



November 2018

# GRADE-CROSSING SAFETY

DOT Should Evaluate  
Whether Program  
Provides States  
Flexibility to Address  
Ongoing Challenges

# GAO Highlights

Highlights of [GAO-19-80](#), a report to congressional committees

## Why GAO Did This Study

Crashes at highway-rail grade crossings are one of the leading causes of railroad-related deaths. According to FRA data, in 2017, there were more than 2,100 crashes resulting in 273 fatalities. Since 2009 crashes have occurred at a fairly constant rate. The federal government provides states funding to improve grade-crossing safety through FHWA's Section 130 Program. The persistence of crashes and deaths raises questions about the effectiveness of the federal grade-crossing-safety program.

GAO was asked to review federal efforts to improve grade-crossing safety. This report examines: (1) the focus of FRA's grade-crossing-safety research, (2) how states select and implement grade-crossing projects and what data are available from FRA to inform their decisions, and (3) the challenges states reported in implementing and assessing projects and the extent to which FHWA assesses the program's effectiveness. GAO analyzed FRA data; reviewed FRA's, FHWA's, and states' documents; reviewed a study of states' selection of projects; and interviewed FRA and FHWA headquarters and field staff, and officials from a non-generalizable sample of eight states, selected to include a mix in the number of grade crossings and crashes, and geographic diversity.

## What GAO Recommends

GAO recommends that FHWA evaluate the program's requirements to determine if they allow states the flexibility to address ongoing safety issues. The Department of Transportation concurred with GAO's recommendation.

View [GAO-19-80](#). For more information, contact Susan Fleming at (202) 512-2834 or [flemings@gao.gov](mailto:flemings@gao.gov).

November 2018

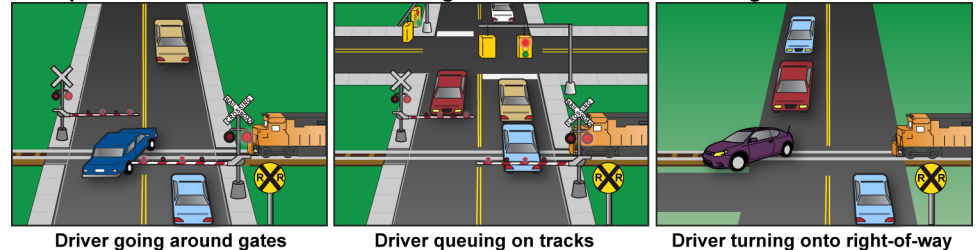
## GRADE-CROSSING SAFETY

### DOT Should Evaluate Whether Program Provides States Flexibility to Address Ongoing Challenges

## What GAO Found

Research sponsored by the Federal Railroad Administration (FRA) has identified driver behavior as the main cause of highway-rail grade crossing crashes and that factors such as train and traffic volume can contribute to the risk of a crash. (See figure.) Over 70 percent of fatal crashes in 2017 occurred at grade crossings with gates.

#### Examples of Drivers' Behavior Contributing to Crashes at Grade Crossings



To meet the requirements of the federal grade-crossing program, states are responsible for selecting and ensuring the implementation of grade-crossing improvement projects. Most state DOT officials and other relevant transportation officials use local knowledge of grade crossings to supplement the results of models that rank grade crossings based on the risk of an accident. These states generally consider the same primary risk factors, such as vehicle and train traffic. FRA is taking steps to improve the data used in its model to help states assess risk factors at grade crossings. For example, FRA's grade-crossing inspectors will review and identify issues with railroad- and state-reported inventory data. FRA is currently developing guidelines, which it plans to finalize by the end of 2018, to implement these inspections as it has for other types of FRA inspections.

Officials we spoke with in eight states reported challenges in pursuing certain types of projects that could further enhance safety, in part because of federal requirements. While safety has improved, many crashes occur at grade crossings with gates, and officials said there could be additional ways to focus program requirements to continue improving safety. States' and the Federal Highway Administration's (FHWA) reporting focuses on the program's funding and activity, such as the number and types of projects, yet the low number of crashes makes it difficult to assess the effectiveness of projects in reducing crashes and fatalities. FHWA reports the program has been effective in reducing fatalities by about 74 percent since 1975. However, since 2009, annually there have been about 250 fatalities—almost one percent of total highway fatalities. FRA expects future crashes to grow, in part, due to the anticipated increase in rail and highway traffic. An evaluation of the program should consider whether its funding and other requirements allow states to adequately address ongoing safety issues. FHWA officials said they are not required to perform such evaluations. GAO has previously reported on the importance of program evaluations to determine the extent to which a program is meeting its objectives. An evaluation of the program could lead FHWA to identify changes that could allow states to more strategically address problem areas.

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### Abbreviations

DOT	Department of Transportation
FAST Act	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
HSIP	Highway Safety Improvement Program
IG	Inspector General
MAP-21	Moving Ahead for Progress in the 21st Century Act
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
Section 130 Program	Railway-Highway Crossings Program
state DOT	state department of transportation

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November 8, 2018

The Honorable John Thune  
Chairman  
The Honorable Bill Nelson  
Ranking Member  
Committee on Commerce, Science, and Transportation  
United States Senate

The Honorable John Barrasso  
Chairman  
The Honorable Tom Carper  
Ranking Member  
Committee on Environment and Public Works  
United States Senate

The Honorable Bill Shuster  
Chairman  
The Honorable Peter A. DeFazio  
Ranking Member  
Committee on Transportation and Infrastructure  
House of Representatives

The U.S. railroad system consists of a vast network of operations. More than 780 railroads operate on 220,000 miles of track—including about 210,000 highway-rail at-grade crossings (hereafter “grade crossings”) meaning where public or private roads intersect with the tracks at the same level as the roadway. Crashes at grade crossings are one of the leading causes of railroad-related deaths and injuries, accounting for about 30 percent of railroad-related fatalities. One recent crash—still under investigation—occurred on January 31, 2018, when a chartered Amtrak train carrying members of Congress hit a refuse truck at a grade crossing near Crozet, Virginia. According to the National Transportation Safety Board’s (NTSB) preliminary report, the crossing was equipped with lights and gates to warn of a train’s presence, but witnesses reported the truck drove around the gates prior to the accident.

Federal investments in grade-crossing safety improvement have noticeably reduced the number of deaths and injuries at public grade

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crossings.<sup>1</sup> According to the Federal Railroad Administration's (FRA) data, since FRA began measuring in 1975, crashes at grade crossings have declined by over 80 percent and fatalities have dropped 70 percent.<sup>2</sup> Crashes have leveled off in recent years, and since 2009, the number of grade-crossing crashes and fatalities has hovered at around 2,100 crashes and 250 fatalities per year. However, FRA expects future crashes to grow, in part, because of the anticipated increase in rail and highway traffic. The persistence of crashes and deaths raises questions as to whether improvements could be made to increase the effectiveness of FRA's rail-safety oversight activities and states' use of federal grade-crossing safety improvement funds.

Within the U.S. Department of Transportation (DOT), the Federal Highway Administration (FHWA) and FRA are the two federal agencies primarily responsible for improving and overseeing safety at public grade crossings. FHWA's Railway-Highway Crossings Program (commonly referred to as the Section 130 Program) is the primary federal program for providing states, through a statutory formula, funding to address safety at grade crossings.<sup>3</sup> FRA oversees railroad safety, including the safety of rail operations at grade crossings. FRA also awards safety discretionary grants to states, local governments, and other public entities to address rail planning, infrastructure, and safety issues. While these grants are not specifically targeted for grade-crossing safety, they may include improvements to rail-highway crossing safety.

You requested that we review federal efforts to improve grade-crossing safety. This report examines:

1. What has been the focus of FRA's grade-crossing-safety research.

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<sup>1</sup>Federal funds can only be used to address safety issues at public grade crossings, which account for approximately 60 percent of the grade crossings in the United States. There are approximately 80,000 private grade crossings. These crossings do not involve a public road. Access is generally determined by the railroad and the private landowner.

<sup>2</sup>According to FRA guidance, grade-crossing crashes can also be referred to as grade-crossing accidents, or grade-crossing accident/incidents. To be recorded as a grade-crossing accident, an accident must meet three conditions: (1) involve railroad on-track equipment, (2) involve a highway user, and (3) the accident occurs at a highway-rail grade crossing.

<sup>3</sup>23 U.S.C. § 130.

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2. How states select and implement grade-crossing projects, and what railroad- and state-reported data are available from FRA to inform states' decisions.
  3. The challenges states reported in implementing and assessing projects, and the extent to which FHWA assesses the program's effectiveness.

The scope of this work focused on the nation's more than 128,000 grade crossings where public roads cross rail tracks. We focused our work on the Section 130 Program. For each of our objectives, we reviewed pertinent statutes and FHWA and FRA regulations and documents, and interviewed FHWA and FRA program officials in headquarters as well as a non-generalizable sample of 10 stakeholders from railroads, industry and transportation associations, and academia, in addition to a rail safety organization and a rail safety consultant. We also interviewed federal officials from the National Transportation Safety Board and the Volpe Center. We selected these organizations based on our initial background research, prior work, and input from other stakeholders, among other things. We also selected eight states for case studies to include a mix of state experiences based on several factors. We selected half of our states from those ranked in the top 25 percent of all states for the number of grade crossings and the amount of Section 130 Program funds received. We selected the other half to include a range of these factors. We also considered geographical diversity in our selections. For these eight states, we conducted in-depth interviews with the FHWA division staff assigned to those states and the FRA regional staff assigned to the regions that included those states, as well as officials from states' departments of transportation (state DOT), public utility commissions, and other state officials involved with state use of Section 130 Program funds (referred to collectively as "state officials" in our report). We used a similar set of questions to collect information from the eight selected states on each of our objectives. Information from these state discussions cannot be generalized to other states; instead, we used the information for illustrative purposes, including when we describe the challenges interviewees reported facing. When appropriate, we indicate whether the challenges we summarize are shared by:

- "some" (two or three);
- "many" (four or five); or
- "most" (six or seven)

of the state officials, but frequency is not necessarily indicative of the relative importance of a challenge or consensus, or lack thereof.

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We also conducted additional work related to each of the objectives.

- To describe the focus of FRA's grade-crossing-safety research, we examined FRA research aimed at understanding the causes of grade-crossing crashes and identifying potential safety improvements and described FRA efforts to test new approaches that could improve safety.
- To describe how states select and implement grade-crossing projects, and what FRA data are available to inform their decisions, we reviewed an academic study that included a literature review and interviews with state officials to describe how states select Section 130 Program projects.<sup>4</sup> We also assessed the reliability of FRA's National Highway-Rail Crossing Inventory data, which are the only source for national statistics on grade-crossing characteristics. We tested whether the data were within reasonable ranges, were internally consistent, and appeared complete. We identified data reliability issues in FRA's crossing inventory that we will discuss more fully later in this report.
- To determine the challenges states reported in implementing and assessing projects and the extent to which FHWA assesses the program's effectiveness, we reviewed program requirements and state project information and other components from FHWA's 2016 and 2018 Biennial Section 130 Program progress reports to Congress.<sup>5</sup> We also reviewed federal laws and guidance related to implementing projects and measuring performance. We interviewed state DOT officials from the eight selected states and other stakeholders on the challenges states face implementing projects and FHWA and FRA officials for their perspectives on managing the program, including how FHWA measures performance and assesses program effectiveness. We compared information collected from FHWA to federal internal control standards and criteria on program evaluation identified in our previous work. Appendix I describes our objectives, scope, and methodology in greater detail.

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<sup>4</sup>Benjamin R. Sperry, Bhaven Naik, Jeffrey E. Warner, *Evaluation of Grade Crossing Hazard Ranking Models*, a report prepared at the request of the Ohio Department of Transportation, May 2016.

<sup>5</sup>Every 2 years the Secretary of DOT sends Congress a report on the progress all the states have made in implementing projects to improve grade crossings. The report is submitted by FHWA's Office of Safety. 23 U.S.C. § 130(g).



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We conducted this performance audit from October 2017 to November 2018 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

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### Grade-Crossing-Safety Trends

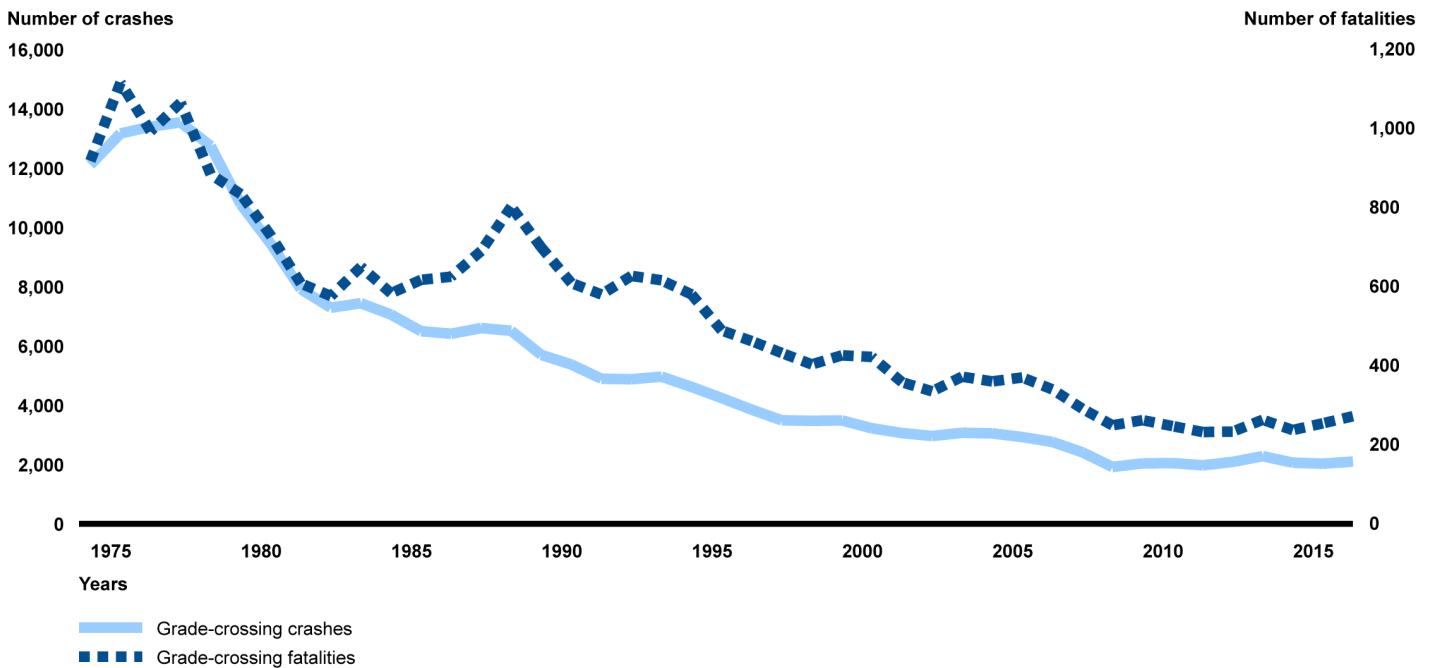
Grade-crossing safety has improved significantly since 1975, but since 2009, the number of crashes and fatalities at grade crossings has plateaued (see fig. 1). The yearly number of grade-crossing crashes declined from 12,126 in 1975 to 2,117 in 2017. In that time frame, fatalities dropped from 917 to 273. The most significant reductions in grade-crossing crashes and fatalities were achieved from 1975 to 1985, when states closed or improved the most dangerous crossings.<sup>6</sup> Grade-crossing safety continued to improve until the mid-2000s, though at a slower rate. Since 2009, the number of grade-crossing crashes and fatalities remains at around 2,100 crashes and 250 fatalities a year. These fatalities typically make up less than one percent of all highway-related fatalities. The decrease in crashes and fatalities occurred as the volume of train and highway traffic generally increased over the years. FRA expects the traffic volumes to continue to increase and has expressed concern that grade-crossing crashes and fatalities may also increase.<sup>7</sup>

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<sup>6</sup>GAO, *Railroad Safety: Status of Efforts to Improve Railroad Crossing Safety*, [GAO/RCED-95-191](#) (Washington, D.C.: Aug. 3, 1995).

<sup>7</sup>FRA faces an emerging challenge in dealing with expected increases in freight rail traffic. FRA has estimated that the amount of freight shipped in the United States would increase by 1.1 billion tons (about 9 percent) across all modes from 2010 to 2020, with about 176-million tons of the increased amount shipped by rail. According to the Association of American Railroads, this includes the rapid increase in freight rail traffic related to energy production, both in the transport of materials such as sand for use in hydraulic fracturing and the shipment of crude oil from fields.

**Figure 1: Crashes at Highway-Rail Grade Crossings and Fatalities from 1975–2017**



Source: GAO analysis of Federal Railroad Administration data. | GAO-19-80

## The Section 130 Program

As a set-aside portion of FHWA’s much larger Highway Safety Improvement Program (HSIP), the Section 130 Program provides funds to state DOTs for the elimination of hazards at highway-rail grade crossings.<sup>8</sup> States determine what improvements need to be made at grade crossings. FHWA has oversight responsibilities regarding the use of federal funds as part of its administration of federal-aid highway programs and funding, including HSIP funds.<sup>9</sup> FHWA uses a statutory formula to distribute to states Section 130 Program funds, which

<sup>8</sup>Under amounts authorized by the Fixing America’s Surface Transportation (FAST) Act, between fiscal years 2016 and 2020, individual state Highway Safety Improvement Program apportionments ranged from approximately \$2.2 billion to an estimated \$2.4 billion. Pub. L. No. 114-94 (2015).

<sup>9</sup>Federal assistance for highway and bridge infrastructure—about \$40 billion each year—is distributed through multiple formulas and discretionary grant programs collectively known as the federal-aid highway program. States have flexibility to use federal-aid highway program funding outside the Section 130 Program to address rail-highway crossing safety improvements.

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averaged \$235 million per year during the last 10 years (fiscal years 2009 through 2018). Section 130 Program projects are funded at a 90 percent federal share, with the state or the roadway authority funding the remaining 10 percent.<sup>10</sup> States have 4 years to obligate their program funds before they expire, meaning that in any given fiscal year, states can obligate funds appropriated in that year as well as any unobligated funds from the previous 3 fiscal years.<sup>11</sup> In addition, states may choose to combine funds from multiple years to fund relatively expensive projects.

The Section 130 Program's requirements direct states to establish an implementation schedule for grade-crossing-safety improvement projects that, at a minimum, include warning signs for all public grade crossings. Grade crossings are generally categorized as "active" or "passive" depending on the type of traffic control devices that are present. As of July 2018, according to FRA's National Highway-Rail Crossing Inventory, there were approximately 68,000 public grade crossings with electronic, or active, traffic control devices in the United States. Another approximately 58,000 public grade crossings have passive traffic-control devices, which include signs and supplementary pavement markings.<sup>12</sup> The requirements also specify that at least 50 percent of Section 130 Program funding must be dedicated to the installation of protective devices at grade crossings, including traffic control devices.<sup>13</sup> States can use remaining program funds for any hazard elimination project.<sup>14</sup> States may also use program funds to improve warning signs and pavement markings or to improve the way the roadway aligns with the tracks (e.g., to ensure low-clearance vehicles do not get stuck on the tracks). In

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<sup>10</sup>Certain grade crossing projects funded with other Highway Safety Improvement Program funds may be eligible for a 100 percent federal share. 23 U.S.C. § 120(c). Currently, the Section 130 funding is a 90 percent federal share. See Pub. L. No. 100-17, § 121 (1987); Pub. L. No. 109-59, § 1401(d) (2005).

<sup>11</sup>23 U.S.C. § 118(b).

<sup>12</sup>As discussed below, we identified data reliability issues related to the inventory, which may cause these statistics to be out of date.

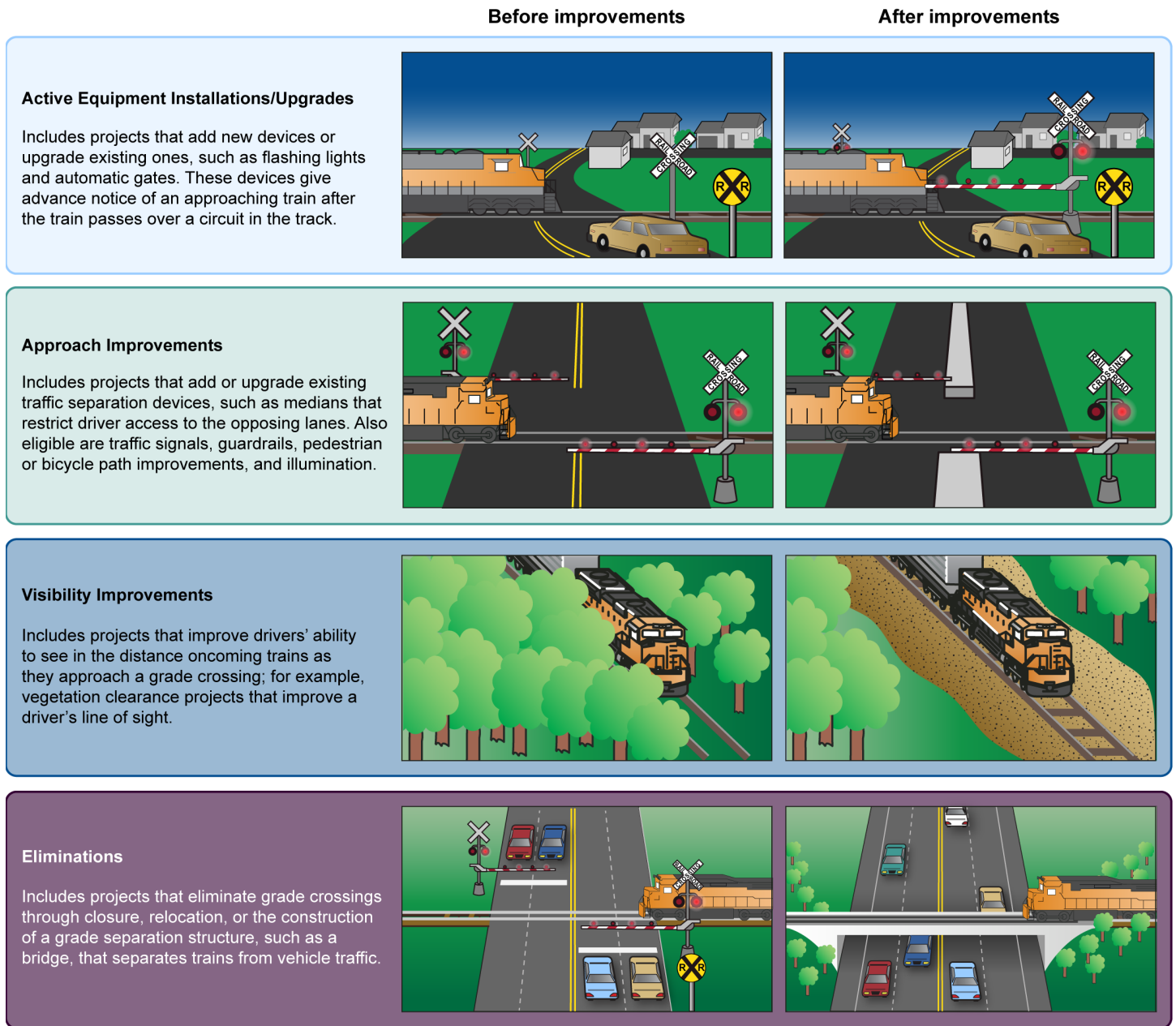
<sup>13</sup>In guidance to states, FHWA has specified that protective devices are grade-crossing improvement projects such as installing signs and pavement markings, upgrading warning devices and traffic signals, illuminating grade crossings, and improving the surface at a grade crossing.

<sup>14</sup>Pursuant to statute, the types of eligible projects have changed over time. For example, the FAST Act amended Section 130 project funding eligibility to include projects to eliminate hazards posed by idling trains that block grade crossings. Pub. L. No. 114-94, § 1412.

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addition, states can use up to 2 percent of the funds to improve their grade-crossing inventories and to collect and analyze data. See figure 2 for examples of the types of projects eligible for Section 130 Program funds and graphical depictions of grade crossings before and after safety improvements have been made.

**Figure 2: Examples of Eligible Projects for the Railway-Highway Crossings Program with Before and After Views of Safety Improvements**



Source: GAO analysis of DOT information. | GAO-19-80

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## The Federal Role in Grade-Crossing Safety

FHWA and FRA are the primary agencies responsible for safety at grade crossings, and they both play key—yet distinct—roles. FHWA oversees the Section 130 Program and monitors states' uses of program funds through 52 division offices located in each state, the District of Columbia, and Puerto Rico and through headquarters staff in Washington, D.C. In addition, FHWA's division staff reviews states' processes for prioritizing and selecting grade-crossing-safety improvement projects. FHWA does not evaluate the appropriateness of individual grade-crossing projects, but instead helps states determine that projects meet program eligibility requirements. Division staff assists in the implementation of Section 130 Program state-administered projects, and they may participate in state-DOT-led, on-site reviews of grade crossings under consideration for Section 130 Program projects. FHWA headquarters staff is responsible for FHWA-wide initiatives, such as working with stakeholders to establish standards for traffic control devices and systems at grade crossings and for engineering oversight of state-administered safety improvement projects.

FRA provides safety oversight of both freight and passenger railroads by:

- collecting and analyzing data;
- issuing and enforcing numerous safety regulations, including on grade-crossings' warning systems;
- conducting focused inspections, audits, and accident investigations; and
- providing technical assistance to railroads and other stakeholders.

Specifically, FRA oversees rail safety through eight regional offices and through headquarters staff in Washington, D.C. Regional staff monitor railroads' compliance with federal safety regulations through inspections and provide technical assistance and guidance to states. In 2017, FRA created a new discipline for grade-crossing safety and is hiring new grade-crossing inspectors.<sup>15</sup> These inspectors conduct field investigations, identify regulatory defects and violations, recommend civil penalty assessments when appropriate, and may participate in state-

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<sup>15</sup>FRA's 342 regional safety inspectors formerly covered five safety disciplines—track; signals and train control; motive power and equipment; operating practices; and hazardous materials.

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DOT-led teams that conduct on-site reviews of grade crossings to evaluate potential safety improvements. According to FRA documentation, FRA's new inspectors will also work with a variety of stakeholders to institute new types of training, explore new safety concepts and technologies, and assist in the development of new or modified highway-rail grade-crossing-safety regulations, initiatives, and programs. The inspectors will also work with FHWA and other DOT operating administrations in a cooperative effort to improve grade-crossing safety. FRA regional staff also investigates select railroad crashes, including those at grade crossings, to determine root causation and any contributing factors, so that railroads can implement corrective actions.<sup>16</sup> FRA headquarters staff develops analytical tools for states to use to prioritize grade-crossing projects. In addition, headquarters staff manages research and development to support improved railroad safety, including at grade crossings.

FRA's Office of Railroad Safety maintains the National Highway-Rail Crossing Inventory database and the Railroad Accident/Incident Reporting System on grade-crossing crashes. Both states and railroads submit information to FRA's crossing inventory, which is designed to contain information on every grade crossing in the nation. Railroads submit information such as train speed and volume; states submit information such as highway speed limits and average annual daily traffic. The Rail Safety Improvement Act of 2008 added requirements for both railroads and states to periodically update the inventory; however, the Moving Ahead for Progress in the 21st Century Act (MAP-21) repealed a provision providing DOT authority to issue implementing regulations that would govern states' reporting to the inventory. According to FRA officials, while FRA's regulations do not require states to report the information, FRA encourages them to do so. FRA regulations require railroads to report and update their information in the inventory every 3 years or sooner in some instances, such as if new warning devices are installed or the grade crossing is closed. FRA's accident system contains details about each grade-crossing accident that has occurred. In addition

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<sup>16</sup>FRA criteria for grade-crossing accident investigations generally involve: serious injury or fatality to persons being transported in a commercial motor vehicle or school bus; three or more motor vehicle occupant fatalities; or without a fatality, but involving credible evidence of a malfunction or failure of an active-warning device. The National Transportation Safety Board (NTSB) also conducts selected accident investigations, including at grade crossings. NTSB's Office of Highway Safety investigates significant crashes that are likely to impact the public's confidence in highway transportation safety, generate high public interest, or highlight national safety issues.

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to submitting immediate reports of fatal grade-crossing crashes, railroads are required to submit accident reports within 30 days after the end of the month in which the accident occurred and describe conditions at the time of the accident (e.g., visibility and weather); information on the grade crossing (e.g., type of warning device); and information on the driver (e.g., gender and age).

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## FRA Has Focused Research on Understanding and Addressing Risky Behavior by Drivers at Grade Crossings

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### Research Sought to Identify Risk Factors at Grade Crossings and Understand Driver Behavior

In its role overseeing grade-crossing safety, FRA has sponsored a number of research efforts to better understand the causes of grade-crossing crashes and identify potential ways to improve engineering, education, and enforcement efforts. For example, FRA sponsored an in-depth data analysis of grade-crossing crashes to better identify which crossing characteristics increase the risk of an accident.<sup>17</sup> The report, issued in 2017, found that the volumes of train and vehicle traffic at a crossing are the biggest predictors of grade-crossing crashes.<sup>18</sup> Changes in vehicle and train traffic therefore affect the annual number of grade-crossing crashes. For example, as highway traffic decreased in 2008, possibly due to the economic recession and higher gas prices, so too did the number of grade-crossing crashes. As previously noted, FRA expects that the number of grade-crossing crashes will likely grow with anticipated increases in future train and highway traffic. As discussed below, vehicle and train volume are included in the U.S. DOT Accident Prediction Model,

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<sup>17</sup>Federal Railroad Administration, *In-Depth Data Analysis of Grade-crossing Accidents Resulting in Injuries and Fatalities* (May 2017). We did not review the analytical sufficiency of FRA's report, as it was beyond the scope of this engagement.

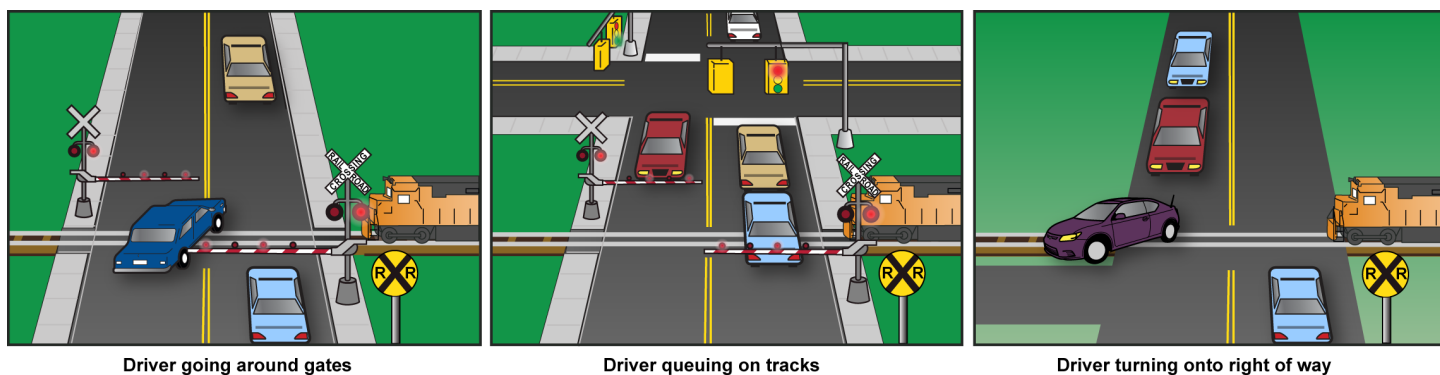
<sup>18</sup>Train speed had a significant effect on the injury and fatality rate. The report also found that grade crossings with multiple traffic lanes and railroad tracks increase accident risk, as does proximity to a highway intersection.



which some states use to select grade-crossing improvement projects.<sup>19</sup> According to FRA officials, FRA is using the results of this recent in-depth data analysis to, in part, evaluate whether additional risk factors, such as the number of male drivers or trains carrying toxic materials, should be added to the model.

FRA has targeted other research into understanding driver behavior at grade crossings, which is the leading cause of crashes. According to FRA's accident data, in 2017, 71 percent of fatal crashes at public grade crossings occurred at those with gates. In 2004, the DOT Inspector General (IG) reported that 94 percent of grade-crossing crashes from 1994 to 2003 could be attributed to risky driver behavior or poor judgement. State officials we spoke with explained that drivers may become impatient waiting at a grade crossing and decide to go around the gates. Drivers may also line up over the grade crossing in heavy vehicular traffic, and be unable to exit before the gates come down. See figure 3 for examples of risky driver behavior at grade crossings.

**Figure 3: Examples of Driver Behavior Contributing to Highway-Rail Grade-Crossing Crashes**



Source: GAO. | GAO-19-80

To better understand driver behavior, FRA sponsored a John A. Volpe National Transportation Systems Center (Volpe Center)<sup>20</sup> study that recorded and analyzed drivers' actions as they approached grade

<sup>19</sup>The US DOT Accident Prediction Model is a multi-step model that uses grade-crossing characteristics and accident history to predict the number of crashes per year at a grade crossing and the severity of predicted crashes.

<sup>20</sup>The John A. Volpe National Transportation Systems Center conducts transportation research for DOT administrations and other entities.

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crossings.<sup>21</sup> The researchers found that almost half of drivers were doing another task, such as eating, and over a third did not look in either direction while approaching passive grade crossings. We have previously reported, and many stakeholders we interviewed agreed, that in light of inappropriate driver behavior, technological solutions alone may not fully resolve safety issues at grade crossings.<sup>22</sup> In addition, public-education and law-enforcement efforts can augment the effectiveness of technological solutions. According to FRA officials, they shared information on driver education with DOT's National Highway Traffic Safety Administration (NHTSA) as NHTSA works more closely with states on driver education manuals. According to DOT officials, NHTSA updates its driver education materials every 2–3 years and plans to consider including grade-crossing-safety materials in the next versions.

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### FRA Works with States to Research New Safety Measures to Address Risky Behavior at Grade Crossings

FRA is also working with states and localities to research and develop new protective devices and other safety measures targeted at improving driver behavior at grade crossings. As most fatal crashes happen at grade crossings already equipped with gates, FRA and state and local agencies are exploring whether additional safety measures can improve safety at those locations. For example, in 2016 and 2017, FRA's Grade Crossing Task Force<sup>23</sup> worked with the Volpe Center and the City of Orlando to test whether photo enforcement at grade crossings could reduce risky driver behavior. The City of Orlando installed automated photo-enforcement devices at a grade crossing, and instead of issuing fines to drivers who had violated its warning devices, sent drivers a warning notice and educational safety materials. Eight months after the photo-enforcement system was installed, grade crossing violations decreased by 15 percent. While FRA judged these enforcement efforts successful at changing driver behavior, a 2015 FRA whitepaper noted that photo enforcement equipment is costly—on average costing over \$300,000 per crossing to install and operate for 2 years—and may not be

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<sup>21</sup>FRA, *Driver Behavior Analysis at Highway-Rail Grade Crossings using Field Operational Test Data— Light Vehicles* (May 2013). We did not review the analytical sufficiency of FRA's report, as it was beyond the scope of this engagement.

<sup>22</sup>[GAO/RCED-95-191](#).

<sup>23</sup>FRA created the Grade Crossing Task Force after 6 people died in a grade-crossing accident involving a commuter railroad in 2015. According to FRA, the taskforce brainstorms new ideas and oversees grade crossing projects in the areas of enforcement, education, engineering, data analysis, and research.

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cost-effective for most grade crossings.<sup>24</sup> FRA found that due to costs and state laws prohibiting photo-enforcement, only two photo-enforcement cameras were currently in operation at grade crossings across the country.

States, localities, and FHWA are also exploring whether new types of pavement markings at grade crossings can improve driver behavior. According to DOT officials, FHWA is working with two states to develop new cross-hatch pavement markings for grade crossings that would comply with the Manual on Uniform Traffic Control Devices, similar to the “don’t block the box” type pavement markings used in intersections. FHWA also worked with a city to test the use of in-roadway lights to delineate the crossing. (See fig. 4).

**Figure 4: Photos of In-Roadway Lights That Delineate a Grade Crossing**



Source: Federal Highway Administration. | GAO-19-80

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<sup>24</sup>FRA, *The Use of Automated Enforcement of Traffic Laws at Highway-Rail Grade Crossings* (October 2015). According to this whitepaper, as of October 2015, 27 states have laws allowing the use of technology to enforce compliance with traffic laws, with 8 states specifically mentioning grade crossings.

FRA and state DOTs are also trying to improve pedestrian safety at grade crossings by developing new safety measures. Grade-crossing accidents involving pedestrians are less frequent than those involving automobiles at grade crossings but have a higher fatality rate. While pedestrians were involved in only 9 percent of accidents at public crossings in 2017, almost 40 percent of fatal grade-crossing accidents involved pedestrians.<sup>25</sup> To try to improve pedestrian safety, in 2012 the Volpe Center worked with New Jersey Transit to study whether adding additional pedestrian gate skirts—hanging gates that further block a crossing (see fig. 5)—would prevent people from ducking under the gates.<sup>26</sup> The Volpe Center reported that these new gates had mixed success. While incidents of people going under and around the gates decreased, more people chose to cross the tracks in the street rather than at the sidewalk.

**Figure 5: Photos of Gate Skirts for Pedestrians in Matawan, New Jersey**



Source: Federal Railroad Administration. | GAO-19-80

<sup>25</sup>Though not discussed in this report, trespasser fatalities, another source of pedestrian rail fatalities, remain an on-going challenge for railroads. The rates of trespasser fatalities have seen little improvement in recent years. According to DOT officials, in 2017, 575 people died and another 505 were injured in railroad trespassing incidents. The sheer amount of railroad track throughout the United States makes preventing trespassers difficult to address, and trespassing cannot be easily predicted or controlled. (GAO-14-85).

<sup>26</sup>FRA, *Effect of Gate Skirts on Pedestrian Behavior at Highway-Rail Grade Crossings* (December 2013).

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Finally, FRA is exploring new automated and connected vehicle technologies that could reduce risky driver behavior at grade crossings. FRA, FHWA, and officials from one state we interviewed said they anticipate that such technology will be critical to further improving safety. Specifically, FRA and FHWA are coordinating with DOT's Intelligent Transportation Systems Joint Program Office to develop pilot technology that would enable crossing infrastructure or trains to communicate wirelessly with vehicles. Vehicles can use this information to warn the driver that a crash or violation is imminent, or integrate with onboard active safety systems. According to FRA officials, they completed a proof of concept in 2013 and completed and tested a prototype of the technology in 2017. DOT officials said that DOT does not have a time frame for when automakers might begin incorporating such connected vehicle technologies and noted that retrofitting older cars with new equipment will likely make this a long-term effort.

FRA shares information on its research in various ways with state DOTs, because states are responsible for deciding which safety measures to install at grade crossings. Specifically, FRA and FHWA jointly hold quarterly webinars with stakeholders, including state DOT officials, and conduct presentations at highway-rail safety workshops. Information on safety measures such as grade-crossing devices, signs, and markings are also included in the *Railroad-Highway Grade Crossing Handbook*.<sup>27</sup> According to DOT officials, the handbook was developed jointly by FHWA and FRA. The last version of the handbook was updated in 2007 and includes some out of date information. FRA and FHWA officials said they began working on an update in 2017, but missed the July 2018 target completion date. According to FHWA officials, updating the handbook is a complex undertaking that has taken more time than they anticipated due to the extensive collaboration required among stakeholders. FHWA officials said they anticipate completing the update during the spring of 2019.

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<sup>27</sup>FHWA, *Railroad-Highway Grade Crossing Handbook: Revised Second Edition* (August 2007).

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## States Use a Risk-Based Approach for Project Selection and May Use FRA Data

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### States Consider Risk when Identifying Grade-Crossing Improvement Projects

The risk of crashes at public grade crossings within a state factors into states' selection of over 1,000 new Section 130 Program projects nationally each fiscal year. FHWA requires states to develop a grade crossing program that considers relative risk.<sup>28</sup> FHWA officials said they review the methods that states use to select projects to ensure that risk is considered. According to a 2016 academic study of 50 states, most states use mathematical formulas, or "accident prediction models," to help assess risk and identify grade crossings for potential projects.<sup>29</sup> More specifically, these accident prediction models use factors such as grade crossing characteristics and accident history to rank grade crossings by risk. DOT provides one such model—the Accident Prediction Model—and some states have developed their own models.<sup>30</sup> The study reported that 19 states used DOT's model and 20 states used a different model.<sup>31</sup> It also found that the DOT and commonly used state models include some similar grade-crossing characteristics to predict accident risk. For example, the selected models reviewed all considered vehicle- and train-traffic volume, which FRA has found to be the strongest predictors of grade-crossing crashes.

FRA makes its Accident Prediction Model available to states online through its Web Accident Prediction System. This system is an online tool that uses FRA's crossing inventory, crossing collision history, and the DOT Accident Prediction Model to predict accident risk for grade crossings in each state. Only one of the eight states in our review used the system as its primary source for ranking grade-crossing risk. Most of

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<sup>28</sup>23 C.F.R. § 924.9(a)(4)(ii).

<sup>29</sup>Benjamin R. Sperry, Bhaven Naik, Jeffery E. Warner, *Evaluation of Grade Crossing Hazard Ranking Models*, a report prepared at the request of the Ohio Department of Transportation, May 2016.

<sup>30</sup>We did not assess the quality or accuracy of DOT's model, as it was beyond the scope of this engagement.

<sup>31</sup>Eleven states did not use models. For example, officials from one state DOT told us they maintained lists of grade crossings that needed certain types of upgrades.

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the other states perform their own calculations to rank grade crossings. Officials from two states said that they believe their state-maintained data are more reliable than FRA's crossing inventory and explained that they go directly to their contacts at railroads to get updated information on factors such as train volume.

Accident prediction models are only one source of information states use when selecting Section 130 Program projects. According to the state officials we spoke with, a variety of other considerations can also influence their decisions, including the following:

- Proximity of projects together along a railroad "corridor" in order to gain efficiencies and reduce construction costs.
- Requests from local jurisdictions or railroads. These stakeholders may have information on upcoming changes at a grade crossing, such as higher train volume or new housing developments nearby, which would increase risk but would not be reflected yet in the accident prediction model.
- Availability of local funding to provide the required 10 percent match for Section 130 Program projects, while trying to spread the funds fairly across the state.

States may also consider grade crossings that have had close calls in the past, such as where a car narrowly avoided being hit by a train. FRA does not require railroads to report on these close calls, or "near misses;" however, according to state officials, railroads sometimes provide this information to states on an ad-hoc basis. State officials from four of the eight states we spoke with said they considered near misses when selecting Section 130 Program projects. A 2004 Volpe Center report noted that studying close calls was a proactive way to improve safety.<sup>32</sup> According to the report, FRA sponsored a workshop to learn about the benefits of collecting and analyzing close calls. However, stakeholders we interviewed noted challenges formalizing near-miss reporting. For example, Volpe Center officials said these reports are subjective in nature—what one engineer considers a close call, others may not.

FRA developed another online tool—GradeDec—to allow states to compare the costs and benefits for various grade-crossing improvement

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<sup>32</sup>Volpe Center, *Proceedings of the Human Factors Workshop: Improving Railroad Safety through Understanding Close Calls* (May 2004).

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projects. GradeDec uses models to analyze a project's risk and calculate cost-benefit ratios and net present value for potential projects. FRA provides state DOTs with on-site GradeDec workshops upon request. While FRA officials noted that many state and local governments have registered to use the program, none of the state officials we spoke with identified GradeDec as a tool that they use to conduct cost-benefit analysis. Officials from two state DOTs we spoke with said that cost-benefit analyses could help them better identify and select the most cost-effective crossing safety projects in the future.<sup>33</sup> According to the academic study of 50 states noted above, because of limited funding for grade-crossing improvements, states should consider the life-cycle costs of the projects as well as net present value to help select projects.<sup>34</sup> As discussed later in this report, the small number of crashes at grade crossings can make it challenging to distinguish between different projects in terms of their effectiveness in reducing accidents.

Finally, after they have considered risk factors and created a list of potential grade crossings for improvement, state officials, along with relevant stakeholders from railroads and local governments, conduct field reviews of the potential projects. According to state officials, these reviews help identify grade-crossing characteristics that may not be included in the accident prediction models, such as vegetation that would obstruct drivers' views.

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## FRA Has Taken Steps to Improve Inventory Data and Is Formalizing How Inspectors Will Validate the Data's Accuracy

In 2008, legislation was enacted mandating reporting by states and railroads to the National Highway-Rail Crossing Inventory.<sup>35</sup> However, the fact that reporting to the inventory remained voluntary until 2015 has had lingering effects on the completeness of the data in the inventory. In 2015, as mandated by statute, FRA issued regulations requiring railroads to update certain data elements for all grade crossings every 3 years.<sup>36</sup> However, our analysis of FRA's crossing inventory found that 4 percent of

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<sup>33</sup>Officials from one state reported using GradeDec to perform "what-if" analyses, to predict, for example, the effect of increased traffic on a grade crossing's accident risk.

<sup>34</sup>B. Sperry, B. Naik, J. Warner, *Current Issues in Highway-Rail Grade Crossing Hazard-Ranking and Project Development*, Journal of the Transportation Research Board, vol.2, No. 2608 (2017).

<sup>35</sup>Pub. L. No. 110-432, § 204 (2008).

<sup>36</sup>49 C.F.R. § 234.409. FRA regulations do not require railroads to periodically update inventory records for grade-separated grade crossings or closed grade crossings.



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grade crossings were last updated in 2009 or earlier. In addition, because MAP-21 repealed DOT's authority to issue regulations that would govern state reporting to the inventory, state reporting of grade-crossing data remains voluntary, according to FRA officials, and all state-reported information is not complete. Our analysis of state-reported data in FRA's crossing inventory found varying levels of completeness. For example, while some state-reported data fields were almost entirely complete, 33 percent of public grade crossings were missing data on posted highway speed. We also found that of the crossings for which states reported the year when the highway-traffic count was conducted, 64 percent of the highway-traffic counts for public grade crossings, another important risk factor, had not been updated since 2009, or earlier. According to the 2015 final rule, FRA will continue to evaluate whether additional regulations to address state reporting are needed to maintain the crossing inventory's accuracy.<sup>37</sup>

FRA officials told us that improving inventory data will help them better deploy their limited resources, particularly their grade-crossing inspectors, and said that they have taken steps to help improve the data. In 2017, FRA regional officials conducted field reviews to verify the latitude and longitude data for grade crossings in the inventory, data that states are responsible for updating. In addition, FRA expects its grade-crossing inspectors as part of their inspections to review and identify issues with the railroad- and state-reported inventory data. According to FRA officials, FRA has begun to both transition its 19 grade-crossing managers into grade-crossing inspectors and also hire new inspectors, for an eventual total of 24 inspectors and eight regional specialists to supervise their activities.<sup>38</sup>

To help ensure railroads' compliance with crossing inventory regulations, officials said that the inspectors will use spot checks to validate the inventory data by comparing grade-crossing characteristics in the field with the information railroads submitted to the inventory. In addition, FRA has incorporated information on inventory-reporting requirements into the grade-crossing inspectors' training. Finally, FRA is currently developing guidelines for the grade-crossing inspections similar to those for other FRA safety disciplines. FRA headquarters officials acknowledged that

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<sup>37</sup>80 Fed. Reg. 746, 748 (Jan. 6, 2015).

<sup>38</sup>According to FRA officials, current grade-crossing managers may choose to transition to being grade-crossing inspectors or regional specialists, or maintain their current position.

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they are still clarifying the details for the inspections that will be included in the compliance manuals that inspectors will use.<sup>39</sup> Specifically, they said they are still determining appropriate inspector workloads and drafting specific guidelines that will need to be integrated into FRA's regional inspection plans.

FRA officials said they are working to develop and make available inventory inspection guidance to the grade-crossing managers and inspectors by December 31, 2018. In the meantime, FRA held training that included information on inventory-reporting requirements. In August 2018, FRA developed guidance for grade-crossing inspections specific to quiet zones in response to a recommendation we made in 2017.<sup>40</sup> It is important that FRA meets its goal to issue similar guidance specific to reviewing the accuracy of the inventory data, as FRA cannot have reasonable assurance that inspections that are already under way are being conducted in such a manner that would allow them to consistently identify data reliability issues at each crossing.

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## States Reported Challenges Implementing Certain Project Types and Measuring Projects' Effectiveness, and FHWA's Efforts to Assess the Program's Effectiveness Have Limitations

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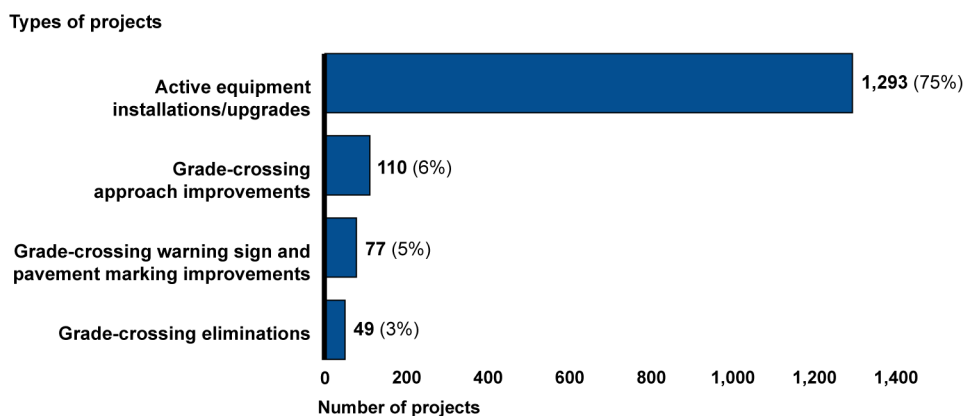
<sup>39</sup>FRA has developed a manual for each of its other five disciplines. For example, FRA's manual for the operating practices discipline includes: pertinent laws and regulations, inspector best practices, field-reporting procedures and forms, and illustrative examples of non-compliance issues.

<sup>40</sup>GAO, *Railroad Safety: Quiet Zone Analyses and Inspections Could Be Improved*, [GAO-18-97](#) (Washington, D.C.: October 2017).

## The Program's Requirements and Other Challenges Cited by States Contribute to the Selection of Active-Warning Equipment Projects over Other Projects

About 75 percent of all Section 130 Program projects states implemented in fiscal year 2016 involved installing or updating active grade-crossing equipment, including warning lights and protective gates (see fig. 6).<sup>41</sup> The prevalence of this type of project is in part due to the Section 130 Program requirement that states spend at least 50 percent of funds on protective devices. Other than eliminating a grade crossing, adding protective devices has long been considered the most effective way of reducing the risk of a crash.

**Figure 6: Railway-Highway Crossings Program's Most Common Project Types Identified by States in Fiscal Year 2016**



Source: GAO analysis of Federal Highway Administration information. | GAO-19-80

Note: The Federal Highway Administration's data from fiscal year 2016 were the most recent data available.

Officials from six of eight state DOTs we interviewed told us that the numbers and types of grade-crossing projects they implement are dependent on the amount of Section 130 Program funding they receive and the cost of the projects. As previously described, funds are set aside from the Highway Safety Improvement Program and distributed to states by a statutory formula that includes factors such as the number of grade crossings in each state. Officials from six of the eight state DOTs we spoke to agreed that the set-aside nature of the program was crucial in allowing them to implement projects, many of which they said would not have been possible without Section 130 Program funds. For example,

<sup>41</sup>FHWA's project data from fiscal year 2016 were the most recent data available.

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many said the formula funding ensures that grade-crossing projects are completed along with highway safety projects, particularly given the fact that fatalities resulting from grade-crossing crashes account for so few when compared to highway deaths. Overall, fatalities resulting from grade-crossing crashes account for less than 1 percent of all highway-related fatalities.

In fiscal year 2018, the funds distributed ranged from a low of approximately \$1.2 million for eight states and Washington, D.C., to over \$16 million for California and over \$19 million for Texas.<sup>42</sup> The number of grade crossings in the eight states and Washington, D.C. ranged from 5 to 380, while California had almost 6,000 and Texas had over 9,000. Project implementation costs varied by project type and ranged widely depending on project scope. Based on 2016 DOT data, some typical project costs ranged as follows:

- adding signs to passive grade crossings—\$500 to \$1,500;
- adding flashing lights and two gates to passive grade crossings—\$150,000 to \$300,000;
- adding four gates to grade crossings with flashing lights—\$250,000 - \$500,000;
- closing a grade crossing—\$25,000 to \$100,000; and
- separating a grade crossing from traffic (Grade Separation)—\$5 million to \$40 million.<sup>43</sup>

State officials we spoke with cited several challenges in pursuing certain types of controversial, innovative, and expensive projects that could help them address the evolving nature of risk at grade crossings and difficulty in measuring the effectiveness of their projects. First, most state DOT officials said that the cost of grade-separation projects and, at times, the controversy of eliminating grade crossings through closure reduces the

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<sup>42</sup>States can use Section 130 Program funds for other highway safety projects if they demonstrate they have met their safety needs for installing or upgrading protective devices. 23 U.S.C. § 130(e)(2). FHWA reported in 2016 that the District of Columbia and Hawaii, with less than 10 active public grade crossings each, were the only states to have obligated program funds for purposes other than grade-crossing projects. According to FHWA officials these two states used program funds for other Highway Safety Improvement Program projects such as traffic signals and intersection improvements.

<sup>43</sup>Costs for grade separation can range widely due to differences in the number of highway lanes and railroad tracks, as well as the lengths of bridges built to traverse the tracks.

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number of these projects, while acknowledging that they are the most effective ways to improve safety. These types of projects made up only 3 percent of Section 130 Program projects in fiscal year 2016 (see fig. 6). Grade-separation projects are often more expensive than the annual Section 130 Program funding available to states. In 2018, only eight states received annual Section 130 Program funding sufficient to fund a \$7-million grade-separation project. As discussed previously, to fund relatively expensive projects, states may choose to combine funds from multiple years. Also, states and railroads may make incentive payments to localities for the permanent closure of a grade crossing.<sup>44</sup> In addition to the cost, most state DOT officials reported challenges obtaining local support for closing grade crossings. They said closures may inconvenience residents who use the road and force emergency responders to take longer routes, potentially slowing response times. Grade-separation projects address these safety concerns and may be more agreeable to residents, but they are substantially more expensive. While up to \$7,500 in Section 130 Program funding can be used to help incentivize communities to close grade crossings, officials from some of our selected state DOTs said this amount is generally not enough to persuade local officials to support the closing.

Second, officials from many state DOTs we interviewed also reported that the requirements of the Section 130 Program create challenges for them in implementing what they considered to be innovative projects. For example, the program requirement that 50 percent of funds be used on protective devices, combined with what one researcher described to us as the tendency by states to implement “known” projects—i.e., protective devices—may impede states’ selection of new, more innovative safety projects. Officials we interviewed from many state DOTs described challenges related to the program’s requirements. They noted that they are prevented from using Section 130 Program funds for new types of safety technologies not yet incorporated into FHWA’s Manual on Uniform Traffic Control Devices. As noted previously in this report, outside the Section 130 Program FHWA is working with states and localities to explore whether new types of pavement markings at grade crossings, not in the manual, can improve driver behavior. One state DOT official we interviewed suggested changes to allow states to fund one grade-crossing pilot project per year or to use a set percentage of program

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<sup>44</sup>23 U.S.C. § 130(i).

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funds to finance a pilot project that could help them explore promising but as yet unproven technologies.

Third, state DOT officials from four of the eight selected states also said it can be difficult to find funding for the required 10 percent state match. As previously mentioned, while certain rail-safety projects are eligible for up to 100 percent federal funding, Section 130 Program projects are funded at a 90 percent federal share. According to DOT documentation we reviewed, only some states have a dedicated source for such a match, and state DOT officials from one of our selected states said their state cannot use state funds for the 10 percent match. Some state DOT officials said this situation can drive project selection. For example, they sometimes chose projects based on which localities or railroads were willing to provide matching funds or offer cost savings.

Finally, many state officials cited challenges in measuring the effectiveness of grade crossing projects in reducing crashes or the risk of crashes. In particular, state officials we spoke to said it can be difficult to use before-and-after crash statistics as a measure of effectiveness because of the low number and random nature of crashes. Also, as FRA research has shown and as FHWA and FRA have noted, reporting on before-and-after grade-crossing accident statistics can be misleading, given the infrequency of crashes and crashes that are not the result of grade crossing conditions.<sup>45</sup> States' required Section 130 Program annual progress reports to the Secretary of DOT call for states to report on the effectiveness of the improvements they made.<sup>46</sup> FHWA reporting guidance suggests they define effectiveness as the reduction in the number of fatalities and serious injuries after grade-crossing projects were implemented, consistent with statutory requirements. In addition, FHWA guidance states that consideration should be given to quantifying effectiveness in the context of fatalities and serious injuries.<sup>47</sup> However, states often report no differences in crashes after specific projects were implemented, and there have been instances where states reported a

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<sup>45</sup>See, for example, Federal Railroad Administration, *Proceedings of the Human Factors Workshop: Improving Railroad Safety Through Understanding Close Calls* (April 2003) and Federal Highway Administration, Federal Railroad Administration, *Noteworthy Practices Guide: Highway-Railway Grade Crossing Action Plan and Project Prioritization* (November 2016).

<sup>46</sup>23 U.S.C. § 130(g).

<sup>47</sup>FHWA, Office of Safety, *Railway-Highway Crossings Program Reporting Guidance* (Feb. 22, 2013).

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slight increase in crashes. Such an increase does not necessarily mean that the project was not effective in reducing the overall risk of a crash. Also, not all projects are implemented at grade crossings where there has been a crash.

Among other information, states also typically report information on funding and data on the numbers and types of projects implemented. In addition, the extent to which states report projects' effectiveness varies greatly. Given states' responsibility for implementing the Section 130 Program and the differences in the amounts of funding they receive, FHWA officials said states should determine and report on the appropriate effectiveness metrics for their programs. According to FHWA officials, during the 2017 reporting year, a few states requested examples of what to include when reporting effectiveness, and FHWA responded with examples of various methods they could use, such as a benefit-cost ratio or the percentage decrease in fatalities, serious injuries, and crashes. Regardless of the difficulty in measuring the effectiveness of specific projects, most state DOT officials we interviewed stressed the importance of the Section 130 Program in funding grade-crossing projects.

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### FHWA Reports Provide Limited Insight into the Program's Effectiveness, and FHWA Has Not Evaluated Program Requirements in Light of Changing Risk Conditions

FHWA's biennial report to Congress is intended to provide information to Congress on the progress being made by the states in implementing projects to improve safety and, in addition, make recommendations for future implementation of the program. FHWA reviews states' annual Section 130 Program reports and uses them to formulate the report to Congress every 2 years. FHWA's 2018 report highlights that the Section 130 Program has seen great success since 1975, with a decrease of approximately 74 percent in fatalities at the same time that there was an increase in vehicle and train traffic. The report described the latest available 10-year trend, from 2007 to 2016, as showing a 31 percent decrease in fatalities. Fatalities have also decreased when adjusted for train traffic. However, FHWA officials acknowledged in interviews with us that crashes and fatalities have remained constant since about 2009, with more recent data showing a slight increase in fatalities over the last 2 to 3 years, data that are consistent with the increases in overall roadway fatalities. The officials said increased train- and vehicle-traffic volumes could be contributing to that increase, in addition to other factors, such as more bicycle riders and pedestrians using grade crossings. As described earlier, states have generally already used Section 130 Program funding to address safety at the riskiest grade crossings by adding protective measures, typically lights and gates. Yet crashes continue to occur at

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these improved grade crossings. Given these trends and the challenges discussed earlier related to the requirements of the Section 130 Program, it is not clear whether the program remains effective in continuing to reduce the risk of crashes and fatalities at grade crossings.

As required, FHWA's biennial report includes a section on "recommendations for future implementation" of the Section 130 Program. As part of this, FHWA reports on challenges and actions being taken to address them. FHWA's 2018 report identified one of the same challenges we heard about from state DOT officials related to the inability or unwillingness of local agencies to provide matching funds and the relatively low amount of funding designed to incentivize localities to close crossings. FHWA reported on its efforts to address these challenges, including by providing guidance, resources, and supportive training to states and local agencies and serving as a clearinghouse for innovative methods of supporting projects. However, with the exception of the funding challenge, FHWA's most recent report does not include the other challenges state officials identified to us related to the requirements of the Section 130 Program discussed above. These include program funding requirements that may impede innovative approaches and the difficulties of using before-and-after crash statistics to measure effectiveness.

Many state DOT officials we spoke with said there may be an opportunity to more broadly assess the Section 130 Program at the national level. It could be more informative to comprehensively assess more detailed crash trends, such as those that look forward over multiple years across the more than 1,700 crashes nationwide, rather than on the approximately 35 that occur on average within a state, and identify strategies to address those trends. Doing so could help FHWA learn more about why crashes are continuing and what types of projects may be effective. There could be ways to evaluate the program in a more comprehensive way; many state DOT officials we interviewed told us such a comprehensive evaluation could help improve program effectiveness in a number of ways, including by enabling the program to better keep up with the rapid pace of technological change and re-examining eligibility requirements that limit the flexibility of states to consider other types of projects beyond engineering. Also, most state DOT officials we interviewed agreed that education and enforcement efforts are crucial to further improving safety, as did 8 out of 10 other stakeholders we spoke to, as well as officials from Volpe Center and NTSB. However, according to FHWA officials, those project types are not allowed under the Section 130 Program's requirements. The officials said FHWA has partnered with FRA and NHTSA on research efforts, such as



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driver-behavior studies, to inform grade-crossing safety issues. However, the officials said that FHWA has not conducted a program evaluation of the Section 130 Program to consider whether the program's funding and other requirements allow states to adequately address ongoing safety issues such as driver behavior. FHWA officials said that there is no federal requirement for them to conduct such a program evaluation.

We have previously reported that an important component of effective program management is through program performance assessment, which helps establish a program's effectiveness—the extent to which a program is operating as it was intended and the extent to which a program achieves what the agency proposes to accomplish.<sup>48</sup> This type of evaluative information helps the executive branch and congressional committees make decisions about the programs they oversee. Assessing program performance includes conducting program evaluations, which are individual systematic studies that answer specific questions about how well a program is meeting its objectives.<sup>49</sup> In addition, federal internal-control standards state that management should identify, analyze, and respond to significant changes in a program's environment that could pose new risks.<sup>50</sup>

FHWA officials said the fact that crashes and fatalities have held steady while the volume of train and vehicle traffic has increased is an indication that grade-crossing safety has continued to improve. However, specific to fatalities per million train-miles, FHWA's 2018 biennial report shows this rate to be fairly constant since 2009. As noted previously, FRA expects train and traffic volumes to continue to increase and has expressed concern that grade-crossing crashes and fatalities may also increase. Without conducting a program evaluation, FHWA cannot ensure that the Section 130 Program is achieving one of the national goals of the federal-

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<sup>48</sup>GAO, *Program Evaluation: Strategies to Facilitate Agencies' Use of Evaluation in Program Management and Policy Making*, [GAO-13-570](#) (Washington, D.C.: June 26, 2013); *Performance Measurement and Evaluation: Definitions and Relationships*, [GAO-11-646SP](#) (Washington, D.C.: May 2011); and *Managing for Results: Enhancing Agency Use of Performance Information for Management Decision Making*, [GAO-05-927](#) (Washington, D.C.: Sept. 9, 2005).

<sup>49</sup>GAO, *Veterans Justice Outreach Program: VA Could Improve Management by Establishing Performance Measures and Fully Assessing Risks*, [GAO-16-393](#) (Washington, D.C.: Apr. 28, 2016).

<sup>50</sup>GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: September 2014).

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aid highway program, to reduce fatalities and injuries.<sup>51</sup> In addition, It is difficult to see how FHWA, in its biennial reports to Congress, could make informed recommendations for future program implementation without conducting a program evaluation to assess, among other things, whether program requirements first established some four decades ago continue to reduce fatalities and injuries. We note that as part of a program evaluation, some changes that FHWA, working with FRA, identifies as potentially having merit to improve the program’s effectiveness could require a statutory change.

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## Conclusions

The continued number of crashes and fatalities at grade crossings with devices intended to warn of a train’s presence calls into question whether the Section 130 Program is structured to help states continue making progress toward the national goal to reduce fatalities and injuries. An evaluation of the program’s requirements could help determine whether Congress should consider better ways to focus federal funds to address the key factor in crashes—risky driver behavior. An FHWA program evaluation could also help determine whether, for example, states could more strategically target emerging safety problems if changes were made to the types of projects eligible for funding under the Section 130 Program. FRA’s new grade-crossing inspectors are meant to increase the effectiveness of FRA’s rail-safety oversight activities, and accordingly, these FRA inspectors, along with FRA researchers, may be well positioned to help FHWA evaluate potential changes to improve the effectiveness of the Section 130 Program.

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## Recommendation for Executive Action

The Administrator of FHWA, working with FRA, should evaluate the Section 130 Program’s requirements to determine whether they allow states sufficient flexibility to adequately address current and emerging grade-crossing safety issues. As part of this evaluation, FHWA should determine whether statutory changes to the program are necessary to improve its effectiveness. (Recommendation 1)

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## Agency Comments

We provided a draft of this report to DOT for review and comment. In written comments, reproduced in appendix II, DOT concurred with our

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<sup>51</sup>23 U.S.C. § 150(b).

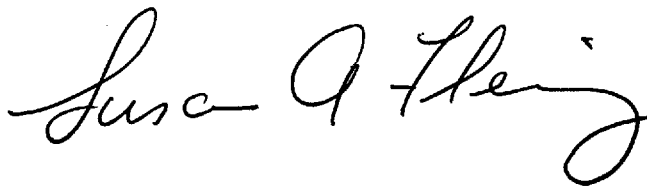
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recommendation. DOT also provided technical comments, which we incorporated as appropriate.

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We are sending copies of this report to the appropriate congressional committees, the Secretary of Transportation, the Administrator of the Federal Highway Administration, and the Administrator of the Federal Railroad Administration. In addition, the report will be available at no charge on GAO's website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-2834 or [flemings@gao.gov](mailto:flemings@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.

A handwritten signature in black ink that reads "Susan A. Fleming". The signature is written in a cursive style with a large, looping "S" and "F".

Susan A. Fleming  
Director, Physical Infrastructure Issues

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# Appendix I: Objectives, Scope, and Methodology

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This report examines (1) what has been the focus of Federal Railroad Administration's (FRA) grade-crossing-safety research, (2) how states select and implement grade-crossing projects and what railroad- and state-reported data are available from FRA to inform states' decisions, and (3) the challenges states reported in implementing and assessing projects and the extent to which the Federal Highway Administration (FHWA) assesses the program's effectiveness. The scope of this work focused on the nation's more than 128,000 public grade crossings. We did not include private grade crossings, as states can only use Railway-Highway Crossings Program (commonly referred to as the Section 130 Program) funds to improve safety at public grade crossings. While FRA provides safety grants to address rail issues, including for grade-crossing projects, we focused our work on the Section 130 Program because it is the primary source of federal funding directed at grade-crossing-safety improvement.

For each objective we reviewed: pertinent statutes and FHWA and FRA regulations and documents; interviewed FHWA and FRA program officials in headquarters; and conducted in-depth interviews with a non-generalizable sample of organizations that included officials from 4 freight and passenger railroads, 12 state agencies from 8 states, 6 FRA regional offices, and 8 FHWA state division offices. We also spoke with representatives from relevant associations and officials from NTSB and Volpe Center. We selected these organizations based on our initial background research, prior work, and input from other stakeholders, among other things. See the paragraph below for additional selection details and table 5 for a complete list of organizations we spoke with.

We selected eight states as part of our non-generalizable sample for interviews. These states included Arizona, California, Florida, Illinois, Missouri, New Jersey, North Carolina, and Pennsylvania. The states were selected to include a mix of state experiences based on a variety of factors, including the number of grade crossings and crashes at those crossings, and the amount of Section 130 Program funding they received. Specifically, we selected four states from those in the top 25 percent of all states in terms of their number of grade crossings and the amount of Section 130 Program funds they received. We selected the other four states to include a mix of these factors. We also considered geographical diversity and recommendations from FRA and FHWA officials. Within these eight states, we conducted in-depth interviews with FHWA division staff, FRA regional staff, and state officials. A variety of state agencies administer the Section 130 Program within their state; the state officials we spoke with from our eight selected states worked for agencies such as

state departments of transportation, corporation commissions, and public utility commissions. We also spoke with a non-generalizable sample of four railroads: Amtrak, CSX, Norfolk Southern, and Sierra Northern. We selected railroads based on a variety of factors including geographic location and stakeholder recommendations.

We also conducted additional work related to each of the objectives. To describe the focus of FRA's grade-crossing-safety research, we examined FRA research aimed at understanding the causes of grade-crossing crashes and identifying potential improvements and described FRA efforts to test new approaches that could improve safety. We did not assess the quality of FRA's research, as that was beyond the scope of this engagement. Instead, we described the nature of the research. We also spoke with FRA research and development staff, Volpe researchers, and state partners about this work.

To describe how states select and implement grade-crossing projects, and what FRA data are available to inform their decisions, we reviewed an academic study that included a literature review and interviews with state officials to describe how states select Section 130 Program projects.<sup>1</sup> We spoke with the researcher and determined the study to be reliable for the purposes of our reporting objectives. We also spoke with officials from our eight selected states, FHWA division staff, and FRA regional staff, and reviewed the states' 2017 Section 130 Program reports. As part of this objective, we also assessed the reliability of data reported for all railroads in FRA's National Highway-Rail Crossing Inventory data as of August 31, 2018. For public grade crossings that were not closed, we examined a selection of fields within the database to identify the frequency of missing data (see table 1), data anomalies (see table 2), relational errors, where two related data fields had values that were incompatible (see table 3), and when the data was last updated (see table 4). Specifically, we conducted the following electronic tests on the crossing inventory data to determine if they were within reasonable ranges, were internally consistent, and appeared complete:

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<sup>1</sup>Benjamin R. Sperry, Bhaven Naik, Jeffrey E. Warner, *Evaluation of Grade Crossing Hazard Ranking Models*, a report prepared at the request of the Ohio Department of Transportation, May 2016.

**Table 1: Electronic Testing of National Highway-Rail Grade Crossing Inventory—Missing Data**

<b>Data element</b>	<b>Number of missing values (out of 130,449 total values)</b>
Weekly train movement	379
Highway speed limit	42,575
Type train service	31,271
Annual average daily traffic	1,429
Number of traffic lanes	1,046
Smallest crossing angle	871
Latitude	706
Longitude	706
Highway traffic signal controlling crossing	676
Regularly used by school bus	472
Roadway gate arms	307
Max timetable speed	536
Day through-train traffic	40
Night through-train traffic	92

Source: GAO analysis of U.S. Department of Transportation information. | GAO-19-80

**Table 2: Electronic Testing of National Highway-Rail Grade Crossing Inventory—Data Anomalies**

<b>Data element</b>	<b>Values we considered outside the normal range</b>	<b>Number of values outside the normal range</b>
Max timetable speed	<1 or >150	1,968
Longitude	For states except Alaska: <-124 or >-66 For Alaska: <-165 or >-132	162
Annual Average Daily Traffic	<1 or >999,999	13
Latitude	For states except AK: <24 or >49 For AK: <50 or >71	10
Weekly train movement	<0 or >999	0
Highway Speed Limit	<0 or >120	0
Roadway gate arms	<0 or >99	0
Number of traffic lanes	<0 or >9	0

Source: GAO analysis of U.S. Department of Transportation information. | GAO-19-80

**Table 3: Electronic Testing of National Highway-Rail Grade Crossing Inventory–Relational Errors**

Data relationship error	Criteria	Number of errors
Crossings with gates are missing information on gate configuration	Gates>0 and Gate Configuration is blank	19,506
Crossing with school busses do not have the number of school busses listed	School buses=1 and School bus count is blank	438
Freight-only lines have passenger counts listed	Type of train service is “11” and Passenger count>0	105

Source: GAO analysis of U.S. Department of Transportation information. | GAO-19-80

**Table 4: Electronic Testing of National Highway-Rail Grade Crossing Inventory–Date Updated**

Data element	Before 1/1/1980	From 1/1/1980 to 12/31/1989	From 1/1/1990 to 12/31/1999	From 1/1/2000 to 12/31/2009	From 1/1/2010 to 8/31/2018	Missing
Revision date	99	942	1,044	3,611	125,554	0
Year of train count data	41	500	6	129	97,033	33,541
Year of annual average daily traffic	2,405	29,924	11,660	37,877	47,497	1,887

Source: GAO analysis of U.S. Department of Transportation information. | GAO-19-80

Before conducting our analysis, we filtered the inventory data to only include open, public, at-grade crossings. To understand FRA’s efforts to improve its crossing inventory data, we interviewed FRA regional and headquarters staff and reviewed job descriptions for FRA’s new grade-crossing inspectors.

Finally, to determine the challenges states reported in implementing and assessing grade-crossing safety projects and the extent to which FHWA assesses the program’s effectiveness, we reviewed program requirements and state project data and other components from FHWA’s 2016 and 2018 Section 130 Program biennial reports to Congress. We also reviewed FHWA’s summary of fiscal year 2018 program funds provided to states and federal laws and guidance related to implementing projects and measuring performance. We interviewed state DOT officials from the eight selected states and other stakeholders on the challenges states reported in implementing and assessing projects, and FHWA and FRA officials for their perspectives on managing the program, including how FHWA measures performance and assesses program effectiveness. We compared information collected from FHWA and FRA to federal internal-control standards and criteria on program evaluation identified in

our previous work. In addition, we reviewed FHWA and FRA documents designed to guide states, such as the *Grade Crossing Handbook*, the *Manual on Uniform Traffic Control Devices*, the *Action Plan and Project Prioritization Noteworthy Practices Guide*, and other related documents.

**Table 5: List of Organizations Interviewed by GAO**

<b>Name of Organization</b>	<b>Type of Organization</b>
<b>Federal Government</b>	
FRA Headquarters	Federal Government
FRA Region 1	Federal Government
FRA Region 2	Federal Government
FRA Region 3	Federal Government
FRA Region 4	Federal Government
FRA Region 6	Federal Government
FRA Region 7	Federal Government
FHWA Headquarters	Federal Government
FHWA Arizona division office	Federal Government
FHWA California division office	Federal Government
FHWA Florida division office	Federal Government
FHWA Illinois division office	Federal Government
FHWA Missouri division office	Federal Government
FHWA New Jersey division office	Federal Government
FHWA North Carolina division office	Federal Government
FHWA Pennsylvania division office	Federal Government
The Volpe National Transportation Systems Center	Federal Government
National Transportation Safety Board	Federal Government
<b>State Agencies</b>	
Arizona Department of Transportation	State Agency
Arizona Corporation Commission	State Agency
California Department of Transportation	State Agency
California Public Utility Commission	State Agency
Florida Department of Transportation	State Agency
Illinois Department of Transportation	State Agency
Illinois Commerce Commission	State Agency
Missouri Department of Transportation	State Agency
New Jersey Department of Transportation	State Agency
North Carolina Department of Transportation	State Agency



**Appendix I: Objectives, Scope, and Methodology**

<b>Name of Organization</b>	<b>Type of Organization</b>
Pennsylvania Department of Transportation	State Agency
Pennsylvania Public Utility Commission	State Agency
<b>Railroads</b>	
Amtrak	Railroad
CSX	Railroad
Norfolk Southern	Railroad
Sierra Northern	Railroad
<b>Others</b>	
American Association of Railroads	Trade Association
American Association of State Highway and Transportation Officials	Transportation Association
American Shortline and Regional Railroad Association	Trade Association
Operation Lifesaver	Safety Organization
Joyce Rose (WSP USA)	Transit and Rail Safety Consultant
Benjamin Sperry (University of Ohio)	Academic

Source: GAO. | GAO-19-80

We conducted this performance audit from November 2017 to November 2018 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

# Appendix II: Comments from the Department of Transportation



U.S. Department of  
Transportation  
Office of the Secretary  
of Transportation

Assistant Secretary for Administration

1200 New Jersey Avenue SE  
Washington, DC 20590

OCT 26 2018

Susan A. Fleming  
Director, Physical Infrastructure Issues  
U.S. Government Accountability Office (GAO)  
441 G Street NW  
Washington, DC 20548

Dear Ms. Fleming:

The Federal Highway Administration (FHWA) and the Federal Railroad Administration (FRA) are committed to enhancing safety at or near public rail-highway crossings. Over the last 10 years, the number of fatalities at rail-highway crossings decreased by 31 percent while train and vehicle traffic increased. Fatalities at rail-highway crossings now comprise less than 1 percent of total highway fatalities. The FHWA's Railway-Highway Crossing Program (Section 130 Program) provides states funding to address safety at grade crossings. This annual set-aside program, which set-aside \$235 million in Fiscal Year 2018, is a small portion of the \$40 billion Federal-aid Highway Program. The purpose of the program is to eliminate hazards at rail-highway crossings. The FHWA's continued emphasis on safety targets have focused States' efforts on streamlining processes, implementing systemic safety improvements, developing innovative methods, and applying noteworthy practices from other States.

In addition, FHWA continues to take the following actions to effectively implement the Section 130 Program:

- Establish State flexibility to use State-specific, data-driven processes for managing their rail-highway crossing program to ensure that States can target Federal-aid investments to reduce rail-highway crossing deaths and serious injuries;
- Offer technical assistance to States as they administer and manage their programs;
- Assist states to determine the most effective processes for selecting, prioritizing and evaluating grade-crossing safety improvement projects that meet their needs;
- Partner with various stakeholders from public and private organizations to improve safety on the Nation's rail-highway crossing sites in a coordinated manner;
- Collect annual outcome program evaluations and partner with States on their program reviews; and
- Submit biennial reports to Congress—seven to date—that include State program implementation efforts, program effectiveness findings, and evaluation of State programs and recommendations for future program implementation.

Further, FRA has taken actions to improve rail-highway safety. For example, FRA has created a Grade Crossing Discipline, consisting in part, of twenty-four regional inspectors and eight

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**Appendix II: Comments from the Department  
of Transportation**

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regional specialists who perform inspections of railroad Emergency Notification Systems to ensure compliance with FRA regulations. FRA's inspectors also inspect quiet zones—grade crossings where train horns are not routinely sounded—to ensure crossing safety enhancements are properly maintained and remain in place. Finally, FRA inspectors plan to work with railroads to ensure the grade crossing inventory data is accurate and updated in accordance with the regulations.

Upon review of the GAO's draft report, we concur with the recommendation that FHWA, working with FRA, determine whether the Section 130 Program requirements allow states sufficient flexibility to adequately address current and emerging grade-crossing safety issues. We will provide a detailed response to the recommendation within 60 days of the final report's issuance.

We appreciate the opportunity to respond to the GAO draft report. Please contact Madeline M. Chulumovich, Director, Audit Relations and Program Improvement, at (202) 366-6512 with any questions or if you would like to obtain additional details.

Sincerely,



Keith Washington  
Deputy Assistant Secretary for Administration

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# Appendix III: GAO Contact and Staff Acknowledgments

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## GAO Contact

Susan A. Fleming, (202) 512-2834, [Flemings@gao.gov](mailto:Flemings@gao.gov).

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## Staff Acknowledgments

In addition to the individual named above, Maria Edelstein (Assistant Director); Gary Guggolz (Analyst in Charge); Steven Campbell; Tim Guinane; Ben Licht; Catrin Jones; Delwen Jones; SaraAnn Moessbauer; Malika Rice; Larry Thomas; and Crystal Wesco made key contributions to this report.

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