gov/. The report is a project cost summary comparing funding types, safety improvement features, incidents, and traffic volumes for the periods six years before and six years after project completion. An example report for projects installed in the year 2010 is available in **Appendix B: Sample Before and After Report**.

Agreements

The Railroad Reimbursement Agreement is the legally binding document that formalizes the understanding of the scope of work, maintenance responsibilities and the reimbursement costs of installation of railroad warning devices and crossing surfaces and/or relocation of railroad track facilities. The Railroad Reimbursement Agreement is between the railroad company and the Department and may include a third-party local governmental agency for their assumption of maintenance responsibilities of warning devices that are off the State Highway System. The Railroad Reimbursement Agreement is the document upon which Federal Aid reimbursement is predicated.

Highway Construction Projects Impacting Railroad Property

Whenever the Department lets a roadway construction project that includes work through a railroad crossing or the project limits are near railroad right-of-way, close coordination between the railroad maintainers and the highway builders is strictly required. Any violation of this requirement may exclude the contractor's ability to be on, near or adjacent to railroad property. These roadway construction projects include new construction, reconstruction, widening, and/or resurfacing work. Close coordination with District Railroad Coordinators is required to ensure roadway construction project scheduling accommodates the railroad's timetable for adjustments to their property and of railroad flagging services.

State Rail Safety Participation Program

Florida participates in the State Rail Safety Participation Program as set out in *Title 49 Code of Federal Regulations (CFR) Part 212*. This regulation requires specific qualifications be met for state inspectors by the Federal Railroad Administration (FRA) and the FRA determines when a state inspector becomes completely qualified, through a rigorous On-The-Job (OJT) training program. State inspectors supplement the rail safety inspectors employed by the FRA, and generally carry the same authority for issuing notices, defects, and recommendations for civil penalties as the FRA inspectors.

Florida has what is considered a 'full program,' in that there is at least one rail safety inspector for each of the 5 FRA inspection disciplines (track, motive power & equipment, signal & train control, operating practices, and hazardous materials). The current state inspector staffing consists of one inspector from each discipline, plus a State Program Manager. The State of Florida's rail safety inspection program has been rated highly by the FRA year after year.

Operation STRIDE

A dynamic envelope is an area near railroad crossings designed to keep motorists out of the danger zone. White connecting Xs are used to visually highlight the zone to increase safety for motorists.

Statewide Traffic and Railroad Initiative Using Dynamic Envelopes

In 2014 and 2017, FDOT conducted dynamic envelope pilot programs in Florida. Following the installation of the dynamic envelopes in the pilot programs, traffic data indicated that the number of vehicles that stopped on or too close to rail crossings was reduced by at least 15%.

As part of its promise to ensure safety is the top priority across the State's rail corridors, FDOT Secretary issued a directive in December 2019 calling for the implementation of dynamic envelopes across Florida, as well as the launch of a statewide education initiative. The directive had the explicit goal of preventing additional fatalities on or near rail crossings on State roads and State-owned land crossings. It involved:

- Implementing dynamic envelopes at every existing FDOT roadway and state-owned land rail crossing across the state.
- Requiring the inclusion of a dynamic envelope in the standard design of any future railroad crossings on FDOT roadways or state-owned land rail crossings.
- Launching a data-driven statewide rail safety education initiative. "Operation STRIDE" (Statewide Traffic and Railroad Initiative using Dynamic Envelopes) will be conducted in conjunction with rail partners to include earned, social, and digital media.
- Partnering with state and local law enforcement agencies, including the Florida Highway Patrol, sheriffs, and police chiefs, to help enforce rail safety laws.
- Continuing to partner with local and private rail partners by sharing FDOT rail safety design standards and framework and encouraging their participation and implementation of the safety and engineering efforts.

Between December 2019 and September 2021, FDOT completed the installation of dynamic envelopes at 620 crossings across the state.

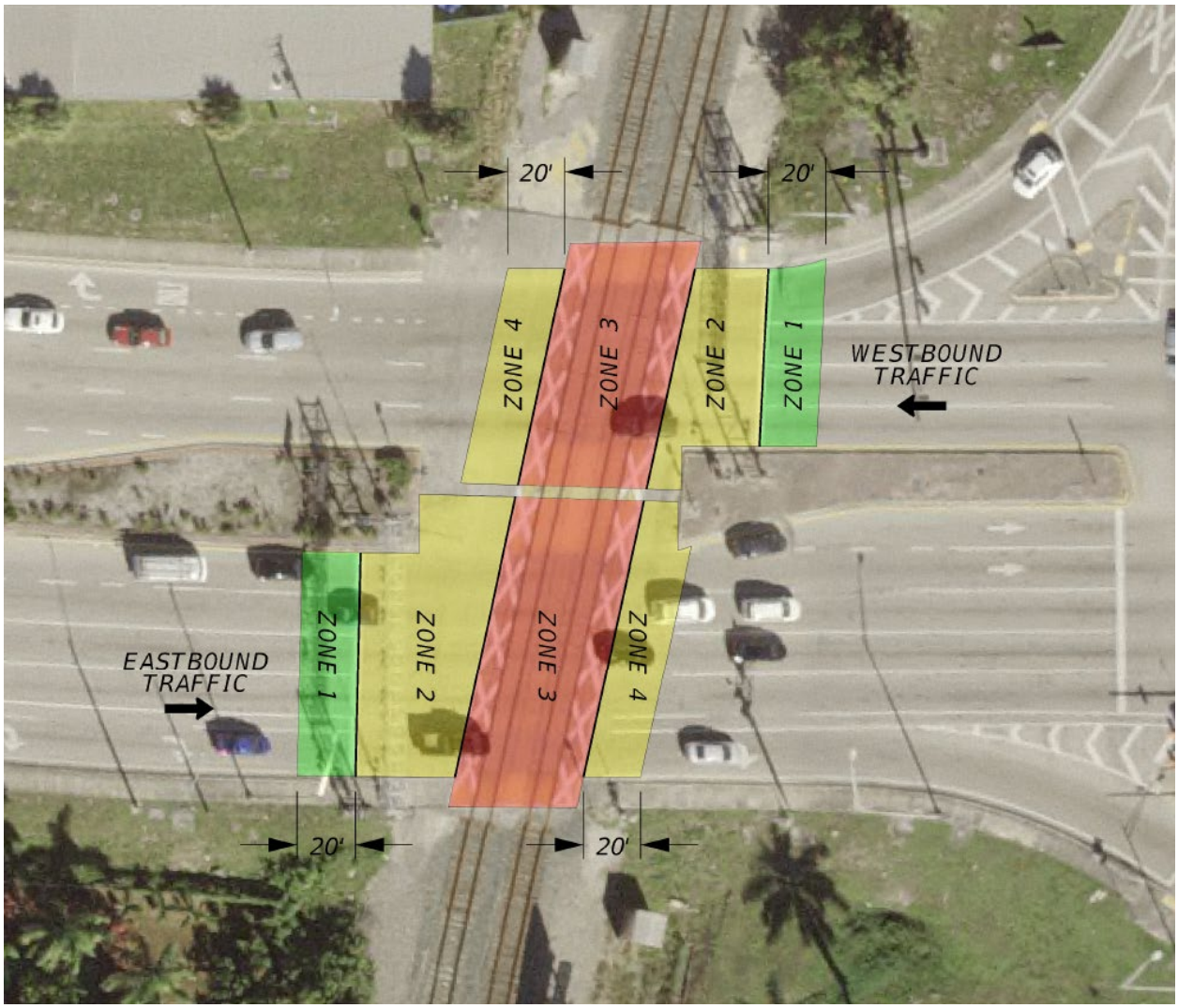
A dynamic envelope being installed at DOT #713448R, South Byron Butler Parkway

The Freight and Multimodal Operations Office, District Rail Offices, and Traffic Engineering and Operations Offices have been in coordination to measure the effectiveness of the dynamic envelope implementations using before-and-after evaluations at key crossings. The evaluations involve recording when a vehicle comes to a complete stop in one of the four zones, before the pavement markings are put in, and after:

- Zone 2 – Downstream of the stop bar but upstream of the track foul zone
- Zone 3 – On the tracks or in the foul zone
- Zone 4 – Twenty feet immediately downstream of the tracks and outside of the track foul zone

The percent change in vehicles stopping in Zone 3 (see **Figure 3**) before and after the dynamic envelope installation is being monitored.

Figure 3: Vehicle Stopping Zones



Source: FRA Effect of Dynamic Envelope Pavement Markings on Vehicle Driver Behavior at a Highway-Rail Grade Crossing, 2014

Operation Lifesaver

Operation Lifesaver, Inc. is a national, nonprofit education and awareness program dedicated to ending tragic collisions, fatalities, and injuries at highway-rail grade crossings and on railroad rights-of-way. The objective of the collaboration between OLI and FDOT is to raise awareness of the amount of trespassing on railroad right-of-way and the dangers involved. Addressing these issues is complicated by the fact that trespassers are not a single, consistent group. Operation Lifesaver, housed in the FMO office, is Florida's, as well as the nation's, most important educational tool to inform people of the tragic results that can occur in entering railroad right-of-way illegally.

The Florida Operation Lifesaver branch has a board that consists of representatives of the primary interests of Florida's rail safety efforts. The current Florida OL board members are listed in **Table 1**. Chief Dixon, a member of the Florida Highway Patrol, was added to the board in 2019 to help bolster the "enforcement" corner of the Florida OL board.

Table 1: Florida Operation Lifesaver Board 2021

Name	Association	Board Title
Pete Petree	Regional Rail	Chair
Fred Wise	HNTB	Vice Chair
Bob Ledoux	FEC	Treasurer
Peggy Smith	CSX	Member
Ali Soule	Brightline	Member
Bob O'Malley	Railroad Consultants	Member
Chief Jeffrey Dixon	Florida Highway Patrol	Member
Rickey Fitzgerald	FDOT	Member

Source: FDOT Freight and Multimodal Operations Office, 2021

While Florida continues to put safety at the forefront of their efforts, there is always work to be done. One of the most important steps is to involve stakeholders and the public to fully understand the scope of the issues at hand. The next section outlines how the public was involved in the creation of this plan, and how they will be involved to measure the progress made.

Public Engagement

In a safety plan, it is important to maximize public benefit by coordinating with key stakeholders; this includes leveraging stakeholder experiences and developing comprehensive strategies. For the creation of this Highway-Rail Grade Crossing State Action Plan, the outreach consisted of three engagement pieces: Operation Lifesaver board meetings, public webinars, and surveys. Stakeholders will continue to be involved in the implementation of the plan.

Operation Lifesaver Board Meetings

In June 2018 a meeting was held with the members of the Florida Operation Lifesaver Board. The purpose of the meeting was to discuss the outline of the State Action Plan and to get the Board's input on how to make improvements before moving on to the public. The presentation outlined the progress made so far, including the goals, the timeline, the proposed emphasis areas, incident history, Florida concerns, and proposed implementation strategies. The final slides of the presentation prompted discussion and comments from the Board. The FOL board provided constructive recommendations that we were able to incorporate into this plan including the importance of considering trespassing as an emphasis area. This approach was repeated at the December 2021 Florida Operation Lifesaver Board meeting, with a focus on highlighting changes made to meet plan regulations outlined in the December 2020 Final Rule.

Public Webinars

In July 2018 a meeting was held with members of the public via webinar. The webinar covered the plan's mission, scope, and goals, and showed charts that depicted incident counts, warning devices, driver behavior, and trespass incidents. The presentation also depicted the Florida-specific concerns, key misconceptions surrounding rail, and the implementation strategies in the form of the four Es. After this information was presented, submitted comments were read aloud and answered. The presentation slides were sent to the participants a week after the webinar. This approach was repeated in a January 2022 public webinar, with a focus on highlighting changes made to meet plan regulations outlined in the December 2020 Final Rule.

Public Comment Period

In mid-December 2021, a draft plan was sent to target groups (District Rail Coordinators, District Freight Coordinators, the inspection team, the Florida Freight Advisory Committee, and FMO's rail and MPO contact lists) for review/comment and to spread the word. The draft plan was also posted on FDOT's public site along with a survey for comment

collection and a registration link for the January 2022 public webinar. All comments received through the survey and during the webinar were considered for final revisions to the document.

Plan Implementation

Aside from being involved in the development of the State Action Plan, all stakeholders are encouraged to be involved in the implementation of solutions:

- Local authorities including railroads, local engineering/planning departments, and local leaders are involved in diagnostic reviews for the Highway Safety Improvement Program.
- The FDOT Freight and Multimodal Operations Office will aim to have a follow-up public meeting and/or webinar and/or survey to share updates on progress of the plan's objectives and gain additional feedback.
- Operation Lifesaver outreach programs and volunteers take the lead on rail safety education.

To effectively identify progress, the plan uses metrics that are guided by the vision and supported by data derived from existing conditions. The next section of this plan includes the data analysis used to define existing conditions.

Data Analysis

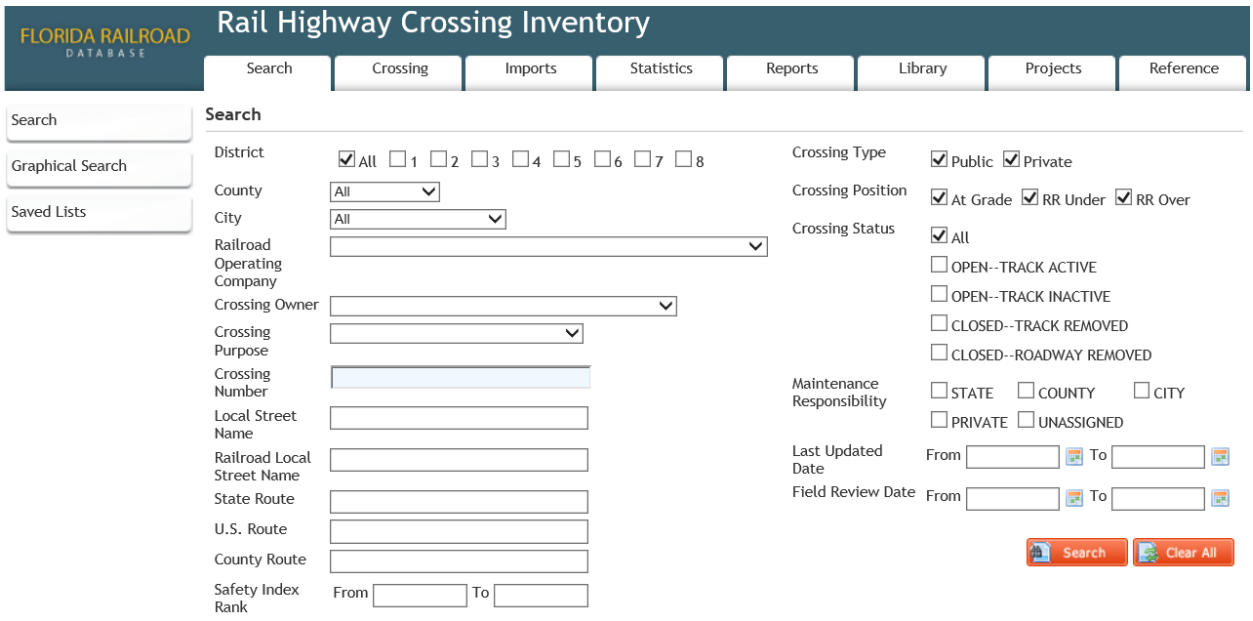
This data analysis section provides the data, conditions and methodology used to identify and determine the cause of the rail safety challenges faced by Florida. It includes a description of the FDOT inventory system, data from outside sources, and how the data are organized, collected, updated, and reported. It examines the existing conditions of railroad crossings in Florida as well as an analysis of incidents.

Datasets, References, and Tools

The following datasets and tools were used to conduct analysis for identifying the safety challenges that Florida faces.

FDOT Railroad-Highway Crossing Inventory (RHCI)

The FDOT Freight and Multimodal Operations Office maintains the Railroad Highway Crossing Inventory (RHCI) that contains the physical and operating characteristics of rail crossing and infrastructure in Florida. The RHCI is updated every three years and is the principal rail dataset for safety programs and initiatives. It is also provided to the Federal Rail Administration (FRA) Highway Rail Crossing Inventory (FRA RCI) and Federal Highway Administration (FHWA).



Screenshot of the Rail Highway Crossing Inventory search page

Specifically, RHCI enables analysis, research, and reference support for each crossing, including an inventory of signals and signs, roadway traffic characteristics, railroad owner

and train volume, and photographs of the crossings. In addition, it supports project managers by helping determine priority projects on or near a railroad, opening and closing of grade crossings, preemption of traffic signals, and quiet zones.

Safety Index Tool

Florida uses RHCI to rank crossings in order of potential risk. These preliminary rankings are called the Safety Index, and are calculated based on safety considerations such as:

- incidents
- vehicular traffic
- posted vehicle speed
- number of trains per day
- maximum timetable train speed
- type of existing warning devices

Safety Index Ranking

District	Safety Index Ranking	County	City	RR Company	Prefix	Milepost	Type	DOT #	Route	Street	Highest Warning	Main Track	Other Tracks	Spur	Status	Recommended Warning Device	Preemption
1	22	POLK	Lakeland	CSX	A	857.03	PUB	624304R		COUNTY LINE RD	CFL&G	1	0	No	OA	CFL&G&P	S
1	54	OKEECHOBEE	Okeechobee	CSX	SX	906.78	PUB	628062L	SR-15 US-441	US-441 / N PARROTT AVE	Full Entrance Closure	1	1	No	OA	CFL & G	N/A
1	75	POLK	Lakeland	CSX	A	852.96	PUB	624296P	CR 542	WABASH AVE	CFL&G	2	1	No	OA	CFL&G&P	S
1	81	POLK	Lake Wales	CSX	SX	834.53	PUB	625419N	SR-60	SR-60	CFL&G	1	0	No	OA	CFL & G	N/A
1	83	POLK	Winter Haven	CSX	SX	822.95	PUB	625396J		SPIRIT LAKE RD	CFL&G	2	0	No	OA	FL & G & P	N/A
1	111	POLK	Lakeland	CSX	A	847.88	PUB	624151P	SR-659	SR-659 / COMBEE RD	CFL&G	1	0	No	OA	CFL&G&P	S
1	119	POLK	Loughman	CSX	A	819.40	PUB	622957K	CR-54	CR-54 / RONALD REAGAN PKWY	CFL&G	1	0	No	OA	CFL & G	N/A
1	145	OKEECHOBEE	Okeechobee	CSX	SX	907.40	PUB	628054U	SR-700 US-98	US-98 / SR-700	CFL&G	1	0	No	OA	CFL & G	N/A
1	150	POLK	Auburndale	CSX	A	839.24	PUB	623066W		DAIRY RD / LAKE ALFRED RD	FL&G 2 Quad	1	1	Yes	OA	CFL & G	N/A
1	156	POLK	Auburndale	CSX	A	844.84	PUB	623085B		OLD DIXIE HWY	FL&G 2 Quad	1	1	No	OA	FL & G & P	S
1	201	POLK	Lakeland	CSX	A	854.75	PUB	624300N	SR-572	SR-572 / AIRPORT RD	FL&G 4 Quad	1	1	Yes	OA	FL & G & P	N/A
1	207	POLK	Mulberry	CSX	CSX	862.03	PUB	926249D		EWELL RD	CFL&G	1	0	No	OA	CFL&G&P	S
1	221	POLK	Auburndale	CSX	SX	820.85	PUB	625391A	CR-544A	CR-544A / DERBY AVE	FL&G 2 Quad	3	4	Yes	OA	FL & G	N/A
1	226	HENDRY	Clewiston	SCXF	AVD	945.88	PUB	627695X	SR-80/25 US-27	US-27 / SR-80 / SR-25	CFL&G	1	0	No	OA	CFL & G	N/A

Example Safety Index Ranking run showing crossings in FDOT District 1

The Safety Index systematically identifies crossings with higher risk. Priority crossings are reviewed, and selected crossings undergo Diagnostic Field Reviews performed by the Department's review teams. Some crossings do not undergo field reviews as the crossing already has the highest level of safety equipment for at grade crossing and further improvements require a grade separation or improvements are awaiting implementation/are part of an upcoming construction project.

Project selection occurs based on several factors including:

- safety index ranking
- project cost
- incident history
- corridor emphasis
- input from local governments and transportation partners
- presence of antiquated equipment, and
- input from rail safety inspectors.

In the interest of maximizing the impact of limited funding, low-cost improvements are also considered. One low-cost application the Department works to implement is to install light-emitting diode (LEDs) to improve warning visibility for the motoring public.

The Department coordinates with local highway agencies and railroads regarding priority crossings and utilizes the federal Highway-Rail Safety Program to fund safety improvements at grade crossings on state, county, and city roads. Occasionally state safety and state maintenance funds are also available for funding improvements. When using state funds, FDOT identifies, prioritizes, and implements surface improvement projects at grade crossings only on state-maintained roads.

While the safety index provides a good base for ranking hazardous crossings, FDOT commissioned a study with Florida State University in 2018 to produce a new optimization model-based decision support tool to improve safety at rail crossings. The study, completed in 2020, developed an accident prediction model for Florida's rail crossings, which can be used to forecast the number of accidents or the rail crossing hazard based on certain characteristics of rail crossings. The new tool, still being integrated into the FMO process, considers the safety of roadway travelers at rail crossings and ensures continuity of freight flows in Florida.

Rail-Highway Grade Separation GIS Tool

Florida has thousands of public at-grade rail-highway crossings; and most of these operate safely with little impact to their local community. However, at some crossings the high volume of automobile or rail traffic, the noise impacts from train horns, or concerns for safety, may warrant improvements that include constructing a grade separated crossing.

This tool is a geographic information system or GIS-based procedure for scoring the grade separation potential of all Florida at-grade crossings and uses six factors that are scored from 0 to 100 for every at-grade crossing under consideration for possible grade-separation:

- Noise
- Community Cohesion
- Traffic Delay
- Accessibility
- Connectivity
- Safety

The output of the GIS tool is a list of crossings FDOT can further evaluate for grade separation improvements.

Railroad-Highway Grade Separation Benefit Cost Analysis Tool

Another tool developed by FDOT is a Microsoft Excel workbook that uses transportation data and other inputs to develop estimates of the benefits and costs associated with a potential grade separation project. It is structured as a set of interrelated worksheets, where project-specific inputs provided by the user (e.g., project timeline, and related annual cost estimates) are combined with a set of model parameters (e.g., average value of travel time) to calculate total benefits and costs.

All the benefits and costs estimated within the tool are expressed in monetary terms. A discount rate is used to account for the time value of money and to convert future benefits and costs to their present-value equivalent. Summary measures indicating the extent to which project benefits are expected to exceed total investment costs (such as Net Present Value or the Benefit-Cost Ratio) are then calculated.

The tool accounts for project estimated benefits and costs in the following major categories:

- Capital/Investment Costs
- Operating & Maintenance Costs
- Safety Benefits
- Time Delay Savings
- Fuel Savings

The output of the Benefit Cost Analysis Tool is a planning level cost estimate that can be refined in a feasibility study or preliminary phases if FDOT chooses to advance the project.

FRA Safety Data

The incident data for the RHCI is received from the FRA Office of Safety Analysis Web Site (SAWS). The purpose of this site is to make railroad safety information including accidents and incidents, inventory, and highway-rail crossing data readily available to the

public. Site users can run dynamic queries, download a variety of safety database files, publications and forms, and view current statistical information on railroad safety[4]. FMO conducts additional queries on the SAWS to capture data for special analysis including spot density analysis and general safety statistics.

ArcGIS

In addition to the Grade Separation GIS tool, FDOT uses ArcGIS[5] tools as its primary method to visualize and analyze data. Data gathered from various sources is plugged into ArcGIS to help spot patterns, such as where crossing incidents are happening. ArcGIS software was used to create several of the maps seen throughout this plan.

Existing Conditions

Population

The size of Florida's rail safety challenge is underscored by the following:

- Florida is the third most populous state in the country. The population estimate in 2020 was 21.6 million people[6].
- Florida is a tourist destination. Tourism was responsible for bringing in 79.8 million visitors in 2020. This was a significant decrease from the record 131.4 million visitors in 2019, attributable to the COVID-19 pandemic [7].
- Between 2010 and 2019, Florida's population grew by 12.8%, the number of licensed drivers rose by 11.8%, and vehicle miles traveled (VMT) increased by 15.3%[8].
- The densest areas of the state are the Miami, Tampa, Orlando, and Jacksonville metro areas.

Rail Network: Operations

Freight rail is a vital asset to the growing state of Florida, providing a critical link to business markets across the state, nation, and ultimately the world. The railroads that operate on Florida's rail network transport many tons of goods and fall under all three classifications based on their annual operating revenues. The classifications are:

- Class I: Carriers having annual carrier operating revenues of $900 million or more after applying the railroad revenue deflator formula.

[4] FRA Office of Safety Analysis https://safetydata.fra.dot.gov/OfficeofSafety/default.aspx
[5] ESRI https://www.esri.com/en-us/arcgis
[6] University of Florida's Bureau of Economic and Business Research (BEBR) – Florida Estimates of Population, 2020
[7] Visit Florida website: https://www.visitflorida.org/about-us/what-we-do/ > Captured 8/30/21
[8] VMT Grows Faster Than Population and Drivers (fdotsourcebook.com)

- Class II: Carriers having annual carrier operating revenues of less than $900 million but in excess of $40.4 million after applying the railroad revenue deflator formula.
- Class III: Carriers having annual carrier operating revenues of $40.4 million or less after applying the railroad revenue deflator formula[9].

Florida's freight rail system is operated by two Class I railroads, one Class II railroad, and multiple Class III railroads that are further categorized as switching and terminal railroads or short lines. Florida's 3,865-mile rail network, including 2,746 miles of mainline, is a vital asset supporting the state's economy and mobility.

Table 2: Rail Mileage in Florida

Railroad	Miles Owned 10	Percent
CSX Transportation	1652	43%
Shortlines	1232	32%
Florida East Coast Railway	562	15%
Norfolk Southern Railway	126	3%
Florida Department of Transportation	136	4%
Other[11]	156	4%
TOTAL	**3865**	**100%**

Source: FDOT Freight and Multimodal Operations Office, 2021

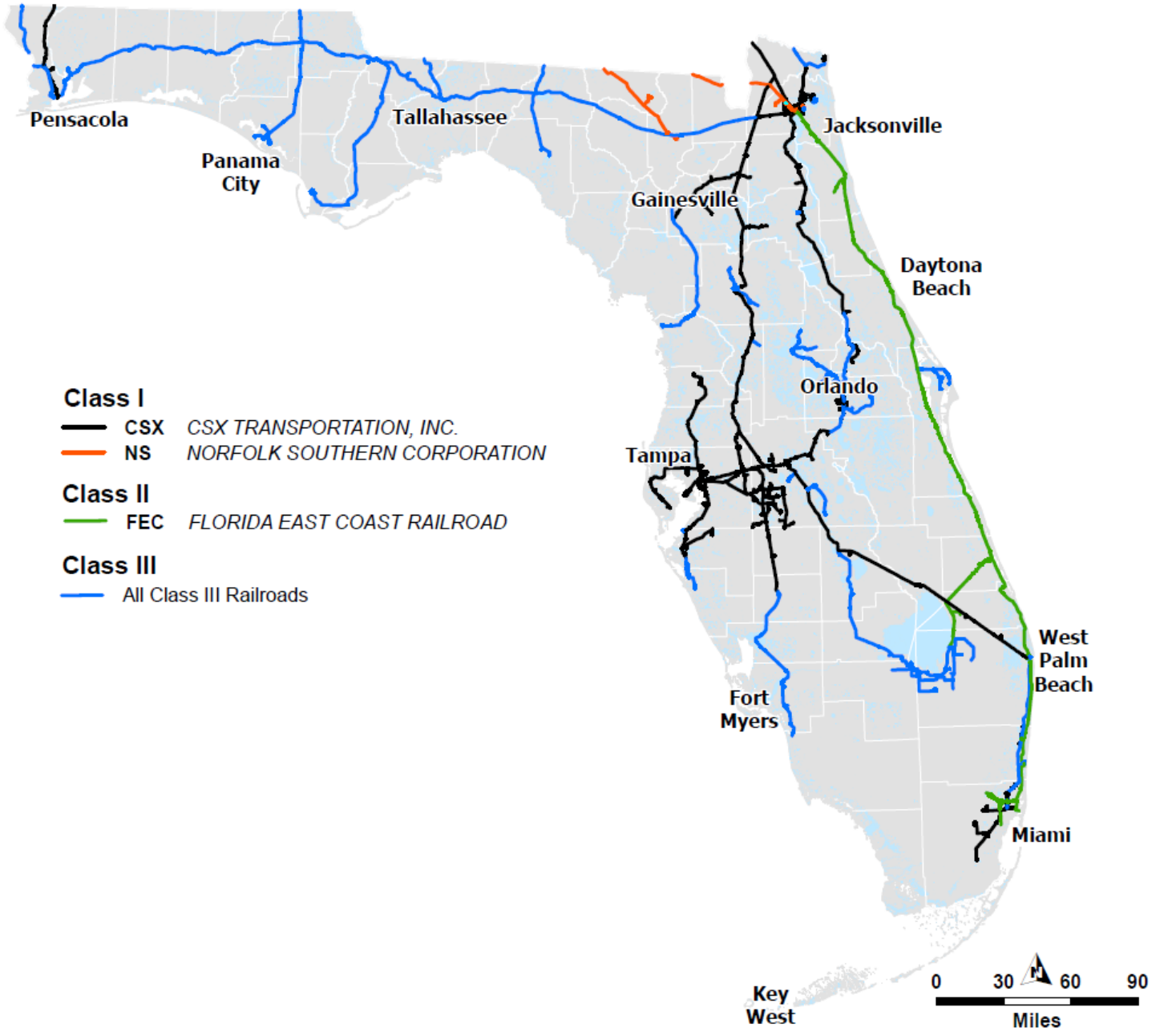
Table 2 shows that most of the rail mileage in the state is owned by the Class I carrier CSX Transportation (CSX), and Class II carrier Florida East Coast Railway (FEC). These railroads own a total of 2,214 miles. Class I Carrier Norfolk Southern Railway (NS), the short line railroads, and the State of Florida own the remaining miles in the state. **Figure 4** shows a map of rail classes in the state.

[9] 49 CFR 1201 (2021)

[10] Includes mainline, siding, spur, connector, yard, and storage miles. Route miles shown elsewhere refer to aggregate length, excluding yard tracks, sidings, and parallel lines.

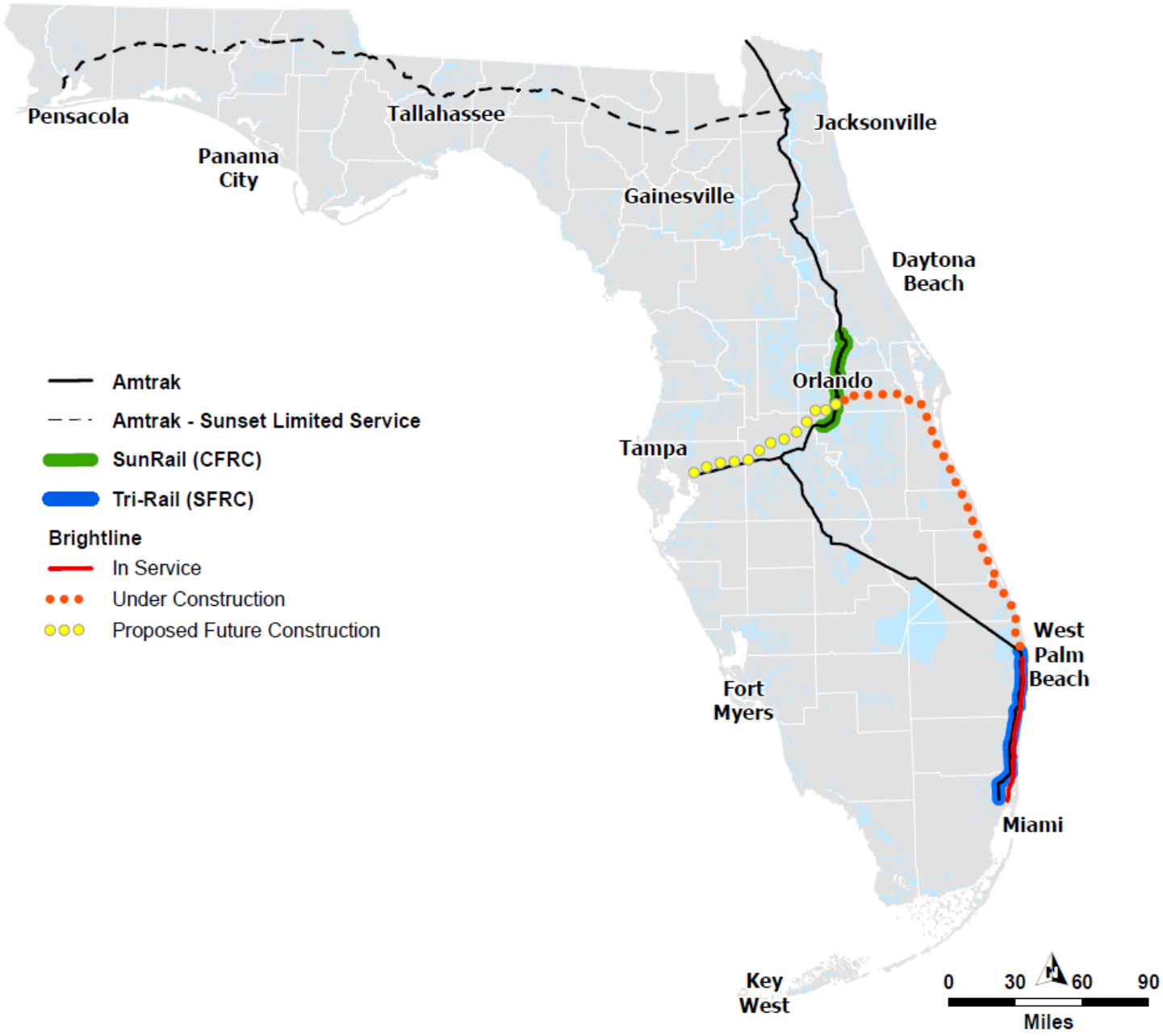
[11] Includes switching, terminal, private operators and US Government.

Figure 4: Rail Classes



Source: FDOT Freight and Multimodal Operations Office, 2021

Figure 5: Passenger Rail



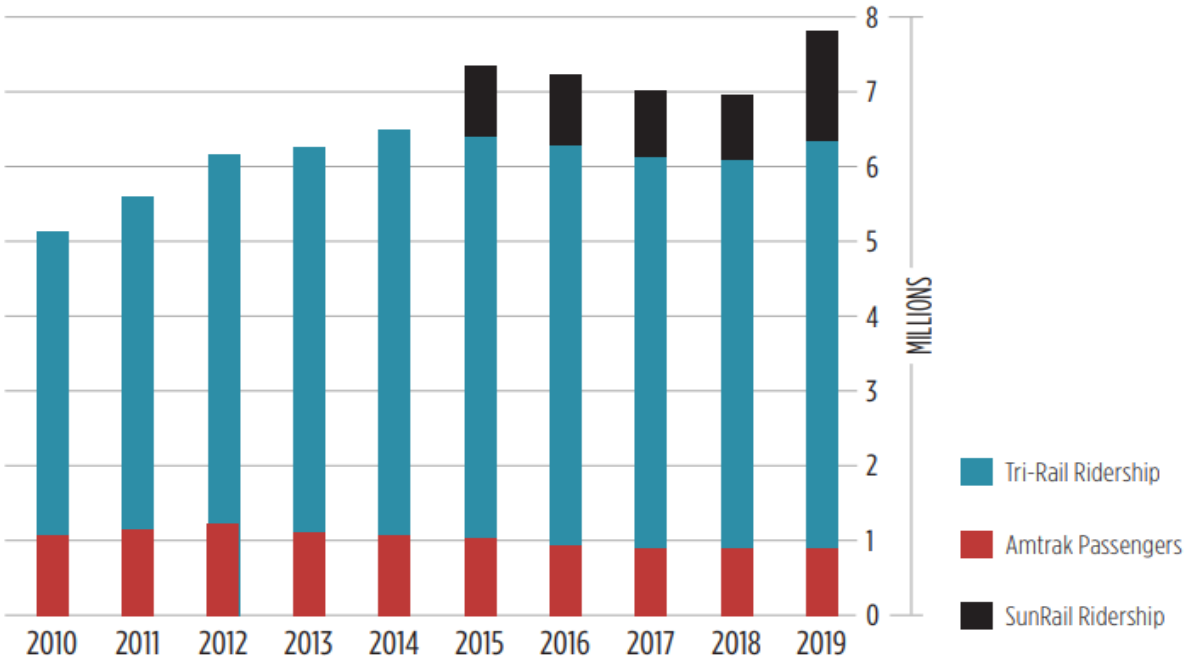
Source: FDOT Freight and Multimodal Operations Office, 2021

Figure 5 shows a map passenger rail service in Florida. Florida has four passenger rail operations:

Amtrak operates mostly over CSX Transportation (CSX) freight trackage, but also operates over state owned trackage between Deland, Orlando and Poinciana, and between Mangonia Park and Miami. A total of over 905,356 passengers boarded and alighted at the 18 Florida Amtrak stations in 2019[12].

Tri-Rail, operating since 1989, links Miami, Fort Lauderdale, and West Palm Beach. Tri-Rail is managed by the South Florida Regional Transportation Authority (SFRTA) along lines owned by FDOT. The 72-mile system has 18 stations and connects to Metrorail and Metrobus, the Miami Airport, and to Amtrak at several stations. In 2019, Tri-Rail recorded 5,433,701 passenger trips for the year[13].

Figure 6: Passenger Rail Ridership



Source: FDOT Sourcebook, 2020

SunRail began operations in May 2014. Owned by the State of Florida, SunRail runs from Deland to Kissimmee. Phase 1 covers 32 miles with 12 stations along former CSX Transportation tracks connecting Volusia and Orange Counties through the City of Orlando. Phase 2 opened July 30, 2018, and added four more stations and extended

[12] FDOT Sourcebook, 2020
[13] FDOT Sourcebook, 2020

south 17.2 miles to Poinciana in Osceola County. In 2019, SunRail recorded 1,469,654 passenger trips[14].

Brightline began operations in 2018 as a privately owned and operated passenger rail service. Brightline runs from West Palm Beach to Miami with plans to expand to Orlando and Tampa. Brightline does not report ridership to the National Transit Database (NTD).

Figure 6 shows that in 2019, 7.8 million people rode rail in Florida, the highest total in over 15 years, and an increase of 6.2% from 2015. SunRail ridership was responsible for most of the increase.

Rail Network: Crossings

Table 3 breaks down Florida crossing statistics. As of December 2021, there are a total of 5,324 open active crossings in the state. 91% of those are at-grade crossings, while the other 9% are instances where tracks go under or over a road. 76% of the open active crossings in the state are public. 135 of the 4,868 at-grade crossings are pathway/pedestrian/other crossings.

Table 3: Florida Crossings

	Public	Private	Total
At-Grade	3577	1291	4868
RR Under	394	6	400
RR Over	54	2	56
Total	**4025**	**1299**	**5324**

Source: FDOT Freight and Multimodal Operations Office, 2021

Some form of warning device should exist at every public at-grade crossing, and all crossings on state highways are designed to meet the Manual on Uniform Traffic Control Devices (MUTCD) criteria. According to *Florida Administrative Code 14-57.013*, all new public highway grade crossings shall have as a minimum roadside flashing lights and gates on all roadway approaches to the crossing. Other protection devices range from crossbucks with a stop or yield sign (considered a "passive" crossing) to full four quadrant gates with curbs, depending on the need. Need is based on type of cross street, traffic counts, and railroad type and speed. **Table 4** shows open active public and private at-grade crossings with warning devices.

[14] FDOT Sourcebook, 2020

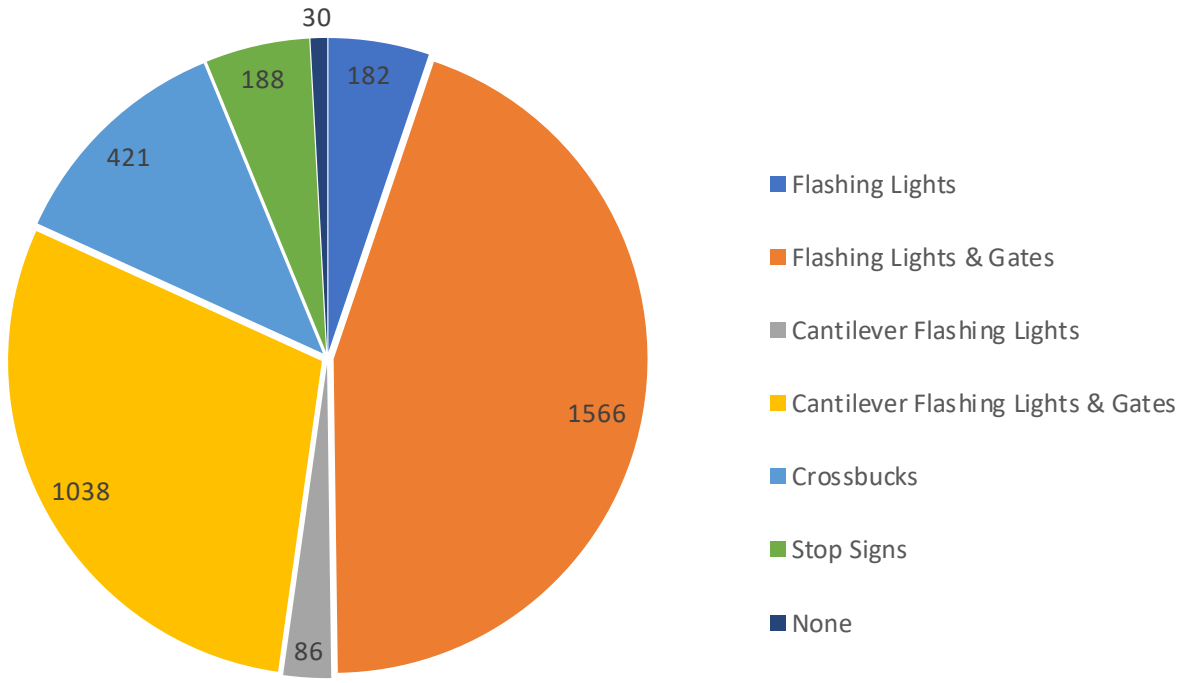
Table 4: At-Grade Crossings with Warning Devices

Type of Warning Device	Number of Crossings	Percent
Active	2952	62%
Passive	1846	38%
Total[15]	**4798**	**100%**

Source: FDOT Freight and Multimodal Operations Office, 2021

Figure 7 shows the number of warning device types for the public at-grade crossings in the state. 82% of public at-grade crossings have active warning devices (flashing lights, flashing lights & gates, cantilever flashing lights, or cantilever flashing lights & gates), while less than 6% of private at-grade crossings have active warning devices. Most private at-grade crossings in the state have passive devices (crossbucks, stop signs, or yield signs).

Figure 7: Public At-Grade Crossing Warning Devices



Source: FDOT Freight and Multimodal Operations Office, 2021

[15] Does not include 70 at-grade pedestrian crossings

Table 5: Crossing Maintenance

Maintained By	Number of Crossings
State	805
County	1705
City	1558
Private	1409
Unassigned	17
Total	**5494**

Source: FDOT Freight and Multimodal Operations Office, 2021

The Florida Department of Transportation has direct responsibility for approximately 12,130 centerline miles of the State Highway System, out of a total of 123,104 centerline miles of public roads in Florida. **Table 5** shows that this accounts for over 800 open crossings on state owned and maintained roadways and over 3,200 on city or county roadways. Privately maintained crossings make up approximately 26% of open crossings in Florida.

Data Analysis

FDOT's Freight and Multimodal Operations (FMO) Office conducted incident analyses using the datasets, references and tools previously listed and measured the output with the existing conditions to determine a baseline for Florida's safety challenges.

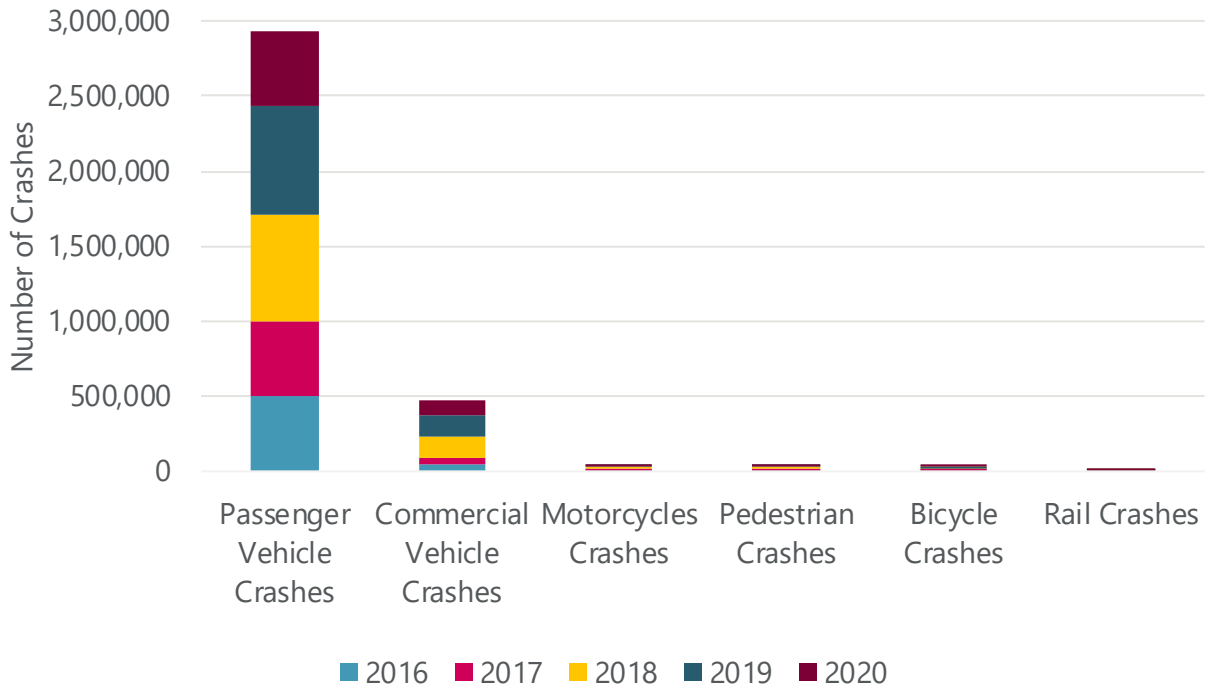
Crash Comparison

FMO reviewed crash statistics across the Florida land surface transportation modes; this review provided a comparison of the safety performance by each mode for the last 5-years of available data (2016, 2017, 2018, 2019, and 2020).

Between 2016 and 2020, there were 2,020 total rail accidents/incidents in Florida, which is the sum of train accidents not at grade-crossings (135), highway-rail incidents[16] (516), and other incidents (1,369). "Other incidents" likely include slow speed yard derailments with little or no threat to public safety. While the occurrences of rail incidents/accidents is still too high, it is important to take into account that they make up less than 1% of the incidents that occur in the state. As seen in **Figure 8**, passenger vehicle crashes make up most incidents, with 2.9 million crashes during the same time period.

[16] Highway-railroad incident: an impact between a rail and a highway user at a crossing site.

Figure 8: Florida Crashes by Mode



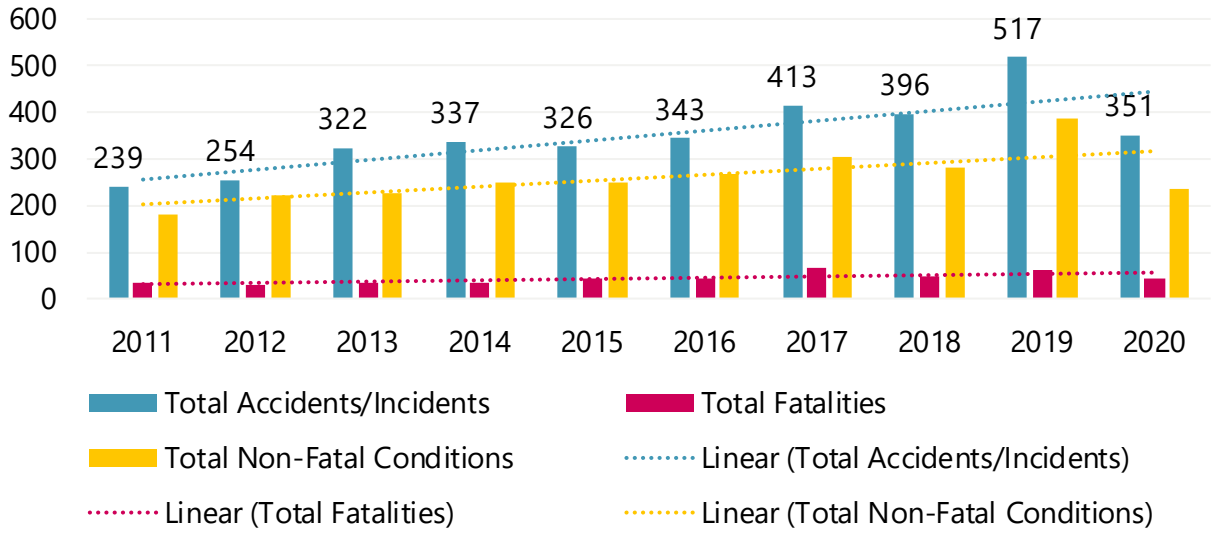
Source: Florida Department of Highway Safety and Motor Vehicles, Florida Department of Transportation, and FRA Office of Safety Analysis, 2021

Additionally, over the same 5-year period, there were a total of 10,538 highway-railroad incidents in the United States that resulted in 1,277 fatalities. It's important for FDOT to note in this discovery that 5% (516) of those total incidents and 7% (89) of those fatalities occurred in Florida.

Trends: 10 Years of Incidents

Figure 9 displays the total rail incidents in Florida over a 10-year timeframe. Florida experienced an upward trend of rail incidents totaling 3,498 occurrences between 2011 and 2020. This period saw a total of 2,592 injuries and 433 deaths.

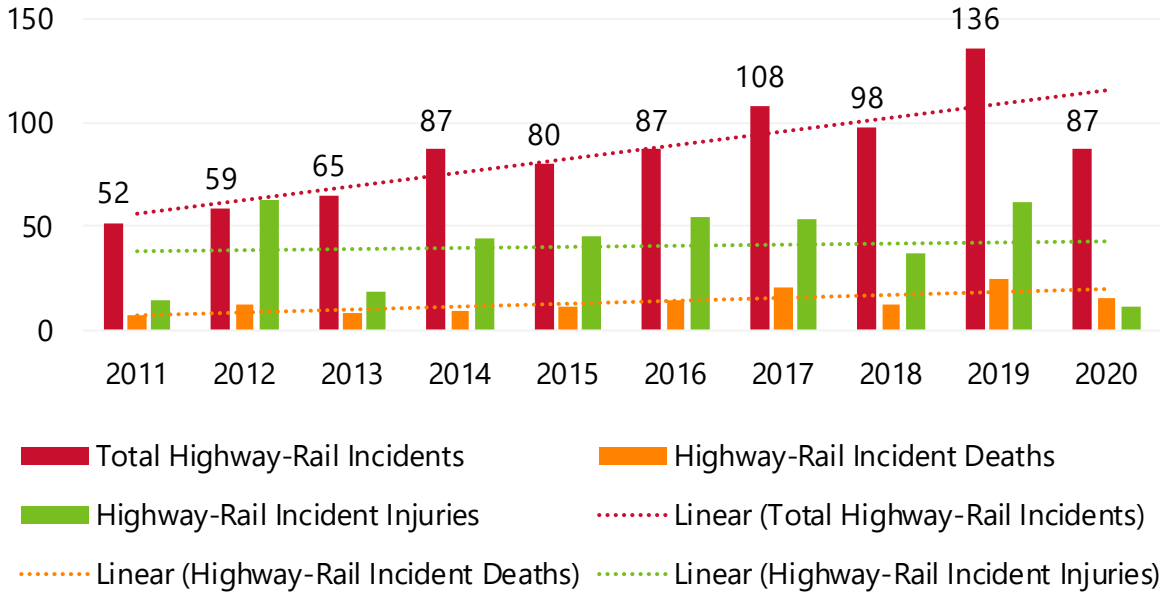
Figure 9: Total Rail Incidents in Florida, 2011-2020



Source: FRA Office of Safety Analysis, 2021

During that decade, 859 of the 3,498 incidents occurred at a highway-railroad grade crossing. **Figure 10** shows that the number of incidents occurring at crossings has also been trending upward.

Figure 10: Total Highway-Rail Grade Crossing Incidents in Florida, 2011-2020



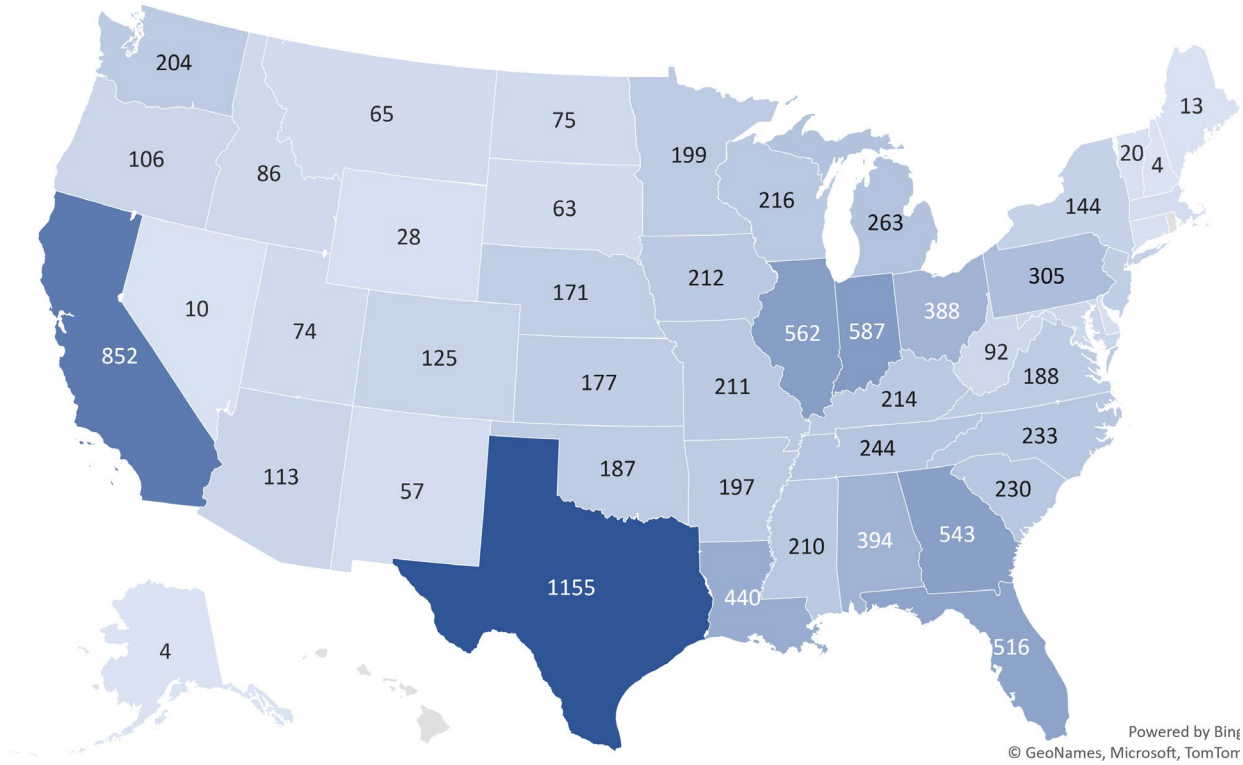
Source: FRA Office of Safety Analysis, 2021

The number of injuries and deaths from rail incidents in Florida have also been trending upward since 2011, but at a slower rate than the increase of incidents. The total number of rail incidents took a downturn in 2020, which can be attributed to the COVID-19 pandemic.

The Past Five Years

To get a more recent picture in time, the following incident breakdowns are comprised of data from 2016 through 2020, the most recent 5-year period with complete datasets.

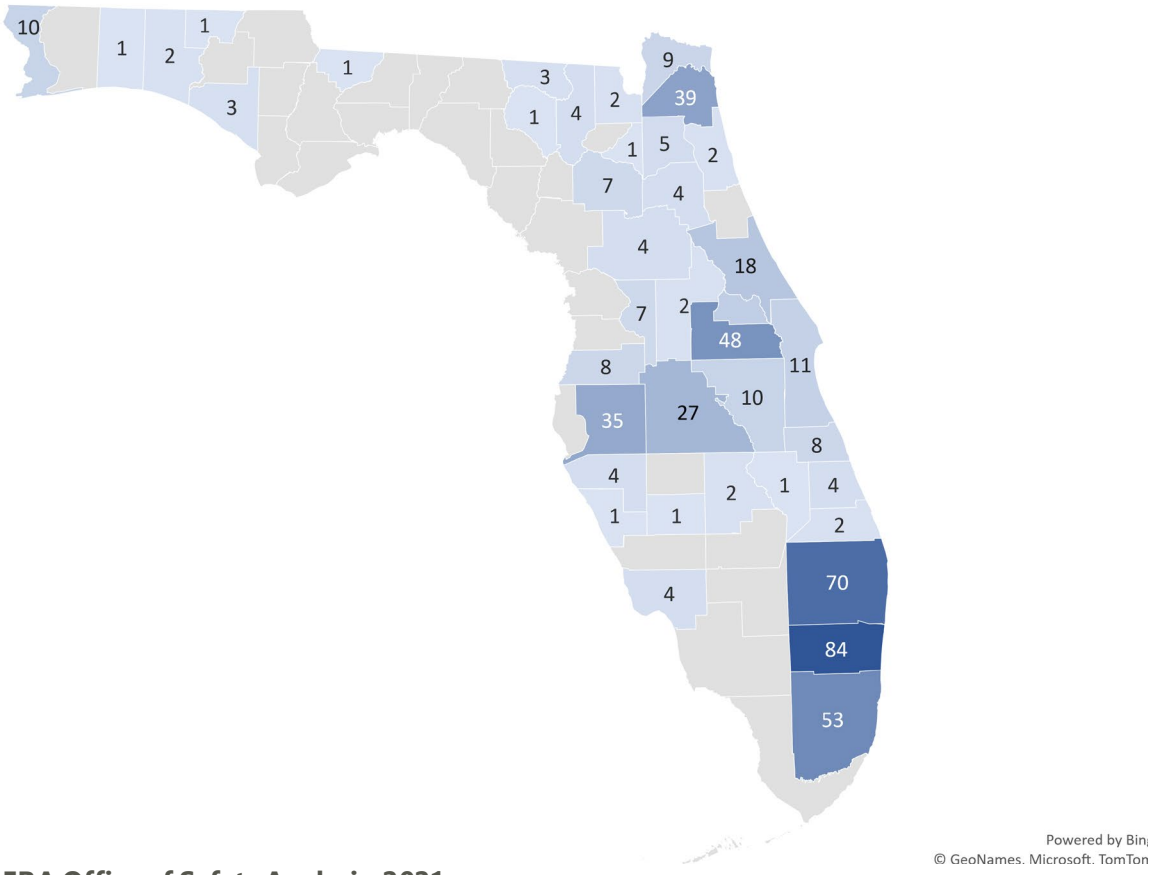
Figure 11: Highway-Rail Grade Crossing Incidents by State, 2016-2020



Source: FRA Office of Safety Analysis, 2021

Between 2016 and 2020, there were a total of 516 highway-railroad grade crossing incidents in Florida. For this period, Florida ranked 6th in the highest number of these incidents in the country, behind Texas, California, Indiana, Illinois, and Georgia, respectively. **Figure 11** shows how this number compares to the rest of the states.

Figure 12: Highway-Rail Grade Crossing Incidents by County, 2016-2020

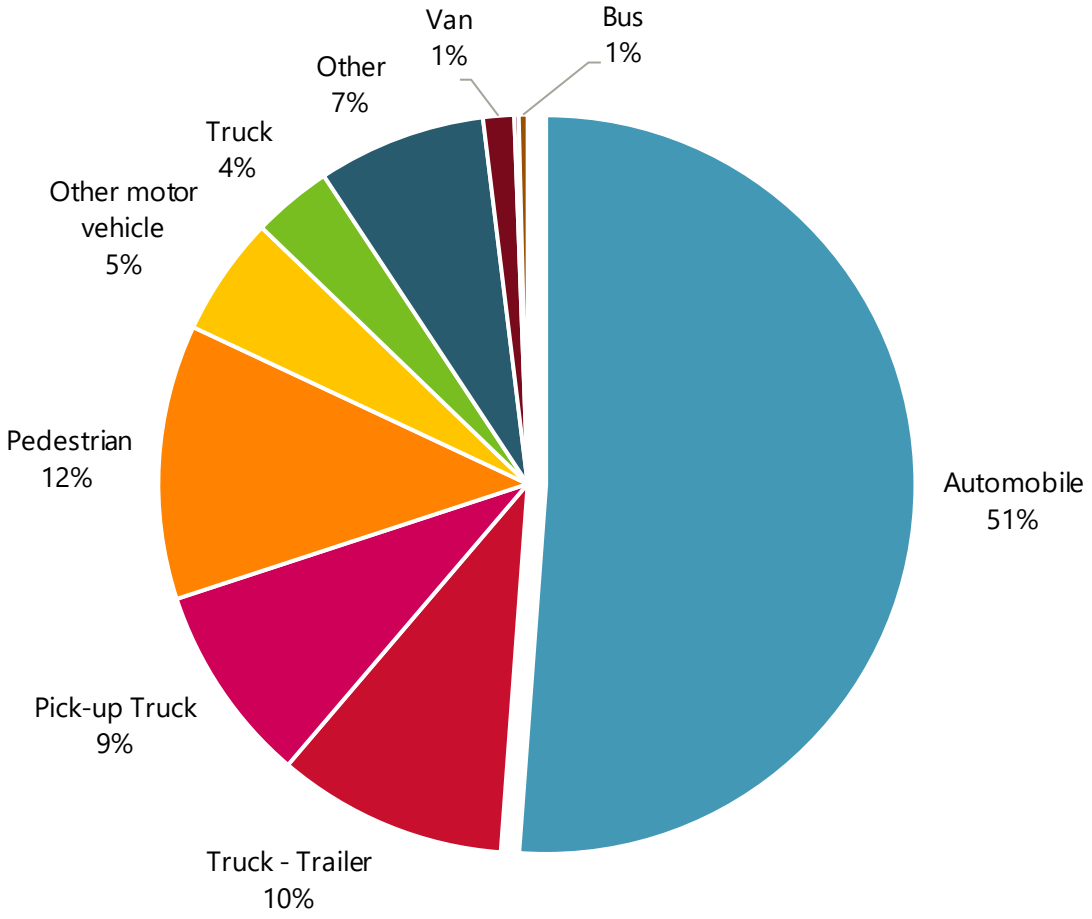


Source: FRA Office of Safety Analysis, 2021

Figure 12 shows that during the same period, the 516 highway-railroad incidents in Florida were concentrated in Broward, Palm Beach, Miami-Dade, Orange, Duval, Hillsborough, and Polk Counties. The higher density ("hot spots") of rail incidents occur in the larger metropolitan areas. A deeper discussion of density analysis is found in the Risk Assessment section of this plan.

Figure 13 provides a breakdown of the vehicle types that were involved in the highway-railroad grade crossing incidents. More than 50% of the incidents involved a car. 37% of incidents involved other vehicle types, and 12% involved pedestrians.

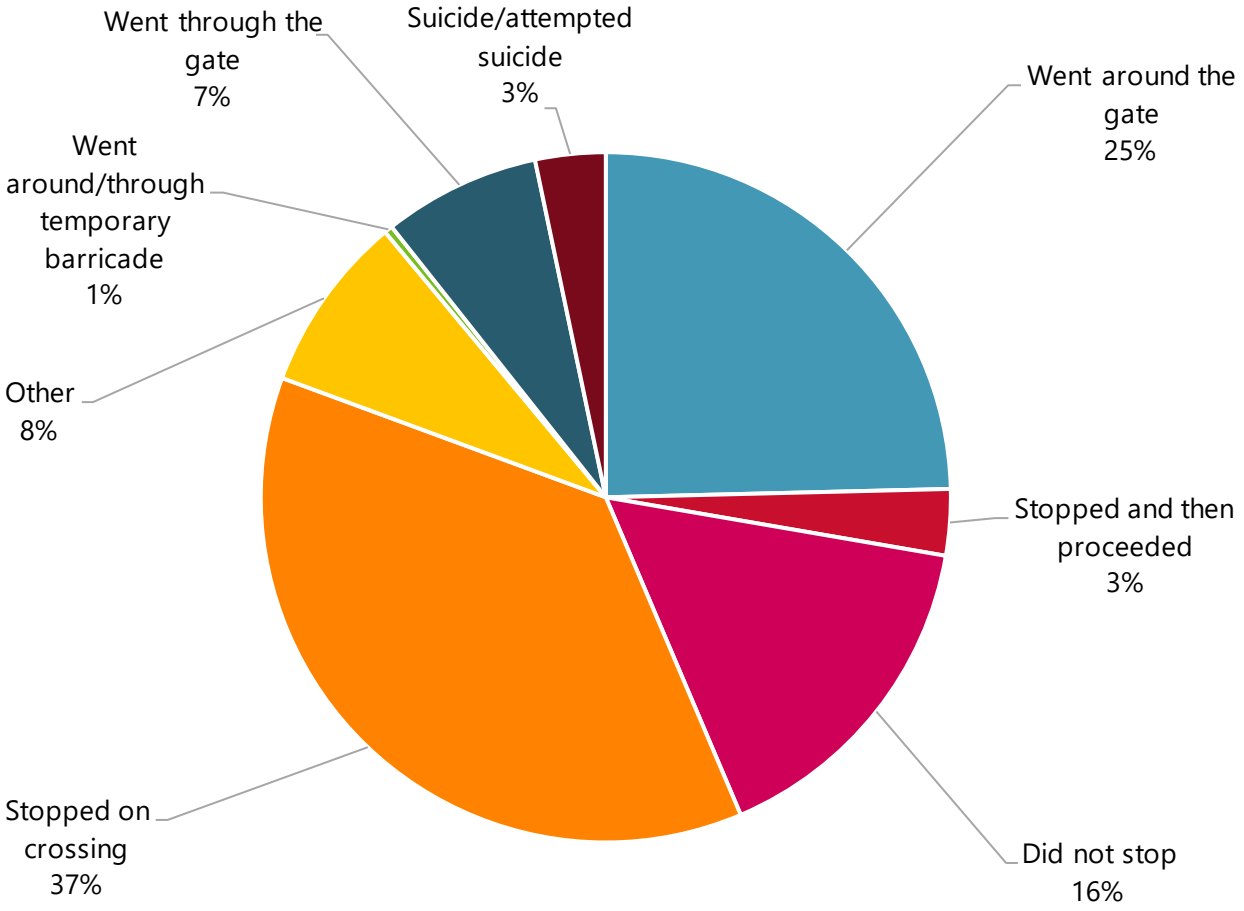
Figure 13: Highway-Rail Grade Crossing Incidents by Vehicle Type, 2016-2020



Source: FRA Office of Safety Analysis, 2021

Figure 14 shows that during the same period, 33% of incidents occurred because the driver/pedestrian went around or through the gates/barricades. 19% of incidents occurred because the driver either did not stop at all or stopped and then proceeded. In 37% of the incidents, the driver stopped on the track. These statistics show that, despite warning devices at these crossings, the biggest obstacle to safety at highway-rail grade crossings is driver and pedestrian behavior. This should be addressed with education and enforcement.

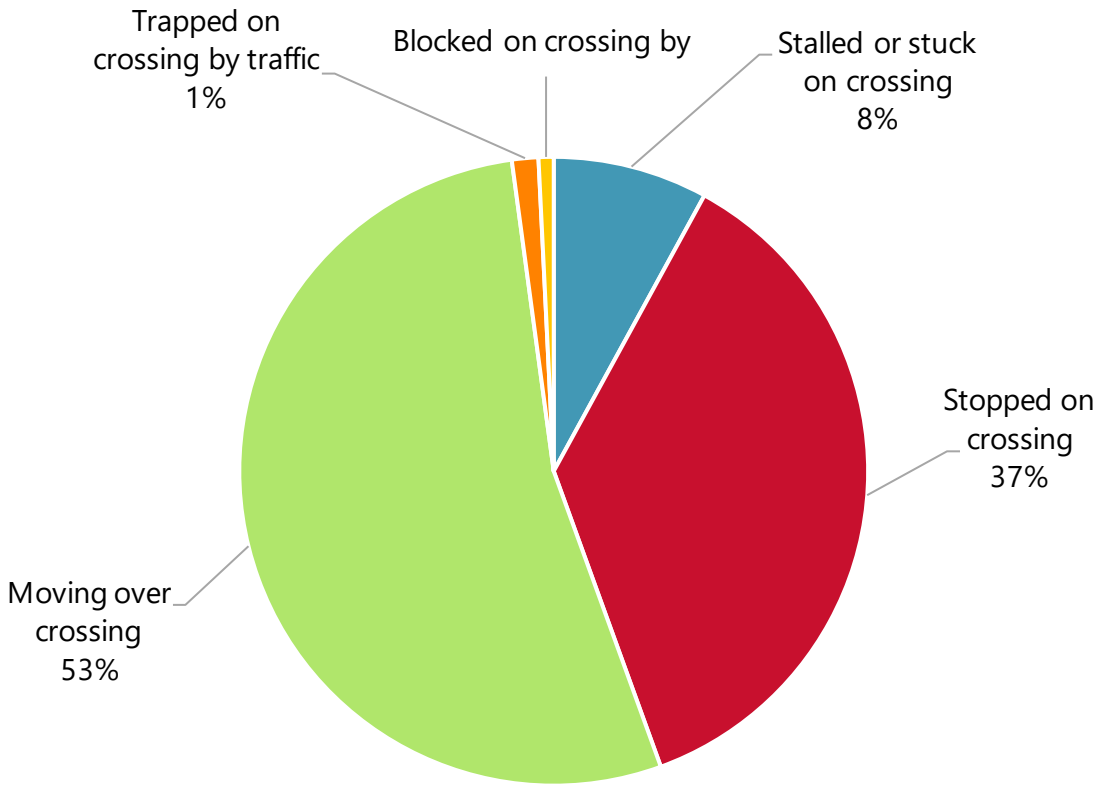
Figure 14: Highway-Rail Grade Crossing Incidents by Highway User Action, 2016-2020



Source: FRA Office of Safety Analysis, 2021

Figure 15 represents the position of the vehicle when the incident occurred. More than half of the incidents during the period of 2016 through 2020 occurred as the highway user was moving over the crossing; 37% of the incidents occurred because the highway user was stopped on the crossing; and 8% occurred because the user was stalled or stuck on the crossing.

Figure 15: Highway-Rail Grade Crossing Incidents by Highway User Position, 2016-2020

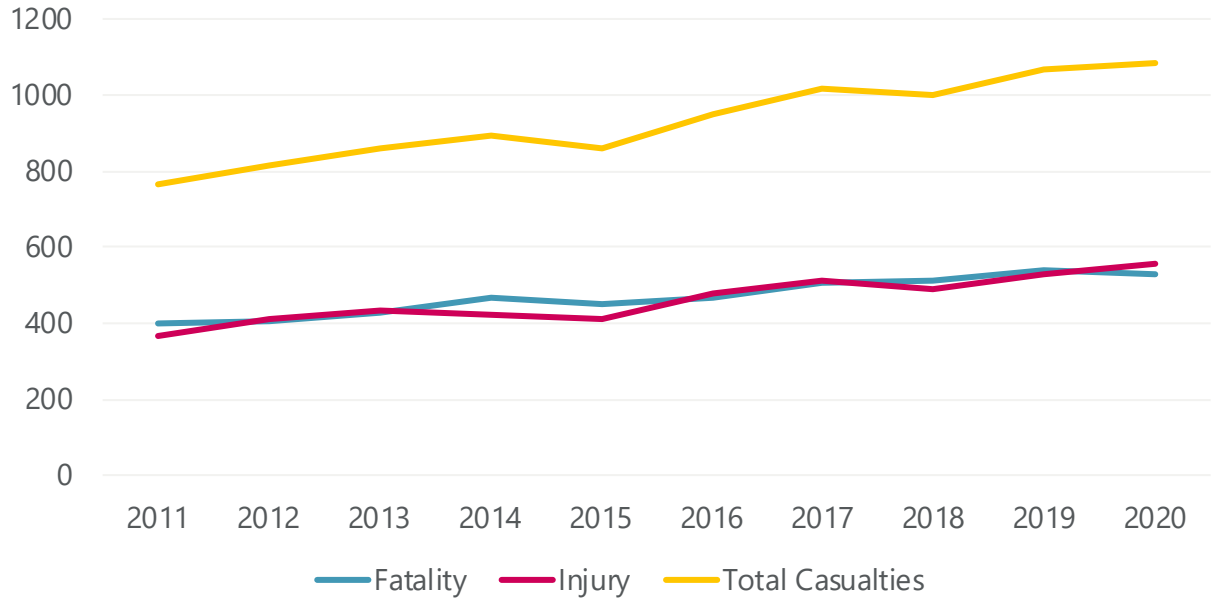


Source: FRA Office of Safety Analysis, 2021

Trespassing

Although this plan focuses mainly on the intersection of railroads and highways, Florida is experiencing many train/pedestrian incidents on parts of its railroad tracks that are not at crossings. This trend has been steadily increasing. In 1990, the number of trespassers who died on rail rights-of-way within the United States exceeded 500 for the first time. Since 1997, trespasser fatalities have exceeded fatalities at grade crossings as the largest category of rail-related deaths. Addressing these issues is complicated by the fact that trespassers are not a single, consistent group.

Figure 16: United States Trespassing Casualties, 2011-2020

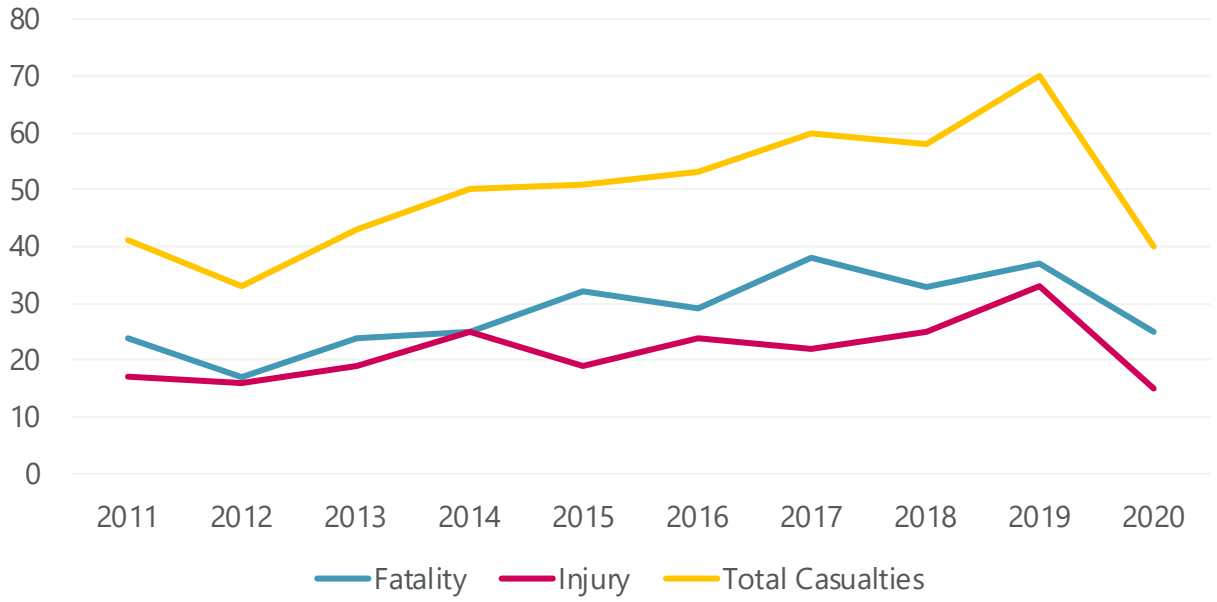


Source: FRA Office of Safety Analysis, 2021

In the United States, over the course of the decade between 2011 and 2020, there were 8,562 incidents with 9,308 casualties (injuries and fatalities) due to trespassing. The casualties consisted of 4,702 fatalities and 4,606 injuries. **Figure 16** shows an increasing trend in trespassing casualties.

Figure 17 shows the same data at a state level. In Florida, there were a total of 458 trespassing incidents with 499 casualties over the same period. The casualties involved 284 fatalities and 215 injuries. Just as with highway-railroad grade crossing incidents, Palm Beach, Broward, and Miami-Dade Counties had the highest number of trespassing occurrences, respectively. Until 2020, trespassing casualties were increasing at a faster rate in Florida than in the United States.

Figure 17: Florida Trespassing Casualties, 2011-2020



Source: FRA Office of Safety Analysis, 2021

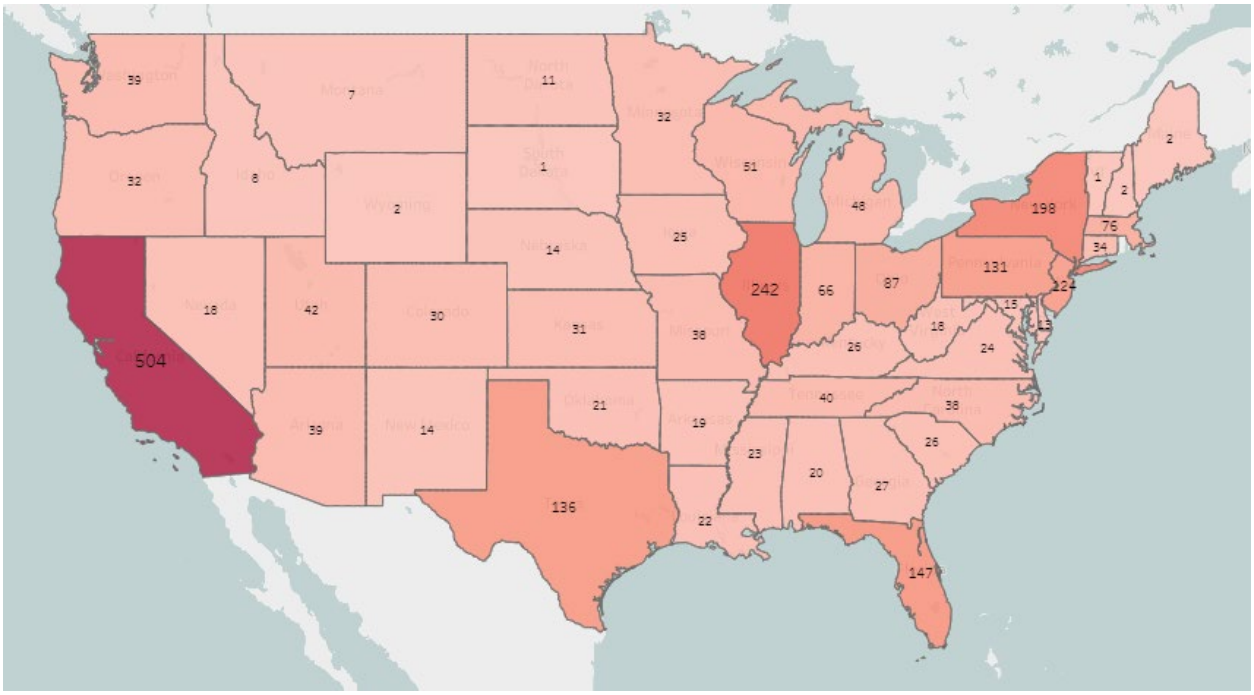
To combat the rise in trespassing incidents, FDOT submitted for and was awarded a Consolidated Rail Infrastructure and Safety Improvements (CRISI) Grant in 2018 to explore strategies for reducing railway trespassing. The project launched a pilot program to aid partnerships among local law enforcement agencies to combat trespassing in Volusia, Seminole, Orange, and Osceola Counties. The grant funding went toward:

- Identifying critical locations on the Central Florida Rail Corridor (CFRC) with a high frequency of trespassing
- Determining trespassing contributing factors
- Developing and implementing a blended approach of validating trespassers
- Preparing enforcement and education trespassing countermeasure strategies and tools
- Developing a program to share and train local law-enforcement and local governments on implementing a response strategy
- Developing a model for building effective problem-solving partnerships with local law-enforcement, community stakeholders and local governments, and
- Identifying funding opportunities for local law-enforcement and community stakeholders to respond to trespassing issues.

A report was produced in 2020 that outlines the work that was done for the project and provides findings and recommendations for future progress in this arena. These recommendations are part of the **Action Plan** for the SAP.

The rates of suicides were increasing as well. Railway suicide incidents tend to be reported as trespass incidents, as they typically occur on parts of the track that are not crossings. **Figure 18** shows an FRA map of suicides by state over the past decade. Florida had the 4th highest suicide rate, with 147 total suicides.

Figure 18: Suicides by State, 2011-2020



Source: FRA Trespass & Suicide Dashboard - Suicide Overview Map, 2021

While behavior (whether driver or pedestrian) remains the biggest takeaway from this data, it is necessary to look at reasons why drivers may be getting stopped, stuck, or blocked on the tracks at crossings. One topic that is currently being researched in the FDOT Freight and Multimodal Operations Office is humped crossings.

Humped Crossings

While a crossing may have been installed by the roadway jurisdiction per standards at one time, track maintenance and crossing surface replacement over time by the railroad can result in raising the track to a higher top-of-rail elevation as new railroad ties and ballast is added to the track structure. In some instances, the highway jurisdiction is not

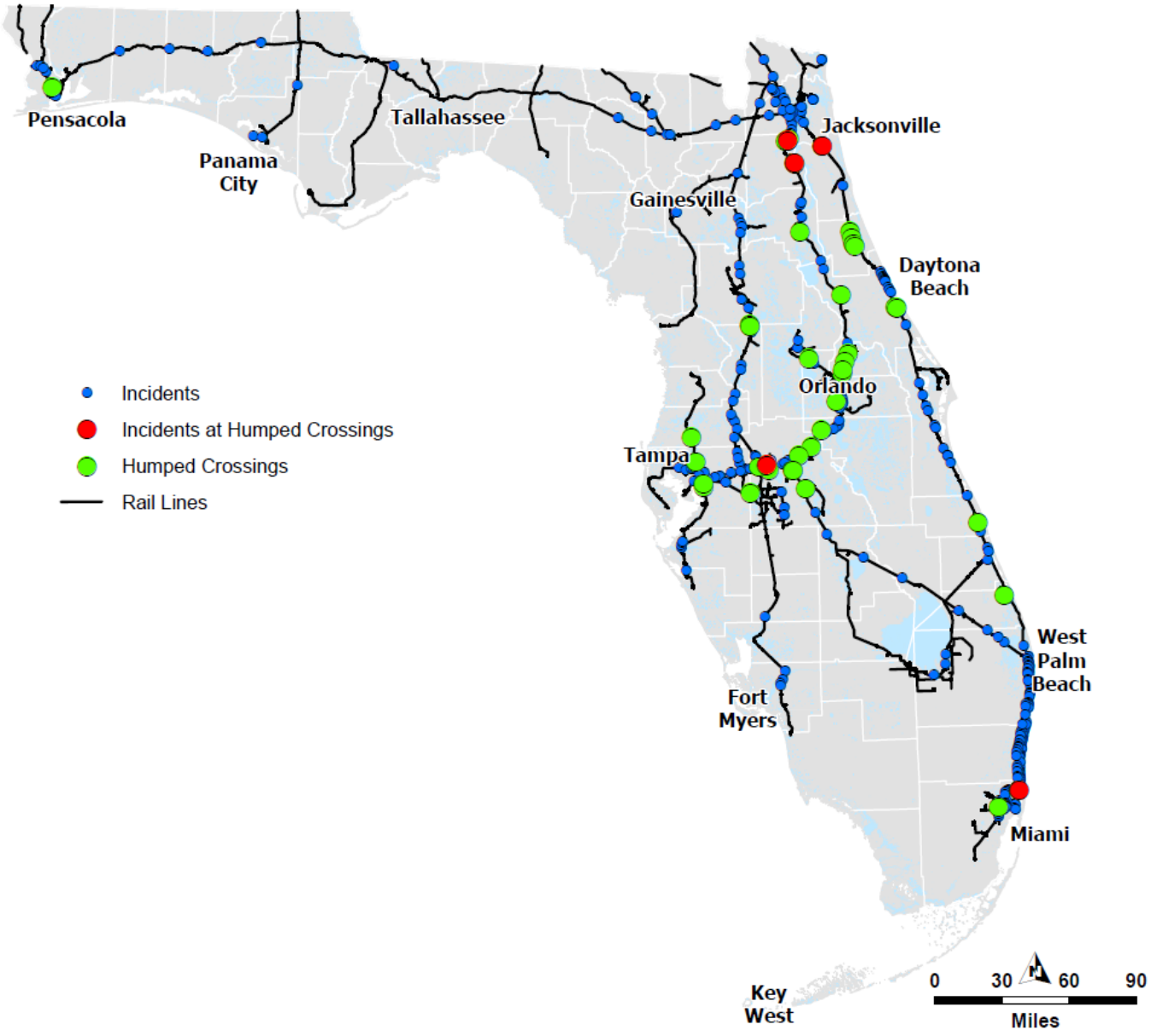
complying with agreements regarding their maintenance responsibility for work outside the ties. Unless the highway profile is properly adjusted when crossing surface renewal work is done, a "humped" roadway profile could result. Depending on the severity of the vertical roadway profile change, this may adversely affect the safety and movement of highway traffic over the track at the crossing. There are currently no federal guidelines as to what physical characteristics define or constitute a humped crossing.

Low-clearance vehicles that are low to the ground relative to the distance between axles pose the greatest risk of becoming immobilized due to contact with the track or highway surface. The danger of a vehicle "bottoming out" or becoming stranded atop a humped crossing is obvious. If a low-clearance vehicle gets stuck and cannot move off the rails, it will eventually be struck by a train if not freed from the crossing. Florida has experienced catastrophic events associated with low clearance vehicles getting caught on crossings before being hit by a train.

Posting of railroad contact information at all grade crossings has improved the notification situation, but incidents cannot be eliminated if the railroad is not notified in time. It is possible that a vehicle could bottom out and scrape across the rails but still be able to continue moving. This could result in potential damage to the track gage or the rails themselves which, depending on severity, could lead to a train derailment with dangerous effects to surrounding communities.

Because there is marginal guidance that exists for humped crossings, there is also a lack of data. For one, it is hard to get a clear count of how many humped crossings exist at any given time, since they are often created or eliminated without reporting. The driver behavior statistics do not detail why a vehicle may have been stuck on the tracks. In addition, near misses, when a vehicle is stuck on the track but can get off the tracks before an incident, are rarely reported. For the purposes of this document, 43 humped crossings were identified in Florida by finding the crossings that had "low-clearance" signs. The highway-railroad grade crossing incidents were overlaid to see where incidents occurred at humped crossings. There were 9 incidents that occurred at 5 humped crossings (shown in **Figure 19**) from 2016 to 2020. The incidents cannot be presumed to be caused by the humped crossings, but when looking at the reported motorist action and position when struck, a high vertical profile of the track could have caused any of those vehicles to be stuck or stopped on the tracks. The FMO office is conducting further research on humped crossings.

Figure 19: Incidents at Humped Crossings, 2016-2020



Source: FDOT Freight and Multimodal Operations Office, 2021; FRA Office of Safety Analysis, 2021

In summary, both freight and passenger rail industries in Florida continue to grow, and the rate of highway-railroad incidents in Florida has been increasing over the past decade. The data in this section illuminates some of the reasons that grade crossings are dangerous, but it alone does not tell a complete story. The next section will help identify the crossings, types of crossings, and corridors where focused attention might contribute to a reduction in crashes and their consequences.

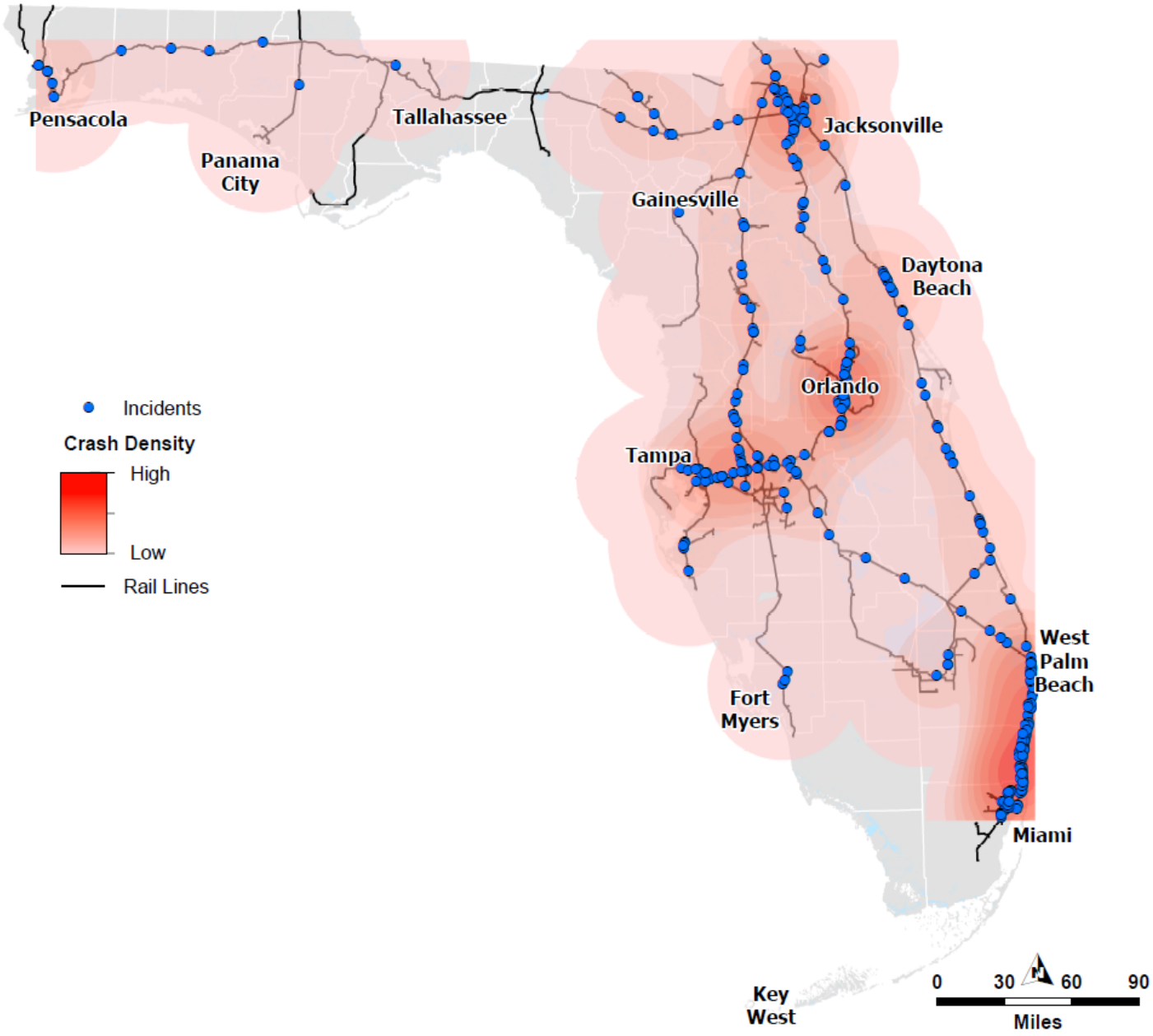
Risk Assessment

The following provides an assessment to augment the previous data analysis; it draws out critical factors from data analysis that could create risks to the rail-roadway system. It identifies which corridors have the highest incident densities, and which specific crossings have the highest numbers of incidents and fatalities. This section also accounts for additional considerations for the implementation of new transportation concepts, for weather, and for challenges with population and traffic growth that create additional risk unique to Florida.

Incident Densities along Crossing Corridors

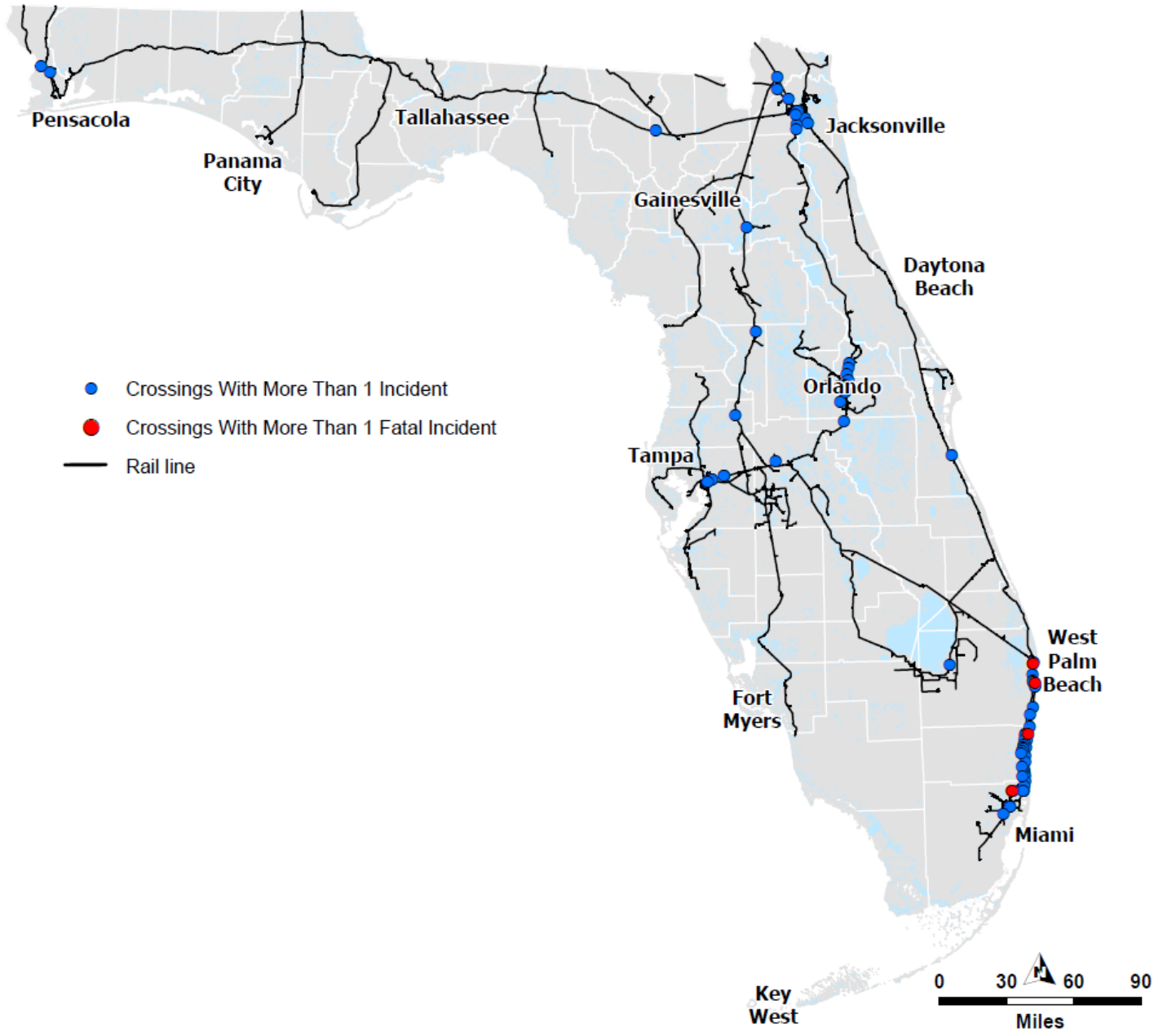
A Highway-Railroad Incident Density analysis from 2016 to 2020 gives a closer look at the concentration of critical areas of the state. During this 5-year period, there were 516 incidents at 408 highway-railroad grade crossings in Florida, accounting for 219 injuries and 89 fatalities. The highest occurrences of incidents happened in the state's most densely populated areas. As noted previously, the Jacksonville, Orlando, Tampa, and Southeast Florida areas are the most crowded. **Figure 20** was created to show the intensity of incident occurrences in densely populated areas with crossings; these factors are critical for rail safety planning and become even more critical as rail services and population continue to grow.

Figure 20: Highway-Rail Incident Density Analysis, 2016-2020



Source: FDOT Freight and Multimodal Operations Office, 2021; FRA Office of Safety Analysis, 2021

Figure 21: Crossings with Highest Number of Incidents & Fatalities, 2016-2020



Source: FDOT Freight and Multimodal Operations Office, 2021; Incident Data - FRA

Figure 21 is a map of all the highway-railroad crossings in Florida that have experienced multiple incidents (at least two) within the 5-year period of 2016 through 2020. During that time, these 75 crossings accounted for 183 incidents, 29 fatalities, and 96 injuries. Tables 6 and 7 show these crossings with more detail.

Table 6: Crossings with Multiple Incidents in Florida, 2016-2020

Crossing ID	County	City	Total Incidents	Fatal Incidents	Total Deaths	Injury Incidents	Total Injuries
622181A	ORANGE	ORLANDO	8	0	0	3	9
273145P	DUVAL	JACKSONVILLE	6	0	0	0	0
272609N	MIAMI-DADE	MIAMI-DADE	5	0	0	1	1
628118D	PALM BEACH	WEST PALM BEACH	4	3	3	0	0
628139W	PALM BEACH	WEST PALM BEACH	4	1	1	0	0
624350S	HILLSBOROUGH	SEFFNER	4	0	0	1	3
272473D	PALM BEACH	LANTANA	4	0	0	3	3
272518H	BROWARD	DEERFIELD BEACH	3	2	2	1	1
628177F	BROWARD	POMPANO BEACH	3	1	1	0	0
628272B	BROWARD	FORT LAUDERDALE	3	1	1	0	0
620891F	DUVAL	JACKSONVILLE	3	1	1	1	1
628144T	PALM BEACH	LAKE WORTH	3	1	1	1	1
628192H	BROWARD	FORT LAUDERDALE	3	1	1	2	2
622072W	SEMINOLE	LONGWOOD	3	0	0	0	0
622086E	ORANGE	MAITLAND	3	0	0	0	0
622307E	ORANGE	ORLANDO	3	0	0	0	0
625013E	ALACHUA	HAWTHORNE	3	0	0	0	0
631058A	MIAMI-DADE	MIAMI	3	0	0	1	1
628378W	MIAMI-DADE	HIALEAH	3	0	0	2	2
272468G	PALM BEACH	LAKE WORTH	2	2	2	0	0
628321V	MIAMI-DADE	MIAMI-DADE	2	2	2	0	0
271819A	DUVAL	JACKSONVILLE	2	1	1	0	0
272603X	MIAMI-DADE	MIAMI-DADE	2	1	1	0	0
620896P	DUVAL	JACKSONVILLE	2	1	1	0	0
622077F	SEMINOLE	ALTAMONTE SPGS	2	1	1	0	0
628163X	PALM BEACH	BOCA RATON	2	1	1	0	0
272519P	BROWARD	POMPANO BEACH	2	1	1	1	1
272550B	BROWARD	FORT LAUDERDALE	2	1	1	1	1
272578S	BROWARD	HOLLYWOOD	2	1	1	1	1
621193R	DUVAL	JACKSONVILLE	2	1	1	1	1
628169N	BROWARD	POMPANO BEACH	2	1	1	1	1
628191B	BROWARD	OAKLAND PARK	2	1	1	1	2
272531W	BROWARD	POMPANO BEACH	2	1	1	1	3
621216V	DUVAL	JACKSONVILLE	2	1	1	1	3
628183J	MIAMI-DADE	MIAMI-DADE	2	1	1	1	5
272467A	PALM BEACH	LAKE WORTH	2	0	0	0	0
272471P	PALM BEACH	LANTANA	2	0	0	0	0

272497S	PALM BEACH	DELRAY BEACH	2	0	0	0	0
272537M	BROWARD	OAKLAND PARK	2	0	0	0	0
272589E	BROWARD	HOLLYWOOD	2	0	0	0	0
272590Y	BROWARD	HOLLYWOOD	2	0	0	0	0
272596P	MIAMI-DADE	MIAMI-DADE	2	0	0	0	0
272609N	DADE	NORTH MIAMI	2	0	0	0	0
273150L	BROWARD	FORT LAUDERDALE	2	0	0	0	0
620752K	DUVAL	JACKSONVILLE	2	0	0	0	0
622178S	ORANGE	ORLANDO	2	0	0	0	0
624146T	POLK	LAKELAND	2	0	0	0	0
624819D	HILLSBOROUGH	TAMPA	2	0	0	0	0
625112C	SUMTER	OXFORD	2	0	0	0	0
628168G	BROWARD	POMPANO BEACH	2	0	0	0	0
628282G	BROWARD	HOLLYWOOD	2	0	0	0	0
628320N	MIAMI-DADE	OPA LOCKA	2	0	0	0	0
643810T	OSCEOLA	KISSIMMEE	2	0	0	0	0
713528J	NASSAU	N/A	2	0	0	0	0
272132K	BREVARD	MELBOURNE	2	0	0	1	1
272297H	PALM BEACH	BELLE GLADE	2	0	0	1	1
272414B	PALM BEACH	WEST PALM BEACH	2	0	0	1	1
272512S	BROWARD	DEERFIELD BEACH	2	0	0	1	1
272577K	BROWARD	HOLLYWOOD	2	0	0	1	1
272584V	BROWARD	HOLLYWOOD	2	0	0	1	1
272610H	MIAMI-DADE	MIAMI-DADE	2	0	0	1	1
339691B	ESCAMBIA	CANTONMENT	2	0	0	1	1
622164J	ORANGE	WINTER PARK	2	0	0	1	1
622190Y	ORANGE	ORLANDO	2	0	0	1	1
622192M	ORANGE	ORLANDO	2	0	0	1	1
624350S	HILLSBOROUGH		2	0	0	1	1
624365G	HILLSBOROUGH		2	0	0	1	1
628186E	BROWARD	FORT LAUDERDALE	2	0	0	1	1
643866M	ORANGE	ORLANDO	2	0	0	1	1
663223W	ESCAMBIA	CANTONMENT	2	0	0	1	1
628187L	BROWARD	FORT LAUDERDALE	2	0	0	1	6
622901R	COLUMBIA	LAKE CITY	2	0	0	2	2
908575J	PASCO	DADE CITY	2	0	0	2	2
620741X	NASSAU	CALLAHAN	2	0	0	2	4
628146G	PALM BEACH	LAKE WORTH	2	0	0	2	24

Source: FRA Office of Safety Analysis, 2021

Similarly, **Table 7** lists the crossings in Florida with at least two fatal incidents between 2016 and 2020. These four crossings are the site of 11 incidents, 9 fatal incidents, 9 deaths, and 1 injury during the 5-year period. All four crossings are in Southeast Florida, are public crossings, and have gates[17] as warning devices.

Table 7: Crossings with Multiple Fatal Incidents in Florida, 2016-2020

Crossing ID	County	City	Total Incidents	Fatal Incidents	Total Deaths	Warning Device	Type of Crossing	Organization Code
628118D	PALM BEACH	WEST PALM BEACH	4	3	3	Gates	Public	SFRV
272518H	BROWARD	DEERFIELD BEACH	3	2	2	Gates	Public	BLF
272468G	PALM BEACH	LAKE WORTH	2	2	2	Gates	Public	FEC
628321V	MIAMI-DADE	MIAMI-DADE	2	2	2	Gates	Public	SFRV

Source: FRA Office of Safety Analysis, 2021

The three fatal incidents occurring at crossing 628118D each involved pedestrians being struck by a commuter train. Of the two fatal incidents at crossing 272518H, one highway user was an automobile, and one was labeled "other". In both cases, the highway user was struck by a passenger train. At crossing 272468G, one automobile and one "other" were stuck by freight trains. Crossing 628321V had two fatal incidents, both involving pedestrians getting struck by passenger trains.

These crossings represent the most consistently fatal highway-rail grade crossings in Florida between 2016 and 2020. However, for each of these incidents, there was one death per fatal incident. There are several crossings in Florida that had only one incident over the same period that resulted in multiple fatalities, shown in **Table 8**.

Table 8: Crossings with Single Fatal Incidents Resulting in Multiple Deaths in Florida, 2016-2020

Crossing ID	County	City	Total Incidents	Fatal Incidents	Total Deaths	Warning Device	Type of Crossing	Organization Code
628088N	PALM BEACH	INDIANTOWN	1	1	3	Stop Sign	Public	ATK
272357P	MARTIN	STUART	1	1	2	Gates	Public	FEC
627561Y	POLK	FROSTPROOF	1	1	2	Gates	Public	CSX

Crossing 628088N had the highest death toll for any one incident during the same period. A passenger train struck an "other motor vehicle" at a crossing with stop signs, killing three

[17] "Gates" indicates flashing lights & gates or cantilevered flashing lights & gates

people. Crossing 272357P had an incident where a freight train struck pick-up truck and killed two people. At crossing 627561Y, a van struck a freight train, killing two people.

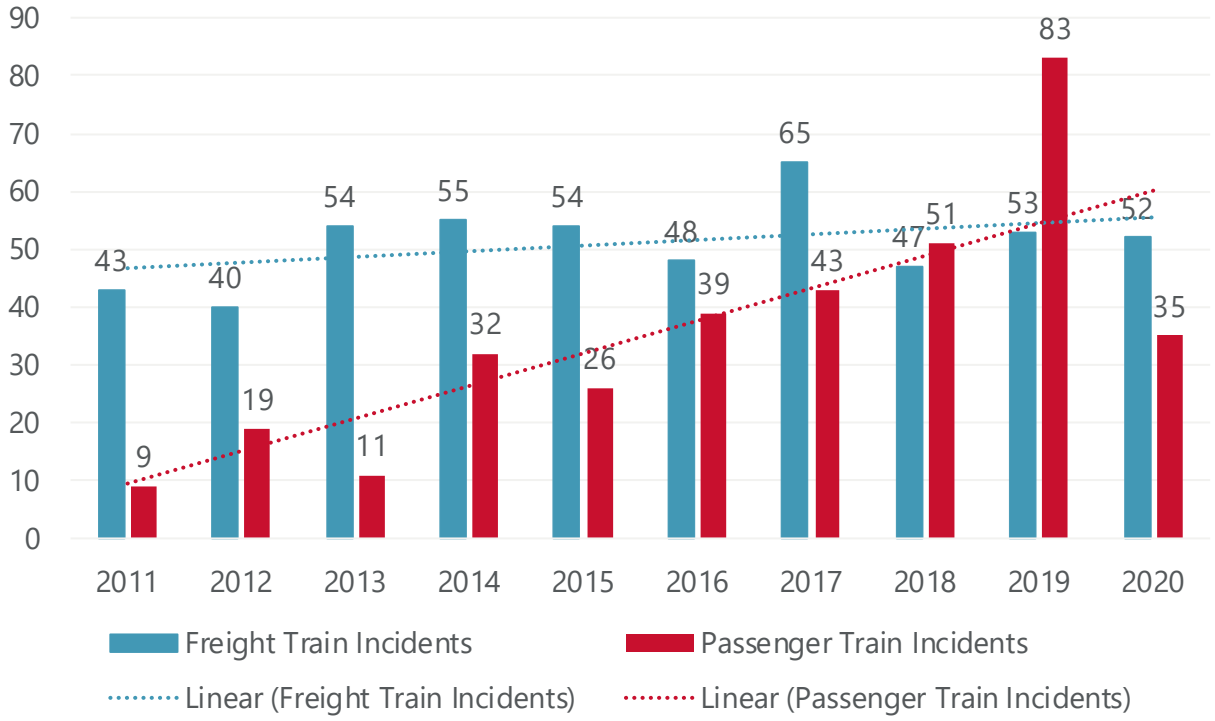
Additional Safety Considerations in Florida

New Transportation Concepts

As Florida grows, there is a greater demand for new transportation concepts in both freight and passenger rail services. These concepts bring greater challenges with increased train volumes and higher train speeds that could require adjustments in impacted communities.

Through the 10-year period observed, there has been a significant change in the percentage of freight train incidents compared to passenger train incidents, as shown in **Figure 22**. Passenger train incidents made up 17% of highway-railroad grade crossing incidents in 2011, but made up 61% of the incidents in 2019. The number of passenger train incidents increased yearly between 2015 and 2019, and passenger train incidents overtook freight train incidents in 2018. In 2020, there was a drastic drop in passenger train incidents compared to freight train incidents, attributable to the decrease in passenger train operations during the COVID-19 pandemic compared to freight train operations. In general, the trend lines show a growth in passenger rail interest and investment in Florida, and safety considerations will need to be closely evaluated.

Figure 22: Florida Highway-Railroad Incidents by Freight vs Passenger Trains, 2011-2020



Source: FRA Office of Safety Analysis, 2021

Hurricanes

Florida is a subtropical state with long coastlines on the Gulf of Mexico and the Atlantic, where hurricanes frequently occur. Therefore, advanced preparation and coordination between the railroads and FDOT is imperative. The Department and rail industry must continue to communicate closely regarding the coordination of responsibility. Close coordination during hurricane events is critical for a rapid recovery. Railroads should develop, document, and share disaster plans before an event. Ensuring an accurate federal crossing inventory is a shared responsibility that is vital to secure federal funding for railroad crossing safety projects.

Quiet Zones

As passenger and freight services in Florida grow, the train volume increases. In some locations, there is the potential of increasing train traffic by more than 30 trains per day. As a result, people living and working near the tracks are disturbed by the train horn and the local governments, working with FRA, are establishing quiet zones (in accordance with the Train Horn Rule 49 CFR Parts 222 and 229). In a Quiet Zone, the Train Engineer is prohibited from routinely blowing the horn at crossings but can blow the horn at his or

her discretion for emergencies. As of October 2021, there are 39 quiet zones in the State of Florida. FDOT does not initiate or approve Quiet Zones[18].

Challenges to Meeting Goals

The biggest issue contributing to incidents in the State of Florida is driver behavior. Florida is a rapidly growing state with a huge tourism industry. Drivers in Florida include a mix of retirees, tourists, commuters, and young drivers. It also has a mix of freight trains and passenger trains on the same tracks. This is a recipe for congestion in urban areas and frustrated drivers ignoring and driving around railroad warning devices. Trespassing around tracks is also an issue in Florida, and the warm year-round climate leads to large homeless populations and camps near railroad right of way. This contributes to pedestrians crossing in areas that are not designated crossings. As mentioned before, Florida has a number of roadways that parallel the railroad corridors. One issue identified with this is the potential for a driver to incorrectly turn onto the railroad track instead of the parallel roadway. This results in a vehicle being left unattended on the tracks while people call emergency responders.

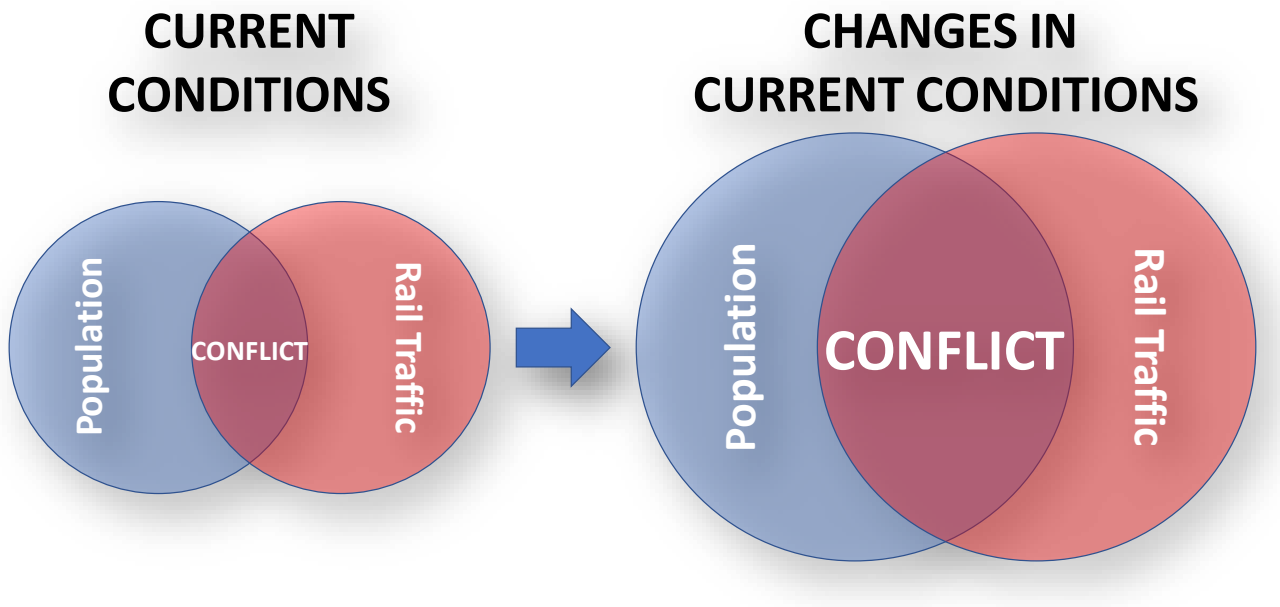
All roads owned by the FDOT are required to meet the Standard Plans for Road Construction Number 830-T01. This calls for the pavement surface to be flat for two feet past the edge of the rail and have a maximum change of elevation of three inches at thirty feet past the rail. FDOT roadways are resurfaced on a regular basis so if the railroad has raised the track, the roadway vertical profiles are raised to meet the standards. If there are conditions such as adjacent intersections or driveways, precluding the vertical profile to meet the FDOT Standard then a Design Variation is requested from the District Design Engineer.

The Design Variation must include a detailed safety report proving that the roadway is safe. Therefore, there should be no humped crossings on state owned or maintained roadways. Humped crossings are more likely found on local roadways. Crossing agreements normally require roadway jurisdictions to address transitions areas when the railroad does work, but many local governments fall out of compliance. Due to local funding, these roads may not be rehabilitated as often as state roads so the railroad may have raised the tracks several times prior to upgrading the roadway approaches and surface. This will compound the difference in elevation and possibly result in a humped condition. FDOT is working on identifying all humped crossings statewide; However, because most of the humped crossings are on local roads, funding the solutions may be problematic.

[18] Source: FRA - https://railroads.dot.gov/sites/fra.dot.gov/files/2021-10/FRAWebReport.pdf

Some of Florida's major highways run parallel to railroad tracks, including I-95, Dixie Highway (US 1) and US 301 in Central Florida and US 231 in the Panhandle. This creates many highway-rail crossings adjacent to signalized intersections. In high traffic areas, vehicles can back up beyond the tracks causing a vehicle to stop on the tracks. All signalized intersections within 200 feet of the tracks must have pre-emption to help clear the tracks. In Florida, most traffic signals are operated by local governments. FDOT can review the existing preemption but can only recommend changes to the signal timing to the authority with jurisdiction.

Blocked crossings are becoming more of an issue in Florida as freight traffic increases and trains become longer. A long train going into a yard can block several crossings for extended periods of time, making travel difficult for highway users and more importantly first responders. In Florida, this is compounded by the number of parallel corridors and the fact that many of the freight terminals are in the most heavily populated areas. The best solution to this problem is grade separation and closing adjacent crossings. The number of parallel roadways makes constructing grade separations more difficult as they need to be long enough to span the parallel road as well as provide access.



Changing Conditions and Impacts on Potential Conflicts

Overall, the current conditions reveal that there is a high-density population as well as an increase in demand for rail transportation services. As illustrated above, a growing high-density population mixed with increasing rail traffic will lead to an increase in human/rail traffic conflicts including behavior-caused incidents, humped crossing incidents, traffic queuing on tracks, and blocked crossings.

Local law enforcement agencies may routinely patrol areas in and around the tracks; however, given the amount of track in the jurisdictions, these agencies are generally constrained by lack of funding, access, and availability of resources. There is also a lack of accurate data when it comes to incidents, which brings another set of challenges when trying to solve these issues. Collecting data through various studies will be at the forefront of FDOT's efforts to address these safety challenges.

This section brings some insight to the confluence of factors that are affecting both the current and future environments of highway-railroad grade crossings in the state. The data presented illuminates necessary considerations. The next section takes these considerations and identifies the highest priority challenges that must be addressed.

Highest Priority Challenges

This section compiles Florida's existing conditions and the data discussed in the previous section into a focused set of challenges. These highest priority issue areas allow FDOT to develop a targeted action plan.

How the Challenges Were Determined

A combination of driver behavior and trespassing data points to human behavior being far and away the largest rail safety challenge. The data on driver behavior displays the variety of driver behaviors that lead to incidents, despite warning and protection devices at crossings. In addition, the safety index continues to bring many of the same crossings to the top of the rankings after improvements are made, due to the nature of certain high-risk corridors. Tangentially, trespasser deaths have increased in the past 10 years on railroad track not on crossings. While some trespassing behaviors can be mitigated through education, often-times trespassing is attributed to homelessness or mental illness, and other measures are needed. Addressing these challenges through education and enforcement is vital to rail safety in Florida.

According to incident reports, only 9 incidents occurred at the 43 known humped crossings (noted by the presence of "low-clearance" signage). It is impossible to determine whether these incidents occurred due to the humped crossing, because a vehicle can be stuck or stopped on the tracks for any number of reasons. In addition, near misses are rarely reported. Nonetheless, the impacts of humped crossings can be devastating. Due to continued track maintenance and lack of compliance on roadway transition areas, the issue could worsen.

Based on the driver position statistics in the past 5 years, at least 1% of incidents occurred because traffic caused a vehicle to stop on the tracks. Queuing traffic could have also contributed to any of the 38% of incidents where vehicles stopped on the tracks or were blocked by gates. Through observation, especially in the high-density corridors mentioned above, it has been seen that adjacent roadway intersection stops line up traffic along the roadway and through a crossing as congestion continues to grow on both sides of the crossing.

The FDOT Freight and Multimodal Operations Office often receives complaints from the public about blocked crossings. Beginning in 2019, the FRA launched a web portal for the public and law enforcement to report blocked crossings in an effort to mitigate the potential safety risks they cause. Switching movements or even normal train operations can cause delays and agitate roadway users. Blocked crossings create a potential hazard for road

users driving into the side of the train during nighttime or low-visibility conditions, and from agitated drivers turning around to find an alternative route. This challenge is heightened when the train is carrying hazardous materials, or an emergency vehicle is unable to use the quickest response route.

Results

The four highest priority safety considerations in the state are:

Driver Behavior at Crossings/Trespassing

Most train/vehicle incidents are directly attributed to driver behavior. Driver education concerning rail safety must be enhanced. Train safety awareness must be increased and individuals ignoring existing traffic laws must be prosecuted. In addition, education and enforcement should be used to mitigate trespassing. Too often individuals ignore the fact that it is illegal to enter onto railroad property. Measures that help with at-risk populations will be an important piece of this effort.

Humped Crossings

In Florida, as elsewhere, there are crossings that are "humped" or have high vertical profile crossings. Low clearance vehicles can get hung up and stuck on the tracks or drag across the crossing damaging its integrity. Measures to define, identify, and fix humped crossing must be created and implemented.

Traffic Queuing on Tracks

Common in dense urban areas, adjacent roadway intersections stop traffic along the roadway and through a crossing as congestion continues to grow on both sides of the crossing. The MUTCD requires adjacent signalized intersection within 200' to have traffic light preemption and those intersections between 200' and 500' have an engineering study to determine if preemption is necessary. However, such traffic queuing in urban areas can be much longer than 500', affecting a crossing farther away. Both education and engineering measures will be emphasized to address this challenge, through the implementation of dynamic envelopes and beyond.

Blocked Crossings

Understanding that this dilemma is going to occur, blocked crossings must be reported to the FRA and technical groups that could relay messages to traffic users so that they can plan other routes to avoid delays.

Action Plan

This section summarizes the "how" in addressing the highest priority safety challenges.

SAFETY CHALLENGES	GOALS	OBJECTIVES
Driver and pedestrian behavior	Reduce hazards based on driver/pedestrian behavior	1 Identify locations of highest trespassing incidents and develop recommendations to solve challenges
		2 Create the "Next Generation Project" to share the importance of rail safety and the significant impact freight and passenger rail service has on improved quality of life

Actions

- Implement the recommendations from the reducing railway trespassing pilot studies.
- Continue to identify trespass hotspots on additional corridors.

Meeting of the CFRC Rail Trespass Task Force

FDOT has a strategic partnership with Operation Lifesaver and will continue coordinating with the rail companies for safety blitzes, partnering with local and state agencies,

delivering safety messages at schools, and recruiting new operation lifesaver volunteers. Some current efforts include:

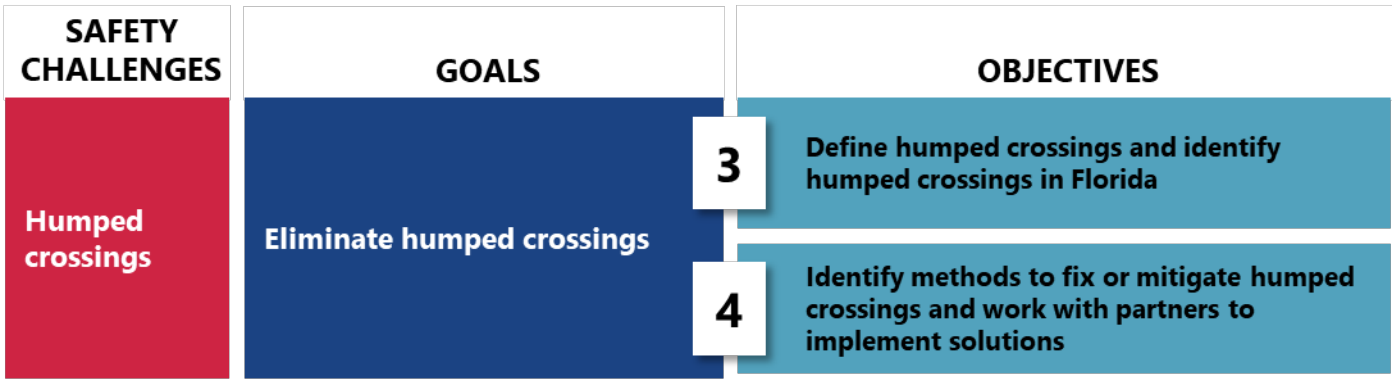
- Target younger volunteers for community involvement to assist with making the topics relevant to the target audience. Use highest levels of activity ranking.
- Utilize data to identify trespassing hotspots.
- Aim for crossings with heavy vehicular traffic.
- Change focus to pedestrian generators such as community centers, Boys & Girls Clubs, YMCAs, and schools.
- Continue partnering with rail companies for safety blitzes at station openings (Brightline, SunRail, Tri-Rail, and Amtrak).
- Lead safety presentations for Brightline employees in Miami-Dade (West Palm & Fort Lauderdale).
- Partner with law enforcement on safety blitzes in Seminole County and Miami Miami-Dade County with Amtrak.
- Partner with Broward County MPO to begin safety blitzes and presentations for employees at Brightline stations.
- Partner with Levy County school board for safety training for school bus drivers with OL sponsored videos and activities.

Schedule

Ongoing: Continue to conduct outreach, targeting community centers, Boys & Girls Clubs, YMCAs, and schools through Operation Lifesaver efforts

Years 1-2: Implement selected recommendations from the reducing railway trespassing pilot studies

Years 3-5: Use data captured from pilot projects and outreach efforts to track behavior changes



Actions

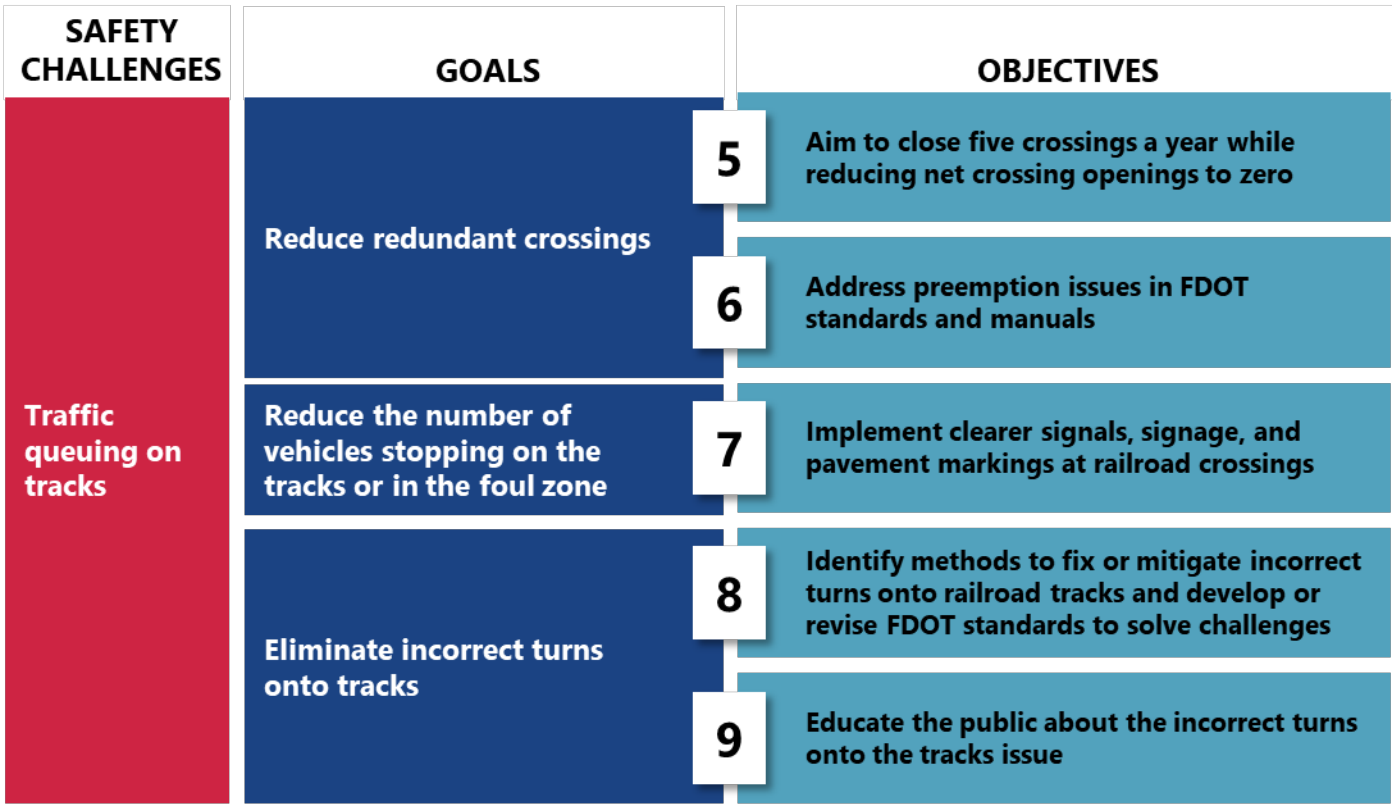
- Identify federal, state, or local definitions of a humped crossing, what design standards and laws govern vertical alignment safety, and the proper treatments for low vertical clearances.
- Use the Rail-Highway Crossing Inventory (RHCI) and other desktop visual tools to locate all crossings with information that identifies it as low clearance crossing (including signage) and export/compile data.
- Conduct desktop validation of signage information by using satellite or aerial photographs programs such as Google Earth.
- Work with the Florida Highway Patrol and local jurisdictions to obtain information about incidents where vehicles become stalled or stuck on tracks
    - Establish a process for local roadway jurisdictions to report incidents of vehicles stranding on crossings, noting the Department's commitment for diagnostic analysis and the potential for financial assistance.
- Create an evaluation tool and engage District Rail Coordinators to further validate information.
- Conduct field validation of information by driving by the crossing.
- Update RHCI with the validated information.
- Review final validated information and brainstorm mitigation and funding ideas.
- FDOT will work with the railroads, local entities, and private crossing owners to improve crossing profiles and/or improve signage.
    - Prioritize working with local jurisdictions to resolve high-profile crossing issues with a history of incidents.
- Work with railroad companies to coordinate track maintenance with impacted roadway jurisdictions.

Schedule

Year 1: Create humped crossing standards and inventory all humped crossings within the State

Years 2-3: Improve humped crossings found on State owned and maintained roadways, and identify resources to improve off-system and private crossings

Years 3-5: Improve humped off-system and private crossings



Actions

- Encourage consolidating redundant crossings using a corridor approach to Grade Crossing Safety Programs. This approach will examine individual crossings, crossings with low traffic volumes, crossing necessity, alternative routes, one-way pairs and encourage the closing of redundant crossings. This effort must factor in unintended consequences of closing crossings, such as the possibility of impacting emergency responders or increasing trespassing.

- Concentrate on crossing consolidation by closing at-grade crossings near grade separated crossings.
- Conduct traffic control studies to ensure existing preemption system timings are working properly. Make recommendations for improvements, if necessary.
- Revise FDOT manuals to include conducting traffic studies in urban areas at railroad crossings with active warning devices within 1,000 feet (2x MUTCD requirement) of signalized traffic intersections to determine if vehicles are queuing over the crossing.
- Based on study results, address queuing issues including traffic control preemption and queue cutter technologies.
- FDOT Freight and Multimodal Operations Office and the University of South Florida conducted research on low-cost counter measures such as pavement markings and median curbs, to reduce incorrect turns.
    - Implement pilot tests of safety strategies introduced by the research study, and determine which strategies are proven effective.
    - Create new FDOT standards or revise existing to institutionalize and standardize effective safety strategies statewide.
    - Include this messaging as part of ongoing Operation Lifesaver outreach.

Schedule

Ongoing: Closing crossings is an integral process of the annual Highway-Rail Grade Crossing Safety Improvement Program

Years 1-3: Revise FDOT design standards and manuals to better address preemption

Implement pilot cases of low-cost countermeasures from research study

Years 4-5: Implement new standards

SAFETY CHALLENGES	GOALS		OBJECTIVES
Blocked crossings	Reduce the number of blocked crossings due to railroad operations	10	Identify areas with blocked crossing issues and work with railroads to resolve
	Rapidly notify the public of blocked crossings and provide alternate route options	11	Identify opportunities to leverage emerging technology to avoid traffic congestion

Actions

- Concentrate on reducing number of redundant, blocked crossings in urban areas.
- Continue to promote the statewide standard for dynamic envelope pavement markings on at-grade crossings.
- Continue to monitor the before and after data of vehicles in Foul Zones.
- Review options to prohibit right-hand turns during stop conditions (red lights) at intersections that travel through grade crossings that are adjacent to parallel corridors. This should help limit the incentive for vehicles to enter the crossing/foul zone to turn.
- As a longer-term solution, review options to have traffic stop ahead of railroad tracks that are adjacent to parallel corridors. This option should help limit vehicles entering the crossing/foul zone at all until able to pass through it with a green light.
- Prioritize sign messaging and reducing signage clutter in urban areas.
- Ensure the preview of all railroad crossing warning devices is not blocked by other signage or other natural causes (trees/brush).
- Work with the FRA, railroads, and other partners to identify crossings that have been blocked on a recurring basis, and the likely cause(s) of the blockage such as switching movements, mechanical issues, or other.
- Identify where grade separations are most needed and practical and identify available funding resources.
- Use the Systematic Evaluation and Prioritization of Rail-Highway Grade Separation GIS Tool to determine where grade separations are needed based on a number of factors including blocked crossings, and rank crossing needs statewide.
- Use the Rail-Highway Grade Separation Benefit-Cost Analysis Tool to begin to determine feasibility of project. Work with the District Rail Coordinators to validate priorities, initial cost estimates, and appropriate timeline for implementation.

- Perform studies on the potential of new advance warning technology.
- A study will be performed using advance train detection and communication methods to give advanced warning of potential blocked crossings to first responders and possibly other roadway users.
- Incorporate new technology to address congestion at blocked railroad crossings.
- Implement new advanced warning technologies that provides motorist an opportunity to make rerouting decisions to avoid traffic congestion
- Identify areas that can use traffic signal preemption technology to notify motorist up stream to use alternate routes to avoid being delayed. Identify alternate routes and place detour signals and signage at appropriate locations.

Schedule

Year 1: Identify highest priority grade separation candidates using GIS tool
Determine the best location(s) for advance train detection pilot

Years 2-3: Revise FDOT design standards and manuals for signals, signage, and pavement markings
Identify funding resources and begin to implement preliminary phases of grade separations
Conduct pilot study to determine effectiveness of advance train detection

Years 4-5: Continue to implement grade separation priorities
If successful, expand advance train detection systems statewide

These SMART goals, objectives, and actions are meant to guide the actions of FDOT over the short-term regarding highway-rail grade crossing safety. They are outlined in a way that allows for measurable progress in accomplishing the plan's mission. **Figure 23: Responsibilities Matrix** provides a summary of the anticipated timelines for each objective, as well as defines the responsible party.

While responsibilities for the objectives will span the Department, the designated state official who will be responsible for managing the implementation of the SAP is Robert Stapleton, the Rail Operations Administrator at the Florida Department of Transportation.

Table 9: Rail Operations Administrator Contact

Name	Phone	Email	Address
Robert Stapleton	850-414-4553	Robert.Stapleton@dot.state.fl.us	605 Suwannee Street-MS 25, Tallahassee, Florida 32399

Figure 23: Responsibilities Matrix

SAFETY CHALLENGES	GOALS	OBJECTIVES	START[19]	END	RESPONSIBLE PARTY
Driver and Pedestrian Behavior	Reduce hazards based on driver/pedestrian behavior	Identify locations of highest trespassing incidents and develop recommendations to solve challenges	Jan 2018	Dec 2023	FMO Office, Safety Office, District Rail Coordinators, SunRail, Tri-Rail
		Create the "Next Generation Project" to share the importance of rail safety and the significant impact freight and passenger rail service has on improved quality of life	Jan 2019	Ongoing	FMO Office, Florida Operation Lifesaver
Humped Crossings	Eliminate humped crossings	Define humped crossings and identify humped crossings in Florida	Jan 2019	Dec 2023	FMO Office
		Identify methods to fix or mitigate humped crossings and work with partners to implement solutions	Jan 2020	Dec 2025	FMO Office
Traffic Queued on Tracks	Reduce redundant crossings	Aim to close five crossings a year while reducing net crossing openings to zero	Jan 2018	Ongoing	FMO Office
		Address preemption issues in FDOT standards and manuals	Jan 2019	Dec 2024	FMO Office, Traffic Engineering and Operations Office, Office of Design
	Reduce the number of vehicles stopping on the tracks or in the foul zone	Implement clearer signals, signage, and pavement markings at railroad crossings	Dec 2019	Dec 2025	FMO Office, Safety Office, Traffic Engineering and Operations Office, Office of Design, District Rail Coordinators, SunRail, Tri-Rail, RRs
	Eliminate incorrect turns onto tracks	Identify methods to fix or mitigate incorrect turns onto railroad tracks and develop or revise FDOT standards to solve challenges	Jan 2022	Dec 2024	FMO Office, Traffic Engineering and Operations Office, Office of Design
		Educate the public about the incorrect turns onto the tracks issue	May 2019	Ongoing	FMO Office, Safety Office
Blocked Crossings	Reduce the number of blocked crossings due to railroad operations	Identify areas with blocked crossing issues and work with railroads to resolve	Mar 2019	Jan 2023	FMO Office, FRA
	Rapidly notify the public of blocked crossings and provide alternate route options	Identify opportunities to leverage emerging technology to avoid traffic congestion	Jan 2019	Dec 2025	FMO Office, Traffic Engineering and Operations Office, Research Office

[19] Many of these efforts have been in progress for several years

Appendix A: Implementation Report

Pursuant to FRA's rule for updating the highway-rail grade crossing action plan, this report outlines (a) what Florida did to implement its previous highway-rail grade crossing action plan, and (b) what Florida will continue to do to reduce safety risks.

The final section of Florida's 2011 SAP discusses action plan strategies for eight areas:

- Grade crossing closures/consolidations.
- Signal safety program.
- Grade separations–new and reconstruction.
- Corridors.
- Pedestrian issues and American with Disabilities Act (ADA).
- Research and analysis through data improvements.
- Public education and awareness programs: Operation Lifesaver.
- Law enforcement.

How did Florida Implement the 2011 SAP?

Grade crossing closures/consolidations.

2011 Strategy: The risk of collisions is reduced by the elimination of redundant crossings; therefore, it is in the best interest of all parties involved to eliminate unnecessary crossings. Since 2002, the Department has fostered the closure of 85 public at-grade crossings and significantly decreased the percentage of remaining crossings that are equipped with passive warning devices. The Department is committed to continuing the crossing consolidation effort.

What Has Been Implemented?

Since 2011, the Department has continued operation of the Opening and Closure Program. With an emphasis on identifying and eliminating hazardous and redundant crossings, the Department manages the process in conjunction with railroad companies, local governments, and citizens. Over the 10-year period between 2011 and 2020, 328 public crossings in the state were closed.[20]

[20] Source: FRA Crossing Inventory Data – FL State Crossing Data, 2021. Not all crossing closures were facilitated by FDOT. Includes rail line abandonments.

Signal safety program.

2011 Strategy: In the continuing effort to improve warning devices at public highway-rail grade crossings, the Department works to identify crossings where certain improvements could potentially increase safety, with the goal of reducing fatalities and injuries….The identified improvements….include: improved active warning devices, signalization improvements, intersection improvements, signage and pavement marking improvements, education, and enforcement. In all cases, the Department will need to weigh the cost of the improvements along with the effectiveness of the potential improvement project.

What Has Been Implemented?

Since the 2011 Plan, the Department has continued to use the Signal Safety Program to rank hazardous crossings for improvement with warning devices. Most of the improvements that have been made to Florida railroad-highway at-grade crossings through the program would not have been possible without Section 130 funding and the contribution of FDOT man hours and expertise. Between 2011 and 2019, 842 projects for rail safety were conducted at crossings around the state, and over $88.6M of federal funding was committed through the Section 130 (or Signal Safety) program through a combination of Rail/Highway Protection (RHP), Rail/Highway Hazard Elimination (RHH) and HSP (Highway Safety Program) funds.

Preemption

Since 2011, there has been a large focus on preemption as a way to keep railroad tracks clear at signalized intersections, and a portion of the Section 130 funds have been focused on preemption needs. In 2014, FDOT did a preemption study with the University of South Florida. USF researchers investigated using advanced features of a widely used traffic signal system management software, ATMS.now (Trafficware, Sugar Land, TX), to resolve safety and mobility problems at highway-railroad crossings and adjacent roadways. Just as preemption precedes an anticipated traffic event (in this case, closing a railroad crossing), the researchers investigated coordinated plans preceding the preemptive phase, a period they termed pre-preemption (PPE), and created a new tool to assist traffic managers in maintaining the efficiency and safety of roadways adjacent to railroad crossings by decreasing congestion and collisions. More recently as a separate effort, FDOT has been continuing to look at PPE and how to use more modern conduits, like fiber optics, to send signals to traffic control earlier.

Making Funding Count

FDOT has been very aggressive about asking for more federal safety dollars every year, and the Section 130 funds have seen an increase over time. The FMO team has also made a concerted effort to stretch the existing federal dollars to address as many

crossings as possible by trying to initiate low-cost programs and by working with the railroad companies to have them help pay for the equipment or provide in-kind services. In some cases, diagnostics found that cantilevers at a crossing were in good condition, but the gate arms and mechanisms were old. In other cases, the roadway equipment was in good condition, but the house needed replacement. Coordinating with the railroad company during diagnostics helped estimate upgrade costs that took into account the parts still in good condition and used Section 130 funds to only replace the older components. This approach allows FDOT to schedule additional signal safety projects annually even though funding remains the same.

By coordinating with the railroads to provide labor and engineering and using Section 130 program funding of materials, the team has also increased LED replacements across the state. In 2019, there were 35 funded LED replacements on CSX crossings in D5. FDOT was responsible for about $3,500 of the approximately $35,000 per crossing, with railroads providing the remaining funding.

Algorithm Updates

In addition to stretching federal funding for upgrades, FDOT has worked on upgrading the safety index tool. Once every three years, researchers/statistical experts review the algorithm and make adjustments to improve it.

In 2018, FDOT commissioned a study with Florida State University to produce a new optimization model for improving safety at rail crossings. The FSU researchers created a new standalone application to help FDOT personnel estimate the potential hazard values of highway-rail grade crossings, prioritize a crossing for upgrade, and choose an appropriate upgrade type. The researchers reviewed existing methods for the tasks they expected the application to assist hazard estimation, prioritization, and upgrade selection. They found six methods for collision prediction and 15 for hazard prediction in the literature, based on from three to twelve predictors. After data-gathering and developing two algorithms - one that minimizes the overall hazard at crossings and one that minimizes overall hazard severity - the researchers turned to programming the application, named “HRX Safety Improvement”. Once fully integrated into the FMO process, the application will direct maintenance services to the crossings most in need of updating, which is likely to have a direct impact on driver and train safety.

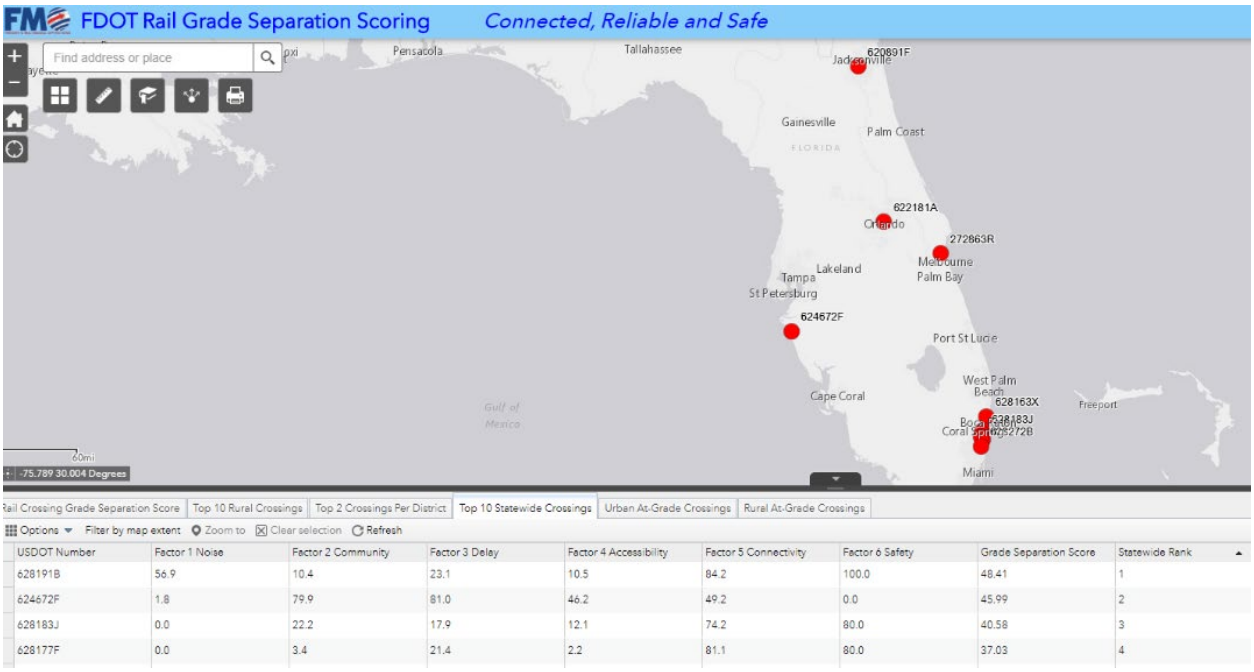
Decentralization

In 2020, the signal safety program was fully decentralized from FDOT’s Central Office to the Districts. The FDOT is a decentralized department and at the local level, the Districts have a better knowledge of their crossings and traffic patterns than Central Office does. Important factors like near misses or proximity to schools aren’t put into the algorithm now but will be taken into consideration by the Districts.

The FDOT Central Office still allocates funds after assessing priorities. The annual allotment of federal funding is divided among the Districts and each District will be responsible for identifying crossings for diagnostics, coordinating the diagnostic review team and schedule, leading the diagnostic, securing estimates from the railroad, selecting projects, and providing that information to Work Program for inclusion in each year's Schedule B. The division of funding will be based on a formula of rail miles and number of crossings to determine the amount each District will receive.

Grade separations–new and reconstruction.

2011 Strategy: The Department actively pursues the construction, reconstruction, and repair of bridges carrying roadways over railroad tracks.



USDOT Number	Factor 1 Noise	Factor 2 Community	Factor 3 Delay	Factor 4 Accessibility	Factor 5 Connectivity	Factor 6 Safety	Grade Separation Score	Statewide Rank
628191B	56.9	10.4	23.1	10.5	84.2	100.0	48.41	1
624672F	1.8	79.9	81.0	46.2	49.2	0.0	45.99	2
628183J	0.0	22.2	17.9	12.1	74.2	80.0	40.58	3
628177F	0.0	3.4	21.4	2.2	81.1	80.0	37.03	4

A Screenshot of the GIS Grade-Separation Scoring Tool

What Has Been Implemented?

FDOT has completed multiple grade separation projects since 2011, including the FEC Pineda Causeway Grade Separation project in Brevard County (totaling $26,160,000) and the SR 60 Grade Separation Over CSX Railroad (totaling $9,128,932). The biggest barrier to creating more grade-separated crossings remains cost. Hundreds more projects during this timeframe have involved bridge repair, reconstruction, and track upgrades.

In addition to physical improvement projects, a GIS tool was created in 2018 for scoring the grade separation potential of all Florida at-grade crossings. This was an effort done

to prioritize grade separation projects from a statewide perspective, as each District provides its own list of high-priority projects. The application can be found online here.

In addition to the GIS tool, a cost-benefit analysis tool was created at the same time to determine which project benefits are expected to exceed total investment costs.

The update of the Freight Mobility and Trade Plan (FMTP), published in 2020, included a revised prioritization methodology for the submittal of freight projects for National Highway Freight Program funding. Any grade separation project submitted is run through the GIS tool for ranking and is weighed on the qualitative side of the prioritization matrix.

Corridors.

2011 Strategy: The Department will work with Florida's railroads to identify corridors where train volumes have increased, train speeds have increased, low-cost improvements can be implemented, and/or crossing consolidations are possible.

What Has Been Implemented?

Since the last SAP was published in 2011, the FMO Office has continued to monitor corridors with recurring incidents. Risk analysis assessments, such as the one seen in Figure 19, identify which corridors have the highest incident densities, and which specific crossings have the highest numbers of incidents and fatalities. This analysis is used for low-cost improvements, crossing consolidations, and general rail safety planning. Corridor analysis will become even more critical as rail services and population continue to grow.

Pedestrian issues and American with Disabilities Act (ADA).

2011 Strategy: During Diagnostic Field Reviews in 2009, the Department surveyed 30 crossings for ADA accessibility issues along with the standard highway-rail review items. Five areas of improvement were identified and reviewed with the Federal Highway Administration – Florida Division:

1. *Sidewalk ends near the crossing with sidewalk connecting to the roadway*
2. *Sidewalk passes through the crossing but connection outside the railroad right-of-way is incomplete/impassible*
3. *Sidewalk ends abruptly short of the crossing often at the railroad right-of-way*
4. *Large gap greater than 3" ADA standard for freight rail within the crossing surface*
5. *Confusing pedestrian crossings occurring with multiple crossings in close proximity at different angles can also include substantial grade changes*

The Department continues to include ADA accessibility reviews as part of diagnostic field reviews. In addition, the Department is considering identifying a section of rail and

performing a comprehensive review of all crossings within a jurisdiction for ADA issues. This way, the Department could ensure that all issues in an area are identified and then issues can be ranked in order of importance (pedestrian traffic, area characteristics, travel pattern). This process will allow local funding to be efficiently spent on the most important issues first.

What Has Been Implemented?

The Department continues to include ADA accessibility reviews as part of diagnostic field reviews. FDOT cannot ask the local government to add a sidewalk for ADA compatibility, though if a sidewalk is present, the condition of the sidewalk can be addressed. The same is true for the inclusion of ADA mats with truncated domes (or lack of) as well as the condition of the mats, and the presence of electronic bells. The diagnostic team discusses changes needed and sends them to the District Rail Coordinator to follow up with the local government.

ADA language still allows for pedestrians to use the roadway at crossings, but for new corridors, the standard is evolving for sidewalks and warning devices to be included at crossings. There is still opposition from railroads, who do not want to expand the width of the crossing and maintain more equipment.

Research and analysis through data improvements.

2011 Strategy: The Department works on a continuous basis to improve the state's highway-rail crossing inventory. Starting in August 2010, the Department initiated a new consultant contract to assist collecting new data related to the state's rail crossings. The initial effort focused on the use of Geographic Information Systems (GIS) to verify and correct the rail line network data. Next highway-rail grade crossing locations were mapped and verified using information from aerial photography, Departmental data, railroad partner data, and the FRA. In addition, efforts will be made to reconcile any differences in the grade crossing inventory databases of the FRA, the Department and the railroads.

What Has Been Implemented?

Around 2009, the Highway-Rail Crossing Inventory (RHCI) evolved into the latest version of several desktop iterations for the federal inventory requirement. While there were some discrepancies between the federal inventory program and RHCI, it was a modern program that provided reporting information and housed the algorithm to run the Signal Safety Index. Since that time, RHCI has evolved; FDOT's Central Office has gone from running reports and sending them out to Districts for the rankings, to having the Districts look up the rankings themselves. The database now includes images of the crossings, and the

ability to obtain information via query. Even so, and with multiple consultant contracts to improve it, many of the same standardization challenges of the RHCI inventory remain.

The FMO office is devising a plan to create a new rail tool. The new tool would be modeled after the aviation program tool and seaport program tool – JACIP and SeaCIP respectively —and would be an application for the development of railroad agreements. The tool would house all existing rail agreements and build new agreements for the Districts.

Public education and awareness programs: Operation Lifesaver.

2011 Strategy: The Department will continue to focus on public education through the Operation Lifesaver program. Florida Operation Lifesaver seeks to continue and expand its public education efforts through the following:

- *Developing and airing public service announcements, directed toward target audiences;*
- *Continuing to educate and expand volunteer recruitment through the Florida Operation Lifesaver website and social networking tools such as Facebook and Twitter;*
- *Expanding educational events during Train Safety Awareness Week (TSAW) and International Level Crossing Awareness Day;*
- *Promoting active enforcement of traffic laws related to highway-rail grade crossings and on railroad right of way; and*
- *Improving driver and pedestrian behavior at railroad crossings by encouraging compliance with traffic laws relating to crossing signs and signals.*

Florida Operation Lifesaver outreach events

What Has Been Implemented?

Since 2011, Florida Operation Lifesaver (OL) has continued to extend its educational reach. Even while operating on an increasingly lean budget and relying more heavily on a social media presence, OL has grown stronger concerning safety message protocol, volunteer etiquette and materials approval. Florida OL gave more than 3,700 presentations to nearly 253,000 participants between 2014 and 2019[21].

Florida has continued to participate in Rail Safety Week each year. The goal is to raise awareness of the need for rail safety education and empower the public to keep themselves safe near highway-rail grade crossings and railroad rights-of-way.

In 2018, Florida OL participated in a mobile barbershop experience called "Buzz Boxx" alongside several organizations and law enforcement throughout the Tri-County area. The idea was to promote rail safety and mental health awareness for underserved youth and the homeless population by providing a free haircut while engaging in meaningful conversation. In 2021, Brightline was awarded a $20,000 grant by Operation Lifesaver to continue the Buzz Boxx campaign.

A highway DMS display in Florida during Rail Safety Week 2020

[21] OL began recording data for presentations in 2014

Florida OL used a "Selfie Booth" in 2019, encouraging the use of a hashtag on Instagram to spread the message. In 2020, with fewer options for in-person engagement, Florida OL was able to get train safety messages on highway dynamic messaging systems. Engagement summaries will continue to be collected as OL works to increase its reach and capture outreach data.

Overall, Florida OL has maintained its commitment to expand its public education and awareness efforts. The goals of the program have evolved over time into four categories, shown in **Table 10**.

Table 10: Florida Operation Lifesaver Goals

Activity	Goal
General Outreach	Coordinate with local communities, public and private railroad companies, and volunteers to conduct at least two (2) events per county within 90 days of the implementation date. The first safety blitz was held in partnership with Brightline. The second safety blitz was held in partnership with Tri-Rail in February 2020. Event times and locations will be published to our partners upon coordination of each event.
Education	Provide documentation on train processes and procedures to be included as part of the materials presented to federal, state, and local officials and community leaders.
Presentations	Conduct a least one statewide outreach engagements (physical and/or virtual) a month.
Community Events	Conduct community events in partnership with local law enforcement agencies, railroad companies, and volunteers to optimize outreach efforts.

Law enforcement.

2011 Strategy: The Department will continue to support Florida's law enforcement agencies as they enforce laws related to highway-rail grade crossings and railroad right of way.

What Has Been Implemented?

FDOT has continued to support Florida's law enforcement agencies. One area of focus has been teaming up with law enforcement to reduce trespassing.

In addition to teaming up for routine safety blitzes, there has been a combined effort of FDOT and law enforcement in Broward County to deploy officers who are specially

trained to deal with potential trespassers including the homeless, those with mental illness, and those intending to commit suicide. Instead of punishing these trespassers for being on the tracks, they are provided information on nearby mental health facilities and homeless shelters.

In 2019, FDOT was awarded a CRISI grant for reducing railway trespassing. The project's goal is to aid and leverage local law enforcement in a partnership to combat trespassing on Florida's railroads. It involves deploying drone technology, closed-circuit television (CCTV) with remote monitoring, Geographic Information System (GIS) spatial analysis to identify critical locations along the Central Florida Rail Corridor that have a high frequency of trespassing, and using data to help determine trespassing contributing factors.

This project aimed to develop a program to train local law-enforcement and local governments on implementing a response strategy using drone and CCTV monitoring as well as trespassing countermeasures, develop a model for building effective problem-solving partnerships with local law-enforcement, community stakeholders and local governments, and to identify funding opportunities for local law-enforcement and community stakeholders to respond to trespassing issues with the use of drone and CCTV technology.

In 2019, FDOT added Chief Dixon of the Florida Highway Patrol to the Operation Lifesaver Board. It was a goal for many years to get a member of law enforcement on the Board and Chief Dixon's statewide reach is critical.

How will Florida Continue to Reduce Crossing Safety Risks?

Florida continues to build upon the strategies laid out in the 2011 plan, and the updated SAP provides a path for implementation of future safety efforts. The SAP uses a combination of analysis and stakeholder input to identify which risks are the highest and where those risks are. The plan outlines goals and objectives based on engineering, education, enforcement, and emergency response specifically designed to help eliminate those risks. The elimination of rail safety hazards starts with SMART goals, objectives; and actions as summarized in **Figure 23: Responsibilities Matrix**.

In addition, FDOT is utilizing innovative emerging technology to bolster their safety efforts. **Table 11** showcases some strategies that are in the works.

Table 11: Strategies for Moving Forward

Focus Area	Strategy	Resolution
Planning	Engineering & Education	State Action Plan mandated by FRA; the plan provides strategies to resolve safety hazards through engineering practices and partnerships to include grade separation, humped crossings, and others.
Planning	Engineering & Education	OL Florida Strategic Safety Outreach 2020 Plan; the plan provides strategies to resolve safety hazards through education, partnership, and awareness.
Planning	Engineering	FRE HSR Safety Integration Pilot Program; HRGCS adopted safety standards that cover operations between 0-79 mph and 111+ mph; however, additional considerations are needed for safety standards to cover operations between 80-110 mph (Higher Speed Rail (HSR)). As a strategy to improve safety for rail operations between 80-110 mph, application of the Florida Rail Enterprise (FRE) program will be updated. The objective of the FRE program update is to integrate HSR projects into the existing FRE Project Prioritization and Section process and improve physical and operational safety. Given FRE's limited resources, and statutory and contractual obligations, a pilot will be conducted to test impact and feasibility of HSR integration prior to full adoption. Integrated HSR projects selections will be determined by the following criteria from three tiers; top ranking project(s) will be candidate(s) for pilot implementation.
Outreach, Education, Awareness	Education	FDOT leads the Florida Operation Lifesaver to provide increased public awareness and education on train safety. OL facilitates public safety awareness training sessions in K-12 classrooms, driver's education courses, and companies employing CDL drivers. Partners include the Florida Highway Patrol, local police departments, and railroad companies including CSX and FEC.
Outreach, Education, Awareness	Education	Media blitz; use existing videos from OL, SunRail, and Tri-Rail for social media and radio ads.
Outreach, Education, Awareness	Education	Work with the Department of Children and Families (DCF) to better serve suicide prevention on tracks.

Focus Area	Strategy	Resolution
Inspections	Engineering	FDOT Rail Inspectors partner with FRA to enforce Federal railroad safety laws and regulations; Florida has 6 state inspectors dedicated to applying federal regulations compliance.
General	Engineering	FDOT applies the following federal and state standards for project development, improvements, maintenance, plans review and agreement development: Manual of Uniform Traffic Devices (MUTCD), American Railway Engineering and Maintenance of Way (AREMA) FDOT Standards (CO, and Districts)
Grade Crossing	Engineering	Highway-Rail Grade Crossing Safety (HRGCS) Improvement Program is a statewide program for rail grade crossing hazard elimination Emerging Tech Signal preemption: traffic signal preemption near railroad grade crossings is to increase safety at these intersections by clearing vehicles from the path of trains. The sequence of events that occur during preemption can be compared to a choreographed dance in which each step is dependent upon the previous in order to make the dance complete. Blocked crossing solutions: use of cellular modem for wireless communications, and event-based historical information about traffic delays on roadways with rail crossings and surrounding network using business intelligence tools; then uses dynamic message boards to divert traffic before getting the block crossings. Active warning signs: primarily used for pedestrian warning located in front of the traditional signals and warning lights; reminder to look both ways prior to crossing; seamless integration with existing ITS safety or railroad crossing signs.
Grade Crossing	Engineering	Dynamic Envelope (systemic implementation): Total $65,736,000
Grade Crossing	Engineering	Sealed corridors along FEC Corridor: quad-gates where non-existing, 100' raised medians, and delineators for double tracks.

Focus Area	Strategy	Resolution
Grade Crossing	Engineering	Optimization Model for Improving Safety at Rail Crossings that will provide the best countermeasure improvement to reduce the most hazards. Emerging Tech Data Analysis Tool
Grade Crossing	Engineering	Crossing Consolidation (crossing closures): FDOT has a methodology for grade crossing closures set by Rule 14-57.012, F.A.C.
Grade Crossing	Engineering	Systematic Evaluation and Prioritization of Rail-Highway Grade Separation tool that will identify and prioritize top grade separation candidates to reduce the most hazards. Emerging Tech Online GIS Spatial Analysis Scoring Tool
Trespassing	Engineering, Education & Enforcement	Strategies for Reducing Railway Trespassing (SRRT) using Geographic Information Systems (GIS), drones, and motion-sensing technologies to target trespassing hot-spots; then partnering with local officials and law enforcement to augment technology with education and enforcement. Emerging Tech Geographic Information Systems (GIS), drones, and motion-sensing Active warning signs: primarily used for pedestrian warning located in front of the traditional signals and warning lights; reminder to look both ways prior to crossing; seamless integration with existing ITS safety or railroad crossing signs.

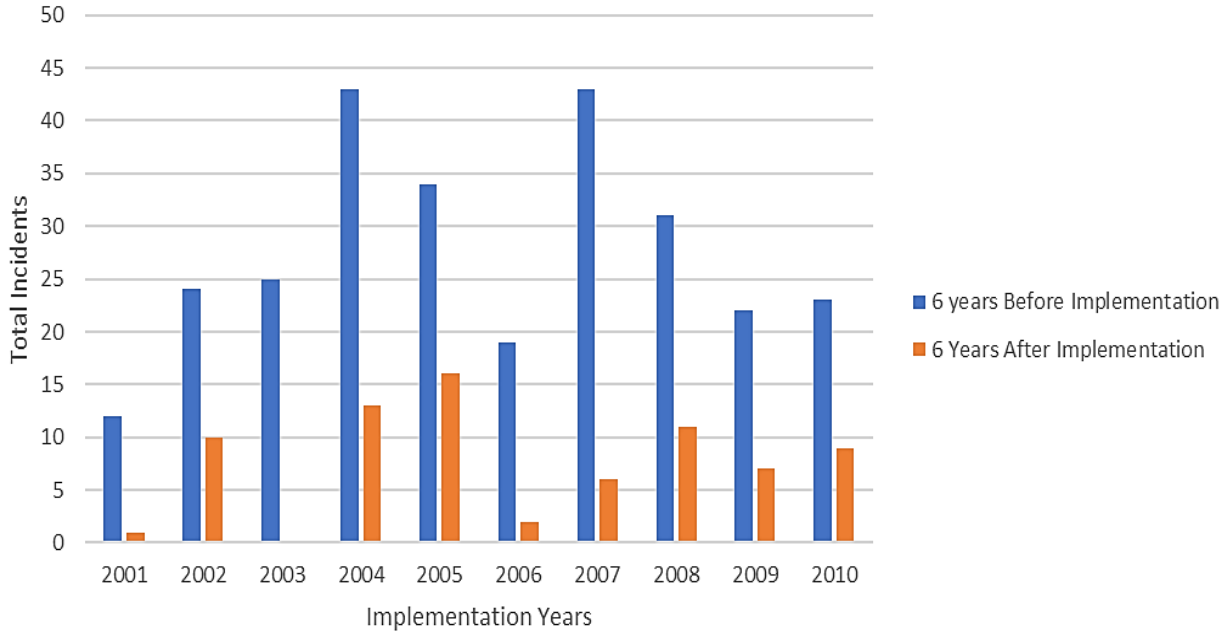
Appendix B: Sample Before and After Report

As an example, the content below is typically included in the annual evaluation of the Highway-Railroad Grade Crossing Safety Improvement Program.

This evaluation compared the 6-year period prior to and after the 2010 installation dates. Evaluation factors included the number of projects, improvement type and costs, impacts to train/vehicular incidents, and considered the variation of average annual daily count of vehicular traffic. Total project costs were $10,500,385 constructing 65 safety improvement projects averaging $161,544 per crossing throughout the State of Florida.

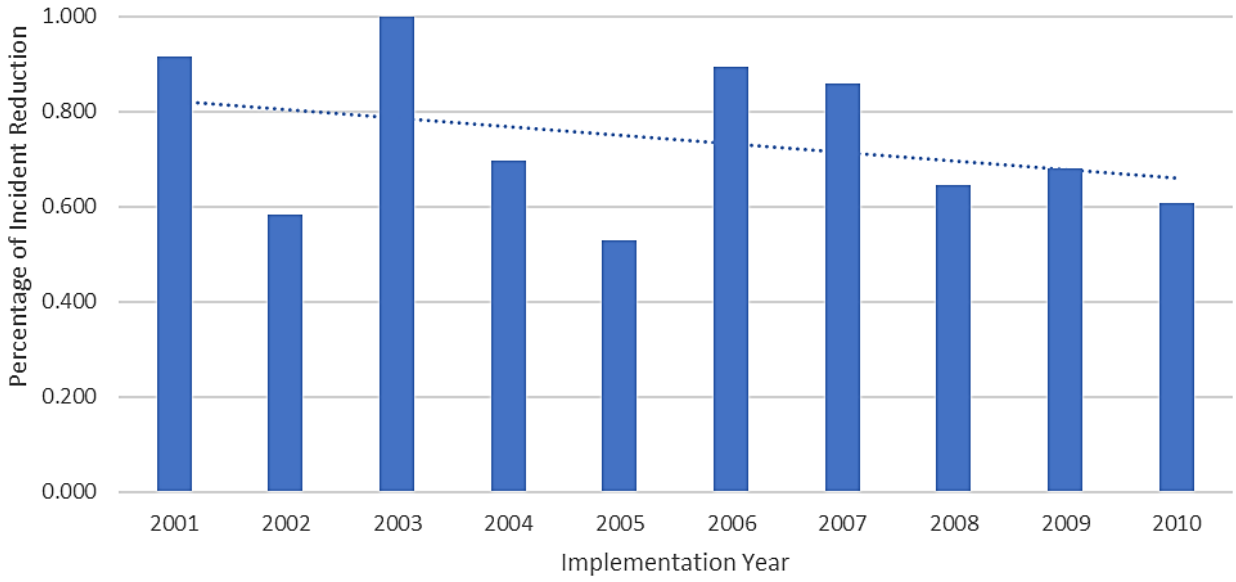
Figure 24 and **Figure 25** show the total number of incidents decreased by 61%, from 23 prior to 9 after the installation of safety projects. Of those incidents, fatalities were reduced by 100%, from 2 to 0. Incidents with serious injuries also decreased by 100% from 8 to 0. Property damage only incidents decreased by 44%, from 13 to 9. Of the post 9 property damage only crashes, 5 crashed into a train because they did not stop and 4 stopped on the tracks prior to being hit by a train.

Figure 24: Incident Total 6 Years Before & After Project Implementation



Source: FDOT Freight and Multimodal Operations Office, 2021

Figure 25: Percentage of Incidents Reduced in 6 Years After Project Implementation



Source: FDOT Freight and Multimodal Operations Office, 2021

Appendix C: FAST Act Checklist

Table 8: FAST Act Requirements

Requirements	Location in Plan
An implementation report	Appendix A; Pg. 61
Crossings with multiple accident/incidents (more than one accident/incident within the previous 5 years)	Table 6; Pg. 43
Specific strategies for improving safety at the identified highway-rail and pathway grade crossings (including grade crossing closures or grade separation projects) – for a period of at least 4 years. States may discuss the types of grade crossing improvement projects they intend to use to improve highway-rail and pathway grade crossing safety -- as opposed to identifying specific projects.	Action Plan; Pg. 53
An implementation timeline for the specific strategies that will be used to improve safety at the identified highway-rail and pathway grade crossings	Figure 23; Pg. 60
Contact information for a designated State official who will be responsible for managing implementation of the SAP	Table 9; Pg. 59

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