City and County of Denver

Freight Railroad Safety Study

April 2023

Prepared for:

DENVER
THE MILE HIGH CITY

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EXECUTIVE SUMMARY

In 2016 Denver Mayor, Michael B. Hancock, commissioned a study to review the City and County of Denver's (CCD or Denver) policies and practices for safety and hazard mitigation in areas near railroad rights-of-way (ROW) (CCD, 2016). This study expands on the mayor's study and reports on hazardous material shipments by rail throughout Denver. The purpose of this study's is to communicate current and future risks associated with freight rail throughout Denver in relation to population growth, land use, rail traffic patterns, and critical/sensitive facilities and resources. In addition to the mayor's 2016 study, the following documents were also reviewed and are incorporated throughout this study as appropriate:

- **City of Calgary *Baseline Risk Assessment of Land Development within Proximity of Freight Rail Corridors* (2018):** The City of Calgary commissioned this study to review rail safety hazards and risk assessment for the city following a large-scale disaster resulting from the derailment of a train carrying hazardous materials. The study assessed Canadian rail traffic volumes and trends, land use adjacent to railroad ROW, and rail operations and served as a model for the study being conducted by Denver.
- **Colorado State Highway-Rail Grade Crossing *Safety Action Plan* (2022a):** The State of Colorado, through the Colorado Department of Transportation (CDOT), generated this plan in compliance with the U.S. Department of Transportation's Federal Railroad Association (FRA) and Section 11401(b) of the Fixing America's Surface Transportation Act, which divided the nation's states into two groups: those with higher numbers of grade-crossing collision incidents and those with lower numbers. Under this Act, as part of the latter group, Colorado is required to develop a Safety Action Plan (SAP) to address high-risk crossings and at-grade crossing incidents.

This study analyzes spatial and statistical data obtained from the Association of American Railroads (AAR), the National Transportation Safety Board, FRA, and the City of Denver to summarize existing rail conditions, road crossings, and trespassing incidents within the city and to identify the locations, causes, types, and frequencies of rail-related accidents compared to the national, state, and local levels. As risk factors such as overall rail traffic volume, hazardous materials shipments, and high-density residential development near railroad ROW continue to increase, HNTB recommends a wide range of short-, medium-, and long-term mitigation measures. These measures can be addressed by Denver and by the railroads to decrease the likelihood of overall rail-related accidents in the city and to reduce the magnitude of impacts on surrounding communities and sensitive environmental resources. Mitigation measures detailed in this study include the following:

Short-term (less than 1 Year)

- Denver might develop and implement hazard management and evacuation plans.
- Denver might consider conducting a more comprehensive "parcel by parcel" study of emergency access and identify areas for improvement.
- Denver could develop an outreach and education program for emergency service responders, residents, and property owners near railroad ROW.
- Denver can request that the railroads manage vegetation near the railroad ROW.
- Denver Fire, in collaboration with the railroads, can monitor shipments of hazardous materials.

Medium-term (1 to 5 Years)

- Denver, with the help of state and federal funds, might consider grade crossing improvements, pedestrian overpasses at areas identified as high-risk for pedestrians, as well as construction of fencing along railroad ROW in high-trespassing areas.
- Denver can request that the railroads improve track conditions and install guard rails along ROW, which are to be identified though later studies.
- Denver planners could consider guidelines and requirements for future development adjacent to railroad ROW.

Long-term (greater than 5 Years)

- Denver and the railroads might also consider a larger construction project to include grade-separation of high-risk vehicle crossings and long-term improvement/and or relocation plans for the freight railroad main lines.
- Denver could incentivize property owners on structural reinforcement of existing buildings along railroad ROW.

With Denver ranking fourth in the nation (for similar sized cities) for most grade-crossing rail accidents, HNTB identified 13 at-grade rail crossings in the city with a high frequency of accidents and the greatest need for safety improvements. Site-specific mitigation measures to improve traffic control and preliminary cost estimates are provided for each of the 13 crossings. Safety models predict more than a 50 percent decrease in risk at some of these locations if the recommended improvements are implemented. The site-specific mitigation measures identified for the at-grade crossings include the addition of pavement markings, warning lights, bells, signing, fencing, and gate systems; construction or relocation of roadway features such as medians, curbs, and traffic lights; asphalt repairs; and measures to improve visibility. Building off the risk assessment, HNTB proposes a list of potential funding sources and grants to aid in the implementation of the recommended safety improvements.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
AADT	annual average daily traffic
AAR	Association of American Railroads
ALARP	as low as reasonably practicable
AM	before noon
APS	accident prediction and severity
BNSF	Burlington Northern Santa Fe
CCD	City and County of Denver
CDBG	Community Development Block Grants
CDOT	Colorado Department of Transportation
CFR	Code of Federal Regulations
CO	Colorado
CPD	Community Planning & Development
CRISI	Consolidated Rail Infrastructure and Safety Improvements
CY	calendar year
DHS	Department of Homeland Security
DOT	Department of Transportation
DOTI	Department of Transportation and Infrastructure
DPHE	Department of Public Health & Environment
EO	Emergency Order
FRA	Federal Railroad Administration
HMEP	Hazardous Materials Emergency Preparedness
IIFR or IR	Involuntary Individual Fatality Risk
mph	mile per hour
OEM	Office of Emergency Management
PM	after noon
ROW	right-of-way
RTDC	Regional Transportation District C-Line
SAP	Highway Rail Safety Action Plan
UPRR	Union Pacific Railroad
US	United States

CHAPTER 1 – INTRODUCTION

In 2022, the City and County of Denver (CCD or Denver) authorized a study of freight rail safety hazards, vulnerabilities, and risk mitigations. The outcome of the Freight Railroad Safety Study identifies risks, therefore, HNTB proposes a wide range of mitigation options to improve safety. Knowing the risks and mitigating them will help Denver become a safer community, while continuing to grow alongside the railroads. Many risks commonly addressed by local governments have been quantified, measured, and mitigated by means of regulations, codes, and standards. This study offers a framework for quantifying and identifying potential risks and mitigation measures. It adds clarity to current conditions along the railroad right-of-way (ROW) that are unknown or not well quantified but are susceptible to derailments and hazardous material releases that could potentially impact nearby land users.

In 2013, a unit train carrying 73 cars of crude oil, operated by a one-man crew, expired on the hours of service outside of Lac Mégantic, Quebec. The locomotive engineer, by railroad rules, must secure the brakes on the locomotive before leaving the train unattended. If the engineer has time, he secures the rest of the train, tying a varying number of brakes according to the tonnage and grade at the location. This day on July 6, 2013, the engineer did not tie the train brakes. As air bled off the train line (a common occurrence in trains), the three locomotive brakes could not hold the train, and it began to roll down a 1.2 percent grade into town. When the train rolled into the city it derailed, resulting in fires and explosions of multiple tank cars. The result of this disaster was that 47 people were killed, twice that number were injured, and more than 30 buildings were destroyed. More than half the town was contaminated by the oil. The blast radius of this accident was more than half a mile. Damages to this city were over $200 million, and the loss of life – immeasurable.

Since this disaster, a few studies have been created to assess potential risk mitigation measures around rail operations. Previous studies have identified issues surrounding cities that have been developed along the railroad ROW (CCD, 2016; CDOT, 2022a). In 2016, Denver Mayor, Michael B. Hancock, commissioned a study to look at and review the city's policies and practices around safety and hazard mitigation in areas near the railroad ROW (CCD, 2016). The conclusions of the 2016 study made recommendations on what needed to be considered to improve safety within the communities that surround the ROW. In 2018, the City of Calgary commissioned a study that reviewed the rail baseline and risk assessment for the city. The report looked at Canadian rail traffic volumes and trends, land adjacent to the ROW in Calgary, and railroad operations within this city. Based on their findings, this study completed a risk assessment of the area that is near the railroad ROW.

The National Transportation Safety Board and the Federal Railroad Administration (FRA) compile reports about train incidents and accidents from around the country (USDOT, 2021). These reports contain data significant to any rail study and highlight the potential for rail incidents and damage within the community where the accident occurs.

This study documents the existing freight rail conditions in Denver (e.g., rail volumes and commodity type) and the surrounding land uses, grade crossings, and facilities that run adjacent to the rail lines. It is the first step in identifying potential risks to life, property, and the environment and in recommending mitigation measures.

CHAPTER 2 – DENVER HAZARD MITIGATION FRAMEWORK

In 2022, Denver updated its overall assessment of hazards that pose risks to the city including, but not limited to, natural disasters, hazardous materials incidents, and transportation incidents. Individual city departments take responsibilities for preventing, reducing, or mitigating the risks these hazards pose. Table 2-1 identifies areas of risk in the hazards assessment conducted by the city (CCD, 2022).

Table 2-1. Denver Hazard Assessment Rankings

Hazard	Location/Spatial Extent	Magnitude/Severity	Likelihood of Future Occurrence	Significance
Communicable Disease	Extensive	Severe	Likely	High
Cyber Attack	Significant	Critical	Likely	High
Drought	Extensive	Moderate	Likely	High
Flooding	Significant	Moderate	Likely	High
Severe Thunderstorm	Extensive	Moderate	Highly Likely	High
Severe Winter Storm	Extensive	Moderate	Highly Likely	High
Extreme Temperatures	Extensive	Moderate	Likely	Medium
Dam Inundation	Significant	Critical	Unlikely	Medium
Earthquake	Extensive	Severe	Unlikely	Medium
Hazmat Incident	Limited	Moderate	Highly Likely	Medium
Critical Infrastructure Failure	Significant	Moderate	Occasional	Medium
Social Unrest	Limited	Moderate	Likely	Medium
Space Weather	Extensive	Critical	Unlikely	Medium
Terrorism and Mass Violence	Limited	Critical	Occasional	Medium
Tornado	Limited	Critical	Likely	Medium
Expansive Soils/Subsidence	Significant	Minor	Occasional	Low
Transportation Incident	Limited	Moderate	Occasional	Low
Mass Influx of Evacuees	Limited	Minor	Occasional	Low
Urban Conflagration	Limited	Moderate	Unlikely	Low
Volcanic Ash	Extensive	Moderate	Unlikely	Low
Wildland Fire	Limited	Moderate	Likely	Low

Source: CCD, 2022

2.1 Hazard of Accidental Deaths in Context

Table 2-2 lists the common causes of accidental deaths and is intended to provide an understanding of accidental deaths and the citywide planning efforts to prevent them. City planning is intended to protect life, safety, and general welfare. With information and awareness, city-wide resources can then be directed, according to each category of accidental deaths, to implement prevention measures.

While accidental deaths may seem unavoidable, a core tenet of Denver's Vision Zero Action Plan (CCD, 2017) is that people should not be killed or seriously injured because of mobility. Humans make mistakes, and physical/mechanical failures occur to cars, trains, and the underlying infrastructure; therefore, the transportation system should be designed and maintained to minimize the consequences of those errors.

Table 2-2. Accidental Deaths List in Denver County

Cause	2020	2021
Drug Overdoses	323	411
Suicides	152	156
Homicides	87	96
Roadway Vehicle Accidents	57	84
Work-Related Accidents	5	12
Freight Railroad Accidents	4	3

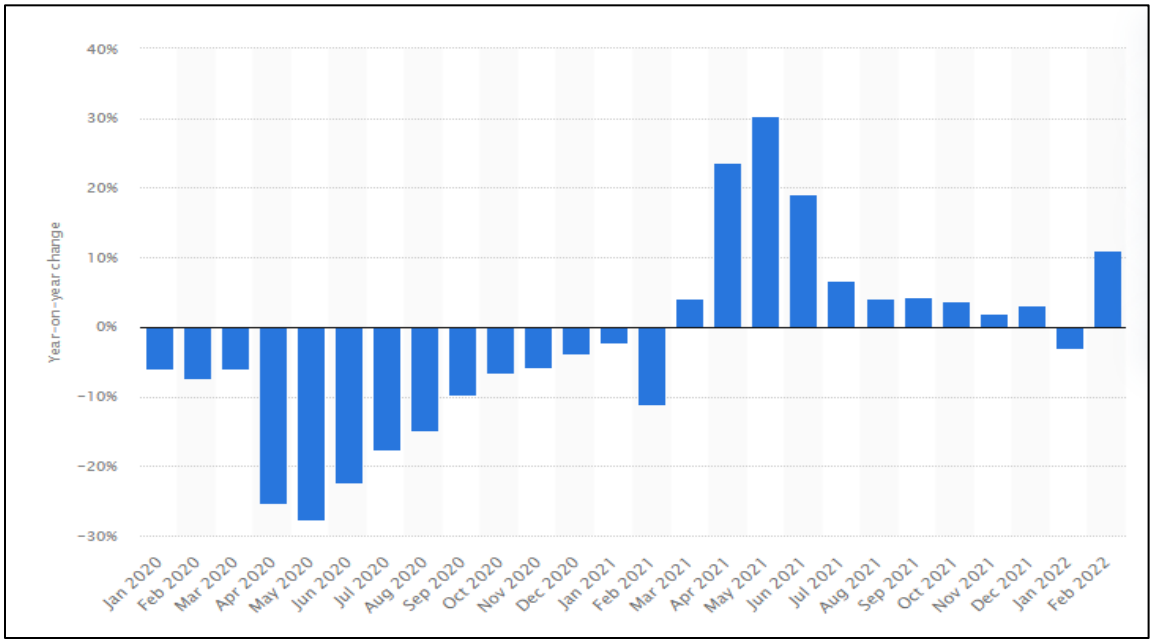
Sources: CDOT, 2022b, 2022c; USDOT, 2021.

CHAPTER 3 – FREIGHT VOLUMES

Currently, there are two major railroads (Class I) and ten local railroads (Class III) that deliver freight in the city. A Class I railroad is a railroad that has revenues of more than $504 million; a Class II railroad has revenues between $40 million and $504 million; and a Class III railroad has revenues less than $40 million. The major Class I railroads are the Burlington Northern Santa Fe (BNSF) and Union Pacific Railroad (UPRR). These major carriers account for 95 percent of the freight that passes through Denver.

The American Association of Railroads indicates that during the COVID-19 pandemic, traffic volumes decreased, as seen on Figure 3-1 (Statista, 2022). These conditions occurred due to manufacturing and product demand decreases during the pandemic and are slowly increasing as consumer product demands increase.

Figure 3-1. Traffic Volume Changes between January 2020 and February 2022



Source: Statista, 2022

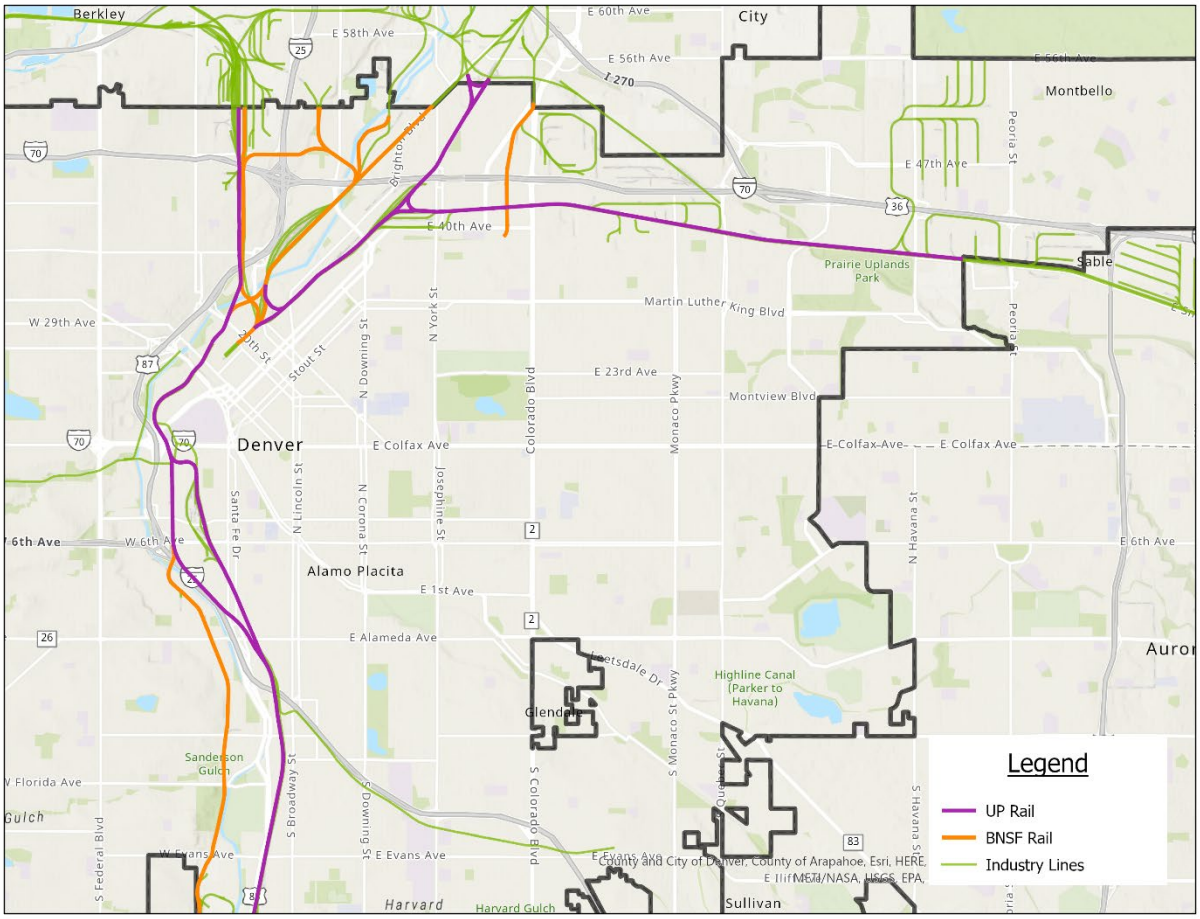
The State of Colorado has 2,640 miles of active rail line, with 41 miles within Denver limits, and approximately 80 miles of industrial spur tracks, which are serviced by short line or Class III railroads (see the freight rail lines route paths through Denver as shown on Figure 3-2.

Overall statistics for Colorado compared to the rest of the United States (US) show the following:

- Colorado ranks 25th in the nation for train volume with 16.8 million tons of freight originating in the state.
- Colorado ranks 19th in tons of lading (freight or cargo that makes up a shipment) terminating within the state with 30 million tons.
- Colorado ranks 32nd with 204,200 railcars originating in the state.
- Colorado ranks 22nd with 427,866 railcars that are destined for Colorado consumers.

The freight rail lines routes paths through Denver are shown on Figure 3-2.

Figure 3-2. Class 1 and Class III Railroads Within Denver Limits



Source: HNTB, 2022

3.1 Hazardous Materials Shipments

The U.S. Department of Transportation (USDOT) defines hazardous materials as substances that can pose an unreasonable risk to health, safety and property when transported in commerce. Class I carriers indicate that the 2021 hazard shipments through the Denver area totaled 102,280 cars (see Table 3-1). Although this is a decrease from previous years, the effects of the COVID-19 pandemic should be factored into this decrease. There has been a steady increase in car loadings over last year's numbers, indicating that Denver could see over 200,000 car loadings within the next few years. The most carried hazardous materials shipments are fuel/gasoline, petroleum crude oil, sulfuric acid, sodium hydroxide, and non-specified elevated temperature liquids. Denver has averaged 3.6 rail-related accidents per year from 2017 to 2021 (not necessarily hazardous-material related). Also, a recently approved train network addition means a petroleum producer from Utah (Uinta Basin Railway) could add 10 more crude oil unit trains through Denver, which will add to these estimates.

Table 3-1. Hazardous Materials Shipments List Within Denver Limits

Interval	Hazardous Cars	Non-Haz Mat	Total
Daily	280	6,720	7,000
Monthly	8,524	204,576	213,100
Yearly	102,280	2,454,720	2,557,000
Uinta Basin Railway (projected)			
Daily	781	Data Not Available	Data Not Available
Monthly	23,430	Data Not Available	Data Not Available
Yearly	281,160	Data Not Available	Data Not Available
Combined Estimate 2025 (+14%)			
Daily	1,061	7,760	8,821
Monthly	31,954	233,217	265,171
Yearly	383,440	2,798,381	3,181,821

Source: HNTB, 2022

Additional data provided by the Class I freight railroads for context is provided in Table 3-2 and describes the transportation of hazardous cargo moving through Denver by intermodal (rail and truck) transportation, as opposed to tank cars that move cargo from its origination destination to its end location.

Table 3-2. Number and Type of Hazardous Cargo Passing through Denver Limits (2021)

Trains Cars/Day	Trains Cars/Month	Train Cars/Year	Type of Cargo
177	5,373	64,473	Hazardous Material
66	2,000	23,997	Loaded Intermodal
37	1,145	13,740	Hazardous Material
0.2	6	70	Loaded Intermodal

Source: HNTB, 2022

Table 3-3 and Table 3-4 show train accident data between 2017 and 2021 that was obtained from FRA for Colorado. Table 3-3 shows accident causes while Table 3-4 shows the types of accidents.

Table 3-3. Train Accident Causes in Colorado (2017-2021)

Major Cause	Killed	Injured	Reportable Damage	Distinct Incident Count
Equipment	0	1	$469,267	6
Human	0	0	$2,356,783	32
Miscellaneous	1	3	$1,521,200	8
Track	0	0	$3,501,516	18
Total	1	4	$7,848,766	64

Source: HNTB, 2022

Table 3-4. Train Accident Types in Colorado (2017-2021)

Accident Type	Killed	Injured	Reportable Damage	Distinct Incident Count
Collision	0	1	$571,998	4
Derailment	0	0	$6,198,622	53
Highway-rail crossing	1	3	$987,102	4
Other Impacts	0	0	$91,044	3
Total	1	4	$7,848,766	64

Source: HNTB, 2022

3.2 Grade Crossing Accidents within Denver Limits

Table 3-5 shows the grade crossing accidents for the last 5 years along the railroad lines within Denver, as reported by the FRA.

Table 3-5. Grade Crossing Accidents within Denver Limits (2017-2021)

Year	Number of Accidents
2021	4
2020	4
2019	4
2018	3
2017	3

Source: HNTB, 2022

The following tables show where Colorado and Denver stand among other states and cities, respectively, in grade crossing accidents. Table 3-6 shows that Colorado ranks about in the middle of all states for accidents within the nation.

Table 3-6. Colorado's Ranking in Grade Crossing Accidents Nationwide (2017-2021)

Rank	State	Total Number of Accidents
1	Texas	641
2	Georgia	339
3	Indiana	313
4	California	268
5	Alabama	220
6	Ohio	210
7	Louisiana	201
8	Illinois	195
9	Pennsylvania	173
10	Tennessee	140
26	**Colorado**	**70**

Source: HNTB, 2022

Table 3-7 shows that Denver stands higher than average among the cities under 1 million in population, in regard to grade crossing accidents.

Table 3-7. Top 10 US Cities (Under 1 million population) with Most Grade Crossing Accidents

Rank	City	State	Total Number of Accidents 2017-2021	Total Number of Grade Crossings	Accidents per Grade Crossing 2017-2021
1	Memphis	TN	26	302	.086
2	Seattle	WA	17	248	.068
3	Nashville	TN	14	200	.070
4	**Denver**	**CO**	**12**	**212**	**.057**
5	Detroit	MI	10	190	.053
6	Portland	OR	8	229	.035
7	El Paso	TX	8	89	.090
8	Oklahoma City	OK	5	138	.036
9	Las Vegas	NV	1	22	.045
10	Washington D.C.		1	7	.143

Source: HNTB, 2022

3.3 Derailments and Accident Reporting

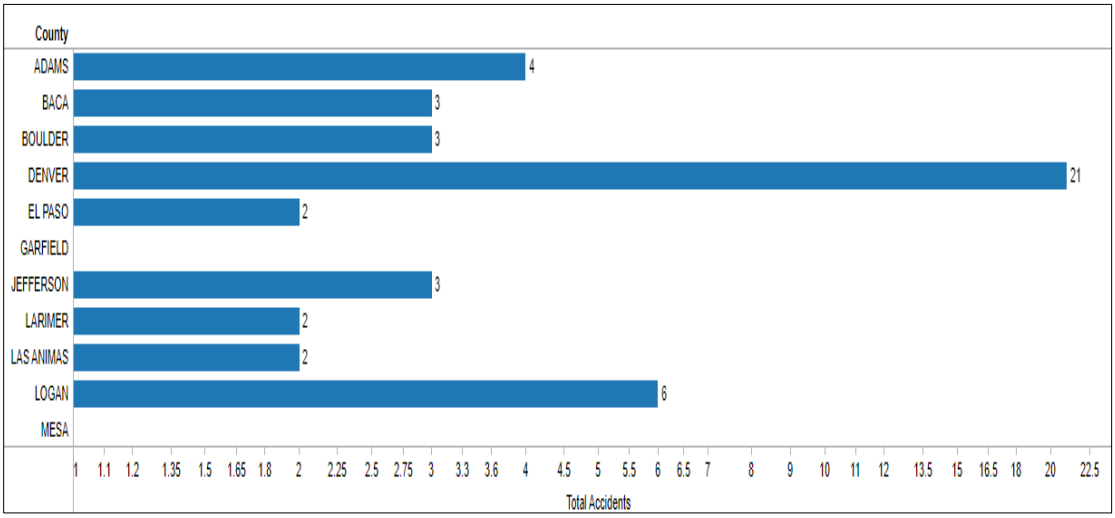
Derailments occur whenever track or railcars are outside of recommended tolerances or whenever defective conditions exist. Title 49 *Code of Federal Regulations (CFR) Part 213*[1] sets standards on the procedures required for upkeep of track and switches to be followed by all railroads. Despite these regulations, metal fatigue, weather, and other conditions can influence the condition and state of these items. In addition to this, human factor also plays a role in derailments. Hard coupling (when excessive force is used to couple railcars together during switching operations), excessive speed (when going over posted or prescribed speeds), Loads-empty or long-short car configuration (when excessively long cars are coupled to short cars, which leads to train derailments; mostly occurs during switching operations) also can contribute to potential derailments. Figure 3-3 shows locations of rail incidents in Denver from 2017-2021 including derailments and classification yards.

3.3.1 Non-grade Crossing Equipment-Related Accidents

Figure 3-3 shows the quantity of non-grade crossing incidents in all counties (excluding derailments in classification yards) causing damage greater than the FRA 2021 monetary threshold notice of $11,200. Figure 3-4 shows locations of all rail incidents in Denver from 2017-2021, including derailments and classification yards causing damage greater than the FRA monetary threshold notice.

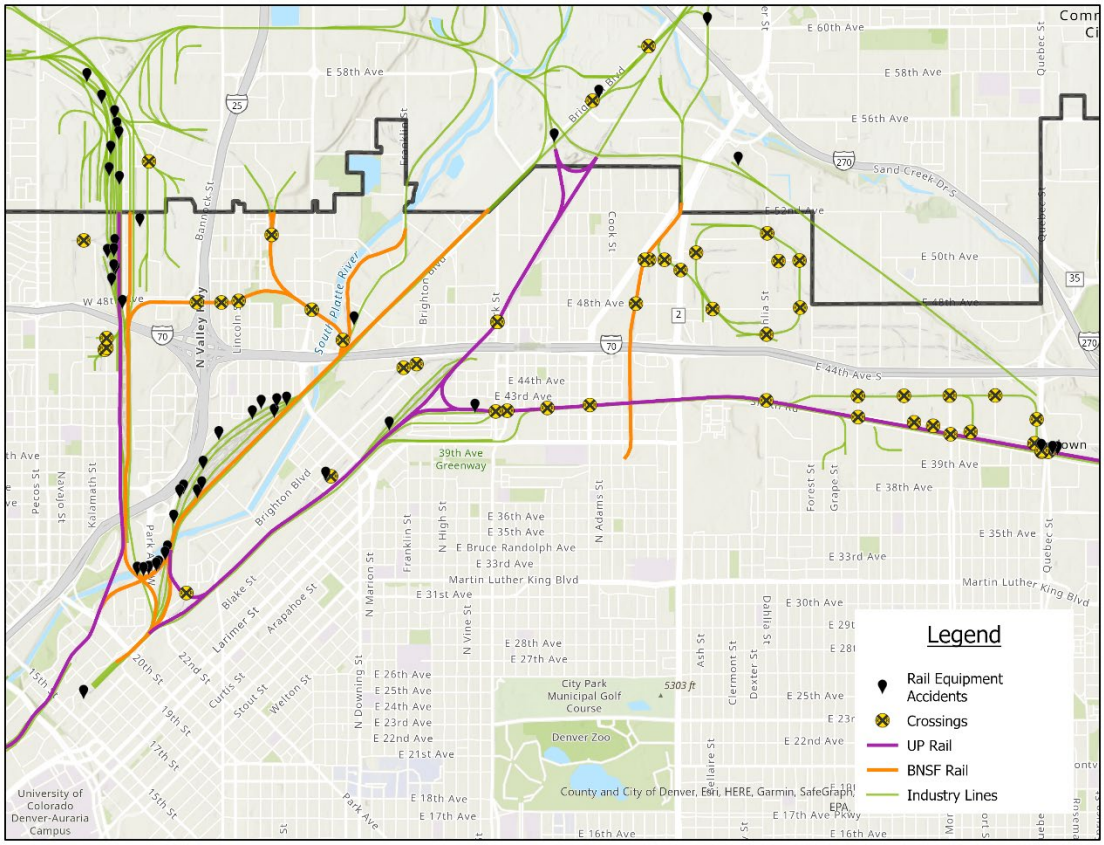
[1] Title 49 CFR Part 213: Available online at: https://www.govinfo.gov/app/details/CFR-2011-title49-vol4/CFR-2011-title49-vol4-part213.

Figure 3-3. Non-grade Crossing Train Accident by County (2017-2021)



Source: USDOT, 2022

Figure 3-4. Locations of Rail Equipment Accidents within Denver from 2017-2021



Source: USDOT, 2022

CHAPTER 4 – RIGHT-OF-WAY

4.1 Current Residential Development along Right-of-Way

Blueprint Denver (CCD, 2019a) is a citywide land use and transportation plan that was first adopted in 2002 and updated in 2019. The plan covers a 20-year period, and according to *Blueprint Denver* the city population has grown by 150,000 between 2002 and 2019. *Blueprint Denver* goes on to state that Denver could approach 900,000 residents by 2040. Thus far, Denver has seen significant development, including high-density housing, near freight ROW over the last 20 years (see Figure 4-1). This is due to strategic and intentional direction of growth to areas near passenger rail stations (light-rail and commuter-rail) intended to reduce automobile trips and create a more livable city of complete neighborhoods connected by complete transportation networks.

Figure 4-1. Current Locations of Multifamily Developments Along Railroad ROW

HNTB, 2022

For example, Photo 4-1 shows the Encore Evans Station apartment complex, which is 18 feet from the edge of the railroad ROW, and Photo 4-2 shows the Glass House Condominiums, which is 26 feet away from the ROW. The freight railroad ROW is generally 100 feet wide.

Photo 4-1. Encore Evans Station Apartment Complex

Source: DOTI, 2022

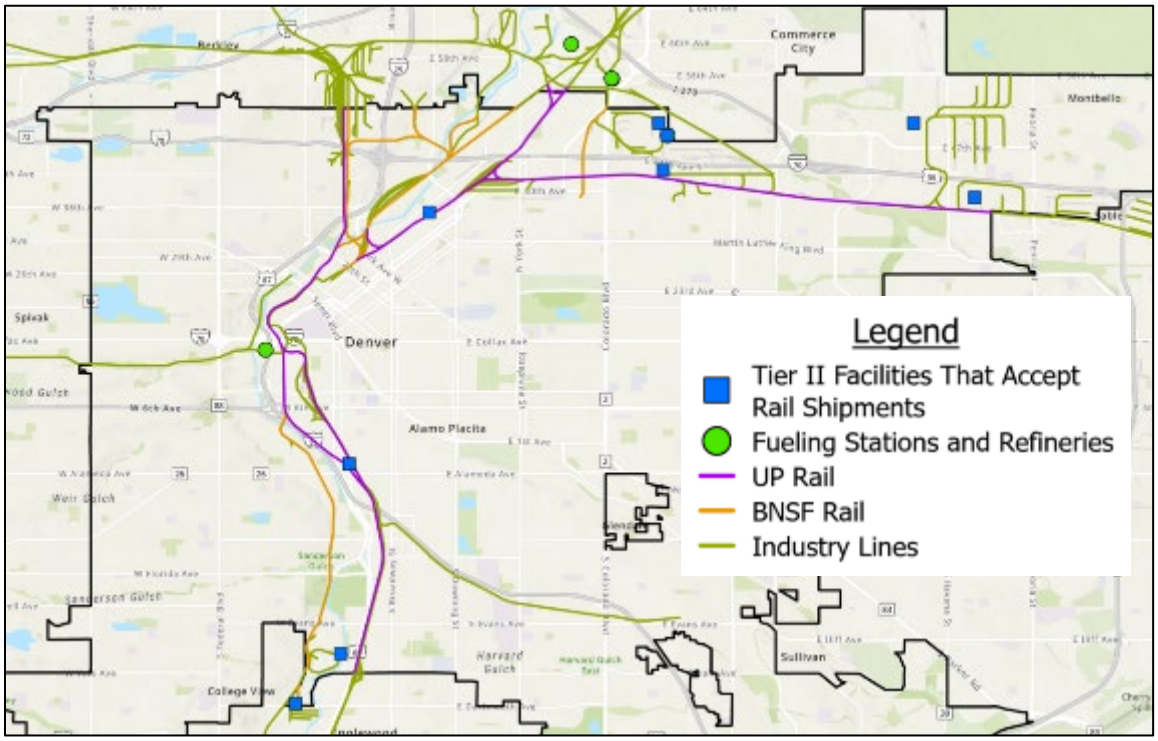
Photo 4-2. Glass House Condominiums at Union Station

Source: DOTI, 2022

4.2 Current Tier II Facilities Along Right-of-Way

According to Denver's *Hazard Mitigation Plan* (CCD, 2022), there are two ways for potential hazardous materials incidents to occur along railroad ROW – those that are being transported through Denver and those that originate or are destined to locations that use and store chemicals daily within Denver limits (known as Tier II facilities). Tier II facilities are those facilities that store 10,000 pounds or more of any hazardous materials according to the Occupational Safety and Health Administration. These facilities are vital to the industrial and manufacturing economy, are tightly regulated, and often produce common household products. See Figure 4-2 for locations of Tier II facilities near railroad lines.

Figure 4-2. Current Locations of Tier II Facilities Along Railroad ROW



Source: HNTB, 2022

As of October 2021, there were 300 Tier II facilities in Denver with mandatory reporting requirements to the Denver Local Emergency Planning Committee; 15 of those facilities also have mandatory reporting requirements to the U.S. Environmental Protection Agency. While almost half of the Tier II facilities do not hold chemicals other than those used in batteries, there are several companies that use ammonia and chlorine daily, and these are considered toxic inhalation hazards.

There is always the potential for a release from either the fixed sites or from a train going through Denver. Based on National Railroad Construction and Maintenance Association data, Denver averages around 19 hazardous materials incidents per year, including an average of one incident per year that results in injuries or property damage. (CCD, 2022).

4.3 Environmental Considerations

Wildlife within the Denver area is monitored by the wildlife specialist. It appears that several species of wildlife within the areas of Denver, Adams, and Arapahoe counties could be severely compromised if there were to be a hazardous material release in the rivers or riparian areas located in Denver.

Photo 4-3 is an example, showing tracks crossing over the South Platte River in Denver. If a train derails in this location, it could affect the wildlife that are present in or along the river or their habitat. In addition, if a derailment occurs and hazardous materials are introduced into the river, river clean-up will be necessary, and downstream safety measures will need to be implemented.

Photo 4-3. Railroad Track Crossing over South Platte River

Source: Google Maps, 2022. https://www.google.com/maps

Another major concern are tank cars containing hazardous chemicals or flammable liquids, such as crude oil, falling into rivers or streams. A derailment like this occurred in Denver in February 2022; fortunately, there were no hazardous cars on the train at the time. To protect the environment, FRA issued an Emergency Order (EO or Order) in 2015 (USDOT, 2015a) to require that trains transporting large amounts of Class 3 flammable liquid through certain highly populated areas, such as Denver, adhere to a maximum authorized operating speed limit. The following is taken from the Emergency Order:

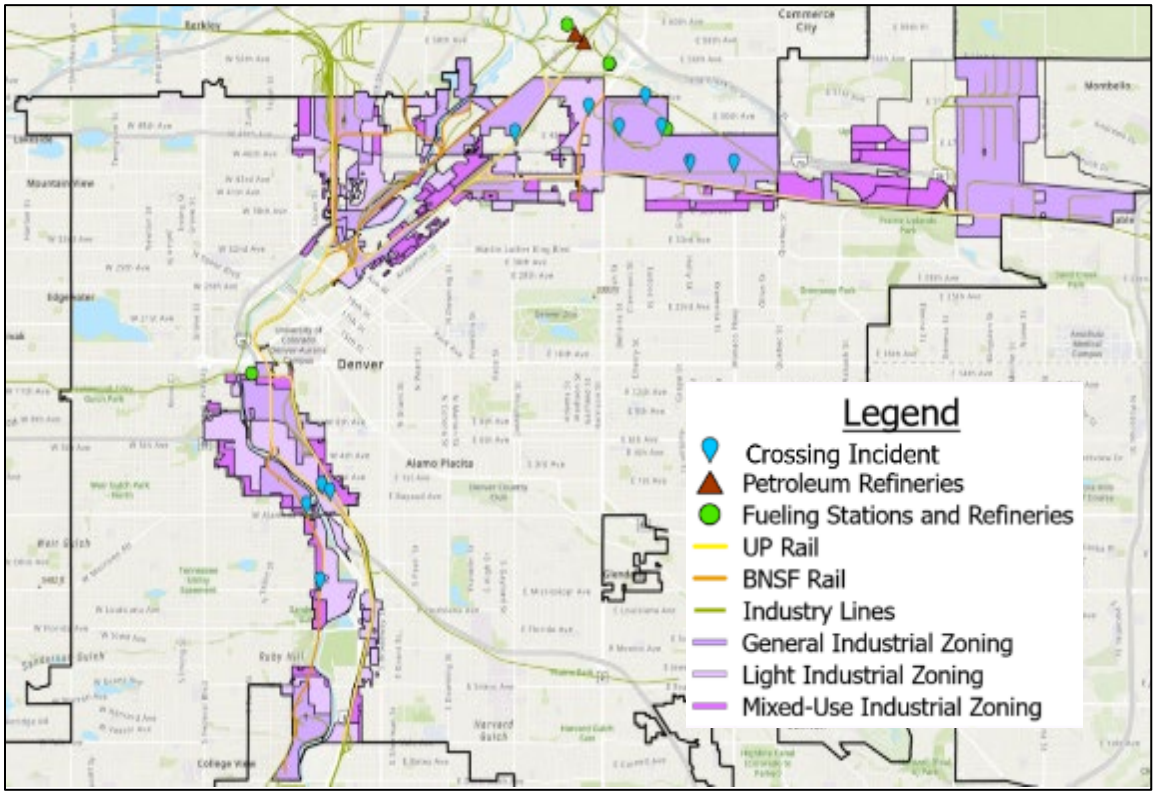
> " This EO is necessary due to the recent occurrence of railroad accidents involving trains transporting petroleum crude oil and ethanol… Under the EO, an affected train is one that contains: 1) 20 or more loaded tank cars in a continuous block, or 35 or more loaded tank cars, of Class 3 flammable liquid; and 2) at least one DOT Specification 111 (DOT-111) tank car (including those built in accordance with AAR) Affected trains must not exceed 40 miles per hour (mph) in high-threat urban areas as defined in 49 CFR 1580.3. (USDOT, 2015.)"

CHAPTER 5 – FUTURE INDUSTRIAL DEVELOPMENT IN DENVER

Blueprint Denver (CCD, 2019a) provides a plan for land use growth, including zones for greater density. Along the rail corridor there are many types of industries. The production and manufacturing districts are classified as heavy production, value manufacturing, and innovative/flex manufacturing. Many of these facilities produce common household products and are vital to the industrial and manufacturing economy of Denver.

Figure 5-1 correlates the locations of crossing incidents and industrial zoning. *Blueprint Denver* identifies certain manufacturing areas to maintain their industrial character in the future. It's expected that some businesses in these locations that have existing industrial zoning will continue to use the existing railroad lines for shipping and receiving of materials; therefore, Denver should continue to expect a higher degree of risk, based on rail-related incidents along these corridors and zones.

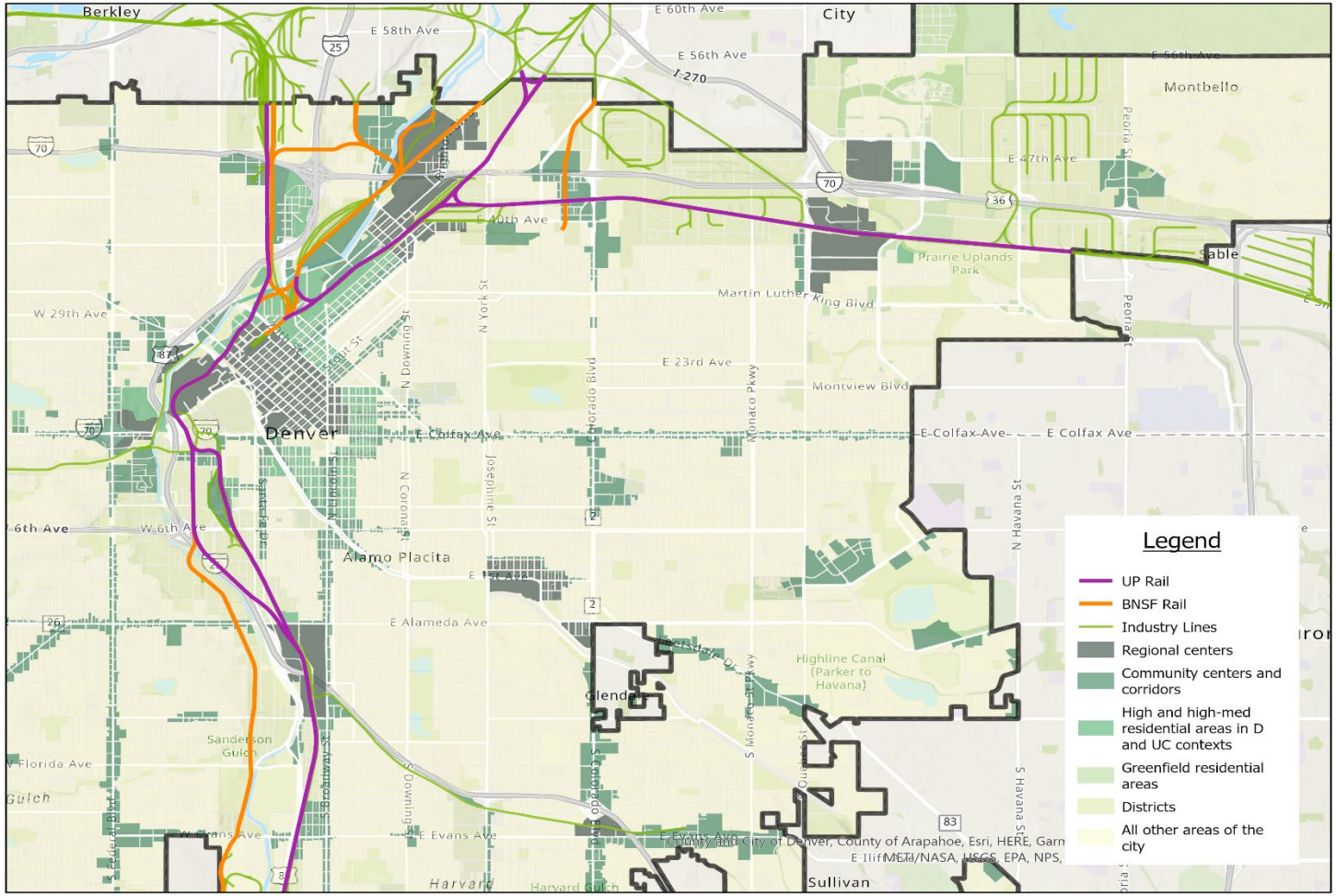
Figure 5-1. High-Density Industrial Development Adjacent to ROW



Source: HNTB, 2022

Blueprint Denver's, growth strategy map (Figure 5-2) shows the aspiration for distributing future growth in Denver. The map reflects community input on various growth scenarios received during the "Growing a Better Denver Game" workshop and online survey. City staff worked with the State Demographer's Office and the Denver Regional Council of Governments to develop projections for population, households, and employment by 2040. This included an analysis of vacant and underutilized land available through 2040 and the estimated development capacity of land based on these future places.

Figure 5-2. Growth Strategy Map from Blueprint Denver (2019)



Source: HNTB, 2022

As Figure 5-2 shows, a portion of this new growth strategy lays along the rail corridor. Four "regional centers" (the highest intensity of development) are located along railroad main lines because of the location of transit stations and transit-oriented development.

CHAPTER 6 – HAZARDOUS RAIL TRAFFIC: PRESENT AND FUTURE

The state of hazardous freight rail traffic in and through Denver depends primarily on economic conditions. In 2021 there were 102,280 hazardous carloadings or train cars that passed through Denver that were carrying hazardous materials (See Table 6-1). Overall, Denver should expect to see growth in rail traffic, including trains passing through the city carrying hazardous materials and trains originating from or destined to industrial and manufacturing facilities within the city (CCD, 2019a). An example driver of this growth is the Uinta Basin Railway Project currently under construction.

Table 6-1. Freight Railroad Traffic - Hazardous Materials

Hazardous Material	2021	2025 Estimated with Uinta Basin Railway
Daily Cars	280	1,061
Monthly Cars	8,524	31,954
Yearly Cars	102,280	383,440
Daily Freight Trains Through Denver	38	45
Freight Cars with Hazardous Materials	4%	14%

Source: HNTB, 2022

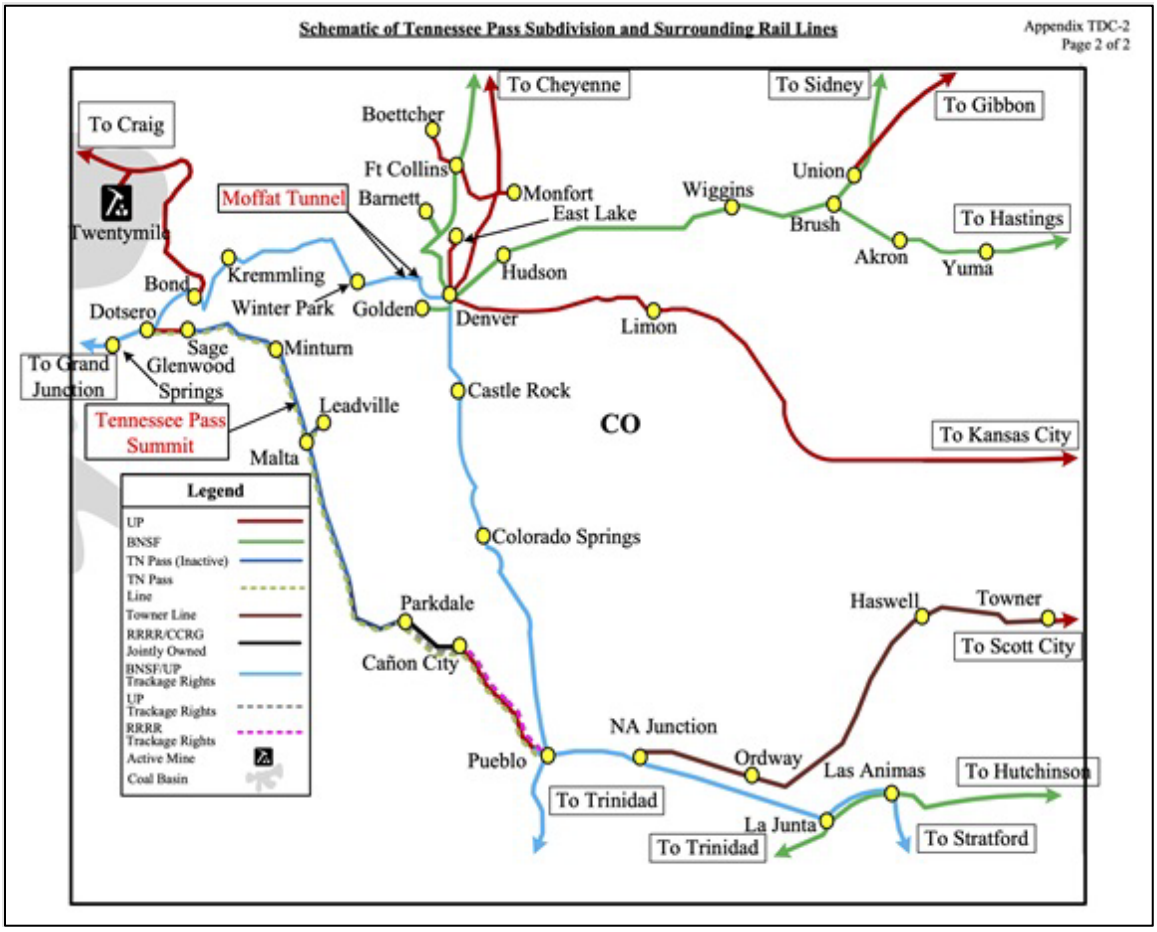
6.1 Uinta Basin Railway

In 2022, the Surface Transportation Board approved the Uinta Basin Railway construction. The $1.5 billion Uinta Basin Railway will be the largest new railroad project in the US in nearly 50 years. The project will connect the Uinta Basin region to the national rail network, allowing crude oil to be transported over the Rocky Mountains to refineries along the Gulf Coast (Woodruff, 2022).

Much of the additional crude oil produced because of the Uinta Basin Railway would be hauled through Colorado on a route that passes through Glenwood Canyon along the Colorado River, then through the Moffat Tunnel and central Denver (Figure 6-1). Up to ten 2-mile-long trains would travel the route daily, and because the Uinta Basin produces a type of oil known as "waxy" crude, the tank cars used to transport it need to be heated, which creates additional safety and environmental risks (Woodruff, 2022).

The *Uinta Basin Railway Environmental Impact Statement* projects an accident rate of two accidents per million train miles on its new track. Once connected to UPRR, the rate drops to 0.5 to 2 per million train miles. Dozens of cities, counties, and water districts along the route have voiced opposition to the project, including Glenwood Springs, where city officials worry about potential impacts to the Colorado River Basin, and Eagle County, which has joined environmental groups in suing the Surface Transportation Board in a federal appeals court over its 4 to 1 vote to approve the project as a whole in December (Surface Transportation Board, 2021).

Figure 6-1. Map of Uinta Railway Route



Source: Jason Blevins, The Colorado Sun, 2022

6.2 National Context for Oil Derailments

For context, at least 21 oil train derailments have occurred in the US and Canada since 2013, according to a 2021 report from the nonprofit Sightline Institute. Such incidents frequently result in fires and spills, such as was the case with the 2016 derailment of an oil train in Oregon's Columbia River Gorge, in which an estimated 42,000 gallons of crude oil were spilled. (Sightline Institute, 2021).

USDOT projects that nationwide, 278 mainline derailments of crude oil or ethanol-carrying trains could statistically occur between 2015 and 2034 (not including derailments of other hazmat, other derailments, or other rail hazmat incidents). These include 93 incidents in densely populated areas (33 percent); 85 incidents with at least one carload of released flammable liquid igniting and causing fire (30 percent); 12 incidents with at least 230,000 gallons of released flammable liquid (7 to 8 tank carloads) and large fires (13 percent); and 2 derailments projected to be high consequence events or major disasters (less than 1percent). (USDOT, 2015b).

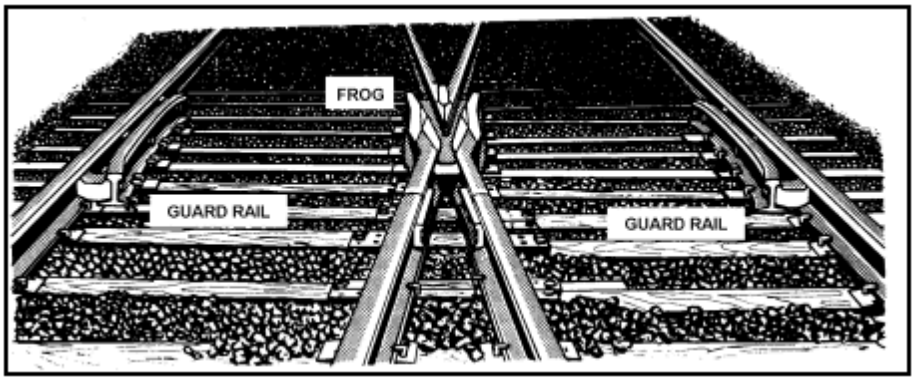
CHAPTER 7 – MITIGATION OPTIONS FOR TRAIN-RELATED ACCIDENTS AND DERAILMENTS

There are multiple types of mitigation to help prevent large impacts associated with hazardous materials spills and/or train derailments. This section discusses some of the more common ones that could be implemented in Denver. The placemaking implications of these options is beyond the scope of this study and would need to be addressed in the planning process.

7.1 Freight Railroads

Train containment (Figure 7-1) is a mitigation method that is designed to prevent conventional trains from overturning or deviating away from its track. Typical containment includes guard rails, parapets, and undercar guards. Specific locations that have relatively higher derailment risks such as bridges, switches, and interlockings are chosen to install railcar containment. Installing train containment is technically feasible for both existing and newly built shared operation settings. The containment methods are installed by the railroads on conventional tracks. A guard rail, for example, is installed to contain the rolling stock and prevent it from intruding the adjacent track when it derails. The cost of containment depends on the type and length of containment (USDOT, 2019, p.40).

Figure 7-1. Example of Train Containment: Railroad Guard Rail



Source: Railway Structure, Reconnaissance, Construction, and Rehabilitation. https://www.globalsecurity.org

7.2 Land Use Options

Along multi-family areas close to the ROW, supplementary barriers may be considered to prevent derailment incursion. Buildings within 100 feet of the edge of the ROW would benefit the most from an installation.

Mitigation options such as ROW defection walls (Photo 7-1) or similar would help mitigate potential risks in case of a derailment. Structural barrier protection can help reduce or eliminate potential impacts into structures from trains that derail.

Photo 7-1. Deflection Wall

Source: Reinforced Earth Company Risk Mitigation & Protective Structures. https://reinforcedearth.com

Anti-climb fencing (see Photo 7-2) can help mitigate risks of trespassers in areas identified by Denver's Office of Emergency Management and along high-density and areas along the railroad ROW, which are prone to trespassing.

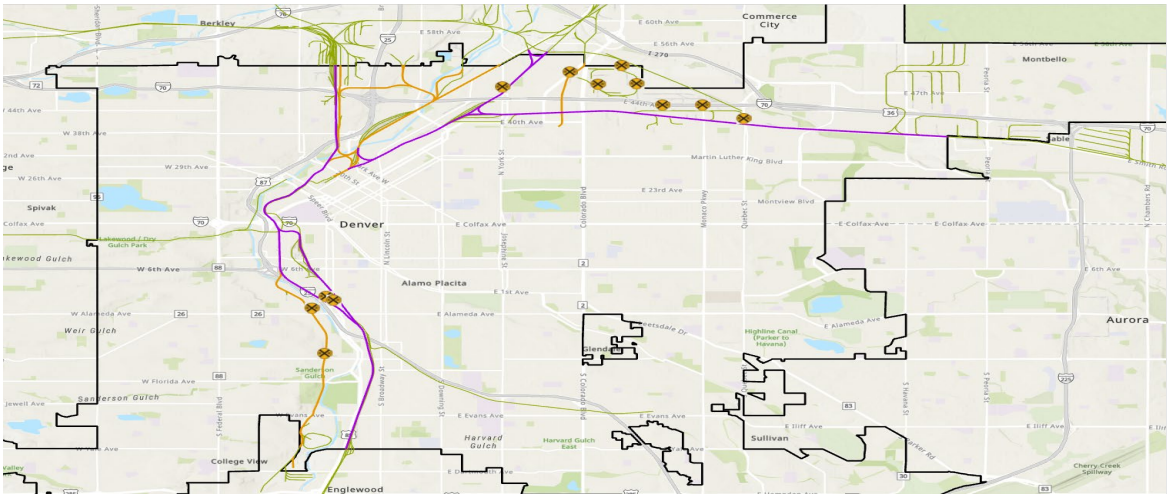
Photo 7-2. Example of Anti-Climb Fencing

Source: Ameristar – ASSA ABLOY. 2022.

7.3 Rail Crossings

Figure 7-2 shows the locations with the highest incident rates according to the available FRA data (2017-2021).

Figure 7-2. Locations of Denver Grade Crossings with the Highest Incident Rates according to FRA Data



Source: HNTB, 2022

FRA rates road risks by analyzing only past accidents that have actually occurred. FRA also provides a statistical software called GradeDec.NET that allows the user to add alternative safety appliances that subsequently change annual predicated accidents that are measured in percentage (USDOT, 2020). Each grade crossing can be improved upon. Whether a full grade-separation is added, or a simple bell to notify pedestrians, grade crossing safety is improved upon exponentially depending on the safety appliance added. More details about the GradeDec.NET results and incidents are available in Appendices C and D, respectively. Appendix E contains the risk register for this project that supports the minimum recommendations. Appendix E also contains a menu of costs for a variety of safety devices and items that can be applied to grade crossings.

California Department of Transportation (CDOT) rates road risks by the potential for future accidents to occur. This is done by analyzing train traffic vs. vehicle traffic over a particular crossing, then assigning a risk factor (the higher the traffic volumes, the greater the risk.) Conversely, FRA measures only the number of incidents at a particular road crossing, and the number of safety appliances at that location. The greater the number of safety appliances at a location the lesser the probability of an incident occurring due to increased warning measures. According to CDOT analysis methods for future potential risk, there is one crossing at 13th Avenue and Umatilla that requires risk mitigation appliances, in addition to the 12 identified through FRA's accident data.

The 13 crossings shown in Table 7-1 are being recommended for safety treatments, ranging from highway markings to crossing gates. The greater the traffic and potential incident rate, the stronger the urgency for grade crossing improvements to be considered; however, there is no zero-effect here, even if the crossing is closed, unless the railroad tracks are removed. For instance, if the crossing was closed, the alternate predicted accident rate would be zero, due to no traffic flow, but incidents will continue to take place due to human error and trespassing.

Table 7-1. Safety Treatments for 13 Specific Locations in Denver

Crossing Location	Possible Safety Treatments	Base Annual Accidents (Fatalities + Injuries+ Property Damage Only)	Alternate Annual Accidents (Fatalities + Injuries+ Property Damage Only)	Preliminary Estimated Costs
BNSF - South Kalamath Street	Extend median, add pavement markings on all quadrants, add warning lights, blank-out signs, relocate signs, raise curb, and repair asphalt.	0.0398	0.02211	~$230,000
RTDC - Quebec Street Southbound Frontage Road	Add pavement markings, move traffic signal to the north side of the rail crossing, add fencing, and add preemption to traffic signal at crossing.	0.04649	0.02583	~$260,000
BNSF - South Santa Fe Drive	Extend median, add pavement markings on all quadrants, add warning lights, blank-out signs, no-right turn signs, relocate signs, raise curb, and repair asphalt.	0.04118	0.02258	~$560,000
UPRR - Holly Street	Add pavement markings on main street as well as on the industry road, add warning lights, blank-out signs, relocate signs, raise curb, repair asphalt, and a two-quadrant gate system.	0.20451	0.09087	~$360,000
BNSF - Dahlia Street North Of 51st Street	Add pavement markings, add warning lights, and add two-quadrant gate system.	0.10207	0.04535	~$220,000
BNSF - Alameda Avenue	Add four quadrant gates, add median, add pavement markings, add warning lights and bells, add pedestrian gates, and ROW fencing.	0.10397	0.00464	~$550,000
UPRR - Monaco Street	Add pavement markings, add warning lights, add two-quadrant gate system.	0.10286	0.04571	~220,000
BNSF – West Mississippi Avenue	Add median, add pavement markings on all quadrants, add warning lights, blank-out signs, no-right turn signs, relocate signs, raise curb, repair asphalt, and a two-quadrant gate system.	0.10337	0.04593	~560,000

Crossing Location	Possible Safety Treatments	Base Annual Accidents (Fatalities + Injuries+ Property Damage Only)	Alternate Annual Accidents (Fatalities + Injuries+ Property Damage Only)	Preliminary Estimated Costs
BNSF – East 48th Avenue at Ash Street	Add median, add pavement markings on all quadrants, add warning lights, blank-out signs, no-right turn signs, relocate signs, raise curb, repair asphalt, and a two-quadrant gate system.	0.1022	0.04541	~560,000
BNSF - 48th Avenue, West of Forest Street	Add two quadrant gates, pavement markings, warning lights, and signage.	0.10239	0.0455	~370,000
BNSF – East 50th Avenue	Add two quadrant gates, pavement markings, warning lights, and signage.	0.10173	0.0452	~370,000
UPRR – East 47th Avenue and York Street	Add four quadrant gates, fencing along ROW, Wrong-Way sign on York Ln., extend median, add pavement markings, add warning lights, add pedestrian gate, and relocate signs.	0.10563	0.00845	~500,000
13th Avenue and Umatilla	Add four-quadrant gates, pavement markings, warning lights, and signage. Add pedestrian crossing gates and sidewalks	0.00663	0.00119	~500,000
Combination of all Crossings in this Table		**Base Annual Average is 0.08945**	**Alternate Annual Average is 0.03452**	**Prelim Estimated Total Cost is $5,260,000**

~ = approximately
RTDC = Regional Transportation District C-Line

CHAPTER 8 – SUGGESTED GUIDELINES AND CONSIDERATIONS

Table 8-1 presents overall suggested considerations based on the analysis from the study, along with some potential sources of funding for capital project improvements discussed in Section 8.1.

Table 8-1. Overall Suggested Guidelines

Guideline Considerations	Lead City Agency	Responsible Parties	Time Horizon
Develop and implement hazard-management plans for railroad corridors	OEM	OEM	Short Term
Conduct a detailed study "parcel by parcel" of emergency access along the railroad ROW and identify areas / projects to enhance access	CPD	CPD	Short Term
Develop and implement evacuation plans in the event of a hazardous materials release in high-risk areas	OEM	OEM	Short Term
Support DFD staffing, training, and equipment for response to rail incidents.	DFD	DFD	Short Term
Provide education and outreach to emergency service responders and adjacent property owners/residents about railroad hazards and response – information should be updated at least annually, but more frequently if significant changes occur. Consider large-scale training exercises to simulate a train derailment with a large hazardous material on-board on a regular basis. Include railroad personnel on regular walkthroughs so that first responders are familiar with the infrastructure/areas prior to an event.	DFD	DFD, DPD	Short Term
Provide education to CCD staff about CCD's recently adopted *Hazard Mitigation Plan* (2022) and ensure that the plan is considered when working in areas adjacent to railroad corridors	OEM	OEM	Short Term
Review current vegetation management requirements and enforcement in areas adjacent to railroad corridors and explore enhancements, such as xeriscaping that is fire-resistant.	CPD	City for Public Property, Private Property Owners	Short Term
Ensure that city and emergency response personnel have real-time alerts on the Rail Crossing Locator app where first responders can request to be notified in advance of a train that is going to go through Denver carrying certain petroleum products in a quantity of 1 million gallons or more. This will allow for proactive preparations in case of a derailment/spill.	DFD	DFD, OEM, PUC	Short Term
Ensure that existing fire hydrants near railroads are accessible to the railroad ROW	DFD	DFD, CPD, DOTI	Short Term
Consider designating projects as pilot projects to test mitigation measure effectiveness.	DOTI	DOTI	Short Term

Guideline Considerations	Lead City Agency	Responsible Parties	Time Horizon
Consider guidelines or requirements for new development along railroad ROW to reduce the effect of derailments, especially in areas with a higher risk of derailment. Development of requirements or guidelines for development should be informed by peer city research, an analysis of impacts and costs on development, and stakeholder outreach. Potential guidelines could include: • Locating surface parking, access aisles, landscape buffers, or other non-structural features adjacent to railroad ROW to reduce the effect of derailments • Requiring reinforced columns in specific locations on structures constructed adjacent to railroad ROW when other mitigation is not feasible • Elevating air intakes and adding chemical sensors to heating, ventilation, and air conditioning equipment adjacent to railroad ROW • Using berms or walls to reduce the effect of derailments in high-risk locations • Elevating the first occupied floor above the railroad ROW grade	CPD	CPD (see also DOTI and PUC below for crossing)	Medium Term
Identify areas with sensitive environmental resources adjacent to railroad corridors and work with railroad owners to add protection strategies, such as guard rails	DPHE	DPHE	Medium Term
Add fencing along the railroad ROW, beginning with areas where higher concentrations of pedestrians and encampments occur	Railroads, DOTI	DOTI, PUC	Medium Term
Implement grade crossing improvements as described in this report	DOTI	DOTI, PUC	Medium Term
Consider adding pedestrian overpasses at areas identified a high risk for pedestrians	DOTI	DOTI, CPD	Medium Term
Work with railroads to repair/upgrade switches, tracks, and other track-related infrastructure causing derailments	DOTI	Railroads, DOTI	Medium Term
Grade-separate high-risk crossings – underpasses or overpasses	DOTI	DOTI, Railroads, CDOT, PUC	Long Term
Place freight rail lines in below-ground (open-air) trenches with access control, fire hydrants, fencing, and intrusion detection alarms	DOTI	Railroads, DOTI	Long Term
Work with railroads to eliminate higher-risk switches, wye tracks, and other higher-risk track conditions	DOTI	Railroads, DOTI	Long Term
Consider incentivizing structural reinforcement of existing buildings along railroad ROW at high-risk locations	CPD	CPD	Long Term
Consider new freight rail lines or routes that direct trains with hazardous cargo away from densely populated areas	DOTI	Railroads, CDOT, DOTI, PUC	Long Term

DPH&E = Department of Public Health & Environment
CDOT = Colorado Department of Transportation
CPD = Community Planning & Development
DFD = Denver Fire Department
DOT = Department of Transportation
DOTI = Department of Transportation and Infrastructure
DPD = Denver Police Department
OEM = Office of Emergency Management
PUC = Colorado Public Utilities Commission

8.1 Potential Funding Sources

There are several grant programs available for things such as wildfire, flooding, training, etc. Some of the grants wouldn't work for a large corridor, but could work for high-risk, spot-specific areas where fire reduction strategies need to be employed, for example. The sources of these grants include:

- Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance grant programs:
  - The Hazard Mitigation Grant Program provides funding to state, local, tribal, and territorial governments so they can develop hazard mitigation plans and rebuild in a way that reduces, or mitigates, future disaster losses in their communities.
  - Building Resilient Infrastructure and Communities supports states, local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards.
  - Flood Mitigation Assistance is a competitive grant program that provides funding to states, local communities, federally recognized tribes, and territories. Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program. This isn't the most applicable but may be applicable in certain areas/instances.
  - Non-Disaster Grants preparedness program funding to improve the capacity of state and local emergency responders to prevent, respond to, and recover from a weapons of mass destruction terrorism incident involving chemical, biological, radiological, nuclear, and explosive devices and cyberattacks.
- Hazardous Materials Emergency Preparedness (HMEP) Grants:
  - In 1993, the Pipeline and Hazardous Materials Safety Administration began issuing grants to assist States, Territories, and Native American Tribes to "develop, improve, and carry out emergency plans" within the National Response System and the Emergency Planning and Community Right-To-Know Act of 1986. The HMEP grant program is designed to allow grantees the flexibility to implement training and planning programs that address differing needs for each location based on demographics, emergency response capabilities, commodity flow studies, and hazard analysis.
- U.S. Department of Homeland Security (DHS) - Transportation Security Administration Surface Transportation Security Grants:
  - DHS provides security grants to mass transit and passenger rail systems, intercity bus companies, freight railroad carriers, ferries, and the trucking industry to help protect the public and nation's critical transportation infrastructure against acts of terrorism and other large-scale events.
- Community Development Block Grants (CDBG):
  - The CDBG Program supports community development activities to build stronger and more resilient communities.
- Federal Railroad Administration
  - Consolidated Rail Infrastructure and Safety Improvements (CRISI):
    - The CRISI grant program supports communities in improving at-grade crossings. Some of the at-grade crossings in this report are already mentioned in ongoing CRISI grant applications for road crossing improvements.

  - Railroad Crossing Elimination Grant Program: This program provides funding for highway-rail or pathway-rail grade crossing improvement projects that focus on improving the safety and mobility of people and goods.

- Federal Highway Administration - The Railway-Highway Crossings (Section 130) Program:
  - This program provides funds for the elimination of hazards at railway-highway crossings. The Infrastructure Investment and Jobs Act (Pub. L. 117-58, also known as the "Bipartisan Infrastructure Law"), and Part 924 of title 23 of the Code of Federal Regulations (23 CFR Part 924), continues the annual set-aside for railway-highway crossing improvements under 23 U.S. Code 130(e).

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APPENDIX A. RISK AND METHODOLOGIES

APPENDIX A – RISK AND METHODOLOGIES

Risk

Risk is a measure of the effect of probabilities of occurrence of detrimental events and the consequence of such events. For involuntary individual fatality risk (IIFR), also known as IR, arising from shipments on rail of hazardous materials, including compressed natural gas and liquid natural gas, it is recommended that the "acceptance" criteria shown on Figure A-1 and Figure A-2 be used to evaluate the IIFRs.

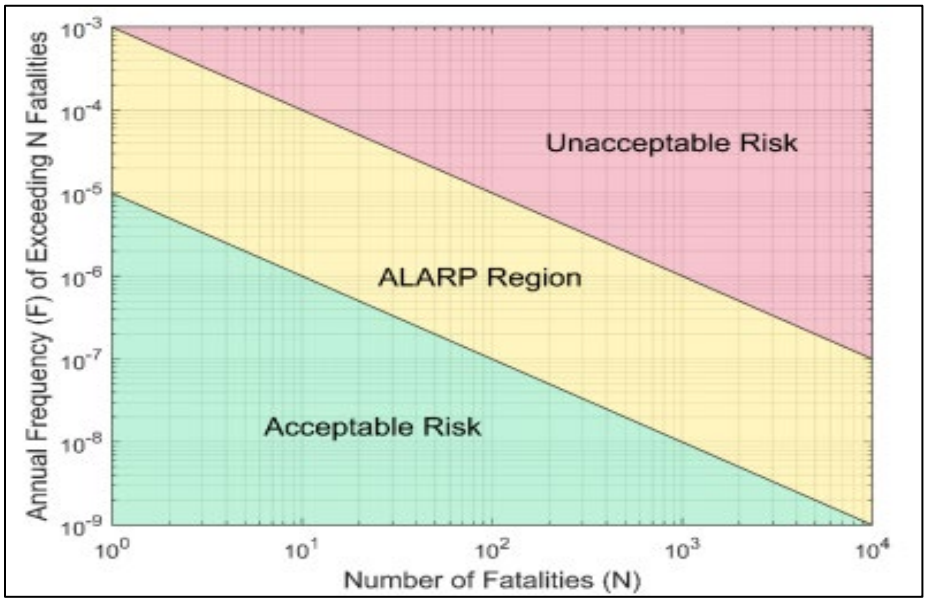
Figure A-1. Acceptance Criteria for Evaluating IIFR

Individual risk (per year)	Comments
Zone 1: IR > 5×10^{-5}	Unacceptable
Zone 2: $3 \times 10^{-7} \leq$ IR $\leq 5 \times 10^{-5}$	ALARP; applies for non-sensitive/non-vulnerable populations only
Zone 3: IR < 3×10^{-7}	Acceptable

Source: USDOT, 2020b

Notes:
< = less than
≤ = less than or equal to
ALARP = as low as reasonably practicable
IR = Individual Risk
5×10^{-5} = 0.00005, or 5 in 100,000
3×10^{-7} = 0.000003, or 3 in 10,000,000

Figure A-2. Risks



The following bullets explain how to interpret Figure A-1 and Figure A-2:

- If the IIFR is less than 3 in 10 million (3×10^{-7}) per year, this falls into Zone 3 and the green "Acceptable Risk" category.
- If the IIFR is above 3 in 10 million per year (3×10^{-7}), this is unacceptable risk for sensitive populations and places of public assembly (e.g., hospitals, schools, prison, houses of worship, major event venues).
- If the IIFR is greater than 5 in 100,000 (5×10^{-5}) per year, this falls into Zone 1 and the red "Unacceptable Risk" category, which is for all populations.
- Conditionally acceptable if the IIFR value is between 3 in 10 million (3×10^{-7}) per year and 5 in 100,000 (5×10^{-5}) per year for non-sensitive populations that will reduce the risk to ALARP. This falls into Zone 2 and the yellow "ALARP" category. (USDOT, 2020a)

Methodology

This section describes the methodology behind the two tools that were used in this report, FRA's GradeDec.Net and CDOT's Hazard Rating formula procedure.

FRA GradeDec.Net

The GradeDec.Net is a web-based support tool that helps evaluate grade crossing improvements and gives the user an idea of the current safety/risk factor at the crossing. The modeling framework was designed by the FRA, Volpe National Transportation Systems Center, and the National Cooperative Highway Research Program to effectively support grade crossing projects. This simulation tool determines risk and generates the results, which includes user quantified variables with an 80 percent confidence rate. This process aids in determining risk (i.e., accidents, injuries) at the road crossing before and after safety devices have been implemented. Risk is reflected in the probability distribution of the results. Figure A-3 is an example of the risk summary for the Holly Street crossing.

GradeDec.Net addresses two types of risk, 1) Accident risk, which is the probability of an accident occurring at a crossing. The principal metric of accident risk is measured in GradeDec.Net using the U.S. Department of Transportation's Accident Prediction and Severity (APS) model (USDOT, 2020b). 2) The type of risk determines that aggravated risk occurrence and risk severity and allows for the assigning of probability distributions to input variables of the analysis and determining the effects of uncertainty on the outcomes. GradeDec.Net also has capabilities for risk analysis, distinct from accident risk, which is concerned with quantifying uncertainty associated with forecasts.

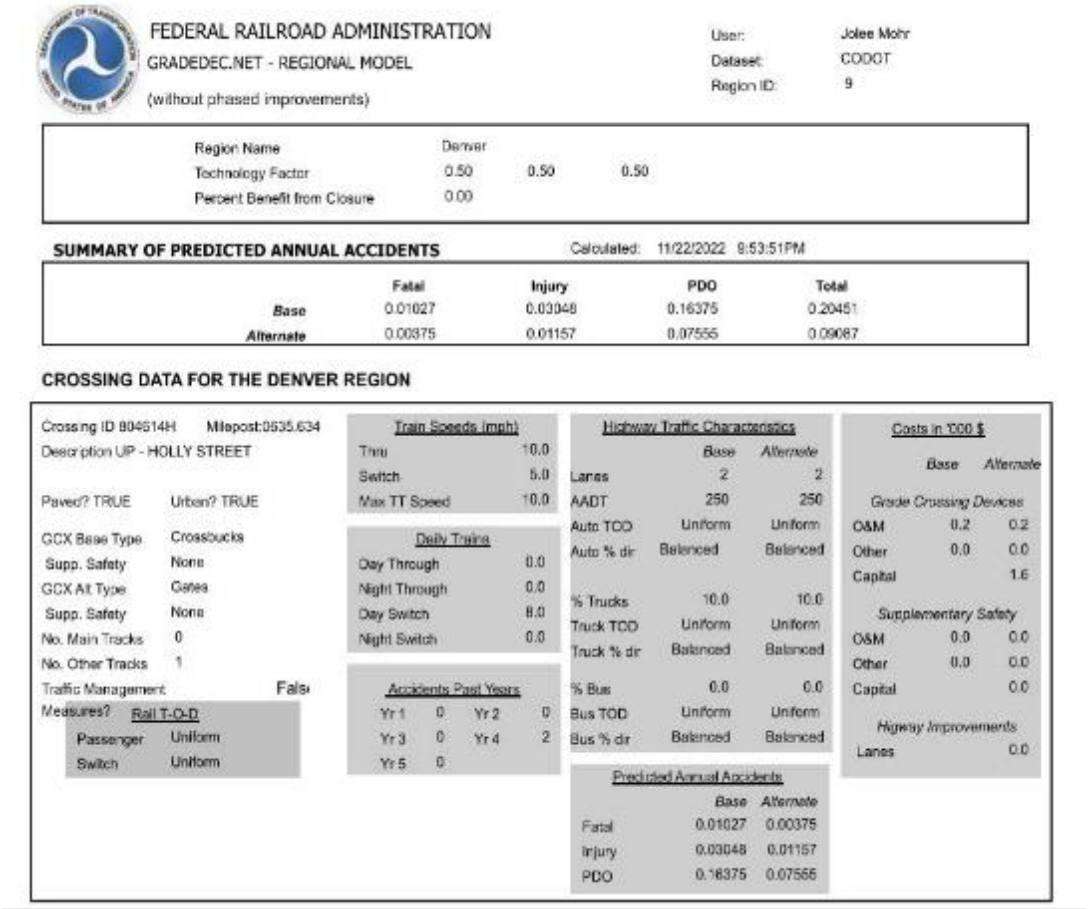
The type of sampling used is repeated Monte Carlo sampling on several random variables that are inputs to a model and repeatedly solving the model to arrive at probability distributions for the resultant variables. Random sample variables take a random number on the 0 to 1 interval. The result is determined by finding the variable whose cumulative probability equals "x" risk, accidents, and occurrence based on the data. The methodology used to determine the values provided are consistent with Executive Order 12866 (Regulatory Planning and Review-1993). The criteria used is based on average annual daily traffic, number of trains per day, and number of accidents in the previous 5 years.

The APS formulas used are based up regression analyses of accidents and grade crossing characteristics. The APS model delivers risk values, and the lower the values the safer the crossing. In the DOT APS, the incident metrics are "fatal accidents" (accidents with at least one fatality), "injury accidents" (accidents with no fatalities and at least one injury), and "property damage only" accidents. This model uses the

same accident prediction methodology as the DOT model but has distinct accident severity formulas. The model is based on an analysis of grade crossing accidents while focusing on the accident types (train strikes vehicle, vehicle strikes train), the impact of severe derailment, and fatalities among train and highway vehicle occupants.

The values required to calculate risk are as follows. Two elements (general and devices) require data from the road crossing such as location and current devices. Highway and rail data provide location, traffic, and speeds of both train and vehicle traffic. Once this data has been introduced, a score is produced in the aggravated risk page (base and alternate) using the resource allocation method. The base model includes the current road crossing safety configuration and measures the road crossing safety values. The alternate model takes into consideration the additional safety devices and measures added to the crossing. The aggravating factors result in a calculated score for occurrence between 0 and 60, and a score for severity between 0 and 60. The occurrence score will scale the predicted accidents down by 30 percent for a score of 0 and up by 30 percent for a score of 60. The more safety devices added to a location will decrease occurrences and will reduce potential incidents (USDOT, 2020a).

Figure A-3. Example Risk Summary – Holly Street Crossing



FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 11/22/2022 9:53:51PM

	Fatal	Injury	PDO	Total
Base	0.01027	0.03048	0.16375	0.20451
Alternate	0.00375	0.01157	0.07555	0.09087

CROSSING DATA FOR THE DENVER REGION

Crossing ID 804614H Milepost:0535.634
Description UP - HOLLY STREET

Paved? TRUE Urban? TRUE

GCX Base Type	Crossbucks
Supp. Safety	None
GCX Alt Type	Gates
Supp. Safety	None
No. Main Tracks	0
No. Other Tracks	1
Traffic Management Measures?	Fals

Rail T-O-D

Passenger	Uniform
Switch	Uniform

Train Speeds (mph)

Thru	10.0
Switch	5.0
Max TT Speed	10.0

Daily Trains

Day Through	0.0
Night Through	0.0
Day Switch	8.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	0
Yr 3	0	Yr 4	2
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	2	2
AADT	250	250
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	10.0	10.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.01027	0.00375
Injury	0.03048	0.01157
PDO	0.16375	0.07555

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	0.2	0.2
Other	0.0	0.0
Capital		1.6
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0
Highway Improvements		
Lanes		0.0

CDOT Hazard Rating Formula Procedure (CDOT H.R.)

CDOT's Railroad Coordination Unit is responsible for inventorying public highway-rail crossings within the State of Colorado (CDOT, 2022). The collected inventory data is used to identify those crossings that are below minimum standards for crossing warning devices and to calculate a hazard rating for each crossing. Numerous elements exist at a rail/highway crossing, and each can impact the calculation of a hazard rating, and yet to consider each of these elements in a single formula would make the formula far too complex to be of practical use.

The hazard rating is affected by whether a highway-rail crossing has active warning devices or passive warning signs. Therefore, the Railroad Coordination Unit has revised previous versions of the procedure to identify more applicable procedures, specifically for active warning crossings and passive warning crossings. Crossing warning devices are categorized as being either passive or active. Passive type devices (e.g., signs) are seen as informing the driver of the existence of a crossing, but it is still the driver's responsibility to determine independently whether a train is approaching and whether it is safe to cross. On the other hand, active type devices (e.g., flashing lights and gates) are seen as offering a driver a positive indication of an approaching train. If a driver can see the crossing while still having stopping sight distance and the crossing has active crossing warning devices, then the procedure views the crossing as being safer than if the crossing had only passive traffic warning devices. For this reason, sight distance to the crossing for crossings treated with active warning is not a relevant calculation because the active warning devices provide clear indication to approaching drivers, by means of their operation, that a train is approaching.

Passive warning crossings, those with static signs, require additional evaluation that includes visibility by approaching crossing users, in the absence of active warning. As such, the formula that the Railroad Coordination Unit uses to determine hazard ratings for passive crossings is unique to Colorado because there is no nationally recognized formula. The formula uses elements that have been selected as having the largest impact on safety at a passive highway-rail crossing.

CDOT's Railroad Coordination Unit evaluates the following elements finishing with a numerical value that indicates the respective crossing hazard rating:

- The crossing's existing crossing warning devices
- A vehicle's stopping sight distance
- Ability of the driver to see approaching trains
- The highway's annual average daily traffic (AADT)
- The railroad's AADT
- The number and type of railroad tracks existing at the crossing

Active warning crossings, those with active devices such as flashing lights and/or gates, utilize the same factors for calculating the hazard index, except for the vehicle's stopping sight distance, and the ability of the driver to see approaching trains. These two factors are not utilized at crossings having active warning, as those devices at the crossing clearly indicate a train is approaching, eliminating the need for approaching drivers to make this determination on their own.

One important element, grade crossing accidents, is not directly used in the Railroad Coordination Unit's hazard rating formula. This non-usage is not an oversight; instead, it is due to Colorado having very few grade crossing accidents each year. As such, it has not been possible to determine a relationship between accidents and physical crossing characteristics for use in a hazard rating formula. However, high accident

numbers at any given crossing should be considered subjectively by the railroad unit in coordination with the Public Utilities Commission staff.

Active/Passive Crossing Hazard Rating Procedure Factor – Highway Traffic (AADT) and Railroad Train Traffic (AADT)

Many of Colorado's public rail/highway crossings have low volumes in both vehicles and trains. While an individual crossing might have poor sight distances and inadequate crossing warning devices, if the crossing has very little train or vehicle traffic, its accident potential is seen as being lower. The Railroad Coordination Unit uses the following relationship as the amount of exposure due to the number of vehicles and trains at both active warning and passive warning crossings:

$$\frac{[AADTvehicles\ x\ AADTtrains]}{100000}$$

Where: $AADTvehicles$ = annual average daily traffic volume of vehicles using crossing (estimated). $AADTtrains$ = annual average daily traffic volume of trains using crossing (from railroad).

One important assumption regarding AADT is that the arrival of both vehicles and trains is uniform throughout the day — no attempt is made to determine the peak hours of vehicle and train usage. This assumption is due to the Railroad Coordination Unit not having enough resources to measure each crossing's traffic volume characteristics and both the railroad's and highway's ever changing usage characteristics. The factor of 100,000 normalizes the overall rating to a reasonable level.

Active/Passive Crossing Hazard Rating Procedure Factor – Number and Type of Tracks

The final element in the hazard rating formula is a factor for the number and type of railroad tracks that must be traversed at each active and passive crossing. This factor [T] is found as follows:

- Take the number of non-mainline tracks and multiply by 0.3.
- The first mainline track equals 1.0
- Take the number of remaining mainline tracks and multiply by 2.

The sum of these numbers gives the [T] factor. As an example: if the number of tracks counted consisted of two mainline tracks and one non-mainline track, the [T] factor would be as follows: [T] = (1 x 0.3) + (1) + (1 x 2) = 3.3.

Hazard Rating Index Formula – Active Crossings

Combining the last element with the first element produces the formula below for active crossings for which the Railroad Coordination Unit calls a crossing's hazard rating.

Hazard Rating = $\frac{[AADTvehicles\ x\ AADTtrains]}{100000}\ x$ [T]

The Railroad Coordination Unit gives extra consideration to public crossings along school bus routes. Also, since Colorado has several tourist-based railroad companies that employ steam locomotives, extra consideration should be given to those public crossings as well. An added factor of 10 percent is given to each condition. Predicting when and where the next rail/highway accident will occur is impossible. Understanding this, CDOT's Railroad Coordination Unit considers each crossing in terms of exposure, drawing the conclusion that accident potential is more likely to occur at those crossings having a higher exposure, that is, a higher hazard rating.

Public crossings that experience higher usage of hazardous cargo trucks are considered during the diagnostic reviews but are not given a separate added factor. The hazard rating formula is completely objective in nature. (CDOT, 2022).

References for Appendix A

Colorado Department of Transportation (CDOT). 2022. *Colorado State Highway-Rail Grade Crossing Safety Action Plan February 14, 2022*. CDOT Project No. 18-HAA-XB-00076-ZD0028 SA 24385

U.S. Department of Transportation (USDOT). 2020a. Federal Railroad Administration (FRA). 2020a. GradeDec.NET Crossing Evaluation Tool. Retrieved online at: https://gradedec.fra.dot.gov/

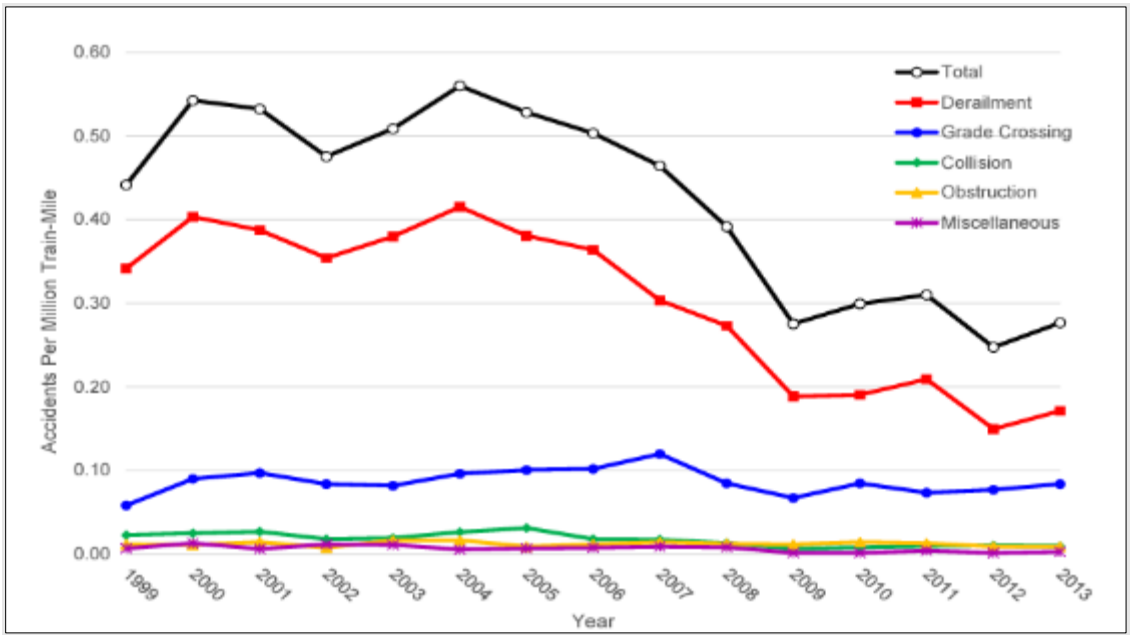
U.S. Department of Transportation (USDOT). 2020b. Federal Railroad Administration (FRA). 2020b. New Model for Highway-Rail Grade Crossing Accident Prediction and Severity. Available online at: https://railroads.dot.gov/elibrary/new-model-highway-rail-grade-crossing-accident-prediction-and-severity

APPENDIX B. NATIONAL DERAILMENT AND ACCIDENT REPORTING

APPENDIX B – NATIONAL DERAILMENT AND ACCIDENT REPORTING

Title 49 *Code of Federal Regulation* (CFR) 213[2]: Track Switches prescribes minimum safety requirements for railroad track that is part of the general railroad system of transportation. In general, the requirements prescribed in this part apply to specific track conditions existing in isolation. Therefore, a combination of track conditions, none of which individually amounts to a deviation from the requirements in this part, may require remedial action to provide for safe operations over that track. This part does not restrict a railroad from adopting and enforcing additional or more stringent requirements not inconsistent with this part. Figure B-1 shows the summary statistics of national accident trends. This chart shows that there is a high occurrence of derailments when compared to other accident types.

Figure B-1. Summary Statistics of National Accident Trends

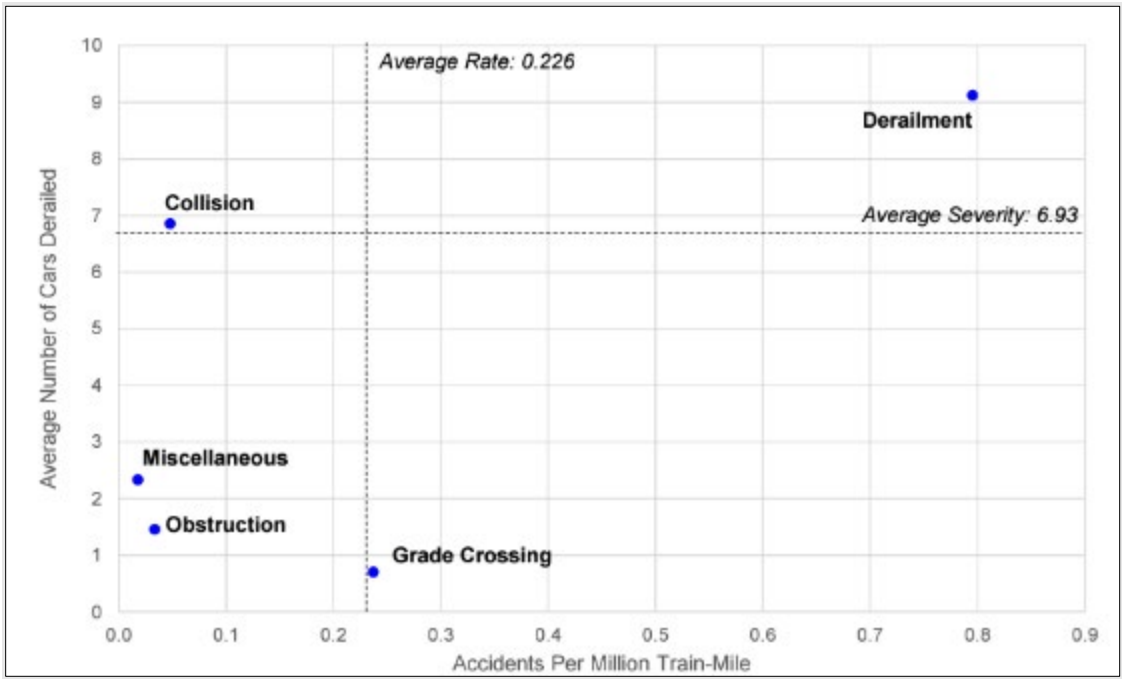


Source: USDOT, 2020

For freight train accidents, derailments are both frequent and severe and thus fall in the upper-right quadrant on Figure B-2. Collisions and derailments are still the most severe accidents among all accident types. Although grade-crossing accidents are the most common type of accident, they are among the least severe in their consequences. Collisions and derailments are caused by the interaction of two or more trains in shared-use corridors regarding passenger train collisions with a derailed freight train, or vice versa (USDOT, 2019, p.29).

[2] Title 49 CFR Part 213: Available online at: https://www.govinfo.gov/app/details/CFR-2011-title49-vol4/CFR-2011-title49-vol4-part213.

Figure B-2. Frequency and Severity Graph of Mainline Freight Train Accidents by Accident Type



Source: USDOT, 2020

FRA Accident Investigations (General Criteria)

Whenever there is some negative occurrence on track, and/or with railcars, derailments can occur. Railroads report accidents under the conditions listed below and jointly investigate accidents and incidents with FRA as determined by the Accident Analysis Branch or regional management:

- Any collision (main or yard track), derailment, or passenger train incident resulting in at least one fatality or serious injury to railroad passengers or crewmembers
- Any railroad-related accident resulting in death to an on-duty railroad employee, including an employee of a contractor to a railroad, regardless of craft
- Any highway-rail grade crossing accident resulting in any of the following:
  - Death to one or more people being transported in a commercial vehicle or school bus
  - Serious injury to several persons being transported in a commercial vehicle or school bus
  - Death to three or more persons in a private highway vehicle
  - Accidents involving grade crossing signal failure or allegations of grade crossing signal failure
- Any non-casualty train accident resulting in derailment of a locomotive, 15 cars or more, and extensive property damage
- Any train accident/incident resulting in a fire, explosion, evacuation, or release of regulated hazardous materials, especially if it exposed a community to these hazards or the threat of such exposure
- Any accident/incident involving a train transporting nuclear materials
- Any train incident involving runaway or rollaway equipment, with or without locomotives

- Any collision involving maintenance-of-way or hi-rail equipment
- Any accident caused by failure of a locomotive or any part of a locomotive, or a person contacting an electrically energized part that resulted in severe injury or death of one or more persons
- Accidents resulting from signal failure including positive train control-related failures and malfunctions
- Any other train accident/incident likely to generate considerable public interest
- Most Amtrak accidents/incidents.

FRA recently amended their accident/incident reporting regulation December 9, 2020 (Title 85 Federal Register 79130). This amended regulation requires railroads to report to the agency all rail equipment accidents/incidents above the monetary reporting threshold (reporting threshold) for that calendar year. For 2021, the monetary threshold was $11,200, and for 2022 it was raised to $11,300.

References for Appendix B

U.S. Department of Transportation (USDOT). 2019. *Hazards Associated with HSR Operations Adjacent to Conventional Tracks – Enhanced Literature Review Part II: Best Practices*, pg. 29

U.S. Department of Transportation (USDOT). 2020. Federal Railroad Administration (FRA). 2020b. New Model for Highway-Rail Grade Crossing Accident Prediction and Severity. Available online at: https://railroads.dot.gov/elibrary/new-model-highway-rail-grade-crossing-accident-prediction-and-severity

APPENDIX C. GRADEDEC.NET RESULTS

APPENDIX C – GRADEDEC.NET RESULTS

South Kalamath Street Crossing – MP 3.466, CDOT Hazard Rating 5

South Kalamath Street is a one-way street in the central part of Denver and in the BNSF Pikes Peak subdivision (See Photo C-1[3]). This crossing has seen three at-grade incidents. Appendix D provides specific accident reports. The primary operating railroad at the South Kalamath Street grade crossing is BNSF, but UPRR also operates less frequently at this crossing. This road crossing has no markings designating direction.

Photo C-1. South Kalamath Street Crossing

Possible Safety Treatments

Traffic Control Systems

Extend the median, add pavement markings on all quadrants, add warning lights and blank-out signs (automated warning signage that display specific instructions, such as road closures, no turn allowed, etc.), relocate signs, raise the curb, and repair asphalt. Reduces risk from 4 percent to 2 percent.

- Estimated cost is ~$230,000

Viewing Considerations

Relocate telephone poles. Sometimes telephone poles obstruct the field of view and can create a hazard to vehicular traffic. Removing or relocating them helps the driver's field of view.

- Estimated cost is ~$10,000

Results

Figure C-1 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. When this number in traffic volume increases, the percentages of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

[3] The source for all the photos in Appendix C is HNTB, 2022.

Figure C-1. South Kalamath Street Crossing

FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 11/29/2022 6:36:47PM

	Fatal	Injury	PDO	Total
Base	0.00548	0.01160	0.02272	0.03980
Alternate	0.00305	0.00644	0.01262	0.02211

CROSSING DATA FOR THE DENVER REGION

Crossing ID 245394V Milepost:0003.466
Description BNSF - S KALAMATH ST

Paved? TRUE Urban? TRUE

GCX Base Type	Gates
Supp. Safety	One-way street
GCX Alt Type	New technology 1
Supp. Safety	Barrier curbs
No. Main Tracks	2
No. Other Tracks	0
Traffic Management Measures?	Fals

Rail T-O-D

Passenger	Uniform
Switch	Uniform

Train Speeds (mph)

Thru	30.0
Switch	1.0
Max TT Speed	30.0

Daily Trains

Day Through	12.0
Night Through	12.0
Day Switch	0.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	1
Yr 3	0	Yr 4	1
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	3	3
AADT	14,000	14,000
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	10.0	10.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.00548	0.00305
Injury	0.01160	0.00644
PDO	0.02272	0.01262

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	2.5	5.0
Other	0.0	1.0
Capital		280.0
Supplementary Safety		
O&M	0.0	5.0
Other	0.0	1.0
Capital		10.0
Highway Improvements		
Lanes		240.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
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Quebec Street Southbound Frontage Road Crossing - MP 5.81, CDOT Hazard Rating 10

The Quebec Street Southbound Frontage Road crossing is in the north part of Denver and in the Regional Transportation District (RTD) C Limon subdivision (see Photo C-2). This crossing has seen two at-grade incidents. Appendix D provides specific accident reports.. The primary operating railroad at the Quebec Street Southbound Frontage Road grade crossing is the RTD A-Line. UPRR and BNSF also operate at this crossing. There have been three trespassing incidents at this location.

Photo C-2. Quebec Street Southbound Frontage Road Crossing

Possible Safety Treatments

Traffic Control Systems

Add pavement markings, move traffic the signal to the north side of the rail crossing, add fencing, and add preemption to the traffic signal at the crossing. Reduces risk from 5 percent to 3 percent.

- Estimated cost is ~ $260,000

Viewing Considerations

Viewing considerations are not applicable.

Results

Figure C-2 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-2. Quebec Street Southbound Frontage Road Crossing

FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 12/2/2022 1:38:38PM

	Fatal	Injury	PDO	Total
Base	0.01122	0.01665	0.01862	0.04649
Alternate	0.00623	0.00925	0.01034	0.02583

CROSSING DATA FOR THE DENVER REGION

Crossing ID 804635B Milepost:0005.810
Description RTDC - QUEBEC STREET SBFR
Paved? TRUE Urban? TRUE

GCX Base Type	Gates
Supp. Safety	One-way street
GCX Alt Type	New technology 1
Supp. Safety	Barrier curbs
No. Main Tracks	2
No. Other Tracks	0
Traffic Management Measures?	False

Rail T-O-D

Passenger	Uniform
Switch	Uniform

Train Speeds (mph)

Thru	79.0
Switch	65.0
Max TT Speed	79.0

Daily Trains

Day Through	92.0
Night Through	50.0
Day Switch	0.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	0
Yr 3	1	Yr 4	1
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	4	4
AADT	19,313	19,313
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	15.0	15.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.01122	0.00623
Injury	0.01665	0.00925
PDO	0.01862	0.01034

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	2.5	5.0
Other	0.0	0.0
Capital		280.0
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0
Highway Improvements		
Lanes		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
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South Santa Fe Drive Crossing – MP 3.653, CDOT Hazard Rating 16

South Santa Fe Drive is in the central part of Denver and in the BNSF Pikes Peak subdivision (see Photo C-3). This crossing has seen two at-grade incidents. Appendix D provides specific accident reports. The primary operating railroad at the South Santa Fe Drive grade crossing is BNSF, but UPRR also operates at the crossing. This crossing is intersected by access roads that lead into local industries. This crossing is closest to South Kalamath Street and is the crossing within the CCD that has the second highest incident rates. Road crossing safety measures are very minimal at this location, which include two gates and no other signage.

Photo C-3. South Santa Fe Drive Crossing

Possible Safety Treatments

Traffic Control Systems

Extend the median; add pavement markings on all quadrants; add warning lights, blank-out signs, and no-right turn signs; relocate signs; raise the curb; and repair asphalt. Reduces risk from 4 percent to 2 percent.

- Estimated cost is ~$ 560,000

Viewing Considerations

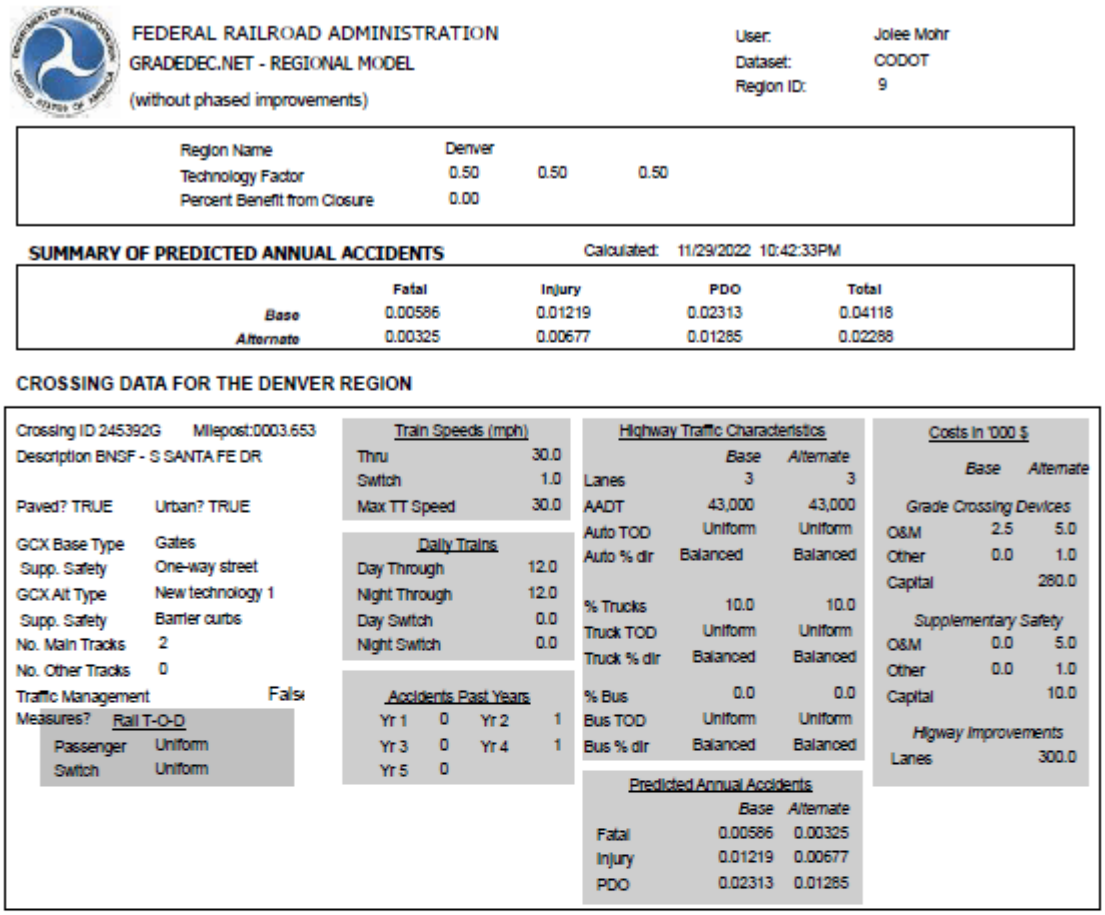
Relocate power poles

- Estimated cost is ~$10,000

Results

Figure C-3 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-3 South Santa Fe Drive Crossing



FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 11/29/2022 10:42:33PM

	Fatal	Injury	PDO	Total
Base	0.00586	0.01219	0.02313	0.04118
Alternate	0.00325	0.00677	0.01285	0.02288

CROSSING DATA FOR THE DENVER REGION

Crossing ID 245392G Milepost:0003.653
Description BNSF - S SANTA FE DR

Paved? TRUE Urban? TRUE

GCX Base Type Gates
Supp. Safety One-way street
GCX Alt Type New technology 1
Supp. Safety Barrier curbs
No. Main Tracks 2
No. Other Tracks 0
Traffic Management Measures? False
Rail T-O-D
Passenger Uniform
Switch Uniform

Train Speeds (mph)

Thru	30.0
Switch	1.0
Max TT Speed	30.0

Daily Trains

Day Through	12.0
Night Through	12.0
Day Switch	0.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	1
Yr 3	0	Yr 4	1
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	3	3
AADT	43,000	43,000
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	10.0	10.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.00586	0.00325
Injury	0.01219	0.00677
PDO	0.02313	0.01285

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	2.5	5.0
Other	0.0	1.0
Capital		280.0
Supplementary Safety		
O&M	0.0	5.0
Other	0.0	1.0
Capital		10.0
Highway Improvements		
Lanes		300.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
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Holly Street Crossing – MP 635.63, CDOT Hazard Rating 0.05

Holly Street is in the north part of Denver and in the UPRR Limon subdivision (see Photo C-4). The primary operating railroad at the Holly Street grade crossing is UPRR. The hazard rating for this location is low (0.05) because of low highway and train traffic volumes. However, this crossing has seen two at-grade incidents over the last 5 years. Appendix D provides specific accident reports. There are industry access roads without any signage in this area.

Photo C-4. Holly Street Crossing

Possible Safety Treatments

Traffic Control Systems

Add pavement markings on Holly Street and on the industry road, add warning lights and blank-out signs, relocate signs, raise the curb, repair asphalt, and add a two-quadrant gate system. Reduces risk from 20 percent to 9 percent.

- Estimated cost is ~$ 360,000

Viewing Considerations

Relocate electric pole (if gate is installed)

- Estimated cost is ~$10,000

Results

Figure C-4 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-4. Holly Street Crossing

FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 11/22/2022 9:53:51PM

	Fatal	Injury	PDO	Total
Base	0.01027	0.03048	0.16375	0.20451
Alternate	0.00375	0.01157	0.07555	0.09087

CROSSING DATA FOR THE DENVER REGION

Crossing ID 804614H Milepost:0635.634
Description UP - HOLLY STREET

Paved? TRUE Urban? TRUE

GCX Base Type	Crossbucks
Supp. Safety	None
GCX Alt Type	Gates
Supp. Safety	None
No. Main Tracks	0
No. Other Tracks	1
Traffic Management Measures?	False

Rail T-O-D

Passenger	Uniform
Switch	Uniform

Train Speeds (mph)

Thru	10.0
Switch	5.0
Max TT Speed	10.0

Daily Trains

Day Through	0.0
Night Through	0.0
Day Switch	8.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	0
Yr 3	0	Yr 4	2
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	2	2
AADT	250	250
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	10.0	10.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.01027	0.00375
Injury	0.03048	0.01157
PDO	0.16375	0.07555

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	0.2	0.2
Other	0.0	0.0
Capital		1.6
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0
Higway Improvements		
Lanes		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
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Dahlia Street North of 51st Street Crossing – MP 3.18, CDOT Hazard Rating 0.01

Dahlia Street is in the north part of Denver and in the BNSF Denver Rock Island subdivision (see Photo C-5). The primary operating railroad at the Dahlia Street grade crossing is BNSF. This crossing is located within the industry area of North CCD and has seen one at grade incident without fatalities. Appendix D provides specific accident reports. This crossing only has crossbucks (signage at highway-rail intersections that indicate trains have the legal ROW) and a yield sign.

Photo C-5. Dahlia Street North of 51st Street Crossing

Possible Safety Treatments

Traffic Control Systems

Add pavement markings, warning lights, and a two-quadrant gate system. Reduces risk from 10 percent to 5 percent.

- Estimated cost is ~$220,000

Viewing Considerations

Viewing considerations are not applicable.

Results

Figure C-5 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-5. Dahlia Street North of 51st Street Crossing

FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 11/22/2022 9:55:41PM

	Fatal	Injury	PDO	Total
Base	0.00663	0.01853	0.07691	0.10207
Alternate	0.00243	0.00711	0.03581	0.04535

CROSSING DATA FOR THE DENVER REGION

Crossing ID 057066K Milepost:0003.183
Description BNSF - DAHLIA NO 51ST

Paved? TRUE Urban? TRUE

GCX Base Type	Crossbucks
Supp. Safety	None
GCX Alt Type	Gates
Supp. Safety	None
No. Main Tracks	0
No. Other Tracks	1
Traffic Management Measures?	False

Rail T-O-D

Passenger	Uniform
Switch	Uniform

Train Speeds (mph)

Thru	10.0
Switch	1.0
Max TT Speed	10.0

Daily Trains

Day Through	0.1
Night Through	0.0
Day Switch	0.0
Night Switch	0.0

Accidents Past Years

Yr 1	1	Yr 2	0
Yr 3	0	Yr 4	0
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	2	2
AADT	1,500	1,500
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	9.0	9.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.00663	0.00243
Injury	0.01853	0.00711
PDO	0.07691	0.03581

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	0.2	0.2
Other	0.0	0.0
Capital		1.6
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0
Highway Improvements		
Lanes		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
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Monaco Street Crossing – MP 635.136, CDOT Hazard Rating 0.04

Monaco Street is in the north part of Denver and in the UPRR Limon subdivision (see Photo C-6). The primary operating railroad at the Monaco Street grade crossing is UPRR. This road crossing is located within the CCD industrial area and has seen one at grade incident without fatalities. Appendix D provides specific accident reports. There is limited signage and crossing safety devices located at this crossing.

Photo C-6. Monaco Street Crossing

Possible Safety Treatments

Traffic Control Systems

Add pavement markings, warning lights, a two-quadrant gate system. Reduces risk from 10 percent to 5 percent.

- Estimated cost is ~$220,000

Viewing Considerations

Relocate telephone poles

- Estimated cost is ~$10,000

Results

Figure C-6 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-6. Monaco Street Crossing

FEDERAL RAILROAD ADMINISTRATION

GRADEDEC.NET
CORRIDOR AND CROSSING DATA
(without phased improvements)

User: Jolee Mohr
Dataset: Initial dataset
Corridor ID 5

					Avg. No. Trains Per Day	Train Time-of-Day Distribution
Corridor Name	Denver			Passenger	0.0	Uniform
Technology Factors	0.50	0.50	0.50	Freight	8.0	Uniform
Signal Synchronization?	False			Switch	0.0	Uniform

CORRIDOR SUMMARY OF PREDICTED ANNUAL ACCIDENTS

Calculated: 21-Jun-2022 12:01 pm

	Fatal	Injury	PDO	Total
Base	0.007661	0.020564	0.074132	0.102357
Alternate	0.004762	0.013469	0.058760	0.076991

CROSSING DATA FOR THE DENVER CORRIDOR

Milepost 635.14 Crossing ID 804609L Accidents in 5 Years 1

Description UP - MONACO STREET

Paved? True Urban? True
GCX Base Type Passive
Safety Sup. Type None
GCX Alt Type Lights
Safety Sup. type None

No. RR Tracks 2

Train Speeds (mph)

Max Timetable	10.0
Passenger	10.0
Freight	8.0
Switch	3.0

Highway Traffic Characteristics

	Base	Alternate
H'way Lanes	4	4.0
Dist from hway	0.10	0.1
AADT	200	200
Auto TOD Dist	Uniform	Uniform
Auto % direction	Balanced	Balanced
Percent Trucks	10.0	10.0
Of this, % trailers	0.0	0.0
Truck TOD Dist	Uniform	Uniform
Truck % direct	Balanced	Balanced
Percent Bus	0.0	0.0
Bus TOD Dist	Uniform	Uniform
Bus % direction	Balanced	Balanced

Costs in '000 $ of Hway Improvement 0.0

Predicted Annual Accidents

	Base	Alternate
Fatal	0.00081	0.00026
Injury	0.00689	0.00311
PDO	0.03339	0.01169
Total	0.04308	0.01506

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	0.2	1.8
Oth. Lcycle	0.0	0.0
Capital		74.8
Supplementary Safety		
O&M	0.0	0.0
Oth. Lcycle	0.0	0.0
Capital		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
Report 1.1 Version 1.0 Printed: 3:05:16PM 6/21/2022 Page 1 of 1

East 48th Avenue at Ash Street Crossing – MP 2.12, CDOT Hazard Rating 0.03

East 48th Avenue is in the north part of Denver and in the BNSF Brush subdivision (see Photo C-7). The primary operating railroad at the East 48th Avenue grade crossing is BNSF. This road crossing is located within the CCD industrial area and has seen one at grade incident without fatalities. Appendix D provides specific accident reports. There is limited signage and crossing safety devices at this crossing.

Photo C-7. East 48th Avenue at Ash Street Crossing

Possible Safety Treatments

Traffic Control Systems

Add median; add pavement markings on all quadrants; add warning lights, blank-out signs, and no-right turn signs; relocate signs; raise the curb; repair asphalt; and add a two-quadrant gate system. Reduces risk from 10 percent to 5 percent.

- Estimated cost is ~$560,000

Viewing Considerations

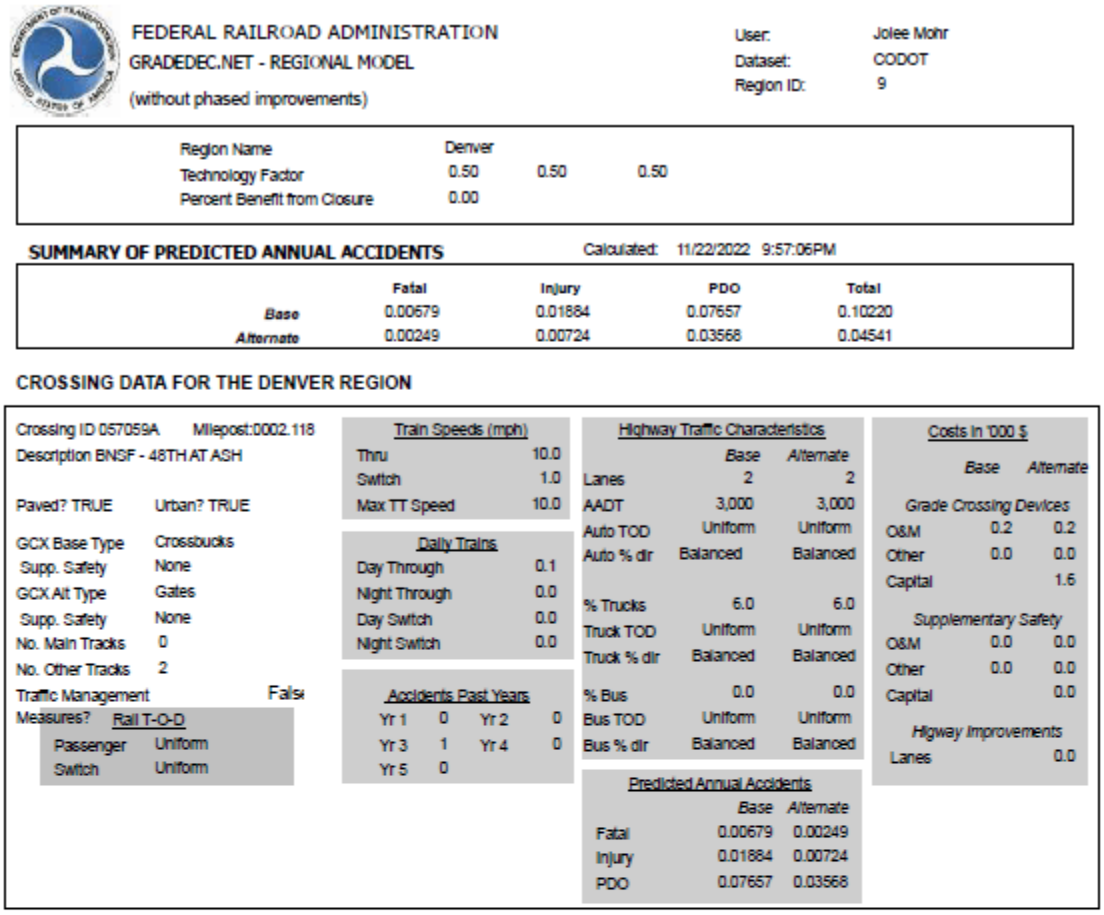
Relocate telephone poles

- Estimated cost is ~$10,000

Results

Figure C-7 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-7. East 48th Avenue at Ash Street Crossing



FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 11/22/2022 9:57:06PM

	Fatal	Injury	PDO	Total
Base	0.00679	0.01884	0.07657	0.10220
Alternate	0.00249	0.00724	0.03568	0.04541

CROSSING DATA FOR THE DENVER REGION

Crossing ID 057059A Milepost:0002.118
Description BNSF - 48TH AT ASH

Paved? TRUE Urban? TRUE

GCX Base Type	Crossbucks
Supp. Safety	None
GCX Alt Type	Gates
Supp. Safety	None
No. Main Tracks	0
No. Other Tracks	2
Traffic Management Measures?	False

Rail T-O-D

Passenger	Uniform
Switch	Uniform

Train Speeds (mph)

Thru	10.0
Switch	1.0
Max TT Speed	10.0

Daily Trains

Day Through	0.1
Night Through	0.0
Day Switch	0.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	0
Yr 3	1	Yr 4	0
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	2	2
AADT	3,000	3,000
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	6.0	6.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.00679	0.00249
Injury	0.01884	0.00724
PDO	0.07657	0.03568

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	0.2	0.2
Other	0.0	0.0
Capital		1.6
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0
Highway Improvements		
Lanes		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
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West Mississippi Avenue Crossing – MP 4.62, CDOT Hazard Rating 0.03

West Mississippi Avenue is in the south part of Denver and on the BNSF Pikes Peak subdivision (see Photo C-8). The primary operating railroad at the West Mississippi Avenue grade crossing is BNSF. This road crossing is located within the CCD industrial area and has seen one at grade incident without fatalities. Appendix D provides specific accident reports. There is limited lighting and signage at this crossing.

Photo C-8. West Mississippi Avenue Crossing

Possible Safety Treatments

Traffic Control Systems

Add median; add pavement markings on all quadrants; add warning lights, blank-out signs, and no-right turn signs; relocate signs; raise the curb; repair asphalt; and add a two-quadrant gate system. Reduces risk from 10 percent to 5 percent.

- Estimated cost is ~$560,000

Viewing Considerations

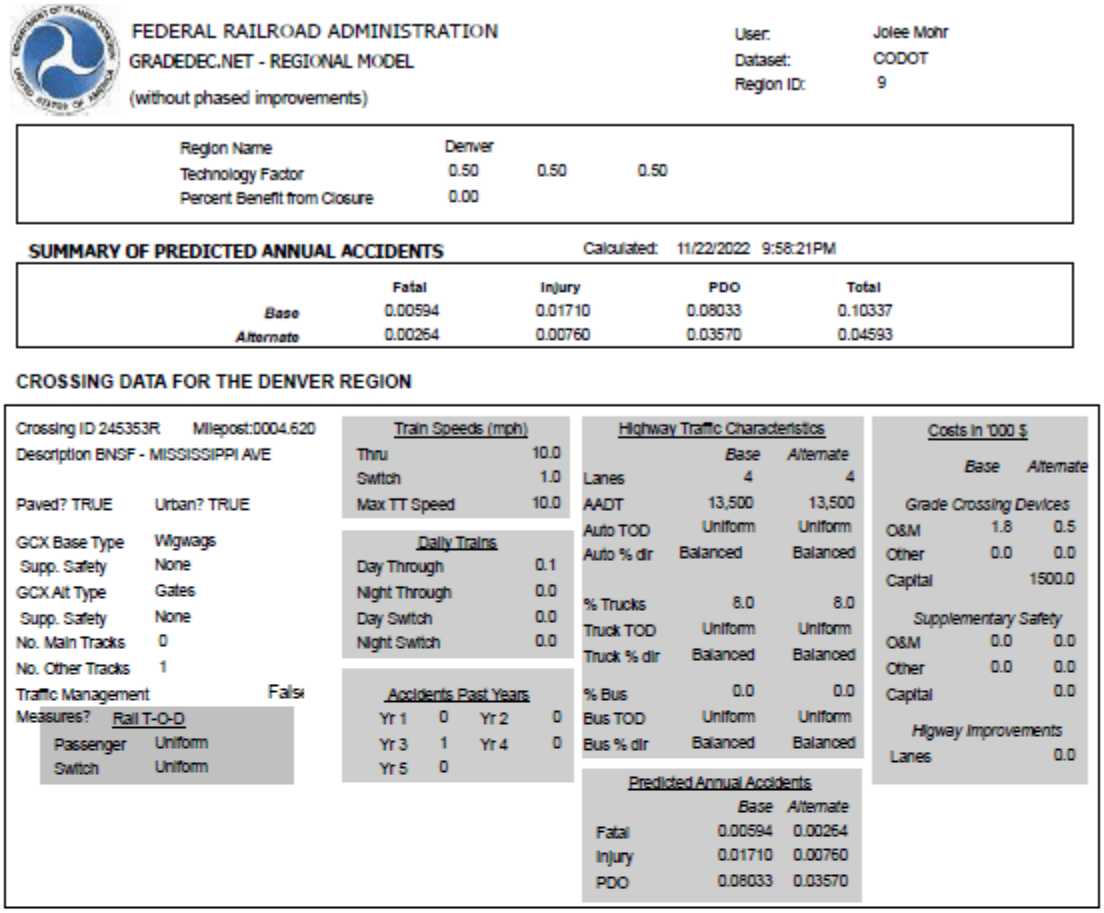
Relocate power poles

- Estimated cost is ~$50,000

Results

Figure C-8 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents.. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-8. West Mississippi Avenue Crossing



FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 11/22/2022 9:58:21PM

	Fatal	Injury	PDO	Total
Base	0.00594	0.01710	0.08033	0.10337
Alternate	0.00264	0.00760	0.03570	0.04593

CROSSING DATA FOR THE DENVER REGION

Crossing ID 245353R Milepost:0004.620
Description BNSF - MISSISSIPPI AVE

Paved? TRUE Urban? TRUE

GCX Base Type	Wigwags
Supp. Safety	None
GCX Alt Type	Gates
Supp. Safety	None
No. Main Tracks	0
No. Other Tracks	1
Traffic Management Measures?	Fals

Rail T-O-D

Passenger	Uniform
Switch	Uniform

Train Speeds (mph)

Thru	10.0
Switch	1.0
Max TT Speed	10.0

Daily Trains

Day Through	0.1
Night Through	0.0
Day Switch	0.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	0
Yr 3	1	Yr 4	0
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	4	4
AADT	13,500	13,500
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	8.0	8.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.00594	0.00264
Injury	0.01710	0.00760
PDO	0.08033	0.03570

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	1.8	0.5
Other	0.0	0.0
Capital		1500.0
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0
Highway Improvements		
Lanes		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
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East 47th Avenue and York Street Crossing – MP 2.98, CDOT Hazard Rating 0.68

York Street is in the north part of Denver and in the UPRR Greeley subdivision (see Photo C-9). The primary operating railroad at the York Street grade crossing is UPRR. This road crossing is located within the CCD between a residential and industrial use area and has seen one at grade incident without fatalities. Appendix D provides specific accident reports. There is limited signage and crossing safety devices at this location. However, CCD recently finished construction of a pedestrian crossing at this location.

Photo C-9. East 47th Avenue and York Street Crossing

Possible Safety Treatments

Traffic Control Systems

Add four quadrant gates, fencing along the ROW, and a wrong-way sign on York Street; extend the median; add pavement markings, warning lights, and a pedestrian gate; and relocate signs. Reduces risk from 10 percent to 0.8 percent.

- Estimated cost is ~ $500,000

Viewing Considerations

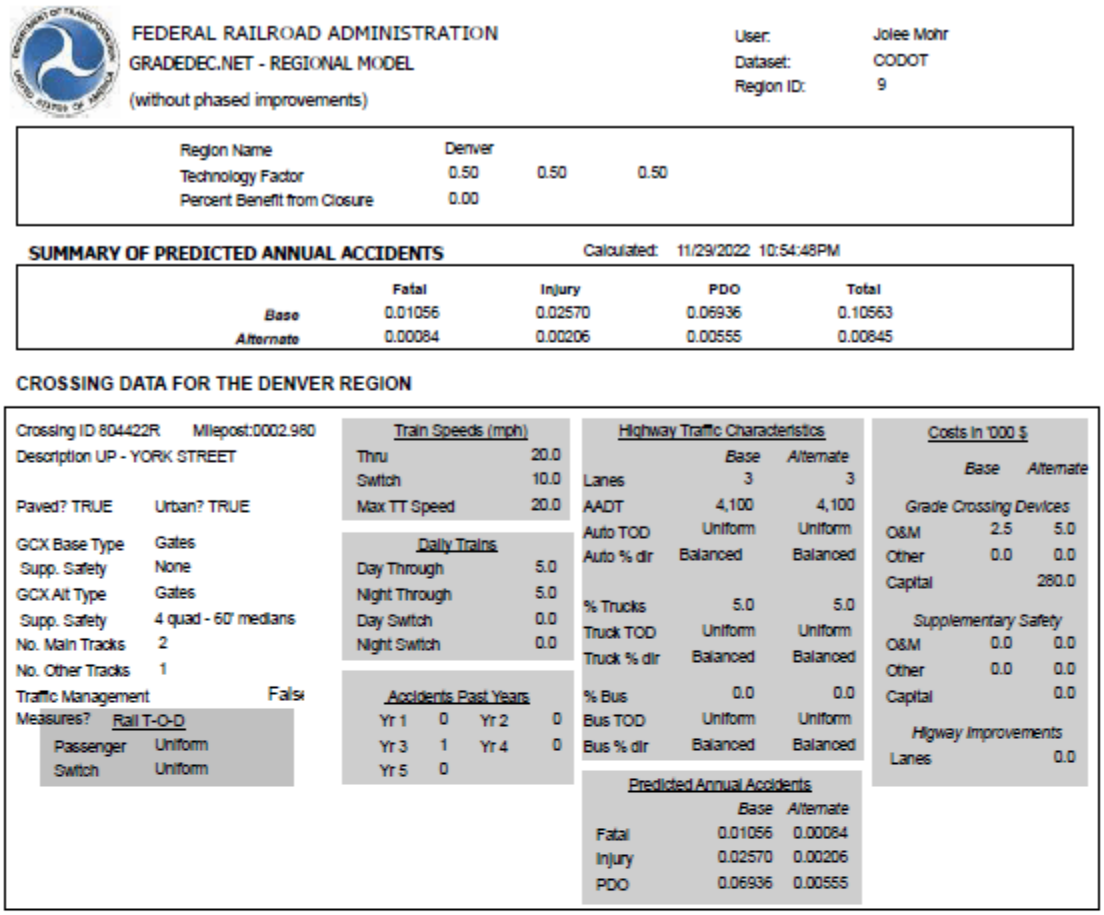
Remove old telephone pole on southeast corner on island (York Street and 47th Avenue)

- Estimated cost is ~$10,000

Results

Figure C-9 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-9. East 47th Avenue and York Street Crossing



FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 11/29/2022 10:54:48PM

	Fatal	Injury	PDO	Total
Base	0.01056	0.02570	0.06936	0.10563
Alternate	0.00084	0.00206	0.00555	0.00845

CROSSING DATA FOR THE DENVER REGION

Crossing ID 804422R Milepost:0002.980
Description UP - YORK STREET

Paved? TRUE Urban? TRUE

GCX Base Type	Gates
Supp. Safety	None
GCX Alt Type	Gates
Supp. Safety	4 quad - 60' medians
No. Main Tracks	2
No. Other Tracks	1
Traffic Management Measures?	False

Rail T-O-D

Passenger	Uniform
Switch	Uniform

Train Speeds (mph)

Thru	20.0
Switch	10.0
Max TT Speed	20.0

Daily Trains

Day Through	5.0
Night Through	5.0
Day Switch	0.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	0
Yr 3	1	Yr 4	0
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	3	3
AADT	4,100	4,100
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	5.0	5.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.01056	0.00084
Injury	0.02570	0.00206
PDO	0.06936	0.00555

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	2.5	5.0
Other	0.0	0.0
Capital		280.0
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0
Highway Improvements		
Lanes		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
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Alameda Avenue Crossing – MP 3.69, CDOT Hazard Rating 0.0716

Alameda Avenue is in the central part of Denver and in the BNSF Pikes Peak subdivision (see Photo C-10). The primary operating railroad at the Alameda Avenue grade crossing is BNSF, but UPRR also operates at the crossing. This road crossing is located within the CCD mixed use area and has seen one at grade incident without fatalities. Appendix D provides specific accident reports. There is limited signage and crossing safety devices at this location.

Photo C-10. Alameda Avenue Crossing

Possible Safety Treatments

Traffic Control Systems

Add four quadrant gates, median, pavement markings, warning lights and bells, pedestrian gates, and ROW fencing. Reduces risk from 10 percent to 0.5 percent.

- Estimated cost is ~$550,000

Viewing Considerations

Install cantilever for traffic semaphores (arms, flags, or poles that are held in certain positions to signal drivers) and railroad warning lights and bells.

- Estimated cost is ~$100,000

Results

Figure C-10 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-10. Alameda Avenue Crossing

FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 11/29/2022 10:59:47PM

	Fatal	Injury	PDO	Total
Base	0.00614	0.01757	0.08025	0.10397
Alternate	0.00027	0.00078	0.00358	0.00464

CROSSING DATA FOR THE DENVER REGION

Crossing ID 245460F Milepost:0003.694
Description BNSF - ALAMEDA AVE

Paved? TRUE Urban? TRUE

GCX Base Type	Flashing lights
Supp. Safety	None
GCX Alt Type	Gates
Supp. Safety	4 quad - 60' medians
No. Main Tracks	0
No. Other Tracks	1
Traffic Management Measures?	Fals

Rail T-O-D

Passenger	Uniform
Switch	Uniform

Train Speeds (mph)

Thru	10.0
Switch	1.0
Max TT Speed	10.0

Daily Trains

Day Through	0.1
Night Through	0.0
Day Switch	0.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	0
Yr 3	1	Yr 4	0
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	5	5
AADT	33,400	33,400
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	2.0	2.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.00614	0.00027
Injury	0.01757	0.00078
PDO	0.08025	0.00358

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	1.8	0.5
Other	0.0	0.0
Capital		1500.0
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0
Highway Improvements		
Lanes		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
Report 2.1 Version 1.0 Printed: 11:00:16PM 11/29/2022 Page 1 of 1

East 50th Avenue Crossing – MP 1.843, CDOT Hazard Rating 0.0086

East 50th Avenue is in the north part of Denver and in the BNSF Brush subdivision (see Photo C-11). The primary operating railroad at the East 50th Avenue grade crossing is BNSF. This road crossing is located within the CCD industrial use area and has seen one at grade incident without fatalities. Appendix D provides specific accident reports. There is limited signage and crossing safety devices at this location.

Photo C-11. East 50th Avenue Crossing

Possible Safety Treatments

Traffic Control Systems

Add two quadrant gates, pavement markings, warning lights, and signage. Reduces risk from 10 percent to 5 percent.

- Estimated cost is ~$370,000

Viewing Considerations

Viewing considerations are not applicable.

Results

Figure C-11 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-11. East 50th Avenue Crossing

FEDERAL RAILROAD ADMINISTRATION

GRADEDEC.NET
CORRIDOR AND CROSSING DATA
(without phased improvements)

User: CARLOS GALLEGOS
Dataset: Initial dataset
Corridor ID 8

					Avg. No. Trains Per Day	Train Time-of-Day Distribution
Corridor Name	Denver County			Passenger	0.0	Uniform
Technology Factors	0.50	0.50	0.50	Freight	0.3	Uniform
Signal Synchronization?	False			Switch	0.0	Uniform

CORRIDOR SUMMARY OF PREDICTED ANNUAL ACCIDENTS

Calculated: 21-Jun-2022 12:00 pm

	Fatal	Injury	PDO	Total
Base	0.006603	0.018429	0.076349	0.101380
Alternate	0.000416	0.001216	0.006108	0.007740

CROSSING DATA FOR THE DENVER COUNTY CORRIDOR

Milepost 1.84 Crossing ID 245288M Accidents in 5 Years 1

Description BNSF - 50TH AVE

Paved? True	Urban? True		
GCX Base Type	Passive		
Safety Sup. Type	None		
GCX Alt Type	Gates		
Safety Sup. type	4 quad - no detection		
No. RR Tracks	2		

Train Speeds (mph)

Max Timetable	10.0
Passenger	10.0
Freight	8.0
Switch	3.0

Highway Traffic Characteristics

	Base	Alternate
H'way Lanes	2	2.0
Dist from hway	0.10	0.1
AADT	1,000	1,000
Auto TOD Dist	Uniform	Uniform
Auto % direction	Balanced	Balanced
Percent Trucks	5.0	5.0
Of this, % trailers	0.0	0.0
Truck TOD Dist	Uniform	Uniform
Truck % direct	Balanced	Balanced
Percent Bus	0.0	0.0
Bus TOD Dist	Uniform	Uniform
Bus % direction	Balanced	Balanced

Costs in '000 $ of Hway Improvement 0.0

Predicted Annual Accidents

	Base	Alternate
Fatal	0.00045	0.00001
Injury	0.00588	0.00015
PDO	0.02178	0.00055
Total	0.02810	0.00071

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	0.2	1.8
Oth. Loycle	0.0	0.0
Capital		74.8
Supplementary Safety		
O&M	0.0	0.0
Oth. Loycle	0.0	0.0
Capital		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS

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48th Avenue, West of Forest Street Crossing – MP 2.69, CDOT Hazard Rating 0.021

48th Avenue is in the north part of Denver in the BNSF Brush subdivision (see Photo C-12). The primary operating railroad at the 48th Avenue grade crossing is BNSF. This road crossing is located within the CCD industrial use area and has seen one at grade incident without fatalities. Appendix D provides specific accident reports. There is limited signage and crossing safety devices at this location.

Photo C-12. 48th Avenue, West of Forest Street Crossing

Possible Safety Treatments

Traffic Control Systems

Add two quadrant gates, pavement markings, warning lights, and signage. Reduces risk from 10 percent to 5 percent.

- Estimated cost is ~ $370,000

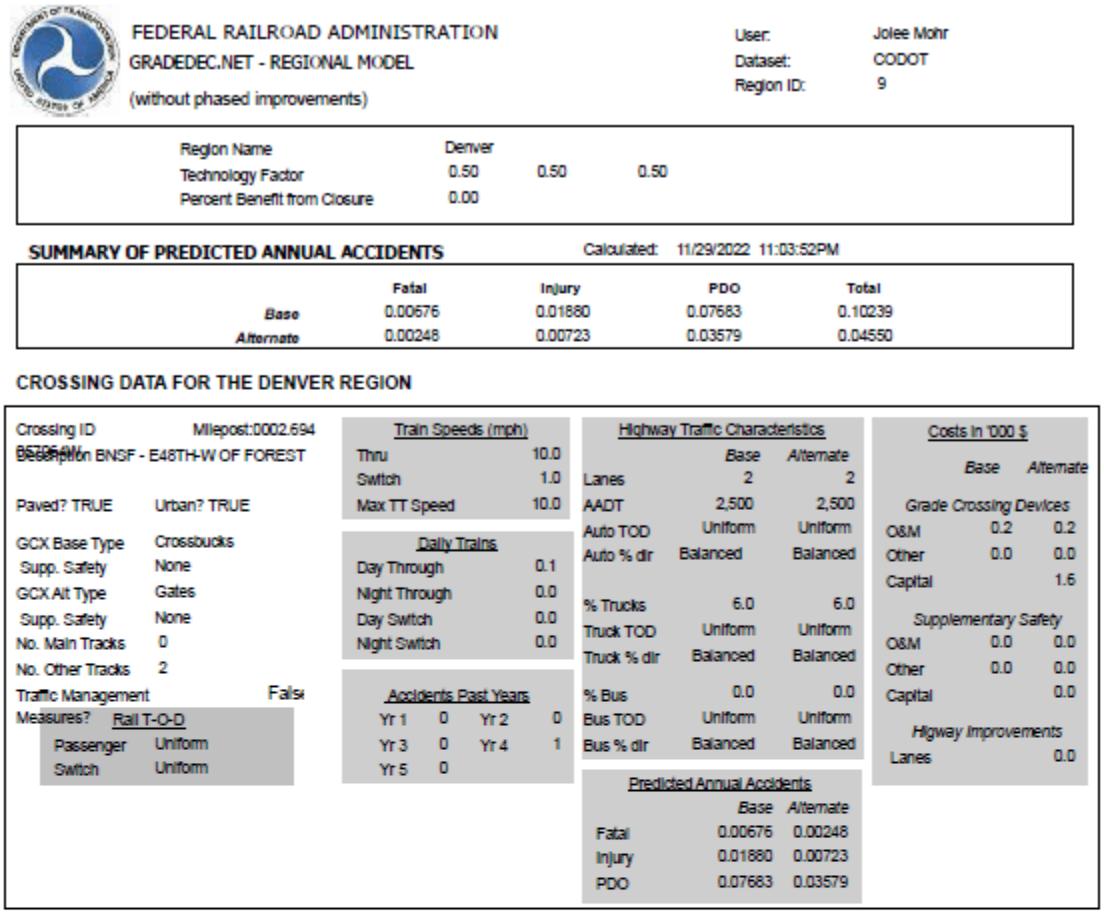
Viewing Considerations

Viewing considerations are not applicable.

Results

Figure C-12 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-12. 48th Avenue, West of Forest Street Crossing



FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 9

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 11/29/2022 11:03:52PM

	Fatal	Injury	PDO	Total
Base	0.00676	0.01880	0.07683	0.10239
Alternate	0.00248	0.00723	0.03579	0.04550

CROSSING DATA FOR THE DENVER REGION

Crossing ID [redacted] Milepost:0002.694
Description BNSF - E48TH-W OF FOREST

Paved? TRUE Urban? TRUE

GCX Base Type Crossbucks
Supp. Safety None
GCX Alt Type Gates
Supp. Safety None
No. Main Tracks 0
No. Other Tracks 2
Traffic Management Measures? False
Rail T-O-D
Passenger Uniform
Switch Uniform

Train Speeds (mph)

Thru	10.0
Switch	1.0
Max TT Speed	10.0

Daily Trains

Day Through	0.1
Night Through	0.0
Day Switch	0.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	0
Yr 3	0	Yr 4	1
Yr 5	0		

Highway Traffic Characteristics

	Base	Alternate
Lanes	2	2
AADT	2,500	2,500
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	6.0	6.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	Alternate
Fatal	0.00676	0.00248
Injury	0.01880	0.00723
PDO	0.07683	0.03579

Costs in '000 $

	Base	Alternate
Grade Crossing Devices		
O&M	0.2	0.2
Other	0.0	0.0
Capital		1.6
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0
Highway Improvements		
Lanes		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
Report 2.1 Version 1.0 Printed: 11:04:16PM 11/29/2022 Page 1 of 1

13th Avenue and Umatilla– MP 2.69, CDOT Hazard Rating 28

13th Avenue and Umatilla is in the La Alma-Lincoln Park neighborhood of Denver in the BNSF Brush subdivision (see Photo C-13). The primary operating railroad at the 13th Avenue grade crossing is BNSF. This road crossing is located within the CCD industrial use area and has seen zero at grade incidents, but it is a high traffic area. Appendix D provides specific accident . There is limited signage and crossing safety devices at this location.

Photo C-13. 13th Avenue and Umatilla

Possible Safety Treatments

Traffic Control Systems

Add four-quadrant gates, pavement markings, warning lights, and signage. Add pedestrian crossing gates and sidewalks. Reduces risk from 0.6 percent to 0.1 percent.

- Estimated cost is ~$500,000

Viewing Considerations

Remove or reduce vegetation to improve road traffic visibility.

- Estimated cost is ~$20,000

Results

Figure C-13 shows the base (current) predicted accidents at the studied road crossing and the alternate (post-construction) predicted accidents. The prediction is based on a statical percentage, which is founded upon current traffic flows. When this number in traffic volume increases, the percentages also increase of potential accidents will also increase. The greater number of safety appliances added, the safer the overall crossing will be.

Figure C-13. 13th Avenue and Umatilla

FEDERAL RAILROAD ADMINISTRATION
GRADEDEC.NET - REGIONAL MODEL
(without phased improvements)

User: Jolee Mohr
Dataset: CODOT
Region ID: 7

Region Name	Denver		
Technology Factor	0.50	0.50	0.50
Percent Benefit from Closure	0.00		

SUMMARY OF PREDICTED ANNUAL ACCIDENTS Calculated: 3/6/2023 1:41:15PM

	Fatal	Injury	PDO	Total
Base	0.00089	0.00191	0.00383	0.00663
Alternate	0.00016	0.00034	0.00069	0.00119

CROSSING DATA FOR THE DENVER REGION

Crossing ID 246254T Milepost 0001.864
Description BNSF - W 13TH AVE

Paved? TRUE Urban? TRUE

GCX Base Type	Gates
Supp. Safety	None
GCX Alt Type	Gates
Supp. Safety	4 quad - no detection
No. Main Tracks	2
No. Other Tracks	2
Traffic Management Measures?	False

Rail T-O-D

Passenger	Uniform
Switch	Uniform

Train Speeds (mph)

Thru	30.0
Switch	1.0
Max TT Speed	30.0

Daily Trains

Day Through	12.0
Night Through	12.0
Day Switch	0.0
Night Switch	0.0

Accidents Past Years

Yr 1	0	Yr 2	0
Yr 3	0	Yr 4	0
Yr 5	0		

Highway Traffic Characteristics

	Base	*Alternate*
Lanes	2	2
AADT	6,400	6,400
Auto TOD	Uniform	Uniform
Auto % dir	Balanced	Balanced
% Trucks	11.0	11.0
Truck TOD	Uniform	Uniform
Truck % dir	Balanced	Balanced
% Bus	0.0	0.0
Bus TOD	Uniform	Uniform
Bus % dir	Balanced	Balanced

Predicted Annual Accidents

	Base	*Alternate*
Fatal	0.00089	0.00016
Injury	0.00191	0.00034
PDO	0.00383	0.00069

Costs in '000 $

	Base	*Alternate*
Grade Crossing Devices		
O&M	2.5	5.0
Other	0.0	0.0
Capital		280.0
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0
Hgway Improvements		
Lanes		0.0

GRADEDEC.NET - SYSTEM FOR HIGHWAY RAIL GRADE CROSSING INVESTMENT ANALYSIS
Report 2.1 Version 1.0 Printed: 1:41:19PM 3/6/2023 Page 1 of 1

APPENDIX D. FRA ACCIDENT REPORTS

APPENDIX D – FRA ACCIDENT REPORTS

Figure D-1. South Kalamath Street Crossing (1 of 3)

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1. Name of Reporting Railroad: **Union Pacific Railroad Company [UP]**	1a. Alphabetic Code: **UP**	1b. Railroad Accident/Incident No.: **1121GP026**
2. Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): **Union Pacific Railroad Company [UP]**	3a. Alphabetic Code: **UP**	3b. Railroad Accident/Incident No.: **1121GP026**
4. U.S. DOT Grade Crossing ID No.: **921020E**	5. Date of Accident/Incident (month/day/year): **1 / 1 / 3 / 2021**	6. Time of Accident/Incident: **1:40** AM ☐ PM ☑
7. Nearest Railroad Station: **SOUTH DENVER**	8. Subdivision: **COLORADO SPRINGS**	9. County: **DENVER**
10. State: Abbr. **CO** Code **08**	11. City (if in a city): **DENVER**	12. Highway Name or No.: **KALAMATH STREET** Public ☑ Private ☐

Highway User Involved

13. Type: C. Truck-trailer, F. Bus, J. Other Motor Vehicle; A. Auto, D. Pick-up truck, G. School Bus, K. Pedestrian; B. Truck, E. Van, H. Motorcycle, M. Other (specify) — Code: **K**

14. Vehicle Speed (est. mph at impact):

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: **2**

16. Position: 1. Stalled or stuck on crossing, 2. Stopped on Crossing, 3. Moving over crossing, 4. Trapped on crossing by traffic, 5. Blocked on crossing by gates — Code: **3**

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: **4**

20c. State here the name and quantity of the hazardous material released, if any

21. Temperature (specify if minus): **64** °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: **2**

24. Type of Equipment Consist (single entry): 1. Freight Train, 2. Passenger Train-Pulling, 3. Commuter Train-Pulling, 4. Work Train, 5. Single Car, 6. Cut of cars, 7. Yard/Switching, 8. Light loco(s), 9. Maint./Inspect. car, A. Spec. MoW Equip., B. Passenger Train-Pushing, C. Commuter Train-Pushing, D. EMU, E. DMU — Code: **1**

27. FRA Track Class (1-9,X): **4**

28. Number of Locomotive Units: **2**

29. Number of Cars: **76**

30. Consist Speed (Recorded speed if available): R. Recorded, E. Estimated — **13** mph — Code: **E**

32. Type of Crossing Warning: 1. Gates, 2. Cantilever FLS, 3. Standard FLS, 4. Wig wags, 5. Hwy. traffic signals, 6. Audible, 7. Crossbucks, 8. Stop signs, 9. Watchman, 10. Flagged by crew, 11. Other (specify), 12. None — Code(s): **01 03 07**

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code: **1**

34. Roadway Conditions: A. Dry, B. Wet, C. Snow/Slush, D. Ice, E. Sand,Mud,Dirt,Oil,Gravel, F. Water (Standing, Moving) — Code: **A**

35. Location of Warning: 1. Both Sides, 2. Side of Vehicle Approach, 3. Opposite Side of Vehicle Approach — Code: **1**

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: **1**

38. Highway User's Age: **38**

39. Highway User's Gender: 1. Male, 2. Female — Code: **1**

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: **2**

41. Highway User: 1. Went around the gate, 2. Stopped and then proceeded, 3. Did not stop, 4. Stopped on crossing, 5. Other (specify), 6. Went around/thru temporary barricade (if yes, see instructions), 7. Went thru the gate, 8. Suicide/Attempted suicide — Code: **5**

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code:

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure, 2. Standing railroad equipment, 3. Passing Train, 4. Topography, 5. Vegetation, 6. Highway Vehicles, 7. Other (specify), 8. Not Obstructed — Code: **8**

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	1
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured

45. Was Driver in the Vehicle? 1. Yes 2. No — Code:

47. Highway Vehicle Property Damage (est. dollar damage):

48. Total Number of Vehicle Occupants (including driver): **0**

50. Total Number of People on Train (include passengers and train crew): **2**

51. Is a Rail Equipment Accident / Incident Report Being Filed? 1. Yes 2. No — Code: **2**

53a. Special Study Block — Video Taken? ☑ Yes ☐ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
HIGHWAY USER'S ACTIONS: WENT AROUND THE GATE - STOPPED.

55. Typed Name and Title | 56. Signature | 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report..." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 7/31/2023

Figure D-1. South Kalamath Street Crossing (2 of 3)

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1. Name of Reporting Railroad: BNSF Railway Company [BNSF]	1a. Alphabetic Code: BNSF	1b. Railroad Accident/Incident No.: PR0421201
2. Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): BNSF Railway Company [BNSF]	3a. Alphabetic Code: BNSF	3b. Railroad Accident/Incident No.: PR0421201
4. U.S. DOT Grade Crossing ID No.: 245394V	5. Date of Accident/Incident (month / day / year): 0 4 / 2 3 / 2021	6. Time of Accident/Incident: 1:30 AM ☑ PM ☐
7. Nearest Railroad Station: SOUTH DENVER	8. Subdivision: PIKES PEAK	9. County: DENVER
10. State: Abbr. CO — Code: 08		
11. City (If in a city): DENVER	12. Highway Name or No.: KALAMATH AVE — Public ☑ Private ☐	

Highway User Involved

13. Type: C. Truck-trailer; F. Bus; J. Other Motor Vehicle; A. Auto; D. Pick-up truck; G. School Bus; K. Pedestrian; B. Truck; E. Van; H. Motorcycle; M. Other (specify) — Code: A

14. Vehicle Speed (est. mph at impact): 25

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 1

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

21. Temperature (specify if minus): 37 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 4

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 1

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 1

26. Track Number or Name: MAIN 2 TRACK

27. FRA Track Class (1-9,X): 4

28. Number of Locomotive Units: 4

29. Number of Cars: 124

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated — 22 mph — Code: R

31. Time Table Direction: 1. North 3. East 2. South 4. West — Code: 2

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None — Code(s): 01 03 06 07

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code: 1

34. Roadway Conditions: A. Dry; B. Wet; C. Snow/Slush; D. Ice; E. Sand, Mud, Dirt, Oil, Gravel; F. Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 2

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 1

38. Highway User's Age: 24

39. Highway User's Gender: 1. Male; 2. Female — Code: 2

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 1

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	4
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 2

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $2,500

48. Total Number of Vehicle Occupants (including driver): 4

50. Total Number of People on Train (include passengers and train crew): 2

51. Is a Rail Equipment Accident / Incident Report Being Filed? 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☑ Yes ☐ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
TRAIN STRUCK VEHICLE THAT WENT AROUND THE GATES AT A GRADE CROSSING. NO HAZMAT RELEASED.

55. Typed Name and Title

56. Signature

57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report..." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (h).

FORM FRA F 6180.57 (Rev. 08/10)

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-1. South Kalamath Street Crossing (3 of 3)

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1. Name of Reporting Railroad: BNSF Railway Company [BNSF]	1a. Alphabetic Code: BNSF	1b. Railroad Accident/Incident No.: PR0519202
2. Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): BNSF Railway Company [BNSF]	3a. Alphabetic Code: BNSF	3b. Railroad Accident/Incident No.: PR0519202
4. U.S. DOT Grade Crossing ID No.: 245394V	5. Date of Accident/Incident (month / day / year): 05 / 03 / 2019	6. Time of Accident/Incident: 10:25 AM ☐ PM ☑
7. Nearest Railroad Station: SOUTH DENVER	8. Subdivision: PIKES PARK	9. County: DENVER; 10. State (Abbr.): CO; Code: 08
11. City (if in a city): DENVER	12. Highway Name or No.: KALAMATH AVE	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pickup truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: A

14. Vehicle Speed (est. mph at impact): 4

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 1

16. Position: 1. Stalled or stuck on crossing 2. Stopped on Crossing 3. Moving over crossing 4. Trapped on crossing by traffic 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any:

Rail Equipment Involved

17. Equipment: 1. Train (mult. pushg) 2. Train (mult. pushg) 3. Train (standing) 4. Car(s) (moving) 5. Car(s) (standing) 6. Light loco(s) (moving) 7. Light loco(s) (standing) 8. Other (specify) A. Train pulling- RCL B. Train pushing- RCL C. Train standing- RCL D. EMU Locomotive(s) E. DMU Locomotive(s) — Code: 1

18. Position of Car Unit in Train: 1

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 1

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

21. Temperature (specify if minus): 50 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 4

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 1

24. Type of Equipment Consist (single entry): 1. Freight Train 2. Passenger Train-Pulling 3. Commuter Train-Pulling 4. Work Train 5. Single Car 6. Cut of cars 7. Yard/Switching 8. Light loco(s) 9. Maint./Inspect. car A. Spec. MoW Equip. B. Passenger Train-Pushing C. Commuter Train-Pushing D. EMU E. DMU

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 1

26. Track Number or Name: MAIN 1 TRACK

27. FRA Track Class (1-6,X): 4

28. Number of Locomotive Units: 4

29. Number of Cars: 124

30. Consist Speed (Recorded speed if available): R. Recorded E. Estimated 4 mph — Code: E

31. Time Table Direction: 1. North 3. East 2. South 4. West — Code: 1

32. Type of Crossing Warning: 1. Gates 2. Cantilever FLS 3. Standard FLS 4. Wig wags 5. Hwy. traffic signals 6. Audible 7. Crossbucks 8. Stop signs 9. Watchman 10. Flagged by crew 11. Other (specify) 12. None

Code(s): 01 03 07

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code: 1

34. Roadway Conditions: A. Dry B. Wet C. Snow/Slush D. Ice E. Sand,Mud,Dirt,Oil,Gravel F. Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach — Code: 3

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 2

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 1

38. Highway User's Age:

39. Highway User's Gender: 1. Male 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate 2. Stopped and then proceeded 3. Did not stop 4. Stopped on crossing 5. Other (specify) 6. Went around/thru temporary barricade (If yes, see instructions) 7. Went thru the gate 8. Suicide/Attempted suicide — Code: 5

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure 2. Standing railroad equipment 3. Passing Train 4. Topography 5. Vegetation 6. Highway Vehicles 7. Other (specify) 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway Rail Crossing Users	0	0
48. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 3

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $2,500

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 2

51. Is a Rail Equipment Accident / Incident Report Being Filed? 1. Yes 2. No — Code: 2

53a. Special Study Block: Video Taken? ☑ Yes ☐ No; Video Used? ☑ Yes ☐ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary):
USER'S AGE UNKNOWN, VEHICLE WAS TRAVELING DOWN A ONE WAY STREET IN THE WRONG DIRECTION AND WAS STRUCK BY THE TRAIN. THE VEHICLE FLED THE SCENE. 40 GATES ON OPPOSITE SIDE OF APPROACH.

55. Typed Name and Title

56. Signature

57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report..." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10)

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-2. Quebec Street Southbound Frontage Road Crossing (1 of 2)

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1.Name of Reporting Railroad: Regional Transit District- Commuter [RTDC]	1a. Alphabetic Code: RTDC	1b. Railroad Accident/Incident No.: 145636
2.Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): Regional Transit District- Commuter [RTDC]	3a. Alphabetic Code: RTDC	3b. Railroad Accident/Incident No.: 145636
4. U.S. DOT Grade Crossing ID No.: 804635B	5. Date of Accident/Incident (month/day/year): 06/26/2020	6. Time of Accident/Incident: 2:27 AM ☐ PM ☑
7. Nearest Railroad Station: CENTRAL PARK	8. Subdivision: A LINE	9. County: DENVER
10. State: Abbr. CO Code 08	11. City (if in a city): DENVER	12. Highway Name or No.: QUEBEC STREET Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto B. Truck C. Truck-trailer D. Pick-up truck E. Van F. Bus G. School Bus H. Motorcycle J. Other Motor Vehicle K. Pedestrian M. Other (specify) — Code: K

14. Vehicle Speed (est. mph at Impact):

15. Direction (geographical) 1. North 2. South 3. East 4. West — Code: 1

16. Position 1. Stalled or stuck on crossing 2. Stopped on Crossing 3. Moving over crossing 4. Trapped on crossing by traffic 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

Rail Equipment Involved

17. Equipment 1. Train (units pulling) 2. Train (units pushing) 3. Train (standing) 4. Car(s) (moving) 5. Car(s) (standing) 6. Light loco(s) (moving) 7. Light loco(s) (standing) 8. Other (specify) A. Train pulling- RCL B. Train pushing- RCL C. Train standing- RCL D. EMU Locomotive(s) E. DMU Locomotive(s) — Code: D

18. Position of Car Unit in Train: 1

19. Circumstance 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 1

20b. Was there a hazardous materials release by 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

21. Temperature (specify if minus): 86 °F

22. Visibility (single entry) 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 2

23. Weather (single entry) 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 2

24. Type of Equipment Consist (single entry) 1. Freight Train 2. Passenger Train-Pulling 3. Commuter Train-Pulling 4. Work Train 5. Single Car 6. Cut of cars 7. Yard/Switching 8. Light loco(s) 9. Maint./Inspect. car A. Spec. MoW Equip. B. Passenger Train-Pushing C. Commuter Train-Pushing D. EMU E. DMU — Code: D

25. Track Type Used by Rail Equipment Involved 1. Main 2. Yard 3. Siding 4. Industry — Code: 1

26. Track Number or Name: TRACK 1

27. FRA Track Class (1-9,X): 4

28. Number of Locomotive Units: 0

29. Number of Cars: 4

30. Consist Speed (Recorded speed if available) R. Recorded E. Estimated: 48 mph — Code: R

31. Time Table Direction 1. North 2. South 3. East 4. West — Code: 1

32. Type of Crossing Warning 1. Gates 2. Cantilever FLS 3. Standard FLS 4. Wig wags 5. Hwy. traffic signals 6. Audible 7. Crossbucks 8. Stop signs 9. Watchman 10. Flagged by crew 11. Other (specify) 12. None

Code(s): 01 | 03 | 05 | 06

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code: 1

34. Roadway Conditions A. Dry B. Wet C.Snow/Slush D.Ice E. Sand,Mud,Dirt,Oil,Gravel F.Water (Standing, Moving) — Code: A

35. Location of Warning 1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals 1. Yes 2. No 3. Unknown — Code: 1

37. Crossing Illuminated by Street Lights or Special Lights 1. Yes 2. No 3. Unknown — Code: 1

38. Highway User's Age:

39. Highway User's Gender 1. Male 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train 1. Yes 2. No 3. Unknown — Code: 3

41. Highway User 1. Went around the gate 2. Stopped and then proceeded 3. Did not stop 4. Stopped on crossing 5. Other (specify) 6. Went around/thru temporary barricade (if yes, see instructions) 7. Went thru the gate 8. Suicide/Attempted suicide — Code: 1

42. Driver Passed Standing Highway Vehicle 1. Yes 2. No 3. Unknown — Code:

43. View of Track Obscured by (primary obstruction) 1. Permanent Structure 2. Standing railroad equipment 3. Passing Train 4. Topography 5. Vegetation 6. Highway Vehicles 7. Other (specify) 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	1	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was 1. Killed 2. Injured 3. Uninjured

45. Was Driver in the Vehicle? 1. Yes 2. No — Code:

47. Highway Vehicle Property Damage (est. dollar damage): $0

48. Total Number of Vehicle Occupants (including driver): 0

50. Total Number of People on Train (include passengers and train crew): 38

51. Is a Rail Equipment Accident / Incident Report Being Filed 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☑ Yes ☐ No; Video Used? ☑ Yes ☐ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
INDIVIDUAL RODE BICYCLE AROUND CROSSING WARNING DEVICES INTO THE ACTIVE CROSSING AND WAS STRUCK BY NORTHBOUND TRAIN 4058/57;4020/19, TRIP 185. AGE OF INDIVIDUAL IS UNKNOWN.

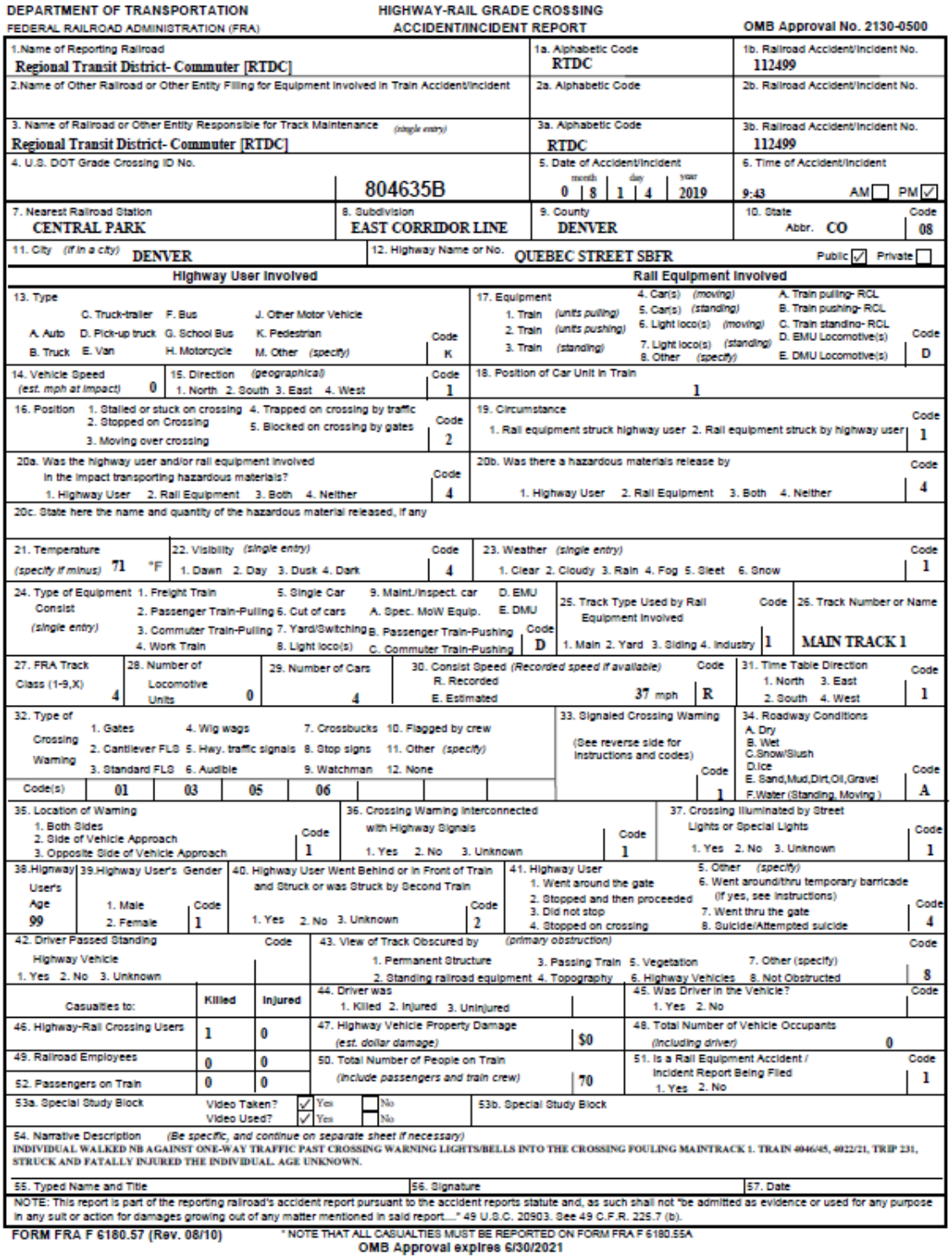
55. Typed Name and Title | 56. Signature | 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-2. Quebec Street Southbound Frontage Road Crossing (2 of 2)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1.Name of Reporting Railroad: Regional Transit District- Commuter [RTDC]	1a. Alphabetic Code: RTDC	1b. Railroad Accident/Incident No.: 112499
2.Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): Regional Transit District- Commuter [RTDC]	3a. Alphabetic Code: RTDC	3b. Railroad Accident/Incident No.: 112499
4. U.S. DOT Grade Crossing ID No.: 804635B	5. Date of Accident/Incident (month/day/year): 08/14/2019	6. Time of Accident/Incident: 9:43 AM ☐ PM ☑
7. Nearest Railroad Station: CENTRAL PARK	8. Subdivision: EAST CORRIDOR LINE	9. County: DENVER / 10. State Abbr.: CO Code: 08
11. City (if in a city): DENVER	12. Highway Name or No.: QUEBEC STREET SBFR	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: K

14. Vehicle Speed (est. mph at Impact): 0

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 1

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 2

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

21. Temperature (specify if minus): 71 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 4

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: D

27. FRA Track Class (1-9,X): 4

28. Number of Locomotive Units: 0

29. Number of Cars: 4

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated: 37 mph — Code: R

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None
Code(s): 01 03 05 06

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code: 1

34. Roadway Conditions: A. Dry; B. Wet; C.Snow/Slush; D.Ice; E. Sand,Mud,Dirt,Oil,Gravel; F.Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 1

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 1

38. Highway User's Age: 99

39. Highway User's Gender: 1. Male; 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 4

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code:

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	1	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured

45. Was Driver in the Vehicle? 1. Yes 2. No — Code:

47. Highway Vehicle Property Damage (est. dollar damage): $0

48. Total Number of Vehicle Occupants (including driver): 0

50. Total Number of People on Train (include passengers and train crew): 70

51. Is a Rail Equipment Accident / Incident Report Being Filed: 1. Yes 2. No — Code: 1

53a. Special Study Block — Video Taken? ☑ Yes ☐ No; Video Used? ☑ Yes ☐ No

53b. Special Study Block

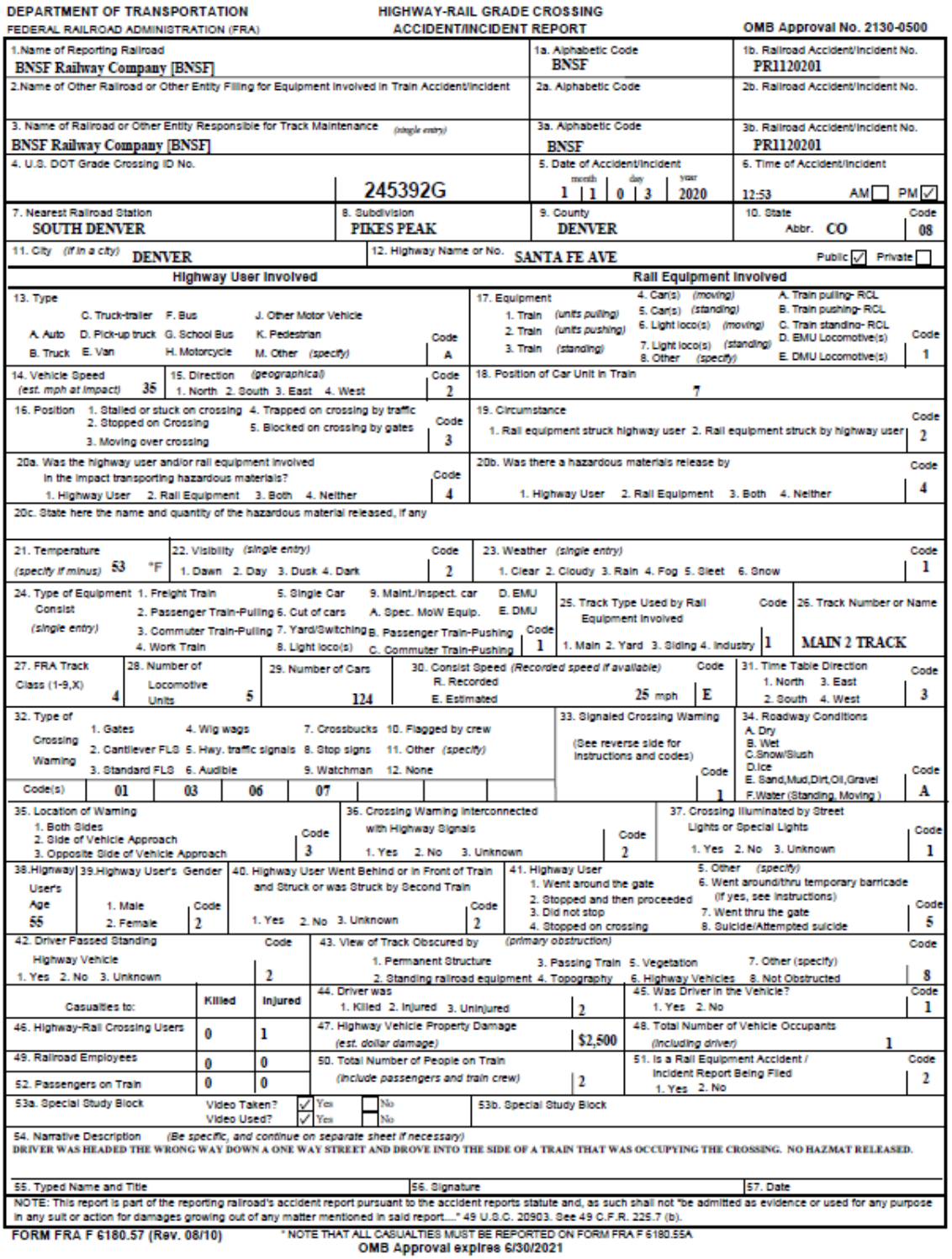
54. Narrative Description (Be specific, and continue on separate sheet if necessary)
INDIVIDUAL WALKED NB AGAINST ONE-WAY TRAFFIC PAST CROSSING WARNING LIGHTS/BELLS INTO THE CROSSING FOULING MAINTRACK 1. TRAIN 4046/45, 4022/21, TRIP 231, STRUCK AND FATALLY INJURED THE INDIVIDUAL. AGE UNKNOWN.

55. Typed Name and Title | 56. Signature | 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A
OMB Approval expires 6/30/2021

Figure D-3. South Santa Fe Drive Crossing (1 of 2)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1. Name of Reporting Railroad: BNSF Railway Company [BNSF]	1a. Alphabetic Code: BNSF	1b. Railroad Accident/Incident No.: PR1120201
2. Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): BNSF Railway Company [BNSF]	3a. Alphabetic Code: BNSF	3b. Railroad Accident/Incident No.: PR1120201
4. U.S. DOT Grade Crossing ID No.: 245392G	5. Date of Accident/Incident (month/day/year): 1 / 1 / 0 / 3 / 2020	6. Time of Accident/Incident: 12:53 AM ☐ PM ☑
7. Nearest Railroad Station: SOUTH DENVER	8. Subdivision: PIKES PEAK	9. County: DENVER
10. State Abbr.: CO Code: 08		
11. City (if in a city): DENVER	12. Highway Name or No.: SANTA FE AVE	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: A

14. Vehicle Speed (est. mph at impact): 35

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 2

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

Rail Equipment Involved

17. Equipment: 1. Train (units pulling); 2. Train (units pushing); 3. Train (standing); 4. Car(s) (moving); 5. Car(s) (standing); 6. Light loco(s) (moving); 7. Light loco(s) (standing); 8. Other (specify); A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL; D. EMU Locomotive(s); E. DMU Locomotive(s) — Code: 1

18. Position of Car Unit in Train: 7

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 2

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

21. Temperature (specify if minus): 53 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 2

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 1

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 1

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 1

26. Track Number or Name: MAIN 2 TRACK

27. FRA Track Class (1-9,X): 4

28. Number of Locomotive Units: 5

29. Number of Cars: 124

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated: 25 mph — Code: E

31. Time Table Direction: 1. North 3. East 2. South 4. West — Code: 3

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None

Code(s): 01 | 03 | 06 | 07

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code: 1

34. Roadway Conditions: A. Dry; B. Wet; C. Snow/Slush; D. Ice; E. Sand,Mud,Dirt,Oil,Gravel; F. Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 3

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 2

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 1

38. Highway User's Age: 55

39. Highway User's Gender: 1. Male; 2. Female — Code: 2

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 5

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	1
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 2

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $2,500

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 2

51. Is a Rail Equipment Accident / Incident Report Being Filed 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☑ Yes ☐ No; Video Used? ☑ Yes ☐ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
DRIVER WAS HEADED THE WRONG WAY DOWN A ONE WAY STREET AND DROVE INTO THE SIDE OF A TRAIN THAT WAS OCCUPYING THE CROSSING. NO HAZMAT RELEASED.

55. Typed Name and Title | 56. Signature | 57. Date

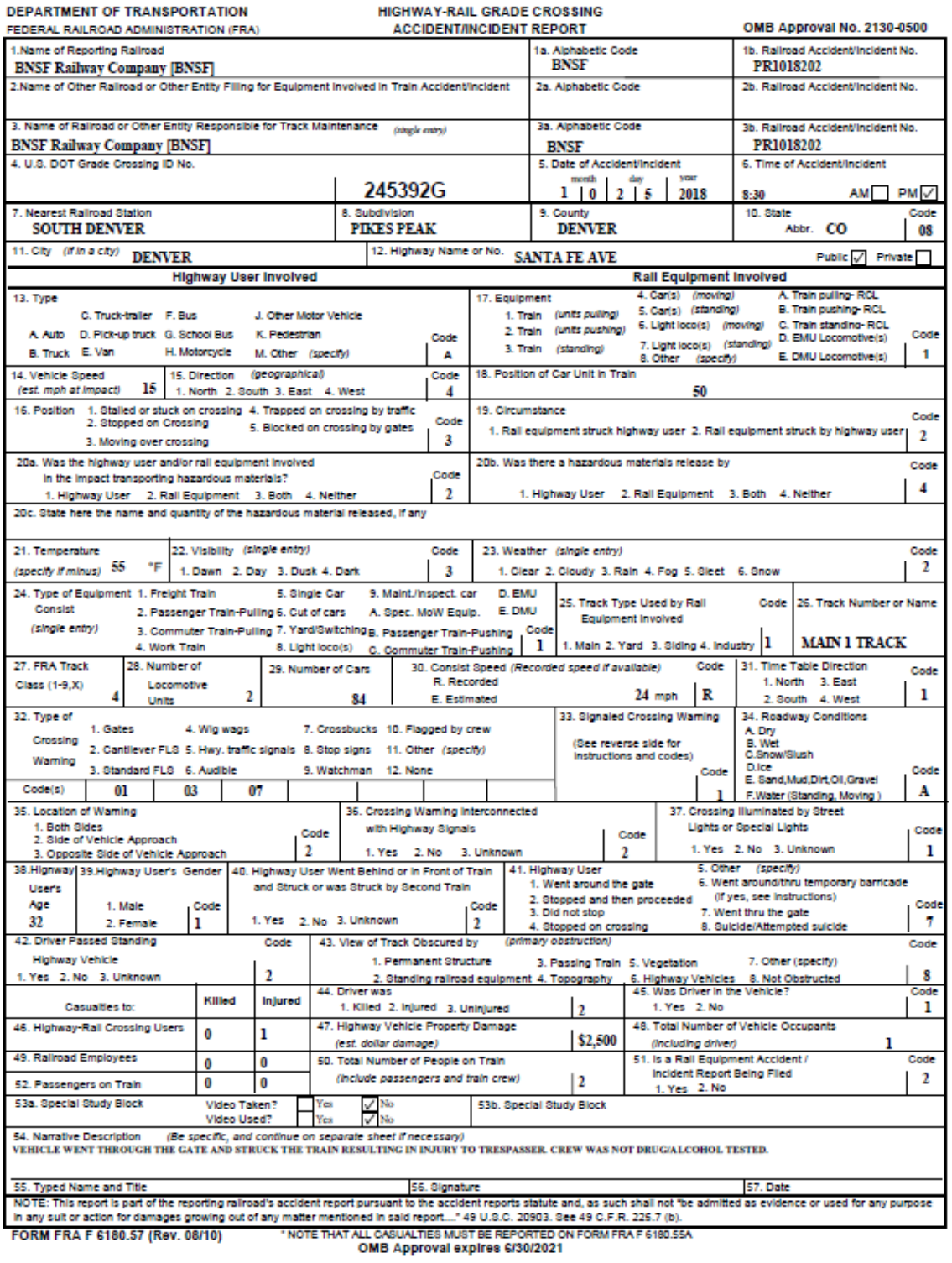
NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10)

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-3. South Santa Fe Drive Crossing (2 of 2)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1.Name of Reporting Railroad: BNSF Railway Company [BNSF]	1a. Alphabetic Code: BNSF	1b. Railroad Accident/Incident No.: PR1018202
2.Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): BNSF Railway Company [BNSF]	3a. Alphabetic Code: BNSF	3b. Railroad Accident/Incident No.: PR1018202
4. U.S. DOT Grade Crossing ID No.: 245392G	5. Date of Accident/Incident (month/day/year): 10/25/2018	6. Time of Accident/Incident: 8:30 AM ☐ PM ☑
7. Nearest Railroad Station: SOUTH DENVER	8. Subdivision: PIKES PEAK	9. County: DENVER / 10. State Abbr.: CO Code: 08
11. City (If in a city): DENVER	12. Highway Name or No.: SANTA FE AVE	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: A

14. Vehicle Speed (est. mph at impact): 15

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 4

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 2

Rail Equipment Involved

17. Equipment: 1. Train (units pulling); 2. Train (units pushing); 3. Train (standing); 4. Car(s) (moving); 5. Car(s) (standing); 6. Light loco(s) (moving); 7. Light loco(s) (standing); 8. Other (specify); A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL; D. EMU Locomotive(s); E. DMU Locomotive(s) — Code: 1

18. Position of Car Unit in Train: 50

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 2

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

21. Temperature (specify if minus): 55 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 3

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 2

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 1

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 1

26. Track Number or Name: MAIN 1 TRACK

27. FRA Track Class (1-9,X): 4

28. Number of Locomotive Units: 2

29. Number of Cars: 84

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated — 24 mph — Code: R

31. Time Table Direction: 1. North 3. East 2. South 4. West — Code: 1

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None — Code(s): 01, 03, 07

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code: 1

34. Roadway Conditions: A. Dry; B. Wet; C.Snow/Slush; D.Ice; E. Sand,Mud,Dirt,Oil,Gravel; F.Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 2

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 2

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 1

38. Highway User's Age: 32

39. Highway User's Gender: 1. Male; 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 7

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	1
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 2

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $2,500

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 2

51. Is a Rail Equipment Accident / Incident Report Being Filed: 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☐ Yes ☑ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
VEHICLE WENT THROUGH THE GATE AND STRUCK THE TRAIN RESULTING IN INJURY TO TRESPASSER. CREW WAS NOT DRUG/ALCOHOL TESTED.

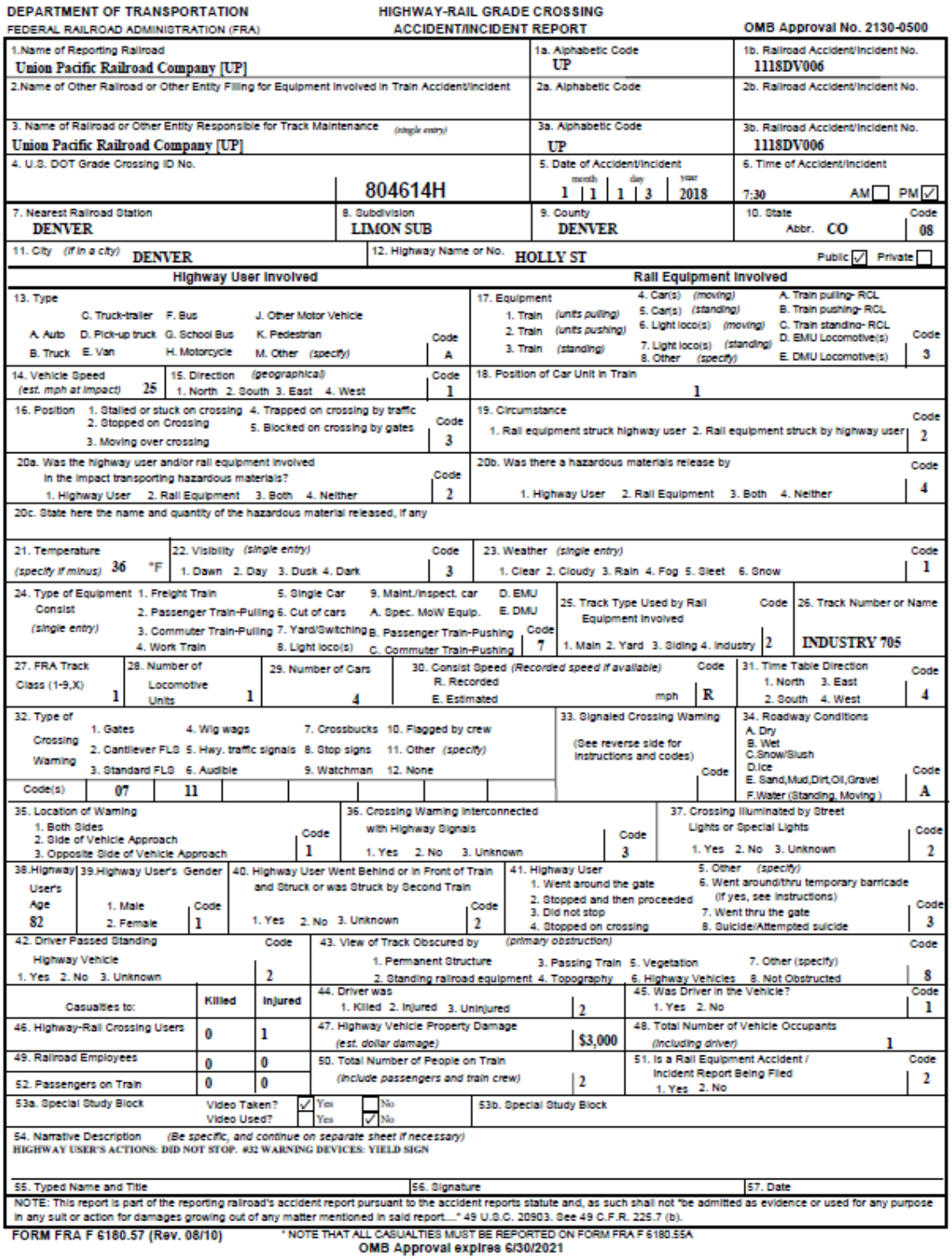
55. Typed Name and Title | 56. Signature | 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-4. Holly Street Crossing (1 of 2)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1. Name of Reporting Railroad: Union Pacific Railroad Company [UP]	1a. Alphabetic Code: UP	1b. Railroad Accident/Incident No.: 1118DV006
2. Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): Union Pacific Railroad Company [UP]	3a. Alphabetic Code: UP	3b. Railroad Accident/Incident No.: 1118DV006
4. U.S. DOT Grade Crossing ID No.: 804614H	5. Date of Accident/Incident (month/day/year): 1/1/3/2018	6. Time of Accident/Incident: 7:30 AM ☐ PM ☑
7. Nearest Railroad Station: DENVER	8. Subdivision: LIMON SUB	9. County: DENVER
10. State Abbr.: CO Code: 08		
11. City (if in a city): DENVER	12. Highway Name or No.: HOLLY ST	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: A

14. Vehicle Speed (est. mph at impact): 25

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 1

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 2

20c. State here the name and quantity of the hazardous material released, if any

Rail Equipment Involved

17. Equipment: 1. Train (units pulling); 2. Train (units pushing); 3. Train (standing); 4. Car(s) (moving); 5. Car(s) (standing); 6. Light loco(s) (moving); 7. Light loco(s) (standing); 8. Other (specify); A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL; D. EMU Locomotive(s); E. DMU Locomotive(s) — Code: 3

18. Position of Car Unit in Train: 1

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 2

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

21. Temperature (specify if minus): 36 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 3

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 1

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 7

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 2

26. Track Number or Name: INDUSTRY 705

27. FRA Track Class (1-9,X): 1	28. Number of Locomotive Units: 1	29. Number of Cars: 4	30. Consist Speed (Recorded speed if available) R. Recorded E. Estimated mph — Code: R	31. Time Table Direction: 1. North 2. South 3. East 4. West — Code: 4	

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None

Code(s): 07 11

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code:

34. Roadway Conditions: A. Dry; B. Wet; C. Snow/Slush; D. Ice; E. Sand,Mud,Dirt,Oil,Gravel; F. Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 3

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 2

38. Highway User's Age: 82

39. Highway User's Gender: 1. Male 2. Female — Code: 1

40. Highway User Went Behind or In Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 3

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	1
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 2

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $3,000

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 2

51. Is a Rail Equipment Accident / Incident Report Being Filed: 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☑ Yes ☐ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
HIGHWAY USER'S ACTIONS: DID NOT STOP. #32 WARNING DEVICES: YELLOW SIGN

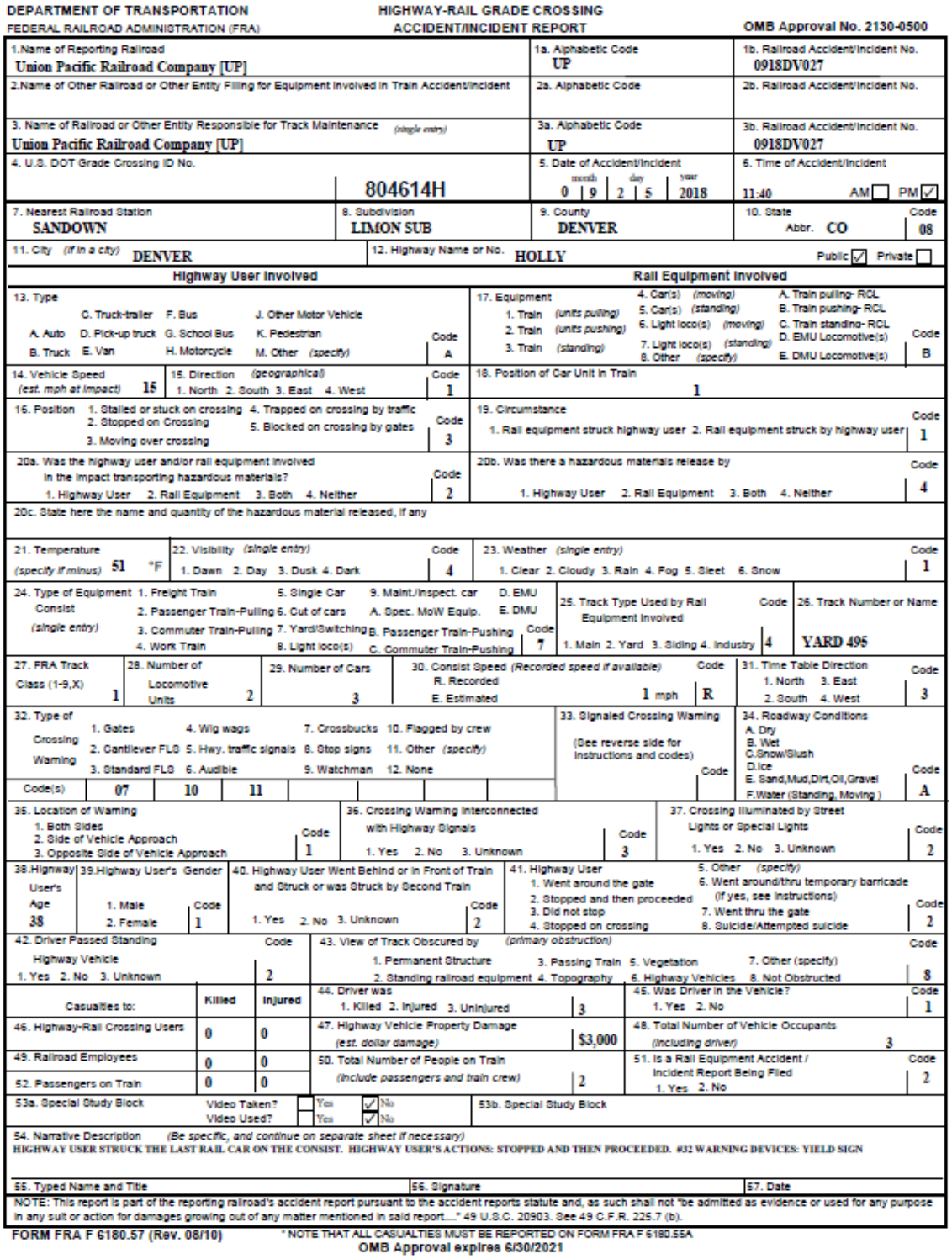
55. Typed Name and Title | 56. Signature | 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-4. Holly Street Crossing (2 of 2)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1. Name of Reporting Railroad: Union Pacific Railroad Company [UP]	1a. Alphabetic Code: UP	1b. Railroad Accident/Incident No.: 0918DV027
2. Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): Union Pacific Railroad Company [UP]	3a. Alphabetic Code: UP	3b. Railroad Accident/Incident No.: 0918DV027
4. U.S. DOT Grade Crossing ID No.: 804614H	5. Date of Accident/Incident (month/day/year): 09/25/2018	6. Time of Accident/Incident: 11:40 AM ☐ PM ☑
7. Nearest Railroad Station: SANDOWN	8. Subdivision: LIMON SUB	9. County: DENVER
10. State: Abbr. CO	Code: 08	
11. City (if in a city): DENVER	12. Highway Name or No.: HOLLY	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: A

14. Vehicle Speed (est. mph at impact): 15

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 1

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 2

20c. State here the name and quantity of the hazardous material released, if any

21. Temperature (specify if minus): 51 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 4

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 7

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 4

26. Track Number or Name: YARD 495

27. FRA Track Class (1-9,X): 1

28. Number of Locomotive Units: 2

29. Number of Cars: 3

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated — 1 mph — Code: R

31. Time Table Direction: 1. North 3. East 2. South 4. West — Code: 3

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None — Code(s): 07, 10, 11

33. Signaled Crossing Warning (See reverse side for Instructions and codes) — Code:

34. Roadway Conditions: A. Dry; B. Wet; C. Snow/Slush; D. Ice; E. Sand,Mud,Dirt,Oil,Gravel; F. Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 3

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 2

38. Highway User's Age: 38

39. Highway User's Gender: 1. Male; 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 2

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 3

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $3,000

48. Total Number of Vehicle Occupants (including driver): 3

50. Total Number of People on Train (include passengers and train crew): 2

51. Is a Rail Equipment Accident / Incident Report Being Filed: 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☐ Yes ☑ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

Rail Equipment Involved

17. Equipment: 1. Train (units pulling); 2. Train (units pushing); 3. Train (standing); 4. Car(s) (moving); 5. Car(s) (standing); 6. Light loco(s) (moving); 7. Light loco(s) (standing); 8. Other (specify); A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL; D. EMU Locomotive(s); E. DMU Locomotive(s) — Code: B

18. Position of Car Unit in Train: 1

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 1

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

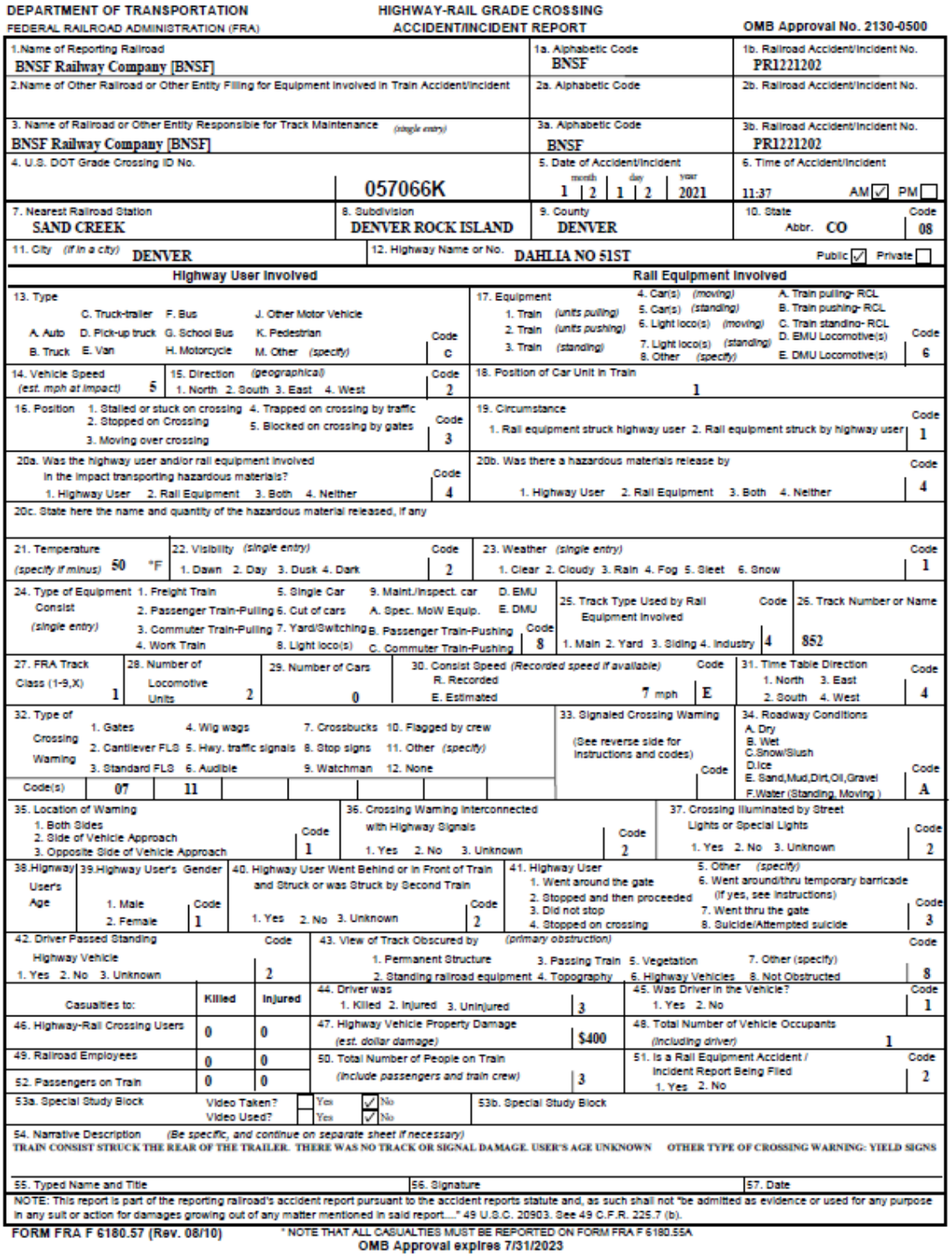
54. Narrative Description (Be specific, and continue on separate sheet if necessary)
HIGHWAY USER STRUCK THE LAST RAIL CAR ON THE CONSIST. HIGHWAY USER'S ACTIONS: STOPPED AND THEN PROCEEDED. #32 WARNING DEVICES: YIELD SIGN

55. Typed Name and Title | 56. Signature | 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A
OMB Approval expires 6/30/2021

Figure D-5. Dahlia Street North of 51st Street Crossing (1 of 1)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1.Name of Reporting Railroad: BNSF Railway Company [BNSF]	1a. Alphabetic Code: BNSF	1b. Railroad Accident/Incident No.: PR1221202
2.Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): BNSF Railway Company [BNSF]	3a. Alphabetic Code: BNSF	3b. Railroad Accident/Incident No.: PR1221202
4. U.S. DOT Grade Crossing ID No.: 057066K	5. Date of Accident/Incident (month/day/year): 1 2 / 1 2 / 2021	6. Time of Accident/Incident: 11:37 AM ☑ PM ☐
7. Nearest Railroad Station: SAND CREEK	8. Subdivision: DENVER ROCK ISLAND	9. County: DENVER
10. State: Abbr. CO — Code: 08		
11. City (if in a city): DENVER	12. Highway Name or No.: DAHLIA NO 51ST	Public ☑ Private ☐

Highway User Involved

13. Type: C. Truck-trailer; F. Bus; J. Other Motor Vehicle; A. Auto; D. Pick-up truck; G. School Bus; K. Pedestrian; B. Truck; E. Van; H. Motorcycle; M. Other (specify) — Code: C

14. Vehicle Speed (est. mph at impact): 5

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 2

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

Rail Equipment Involved

17. Equipment: 1. Train (units pulling); 2. Train (units pushing); 3. Train (standing); 4. Car(s) (moving); 5. Car(s) (standing); 6. Light loco(s) (moving); 7. Light loco(s) (standing); 8. Other (specify); A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL; D. EMU Locomotive(s); E. DMU Locomotive(s) — Code: 6

18. Position of Car Unit in Train: 1

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 1

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

21. Temperature (specify if minus): 50 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 2

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 1

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 8

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 4

26. Track Number or Name: 852

27. FRA Track Class (1-9,X): 1

28. Number of Locomotive Units: 2

29. Number of Cars: 0

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated — 7 mph — Code: E

31. Time Table Direction: 1. North 3. East 2. South 4. West — Code: 4

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None

Code(s)						
07	11					

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code:

34. Roadway Conditions: A. Dry; B. Wet; C. Snow/Slush; D. Ice; E. Sand,Mud,Dirt,Oil,Gravel; F. Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 2

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 2

38. Highway User's Age:

39. Highway User's Gender: 1. Male; 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 3

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 3

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $400

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 3

51. Is a Rail Equipment Accident / Incident Report Being Filed 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☐ Yes ☑ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
TRAIN CONSIST STRUCK THE REAR OF THE TRAILER. THERE WAS NO TRACK OR SIGNAL DAMAGE. USER'S AGE UNKNOWN OTHER TYPE OF CROSSING WARNING: YIELD SIGNS

55. Typed Name and Title

56. Signature

57. Date

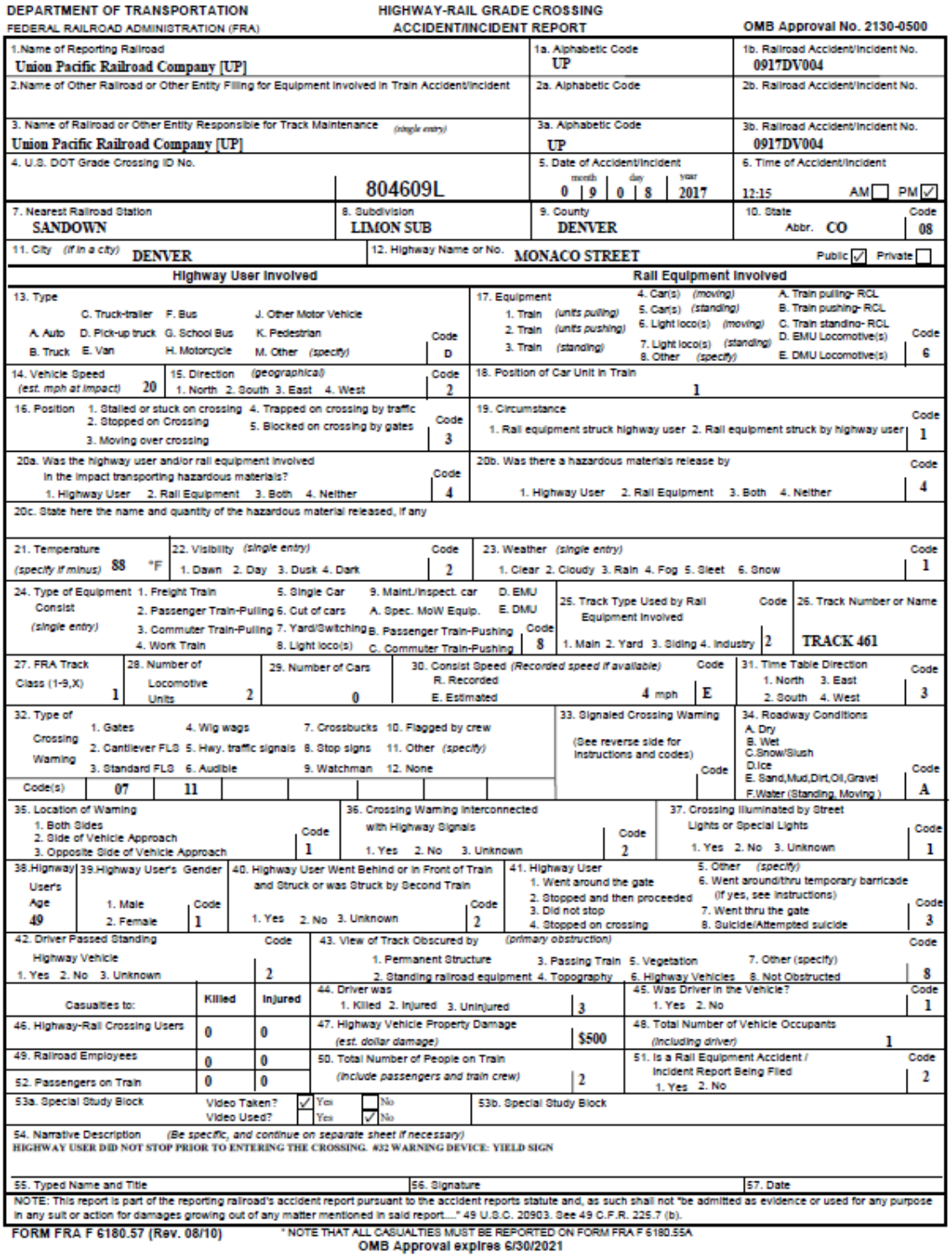
NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10)

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 7/31/2023

Figure D-6. Monaco Street Crossing (1 of 1)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1. Name of Reporting Railroad: Union Pacific Railroad Company [UP]	1a. Alphabetic Code: UP	1b. Railroad Accident/Incident No.: 0917DV004
2. Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): Union Pacific Railroad Company [UP]	3a. Alphabetic Code: UP	3b. Railroad Accident/Incident No.: 0917DV004
4. U.S. DOT Grade Crossing ID No.: 804609L	5. Date of Accident/Incident (month/day/year): 09/08/2017	6. Time of Accident/Incident: 12:15 AM ☐ PM ☑
7. Nearest Railroad Station: SANDOWN	8. Subdivision: LIMON SUB	9. County: DENVER — 10. State Abbr.: CO — Code: 08
11. City (if in a city): DENVER	12. Highway Name or No.: MONACO STREET	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: D

14. Vehicle Speed (est. mph at impact): 20

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 2

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

Rail Equipment Involved

17. Equipment: 1. Train (units pulling); 2. Train (units pushing); 3. Train (standing); 4. Car(s) (moving); 5. Car(s) (standing); 6. Light loco(s) (moving); 7. Light loco(s) (standing); 8. Other (specify); A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL; D. EMU Locomotive(s); E. DMU Locomotive(s) — Code: 6

18. Position of Car Unit in Train: 1

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 1

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

21. Temperature (specify if minus): 88 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 2

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 1

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 8

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 2

26. Track Number or Name: TRACK 461

27. FRA Track Class (1-9,X): 1

28. Number of Locomotive Units: 2

29. Number of Cars: 0

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated — 4 mph — Code: E

31. Time Table Direction: 1. North 3. East 2. South 4. West — Code: 3

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None
Code(s): 07; 11

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code:

34. Roadway Conditions: A. Dry; B. Wet; C. Snow/Slush; D. Ice; E. Sand,Mud,Dirt,Oil,Gravel; F. Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 2

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 1

38. Highway User's Age: 49

39. Highway User's Gender: 1. Male 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 3

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 3

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $500

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 2

51. Is a Rail Equipment Accident / Incident Report Being Filed: 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☑ Yes ☐ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

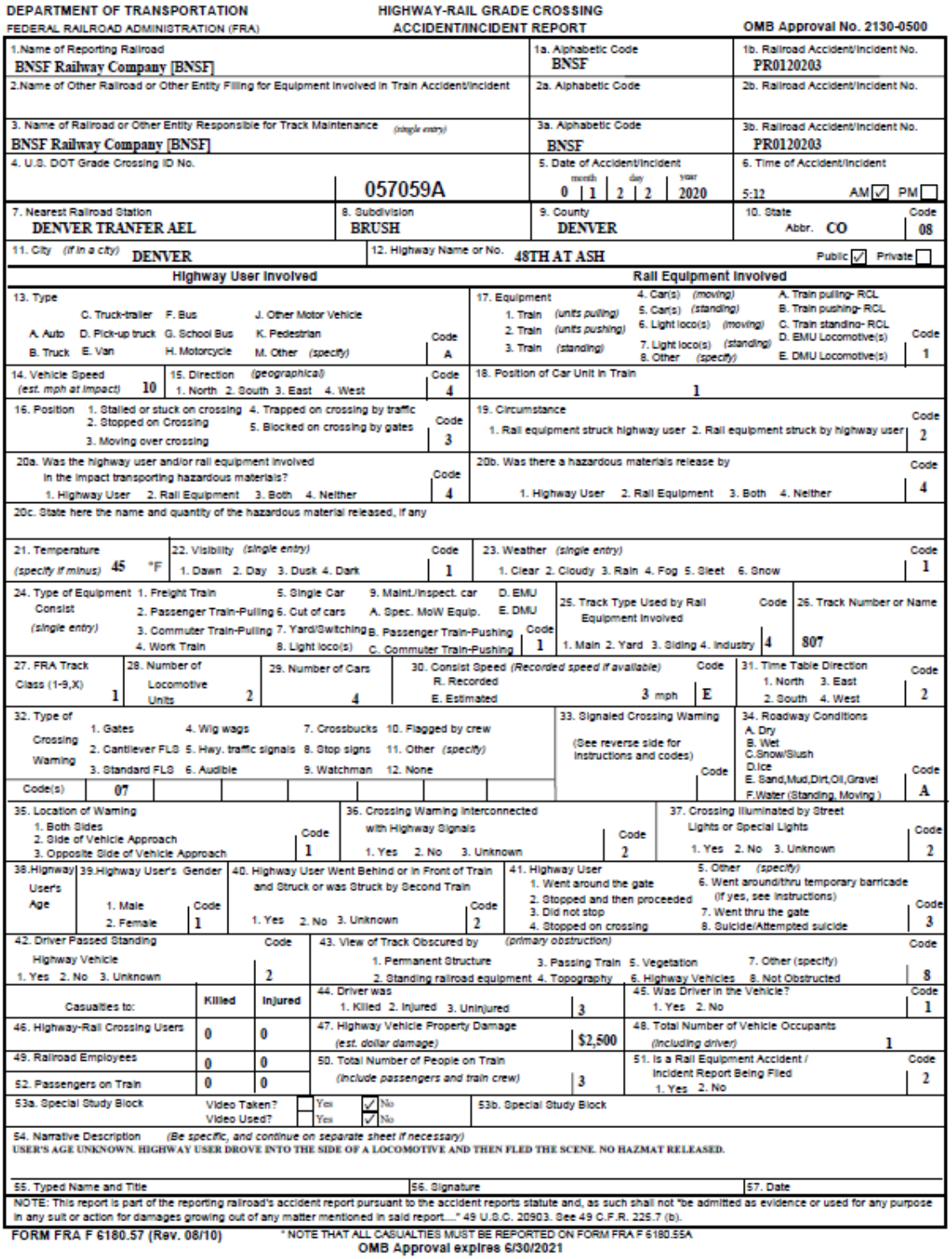
54. Narrative Description (Be specific, and continue on separate sheet if necessary)
HIGHWAY USER DID NOT STOP PRIOR TO ENTERING THE CROSSING. #32 WARNING DEVICE: YIELD SIGN

55. Typed Name and Title — 56. Signature — 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A
OMB Approval expires 6/30/2021

Figure D-7. East 48th Avenue at Ash Street Crossing (1 of 1)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1. Name of Reporting Railroad: BNSF Railway Company [BNSF]	1a. Alphabetic Code: BNSF	1b. Railroad Accident/Incident No.: PR0120203
2. Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): BNSF Railway Company [BNSF]	3a. Alphabetic Code: BNSF	3b. Railroad Accident/Incident No.: PR0120203
4. U.S. DOT Grade Crossing ID No.: 057059A	5. Date of Accident/Incident (month/day/year): 01/22/2020	6. Time of Accident/Incident: 5:12 AM ☑ PM ☐
7. Nearest Railroad Station: DENVER TRANFER AEL	8. Subdivision: BRUSH	9. County: DENVER; 10. State Abbr.: CO; Code: 08
11. City (if in a city): DENVER	12. Highway Name or No.: 48TH AT ASH	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: A

14. Vehicle Speed (est. mph at impact): 10

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 4

16. Position: 1. Stalled or stuck on crossing 2. Stopped on Crossing 3. Moving over crossing 4. Trapped on crossing by traffic 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

Rail Equipment Involved

17. Equipment: 1. Train (units pulling); 2. Train (units pushing); 3. Train (standing); 4. Car(s) (moving); 5. Car(s) (standing); 6. Light loco(s) (moving); 7. Light loco(s) (standing); 8. Other (specify); A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL; D. EMU Locomotive(s); E. DMU Locomotive(s) — Code: 1

18. Position of Car Unit in Train: 1

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 2

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

21. Temperature (specify if minus): 45 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 1

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 1

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 1

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 4

26. Track Number or Name: 807

27. FRA Track Class (1-9,X): 1

28. Number of Locomotive Units: 2

29. Number of Cars: 4

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated: 3 mph — Code: E

31. Time Table Direction: 1. North 3. East 2. South 4. West — Code: 2

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None — Code(s): 07

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code:

34. Roadway Conditions: A. Dry; B. Wet; C. Snow/Slush; D. Ice; E. Sand,Mud,Dirt,Oil,Gravel; F. Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 2

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 2

38. Highway User's Age:

39. Highway User's Gender: 1. Male; 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 3

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 3

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $2,500

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 3

51. Is a Rail Equipment Accident / Incident Report Being Filed: 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☐ Yes ☑ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
USER'S AGE UNKNOWN. HIGHWAY USER DROVE INTO THE SIDE OF A LOCOMOTIVE AND THEN FLED THE SCENE. NO HAZMAT RELEASED.

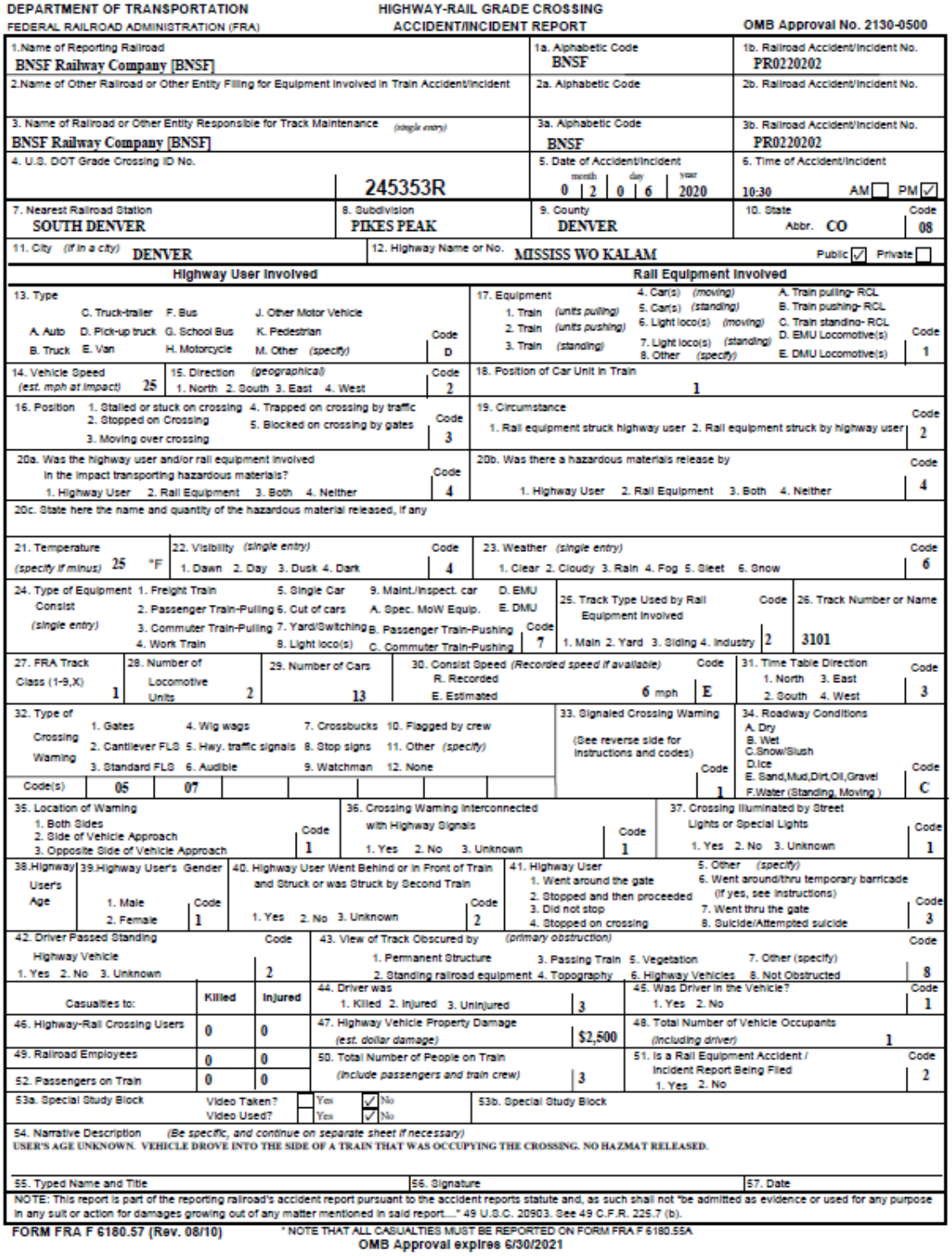
55. Typed Name and Title | 56. Signature | 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-8. West Mississippi Avenue Crossing (1 of 1)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1.Name of Reporting Railroad: BNSF Railway Company [BNSF]	1a. Alphabetic Code: BNSF	1b. Railroad Accident/Incident No.: PR0220202
2.Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): BNSF Railway Company [BNSF]	3a. Alphabetic Code: BNSF	3b. Railroad Accident/Incident No.: PR0220202
4. U.S. DOT Grade Crossing ID No.: 245353R	5. Date of Accident/Incident (month/day/year): 0 2 / 0 6 / 2020	6. Time of Accident/Incident: 10:30 AM ☐ PM ☑
7. Nearest Railroad Station: SOUTH DENVER	8. Subdivision: PIKES PEAK	9. County: DENVER
10. State: Abbr. CO — Code: 08		
11. City (if in a city): DENVER	12. Highway Name or No.: MISSISS WO KALAM	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: D

14. Vehicle Speed (est. mph at impact): 25

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 2

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

Rail Equipment Involved

17. Equipment: 1. Train (units pulling); 2. Train (units pushing); 3. Train (standing); 4. Car(s) (moving); 5. Car(s) (standing); 6. Light loco(s) (moving); 7. Light loco(s) (standing); 8. Other (specify); A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL; D. EMU Locomotive(s); E. DMU Locomotive(s) — Code: 1

18. Position of Car Unit in Train: 1

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 2

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

21. Temperature (specify if minus): 25 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 4

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 6

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 7

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 2

26. Track Number or Name: 3101

27. FRA Track Class (1-9,X): 1

28. Number of Locomotive Units: 2

29. Number of Cars: 13

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated — 6 mph — Code: E

31. Time Table Direction: 1. North 3. East 2. South 4. West — Code: 3

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None

Code(s): 05 | 07

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code: 1

34. Roadway Conditions: A. Dry; B. Wet; C.Snow/Slush; D.Ice; E. Sand,Mud,Dirt,Oil,Gravel; F.Water (Standing, Moving) — Code: C

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 1

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 1

38. Highway User's Age:

39. Highway User's Gender: 1. Male; 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 3

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 3

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $2,500

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 3

51. Is a Rail Equipment Accident / Incident Report Being Filed 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☐ Yes ☑ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
USER'S AGE UNKNOWN. VEHICLE DROVE INTO THE SIDE OF A TRAIN THAT WAS OCCUPYING THE CROSSING. NO HAZMAT RELEASED.

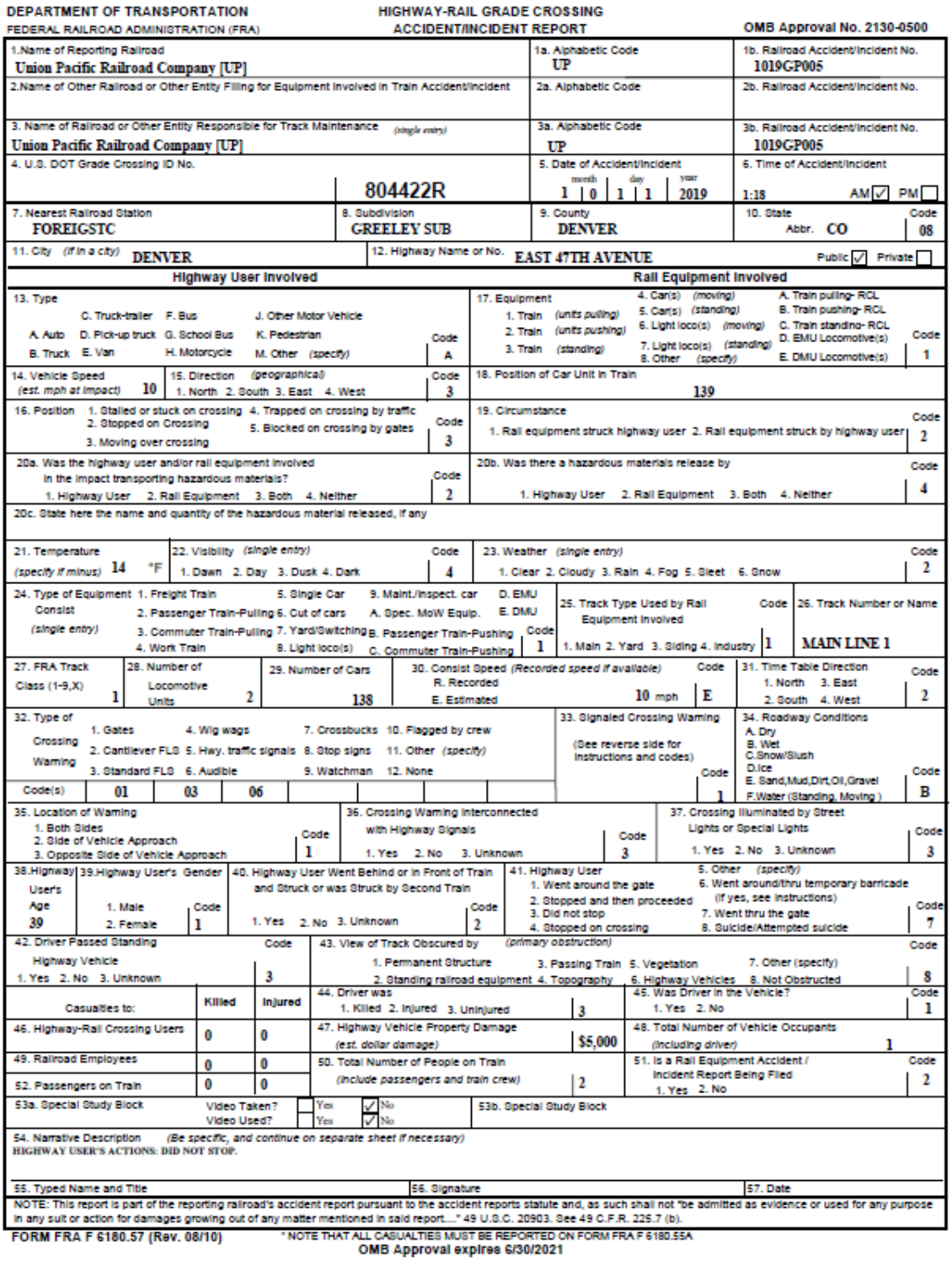
55. Typed Name and Title | 56. Signature | 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-9. East 47th Avenue and York Street Crossing (1 of 1)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1. Name of Reporting Railroad: Union Pacific Railroad Company [UP]	1a. Alphabetic Code: UP	1b. Railroad Accident/Incident No.: 1019GP005
2. Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): Union Pacific Railroad Company [UP]	3a. Alphabetic Code: UP	3b. Railroad Accident/Incident No.: 1019GP005
4. U.S. DOT Grade Crossing ID No.: 804422R	5. Date of Accident/Incident (month/day/year): 1 / 0 / 1 / 1 / 2019	6. Time of Accident/Incident: 1:18 AM ☑ PM ☐
7. Nearest Railroad Station: FOREIGSTC	8. Subdivision: GREELEY SUB	9. County: DENVER
10. State Abbr.: CO Code: 08		
11. City (if in a city): DENVER	12. Highway Name or No.: EAST 47TH AVENUE	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: A

14. Vehicle Speed (est. mph at impact): 10

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 3

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 2

Rail Equipment Involved

17. Equipment: 1. Train (units pulling); 2. Train (units pushing); 3. Train (standing); 4. Car(s) (moving); 5. Car(s) (standing); 6. Light loco(s) (moving); 7. Light loco(s) (standing); 8. Other (specify); A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL; D. EMU Locomotive(s); E. DMU Locomotive(s) — Code: 1

18. Position of Car Unit in Train: 139

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 2

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

21. Temperature (specify if minus): 14 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 4

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 2

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 1

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 1

26. Track Number or Name: MAIN LINE 1

27. FRA Track Class (1-9,X): 1

28. Number of Locomotive Units: 2

29. Number of Cars: 138

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated — 10 mph — Code: E

31. Time Table Direction: 1. North 2. East 3. South 4. West — Code: 2

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None — Code(s): 01, 03, 06

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code: 1

34. Roadway Conditions: A. Dry; B. Wet; C. Snow/Slush; D. Ice; E. Sand,Mud,Dirt,Oil,Gravel; F. Water (Standing, Moving) — Code: B

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 3

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 3

38. Highway User's Age: 39

39. Highway User's Gender: 1. Male; 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 7

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 3

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 3

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $5,000

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 2

51. Is a Rail Equipment Accident / Incident Report Being Filed: 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☐ Yes ☑ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
HIGHWAY USER'S ACTIONS: DID NOT STOP.

55. Typed Name and Title | 56. Signature | 57. Date

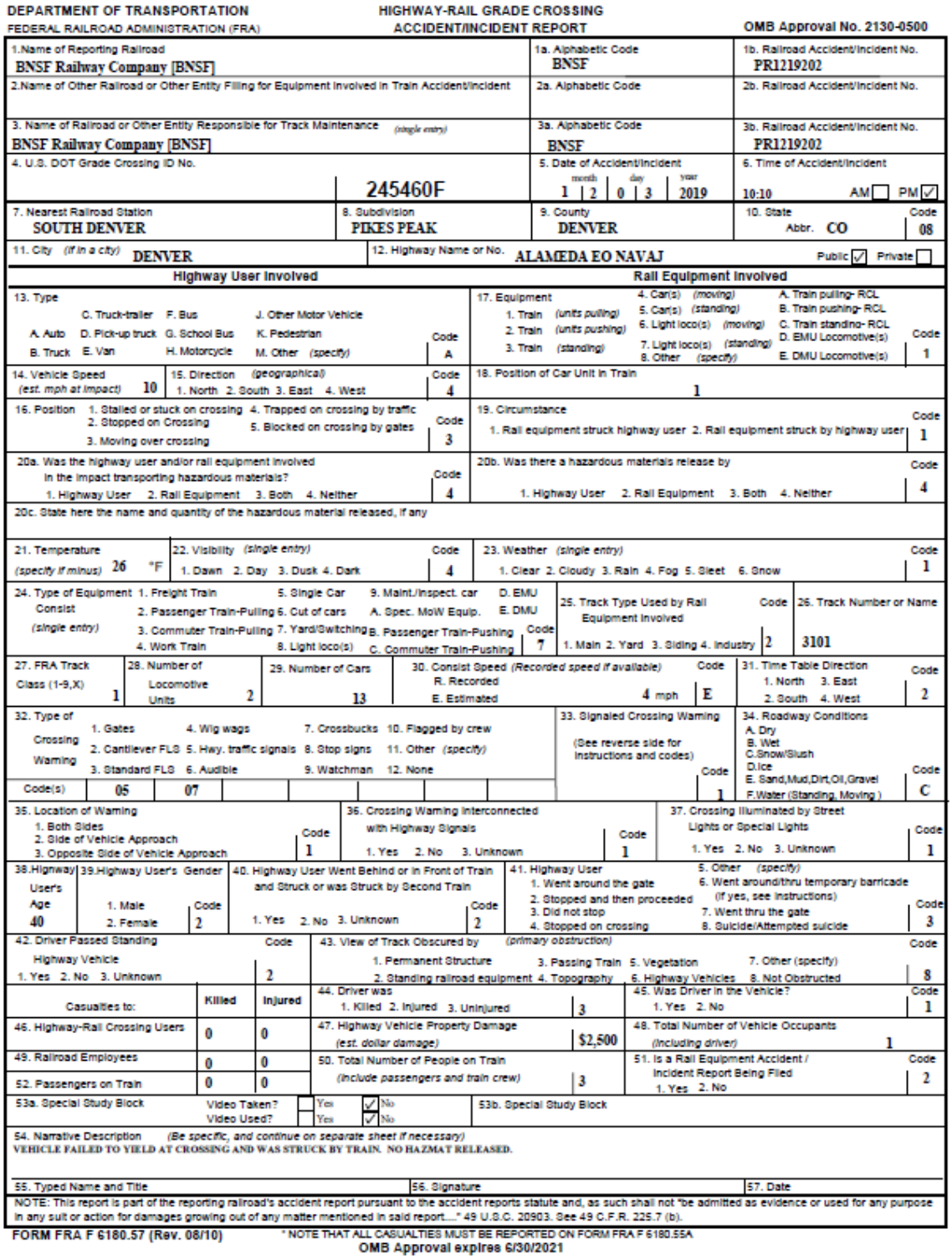
NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10)

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-10. Alameda Avenue Crossing (1 of 1)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1.Name of Reporting Railroad: BNSF Railway Company [BNSF]	1a. Alphabetic Code: BNSF	1b. Railroad Accident/Incident No.: PR1219202
2.Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): BNSF Railway Company [BNSF]	3a. Alphabetic Code: BNSF	3b. Railroad Accident/Incident No.: PR1219202
4. U.S. DOT Grade Crossing ID No.: 245460F	5. Date of Accident/Incident (month/day/year): 1 2 / 0 3 / 2019	6. Time of Accident/Incident: 10:10 AM ☐ PM ☑
7. Nearest Railroad Station: SOUTH DENVER	8. Subdivision: PIKES PEAK	9. County: DENVER / 10. State Abbr.: CO Code: 08
11. City (if in a city): DENVER	12. Highway Name or No.: ALAMEDA EO NAVAJ	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: A

14. Vehicle Speed (est. mph at impact): 10

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 4

16. Position: 1. Stalled or stuck on crossing; 2. Stopped on Crossing; 3. Moving over crossing; 4. Trapped on crossing by traffic; 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

Rail Equipment Involved

17. Equipment: 1. Train (units pulling); 2. Train (units pushing); 3. Train (standing); 4. Car(s) (moving); 5. Car(s) (standing); 6. Light loco(s) (moving); 7. Light loco(s) (standing); 8. Other (specify); A. Train pulling- RCL; B. Train pushing- RCL; C. Train standing- RCL; D. EMU Locomotive(s); E. DMU Locomotive(s) — Code: 1

18. Position of Car Unit in Train: 1

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 1

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

21. Temperature (specify if minus): 26 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 4

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 1

24. Type of Equipment Consist (single entry): 1. Freight Train; 2. Passenger Train-Pulling; 3. Commuter Train-Pulling; 4. Work Train; 5. Single Car; 6. Cut of cars; 7. Yard/Switching; 8. Light loco(s); 9. Maint./Inspect. car; A. Spec. MoW Equip.; B. Passenger Train-Pushing; C. Commuter Train-Pushing; D. EMU; E. DMU — Code: 7

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 2

26. Track Number or Name: 3101

27. FRA Track Class (1-9,X): 1

28. Number of Locomotive Units: 2

29. Number of Cars: 13

30. Consist Speed (Recorded speed if available): R. Recorded; E. Estimated — 4 mph — Code: E

31. Time Table Direction: 1. North 3. East 2. South 4. West — Code: 2

32. Type of Crossing Warning: 1. Gates; 2. Cantilever FLS; 3. Standard FLS; 4. Wig wags; 5. Hwy. traffic signals; 6. Audible; 7. Crossbucks; 8. Stop signs; 9. Watchman; 10. Flagged by crew; 11. Other (specify); 12. None
Code(s): 05 | 07

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code: 1

34. Roadway Conditions: A. Dry; B. Wet; C.Snow/Slush; D.Ice; E. Sand,Mud,Dirt,Oil,Gravel; F.Water (Standing, Moving) — Code: C

35. Location of Warning: 1. Both Sides; 2. Side of Vehicle Approach; 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 1

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 1

38. Highway User's Age: 40

39. Highway User's Gender: 1. Male 2. Female — Code: 2

40. Highway User Went Behind or In Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate; 2. Stopped and then proceeded; 3. Did not stop; 4. Stopped on crossing; 5. Other (specify); 6. Went around/thru temporary barricade (if yes, see instructions); 7. Went thru the gate; 8. Suicide/Attempted suicide — Code: 3

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure; 2. Standing railroad equipment; 3. Passing Train; 4. Topography; 5. Vegetation; 6. Highway Vehicles; 7. Other (specify); 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 3

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $2,500

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 3

51. Is a Rail Equipment Accident / Incident Report Being Filed: 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☐ Yes ☑ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
VEHICLE FAILED TO YIELD AT CROSSING AND WAS STRUCK BY TRAIN. NO HAZMAT RELEASED.

55. Typed Name and Title | 56. Signature | 57. Date

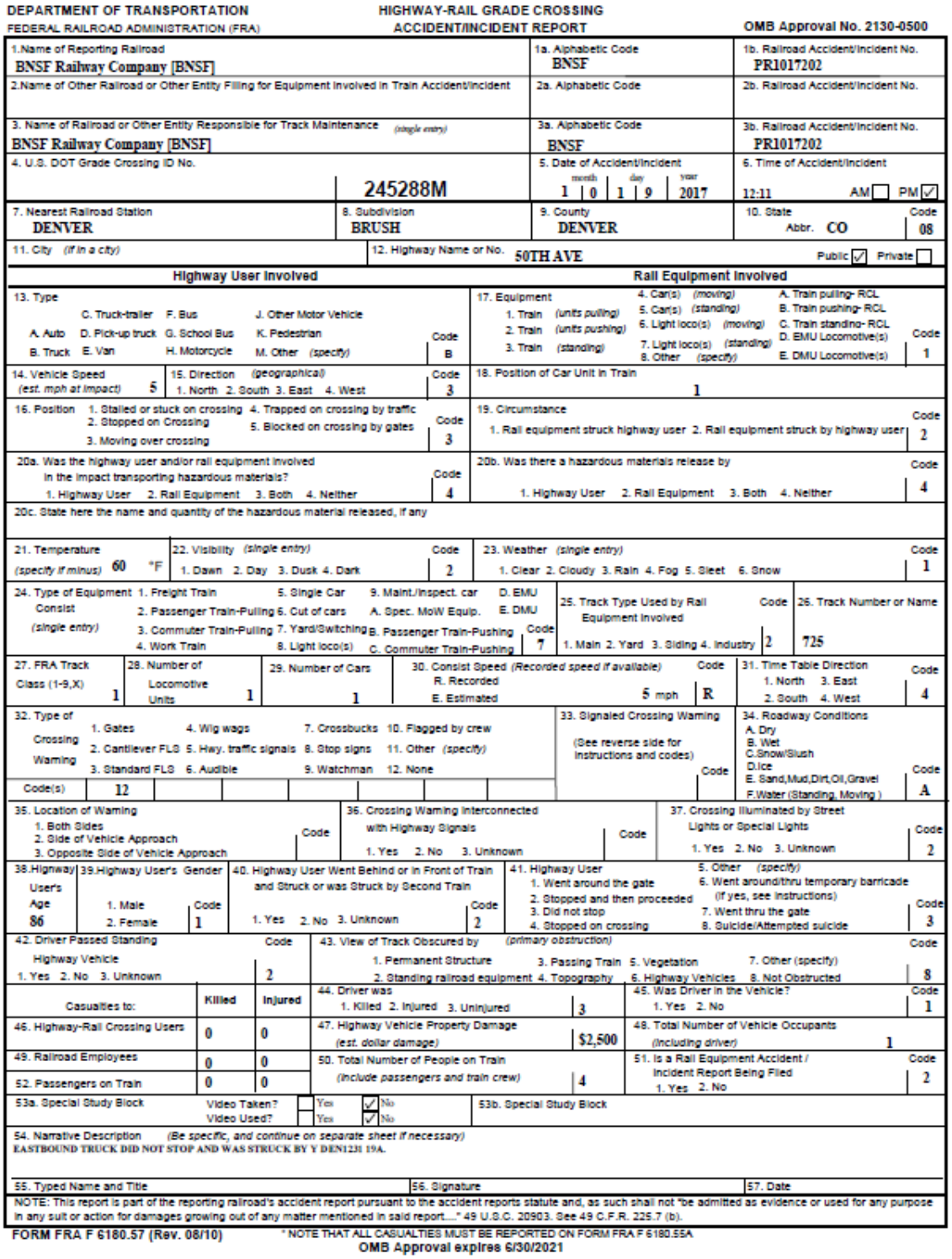
NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10)

* NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-11. East 50th Avenue Crossing (1 of 1)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1.Name of Reporting Railroad: BNSF Railway Company [BNSF]	1a. Alphabetic Code: BNSF	1b. Railroad Accident/Incident No.: PR1017202
2.Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): BNSF Railway Company [BNSF]	3a. Alphabetic Code: BNSF	3b. Railroad Accident/Incident No.: PR1017202
4. U.S. DOT Grade Crossing ID No.: 245288M	5. Date of Accident/Incident (month/day/year): 10/19/2017	6. Time of Accident/Incident: 12:11 AM ☐ PM ☑
7. Nearest Railroad Station: DENVER	8. Subdivision: BRUSH	9. County: DENVER; 10. State Abbr.: CO; Code: 08
11. City (if in a city)	12. Highway Name or No.: 50TH AVE	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto; B. Truck; C. Truck-trailer; D. Pick-up truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (specify) — Code: B

14. Vehicle Speed (est. mph at impact): 5

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 3

16. Position: 1. Stalled or stuck on crossing 2. Stopped on Crossing 3. Moving over crossing 4. Trapped on crossing by traffic 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

21. Temperature (specify if minus): 60 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 2

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 1

24. Type of Consist (single entry): 1. Freight Train 2. Passenger Train-Pulling 3. Commuter Train-Pulling 4. Work Train 5. Single Car 6. Cut of cars 7. Yard/Switching 8. Light loco(s) 9. Maint./Inspect. car A. Spec. MoW Equip. B. Passenger Train-Pushing C. Commuter Train-Pushing D. EMU E. DMU — Code: 7

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 2

26. Track Number or Name: 725

27. FRA Track Class (1-9,X): 1

28. Number of Locomotive Units: 1

29. Number of Cars: 1

30. Consist Speed (Recorded speed if available): R. Recorded E. Estimated — 5 mph — Code: R

31. Time Table Direction: 1. North 2. South 3. East 4. West — Code: 4

32. Type of Crossing Warning: 1. Gates 2. Cantilever FLS 3. Standard FLS 4. Wig wags 5. Hwy. traffic signals 6. Audible 7. Crossbucks 8. Stop signs 9. Watchman 10. Flagged by crew 11. Other (specify) 12. None — Code(s): 12

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code:

34. Roadway Conditions: A. Dry B. Wet C.Snow/Slush D.Ice E. Sand,Mud,Dirt,Oil,Gravel F.Water (Standing, Moving) — Code: A

35. Location of Warning: 1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach — Code:

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code:

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 2

38. Highway User's Age: 86

39. Highway User's Gender: 1. Male 2. Female — Code: 1

40. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate 2. Stopped and then proceeded 3. Did not stop 4. Stopped on crossing 5. Other (specify) 6. Went around/thru temporary barricade (if yes, see instructions) 7. Went thru the gate 8. Suicide/Attempted suicide — Code: 3

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure 2. Standing railroad equipment 3. Passing Train 4. Topography 5. Vegetation 6. Highway Vehicles 7. Other (specify) 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 3

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $2,500

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 4

51. Is a Rail Equipment Accident / Incident Report Being Filed? 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☐ Yes ☑ No; Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
EASTBOUND TRUCK DID NOT STOP AND WAS STRUCK BY Y DEN1231 19A.

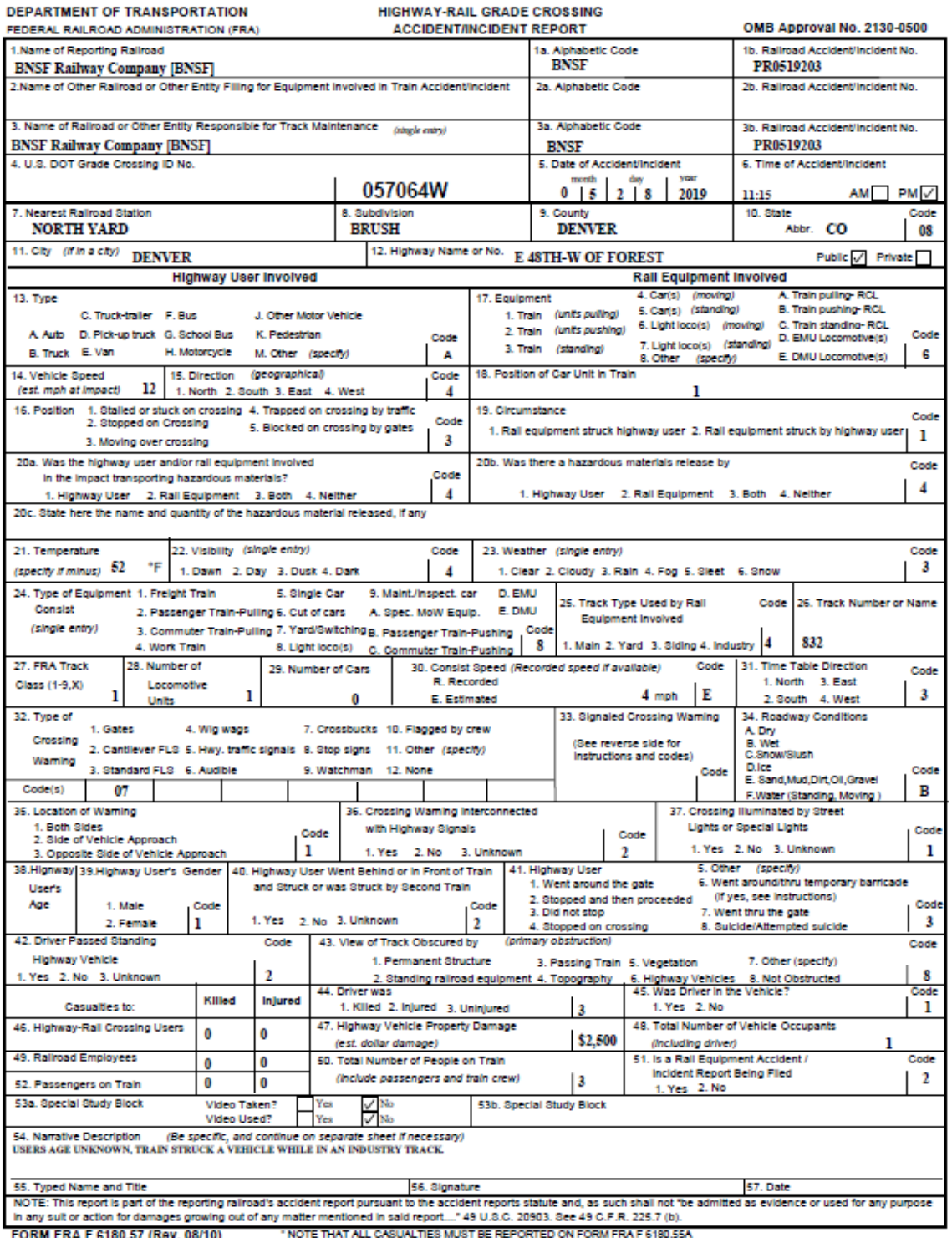
55. Typed Name and Title | 56. Signature | 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A

OMB Approval expires 6/30/2021

Figure D-12. 48th Avenue, West of Forest Street Crossing (1 of 1)



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

OMB Approval No. 2130-0500

1.Name of Reporting Railroad: BNSF Railway Company [BNSF]	1a. Alphabetic Code: BNSF	1b. Railroad Accident/Incident No.: PR0519203
2.Name of Other Railroad or Other Entity Filing for Equipment Involved in Train Accident/Incident	2a. Alphabetic Code	2b. Railroad Accident/Incident No.
3. Name of Railroad or Other Entity Responsible for Track Maintenance (single entry): BNSF Railway Company [BNSF]	3a. Alphabetic Code: BNSF	3b. Railroad Accident/Incident No.: PR0519203
4. U.S. DOT Grade Crossing ID No.: 057064W	5. Date of Accident/Incident: month 0 5 / day 2 8 / year 2019	6. Time of Accident/Incident: 11:15 AM ☐ PM ☑
7. Nearest Railroad Station: NORTH YARD	8. Subdivision: BRUSH	9. County: DENVER / 10. State Abbr.: CO Code: 08
11. City (if in a city): DENVER	12. Highway Name or No.: E 48TH-W OF FOREST	Public ☑ Private ☐

Highway User Involved

13. Type: A. Auto B. Truck C. Truck-trailer D. Pick-up truck E. Van F. Bus G. School Bus H. Motorcycle J. Other Motor Vehicle K. Pedestrian M. Other (specify) — Code: A

14. Vehicle Speed (est. mph at Impact): 12

15. Direction (geographical): 1. North 2. South 3. East 4. West — Code: 4

16. Position: 1. Stalled or stuck on crossing 2. Stopped on Crossing 3. Moving over crossing 4. Trapped on crossing by traffic 5. Blocked on crossing by gates — Code: 3

20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

Rail Equipment Involved

17. Equipment: 1. Train (units pulling) 2. Train (units pushing) 3. Train (standing) 4. Car(s) (moving) 5. Car(s) (standing) 6. Light loco(s) (moving) 7. Light loco(s) (standing) 8. Other (specify) — A. Train pulling- RCL B. Train pushing- RCL C. Train standing- RCL D. EMU Locomotive(s) E. DMU Locomotive(s) — Code: 6

18. Position of Car Unit in Train: 1

19. Circumstance: 1. Rail equipment struck highway user 2. Rail equipment struck by highway user — Code: 1

20b. Was there a hazardous materials release by: 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: 4

20c. State here the name and quantity of the hazardous material released, if any

21. Temperature (specify if minus): 52 °F

22. Visibility (single entry): 1. Dawn 2. Day 3. Dusk 4. Dark — Code: 4

23. Weather (single entry): 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — Code: 3

24. Type of Equipment Consist (single entry): 1. Freight Train 2. Passenger Train-Pulling 3. Commuter Train-Pulling 4. Work Train 5. Single Car 6. Cut of cars 7. Yard/Switching 8. Light loco(s) 9. Maint./Inspect. car A. Spec. MoW Equip. B. Passenger Train-Pushing C. Commuter Train-Pushing D. EMU E. DMU — Code: 8

25. Track Type Used by Rail Equipment Involved: 1. Main 2. Yard 3. Siding 4. Industry — Code: 4

26. Track Number or Name: 832

27. FRA Track Class (1-9,X): 1

28. Number of Locomotive Units: 1

29. Number of Cars: 0

30. Consist Speed (Recorded speed if available): R. Recorded E. Estimated — 4 mph — Code: E

31. Time Table Direction: 1. North 2. East 3. South 4. West — Code: 3

32. Type of Crossing Warning: 1. Gates 2. Cantilever FLS 3. Standard FLS 4. Wig wags 5. Hwy. traffic signals 6. Audible 7. Crossbucks 8. Stop signs 9. Watchman 10. Flagged by crew 11. Other (specify) 12. None — Code(s): 07

33. Signaled Crossing Warning (See reverse side for instructions and codes) — Code:

34. Roadway Conditions: A. Dry B. Wet C.Snow/Slush D.Ice E. Sand,Mud,Dirt,Oil,Gravel F.Water (Standing, Moving) — Code: B

35. Location of Warning: 1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach — Code: 1

36. Crossing Warning Interconnected with Highway Signals: 1. Yes 2. No 3. Unknown — Code: 2

37. Crossing Illuminated by Street Lights or Special Lights: 1. Yes 2. No 3. Unknown — Code: 1

38. Highway User's Age:

39. Highway User's Gender: 1. Male 2. Female — Code: 1

40. Highway User Went Behind or In Front of Train and Struck or was Struck by Second Train: 1. Yes 2. No 3. Unknown — Code: 2

41. Highway User: 1. Went around the gate 2. Stopped and then proceeded 3. Did not stop 4. Stopped on crossing 5. Other (specify) 6. Went around/thru temporary barricade (if yes, see instructions) 7. Went thru the gate 8. Suicide/Attempted suicide — Code: 3

42. Driver Passed Standing Highway Vehicle: 1. Yes 2. No 3. Unknown — Code: 2

43. View of Track Obscured by (primary obstruction): 1. Permanent Structure 2. Standing railroad equipment 3. Passing Train 4. Topography 5. Vegetation 6. Highway Vehicles 7. Other (specify) 8. Not Obstructed — Code: 8

Casualties to:	Killed	Injured
46. Highway-Rail Crossing Users	0	0
49. Railroad Employees	0	0
52. Passengers on Train	0	0

44. Driver was: 1. Killed 2. Injured 3. Uninjured — 3

45. Was Driver in the Vehicle? 1. Yes 2. No — Code: 1

47. Highway Vehicle Property Damage (est. dollar damage): $2,500

48. Total Number of Vehicle Occupants (including driver): 1

50. Total Number of People on Train (include passengers and train crew): 3

51. Is a Rail Equipment Accident / Incident Report Being Filed: 1. Yes 2. No — Code: 2

53a. Special Study Block — Video Taken? ☐ Yes ☑ No — Video Used? ☐ Yes ☑ No

53b. Special Study Block

54. Narrative Description (Be specific, and continue on separate sheet if necessary)
USERS AGE UNKNOWN, TRAIN STRUCK A VEHICLE WHILE IN AN INDUSTRY TRACK.

55. Typed Name and Title | 56. Signature | 57. Date

NOTE: This report is part of the reporting railroad's accident report pursuant to the accident reports statute and, as such shall not "be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in said report...." 49 U.S.C. 20903. See 49 C.F.R. 225.7 (b).

FORM FRA F 6180.57 (Rev. 08/10) * NOTE THAT ALL CASUALTIES MUST BE REPORTED ON FORM FRA F 6180.55A
OMB Approval expires 6/30/2021

APPENDIX E. RAIL CROSSING RISK REGISTER AND MENU OF COSTS

Denver Freight Railroad Safety Risk Study and Analysis

CCD Project Risk Register

Draft Template

Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
BNSF - SOUTH KALAMATH STREET	30	3	**1**	**33%**	**50%**	**42%**	*Action*	1. Near Term	Extend median, add pavement markings on all quadrants, add warning lights, blank-out signs, relocate signs, raise curb, and repair asphalt.
RTDC - QUEBEC STREET SOUTHBOUND FRONTAGE ROAD	40	2	**2**	**25%**	**10%**	**18%**	*Action*	1. Near Term	Add pavement markings, move traffic signal to the north side of the rail crossing, add fencing, and add preemption to traffic signal at crossing.
BNSF - SOUTH SANTA FE DRIVE	30	2	**3**	**23%**	**155%**	**89%**	*Action*	1. Near Term	Extend median, add pavement markings on all quadrants, add warning lights, blank-out signs, no-right turn signs, relocate signs, raise curb, and repair asphalt.
UPRR - HOLLY STREET	10	2	**4**	**20%**	**0%**	**10%**	*Action*	1. Near Term	*Add pavement markings on main street as well as on the industry road, add warning lights, blank-out signs, relocate signs, raise curb, repair asphalt, and a two-quadrant gate system.*
BNSF - DAHLIA STREET NORTH OF 51ST STREET	10	1	**5**	**10%**	**0%**	**5%**	*Opportunity*	3. Mid-Term	*Add pavement markings, add warning lights, add two-quadrant gate system.*
BNSF - ALAMEDA AVENUE	10	1	**6**	**4%**	**1%**	**3%**	*Opportunity*	3. Mid-Term	*Add four quadrant gates, add median, add pavement markings, add warning lights and bells, add pedestrian gates, and ROW fencing.*
UPRR - MONACO STREET	10	1	**7**	**4%**	**0%**	**2%**	*Opportunity*	3. Mid-Term	*Add pavement markings, add warning lights, add two-quadrant gate system.*

Denver Freight Railroad Safety Risk Study and Analysis

CCD Project Risk Register

Draft Template

Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
BNSF – WEST MISSISSIPPI AVENUE	10	1	**8**	**3%**	**0%**	**2%**	*Opportunity*	3. Mid-Term	*Add median, add pavement markings on all quadrants, add warning lights, blank-out signs, no-right turn signs, relocate signs, raise curb, repair asphalt, and a two-quadrant gate system.*
BNSF – EAST 48TH AVENUE AT ASH STREET	10	1	**9**	**3%**	**0%**	**2%**	*Opportunity*	3. Mid-Term	*Add median, add pavement markings on all quadrants, add warning lights, blank-out signs, no-right turn signs, relocate signs, raise curb, repair asphalt, and a two-quadrant gate system.*
BNSF - 48TH AVENUE, WEST OF FOREST STREET	10	1	**10**	**3%**	**0%**	**1%**	*Opportunity*	3. Mid-Term	*Add two quadrant gates, pavement markings, warning lights, and signage.*
BNSF – EAST 50TH AVENUE	10	1	**11**	**3%**	**0%**	**1%**	*Opportunity*	3. Mid-Term	*Add two quadrant gates, pavement markings, warning lights, and signage.*
UPRR – EAST 47TH AVENUE AND YORK STREET	20	1	**12**	**2%**	**7%**	**4%**	*Opportunity*	3. Mid-Term	*Add four quadrant gates, fencing along ROW, Wrong-Way sign on York Ln., extend median, add pavement markings, add warning lights, add pedestrian gate, and relocate signs.*
RTDC - QUEBEC STREET NORTHBOUND FRONTAGE ROAD	40	0	**13**	**7%**	**10%**	**9%**	*Decision*	2. Far-Term	*Add: 4 quad*
UPRR - SANTA FE DRIVE	25	0	**14**	**4%**	**5%**	**4%**	*Opportunity*	3. Far-Term	*Add: 4 quad*
BNSF - WEST 13TH AVENUE	30	0	**15**	**4%**	**28%**	**16%**	*Concern*	1. Near Term	*Add: 4 quad*

Denver Freight Railroad Safety Risk Study and Analysis

CCD Project Risk Register

Draft Template

Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
UPRR - KALAMATH STREET	10	0	**16**	**4%**	**3%**	**3%**	*Opportunity*	3. Far-Term	*Add: 4 quad*
UPRR - BRIGHTON BOULEVARD	10	0	**17**	**3%**	**5%**	**4%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
BNSF - WALNUT STREET	20	0	**18**	**3%**	**7%**	**5%**	*Opportunity*	3. Far-Term	*Add: 4 quad*
BNSF - WEST BAYAUD AVENUE	30	0	**19**	**3%**	**7%**	**5%**	*Opportunity*	3. Far-Term	*Add: 4 quad*
UPRR - WEST 1ST AVENUE	10	0	**20**	**3%**	**2%**	**2%**	*Opportunity*	3. Far-Term	*Add: 4 quad*
UPRR - WEST 3RD AVENUE	10	0	**21**	**3%**	**1%**	**2%**	*Opportunity*	3. Far-Term	*Add: 4 quad*
UPRR - IRONTON STREET	10	0	**22**	**2%**	**11%**	**7%**	*Opportunity*	2. Mid-Term	*Add: Flashing lights*
UPRR - BRIGHTON BOULEVARD	10	0	**23**	**2%**	**5%**	**3%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
UPRR - BRIGHTON BOULEVARD	10	0	**24**	**2%**	**5%**	**3%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
UPRR - 47TH AVENUE	10	0	**25**	**2%**	**10%**	**6%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
BNSF – WEST COLFAX AVENUE	30	0	**26**	**2%**	**2%**	**2%**	*Opportunity*	3. Far-Term	*Add: 4 quad*

Denver Freight Railroad Safety Risk Study and Analysis

CCD Project Risk Register

Draft Template

Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
UPRR - HAVANA STREET	10	0	**27**	**2%**	**9%**	**6%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
UPRR - 47TH AVENUE	10	0	**28**	**2%**	**8%**	**5%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
UPRR - HAVANA STREET	10	0	**29**	**2%**	**8%**	**5%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
UPRR - 47TH AVENUE	10	0	**30**	**2%**	**7%**	**5%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
UPRR - KINGSTON STREET	10	0	**31**	**2%**	**6%**	**4%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
UPRR - 45TH AVENUE	5	0	**32**	**2%**	**6%**	**4%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
UPRR - YORK STREET	15	0	**33**	**2%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
RTDC - HAVANA STREET	40	0	**34**	**2%**	**11%**	**6%**	*Opportunity*	3. Far-Term	*Add: 4 quad - 60' medians*
UPRR - ONEIDA STREET	10	0	**35**	**2%**	**3%**	**2%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
UPRR - 36TH STREET	10	0	**36**	**1%**	**2%**	**2%**	*Opportunity*	3. Far-Term	*Add: Flashing lights*
RTDC - MONACO STREET	40	0	**37**	**1%**	**5%**	**3%**	*Opportunity*	3. Far-Term	*Add: 4 quad - 60' medians*

Denver Freight Railroad Safety Risk Study and Analysis

CCD Project Risk Register

Draft Template

Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
UPRR - 39TH AVENUE	10	0	**38**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
RTDC - HOLLY STREET	40	0	**39**	**1%**	**3%**	**2%**	*Opportunity*	3. Far-Term	*Add: 4 quad - 60' medians*
RTDC - STEELE STREET	20	0	**40**	**1%**	**4%**	**3%**	*Opportunity*	3. Far-Term	*Add: 4 quad - 60' medians*
RTDC - DAHLIA STREET	40	0	**41**	**1%**	**9%**	**5%**	*Opportunity*	3. Far-Term	*Add: 4 quad - 60' medians*
UPRR - 42ND AVENUE	10	0	**42**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 42ND AVENUE	10	0	**43**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - 44TH STREET	10	0	**44**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - JOSEPHINE STREET	20	0	**45**	**1%**	**0%**	**1%**	*No Threat*	3. Far-Term	*None*

Denver Freight Railroad Safety Risk Study and Analysis

CCD Project Risk Register

Draft Template

Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
RTDC - ULSTER STREET	40	0	**46**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
BNSF - EVANS AVENUE	10	0	**47**	**1%**	**0%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - 46TH AVENUE	10	0	**48**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
RTDC - CLAYTON STREET	20	0	**49**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - SANDOWN ROAD	10	0	**50**	**1%**	**0%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - KALAMATH STREET	10	0	**51**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - KEARNEY STREET	10	0	**52**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*

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Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
BNSF - W FLORIDA AVENUE	10	0	**53**	**1%**	**0%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 47TH AVENUE	10	0	**54**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - LIMA STREET	10	0	**55**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - SANDOWN ROAD	10	0	**56**	**1%**	**0%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - 51ST AVENUE	10	0	**57**	**1%**	**1%**	**1%**	*No Threat*	3. Far-Term	*None*
BNSF - JEWELL AVENUE	10	0	**58**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - DENARGO STREET	10	0	**59**	**1%**	**0%**	**1%**	*No Threat*	3. Far-Term	*None*

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CCD Project Risk Register

Draft Template

Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
UPRR - JASON STREET	10	0	**60**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - 37TH AVENUE	10	0	**61**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - DAHLIA STREET AT 47TH AVENUE	10	0	**62**	**1%**	**0%**	**1%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 53RD AVENUE	10	0	**63**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 45TH AVENUE	10	0	**64**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - JASON STREET NORTH OF MISSISSIPPI AVENUE	10	0	**65**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 53RD AVENUE	10	0	**66**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*

Denver Freight Railroad Safety Risk Study and Analysis

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Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
UPRR - MOLINE STREET	10	0	**67**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - 45TH AVENUE	10	0	**68**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 37TH AVENUE	10	0	**69**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - 37TH AVENUE	10	0	**70**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 45TH AVENUE	10	0	**71**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - JOLIET STREET	10	0	**72**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 55TH AVENUE	10	0	**73**	**1%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*

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Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
BNSF - COLORADO BOULEVARD SOUTH OF 50TH AVENUE	10	0	**74**	**0%**	**1%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - WARNER PLACE	10	0	**75**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 40TH AVENUE	10	0	**76**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - WASHINGTON STREET	10	0	**77**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF – BROADWAY -AT EAST 48TH AVENUE	10	0	**78**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - QUEBEC STREET FRONTAGE	10	0	**79**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - UMATILLA NORTH OF 13TH AVENUE	10	0	**80**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*

Denver Freight Railroad Safety Risk Study and Analysis

CCD Project Risk Register

Draft Template

Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
BNSF - LOUISANA EAST OF LIPAN STREET	10	0	**81**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - 51ST EAST OF LOGAN STREET	10	0	**82**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - WEST BAYAUD AVENUE	10	0	**83**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - WEST NEVADA PLACE	10	0	**84**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - WEST ALASKA PLACE	10	0	**85**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - WEST CUSTER PLACE	10	0	**86**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 53RD AVENUE	10	0	**87**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*

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Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
BNSF - FOREST STREET NORTH OF E	10	0	**88**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - LIPAN STREET VIRGINIA AVENUE	10	0	**89**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - BYERS PLACE NAVAJO STREET	10	0	**90**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - LINCOLN STREET NORTH	10	0	**91**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 55TH AVENUE	10	0	**92**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - 50TH AVENUE AT EUDORA STREET	10	0	**93**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - WEST MAPLE AVENUE	10	0	**94**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*

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Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
UPRR - SHOSHONE STREET	10	0	**95**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - RIO COURT	10	0	**96**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 53RD AVENUE	10	0	**97**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - NATIONAL WESTERN DRIVE	10	0	**98**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - 50TH AVENUE WEST OF ASH STREET	10	0	**99**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 49TH AVENUE	10	0	**100**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
UPRR - EAST 35TH PLACE	10	0	**101**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*

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Risk Criteria			
Rating Rank	GradeDec Rating	CDOT Rating	Haz Index Rating
Very High	> 20%	> 20%	> 20%
High	14% - 20%	14% - 20%	14% - 20%
Medium	8% - 13%	8% - 13%	8% - 13%
Low	2% - 7%	2% - 7%	2% - 7%
Very Low	<= 1%	<= 1%	<= 1%

Time Horizon	
Near Term	< 1 Year
Mid Term	1 - 5 Years
Far Term	> 5 Years

Crossing Location	Speeds	Accidents	Top Risks Rank	GradeDec Incident Rating	CDOT Hazard Rating	Average Hazard Index Rating	Risk Type	Time Horizon	Risk Response Plan (Mitigation Strategy) Short Term (What can we do here and now?)
BNSF - 48TH AVENUE WEST OF MONROE STREET	10	0	**102**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - EAST 50TH AVENUE	10	0	**103**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*
BNSF - EAST 50TH AVENUE	10	0	**104**	**0%**	**0%**	**0%**	*No Threat*	3. Far-Term	*None*

Source: HNTB, 2023
Note: Data was compiled from information collected from the FRA GradeDec.Net analysis

High-Level Estimated Crossing Improvement Costs

TRAFFIC CONTROL SYSTEMS		
Audible / Visual Warnings		
"No Left Turn" Signal	LS	$ 20,000
Warning Lights	LS	$ 25,000
Relocate bells lower on cantilever	LS	$ 20,000
Blank Out Sign	LS	$ 5,000
Exit Signals / Gate	EA	$ 175,000
Pre-Signals / Queue-Cutter Signals	EA	$ 125,000
Preemption	N/A	Location Specific
Detection	N/A	Location Specific

SITE IMPROVEMENTS		
Remove Obstructions		
Trim & Maintain Vegetation	LS	$ 5,000
Remove/lower platform wall	LS	$ 20,000
Crossing Geometry		
Realign Intersection	LS	$ 1,500,000
Roadway Pavement Repair / Resurface		
Reprofile Road Crossing	LS	$120,000
Resurface Roadway/restripe	LS	$ 220,000
Replace/raise curb/repair asphalt	LS	$ 30,000
Pedestrian Pavement Repair / Resurface		
Widen walkway	LS	$ 25,000
Minor grading	LS	$ 20,000
Replace track panel rubber filler / Patch asphalt voids	LS	$ 10,000
Add tactile warning mats/strips	LS	$ 5,000
Illumination		
Add Street Lights	LS	$ 20,000
Safety Barriers		
SGL TK Approach Embankment w/Retaining Wall-High Impact Barrier	LF	$ 5,129
DBL TK Embankment w/Retaining Wall-High Impact Barrier	LF	$ 9,424
Extend Median	LS	$ 25,000

SITE IMPROVEMENTS		
Signage & Striping		
Add pavement markings	LS	$ 10,000
Add pavement striping	LS	$ 10,000
Add signs	LS	$ 5,000
Add convex mirror	LS	$ 5,000
Remove pavement striping/marking	LS	$ 5,000
Relocate signs	LS	$ 5,000
Add Wayfinding Signage	LS	$ 5,000
Remove platform tactile warning strip & add curb	LS	$ 20,000
Add HiViz LED Crosswalk Lighting	LS	$ 25,000
Fencing / Railing / Channelization		
Extend/Add cable/picket fencing	LS	$ 8,000
Add "No Pedestrian" tubular railing	LS	$ 5,000
Upgrade pedestrian channelization railing	LS	$ 50,000
Intertrack Fencing / ROW Fencing	LF	$ 25
Pedestrian Gates with Emergency Exit Gates	PAIR	$ 50,000
Driveway Closures	N/A	$ -

OTHER STRATEGIES / METHODS TO ENHANCE SAFETY		
Upgrade to Quiet Zone Ready	LS	$ 750,000
Grade Crossing Closure	LS	$ 125,000

- **Minor crossing upgrades - $175,000 (est.)**
- **Full Grade Separation - $100m (est.)**
- **Crash Barrier Protection (per 100') - $5,130 (per LF) (est.)**
- **Track Separation (Trench) - $2.5b (per 20-mile, est.)**

APPENDIX F. DENVER TRESPASSING RECORDS

Incident Date	Railroad	Age Group	CASFATAL	Railroad Class	AM/ PM	Event	Injury	NARR1	phyactdesc	LATITUDE	LONGITUDE
4/18/2021	UP	20-29	Non-Fatal	Class 1	PM	Assaulted by other	Cut/laceration/abrasion, injuries to multiple body part of relatively equal severity.		Walking	39.803849	-104.962583
3/20/2021	RTDC	Unknown	Fatal	Class 3	AM	Struck by on-track equipment	Fatally injured, injuries to multiple body part of relatively equal severity.	SOUTHBOUND TRAIN 4051/52, 4061/62, TRIP 244, STRUCK AND FATALLY INJURED A TRESPASSER JUST NORTH OF THE NORTHBOUND QUEBEC STREET CROSSINGON TRACK 2, MP 5.9. CASE CURRENTLY UNDER INVESTIGATION. AGE UNKNOWN	Standing	39.771819	-104.90207
1/17/2021	UP	30-39	Fatal	Class 1	PM	Aggravated pre-existing condition	Fatally injured, internal injuries.		Laying	39.737787	-105.010188
12/2/2020	UP	40-59	Fatal	Class 1	AM	Aggravated pre-existing condition	Fatally injured, internal injuries.		Lying down	39.71438	-104.99926
9/26/2020	RTDC	40-59	Fatal	Class 3	AM	Struck by on-track equipment	Fatally injured, injuries to multiple body part of relatively equal severity.	SOUTHBOUND TRAIN 4003/04, 4029/30, TRIP 114 STRUCK AND FATALLY INJURED A TRESPASSER UNDER THE SAND CREEK BRIDGE, MP 6.74. CASE CURRENTLY UNDER INVESTIGATION.	Lying down	39.77132	-104.88564
8/15/2020	BNSF	40-59	Fatal	Class 1	AM	Stabbing, knifing, etc.	Fatally injured, injuries to multiple body part of relatively equal severity.	TRESPASSER STABBED BNSF POLICE OFFICER WITH A KNIFE. TRESPASSER WAS FATALLY INJURED.	Using, other	39.778551	-104.976865
6/26/2020	RTDC	60+	Fatal	Class 3	PM	Highway-rail collision/impact	Fatally injured, injuries to multiple body part of relatively equal severity.	INDIVIDUAL RODE BICYCLE AROUND CROSSING WARNING DEVICES INTO ACTIVE CROSSING AND WAS STRUCK BY NORTHBOUND TRAIN 4058/57, 4020/19, TRIP 185. INDIVIDUAL AGE IS UNKNOWN.	Riding	39.772035	-104.903477
4/6/2020	RTDC	60+	Non-Fatal	Class 3	AM	Slipped, fell, stumbled, other	Bruise/contusion, injuries to multiple body part of relatively equal severity.	TRESPASSER CLIMBED ONTO THE OUTSIDE OF THE END OF SOUTHBOUND TRAIN 4014 AND FELL OFF WHILE THE TRAIN WAS TRAVELLING.	Standing	39.771876	-104.902321
1/13/2020	UP	30-39	Non-Fatal	Class 1	AM	Rubbed, abraded, etc.	Cut/laceration/abrasion, hand.		Standing	39.769262	-104.975984
10/12/2019	RTDZ	40-59	Fatal	Class 3	AM	Struck by on-track equipment	Fatally injured, unspecified	PEDESTRIAN/TRESPASSER ASSISTING IN PUSHING/PULLING GROCERY CART OVER CROSSING/TRACKS; CART BECAME STUCK ON UP TRACKS WHEN DEVICES ACTIVATED. ONE TRESPASSER EXITED TO WEST, THE FATALITY RAN TO THE EAST AND IN FRONT OF THE LIGHT-RAIL TRAIN. DOA BY DENVER PARAMEDICS.	Jumping onto	39.7147	-104.9968
10/7/2019	RTDC	Unknown	Non-Fatal	Class 3	PM	Electrical shock due to contact with 3rd rail, catenary, pantograph	Electrical shock/burn, injuries to multiple body part of relatively equal severity.	INDIVIDUAL (AGE UNKNOWN) WAS WASHING WINDOWS FOR ADJACENT BUILDING WHEN THE EXTENSION POLE HE WAS US ING MADE CONTACT WITH THE OVERHEAD CATENARY SYSTEM.	Lifting other material	39.753429	-105.00048
5/28/2019	BNSF	20-29	Non-Fatal	Class 1	AM	Struck by on-track equipment	Amputation, toes.	TRESPASSER WAS INJURED WHEN STRUCK BY TRAIN.	Laying	39.767439	-104.991391

Incident Date	Railroad	Age Group	CASFATAL	Railroad Class	AM/ PM	Event	Injury	NARR1	phyactdesc	LATITUDE	LONGITUDE
2/6/2019	RTDC	13-19	Fatal	Class 3	AM	Struck by on-track equipment	Fatally injured, injuries to multiple body part of relatively equal severity.	NORTHBOUND TRAIN 4019/20, 4027/28, TRIP 243, STRUCK AND FATALLY INJURED A TRESPASSER JUST NORTH OF THE SOUTHBOUND QUEBEC STREET CROSSING ON THE QUEBEC STREET BRIDGE, MP 5.85. CASE CURRENTLY UNDER INVESTIGATION.	Lying down	39.771937	-104.902634
9/1/2018	UP	20-29	Non-Fatal	Class 1	PM	Lost balance	Cut/laceration/abrasion, injuries to multiple body part of relatively equal severity.		Climbing over/on	39.771409	-104.973419
7/11/2018	BNSF	13-19	Non-Fatal	Class 1	AM	Struck by on-track equipment	Crushing injury, hips/buttocks/pelvis.	TRESPASSER WAS INJURED AFTER CRAWLING UNDER THE TRAIN.	Crossing or crawling under	39.690422	-104.989674
3/23/2018	UP	40-59	Non-Fatal	Class 1	PM	Caught, crushed, pinched, other.	Crushing injury, lower leg.		Walking	39.764965	-104.98379
11/18/2017	RTDC	60+	Non-Fatal	Class 3	PM	Struck by on-track equipment	Amputation, thumb/finger.	INDIVIDUAL WAS AN ELDERLY FEMALE SUFFERING FROM ALZEIMERS AND DEMENTIA WHO WANDERED AWAY FROM HER CAR.	Laying	39.847466	-104.673781
10/29/2017	RTDC	Unknown	Non-Fatal	Class 3	AM	Slipped, fell, stumbled, other	Cut/laceration/abrasion, knee.	TRESPASSER TRIPPED ON RAIL CAUSING HIM TO FALL AND SCRAPE HIS KNEES. TRESPASSER WAS TAKEN TO DENVER	Walking	39.753429	-105.00048
5/5/2017	RTDC	13-19	Non-Fatal	Class 3	AM	Struck by on-track equipment	Fracture, skull/scalp.		Sitting	39.768669	-104.976657
2/27/2017	UP	20-29	Non-Fatal	Class 1	PM	Bitten by animal	Animal/snake/insect bite, external injuries.		Arresting/ apprehending/ subduing	39.76925	-104.97648
11/6/2016	BNSF	40-59	Non-Fatal	Class 1	PM	Slipped, fell, stumbled, other	Fracture, lower leg.		Climbing over/on	39.755765	-105.003186
10/2/2016	BNSF	40-59	Non-Fatal	Class 1	PM	Slipped, fell, stumbled, other	Cut/laceration/abrasion, skull/scalp.		Climbing over/on	39.76842	-104.990051
9/25/2016	BNSF	20-29	Fatal	Class 1	AM	Struck by on-track equipment	Fatally injured, injuries to multiple body part of relatively equal severity.		Laying	39.824618	-105.032857
9/13/2016	BNSF	20-29	Fatal	Class 1	AM	Struck by on-track equipment	Fatally injured, injuries to multiple body part of relatively equal severity.		Laying	39.701489	-104.990871
6/3/2016	BNSF	40-59	Non-Fatal	Class 1	PM	Struck by on-track equipment	Bruise/contusion, elbow.		Sitting	39.746895	-105.01354
2/9/2016	BNSF	20-29	Fatal	Class 1	PM	Slipped, fell, stumbled, other	Fatally injured, injuries to multiple body part of relatively equal severity.		Jumping from	39.747813	-105.012124

APPENDIX G. RAIL EQUIPMENT ACCIDENTS

INCDTNO	YR	MTH	DY	HR	MIN	AMPM	CARSHZD	TRNSPD	TYPSPD	RAILROAD	SUBDIV	MILEPOST	NARR1
PR0322103	22	3	6	3	0	AM	0	3	E	BNSF	BRUSH	541.3	Y-DEN5131-05 DERAILED 1 LOCOMOTIVE WHILE OPERATING LIGHT LOCOMOTIVES IN YARD TRACK 317 DUE TO FAILURE TO CONTROL SHOVE MOVE IN TURN RUNNING OVER A DERAIL. NO HAZARDOUS MATERIALS WERE RELEASED.
PR0222118	22	2	21	2	15	PM	0	4	E	BNSF	BRUSH	540.4	Y-DEN1031-21 DERAILED 5 RAILCARS WHILE PULLING OUT OF YARD TRACK 138 DUE TO OVERLOADED RAILCAR WITHSCRAP METAL FALLING FROM RAILCAR. NO HAZARDOUS MATERIALS WERE RELEASED.
PR0222115	22	2	18	5	30	PM	0	4	E	BNSF	BRUSH	541.3	Y-DEN1012-18 IMPACTED THE E-CRDSCM0-03 WHILE SHOVING YARD TRACK 541 DUE TO FAILURE TO CONTROL SHOVEMOVEMENT AND RADIO COMMUNICATION FAILURE TO COMPLY. CAR COUNTS DID NOT STOP MOVEMENT PRIOR TO IMPACT. RESULTED IN A TOTAL OF 5 RAILCARS DERAILED. NO HAZARDOUS MATERIALS WERE RELEASED.
PR0222115	22	2	18	5	30	PM	0	10	E	BNSF	BRUSH	541.3	Y-DEN1012-18 IMPACTED THE E-CRDSCM0-03 WHILE SHOVING YARD TRACK 541 DUE TO FAILURE TO CONTROL SHOVEMOVEMENT AND RADIO COMMUNICATION FAILURE TO COMPLY. CAR COUNTS DID NOT STOP MOVEMENT PRIOR TO IMPACT. RESULTED IN A TOTAL OF 5 RAILCARS DERAILED. NO HAZARDOUS MATERIALS WERE RELEASED.
PR0222114	22	2	18	4	35	AM	0	3	E	BNSF	BRUSH	540.3	Y-DEN3031-17 DERAILED 6 RAILCARS WHILE PULLING IN YARD TRACK 104 DUE TO TRACK WIDE GAGE DUE TO WORNRAILS. NO HAZARDOUS MATERIALS WERE RELEASED.
PR0222108	22	2	12	7	22	AM	0	4	E	BNSF	FRONT RANGE	0.8	H-DENLAU1-11 DERAILED 7 RAILCARS WHILE SHOVING YARD TRACK 323 DUE TO EXCESSIVE LATERAL DRAWBAR FORCEON A CURVE. NO HAZARDOUS MATERIALS WERE RELEASED.
1121GP032	21	11	17	7	8	PM	0	7	R	UP	MOFFAT TUNNEL SUB	3.02	YDV71-R ESTABLISHED A RCL ZONE ON THE NORTH END OF THE YARD ZONE 2, 2B AND 3 AT 1845 AND WAS SWITCHING ON THE NORTH END OF NORTH YARD AFTER SETTING OUT A SINGLE CAR INTO TRACK 13. THE CREW THEN WENTINTO TRACK 17 THINKING THAT THEY WERE LINED INTO THEIR ZONE. CREW PULLED OUT 22 LOADS AND 4 EMPTIES.THE YDV71R WAS LINED TOWARDS THE NORTH LEAD INSTEAD OF INTO ZONE, SO ONCE CREW PULLED NORTH, THEYRAN THRU THE HIGH STAND SWITCH NEXT TO 37 BLOCK AND FAILED TO CONTROL THEIR TRAIN IN ACCORDANCE WITHSIGNAL INDICATION (RUNNING A RED BLOCK). WHEN THE CREW STARTED THEIR SHOVE, DERAILING 3 CARS AS ARESULT OF THE RUN THRU SWITCH.
0321GP007	21	3	6	5	45	AM	0	3	E	UP	MOFFAT TUNNEL SUB	3.22	MNYGR-06 CREW WAS GOING TO PUT THEIR POWER ON THEIR TRAIN. WHILE TRAVERSING THE NUMBER 4 SWITCH AT THE NORTH END, THE SWITCH MOVED UNDER THE LOCOMOTIVE RESULTING IN THE REAR OF THE LOCOMOTIVE UP7845 STARTING TO GO DOWN ANOTHER TRACK, AND DERAILING.
1220ME019	20	12	29	8	21	AM	0	5	E	UP	MOFFAT TUNNEL SUB	2.29	WHILE MOVING LOCOMOTIVES INSIDE THE CIRCLE AT NORTH YARD, TWO LOCOMOTIVES DERAILED WHILE MOVING OVERA BROKEN SWITCH POINT.
PR0920108	20	9	17	3	15	PM	0	1	E	BNSF	FRONT RANGE	0.6	Y-DEN0311-17 DERAILED 5 RAILCARS WHILE SHOVING YARD TRACK 354 DUE TO TOO RAPID ADJUSTMENT OF THROTTLE POWER. NO HAZARDOUS MATERIALS WERE RELEASED.
0920GP014	20	9	16	2	16	PM	0	8	E	UP	MOFFAT TUNNEL SUB	2.9	LDV08-16, AFTER CLEARING FIVE CROSSOVERS, THE CREW WALKED THE AIR TEST FROM THE REAR TO HEAD END ONBOTH SIDES OF THE TRAIN. ONCE THE AIR TEST WAS COMPLETED, THEY DEPARTED NORTH, ONTO DENVER BELTLINE. THE TRAIN TRAVELED APPROXIMATELY 1,388 FEET, WHEN THE TRAIN WENT INTO THE EMERGENCY, DERAILING THE BNSF490482 AND THE BNGX31136. THE CAUSE OF THE DERAILMENT WAS DETERMINED TO BE A MECHANICAL BLUEFLAG THAT HAD WEDGED UNDERNEATH AND CAUSED THE CARS TO LEAVE THE RAIL.
0720GP033	20	7	9	9	30	AM	1	5	E	UP	BRUSH BNSF	537.65	UP TRANSFER JOB YDV22-09 WAS PULLING INTO BNSF TRACK 146 AND DERAILED 6 RAILCARS DUE TO BROKEN RAIL.ASPHALT WAS RELEASED FROM ONE OF THE CARS. BNSF REPORTED $35,000 IN TRACK DAMAGE. CAR#: CTCX 207857 ASPHALT, 20,000 GAL.
PR0720102	20	7	9	9	30	AM	0	0		BNSF	BRUSH	540.6	FOREIGN TRAIN F-TUPBN1-09 DERAILED 6 RAILCARS WHILE PULLING INTO YARD TRACK 146 DUE TO TRACK BROKENRAIL. APPROXIMATELY 20,000 GALLONS OF ASPHALT WAS RELEASED FROM 1 RAILCAR.
0620GP016	20	6	18	6	26	AM	0	2	R	UP	MOFFAT TUNNEL SUB	2.45	MNYGR-18 WAS SHOVING THEIR POWER WESTWARD ON THE SOUTH LEG OF THE WYE. TWO UNITS PASSED POD WHEN THE THIRD UNIT DERAILED AXLE 5 AND 6. APPROXIMATELY A FOOT PRIOR TO THE POD HAD BROKEN RAIL.
PR0620106	20	6	13	11	30	PM	0	1	E	BNSF	BRUSH	541.1	H-DENPUE1-13 DERAILED 9 RAILCARS WHILE SHOVING YARD TRACK 2005 DUE TO TRACK WIDE GAGE. NO HAZARDOUS MATERIALS WERE RELEASED.
PR0520113	20	5	21	6	0	PM	0	5	R	BNSF	BRUSH	540.8	Y-DEN2071-21 DERAILED 6 RAILCARS WHILE SHOVING YARD TRACK 132. NO HAZARDOUS MATERIALS WERE RELEASED. CAUSE WAS DETERMINED TO BE EXCESSIVE COUPLING SPEED.

INCDTNO	YR	MTH	DY	HR	MIN	AMPM	CARSHZD	TRNSPD	TYPSPD	RAILROAD	SUBDIV	MILEPOST	NARR1
0420GP031	20	4	28	5	13	PM	0	5	E	UP	MOFFAT TUNNEL SUB	3.1	YDV21-28, AFTER DOUBLING 12 TRACK WITH 36 CARS TO 18 TRACK, PULLED PAST 37 BLOCK AND LINED THE SWITCH FOR THEIR MOVEMENT TOWARDS THE LOW SIDE OF TRACKS. THE FOREMAN WALKED TO THE CLEARANCE CONE AT THE NORTH END OF 2 TRACK, AND THE BRAKEMAN GOT A RIDE TO THE SOUTH END OF 2 TRACK TO PROTECT THE SHOVE. THE REAR CAR WAS A LOADED LUMBER FLAT THAT WAS NOT RIDEABLE. THE FOREMAN STARTED THE SHOVE INTO 2 TRACK AND THE BRAKEMAN TOOK OVER ONCE THE CARS WERE IN 2 TRACK. AT APPROXIMATELY 1713, WHEN THE BRAKEMAN GAVE A 15 CAR COUNT, THE FOREMAN NOTICED THE CARS HAD DERAILED AND IMMEDIATELY TOLD THEIR ENGINEER TO STOP. AFTER INVESTIGATING, IT HAS BEEN DETERMINED THE CAUSE OF THE DERAILMENT WAS A BOLTSTUCK IN THE MIDDLE OF THE FROG THAT SPLITS TRACKS 1, 2, 3 AND 4, 5, 6, 7 ON THE NORTH END. A TOTALOF 5 EMPTY RAILCARS DERAILED.
0420GP010	20	4	8	7	18	PM	0	9	R	UP	MOFFAT TUNNEL SUB	3.15	YDV21-08, LEAD LOCOMOTIVE UP1510, WAS SHOVING A CUT OF CARS INTO ONE TRACK. CARS 9 - 12 FROM NORTHEND DERAILED ON FROG AND GUARD RAIL. DERAILMENT DAMAGED LEAD FROM 1 THROUGH 7 TRACKS. 1 DRUG POSITIVE - NOT DETERMINED TO BE A CAUSAL FACTOR.
PR0320115	20	3	28	9	15	AM	0	9	R	BNSF	DENVER ROCK ISLAND	0.5	Y-DEN3051-27 DERAILED 6 RAILCARS WHILE PULLING INTO FOREIGN YARD TRACK 1 DUE TO TRACK DEFECTIVE OR MISSING CROSSTIES. NO HAZARDOUS MATERIALS WERE RELEASED.
3282002	20	3	28	9	15	AM	0	0		DRIR	STOCKYARDS	0.1	THE BNSF CREW WAS PULLING THE DRIR OUT BOUND BACK TO THEIR YARD WHEN THEY DERAILED 6 CARS. THE CREWWAS PULLING THE CARS TO THE SINGLE POINT DERAIL AND STOPPED ONLY USING THE BRAKES OF THE LOCOMOTIVETO DROP THE CONDUCTOR THERE TO CLOSE AFTER PASSING WHICH CAUSED THE CARS TO ABRUPTLY BANG INTO EACHOTHER CLOSING THE SLACK FROM ALL THE DRAFT GEARS OF THE CARS. THE POINT OF DERAILMENT WAS CLOSE TOMID CONSIST WHERE THE HIGH SIDE RAIL WAS ROLLED DUE TO THE LOADED CARS BANGING TOGETHER, THEY THEN PULLED AHEAD FOR 250+- FT WITH THE WHEELS OF THE LOCOMOTIVE SPINNING AS THERE ARE MARKS TO PROVE IT ALONG WITH SAND ON THE RAIL.
PR1219106	19	12	12	7	30	PM	0	4	E	BNSF	FRONT RANGE	2.3	RCO Y-DEN2012-12 DERAILED 1 RAILCAR WHILE INTO YARD TRACK 209 DUE TO TRACK SWITCH POINT GAPPED. NO HAZARDOUS MATERIALS WERE RELEASED.
PR0819111	19	8	27	7	0	AM	0	7	E	BNSF	BRUSH	540.9	Y-DEN3051-26 DERAILED 3 RAILCARS WHILE SHOVING YARD TRACK 103 DUE TO CROSS LEVEL OF TRACK IRREGULAR.NO HAZARDOUS MATERIALS WERE RELEASED.
0419GP037	19	4	16	11	14	AM	0	4	E	UP	MOFFAT TUNNEL SUB	2.45	YDV68R-16 TRANSFERRED ZONE TO THE YDV72R-16 AT 0959. AT APPROXIMATELY 1114 CREW WAS NOTIFIED THEY WERE ON THE GROUND. CREW WALKED UP TO THE HEAD END. THEY HAD ZONE 2, 2A AND 3, AND FOUND A DERAIL SOUTH SIDE OF NUMBER FIVE CROSSOVER INSIDE OF AN ACTIVE ZONE. CREW HAD PREVIOUSLY TRAVERSED THE SWITCHES. TWO ENGINES AND ONE CAR DERAILED.
PR0319104	19	3	14	2	45	AM	0	4	R	BNSF	BRUSH	541.5	K-PUEPUE1-14 DERAILED 2 LOCOMOTIVES WHILE OPERATING LIGHT LOCOMOTIVES IN YARD TRACK 316 DUE TO ICE AND SNOW BUILDUP ON TRACK. NO HAZARDOUS MATERIALS WERE RELEASED.
PR0119120	19	1	22	8	15	PM	0	4	E	BNSF	BRUSH	540.3	RCO Y-DEN2062-22 DERAILED 2 RAILCARS THAT IN TURN IMPACTED A CUT OF RAILCARS IN ADJACENT TRACK WHILESHOVING YARD TRACK 130 DUE TO A SWITCH BEING IMPROPERLY LINED UNDER RAILCARS. NO HAZARDOUS MATERIALS WERE RELEASED.
PR0119120	19	1	22	8	15	PM	0	0	E	BNSF	BRUSH	540.3	RCO Y-DEN2062-22 DERAILED 2 RAILCARS THAT IN TURN IMPACTED A CUT OF RAILCARS IN ADJACENT TRACK WHILESHOVING YARD TRACK 130 DUE TO A SWITCH BEING IMPROPERLY LINED UNDER RAILCARS. NO HAZARDOUS MATERIALS WERE RELEASED.
PR0119103	19	1	2	8	45	PM	0	6	R	BNSF	FRONT RANGE	0.7	Y-DEN2051-02 DERAILED 5 RAILCARS WHILE PULLING INTO YARD TRACK 354 DUE TO EXCESSIVE BUFFERING OR SLACK ACTION. NO HAZARDOUS MATERIALS WERE RELEASED.
1118DV009	18	11	22	9	35	PM	0	2	E	UP	GREELEY SUB	2.63	AFTER FINISHING THEIR SHOVE INTO 802 THE ZLADV-21 LINED UP TO SHOVE 803 WITH THE CONDUCTOR RIDING THE POINT AS THEY WERE SHOVING WITH 4 UNITS AND 4 CARS AND 14 LBS OF AUTOMATIC BRAKES INTO THE TRACK, THE ENGINEER NOTICED HIS SPEED DECLINING AND THROTTLED UP FROM NOTCH 2 TO NOTCH 4, AFTER GETTING A WHEEL SLIP WARNING HE THROTTLED DOWN AND BROUGHT THE TRAIN TO A STOP. THE REAR THREE LOCOMOTIVES AND SUBSEQUENT AUTORACK DERAILED. NO INJURIES.

INCDTNO	YR	MTH	DY	HR	MIN	AMPM	CARSHZD	TRNSPD	TYPSPD	RAILROAD	SUBDIV	MILEPOST	NARR1
0718DV002	18	7	3	3	43	AM	0	0	R	UP	MOFFAT TUNNEL SUB	2.36	YDE36R-02, WAS PULLING OUT OF TRACK 5 AND DERAILED THE LEADING AXLE ON CAR GBRX700009, DUE TO A BROKEN RAIL IN THE TRACK 5 SWITCH. THE CREW PROCEEDED TO SHOVE NORTHWARD INTO TRACK 8, WHICH CAUSED THE REST OF THE AXLES TO DERAIL. 2 ADDITIONAL CARS WHICH STRUCK ON ADJACENT TRACK 3. 1 DRUG POSITIVE -- NOT DETERMINED TO BE A CAUSAL FACTOR.
0718DV002	18	7	3	3	43	AM	0	8	E	UP	MOFFAT TUNNEL SUB	2.36	YDE36R-02, WAS PULLING OUT OF TRACK 5 AND DERAILED THE LEADING AXLE ON CAR GBRX700009, DUE TO A BROKEN RAIL IN THE TRACK 5 SWITCH. THE CREW PROCEEDED TO SHOVE NORTHWARD INTO TRACK 8, WHICH CAUSED THE REST OF THE AXLES TO DERAIL. 2 ADDITIONAL CARS WHICH STRUCK ON ADJACENT TRACK 3. 1 DRUG POSITIVE -- NOT DETERMINED TO BE A CAUSAL FACTOR.
0518DV021	18	5	27	4	0	AM	0	5	E	UP	MOFFAT TUNNEL SUB	2.85	YDV25-26 WAS SHOVING 87 CARS INTO TRACK 2 AND HAD TRAVERSED THE CROSSING WHEN 4 CARS DERAILED AND THE MOVE CAME TO A STOP. THE UP5487 WAS ON AN ADJACENT TRACK AND WAS DAMAGED WHEN THE TILX305078 DERAILED.
0518DV021	18	5	27	4	0	AM	0	0	E	UP	MOFFAT TUNNEL SUB	2.85	YDV25-26 WAS SHOVING 87 CARS INTO TRACK 2 AND HAD TRAVERSED THE CROSSING WHEN 4 CARS DERAILED AND THE MOVE CAME TO A STOP. THE UP5487 WAS ON AN ADJACENT TRACK AND WAS DAMAGED WHEN THE TILX305078 DERAILED.
PR0418113	18	4	19	6	5	PM	0	8	R	BNSF	BRUSH	541	Y-DEN1031-19 DERAILED 8 CARS DUE TO IMPROPER TRAIN HANDLING. NO HAZARDOUS MATERIALS WERE RELEASED.
0318DV003	18	3	4	10	30	AM	0	0	E	UP	GREELEY SUB	2.14	YDE22R-04 WAS SWITCHING ON THE SOUTH END OF THE LEAD TRACK AND HAD A HANDLE OF 13 CARS. THEY PROCEEDED INTO TRACK 406, RELEASED THREE CARS, FOLLOWED BY A CUT OF TWO CARS. SPEED WAS 3 MPH, THERE WERE FIVE HANDBRAKES TIED ON THE NORTH END OF TRACK 406, PER SUPERINTENDENT BULLETIN. SUBSEQUENTLY THE YDE54R-04 WAS SWITCHING ON THE NORTH END OF THE YARD IN TRACK 411 AND PULLING NORTH LINED OUT OF THE LEAD THROUGH TRACK 410, WHEN YDE54R-04 WENT INTO EMERGENCY. UPON INSPECTION DISCOVERED THEY WERE STRUCK BY A ROLL OUT FROM TRACK 406. IMPACT OCCURRED WHEN CAR ADMX16956 STRUCK CAR TILX257071, CAUSING A DERAILMENT OF SIX CARS.
0318DV003	18	3	4	10	30	AM	0	3	E	UP	GREELEY SUB	2.14	YDE22R-04 WAS SWITCHING ON THE SOUTH END OF THE LEAD TRACK AND HAD A HANDLE OF 13 CARS. THEY PROCEEDED INTO TRACK 406, RELEASED THREE CARS, FOLLOWED BY A CUT OF TWO CARS. SPEED WAS 3 MPH, THERE WERE FIVE HANDBRAKES TIED ON THE NORTH END OF TRACK 406, PER SUPERINTENDENT BULLETIN. SUBSEQUENTLY THE YDE54R-04 WAS SWITCHING ON THE NORTH END OF THE YARD IN TRACK 411 AND PULLING NORTH LINED OUT OF THE LEAD THROUGH TRACK 410, WHEN YDE54R-04 WENT INTO EMERGENCY. UPON INSPECTION DISCOVERED THEY WERE STRUCK BY A ROLL OUT FROM TRACK 406. IMPACT OCCURRED WHEN CAR ADMX16956 STRUCK CAR TILX257071, CAUSING A DERAILMENT OF SIX CARS.
PR0118109	18	1	15	3	51	PM	0	5	E	BNSF	BRUSH	540.4	RCO Y-DEN1142-15 DERAILED 4 RAILCARS WHILE PULLING OUT OF YARD TRACK 146 DUE TO BROKEN RAIL. NO HAZARDOUS MATERIALS WERE RELEASED.

HNTB, 2023
Note: Data was compiled from information provided by UPRR and BNSF

APPENDIX H. TIER II FACILITIES

APPENDIX H. TIER II FACILITIES

Table H-1. Tier II Facilities

Name	Address
Thermofluids Denver	4845 Forest Street Denver, CO 80022 USA
General Shale Brick Inc. Plant #60	1845 West Dartmouth Avenue
ChemTrade Solutions	5075 East 50th. Avenue Denver, CO 80216 USA
Mountain Cement Company	1630 35th Street Denver, CO 80216 USA
Safeway Denver Milk Plant	4301 Forest Street Denver, CO 80216 USA
Airgas USA LLC	2455 South Platte River Drive Denver, CO 80223 USA
US Mix Co	112 South Santa Fe Drive Denver, CO 80223 USA
AMERICAN BUILDING SUPPLY	5025 Florence Street Unit D Denver, CO 80238 USA
Colorado Salt Products	3910 Joliet Street Denver, CO 80239 USA

Note: See Figure 4-2 for locations of Tier II Facilities in the main document.