Photo: Brightline; Eric Czerniejewski

RAIL

EXECUTIVE SUMMARY

The U.S. rail network consists of approximately 140,000 miles of track and serves freight and passenger services. Freight rail supports the movement of 1.5 billion tons of goods annually.[1] Amtrak reported 28.6 million passengers in 2023, up from 22 million in 2022. Ridership on the Northeast Corridor shows fast growth, with passenger services on the national network increasing in frequency, speed, and scope.[2] The Infrastructure Investment and Jobs Act (IIJA) authorized $66 billion for rail projects from Fiscal Year 2022 to 2026, making vital improvements such as intercity passenger rail service expansion, Amtrak corridor development, and road–rail crossing grade separation possible.[3] Train safety incidents show a promising long-term trend, down 23% in the 23 years from 2000 to 2023, but recent incidents like 2023's derailment in East Palestine, Ohio, raise concerns and is just one of 10,577 incidents that year.[4,5] Recent programs and actions implemented by the U.S. Department of Transportation (DOT) can improve the rail network, which calls for a balance between modern advancements in the sector, such as precision-scheduled railroading, and sufficient staffing to ensure public safety.

BACKGROUND

Rail transportation was first conceived in the early 19th century as more efficient and expedient than water navigation to move people and goods. The network expanded throughout the century, going from only a few miles between end points to the initial transcontinental rail line in mid-century and several other lines spanning the national footprint by 1900. Rail experienced considerable growth in the early 20th century, followed by a downturn in the 1970s.

The 21st century represents a renaissance in the rail industry with the use of new technologies and the reemergence of passenger rail transportation. Although rail infrastructure continues to experience its share of challenges, it remains reliable, safe, and fuel efficient.[6]

CAPACITY AND CONDITION

Freight rail companies own and maintain their own infrastructure, while U.S. passenger rail consists of Amtrak and commuter rail systems that transport riders from suburban communities to dense urban centers.

Freight Rail

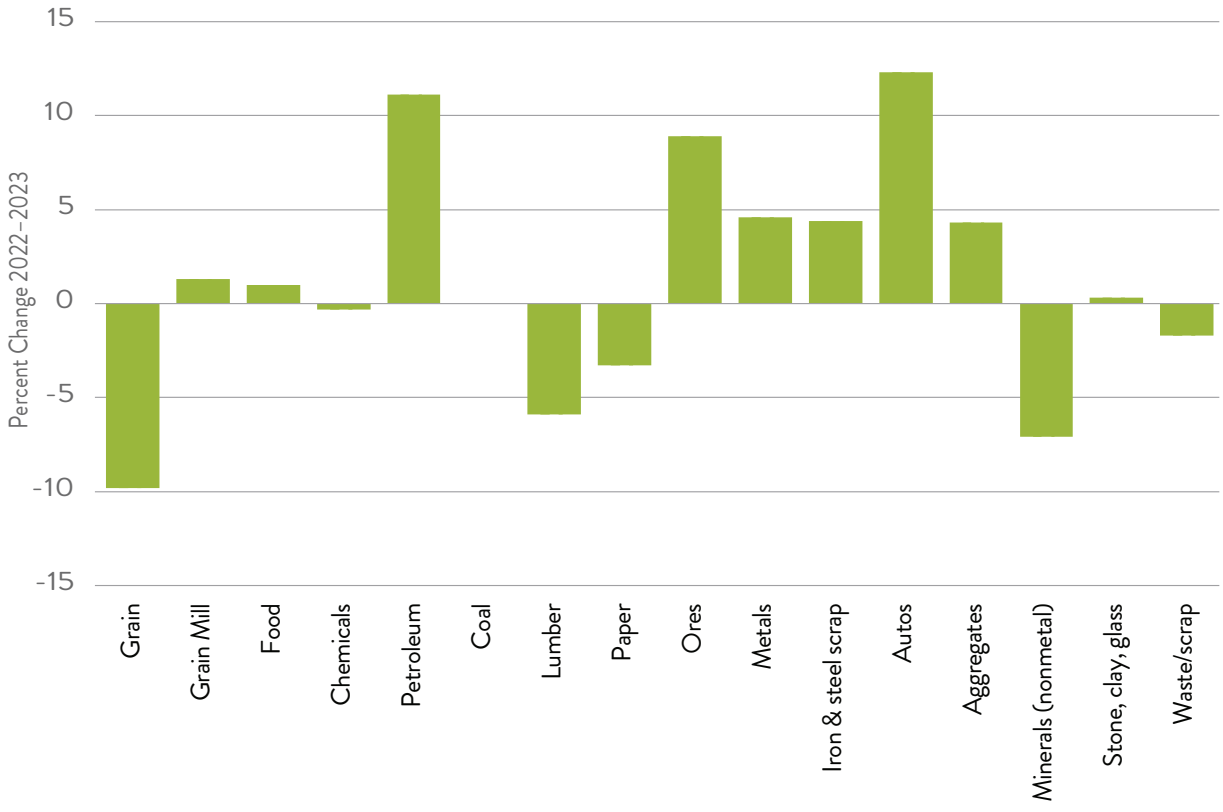
Freight rail moves 1.5 billion tons of goods, a figure that has been increasing over the last two decades. **In 2022, the average train car hauled 4,089 tons compared to 2,923 tons in 2000.** Freight rail transports agricultural products, chemicals, coal, crude oil, intermodal goods, and motor vehicles, among other essential items.[7]

Hundreds of private rail companies own and maintain the national freight network and are classified based on annual revenue. There are six large Class I railroads and 615 total Class II and Class III short line railroads in the U.S.[8] Together, these companies serve 49 states and Washington, DC.

Type	Definition as of 2023 (revenue numbers updated annually by STB and reflect inflation)	Mileage	Number of Systems
Class I	Revenue of at least $1 billion	Approximately 92,000 miles (accounts for 67% of freight rail mileage)[9]	6
Class II	Revenue of at least $47.3 million	47,500 route miles of Class II/Class III[10]	615[11]
Class III	Revenue less than $47.3 million[12]		

Freight rail traffic decreased during the early days of the COVID-19 pandemic but rebounded sharply in the months and years after. Although supply chain choke points existed, rail infrastructure performed adequately during this era of increased traffic.[13] Between 2022 and 2023, rail traffic increased slightly by 0.7% or 81,504 carloads. For October 2024, freight rail volume managed a 3.5% increase year-over-year. Though uncertainty exists, capacity on the freight rail network is currently sufficient.[14,15]

Carloads by Commodity, 2023



Source: American Association of Railroads Policy and Economics Departments (via Progressive Railroading, February 2024)

Carload Traffic for 2023

Traffic	Units	vs 2022 (%)
Total Carloads	11,701,875	0.7
Total Intermodal Units	12,667,354	-4.9
Total Traffic	24,369,229	-2.3

Source: Association of American Railroads, Week 52, 2023—Ending December 30, 2023

Railroads do not provide aggregated information on the condition of their infrastructure or ongoing maintenance priorities. Weight restrictions can be a proxy metric for rail infrastructure, as they can indicate the structural integrity of railroad tracks and the overall state of repair. Most railcars weigh up to 280,000 pounds, whereas heavy-axle freight cars weigh as much as 315,500 pounds.[16] Four of the largest freight rail networks in the U.S. indicate that most company rail lines support 286,000 pounds for 4-axle cars from 39 ft and longer.[17]

Class II and III railroads provide connections or serve as feeder lines to the larger Class I railroads. They might serve specific markets or regions, are often vital to transferring goods between modes, and serve as a "last mile" connection. Many of the Class II and III railroads in the U.S. have inherited track in need of maintenance and upgrades that were deferred by legacy owners. According to the American Short Line and Regional Railroad Association, **it is estimated that of the 86,000 miles of track and 31,000 bridges in operation, only 41,500 track miles (48%) and 17,000 bridges (53%) can sustain 286,000 lb. rail car traffic—the current industry standard across Class I operators.**[18]

Today, short line railroads invest at least 25% of their annual revenue in upgrading their track and other infrastructure, but challenges remain. For instance, Class II and III railroads are more dependent on individual industries or commodities than Class I railroads. A key example is coal. As coal demand has diminished, short line rails have sought alternative cargo to replace it.[19]

Passenger Rail

Passenger rail in the U.S. consists of Amtrak and commuter rail systems for passengers who rely on heavy rail to get from suburbs to major city centers. In Fiscal Year 2023, Amtrak reported more than 28.6 million riders—an increase of 25% from FY22 (22.9 million).[20]

Amtrak service can be divided into three categories:

- **The Northeast Corridor (NEC):** As the passenger rail corridor between Boston and Washington, D.C., the NEC is the only passenger rail corridor owned by Amtrak; other routes operate almost exclusively on privately owned freight railroad tracks. Before the pandemic, 39% of all Amtrak trips were on the NEC.
- **State-supported routes**: Routes under 750 miles that receive financial assistance from the state(s) where they are located; 47% of all Amtrak trips before the pandemic.
- **Long-distance routes**: Segments of track over 750 miles; 14% of all Amtrak trips before the pandemic.[21,22]

Service expansion and projects are underway as Amtrak looks to double ridership to 66 million by 2040. Capital improvements will support additional service stops, upgrade lines for improved rail performance, and update facilities. Projects include the Gateway Program, which will address ongoing congestion along a 10-mile stretch of Amtrak rail between New York and New Jersey, and the Chicago Hub Improvement Program (CHIP), which will implement key infrastructure improvements in this critical access point for long-distance travel.[23] The new Fredrick Douglass Tunnel Program will also address the NEC's biggest bottleneck, replacing the 1.4-mile Baltimore and Potomac Tunnel, which experiences persistent age-related issues.[24]

FUNDING AND FUTURE NEED

Freight rail companies in the U.S. invest an average of 18.4% ($23 billion) of their revenue on capital expenditures annually.[25] Class I railroads do not report an unfunded need or deferred maintenance. Short line railroads specifically invest 25% of their annual revenue in Operation and Maintenance.[26]

Several federal programs support financing for freight rail. In 2020, the Railroad Track Maintenance Tax Credit was permanently extended. The program, or 45G as it is frequently called, provides short line and regional railroads with a tax credit for maintenance up to $3,500 per mile.[27] Other programs were strengthened through the IIJA. The Consolidated Rail Infrastructure & Safety Improvements (CRISI) Grant Program offers funds to improve safety, efficiency, and reliability of rail networks; over $2 billion was made available in FY24.[28] Low-interest loans are also made available through the Railroad Rehabilitation and Improvement Financing (RRIF) program with $35 billion in direct loans and loan guarantees; as of 2023, Amtrak has two active RRIF loans totaling over $3 billion.[29,30] IIJA also authorized $245 million over 5 years for a new Railroad Crossing Elimination Program to invest in grade separation projects nationwide.[31]

Amtrak operates with support from the federal government's general fund. Before COVID, Amtrak was moving toward supporting itself through ticket sales and other sources of revenue, although capital expenses would still need to be paid for by the federal government. In FY19, Amtrak's revenue was $3.5 billion with expenses totaling $4.9 billion, a difference of $1.4 billion.[32] Incoming revenue significantly declined in FY2020 due to the pandemic with a 50% drop in riders and revenue down over 30% from the previous year.[33] The federal government responded by increasing federal subsidies over base funding by $3.7 billion in FY20 and FY21.

Most of Amtrak's capital needs are on the NEC. In July 2021, the organization issued CONNECT 2035, a comprehensive 15-year plan that outlines needed revitalizations along the corridor. Over 150 projects have been identified in CONNECT 2035, new and revitalized stations, the Gateway Program rebuilding the connection between New York City and New Jersey, bridge replacements, and storm hardening efforts. The plan costs $117 billion, with a $100 billion funding gap identified.[34] The NEC Commission revised its 15-year plan by releasing its Connect 2037 (C37) plan in November 2023. The update would address projects with a total cost of $135 billion in 2023 dollars or $175 billion when considering inflation. About 40% of this amount would be covered by existing or expected funds leaving a funding gap of $100 billion. Over one-third of the funding for C37 will be provided by the Federal-State Partnership for Intercity Passenger Rail grant program. The report cites 171 projects to get underway within the next 5 years, 2024–2028; however, only 74 projects have funding available to start, and only 21 are fully funded.[35]

In addition to studying the NEC specifically, the organization issued Amtrak Connects US in 2021, which proposes nationwide service expansion, including 39 new and 25 enhanced routes, eventually serving 20 million new passengers annually. The Amtrak Connects US program is projected to cost $75 billion over 15 years.[36]

Photo: Matt Kirby

Amtrak Proposed Expansion

Source: Amtrak, Connects US, April 2021

Robust funding from 2021's IIJA is a significant resource for rail improvements and expansion. The IIJA provides passenger and freight infrastructure with $66 billion over 5 years. Most of that funding goes to passenger rail service, including $22 billion directly to Amtrak as well as an additional $44 billion through competitive grants available for both freight and passenger rail.[37] In total, **$58 billion is available for passenger rail**, which, according to Amtrak, is the equivalent of the total federal funding for Amtrak to date over the organization's entire lifespan.[38]

In addition to the recent influx of federal funds, Amtrak's revenue is rebounding from considerable losses due to the pandemic. The agency's revenue was $3.4 billion in FY23, an increase of 20% from FY22 and 97% of pre-pandemic annual revenue.[39]

Robust funding from IIJA is a significant resource for rail improvements and expansion. The IIJA provides passenger and freight infrastructure with $66 billion over 5 years.

Photo: Matt Kirby

Amtrak Enacted Federal Funding FY2019–24

Year	Base	COVID-19 Relief/IIJA	Total
2019	$1,941,600,000		$1,941,600,000
2020	$2,000,000,000	$2,700,000,000	$4,700,000,000
2021	$2,000,000,000	$1,018,000,000	$3,018,000,000
2022	$2,331,371,000	$4,400,000,000	$6,731,371,000
2023	$2,453,000,000	$4,400,000,000	$6,853,000,000
2024	$2,427,763,000	$4,400,000,000	$6,827,763,000

Source: Amtrak. General and Legislative Annual Report & Fiscal Years 2023 & 2025 Grant Requests

OPERATION AND MAINTENANCE

Competing interests between freight and passenger rail unfortunately continues to pose ongoing operational challenges. For 2023, Amtrak reports issues with on-time performance (OTP), showing an overall 74.4% OTP for customers. Federal law requires freight railroad dispatching to prioritize Amtrak trains over freight, but the agency contends this is often ignored and results in lower OTP.[40] Freight and passenger rail can benefit from partnerships to improve track sharing and avoid delays such as the Chicago Region Environmental and Transportation Efficiency Program.

Class I Rail Employment

Source: Surface Transportation Board

While freight traffic is decreasing, there are some indicators that service delays are increasing. A survey commissioned by the American Chemistry Council (ACC) on its members' experience with the freight and rail system found that "companies that ship by rail are increasingly reporting that railroad delays and service challenges are worse. Since the fourth quarter of 2021, nearly all companies (93%) reported conditions were either getting worse (46%) or were about the same (48%). A small number (7%) of companies reported that rail transportation-related delays/service challenges have improved overall. Many rail users reported longer transit times (90%), missed switches (66%), increased demurrage charges (59%), reduced service days (64%), and higher rates (59%)."[41] In September 2024, ACC cited continued challenges in moving products by rail largely due to excessive costs, lack of service reliability, and insufficient network resiliency.[420]

Amtrak is expanding its maintenance capacity nationwide. New maintenance facilities are planned or under construction in Seattle, Washington, DC, New York, Boston, and Philadelphia, and are largely due to IIJA funds[43] Track maintenance is also underway including $240 million deployed in summer 2024 for infrastructure upgrades along the Northeast Corridor.[44] Amtrak is also making strides to increase staffing, which is necessary to carry out its goals, hiring more than 4,800 positions in FY23, with 21,600 total workers. Amtrak also aims to bolster workforce education through its Training Center and Workforce Development initiative with a new, consolidated training center and expanding training through activities such as the Mechanical Craft Workforce Development Apprenticeship Training Program.[45]

PUBLIC SAFETY

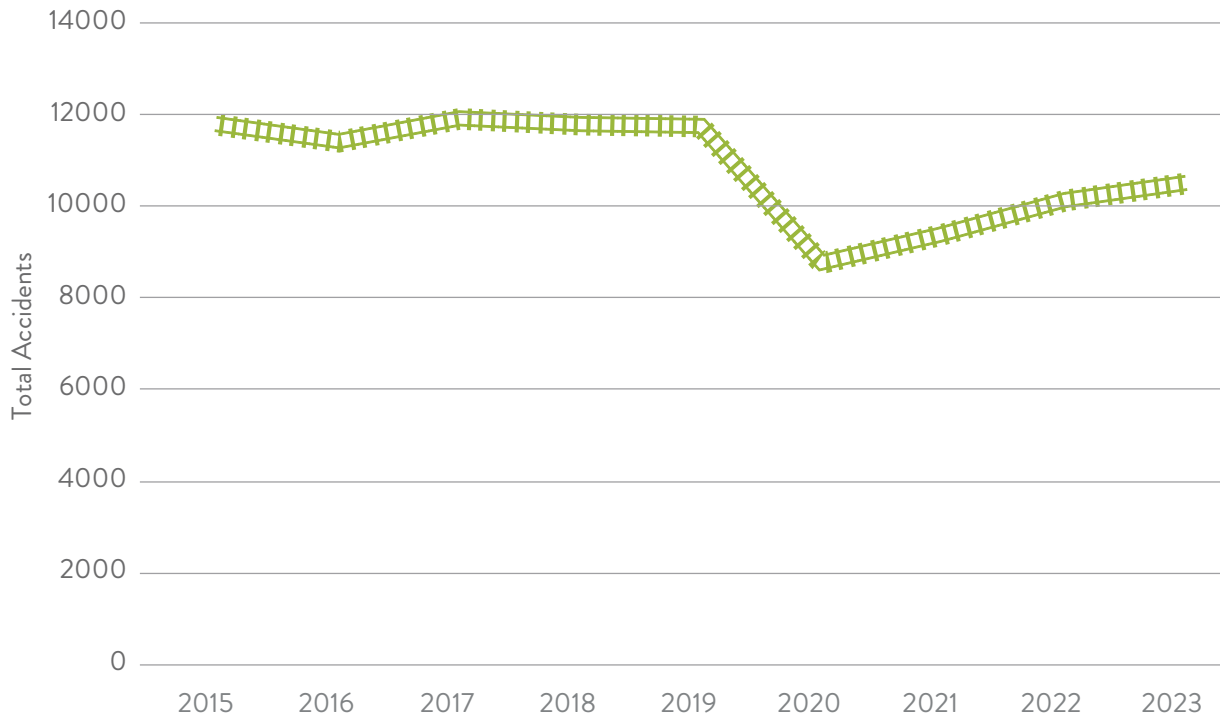
Freight railroads have experienced improved safety over the last two decades, although an uptick of incidents has been reported in recent years. For Class I railroad employees, fatality and injury rates for freight rail employees have dropped 63% since 2000, reaching an all-time low in 2023. However, more incidents and fatalities have been reported recently. According to Federal Railroad Administration (FRA) safety data, railroad deaths totaled 970 in 2023, an 7% increase from 2022's 904 and much higher than nearly a decade ago. Overall incidents were 10,578 in 2023, also larger than immediately preceding years. Trespassing is the top cause of rail-related deaths with a high number of incidents also occurring at highway-rail grade crossings.[46,47]

Rail Accident/Incident Overview 2015-2023

	2015	2016	2017	2018	2019	2020	2021	2022	2023
Number of railroads included	820	829	839	835	847	839	837	844	837
TOTAL ACCIDENTS/ INCIDENTS	11,851	11,482	11,990	11,874	11,800	8,807	9,453	10,207	10,578
Total fatalities	749	761	817	793	849	729	849	904	970

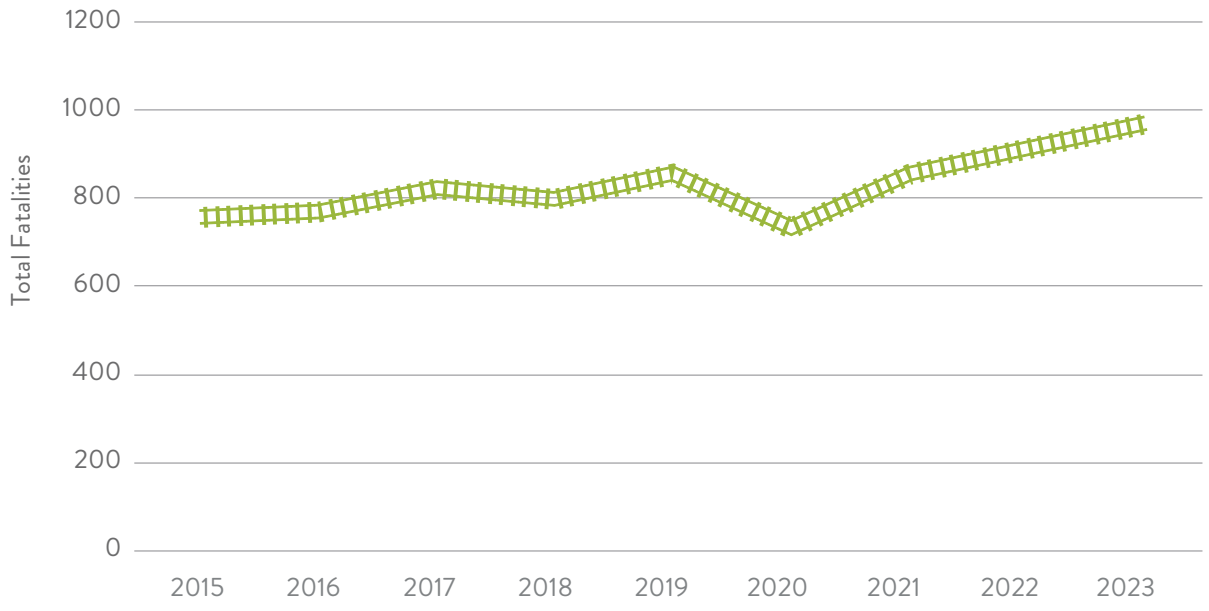
Source: Federal Railroad Administration

Rail Accident/Incident Overview 2015–2023



Source: Federal Rail Administration

Rail Fatalities Overview 2015 - 2023



Source: Federal Rail Administration

At the center of rail safety was a high-profile train derailment in East Palestine, OH, on February 3, 2023.[48] The derailment was caused by an overheated wheel bearing on a 149-car train passing through Ohio and carrying hazardous material.[49] According to the National Transportation Safety Board, 38 cars derailed, 11 of which were carrying hazardous material. Residents reported a myriad of health issues after hazardous chemicals were released into the soil, air, and water, including sore throats, coughing, and nausea, and thousands of nearby animals died.[50]

Overheated wheel bearings are frequently the cause of derailments. To counter these impacts, freight rail lines have "hot-bearing detectors" installed along tracks to provide alerts regarding overheating. NTSB found that the tracks had properly functioning detectors, but because they were spaced 20-plus miles apart, by the time employees received the alert showing that the bearing was heating up it was too late to respond. The derailed train also included DOT-111, cars which the NTSB had recommended be phased out due to risks presented in transporting flammable chemicals.[51]

In another high-profile public safety failure, the NTSB found that poor track conditions contributed to a fatal Amtrak train derailment near Joplin, MT, in September 2021. NTSB recommended increased track inspections and continued deployment of autonomous track monitoring systems to prevent future tragedies.[52]

In response to these and other rail incidents, the FRA finalized its latest regulation in April 2024 requiring a minimum size of train crews. With exception to some Class II and III railroads, freight trains must now be crewed by at least two workers.[53]

RESILIENCE AND INNOVATION

Rail lines face considerable threats from extreme weather, making resilience a key priority for future projects. In 2024 alone, Hurricane Helene damaged to rail lines in the Southeast, while rising waters caused the collapse of a rail bridge over the Big Sioux River between South Dakota and Iowa, and excessive heat along the Northeast Corridor delayed Amtrak trains due to fires and speed restrictions.[54,55]

It is estimated that for every $1 invested on project upgrades, another $4 in cost savings is achieved, which would otherwise have had to address network failures.[56] In 2024, Amtrak established design guidelines and identified current resilience certifications to incorporate climate considerations in asset development. Amtrak's development of a national network climate vulnerability assessment and

strategic plan is also underway. Based on a similar study for the Northeast Corridor in 2022, the assessment will incorporate future climate conditions to inform network plans and financing of capital improvements.[57] In addition, Amtrak's CONNECT NEC 2037 includes 215 miles of track renewal and signal replacement between Connecticut, Massachusetts, and Rhode Island, which will help protect the network against extreme weather.

Class I rail companies continue to implement strategies aimed at increasing efficiency and performance. Precision-scheduled railroading (PSR) has been increasingly adopted, improving efficiency through the simplification of routes, use of technology, train lengthening, eliminating unnecessary stops, and cutting costs. However, PSR is not without controversy, as it typically decreases the number of engineers on each train, while simultaneously increasing the length of trains. The GAO found that PSR has reduced overall staff among the largest freight railroads by 28% from 2011 to 2021.[58] However, FRA's new regulation directing minimum staff may result in added employees across the industry.

In addition, freight railroads have been implementing automated track inspection equipment that includes sensors. This provides more data for a lower cost than manual inspections and can provide additional insights into necessary improvements. However, these are not yet widely approved for FRA-required track inspection, nor is the data shared outside of the railroads.[59]

Although adding more train cars is not new, recent technologies, like positive train control and enhanced rail analytics, have helped companies expand train lines.[60]However, concerns exist related to grade crossing and difficulty in train controls for unexpected stopping. To reduce carbon emissions, freight companies are updating vehicles with more fuel-efficient locomotives, using railcars with lighter-weight steel, testing low-carbon fuels, and applying electric and hybrid vehicles and automation at rail yards and related facilities.[61] Companies are increasingly using active and remote monitoring on track bed and rail head conditions through LiDAR and related sensors. The ability of LiDAR to collect spatial data at centimeter levels offers companies the ability to improve safety and movement of goods across its infrastructure.[62]

For passenger rail, updated trains and infrastructure will improve performance and rider experience. Amtrak aims to reach 100% net-zero emissions by 2045. A significant share of Amtrak's fleet already features zero-emission vehicles, including 108 electric Northeast Regional and Acela locomotives.[63] As part of its capital improvement plan, Amtrak will implement infrastructure updates such as redesigned interlockings, new tracks, and modernized signals to accommodate higher speed rail as a part of the Susquehanna River Bridge Replacement.[64] For long-distance trips, Amtrak has renewed its delay notification system and improved accessibility through expanded ADA-compliant facilities.[65]

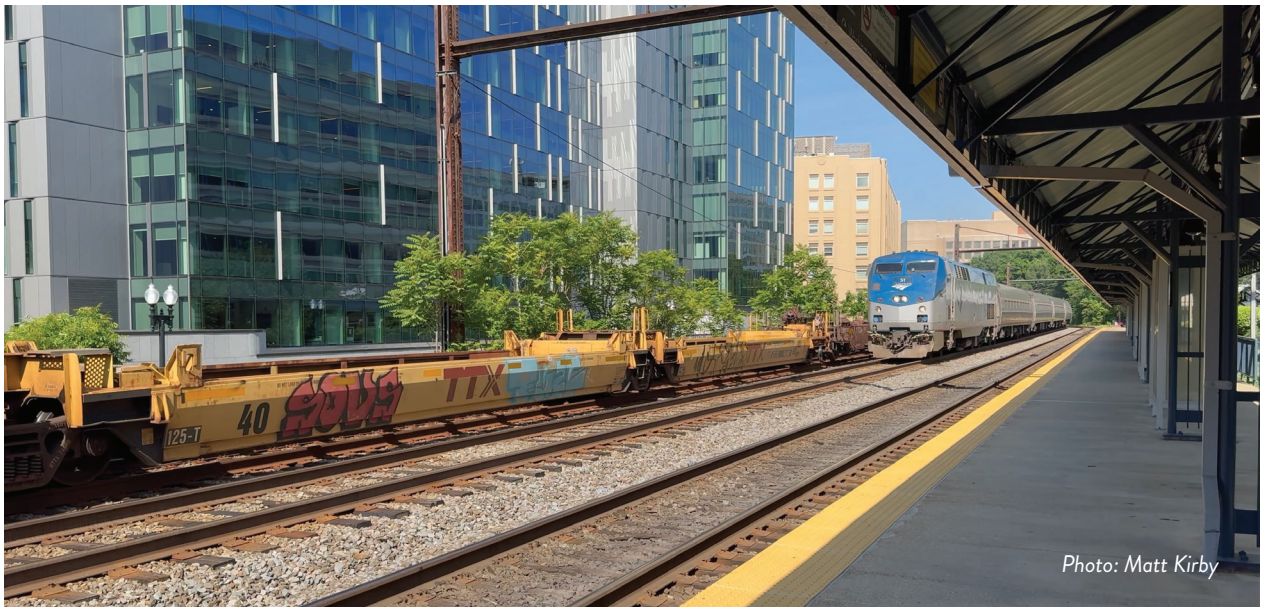


Photo: Matt Kirby

RECOMMENDATIONS TO RAISE THE GRADE

- Support improvements to the multimodal freight network, enhance safety, provide capacity improvements, and improve economic competitiveness, as outlined by the National Freight Strategic Plan (NFSP). To implement the NFSP, a robust National Asset Management system should be created to support identifying, prioritizing, and sourcing funding for capital investment projects.
- Implement safety technologies on additional wayside monitoring infrastructure to detect defects in rolling stock.
- Modernize rail tank cars, including transitioning from DOT-111 to DOT-117 and related infrastructure, and equipment upgrades to improve safety and reduce risk to the public.
- Enact renewed federal legislation addressing railway–highway crossings, hazardous materials, rail car inspections and maintenance, and emergency response.
- Support a financial and regulatory environment that grows private rail investment and innovative financing options.
- Enact public-private rail programs to enhance both freight and passenger service for more efficient operations.
- Encourage passenger rail infrastructure investment in high-population centers, particularly focused in the NEC, which will relieve system stress on other modes.
- Ensure passenger and freight projects supported by IIJA are implemented.
- Facilitate resilience of the current and future rail network by leveraging long-term partnerships with federal, state, and local agencies; freight railroads; and neighboring communities.

Photo: Kiewit Corporation

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