Washington Highway-Rail Grade Crossing State Action Plan

February 2022

UTC
Washington Utilities and Transportation Commission

State Action Plan

Table of Contents

List of Appendices

List of Tables

List of Figures

List of Acronyms

AADT	Average Annual Daily Traffic
BC	British Columbia
BCR	Benefit-Cost Ratio
BNSF	BNSF Railway Company
CARSI	Commuter Authority Rail Safety Improvement Grant Program
CFR	Code of Federal Regulations
CRISI	Consolidated Rail Infrastructure and Safety Improvement Program
DOE	Washington State Department of Ecology
EMD	Emergency Management Division, Washington Military Department
EOC	State Emergency Operations Center
FAST Act	Fixing America's Surface Transportation Act of 2015
FHWA	Federal Highway Administration
FMSIB	Freight Mobility Strategic Investment Board
FRA	Federal Railroad Administration
FY	Fiscal Year
GCPF	Grade Crossing Protective Fund
HSIP	Highway Safety Improvement Program
IBL	Information by Location
IIJA	Infrastructure Investment and Jobs Act
INFRA	Infrastructure for Rebuilding America
JTC	Washington Joint Transportation Committee
LED	Light Emitting Diode
MUTCD	Manual on Uniform Traffic Control Devices
NOFO	Notice of Funding Opportunity
RAISE	Rebuilding American Infrastructure with Sustainability and Equity

RCW	Revised Code of Washington
SAP	State Action Plan
SOGR	Federal-State Partnership for State of Good Repair
UPRR	Union Pacific Railroad Company
USDOT	United States Department of Transportation
USC	United State Code
UTC	Washington Utilities and Transportation Commission
WAC	Washington Administrative Code
WAOL	Washington Operation Lifesaver
WBAPS	Web-Based Accident Prediction Systems
WSDOT	Washington State Department of Transportation
WTSC	Washington Traffic Safety Commission

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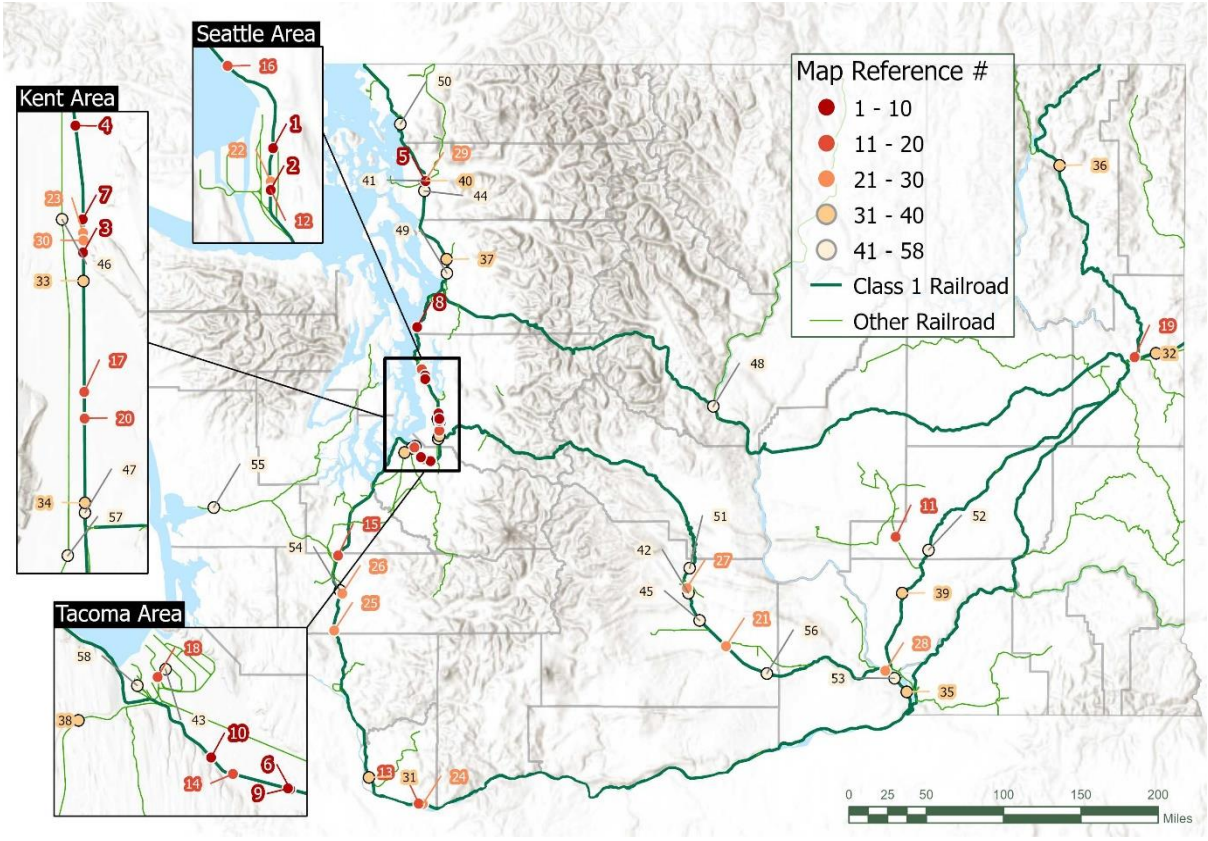
Executive Summary

Along Washington's more than 3,200 miles of operating rail lines, there are 2,654 highway-rail at-grade crossings. Those crossings include 2,185 public at-grade crossings (where a public road crosses a rail line), and 469 private crossings (where a private road leading to an industrial facility, farm, or driveway crosses a rail line). Overall, the number of highway-rail crossing incidents in Washington has declined significantly in the last 30 years, even while the average annual vehicles miles traveled on the state's public streets and highways have increased. The decline in incidents is a testament to the success of statewide highway-rail crossing safety improvement programs and projects, as well as public education, over time. The Washington Utilities and Transportation Commission (UTC) developed this Washington Highway-Rail Grade Crossing State Action Plan (SAP) to focus safety improvement efforts on the higher-risk highway-railroad crossings to reduce accidents and incidents even further.

Figure ES-1: SAP Top 58 Priority Crossings



The SAP analysis used data collected by the Federal Railroad Administration (FRA) on crossing inventory and on incidents and accidents at crossings, as well as the FRA's Web-Based Accident Prediction Systems (WBAPS) model, to identify and rank an initial list of incident-prone crossings.

After generating the initial list, the UTC used six additional factors to further evaluate and score the higher-risk highway-rail at-grade crossings:

- **Exposure**, based on daily train counts and average annual daily traffic at each crossing.
- **Accident prediction**, using FRA's Accident Prediction Model.
- **Accident severity**, using FRA's Accident Severity Model.
- **Benefit-cost ratio**, using representative interim improvements at crossings.
- **Equity**, based on a transportation equity index using summary demographic U.S. Census data.
- **Oil-by-rail**, reflecting the proximity of the crossing to a railroad line carrying significant amounts of crude oil as cargo.

This analysis generated a list of the top 58 priority higher-risk crossings in Washington. Higher-risk crossings tended to be found in more populated areas and along the more heavily traveled rail corridors.

Addressing safety concerns at highway-rail at-grade crossings involves engineering, education, and enforcement tools and strategies. Implementing solutions involves active engagement from the railroad and the local, state, and federal governments and can be supported by a variety of funding sources. Potential crossing improvements can include treatments and strategies such as grade separations, closures, consolidation, passive treatments, active warning devices, and specialized treatments for pedestrian/bicycle facilities.

Implementing the SAP over the next four years will be guided by several goals and objectives to improve rail crossing safety. Goals for the SAP include:

1. Implementing the Washington Highway-Rail Grade Crossing State Action Plan.
2. Strengthening coordination and cooperation between the UTC and key partners to advance grade crossing safety.
3. Enhancing grade crossing safety education and outreach activities.
4. Supporting enforcement efforts to address dangerous behavior at or near railroad crossings.
5. Monitoring SAP progress and providing annual reports.
6. Improving/modernizing the UTC's rail data collection, storage, and analysis system.

The Washington SAP provides a framework for continued focus on safety improvement, aiming to reduce accidents and incidents at highway-rail crossings.

Chapter 1: Introduction and Background

Since the 1970s, the United States Department of Transportation (USDOT) has worked to improve the safety of the nation's highway-rail at-grade crossings. In the late 1970s there were over 1,000 fatalities at highway-rail grade crossings each year in the United States.

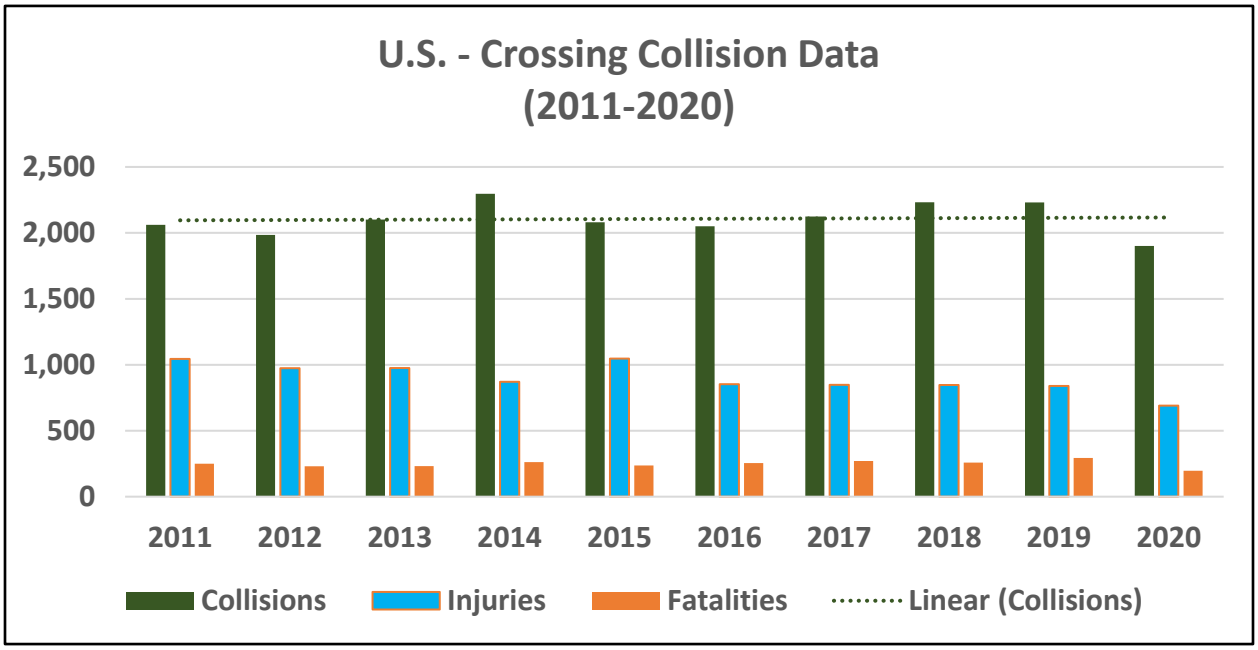
To help reduce these accidents, in 1987 Congress created the Railway-Highway Crossing Program (23 United States Code (USC) Section 130) to provide funding to eliminate hazards at highway-rail crossings. Since the program's inception, fatalities at highway-rail grade crossings have decreased by more than 50 percent.[1] From 1989 to 2019, the number of incidents at highway-rail grade crossings decreased by 68 percent.[2] Congress has continued to support this program through reauthorizations of transportation legislation and appropriations to states for safety improvements through the Federal Highway Administration (FHWA). The FHWA's Section 130 program is discussed in more detail in Chapter 3.

Even with this significant decrease in accidents and incidents at highway-rail grade crossings, such accidents still happen regularly around the nation. In the United States, there are more than 200,000 public and private at-grade crossings. According to the FRA, a motorist is about 20 times more likely to die in a crash involving a train than in one involving another motor vehicle.[3]

Over the past 10 years, the number of collisions at highway-rail at-grade crossings[4] nationally has remained essentially the same, at approximately 2,000 annually (Figure 1). The data does indicate a reduction in injuries over the same time frame, although fatalities remained flat. Nevertheless, the financial and psychological impacts of these accidents and incidents in the United States are significant,[5,6] not only to those directly involved, but to entire communities.

[1] https://safety.fhwa.dot.gov/hsip/xings/
[2] https://safety.fhwa.dot.gov/hsip/xings/docs/Final_Senate_Report_508.pdf
[3] https://railroads.dot.gov/sites/fra.dot.gov/files/2019-11/Grade%20Crossing%20Resource%20Guide%20022015.pdf
[4] At-grade crossings do not include over-crossings or under-crossings, or grade-separated, railroad tracks.
[5] http://jaapl.org/content/34/2/191
[6] https://railroads.dot.gov/sites/fra.dot.gov/files/fra_net/3628/Critical%20Incident%20Intervention%20Program_FINAL.pdf

Figure 1: U.S. Rail Crossing Collision Data (2011–2020)



Congress Increases Focus on Highway-Rail Grade Crossing Safety

Congress passed the first requirements for state action plans (SAPs) for highway-rail grade crossings as part of the Rail Safety Improvement Act of 2008 (Public Law 110-432). This act required the 10 states with the highest number of highway-rail grade crossing collisions from 2006 to 2008 to develop the first SAPs. The FRA subsequently developed procedures through a rulemaking process, which was codified as Title 49 Code of Federal Regulations (CFR) 234.11.

The 10 states that were required to develop the first SAPs are:

- Alabama
- California
- Florida
- Georgia
- Illinois
- Indiana
- Iowa
- Louisiana
- Ohio
- Texas

In 2010, these 10 states began working on the development of their initial SAPs. These plans were developed with a five-year planning horizon and analyzed highway-rail grade crossing accident data to develop strategies and focus areas. Stakeholder involvement varied within each state during SAP development.

Congress Expands the Requirement for SAPs to Include All States

The Fixing America's Surface Transportation Act (FAST Act) of 2015, Section 11401, expanded the requirement for SAP development to all states. Following the passage of the FAST Act, the FRA issued guidance and a series of requirements for the development of SAPs. On December 10, 2020, the FRA published a final rule (49 CFR 234.11) requiring states to develop or update their highway-rail grade crossing SAPs and submit them to the FRA for approval by February 14, 2022.

Each SAP must:

(A) Identify highway-rail grade crossings that have experienced recent highway-rail crossing accidents or incidents or multiple highway-rail at-grade crossing accidents or incidents, or are at higher-risk for accidents or incidents.

(B) Identify specific strategies for improving safety at highway-rail grade crossings, including highway-rail grade crossing closure or grade separations.

(C) Cover a period of at least four years.

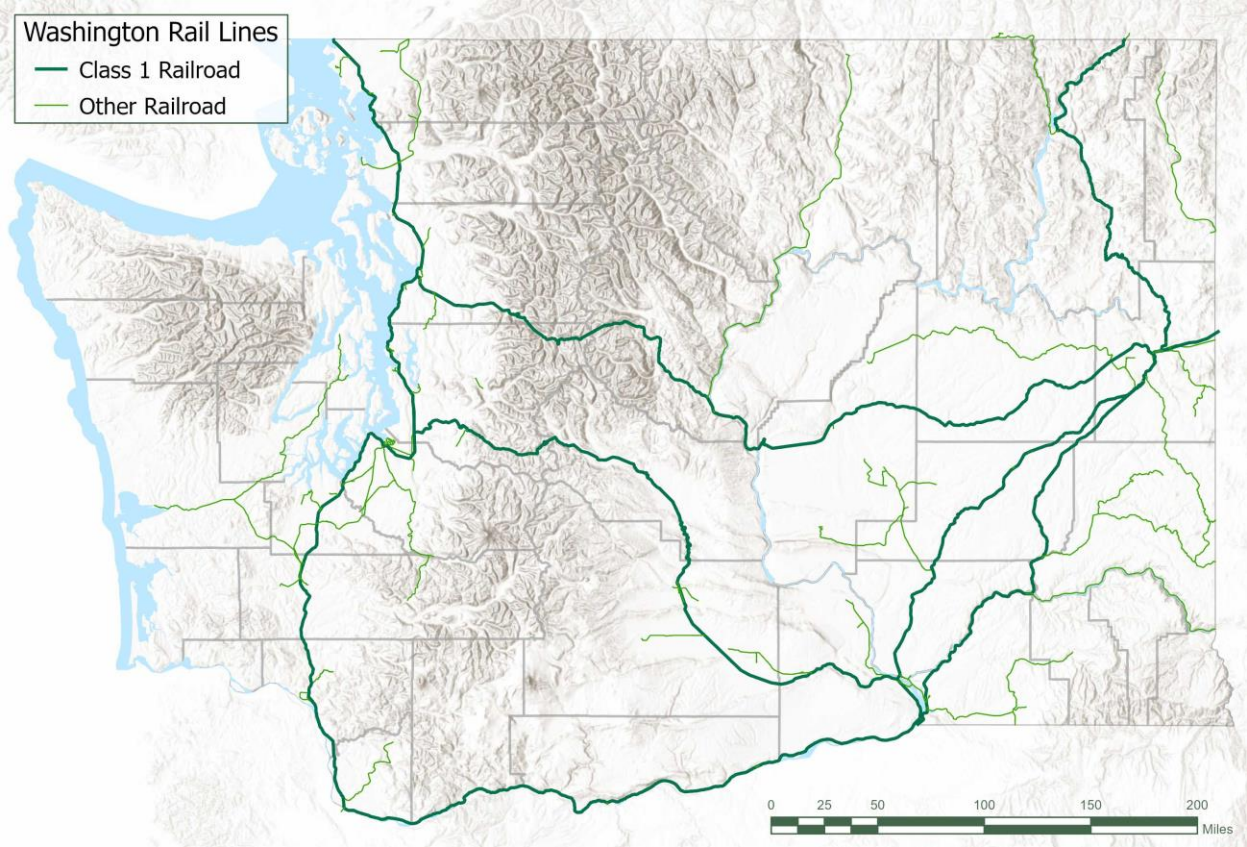
The UTC developed its SAP with a focus on safety improvement efforts at the higher-risk highway-railroad crossings in Washington to reduce accidents and incidents.

Washington's Freight and Passenger Railroad System

According to WSDOT's *Washington State Rail Plan 2019-2040*, there are more than 3,200 miles of track in operation in Washington. The state's two largest rail providers, BNSF Railway Company (BNSF) and Union Pacific Railroad Company (UPRR), connect Washington to the rest of the United States via their major east-west and north-south routes, as shown below in Figure 2. Both railroads also provide important international rail connections to British Columbia (BC), Canada. These two railroads are classified as Class I railroads by the Surface Transportation Board with annual revenues over $900 million.[7] They account for the majority of the interstate and international rail freight movements in Washington and are vital to the state's economy.

[7] https://www.stb.gov/news-communications/latest-news/pr-21-16/

Figure 2: Washington State Railroad Network



In addition, the state has 27 short line railroads that provide rail services to local rail shippers. These short lines comprise approximately 40 percent of all rail mileage in Washington and have a wide variety of owners, traffic types, and mileages. Short lines are an important part of the rail network, providing rail car switching services to local industries and supporting small and medium-size shippers around Washington. Several key segments of short line trackage are owned by public entities, including the Washington State Department of Transportation (WSDOT).

Passenger rail services play an important role in Washington as well. The National Railroad Passenger Corporation, doing business as Amtrak, operates three intercity routes in Washington, and the Central Puget Sound Regional Transit Authority, doing business as Sound Transit, operates two commuter rail routes. Amtrak's long-distance Empire Builder operates daily from Seattle to Spokane and continues to Chicago. A branch of the service operates from Portland, Oregon, to Spokane, Washington, as well, via Vancouver, Washington, and then Pasco, Washington.

State-supported Amtrak Cascades service operates between Vancouver, BC, and Eugene, Oregon. Due to the pandemic, current service levels have been reduced to two daily round trips between Seattle, Washington, and Eugene, Oregon, and one daily round trip between Seattle, Washington, and Portland, Oregon. Service north of Seattle will resume when pandemic cross-border rail protocols have been finalized. Amtrak's long-distance Coast Starlight operates daily between Seattle, Portland, and Los Angeles over the same BNSF route. In Washington, rail passenger services operate primarily over BNSF-owned track.

Sound Transit operates two commuter rail services north and south of Seattle on BNSF trackage. Known collectively until 2021 as Sounder, these commuter rail services operate on weekdays, primarily during peak commute periods.

Table 1: Washington State Rail Lines

Railroad Type	Railroad	Track Miles
Class I	BNSF Railway Company	1,480.7
	Union Pacific Railroad Company	290.8
Short Line	Palouse River and Coulee City Railroad	165
	Cascade and Columbia River Railroad	135.4
	Puget Sound and Pacific Railroad	132.5
	Kettle Falls International Railway	130.6
	Tacoma Rail	163.6
	Eastern Washington Gateway	116.8
	Washington and Idaho Railroad	107.8
	Columbia Basin Railroad	87.8
	Great Northwest Railroad	69.9
	Pend Oreille Valley Railroad	62
	Central Washington Railroad	50.1
	Portland Vancouver Junction Railroad	33.6
	Tri-City & Olympia Railroad	32.4
	Royal Slope Line	26.8
	Yakima Central Railroad	20.9
	Patriot Woods Railroad	11.2
	Port of Chehalis	7.5
	Columbia and Cowlitz Railway	7.4
	Sound Transit	18.1
	US Navy	5.7
	Meeker Southern Railroad	5
	Lake Whatcom Railway (Tourist)	4.3
	Puget Sound & Snoqualmie Valley Railroad	4.2
	Yelm Railroad	4.2
	Ballard Terminal Railroad	3.1
	Yakima Valley Trolleys (Tourist)	2.6
	Yakima Valley Transportation Company	2.1
	Department of the Army	1.5

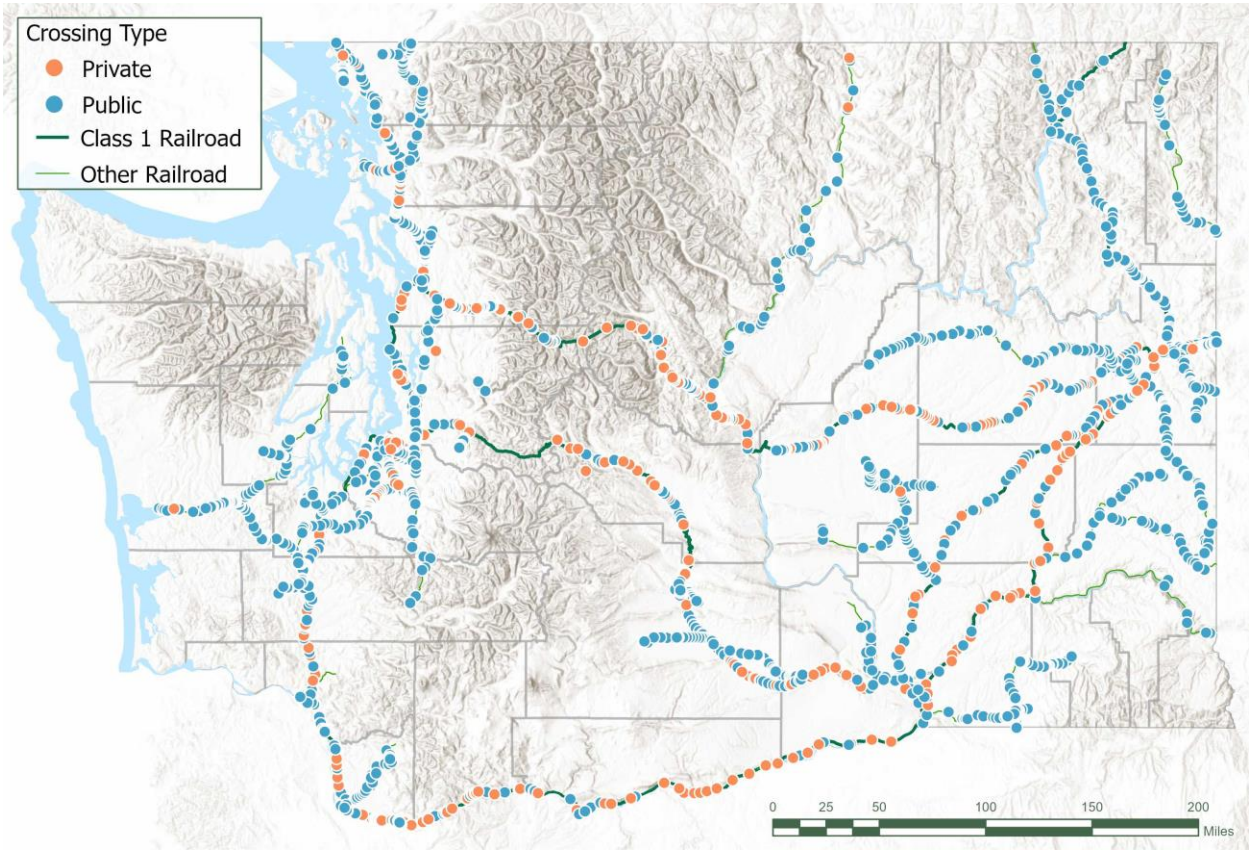
Source: FRA

For a detailed description of Washington's rail system, please see WSDOT's *Washington State Rail Plan 2019-2040*.[8]

Washington's Highway-Rail At-grade Crossings

There are approximately 2,654 highway-rail at-grade crossings in Washington, including 2,185 public at-grade crossings (where a public road crosses a rail line), and 469 private crossings (where a private road leading to an industrial facility, farm, or driveway crosses a rail line) as shown below in Figure 3.

Figure 3: Washington Public and Private Highway-Rail At-grade Crossings



During the past 30 years, the number of at-grade crossings decreased in Washington for several reasons, as the FRA emphasized the consolidation of at-grade crossings as part of its overall safety policy.[9] This policy focused on a corridor approach to improving grade crossing

[8] https://wsdot.wa.gov/construction-planning/statewide-plans/freight-rail-plans/2019-washington-state-rail-plan
[9] https://railroads.dot.gov/elibrary/highway-railroad-grade-crossings-guide-crossing-consolidation-and-closure

safety, where nearby grade crossings are assembled into an overall safety improvement project, including the elimination of crossings along with upgrades or grade separations.

Table 2: At-Grade Highway-Rail Crossing Closures in Washington Since 1980

Class I	Short Line (Class III)
4,728 closures	395 closures

In addition, the number of highway-rail at-grade crossings also decreased when the rail line from Blaine, Washington, to Vancouver, Washington, was designated a high-speed rail corridor in 1992.[10] This designation provided additional federal funding for, and emphasis on, upgrading at-grade crossings and eliminating unnecessary or redundant highway-rail crossings on this corridor.

Several rapidly growing communities in Washington's urban areas have focused on removing at-grade crossings in their jurisdictions. As communities grew, vehicular traffic increased on major state highways and local roads as well as to and from major Puget Sound and Columbia River ports. To reduce vehicular traffic delays and improve regional mobility, local, regional, and state public agencies made investments to eliminate highway-rail at-grade crossings along major freight and travel corridors in several urban areas around Washington.

The Role of the FRA in Highway-Rail Grade Crossing Safety

The FRA's role has evolved over the past 20 years, especially with the passage of the Rail Safety Improvement Act,[11] the Passenger Rail Investment and Improvement Act,[12] the American Recovery and Reinvestment Act,[13] and the Infrastructure Investment and Jobs Act (IIJA).[14]

In addition to its core role of implementation and enforcement of safety regulations, the FRA has two other central roles. The FRA provides selective investments in rail corridors across the country. Washington benefited significantly from the FRA's funding of numerous freight and passenger projects across the state, including track, signal, and siding improvements from Seattle to the Canada border, such as the Point Defiance Bypass project,[15] and the Vancouver

[10] https://railroads.dot.gov/passenger-rail/high-speed-rail/high-speed-rail-timeline
[11] https://railroads.dot.gov/legislation-regulations/legislation/rail-safety-improvement-act-2008-rsia
[12] https://railroads.dot.gov/elibrary/overview-highlights-and-summary-passenger-rail-investment-and-improvement-act-2008-priia
[13] https://railroads.dot.gov/grant-administration/reporting-requirements/arra-report
[14] https://www.congress.gov/bill/117th-congress/house-bill/3684/text
[15] https://railroads.dot.gov/environment/environmental-reviews/point-defiance-bypass

Rail Yard Bypass project.[16] The FRA, through the Office of Research, Development and Technology and the Railroad Safety Advisory Committee, also has a key role in research and technology development to improve safety.

The FRA's Office of Railroad Safety regulates and promotes safety across the railway industry. The FRA's rail safety experts and inspectors specialize in six technical areas:

- Hazardous materials
- Operating practices
- Track
- Motive power and equipment
- Signal and train control
- Grade crossings

FRA's Grade Crossing and Trespasser Outreach Division

As the FRA's highway and grade crossing safety expert, the Grade Crossing and Trespasser Outreach Division works with states, railroads, private entities, and others to improve safety at highway-rail grade crossings and to prevent trespassing incidents on railroads. The division works to promote safety efforts around the country and collaborate with states on various safety efforts. The FRA also collects and analyzes data from around the country related to incidents and maintains the national database of accidents and incidents that occur at highway-rail grade crossings. The FRA staff provides technical assistance on blocked crossings, quiet zones, crossing safety improvements, and trespass prevention.

[16] https://bnsfnorthwest.com/news/2017/07/05/bnsf-engineering-completes-7-year-arra-program-washington-state/

As part of its mission to improve safety, the FRA works to reduce railroad crossing and trespasser incidents through the "3 E" framework—**E**ducation, **E**ngineering, and **E**nforcement—as well as through extensive analysis of rail safety data and statistics, as follows:

- Education: The FRA works closely with Operation Lifesaver, Inc., a national non-profit safety entity that works to educate the public about rail safety.
- Engineering: The FRA conducts research on and implements physical improvements to highway-rail at-grade crossings.
- Enforcement: The FRA works closely with law enforcement agencies across the country to improve railroad crossing safety and trespass prevention.

The Role of FHWA in Highway-Rail Grade Crossing Safety

The FHWA also has a significant role in highway-rail grade crossing safety through funding of the Section 130 program as part of its overall highway safety improvement program. In Fiscal Year (FY) 2022, the federal government appropriated $245 million for the Section 130 program nationwide. Chapter 3 discusses the Section 130 program in more detail.

The FHWA also provides stakeholders with a variety of resources to support program implementation, including the *Highway-Railway Grade Crossing Handbook (3rd Edition)*, peer exchanges, and noteworthy practices guides. The FHWA and FRA frequently conduct joint online webinars on railroad-highway crossing topics.

Rail Safety in Washington

Washington has a long history in rail regulation. The Washington State Legislature in 1905 created the three-member Railroad Commission, the precursor to the UTC, that had regulatory authority to inspect and evaluate railroad company accounts, set rates, approve time schedules, monitor safety issues, and enforce violations. However, in 1970 and again in 1980, the United States Congress passed legislation preempting states in all areas pertaining to economic regulation of railroads and limited the scope of state jurisdiction regarding safety.[17] Various federal agencies assumed more oversight[18] in some railroad regulatory areas (e.g., FRA and the Surface Transportation Board).

Today, in addition to the UTC, several state agencies in Washington have some regulatory and/or fiscal responsibility for rail safety or highway-rail crossings. While the UTC has the primary role in overall highway-rail crossing safety regulation, other agencies with key roles in

[17] The Federal Railroad Safety and Hazardous Materials Transportation Control Act of 1970, the Interstate Commerce Commission Termination Act (ICCTA) and the Staggers Rail Act of 1980.
[18] https://www.nap.edu/read/22093/chapter/36

rail safety include WSDOT, the Department of Labor and Industries (L&I), the Emergency Management Division (EMD) of the Washington Military Department, and the Department of Ecology (DOE).

Washington Utilities and Transportation Commission

The UTC is a three-member commission appointed by the Governor and confirmed by the Washington State Senate. The mission of the UTC is to protect the people of Washington by ensuring that investor-owned utility and transportation services are safe, available, reliable, and fairly priced.

The UTC regulates the rates and services of investor-owned electric utilities, telecommunications, natural gas, and water companies, garbage-collection haulers, household-goods movers, charter-bus companies, commercial ferries, pipeline companies, and a low-level radioactive waste repository. The commission does not regulate broadband or Internet services, including those provided by regulated telecommunications companies.

The UTC regulates the rates and services of the state's investor-owned electric and natural gas utilities, landline telephone companies, solid waste haulers, private water systems, and residential movers, among other industries. The agency also manages the state's pipeline, railroad, and intrastate bus and trucking safety program.

Unlike most state agencies, the UTC often functions as a quasi-judicial body, meaning that, like a court of law, it rules on cases brought before it. At the UTC, these cases are usually requests from companies for increased revenue, permission to build new plant, or changes in service policies. Like a court of law, the UTC cannot simply rule out of hand. It must base its decisions on the evidence it collects, including expert testimony, company records or data, statements from members of the public, and other information. Cases are heard in a formal, legal setting, with the commission hearing evidence from all sides before issuing a decision. The UTC's decisions are reviewable by courts of law.

Titles 80 and 81 of the Revised Code of Washington (RCW) establish the UTC and define its powers and authority regarding utility and railroad regulations. The focus of Title 80 RCW is primarily on utility regulation, and Title 81 RCW covers a variety of transportation laws for Washington. Titles 80 and 81 also empower the UTC to develop regulations under the Washington Administrative Code (WAC) necessary to carry out its responsibilities under these laws.

RCW 81.36 through RCW 81.61 contain railroad-specific laws. RCW 81.53 and RCW 81.54 specifically cover highway-rail crossings. These statutes articulate the UTC's jurisdiction and authority related to highway-rail crossings in Washington.

The UTC developed several regulations to carry out its duties under WAC Chapter 480. Specifically, WAC 480-60 governs railroad clearances and walkways; WAC 480-62 governs railroad operations; and WAC 480-66 governs sanitation.

The UTC's jurisdiction over railroad safety and the mission of the agency's railroad safety program is focused in a few key areas that are not preempted by federal law. Those areas include opening, closing, and reconfiguring railroad-highway crossings, enforcing crossing safety at public crossings and private crossings on crude oil routes, ensuring railroad employee safety, administering the Grade Crossing Protective Fund (GCPF), educating the public and promoting awareness, responding to citizens' complaints, and providing technical assistance. The UTC's highway-rail crossing jurisdiction is not operative within the limits of first-class cities (as explained in detail below).

UTC Rail Safety Program

The UTC's Rail Safety program protects the public and railroad employees by ensuring that railroad companies meet established state and federal safety standards and by educating the public about the dangers of traveling on or near railroad tracks.

The UTC partners with the FRA and participates in Title 49 CFR, Part 212, State Safety Participation Regulations. The UTC has 12 FRA-certified inspector positions located throughout the state that cover all six FRA disciplines (e.g., signal and train control equipment, track, motive power and equipment, railroad operating practices, and grade crossing). These UTC field resources significantly increase inspection activity throughout the state, and inspectors also partner with other border state programs in Idaho and Oregon for joint inspections. The UTC's FRA-certified inspectors also investigate complaints, respond to accidents, and provide on-the-job training for new inspectors.

UTC staff inspects railroad crossings in the state every three years, and railroad crossings located on crude oil routes every 18 months, tracking railroad grade crossing inventory information, and documenting trespassing and incident data. UTC staff also investigate incidents and work with road authorities and railroads on crossing improvements including construction and widening of public crossings, installation of signals and gates, and closures.

UTC staff acts as the state highway-rail crossing inventory manager. The UTC maintains its own state inventory of highway-rail crossings and inspection data. UTC staff also submits updates to the FRA's USDOT crossing inventory system.

UTC staff work with citizens, local governments, and companies to resolve complaints related to issues such as poor crossing surface conditions, drivers circumventing crossing gates, train noise levels, blocked crossings, and trespassing on railroad rights-of-way.

UTC staff also enforce railroad employee safety regulations. Because L&I and the UTC have some overlap in jurisdiction related to these regulations, an interagency agreement between L&I and the UTC avoids duplication of effort.

The UTC funds projects to improve public safety at crossings and to limit pedestrian access to railroad rights-of-way through the GCPF, as discussed in more detail in Chapter 3.

In its efforts to educate the public and promote public awareness of railroad safety, the UTC is actively engaged in Washington Operation Lifesaver (WAOL), a free public service education program dedicated to preventing and reducing fatalities and injuries at highway-railroad grade crossings and along railroad rights-of-way. Through its participation in the WAOL, the UTC coordinates presentations to the public on grade crossing safety and provides vital information about the dangers people encounter when they are on railroad property.

Washington State Department of Transportation

WSDOT is charged with planning, funding, implementing, constructing, and maintaining the multimodal transportation system in the state. Rail is an integral part of the statewide multimodal transportation system that keeps people and businesses moving. Serving freight and passengers, the rail system provides efficient transportation critical to maintaining our economy, environment, and quality of life.

WSDOT is responsible for managing and directing the state's freight and passenger rail capital and operating programs. WSDOT sponsors the previously discussed Amtrak Cascades intercity passenger rail service in conjunction with the Oregon Department of Transportation. WSDOT also owns and manages the Palouse River and Coulee City Railroad system, which comprises three short line railroads in eastern Washington leased to private operators.

As summarized in Appendix A, WSDOT's *Washington State Rail Plan 2019-2040* is integral to WSDOT's rail program. It is a single, integrated plan for both passenger and freight rail, and is the planning foundation for future actions. To address rail system challenges and identify opportunities for improvement, the WSDOT plan describes the rail system and the state's

interest in it, identifies potential actions to improve the rail system, and recommends strategies consistent with Washington's' transportation policy goals of economic vitality, preservation, safety, mobility, environment, and stewardship.

In terms of funding, WSDOT manages the Freight Rail Assistance Program (grants) and Freight Rail Investment Bank (loans) that provide state funding for freight rail capital projects across the state.

WSDOT also acts as the statewide administrator of FHWA Section 130 program funding, which is housed in the WSDOT Local Programs Division Highway Safety Improvement Program. As such, WSDOT has been responsible for managing project selection and administration for the Section 130 program funding in the state.

Finally, WSDOT partners with the Washington State Patrol to assist the Washington Traffic Safety Commission (WTSC) in the development of the *Washington State Strategic Highway Plan*[19] *(Target Zero* plan). WTSC acts as the lead agency, and the plan represents a vision for zero deaths and serious injuries on Washington's roadways by 2030.

Department of Labor and Industries

L&I is dedicated to the safety and health of Washington's workforce. In that role, L&I, through the Division of Occupational Safety and Health, develops and enforces safety and health rules by inspecting worksites for unsafe working conditions. L&I is the administrator of the state's workers' compensation system, providing medical and limited wage-replacement coverage to workers who suffer job-related injuries and illness. It also ensures workers are properly paid, that children and teenagers are not overworked, and that the public is protected from unsafe and unsound building practices.

The Washington Industrial Safety and Health Act gives broad jurisdiction to L&I to regulate and enforce employee occupational health and safety matters. In this capacity, L&I has authority over walkways and clearances in private rail yards and plants, including logging railroad yards, mill yards, and sorting yards. The UTC also enforces some employee safety regulations, as discussed later in this plan document.

Emergency Management Division of the State Military Department

The mission of the Washington Military Department's EMD is to minimize the impact of emergencies and disasters on the people, property, environment, and economy of Washington.

[19] Target Zero – Washington's Strategic Highway Safety Plan

The EMD notifies and alerts state agencies and local governments of impending emergencies and disasters. During state emergencies, the EMD manages the State Emergency Operations Center (EOC) located in Camp Murray, near Tacoma, and coordinates the response to ensure help is provided quickly and effectively to those who need it. The EOC is designated as the central location for information gathering, disaster analysis, and response coordination.

The EOC is the UTC's designee for railroad accident reports. UTC regulations (WAC 480-62-310) require railroad companies to provide detailed reports for any event connected to the operation of the railroad that results in an accident involving:

- Release of a hazardous material (i.e., materials that are corrosive, flammable, explosive, reactive with other materials, or toxic).
- Death of any person.
- Injury to any person involved in a railroad-highway crossing accident that requires medical treatment in addition to first aid.
- Property damage amounting to $50,000 or more.

EOC uses the information gathered to make decisions concerning emergency actions and to identify and prioritize the use of state resources needed to respond to the emergency. The EOC may issue emergency warnings or disseminate critical information and instructions to government personnel and the public, who may need to take emergency protective actions.

Washington State Department of Ecology

The DOE is charged with oversight to increase the spill preparedness and response requirements of companies that move oil by rail. Specifically, the DOE requires rail companies to:

- Enhance readiness requirements for non-floating oils – to address response measures for oils that may degrade and sink when spilled. This type of oil is a challenge to traditional cleanup plans that are designed to respond to floating oils.
- Establish requirements for spill and wildlife response teams – Spill Management Teams are the groups of people who respond to oil spills. Wildlife response service providers locate and care for oiled animals during a spill.
- Require railroad operators to conduct new oil spill preparedness drills – Drills help companies and their partners (e.g., local governments, tribes, and state and federal agencies) know what to do when an oil spill occurs. Companies are required to test their plans and staff, depending on the size of their operation and the type of oil they transport.

- Streamline plans for smaller rail lines – Some short line railroads haul non-crude oils, such as lube and vegetable oils, as cargo. Though these small railroad companies do not carry crude oil and serve small communities, oil of any kind is an environmental toxin and planning for spills is important. DOE rules streamline planning requirements for smaller rail companies, depending on the type and volume of non-crude oil carried.

First-class Cities

A "first-class" city is defined in RCW 35.01.010 as a city with a population of 10,000 or more at the time of organization or reorganization that has adopted a charter. A city may choose to form a government through adoption of local charters; governments of first-class cities, therefore, do not follow a uniform pattern.

Washington has 10 first-class cities: Aberdeen, Bellingham, Bremerton, Everett, Richland, Seattle, Spokane, Tacoma, Vancouver, and Yakima. RCW 81.53 is not operative within the limits of first-class cities, which means these cities are responsible for regulating and ensuring grade crossing safety within their cities. First-class cities may opt into the UTC's rail safety jurisdiction by applying for GCPF funding to improve signals or warning devices at a city crossing, or by requesting to participate in the UTC's crossing safety inspection program, as discussed below.

In 2015, the Washington State Legislature expanded the UTC's regulatory jurisdiction in first-class cities to improve safety in response to increasing movements of crude oil trains traveling through the state. First-class cities must keep public railroad crossing data current and provide updated crossing inventory information to the UTC as crossings are modified, closed, or opened, within 30 days of the action, so that the UTC can update and maintain the statewide database of public grade crossings (RCW 81.53.240(2)).

In addition, first-class cities may opt into the UTC's railroad crossing safety inspection program, which includes regular UTC inspections, identification of defects, and enforcement for correcting those defects. For first-class cities that have opted into the program, UTC staff provides technical assistance on grade crossing safety, maintenance, and modifications as agreed between the city and the UTC. To date, four first-class cities have opted into the program: Bellingham, Richland, Vancouver, and Tacoma.

Recent Studies Relevant to the SAP

Multiple Washington studies and plans relating to safety or rail informed the development of the SAP. These documents and their relevance to the SAP are summarized in Table 3 below, and additional details are provided in Appendix A.

The studies most relevant to the development of the SAP either provided insight into developing the strategy for prioritizing crossings or informed the Crossing Safety Toolkit discussed in Chapter 3.

Table 3: Previous Studies Relevant to the SAP

Study Title	Commissioning Body	Relevance to SAP								
		Collision Reduction	Funding	Future Studies	Legislative	List of Projects	Prioritization	Regulatory	Solutions	Voluntary
Washington State 2014 Marine and Rail Oil Transportation Study	State of Washington Department of Ecology			x	x			x		x
Prioritization of Prominent Road-Rail Conflicts in Washington State (2017)	Joint Transportation Committee, Washington State Legislature		x				x			
Study of Road-Rail Conflicts/Phase 2 Development of Project Priorities (2018)	Washington State Freight Mobility Strategic Investment Board					x	x			
Target Zero: Washington State Strategic Highway Safety Plan 2019	Washington Traffic Safety Commission	x	x				x		x	
2020 Washington State Traffic Safety Annual Report	Washington Traffic Safety Commission	x								
Washington State Rail Plan 2019-2040	Washington State Department of Transportation			x					x	
An Assessment of Rail Safety Governance in Washington State (2021)	Joint Transportation Committee, Washington State Legislature				x					

In 2016, the Washington State Legislature Joint Transportation Committee (JTC) conducted a study documented in a final report, *Prioritization of Prominent Road-Rail Conflicts in Washington State* (2017). The study created a corridor-based prioritization process that resulted in a list of the top 50 at-grade crossings at risk of road-rail conflicts in Washington. The process included identifying areas potentially impacted by increased rail traffic and areas of state public policy interest, as well as impacts to current and future mobility, communities, and safety. The prioritization process of the crossings identified in this SAP mimics the process used in the JTC study, utilizing a data-driven analysis of the crossing impacts to prioritize crossings for funding.

Another report with a similar prioritization process is the *2018 Study of Road-Rail Conflicts* prepared for the Freight Mobility Strategic Investment Board (FMSIB). A continuation of the 2017 JTC study, this report developed a corridor-based project prioritization process to recommend a list of highway-rail improvement projects to the state. As in the SAP, the FMSIB study categorized each crossing into a hierarchical tier and applied criteria to evaluate the benefit of each project.

The study most relevant to development of the SAP is WSDOT's *Washington State Rail Plan 2019-2040*. This plan analyzed rail system challenges and identified opportunities for improvements, along with specific strategies to accomplish those improvements.

Stakeholder Coordination

Engaging stakeholders was a critical part of developing the SAP. Representatives from a variety of stakeholder groups met with the UTC throughout the process. By engaging stakeholders, it was possible to bring issues and questions to the surface early in plan development so they could be addressed. The dialogue with stakeholders during meetings also allowed the UTC to set clear expectations about the scope of the SAP.

The SAP stakeholder group was formed to:

- Provide a forum for surfacing and understanding issues related to the SAP;
- Collaborate and engage to support project efforts; and,
- Make recommendations to UTC staff.

The UTC identified members of the stakeholder group including state agencies, law enforcement, railroads, advocacy organizations, and local jurisdictions engaged in rail safety. Approximately 40 individuals agreed to participate in the group and committed to attending a series of four meetings over a span of five months. Each meeting focused on one of the stages of plan development: assembly, analysis, solutions, and actions.

See the discussion below and Appendix B for a summary of each stakeholder group meeting.

Meeting 1: Assembly Phase

Stakeholders gathered at a first meeting to learn more about the context of highway-rail crossing safety in Washington, as well as requirements for the SAP. They shared issues that were of most concern to them, and the team discussed whether those issues would be addressed as part of the SAP.

Meeting 2: Analysis Phase

Stakeholders reviewed detailed data analyses of accident and incident frequency and trends in Washington. The group also reviewed a model for predicting crossing risk and discussed the elements that would contribute to the ranking of the highest-risk crossings.

Meeting 3: Solutions Phase

Based on the model discussed in the previous meeting, stakeholders reviewed the draft list of the priority highest-risk crossings in Washington. The project team discussed potential tools to improve crossing safety, including engineering, education, and enforcement. Stakeholders also heard about funding options for rail crossing safety improvement projects available through local, state, and federal funding programs.

Meeting 4: Actions Phase

Stakeholders heard about possible implementation strategies that could help achieve the goals and objectives of the SAP. The project team also discussed how the SAP document would bring together pieces from the four plan development phases to provide a comprehensive plan for future action.

Chapter 2
Analysis

Chapter 2: Analysis

Chapter 2 summarizes the analysis phase of the SAP and contains a comprehensive evaluation of highway-rail crossing incidents and rail-related pedestrian accidents in Washington. This chapter first defines the terms related to highway-rail crossings and summarizes the existing crossings, and then presents the SAP analysis in the following four sections:

- Assembling the Highway-Rail Grade Crossing Data
- Analyzing the History of Crossing Incidents
- Identifying Higher-risk Highway-Rail Crossings
- Evaluating Higher-risk At-grade Crossings

The last section then lists and discusses the priority higher-risk at-grade crossings.

Defining the Terms and Summarizing the Existing Highway-Rail Crossings in Washington

Table 4 defines the terms for highway-rail crossing types referred to in the SAP, consistent with RCW 81.53.010. As shown in the two maps contained in Figure 4, there are a total of 3,359 highway-rail crossings in the state. This total includes grade separations, but at-grade highway-rail crossings constitute the vast majority of those (2,654). As listed in Table 5, of the total number of at-grade crossings, 469 are private and 2,185 are public, including 37 pedestrian-only at-grade crossings. Table 5 also notes the type of crossing protection provided at public highway-rail at-grade crossings. There are 1,180 at-grade public crossings with passive protection, and 969 crossings with active protection. Figure 5 shows the location of active and passive at-grade crossings across Washington (see Table 4 for definitions of passive and active protection).

The focus of the SAP analysis is on public at-grade pedestrian and highway-rail crossings in Washington.

Table 4: Highway-Rail Crossing Types and Definitions

Crossing Type	Definition
At-grade crossing	Intersections where a highway crosses a railroad at grade. Termed "level crossings" in Canada and other countries. "Grade crossing" is also a standard usage.
Over-crossing	A roadway or pathway/trail structure **over** (above the grade of) the railroad right-of-way.
Under-crossing	A roadway or pathway/trail structure **under** (below the grade of) the railroad right-of-way.
Grade Separated Crossing	A term that can be used to describe either an over-crossing or under-crossing.
Definitional Term	**Definition**
Incidents and Accidents	Any impact between railroad on-track equipment and a *highway user* at an at- grade crossing or pathway grade crossing.
Highway	Includes all state and county roads, streets, alleys, avenues, boulevards, parkways, and other public places actually open and in use, or to be opened and used, for travel by the public (RCW 81.53.010 (3)).
Highway User	Automobiles, buses, trucks, motorcycles, bicycles, farm vehicles, pedestrians, and all other modes of surface transportation, motorized and non-motorized**.**
Passive Crossing	An at-grade crossing where warnings and traffic control are provided by passive devices such as signs and pavement markings.
Active Crossing	An at-grade crossing that includes warning systems with flashing-light signals, with or without warning gates, and other necessary control equipment used to inform road users of the approach or presence of rail traffic at grade crossings.

Figure 4: Washington Highway-Rail Crossings by Type

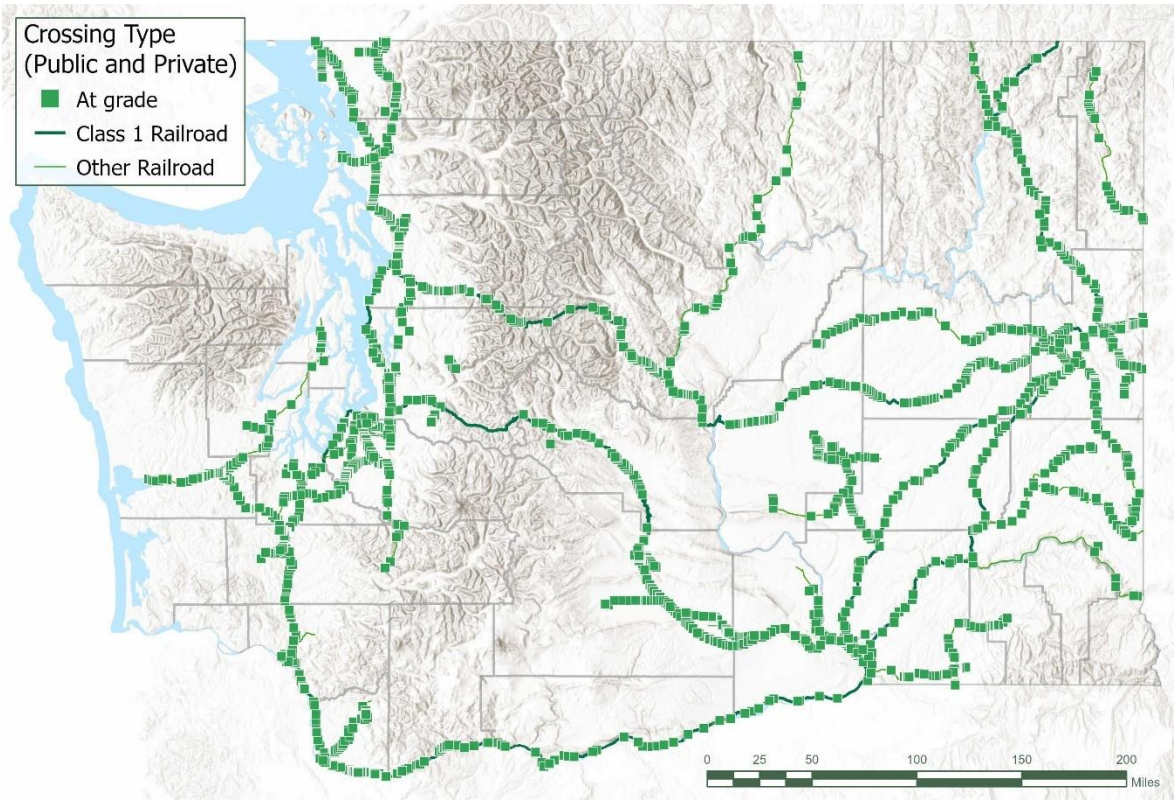
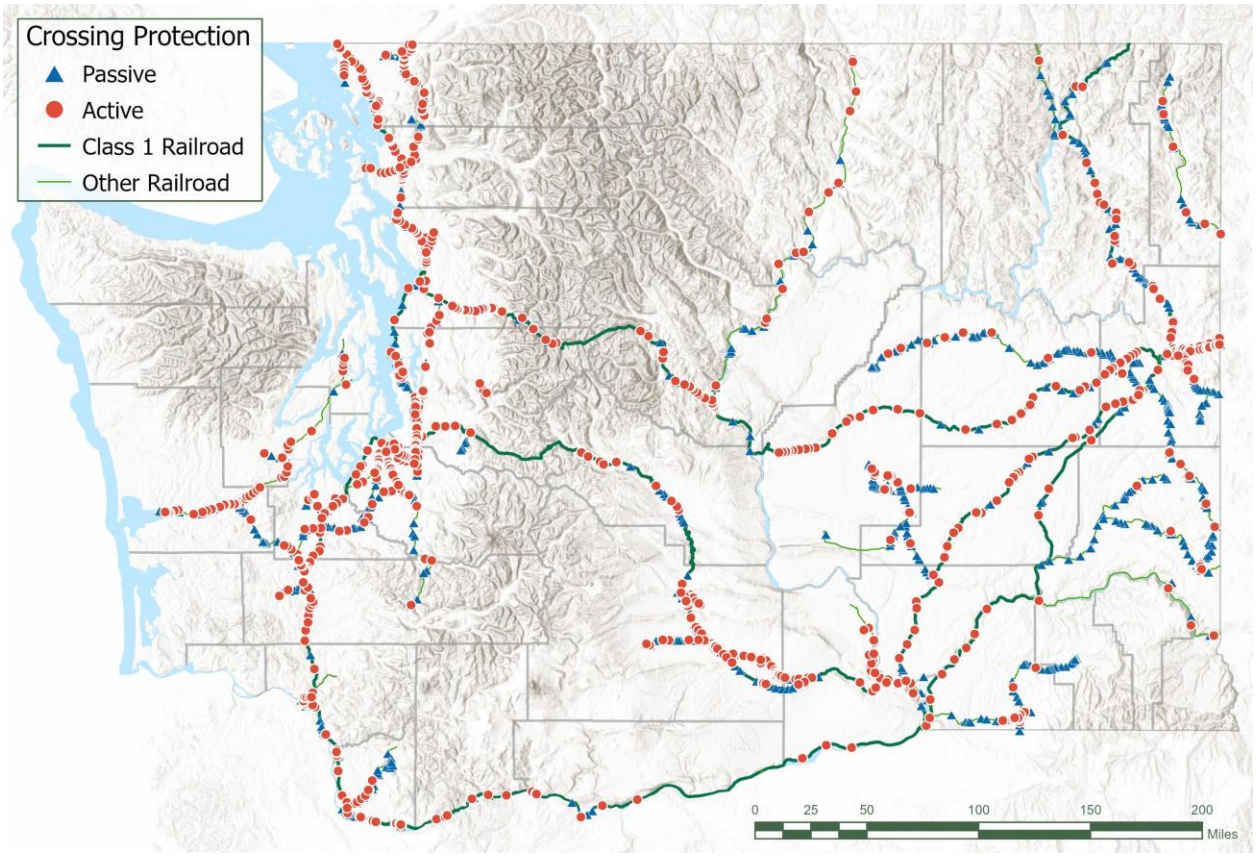


Table 5: At-grade Highway-Rail Crossings in Washington

At-grade Crossings		**2,654**
Private	Pedestrian	9
	Highway	460
Public	Pedestrian	37
	Highway	2,148
Public Highway At-grade Crossings		**2,148**
Crossing Protection	**Passive**	**1,180**
	Active	**968**

Figure 5: Crossing Protection at Public Highway-Rail At-grade Crossings



Assembling the Highway-Rail Grade Crossing Data

Washington's rail network spans nearly 3,200 miles of track, with a total of 2,654 public, at-grade highway-rail crossings.

Rail Crossing Inventory and Incident/Accident Data Sources

Both FRA and the UTC maintain highway-rail crossing inventories and histories of crossing incidents and accidents in Washington. The SAP analysis uses the FRA-sourced inventory and incident/accident data for consistency with FRA-developed tools (e.g., estimates of accident probability, accident severity, and cost-benefit analyses) that are applied later in the process to help identify higher-risk crossings.

The nationwide FRA highway-rail crossing database relies on state rail inventory managers, such as the UTC and operating railroads, to maintain and report current and accurate information, including crossing location and daily train volumes.[20] FRA-sourced rail crossing inventory data used in the SAP analysis is dated September 2021.[21]

Analyzing the History of Crossing Incidents

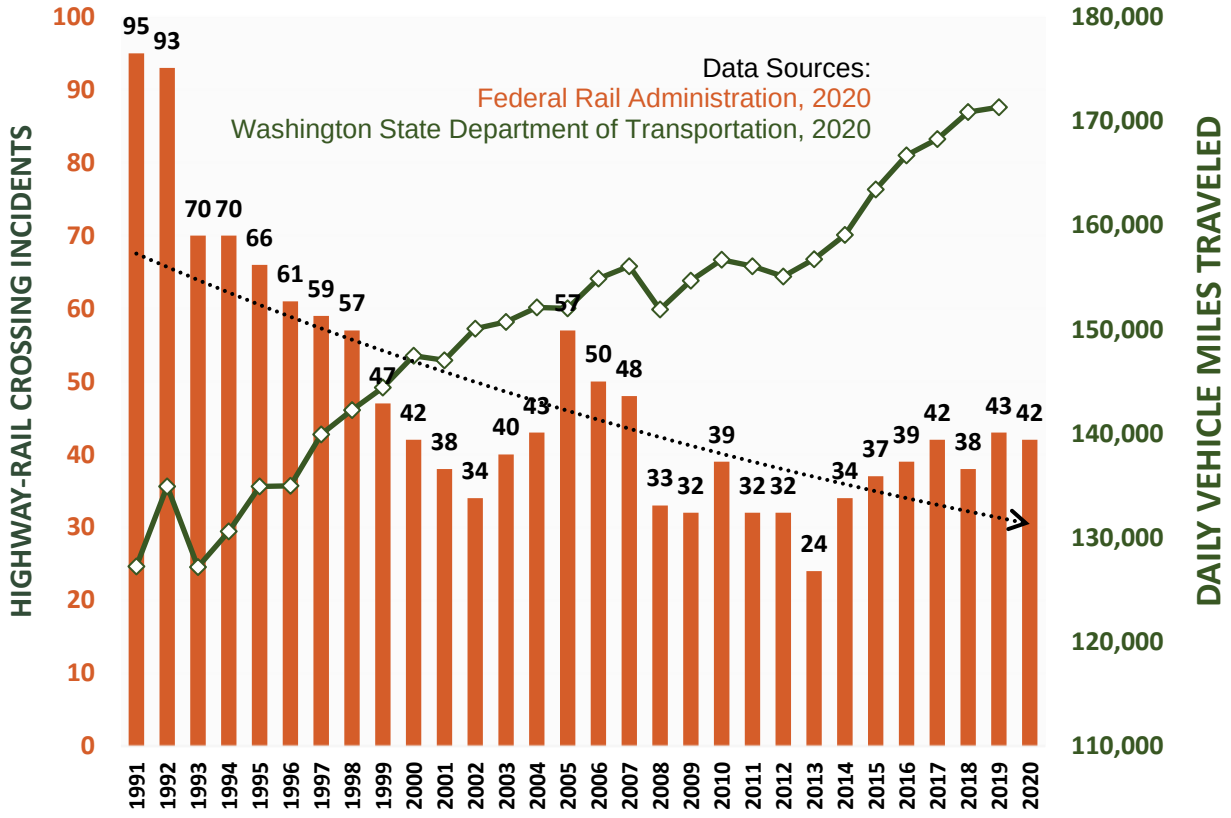
This section summarizes the 30-year history of highway-rail crossing incidents in the state to provide a general, statewide trend assessment. The assessment of risk for individual crossings in the SAP analysis uses the most recent five-year incident history.

Historic Incident Analysis

As shown in Figure 6, the number of highway-rail crossing incidents has declined significantly since 1991. A total of 95 highway-rail crossing incidents occurred in 1991 compared to 42 incidents in 2020. The lowest annual incident count occurred in 2013 (34 incidents). This decline is particularly notable because the average annual vehicle miles traveled on the state's public streets and highways have significantly increased over the past 30 years. The decline in highway-rail crossing incidents is testament to the success of statewide highway-rail crossing safety improvement programs and projects over time, as well as public education.

[20] During the data assembly process, the SAP team uncovered erroneous data points regarding information at several at-grade highway-rail crossings (see Appendix C). These were noted and resolved as part of the data quality assurance process to help ensure that the information presented in the SAP is as accurate as possible.
[21] https://safetydata.fra.dot.gov/officeofsafety/publicsite/DownloadCrossingInventoryData.aspx

Figure 6: Annual Highway-Rail Crossing Incidents and Average Highway Daily Vehicle Miles Traveled in Washington (1991–2020)

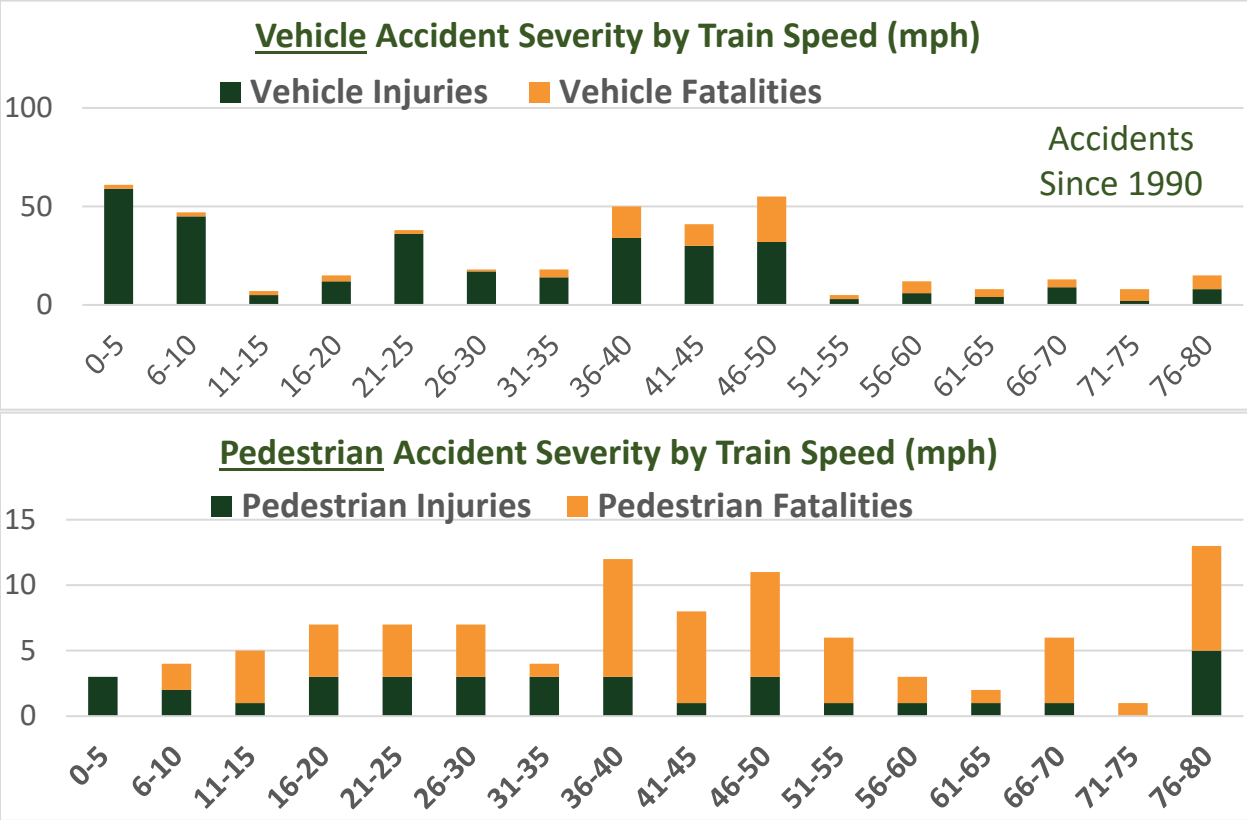


Highway-Rail Crossing Accident/Incident Train Speed

Several factors influence the severity of highway-rail crossing accidents that result in injuries or fatalities; the chief factor is train speed[22]. As shown in Figure 7, train incidents at highway-rail crossings with passengers in vehicles are less likely to result in a fatality when trains are traveling at speeds lower than 30 miles per hour (mph). On the other hand, pedestrians are much more vulnerable than vehicle passengers, and any train-pedestrian accident is more likely to result in serious injury or fatality regardless of the train speed at the time of the collision. This data helps inform and support measures to increase highway-rail crossing safety education and outreach efforts, as discussed in Chapters 3 and 4.

[22] https://rdw.rowan.edu/cgi/viewcontent.cgi?article=1141&context=engineering_facpub

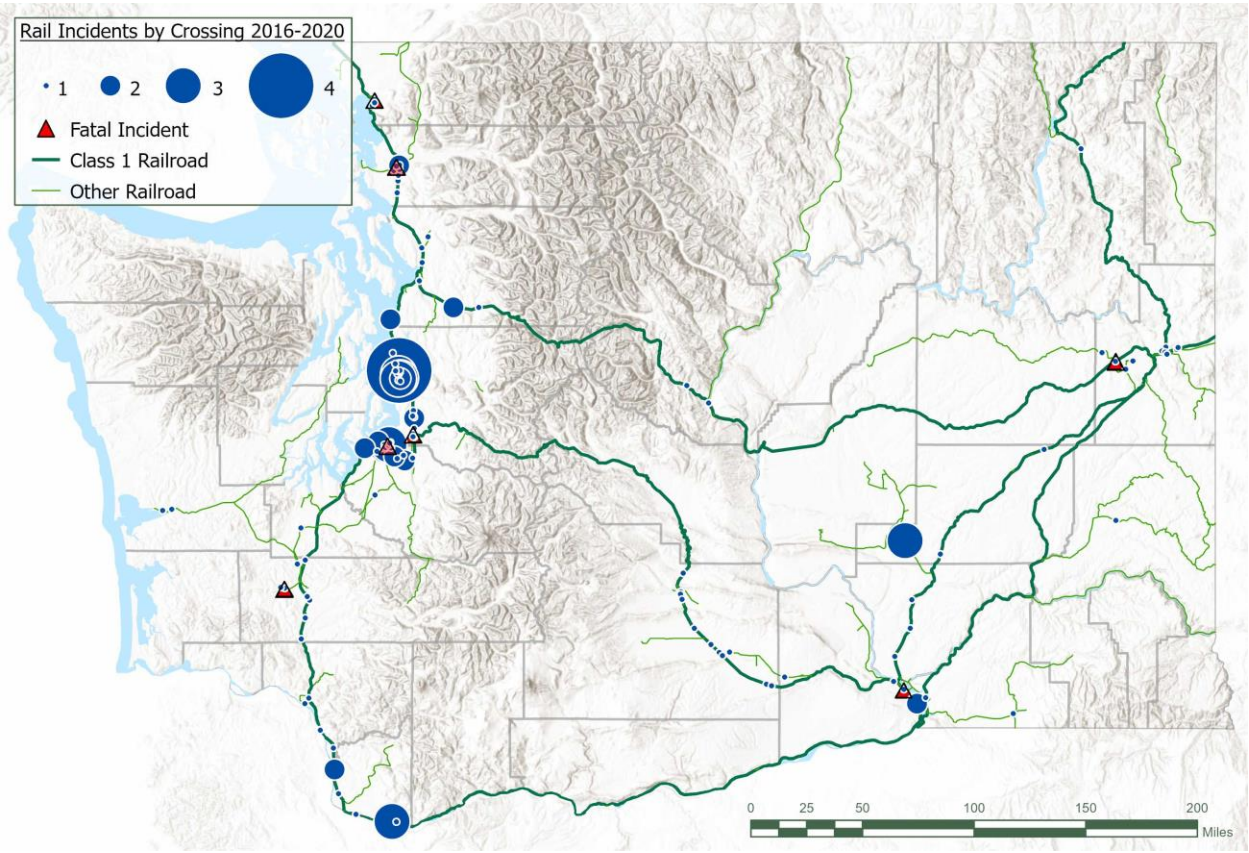
Figure 7: Accident Severity of Highway-Rail Crossing Accidents by Train Speed and User Type



Highway-Rail Crossing Accident/Incident Frequency

Figure 8 shows a five-year history (2016 to 2020) of incidents at highway-rail crossings in Washington, and the locations of crossing incidents that resulted in a fatality. Highway-rail crossings with more incidents tend to be in the more populated cities of Seattle, Tacoma, Vancouver, and Spokane, in the Richland/Kennewick/Pasco urban area, and along the more heavily traveled Class I rail corridors, where the train and vehicle crossing traffic is highest.

Figure 8: Washington At-grade Highway Rail Crossings with Multiple Incidents



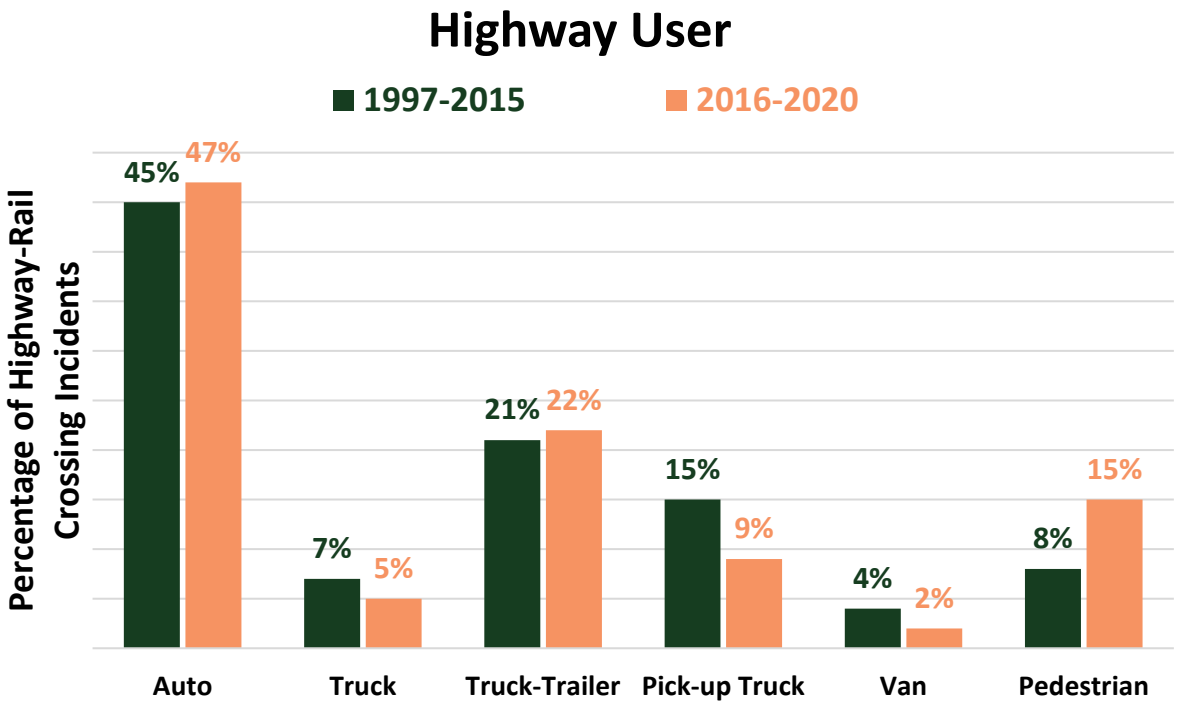
Data Source: FRA, USDOT

Highway Users Involved in At-grade Crossing Incidents

In general, the percentage of highway-rail at-grade crossing incidents by highway user type has seen relatively little change in the past 30 years. However, there are two exceptions: within the past five years there has been a marked decrease in pick-up truck incidents and a remarkable increase in the proportion of pedestrian incidents at Washington's highway-rail at-grade crossings (see Figure 9).The FRA and the UTC do not report whether these increased pedestrian incidents are suicide-related due to a lack of availability of this information.[23] Examination of the data indicates that several pedestrian incidents occurred in the Seattle industrial area, an area that may be considered for increased enforcement as well as education and outreach efforts through this SAP.

[23] https://railroads.dot.gov/highway-rail-crossing-and-trespasser-programs/trespassing-prevention/rail-suicide-prevention

Figure 9: Highway-Rail At-grade Crossing Incidents by Highway User Type (1991–2020)

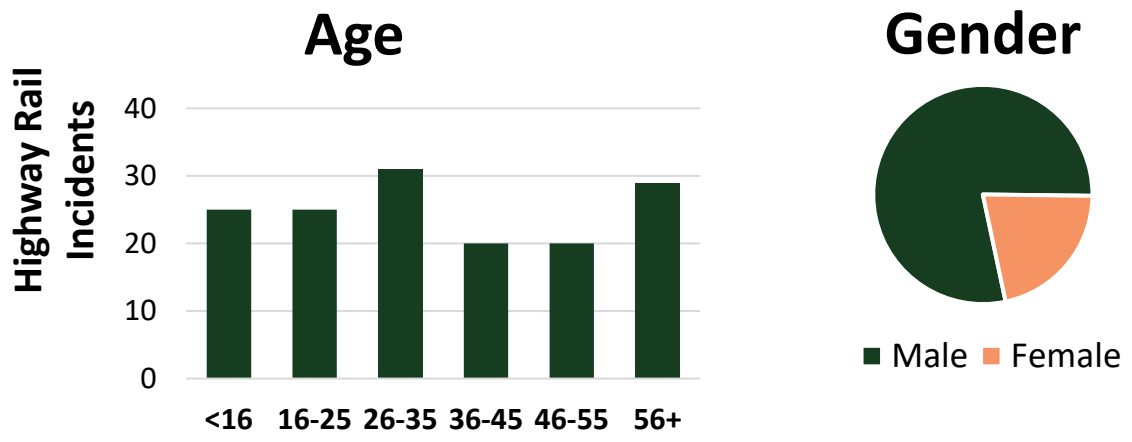


The profiles and traveler actions of vehicle drivers and those of pedestrians involved in highway-rail crossing incidents differ greatly. The following discussion summarizes these characteristics separately for vehicle drivers and pedestrians.

Vehicle Driver Profiles

Figure 10 summarizes the profile of vehicle drivers involved in highway-rail crossing incidents from 2016 to 2020. Over those five years, the typical drivers involved in at-grade crossing incidents were men (77 percent), either ages 26 to 35 or older than 56 years of age. This vehicle driver profile data helps to inform continued enforcement and driver education measures to implement as part of the SAP, as noted in Chapter 3.

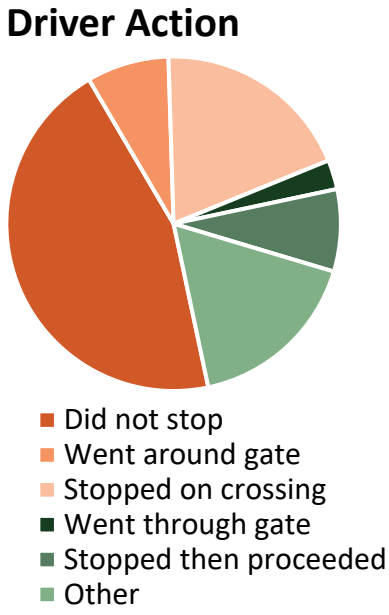
Figure 10: Profile of Washington Vehicle Drivers Involved in Highway-Rail Crossing Incidents (2016–2020)



Vehicle Driver Actions

Most of the driver actions that occur as part of highway-rail crossing incidents are either failing to stop at the crossing (which happens at both passive and active crossings), driving around crossing gates, or stopping on the crossing (the FRA and UTC incident reporting generally does not contain the reasons that drivers stop on crossings during a crossing incident, as this information may be unknown or not disclosed in accident reports). Figure 11 summarizes the actions of drivers involved in highway-rail crossing incidents statewide. The identification of potential engineering solutions to improve crossing safety is included as part of the SAP Toolkit (see Chapter 3 and Appendix F).

Figure 11: Actions of Drivers Involved in Highway-Rail Crossing Incidents

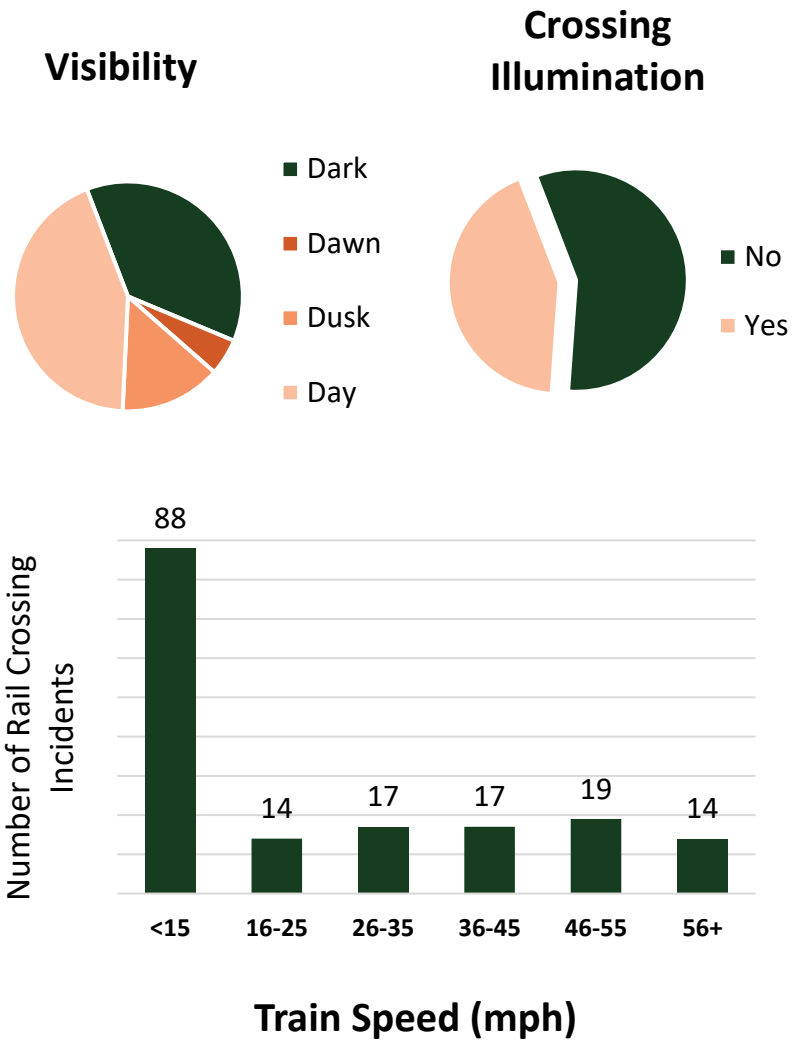


Environmental Conditions in Incidents Involving Vehicles

Environmental conditions are a factor in the occurrence of highway-rail crossing incidents. As illustrated in Figure 12, the data for Washington regarding the prevailing environmental conditions when vehicle crossing incidents occur indicate:

- About half of the incidents occurred during the daytime or at dawn.
- More than half of the highway-rail crossings are not illuminated.
- A significant proportion of incidents occur at highway-rail crossings where the train speed is very low.

Figure 12: Environmental Conditions During Vehicle Rail Crossing Incidents

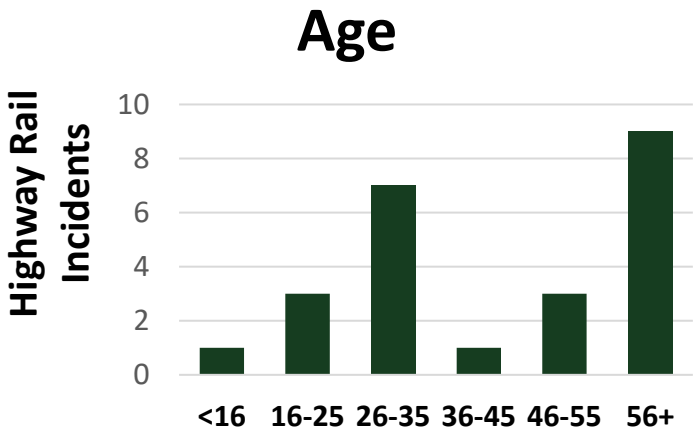


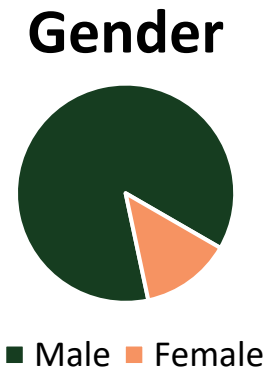
Assessment of the incident data indicates that the majority of vehicle incidents involving low train speeds occurred in the Tacoma and Seattle port areas. These findings can help identify potential capital improvements as well as SAP education measures to focus on in the two port areas (see Chapter 3).

Pedestrians

Figure 13 summarizes the profile of pedestrians involved in highway-rail crossing incidents throughout Washington. From 2016 to 2020, the typical pedestrians involved in rail crossing incidents were men (85 percent), aged between 26 and 35 or older than 56 years of age (the majority). This pedestrian profile data helps to inform continued enforcement and driver education measures to implement as part of the SAP.

Figure 13: Profile of Pedestrians Involved in Washington Highway-Rail Crossing Incidents (2016–2020)

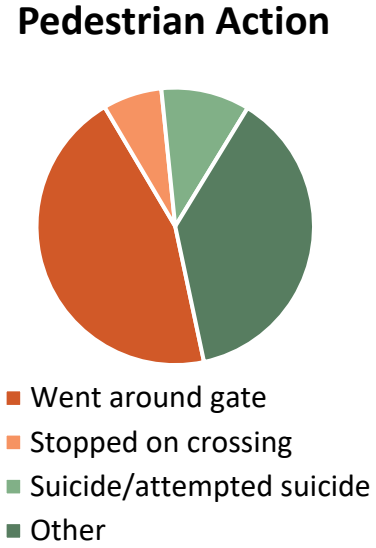




Pedestrian Actions

Most of the pedestrian actions in highway-rail crossing incidents were either failing to stop at the crossing (crossings with both passive and active protection devices), going around crossing gates, or stopping on the crossing (FRA and UTC incident reporting does not contain apparent reasons why motorists stop on crossings during a train event, as this information is generally not known or disclosed in accident reports). Figure 14 summarizes the actions of pedestrians involved in highway-rail crossing incidents statewide. The identification of potential engineering solutions to improve crossing safety is included as part of the SAP Toolkit (see Chapter 3 and Appendix F).

Figure 14: Actions of Pedestrians Involved in Rail Crossing Incidents



Washington State 2016-2020
Source: FRA

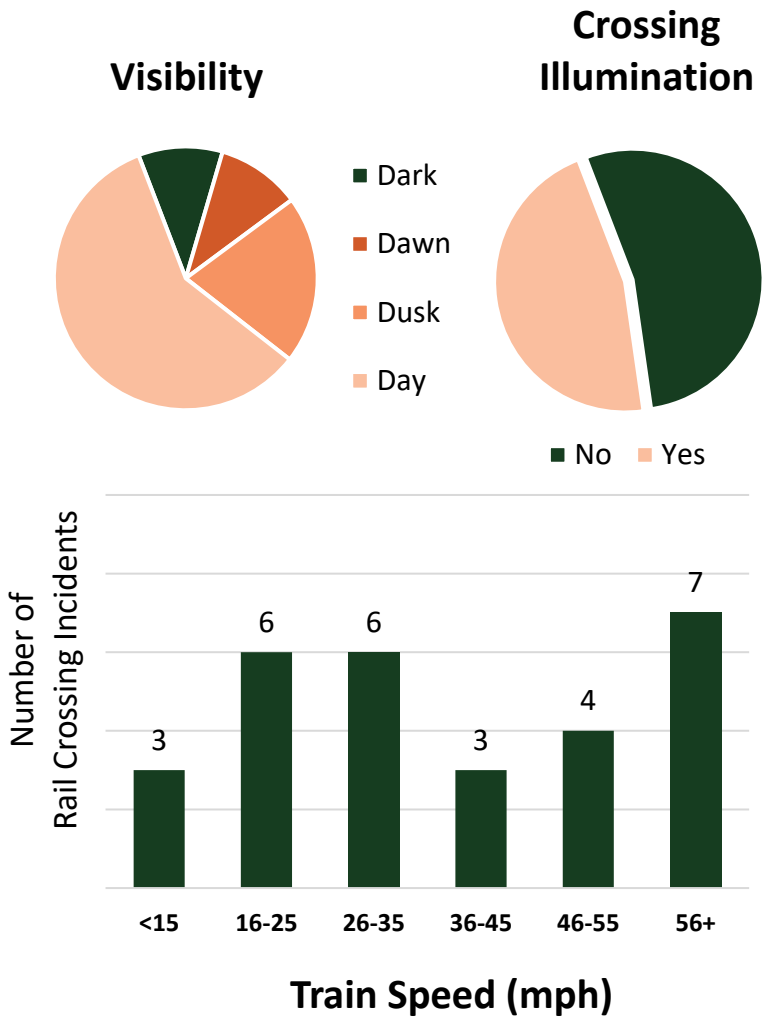
Environmental Conditions in Incidents Involving Pedestrians

As illustrated in Figure 15, the prevailing environmental conditions surrounding pedestrian at-grade crossing incidents indicate:

- A significant number of pedestrian at-grade crossing incidents occurred during dusk and dawn hours.
- Slightly more than half of the at-grade crossings are not illuminated.
- The train speed at the time of the pedestrian crossing incident varies significantly.

Findings from the pedestrian incident data analysis help to identify potential pedestrian at-grade crossing enhancements that would improve crossing awareness (see Chapter 3).

Figure 15: Environmental Conditions During Pedestrian Rail Crossing Incidents



Identifying Higher-risk Highway-Rail Crossings

Utilizing the FRA's guidelines for state action plans, the UTC's SAP is focused exclusively on public, at-grade crossings. The FRA's rule narrows the SAP's examination of at-grade crossings using the following three fundamental criteria:

1. Crossings that have experienced more than one accident/incident in the past five years.
2. Crossings that have experienced at least one accident/incident in last three years.
3. Crossings that are "higher-risk" as defined locally.

Locally Defined Higher-risk Crossings

The SAP analysis uses locally defined criteria to help select higher-risk highway-rail crossings in Washington.

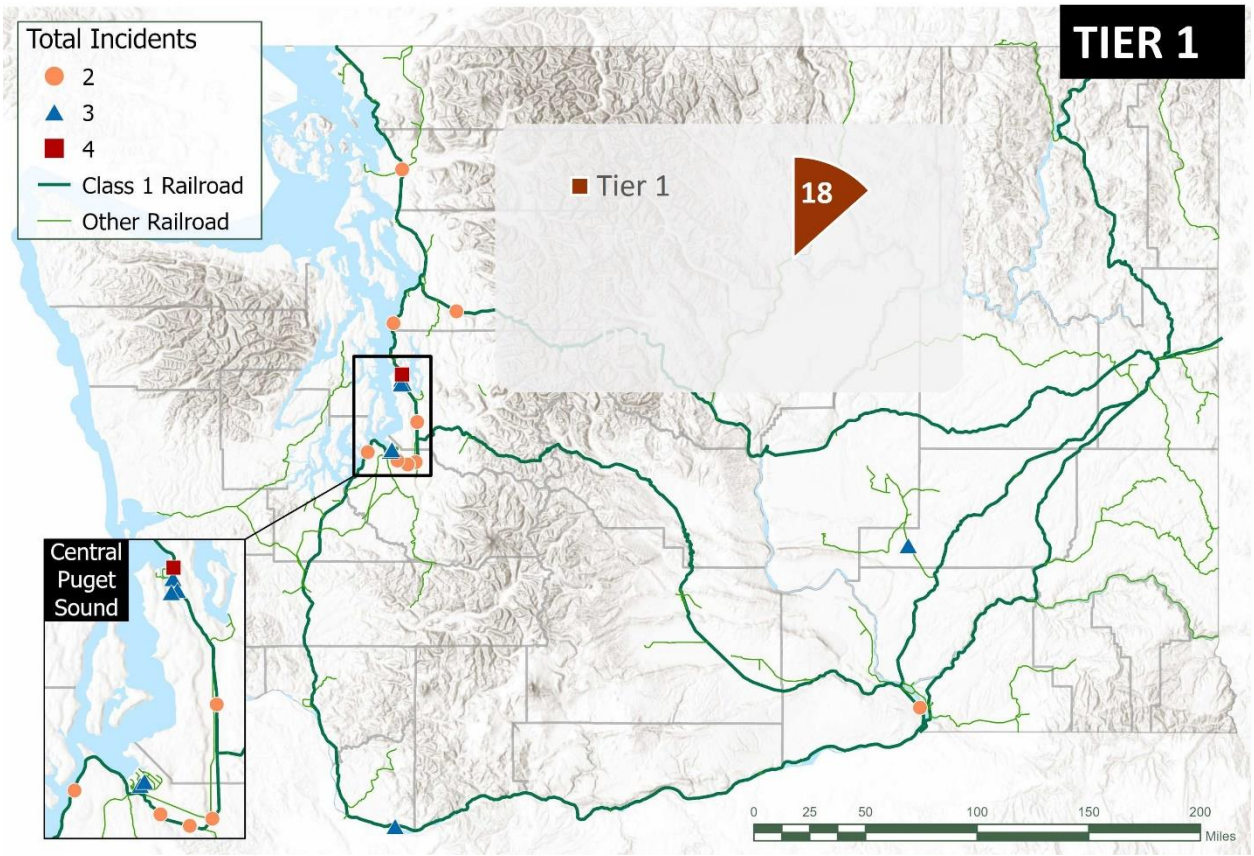
Definition of "Tiers" of Public At-grade Crossings

Using the FRA's online incident and accident data for the five-year period from 2016 to 2020 and applying the FRA's three fundamental criteria and the Washington defined criteria, the SAP analysis established four separate tiers of public at-grade crossings. These four tiers are used to help define the potential higher-risk crossings in Washington.

Tier 1

Tier 1 includes those public highway-rail and pathway-rail at-grade crossings that experienced multiple incidents or accidents (more than two) during the five-year period from 2016 to 2020. As illustrated in Figure 16, there are 18 crossings in the state that experienced multiple incidents or accidents during the five-year period. Several multi-incident crossings are found along the BNSF north-south main line.

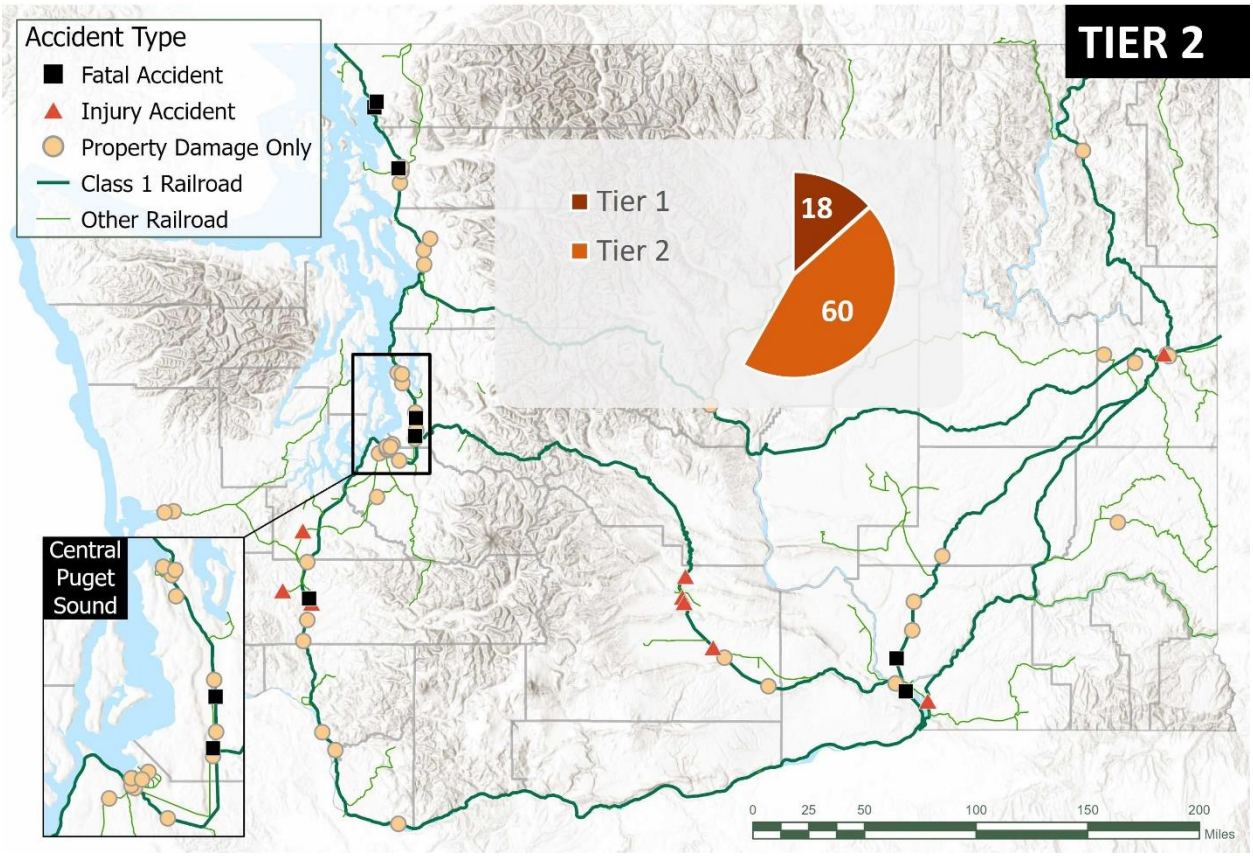
Figure 16: Tier 1 - Multi-incident Highway-Rail Crossings in Washington (2016–2020)



Tier 2

Tier 2 includes those public highway-rail and pathway-rail at-grade crossings that experienced one incident within the three-year period of 2018 to 2020. As shown in Figure 17, there are 60 public highway and pathway at-grade crossings in the state that experienced one incident within the three-year reporting period. Most of these single-incident crossings are located along the state's Class I rail lines.

Figure 17: Tier 2 - Single-incident Highway-Rail Crossings (2018–2020)



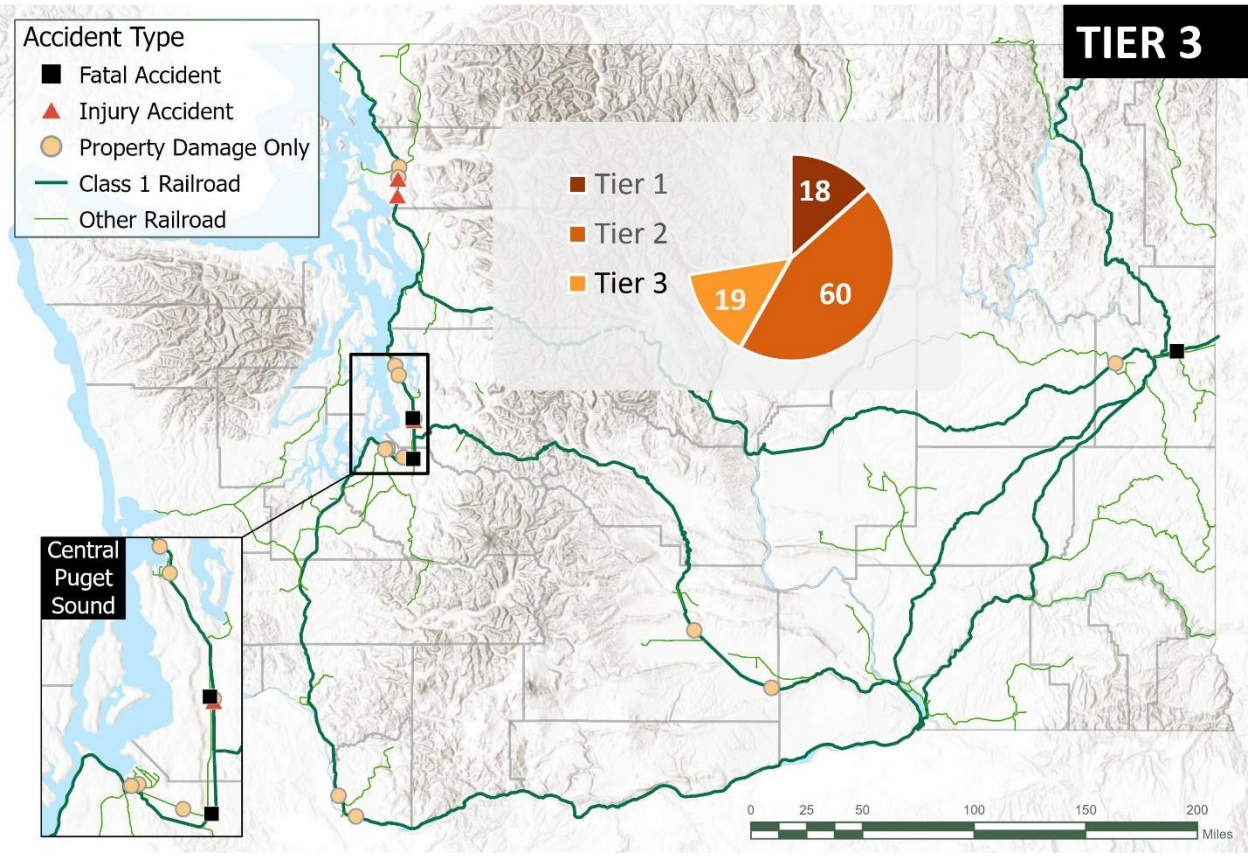
Tier 3

The SAP applies the FRA's Web-Based Accident Prediction Systems (WBAPS) model to help identify and rank incident-prone crossings. The WBAPS methodology incorporates key crossing characteristics, including the type of warning device (flashing lights and/or gates), crossing surface, maximum train timetable speed, the total number of daily trains, and highway vehicle traffic. With the correct inputs applied, the WBAPS model generates scores for all public, at-grade highway crossings in Washington. Higher WBAPS scores reflect crossings that are more incident-prone. The SAP analysis uses these crossing scores to initially rank all crossings and to help identify the top 100 incident-prone crossings for further classification in Tiers 3 and 4 below.

Tier 3 includes those public highway and pathway at-grade crossings that experienced one incident within the period of 2016 to 2020 and rank within the top 100 incident-prone crossings. As shown in Figure 18, there are 19 crossings in Washington that had one reported incident in 2016 or 2017 that also rank within the top 100 incident-prone crossings.

Of note, several of the top 100 incident-prone highway-rail crossings are already ranked in Tiers 1 and 2 above.

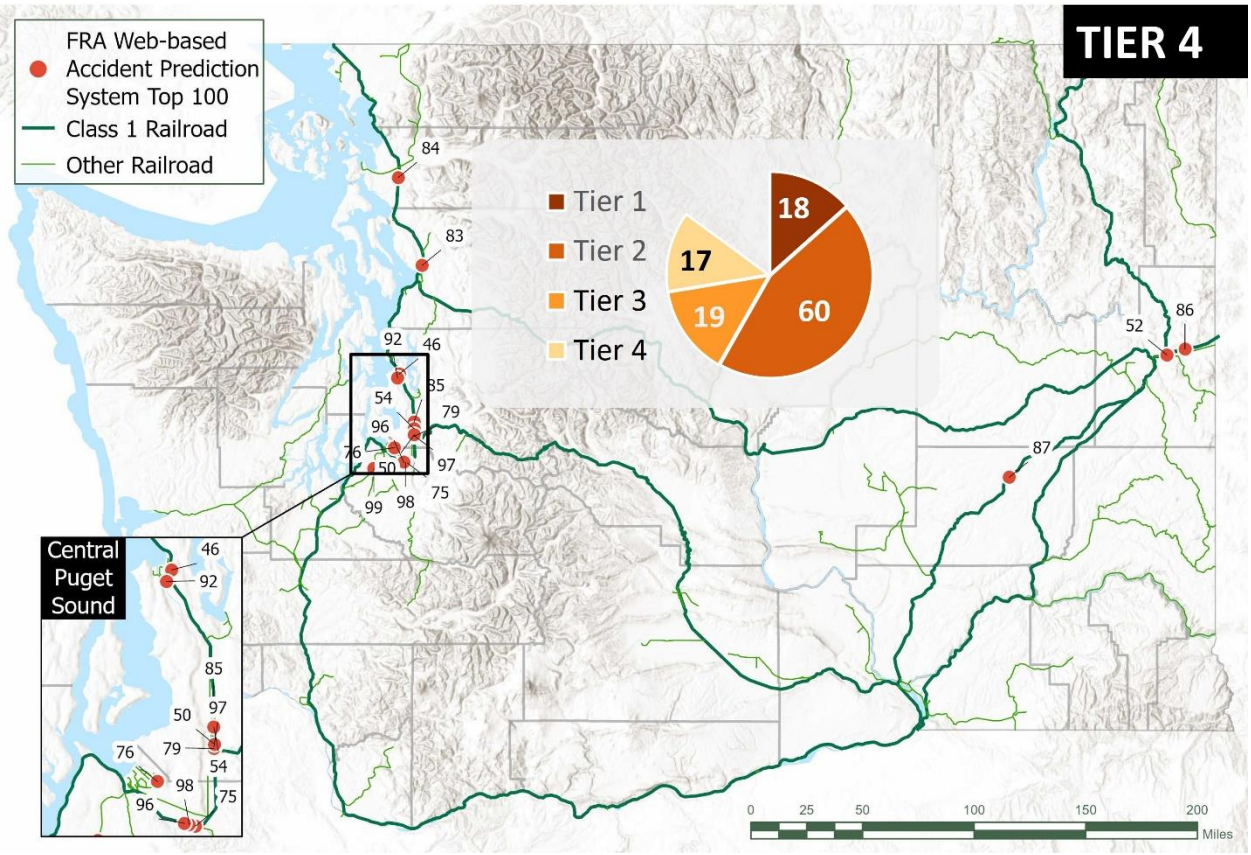
Figure 18: Tier 3 – Top 100 Incident-prone Highway-Rail Crossings with One Incident (2016–2018)



Tier 4

The remaining top 100 incident-prone highway-rail crossings in Washington that have not experienced an incident in the five-year period from 2016 through 2020 are included in Tier 4. Figure 19 maps the 17 Tier 4 crossings.

Figure 19: Tier 4 - Top 100 Incident-prone Crossings with No Incidents in 2016–2020



Evaluating Higher-risk At-grade Crossings

Higher-risk At-grade Crossings

A total of 114 public at-grade crossings identified in Tiers 1 to 4 as the higher-risk crossings in Washington were subject to further evaluation, as described in this section. This evaluation determined the Top 58 SAP crossings.

Crossing Risk and Evaluation Factors

The SAP project team used six factors to evaluate and score the higher-risk highway-rail at-grade crossings in Washington. These six factors are:

Exposure

An exposure score for each higher-risk at-grade crossing was calculated by multiplying the daily train count and average annual daily traffic (AADT) at that crossing.

Accident Prediction

An accident prediction score for each public at-grade crossing was derived by applying FRA's Accident Prediction Model. Inputs to the model include the five-year (2016–2020) incident history, setting (urban versus rural), maximum train timetable speed, crossing surface type, number of daily trains, AADT, and crossing protection device (flashing lights and/or gates). The Accident Prediction regression model estimates the probability of accidents at higher-risk at-grade crossings.

Accident Severity

Similarly, an accident severity score for each at-grade crossing was derived by applying FRA's Accident Severity Model. Inputs to the model include the five-year incident history, setting (urban versus rural), maximum train timetable speed, number of daily trains, and crossing protection device (flashing lights and/or gates). The accident severity factor estimates the probabilities of accidents at higher-risk crossings belonging to each severity category (non-injury, injury, and fatality). This score more heavily weights at-grade crossings where fatal crashes have occurred.

Benefit-Cost Ratio

Another factor used to evaluate the higher-risk crossings in this SAP analysis is the benefit-cost ratio (BCR).[24] The analysis included developing interim crossing improvements for each higher-risk crossing and then inputting the improvements data into a specific model (FRA's GradeDec model) to yield a BCR score (see Chapters 3 and 4 for further discussion on developing and

[24] The UTC is committed to rail crossing safety. The interim benefit-cost assessment in the SAP methodology is used exclusively in the rating and ranking of higher-risk crossings and does not imply either an assumption of final crossing operational or capital improvement plans or designs, or of their economic costs or benefits.

implementing plans for highway-rail crossing improvements). Examples of safety improvements assumed in the BCR analysis include:

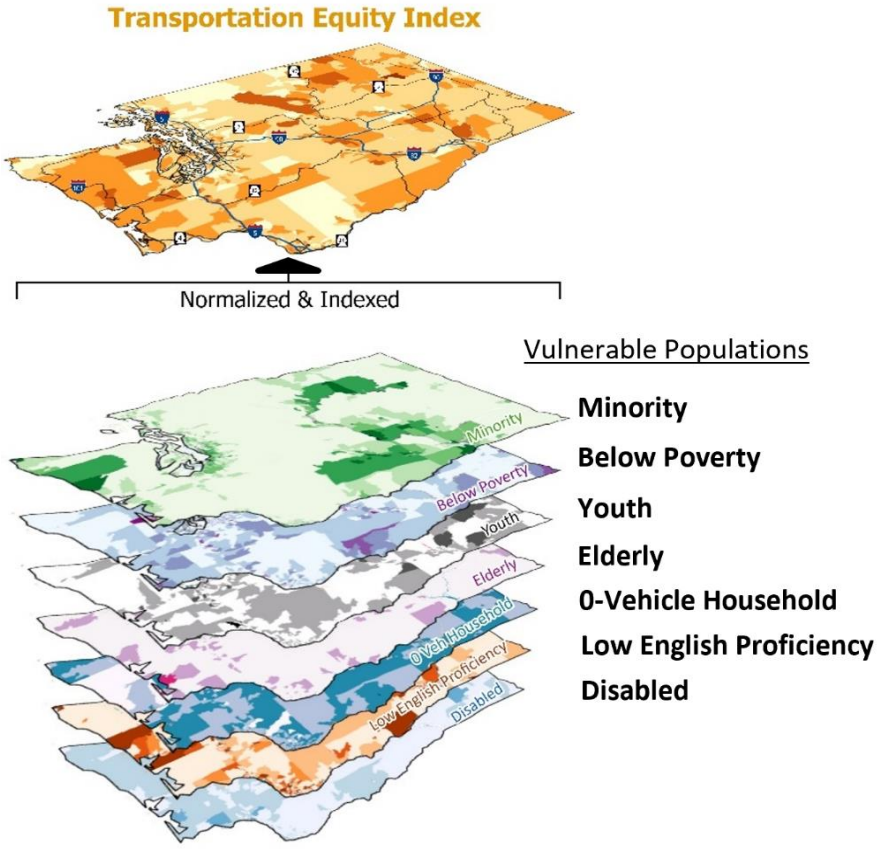
- *Active Crossings* – raised medians, signal interconnect, four-quadrant gates, and pedestrian gates
- *Passive Crossings* – gates and flashing lights

The GradeDec model estimates the safety benefit of potential highway-rail crossing safety improvements while accounting for capital investment and operational and maintenance costs. It incorporates estimates for costs associated with higher-risk rail crossing incidents and accounts for factors such as time of a stopped train, freight system and environmental impacts, and crash severity.

Equity

As part of the evaluation of higher-risk crossings, the SAP project team developed a statewide transportation equity index based on summary demographic data provided by the U.S. Census Bureau, *American Community Survey* (2015–2019).[25] As shown in Figure 20, estimates of seven vulnerable populations are recoded for each U.S. Census block group in the state.

Figure 20: Transportation Equity Index for Washington State



[25] The SAP transportation equity index is in direct alignment with the Washington Department of Health's Health Environment for All Act and utilizes the department's Information by Location (IBL) site and tool with respect to component parts of noted socioeconomic factors, including: (1) poverty, (2) race, (3) limited English speaking, (4) seniors (population 65 and older), and (5) populations with a disability. The SAP index also includes other vulnerable populations from the American Community Survey, including (6) youth and (7) zero-vehicle households, that the IBL tool does not.

These estimates are normalized, ranked, and scored to give a single index value. Those block groups with the darkest shading in Figure 20 reflect subareas of the state with the highest percentage of vulnerable populations. Each higher-risk crossing is assigned a transportation equity index score associated within its respective block group.

Oil-by-Rail

The SAP project team also considered, as an evaluation factor for higher-risk highway-rail crossings, whether the crossing was located along a Class I railroad line that carries significant amounts of crude oil as cargo. The scoring for this evaluation factor is a simple binary score: each higher-risk crossing along a Class I oil-by-rail route received a score of 1, and each higher-risk highway-rail crossing that is not along such a route received a score of 0.

Risk Factor Data Normalization and Scoring

Each of the risk and evaluation factors yields a unique score for the higher-risk at-grade highway-rail crossings. The evaluation applied statistical analyses of the mean and standard deviation of each risk factor data range, and normalized and scored the data for consistency, as summarized in Table 6, below.

Table 6: Risk Factor Data Normalization and Scoring

Standard Deviation	Risk Factor Score
Below -1 standard deviation below the mean	0
Between -1 standard deviation and the mean	1
Between the mean and +1 standard deviation	2
Between +1 and +2 standard deviations	3
Above +2 standard deviation	4

This scoring is applied to all risk factors except for oil-by-rail, as noted above.

Ranking of Higher-risk At-grade Crossings

Once normalized, the highest possible total score for higher-risk at-grade crossings is 21. Total scores for all higher-risk crossings (114) are tabulated and sorted from highest to lowest scores. The highest at-grade crossing score is 18 and the lowest is 1.

Appendix D includes the preliminary list of the higher-risk crossing scores and rankings.

Priority Higher-risk At-grade Crossings

Higher-risk At-grade Crossings Funded Under the Section 130 Program

Twelve of the 114 higher-risk crossings that this SAP evaluation initially identified statewide were previously approved for funding for improvements through WSDOT's Section 130 program and are therefore not considered further. These crossings have also been previously identified for priority improvements in the WSDOT *State Rail Plan* and the JTC *Prioritization of Prominent Road-Rail Conflicts in Washington State*. Table 7 summarizes those higher-risk crossings identified in Chapter 2 that have already been constructed (e.g., the Lander Street over-crossing in Seattle) or have been identified for full funding through the Section 130 program.

Table 7: Higher-Risk Highway-Rail Crossings Already Constructed or Funded

USDOT No.	Railroad	City	Highway
084565X	BNSF Railway Company	Monroe	Kelsey Street
058642C	BNSF Railway Company	Spokane	S Brooks Road
844396M	Union Pacific Railroad Company	Walla Walla County	Dodd Road
085742D	BNSF Railway Company	Tacoma	6th Avenue
852638B	Tacoma Rail	Tacoma	Port of Tacoma
077846P	BNSF Railway Company	Bellingham	F St/Roeder Street
084758W	BNSF Railway Company	Mount Vernon	4th Street N/Riverside Drive
084735P	BNSF Railway Company	Mount Vernon	Peter Johnson Road
084640G	BNSF Railway Company	Marysville	4th Street
101004G	BNSF Railway Company	Seattle	Lander Street
084754U	BNSF Railway Company	Mount Vernon	N 4th Street/Riverside Drive
092437K	BNSF Railway Company	Woodland	Scott Avenue West

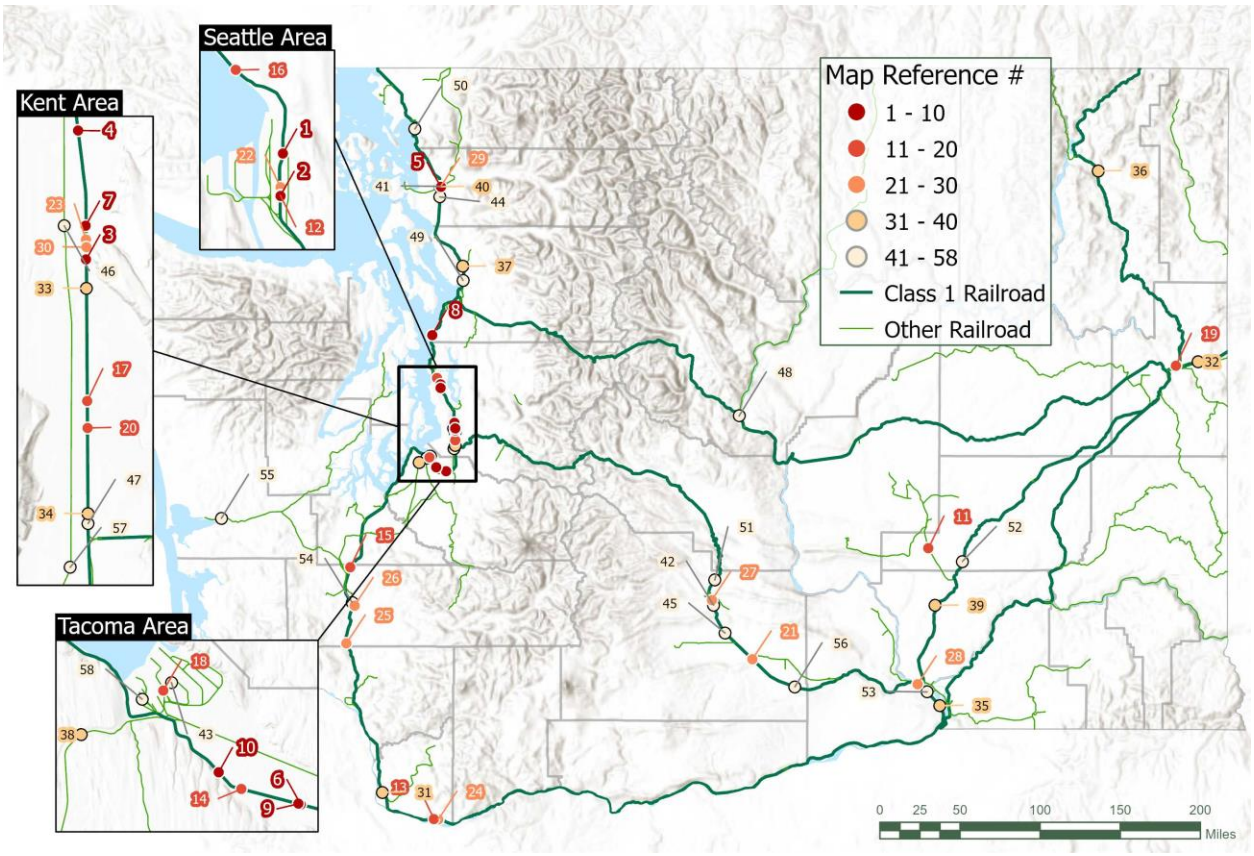
Other Refinements to the Higher-risk Crossing Data

The FRA database is missing AADT and daily train count data for a limited number of the higher-risk crossings identified in Chapter 2. The SAP project team identified local data sources to supplement AADT and train counts for these crossings and recalculated the exposure score for each.

SAP Top 58 Priority Higher-risk Crossings

Eight higher-risk crossings tied for the fiftieth higher-risk crossing, thus there are a total of 58 crossings mapped and listed as the top priority higher-risk crossings. Figure 21 maps and Table 8 lists the Top 58 priority higher-risk crossings in the SAP.[26]

Figure 21: SAP Top 58 Priority Higher-Risk Crossings



[26] Using the analysis findings from the evaluation of highway-rail crossings described in Chapter 2 and refining those findings and data as described in the preceding two sections (removing already funded and constructed crossings and using supplementary data for the exposure scoring), the list of the top priority higher-risk crossings has been re-scored and ranked.

Table 8: SAP Top 58 Priority Higher-Risk Crossings

USDOT Crossing Number	City	Highway	Top 58 Ranking	Tied Ranking	Tier
927461X	Seattle	Holgate St.	1	1	1
085587B	Seattle	Eastbound Spokane St.	2	2	1
085640K	Kent	State Route 516 Willis St.	3	3	1
085625H	Kent	S 212th St.	4	4	2
084764A	Burlington	Greenleaf St.	5	5	1
085695X	Puyallup	3rd St. NE 1-Way	6	5	1
085629K	Kent	James St.	7	5	2
085439G	Edmonds	Dayton St.	8	8	1
085696E	Puyallup	Meridian St. 1-Way	9	8	1
085706H	Puyallup	52nd St. E	10	8	1
089775E	Othello	Lee Rd.	11	8	1
085586U	Seattle	Westbound Spokane St.	12	8	2
090110F	Camas	3rd St. NW	13	13	1
085703M	Puyallup	Stewart Ave./66th St	14	13	2
092523G	Centralia	Hanford Valley Rd.	15	13	2
085414L	Seattle	Broad St.	16	13	3
085647H	Auburn	37th St. NW	17	13	4
852612Y	Tacoma	Milwaukee Sim	18	18	1
065984U	Spokane	E Mission Ave.	19	18	2
085650R	Auburn	29th St. NW	20	18	2
104520Y	Toppenish	State Hwy. 223	21	18	2
085585M	Seattle	Horton St.	22	18	3
085633A	Kent	Smith St.	23	18	3
090115P	Washougal	24th St.	24	24	2
092484T	Vader	State Route 506	25	24	2
092504C	Napavine	Washington St.	26	24	2
099165Y	Yakima	Yakima Ave.	27	24	2
104572R	Kennewick	N Fruitland St.	28	24	2
084765G	Burlington	Fairhaven St. (1)	29	24	3
085637C	Kent	Gowe St.	30	24	3
092421N	Vancouver	NW 122nd St.	31	24	3
066367E	Spokane Valley	Pines Rd.	32	24	4
085642Y	Kent	S 259th St.	33	24	4

USDOT Crossing Number	City	Highway	Top 58 Ranking	Tied Ranking	Tier
085652E	Auburn	3rd St. NW	34	24	4
090051F	Kennewick	Cushman Rd.	35	35	1
059152N	Colville	1st Ave.	36	35	2
084664V	Marysville	136th St. NE	37	35	2
085382H	Tacoma	Pine St.	38	35	2
089695L	Mesa	Sheffield Rd.	39	35	2
092259B	Burlington	Walnut St.	40	35	2
092261C	Burlington	Fairhaven St. (2)	41	35	2
099168U	Yakima	E Meade Ave.	42	35	2
932777T	Tacoma	Lincoln Ave.	43	35	2
084753M	Mount Vernon	Fir St.	44	35	3
099180B	Wapato	Donald Rd.	45	35	3
396578L	Kent	W James St.	46	35	3
085655A	Auburn	W Main St.	47	35	4
065839V	Wenatchee	Miller St.	48	48	2
084644J	Marysville	8th St.	49	48	2
084805C	Bellingham	City Park	50	48	2
085196G	Selah	Pomona Rd.	51	48	2
089682K	Hatton	Hampton Rd.	52	48	2
090036D	Kennewick	Perkins Rd. 7572	53	48	2
092505J	Napavine	Somerville Rd.	54	48	2
096029N	Aberdeen	S Tyler St./Wishkah Mall	55	48	2
104537C	Mabton	Phillips Rd.	56	48	2
396593N	Auburn	15th St. SW	57	48	2
808728J	Tacoma	E 15th St./E J St.	58	48	2

Appendix E summarizes the re-scored top 58 priority higher-risk crossings, including their evaluation scores and final rankings.

Chapter 3
Solutions

Chapter 3: Solutions

Chapter 3 summarizes the solutions phase of the SAP and contains a comprehensive discussion of potential tools and available highway-rail crossing funding sources. This chapter is designed to be used as a reference guide, to provide information for improving highway-rail crossing safety in Washington.

Highway-Rail At-grade Crossing Safety Toolkit

The SAP development process included the creation of the Highway-Rail At-grade Crossing Safety Toolkit (Toolkit), which provides information and tools to identify potential crossing improvements for existing at-grade crossings. The Toolkit can guide the approach and advancement of project preparation into refined design. Ultimately, the appropriate traffic control system to be used at any highway-rail grade crossing should be determined by an engineering study involving both the road authority and the railroad company. Highway-rail crossing modifications must generally be approved by the UTC.

The Toolkit describes highway-rail crossing treatments and strategies, and where they may be most applicable. Treatments and strategies include grade separations, closures, consolidation, passive treatments, active warning devices, specialized treatments for pedestrian/bicycle facilities, and education and enforcement opportunities.

The Toolkit is explained further in the following sections:

- **Three Es:** Describes engineering, education, and enforcement efforts to address safety issues at highway-rail grade crossings.
- **Toolkit Treatments Summary:** Lists the at-grade crossing treatments ranging from low-cost safety treatments to complex grade separations (see Table 9).

In addition, Appendix F includes a standalone toolkit and supplemental information to consider when implementing at-grade crossing improvement treatments. It includes a discussion of the categories of crossing treatments as well as important considerations to determine whether a highway-rail crossing would benefit from the treatments.

Three Es

Efforts to address safety concerns at at-grade crossings include a variety of tools and strategies that fall within broader categories of the Three Es (engineering, education, and enforcement). A combination of strategies from all three categories can provide a comprehensive solution when

a single strategy is unable to adequately address safety. Implementation of solutions involves active engagement from the railroad and the local, state, and federal governments.

Engineering

Engineering can be either passive or active treatments that provide physical modifications to the highway-rail grade crossing or surrounding area. Passive treatments include static signs, pavement markings, medians, and grade separation. Examples of active treatments include flashing light signals, automated gates, and train detection. The Manual on Uniform Traffic Control Devices (MUTCD) includes examples of and specifications for both passive and active devices used at at-grade crossings. In addition, several agencies and organizations, including USDOT's Volpe Center, the National Academies of Sciences, Engineering, and Medicine's Transportation Research Board, universities, and the FRA continue to research and develop emerging technologies to improve safety at highway-rail grade crossings.

Education

Educational programs aim to inform the public on how to make safer decisions at at-grade crossings. The rail network in Washington crosses through the heart of many communities, including urban hubs and residential areas. Addressing safety near railroad tracks is a challenge that, in addition to engineering and enforcement efforts, must include education to be successful.

As described in Chapter 1, the WAOL program provides education and outreach in higher-risk areas throughout the state through presentations to targeted audiences, participation at special events, and social media and digital media campaigns. The UTC sponsors WAOL by funding a full-time position and providing in-kind contributions (e.g., a vehicle to transport the WAOL trailer).

Education and the work of WAOL are a component of the SAP implementation strategies (see Chapter 4).

Enforcement

Safety concerns cannot be addressed through engineering or education alone but must include active enforcement of safety laws. The only legal place to cross a railroad is at a designated public crossing; otherwise, it is considered unlawful encroachment of private property and a

citation may be issued for violations under the law. To make enforcement more effective, it can be increased and targeted to occur during times and occasions when trespass incidents are higher. Enforcement officers can participate in the education process to make clear that trespassing is both a legal issue and a safety issue.

Class I railroads, Amtrak, and some short line railroads have their own law enforcement personnel. These officers have Federal Interstate Authority,[27] which allows members of the police teams to conduct law enforcement activities in the states in which the railroad operates. Railroad police often work with local, state, and federal law enforcement agencies on issues concerning the railroad, including crossing safety and trespassing on railroad property.

FRA established a grant program to assist with trespassing enforcement efforts in and around railroads. These grants fund the wages of law enforcement officers who enforce trespassing laws at rail trespass hot spots within their respective jurisdictions or at areas that demonstrate rail trespassing problems in the community on FRA-regulated track. See Appendix G for more information on these grants.

Toolkit Treatments Summary

The treatments described in the Toolkit are targeted to address safety. Table 9 presents a full list of specific treatments in the Toolkit and the primary issue that each detailed treatment is intended to address.

[27] https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title49-section28101&num=0&edition=prelim#:~:text=49%20USC%2028101%3A%20Rail%20police%20officers%20Text%20contains,Amendments%20Effective%20Date%20Regulations%20%C2%A728101.%20Rail%20police%20officers

Table 9: Toolkit Treatments Summary

Category	Specific Safety Treatment	Primary Issue Addressed
Grade Separation	Under-crossing	High level of collisions and delay.
	Over-crossing	High level of collisions and delay.
Closure and Consolidation	Close Crossing to Railroad Traffic	High level of collisions and delay.
	Close Crossing to Highway Traffic	High level of collisions and delay.
	Consolidation	High level of collisions and delay with nearby rail crossing.
Bicycle/ Pedestrian Treatments	Pedestrian Signal Interconnect	Pedestrians crossing tracks at improper times.
	Pedestrian Pathway Crossing Signs and Markings	Lack of warning and direction to safely navigate the crossing.
	Pedestrian Gates	Distracted pedestrians crossing the tracks at unsafe paths of travel.
	Z-Crossing Channelization	Pedestrians/bicyclists unable to see approaching train due to crossing angle.
	Pedestrian Flashing Light Signals	Low pedestrian compliance with existing signs and directions and/or distracted pedestrians.
	Sidewalk Improvements	Inadequate sidewalk, which discourages pedestrians and mobility device users from staying on the safest path of travel.
	Audible Warning	Low pedestrian compliance with existing signs and directions and/or distracted pedestrians.
Education	Washington Operation Lifesaver Campaigns	Pattern of unsafe behavior at railroad crossings and near railroad tracks.
Enforcement	Trespass Enforcement	Pedestrians crossing the railroad away from the designated crossing and occupying railroad rights-of-way.
Geometry/ Reconfiguration	Crossing Surfaces/Roadway Surface Improvement	Location of crossing is not clear, and/or crossing surface is in poor condition.
	Adjust Crossing Geometry	Skewed crossing angle provides poor visibility of approaching trains.
	Adjust Crossing Grade	Physical hump at crossing impedes smooth passage across tracks; reduced sightline at crossing.

Category	Specific Safety Treatment	Primary Issue Addressed
Signing and Striping	Warning Signs and Plaques	Lack of notification to cars, trucks, pedestrians, and bicyclists about approaching railroad crossing.
	General Sign Enhancement	Low compliance with existing signs and directions; low light conditions.
	"Do Not Stop on Tracks" Sign	High level of collisions due to vehicles queuing on the tracks.
	LED Blank-out Sign - "No Turn on Red"	Low compliance with existing signs and directions; high level of collisions due to illegal turns.
	Flashing Sign - "STOP"	Low compliance with existing signs and directions; high level of collisions due to illegal vehicle crossings.
	Grade Crossing Pavement Markings	Lack of notification to highway vehicles, pedestrians, and bicyclists about approaching railroad crossing.
	Raised Pavement Markers	Poor visibility of existing pavement markings during low light and/or inclement weather.
	Exclusion Zone (Keep Clear) Treatments	Highway vehicles stop on tracks or cross tracks when gates are down.
	Edge Lines	Highway vehicles turn into track area due to driver confusion.
	Dynamic Envelope	Highway vehicles stop on tracks or cross tracks when gates are down.
Gates and Signals	Implement Traffic Signal Interconnect or Reoptimize Existing Signal Interconnect	Highway vehicles stop on tracks while waiting for traffic signal queue to clear.
	Cantilever Flashing-light Signals	Low compliance with existing signs and directions; limited warning at low light conditions.
	Supplemental Flashing-light Signals	Low compliance with existing signs and directions; limited warning at low light conditions.
	Illumination	Poor visibility during low light conditions and/or inclement weather.
	Four-quadrant Gates	Autos and trucks circumvent two-quadrant gates.
	Two-quadrant Gates	Low compliance with existing signs and directions; high level of collisions.

Category	Specific Safety Treatment	Primary Issue Addressed
Surrounding Environment Improvements	Reconfigure Parking	Autos and trucks circumvent gates, and existing parking prevents implementation of medians.
	Removing Obstructions and Sight Distance	Obstructions provide poor visibility of approaching trains.
	Relocate Nearby Connections (Local Street and Access Management)	Autos and trucks circumvent gates, and nearby connections prevent implementation of medians.
	Relocate Existing Nearby Transit Stop	Highway vehicles circumvent gates, and nearby transit stop prevents implementation of medians.
Medians	Mountable Raised Curb Systems (Traffic Separators)	Highway vehicles drive across roadway centerline to evade crossing gates, and limited right-of-way is available.
	Wide Raised Medians	Highway vehicles drive across roadway centerline to evade crossing gates and violate mountable raised curb systems.
	Delineator Median Separators	Highway vehicles drive across roadway centerline to evade crossing gates and violate mountable median.
	Non-mountable (Non-traversable) Curb Islands	Highway vehicles drive across roadway centerline to evade crossing gates and violate mountable median.

2022–2026 Rail Safety Funding

This section provides information on various state and federal funding programs that could be used to provide solutions for improving highway-rail grade crossing safety in the future. The information provided is general information and is subject to changes in national and state appropriations, so the actual amounts may vary. The programs listed here have historically funded all or part of grade crossing safety improvements projects and, in some cases, educational and enforcement programs.

Some funding programs discussed in this section have a wide variety of requirements and special provisions that limit their applicability to projects and use by some entities. Some of these programs also require detailed application packages and matching fund commitments.

Federal Funds

The USDOT is the single largest provider of funding for highway-rail grade crossing safety in the United States. The USDOT has provided this funding in a variety of ways over time, generally through the federal transportation funding programs. While Congress has occasionally used

earmarks to provide funding for some projects, this discussion focuses on the established programs that USDOT primarily uses to fund highway-rail grade crossing safety improvements.

The IIJA, which was signed into law in November 2021, includes some substantial changes to transportation programs and funding. It reauthorized several surface transportation programs for FY 2023 through FY 2026, and it extended the enacted funding levels of FY 2021 through FY 2022 for highway, transit, and safety programs. The IIJA includes approximately $550 billion in new spending above baseline funding levels. The IIJA does two things regarding funding: it authorizes the programs and it appropriates the funding for the programs. For several of the programs, the IIJA authorized funding at higher levels than was actually appropriated. This means that Congress could provide additional appropriations, up to the authorized program funding levels, in the future.

Funding from the Section 130 Railway-Highway Crossing Program

The Railway-Highway Crossing Program (23 USC 130 or Section 130) provides funds for the elimination of hazards at railway-highway crossings. Funding for this program is part of FHWA's Highway Safety Improvement Program (HSIP), which is focused on improving highway safety. According to FHWA, implementation of the Section 130 program correlates with a significant decrease in fatalities at railway-highway grade crossings. Funding for the Section 130 program is part of the Federal-Aid Highway Program, which means that funds are apportioned to each state according to a formula.

Eligibility

Projects at all public railway crossings, including roadways, pedestrian paths, and bicycle trails, are eligible for Section 130 program funds. Fifty percent of a state's apportionment under Section 130 is reserved for the installation of protective devices at crossings (e.g., flashing lights and gates). States can use the remainder of the fund apportionment for any hazard elimination project, including protective devices.

Section 130 program funds can be used as incentive payments for local agencies to close public crossings, provided there are matching funds from the railroad. Funds can also be used for local agencies to provide matching funds for state-funded projects.

Washington Section 130 Funding

The IIJA reauthorized the HSIP, which includes Section 130 funding. The appropriated funding levels for the entire HSIP were kept at $245 million for each fiscal year covered by the IIJA. The funding allocation for Washington for FY 2022 is just over $4.4 million.[28] For the FY 2022

[28] https://www.fhwa.dot.gov/legsregs/directives/notices/n4510858/n4510858_t1.cfm#note1

through FY 2026 period, this allocation amount will likely remain constant, meaning that approximately $22 million should be available for highway-rail grade crossing improvement projects in Washington under the Section 130 program.

IIJA Changes to the Section 130 Program

The recent enactment of the IIJA included some changes to the requirements of the Section 130 program. These changes:

- Allow funds to be used for the replacement of functionally obsolete warning devices.
- Increase the federal share of projects from 90 percent to 100 percent.
- Increase the percentage of a state's apportionment to be used for compilation and data analysis from 2 percent to 8 percent.
- Increase the amount allowed for incentive payments to local jurisdictions for crossing closures from $7,500 to $100,000.

It is likely that these changes to the program will encourage more local agencies and railroads to apply for future funding.

Discretionary Grant Programs

The USDOT has several discretionary grant programs that provide funding opportunities for transportation projects. Some of these grant programs are administered by different sections of USDOT, including modal branches and the Office of the Secretary of Transportation. However, these programs have historically been used by public agencies to fund projects that improve highway-rail grade crossing safety, such as grade separations, rail line relocations, crossing consolidations, and installation of new warning devices.

USDOT's discretionary grant programs generally require compliance with some standard elements that must be included in a funding application. These elements can include but are not limited to:

- Detailed grant narrative
- Project scope of work
- Detailed project budget
- Matching funding
- Local support for project
- Benefit-cost analysis

Each grant program issues a "Notice of Funding Opportunity" (NOFO) in the Federal Register, which formally announces that the agency will be accepting grant applications. The NOFO

stipulates the requirements for the grant application, timelines, and specific federal forms that must be submitted. These requirements are different for each agency and program, so each NOFO must be examined carefully to determine whether the specific project is a good candidate for that grant program and whether the project sponsoring entity is eligible to apply for funding.

The discretionary grant programs that have historically been used by public agencies to fund projects to improve highway-rail grade crossing safety include:

- Consolidated Rail Infrastructure and Safety Improvement (CRISI) Program
- Federal-State Partnership for State of Good Repair (SOGR) Grant Program[29]
- Rebuilding American Infrastructure with Sustainability and Equity (RAISE)
- Infrastructure for Rebuilding America (INFRA) Grant Programs
- Commuter Authority Rail Safety Improvement (CARSI) Grant Program

Additional details about these programs, and the new railroad crossing elimination competitive grant program are in Appendix G.

State Funding

Historically the Washington State Legislature has funded a variety of highway-rail safety projects in communities all over the state through specific project appropriations to communities and through WSDOT. Many of projects have been part of larger overall transportation improvement projects, such as the I-5 Mounts Road to Thorne Lane project, which resulted in the grade separation of two at-grade railroad crossings as part of the interchange improvements.

The Washington State Legislature has also established several specific programs that regularly receive funding used to improve highway-rail crossing safety. These programs are discussed below.

Freight Mobility Strategic Investment Board (FMSIB)

Established in 1998, the FMSIB is a 12-member board authorized by RCW 47.06A. The members of the FMSIB are appointed by the Governor and directed to create a comprehensive and coordinated state program to facilitate freight movement between and among local, national, and international markets that enhances trade opportunities. The board is also charged with finding solutions that lessen the impact of the movement of freight on local communities.

[29] https://railroads.dot.gov/BIL

Historically, FMSIB has provided funding for several projects that have reduced conflicts between highways and railroads, as reflected in Figure 22.

The FMSIB's biennial budget is approximately $28 million. For more information, visit the FMSIB website at https://fmsib.wa.gov/.

Figure 22: FMSIB Project #35 Kent, Washington – S. 228th Grade Separation (USDOT 085627W)

(Source: FMSIB.)

UTC Grade Crossing Protective Fund

As mentioned earlier in Chapter 1 of the SAP, the UTC administers the GCPF. Created in 1969, the GCPF was for a long time the only source of funding for highway-rail grade crossing improvements. With the establishment of FHWA's Section 130 program, the GCPF became a less attractive option, due to its higher local fund matching requirements.

In 2003, the Washington State Legislature updated the law that established the GCPF and enabled the funds to be used for a variety of rail-safety-related projects, providing a new life for the program. Funding for projects comes from the state's Public Service Revolving Fund, and approximately $504,000 is appropriated by the Washington State Legislature each biennium.

The UTC generally limits its share of individual project funding to $20,000, but it will consider raising its contribution level if there is a compelling safety reason and business case.

The GCPF has been utilized to target several specific projects. In the 2009-11 biennium the UTC specifically targeted GCPF funding to upgrading passive crossing signage to meet new MUTCD requirements. In the 2017-2019 biennium, a one-time GCPF appropriation of $1.1 million enabled three crossings to be upgraded on designated oil-by-rail routes in Washington. Projects included:

- Marguerite Street, Millwood (USDOT 662513B) - installation of active warning devices (lights and gates)
- Butler Road, Skamania County (USDOT 090135B) - installation of gates and upgrades to the rail signal system
- 48th Ave. NW, Snohomish County (USDOT 084683A) - installation of active warning devices (lights and gates)

Figure 23: GCPF Project at 48th Ave. NW in Snohomish County, Washington (USDOT 084683A)

48th Avenue NW – Before installation of active warning devices. (Source: UTC.)

48th Avenue NW – After installation of active warning devices. (Source: UTC.)

Several recent examples of GCPF-funded projects include pedestrian signals and gates and fencing.

The UTC provided grant funds to the City of Tacoma to assist with the cost of a project installing pedestrian signals and other improvements at the McCarver Street crossing (USDOT 085730J), where several pedestrian fatalities occurred.

Figure 24: McCarver Street Grade Crossing, Tacoma, WA (USDOT 085730J)

(Source: UTC.)

The UTC also provided grant funds to the City of Kent to assist with the costs of installing fencing in two known trespass areas (near E. James Street and S. Willis Street adjacent to the BNSF Railway Seattle Subdivision).

Figure 25: Fencing Project in Kent, WA, to Deter Trespassing

The UTC issues a call for GCPF projects every two years. Project applications for the GCPF are available on the UTC website at: www.utc.wa.gov/GCPF.

Chapter 4

Actions

Chapter 4: Actions

Goals, Objectives, and Implementation Strategies

The FRA rule requires state action plans to discuss specific strategies, including highway-rail grade crossing closures or grade separations, to improve safety at those crossings over a period of at least four years. Plans should also provide an implementation timeline for the strategies discussed.

The SAP project team established the following goals, objectives, and strategies for implementation, grouped together by goal.

1. **Goal: Implement the UTC Highway-Rail Grade Crossing State Action Plan**
   - **A. Objective:** By March 2022 the UTC will hire a staff person to facilitate implementation of the Washington State Highway-Rail State Action Plan.

     Implementation Strategies:

     i. Develop implementation tactics related to each SAP Implementation Strategy.
     ii. Regularly monitor and document SAP implementation.

   - **B. Objective:** By June 2022 the UTC will begin outreach to local agencies and railroads to discuss the priority higher-risk crossings identified in the SAP and identify next steps.

     Implementation Strategies:

     i. Conduct outreach to railroads about crossings identified in the SAP to increase awareness and discuss possible improvements, gauge interest, and determine priorities.
     ii. Engage in outreach to cities, counties, and other public agencies about crossings identified in the SAP to increase awareness, gauge interest, and discuss possible improvements and priorities.
     iii. Follow up with railroads and public agencies to improve highway-rail safety at the priority higher-risk crossings.

2. **Goal: Strengthen coordination and cooperation between the UTC and key partners to advance grade crossing safety**
   - **A. Objective:** By December 2022 the UTC will establish quarterly meetings with WSDOT Local Programs and FHWA staff to discuss Grade Crossing Protective Fund and FHWA Section 130 project funding, coordination, and implementation.

     Implementation Strategies:

     i. Coordinate with WSDOT Local Programs/FHWA staff to establish quarterly meetings on improving highway-rail grade crossing safety efforts statewide, with a focus on the SAP priority higher-risk crossings.
        a. Share information on program and agency challenges and opportunities to understand background issues and experiences related to highway-rail safety funding programs.
        b. Study ways to enhance technical assistance efforts for local communities implementing highway-rail grade crossing improvement projects.

   - **B. Objective:** By December 2022 the UTC will establish regular communication with key stakeholders to discuss grade crossing improvements issues.

     Implementation Strategies:

     i. Educate key stakeholders about state and federal grade crossing funding programs to increase awareness of various potential resources.
     ii. Inform key stakeholders about status and progress of grade crossing improvement projects within Washington to generate awareness of highway-rail safety efforts.

3. **Goal: Enhance grade crossing safety education and outreach activities**
   A. **Objective**: By September 2022 the UTC will partner with WAOL to target rail safety educational opportunities at select crossings identified in the SAP, or along a corridor.

      Implementation Strategies:

      i. Educate drivers and pedestrians about the dangers and benefits of driving/walking safely at highway-rail crossings.
      ii. Conduct outreach to professional drivers (trucking companies/transit/delivery firms) and safety officers with information to increase awareness of highway rail safety.

4. **Goal: Support enforcement efforts to address dangerous behavior at or near railroad crossings**
   A. **Objective:** By September 2022 (Rail Safety Week) the UTC, through WAOL, will conduct outreach to law enforcement associations about grade crossing safety to increase awareness of WAOL program and its impact on highway-rail crossing safety.

      Implementation Strategy:

      i. Actively participate with Amtrak and Operation Lifesaver, Inc. to facilitate and support an Operation Clear Track event in Washington.

   B. **Objective:** By December 2024 the UTC will encourage eligible law enforcement agencies to apply for FRA grants to enhance highway-rail safety and enforcement activities in Washington.

      Implementation Strategy:

      i. Support law enforcement agencies seeking funding by facilitating connections with appropriate funding agencies and resources.

5. **Goal: Monitor SAP progress and report annually**
   A. **Objective:** By April 2023 the UTC will provide a report on the progress toward achieving the goals and objectives of the SAP and updates on the status of the priority higher-risk crossings.

      Implementation Strategies:

      i. Collect information regularly for inclusion in the progress report.
      ii. Utilize information from various implementation strategies in compiling the report.
      iii. Share the SAP progress report with key stakeholders and public officials.

6. **Goal: Improve/modernize the UTC's rail data collection, storage, and analysis system**
   A. **Objective:** By March 2023 the UTC will research alternative data systems, develop a detailed list of requirements, and work with UTC information technology staff to determine the feasibility of deploying a new data system.

      Implementation Strategies:

      i. Study the data systems of other State Grade Crossing programs to gather information on system capabilities and shortcomings.
      ii. Consider how data is collected, analyzed, and reported by UTC staff and how that will change in the future in order to develop a data strategy for the UTC.

   B. **Objective:** If a new data system is deemed feasible, the UTC by October 2023 will develop cost estimates and identify potential revenue sources to fund a new data system purchase, deployment, and ongoing maintenance.

      Implementation Strategies:

      i. Develop a business case for the for the new data system and demonstrate the merits of system replacement.
      ii. Research potential funding sources to support system replacement.

The Washington SAP enables the UTC to look ahead to the future. It also defines the course of action needed to achieve the stated goals.

Designated Official for Responsible for Managing SAP Implementation

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Appendix A:

Related Studies Summaries

Study Title:	Washington State 2014 Marine and Rail Oil Transportation Study
Date:	March 1, 2015
Commissioning Body:	State of Washington Department of Ecology
Purpose of the Study:	Significant changes in the transportation of crude oil occurred in Washington State with increasing delivery of oil by pipeline and rail. This report contains the results of the Marine and Rail Oil Transportation Study authorized by the Legislature in April 2014, including 43 findings and recommendations for legislative, regulatory, or voluntary actions. The recommendations propose ways to maximize public safety and protect the environment, tribal treaty rights, and the state's natural and economic resources. The report also identifies gaps in information that future studies should address. Seven of the appendices in the report contain detailed information on oil transport by rail, facilities and vessels, spill planning and response, properties of oil, and the fate of oil when spilled.
Study Objectives:	The objective of the study was to analyze the risks to public health and safety and to the environment associated with the transport of oil in Washington.
Plan Guidance Available for SAP Consideration:	Key recommendations to the Washington State Legislature for the 2015-2017 Biennium (as it relates to the UTC) were to: • Modify the railroad regulatory fee structure. It should allow the UTC to fund additional inspector positions, including Federal Railroad Administration (FRA)-certified inspectors, with increased pay that is competitive with comparable private sector and federal inspectors. As part of this increase in inspectors, the certified inspectors would increase inspections in the areas of track, hazardous materials, operating practices, motive power and equipment, and crossing signals (increase of eight full-time equivalents (FTEs); $2.5 million). • Amend statutory authority to allow UTC inspectors to enter a private shipper's property to conduct hazardous material inspections related to rail operations, which would require no additional resources.

Study Title:	Washington State 2014 Marine and Rail Oil Transportation Study
Plan Guidance Available for SAP Consideration (cont.):	• Amend statutory authority to allow designated "first-class cities" to join the UTC's railroad crossing inspection and enforcement program. Grant the UTC jurisdiction to require that first class cities inform the UTC when crossings are opened or closed. • Provide funding for the UTC to conduct railroad and road authority diagnostic reviews of high-risk crossings. Create new statutory authority to give the UTC jurisdiction over private road crossings on the primary railroad routes, including those over which crude oil is transported. This authority and funding would allow the UTC to establish minimum safety standards, including appropriate safety signage.
Link to Study:	Washington State 2014 Marine and Rail Oil Transportation Study

Study Title:	**Prioritization of Prominent Road-Rail Conflicts in Washington State**
Date:	**January 2017**
Commissioning Body:	Joint Transportation Committee, Washington State Legislature
Purpose of the Study:	Identifies prominent road-rail conflicts, recommends a corridor-based prioritization process for addressing the impacts of projected increases in rail traffic, and identifies areas of state public policy interest, such as the critical role of freight movement to the Washington economy and the state's competitiveness in world trade. Road-rail conflicts at potentially problematic at-grade rail crossings include: • Long and unpredictable travel delays for both the general public and freight users • Collisions between trains and vehicles or pedestrians • Temporary increase of emergency response time
Study Objectives:	• Summarize the current and future mobility, community impacts, and safety problems occurring at at-grade crossings in the state • Summarize state, local, and private entity policy interests in improving at-grade crossings • Develop a data-driven analysis of crossing impacts and apply a corridor-based project prioritization process • Develop and apply a criteria-based decision-making process for prioritizing statewide investments in at-grade crossing solutions
Study Data Available for SAP Consideration	• Presence and number of alternate grade-separated crossings (over-crossings or under-crossings) within one-half mile of the at-grade crossing • Number of emergency service providers (hospital, police, fire) within one-half mile of a crossing • Freight and Goods Transportation System classification for roadway (WSDOT) • Number of jobs per acre (EPA Smart Location Database) • Number of major (arterials and above) roadway intersections within 200 feet of crossing • Estimated emissions at crossing associated with delay and vehicle volumes
Link to Study:	JTC Prioritization of Prominent Road-Rail Conflicts in Washington State

Study Title:	Study of Road-Rail Conflicts / Phase 2 Development of Project Priorities
Date:	**August 2018**
Commissioning Body:	Freight Mobility Strategic Investment Board
Purpose of the Study:	Provides updates to the Joint Transportation Committee's Study of Road-Rail Conflicts (Phase 1, 2016), including: • Updates the road-rail conflicts database • Develops a corridor-based project prioritization process • Identifies and recommends a statewide list of projects
Study Data Available for SAP Consideration:	FMSIB project priorities, their ranking, and cost estimates. • Tier 1 – 15 projects (Total Costs: $953,990,790; Fully Funded: $824,192,622) • Tier 2 – 34 projects (Total Costs: $889,379,000; Fully Funded: $3,783,000)
Link to Study :	Study of Road-Rail Conflicts / Phase 2 Development of Project Priorities

Study Title:	**Target Zero: Washington State Strategic Highway Safety Plan 2019**
Date:	2019
Commissioning Body:	Washington Traffic Safety Commission
Purpose of the Plan:	Satisfies the federal government's requirement for each state to have a Strategic Highway Safety Plan (SHSP). This Target Zero plan set a vision of zero deaths and serious injuries on Washington's roadways by 2030.
Plan Objectives:	Target Zero is a data-driven strategic plan used to identify priorities and solutions, help create common goals, and develop a common language to work together across disciplines. Specifically, the plan is used to: • Set statewide priorities for all traffic safety partners over the next three to four years • Provide a resource of various strategies to address each emphasis area and factor • Help guide federal and state project funding toward the highest priorities and most effective strategies • Monitor outcomes at a statewide level for each priority area
Plan Guidance Available for SAP Consideration:	Although the plan does not provide railroad-specific strategies or countermeasures, some of the intersection crash strategies could be considered at railroad intersections (see pages 107-108 of the plan).
Link to Plan:	Target Zero: Washington State Strategic Highway Safety Plan 2019

Study Title:	**2020 Washington State Traffic Safety Annual Report**
Date:	2020
Commissioning Body:	Washington Traffic Safety Commission (WTSC)
Purpose of the Report:	Provides an assessment of Washington State's progress in achieving performance targets in the prior year and a description of how the State Highway Safety Office will adjust its Highway Safety Plan to better meet performance targets if a performance target has not been met.
Report Objectives:	• Describe projects and activities funded and implemented, and the amount of federal funds obligated and expended • Describe the state's evidence-based enforcement program activities • Provide the required information regarding mobilizations • Explain the reasons for planned activities not implemented • Describe how the projects funded contributed to meeting the performance targets
Plan Guidance Available for SAP Consideration:	New Traffic Data Dashboards In 2020, the Research and Data Division introduced the Target Zero Performance Dashboard for Traffic Fatalities. The dashboard can be filtered by year, county, city, or a combination of the three. The dashboard is available online at: https://wtsc.wa.gov/research-data/tz-performance-dashboard/.
Link to Report:	Washington State Traffic Safety Annual Report 2020

Title:	**Washington State Rail Plan 2019-2040**
Date:	**August 2020**
Commissioning Body:	Washington State Department of Transportation (WSDOT)
Purpose of the Plan:	The Washington State Rail Plan is a single, integrated plan for both passenger and freight rail and is the planning foundation for future actions in the state. To address rail system challenges and identify opportunities for improvement, the plan describes the rail system and the state's interest in it, identifies potential actions to improve the rail system, and recommends strategies consistent with Washington's transportation policy goals of economic vitality, preservation, safety, mobility, environment, and stewardship. The plan is required by the FAST Act of 2015, as well as several state statues in RCW 47.
Plan Vision:	As an integral part of Washington's multimodal transportation network, the rail system provides for the safe, reliable, and environmentally responsible movement of freight and passengers to ensure the state's economic vitality and quality of life
Selective Key Findings:	• The plan's illustrative project list contains 74 projects around Washington. Forty-five of these were grade crossing improvement projects, which are estimated to cost, in total, approximately $1.4 billion. • Rail demand forecasts vary greatly, depending on several economic and political variables. • Interest in investments to improve highway-rail safety is high.
Plan Guidance Available for SAP Consideration:	Rail System by Owner State Map Rail Passenger Corridor State Map List of Washington State Short Line Operators Demand for Freight Rail Transportation Section 5.4, Rail System in Communities (Safety) Section 6.3, Integrate Rail System Strategies: • Rail system in communities Section 7.3, Integrated Rail System: • At-grade crossing and trespassing • 2017 Section 130 funding table • Exhibit 7-6, Funded Grade Separation Projects • Exhibit 7-7, Unfunded Grade Separation Projects Chapter 8, Rail Funding Sources: Federal and State Appendix A, Illustrative List of Investments (Grade Crossing Improvements) Appendix B, Future Rail Demand Estimates
Link to Plan:	Washington State Rail Plan 2019-2040

Study Title:	An Assessment of Rail Safety Governance in Washington State
Date:	**January 2021**
Commissioning Body:	Joint Transportation Committee, Washington State Legislature
Purpose of the Study:	Examines structure of rail safety agencies and responsibilities in Washington State and provides recommendations on improving governance of rail safety in Washington State.
Study Objectives:	• Summarize state, local, and federal roles in rail safety • Review rail safety best practices and highlight research findings • Consult with agencies and stakeholders and understand their roles, and share information • Develop recommendations for consideration by the State Legislature
Study Data Available for SAP Consideration	• Executive Summary: Findings and Recommendations • Chapter 3, Washington State Safety Record • Chapter 4, Overview of Laws Governing Rail Safety • Appendix B, List of laws applicable to rail safety • Appendix E, Railway-Highway Crossing (Section 130) Program
Link to Study:	An Assessment of Rail Safety Governance in Washington State

Appendix B:

Stakeholder Meeting Summaries

Summary of Stakeholder Meetings

Meeting 1: Assembly Phase

September 21, 2021

Stakeholders gathered at a first meeting to learn more about the context of highway-rail crossing safety in Washington, as well as requirements for the SAP. Stakeholders shared the issues that were of most concern to them, and the team discussed whether those would be addressed as part of the SAP.

Agenda items

- Background of the SAP, including data on crossing collisions across the United States and in Washington, and rules guiding state highway-rail grade crossing action plans
- Purpose and objectives of the stakeholder group, its role, and expectation of stakeholders for how information would be shared
- Laws and policies governing state action plans, as well as roles and responsibilities of various agencies in highway-rail crossing safety
- Common terms related to highway-rail crossings
- Data showing grade crossing types across the state (including public and private), types of grade crossing protection, and grade crossings with single and multiple incidents

Meeting 2: Analysis Phase

November 2, 2021

Stakeholders reviewed data analyses of accident and incident frequency and trends in Washington. The group also reviewed a model for predicting crossing risk and discussed the elements that would contribute to ranking higher-risk highway-rail crossings.

Agenda items

- Detailed analysis of statewide incident data, including both the frequency and trends of incidents occurring at highway-rail grade crossings
- Tools for estimating crossing risk, including benefit-cost assessments and equity assessments

Meeting 3: Solutions Phase

December 14, 2021

Stakeholders reviewed the draft list of the top 50 higher-risk crossings in Washington and discussed potential refinements to the list. The group discussed potential tools to improve highway-rail crossing safety, including engineering, education, and enforcement. Stakeholders also heard about funding options for highway-rail crossing safety improvement projects, available through both state and federal funding programs.

Agenda items

- Assessment of higher-risk crossings, benefit-cost analysis, and draft list of top 50 higher-risk highway-rail crossings

- Toolkit providing potential improvement strategies and considerations, including engineering, education, or enforcement approaches
- Draft goals for the SAP
- Key federal and state funding sources for highway-rail crossing improvements

Meeting 4: Actions Phase

January 18, 2022

Stakeholders heard about possible implementation strategies that could help achieve the goals and objectives of the SAP. The group also discussed how the SAP document would bring together pieces from the four project phases to provide a comprehensive plan for future action.

Agenda items

- Goals, objectives, and potential strategies, and tactics for implementing the SAP
- General content of each SAP chapter and appendices
- Schedule for submitting the SAP to UTC and then to FRA for review and approval

Appendix C:

FRA Database Issues and Opportunities

The Federal Railroad Administration (FRA) highway-rail crossing inventory database provided critical information for the Washington Highway-Rail Grade Crossing State Action Plan (SAP) analysis. Title 49 Code of Federal Regulations (CFR) Part 234, Subpart F – Highway-Rail and Pathway Crossing Inventory Reporting, outlines information on periodic updates to the FRA highway-rail crossing inventory. Responsibility for updating the inventory falls on both the state inventory contact and the operating railroad—each of which updates the elements and data fields that are in its purview. As a minimum, all crossing inventory data should be reviewed and updated at least once every three years to keep the inventory current.

During data assembly and analysis phases, the SAP project team encountered several issues within the FRA highway-rail crossing inventory database, including outdated average annual daily traffic (AADT) counts, inaccurate or outdated daily train crossing volumes, and inaccurate mapping coordinates of highway-rail crossings in Washington.

Average Annual Daily Traffic

Problem: Many highway-rail at-grade crossings have recorded AADT counts that are significantly outdated; some data is over 30 years old. A sampling of the FRA highway-rail crossing inventory AADT data is listed in Table C-1.

Purpose of Updating AADT: Updated AADT will more accurately reflect current travel conditions and is key input to multiple higher-risk crossing evaluation factors, including the Exposure score (AADT multiplied by daily train volumes), and the Accident Prediction and Accident Severity models. Future updates of the SAP and priority higher-risk crossings will benefit from more accurate calculation of these evaluation factors.

Action Steps: As the Washington grade crossing inventory manager, the UTC will continue to encourage cities and counties to provide more current AADT data for highway-rail crossings. As it receives updated AADT information, the UTC will provide the data directly to FRA through the FRA's Grade Crossing Inventory System (GCIS).

Table C-1: Sample Listing of Highway-Rail Crossings with Outdated Average Annual Daily Traffic (AADT) Volumes

USDOT Crossing Number	City	Highway	AADT	AADT YEAR
059152N	Colville	1st Ave.	796	1986
092261C	Burlington	Fairhaven St. (2)	9,800	1986
099180B	Wapato	Donald Rd.	2,050	1986
089682K	Hatton	Hampton Rd.	36	1986
104537C	Mabton	Phillips Rd.	240	1986
104572R	Kennewick	N Fruitland St.	4,500	1987
090051F	Kennewick	Cushman Rd.	10	1987
089695L	Mesa	Sheffield Rd.	320	1987
092259B	Burlington	Walnut St.	450	1987
065839V	Wenatchee	Miller St.	2,434	1987
090036D	Kennewick	Perkins Rd. 7572	440	1987
085706H	Puyallup	52nd St. E	1,583	1988
065984U	Spokane	E Mission Ave.	16,400	1988
092484T	Vader	State Route 506	1,300	1988
099165Y	Yakima	Yakima Ave.	20,100	1988
099168U	Yakima	E Meade Ave.	6,800	1988
396593N	Auburn	15th St. SW	3,800	1988
085587B	Seattle	Eastbound Spokane St.	9,817	1993
084764A	Burlington	Greenleaf St.	2,091	1993
085695X	Puyallup	3rd St. NE 1-Way	11,437	1993
085439G	Edmonds	Dayton St.	8,520	1993
085696E	Puyallup	Meridian St. 1-Way	9,720	1993
092523G	Centralia	Hanford Valley Rd.	2,200	1993
085647H	Auburn	37th St. NW	5,005	1993
085650R	Auburn	29th St. NW	369	1993
085585M	Seattle	Horton St.	3,530	1993
092504C	Napavine	Washington St.	2,050	1993

Daily Train Counts

Problem: During data analysis, the SAP team found several highway-rail crossings in the FRA database with recorded daily train counts that appear to be inaccurate. Figure C-1 is a screenshot of the FRA crossing Daily Train Count data for Regal Street (USDOT 066410H) in Spokane, WA. The train count information appears to be for the nearby BNSF Railway Company main line and not the actual branch line track which crosses Regal Street.

Figure C-1: Screenshot of FRA Highway-Rail Crossing Database with Inaccurate Daily Train Counts

A. Revision Date (MM/DD/YYYY)	B. Reporting Agency	C. Reason for Update (Select only one)	D. DOT Crossing Inventory Number
09 / 03 / 2020	☒ Railroad ☐ Transit ☐ State ☐ Other	☒ Change in Data ☐ New Crossing ☐ Closed ☐ No Train Traffic ☐ Quiet Zone Update ☐ Re-Open ☐ Date Change Only ☐ Change in Primary Operating RR ☐ Admin. Correction	066410H

Part I: Location and Classification Information

1. Primary Operating Railroad	2. State	3. County
BNSF Railway Company [BNSF]	WASHINGTON	SPOKANE

4. City / Municipality	5. Street/Road Name & Block Number	6. Highway Type & No.
☒ In ☐ Near SPOKANE	REGAL ST (Street/Road Name) | * (Block Number)	Not Yet Reported by State

7. Do Other Railroads Operate a Separate Track at Crossing?	8. Do Other Railroads Operate Over Your Track at Crossing?
☐ Yes ☒ No If Yes, Specify RR	☐ Yes ☒ No If Yes, Specify RR

9. Railroad Division or Region	10. Railroad Subdivision or District	11. Branch or Line Name	12. RR Milepost
☐ None NORTHWEST	☐ None SPOKANE	☐ None STOCKYARD SP	(prefix) | 0069.362 | (suffix)

13. Line Segment *	14. Nearest RR Timetable Station *	15. Parent RR (if applicable)	16. Crossing Owner (if applicable)
45	LEE ST	☒ N/A	☐ N/A BNSF

17. Crossing Type	18. Crossing Purpose	19. Crossing Position	20. Public Access (if Private Crossing)	21. Type of Train	22. Average Passenger Train Count Per Day
☒ Public ☐ Private	☒ Highway ☐ Pathway, Ped. ☐ Station, Ped.	☒ At Grade ☐ RR Under ☐ RR Over	☐ Yes ☐ No	☒ Freight ☐ Intercity Passenger ☐ Commuter ☐ Transit ☐ Shared Use Transit ☐ Tourist/Other	☐ Less Than One Per Day ☐ Number Per Day 0

23. Type of Land Use
☐ Open Space ☐ Farm ☐ Residential ☐ Commercial ☒ Industrial ☐ Institutional ☐ Recreational ☐ RR Yard

24. Is there an Adjacent Crossing with a Separate Number?	25. Quiet Zone (FRA provided)
☐ Yes ☒ No If Yes, Provide Crossing Number	☒ No ☐ 24 Hr ☐ Partial ☐ Chicago Excused Date Established

Part II: Railroad Information

1. Estimated Number of Daily Train Movements

1.A. Total Day Thru Trains (6 AM to 6 PM)	1.B. Total Night Thru Trains (6 PM to 6 AM)	1.C. Total Switching Trains	1.D. Total Transit Trains	1.E. Check if Less Than One Movement Per Day ☐ How many trains per week?
23	23	0	0	

2. Year of Train Count Data (YYYY)	3. Speed of Train at Crossing
2019	3.A. Maximum Timetable Speed (mph) 40 3.B. Typical Speed Range Over Crossing (mph) From 1 to 40

4. Type and Count of Tracks
Main 0 Siding 0 Yard 1 Transit 0 Industry 0

5. Train Detection (Main Track only)
☐ Constant Warning Time ☐ Motion Detection ☐ AFO ☐ PTC ☐ DC ☐ Other ☒ None

6. Is Track Signaled?	7.A. Event Recorder	7.B. Remote Health Monitoring
☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

Purpose of Updating Daily Train Counts: Updated daily train counts more accurately reflect current rail traffic conditions and are key inputs to multiple crossing evaluation factors, including the Exposure score and the Accident Prediction and Accident Severity models. Future updates of the SAP and the priority higher-risk crossings will benefit from more accurate calculation of these evaluation factors.

Action Steps: According to 49 CFR Part 234.409, primary operating railroads must submit periodic updates to the crossing inventory at least every three years. UTC staff will continue to encourage operating railroads to review, update, and provide FRA with accurate current daily train counts.

Mapping Coordinates

Problem: A sampling of the FRA highway-rail crossing inventory revealed that some crossing map coordinates are in error. UTC staff regularly conducts grade crossing inspections and updates its grade crossing inventory with current mapping coordinates.

Purpose of Updating Mapping Coordinates: Accurate mapping of coordinates enables UTC staff to more efficiently and accurately map FRA's highway-rail grade crossings in support of future analyses and updates to the SAP.

Action Steps: UTC staff will continue to submit updated highway-rail crossing map coordinates to the GCIS database.

Appendix D:

Preliminary Listing of Higher-risk Crossings

Inventory				Evaluation						Ranking		
USDOT Crossing Number	City	Highway	Total Incidents	UTC Oil-by-Rail	Exposure	Accident Probability	Accident Severity	Benefit-Cost Ratio	Equity Score	Total Score	Rank	Tier
927461X	Seattle	Holgate St	4	1	4	4	4	4	1	18	1	1
085587B	Seattle	EB Spokane St	3	1	3	4	4	3	1	16	2	1
085640K	Kent	SR 516/Willis St	2	1	4	3	4	2	2	16	3	1
085696E	Puyallup	Meridian St 1 Way	2	1	3	2	4	2	3	15	4	1
084565X	Monroe	Kelsey St	2	1	2	3	3	2	2	13	5	1
085695X	Puyallup	3rd St NE 1 Way	2	1	3	3	2	2	2	13	6	1
085706H	Puyallup	52nd Street E	2	1	1	3	3	2	3	13	7	1
085625H	Kent	S 212th Street	1	1	4	0	4	2	2	13	8	2
084764A	Burlington	Greenleaf St	2	1	1	3	2	4	1	12	9	1
085629K	Kent	James St	1	1	4	2	3	2	0	12	10	2
085633A	Kent	Smith St	1	1	4	2	1	1	3	12	11	3
085439G	Edmonds	Dayton St	2	1	2	3	3	1	1	11	12	1
090110F	Camas	3rd St	3	1	1	3	4	2	0	11	13	1
085586U	Seattle	WB Spokane St	1	1	2	2	2	2	2	11	14	2
058642C	Spokane	S Brooks Rd	1	1	1	2	1	3	3	11	15	3
085647H	Auburn	37th Street NW	0	1	2	3	1	2	2	11	16	4
085650R	Auburn	29th St NW	1	1	1	2	2	2	2	10	17	2
092504C	Napavine	Washington St	1	1	1	2	2	2	2	10	18	2
104520Y	Toppenish	State Hwy	1	1	1	3	1	2	2	10	19	2
844396M	Walla Walla Co.	Dodd Road	1	1	0	2	0	4	3	10	20	2
085414L	Seattle	Broad Street	1	1	2	2	2	2	1	10	21	3
085585M	Seattle	Horton St	1	1	2	2	1	1	3	10	22	3
092421N	Vancouver	NW 122nd St	1	1	1	2	1	2	3	10	23	3
085642Y	Kent	S 259th Street	0	1	1	0	1	3	4	10	24	4
085652E	Auburn	3rd Street NW	0	1	2	2	1	1	3	10	25	4
085742D	Tacoma	6th Avenue	2	1	1	3	3	1	0	9	26	1
809513N	Seattle	South Lucile Street/ 8th Avenue South	3	0	0	3	2	1	3	9	27	1
809577A	Seattle	South Fidalgo Street	3	0	0	3	2	1	3	9	28	1
852638B	Tacoma	Port of Tacoma	3	1	1	3	3	1	0	9	29	1

Inventory				Evaluation						Ranking		
USDOT Crossing Number	City	Highway	Total Incidents	UTC Oil-By-Rail	Exposure	Accident Probability	Accident Severity	Benefit-Cost Ratio	Equity Score	Total Score	Rank	Tier
065839V	Wenatchee	Miller St	1	1	1	2	1	1	3	9	30	2
065984U	Spokane	E Mission Ave	1	1	1	2	2	1	2	9	31	2
077846P	Bellingham	F St/Roeder St	1	1	1	2	3	2	0	9	32	2
085703M	Puyallup	Stewart Ave/66th	1	1	2	2	2	2	0	9	33	2
090036D	Kennewick	Perkins Rd 7572	1	1	1	2	1	2	2	9	34	2
104537C	Mabton	Phillips Rd	1	1	1	2	1	1	3	9	35	2
084758W	Mount Vernon	4th St N/Riverside Dr	1	1	2	2	2	1	1	9	36	3
085637C	Kent	Gowe St	1	1	2	2	1	1	2	9	37	3
089775E	Othello	Lee Rd	3	0	1	4	2	1	0	8	38	1
090051F	Kennewick	Cushman Rd	2	1	0	3	1	1	2	8	39	1
852612Y	Tacoma	Milwaukee Sim	3	1	1	2	2	1	1	8	40	1
059152N	Colville	1st Avenue	1	0	1	2	1	1	3	8	41	2
084664V	Marysville	136th St NE	1	1	1	2	2	2	0	8	42	2
085382H	Tacoma	Pine St	1	0	2	0	2	2	2	8	43	2
089682K	Hatton	Hampton Road	1	1	0	2	1	1	3	8	44	2
089695L	Mesa	Sheffield Road	1	1	1	2	1	2	1	8	45	2
089702U	Pasco	Selph Landing Rd	1	1	1	2	1	1	2	8	46	2
092259B	Burlington	Walnut St	1	1	1	3	1	1	1	8	47	2
092523G	Centralia	Hanford Valley Rd	1	1	1	2	2	1	1	8	48	2
104572R	Kennewick	N Fruitland St	1	1	1	2	1	1	2	8	49	2
084735P	Mount Vernon	Peter Johnson Rd	1	1	0	2	1	1	3	8	50	3
084753M	Mount Vernon	Fir St	1	1	1	2	2	1	1	8	51	3
396578L	Kent	West James St	1	0	1	2	2	1	2	8	52	3
066367E	Spokane Valley	Pines Rd	0	1	4	0	1	1	1	8	53	4
066402R	Spokane	Freya St	0	0	3	0	1	1	3	8	54	4
085655A	Auburn	West Main St	0	1	2	0	1	1	3	8	55	4
085694R	Puyallup	5th St SE	0	1	3	0	1	1	2	8	56	4
085683D	Sumner	Main St	2	1	2	0	2	1	1	7	57	1
066351H	Reardan	Coulee Hite Rd	1	0	0	2	1	1	3	7	58	2
066410H	Spokane	Regal St	1	0	1	2	1	1	2	7	59	2

Inventory				Evaluation						Ranking		
USDOT Crossing Number	City	Highway	Total Incidents	UTC Oil-By-Rail	Exposure	Accident Probability	Accident Severity	Benefit-Cost Ratio	Equity Score	Total Score	Rank	Tier
084805C	Bellingham	City Park	1	1	1	2	1	1	1	7	60	2
089699N	Pasco	Eltopia Rd W	1	1	1	0	1	2	2	7	61	2
090115P	Washougal	24th St	1	1	1	2	1	1	1	7	62	2
809122U	Spokane	North Freya St	1	0	1	2	1	1	2	7	63	2
809648U	Seattle	8th Ave South	1	0	1	2	1	1	2	7	64	2
066375W	Spokane Valley	Vista Rd	1	1	1	2	2	1	0	7	65	3
084765G	Burlington	Fairhaven St	1	1	1	2	1	1	1	7	66	3
085680H	Sumner	Zehnder St	1	1	1	2	1	1	1	7	67	3
099180B	Wapato	Donald Rd	1	1	1	2	1	1	1	7	68	3
104538J	Mabton	Bus Rd	1	1	1	2	1	1	1	7	69	3
084640G	Marysville	4th St	0	1	3	0	1	1	1	7	70	4
085699A	Puyallup	5th St NW	0	1	3	0	1	1	1	7	71	4
085196G	Selah	Pomona Rd	1	1			1	2	2	6	72	2
092484T	Vader	State Route 506	1	1	1	0	2	2	0	6	73	2
092505J	Napavine	Somerville Rd	1	1	1	0	2	2	0	6	74	2
096029N	Aberdeen	S Tyler St/Wishkah Mall	1	0	1	2	2	1	0	6	75	2
099165Y	Yakima	Yakima Ave	1	1	2	0	2	1	0	6	76	2
099168U	Yakima	E Meade Ave	1	1	1	0	2	1	1	6	77	2
099191N	Toppenish	S Toppenish Ave	1	1	1	0	1	1	2	6	78	2
396593N	Auburn	15th St Southwest	1	0	1	2	1	1	1	6	79	2
929012P	Burlington	Garrett Rd	1	1			1	2	2	6	80	2
932777T	Tacoma	Lincoln Ave	1	1	1	1	1	1	1	6	81	2
090072Y	Vancouver	Wintler Park/SE Beach Dr	1	1	1	2	1	1	0	6	82	3
396614E	Puyallup	96th Ave East	1	0	0	2	1	2	1	6	83	3
872213S	Tacoma	St Paul Ave	1	0	1	1	1	1	2	6	84	3
809556G	Seattle	East Marginal Way South/WA 99	0	0	1	0	1	1	3	6	85	4
852624T	Tacoma	Taylor Way	0	1	1	0	0	1	3	6	86	4
084644J	Marysville	8th St	1	1	1	0	1	2	0	5	87	2
084763T	Burlington	Pease Rd	1	1	1	0	0	1	2	5	88	2
092261C	Burlington	Fairhaven St	1	0	1	2	1	1	0	5	89	2

Inventory				Evaluation						Ranking		
USDOT Crossing Number	City	Highway	Total Incidents	UTC Oil-By-Rail	Exposure	Accident Probability	Accident Severity	Benefit-Cost Ratio	Equity Score	Total Score	Rank	Tier
095972G	Airway Heights	Garfield Rd	1	0			1	1	3	5	90	2
101004G	Seattle	Lander St	1	0			1	1	3	5	91	2
396591A	Auburn	West Main St	1	0	1	0	1	1	2	5	92	2
396703W	Roy	East Gate to Fort Lewis	1	1			1	2	1	5	93	2
859618N	Seattle	13th Ave SW	1	0			1	1	3	5	94	2
867859X	Tacoma	Taylor Way	1	1	1	1	0	1	1	5	95	2
857729Y	Tacoma	Marshall Ave	1	1	1	1	1	1	0	5	96	3
084754U	Mount Vernon	N 4th St/Riverside Dr	0	0	2	0	1	1	1	5	97	4
085402S	Lakewood	100th St SW	0	0	2	0	1	1	1	5	98	4
084739S	Mount Vernon	Blackburn/Pac Hwy	1	1	1	0	2	0	0	4	99	2
092437K	Woodland	Scott Ave West	1	1	1	0	0	2	0	4	100	2
092495F	Winlock	State Route 603	1	0	1	0	1	1	1	4	101	2
396757C	Maytown	Case Rd	1	0			1	1	2	4	102	2
808728J	Tacoma	East 15th St/East J St	1	0			1	1	2	4	103	2
848781E	Chehalis	Spooner Rd	1	0			0	1	3	4	104	2
085691V	Puyallup	15th St SE	0	1			1	1	1	4	105	4
924634A	Ritzville	Division St	0	0	1	0	0	1	2	4	106	4
945561A	Auburn	A St	0	0	1	0	1	1	1	4	107	4
092087V	Arlington	188th St NE	1	0			0	2	1	3	108	2
808061C	Endicott	3rd St	1	0	0	0	1	1	1	3	109	2
808715H	Hoquiam	28th St	1	0	0	1	1	1	0	3	110	2
808723A	Tacoma	East River St	1	0	0	0	0	1	2	3	111	2
808734M	Tacoma	East Portland Ave	1	0			0	1	2	3	112	2
809503H	Seattle	South Lander St	0	0	1	0	0	1	0	2	113	4
917935D	Kalama	N Hendrickson	1	0	0	0	0	1	0	1	114	2

Appendix E:

Risk Assessment Scoring, Ranking, and Listing of Higher-risk Crossings

Inventory				Evaluation						Ranking		
USDOT Crossing Number	City	Highway	Total Incidents	UTC Oil-By-Rail	Exposure	Accident Probability	Accident Severity	Benefit-Cost Ratio	Equity Score	Total Score	Rank	Map Ref#
927461X	Seattle	Holgate St	4	1	4	4	4	4	3	20	1	1
085587B	Seattle	EB Spokane St	3	1	3	4	4	3	3	18	2	2
085640K	Kent	SR 516/Willis St	2	1	4	3	4	2	2	16	3	3
085625H	Kent	S 212th Street	1	1	4	0	4	2	3	14	4	4
084764A	Burlington	Greenleaf St	2	1	1	3	2	4	2	13	5	5
085695X	Puyallup	3rd St NE 1 Way	2	1	3	3	3	2	1	13	5	6
085629K	Kent	James St	1	1	4	2	3	2	1	13	5	7
085439G	Edmonds	Dayton St	2	1	2	3	3	1	2	12	8	8
085696E	Puyallup	Meridian St 1 Way	2	1	3	2	4	2	0	12	8	9
085706H	Puyallup	52nd St E	2	1	1	3	3	2	2	12	8	10
089775E	Othello	Lee Rd	3	0	1	4	3	1	3	12	8	11
085586U	Seattle	WB Spokane St	1	1	2	2	2	2	3	12	8	12
090110F	Camas	3rd St	3	1	1	3	4	2	0	11	13	13
085703M	Puyallup	Stewart Ave/66th	1	1	2	2	2	2	2	11	13	14
092523G	Centralia	Hanford Valley Rd	1	1	1	2	2	1	4	11	13	15
085414L	Seattle	Broad St	1	1	2	2	3	2	1	11	13	16
085647H	Auburn	37th St NW	0	1	2	3	1	2	2	11	13	17
852612Y	Tacoma	Milwaukee Sim	3	1	1	3	2	1	2	10	18	18
065984U	Spokane	E Mission Ave	1	1	1	2	2	1	3	10	18	19
085650R	Auburn	29th St NW	1	1	1	2	2	2	2	10	18	20
104520Y	Toppenish	State Hwy	1	1	1	3	1	2	2	10	18	21
085585M	Seattle	Horton St	1	1	2	2	1	1	3	10	18	22
085633A	Kent	Smith St	1	1	4	2	1	1	1	10	18	23
090115P	Washougal	24th St	1	1	1	2	1	1	3	9	24	24
092484T	Vader	State Route 506	1	1	1	0	2	2	3	9	24	25
092504C	Napavine	Washington St	1	1	1	2	2	2	1	9	24	26
099165Y	Yakima	Yakima Ave	1	1	2	0	2	1	3	9	24	27
104572R	Kennewick	N Fruitland St	1	1	1	2	1	1	3	9	24	28
084765G	Burlington	Fairhaven St	1	1	1	2	1	1	3	9	24	29
085637C	Kent	Gowe St	1	1	2	2	1	1	2	9	24	30

Inventory				Evaluation						Ranking		
USDOT Crossing Number	City	Highway	Total Incidents	UTC Oil-By-Rail	Exposure	Accident Probability	Accident Severity	Benefit-Cost Ratio	Equity Score	Total Score	Rank	Map Ref#
092421N	Vancouver	NW 122nd St	1	1	1	2	1	2	2	9	24	31
066367E	Spokane Valley	Pines Rd	0	1	4	0	1	1	2	9	24	32
085642Y	Kent	S 259th St	0	1	1	0	1	3	3	9	24	33
085652E	Auburn	3rd St NW	0	1	2	2	1	1	2	9	24	34
090051F	Kennewick	Cushman Rd	2	1	0	3	1	1	2	8	35	35
059152N	Colville	1st Ave	1	0	1	2	1	1	3	8	35	36
084664V	Marysville	136th St NE	1	1	1	2	2	2	0	8	35	37
085382H	Tacoma	Pine St	1	0	2	0	2	2	2	8	35	38
089695L	Mesa	Sheffield Rd	1	1	1	2	1	2	1	8	35	39
092259B	Burlington	Walnut St	1	1	1	3	1	1	1	8	35	40
092261C	Burlington	Fairhaven St	1	0	1	2	1	1	3	8	35	41
099168U	Yakima	E Meade Ave	1	1	1	0	2	1	3	8	35	42
932777T	Tacoma	Lincoln Ave	1	1	1	2	1	1	2	8	35	43
084753M	Mount Vernon	Fir St	1	1	1	2	2	1	1	8	35	44
099180B	Wapato	Donald Rd	1	1	1	2	1	1	2	8	35	45
396578L	Kent	West James St	1	0	2	2	2	1	1	8	35	46
085655A	Auburn	West Main St	0	1	2	0	1	1	3	8	35	47
065839V	Wenatchee	Miller St	1	1	1	2	1	1	1	7	48	48
084644J	Marysville	8th St	1	1	1	0	1	2	2	7	48	49
084805C	Bellingham	City Park	1	1	1	2	1	1	1	7	48	50
085196G	Selah	Pomona Rd	1	1	0	2	1	2	1	7	48	51
089682K	Hatton	Hampton Rd	1	1	0	2	1	1	2	7	48	52
090036D	Kennewick	Perkins Rd 7572	1	1	1	2	1	2	0	7	48	53
092505J	Napavine	Somerville Rd	1	1	1	0	2	2	1	7	48	54
096029N	Aberdeen	S Tyler St/Wishkah Mall	1	0	1	2	2	1	1	7	48	55
104537C	Mabton	Phillips Rd	1	1	1	2	1	1	1	7	48	56
396593N	Auburn	15th St SW	1	0	1	2	2	1	1	7	48	57
808728J	Tacoma	East 15th St/East J St	1	0	1	2	1	1	2	7	48	58
066375W	Spokane Valley	Vista Rd	1	1	1	2	2	1	0	7	48	59
090072Y	Vancouver	Wintler/SE Beach Dr	1	1	1	2	1	1	1	7	48	60

Inventory				Evaluation						Ranking		
USDOT Crossing Number	City	Highway	Total Incidents	UTC Oil-By-Rail	Exposure	Accident Probability	Accident Severity	Benefit-Cost Ratio	Equity Score	Total Score	Rank	Map Ref#
104538J	Mabton	Bus Rd	1	1	1	2	1	1	1	7	48	61
857729Y	Tacoma	Marshall Ave	1	1	1	2	1	1	1	7	48	62
872213S	Tacoma	St Paul Ave	1	0	1	2	1	1	2	7	48	63
085402S	Lakewood	100th St SW	0	0	2	0	1	1	3	7	48	64
085694R	Puyallup	5th St SE	0	1	3	0	1	1	1	7	48	65
809556G	Seattle	East Marginal Way South/WA 99	0	0	2	0	1	1	3	7	48	66
085683D	Sumner	Main St	2	1	2	0	2	1	0	6	67	67
809513N	Seattle	South Lucile St/8th Ave South	3	0	0	3	2	1	0	6	67	68
809577A	Seattle	South Fidalgo St	3	0	0	3	2	1	0	6	67	69
066410H	Spokane	Regal St	1	0	1	2	1	1	1	6	67	70
089699N	Pasco	Eltopia Rd W	1	1	1	0	1	2	1	6	67	71
089702U	Pasco	Selph Landing Rd	1	1	1	2	1	1	0	6	67	72
099191N	Toppenish	S Toppenish Ave	1	1	1	0	1	1	2	6	67	73
808715H	Hoquiam	28th St	1	0	0	1	1	1	3	6	67	74
809122U	Spokane	North Freya St	1	0	1	2	1	1	1	6	67	75
867859X	Tacoma	Taylor Way	1	1	1	1	0	1	2	6	67	76
085680H	Sumner	Zehnder St	1	1	1	2	1	1	0	6	67	77
085691V	Puyallup	15th St SE	0	1	3	0	1	1	0	6	67	78
085699A	Puyallup	5th St NW	0	1	3	0	1	1	0	6	67	79
945561A	Auburn	A St	0	0	1	0	1	1	3	6	67	80
084739S	Mount Vernon	Blackburn Pac	1	1	1	0	2	0	1	5	81	81
084763T	Burlington	Pease Rd	1	1	1	0	0	1	2	5	81	82
092495F	Winlock	State Route 603	1	0	1	0	1	1	2	5	81	83
095972G	Airway Heights	Garfield Rd	1	0	0		1	1	3	5	81	84
396591A	Auburn	West Main Street	1	0	1	0	1	1	2	5	81	85
396757C	Maytown	Case Rd	1	0	1	2	1	1	0	5	81	86
809648U	Seattle	8th Ave South	1	0	1	2	1	1	0	5	81	87
859618N	Seattle	13th Ave SW	1	0	1	2	1	1	0	5	81	88
929012P	Burlington	Garrett Rd	1	1			1	2	1	5	81	89
396614E	Puyallup	96th Ave East	1	0	0	2	1	2	0	5	81	90

Inventory				Evaluation						Ranking		
USDOT Crossing Number	City	Highway	Total Incidents	UTC Oil-By-Rail	Exposure	Accident Probability	Accident Severity	Benefit-Cost Ratio	Equity Score	Total Score	Rank	Map Ref#
809503H	Seattle	South Lander St	0	0	1	0	0	1	3	5	81	91
852624T	Tacoma	Taylor Way	0	1	1	0	0	1	2	5	81	92
066351H	Reardan	Coulee Hite Rd	1	0	0	2	1	1	0	4	93	93
092087V	Arlington	188th St NE	1	0	0	1	0	2	1	4	93	94
396703W	Roy	East Gate to Fort Lewis	1	1			1	2	0	4	93	95
848781E	Chehalis	Spooner Rd	1	0	0	2	0	1	1	4	93	96
066402R	Spokane	Freya St	0	0	1	0	1	1	1	4	93	97
924634A	Ritzville	Division St	0	0	1	0	0	1	2	4	93	98
808723A	Tacoma	East River St	1	0	0	0	0	1	2	3	99	99
808734M	Tacoma	East Portland Ave	1	0			0	1	2	3	99	100
808061C	Endicott	3rd St	1	0	0	0	1	1	0	2	101	101
917935D	Kalama	N Hendrickson	1	0	0	0	0	1	1	2	101	102

Appendix F:

Highway-Rail At-grade Crossing Safety Toolkit

This Washington Highway-Rail Grade Crossing State Action Plan (SAP) Toolkit provides supplemental information to consider when implementing strategies and treatments at highway rail at-grade crossings. It includes categories of crossing treatments as well as important considerations to determine whether a highway-rail crossing would benefit from the treatments.

The Toolkit serves as a resource document only. Ultimately, the appropriate traffic control system to be used at any highway-rail grade crossing should be determined by an engineering study involving both the road authority and the railroad company. Highway-rail crossing modifications must generally be approved by the UTC prior to implementation.

The treatments described in the Toolkit can be summarized by the following categories:

- Grade Separation
- Closure and Consolidation
- Bicycle/Pedestrian Treatments
- Education
- Enforcement
- Geometry/Reconfiguration
- Signing and Striping
- Gates and Signals
- Surrounding Environment Improvements
- Medians

The Toolkit, provided in Table A-1, describes specific strategies, whether they are best suited for active or passive crossings (or both), the source of the strategies, the primary issues they are meant to address, and benefits of and considerations for implementation.

Table A-1: SAP Toolkit

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Bicycle/ Pedestrian	Audible Warning	Install a bell or wayside horn to provide audible warning to pedestrians and bicyclists before crossing	Active	Manual on Uniform Traffic Control Devices (MUTCD)	Low pedestrian compliance	Insufficient warning prior to crossing				Installing audible warnings help get the attention of distracted pedestrians before they cross in dangerous conditions.	• Used to supplement other active traffic control devices and is most effective as a warning to pedestrians and bicyclists. • Audible device(s) should be heard on all approaches.
Bicycle/ Pedestrian	Pedestrian Barriers	Install pedestrian barriers to prevent pedestrians from crossing at unsafe locations	Active or Passive	Highway-Rail Crossing Handbook	Low pedestrian compliance					Barriers provide channelization to designate the intended path of travel. The behavior of pedestrians crossing the tracks is difficult to control and channelization can help keep them on the safest path of travel.	• The location should be targeted to where pedestrians are known to cross. • Channelization system should direct pedestrians to legal rail crossing(s). • Updates or reconfiguration of pedestrian crossings must consider requirements of the Americans with Disabilities Act.
Bicycle/ Pedestrian	Pedestrian Flashing Light Signals	Install pedestrian flashing light signals to prevent pedestrians from crossing at unsafe times	Active	MUTCD	Low pedestrian compliance	Fatalities	Inadequate clearing sight distance			The flashing light signal helps get the attention of distracted pedestrians before they cross in dangerous conditions.	• Needs to be coordinated with the rail system. • Can be paired with audible and physical warning systems.
Bicycle/ Pedestrian	Pedestrian Pathway Crossing Signs and Markings	Install pedestrian pathway crossing signs and markings to help pedestrians locate the safest path of travel across a crossing	Passive	MUTCD	Low pedestrian compliance	Insufficient warning prior to crossing				Pedestrians often seek the shortest path of travel and therefore do not always cross the tracks at the highway or intended path of travel without proper instructions.	• Can be used in conjunction with active devices. • Updates or reconfiguration of pedestrian crossings must consider requirements of the Americans with Disabilities Act.

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Bicycle/ Pedestrian	Pedestrian signal interconnect	Install pedestrian signal interconnect so that pedestrians do not navigate the crossing as a train approaches	Active	Preemption of Traffic Signals Near Railroad Grade Crossings 2nd Edition, ITE.[1]	Low pedestrian compliance	Inadequate clearing sight distance				Best used in areas of high pedestrian traffic.	• Can be combined with and is complementary to other active traffic control devices to provide safe pedestrian movements.
Bicycle/ Pedestrian	Sidewalk Improvements	Install sidewalk improvements to allow for safer travel across the crossing	Passive	SAP Project Team	Low pedestrian compliance					Pedestrians often seek the shortest path of travel and therefore do not always cross the tracks at the highway or intended path of travel. When the sidewalk conditions are improved, pedestrians may find it the obvious choice for crossing.	• Can be used in conjunction with active devices.
Bicycle/ Pedestrian	Z-Crossing Channelization	Install z-crossing channelization to encourage pedestrians to look for oncoming trains before crossing	Passive	MUTCD	Low pedestrian compliance					Z-crossing channelization helps designate the intended path of travel. Z-crossings also encourage pedestrians to look for oncoming trains before crossing.	• Z-crossings should be close to 90 degrees. • Skew angle crossings can trap bicycle wheels.

[1] https://www.ite.org/technical-resources/councils/traffic-engineering/joint-rail-grade-crossing-committee/preemption-of-traffic-signals-near-railroad-grade-crossings-recommended-practice-second-edition/

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Closure and Consolidation	Close Crossing to Highway Traffic	Close the crossing to highway traffic and remove the roadway crossing surface	Active or Passive	Highway-Rail Crossing Handbook	Fatalities	Low compliance with posted signs	Low compliance with active crossing warning			Provides highest level of crossing safety compared to other alternatives because the point of intersection between highway and railroad is removed. Can reduce certain types of collisions and decrease delays to highway and rail traffic. Decreases maintenance costs.	• Effect to local access and circulation. • Should consider providing opportunities for public input. • Consider pairing with improvements to nearby crossing. • Could consider seasonal/temporary closures of at-grade crossings. Use treatments such as a variable message signs or physical blockades of the roadway.
Closure and Consolidation	Close Crossing to Railroad Traffic	Close the crossing to railroad traffic through the abandonment or relocation of the rail line and removal of the railroad tracks	Active or Passive	Highway-Rail Crossing Handbook	Fatalities	Low compliance with posted signs	Low compliance with active crossing warning			Provides highest level of crossing safety compared to other alternatives because the point of intersection between highway and railroad is removed. Can reduce certain types of collisions and decrease delays to highway and rail traffic. Decreases maintenance costs.	• Can increase options for reducing train noise along a rail corridor.
Closure and Consolidation	Consolidation	Consolidate a series of consecutive crossings and improve crossing treatments	Active or Passive	Highway-Rail Crossing Handbook	Significant number of crossings within a segment of rail line that need improvements					Provides highest level of crossing safety compared to other alternatives because the point of intersection between highway and railroad is removed. Can reduce certain types of collisions and decrease delays to highway and rail traffic. Decreases maintenance costs. Can be hard to navigate public appeal.	• Affect to local access and circulation. • Should consider providing opportunities for public input. • Consider pairing with improvements to nearby crossing.

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Education	Education	Implement community education to improve the community's ability to navigate crossings safely	Active or Passive	SAP Project Team	Low compliance with posted signs	Lack of success with previous improvements				Education on crossing safety at the national level is provided by Operation Lifesaver, Inc. (OLI) and several federal agencies.	• Washington's Operation Lifesaver Program (WAOL) targets education and outreach in higher-risk areas throughout the state. • WAOL is a resource available through the UTC, to any group, business, or organization.
Enforcement	Enforcement	Implement enforcement strategies to encourage compliance to signs and pavement markers where they have not been effective	Active or Passive	SAP Project Team	Low compliance with posted signs	Lack of success with previous improvements				Enforcement can help prevent crossing collisions. Local initiatives and targeted enforcement campaigns have been used to enhance crossing safety.	• Volpe Center prepared an in-depth study of enforcement campaigns in the Public Education and Enforcement Research Study (USDOT[2], December 2006), which describes examples of local initiatives and success factors.
Gates and Signals	Cantilever Flashing-Light Signals	Install overhead cantilever flashing-light signals to improve awareness of approaching trains	Active	Highway-Rail Crossing Handbook	Low compliance with posted signs	Insufficient warning prior to crossing	Needs improved guidance at night or in rain	Supplements existing warnings	Poor visibility	Helps improve visibility for approaching traffic.	• Post-mounted lights would have to be more than 10 feet from the edge of the travel lane. • Roadside foliage obstructs the view of post-mounted lights. • Background is distracting. • Horizontal or vertical curves are present. • Multilane approaches are mutually visible from adjacent driving lanes.
Gates and Signals	Four-quadrant Gates	Install four-quadrant gates to prevent vehicles from blocking the crossing for oncoming trains	Active	Highway-Rail Crossing Handbook	Circumventing the gates	Low compliance with posted signs	Circumvent-ing the gates	Supplements existing warnings	Low compliance in quiet zones	Implementing four-quadrant gates can provide additional visual constraints and inhibits most traffic movements over the crossing after the gates have been lowered.	• Maintenance of the sensor system of this technology.

[2] https://railroads.dot.gov/elibrary/public-education-and-enforcement-research-study

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Gates and Signals	Illumination	Install illumination to improve visibility at a crossing	Passive	Highway-Rail Crossing Handbook	Needs improved guidance at night or in rain	Poor visibility	Supplements existing warnings			Improves crossing where the horizontal or vertical alignment of the highway approach does not allow the vehicle headlight beam to fall on the train until the vehicle has passed the safe stopping distance. Can reduce nighttime collisions.	• Requires infrastructure/power source.
Gates and Signals	Implement Traffic Signal Interconnect or Reoptimize Existing Signal Interconnect	Implement traffic signal interconnect at nearby crossings or reoptimize existing signal interconnect to avoid crossing conflicts	Active	Highway-Rail Crossing Handbook	Queuing on tracks					Prevents downstream traffic signals to cause traffic to back up through a grade crossing.	• Can be used in conjunction with and complementary to other active traffic control devices to provide safe vehicular movements. • Two preemption types: "Simultaneous" and "Advance." • Signals within 200 feet of crossing should be interconnected (minimum). • Level of pedestrian activity may impact preemption type.
Gates and Signals	Supplemental Flashing-light Signals	Install supplemental flashing-light signals to improve awareness of approaching trains	Active	MUTCD	Low compliance with posted signs	Insufficient warning prior to crossing	Needs improved guidance at night or in rain	Supplements existing warnings	Poor visibility	Helps identify and direct attention to the location of a crossing and helps prepare drivers and pedestrians to make appropriate actions.	• Can be used in conjunction with other active devices.
Gates and Signals	Two-quadrant Gates	Install two-quadrant gates to prevent vehicles from blocking the crossing for oncoming trains	Active	Highway-Rail Crossing Handbook	Low compliance with posted signs	Insufficient warning prior to crossing	Supplements existing warnings	Supplements existing warnings		Prevents vehicles from stopping on tracks when a train approaches.	• Can be combined with standard flashing-light signal to provide additional warning.

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Geometry/ Reconfiguration	Adjust Crossing Geometry	Reconfigure crossing to have appropriate roadway geometry and improve visibility	Passive	Highway-Rail Crossing Handbook	Poor visibility	Site obstructions				The ideal crossing geometry between track and highway is 90 degrees with ascending grade on either approach to reduce of the flow of water towards crossing. This layout enhances the view of the crossing and tracks and reduces conflicting vehicular movements from crossroads and driveways. It directs the driver's attention away from negotiating the highway geometry to looking for a train.	• Realignment may require additional right-of-way. • Where impractical to improve the roadway alignment, consider “squaring off” the bicycle/pedestrian pathway to improve safety.
Geometry/ Reconfiguration	Adjust Crossing Grade	Reconfigure crossing to have appropriate roadway grade	Passive	Highway-Rail Crossing Handbook	Poor visibility	Site obstructions	Poor drainage	Humped crossing		The ideal crossing geometry between track and highway is 90 degrees with ascending grade on either approach to reduce of the flow of water towards crossing. This layout enhances the view of the crossing and tracks and reduces conflicting vehicular movements from crossroads and driveways. It directs the driver's attention away from negotiating the highway geometry to looking for a train.	• Can decrease pavement maintenance. • Allows for trucks and trailers to fully cross the tracks without physical barriers (humped crossing). • Installation of a “humped crossing” sign is available as an interim treatment.
Geometry/ Reconfiguration	Crossing Surfaces and Roadway Surface Improvement	Install improved crossing surface material	Passive	American Railway Engineering and Maintenance of Way Association (AREMA) Manual of Railway Engineering	Crossing surface deterioration	Poor drainage				Improves the durability of the crossing. Provides a surface that vehicles can cross at posted speed limits for roadway.	• Can be used in conjunction with active devices.

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Grade Separation	Over-crossing	Construct a structure over the railroad right-of-way to separate rail traffic from other traffic	Passive	Highway-Rail Crossing Handbook	Fatalities	Lack of success with previous improvements	Low compliance with posted signs	Low compliance with active crossing warning	Closure desired but crossing frequently utilized by emergency vehicles	Grade Separation provides the highest level of crossing safety compared to other alternatives because the point of intersection between highway and railroad is removed.	• Can reduce certain types of collisions and decrease delays to highway and rail traffic. • Not as bicycle- or pedestrian-friendly due to grades. • May reduce access on adjacent properties.
Grade Separation	Under-crossing	Construct a structure under the railroad right-of-way to separate rail traffic from other traffic	Passive	Highway-Rail Crossing Handbook	Fatalities	Lack of success with previous improvements	Low compliance with posted signs	Low compliance with active crossing warning	Closure desired but crossing frequently utilized by emergency vehicles	Grade Separation provides the highest level of crossing safety compared to other alternatives because the point of intersection between highway and railroad is removed.	• Can reduce certain types of collisions and decrease delays to highway and rail traffic. • Not as bicycle- and pedestrian-friendly due to grades. • May reduce access on adjacent properties.
Medians	Delineators	Install delineators to improve visibility to the crossing's boundaries	Passive	Highway-Rail Crossing Handbook	Circumventing the gates	Low compliance with posted signs	Low compliance with active crossing warning	Supplements existing warnings		Flexible tubular delineators provide a visual impediment to crossing into opposing traffic lanes or crossing onto the tracks.	• Relatively inexpensive installation. • Requires adequate retro-reflectivity to work at night. • Size of delineator can vary based on need.
Medians	Mountable Raised Curb Systems (Traffic Separators)	Install a mountable raised curb system with traffic separators to prevent vehicles from circumventing the gate	Passive	Highway-Rail Crossing Handbook	Circumventing the gates	Low compliance with posted signs	Low compliance with active crossing warning	Supplements existing warnings		Combined with flexible tubular delineators or vertical panels, these present the driver with a visual and physical impediment to crossing to the opposing traffic lane. This system allows for emergency vehicles to cross opposing lanes but deters errant vehicles.	• Unlike the other median options, it can be implemented without widening the road. • Limits access to nearby connections and businesses.

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Medians	Non-mountable (Non-traversable) Curb Islands	Install a non-mountable curb island to prevent vehicles from circumventing the gate	Passive	Highway-Rail Crossing Handbook	Circumventing the gates	Low compliance with posted signs	Low compliance with active crossing warning	Supplements existing warnings		With a typical height of 6 to 9 inches, non-mountable curb islands make it difficult for drivers to attempt to violate these types of islands by mounting or crossing them.	• Requires significant right-of-way. • Limits access to nearby connections and businesses. • Must be significant enough that an errant vehicle cannot bottom-out and protrude into oncoming traffic. • Paint and reflective beads should be used on the curb for proper night visibility.
Medians	Wide Raised Medians	Install a wide raised median to prevent vehicles from circumventing the gate	Passive	Highway-Rail Crossing Handbook	Circumventing the gates	Low compliance with posted signs	Low compliance with active crossing warning	Supplements existing warnings		While wide raised medians do not present a true barrier, they can be nearly as effective as barriers because the driver would have significant difficulty attempting to drive across the opposing lanes. The impediment becomes more substantial as the width of the median increases.	• Requires significant right-of-way or surface/landscape maintenance. • Limits access to nearby connections and businesses.
Signing and Striping	Dynamic Envelope	Install pavement marking at the edge of the region between and immediately adjacent to the tracks where a road user could be struck by a train, considering equipment sway	Passive	MUTCD	Queuing on tracks	Insufficient warning prior to crossing				Helps identify and direct attention to the location of a crossing and prepare drivers and pedestrians to make appropriate actions.	• Can be used in conjunction with active devices. • Not applicable with four-quadrant gate system, which has unique marking requirements.

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Signing and Striping	Edge Lines	Install pavement markings to carry edge lines and centerlines across the tracks, as well as arrow markings	Passive	MUTCD	Turning onto tracks	Needs improved guidance at night or in rain	Crossing surface deterioration			Reduces road users inadvertently turning onto the tracks ahead of a highway intersection at night (drivers typically attempting to follow Global Positioning System (GPS) guidance).	• Where edge lines are present on a roadway, they should be carried through the crossing. • In rural locations, locations with no curb, and/or if the roadway approach is curved, edge lines can be enhanced with retroreflective white tubular delineators to enhance the visibility of a crossing at night.
Signing and Striping	Exclusion Zone (Keep Clear) Treatments	Install pavement markings to mark the edges of an intersection area that is in close proximity to a railroad crossing	Passive	MUTCD	Insufficient warning prior to crossing	Low compliance with posted signs	Queuing on tracks			Helps identify and direct attention to the location of a crossing and prepare drivers and pedestrians to make appropriate actions.	• Can be used in conjunction with active devices. • Relatively easy implementation.
Signing and Striping	Flashing Light Emitting Diode (LED) Sign - "Do Not Stop on Tracks"	Install a flashing LED "Do Not Stop on Tracks" sign	Active	Emerging Technology[3]	Insufficient warning prior to crossing	Queuing on tracks	Needs improved guidance at night or in rain	Supplements existing warnings		Increases attention to signage and is a low-impact solution.	• Applicable in areas where there is low compliance with the posted passive signs and where pavement markings and additional measures need to be taken to get the attention of road users. • Can be mounted to existing posts.
Signing and Striping	Flashing Sign - "STOP"	Install a flashing LED "STOP" sign	Active	MUTCD	Insufficient warning prior to crossing	Low compliance with posted signs	Needs improved guidance at night or in rain	Supplements existing warnings		Increases attention to signage and is a low-impact solution.	• Applicable in areas where there is low compliance with the posted passive signs and where pavement markings and additional measures need to be taken to get the attention of road users. • Can be mounted to existing posts.

[3] https://railroads.dot.gov/elibrary/effectiveness-led-enhanced-signs-reducing-incidents-vehicles-stopping-tracks

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Signing and Striping	General Sign Enhancement	Easily implemented improvement to a crossing to help current signage standout or add to existing conditions	Active or Passive	MUTCD	Low compliance with posted signs	Supplements existing warnings				Increases attention to signage and is a low-impact solution.	• Applicable in areas where there is low compliance with the posted passive signs and where pavement markings and additional measures need to be taken to get the attention of road users. • Can be mounted to existing posts.
Signing and Striping	Grade Crossing Pavement Markings	Install MUTCD-compliant pavement markings to provide static source of warning, guidance, and/or mandatory action for the driver	Passive	MUTCD	Crossing does not meet regulation	Insufficient warning prior to crossing				Provides static messages of warning, guidance, or mandatory action for the driver. Helps identify and direct attention to the location of a crossing and prepare drivers and pedestrians to make appropriate actions.	• Can be used in conjunction with active devices. • Relatively low-cost installation.
Signing and Striping	LED Blank-out Sign - "No Turn on Red"	Install a LED blank-out "No Turn on Red" sign	Active	MUTCD	Low compliance with posted signs	Insufficient warning prior to crossing	Needs improved guidance at night or rain	Supplements existing warnings		Increases attention to signage and is a low-impact solution.	• Applicable in areas where there is low compliance with the posted passive signs and where pavement markings and additional measures need to be taken to get the attention of road users. • Can be mounted to existing posts.
Signing and Striping	Raised Pavement Markers	Install raised pavement markers to existing pavement markings	Passive	MUTCD	Insufficient warning prior to crossing	Low compliance with posted signs				Provides guidance at night and during periods of rain and fog. Relatively easy implementation.	• Can be used in conjunction with passive and active devices.
Signing and Striping	Warning Signs and Plaques	Install MUTCD-compliant signs to provide static source of warning, guidance, and/or mandatory action for the driver	Passive	Highway-Rail Crossing Handbook	Insufficient warning prior to crossing	Low compliance with posted signs				Provides static messages of warning, guidance, or mandatory action for the driver. Helps identify and direct attention to the location of a crossing and prepare drivers and pedestrians to make appropriate actions.	• Can be used in conjunction with active devices. • Relatively low-cost installation.

Category	Specific Strategy	Description	Treatment Type	Source	Issue 1	Issue 2	Issue 3	Issue 4	Issue 5	Benefits	Considerations
Surrounding Environment Improvements	Reconfigure Parking	Relocate nearby parking to simplify the crossing area and allow for potential median implementation	Passive	AASHTO Roadside Design Guide[4]	Circumventing gates; surroundings not conducive for medians	Too many potential traffic conflicts before crossing				Removing or relocating surrounding parking allows for medians to be implemented to help improve compliance to crossing gates. This also reduces the number of roadway conflicts the driver potentially has to navigate prior to the crossing.	• Coordination with local road authority.
Surrounding Environment Improvements	Relocate existing nearby transit stop	Relocate nearby transit stops to simplify the crossing area and allow for potential median implementation.	Passive	AASHTO Roadside Design Guide [5]	Circumventing gates; surroundings not conducive for medians	Too many potential traffic conflicts before crossing				Removing or relocating nearby transit stops allows for medians to be implemented to help improve compliance to crossing gates. It also reduces the number of roadway conflicts the driver potentially has to navigate prior to the crossing.	• Requires coordination with transit agency, local road authority, and surrounding businesses/landowners.
Surrounding Environment Improvements	Relocate Nearby Connections (local street and access management)	Relocate nearby connections to simplify the crossing area and allow for potential median implementation	Passive	Highway-Rail Crossing Handbook	Circumventing gates; surroundings not conducive for medians	Too many potential traffic conflicts before crossing				Removing or relocating nearby connections allows for medians to be implemented to help improve compliance to crossing gates. It also reduces the number of roadway conflicts the driver potentially has to navigate prior to the crossing.	• Requires coordination with local road authority and surrounding businesses/landowners.
Surrounding Environment Improvements	Removing Obstructions and Sight Distance	Remove obstructions to improve sight distance and improve awareness of approaching trains	Passive	Highway-Rail Crossing Handbook	Crossing does not meet regulation	Poor visibility	Crossing does not meet regulation			Removing existing obstructions allows for the crossing to meet required clear sight lines and helps drivers clearly assess the crossing before traveling across.	• Maintenance cost associated with surrounding vegetation. • Can be costly to remove permanent obstructions such as buildings.

[4] https://trust.dot.state.wi.us/ftp/dtsd/bts/environment/library/PE/AASHTO-RSDG-4-2011-with-2012-&-2015-errata.pdf
[5] https://trust.dot.state.wi.us/ftp/dtsd/bts/environment/library/PE/AASHTO-RSDG-4-2011-with-2012-&-2015-errata.pdf

Toolkit Considerations

This section provides additional information on the categories of treatments, as well as considerations and details for some of the specific treatments and countermeasures to consider in addressing highway-rail crossing safety.

Grade Separations, Closures, and Consolidation

Grade separations, closures, and consolidations are all treatments that result in the elimination of one or more highway-rail at-grade crossings. The elimination of at-grade crossings is an effective method to address safety, delay, and vehicle emissions issues. It can also increase options for reducing train horn noise along a rail corridor. However, grade separations can be very expensive.

Bicycle/Pedestrian Treatments

For many crossings in urban areas, elimination of at-grade crossings through grade separation or closure is not feasible. This section describes at-grade treatments that could increase pedestrian and bicyclist safety while crossing the railroad tracks.

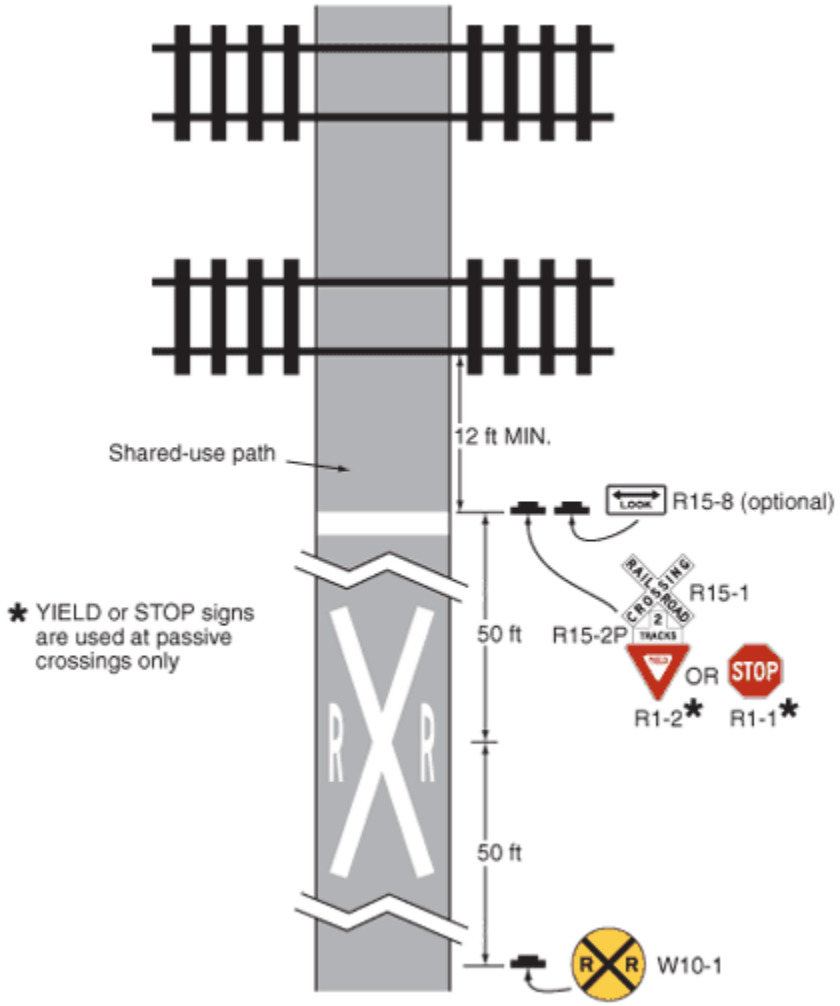
Pedestrian Signal Interconnect

Pedestrian signal interconnect allows pedestrians and bicycles to safely move across the highway-rail crossing. At a crossing with high pedestrian and bicycle traffic, it is essential that pedestrian and bicycle traffic signals do not conflict with an oncoming train. For vehicles, traffic signal preemption allows the queue to clear so that the crossing is not blocked by vehicles, and the same can be done for pedestrians and bicycles. This treatment/countermeasure is applicable in urban areas. Specifications for this treatment can be found in the Manual on Uniform Traffic Devices (MUTCD).

Pedestrian Pathway Crossing Signs and Markings

Pedestrians often seek the shortest path of travel and in some areas do not cross the tracks at the highway or intended path of travel without increased direction. Additional signage and pavement markings can be used in conjunction with active devices to guide pedestrians. More detail about pedestrian pathway crossing signs and markings can be found in the MUTCD Section 8D.03, and Figure A-1 illustrates these treatments.

Figure A- 1: Example of Signing and Marking for a Pedestrian Pathway Crossing

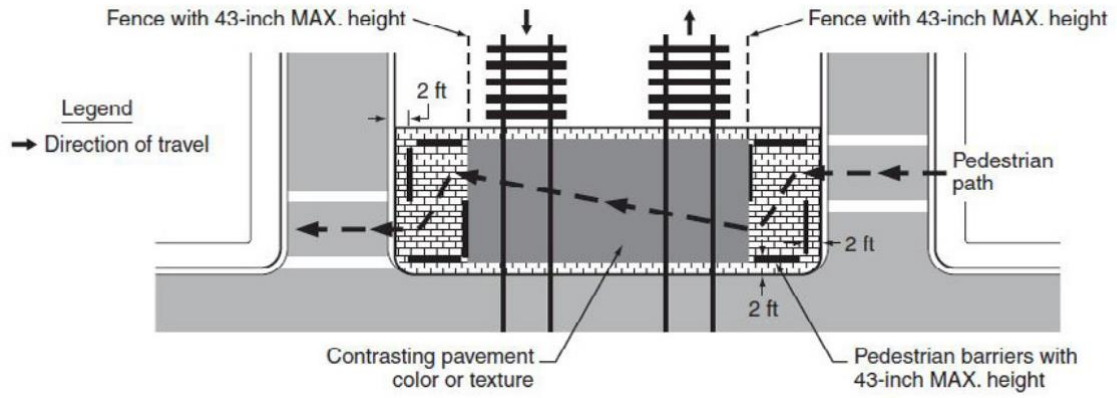


Source: Manual on Uniform Traffic Control Devices 2009 Edition, Figure 8D-1, FHWA, Washington, DC, 2009.

Pedestrian Barriers and Gates

Pedestrian barriers provide channelization to designate the intended path of travel. Highway-rail crossings with many tracks can be difficult to navigate, and pedestrian barriers help clarify the safest location to cross. The orientation of the barriers can also cause pedestrians to look both ways approaching a crossing and can be combined with a pedestrian refuge zone between the tracks. The MUTCD provides a diagram of an example of the use of pedestrian barriers, as shown in Figure A-2.

Figure A-2: Diagram of Pedestrian Barriers



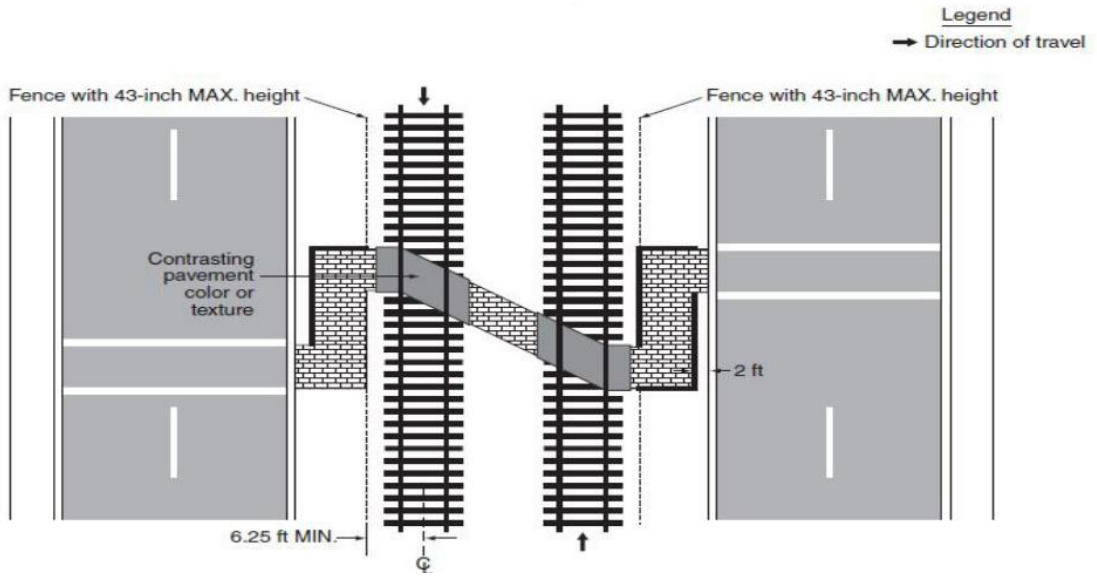
Source: Manual on Uniform Traffic Control Devices 2009 Edition, Figure 8C-9, FHWA, Washington, DC, 2009.

Z-Crossing Channelization

A Z-crossing uses pedestrian barriers to force pedestrians to turn towards the tracks to be able to see oncoming trains (see Figure A-3). These are best implemented where pedestrians travel unimpeded across the tracks, where there is good stopping sight distance, and where pedestrian volumes are low and active devices are not required. This type of channelization is not ideal in single- or double-track locations, where trains regularly travel in both directions. One consideration in implementing Z-crossings is that they increase the difficultly for wheelchairs and bicycles to navigate the crossing. The MUTCD provides a diagram of an example Z-crossing plan, as shown in Figure A-4.

Figure A-3: Z Channelization at Sunnyside Beach (USDOT 085754X) Steilacoom, WA

Figure A-4: *Example of a Z-Crossing Plan*



Source: Manual on Uniform Traffic Control Devices 2009 Edition, Figure 8C-10, FHWA, Washington, DC, 2009.

Pedestrian Flashing Light Signals

Flashing light signals help get the attention of pedestrians before they enter a crossing. An example of flashing light signals for pedestrian crossings is shown in the MUTCD in Section 8C.4, with Section 8C.13 relating to light rail crossings. MUTCD Section 8D.06 – Active Traffic Control for Pathway Grade Crossings also indicates that flashing-light signals must be installed in either direction and be accompanied by an audible warning such as a bell.

Sidewalk Improvements

The safety of pedestrians can be enhanced by sidewalk improvements (see an example in Figure A-5, below). Pathways and sidewalks should be designed such that they cross the tracks at as close to a right angle as possible and such that they have a consistent horizontal alignment. Crossings with very few or poorly maintained sidewalks can confuse pedestrians about choosing the best path of travel. Improving sidewalk conditions can also improve accessibility.

Figure A-5: Update of the Sidewalk-Rail Crossing on 119th Street (USDOT 852436D) in Vancouver, WA

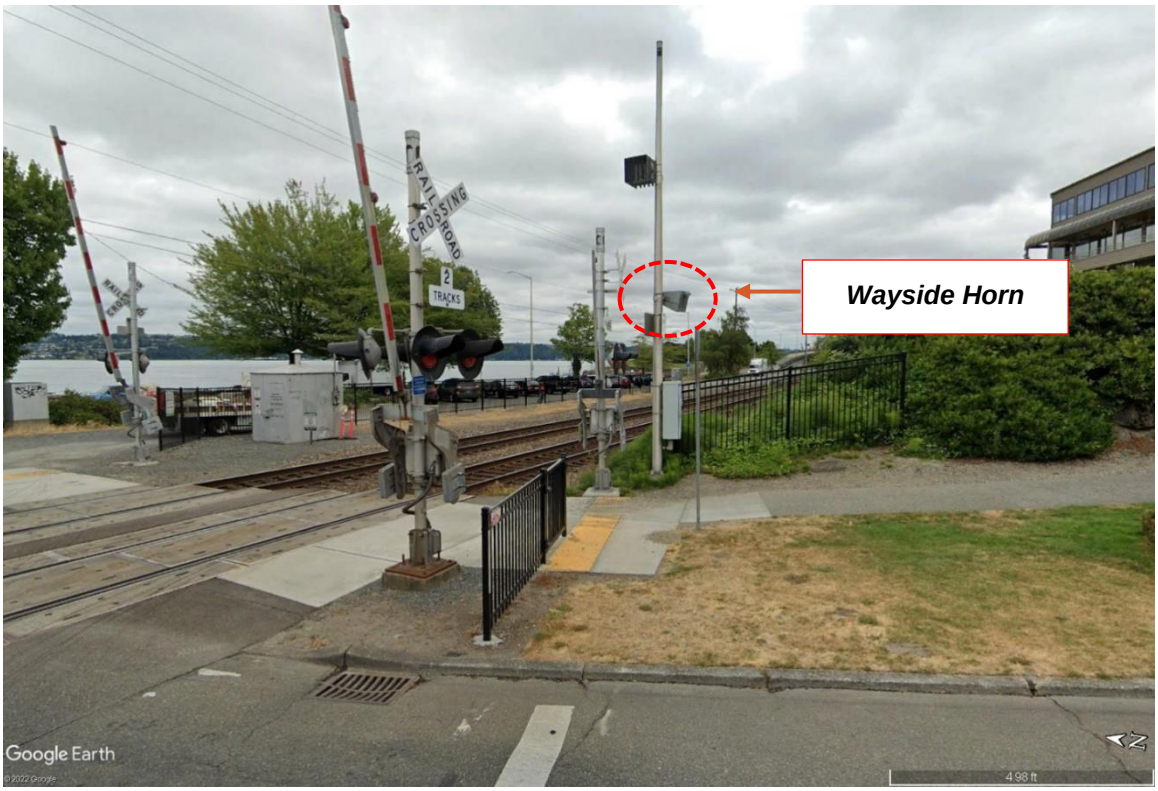
Source: Google Earth 2019.

Audible Warning

A crossing bell or other audible warning devices are used to supplement other active devices. These devices are most effective as a warning to pedestrians and bicyclists. Another form of audible warning is the wayside horn (See Figure A-6). The wayside horn system consists of a horn or series of horns located at a public highway-rail crossing and directed at oncoming motorists. The American Railway Engineering and Maintenance-of-Way Association (AREMA) provides specifications on the implementation and use of audible warning devices. Before implementing audible warning devices, the surrounding community must be considered. The photo in Figure A-6 shows a highway-rail crossing that uses both a wayside horn (audible warning) and a wayside horn indicator, which shows that the horn is functioning.

Audible warning devices are primarily supplemental devices and are used to increase compliance; they may not be applicable in areas that don't have any other active devices.

Figure A-6: Example of a Wayside Horn at McCarver Street (USDOT 085730J) in Tacoma, WA



Source: Google Earth 2021.

Geometry/Reconfiguration

Historically, many communities in Washington were built around established rail lines, which means that roadways and railway tracks may meet at sharp angles either horizontally or vertically. If the highway-rail crossing will remain at-grade, it can be reconfigured to reduce these angles to improve sight lines or to smooth the profile (which will reduce trapping vehicles with long wheelbases or low clearance on a vertical "hump"). Reconfiguration of a highway-rail crossing refers to the redesign of the alignment between the road and track without making changes to signs, markings, or signals.

Signing and Striping

Signing and striping at highway-rail at-grade crossings are typical examples of passive crossing treatments; however, signing and striping can enhance an active crossing through pairing with flashing lights, automatic gates, and signals. Signing and striping can improve identification of and direct attention to the location of a highway-rail at-grade crossing.

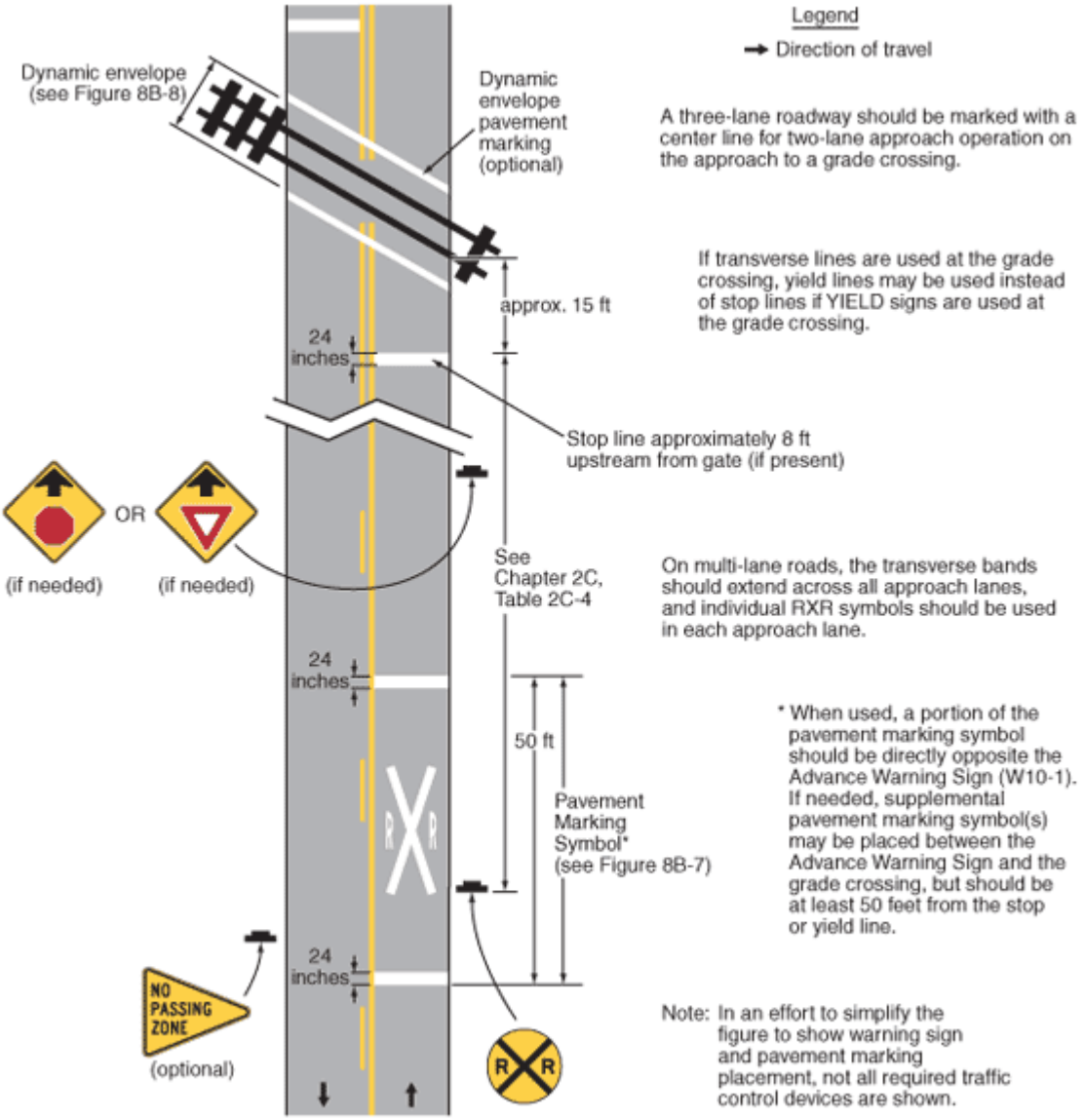
"Do Not Stop on Tracks" Signage

“Do Not Stop on Tracks” signs are best used in areas where there is low compliance with pavement markings and additional measures need to be taken to get the attention of vehicle drivers. These passive signs could be especially useful in areas where vehicles are consistently queuing on the tracks for nearby intersections. They can be mounted to existing posts and require relatively little maintenance. Section 8B.09 of the MUTCD specifies how to install these signs.

Grade Crossing Pavement Markings

MUTCD-compliant grade crossing pavement markings provide a static source of warning, guidance, and/or mandatory action for the vehicle driver. These markings help the vehicle driver take appropriate actions and can be used in conjunction with other passive or active devices. All pavement markings must meet the requirements of MUTCD Section 8B.27, which details the standard use of these markings. Pavement markings are not required at all highway-rail crossings, as explained in the MUTCD, but may be placed at a highway-rail crossing where an engineering study finds a high risk of potential vehicle-train conflicts. Figure A-7 shows the potential placement of warning signs and pavement markings at a crossing.

Figure A-7: Example of Placement of Warning Signs and Pavement Markings at a Highway-Rail Crossing



Source: Manual on Uniform Traffic Control Devices 2009 Edition, Figure 8B-6, FHWA, Washington, DC, 2009.

Gates and Signals

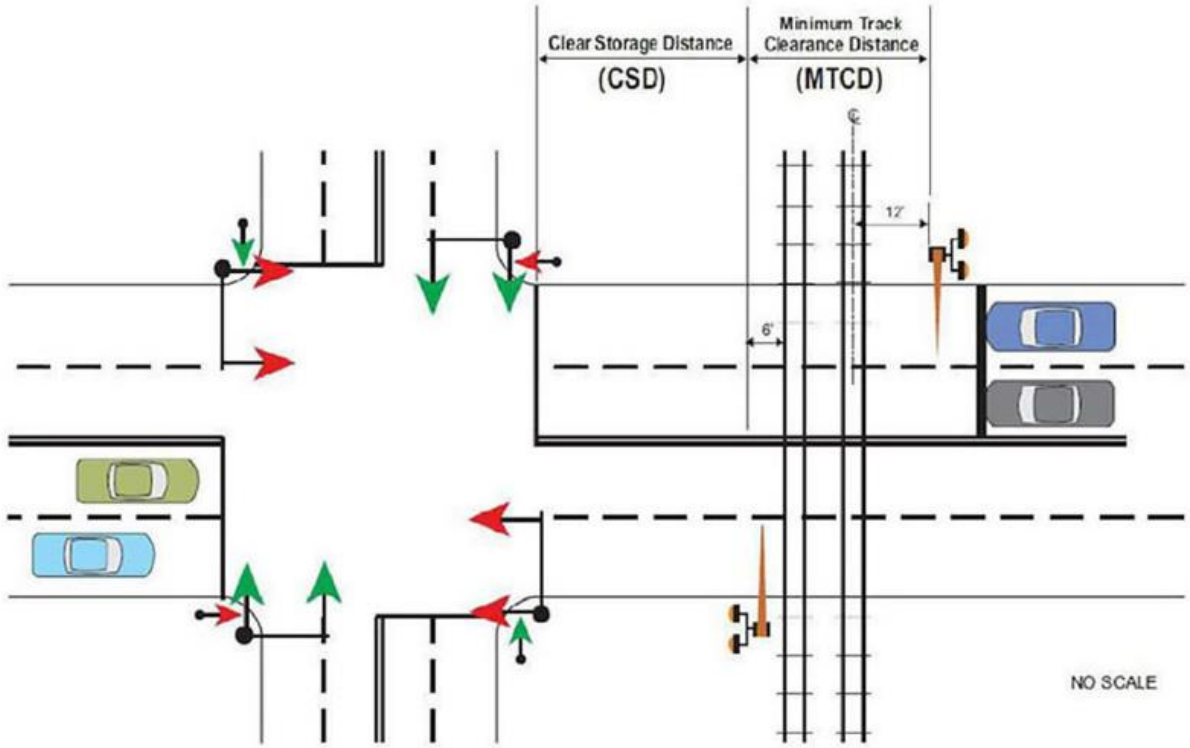
Railroad crossing gates and signals are active warning devices that inform motorists and pedestrians of the approach or presence of train traffic on or near highway-rail at-grade crossings. Active devices such as gates and signals should be placed as required by the MUTCD, and there should be supplemental flashing-light devices where frontage roads and additional approaches (or curved approaches) are present.

Implementing or Reoptimizing Traffic Signal Interconnect

Traffic signal interconnect, also known as traffic signal preemption, is used to clear traffic caused by a backup from a downstream traffic signal to a highway-rail at-grade crossing. To clear the traffic, the normal traffic signal operations are suspended, and a preemption sequence coordinated with the active traffic control devices at the crossing takes over. Figure A-8 shows use of preemption at a crossing. The MUTCD Section 8C.09 details that an at-grade crossing with active control devices within 200 feet of an intersection or traffic signal should be interconnected, so that the railroad train detection devices can send a preemption call to the traffic signals when they detect an approaching train. Implementing traffic signal interconnect is most useful in situations where traffic queues from a nearby traffic signal could extend across the highway-rail crossing or potentially interfere with the traffic signal. Specifics regarding preemption can be found in the 2019 Institute of Transportation Engineers' Proposed Recommended Practice: *Preemption of Traffic Signals Near Railroad Crossings*[6].

[6] https://www.ite.org/technical-resources/councils/traffic-engineering/joint-rail-grade-crossing-committee/preemption-of-traffic-signals-near-railroad-grade-crossings-recommended-practice-second-edition/

Figure A-8: Using Preemption to Clear Storage and Minimum Track Clearance Distance



Source: FHWA Grade Crossing Handbook 3rd Edition/AECOM, Inc.

Four-quadrant Gates

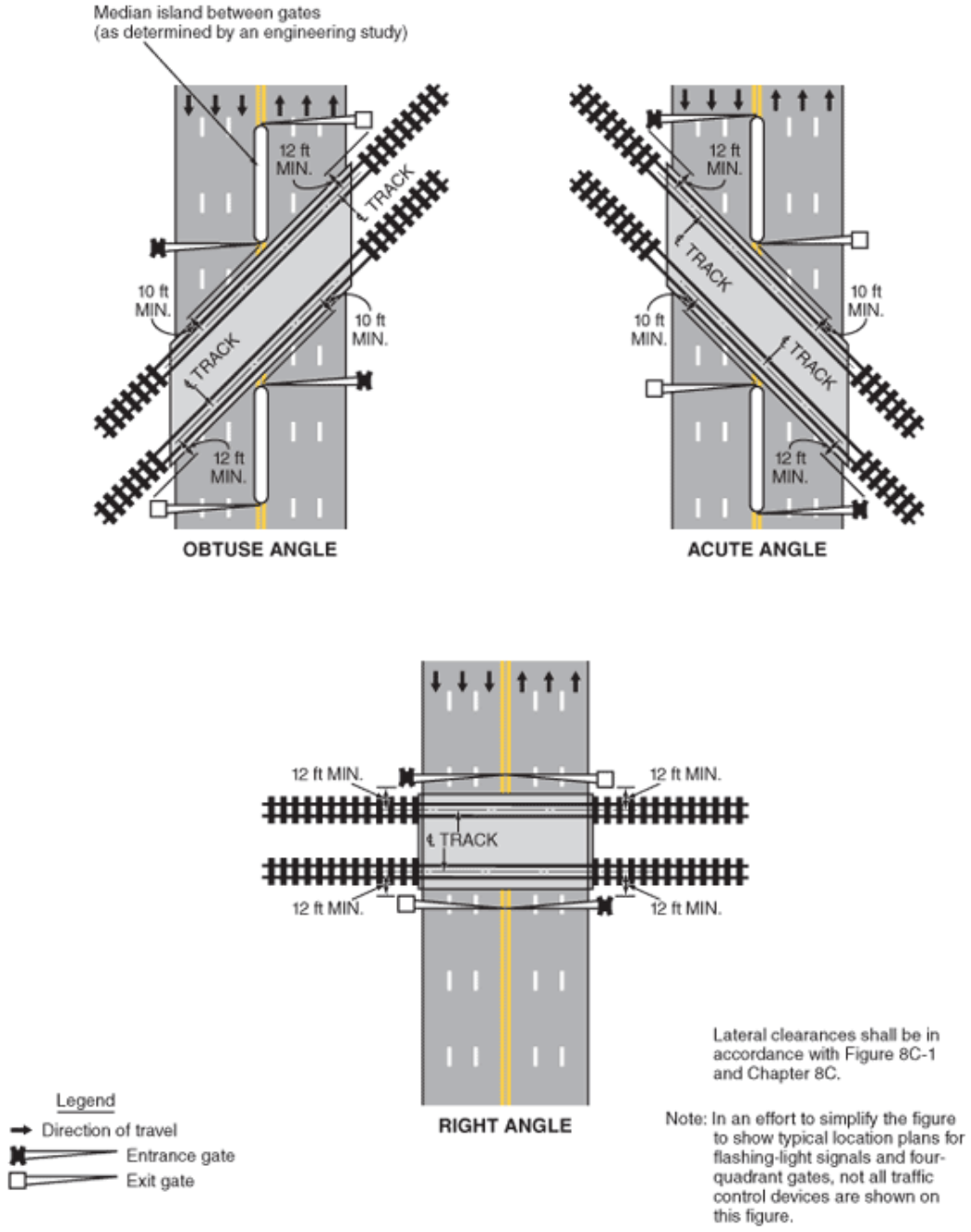
To stop highway users from crossing the highway centerline and evading lowered entry gates on the travel lane, highway-rail grade crossings may be equipped with exit gates, resulting in a "four-quadrant" gate system (for a standard crossing with two roadway approaches and two roadway departure legs) that provides full closure when the gates are lowered. Four-quadrant gate systems may be installed to improve safety at at-grade crossings, based on an engineering study, when less restrictive measures, such as automatic gates and median islands, are not effective. Figure A-9 is a photo of a four-quadrant gate system, and Figure A-10 illustrates three examples of railroad tracks crossing roadways with four-quadrant gates and signals.

The advantage of the four-quadrant gate system is that it is a physical barrier that is effective at preventing vehicles from entering the crossing when a train is approaching or on the track. However, a primary disadvantage of the system is the need to maintain the additional sensor system of this technology and extra gates/lights.

Figure A-9: Example of Right-angle Four-quadrant Gate System at Russell Avenue (USDOT 090148C) in Stevenson, WA

Source: UTC.

Figure A-10: Example of Location Plan for Flashing-light Signals and Four-quadrant Gates



Source: Manual on Uniform Traffic Control Devices 2009 Edition, Figure 8C-2, FHWA, Washington, DC, 2009.

Surrounding Environment Improvements

Reconfigure Parking

Parking areas located near a highway-rail crossing can be hazardous if vehicle drivers need to back into the crossing to exit the parking area or if other vehicles stop on the crossing to wait for parking or to avoid an exiting vehicle. Although this issue may not be common, the primary reason for reconfiguring parking near a crossing is to accommodate a median[7]. Medians can prevent vehicles from circumventing the crossing gates but cannot be implemented if nearby parking takes up too much right-of-way or if it would prevent the use of the nearby parking spots.

Relocate Nearby Connections (Local Street and Access Management)

Local street and business connections near a highway-rail crossing can complicate crossing navigation for highway users. Where feasible, closing streets or relocating business connections can simplify the crossing and reduce incidents where there is vehicle queuing on the tracks or where vehicles turn onto the tracks. The primary reason for reconfiguring nearby connections is to accommodate a median; medians can prevent vehicles from circumventing the crossing gate but cannot be implemented if they block nearby connections.

Medians

Medians can effectively reduce the number of collisions caused by vehicles circumventing the crossing gates. While not as effective as four-quadrant gates, a median may provide a substantial safety benefit.

Mountable Raised Curb Systems (Traffic Separators)

Mountable raised curb systems are best used in areas with limited right-of-way and where there are collisions caused by vehicles circumventing the crossing gates. The curbs are no more than 6 inches high and less than 12 inches wide. The limited footprint of these systems allows for them to be installed on existing roads without needing to widen them. Combined with flexible tubular delineators or vertical panels, these medians create both a physical and visual impediment to crossing into opposing traffic. The mountable aspect of these systems allows for emergency vehicles to cross opposing lanes if needed. Mountable raised curb systems have proven effective and are relatively inexpensive compared to the options that require significant

[7] https://trust.dot.state.wi.us/ftp/dtsd/bts/environment/library/PE/AASHTO-RSDG-4-2011-with-2012-&-2015-errata.pdf

roadway reconstruction.[8] One consideration in determining the use of this treatment is whether there is 70 feet to 100 feet of space for the system to be installed along the centerline without inhibiting local businesses and nearby connections.

Wide Raised Medians

Wide raised medians typically have a width between 4 feet and16 feet and provide a significant obstacle for drivers to cross into opposing lanes and circumvent the crossing gates. The main consideration with wide raised medians is that they require substantial right-of-way as well as maintenance of the median surface, landscaping, or both. However, the wider the median, the more formidable the impediment and the less likely that collisions resulting from circumvention of the gates will occur. Raised medians have also been found to reduce motor vehicle crashes by 68 percent.[9] The photo in Figure A-11 shows an example of a wide raised median.

Figure A-11: Example of Wide Raised Median 100th Street SW (USDOT 085402S) in Lakewood, WA

Source: Google Earth 2021.

[8] Federal Railroad Administration (FRA). 2010. Use of Traffic Channelizing Devices at Highway-Rail Grade Crossings. https://railroads.dot.gov/sites/fra.dot.gov/files/fra_net/137/RR1003.pdf

[9] https://railroads.dot.gov/sites/fra.dot.gov/files/fra_net/137/RR1003.pdf

Delineators

Crossings with only a mountable raised curb are not always effective at deterring motorists from crossing into opposing traffic to circumvent the gate. Installing delineators creates a more visual impediment. The size of the delineator can further increase the obstacle the vehicle would have to overcome to circumvent the gate (see Figure A-12).

Figure A-12: Delineators at Cove Road (USDOT 084795Y) in Whatcom County, WA

Source: UTC.

Non-mountable (Non-traversable) Curb Islands

Non-mountable curb islands are a potential solution where raised curb medians, such as wide raised medians or mountable raised curb systems, are not able to sufficiently reduce the number of vehicles that circumvent the gates. Non-traversable curb islands are typically 6 inches to 9 inches tall, at least 2 feet wide, and sometimes include flexible reflectorized tubular delineators or vertical panels. The height of the curb islands makes it more difficult for drivers to violate these types of islands. The main consideration with non-mountable curb islands is that the road must be wide enough to accommodate a 2-foot median. In addition, the potential for increased crashes with these curb islands should be evaluated. It is also important to consider

whether an errant vehicle could bottom-out on the curb island and protrude into the oncoming traffic.

Appendix G:

Federal Discretionary Grant Funding

The United States Department of Transportation (USDOT) discretionary grant programs discussed below are only some of the grant opportunities available at USDOT. This section of the SAP provides general information that is subject to changes in appropriations/funding, so actual amounts may vary. These programs have historically been used by public agencies to fund projects that improve highway-rail grade crossing safety, such as grade separations, rail line relocations, crossing consolidations, and installation of new warning devices. Several examples of Washington projects are included as information.

Consolidated Rail Infrastructure and Safety Improvement (CRISI) Program

The Federal Railroad Administration (FRA) administers the CRISI program within USDOT. The program is structured broadly, and funds can be used for projects that improve the safety, efficiency, and reliability of freight and intercity rail passenger services. CRISI grants have been used for improving highway-rail grade crossings in the past, and numerous examples of these projects are available online. In Fiscal Year (FY) 2021, the FRA had $360 million available for CRISI grants, but the Infrastructure Investment and Jobs Act (IIJA) has now appropriated $1 billion for the next five years. (The authorized program level under the IIJA is $10 billion; therefore, it is possible that even more funding could be made available.) The FRA has an extensive webpage on the CRISI program that can be accessed at: https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/consolidated-rail-infrastructure-and-safety-2 .

The IIJA included some changes to the CRISI grant program that that are noteworthy. These changes are:

- Expands applicant eligibility to, among others, the District of Columbia and federally recognized Indian Tribes.
- Adds to the list of eligible projects: trespassing prevention, advancing innovative rail technologies, and improving hazardous material emergency response plans.
- Permits applicants to use the costs incurred previously for preliminary engineering associated with highway-rail grade crossing improvement projects and trespassing prevention projects to satisfy the non-federal share requirements.

FRA's National Strategy to Prevent Trespassing Grants

In 2018, the FRA submitted the National Strategy to Prevent Trespassing on Railroad Property to Congress.[1] Working with both Congress and the executive branch, funding was identified for a new grant program to assist communities with at least 1 mile of FRA-regulated track within their boundaries with rail trespassing-related incidents and fatalities. The Railroad Trespassing

[1] https://railroads.dot.gov/elibrary/national-strategy-prevent-trespassing-railroad-property#p1_z5_gD_lRC

Enforcement Grant Program[2] provides grants to local governments to pay for the wages of law enforcement officers to enforce trespassing laws at trespassing hot spots within their jurisdictions.

In FY 2021, the grant program was announced in conjunction with the CRISI grant Notice of Funding Opportunity. More than $2 million was available for grants.[3]

Federal-State Partnership for State of Good Repair (SOGR) Grant Program

Historically the SOGR grant program provided funding for capital projects to repair, replace, or rehabilitate qualified railroad assets to reduce the state of good repair backlog and improve intercity passenger rail performance. Grade crossing improvement projects were part of these SOGR grant applications if they met the specific requirements in the SOGR program. In FY 2021, FRA had $198 million available for SOGR grants. FRA has an extensive website on the program that can be accessed at: https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/federal-state-partnership-state-good-repair-1.

Recently, the IIJA has significantly changed the SOGR grant program. The program will now be called the Federal-State Partnership for Intercity Passenger Rail. Congress has appropriated $36 billion for this program over five years, or $7.2 billion annually. Congress authorized the program at the $43.5 billion level, so an additional $1.5 billion per year could become available.

For more information on FRA's budget and the IIJA, please see: https://railroads.dot.gov/sites/fra.dot.gov/files/2021-12/Bipartisan%20Infrastructure%20Law%20Funding%20Table_Dec2021.pdf.

Rebuilding American Infrastructure with Sustainability and Equity (RAISE) and Infrastructure for Rebuilding America (INFRA) Grant Programs

The Office of the Secretary of Transportation administers several discretionary grant programs for USDOT. Two of these—RAISE and INFRA—have been around in various forms for at least the past 10 years.

The RAISE grant program comprises the former Transportation Investment Generating Economic Recovery (TIGER) and Better Utilizing Investments to Leverage Development (BUILD) grant programs. The program selection criteria encompass safety, environmental

[2] https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/railroad-trespassing-enforcement-grant-0
[3] https://www.transportation.gov/briefing-room/fra-fund-grants-rail-improvement-opportunities

sustainability, quality of life, economic competitiveness, state of good repair, innovation, and partnerships with a broad range of stakeholders. Its focus is not specifically railroads, but rather is overall transportation improvements, with projects ranging from ports and transit to highways and railroads across the United States. Appropriated funding for the RAISE program is $15 billion over the next five years. A recent example of a successful RAISE grant in Washington with a rail safety component is the Aberdeen US-12 Highway-Rail Separation project. This project would eliminate several at-grade crossings adjacent to a major commercial shopping area in the City of Aberdeen. For more information please see: https://wstc.wa.gov/wp-content/uploads/2021/11/2021-1117-BP14-US12-Hwy-RailSeperationProject.pdf.

The INFRA program requirements focus on advancing projects with regional or national significance that have some element of freight movement. The INFRA program has provided funding for projects such as intermodal freight facilities, grade separations, and highway capacity additions. Successful INFRA funding projects with rail safety elements in Washington include the S. Lander Street Grade Separation project and the Apple Capital Loop project in Wenatchee, Washington.

Opened in 2020, the S. Lander Street Grade separation project is located in the south of downtown or “SODO” area of Seattle. Identified as a major east-west gateway to and from the Port of Seattle, the at-grade crossing was used frequently by BNSF Railway Company (BNSF) freight trains, Sounder commuter trains, and Amtrak intercity passenger trains. The project cost approximately $123 million and provides a roadway that is unimpeded by rail operations and eliminates one of the busiest at-grade crossings in the state. For more information please see: https://www.seattle.gov/transportation/projects-and-programs/programs/bridges-stairs-and-other-structures/bridges/lander-st-bridge.

The Apple Capital Loop project is a $290 million highway project located in Wenatchee and East Wenatchee, Washington. It will enhance the regional highway network to improve safety and accessibility for freight and passenger traffic. As part of the project the existing at-grade crossing at Hawley Street over the BNSF Scenic subdivision main line will be eliminated and replaced with a new underpass at McKittrick Street. For more information please see: https://www.applecapitalloop.info/.

Appropriated funding for the INFRA program is $14 billion over the next five years.

Commuter Authority Rail Safety Improvement (CARSI) Grant Program

The CARSI grant program is a small grant program that has approximately $55 million available annually. CARSI program funding is extremely focused and available only to commuter rail authorities that have experienced at least one accident investigated by the National Transportation Safety Board over the past 10 years. In Washington, Sound Transit utilized $1.4 million of CARSI program funding to make at-grade crossing safety improvements in Puyallup.

New Discretionary Programs with Rail Safety Components

The IIJA provides funding for and authorizes a number of new transportation grant programs. While the full extent of the impact of these new programs on funding for highway-rail grade crossing safety is not known, there is one new program in the IIJA to note: The Railroad Crossing Elimination competitive grant program.

Railroad Crossing Elimination Competitive Grant Program

The IIJA establishes a new competitive grant program for projects that make improvements to highway or pathway rail crossings. Eligible projects include grade separations or closures, including using a bridge, embankment, or tunnel; track relocation; improvement or installation of protective devices, signals, or signs provided that they are related to a separation or relocation project; other means to improve safety at crossings (including technology); or the planning, environmental review, and design of such a project. In addition, commuter rail highway-rail crossing projects are eligible for funding under this program. Appropriated funding for this Railroad Crossing Elimination grant program is $3 billion over the next five years, or $600 million per year; however, an additional $2.5 billion in funds have been authorized. It appears that FRA will be administering these funds.