



MISSOURI HIGHWAY-RAIL GRADE CROSSING STATE ACTION PLAN

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Acronyms

AASHTO	American Association of State Highway and Transportation Officials
AREMA	American Railway Engineering and Maintenance-of-Way Association
AM	Arkansas and Missouri Railroad
AADT	Average annual daily traffic
BNSF	BNSF Railway Company
CP	Canadian Pacific
CRISI	Consolidated Rail Infrastructure and Safety Improvements
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FAST	Fixing America’s Surface Transportation
GCSA	Grade Crossing Safety Account
KCS	Kansas City Southern Railway
KCT	Kansas City Terminal Railway
KAW	Kaw River Railroad
MUTCD	Manual on Uniform Traffic Control Devices
MPO	Metropolitan Planning Organization
MARC	Mid-America Regional Council
MNA	Missouri and Northern Arkansas Railroad
MoDOT	Missouri Department of Transportation
MHTC	Missouri Highways and Transportation Commission
MO OL	Missouri Operation Lifesaver
NTAD	National Transportation Atlas Database
NS	Norfolk Southern Corporation
NEMO RPC	Northeast Missouri Regional Planning Commission
OLI	Operation Lifesaver, Inc.
PDO	Property damage only
PSA	Public Service Announcement
SLOI	St. Louis Iron, Mountain, and Southern
SAP	State Action Plan
STIP	Statewide Transportation Improvement Program
TRRA	Terminal Railroad Association of St. Louis
UP	Union Pacific Railroad
U.S. DOT	United States Department of Transportation

EXECUTIVE SUMMARY

Section 11401 of the Fixing America's Surface Transportation (FAST) Act mandates all states to develop and implement a State Action Plan (SAP). The SAP must identify highway-rail and pathway-rail grade crossings that have experienced recent incidents and identify specific strategies for improving safety at grade crossings. Missouri's SAP was based around MoDOT's vision to provide a world-class transportation system that is safe, innovative, reliable and dedicated to a prosperous Missouri, along with MoDOT's core values of Safety, Service and Stability.

The Missouri State Rail Plan (anticipated 2022) reports a total of 5,392 miles of operating freight railroad lines. Six Class I freight railroads and several Class III shortline, switching and terminal and tourist railroads operate in Missouri. Amtrak operates on four passenger rail routes in Missouri: Missouri River Runner, Southwest Chief, Texas Eagle and Lincoln Service. There are 6,564 highway-rail grade crossings in Missouri, according to the U.S. DOT Crossing Inventory. Of these, 4,381 crossings are public and 2,183 crossings are private.

The MoDOT Multimodal Division receives approximately \$7.5M in dedicated federal and state funding to support annual investments in highway-rail grade crossing safety improvements. From 2017 to 2021, MoDOT has completed around 20 highway-rail grade crossing projects each year. The projects range from active warning device installations and upgrades to statewide programs for crossbuck assembly upgrades to meet Manual on Uniform Traffic Control Devices (MUTCD) standards. Historically, the average project costs around \$400,000.

The Missouri SAP identifies highway-rail and pathway-rail grade crossings that have experienced one or more incidents within the previous 5 years. Over the last five years (2016-2020), highway-rail grade crossings in Missouri experienced 211 incidents. Of these, 63 incidents resulted in one or more injuries and 33 incidents resulted in one or more fatalities. There were 37 incidents on passenger rail corridors. Incidents occurred at 190 crossings, with 20 crossings experiencing two or more incidents. Multiple incident locations generally indicated similar patterns (e.g., railroad, cause, vehicle type) as all incident locations within Missouri between 2016-2020.

Several key findings were identified for Missouri incidents and are listed below.

- 53% of incidents occurred at passive crossings
- 47% of incidents occurred at active crossings.
- 49% of incidents occurred due to a vehicle failing to stop.
- 42% of incidents occurred during dark or limited light levels.
- 44% of incidents occurred between an automobile and train.
- 72% of incidents occurred at crossings where the roadway has 500 or fewer vehicles per day.

The Missouri SAP strategies align with the core values and each action is categorized by the four E's of safety that align with the Missouri Strategic Highway Safety Plan. The Federal Highway Administration sees the four E's of safety as the focus areas with the greatest potential to reduce fatalities and serious injury. The four E's of safety are: education, enforcement, engineering and emergency response. The FRA directs that the SAP strategies target safety enhancements over a period of at least four years. The following are strategies to enhance safety within Missouri at highway-rail and pathway-rail grade crossings.

Comprehensive Strategies

SAFETY, SERVICE & STABILITY	Strategy: Enhance safety of at-grade crossings by implementing grade crossing improvements.	
SAFETY, SERVICE & STABILITY	Strategy: Seek additional funding for highway-rail crossing improvements.	
SAFETY, SERVICE & STABILITY	Strategy: Revise State Legislation to allow more flexible use of state funding.	

Education - Education strategies and actions help to inform drivers and pedestrians on ways to modify behavior to avoid unsafe outcomes.

SAFETY	Strategy: Strengthen education efforts focused on target populations.	
SAFETY	Strategy: Strengthen outreach efforts focused on target populations.	
SERVICE	Strategy: Promote safety messaging to all Missouri highway users.	

Enforcement - Enforcement strategies and actions can improve compliance and broaden awareness of rules at highway-rail grade crossings.

SAFETY	Strategy: Engage with partner agencies to enhance highway-rail grade crossing safety.	
STABILITY	Strategy: Work with stakeholders to improve incident reporting.	

Engineering - Engineering strategies and actions address the physical components at highway-rail grade crossings.

SAFETY	Strategy: Enhance safety at existing highway-rail at-grade crossings.	
SERVICE	Strategy: Enhance safety at existing highway-rail at-grade crossings along passenger rail corridors.	
SAFETY	Strategy: Promote review of multimodal solutions as part of project improvements.	
SERVICE	Strategy: Improve coordination with stakeholders to expedite project implementation.	
STABILITY	Strategy: Coordinate internally at MoDOT and with local jurisdictions to update crossing inventory data.	
STABILITY	Strategy: Investigate new technologies to provide messaging to roadway users.	

Emergency Response - Delay to emergency medical services can impact health outcomes for communities.

SAFETY	Strategy: Identify solutions to reduce delay at crossings.	
SERVICE	Strategy: Educate local and regional agencies on importance of emergency response plans that include railroad safety.	

On-Going
 Short-Term 0-2 Years
 Mid-Term 2-4 Years
 Long-Term 4+ Years

INTRODUCTION

Section 11401 of the Fixing America's Surface Transportation (FAST) Act mandates Missouri, along with all other states, to develop and implement a State Action Plan (SAP). The SAP must identify highway-rail and pathway-rail grade crossings that have experienced recent incidents and identify specific strategies for improving safety at grade crossings, including closures or grade separations.

The Federal Railroad Administration (FRA) highway-rail grade crossing SAP regulations can be found in Section 234.11 of Title 49 of the Code of Federal Regulations (49 CFR § 234.11). FRA issued these SAP regulations in a Final Rule published in the Federal Register on December 14, 2020.

State Action Plan Requirements

The FRA's Final Rule for SAPs directs states to identify highway-rail and pathway-rail grade crossings that:

- (i) Have experienced at least one incident within the previous 3 years;
- (ii) Have experienced more than one incident within the previous 5 years; or
- (iii) Are at high-risk for incidents as defined in the State Action Plan.

The Missouri SAP identifies highway-rail and pathway-rail grade crossings that have experienced more than one incident within the previous five years. To address the FRA's specific requirements the SAP discusses strategies to improve safety at those crossings over a four-year period. The study includes a short-, mid- and long-term implementation timeline for each of the specific strategies. The Missouri Department of Transportation (MoDOT) is the state agency leading the effort to complete the SAP.

The purpose of the SAP is to identify strategies that enhance safety at highway-rail grade crossings in Missouri.

Alignment with MoDOT Vision and Values

MoDOT's vision is to provide a world-class transportation system that is safe, innovative, reliable and dedicated to a prosperous Missouri. The state's long-range plan sets the following goals for the state's transportation system.

- Take care of the transportation system and services we enjoy today
- Keep all travelers safe, no matter the mode of transportation
- Invest in projects that spur economic growth and create jobs
- Give Missourians better transportation choices
- Improve reliability and reduce congestion on Missouri's transportation system

MoDOT focuses on its customers and delivering results that support its core values of Safety, Service and Stability. As part of MoDOT's commitment to its core values, safe operation of a 21st Century transportation system is promoted and provided while keeping employees safe within the field.

The Missouri SAP specifically identifies strategies that align with the long-range plan goals and core values in support of MoDOT's commitment to preserving the transportation system and investing in safety enhancements.

MISSOURI RAIL SYSTEM

The rail system plays an important role for freight and passenger movement within and through Missouri. Figure 1 displays the overall Missouri rail network.

Freight Rail System

Six Class I freight railroads operate in Missouri including the BNSF Railway Company (BNSF), Canadian Pacific (CP), CSX Transportation (CSX), Kansas City Southern Railway (KCS), Norfolk Southern Corporation (NS) and Union Pacific Railroad (UP). There are several Class III shortline, switching and terminal and tourist railroads operating in Missouri. The rail network has 5,392 miles of operating freight railroad lines.

The Missouri State Freight and Rail Plan (anticipated 2022) reported that in 2018 more than 400 million tons of freight were carried to, from, within and through Missouri on the rail network. Coal represented over 32% of total rail freight tonnage. By tonnage, 77% of rail freight traveled through Missouri, while only 17% was inbound shipments.

The value of Missouri's rail freight shipments exceeded \$100 billion. Motor vehicle shipments represented around 21% of the value. Again, through shipments were the dominant movement at 82% by value. Inbound and outbound shipments were equal at 9% each.

Missouri is primarily a through-freight state but it is a key component in the national freight rail network. System efficiency and reliability is important to maintain Missouri's economy and support the national economy.

Passenger Rail System

Amtrak operates on four passenger rail routes in Missouri: Missouri River Runner, Southwest Chief, Texas Eagle and Lincoln Service.

Missouri River Runner is a cross-state service, running between Kansas City and St. Louis. It runs on the following subdivisions: KCT Main Tracks, UP Sedalia, UP Jefferson City and TRRA Merchants. The service stops at stations in Kansas City, Independence, Lee's Summit, Warrensburg, Sedalia, Jefferson City, Hermann, Washington, Kirkwood and St. Louis. There are two daily round trips, and an annual ridership of 152,709 (2019).

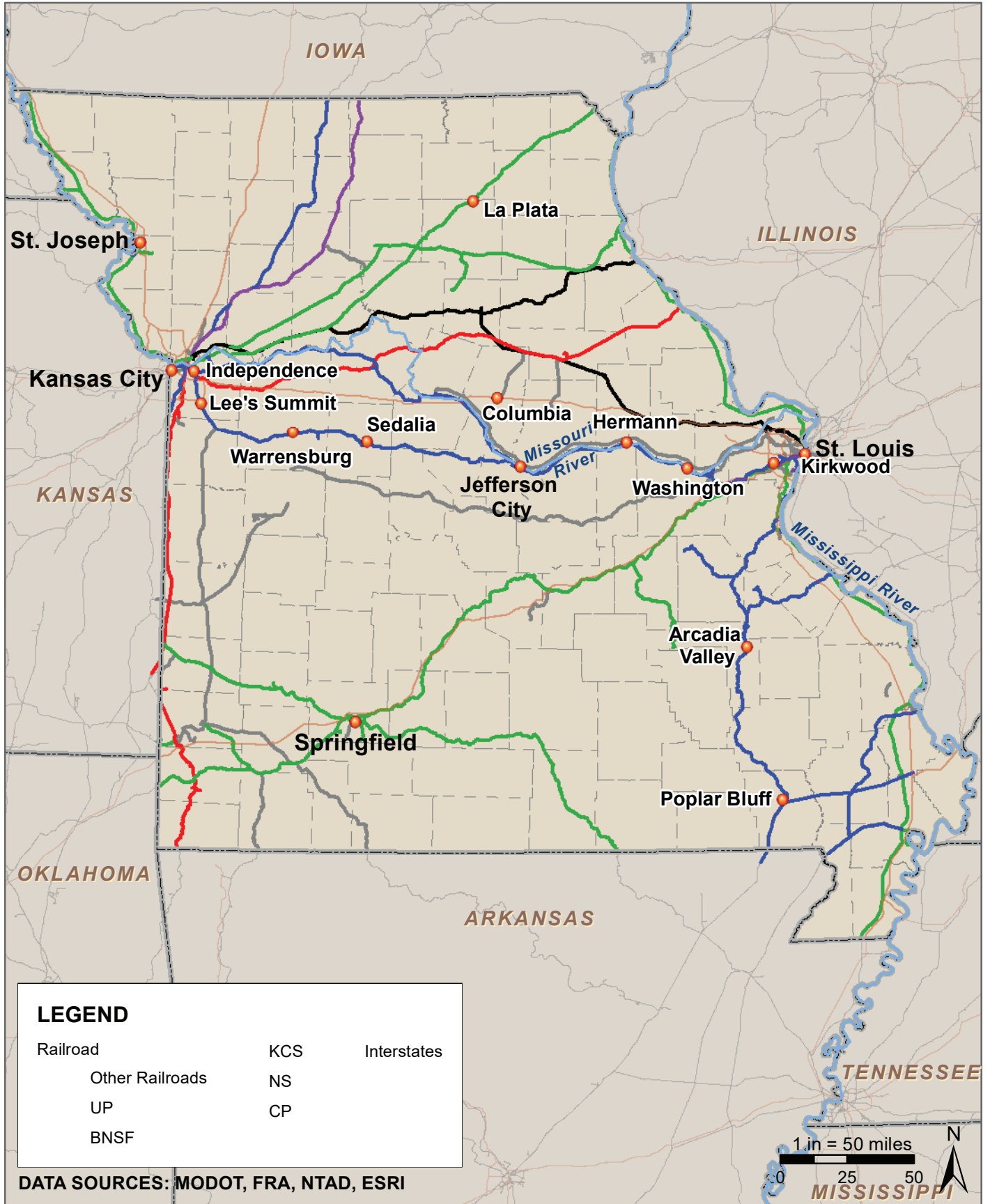
The Southwest Chief is a long distance service. It connects Chicago to Los Angeles, and has two stops within Missouri in Kansas City and La Plata. The Southwest Chief runs on the following subdivisions: BNSF Marceline, BNSF Sheffield Flyover, KCT Main Tracks and BNSF Emporia. There is one daily round trip, and an annual ridership of 334,415 (2019).

Similarly, the Texas Eagle is a long distance service that runs between Chicago and San Antonio. There are three stops within Missouri at St. Louis, Arcadia Valley and Poplar Bluff. The Texas Eagle runs on the following subdivisions: TRRA Merchants, UP Desoto and UP Hoxie. There is one daily round trip, and an annual ridership of 318,000 (2019).

The Lincoln Service is a bi-state service that runs between Chicago and St. Louis. There is only one stop within Missouri at the Gateway Station in St. Louis. The train uses the same tracks as the Texas Eagle. There are four daily round trips, and an annual ridership of 627,599 (2019).

The Bi-State Development Agency operates the light rail service in St. Louis and the Kansas City Streetcar Authority operates the streetcar in Kansas City. The Loop Trolley operates heritage trolleys on a two-mile route in St. Louis. Three excursion railroads operate in Missouri. MoDOT administers the Federal Transit Administration State Safety Oversight program that oversees safety for rail transit systems in Missouri.

Figure 1. Missouri Rail Network



Missouri Public Crossings

More than 50% of public at-grade crossings are equipped with active warning devices.

Over 75% of public crossings in Missouri are located on the Class I rail network.

Around 70% of public at-grade crossings are located in rural areas of the state.

Over 75% of public at-grade crossings are on low volume roadways with less than 1,000 vehicles per day.

MoDOT closed 22 at-grade crossings in the last five years including projects to grade separate crossings.

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Source: U.S. DOT Crossing Inventory, Missouri Department of Transportation Multimodal Division.

Missouri Highway-Rail Grade Crossing Overview

Highway-railroad grade crossings are intersections where a highway crosses a railroad at-grade. Public grade crossings are roadways that are under the jurisdiction of, and maintained by, a public authority and are open for public use. Generally, private grade crossings are on privately owned roadways, such as on a farm or industrial area, and are intended for use by the owner or by the owner’s licensees and invitees. A private crossing is not intended for public use and is not maintained by a public highway authority.

Active grade crossings have active warning and control devices such as bells, flashing lights and gates, in addition to passive warning devices such as crossbucks, yield or stop signs and pavement markings. Passive grade crossings have only passive warning devices such as crossbucks, yield or stop signs and pavement markings.

According to the U.S. DOT Crossing Inventory (September 2021), there are 6,564 highway-rail grade crossings in Missouri. There are 4,381 public crossings and 2,183 private crossings. There are crossings located in 90 of the 114 counties in Missouri.

Table 1 shows the number of grade crossings by type for public and private crossings including at grade and grade separated for railroad over or under.

Table 1. All Grade Crossings by Type in Missouri, 2021

Highway-Rail Crossing Type	Number
Public Crossings	4,381
At Grade	3,311
Grade Separated, Railroad Over	397
Grade Separated, Railroad Under	673
Private Crossings	2,183
At Grade	2,116
Grade Separated, Railroad Over	60
Grade Separated, Railroad Under	7

Source: TranSystems analysis of U.S. DOT Crossing Inventory.

The requirements for the SAP include evaluating pathway crossings in Missouri. There are 63 pathway crossings in Missouri including 59 public pathway crossings and four private pathway crossings. Table 2 shows details on pathway crossings in Missouri.

Table 2. Pathway-Rail Grade Crossings by Type in Missouri, 2021

Pathway-Rail Crossing Type	Number
Public Crossings	59
At Grade	36
Grade Separated, Railroad Over	12
Grade Separated, Railroad Under	11
Private Crossings	4
At Grade	0
Grade Separated, Railroad Over	2
Grade Separated, Railroad Under	2

Source: TranSystems analysis of U.S. DOT Crossing Inventory.



- Section 130 (\$6 million)
- Grade Crossing Safety Account (\$1.5 million)

MISSOURI DEPARTMENT OF TRANSPORTATION RAIL PROGRAM

The Missouri Highways and Transportation Commission is the state agency with full authority over all public railroad crossings within Missouri. The MoDOT Multimodal Division administers the state’s railroad program. This program includes freight rail regulation, passenger rail, light rail safety regulation, highway/rail crossing safety, rail/highway construction and railroad safety inspection and outreach. The Rail Section staff of 13 includes the Administrator of Railroads, Railroad Project Manager, the Project Section team, State Safety Oversight, Railroad Operations Manager and Rail Safety Inspectors.

Funding Programs

The MoDOT Multimodal Division receives federal and state funding to support annual investments in highway-rail grade crossing safety improvements. Dedicated federal funding comes through the Railway-Highway Crossing Program (23 USC § 130), more commonly referred to as Section 130 funding, while state funding is available in the Grade Crossing Safety Account (GCSA).

Section 130 funds the elimination of hazards at public highway-rail grade crossings. According to 23 USC § 130(i), 50% of funds are dedicated to the installation of protective devices at crossings. The remaining 50% of funds may be used for any hazard-eliminating project. In accordance with 23 USC 130(f), Section 130 projects are funded at a 90% federal share. Missouri generally receives approximately \$6 million of Section 130 funds annually. Section 130 funds are eligible for use at all public rail grade crossings with roadways, bike trails and pedestrian paths for projects targeted at reducing fatalities, serious injuries and incidents; reducing the number of existing crossings by closure and grade separation; and reducing delays or improving system performance by eliminating hazards posed by blocked grade crossings from idling trains.

Missouri’s GCSA receives collections of fees from state motor vehicle and all-terrain vehicle licensing fees. Under the provisions of Section 389.612 of the Missouri Revised Statutes, each motor vehicle registration or renewal is assessed 25 cents for this purpose. MoDOT generally receives \$1.2 to \$1.5 million of GCSA funds annually. Funds from the GCSA can be used only for installation, construction or reconstruction of automatic signals or other safety devices or other safety improvements at crossings of railroads and public roads, streets or highways.

From 2017 to 2021, MoDOT has completed around 20 highway-rail grade crossing projects each year. The projects range from active warning device installations and upgrades to statewide programs for crossbuck assembly upgrades to meet Manual on Uniform Traffic Control Devices (MUTCD) standards. Historically, the average project costs around \$400,000. Table 3 provides an overview of the project types and approximate funding allocations.

Table 3. Percent Funding by Grade Crossing Project Type, 2017-2021

Project Type	Percent of Funding
Active Warning Device Installation and Upgrade	69%
Statewide Programs (i.e., LED upgrades, inventory improvements)	10%
Closures	8%
Stop Yield Program	4%
Crossing Surface and Profile Improvements	3%
Grade Separations	3%
Federal Discretionary Grant Match	3%

Source: MoDOT Grade Crossing Project Data, 2021.

Missouri Grade Crossing Project Selection Process

MoDOT uses an exposure index and FRA’s accident prediction formula as part of a ranking process to assess potential risk at highway-rail grade crossings in Missouri and prioritize crossing projects. As part of the prioritization process, MoDOT also considers feedback from public agency partners and the railroads. MoDOT’s Multimodal Division creates a priority list of crossings, and as projects are advanced, they are listed on the Statewide Transportation Improvement Program (STIP) after public comment review and approval from the Missouri Highways and Transportation Commission.

The project development process generally includes diagnostic field reviews to determine the needed enhancements at a highway-rail grade crossing. Generally, engineering enhancements related to warning devices or railroad signaling are completed by the owning railroad. Any civil improvements for on-system routes are designed by MoDOT and off-system routes may be designed by MoDOT or the road authority.

MoDOT values the timely execution of projects and constantly assesses process improvements. Process improvements to the project selection process for highway-rail grade crossing improvements that are under evaluation include streamlining the project agreement process with local road authorities and looking at opportunities to enhance corridors over individual crossings.

Federal Discretionary Grant Funded Corridor Projects

In 2017, MoDOT Multimodal Division completed an 18-mile corridor study of 29 highway-rail grade crossings from Republic to Aurora along the BNSF Cherokee Subdivision. This corridor had one of the highest incident rates in Missouri. MoDOT used a proactive community engagement process in three counties, four special road districts and four municipalities. The FHWA recognized the study on a national level in 2018 as a “Noteworthy Practice – Empowering the Community to Achieve Consensus” in Publication SA-18-073.

The corridor study led to the successful award of a FY2017 Consolidated Rail Infrastructure and Safety Improvements (CRISI) Program Federal Discretionary Grant.

MoDOT Rail Corridor Consolidation and At-Grade Crossing Safety Improvement Project

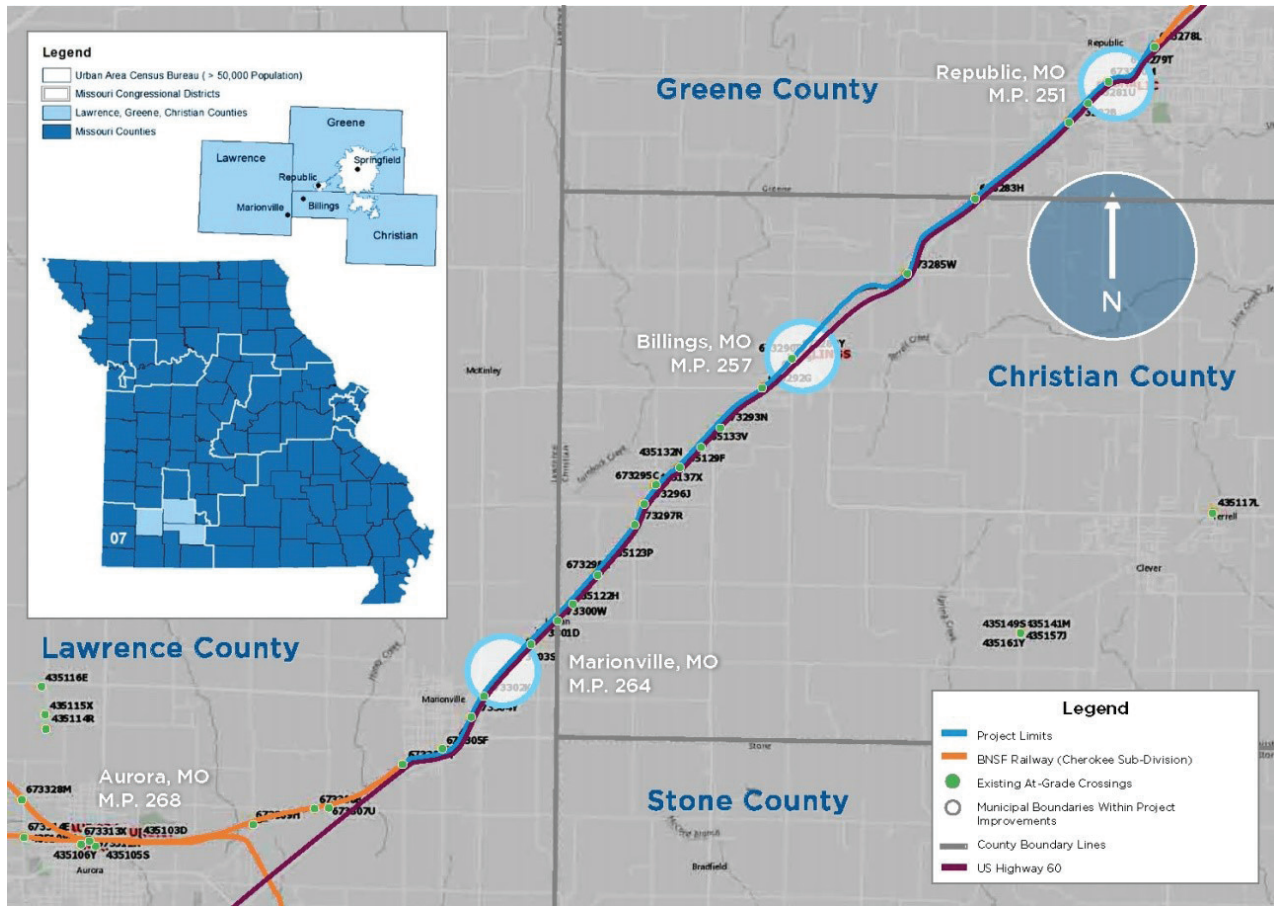
The proposed project (shown in Figure 2) will implement a grade crossing consolidation plan and other grade crossing improvements along a 19-mile segment in southwest Missouri. Four crossings will be closed and nine additional crossings will receive safety improvements, including active warning devices and gates, vertical and horizontal geometric improvements, adjacent roadway intersections, crossing surfaces, accessible sidewalks, pavement marking, security fencing and drainage. The total project cost is \$5,170,160 with 50% of the cost up to \$2,585,080 in federal funds.

Building on the success of the project in Greene, Christian and Lawrence Counties, MoDOT partnered with Webster County and BNSF on a second corridor study in Webster County. The Webster County corridor was 22-miles with 49 intersections and 36 railroad crossings. The project will close 21 at-grade railroad crossings, and will construct eight interchanges, two overpasses and 27 miles of outer roads. The project is estimated to cost \$132.8 million dollars. The project will be completed within phases. The corridor study led to the successful award of a FY2020 CRISI Program Federal Discretionary Grant for the first phase.

Thayer-North Rail Corridor At-Grade Consolidation and Safety Improvement

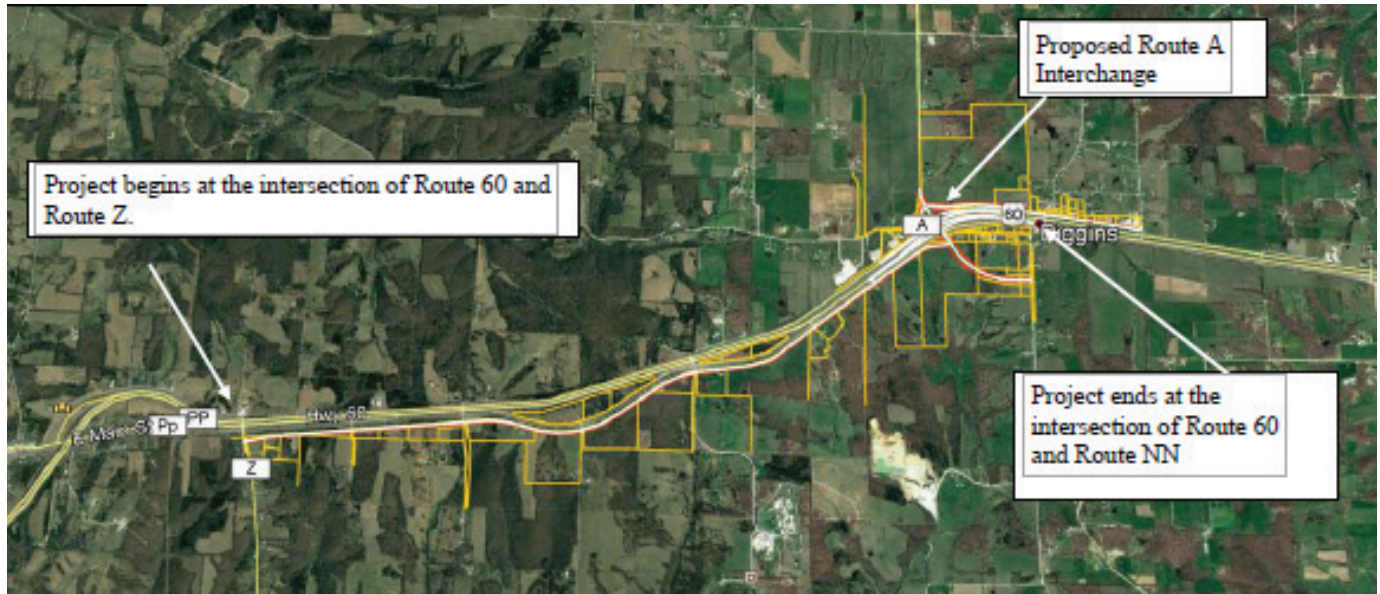
The project funds one grade separation and associated road alignments along the U.S. 60 and BNSF Thayer-North Rail Corridor in Webster County, Missouri. The project also closes eight additional at-grade crossings. The total project cost is \$18.5 million with up to \$10,357,239 in federal funds. This project is illustrated in Figure 3.

Figure 2. MoDOT Rail Corridor Consolidation and At-Grade Crossing Safety Improvement Project



Source: MoDOT.

Figure 3. Webster County Corridor Project



Source: MoDOT.

PREVIOUS FIVE-YEAR CROSSING INCIDENT REVIEW

The FRA Incident data for a five-year period (2016-2020) was used to review the highway-rail grade crossing incidents and statewide inventory data for the SAP. Data was acquired in April and September 2021 from the FRA Office of Safety Analysis website.

The FRA defines a highway-rail grade crossing incident as an action that involves on-track railroad equipment striking a highway user or a highway user striking on-track equipment at a highway-rail grade crossing. It must meet the following three conditions: (1) involves on-track equipment, (2) involves a highway user and (3) the incident occurred at a designated crossing.

The term “incident” was used within the report to refer to any collision between a highway user and a train. “Crash” is often used to describe this action, however this report uses “incident”.

The Missouri SAP focuses on incidents that occurred in the previous five years. The initial review focuses on all incidents. The secondary analysis reviews the subset of highway-rail crossings with multiple incidents in more detail. In general, private crossings were included within the analysis, unless specified.

Highway-Rail Grade Crossing Overall Incident Review

There were 211 reported incidents that occurred at public and private highway-rail grade crossing in Missouri during the five-year study period between 2016 and 2020. This averages to approximately 42 incidents per year. In 2020, Missouri ranked 12th out of all states for the highest number of grade crossing incidents. These incidents occurred at highway-rail grade crossings; there were no pathway crossing incidents reported. Table 4 includes information about the severity of the incidents. If an incident included both an injury and fatality, the incident was analyzed as a fatality to display the greatest severity.

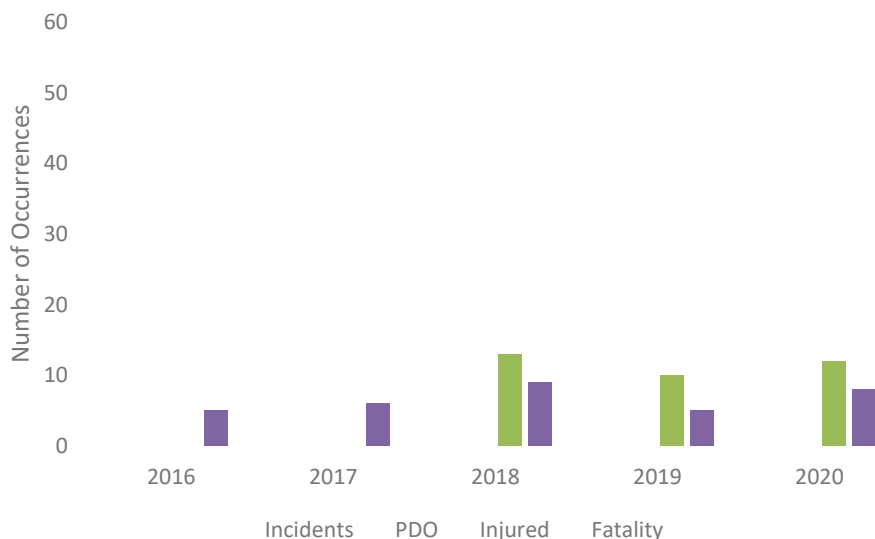
Table 4. Total Highway-Rail Grade Crossings Incidents by Severity, 2016-2020

Year	Incidents	Property Damage Only	Injury	Fatality
2016	39	20	14	5
2017	35	15	14	6
2018	53	31	13	9
2019	39	24	10	5
2020	45	25	12	8
Total	211	115	63	33

Source: TranSystems analysis of FRA highway-rail incident data.

Sixty-three injury incidents and 33 fatality incidents occurred in the analysis time period, as shown in Table 4 and Figure 4. The highest number of incidents and fatalities both occurred during 2018. During 2016 and 2017 there were 14 injury incidents, which was the highest amount of injury incidents within a year. Property damage only (PDO) incidents were the most common incident type by severity.

Figure 4. Incidents by Severity at all Crossings, 2016-2020



Source: TranSystems analysis of FRA highway-rail incident data.

Table 5 includes all fatalities and injuries at all crossings. There were 37 total fatalities and 89 total injuries during the past five years in Missouri. Approximately 80% of injuries and 73% of fatalities occurred at public crossings. The highest total injuries occurred in 2018. The most fatalities occurred during 2018 and 2020. Seven crossings with incidents have since closed:

- 414072Y – Riverside Drive, Jefferson County
- 095363F – Private Crossing, Farley
- 673312R – McNatt Avenue, Aurora
- 667602K – River Walk Road, Springfield
- 673313X - Morgan Avenue, Aurora
- 668348N – Spring Street, Ritchey
- 919820R – Enterprise Street, Webb City

Table 5. Total Grade Crossing Incident Injuries and Fatalities, 2016-2020

Year	All Crossings		Public Crossings		Private Crossings	
	Injuries	Fatalities	Injuries	Fatalities	Injuries	Fatalities
2016	17	8	13	7	4	1
2017	18	6	16	3	2	3
2018	22	9	14	8	8	1
2019	14	5	14	3	0	2
2020	18	9	14	6	4	3
Total	89	37	71	27	18	10

Source: TranSystems analysis of FRA highway-rail incident data.

Figure 5 displays the locations of all incidents within the previous five years. The incidents are labeled with circles. The size of the circle indicates the number of incidents. The four passenger rail corridors are also highlighted.

Of the 90 counties in Missouri with railroad crossings, 67 experienced at least one incident. There were 44 counties that experienced two or more incidents, and two counties that experienced 10 or more incidents. The six counties that experienced the highest number of incidents are shown within Table 6.

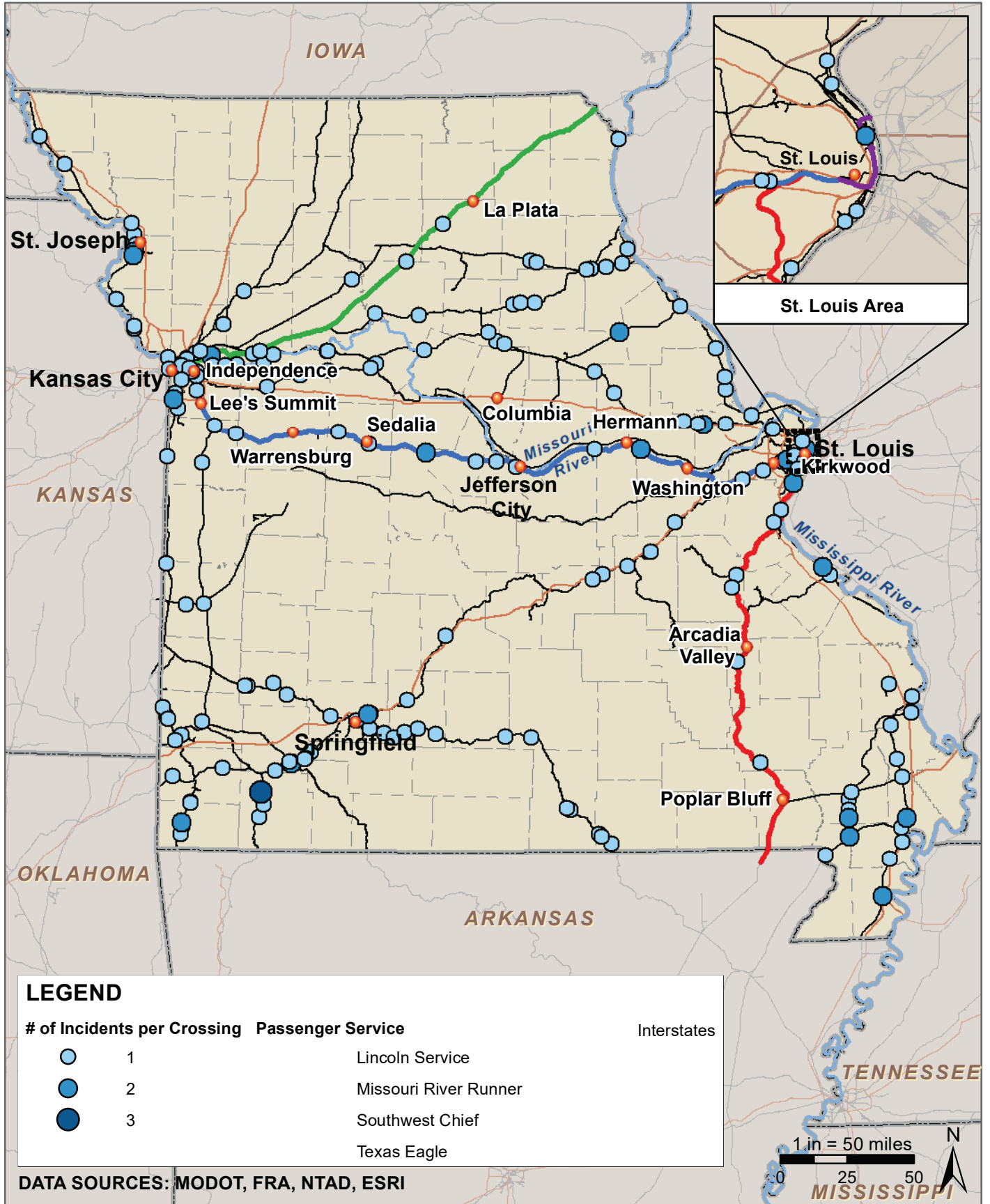
Table 6. Counties with Highest Number of Incidents, 2016-2020

County	Number of Incidents
Jackson	22
St Louis	10
St Louis City	8
Barry	7
Greene	7
Lawrence	7

Source: TranSystems analysis of FRA highway-rail incident data.

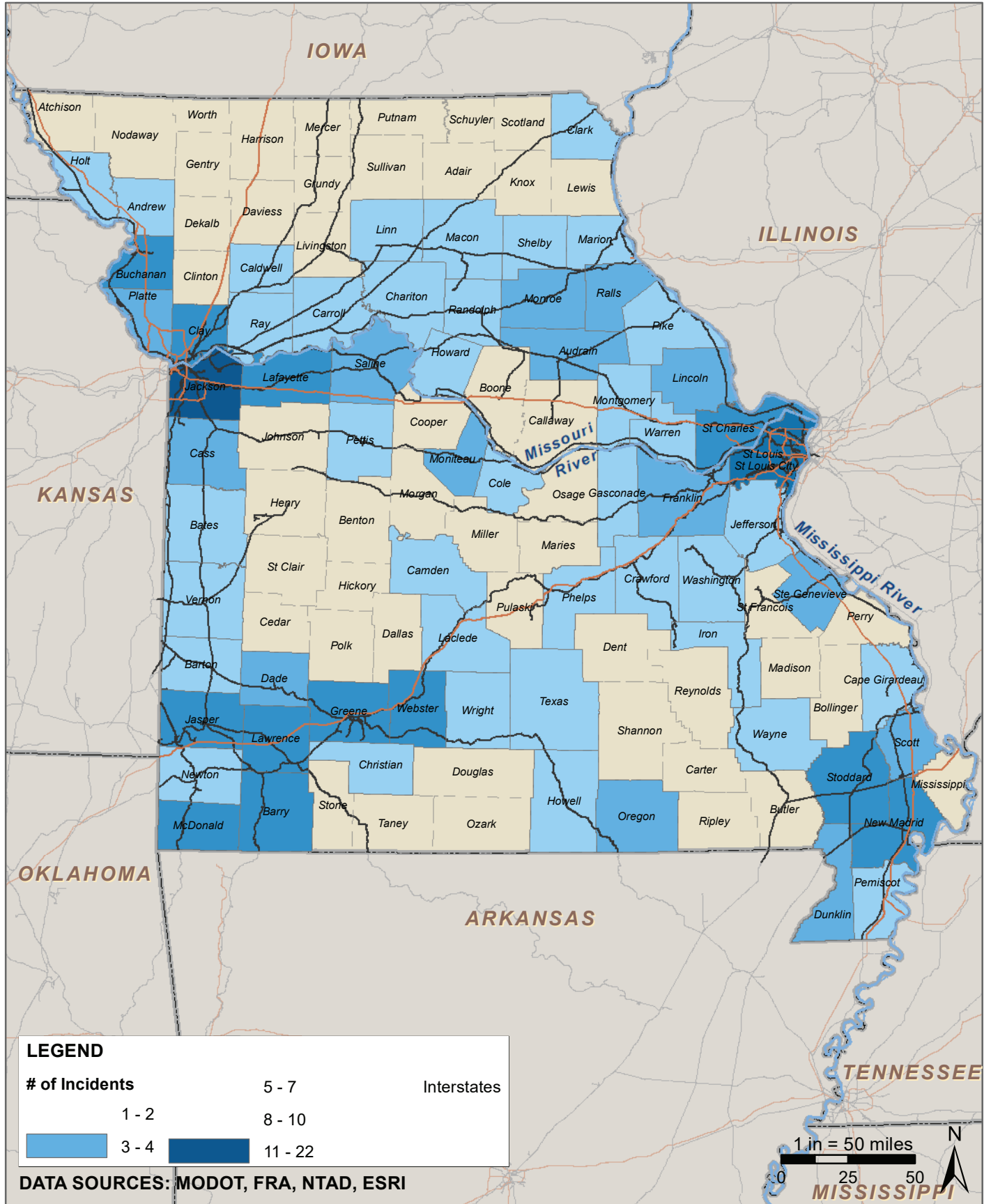
Jackson County had the most incidents within the five year analysis period. This county has 447 active railroad crossings, which accounts for roughly 7% of the crossings in the entire state. St. Louis County and city have 634 crossings, which accounts for the most crossings within the state (roughly 10%). The six counties with the highest amount of incidents account for roughly 22% of all crossings. Figure 6 shows the number of incidents per county within the previous five years.

Figure 5. Incident Locations, 2016-2020



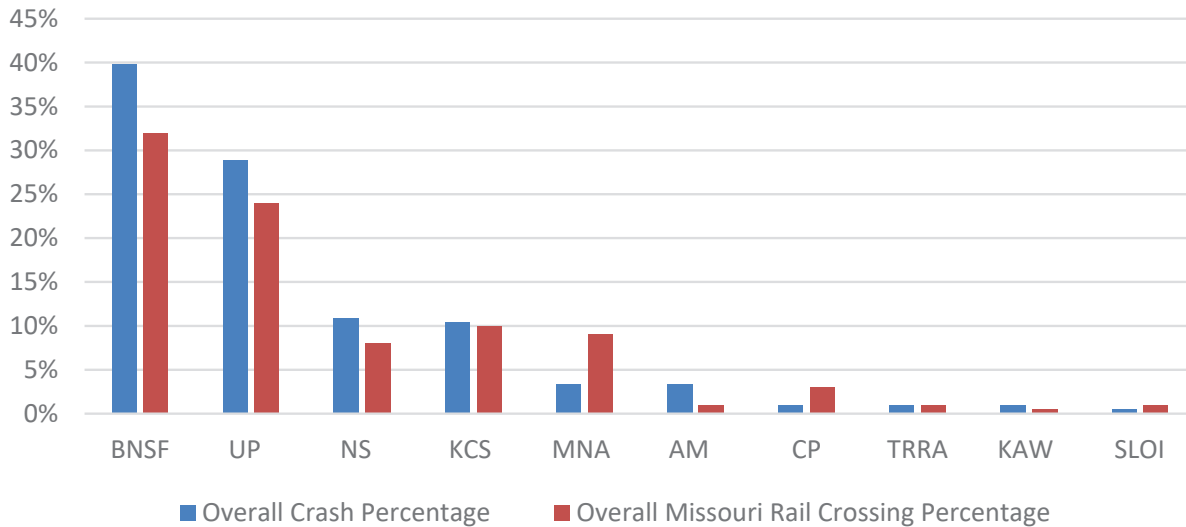
Source: TranSystems analysis of FRA Highway-Rail Incidents and Crossing Inventory

Figure 6. Concentration of Incidents by County, 2016-2020



Each incident was reviewed to determine the owning railroad, then compared to the amount of highway-rail crossings the railroad owns within the state. Figure 7 displays that information.

Figure 7. Incidents by Railroad Owner, 2016-2020



Source: TranSystems analysis of FRA Highway-Rail Incidents and Crossing Inventory

BNSF has the highest amount of incidents (40%), along with the highest number of crossings. BNSF, UP, NS, KCS, AM and KAW all account for a higher incident percentage than the overall percentage of crossings within the state.

Table 7 displays the cause of incidents. By a substantial amount, the majority of incidents were due to a vehicle not stopping at a crossing.

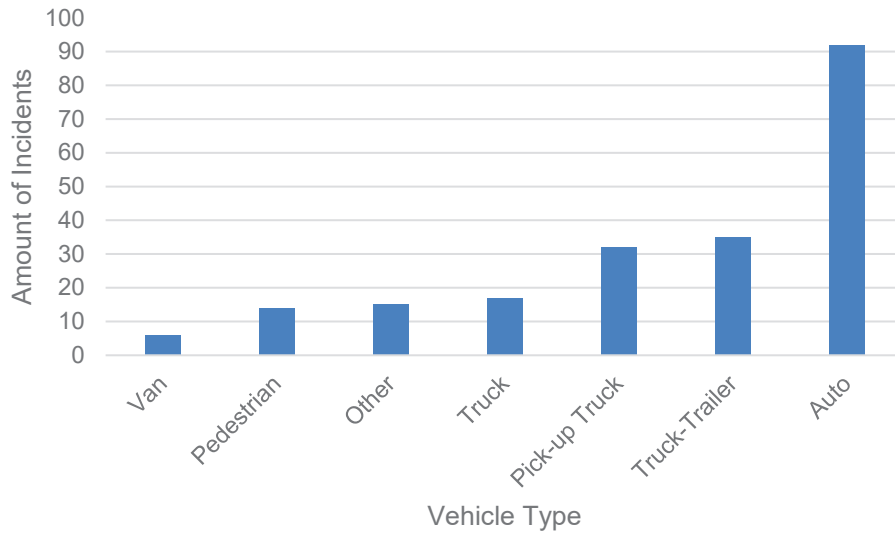
Table 7. Cause of Incident, 2016-2020

Incident Cause	Number of Incidents	Overall Percentage (%)
Did not stop	103	49
Stopped on crossing	38	18
Other	29	14
Went around Gates	20	9
Stopped then proceeded	18	9
Went through gate	2	1
Went around/through temporary barricade	1	<1

Source: TranSystems analysis of FRA highway-rail incident data.

Figure 8 shows the amount of incidents that occurred with each vehicle type. Most incidents at an at-grade crossing occurred with an automobile. There were 35 incidents that occurred with a truck-trailer. Several truck-trailer incidents (roughly 15%) occurred from a vehicle being stuck at a humped crossing. Pedestrian incidents included incidents at an at-grade crossing.

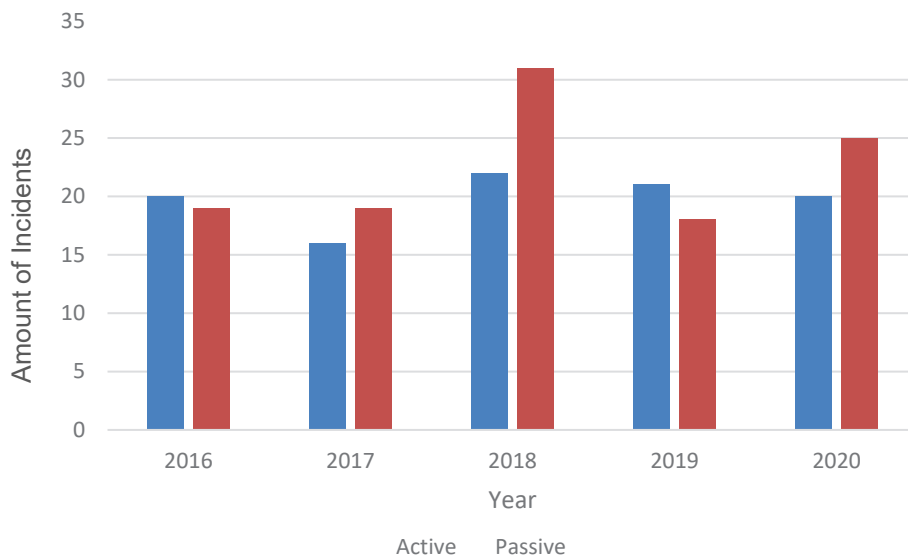
Figure 8. Vehicle Type at Incident Location, 2016-2020



Source: TranSystems analysis of FRA highway-rail incident data.

The amount of incidents at active and passive crossings is shown within Figure 9. Within the five year study period, 53% of the crossings where incidents occurred had passive warning devices and 47% had active warning devices.

Figure 9. Incidents at Active vs Passive Crossings, 2016-2020



Source: TranSystems analysis of FRA highway-rail incident data.

HIGHLIGHT:

Humped Crossings

The Volpe Center reported that in 2017 there were 2,123 train incidents at railroad crossings, resulting in 309 fatalities. Of these, 160 incidents involved trucks or buses “stuck” or “stopped” on the tracks. While the data doesn’t specifically clarify, it is likely that in many of these incidents, the trucks or buses lacked sufficient ground clearance to traverse the hump in the crossing, causing the vehicle to become stuck or hung up.

The vehicles most at risk of getting stuck on humped crossings are buses, trucks and trailers-- but even certain models of cars that are low to the ground relative to the distance between their axles are at risk. Similarly, a low vehicle’s front or rear bumper overhang may strike or drag along the pavement surface in a sag vertical curve.

If a crossing does not meet recommended design practices, a reconfiguration is recommended either during routine maintenance or by reconstructing the roadway approaches.



If the crossing profile cannot be reconfigured, a Low Ground Clearance Grade Crossing (W10-5) warning sign and a LOW GROUND CLEARANCE (W10-5P) supplemental plaque is warranted.

The FRA and FHWA support the recommended design practices for humped crossings given in the American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering. AASHTO has also adopted these guidelines.

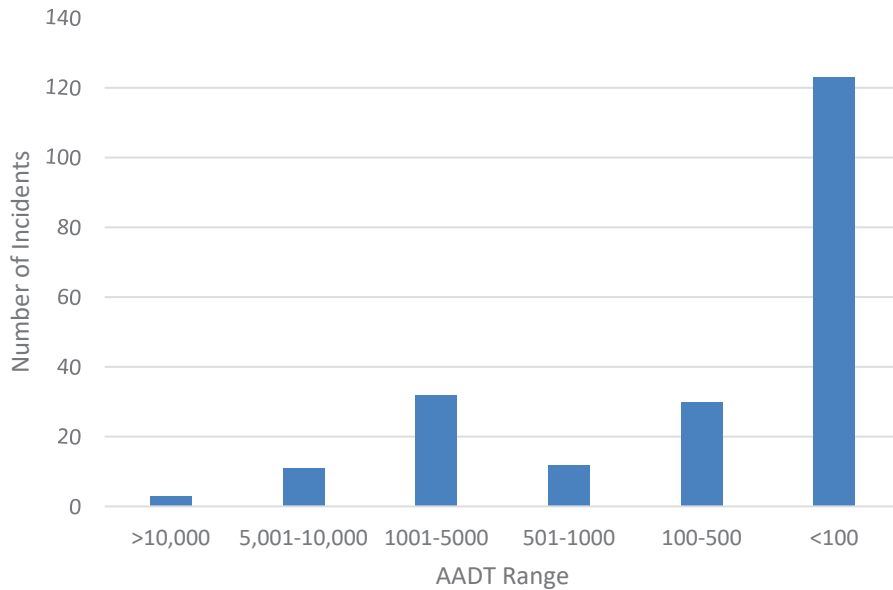
.....
Report References:

- U.S. Department of Transportation, Volpe Center. Using an Unmanned Aerial Vehicle to Produce Accurate Grade Crossing Profile Data, December 2019.*
- FRA and FHWA. Minimizing “Humped Crossings”, October 2018.*

There were 33 total fatality incidents within the last five years, and 17 of these incidents occurred at crossings with passive warning devices. There were 16 fatality incidents at crossings with active warning devices and seven resulted from a vehicle/pedestrian going around the gate. The most common cause of incidents at both types of crossings is a failure to yield/vehicles do not stop.

Incident locations were compared to available average annual daily traffic (AADT) volumes, as shown in Figure 10. Most crossings with incidents in Missouri occurred at crossings with low overall AADTs.

Figure 10. Incident by Roadway AADT, 2016-2020

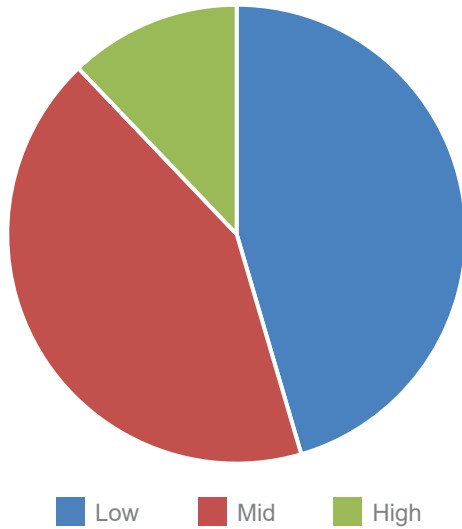


Source: TranSystems analysis of FRA highway-rail incident data.

One hundred fifty-two incidents occurred at crossings where the roadway has 500 or fewer vehicles per day. Of these, roughly 70% are passive crossings. Of the 33 fatality incidents, 26 occurred at crossings with fewer than 500 vehicles per day. Only one fatality incident occurred at a crossing with an AADT of more than 5,000 vehicles per day.

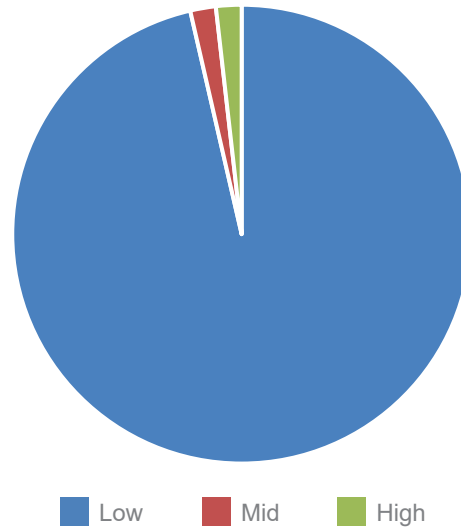
AADT was analyzed separately for active and passive crossings at each incident location, as shown in Figure 11 and Figure 12. The high AADT threshold is greater than 5,000 vehicles per day, the mid AADT threshold is between 500 and 5,000 vehicles per day and the low AADT threshold is fewer than 500 vehicles per day.

Figure 11. AADT at Active Crossings with Incidents, 2016-2020



Source: TranSystems analysis of FRA highway-rail incident data.

Figure 12. AADT at Passive Crossings with Incidents, 2016-2020



Source: TranSystems analysis of FRA highway-rail incident data.

Roughly 72% of incidents occurred at crossings with a low AADT. The active crossings had an even split between low and mid AADTs, with the smallest amount being at high AADT locations. Almost all incidents at passive crossings occurred at a location with a low AADT.

Incident reports show that all private crossings with incidents have less than 100 AADT. Although this is likely accurate, it is unlikely that the local and/or state agencies have performed traffic counts at private crossings. Even without the private crossings included in the analysis, 73 incidents occurred at crossings with an AADT less than 100, which concludes that most incidents are occurring at low volume roads.

Figure 13 shows the percent of drivers involved in incidents versus the amount of drivers per age range within the United States, based on 2010 Census data. Approximately 13% of the licensed drivers within the United States are below the age of 25. The amount of young drivers involved in incidents within the last five years in Missouri was 11%. Drivers over the age of 65 accounted for 10% of all incidents in Missouri, and they account for 16% of licensed drivers nationally.

HIGHLIGHT:

Operation Lifesaver, Inc.

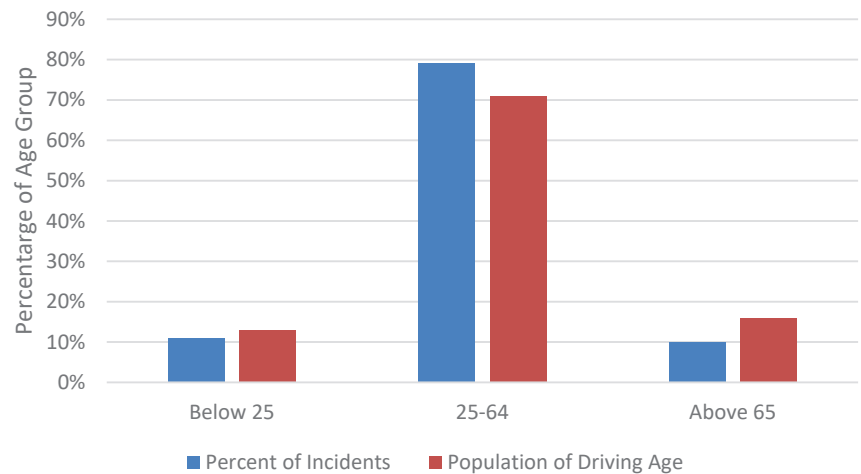
Operation Lifesaver, Inc. (OLI) is a non-profit organization committed to preventing collisions, injuries and fatalities on and around railroad tracks and highway-rail grade crossing.

Missouri adopted the Operation Lifesaver program in October 1977.



Missouri Operation Lifesaver (MO OL) is a non-profit public safety education and awareness organization dedicated to reducing collisions, fatalities and injuries at highway-rail crossings and trespassing on or near railroad tracks. MO OL promotes rail safety through public awareness campaigns and education initiatives, including free safety presentations by authorized volunteers. This is encouraged through engineering, enforcement and education. MO OL provides programs, presentations and campaigns to students, driver's education classes, school bus drivers, professional drivers, law enforcement and general adult population. MO OL is co-sponsored by state and local government agencies, highway safety organizations and private railroads.

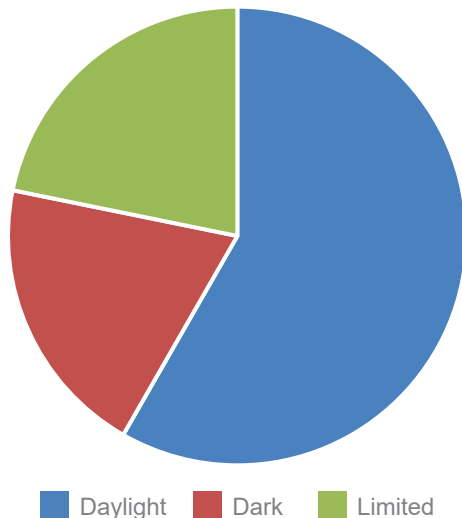
Figure 13. Incidents based on Driver's Age, 2016-2020



Source: TranSystems analysis of FRA highway-rail incident data.

Incidents were reviewed to determine the light level at the time of the occurrence, as shown in Figure 14. Overall, 42% of incidents occurred with dark or limited light levels. There were 42 incidents that occurred in the dark and 46 incidents that occurred during the dawn or dusk, which are classified as limited light levels. Of all incidents with limited light levels, 36 incidents in the dark and 31 incidents with limited light occurred at crossings without street lighting.

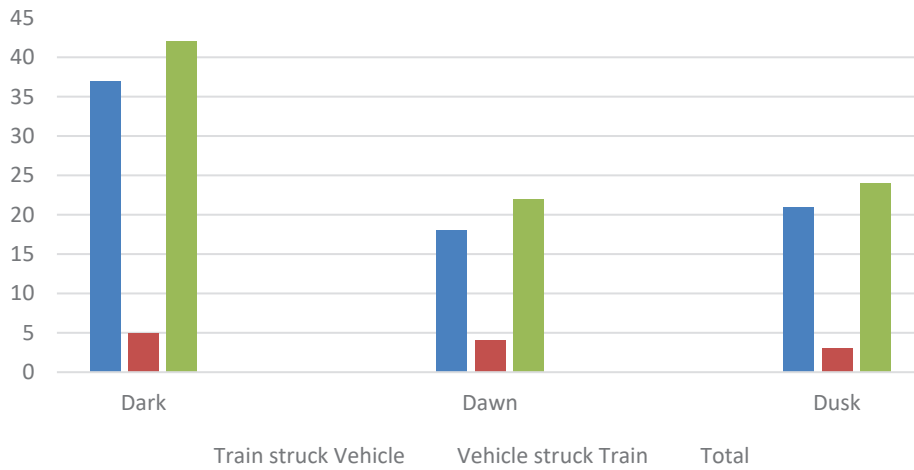
Figure 14. Incidents based on Light Level, 2016-2020



Source: TranSystems analysis of FRA highway-rail incident data.

Incidents were categorized to determine if the vehicle struck the train or the train struck the vehicle, as shown in Figure 15. Missouri incidents show that it is more likely that the train strikes the vehicle. Incidents where drivers did not stop or vehicles stopped on tracks normally result in the train striking the vehicle.

Figure 15. Incidents by Vehicle or Train Strike by Light Level, 2016-2020

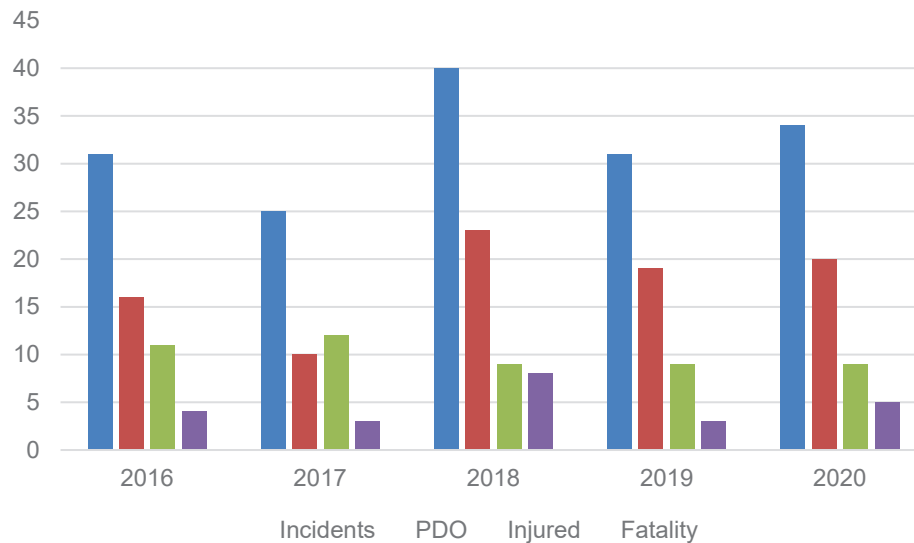


Source: TranSystems analysis of FRA highway-rail incident data.

There were 12 incidents during dark, dawn and dusk where a vehicle struck a train. Of these, seven struck the first railcar and five struck a railcar in the middle of the train. Two of these railcars were UP, two were BNSF and one was MNA.

Of the 211 total incidents, 161 occurred at public crossings. The statistics at the public crossings are similar to the overall crossing information. Incidents that occurred at only public crossings are shown in Figure 16.

Figure 16. Incidents at Public Crossings, 2016-2020



Source: TranSystems analysis of FRA highway-rail incident data.

Highway-Rail Grade Crossing Multiple Incident Review

Within Missouri, there were 20 at-grade crossing locations with two or more incidents within the last five years. Most of these locations experienced two incidents, however crossing 667024H experienced three incidents. Table 8 includes general information about the multiple incident locations.

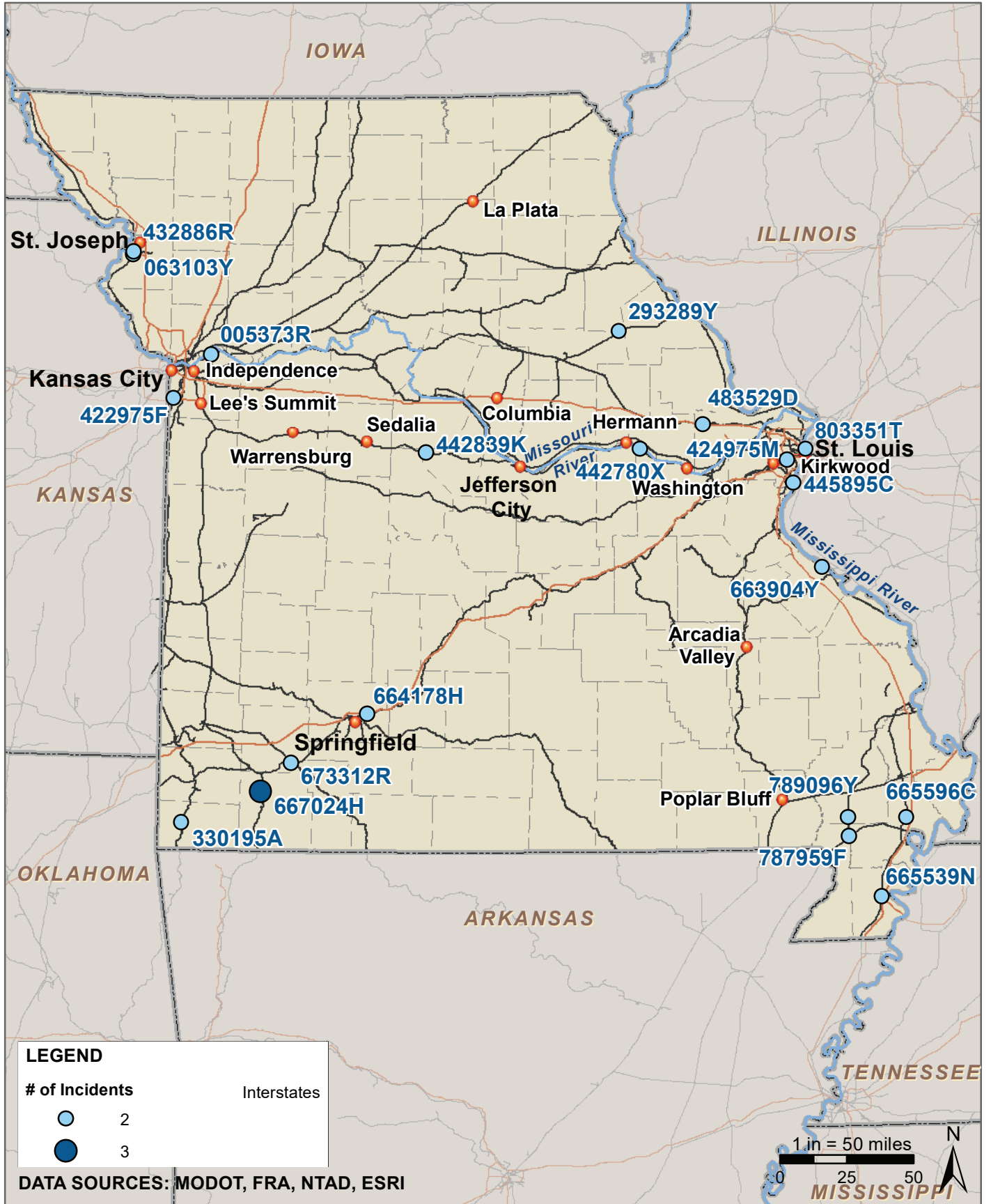
Table 8. Multiple Incident Locations, 2016-2020

Crossing Number	Number of Incidents	Street Name	County	Railroad	Public or Private?	Warning Device
005373R	2	Courtney Rd	Jackson	BNSF	Public	Active
063103Y	2	Alabama St	Buchanan	BNSF	Public	Active
293289Y	2	RD 577	Audrain	KCS	Public	Passive
330195A	2	Simmons Feed Mill	McDonald	KCS	Private	Passive
422975F	2	East 103rd St	Jackson	UP	Public	Active
424975M	2	Sutton Blvd	St. Louis	UP	Public	Active
432886R	2	Southwest Lower Lake Rd	Buchanan	UP	Public	Passive
442780X	2	Market St/MO B	Franklin	UP	Public	Active
442839K	2	Private Industry	Moniteau	UP	Private	Passive
445895C	2	Private	St. Louis	UP	Private	Passive
483529D	2	Wacky Rd	St. Charles	NS	Private	Passive
663904Y	2	Private	Ste Genevieve	BNSF	Private	Passive
664178H	2	Mustard Way	Greene	BNSF	Public	Passive
665539N	2	Gettings Ln	Pemiscot	BNSF	Public	Passive
665596C	2	CO Rd 635	New Madrid	BNSF	Public	Passive
667024H	3	Washington St	Barry	AM	Public	Passive
673312R	2	McNatt Ave	Lawrence	BNSF	Public	Active
787959F	2	East Laclede St	Dunklin	UP	Public	Active
789096Y	2	Zimmerman Ln	Stoddard	UP	Public	Passive
803351T	2	Buchanan Hall	St. Louis	TRRA	Public	Passive

Source: TranSystems analysis of FRA highway-rail incident data.

One crossing is now closed (673312R). Crossing 665539N is scheduled for upgrade in 2022 and crossing 667024H was upgraded to an active crossing in October 2020. All multiple incident locations are shown in Figure 17.

Figure 17. Multiple Incident Locations, 2016-2020



A comparison of the various incident parameters (location, railroad, cause, vehicle type, etc.) indicated a similar pattern for multiple incident crossings to all incidents in Missouri from 2016-2020. Table 9 shows a comparison of the severity of all incidents to the multiple incident locations. One notable difference was that multiple incident locations were more frequent at passive crossings (53% of all incidents vs 61% at multiple incident locations).

Table 9. Comparison of Severity at All versus Multiple Incident Locations, 2016-2020

Severity	All Incidents		Multiple Incidents	
	Count	Percentage	Count	Percentage
PDO	115	55%	22	54%
Injury	63	30%	11	27%
Fatality	33	16%	8	20%
Total	211		41	

Highway-Rail Grade Crossing Incident Review on Passenger Rail Corridors

Each of the passenger rail corridors were separately reviewed for incidents. Multiple passenger rail services run on the KCT and TRRA Merchants subdivisions. Therefore, all incidents on the TRRA Merchants were included within the Texas Eagle. No incidents occurred on the KCT. Table 10 displays the number and severity of the incidents along each passenger rail corridor.

Table 10. Passenger Rail Corridor Incidents, 2016-2020

Year	Missouri River Runner Route				Southwest Chief Route				Texas Eagle Route			
	Incidents	PDO	Injured	Killed	Incidents	PDO	Injured	Killed	Incidents	PDO	Injured	Killed
2016	2	1	0	1	0	0	0	0	3	1	2	0
2017	2	0	2	0	0	0	0	0	1	0	1	0
2018	4	3	1	0	4	2	1	1	2	2	0	0
2019	6	3	2	1	0	0	0	0	2	1	1	0
2020	7	4	1	2	2	0	1	1	2	1	1	0
Total	21	11	6	4	6	2	2	2	10	5	5	0

Source: TranSystems analysis of FRA highway-rail incident data.

Note: The Lincoln Service operates on the same route as the Texas Eagle, therefore, incidents were only reported for the Texas Eagle route.

There were 21 grade crossing incidents along the Missouri River Runner route; this was the highest incident count along the four passenger rail services. Six of the incidents were injury and four were fatalities. Three of these crossings had two incidents (442780X, 442839K, 424975M), and a fatality occurred at two locations. There were six incidents with two injuries along the Southwest Chief route. Along the Texas Eagle route there were 10 incidents with five injuries. There were two fatalities along the Southwest Chief route and none along the Texas Eagle.

Blocked Crossing Reports in Missouri

Blocked crossings occur when stopped trains stop the flow of traffic (vehicular and pedestrian) at railroad tracks for an extended period. Blocked crossings can impact safety, specifically in locations where trains routinely block the crossing for extended periods of time. This may cause drivers to become frustrated, potentially causing drivers to attempt to clear the crossing before the train arrives or pedestrians to walk around or through the stopped train. Additionally, blocked crossings may cause delays in travel time.

Beginning in late 2019, the FRA created an interactive map where people are able to manually input blocked crossing events. The data reports the crossing and location, along with the approximate time and duration of the blocked crossing. The data utilized on this SAP is from reports between Jan. 1, 2020 and June 8, 2021.

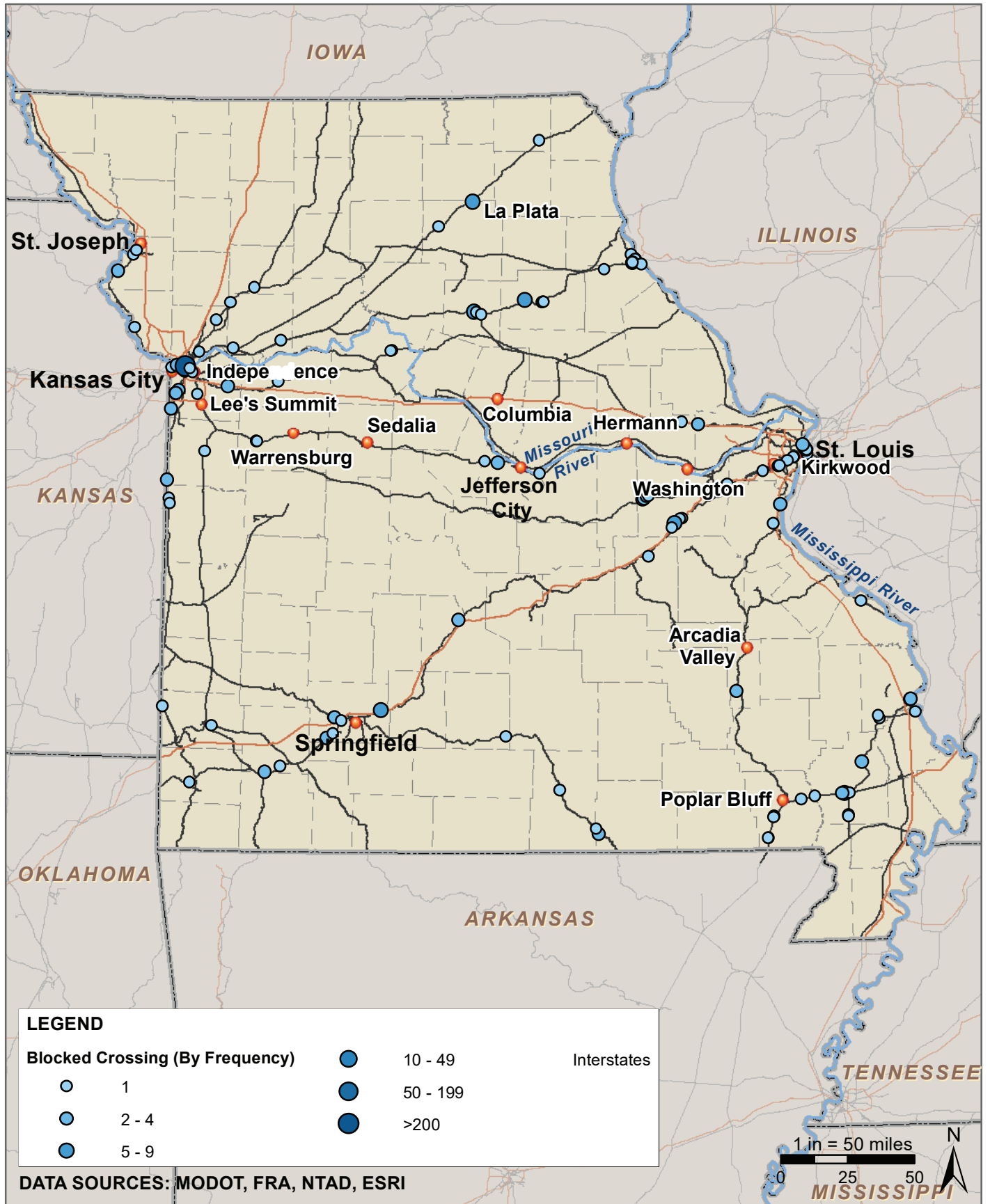
There were 476 blocked crossing events reported in the state of Missouri. There were 107 reports in 2020 and 369 reports in 2021. Of these, there were 122 unique crossings. Eight crossings experienced five or more reports within the last 18 months, as shown in Table 11. Crossing 450408N received the most reports, accounting for approximately 50% of all reports filed. The highest number of reports at these two crossings were made in April and May 2021, mostly noting short duration blockages around 5pm. These crossings are located in an area of Kansas City with a high volume of trains and intersecting rail corridors that may result in slow moving trains.

Table 11. Highest Number of Blocked Crossing Reports, January 2020-June 2021

Crossing	Number of Reports	Street Name	County	Railroad	Public or Private
450408N	239	Private - Water Treatment Plant	Jackson	UP	Private
329680L	41	Private - Water Treatment Plant	Jackson	UP	Private
446330P	8	Two Mile Rd	Stoddard	UP	Public
480703A	6	Main St	Monroe	NS	Public
483706F	6	Pea Ridge Rd	Randolph	NS	Public
664386J	6	MO-W	Franklin	BNSF	Public
005089Y	5	Owensby St	Macon	BNSF	Public
673255E	5	Washington St	Greene	BNSF	Public

Figure 18 shows the locations of all reported blocked crossings.

Figure 18. Blocked Crossing Reports by Location, January 2020 - June 2021



Trespassing Incidents

Trespassing is the illegal act of crossing onto private railroad property. Typically, trespassers make a choice to enter private property because it provides the most direct route to a desired destination. These people may be unaware of the dangers involved and/or may be distracted by another activity, such as biking, hunting or using a cell phone. Trespassing is the leading cause of rail-related deaths in America.

Trespassing data between 2016 and 2020 was analyzed for Missouri. Within these five years, Missouri experienced 75 casualties. Casualty refers to the individuals injured or killed due to trespassing on railroad property. Table 12 shows all trespassing casualties.

Table 12. Trespass Incident Overview, 2016-2020

Year	Incidents	Injured	Fatality
2016	11	7	4
2017	17	11	6
2018	16	7	9
2019	16	5	11
2020	15	9	6

Source: FRA Trespassing Data

Overall, 39 people were injured and 36 people were killed between 2016 and 2020. Four counties experienced five or more trespassing incidents, and three counties experienced four or more trespassing fatalities, as shown in Table 13.

Table 13. Counties with Highest Amount of Trespassing Incidents, 2016-2020

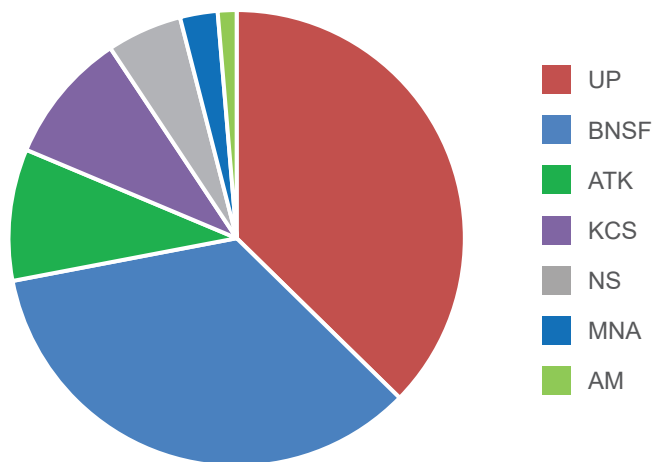
County	Total Incidents	Total Fatalities
Jackson	19	8
St. Louis	8	4
Cole	5	4
Greene	5	2

Source: FRA Trespassing Data

Local law enforcement officers face greater challenges monitoring and enforcing trespassing in more sparsely populated counties. Heavily populated counties have a higher population of walking traffic, along with increased passenger and freight train traffic.

Figure 19 shows the owning railroads at the locations of trespassing. Similar to the overall incidents by railroad, UP and BNSF had the highest percentage of trespassing incidents. UP and BNSF have the largest rail track mileage presence in Missouri.

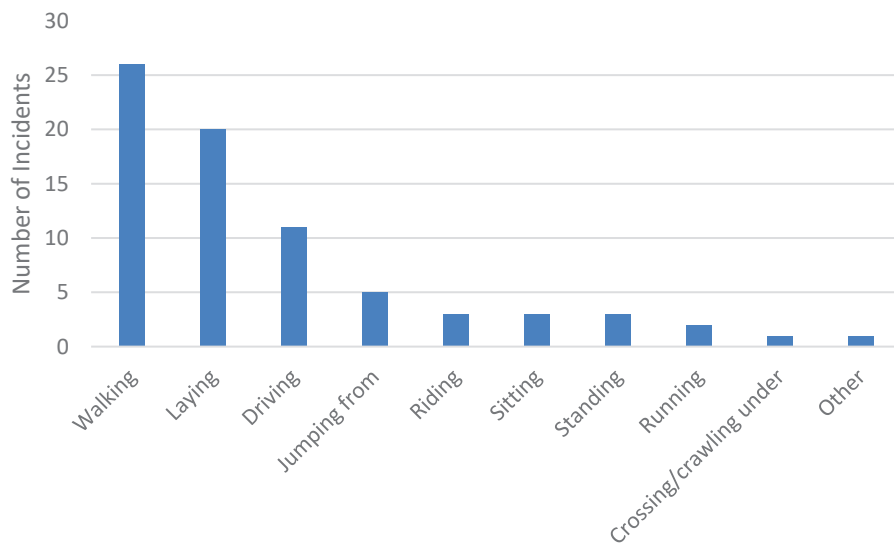
Figure 19. Number of Trespassing Incidents by Railroad, 2016-2020



Source: FRA Trespassing Data

Trespassing incidents are classified by the physical act before the incident, which is shown in Figure 20. The most common physical act before incident was walking near/on the tracks.

Figure 20. Number of Trespassing Incidents by Physical Act Before Incident , 2016-2020



Source: FRA Trespassing Data

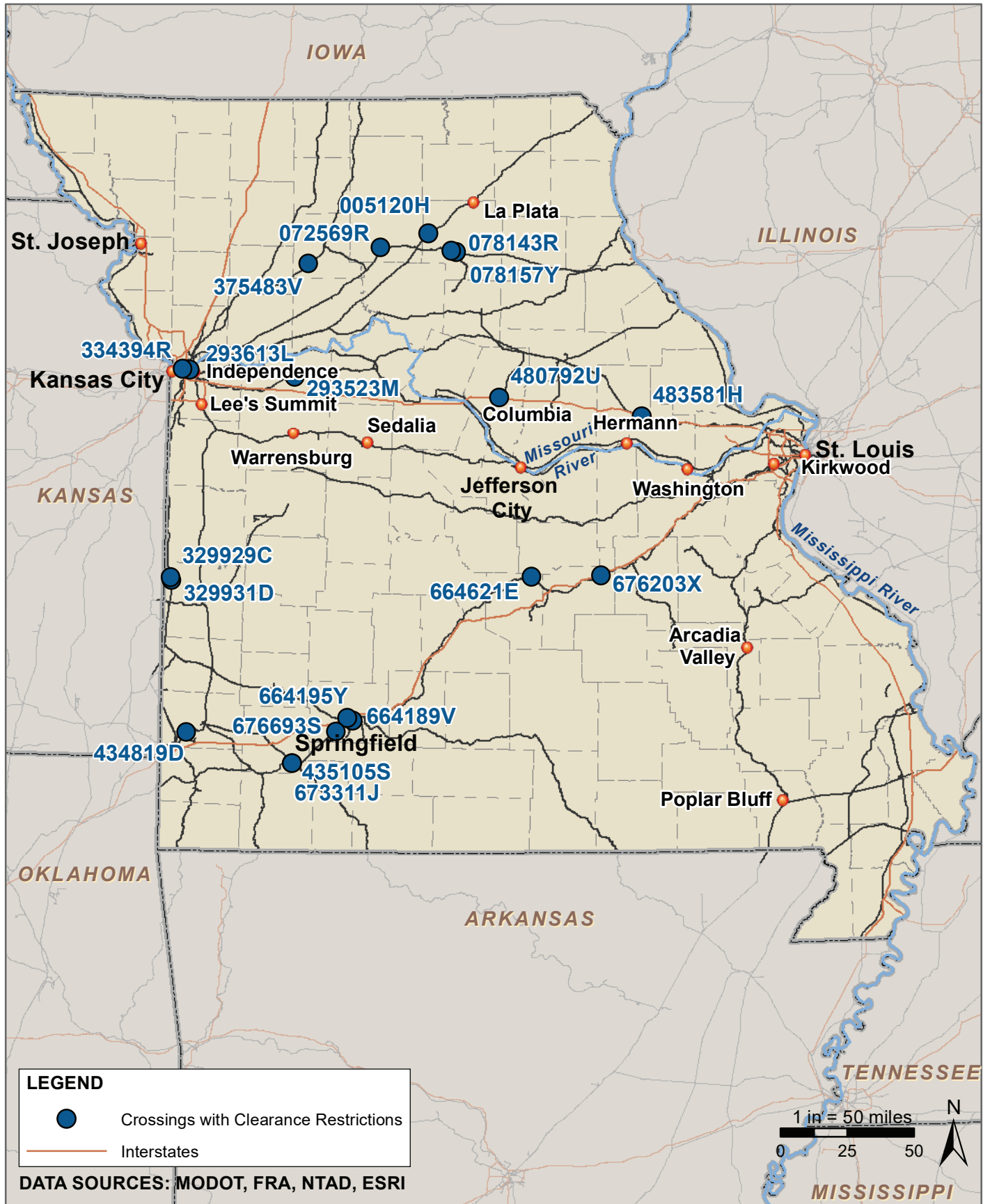
Low Clearance Bridge Strikes

Bridge strikes can result in injury and loss of life, damage to infrastructure, economic disruptions and travel time delays. A bridge strike occurs when an overheight vehicle, typically trucks, strike the railroad bridge located over the roadway. While bridge strikes are avoidable through awareness of route restrictions, paying closer attention to road signs and the proper use of route planning systems, they still do occur.

These types of incidents are not documented by the FRA. Typically, these incidents are documented by local law enforcement as property damage crashes. Many times incidents go unreported to the railroad bridge owner.

Although not a comprehensive list within Missouri, Figure 21 displays locations noted by MoDOT staff and stakeholders with low clearance restrictions.

Figure 21. Crossings with Bridge Clearance Restrictions



STAKEHOLDER ENGAGEMENT SUMMARY

MoDOT utilized a stakeholder engagement process to gather input from across the state. An online survey was promoted through direct emails and newsletters to targeted stakeholder groups. MoDOT hosted virtual meetings with planning partners, including metropolitan planning organizations, regional planning commissions and private stakeholders to provide feedback on the topics included within the SAP.

Figure 22. Stakeholder Engagement Activities



Source: TranSystems

The online stakeholder survey was created to provide MoDOT insights into how to develop a State Action Plan that benefits all stakeholders. Stakeholders were asked questions regarding the state railroad system and to provide feedback at specific highway-rail grade crossing locations. MoDOT incorporated the feedback provided by the stakeholders through the survey into the pool of comments obtained throughout the stakeholder engagement process.

The survey was embedded in an ArcGIS StoryMap. The StoryMap provided stakeholders with the study background, goals and an infographic related to highway-rail grade crossing statistics for Missouri. The survey used the Survey123 tool to collect responses.

HIGHLIGHT:

Missouri Social Media & Public Outreach

MoDOT believes that good organizations share information with the people they serve and engage customers in conversation. MoDOT interacts with its customers through social media networking websites and applications.

MoDOT's July 2021 Performance Highlights reported an increase of 5.2% in Social Media Followers.

Social media is becoming an ever-present tool in everyone's lives and is an efficient and direct way to provide educational messages.

During Rail Safety Week 2021, MoDOT shared Missouri River Runner's safety messages on its social media platforms.



The survey was emailed by MoDOT staff to the following targeted stakeholder groups:

- Transportation Partners
- Highway Safety Group (includes Law Enforcement)
- Missouri Operation Lifesaver

The survey link was also included in MoDOT's internal staff newsletter and the Motor Carrier Services newsletter. The survey was available between July 7, 2021 and Aug. 15, 2021. There were 119 total stakeholder responses.

MoDOT held one railroad and six public agency stakeholder virtual meetings between July 26, 2021 and Aug. 4, 2021. Public agency stakeholder meetings were held in each MoDOT District to gather specific feedback about each region. Each presentation outlined the background and goals of the SAP along with a brief overview of the data analyzed. During each stakeholder meeting, an interactive poll was given to the participants using the online polling tool Mentimeter. Following the polling, an interactive ArcGIS map was used to pin specific locations identified by stakeholders and noted their comment.

The following points summarize key information from stakeholders:

- Overall, engineering and education were viewed as the most important of the four E's of safety (engineering, education, enforcement and emergency response).
- Young driver education was indicated as the most important target for education and outreach.
- Crossing closures were viewed as the most important engineering strategy from the stakeholder meetings. Survey data indicated that upgraded warning devices is also a top engineering strategy.
- Positive feedback was received about the "Officer on a Train" program.
- Several stakeholders noted that their surrounding communities likely do not have (or have limited) emergency response plans in place.
- Blocked crossings were a highly noted concern, showing that many communities experience issues from trains blocking crossings.
- Humped crossings were identified at several locations.

Survey and stakeholder meeting comments were reviewed and 12 crossings were noted more than once. The locations are listed within Table 14.

Table 14. Crossings with Two or More Comments

Crossing ID	Frequency of Comment	Location	Comments
063103Y*	3	Alabama Street <i>St. Joseph</i>	This is a heavily traveled train corridor within a primarily industrial area, which can cause congestion.
375513K	2	Ryan Lane <i>Chillicothe</i>	This crossing was recently closed due to poor bridge conditions. Traffic previously using crossing now diverted to two adjacent crossings.
442439S	2	MO-H <i>Nelson</i>	Crossing is often blocked.
480616W**	3	Lindell Avenue <i>Hannibal</i>	Crossing is often blocked.
480617D**	4	Warren Barrett <i>Hannibal</i>	Crossing is often blocked.
667623D	2	Porter Crossing Road <i>Rogersville</i>	Humped crossing with close proximity to U.S. 60.
673163S**	2	MO-JJ & MO-F <i>Sleeper</i>	Crossing is often blocked.
673237G*	2	Webster Lane <i>Marshfield</i>	Passive crossing with limited visibility to the north due to the curvature of the track.
673257T	2	Mo-125 <i>Strafford</i>	Crossing very close to highway. Confusing intersection configuration.
673274J	2	Brookline Ave <i>Springfield</i>	Project programmed with STIP funding. MoDOT may seek additional grant funds for project.
673280M	2	Main Ave <i>Republic</i>	At-grade crossing along heavily traveled road. Crossing is often blocked, causing congestion.
673327F**	2	Farm Road 1090 <i>Monett</i>	City is interested in funding a grade separated crossing, as it is commonly blocked. Industrial development is anticipated to the south of the at-grade crossing.

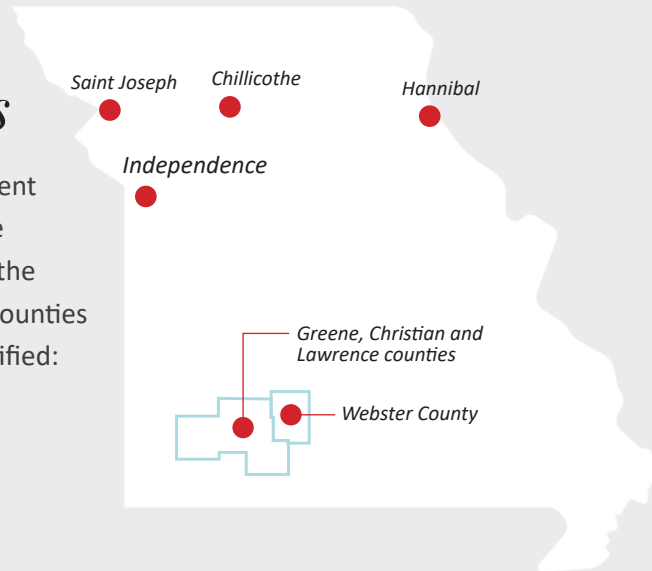
* One or more incidents occurred at the crossing between 2016 – 2020

** Crossing appeared one or more times on FRA Blocked Crossing list

HIGHLIGHT:

Candidate Corridor Projects

The review of Missouri highway-rail grade crossing incident data and stakeholder input resulted in a list of candidate corridor projects to continue building on the success of the CRISI grant projects in Greene, Christian and Lawrence counties and Webster County. The following corridors were identified:



St. Joseph Industrial Rail Corridor

From U.S. Route 50 south to Alabama Street along the east bank of the Missouri River there are numerous industries that are centered along the UP Atchison Industrial Lead and BNSF St. Joseph Subdivision. Two incidents were recorded at Alabama Street (DOT #063103Y); additionally two incidents were recorded at Southwest Lower Lake Road (DOT #432886R) over the last five years. These incidents involved trucks likely serving the industries in this area. A comprehensive rail corridor study could identify solutions to further enhance safety for travelers in St. Joseph.

Hannibal Corridor

The proposed corridor study could review grade crossings on the BNSF and NS rail corridors through Hannibal. Stakeholders reported that trains block the crossings at Warren Barrett Drive (DOT #480617D) and Lindell Avenue (DOT #480616W) on the NS Hannibal Subdivision. There are reports of events at these locations in the FRA Blocked Crossing database. MoDOT Northwest District Staff also indicated that future construction projects may result in drivers diverting onto routes with grade crossings. A comprehensive corridor study could identify solutions to enhance safety and increase reliability for travelers in Hannibal.

Chillicothe Grade Separation

In 2019, the grade separation at Ryan Lane (DOT #375513K) over the CP Kansas City Subdivision was closed due to damage sustained after two vehicles traveling on the bridge collided. A corridor study along the CP rail corridor in Chillicothe may identify comprehensive solutions that minimize out of route travel for motorists and enhance safety of all travelers while the grade separation is out of service.

Independence Parallel Rail Corridors

The KCS Mexico Subdivision and the UP Sedalia Subdivision run parallel through the City of Independence. Stakeholders reported that the Sterling Avenue (DOT #441933V) at-grade crossing on the UP rail corridor should be considered for grade separation. A comprehensive corridor study of the numerous crossings along the KCS and UP corridors could identify solutions to enhance safety and improve quality of life for residents in Independence.

STRATEGIES AND ACTIONS

MoDOT uses a set of core values to guide its management practices used to deliver transportation infrastructure efficiently and safely. The core values of safety, service and stability guide MoDOT’s strategic initiatives and the commitment to results-based actions.

As a strategy-focused plan, the Missouri Grade Crossing State Action Plan aligns with the core values in support of MoDOT’s commitment to preserve the transportation system and invest in safety enhancements. See Figure 23 below.

Figure 23. MoDOT’s Core Values



While the Missouri SAP strategies align with the core values, the actions developed to execute the strategies are categorized by the four E’s of safety to align with the Missouri Strategic Highway Safety Plan. The Federal Highway Administration (FHWA) sees the four E’s of safety as the focus areas with the greatest potential to reduce fatalities and serious injury.



Education gives drivers information about making good choices and to inform people about the rules of the road.



Enforcement of traffic laws and a visible police presence may deter motorists from unsafe driving behavior.



Engineering addresses roadway and railroad infrastructure improvements to prevent incidents or reduce the severity of collisions when they occur.




Emergency Response services provide rapid response and quality of care when responding to collisions causing injury by stabilizing victims and transporting them to medical facilities.

The FRA directs that the SAP strategies be targeted to improve safety over a period of at least four years. MoDOT strategies are assigned **on-going, short-, mid- and long-term** timeframes. FRA’s four-year period aligns with the mid-term timeframes for MoDOT’s strategies.



Comprehensive Strategies


Comprehensive approaches that include Education, Enforcement, Engineering and Emergency Response are:

SAFETY SERVICE STABILITY	Strategy: <i>Enhance safety of at-grade crossings by implementing grade crossing improvements.</i>	
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Actions:

- Conduct an annual review of crossing characteristics (i.e., train traffic and speed, vehicle traffic and speed, crash history, sight distance, emergency services routes, school bus routes, volume and speed of traffic and other nearby crossings) to develop the MoDOT Railroads Projects Under Conceptual Review list.
- Engage local stakeholders to review the MoDOT Railroads Projects Under Conceptual Review list to promote understanding of closure benefits and identify the appropriate type of safety improvements for each listed crossing.
- Update the Statewide Transportation Improvement Program (STIP) with crossings from the MoDOT Railroads Projects Under Conceptual Review list.
- Apply appropriate improvement types to develop projects and advance projects to the MoDOT Railroads Ready for Funding and Funded categories in the STIP.
- Implement the MoDOT Railroads Funded projects listed in the STIP for improvement types that include:
 - » Construct corridor improvements as outlined in Federal grant agreements
 - » Upgrade crossings from passive to active warning devices
 - » Upgrade obsolete warning devices
 - » Improve grade crossing surfaces
 - » Improve roadway geometry
 - » Upgrade flashing light assemblies to LED at existing and new warning devices


Goal: Initiate “Funded” category STIP projects in the program funding year.

SAFETY SERVICE STABILITY	Strategy: <i>Seek additional funding for highway-rail crossing improvements.</i>	
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Actions:

- Evaluate projects on the MoDOT Railroads Ready for Funding list for eligibility for Federal Discretionary Grant programs and other funding programs.
- Prepare Federal Discretionary Grant program applications for eligible MoDOT Railroads Ready for Funding projects.
- Leverage available state funding as match for projects eligible for Federal Discretionary Grants.
- Assign funding to remaining projects from available programs, such as Section 130 or state general revenue budget, as available.

Goal: Increase available funding from programs outside normal funding mechanisms.

SAFETY SERVICE STABILITY	Strategy: <i>Revise State Legislation to allow more flexible use of state funding.</i>	
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Actions:


- Prioritize a Legislative Proposal to revise RSMo 389.612 to increase the motor vehicle registration fee.
- Prioritize a Legislative Proposal to revise RSMo 389.612 to apply funds to pedestrian treatments, trespasser prevention, railroad safety outreach and education and administration.

Goal: Increase available funding from programs outside normal funding mechanisms.



Education


Education strategies and actions help to inform drivers and pedestrians on ways to modify behavior to avoid unsafe outcomes. Education strategies are relatively low cost and can build on efforts already underway by organizations like Operation Lifesaver.

SAFETY	Strategy: <i>Strengthen education efforts focused on target populations.</i>	
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Actions:

- Leverage partnerships to improve and expand education materials targeted at driver training programs.
- Identify opportunities to distribute materials.


Goal: Increase number of people receiving education materials.

SAFETY	Strategy: <i>Strengthen outreach efforts focused on target populations.</i>	
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Actions:

- Leverage partnerships to provide Public Service Announcements (PSA) targeted at high risk populations.

Goal: Increase number of people reached by PSAs.

SERVICE	Strategy: <i>Promote safety messaging to all Missouri highway users.</i>	
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Actions:

- Continue to utilize MoDOT's social media platforms to issue highway-rail grade crossing safety messages.
- Explore usage of Dynamic Message System for statewide messaging.

Goal: Increase number of people reached through Social Media.



Enforcement

Enforcement strategies and actions can improve compliance and broaden awareness of rules at highway-rail grade crossings. Joint efforts help to maximize success when considering the limited enforcement resources available.

SAFETY	Strategy: <i>Engage with partner agencies to enhance highway-rail grade crossing safety.</i>	
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Actions:

- Collaborate with Department of Revenue and State Highway Patrol to enhance driver education materials that include highway-rail safety themes.

Goal: Increase cross agency communication to promote program improvements.

STABILITY	Strategy: <i>Work with stakeholders to improve incident reporting.</i>	
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Actions:

- Leverage partnerships to execute incident report training.

Goal: Increase number of Law Enforcement officers and personnel that attend training.



Engineering


Engineering strategies and actions address the physical components at highway-rail grade crossings. Ranging from costly improvements like grade separations to relatively low cost improvements like signage and pavement markings, these solutions are widely studied and their effectiveness is understood. New technology solutions are providing innovative ways to enhance crossing safety.

SAFETY	Strategy: <i>Enhance safety at existing highway-rail at-grade crossings.</i>	
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Actions:

- Promote use of engineering best practices when designing crossing improvements.
- Implement corridor improvements.
- Evaluate crossing closures.
- Evaluate use of fencing in high trespass locations.
- Program to upgrade advance warning signs and pavement markings at crossings.


Goal: Reduce at-grade crossings incidents within Missouri.

SERVICE	Strategy: <i>Enhance safety at existing highway-rail at-grade crossings along passenger rail corridors.</i>	
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Actions:

- Conduct corridor studies to identify crossing improvements.


Goal: Enhance safety of rail passengers in Missouri.

SAFETY	Strategy: <i>Promote review of multimodal solutions as part of project improvements.</i>	
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Actions:

- Meet the needs of pedestrians, bicyclists and motorists through targeted improvements.


Goal: Increase application of multimodal solutions in crossing improvements.

SERVICE	Strategy: <i>Improve coordination with stakeholders to expedite project implementation.</i>	
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Actions:

- Review project implementation process to identify elements that repeatedly cause delay.
- Improve process to streamline or eliminate steps that cause delay.
- Continue involvement with the SHRP2 Community of Interest initiative and incorporate appropriate outcomes.
- Continue coordination with Federal Railroad Administration and the Federal Highway Administration.


Goal: Improve speed of project delivery.

STABILITY	Strategy: <i>Coordinate internally at MoDOT and with local jurisdictions to update crossing inventory data.</i>	
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Actions:

- Improve process for local jurisdictions to deliver relevant data to MoDOT for inventory updates (i.e., traffic counts).

Goal: Improve data analytics needed for project selection.

STABILITY	Strategy: <i>Investigate new technologies to provide messaging to roadway users.</i>	
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Actions:

- Partner with MoDOT Highway and Traffic Safety on innovative technology programs to alert drivers at crossings.

Goal: Reduce instances of incidents where motorist did not stop.



Emergency Response

Delay to emergency medical services can impact health outcomes for communities. Strategies and actions that support solutions for emergency response aim to improve community quality of life and overall safety.

SAFETY	Strategy: <i>Identify solutions to reduce delay at crossings.</i>	
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Actions:

- Develop a priority list of grade separation projects.
- Support local agencies in identifying alternate routes or transportation network changes to avoid grade crossings.

Goal: Decrease delay experienced by motorists, pedestrians and emergency responders.

SERVICE	Strategy: <i>Educate local and regional agencies on importance of emergency response plans that include railroad safety.</i>	
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Actions:

- Promote comprehensive emergency response coordination planning within all MPOs and RPCs.
- Monitor reports of blocked crossing locations.

Goal: Increase coordination and dialogue between agency, State and railroad partners.

Monitoring Progress

MoDOT performance measurement and monitoring is part of the organizational culture and documented in the *Tracker: Measures of Departmental Performance* quarterly reports. The foundation provided by MoDOT's *Tracker* will ensure that progress toward the goals set for each of the SAP strategies will be monitored and assessed to determine whether progress is being made towards achieving results.

The SAP primary point of contact for Missouri is:

Troy Hughes

Missouri Department of Transportation

Administrator of Railroads

105 W. Capitol Avenue

Jefferson City, MO 65102

Troy.Hughes@modot.mo.gov

(573) 751-7476

The SAP secondary point of contact for Missouri is:

Greg Leary

Missouri Department of Transportation

Railroad Projects Manager

105 W. Capitol Avenue

Jefferson City, MO 65102

Gregory.Leary@modot.mo.gov

(573) 526-3577

The MoDOT Multimodal Division Rail Section can be contacted at (573) 526-2169 or MoRail@modot.mo.gov.

APPENDIX A: *Stakeholder Meeting Notes*

Missouri Highway-Railroad Grade Crossing State Action Plan

Stakeholder Meeting Summary

July 26 – August 4, 2021

OBJECTIVE

Purpose: Meet with Public and Railroad stakeholders to provide feedback on the Missouri State Action Plan

All Meeting Attendants:

Aaron Groff (*MoDOT Project Manager*)
Aishwarya Shrestha (*Southwest Missouri Regional County of Governments*)
Alvin Nieves-Rosario (*MoDOT Project Manager*)
Amy Dowis (*Northwest Missouri Regional Council of Governments*)
Angela Shoutz (*Green Hills Regional Planning Commission*)
Brandi Webster (*MNA*)
Brian Umfleet (*MoDOT, Traffic*)
Chance Gallagher (*St. Joseph MPO*)
Chris Ashley (*KCS*)
Chris Feeney (*NEMO RPC, Transportation Planner*)
Cindy Hultz (*Executive Director of Mark Twain Regional Council of Governments*)
Danny Lites (*KCS*)
Darryl Fields (*MARC*)
Dave Earls (*MoDOT*)
David Bock (*Mid-Missouri Regional Planning Commission, Director*)
Derek Weber (*Executive Director of Northeast District Planning Commission*)
Ernest Jackson (*NS*)
Frank Miller (*MoDOT*)
Gerritt Brinks (*Harry S Truman Coordination Council*)
Greg Breaston (*MNA*)
Griffin Smith (*MoDOT Kansas City District*)
Jack Wright (*MoDOT*)
Jason Ray (*SCOG Springfield*)
Jeffery Bohler (*MoDOT St Louis District Design Engineer*)
Jennifer Wade (*MoDOT*)
Jeremy Morken (*TranSystems*)
Joe Arbona (*MNA*)
John Caufield (*BNSF*)
John Miller (*FHWA, Missouri Division*)
Joshua Colligan (*MoDOT, Communications*)
Kyle Baker (*MNA*)

Larry Scheperle (*MoDOT Rail*)
Laura Bolt (*Watco*)
Matt Jones (*UP*)
Matthew Miller (*Canadian Pacific*)
Melinda DuBay (*UP*)
Michael Martin (*KCS*)
Mike Henderson (*MoDOT, Transportation Planning*)
Nik Shepard (*Alfred Benesch & Co. Representing UP*)
Rob Frese (*MoDOT, Planning Manager North East District*)
Ryan Percy (*Southwest Area District Engineer*)
Samantha Diffenderfer (*COG, Transportation Planner*)
Shannon Kusilek (*MoDOT Northwest District*)
Sheridan German-Neeman (*Kaysinger Basin Regional Planning Commission*)
Shirley Norris (*MoDOT Project Manager*)
Steve Engelbrecht (*MoDOT, Planning Department*)
Tim Hull (*Operation Lifesaver*)
Timothy Leaf (*MoDOT, Bridge Division*)
Trevor Tutt (*Mo-Kan*)
Wesley Stephen (*MoDOT St Louis District Planning Manager*)

MoDOT Project Team

Greg Leary (*MoDOT Railroad Projects Manager*)
Troy Hughes (*MoDOT, Rail Administrator*)

Consultant Team

Andrew Young (*TranSystems*)
Emma Martin (*TranSystems*)
Frank Weatherford (*TranSystems*)
Kirsten Clayward (*TranSystems*)
Sara Clark (*TranSystems*)

Meeting Overview

TranSystems held one railroad and six¹ public stakeholder meetings virtually over MS Teams between July 26 – August 4, 2021. The public stakeholder meetings were split into different regions within Missouri to receive specific feedback about the region(s) they represent. Each presentation outlined the background and goals of the Missouri State Action Plan (SAP) along with a brief overview of the data analyzed within the State. Stakeholders were then provided a poll reviewing important topics pertaining to the SAP. Stakeholders were also asked to provide specific noteworthy locations during an interactive mapping session. The following information goes into detail about the comments received from the stakeholders.

Interactive Polling

During each Stakeholder meeting, an interactive poll was given to the participants using the online polling tool Mentimeter. Each of the five questions provided information about the four E's (Engineering, Education, Enforcement, and Emergency Response). The poll also asked participants to rank the importance of specific strategies regarding each of the four E's.

The following figures show the results of the Public Stakeholder and Railroad Stakeholder meetings. The questions are written above each of the results. Most questions were provided in a ranking format. The graphics were created based on a weighted poll, i.e.: a first place ranking was worth the most points and last place was worth the least amount of points. One question asked participants to rank their top three engineering solutions, and the results are based on the number of votes received for each category. Each of the four E's was discussed more in-depth, and key findings were noted after the polling results.

Map Interaction

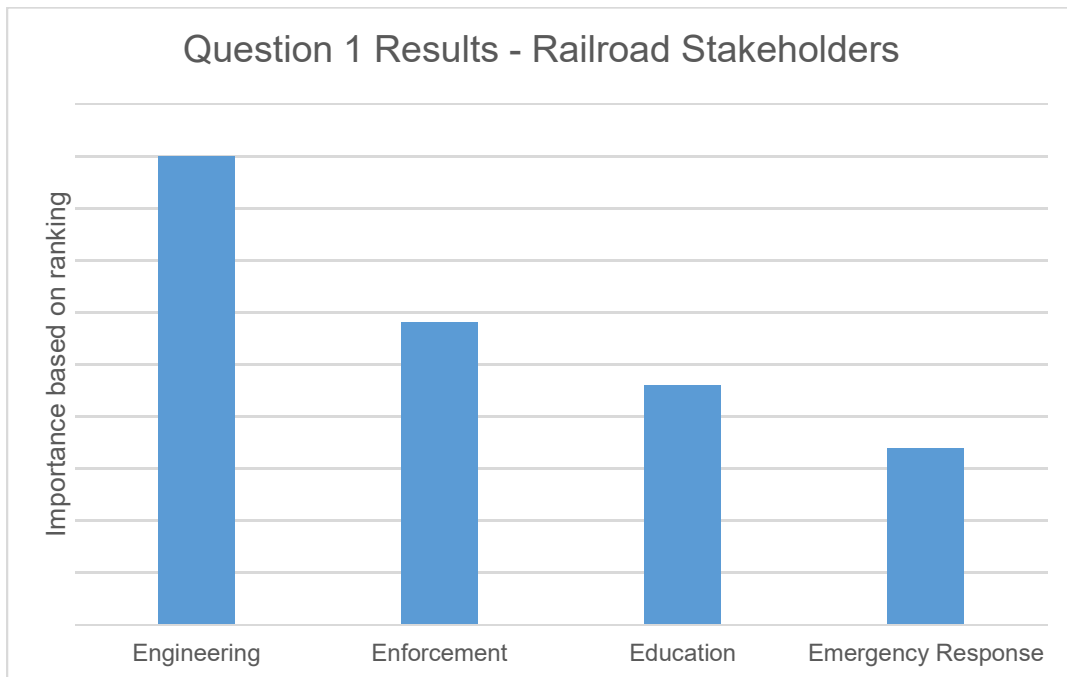
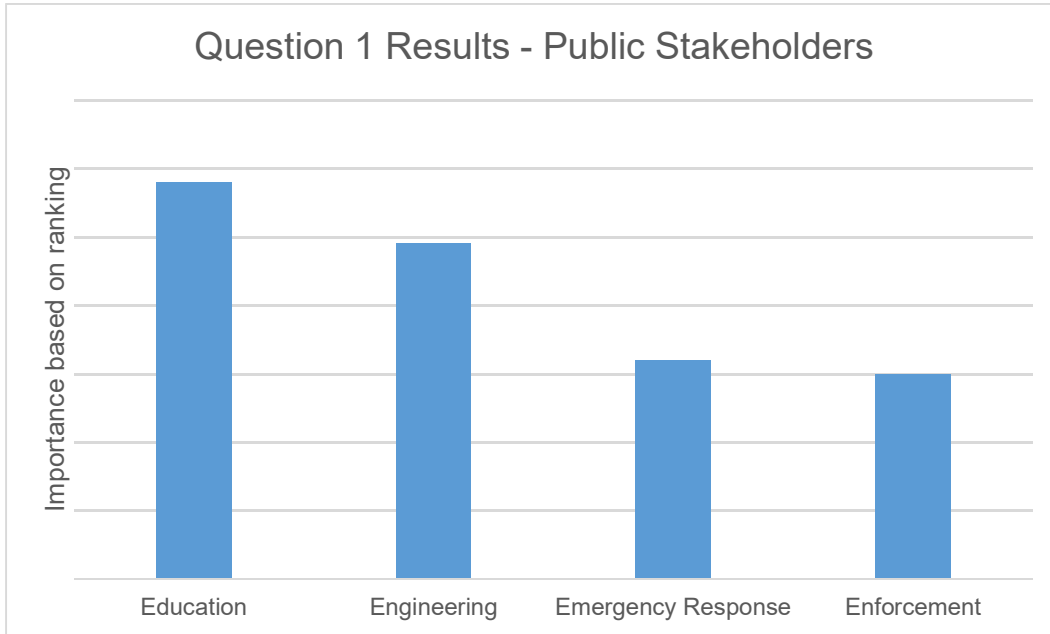
Following the polling, participants were asked to provide key locations throughout the state. Using an interactive ArcGIS map, each location was pinned with a comment on the identified location. These comments included, but were not limited to, frequently blocked crossings, low railroad bridge clearances, and at-grade crossings with safety concerns. A list and map of the locations noted by stakeholders is listed below.

¹ Invitees for the Southeast District attended other meetings after they were unable to attend the meeting scheduled specifically for their District.

Mentimeter Results

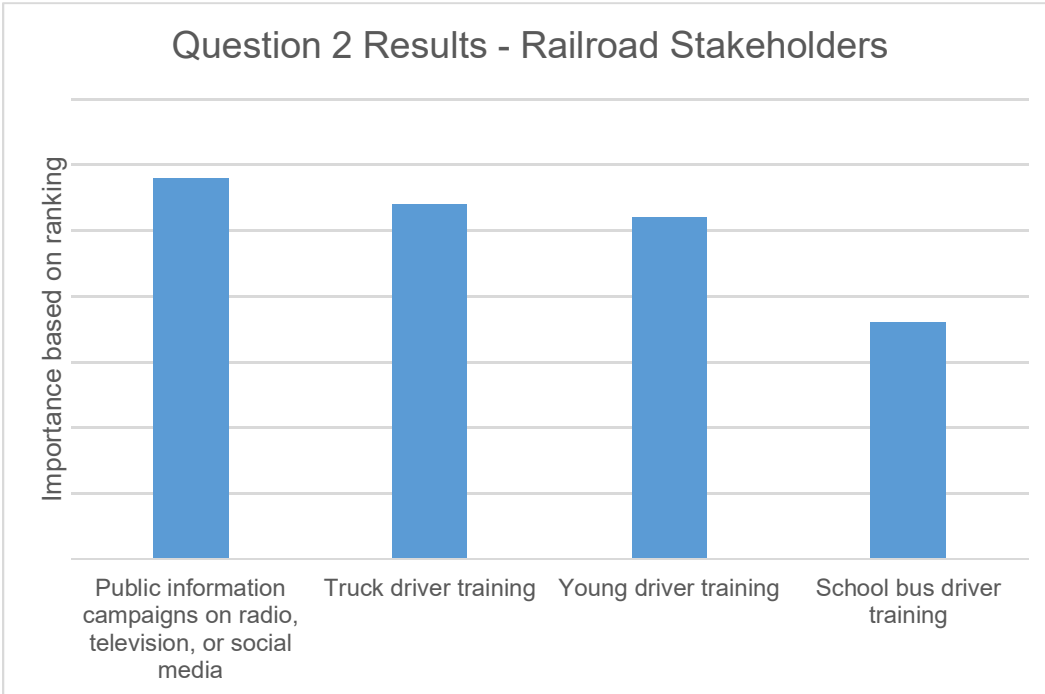
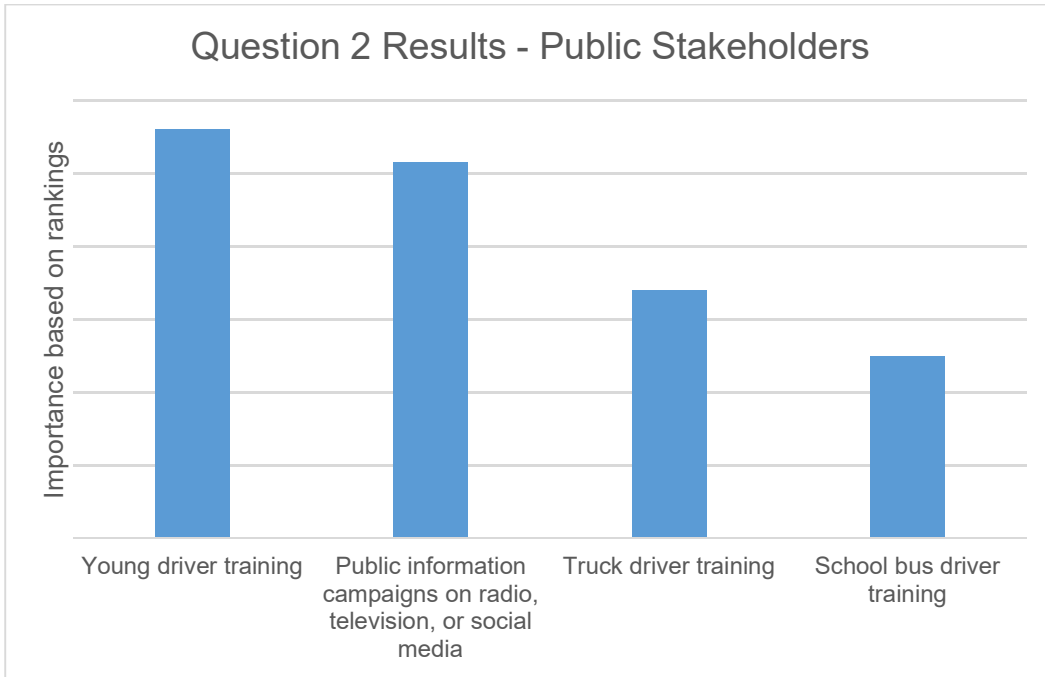
Question 1:

There are four primary transportation safety strategies: Education, Engineering, Enforcement, Emergency Response. Rank in order of importance to you:



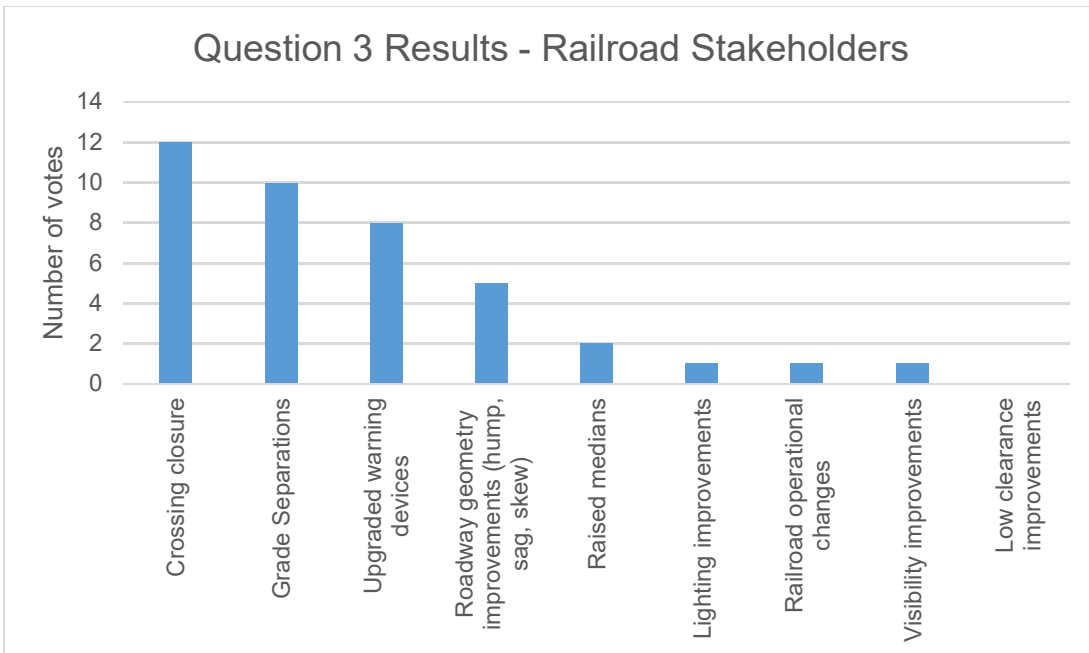
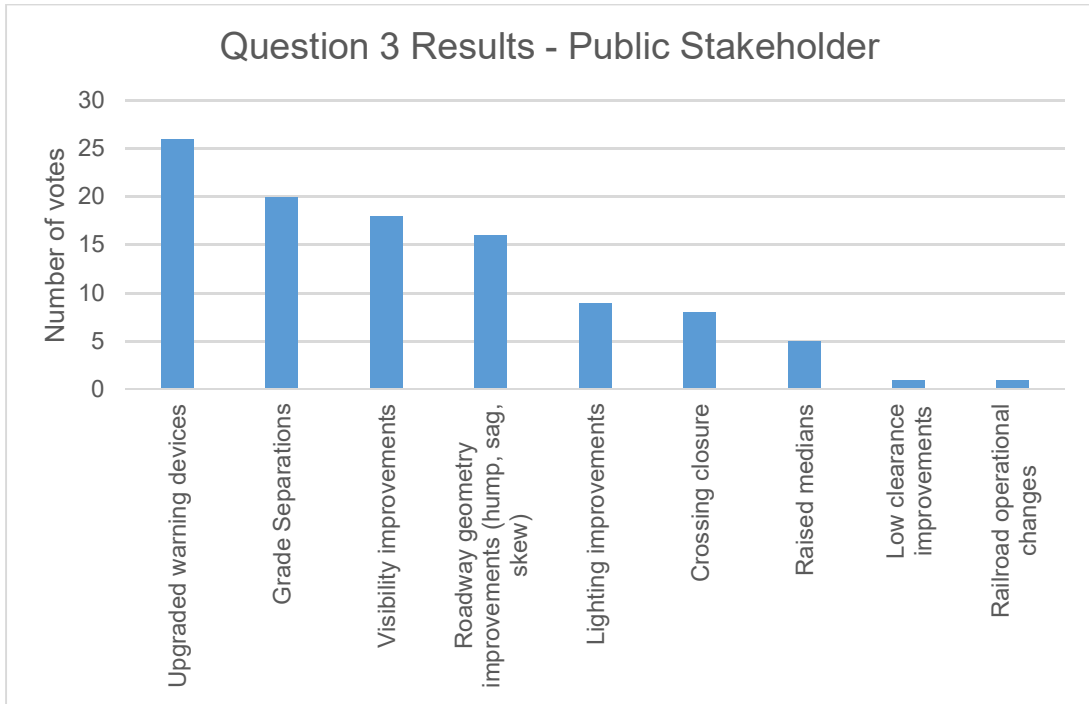
Question 2:

Please rank the topics by your assessment of past success of following Education strategies.



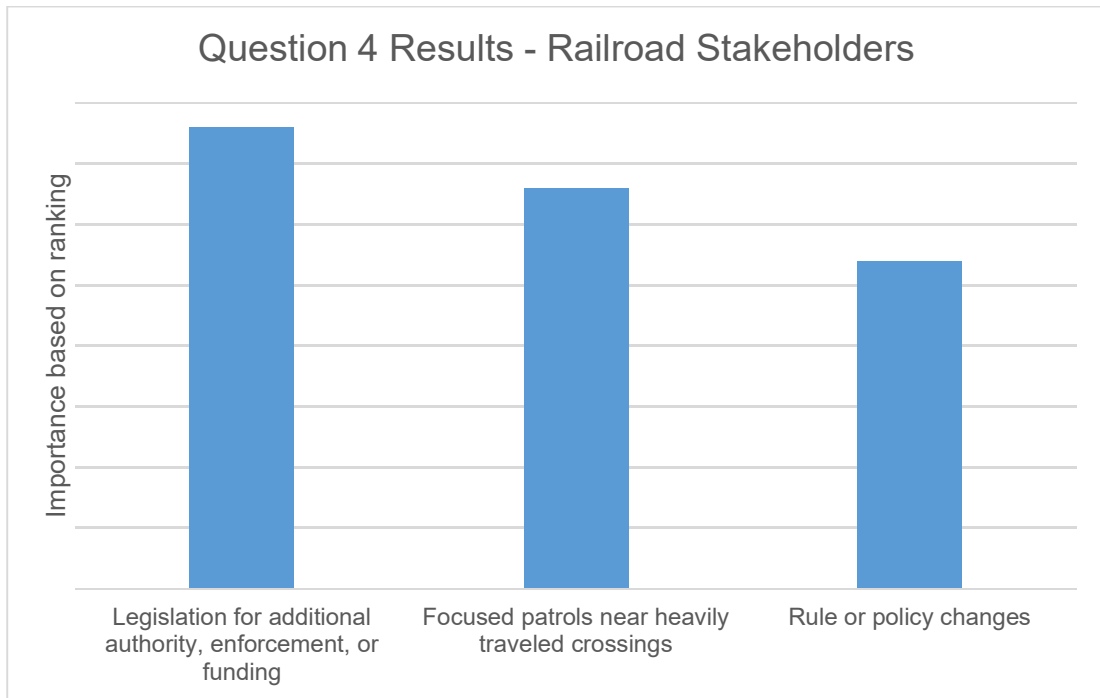
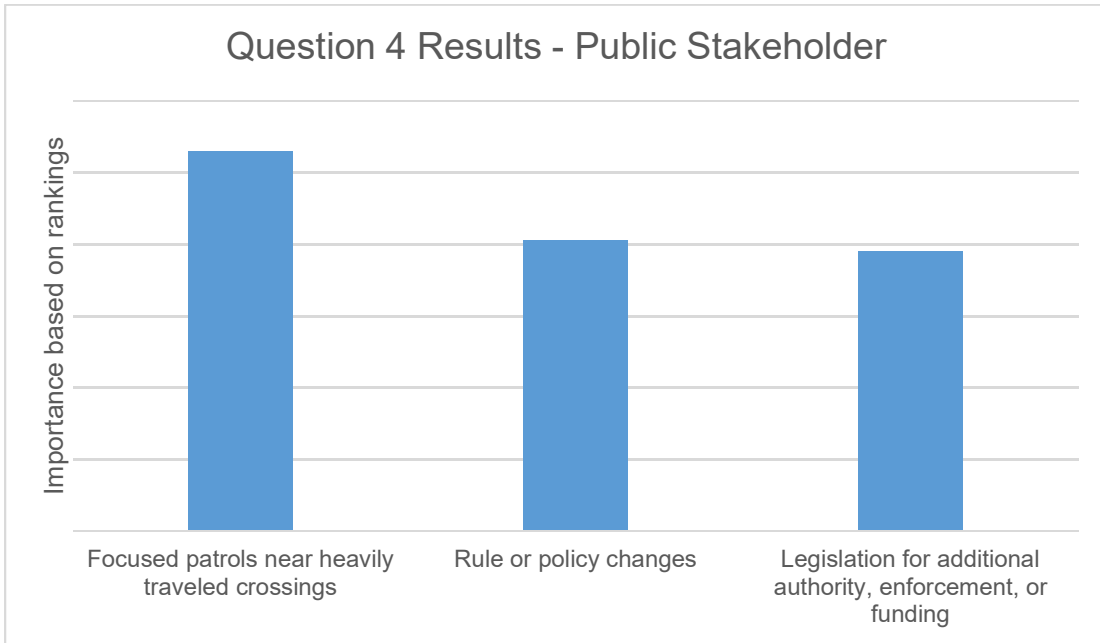
Question 3:

Please select your three most important Engineering strategies.



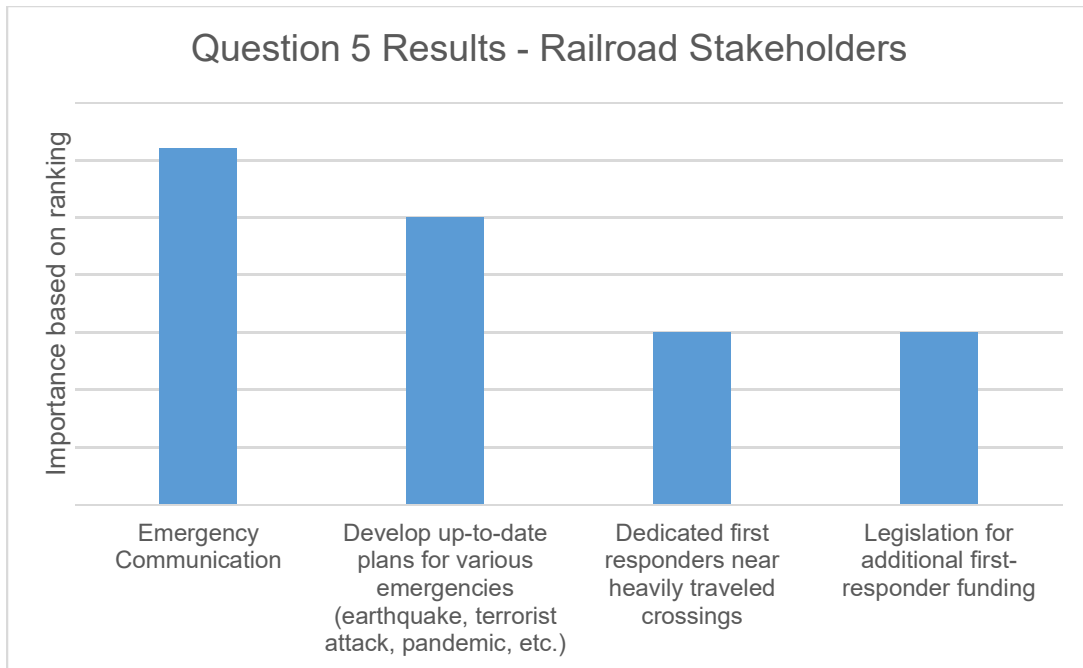
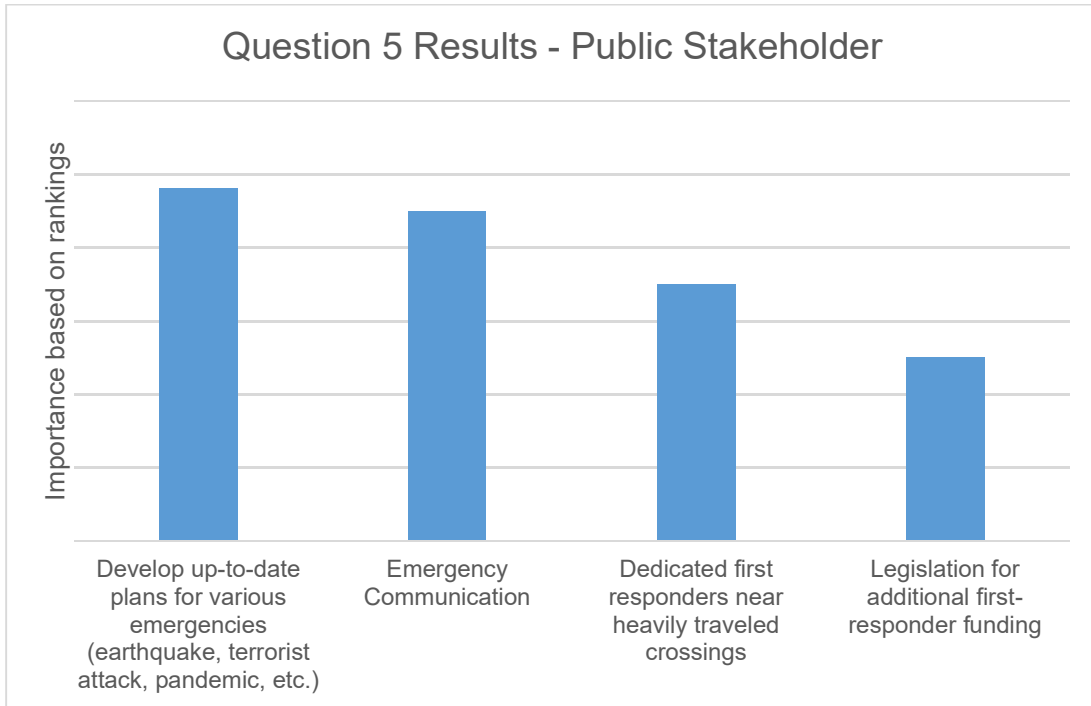
Question 4:

Please rank the importance to you of the following Enforcement strategies:



Question 5:

Please rank the importance to you of the following Emergency Response strategies.



Key Findings

Education

- PSA campaigns were a common choice for educational efforts. A Central District stakeholder noted that their organization sends newsletters and email blasts to educate their community. They also conduct one-on-one informational campaigns for smaller communities. Although this organization does not use mass standardized media, they have successful, relationship-based information campaigns. Some social media is also used to post educational information.
- Young driver education was another popular choice. Many stakeholders think that young driver training is vital as soon as possible, as gaining good driving habits early can make a long-term change. Stakeholders described the St. Louis area's Safety Blueprint program that provides high school students with educational classes. Adults may be more receptive to continued education through PSAs.
- The rail safety and school bus safety ads seem beneficial overall, but stakeholders felt it was tough to quantify success. In general, it is difficult to measure the success of crashes that do not occur.
- Operation Lifesaver (OL) is a non-profit organization that focuses on educating people about railroad safety. Several stakeholders have seen ads created by OL.
- Stakeholders reported that the St. Louis area has had some success encouraging people involved in minor crashes to relocate their vehicle to the shoulder. It started as a major media campaign (radio) and has moved to social media and streaming services. These platforms have hyper-focused audience targeting.

Engineering

- Crossing closures was the highest rated engineering solution for both railroad and public stakeholders. Grade separation was the second highest engineering solution for both stakeholders. The third most selected engineering choice was visibility improvements for public stakeholders and upgraded warning devices for the railroads.
- Sight lines were noted as a concern at several locations around Missouri. Intersection realignment/reconfiguration was mentioned as an ideal way to improve sight lines, particularly at intersection at skew angles and along curves. Additionally, stakeholders reported that some intersections are often blocked with brush (typically in railroad right-of-way) and other trains that may be parked on another adjacent track, especially at passive crossings.
- Lighting improvements were a well-received engineering improvement.
- Although an uncommon choice during the polling, railroad operational changes that may improve safety were discussed. Stakeholders indicated that shifting operations to off-peak times and/or decreasing interactions could enhance safety at crossings.
- Closing crossings can be beneficial, however stakeholders indicated that closures can negatively affect the highway/roadway and bring more traffic to other crossings. Stakeholders emphasized that it is important to keep heavily used pedestrian crossings open because pedestrians are unlikely to move to another crossing. Crossing closures

tend to be more widely accepted by the public when paired with improved adjacent crossings.

- Discussions suggested that raised medians may be a good option at active crossings to reduce the number of vehicles driving around the gates.
- Several regions noted low clearance bridges as issues. Typically these bridges were struck often, and/or did not allow truck passage. These bridges were noted within the interactive mapping tool.
- Many stakeholders noted that as money allows, a focus around curves and sharp grades (improving existing grade separated crossings, upgrading at-grade crossings) is ideal.

Enforcement

- Focusing patrols near heavily traveled crossings may help solidify the importance of safe driving. However, many communities do not have heavily traveled corridors, so this may not work in all regions of the state.
- A stakeholder mentioned that policy change pertaining to driving rules may confuse drivers.
- Some police officers have gone through the “Officer on a Train” program. A stakeholder noted that the program works well because officers are able to see the improper behavior of drivers and ticket them, and understand dangerous driving behavior from a locomotive engineer’s prospective.

Emergency Response

- Several stakeholders noted that their surrounding communities likely do not have (or have limited) emergency response plans in place, however it would be beneficial to add railroad communication or related incidents to their plans.
- Blocked railroad crossings may make it difficult to cross to the other side of the road. In many small communities (Pleasant Hill, Butler, etc.), parts of town are cut off from each other when a train is blocking an at-grade crossing. Stakeholders expressed concern especially if the emergency response vehicle/provider is blocked from getting to an incident. It was noted that adding “Blocked crossing. Use alternative route” signs may be beneficial to prohibit people from driving onto the rail track to move around vehicles and to limit congestion while waiting for a train to clear a crossing.
- Within the Kansas City area, emergency response plans have been difficult to create due to the coordination with the right people. Stakeholders suggested a good first step would be to get in touch with important stakeholders to begin creating emergency coordination plans.
- Cross-platform communication was reported to be a challenge. Trucks do not communicate with police radio and few people have access to communication with the railroad. A stakeholder stated that one does not realize the lack of communication until there is an event.

Mapping Location Comments

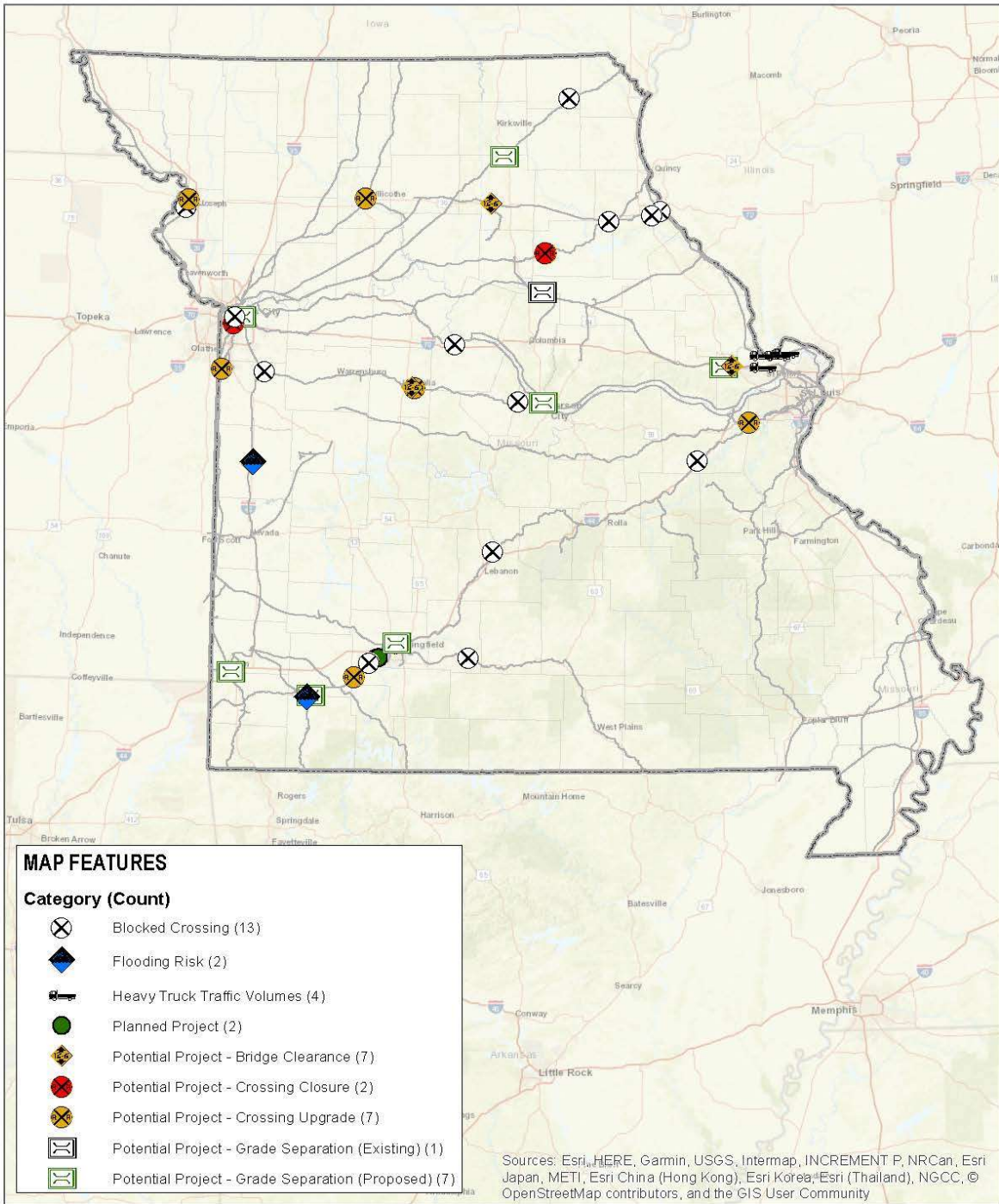
The following locations were noted by stakeholders, then generally categorized for reason of noteworthiness. Each location is listed below with a brief description. The map below shows each crossing comment location labeled based on its reasoning.

- **Pleasant Hill** – (*Blocked Crossing*)
 - MNA line can cut off southwest part of Pleasant Hill, limiting emergency response. Adjacent city has contract to help if incident is on other side of crossing.
- **Sterling Avenue, Independence** – (*Potential Project – Grade Separation (Proposed)*)
 - Several closely spaced crossings. There is a potential for a corridor upgrade centered on grade separation and closure of other at grade-crossings.
- **KCT near the Leeds Industrial Park, Kansas City** – (*Potential Project - Crossing Closure*)
 - This area has extremely low traffic volumes, and may be candidate for crossing closure.
- **663512X, 17th Street - Kansas City** – (*Blocked Crossing*)
 - This crossing has received several complaints about crossing being blocked.
- **329821T, 187th Street - Belton** – (*Potential Project - Crossing Upgrade*)
 - This is a humped crossing.
- **480656U/072688A, US-24 - Monroe City** – (*Blocked Crossing*)
 - US-24 carries high traffic volumes. There are two rail lines with multiple at-grade crossings throughout the city. This can create potential for conflict, especially with blocked crossings.
- **005040P, Mo-U - Gorin** - (*Blocked Crossing*)
 - Three roadways converge at this point, and trains tend to stop for long periods of time, which may block the intersection. Communication with the railroad has been difficult.
- **293374N, M-22 – Audrain County** – (*Potential Project - Grade Separation (Existing)*)
 - Grade separated crossing (narrow, steep bridge) along curve.
- **480609L – Main Street - Hannibal** – (*Blocked Crossing*)
 - This an at-grade crossing that is often blocked by trains. The adjacent bridge (grade separated) crossing is scheduled to be under construction soon, and this will be used as emergency path. Concerns about emergency access during blocked crossing.
- **480623G – Paris Gravel Road - Hannibal** – (*Blocked Crossing*)
 - At-grade crossing that is often blocked by trains. Restricts emergency access when blocked.
- **480711S, Marion Street - Madison** – (*Potential Project - Crossing Upgrade*)
 - Steep at-grade crossing. A trash truck had issues at crossing.
- **480712Y, Main Street - Madison** – (*Potential Project - Crossing Closure*)
 - Possible candidate for crossing closure.
- **005091A, Mo-156 - La Plata** – (*Potential Project - Grade Separation*)

- Possible candidate for grade separation, as crossing is often blocked.
- **US-36 Corridor - (Potential Project - Bridge Clearance)**
 - US-36 Corridor was noted for several low vertical clearance bridges.
- **063103Y, Alabama Street - St. Joseph – (Blocked Crossing)**
 - Heavily traveled train corridor, which causes congestion. Intersection improvements (corridor) may be possible within the next 3-5 years.
- **I-229, St. Joseph - (Potential Project - Crossing Upgrade)**
 - I-229 Study throughout the city limits. The study may have impact on 4th Street railroad crossing (removing double deck bridge and making it an at-grade crossing).
- **375513K, Ryan Lane - Chillicothe – (Potential Project - Crossing Upgrade)**
 - This crossing was recently closed due to poor bridge conditions. Traffic previously using crossing now diverted to two adjacent crossings. Safety checks will be completed at two adjacent crossings.
- **673163S, Mo- F - Sleeper – (Blocked Crossing)**
 - Several roads converge at crossing, and blocked crossing can split up town. May be candidate for realignment.
- **442149J, Rissler Road - Sedalia - Potential Project - (Crossing Upgrade)**
 - At-grade crossing located very close to highway.
- **442147V, US-50 - Sedalia – (Potential Project - Bridge Clearance)**
 - Low clearance grade separated crossing.
- **442247A, Monroe Street/Mo-NN - Centertown – (Blocked Crossing)**
 - At-grade crossing often blocked.
- **442464A, M-41 - Lamine – (Blocked Crossing)**
 - At-grade crossing with humped/steep configuration. Vehicles need to drive slowly over crossing. May be a candidate for grade separation.
- **442259U, Mo-179 - Jefferson City – (Potential Project - Grade Separation (Proposed))**
 - Heavily traveled corridor with expansion to north. May be candidate for grade separation.
- **Nursery Street - Butler – (Potential Project - Bridge Clearance)**
 - Low clearance, grade separated crossing. Trucks do not fit. May be able to improve with additional signing.
- **443069U, W. Fort Scott Street - Butler – (Potential Project - Bridge Clearance)**
 - Low clearance, grade separated crossing. Trucks often strike bridge. May be able to improve with additional signing.
- **443067F, Pine Street - Butler – (Flooding Risk)**
 - At-grade crossing that is known for flooding.
- **664162L, Grant Avenue - Springfield – (Potential Project - Bridge Clearance)**
 - Low clearance, grade separated crossing. Trucks cannot fit under bridge.
- **664158W, Washington Avenue - Springfield – ((Potential Project - Bridge Clearance)**
 - Low clearance, grade separated crossing. Trucks cannot fit under bridge.
- **673274J, Mo-MM - Springfield – (Planned Project)**
 - Programmed grade separated crossing

- **Farm Rd 103, Springfield – (Planned Project)**
 - Programmed grade separated crossing
- **330061B, 32nd Street - Joplin – (Potential Project - Grade Separation (Proposed))**
 - At-grade crossing with heavy truck traffic. Area is expected to see additional development, which will likely increase existing truck traffic.
- **673297R, Lambeth Road – Christian County – (Potential Project - Crossing Upgrade)**
 - Skewed at-grade crossing adjacent to US-60 Highway. Visibility issues noted.
- **673280M, Main Street - Republic – (Blocked Crossing)**
 - At-grade crossing along heavily traveled road. Crossing is often blocked, causing congestion.
- **667659L, Main Street - Seymour – (Blocked Crossing)**
 - At-grade crossing along heavily traveled road. Crossing is often blocked, causing congestion.
- **Jefferson Avenue, Springfield – (Potential Project - Grade Separation (New))**
 - Not-in-use pedestrian bridge is often struck by trains. City does have funds to modify bridge.
- **673327F, Chapel Drive - Monett – (Potential Project - Grade Separation (Proposed))**
 - City is interested in funding a grade separated crossing. Industrial development is anticipated to the south of the at-grade crossing.
- **Downtown Monett – (Flooding Risk)**
 - Downtown Monett (near 1st & Front St) is frequently flooded. Nearby rail line may also see frequent flooding.
- **442732H, I-44/US-66 - Pacific – (Potential Project – (Crossing Upgrade))**
 - Passive at-grade crossing that may be candidate for upgrade.
- **Wentzville, South of I-70 – (Potential Project - Grade Separation (Proposed))**
 - Several crossings noted within Wentzville. Further information about crossings in City Master Plan.
- **904562U, Mid Rivers Mall Drive - St. Peters – (Heavy Truck Traffic Volumes)**
 - At-grade crossing with heavy traffic, including industrial truck traffic.
- **068775W, Mo-C – St. Charles County – (Heavy Truck Traffic Volumes)**
 - At-grade crossing with heavy industrial truck traffic.
- **068788X, Seeburger Road - St. Charles County – (Heavy Truck Traffic Volumes)**
 - At-grade crossing with heavy industrial truck traffic.
- **664386J, Elliott Street - Stanton – (Blocked Crossing)**
 - At-grade crossing that is often blocked by trains (found 6 reports in blocked crossing inventory). Restricts emergency access when blocked.
- **068793U, Mo-94 - Orchard Farm – (Heavy Truck Traffic Volumes)**
 - At-grade crossing with heavy amounts of agriculture truck traffic.
- **483523M, Luetkenhaus Boulevard - Wentzville – (Potential Project - Bridge Clearance)**
 - Grade separated crossings with low clearance.

Stakeholder Noteworthy Locations



DATA SOURCES: MODOT, FRA, NTAD, ESRI

Public & Railroad Meeting Comments
MoDOT SAP



MoDOT SAP

FIGURE 1

Closing Remarks

Stakeholders were encouraged to contact MoDOT with additional information on crossings that was not captured at the meetings. MoDOT staff noted examples like locations where rear-end collisions (vehicle-vehicle) at a crossing because they do not show up on FRA incident reports. Additionally, “humped” crossings locations are of interest, especially if trucks or low-boys are getting stuck. Any additional comments regarding potential project locations or concerns were requested to be relayed to MoDOT staff.

Meeting Dates

Monday, July 26, 2021 at 9:00am for Kansas City District
Monday, July 26, 2021 at 2:30pm for Northeast District
Tuesday, July 27, 2021 at 9:00am for Southeast District
Tuesday, July 27, 2021 at 1:30pm for Northwest District
Thursday, July 29, 2021 at 9:00am for Railroad Partners
Tuesday, August 3, 2021 at 10:00am for Central District
Tuesday, August 3, 2021 at 2:30pm for Southwest District
Wednesday, August 4, 2021 at 10:00am for St. Louis District

APPENDIX B: *Survey Summary*

Missouri Highway-Railroad Grade Crossing State Action Plan

Stakeholder Survey Summary

Overview

The online stakeholder survey was created to provide the Missouri Department of Transportation (MoDOT) insights into how to develop a State Action Plan that benefits all stakeholders. Stakeholders were asked questions regarding the state railroad system and to provide feedback at specific rail crossing locations. MoDOT incorporated the feedback provided by the public through the survey into the pool of comments obtained throughout the public involvement process.

The survey was embedded in an ArcGIS StoryMap. The StoryMap provided stakeholders with the study background, goals, and an infographic related to grade crossing statistics for Missouri. The survey used the Survey123 tool to collect responses.

The survey was emailed by MoDOT staff to the follow targeted groups:

- Transportation Partners
- Highway Safety Group (includes Law Enforcement)
- Missouri Operation Lifesaver

The survey link was also included in MoDOT's internal staff newsletter and the Motor Carrier Services newsletter. There were 119 total stakeholder responses. The following sections note key information obtained from the survey.

Survey Questions

The survey asked six questions regarding the Missouri railroad system, including information about the four E's (Engineering, Education, Enforcement, and Emergency Response). All questions ranked the importance of specific strategies regarding each of the four E's.

The following figures show the results of the survey data. Prompted questions are written above each of the results. The graphics were created based on a weighted poll, i.e.: a first place ranking was worth the most points and last place was worth the least amount of points. Since a weighted poll is used, no value is shown on the vertical axis; the magnitude of the bars should be viewed relative to one another. Several questions included "other" as an answer. These were not counted with the other responses; however, other comments from the survey were recorded.

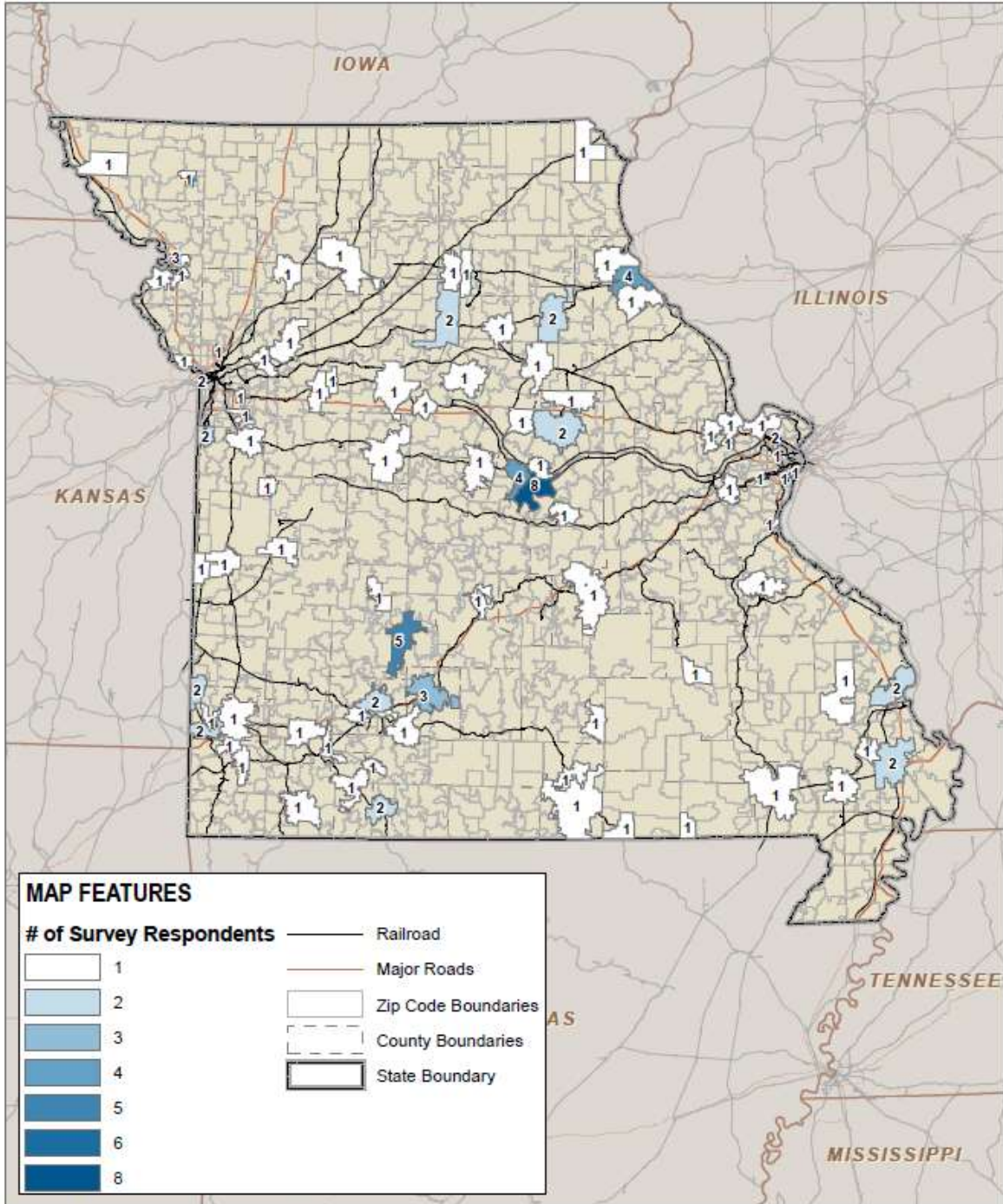
Map Interaction

Following the survey questions, stakeholders were asked to provide key locations throughout the state. Using an interactive ArcGIS map, stakeholders were able to select locations and add input. They were also able to use a text format to provide input. These comments included, but were not limited to, frequently blocked crossings, low railroad bridge clearances, and at-grade crossings with safety concerns. A list and map of the locations noted by stakeholders is listed below. Overall, there were 109 locations noted.

Survey Participant Information

Survey participants were asked to provide the zip code they reside in and their type of work. Figure 1 shows the areas within the state where participants reside. Table 1 displays the participant place of work. The data shows participants were from 90 counties, providing a wide range of data and input from across the state.

Figure 1: Survey Participants (by zipcode)



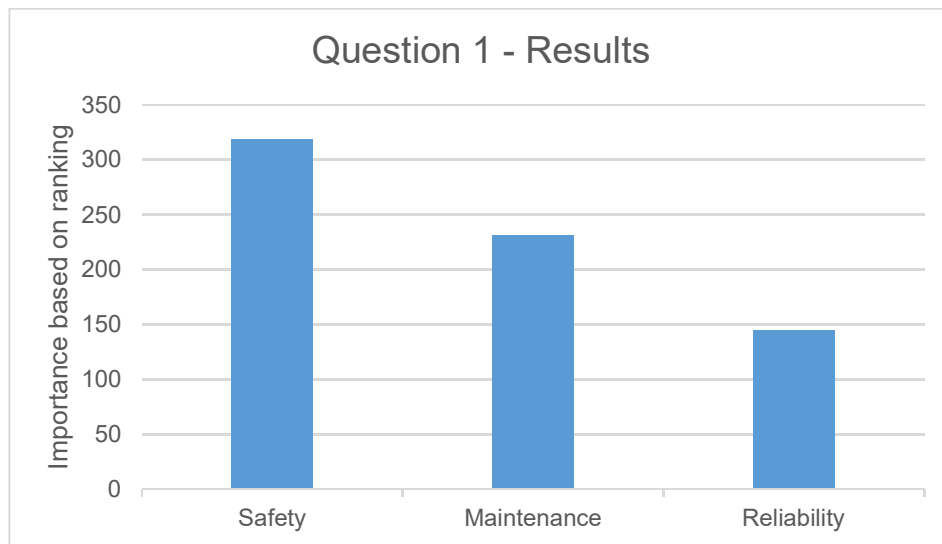
DATA SOURCES: MODOT, MSDIS, NTAD, ESRI

Table 1. Survey Respondent's Place of Work

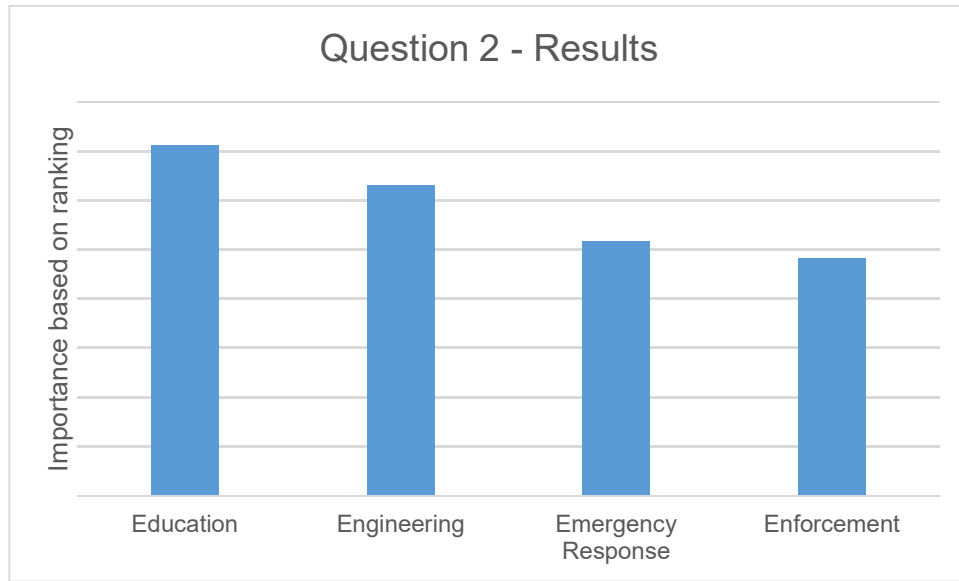
Place of Work	Number of Participants
School District	56
Planning	37
Law Enforcement	11
Other	7
Railroad	3
Trucking	1
No Response	4

Survey Results

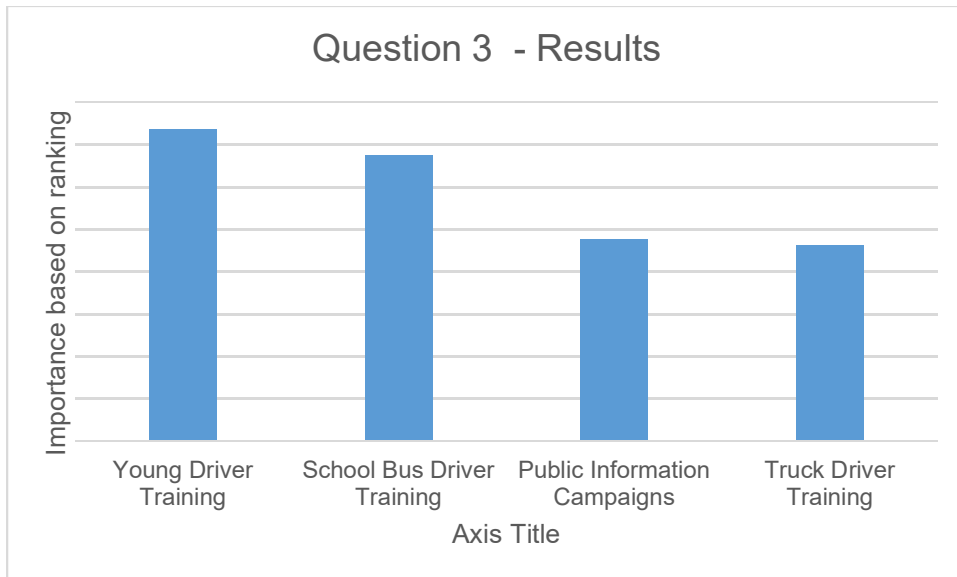
Question 1: What is of most importance to you of the following goal areas for the State Action Plan?



Question 2: There are four primary areas of focus in developing safety strategies for transportation systems: Education, Engineering, Enforcement, Emergency Response. What is the most important focus area to you?

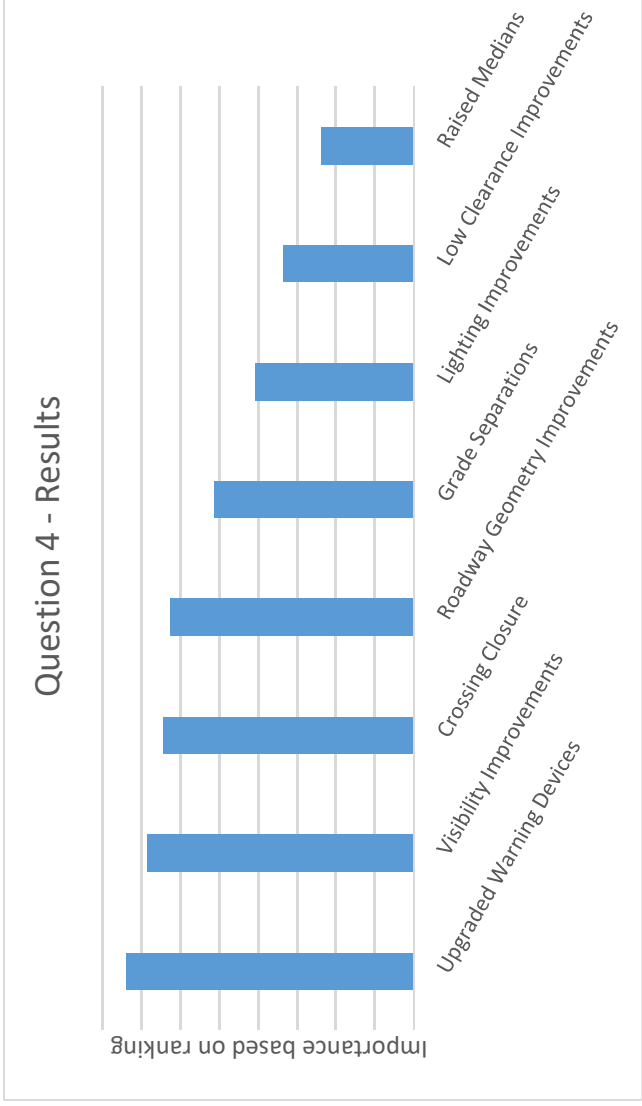


Question 3: Please rank the importance to you of the following Education strategies: young driver training, school bus driver training, public information campaigns, truck driver training.

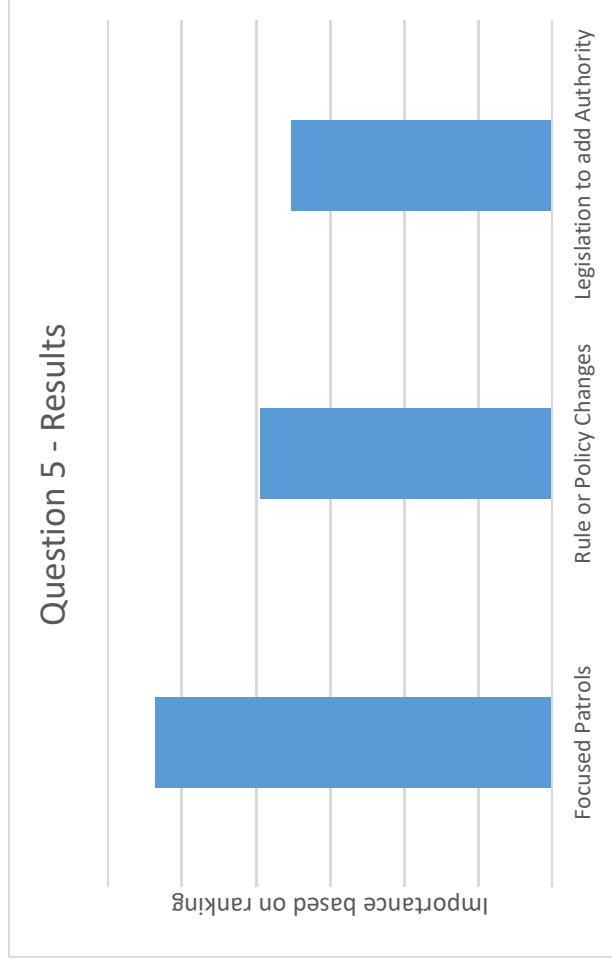


Young driver and school bus driver training was rated highly within the survey data. Roughly half of the survey respondents were from the school district, which may have skewed the data. However, because of the high turnout, this shows the emphases for safety related to these two drivers.

Question 4: Please rank the importance to you of the following Engineering strategies: crossing closure, grade separations, roadway geometry improvements, visibility improvements, low clearance improvements, upgraded warning devices, lighting improvements, raised medians, other.

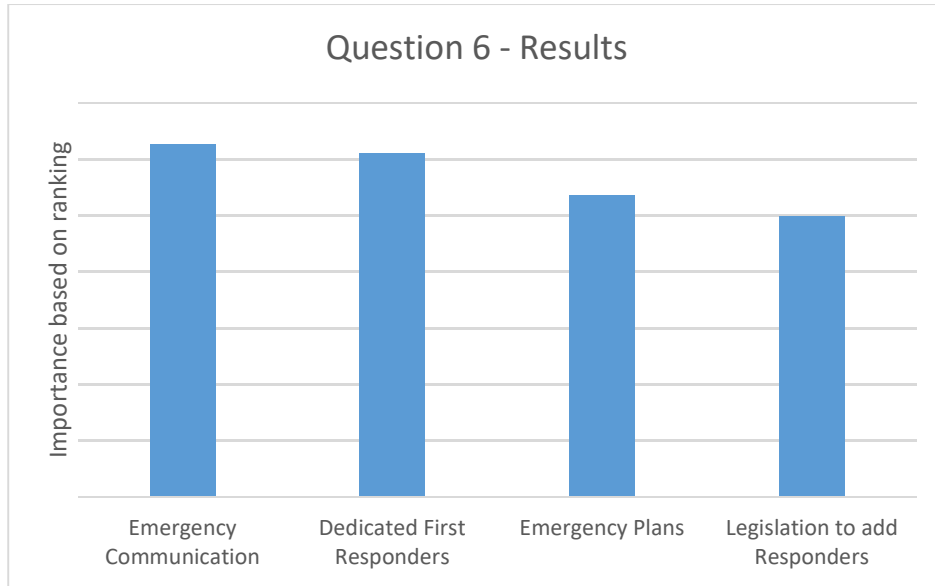


Question 5: Please rank the importance to you of the following Enforcement strategies: focused patrol, rule or policy changes, legislation to add authority.



Question 6:

Please rank the importance to you of the following Emergency Response strategies: legislation add responders, dedicated first responders, emergency communication, emergency plans, other.



Other Comments

- Additional comments on types of Education/training:
 - In school training (elementary, middle school, high school)
 - Older driver training
 - Engineer training
 - Local and volunteer responders training
- Additional comments on types of Engineering Solutions:
 - Fix erosion issues
 - Eliminating at-grade crossings
 - Eliminating double/adjacent tracks. It can be confusing when one gate is raised after train passes, yet adjacent gate is closed.
 - Eliminate humped crossings.
 - Lighting would be beneficial at all crossings.
 - Create crossing exemptions for school buses at crossings no longer in use. Several crossings in Central Mo (near Kingdom City) have inactive tracks (asphalted over with trees growing in track), yet are still considered active. Because of this, school buses are still required to stop.
- Additional comments:
 - Additional funding to eliminate at-grade crossings
 - Coordinate with railroad companies to make changes.
 - Greater authority to railroad special agents to enforce traffic grade crossing violations
 - Enforcement around crossings, monitoring similar to DWI traffic stops.
 - Enforcement is not viable strategy.

Mapping Location Comments

Table 2 lists the most frequently reported comment locations. Twelve locations were listed two or more times. These crossings were reviewed further, and the table shows information regarding the crossings with multiple concerns. The locations are identified on Figure 2.

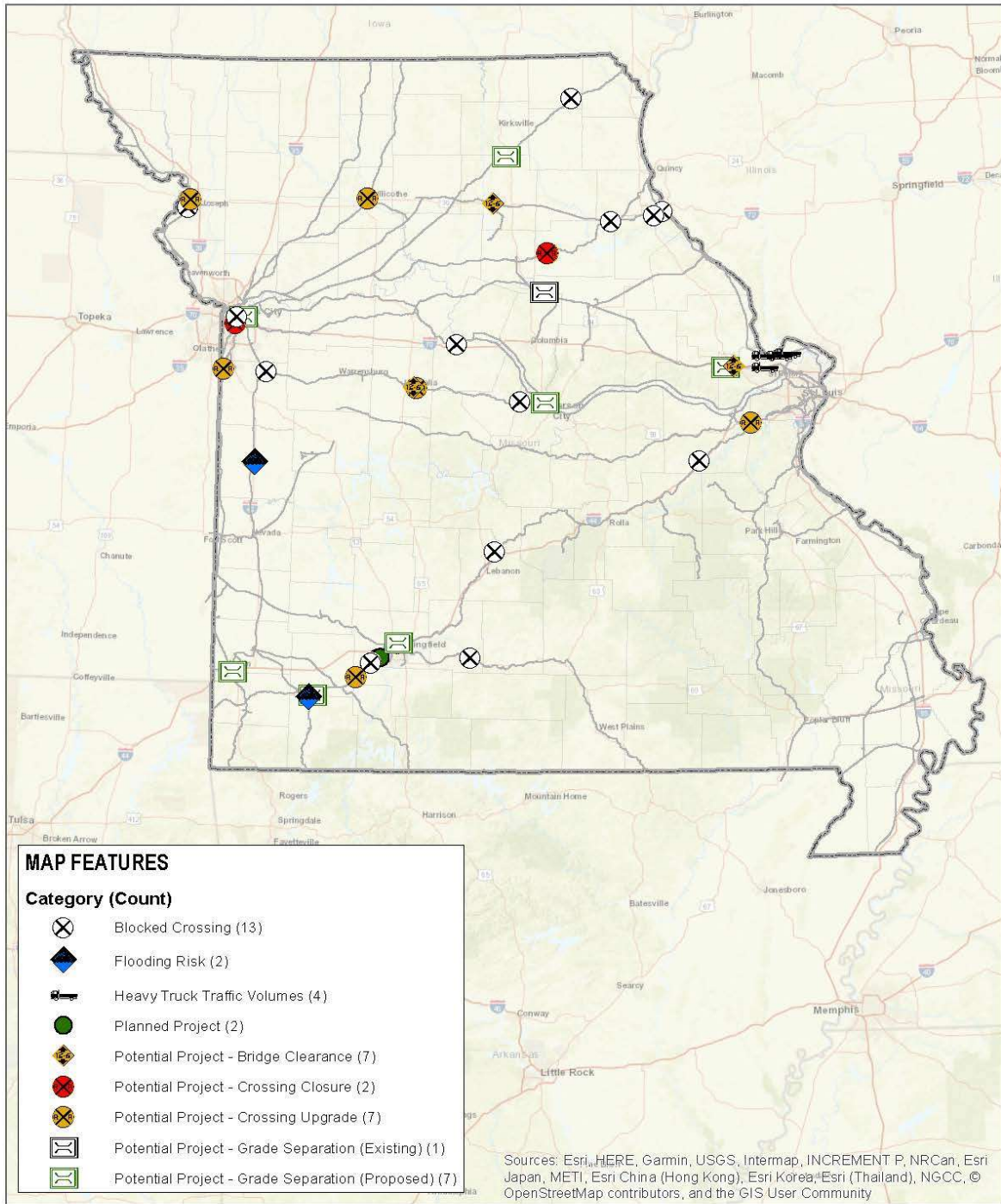
Table 2: Crossings with Two or More Concerns

Crossing ID	Frequency of Comment	Location	Concern
063103Y*	3	Alabama Street <i>St. Joseph</i>	This is a heavily traveled train corridor within a primarily industrial area, which can cause congestion.
375513K	2	Ryan Lane <i>Chillicothe</i>	This crossing was recently closed due to poor bridge conditions. Traffic previously using crossing now diverted to two adjacent crossings.
442439S	2	MO-H <i>Nelson</i>	Crossing is often blocked.
480616W**	3	Lindell Avenue <i>Hannibal</i>	Crossing is often blocked.
480617D**	4	Warren Barrett <i>Hannibal</i>	Crossing is often blocked.
667623D	2	Porter Crossing Road <i>Rogersville</i>	Humped crossing with close proximity to US-60.
673163S**	2	MO-JJ & MO-F <i>Sleeper</i>	Crossing is often blocked.
673237G*	2	Webster Lane <i>Marshfield</i>	Passive crossing with limited visibility to the north due to the curvature of the track.
673257T	2	Mo-125 <i>Strafford</i>	Crossing very close to highway. Confusing intersection configuration.
673274J	2	Brookline Ave <i>Springfield</i>	Project programmed with STIP funding. MoDOT may seek additional grant funds for project.
673280M	2	Main Ave <i>Republic</i>	At-grade crossing along heavily travelled road. Crossing is often blocked, causing congestion.
673327F**	2	Farm Road 1090 <i>Monett</i>	City is interested in funding a grade separated crossing, as it is commonly blocked. Industrial development is anticipated to the south of the at-grade crossing.

* One or more crashes occurred at the crossing between 2016 – 2020

** Crossing appeared one or more times on FRA Blocked Crossing list

Figure 2. Location of Comments from Public and Railroad Stakeholder Meetings



DATA SOURCES: MODOT, FRA, NTAD, ESRI

APPENDIX C: *Data Corrections*

Data Corrections

One crossing (427308B) was recoded to crossing (446427L) because it was originally coded incorrectly to a crossing outside of Missouri.

Several incidents were coded as the operating railroad instead of the owning railroad, or the railroad name has changed. The following changes were implemented within the analysis.

- 445895C: From Amtrak (ATK) to Union Pacific (UP)
- 442839K: From ATK to UP
- 445945D: From ATK to UP
- 442797B: From ATK to UP
- 441933V: From ATK to UP
- 414072Y: From ATK to UP
- 005352X: From ATK to UP
- 005372J: From ATK to UP

APPENDIX D:
*Multiple Incident Locations
Summary Sheets*

Missouri State Action Plan

Multiple Incident
Locations
July 2021

TranSystems

EXPERIENCE | Transportation



Multiple Incident Locations

Crossing Number	Number of Incidents	Street Name	County	Railroad	Public or Private?	Incident Year(s)	Roadway ADT	Number of Trains (per day)	Warning Device
005373R	2	Courtney Rd	Jackson	BNSF	Public	2018	50	58	Active
063103Y	2	Alabama St	Buchanan	BNSF	Public	2018, 2020	7817	32	Active
293289Y	2	RD 577	Audrain	KCS	Public	2016, 2017	10	6	Passive
330195A	2	Simmons Feed Mill	McDonald	KCS	Private	2016, 2018	1	15	Passive
422975F	2	East 103rd St	Jackson	UP	Public	2020	3100	21	Active
424975M	2	Sutton Blvd	St. Louis	UP	Public	2018, 2019	1402	24	Active
432886R	2	Southwest Lower Lake Rd	Buchanan	UP	Public	2018, 2020	5510	1	Passive
442780X	2	Market St/MO B	Franklin	UP	Public	2020	180	23	Active
442839K	2	Private Industry	Moniteau	UP	Private	2020	1	22	Passive
445895C	2	Private	St. Louis	UP	Private	2016	1	7	Passive
483529D	2	Wacky Rd	St. Charles	NS	Private	2017, 2019	0	7	Passive
663904Y	2	Private	Ste Genevieve	BNSF	Private	2018	0	4	Passive
664178H	2	Mustard Way	Greene	BNSF	Public	2017, 2020	50	1	Passive
665539N	2	Gettings Ln	Pemiscot	BNSF	Public	2017, 2020	456	4	Passive
665596C	2	CO Rd 635	New Madrid	BNSF	Public	2016, 2020	30	4	Passive
667024H	3	Washington St	Barry	AM	Public	2018, 2020	480	2	Passive
673312R	2	McNatt Ave	Lawrence	BNSF	Public	2016	1550	0	Active
787959F	2	East Laclede St	Dunklin	UP	Public	2018, 2019	3630	16	Active
789096Y	2	Zimmerman Ln	Stoddard	UP	Public	2018	1	16	Passive
803351T	2	Buchanan Hall	St. Louis	TRRA	Public	2016, 2020	300	20	Passive

Multiple Incident Locations

Crossing Number	Number of Incidents	Street Name	County	Railroad	Public or Private?	Incident Year(s)	Roadway ADT	Number of Trains (per day)	Warning Device
005373R	2	Courtney Rd	Jackson	BNSF	Public	2018	50	58	Active
063103Y	2	Alabama St	Buchanan	BNSF	Public	2018, 2020	7817	32	Active
293289Y	2	RD 577	Audrain	KCS	Public	2016, 2017	10	6	Passive
330195A	2	Simmons Feed Mill	McDonald	KCS	Private	2016, 2018	1	15	Passive
422975F	2	East 103rd St	Jackson	UP	Public	2020	3100	21	Active
424975M	2	Sutton Blvd	St. Louis	UP	Public	2018, 2019	1402	24	Active
432886R	2	Southwest Lower Lake Rd	Buchanan	UP	Public	2018, 2020	5510	1	Passive
442780X	2	Market St/MO B	Franklin	UP	Public	2020	180	23	Active
442839K	2	Private Industry	Moniteau	UP	Private	2020	1	22	Passive
445895C	2	Private	St. Louis	UP	Private	2016	1	7	Passive
483529D	2	Wacky Rd	St. Charles	NS	Private	2017, 2019	0	7	Passive
663904Y	2	Private	Ste Genevieve	BNSF	Private	2018	0	4	Passive
664178H	2	Mustard Way	Greene	BNSF	Public	2017, 2020	50	1	Passive
665539N	2	Gettings Ln	Pemiscot	BNSF	Public	2017, 2020	456	4	Passive
665596C	2	CO Rd 635	New Madrid	BNSF	Public	2016, 2020	30	4	Passive
667024H	3	Washington St	Barry	AM	Public	2018, 2020	480	2	Passive
673312R	2	McNatt Ave	Lawrence	BNSF	Public	2016	1550	0	Active
787959F	2	East Laclede St	Dunklin	UP	Public	2018, 2019	3630	16	Active
789096Y	2	Zimmerman Ln	Stoddard	UP	Public	2018	1	16	Passive
803351T	2	Buchanan Hall	St. Louis	TRRA	Public	2016, 2020	300	20	Passive

The highlighted line indicates a closed crossing.

Multiple Incident Locations

Crossing Number	Number of Incidents	Street Name	County	Railroad	Public or Private?	Incident Year(s)	Roadway ADT	Number of Trains (per day)	Warning Device
005373R	2	Courtney Rd	Jackson	BNSF	Public	2018	50	58	Active
063103Y	2	Alabama St	Buchanan	BNSF	Public	2018, 2020	7817	32	Active
293289Y	2	RD 577	Audrain	KCS	Public	2016, 2017	10	6	Passive
330195A	2	Simmons Feed Mill	McDonald	KCS	Private	2016, 2018	1	15	Passive
422975F	2	East 103rd St	Jackson	UP	Public	2020	3100	21	Active
424975M	2	Sutton Blvd	St. Louis	UP	Public	2018, 2019	1402	24	Active
432886R	2	Southwest Lower Lake Rd	Buchanan	UP	Public	2018, 2020	5510	1	Passive
442780X	2	Market St/MO B	Franklin	UP	Public	2020	180	23	Active
442839K	2	Private Industry	Moniteau	UP	Private	2020	1	22	Passive
445895C	2	Private	St. Louis	UP	Private	2016	1	7	Passive
483529D	2	Wacky Rd	St. Charles	NS	Private	2017, 2019	0	7	Passive
663904Y	2	Private	Ste Genevieve	BNSF	Private	2018	0	4	Passive
664178H	2	Mustard Way	Greene	BNSF	Public	2017, 2020	50	1	Passive
665539N	2	Gettings Ln	Pemiscot	BNSF	Public	2017, 2020	456	4	Passive
665596C	2	CO Rd 635	New Madrid	BNSF	Public	2016, 2020	30	4	Passive
667024H	3	Washington St	Barry	AM	Public	2018, 2020	480	2	Passive
673312R	2	McNatt Ave	Lawrence	BNSF	Public	2016	1550	0	Active
787959F	2	East Laclede St	Dunklin	UP	Public	2018, 2019	3630	16	Active
789096Y	2	Zimmerman Ln	Stoddard	UP	Public	2018	1	16	Passive
803351T	2	Buchanan Hall	St. Louis	TRRA	Public	2016, 2020	300	20	Passive

★ Scheduled for upgrade in 2022

The highlighted lines indicate an upgraded crossing.

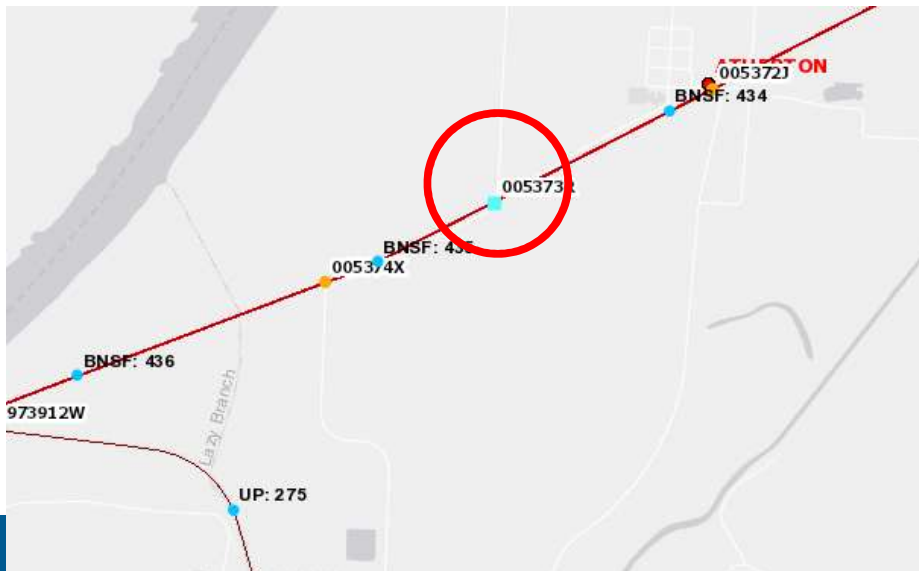
Incident Location – 005373R

General Information

- ▶ Courtney Road (Public)
- ▶ Active Warning Devices
- ▶ 2 Incidents
 - 2018 – Preceded gates (uninjured)
 - 2018 – Train struck unoccupied vehicle (uninjured)



Google Streetview, 2008



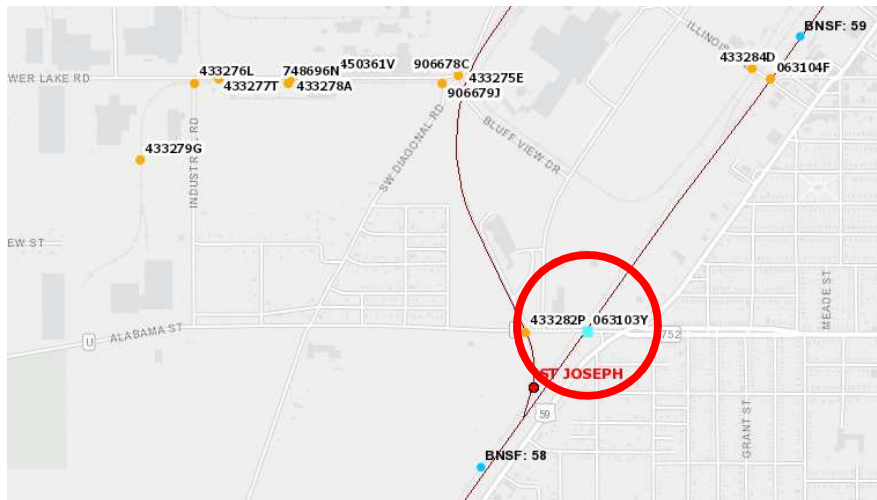
Incident Location – 063103Y

General Information

- ▶ Alabama Street (Public)
- ▶ Active Warning Devices
- ▶ 2 incidents
 - 2018 – Preceded gates (uninjured)
 - 2020 – Went around gate (uninjured)



Google Streetview, 2019



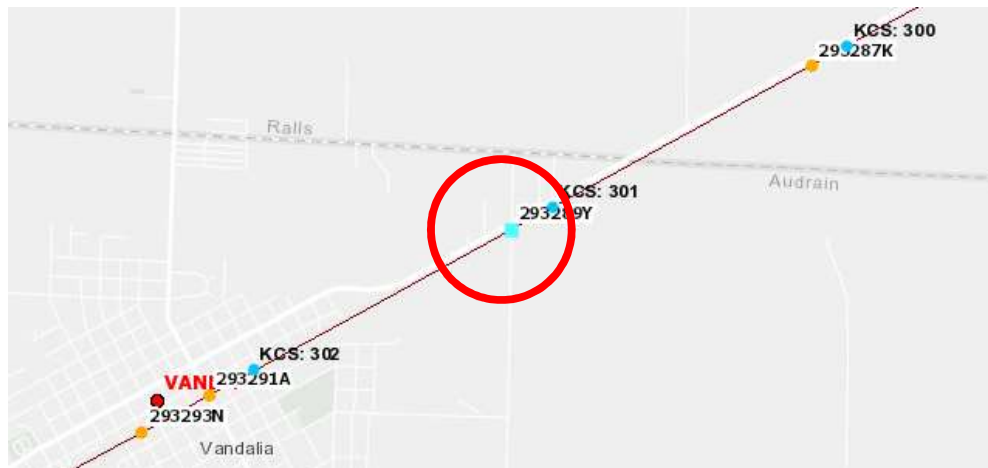
Incident Location – 293289Y

General Information

- ▶ RD 577 (Public)
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2016 – Vehicle slid on ice when stopping (injured)
 - 2017 – Failure to yield (injured)



Google Streetview, 2018



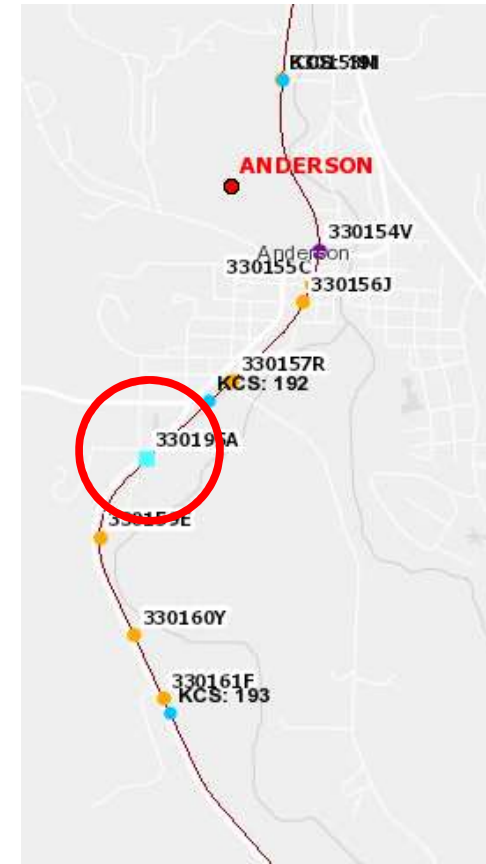
Incident Location – 330195A

General Information

- ▶ Simmons Feed Mill (Private)
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2018 – Semi-truck fouling track (injured)
 - 2019 – Failure to yield (uninjured)



Google Streetview, 2018



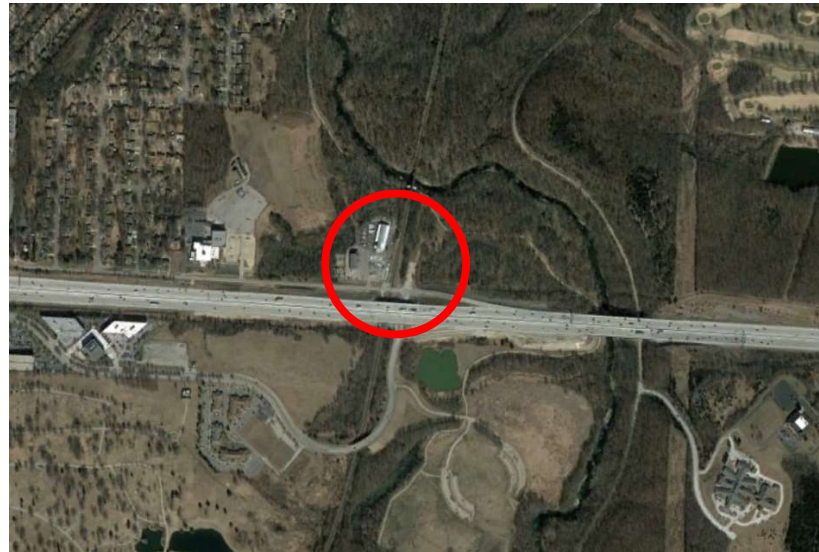
Incident Location – 422975F

General Information

- ▶ East 103rd Street (Public)
- ▶ Active Warning Devices
- ▶ 2 incidents
 - 2020 – Stopped on crossing (uninjured)
 - 2020 – Abandoned vehicle on tracks (uninjured)



Google Streetview, 2019



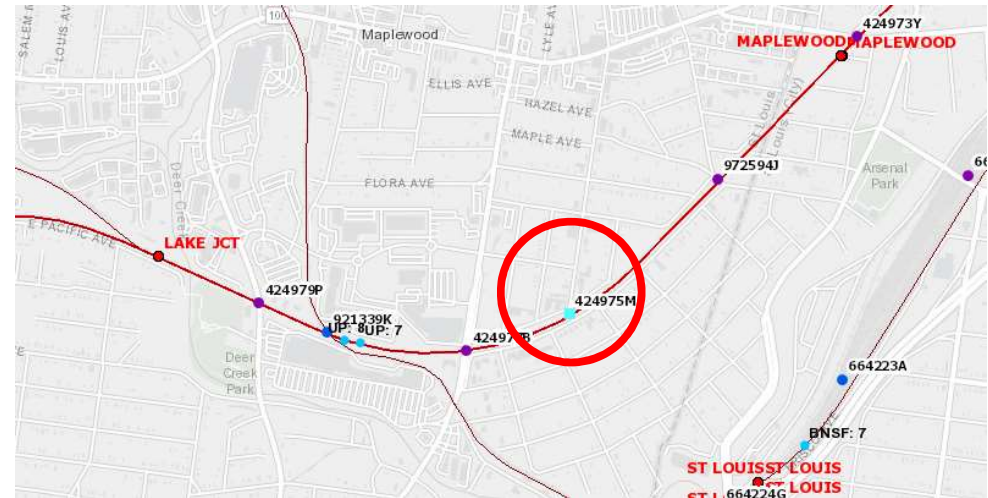
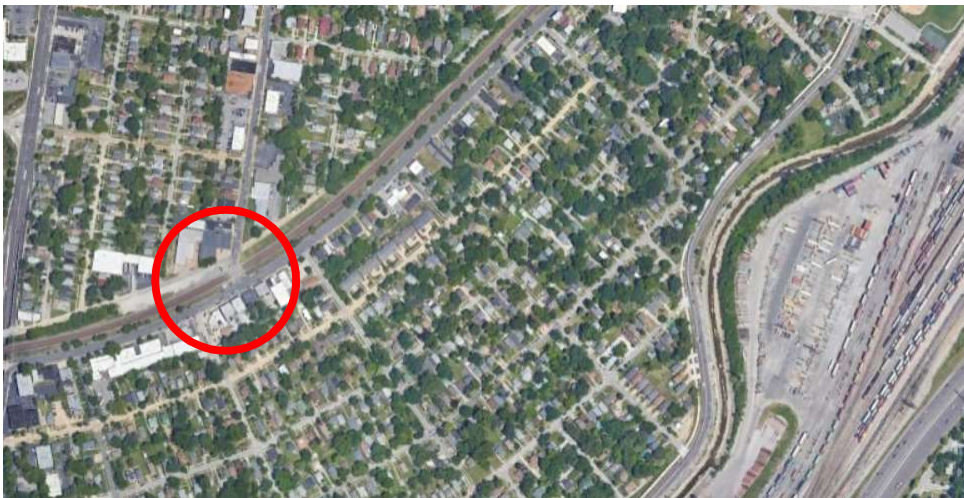
Incident Location – 424975M

General Information

- ▶ Sutton Boulevard (Public)
- ▶ Active Warning Devices
- ▶ 2 incidents
 - 2018 – Stopped on crossing (uninjured)
 - 2019 – Stopped on crossing (uninjured)



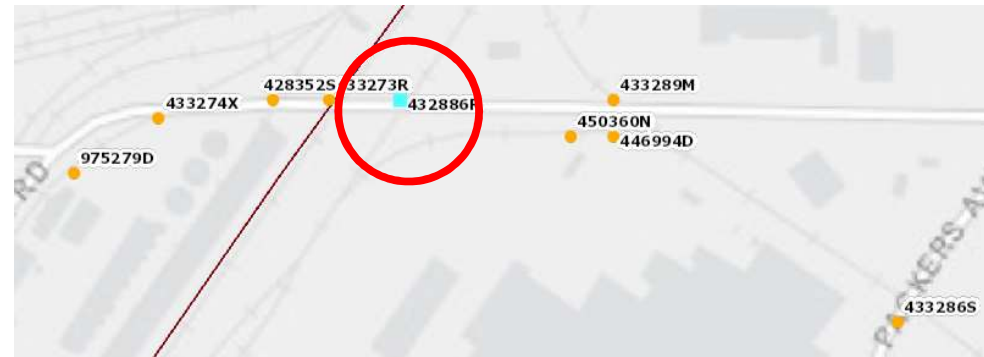
Google Streetview, 2019



Incident Location – 432886R

General Information

- ▶ Southwest Lower Lake Road (Public)
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2018 – Did not stop (uninjured)
 - 2020 – Did not stop (uninjured)



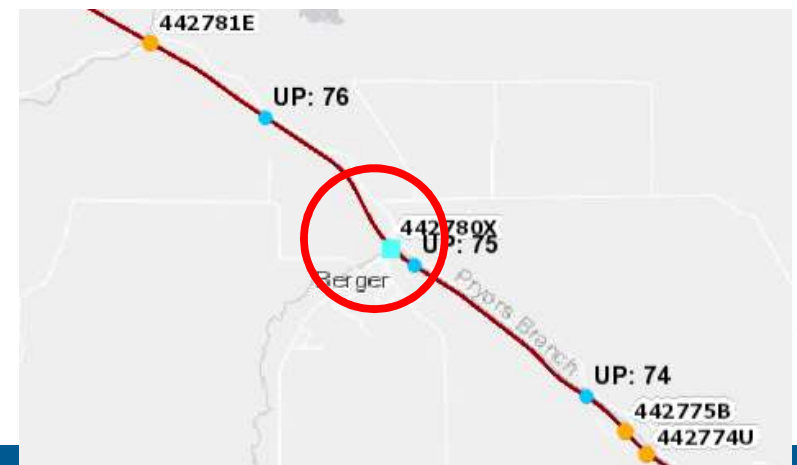
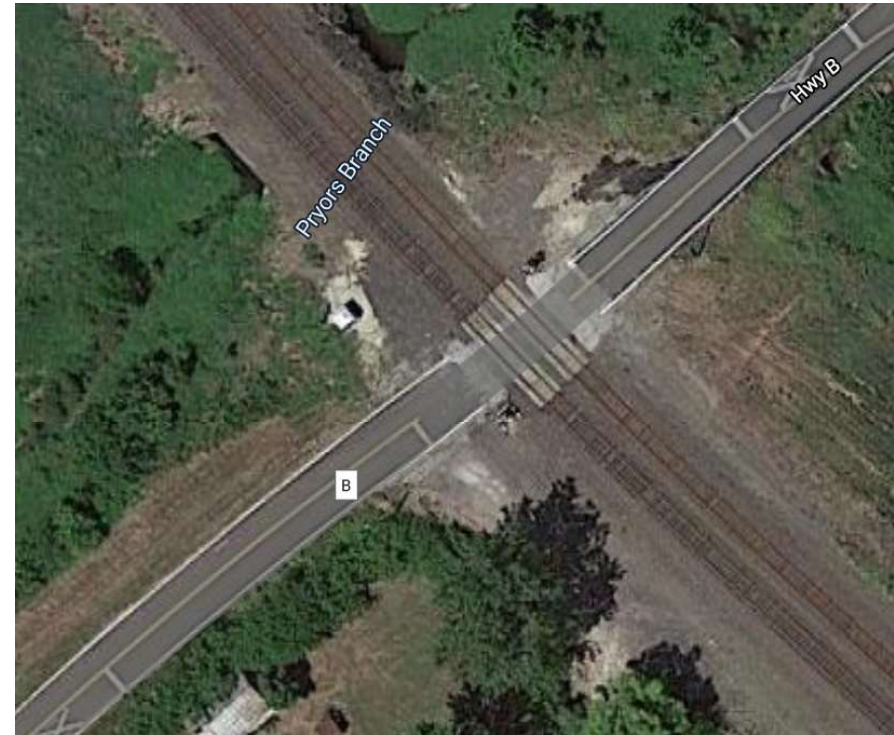
Google Streetview, 2019



Incident Location – 442780X

General Information

- ▶ Market Street/MO B (Public)
- ▶ Active Warning Devices
- ▶ 2 incidents
 - 2020 – Stopped on crossing (uninjured)
 - 2020 – Went around gate (fatality)



Incident Location - 442839K

General Information

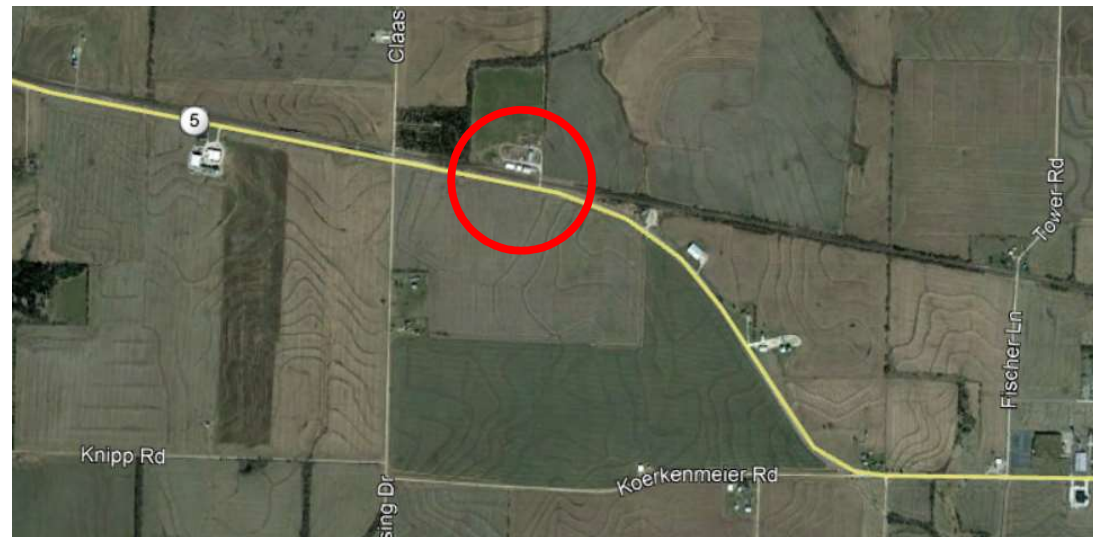
- ▶ Private Crossing
- ▶ Passive Warning Device
- ▶ 2 incidents

2020 – Did not stop (uninjured)

2020 – Train struck lowboy trailer (uninjured)



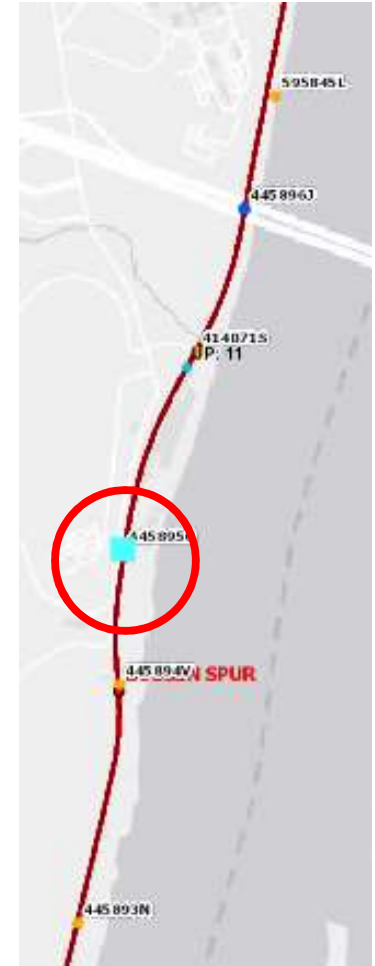
Google Streetview, 2019



Incident Location – 445895C

General Information

- ▶ Private
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2016 – Train struck rear of tractor-trailer (uninjured)
 - 2016 – Failure to yield (injured)



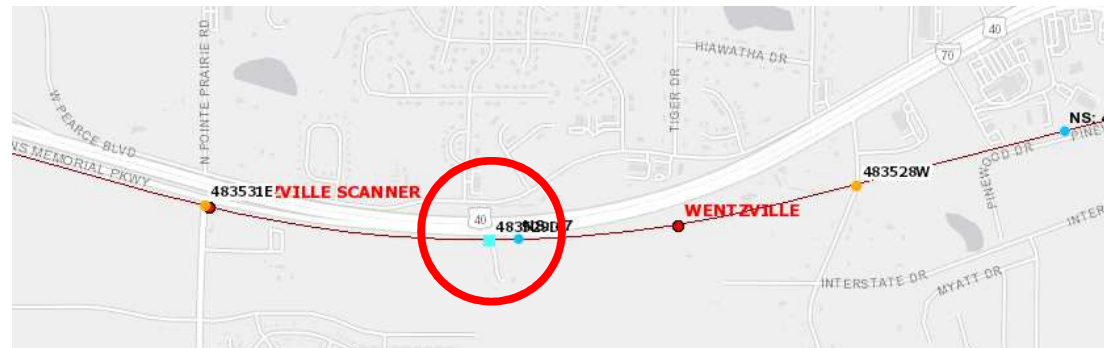
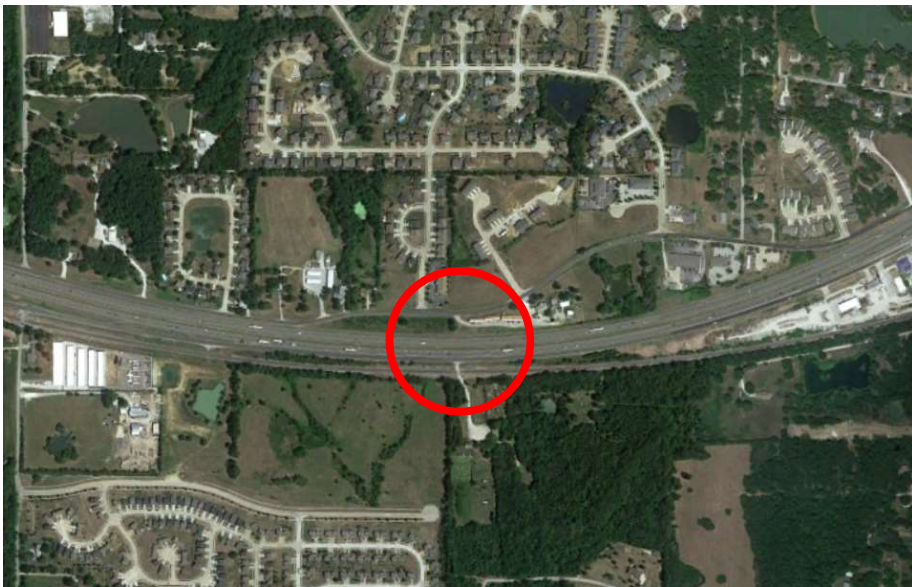
Incident Location – 483529D

General Information

- ▶ Wacky Road (Private)
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2017 – Vehicle struck train (uninjured)
 - 2019 – Vehicle struck train (uninjured)



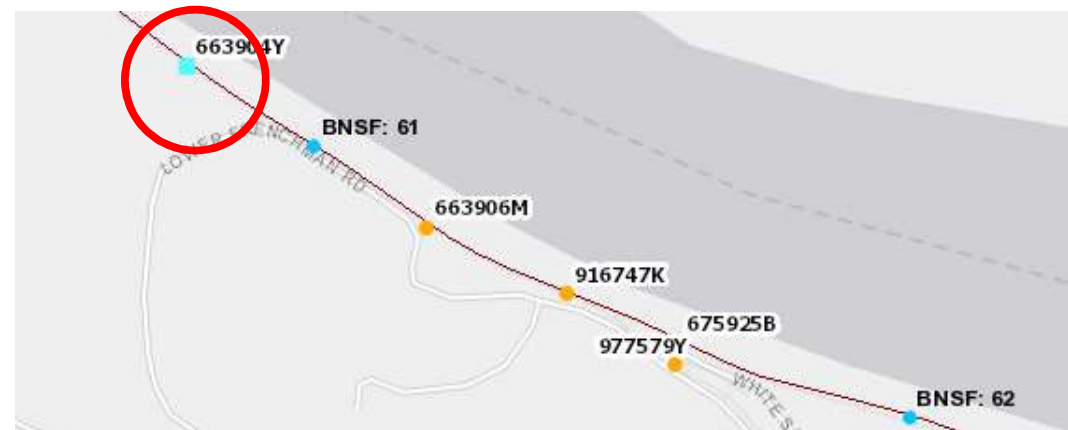
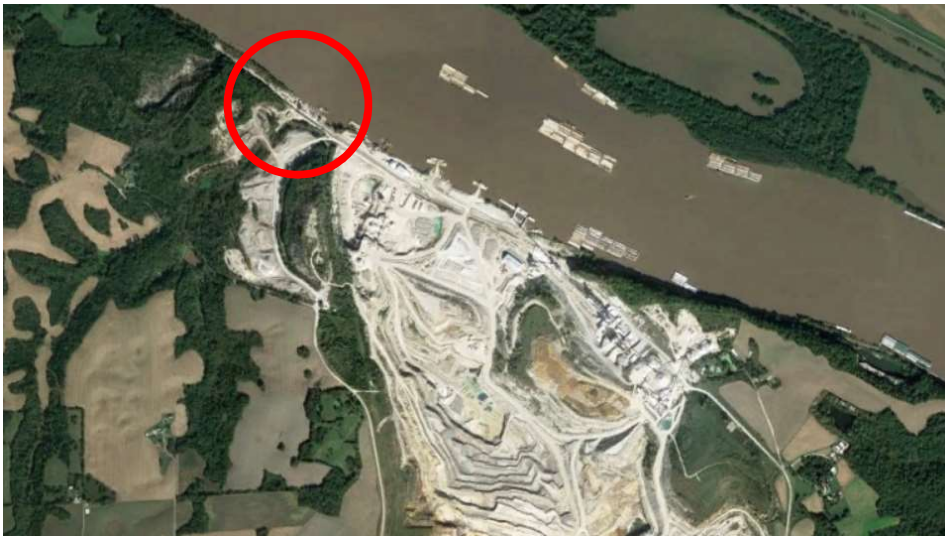
Google Streetview, 2015



Incident Location – 663904Y

General Information

- ▶ Private
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2018 – Failure to yield (uninjured)
 - 2018 – Failure to yield (uninjured)



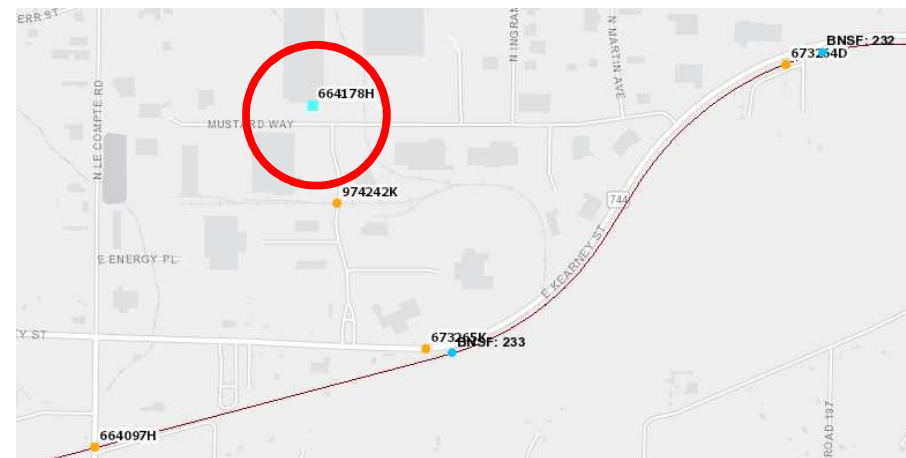
Incident Location – 664178H

General Information

- ▶ Mustard Way (Public)
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2017 – Did not stop (injured)
 - 2020 – Vehicle struck train (uninjured)



Google Streetview, 2019



Incident Location – 665539N

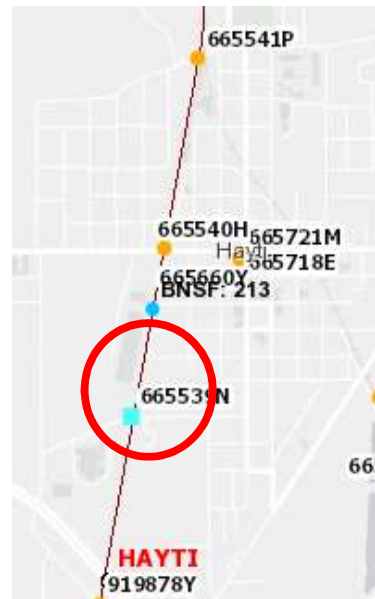
General Information

- ▶ Gettings Lane (Public)
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2017 – Failure to yield (injured)
 - 2020 – Failure to yield (fatality)



Google Streetview, 2012

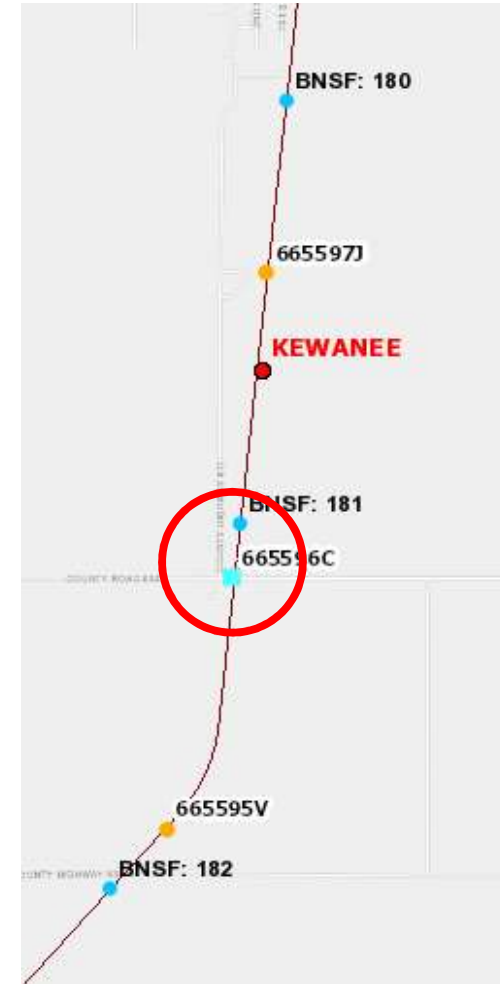
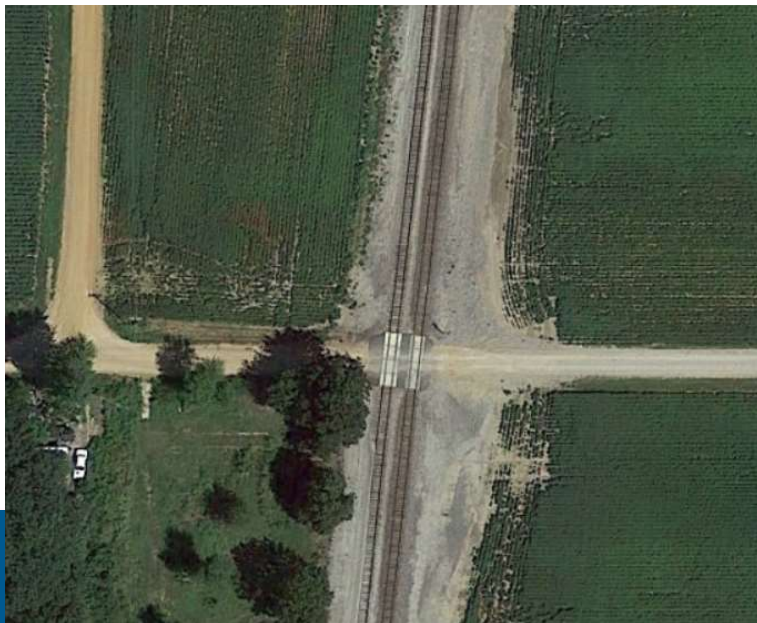
- Scheduled for active warning devices upgrade in 2022



Incident Location – 665596C

General Information

- ▶ CO Rd 635 (Public)
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2016 – Failure to yield (uninjured)
 - 2020 – Stopped then proceeded (injured)



Incident Location – 667024H

General Information

- ▶ Washington Street (Public)
- ▶ Passive Warning Devices
- ▶ 3 incidents
 - 2018 – Stopped then proceeded (uninjured)
 - 2018 – Failure to yield (injured)
 - 2020 – Stopped on crossing (fatality)



- Upgraded to active warning devices October 2020

Google Streetview, 2016



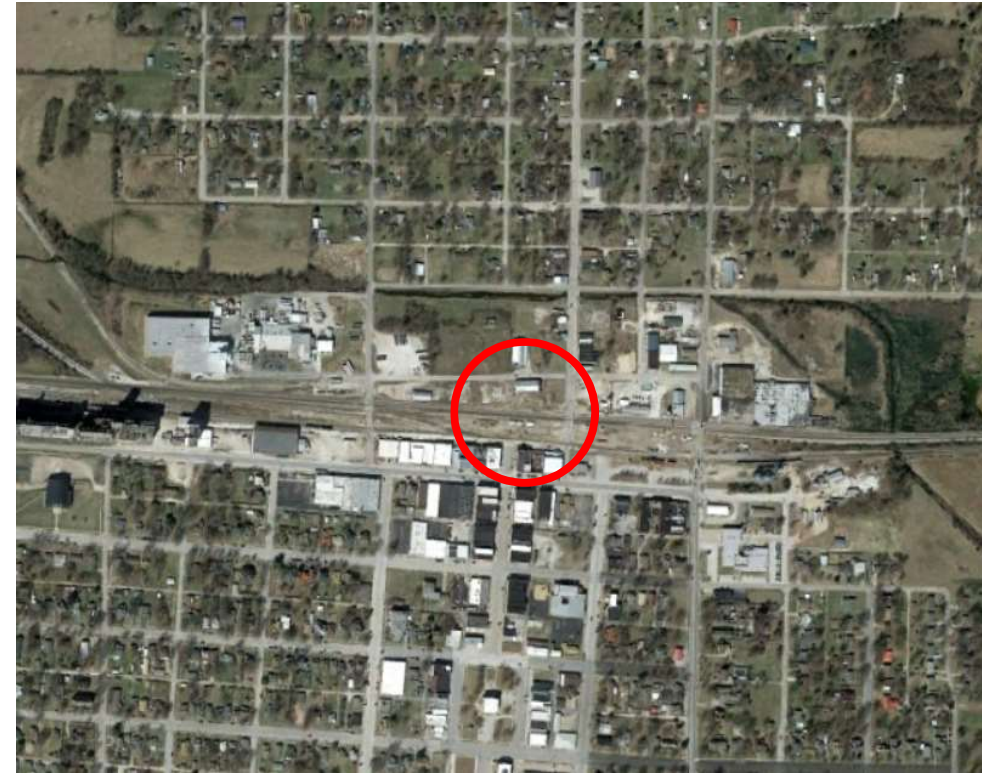
Incident Location – 6733 I 2R

General Information

- ▶ McNatt Avenue (Public)
- ▶ Active Warning Devices
- ▶ 2 incidents
 - 2016 – Pedestrian walked around gate (uninjured)
 - 2016 – Train struck unoccupied vehicle (uninjured)



Google Streetview, 2013



- Crossing Closed in 2018/2019

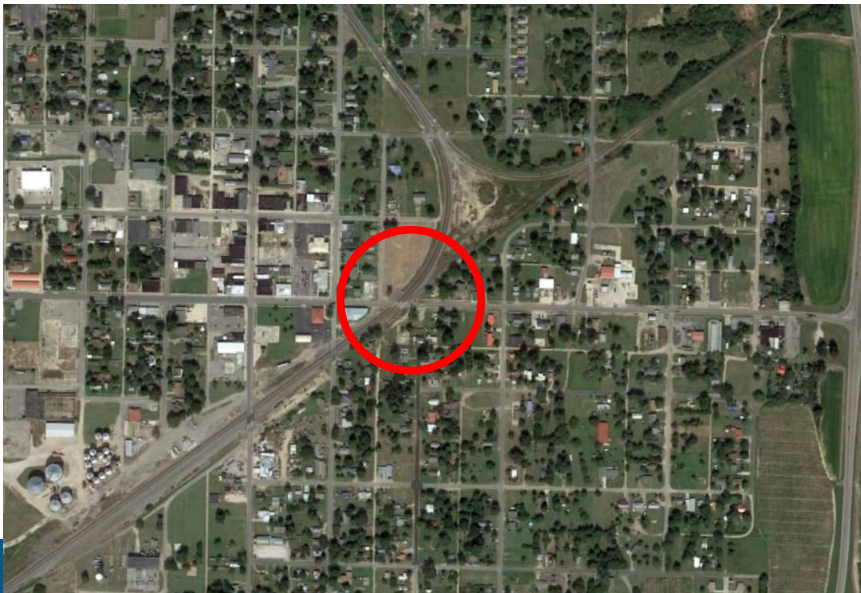
Incident Location – 787959F

General Information

- ▶ East Laclede Street (Public)
- ▶ Active Warning Devices
- ▶ 2 incidents
 - 2018 – Stopped on crossing (uninjured)
 - 2019 – Went around gate (uninjured)



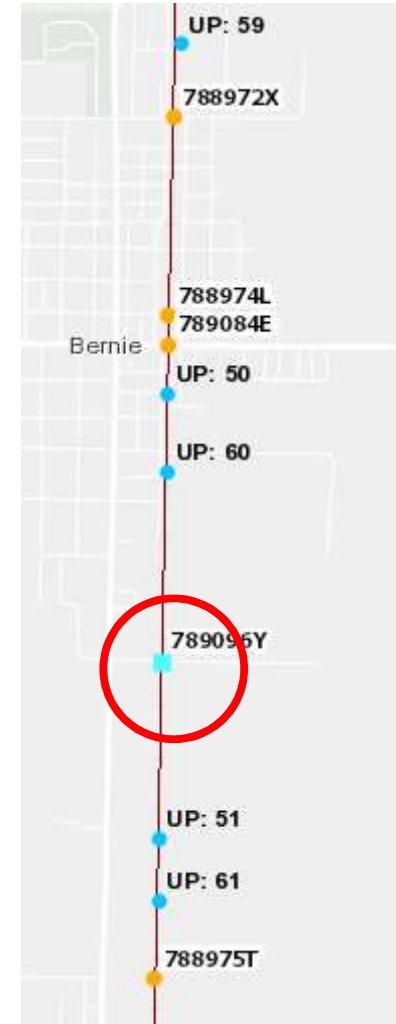
Google Streetview, 2016



Incident Location – 789096Y

General Information

- ▶ Zimmerman Lane (Public)
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2018 – Did not stop (fatality)
 - 2018 – Stopped on crossing (uninjured)



Google Streetview, 2016

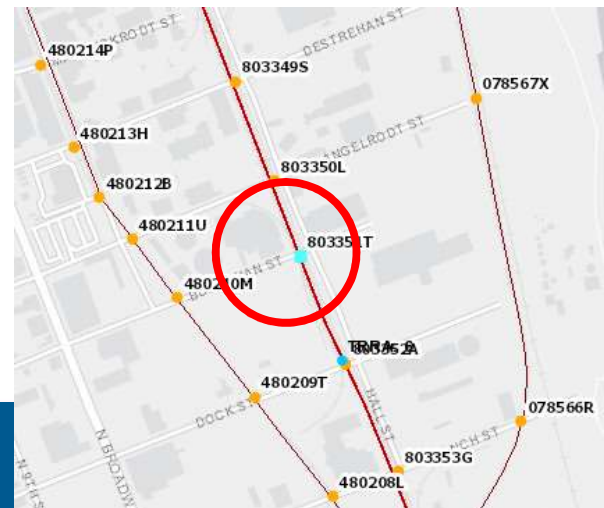
Incident Location – 80335 IT

General Information

- ▶ Buchanan Hall (Public)
- ▶ Passive Warning Devices
- ▶ 2 incidents
 - 2016 – Did not stop (injured)
 - 2020 – Train backed into vehicle (uninjured)



Google Streetview, 2016



APPENDIX E:
*Assessment Of Trends At
Highway-Rail Grade Crossings*

ASSESSMENT OF TRENDS AT HIGHWAY-RAIL GRADE CROSSINGS

Missouri highway-rail grade crossing incident data, stakeholder input and further research were analyzed to determine general trends involving Missouri highway-rail grade crossings. This data was then used to identify opportunities for improvement at highway-rail grade crossings. The analysis of FRA incident data determined that the majority of incidents occurred at public crossings, as a result of poor driver behavior involving vehicles at active, medium volume crossings. The overall categories identified for improvement fall into four main focus areas:

- 1. Driver and Pedestrian Behavior**
- 2. Physical Conditions**
- 3. Coordination and Collaboration**
- 4. Funding Flexibility**

Driver and Pedestrian Behavior

- Incident totals have remained steady over the previous five years. A multi-pronged approach is needed to modify driver and pedestrian behavior through engineering, education, enforcement and emergency response actions.
- Commercial truck and truck-trailers accounted for 25% of incidents. Truck drivers would be a beneficial target audience for education outreach.
- Data indicates that 43% of incidents involved male drivers between the ages of 25 and 65, making them a target demographic for education efforts.
- The two counties with the highest amount of incidents over the previous five years are Jackson and St. Louis counties. These account for 15% of total incidents. These counties have the largest populations within the state, and would be ideal locations to target education and outreach activities.
- Nine percent of incidents occurred due to a motorist driving around the gate. Education targeted to this issue may reduce this behavior.
- MoDOT reported increase of 5.25% in social media followers. Social media platforms may be a good outlet to reach drivers with education messages.
- Trespassing causalities have remained steady over the past five years. The complexity of trespassing makes it difficult to target specific solutions to mitigate this issue. Education through workshops and local law enforcement engagement may be an ideal focus to reduce and eliminate trespassing. Additionally, new technology (video cameras, etc.) may help detect and alert trespassers.



Physical Conditions



- Overall, 42% of incidents occurred with dark or limited light levels. Insufficient light levels can lead to a higher numbers of incidents due to the driver's limited sight. Due to the high amount of incidents that occurred during these periods, additional lighting may assist in reducing the number of incidents.
- There were 476 blocked crossing reports in Missouri between January 1, 2020 and June 8, 2021. Train volume and length is increasing, resulting in longer duration of blocked crossings. Stakeholder comments and FRA reporting indicate that blocked crossings events are increasing.
- The four Missouri passenger rail corridors experienced 37 incidents over the previous five years. Of these, six resulted in fatalities and 13 resulted in an injury. The Missouri River Runner corridor, specifically, experienced most of the total passenger rail incidents (21). Measures to improve safety for passengers and drivers along these corridors could include studies of engineering solutions.
- Vehicles that did not stop caused 103 (49% of) incidents. Using technology to provide digital alerts and other additional messaging may help roadway users to stop at crossings.
- More than 50% of incidents occurred at public crossings. MoDOT only has jurisdiction over public crossings and should continue efforts to reduce the number of at-grade crossings.
- There were 22 at-grade crossing closures in the last five years in Missouri. This includes at-grade crossing closures and upgrades to grade separation crossings.
- There were 14 incidents that involved pedestrians, with 12 at active crossings and two at passive crossings. No incidents occurred at pathway crossings.
- There were 152 incidents (around 70%) that occurred on roadways with less than 500 vehicles per day. Solutions to decrease incidents at low volume crossings should continue to be prioritized, but recognize that exposure at high volume crossings should also be addressed.

Coordination and Collaboration



- Review of incident records identified that some data recorded was unclear. Training for law enforcement will help to create records that more accurately describe conditions and incident causes.
- MoDOT staff reported project implementation delays associated with stakeholder agreements and coordination.
- AADT data at crossings is out of date in the FRA inventory. Increased coordination between divisions/departments will allow for updated data and more accurate data analysis.
- There were 12 incidents during low light conditions where a vehicle struck a train. Coordination with MoDOT and railroads may assist in improving train visibility.

Funding Flexibility



- MoDOT receives approximately \$7.5M in dedicated funding every year. This supports approximately 20-25 projects each year.
- According to 23 USC 130(i), 50% of funds are dedicated to the installation of protective devices at crossings. The remaining 50% may be used for any hazard eliminating project. Funds from the GCSA have limited uses, and may only be used for: installation, construction or reconstruction of automatic signals, safety devices, or safety improvements at crossings of railroads at public roads, streets, or highways. This restricts flexibility when determining priority projects and flexible solutions, such as innovative technologies, outreach and education.
- The GCSA has not received an adjustment for inflation since the fee was incorporated. A higher fee would provide for additional funding for trespasser prevention, rail safety education and additional safety projects.