7.18 Safety

7.18 SAFETY

7.18.1 Introduction

A critical element of the Federal Railroad Administration's (FRA) mission is the safe operation of the passenger and freight rail systems in the United States. This section addresses how the Tier 1 Draft Environmental Impact Statement (Tier 1 Draft EIS) No Action and Action Alternatives could affect railroad safety, railroad users, and those who live and work along the Northeast Corridor (NEC). This assessment takes a corridor-wide, multimodal approach and considers highways, public transportation, Intercity and regional passenger rail, freight rail, and aviation. The FRA analyzed data for the 2012 calendar year, or where noted, highlighted trends from 2009 through 2013.

7.18.1.1 Definition of Resource

For purposes of this analysis, the FRA divided safety into three categories: modal safety, railroad operational safety, and railroad infrastructure safety and security. These categories are defined below. The NEC FUTURE safety analysis of the Action Alternatives focuses on the following:

- Overall safety of passenger rail compared to the other modes in the Affected Environment
- The effects of the Action Alternatives on passenger rail service operations
- Rail incidents resulting from infrastructure deficiencies or failures

The FRA considered safety in the following contexts:

- **Modal Safety:** This term refers to the overall safety of passenger rail as a transportation mode when compared to other transportation modes, including highway and air travel. The FRA considered the safety of passenger rail as a mode compared to other modes based on the number and rate of accidents.
- **Railroad Operational Safety**: The Intercity and Regional rail operators on the NEC operate different equipment types, at different speeds, and with different stopping patterns. The multiplicity of operators with distinct operating practices together influences the overall safety of the railroad. Train collisions or derailments represent the types of incidents related to operating practices.
- **Railroad Infrastructure Safety and Security:** This term refers to accidents or incidents caused by the failure of existing railroad infrastructure. Infrastructure failures can contribute to either train- or station-related incidents that involve operating personnel and passengers. Security-related vulnerabilities include incidents resulting from unwanted intrusions or trespassing on the railroad infrastructure, whether unintended or intentional.

7.18.1.2 Effects-Assessment Methodology

The FRA developed an effects-assessment methodology to evaluate safety, which is provided in Appendix E, Section E.18. The methodology provides a detailed definition of each resource, data sources, an explanation on how the Affected Environment was defined and established, and how the effects on each resource were evaluated and reported. Table 7.18-1 summarizes key factors and data application associated with the methodologies for each safety resource evaluated.

Table 7.18-1: Effects-Assessment Methodology Summary: Safety

Resource	Affected Environment	Type of Assessment	Outcome
Modal Safety	Study Area	▪ Number of accidents, injuries and deaths from motor vehicle crashes ▪ Data on a variety of driver and vehicle types with their respective safety records ▪ Data on accidents in the aviation industry ▪ Summary of aviation accident statistics ▪ Safety statistics on a variety of transportation modes ▪ Accident data for aviation, railroad, and highway transportation modes.	▪ Quantification of overall safety measures presented by mode to establish an understanding of relative modal safety
Railroad Operational Safety	Study Area	▪ Data on highway grade-crossing accidents for the railroad system ▪ Accidents by railroad by type ▪ Summary statistics on accidents by type ▪ Data on trespasser incidents by railroad by location ▪ Summary statistics on overall safety of regional railroads by railroad and type of incident ▪ Regional railroad specific statistics on number of safety incidents by type ▪ Summary data on overall regional rail safety	▪ Quantification of overall safety for the passenger rail network within the Study Area presented by type of rail operations to isolate the role that operating practices contribute to overall passenger rail system safety
Railroad Infrastructure Safety and Security	Study Area	▪ Accidents by railroad by type ▪ Summary statistics on accidents by type ▪ Data on trespasser incidents by railroad by location	▪ Quantification of overall safety for the passenger rail network within the Study Area manifested by infrastructure failure to isolate the role of infrastructure in overall passenger rail system safety

Source: NEC FUTURE Safety Effect-Assessment Methodology, Appendix E, Section E.18, 2014

7.18.2 Resource Overview

In light of the network characteristics of the passenger rail system, the FRA considered the entire Study Area for the safety analysis. The Study Area includes a broad geographic area, spanning 457 miles from Washington, D.C., to Boston, MA. The Action Alternatives assume that the passenger rail system throughout the Study Area will achieve a state of good repair by 2040. The FRA considered the overall safety of the transportation network, with a specific focus on the passenger rail network for the modes presently operating and expected to be operating in 2040. Safety is principally a

function of the travel mode that users select. Within the passenger rail mode, rail operations and infrastructure influence overall passenger rail system safety.

7.18.3 Affected Environment

7.18.3.1 Modal Safety

This section compares safety data, including the number of fatalities for the various transportation modes in the Affected Environment. Table 7.18-2 identifies the total number of fatalities, by transportation mode, for the primary transportation services in the Affected Environment. This table includes highway fatalities—which include all roadway travel—and public transportation, rail, and aviation fatalities, encompassing the motorized modes of travel available to the traveling public. Public transportation travel is often a part of a rail or air trip as passengers travel to access airports or rail stations. For comparison, the table includes the modal fatalities for the United States.

Table 7.18-2: Affected Environment: Fatalities by Transportation Mode (2009–2013 Average)

		Affected Environment Portion of Each State									Affected Environment Total
Transportation Mode	U.S.	D.C.	MD	DE	PA	NJ	NY	CT	RI	MA	
Highway	33,172	24	286	48	174	175	544	227	61	205	1,744
Public Transportation*											
Bus	87	2	1	0	3	3	7	1	0	2	20
Demand Response	9	0	0	0	0	0	0	0	0	0	1
Heavy Rail (Subway)	51	4	1	0	3	0	30	0	0	1	38
Light Rail	27	0	0	0	0	1	0	0	0	0	2
All Other	5	0	0	0	0	0	0	0	0	0	0
TOTAL	179	6	2	1	6	5	37	1	0	4	62
Rail											
Regional	5	—	—	—	0	1	2	1	—	—	4
Intercity (Amtrak)	19	—	—	—	—	—	—	0	0	—	0
Freight	120	—	—	—	1	1	—	0	—	—	2
TOTAL*	145	—	—	—	1	2	2	1	0	—	7
Aviation	441	0	0	0	0	3	3	2	0	1	9

Sources:
Highway: National Highway Transportation Safety Administration Traffic Safety Facts for States, FARS query for years 2009-2013
Public Transportation: National Transit Database Safety & Security Time Series Data for years 2009-2013, excluding suicides
Aviation: NTSB Aviation Database & Synopses for 2012 for United States and also by state and county U.S. Department of Transportation–Research and Innovative Technology Administration; Bureau of Transportation Statistics.
* Public transportation data do not include suicides, and rail data do not include trespassers. Totals may not sum due to rounding.

Highway fatalities rank the highest among all modes for the United States as well as for the Affected Environment. Highway fatalities within the Affected Environment represented 5 percent of all highway fatalities within the United States and totaled 1,744 fatalities within the states comprising the Study Area. Public transportation fatalities within the Affected Environment represented 35 percent of all public transportation-related fatalities within the United States.

As shown in Table 7.18-2, there was an average of 4 passenger rail fatalities within the Affected Environment each year over the 5-year period and an average of 2 freight rail fatalities annually. Over the 5-year period in the Affected Environment, there were 5 passenger fatalities on Regional trains and no passenger fatalities on Intercity (Amtrak). Over the 5-year period within the Affected Environment, there were 34 fatalities of contractors, employees, or other non-passengers related to railroad operations across all passenger and freight rails. The passenger rail fatality rate within the Affected Environment was below 0.01 per 100,000 people. These performance metrics signify the exceptional safety of rail as it pertains to the traveling public.

The numbers included within the table for rail and public transportation fatalities are related to the traveling public's safety experience in actual conditions. Rail trespasser fatalities are included in Section 7.18.3.2, Railroad Operational Safety.

Table 7.18-3 summarizes the number of passenger rail accidents reported within the Affected Environment in the 5-year period (2009–2013). These accidents included slips, falls, natural causes, and other injuries reported on trains, including any reported crimes, bug or bee stings, or accidents related to passenger behavior. New York and New Jersey reported the greatest number of passenger accidents, although New York and New Jersey also carried the largest number of passenger rail passengers in the Affected Environment.

Table 7.18-3: Affected Environment: Passenger Accidents (2009–2013)

Geography	Passenger rail Accidents					2009–2013 Average
	2009	2010	2011	2012	2013	
D.C.	19	23	27	26	32	25.4
MD	26	36	28	20	31	28.2
DE	0	7	7	8	5	5.4
PA	101	94	55	68	57	75.0
NJ	68	121	218	216	254	175.4
NY	163	197	201	303	339	240.6
CT	19	30	20	25	141	47.0
RI	2	5	4	6	9	5.2
MA	66	48	38	47	34	46.6
TOTAL	**464**	**561**	**598**	**719**	**902**	3,244

Source: Federal Railroad Administration Office of Safety Analysis: Table 4.12 - Query by State and County and by Type Person (Calendar Years 2009-2013). Retrieved from *http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/casabbr.aspx.*

7.18.3.2 Railroad Operational Safety

Table 7.18-4 highlights accident totals on the Intercity, passenger, and freight rail networks located within the Affected Environment related to rail operations. This table indicates rail accidents involving rail equipment that resulted in monetary damage as well as fatalities that occurred on railroad equipment or property.

Table 7.18-4: Affected Environment: Rail Accidents (2012)

Geography	TOTAL	Derailments	Collisions*	Other**
United States	**1,931**	**1,466**	**303**	**658**
D.C.	5	5	0	1
MD	14	5	2	8
DE	3	2	0	1
PA	14	7	2	7
NJ	47	26	7	26
NY	16	8	0	11
CT	10	5	0	6
RI	2	3	0	0
MA	4	3	2	0
TOTAL	**115**	**64**	**13**	**60**

Source: Federal Railroad Administration (FRA), Office of Safety Analysis; **U.S. Data**: FRA Office of Safety Analysis: Table 3.01; **Rail Accidents**: FRA Office of Safety Analysis: Table 3.18 - Query by State and County and Type Accident (Calendar Year 2012)
* Collisions include those occurring at highway at-grade crossings.
** "Other" includes obstructions, explosions, fire/rupture and other impacts.

Within the Affected Environment, there were 115 railroad accidents involving 137 trains reported in 2012. (If two trains collide, it is counted as one accident.) Derailments accounted for 48 percent of the accident causes for all trains involved, with collisions (including those occurring at highway at-grade crossings) accounting for 9 percent of the trains involved in accidents. In the United States, 76 percent of all trains involved in accidents were involved in derailments, which is a much higher percentage than the 48 percent of trains in the Affected Environment.

While many of the railroad lines within the Affected Environment contain at-grade crossings, the NEC is predominantly grade-separated. In 2012, six fatalities were reported at grade crossings within the Affected Environment.[1]

Table 7.18-5 provides the rail fatalities related to operational incidents along the NEC. The number of accidents for each state is reported for each train involved.

There were 152 rail-related fatalities in the United States in 2012, not including trespassers. Seven rail fatalities in the Affected Environment were related to passenger rail operations, and one was related to freight rail operation. Nationally, 20 percent of rail fatalities related to passenger rail operations and 80 percent related to freight rail operations.

The "Other" category represents fatalities for those listed as non-trespassers, including highway grade-crossing incidents.

[1] Federal Railroad Administration, Office of Safety Analysis, Table 5.15 Consolidated Hwy Rail Accident Incidents: Query by State, County and Tot Kld.

Table 7.18-5: Affected Environment: Rail Fatalities (2012)

Geography	TOTAL	Passenger rail Operations			Freight rail Operations	
		Passengers	Employees/Contractors	Other	Employees/Contractors	Other
United States	**152**	**5**	**2**	**23**	**17**	**105**
D.C.	0	0	0	0	0	0
MD	0	0	0	0	0	0
DE	0	0	0	0	0	0
PA	0	0	0	0	0	0
NJ	3	1	1	0	1	0
NY	3	0	1	2	0	0
CT	2	0	0	2	0	0
RI	0	0	0	0	0	0
MA	0	0	0	0	0	0
TOTAL	**8**	**1**	**2**	**4**	**1**	**0**

Sources: Federal Railroad Administration (FRA), Office of Safety Analysis; **U.S. Data**: **Rail Fatalities**: FRA Office of Safety Analysis: Table 4.12 - Query by State and County and Condition and Type Person (Calendar Year 2012)
Note: Fatalities do not include trespassers.

Operations-related fatalities on the passenger rail network are overwhelmingly the result of trespassing. Trespassers are people who have entered railroad property without permission. In 2012, there were 8 rail-operations-related fatalities in the Affected Environment and 45 fatalities of trespassers (Table 7.18-6). In 2012, 9 percent of nationwide trespasser fatalities occurred in the Affected Environment. Trespassers are often members of the public who have allegedly committed suicide. These are often deliberate and not related to the nature of the rail operations. The FRA works continuously with railroads and public authorities to prevent railroad suicides and promote responsible behavior near rail infrastructure through Operation Lifesaver, Inc.[2]

Table 7.18-6: Affected Environment: Rail Fatalities of Trespassers (2012)

Geography	TOTAL
United States	**524**
D.C.	0
MD	5
DE	0
PA	15
NJ	2
NY	12
CT	3
RI	1
MA	7
TOTAL	**45**

Source: U.S. Data: **Rail Fatalities**: FRA Office of Safety Analysis: Table 4.12 – Query by State and County and Condition and Type Person (Calendar Year 2012)

[2] **Operation Lifesaver** is a 501(c)(3) educational organization in the United States dedicated to promoting safety at railroad grade crossings and railroad rights-of-way.

7.18.3.3 Railroad Infrastructure Safety

According to FRA statistics, approximately 40 percent of rail accidents in 2012 were the result of equipment or infrastructure deficiencies or failures. Equipment and infrastructure deficiencies or failures can contribute to train- or station-related accidents involving passengers, employees, contractors, visitors, or others with permission to be on railroad property. These infrastructure deficiencies or failures include (but are not limited to) the following:

- Broken/bent railroad car axle
- Broken rim
- Catenary system defect
- Current collector system defect
- Defective/missing crossties (wide gauge)
- Pantograph defect
- Roller bearing overheating
- Switch point worn or broken
- Track bent/broken/or misplaced
- Transverse/compound fissure

Table 7.18-7 summarizes the number of rail accidents reported within the Affected Environment that were the result of infrastructure or equipment failures or malfunctions. This included anything reported as track, signal, or equipment as the primary cause. In 2012, 42 percent of rail accidents resulted from infrastructure and equipment failure or malfunction.

Table 7.18-7: Affected Environment: Rail Accidents from Infrastructure or Equipment Failures/Malfunctions (2012)

Geography	TOTAL	Accidents Resulting from Infrastructure or Equipment Failures/Malfunctions
D.C.	5	2
MD	14	9
DE	3	1
PA	14	9
NJ	47	14
NY	16	5
CT	10	5
RI	2	0
MA	4	3
TOTAL	**115**	**48**

Source: Federal Railroad Administration Office of Safety Analysis: Table 3.18 - Query by State and County and Primary Cause (Calendar Year 2012) (Primary Cause: Equipment, Track, and Signals). *http://safetydata.fra.dot.gov/OfficeofSafety/Default.aspx*

7.18.4 Environmental Consequences

7.18.4.1 Modal Safety

The NEC FUTURE Travel Demand Model anticipates that interregional travel within the transportation network in the Affected Environment will shift between modes in 2040. Model outputs estimate that in the No Action Alternative, the percentage of interregional travel occurring on rail for 2040 will be 5.9 percent. For the Action Alternatives for 2040, interregional travel is projected to range from 8.4 percent to 9.5 percent. Relocating trips anticipated for highways onto increased Intercity rail capacity, operating on a combination of safer shared-rail corridor and segregated rail right-of-way, would result in a safer overall mix of transportation tripmaking in 2040. Table 7.18-8 identifies the anticipated modal shift for interregional travel.

Table 7.18-8: Anticipated Tripmaking by Mode (2040)

Mode	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Highway	438,576,127	431,772,804	430,144,159	429,236,242
Intercity Rail	28,846,063	41,538,334	44,657,266	46,808,455
Aviation	20,427,266	19,403,476	19,080,172	18,726,017
TOTAL	**487,849,456**	**492,714,614**	**493,881,597**	**494,770,713**
% of Overall Intercity Tripmaking	**5.9%**	**8.4%**	**9.0%**	**9.5%**

Source: NEC Future, Travel Demand Model Output, Group 2 MSA to MSA Intercity Trips
Note: Alternative 3 represents an average of its route options.
Note: The FRA adjusted the NEC FUTURE Interregional Model based on issues identified during the Tier 1 Draft EIS comment period and a reassessment of the overall model outcomes. These adjustments did not affect the relative findings of the Action Alternatives (when compared to the No Action Alternative), but did result in modifications to the total numbers of trips and their distribution by station or metropolitan area. Volume 1, Appendix BB, Technical Analysis of the Preferred Alternative, contains a detailed description of the reasoning for these adjustments and the process used, and a summary of the changes in the model results, compared to the results presented in the Tier 1 Draft EIS.

7.18.4.2 Railroad Operational Safety

Along the NEC, many different types of passenger and freight trains operate in physically and temporally shared lines. The NEC is unique in the Unites States in functioning simultaneously as a high-speed rail line, a corridor for Intercity and Regional passenger trains, and in various locations as a corridor that includes both through and local freight trains.

The FRA's passenger-equipment safety standards currently govern the crashworthiness standards and emergency egress/rescue access systems of Tier I and Tier II passenger equipment. Tier I equipment operates at speeds not exceeding 125 mph. Tier II equipment operates at speeds between 125 mph and 150 mph, and requires regulatory approval for the operation of Tier II equipment that has not been previously used in revenue service in the United States. The FRA's track regulations also set the maximum allowable speed for different classes of track, and regulatory approval is required for equipment operating at speeds above 125 mph.

Because the FRA has authorized the operation of Amtrak's Acela Express at speeds up to 150 mph, the existing NEC has trains operating in both Tier I and Tier II environments. Because of this unique mix of services on the NEC, waivers to FRA regulations in certain cases are granted by the FRA to permit operating characteristics outside of the limits prescribed in the regulations. There are

currently no Tier I restrictions regarding shared use of right-of-way with freight operations. The Connecting Corridors off the NEC also operate in the Tier I environment.

Tier II standards govern operations along the portions of the NEC where maximum authorized speeds for passenger trains range between 125 mph and 150 mph. Amtrak Acela Express trains are the only Tier II train equipment permitted to operate at these speeds. Under its current FRA waiver, the Acela equipment can operate intermixed with other Tier I passenger and freight operations and operate above 125 mph, provided that freight operations and passenger operations occur at separate times (i.e., temporal separation). Intermixed operations currently include Amtrak Intercity-Corridor and long-distance trains, along with Regional rail and freight trains along significant portions of the NEC. Amtrak has petitioned the FRA to increase the top speed of its Tier II operations to 160 mph in certain locations, which would require modification to its current waiver.

The FRA is currently developing Tier III passenger-equipment safety standards. The Tier III standards would represent a new national standard for rail operations and equipment, which will apply to the California high-speed rail system, and are assumed for future NEC operations in all of the Action Alternatives as further described in Section 7.18.3.4.

The FRA's track safety standards also govern other factors, such as at-grade crossings. No at-grade crossings are permitted when operating speeds exceed 125 mph (Class 8 and Class 9 track). This is generally not an issue on the NEC: there are no at-grade crossings south of Waterford, CT, or north of Stonington, CT. Eleven crossings remain between Waterford and Stonington, where the maximum authorized speed of trains is 125 mph or less.

The implications for operational safety of the No Action Alternative is that safety conditions would be expected to remain fairly consistent with 2012 figures and in general proportion to increases in overall travel. Under several of the Action Alternatives, separating passenger rail from freight rail would decrease the number of accidents, especially those accidents associated with Intercity passenger rail.

In conjunction with the FRA's track safety standards and other regulations, the pending Tier III standards will establish the crashworthiness standards for equipment that can operate on shared tracks or on separate tracks within a shared right-of-way and the infrastructure and systems required for safe operations. It is anticipated that Tier III passenger equipment safety standards (along with the FRA's track safety standards) would permit higher-performance high-speed rail operations, with maximum authorized speeds above 125 mph and up to 220 mph. The Tier III environment would require exclusive right-of-way for high-performance trainsets operating above 125 mph and prohibit other equipment types from sharing the exclusive high-speed tracks. There would be no intermixing of high-speed operations with freight or non-Tier III passenger operations (Tier I or Tier II) at speeds above 125 mph. However, Tier III equipment could operate in a Tier I shared-use environment on tracks used by conventional passenger and freight equipment at speeds at or below 125 mph. With a waiver of these standards to permit Tier III high-performance trainsets to operate at up to 160 mph in a shared-use environment, as assumed in the Action Alternatives, these trains would be able to match the performance of the Tier II Acela Express equipment when operating on the existing NEC.

Tier III passenger equipment is assumed to be able to operate with a waiver above 125 mph, up to 160 mph (Class 8 track), on tracks that are also used by freight trains, provided the freight trains are temporally separated. As a result, freight service would be strictly limited to times of day and night during which passenger service with Tier III equipment is not operating.

The use of Tier III equipment would preclude operation of freight trains on Class 9 track with speeds above 160 mph and up to 220 mph. The Action Alternatives provide for freight operations on separate conventional (non-high-speed) tracks. Where operation of freight trains on high-speed or express tracks (at Class 8 or below) would be unavoidable and could be accommodated—either for normal or contingency operations—restrictions may be placed on the type, weight, or maximum speed of freight trains operating on the high-speed tracks, with possible requirements for signaling, dragging equipment, overheated bearing, shifted load, and high-impact wheel detectors in place at entry points to such tracks.

All new rail right-of-way included in the Action Alternatives would be completely grade-separated. The eleven existing at-grade crossings on the NEC in southeastern Connecticut would not be eliminated.

7.18.4.3 Railroad Infrastructure Safety

The implications for infrastructure safety of the No Action Alternative is that safety conditions will be expected to remain fairly constant with 2012 figures, in proportion to increases in overall travel. Under the Action Alternatives there would be numerous equipment and infrastructure upgrades that would likely reduce the number of accidents associated with equipment failures or infrastructure deficiencies. Additionally, separating passenger and freight trains would reduce the wear and tear on rail infrastructure resulting from the hauling of heavier freight rail. Furthermore, the Action Alternatives propose a fully grade-separated NEC for the new route options, which would reduce the frequency of conflicts and potential accidents throughout the entirety of the NEC that would occur at highway-rail at-grade crossings.

Positive Train Control (PTC) is a control technology used to prevent or avoid train collisions and derailments. The purpose of PTC is to slow or stop a train that is operating at an excessive speed or operating in a manner inconsistent with the section of track it is traversing. The Rail Safety Improvement Act of 2008 requires that Positive Train Control is implemented over much of the passenger and freight rail network by December 31, 2015.[3]

7.18.5 Potential Mitigation Strategies

No mitigation strategies are proposed for safety. The FRA assumes that the future Tier 2 actions would include all necessary analysis and coordination with the FRA to ensure that any improvements associated with implementing the Selected Alternative would be consistent with existing and proposed safety standards and regulations.

[3] Federal Railroad Administration, Positive Train Control Information, Accessed August 2, 2015, *https://www.fra.dot.gov/Page/P0152*

7.18.6 Subsequent Tier 2 Analysis

Subsequent Tier 2 analysis to address safety concerns would occur for site-specific elements as needed.