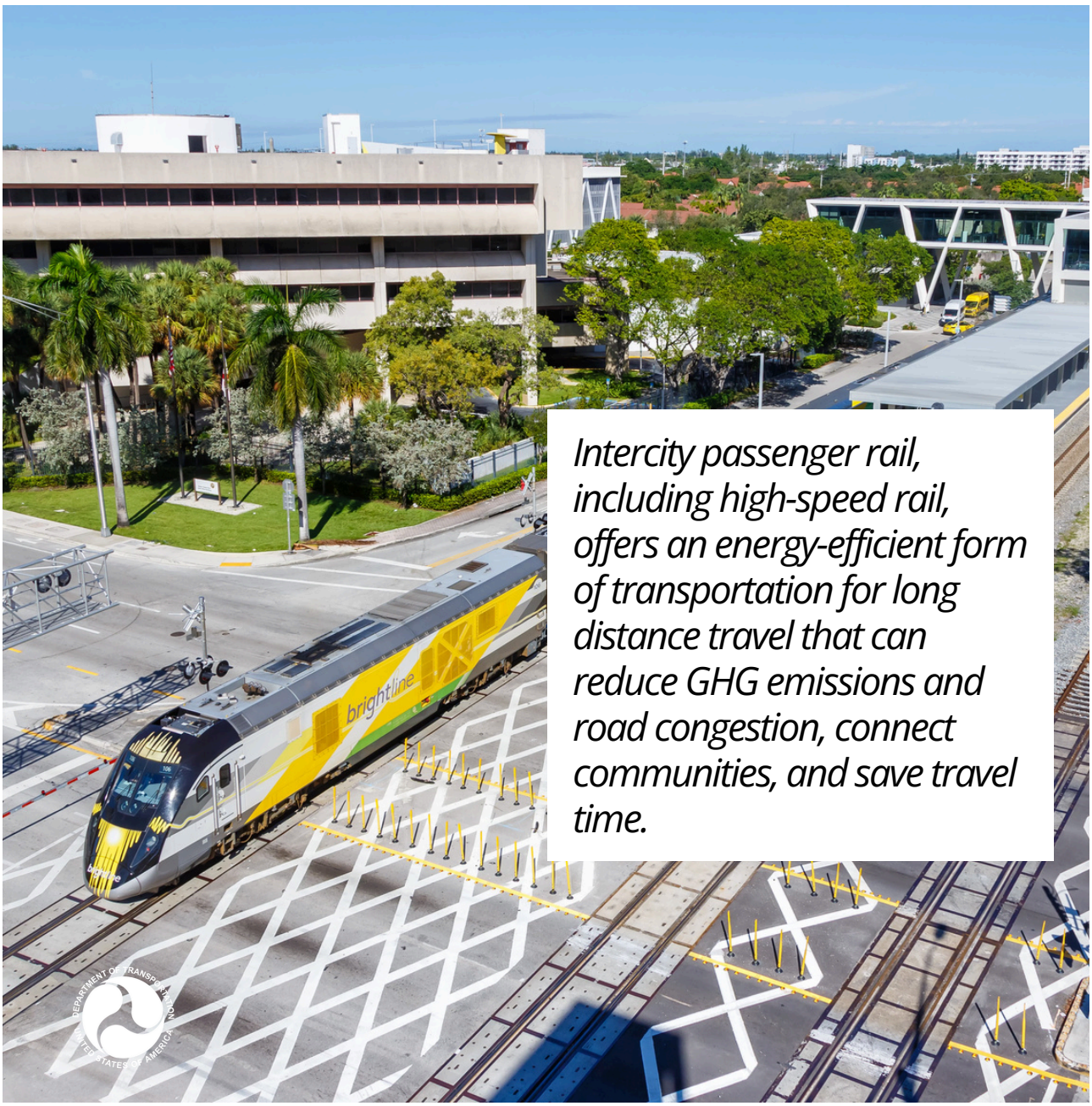
U.S. Department of Transportation, Climate Change Center
Climate Strategies that Work

INTERCITY PASSENGER RAIL



Intercity passenger rail, including high-speed rail, offers an energy-efficient form of transportation for long distance travel that can reduce GHG emissions and road congestion, connect communities, and save travel time.

Table of Contents

OVERVIEW

Best Suited for:
Long Term
Urban, Suburban, Rural, & Tribal

Intercity rail service connects cities over longer distances than commuter or regional trains. Intercity rail travel, including high-speed rail (HSR), **is generally less carbon-intensive than air or single-occupancy car travel** on a passenger-mile basis. Emissions savings are even greater on the electrified portion of rail which currently includes Amtrak's Northeast Corridor, the busiest passenger railroad corridor in the U.S. network. Giving passengers the choice to take passenger rail can help avoid greenhouse gas emissions from long distance travel and vehicle congestion. Additionally, **intercity passenger rail has the potential to save travel time in comparison to driving or flying** when accounting for time spent at and travelling to the airport.

(Source: Amtrak)

(Source: Brightline)

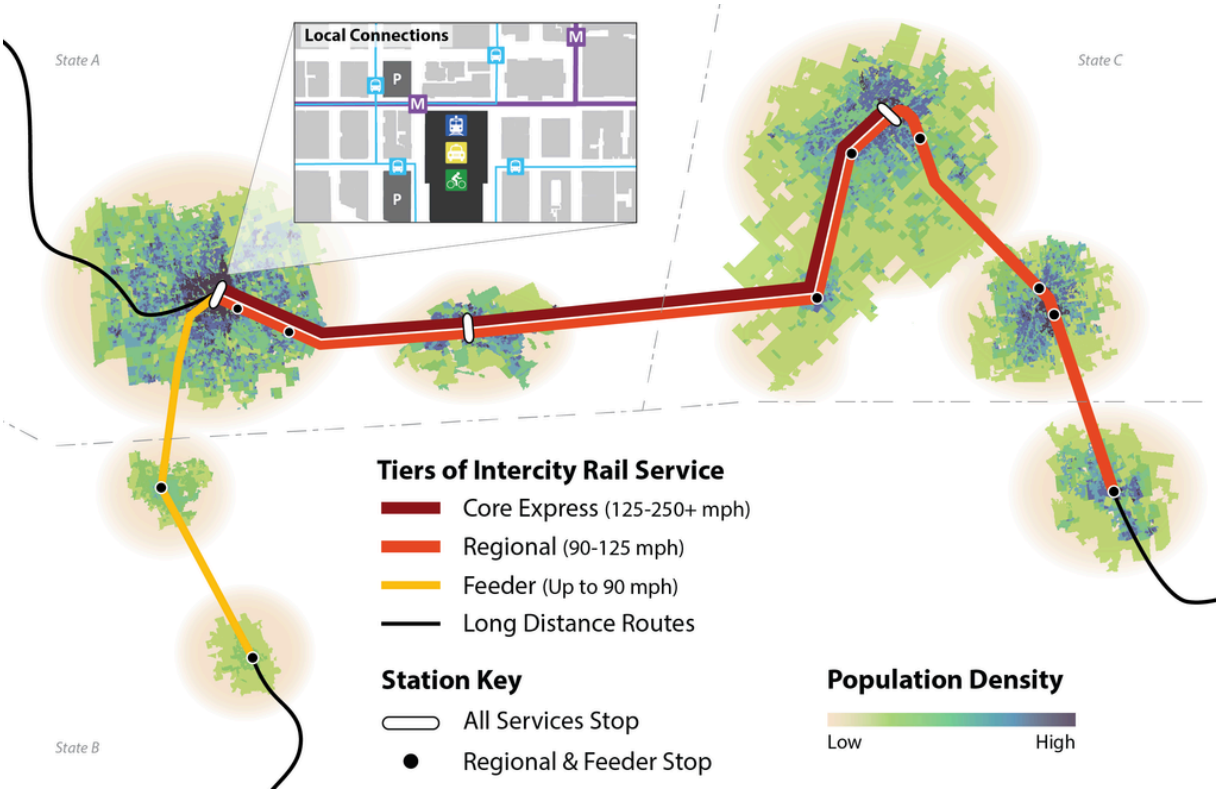
Did you know?

Amtrak's Connect US Vision calls for 20 million more passengers and more than 30 new routes by 2035.

Outside the U.S., rail emissions per passenger-mile are, on average, 80% lower than those of air travel due to high rates of electrification and railcar occupancy, suggesting that **additional investments in U.S. passenger rail could provide even more benefits from a climate perspective, relative to other modes.** High-speed rail, which operates at speeds above 155 mph on newly built lines and above 124 mph on upgraded lines, may provide the greatest climate benefits in terms of offering mode choice, particularly along congested routes. The Federal Railroad Administration (FRA), Amtrak, state and local governments, and private companies are working together to enable high speed rail in the U.S., in support of more convenient, efficient passenger travel.

JUMP TO: Overview | GHG Reduction Potential | Co-Benefits | Cost Considerations
Funding Opportunities | Complementary Strategies | Case Studies | What to Read Next | Resources

Intercity rail supports communities of different sizes from cities to rural areas. The figure below highlights how different tiers of rail service connect the wider regional area. *(Source: FRA)*



GREENHOUSE GAS REDUCTION POTENTIAL

This section provides an overview of greenhouse gas (GHG) emission reductions associated with the strategy. It highlights key findings and relevant metrics from GHG modeling resources, peer-reviewed studies, and real-world applications.

RAIL TRAVEL IS MORE EFFICIENT THAN SINGLE-OCCUPANCY PASSENGER VEHICLES AND AIR TRAVEL

Travel on intercity rail in the U.S. is approximately 30% less energy intensive per passenger than travel in single-occupancy vehicles (Davis and Boundy, 2022).

Traveling from St. Louis, MO to Chicago, IL by diesel train emits four times fewer CO_2 emissions (per passenger mile) than traveling by a gasoline-powered car (Simon et al., 2022).

The Heartland Flyer, an intercity rail line connecting Oklahoma City, OK and Fort Worth, TX produces only one quarter of the GHG emissions per passenger mile compared with the same trip taken by single occupancy vehicle and only one third of the GHG emissions from air travel (NASEM, 2015).

The Northeast Corridor is the busiest passenger railway in the U.S., accounting for 32.2% of customer trips but only 2.1% of track-miles in Amtrak's network (Amtrak, 2022). Because the route is electrified, emissions reductions are even greater as compared to other modes of travel. For example, traveling from Boston to New York on the Northeast Corridor has more than five times fewer GHG emissions than traveling by air (Simon et al., 2022). This is even when accounting for the GHG emissions from electricity production in the region. Greenhouse gas emissions avoided with electrified intercity passenger rail using clean energy would be significantly higher.

INTERCITY PASSENGER RAIL CAN REDUCE VEHICLE MILES TRAVELED (VMT)

Surveys of rail passengers indicate that 60-70% of rail travelers would use a personal vehicle for travel if the rail service was unavailable. This finding suggests that passenger rail provides an important alternative to personal vehicle use (Sperry & Collins 2018).

Highlighting the potential to reduce VMT, a survey of intercity travelers along the Northeast Corridor found that 38% of drivers and 54% of bus riders would take the train if their first choice travel mode were unavailable (Northeast Corridor Commission, 2015).

INCREASED USE OF PASSENGER RAIL HAS THE POTENTIAL TO GREATLY REDUCE TRANSPORTATION SECTOR EMISSIONS

One study modeled what U.S. transportation sector emissions would have been in 2019 if electric-powered high-speed rail was widely available. The results indicated that emissions would have been 23% lower, largely due to the study predicting that more travelers would have widely chosen high-speed rail over short-haul flights (<2000 km) (Zheng, 2022).

(Source: Amtrak)

CO-BENEFITS

This section outlines the multiple co-benefits associated with the strategy, including safety benefits, local air quality improvements, and improved accessibility. Each co-benefit presents examples that demonstrate how the strategy enhances regional or community well-being while addressing emissions.

SAFETY

Like air travel, traveling by rail is one of the safest modes of transportation. In the U.S., for the same distance traveled, a person is 17 times more likely to die while driving a car than if they were taking the train instead (Savage, 2013).

Intercity rail service contributes to roadway safety by providing a reliable and comfortable transportation option, reducing the risks associated with long-distance driving, such as fatigue. Nearly 17% of fatal motor vehicle crashes in the U.S. involve a drowsy driver (Tefft, 2012).

ACCESSIBILITY AND EQUITY

Amtrak offers discounts for students, children, seniors, people with disabilities, military personnel, and veterans (Amtrak, n.d.).

Intercity rail increases access to job opportunities, education, and everyday destinations for those who cannot or do not drive, especially the elderly, disabled, youth, and people living in lower-income communities.

COST SAVINGS

Traveling on passenger rail can save customers money on tickets compared to air travel.
Average cost savings traveling by rail rather than air on different U.S. routes (Glusac, 2019).

Trip	Average Cost Savings
Boston – New York City	$110
Seattle – Vancouver	$203
Los Angeles – San Diego	$70
Tampa – Fort Lauderdale	$82

Discounting tickets at off-peak travel times can incentivize ridership: A study in Switzerland demonstrated that a discount of one percentage point would cause a 0.16% increase in rescheduled trips among riders who would have traveled by train regardless of the discount. The impact of this slight discount demonstrates the potential of discounts at off-peak travel times to encourage rail ridership (Huber et al., 2022).

ECONOMIC GROWTH

Investment in intercity rail generates large economic return: Amtrak's services across the country return between $7 and $8 billion per year to the national GDP which is four times the typical annual investment (Rail Passengers Association, 2022).

Investment in intercity rail creates new jobs: The Brightline West high speed rail project is projected to create 35,000 construction jobs and 1,000 permanent jobs once service begins (The White House, 2023).

AIR QUALITY AND HEALTH

Reducing the number of vehicles on the road (especially in densely-populated areas) will decrease the concentration of air pollutants that are harmful to human health (VTPI, 2023).

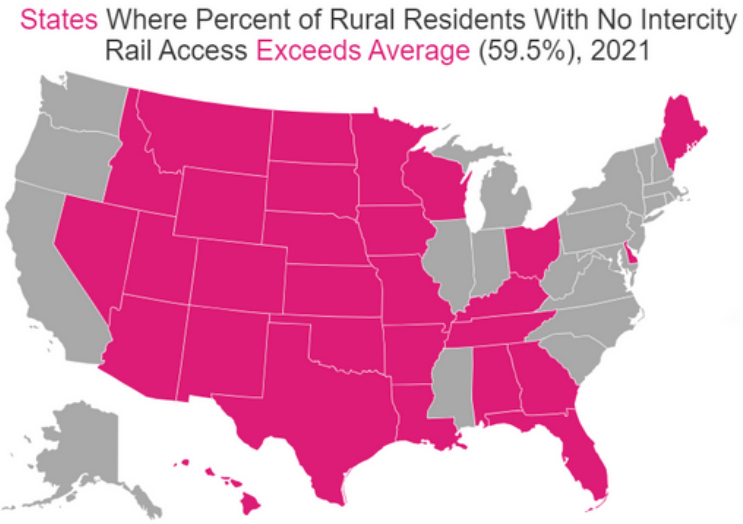
Passenger rail travel in Virginia removes around 271 million miles of VMT from Virginia roads (Department of Rail & Public Transportation, 2017), which in turn avoids the emissions from those vehicles.

Brightline West, connecting Los Angeles and Las Vegas with a fully electric high speed rail line, is projected to result in 3 million fewer cars traveling on Interstate 15 every year, as passengers opt to use high speed rail (Lazo, 2023).

RURAL COMMUNITIES

Intercity rail connects residents to opportunities and resources across communities. For example, workers gain access to jobs and businesses gain new customers from other communities.

Intercity rail provides mode choice for intercity trips and can connect residents to other transportation modes. For example, 54% of rural residents did not live within 75 miles of a major airport (Bureau of Transportation Statistics, 2023). Rail provides the opportunity to choose an alternative mode instead of enduring long drives for intercity trips.



Map showing transit access for rural residents (Source: Bureau of Transportation Statistics, 2023). Access to Intercity Transportation database is available here.

COST CONSIDERATIONS

The cost to implement intercity passenger rail varies widely depending on the scale, scope, and location of the project.

The cost of constructing intercity passenger rail, including high speed, can be less than constructing and maintaining roadways.

In 2019, the Washington State Department of Transportation examined different strategies to ease congestion on Interstate-5 which connects Portland, Oregon, Seattle, Washington, and Vancouver, Canada. Estimates for constructing a HSR line are around $24-42 billion while estimates for adding a lane to the highway are $108 billion (Scruggs, 2019).

Investing in intercity passenger rail can reduce cost burdens on other transportation modes by relieving congestion and reducing costs related to maintenance and traffic incidents.

Investment in the Northeast Corridor rail system has the potential to save the aviation and highway systems $8.2 billion per year by 2040 (Northeast Corridor Commission, 2014).

FUNDING OPPORTUNITIES

FRA's **Corridor Identification and Development Program** is a comprehensive intercity passenger rail planning and development program that will help guide intercity passenger rail development throughout the country and create a pipeline of projects ready for implementation. Grantees receive funding to develop a scope, schedule, and cost estimate for a service development plan.

FRA's **Federal-State Partnership for Intercity Passenger Rail Grant Program** provides funding for capital projects that reduce the state of good repair backlog, improve performance, or expand or establish new intercity passenger rail service. Funded projects will expand passenger rail service and improve existing corridors, making it more competitive with higher-emission intercity travel modes.

FRA's **Consolidated Rail Infrastructure and Safety Improvements (CRISI) Program** funds projects that improve the safety, efficiency, and reliability of intercity freight and passenger rail. CRISI funds can be used for a wide variety of projects supporting the development of rail, ranging from capital investments to workforce development and training, to research and development, and more.

JUMP TO: Overview | GHG Reduction Potential | Co-Benefits | Cost Considerations
Funding Opportunities | Complementary Strategies | Case Studies | What to Read Next | Resources

COMPLEMENTARY STRATEGIES

Connecting bus rapid transit routers to intercity rail can expand access to both and mutually reinforce opportunities for riders, especially for rural communities.

Commuter benefits incentivize employees to take public transit to the office which may include intercity passenger rail for longer commutes.

Cross-jurisdictional planning and collaboration can support efficient and high utilization intercity and cross-regional rail facilities.

Expanded public transit options can support access to intercity bus lines and mutually reinforce use of both in-city and intercity transit networks.

Shared micromobility and microtransit systems, located at intercity rail stations can help address last-mile travel and further support access to intercity passenger rail services.

Including intercity passenger rail locations and service schedule alongside intra-city public transit options supports public education about medium- and long-haul passenger public transportation options and encourages use of intercity passenger rail.

In a rural context, transit oriented development would focus on a rural downtown or town center, which could co-locate with intercity rail station routes, supporting additional economic growth and mobility options.

View All Strategies

JUMP TO: Overview | GHG Reduction Potential | Co-Benefits | Cost Considerations Funding Opportunities | Complementary Strategies | Case Studies | What to Read Next | Resources

CASE STUDIES

LOS ANGELES TO LAS VEGAS HIGH-SPEED RAIL - CALIFORNIA/NEVADA

The Nevada Department of Transportation (NDOT) received $3 billion from U.S. Department of Transportation (DOT) to help construct a Los Angeles to Las Vegas high-speed rail line in partnership with Brightline West, an intercity passenger high-speed rail service company. The new service will feature all-electric trains that travel at over 186 miles per hour, covering the 218-mile corridor in two hours and ten minutes, twice as fast as the average drive time. The project will break ground in 2024 and is expected to open before the Los Angeles Summer Olympic Games in 2028.

Brightline West High Speed Rail Project Map (Source: Nevada Department of Transportation).

BRIGHTLINE HIGH SPEED RAIL - FLORIDA

(Source: Brightline)

Brightline is the 235-mile long high-speed railway connecting Miami, West Palm Beach, Fort Lauderdale, Aventura, Boca Raton, and Orlando, with plans of expanding to Tampa. Trains travel up to 125 mph, so passengers can travel between downtown Miami and downtown Fort Lauderdale in 30 minutes between Miami and Orlando in 3 hours. A December 2023 report shows that ridership increased 29% from the prior year. The expansion to Orlando during this period led to an increase of long-distance ridership which accounted for 49% of riders.

RIGHT-OF-WAY ACQUISITION AND INFRASTRUCTURE IMPROVEMENTS - VIRGINIA

In Virginia, the acquisition of right-of-way from track owner, CSXT, has been a priority strategy to expand rail service options throughout the state. In addition, capital improvements such as a new passenger-dedicated bridge crossing the Potomac River and an increase in Amtrak service will reduce bottlenecks. The extension of the Roanoke Amtrak line to Christiansburg, Virginia, a town with less than 24,000 residents, will improve service to rural travelers. A 60% increase in service on the Virginia Railway Express, the region's commuter rail service, is expected from these changes which are 1/3 the cost of expanding I-95 in Virginia.

(Source: Virginia Passenger Rail Authority)

IMPLEMENTING INTERCITY PASSENGER RAIL: **WHAT TO READ NEXT**

The high cost of train tickets combined with the lack of high-speed options remains a barrier to widespread intercity rail acceptance in the U.S. Strategies that focus on lowering cost and increasing speed can help encourage mode choice.

A boom in European rail travel has been attributed to increased competition in the rail industry lowering prices such that they are often lower than flights as well as consumer demand for sustainable transportation modes (Mcclanahan, 2024).

> To learn more about costs and rail management, read PPIAF's Railway Reform: Toolkit for Improving Rail Sector Performance.

Public-private partnerships are useful for improving rail service and increasing the passenger base.

Intermodal partnerships can make it easier for passengers to choose modes. For example, partnerships between airline and rail companies are becoming more common. United Airlines and Lufthansa Airlines partnered with the Deutsch Bahn to allow passengers flying through Frankfurt Airport to book rail tickets at the same time as their airline ticket (Cole, 2023).

Many intercity passenger rail operators must negotiate with freight operators to gain access to or acquire rail lines. Successful agreements reduce delays and increase passenger rail service.

> To learn more about rail partnerships, read Transportation Research Board's Guidebook for Implementing Passenger Rail Service on Shared Passenger and Freight Corridors.

RESOURCES

GENERAL RESOURCES

FRA Rail Climate Considerations: This webpage provides an overview of strategies to address climate concerns. Links are included for resources, research, initiatives, and funding opportunities.

FRA Resources: This webpage provides links to guidance regarding planning, management, operations, grants, regulations, and NEPA.

FRA Maps- Geographic Information System: This webpage includes links to different maps relevant to rail safety and equity.

International Union of Railways Rail Adapt - Adapting the railway for the future: This report comes from the United Kingdom. The analysis of adaptation strategies and global case studies can be useful for U.S. stakeholders.

Transportation Research Board Guidebook for Implementing Passenger Rail Service on Shared Passenger and Freight Corridors: The guidebook outlines the steps to a successful public-private partnership from negotiations to modeling.

Texas A&M Transportation Institute Public Use of Rail Right-of-Way in Urban Areas Final Report: the report focuses on negotiating agreements with private freight companies, detailing different strategies with case study examples.

FRA Railroad Capital Project Guidance: This guidance document outlines the timeline, steps, and project management strategies to implement a railroad capital project.

TOOLKITS AND MODELLING APPROACHES

PPIAF Railway Reform: Toolkit For Improving Rail Sector Performance: This toolkit details strategies for improving the performance of the rail sector and provides numerous global case studies.

(Source: Brightline)

REFERENCES

Amtrak. (n.d.). *Amtrak everyday discounts: Deals for kids, seniors, Military & More*. https://www.amtrak.com/deals-discounts/everyday-discounts.html

Amtrak. (2022). *Amtrak 2021 Sustainability Report.* AmtrakSustains. https://www.amtrak.com/content/dam/projects/dotcom/english/public/documents/environmental1/Amtrak-Sustainability-Report-FY21.pdf

Amtrak. (2023). *FY 2022 Company Profile.* https://www.amtrak.com/content/dam/projects/dotcom/english/public/documents/corporate/nationalfactsheets/Amtrak-Company-Profile-FY2022-020823.pdf

Bureau of Transportation Statistics. (2023). *Access to Intercity Transportation in Rural Areas.* U.S. Department of Transportation. https://data.bts.gov/stories/s/Rural-Access-to-Intercity-Transportation/gr9y-9gjq/

Cole, F. (2023). *United partners with Lufthansa and Deutsche Bahn for rail connections in Frankfurt.* Business Traveler USA. https://businesstravelerusa.com/news/united-lufthansa-deutsche-bahn/

Davis, S., and Boundy, R. (2022). *Transportation Energy Data Book, Edition 40.* Oak Ridge National Laboratory. ORNL/TM-2022/2376. https://tedb.ornl.gov/wp-content/uploads/2022/03/TEDB_Ed_40.pdf

Department of Rail & Public Transportation. (2017). *Virginia State Rail Plan.* https://www.ctb.virginia.gov/resources/2018/feb/varailplan_execsummary_final_010818.pdf

Glusac, E. (2019). *Train vs. plane: And the winner is … well, it depends.* The New York Times. https://www.nytimes.com/2019/09/20/travel/trains-airplanes.html

Huber, M., Meier, J., & Wallimann, H. (2022). Business analytics meets Artificial Intelligence: Assessing the demand effects of discounts on Swiss train tickets. *Transportation Research Part B: Methodological, 163*, 22–39. https://doi.org/10.1016/j.trb.2022.06.006

Lazo, L. (2023). *Las Vegas-S. California high-speed rail gets $3 billion federal grant.* Washington Post. https://www.washingtonpost.com/transportation/2023/12/05/brightline-west-high-speed-rail-grant/

Lin, Y., Qin, Y., Wu, J., & Xu, M. (2021). Impact of high-speed rail on road traffic and greenhouse gas emissions. *Nature Climate Change, 11*(11), 952-957. https://doi.org/10.1038/s41558-021-01190-8.

Litman, T. (2024). *Community Cohesion as a Transport Planning Objective.* Victoria, BC, Canada: Victoria Transport Policy Institute. https://www.vtpi.org/cohesion.pdf

Mcclanahan, P. (2024). *In Europe, trains are full, and more are on the way.* The New York Times. https://www.nytimes.com/2024/01/04/travel/europe-new-trains.html

National Academies of Sciences, Engineering, and Medicine (NASEM). (2015). *Comparison of Passenger Rail Energy Consumption with Competing Modes.* Washington, DC: The National Academies Press. https://doi.org/10.17226/22083.

Northeast Corridor Commission. (2014). *The Northeast Corridor and the American Economy.* http://nec-commission.com/app/uploads/2018/04/NEC-American-Economy-Final.pdf

Northeast Corridor Commission. (2015). *Northeast Corridor Intercity Travel Study.* https://nec-commission.com/app/uploads/2018/04/2015-09-14_NEC-Intercity-Travel-Summary-Report_Website.pdf

OneRail. (2016). *Rail Safety in the United States.* https://www.onerail.org/wp-content/uploads/2018/03/OneRail-Safety-Report.pdf

Rail Passengers Association. (2022). *Passenger trains: Economic Engines.* https://www.railpassengers.org/site/assets/files/25442/economic_benefits_2022_final.pdf

Savage, I. (2013). Comparing the fatality risks in United States transportation across modes and over time. *Research in transportation economics, 43*(1), 9-22. https://doi.org/10.1016/j.retrec.2012.12.011

Scruggs, G. (2019). *The Case for Portland-to-Vancouver High-Speed Rail.* Bloomberg. https://www.bloomberg.com/news/articles/2019-12-04/the-case-for-portland-to-vancouver-high-speed-rail

Simon, M. C., Mittelman, A., Solman, G., Gilman, S., Henning, O., Raymond, A., & Blatnica, R. (2022). *Carbon Dioxide Emissions from Four Real World Inter-City Passenger Trips: A Comparison of Rail, Air, and Road Travel Modes by City Pair (No. DOT-VNTSC-FRA-22-02).* Federal Railway Administration. https://railroads.dot.gov/sites/fra.dot.gov/files/2022-12/CO2EmissionsByMode_FinalReport_FRA_12.2.22_PDFa.pdf

Sperry, B. R., & Collins, T. (2018). Improving Intercity Passenger Rail Planning using Evidence from Passenger Survey Data. *Transportation Research Record, 2672*(10), 236-246. https://doi.org/10.1177/0361198118793494

Tefft, B. C. (2012). Prevalence of motor vehicle crashes involving drowsy drivers, United States, 1999-2008. *Accident; analysis and prevention, 45,* 180–186. https://doi.org/10.1016/j.aap.2011.05.028

The White House. (2023). *Fact sheet: President Biden announces billions to deliver world-class high-speed rail and launch new passenger rail corridors across the country.* The White House. https://www.whitehouse.gov/briefing-room/statements-releases/2023/12/08/fact-sheet-president-biden-announces-billions-to-deliver-world-class-high-speed-rail-and-launch-new-passenger-rail-corridors-across-the-country/.

Zheng, S. (2022). *The Bullet Train to Lower-Carbon Travel.* International Council on Clean Transportation. https://theicct.org/aviation-rail-shift-lower-carbon-mar22/

For more information visit the DOT Climate Change Center, https://www.transportation.gov/priorities/climate-and-sustainability/dot-climate-change-center