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The Economic and Environmental Potential of **High-Speed Rail**

Mineta Transportation Institute

What is High-Speed Rail (HSR)?

High-speed rail (HSR) is a passenger rail system that operates at speeds greater than 150 miles per hour (mph). In the U.S., Amtrak's Acela is the only system presently capable of operating at such speeds, but only for approximately 50 miles of track. Planned HSR systems include Brightline West (Las Vegas to Southern California), the California High-Speed Rail Authority (Los Angeles to San Francisco), Texas Central (Dallas to Houston), and the Cascadia Project (Portland, OR to Vancouver, BC).



Amtrak service and high-speed rail proposals

Map of Planned HSR Systems in the U.S. Figure 1.

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Did You Know?

In the U.S., railroads have typically operated at speeds less than 125 mph. Several factors impact how fast a train can operate. Railroad speed restrictions are based on safety factors such as track curvature, signaling, track condition, and grade crossings. Passenger trains that share tracks with freight trains are limited to 79 mph. In the U.S., higher-speed trains (sometimes referred to as emerging high-speed rail) can operate between 125-160 mph. These trains are faster than traditional railroads and but slower than true high-speed rail.

What are the potential benefits of HSR?

Several academic and industry studies document the potential benefits of HSR. These include:

Job Creation and Economic Output:

Economic analyses of HSR projects attempt to identify direct spending (e.g., direct jobs and value of contracts for primary contractors and subcontractors), indirect spending (e.g., products and services ordered from local suppliers), and induced spending (e.g., every dollar spent on HSR will result in additional consumer spending).

One study by the U.S. Conference of Mayors finds that HSR in Los Angeles and Orlando can annually generate \$7.6B and \$2.9B respectively, creating new economic activity such as business sales, jobs, income, and tax revenue.¹ The study also finds that HSR could generate between 27,500 and 55,000 new jobs in Orlando and Los Angeles, respectively. The study also finds that in Albany, Chicago, Los Angeles, and Orlando, HSR can broaden labor markets, increase business productivity, and support the growth of technology clusters.

A study of HSR in the Chicago area estimates that regional HSR system could generate \$13.8 billion in new business sales annually, 104,000 new jobs from increased economic activity, and \$314 million in annual visitor spending in downtown Chicago.²

Another study estimates that the planned HSR system in California will generate more than 25,000 full-time equivalent job years (one person working full time for a year equals 1 job year), valued at \$67,200 per a job year between 2015 and 2029 under the most conservative scenario evaluated.³

The California High-Speed Rail Authority (CHSRA) estimates that HSR has generated an estimated 74,000 to 80,000 job years, \$5.6 billion to \$6.0 billion in labor income, and \$15 billion to \$16 billion in economic output between 2006 and 2022.⁴

Studies by Brightline suggest similar economic impacts, estimating the system between Las Vegas and California will generate \$10 billion in economic impact and 35,000 jobs, including nearly 1,000 permanent jobs for ongoing system operations and maintenance (Brightline West, 2023). ⁵A similar study from Brightline Florida estimates that the service will generate 2,000 jobs and \$6.4 billion in direct economic impact within the first 8 years of operation.⁶ Differences in economic models,

data collection, and study methodologies can produce a range of findings, which are sometimes difficult to compare. These estimates are similar to retrospective studies conducted of completed HSR projects in Europe.

In addition to the benefits indicated by these system-wide economic studies, the specific operational facilities required by HSR also directly generate jobs. These facilities include:

- Heavy Maintenance Facilities (HMF): HMFs provide in-depth maintenance and overhaul, including periodic major inspections and major component replacement. The CHSRA estimates that each HMF will require 150 to 160 staff, including specialist technicians/machinists and electronic technicians/welders.
- Light Maintenance Facilities (LMF): LMFs provide regular maintenance and operations for high-speed trains, such as inspections, cleaning, and emergency repair services. The CHSRA estimates that 125 to 150 jobs will be located at each LMF, including mechanical technicians, cleaners, and inspectors.
- Maintenance of Way Facilities (MOWFs): MOWFs provide for track and systems construction and maintenance for the rail infrastructure. The CHSRA estimates 400 to 500 jobs will be located at each MOWF, including warehouse staff, welders, machinists, signaling and communications technicians, electricians/linemen for the overhead catenary system and electricians for traction power facilities.
- **Operations Centers and Personnel:** The CHSRA estimates that approximately 500 additional personnel are required along a high-speed rail corridor to serve various roles, such as station personnel, drivers, onboard conductors, and security staff.

Source: California High-Speed Rail Authority

Domestic Manufacturing:

The Buy American Act generally requires Federal agencies to procure domestically sourced materials and products. For federally funded HSR programs, it is the Federal Railroad Administration's (FRA) policy to encourage domestic production, especially where domestic production doesn't currently exist.

Due to the vast number of railcar systems, components, and structural construction materials required to establish HSR in the U.S., the Buy American Act could support the growth of design, manufacturing, and assembly of HSR trains, components, systems, and other infrastructure, leading to a robust new economic sector in the United States.

As of 2015, it was estimated that the rail manufacturing industry supports 90,000 jobs and that more than 750 companies in at least 39 states manufactured components for passenger rail and transit. Additionally, more than 540 additional companies are manufacturing sub-components, materials, track, and infrastructure in the Midwest and Mid-Atlantic, as of 2015.⁷ Accordingly, investing in a single HSR corridor benefits not just that corridor but a vast array of suppliers across the nation.

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Take, for example, Brightline West's high-speed rail corridor from Las Vegas to Rancho Cucamonga. In addition to all the American made products that go into the manufacturing of the train sets and the rail stations along the route, this project will require approximately the following American-made or American-produced products:

- 60,000 tons of steel rail
- 1 million cubic yards of cast-in-place concrete
- 50,000 tons of structural steel
- 2 million tons of ballast rock
- 5 million tons of aggregate materials
- 900,000 tons of asphalt
- 700,000 concrete ties

This extraordinary volume of material won't come only from manufacturers and suppliers in Nevada and California where the system is going to operate, but from manufacturers and suppliers across the nation. In short, investing in high-speed rail will invigorate, strengthen, and enhance our domestic manufacturing base and create a new industrial sector for domestic production, with export potential.

Currently, the Railway Supply Institute (RSI) U.S. Rail Supplier Map (<u>https://www.rsiweb.org/advocacy/u-s-rail-supplier-mapping-project/</u>), highlights their 200+ member company headquarter locations and facilities within the United States. Currently, the analysis shows that RSI members represent more than 725 rail supply locations in 46 states and in 277 congressional districts.



Concrete railroad ties are manufactured in Clinton, Iowa; Cleveland, Ohio; Fort Payne, Alabama; Gary, Indiana; Harrisburg, Pennsylvania; Houston, Texas; and Taylorsville, North Carolina.



Steel rails are manufactured in Blytheville, Arkansas; New Haven, West Virginia; Bessemer, Alabama; and Butler, Indiana.



Ballast rock is quarried in forty-three states.



Asphalt is produced in forty-four states.



Structural steel is manufactured in more than twenty-eight states.

These are just a few examples.

Figure 2 depicts the equipment, systems, and infrastructure that will probably be required to be produced domestically. For example, Alstom—one of the major potential suppliers of HSR trainsets—has invested more than \$500 million with 170 suppliers in 27 states to manufacture the trainsets, such as those that would be used as part of California's high-speed rail system.



Figure 2. Rail Equipment, Systems, and Infrastructure that Could be Produced in the U.S. *Source:* American Public Transportation Association (APTA)



Figure 3. Station Equipment, Systems, and Infrastructure that Could be Produced in the U.S.

Source: American Public Transportation Association (APTA)

Station Area Development, Regional Connectivity, and Smart Growth:

Studies have documented local economic growth around station areas.⁸ The potential benefits of investing in HSR are not limited to the manufacturing of train sets and the construction of the track. There is considerable investment in the construction of local transit stations, which can contribute to transit-oriented development around the stations, creating local area and regional economic development. Some regions have been entirely transformed by the addition of local transit or intercity rail stations, stimulating mixed-use, high-density growth that is both economically and environmentally beneficial.

Studies also suggest that HSR in the U.S. could connect megaregions, forming the corridors of housing, employment, and recreation in more densely populated areas of the country.^{9 10 11}

Studies of high-speed rail systems in Europe have found that medium-sized cities within one hour travel time on HSR of a larger city have transformed from being spatially isolated to becoming integrated with larger metropolitan areas. It is likely that HSR in the U.S. could similarly transform auto-dependent suburbs into dense transit-oriented developments around station areas.

Greenhouse Gas (GHG) Emissions Reduction:

Mode shift from flying and driving to electrified HSR would reduce GHG emissions. One study estimates high-speed rail in the U.S. can save up to 0.8 billion short tons of CO2 emissions over a 40-year period.¹² The CHSRA estimates the state's HSR project will save 102 million metric tons of carbon dioxide equivalents (MTCO2e) over the first 50 years of the project's operating life.¹³

Another study of a planned HSR system along the Houston-Dallas I-45 corridor finds the lifecycle emissions of HSR are forecast to be significantly lower than passenger vehicles.¹⁴ The study concludes that the energy consumption of HSR is comparable to bus and aircraft, and is 27% lower than driving, which is the largest mode share along the corridor.

Cost Savings Associated with Foregone Infrastructure Improvements Impacts:

In 2019, the CHSRA commissioned an Equivalent Capacity Analysis study to estimate what it would cost to add the equivalent of the 500-mile high-speed rail system's people-carrying capacity by expanding highways and airports instead.¹⁵ The study found that it would cost an estimated \$122-199 billion to provide the equivalent highway and airport capacity that the San Francisco to Los Angeles high-speed rail network would provide. The study concludes that the equivalent roadway and airport capacity would cost about twice as much as high-speed rail and result in greater greenhouse gas emissions.

Key Takeaways:

An increasing number of studies suggest that HSR could have many economic and environmental benefits for the U.S. Broadly, these impacts can include job growth and increased economic activity; creation of an entirely new domestic manufacturing base; station area development and improved regional connectivity; and reduced GHG emissions and better land use. Additionally, a shift to HSR from other modes of transportation could help the public sector save money by reducing the need for highway, airport, and other infrastructure improvements. Further research and policy can help the U.S. leverage these potential benefits.

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