High-Speed Intercity Passenger Rail

SPEEDLINES

TŌHOKU SHINKANSEN
JR EAST - E10系 SERIES

December 2025
ISSUE #43

SPAIN'S NETWORK - With close to 4000 kilometres (over 2485 miles) of track, the Spanish High-Speed AVE trains operate on the longest high-speed network in Europe. Running at speeds of up to 310 km/h, this extensive network allows for fast connections between cities in Spain. Travel from Madrid to Barcelona in less than 3 hours! This modern train system connects many cities across Spain from Madrid and Barcelona, to Córdoba, Seville, Málaga, León, and Valencia.

CONTENTS

ABOVE:
THERE'S SOMETHING EXHILARATING ABOUT TRAVELING ON A JAPANESE BULLET TRAIN, OR ANY HIGH-SPEED TRAIN FOR THAT MATTER. THE SPEED, THE SLEEK DESIGN, AND THE EFFICIENCY MAKE IT A UNIQUE AND EXCITING EXPERIENCE.

ON THE FRONT COVER:
THE JAPANESE E10系 SHINKANSEN IS A NEXT-GEN BULLET TRAIN REVEALED IN 2025 BY JR EAST, SET FOR SERVICE IN 2030 ON THE TOHOKU LINE TO REPLACE OLDER MODELS (E2/E5. THEY FEATURE ADVANCED EARTHQUAKE SAFETY, UK-DESIGNED NATURE-INSPIRED GREEN LIVERY, ENHANCED PRIVACY SEATING, AND FASTER OPERATIONS USING ALFA-X TECH-AIMING FOR IMPROVED COMFORT, EFFICIENCY, AND POTENTIAL GLOBAL ROLLOUT, WITH TEST RUNS STARTING IN 2027.

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HS&IPR Committee & Friends

CHAIRMAN'S LETTER

A MESSAGE FROM CHAD EDISON

As the year 2025 is coming to an end, it is good to reflect on some of the positive news helping to shape high-speed and intercity passenger rail around the world. There are many lessons learned that can be shared, and the APTA High-Speed and Intercity Passenger Rail Committee provides a terrific forum for sharing some of these lessons. This latest edition of SPEEDLINES is a wonderful vehicle for disseminating some of the news and research that is helping to shape passenger rail in the U.S. and beyond. I especially want to draw your attention to several of our international partners highlighted in the Spotlight section of this issue. They are committed to transforming passenger rail in the U.S. through information sharing about best practices in Europe and Asia. Three of the four in the Spotlight wrote articles for this edition.

APTA understands the importance of experiencing and learning from passenger rail operators in other countries. The 2025 Executive Study Mission to Asia recently took place from November 5–14. The study tour focused on public transportation and rail advancements in Singapore, Seoul, and Tokyo. Participants engaged with local leaders to learn about innovations in service delivery, technology, and operational efficiency through site visits and discussions.

On November 14, Japan Central Railway (JRC) hosted the APTA Study Mission Tour group when visiting Japan. The delegation traveled from Tokyo aboard the JRC Tokaido Shinkansen to Mishima, where they were guided through the JRC General Education Center. There, they observed group training sessions and gained insights into the JRC approach to human resource development, an essential element in maintaining the safety and reliability of the Shinkansen. JRC also introduced their technical development initiatives, showcasing advanced capabilities that support high-speed rail operations.

In this issue of SPEEDLINES, we review high-speed rail ridership around the world. High-speed rail ridership has now fully recovered from the pandemic and is again growing. Here in the U.S., Amtrak has reported record breaking ridership for its fiscal year just ended on September 30. Over 34.5 million passenger trips were made in FY 2025), a 5.1 percent increase over the previous year. This record was driven by factors like new service (Mardi Gras) and expanded service options, improved reliability, and fleet modernization.

On a personal note, in case you have not heard, I have left my position with the California State Transportation Agency after serving 12-years. Now, I have joined Kimley-Horn as a Rail and Transit Practice Leader and will remain in Sacramento.

I hope to see you at the Legislative Conference in April 2026.

CHAD EDISON

FEDERAL
Transportation Funding

RAIL - Moving America Forward...

PUBLIC TRANSPORTATION IS A $93 BILLION INDUSTRY THAT EMPLOYS MORE THAN 430,000 PEOPLE AND SUPPORTS MILLIONS OF PRIVATE-SECTOR JOBS.

The IIJA offers significant federal funding for improving rail projects in America. From fiscal years 2022 to 2026, it aims to expand current Federal Railroad Administration (FRA) programs and create new ones to strengthen the rail network. The total rail funding amounts to $102 billion, which includes $66 billion from advanced appropriations and $36 billion in authorized funding.

FEDERAL APPROPRIATIONS:

IIJA 5-YEAR TOTAL FY 2022 - FY 2026	**$108.1B**
FAST ACT 5-YEAR TOTAL FY 2016 - FY 2020	**$64.2B**

UPCOMING APTA CONFERENCES

BUSINESS MEMBER ANNUAL MEETING
JANUARY 27-30
SAVANNAH, GA

LEGAL AFFAIRS SEMINAR
MARCH 15-17
PHILADELPHIA, PA

TRANSIT CEOS SEMINAR
MARCH 20-22
MONTEREY, CA

LEGISLATIVE CONFERENCE
APRIL 12-14
WASHINGTON, DC

INTERNATIONAL BUS ROADEO
MAY 15-19
SALT LAKE CITY, UT

MOBILITY CONFERENCE
MAY 17-20
SALT LAKE CITY, UT

RAIL CONFERENCE
JUNE 28-JULY 1
BALTIMORE, MD

START PLANNING YOUR SCHEDULES TO ATTEND UPCOMING CONFERENCES

APTA TRANSform & EXPO:
October 4–7, 2026, in Chicago, IL

APTA Rail Conference:
June 28–July 1, 2026, in Baltimore, MD

These events cover all modes of rail and features sessions on technology, operations, maintenance, safety, finance, and more.

TRANSform

BOSTON, MA

HSIPR COMMITTEE AT TRANSFORM - *RECAP*

Contributed by: SPEEDLINES STAFF

The High-Speed and Intercity Passenger Rail Committee had a full agenda at the Sunday, September 14th meeting at the TRANSform Conference in Boston. There were also several other related committee activities including an Amtrak and Alstom hosted NextGen Acela Open House at Boston South Station on Sunday afternoon (See Page 26 of this Issue) and a committee sponsored session on Tuesday about "Connecting the Northeast Megaregion: The Economic Necessity of Rail Service Along the NEC". On Saturday, September 13th, Amtrak and Alstom sponsored a TRANSform attendees-only private car on an Acela NextGen train that travelled from Moynihan Train Hall in New York City to Boston. Needless to say, committee members were kept busy throughout the conference.

COMMITTEE MEETING

Committee Chair Chad Edison led a lively agenda with updates from APTA and the Federal Railroad Administration, as well as review/recap of the June High-Speed Rail Seminar held at the APTA Rail Conference in San Francisco. The majority of the meeting was set aside for presentations from Alice Rodriguez (California High-Speed Rail Authority), Patricia Quinn and Natalie Bogart (Northern New England Passenger Rail Authority), and Jennifer Mitchell (Amtrak) and John Cohen (Alstom) highlighted transformative updates and developments across the country.

CALIFORNIA HIGH-SPEED RAIL AUTHORITY

Alice Rodriguez shared that the California High-Speed Rail Authority (CHSRA) continues to advance construction across the Central Valley. With 171 miles in development, including 119 miles under construction and 52 miles in advanced design, the project is moving toward the goal of delivering America's first true high-speed rail system.

The recent extension of California's cap-and-invest program to 2045 secures an estimated $1 billion annually in funding for the next 15 years, closing the funding gap for the Central Valley Early Operating Segment and opening the door for meaningful Public-Private Partnerships. The Authority now forecasts project delivery between 2038 and 2039, contingent on sustained funding and legislative support. To-date, CHSRA has created over 15,800 jobs, completed 58 structures, and continues to progress on the 150-acre Kern County Railhead near Bakersfield in preparation for track installation beginning in 2026.

NORTHERN NEW ENGLAND PASSENGER RAIL AUTHORITY

Patricia Quinn and Natalie Bogart (NNEPRA) highlighted continued growth along the Amtrak Downeaster Corridor, which has served 10 million riders since inception. This year there has been an increase of 112% in ridership from last year, the previous best year. A major focus at NNEPRA is the Portland Station relocation project. This public-private partnership is designed to reduce travel times, improve reliability, and enhance multimodal connectivity. The selected site, co-located

Record Ridership

NATIONAL TRANSIT TRENDS ARE UP

Overall public transportation ridership across the U.S. has been increasing post-pandemic. A report from the Federal Transit Administration (FTA) noted a more than 17% growth nationwide between 2022 and 2023, totaling 6.9 billion trips. More recent data from May 2025 indicates that U.S. transit ridership has reached 85% of pre-pandemic levels, with smaller cities recovering faster than large metro areas that are still impacted by changes in commuting patterns. New York City Subway: Has the highest annual ridership of any U.S. rapid transit system, with over 2 billion annual riders. Washington Metro: The second-highest annual ridership, with over 166 million passengers. Chicago 'L': The third-highest with over 127 million annual riders. NC By Train had its highest-ever ridership month in October 2025.

Amtrak provided 34.5 million customer trips – setting all-time records for both ridership and revenue for the second consecutive year. Through deliberate planning and thoughtful execution, Amtrak increased network capacity by 4.3% despite the challenges of an aging fleet – and customers responded with a strong demand for quality service, driving revenue that outpaced ridership.

with intercity bus service and near major employment centers, with 9,500 jobs within a half mile walk, Mercy Hospital adjacent and preferred by Amtrak and CSX promises operational savings of nearly $1 million and significant time efficiencies. Next steps include securing community support, pursuing federal design grants, and advancing transit-oriented development along the corridor.

AMTRAK/ALSTOM

Amtrak continues to expand and modernize its national network. Jennifer Mitchell spotlighted recent milestones including the launch of Mardi Gras service on the Gulf Coast in August 2025, preparations for Airos service in 2026 and major infrastructure projects that continue to progress, including new facilities across the country, the East River Tunnel rehabilitation and the Portal North Bridge, now 88% complete. The biggest celebration of the weekend was the launch of the NextGen Acela and John Cohen from Alstom joined Jennifer on stage to celebrate the launch of the first train meeting FRA's Tier III High-Speed Rail Guidelines. Amtrak has ordered 28 train sets for use on its flagship Acela service along the Northeast Corridor between Boston, New York, and DC, promising higher capacity and faster service.

These presentations and other discussions can be found on the High-Speed & Intercity Rail forum on APTAconnect.com, APTA's members-only, secure online community space specifically designed to connect you to your peers, colleagues, and friends.

CONNECTING THE NORTHEAST MEGAREGION: ECONOMIC NECESSITY OF RAIL SERVICE ALONG THE NEC

On Tuesday, September 16 at APTA's TRANSform Conference, the High-Speed and Intercity Passenger Rail (HS&IPR) Committee hosted a session focused on the importance of the Northeast Corridor and the connectivity it provides. The session featured Mitch Warren, Executive Director of the Northeast Corridor Commission; Meredith Slesinger, Rail and Transit Division Administrator MassDOT; Catherine Rinaldi, Executive Vice President, Gateway Development Corporation; and Jim Short, Acting Senior Vice President for Capital Delivery Amtrak.

Mitch Warren (NEC Commission) kicked off the session with the history and purpose of the Northeast Corridor Commission and its critical mission in fostering a collaborative environment among the multiple NEC stakeholders. The 457-mile NEC has four right of way owners and nine passenger service operators. Over 2,000 daily commuter trains, intercity and freight trains operate in the corridor. In 2024, over 628,000 daily trips were made on the NEC; 44,000 Amtrak trips and 584,000 commuter trips. Warren spoke to the roles of the states and operators that utilize the Corridor and their varying needs and abilities to support the necessary modernization of the NEC.

Meredith Slesinger (MassDOT) spoke to the plans to grow passenger rail across the state and provided an overview the role of MassDOT as owner of the NEC within the state. The NEC is anchored by South Station, Massachusetts Bay Transportation Authority's (MBTA) busiest station and Amtrak's fifth busiest station. The NEC is host to the MBTA's Providence Line Service which sees over 20,000 boardings a day. Slesinger also spoke to the Compass Rail Program, focused on the east-west corridor across Massachusetts through Springfield to Albany, NY and the north-south corridor that brings more rail access to western Massachusetts up and down the Connecticut River.

Catherine Rinaldi (Gateway Development Corporation) discussed the urgency and benefits of the Hudson Tunnel Project. The current two track North River Tunnel is over 115 years old and in need of major rehabilitation. The Hudson Tunnel Project will provide a new two track tunnel into Penn Station along with a new alignment providing much-needed redundancy and increased capacity. Rinaldi also updated the audience on construction activities in New Jersey, New York and in the Hudson River.

Jim Short (Amtrak) provided a business update on the NEC noting record ridership in FY2025, the $4.28 billion in planned capital investments for 2025, and the successful launch of the NextGen Acela trains on August 28, 2025. He shared an overview Amtrak's 30 plus projects along the NEC, including tunnel, bridge, major station, rail yard, and rail systems projects.

It was a highly informative and dynamic session on the critical role the Northeast Corridor plays in the country's economic growth.

BUILDING TRUST THROUGH RESILIENCY

Contributed by: Lucie Anderton, UIC

Passengers should expect safe, seamless journeys. To build trust and for rail passenger numbers to grow, rail must provide excellent service and be reliable and therefore resilient—able to withstand stresses without compromising safety or performance. Across North America, as in many regions worldwide, this means investing in rail systems that are designed to deliver continuity and recover quickly from disruption. At APTA's Transform 2025, national weather delay analysis was discussed in a dedicated panel discussion, showing delays along the national network in the US attributed to weather have risen from 1.9% to 4.5% (2002-2024).

The UICs recent 'Resilient Railways' (RERA) projects provide valuable insights from railways around the world on how railways can achieve this balance, offering practical lessons for building networks that remain strong, dependable, and ready to meet the demands of the future. The UIC's RERA Temp (Resilience to Extreme Temperatures) and RERA Rain (Resilience to Heavy Rainfall) projects provide structured methodologies and evidence on how rail networks can anticipate, absorb, and recover from disruption. For North America, these findings offer both caution and opportunity: the sector must embed resilience into design, operations, and governance to deliver on growing passenger expectations.

Temperature extremes place railways under severe stress. Tracks can buckle in extreme heat as metal expands, tracks also suffer when underlying soils dry and shrink in droughts. Sand can cause a range of issues on tracks and locomotive engines as deserts expand and drift onto lines. On top of this, wildfires are frequent during extreme heatwaves, causing widespread damage in many regions both rural and urban. Beyond the urgent events, the long-term effects of heat stress include fatigue in metals and accelerated ballast degradation. All these extreme heat hazards are leading to significant safety concerns, but they also affect service, with delays and cancellations eroding trust in the railways. Adding to this, heat waves test passenger

> *"The list of sustainability projects we are working on is getting longer every year! We started working on energy decades ago, and today, in the Sustainability Platform, we now actively work in noise and vibration, air quality, biodiversity and circular economy."*

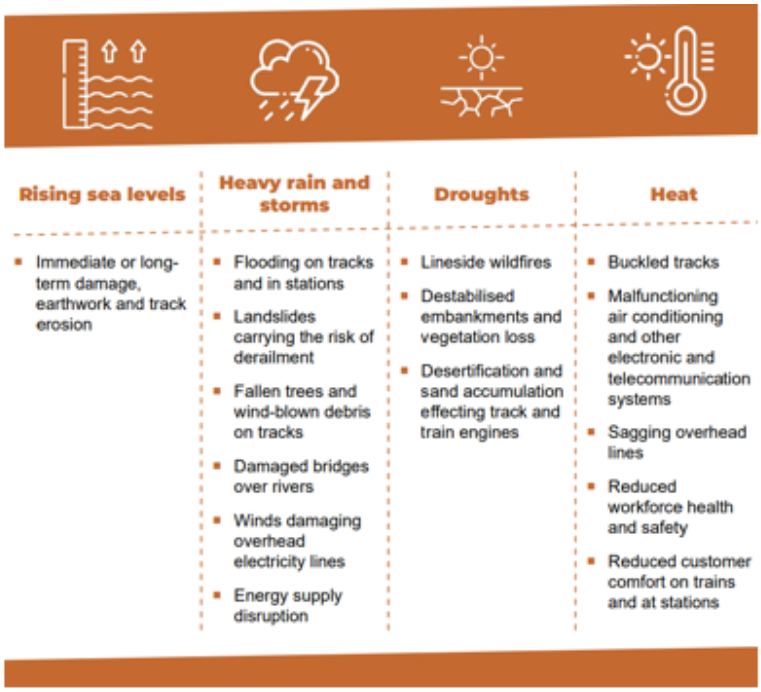
comfort at stations and on-board systems can become strained as cooling capacity is exceeded. In North America, railways face the dual challenge of extreme cold in Canada and the northern U.S. and extreme heat in the deserts of the Southwest.

The disruptive force of heavy precipitation has been a UIC focus as well. Flooding events damage track foundations and river bridges, overwhelm drainage, and in some regions trigger landslides that cut off corridors entirely and can cause derailments. Resilience is not simply about rebuilding after the event, but about designing railways that can manage water flows dynamically.

WHAT IS THE KEY LEARNING FROM THE GLOBAL DISCUSSION?

Through collaborative workshops and knowledge sharing, the UIC project identified key lessons for strengthening climate resilience in rail. Effective adaptation requires cross-sector learning, routine risk assessments, investment in research, and staff training, supported by stress testing and simulation exercises. Infrastructure must be designed for extremes, with elevated assets, improved drainage, water-resistant equipment, and nature-based solutions complementing engineering measures such as waterproofing and thermal expansion devices. Regular maintenance and geotechnical stabilization are vital to sustaining resilience.

Emergency management reduces disruption through clear communication, pre-positioned defenses, backup power, and recovery plans, while public awareness campaigns improve passenger safety. Monitoring technologies—including weather forecasting, drone surveillance, and automated sensors—enable proactive responses, with performance indicators guiding continuous improvement. Embedding resilience in long-term planning is essential; the RERA approach advances climatic-informed asset management by using probabilistic, forward-looking models and criticality mapping to prioritize interventions, ensuring resources strengthen the most vulnerable and essential parts of the network.



^ *Figure Above-*
Top impacts as reported by RERA project participants

WHAT ARE THE SOLUTIONS THAT ARE BEING TRIED IN NORTH AMERICA AND AROUND THE WORLD?

California High-Speed Rail Authority is adapting their railway for extreme heat and desertification as well as flooding. The authority provides clear requirements to their designers to consider these hazards, finding the essential ingredient is collaboration with their suppliers but also statewide guidance and global partners. Also in California,

Caltrain's electrification project incorporates overhead catenary systems with automatic tensioning designed for wide thermal variability.

Canadian National (CN), has begun experimenting with rail stress monitoring and infrared inspection to manage rail breaks and heat-related distortions. Amtrak, in partnership with local authorities, has upgraded drainage and seawall protections along the Northeast Corridor in New Jersey, where storm surges and heavy rainfall routinely threaten service continuity. In the Pacific Northwest, BNSF Railway has piloted slope stabilization projects and monitoring systems to detect early signs of landslides along coastal routes, allowing preemptive action before failures occur. Similarly, in Houston, Union Pacific (UP) has worked with local flood-control districts to expand culvert capacity on freight corridors, ensuring that supply chains remain open even during intense rainfall events.

Norfolk Southern (NS) installed a "Living Shoreline" at Lamberts Point in Norfolk, Virginia, a key marine terminal for railroad operations, facing flood risks due to erosion at the Elizabeth River shoreline. Norfolk Southern collaborated with the Elizabeth River Project to create a sustainable living shoreline using sand, marsh plantings, stone, and oysters. This project provided flood protection, benefiting the railroad, environment, local community, and businesses.

Elsewhere around the world, SNCF (France) has implemented predictive maintenance using thermal sensors, resulting in a 30% reduction in heat-related delays. ADIF (Spain) deployed automated flood barriers and drainage sensors, successfully preventing service disruptions during flood events. ÖBB (Austria), implemented a large-scale river restoration project during the construction of a new rail line on the Baltic–Adriatic Corridor. ÖBB restored 1.4 km of natural river course and created multiple connected wetland habitats across 20 hectares. These wetlands now act as flood retention areas, improving protection for the railway infrastructure.

The combined lessons of RERA Temp and RRA Rain pint to a shift from reactive recovery toward proactive resilience management. Operators can employ scenario-based risk assessments in their capital planning, prioritizing investments that best expand adaptive capacity. Advances in digital technology are particularly important. Predictive analytics, digital twins, and sensors are already being trialed, offering real-time visibility into asset condition and enabling maintenance to be performed before failures occur. These tools, coupled with operational strategies such as pre-emptive speed restrictions, customer communications, and mode-switching agreements, transform resilience from a defensive posture into a competitive advantage.

Most importantly, the UIC projects reinforce that resilience means more than bouncing back. It is about bouncing forward—learning from each disruption and emerging stronger, more adaptive, and more reliable. For railways in North America, adopting this mindset means integrating resilience indicators into investment decisions, modernizing engineering codes to reflect future extremes, and working collaboratively across the industry to share best practices. Rail has long been one of the most energy-efficient and reliable modes of transport. By embedding resilience as a core principle, North America can ensure that its railways continue to serve customers with safety, continuity, and confidence, even under the stresses of an uncertain operating environment.

Find out more about ***UIC*** *work on the topic at :*

https://uic.org/sustainability/article/adapting-to-climate-changes

Lucie Anderton
UIC Head of Sustainability Unit

LUCIE ANDERTON IS THE DIRECTOR OF SUSTAINABILITY AT THE INTERNATIONAL UNION OF RAILWAYS (UIC), WHERE SHE LEADS GLOBAL WORK ON SOCIAL AND ENVIRONMENTAL TOPICS ACROSS THE RAIL SECTOR. A PASSIONATE ADVOCATE FOR RAIL AS A CLIMATE SOLUTION, LUCIE REPRESENTS UIC IN INTERNATIONAL SUSTAINABILITY FORUMS AND DRIVES COLLABORATION AMONG MEMBERS WORLDWIDE. SHE SERVES AS THE UIC COORDINATOR FOR THE NORTH AMERICAN REGION. WITH OVER 20 YEARS OF EXPERIENCE IN SUSTAINABILITY POLICY AND ENVIRONMENTAL MANAGEMENT—GAINED PRIMARILY AT NETWORK RAIL, THE UK'S RAIL INFRASTRUCTURE MANAGER—LUCIE BRINGS DEEP EXPERTISE IN ADVANCING SUSTAINABLE PRACTICES WITHIN THE RAIL INDUSTRY AND MAJOR INFRASTRUCTURE PROJECTS.

INTERNATIONAL HIGH-SPEED RAIL EXPERIENCES

Contributed by: SPEEDLINES STAFF

International high-speed trains have long been the envy of the United States. The high-speed services offered in Asia, Europe and Africa have well established track records of delivering fast and convenient service with high ridership. Like all travel modes, these international high-speed services suffered significant losses of ridership when the COVID-19 pandemic emerged in early 2020.

International high-speed rail ridership witnessed a significant rebound in 2024, and ridership on many high-speed routes has fully recovered from the drop due to the COVID-19 pandemic. In 2024, Taiwan High-Speed Rail carried a record 78.25 million passengers, a 7 percent increase from the year before. Travel and Tour World notes that rail passenger numbers in Europe recovered rapidly post-COVID, with countries like Germany and France experiencing 30 percent growth from the previous year in 2024.

The high-speed rail market is poised for continued expansion, with increasing urbanization and the need for efficient mass transit, and as highways and airports continue to become congested and unable to keep pace with population growth, the need for alternative transportation grows and people are looking for new solutions. Efforts to integrate high-speed rail with other transport modes like long-haul air networks and regional and local public transport services can facilitate seamless travel and create more attractive options for passengers in the future.

Fueled by rapid economic development and infrastructure investment, there is expected substantial growth in high-speed rail in China and India. The massive infrastructure investment, especially in China, has raised concerns about high debt levels among local governments and railway operators. Addressing the challenges of sustainable financing models, high costs, political opposition, and land acquisition will be crucial for the continued growth and success of high-speed rail globally.

CHINA

China's staggering high-speed rail ridership—over 4 billion passengers in 2024—is driven by a powerful mix of infrastructure and policy factors. With the addition of new high-speed lines, China is again setting the pace for high-speed rail development in the world and is in a class all alone.

Let's unpack what fuels this rail revolution.

Massive Network Coverage – By far, the high-speed rail network in China is the world's largest. There is over 27,900 miles (45,000 km) of operational high-speed rail lines. The network connects almost every major city, including remote regions, making rail the most accessible mode of long-distance travel. High-speed rail has reduced domestic air travel by nearly 30 percent in some corridors.

Speed & Frequency - Trains run at maximum operating speeds of 155 – 220 mph (250–350 km/h), which reduces travel times between cities when compared to driving or flying. Some routes operate up to 54 trains per day or almost every 25 minutes on average.

Affordable Pricing - Fares are competitive with buses and cheaper than flights, especially on routes exceeding 150 miles. Frequent promotions and tiered pricing make it accessible to a wide range of travelers.

Multimodal Connectivity - Stations are integrated with subways, buses, taxis, and bike-sharing, making transfers seamless to local and regional public transportation. Many stations have parking, rental car facilities, and bicycle stands. The integrated passenger network boosts regional development, tourism, and labor mobility.

Continuous Expansion & Innovation - New corridors like Chongqing–Xiamen are closing gaps between inland and coastal cities. Investment in advanced electric multiple unit (EMU) trains, control systems, and power supply keeps the system fast and reliable.

Strategic Policy & Planning – Central government support includes tech innovation plans, safety regulations, and massive infrastructure budgets. Policies encourage urban integration, economic growth, and public adoption.

China's high-speed rail isn't just a transport system—it's a national strategy.

EUROSTAR

Eurostar reported transporting 19.5 million passengers in 2024, marking a record-breaking year. This ridership increase reflects the merge of Eurostar and Thalys in 2022. Ridership increased by 5 per cent compared to 2023, when Eurostar transported 18.6 million people, with 850,000 more passengers than the previous year. The Paris 2024 Olympic and Paralympic Games played a major role, contributing 1.9 million riders and over 900 dedicated trains for athletes and teams. There was very strong growth on key routes:

- London–Paris: +280,000 passengers
- London–Brussels: +250,000
- Paris–Brussels: +160,000
- Paris–Netherlands: +140,000

Eurostar also expanded its services, relaunched its "Snap" discount program, and saw a 39 percent increase in loyalty program membership, reaching nearly 4 million members.

FRANCE

The TGV continues to deliver on its promise of fast, convenient and comfortable travel. In 2024, TGV ridership reached a new record high with 126 million passengers, a 3.8 percent increase compared to 2023. This growth reflects a sustained post-pandemic recovery for French rail travel. The Paris 2024 Olympic and Paralympic Games played a major role in this growth. The influx of 500,000 spectators daily for Olympic events created a huge surge in demand for TGV service, especially on routes connecting major French cities to Paris. Additional trains were added to high demand lines such as Paris – Lyon and Paris – Lille to handle the surge in demand.

There were major disruptions from sabotage acts targeting TGV routes just before the Olympic Opening Ceremony. SNCF worked overnight to restore services. The French government and SNCF implemented enhanced security to mitigate further disruptions.

The overall passenger numbers, including cross-border services like Eurostar and Lyria, soared to 156 million, marking a 6 percent increase over 2023. France's love affair with high-speed rail is clearly going strong.

HSR	Operator	Annual Passengers (Millions)					
		2019	2020	2021	2022	2023	2024
Acela	Amtrak	3.6	1.6	.09	2.1	3.0	3.2
NEC Regionals	Amtrak	8.9	4.5	3.5	7.1	9.1	10.8
China HSR	CRH	2,290.0	1,560.0	1,920.0	1,228.8	2,940.0	4,080.0
Eurostar	Eurostar	11.1	8.3	1.6	8.3	18.6	19.5
Thalys	Thalys	7.9	2.7	2.5	6.5	w/Euro	w/Euro

GERMANY

Germany has a fully integrated railway network and a fleet of 410 intercity express (ICE) high-speed trains. There are currently 35 scheduled ICE lines in Germany. This network connects major German cities and extends to neighboring countries like Austria, Belgium, France, the Netherlands, and Switzerland. Key domestic routes include connections between major cities like Frankfurt, Hannover, Hamburg, Dortmund, Düsseldorf, Cologne, Stuttgart, Munich, Münster, Bremen, Nuremberg, Dresden, Berlin, Halle, and Erfurt. The ICE network is constantly evolving, with new trains being introduced and service adjustments happening regularly.

YOU CAN VIEW THE DEUTSCHE BAHN ICE/IC NETWORK MAP AT: HTTPS://CMS.STATIC-BAHN.DE/WMEDIA/REDAKTION/AUSHAENGE/STRECKENKARTE/LINIENNETZ-ICE-IC.PDF

In 2024, approximately 105.6 million passengers rode ICE trains in Germany, according to data from Deutsche Bahn's (DB) Annual Report. This figure marks a 2.1 percent decrease from 2023 when 107.9 million passengers rode ICE trains. Continuing issues with poor punctuality and service disruptions, especially during high-profile events like UEFA Euro 2024, led to public frustration and likely discouraged some potential riders. While long-distance travel stagnated and decreased in volume, regional train usage increased by about 6 percent, partly due to the popularity of the Deutschland Ticket, a low-cost monthly pass for regional trains. This may have diverted some travelers from ICE to regional options.

As reported in SPEEDLINES previously, in Issue 37, German railway punctuality—especially for long-distance

SHINKANSEN LINES

Line	Route	Estimated Annual Ridership (millions)	Notes
Hokkaidō	Aomori – Hakodate	~1	Still under expansion toward Sapporo
Tōhoku	Tokyo – Sendai – Aomori	~15	Longest line; serves northern Honshu
Joetsu	Tokyo – Kumagaya - Niigata	~39	The line also stops at Echigo-Yuzawa, a popular gateway to ski areas.
Tōkaidō	Tokyo – Nagoya – Osaka	~167	Busiest line; business and tourism hub
Hokuriku	Tokyo – Kanazawa	~5.5	Popular for tourism to Japan Alps
Sanyō	Osaka – Hiroshima – Hakata	~70	Connects western Honshu to Kyushu
Kyushu	Hakata – Kagoshima-Chūō	~4.4	Southernmost line

trains—remains a major challenge despite ongoing efforts by DB to improve performance. The on-time performance of long-distance intercity and ICE trains plummeted from 73 percent in January 2023 to 52 percent in November. In 2024, 62.5 percent of long-distance trains arrived on time (defined as within 5 minutes and 59 seconds of schedule). The decline in punctuality is attributed to aging infrastructure. Many parts of the network are outdated and prone to disruptions. As DB renews its infrastructure and purchases new trains, punctuality will improve.

JAPAN

Currently, there are seven companies governing the Shinkansen high-speed rail system serving seven different regions of Japan. The table below lists the lines from North to South:

The Tōkaidō Shinkansen was the first Shinkansen line built and is by far the busiest Shinkansen line in Japan, which covers the route between Tokyo and Osaka, Japan's two largest metropolitan areas. The Tōkaidō line alone accounts for over 65 percent of total Shinkansen ridership. This line was opened for revenue service in 1964 in time for the first Tokyo Olympics. During peak traffic times, 10 or more trains depart from Tokyo Station hourly. In 2024, the Tokaido Shinkansen had an average delay of just 1.6 minutes per train.

Regional lines like Hokuriku and Kyushu serve fewer passengers but are vital for tourism and regional development. The Hokkaidō Shinkansen is expected to grow significantly once the extension to Sapporo opens, which has now been delayed to FY2038.

In 2024, the Japanese passenger rail sector, including Shinkansen, saw a 2.0 percent growth, which was fueled by a rise in travel and tourism, both domestic and international. The pandemic's long-term impacts, particularly on business travel, may continue to influence ridership figures.

In 2024, approximately 35.3 million domestic travelers used the Shinkansen for tourism with an overnight stay, according to Statista. Despite competition from other transportation options like JAL's free domestic flights for international tourists, the Shinkansen continues to play a significant role in domestic travel, especially for recreational and business trips with overnight stays. The 2025 World Exposition in Osaka and a surge in tourist arrivals are believed to drive increased ridership. The total number of passengers on Shinkansen and other express trains during Golden Week in 2025 increased by 3 percent from the previous year, surpassing 13 million according to published news reports.

KOREA

The Korea Railroad Corporation (KORAIL) is the national railway operator in South Korea. It operates intercity/regional, commuter/metro and freight trains throughout South Korea. KTX (Korea Train eXpress) is the high-speed rail (HSR)

services provided by KORAIL. There are five HSR lines in Korea. The first KTX service was launched in 2004, with high-speed rail service on the Gyeongbu line from Seoul to Busan. The KTX Gangneung Line is the latest line to open in 2017. It goes between Seoul and Gangneung. The five KTX lines enables people to travel anywhere in South Korea within a half-day, subsequently altering people's lives and improving access across South Korea.

The Korean Super Rapid Train (SRT) is a high-speed rail service in South Korea operated by SR Corporation. It serves as a competitor to the main KTX service and offers high-speed rail service between major cities. SRT service in Korea began operation on December 9, 2016. It was introduced to provide high-speed rail services from Suseo Station in Seoul to Busan and Mokpo, complementing the existing KTX network. The SRT offers a new high-speed rail experience, connecting the southeastern metropolitan area to other parts of the country.

The SRT primarily operates on two main routes:

- Suseo (Seoul) to Busan.
- Suseo (Seoul) to Mokpo.

In 2023, SRT services were extended to include the Jeolla, Donghae, and Gyeongjeon Lines.

Unlike KTX trains that mainly depart from Seoul Station, the SRT departs from Suseo Station, located in southeastern Seoul, providing convenient access for those in the Gangnam area. SRT can be slightly faster on some routes due to its dedicated lines.

Ridership on KTX and SRT mirrors the recovery of the KORAIL system. Ridership on KORAIL passenger services has fully recovered from the pandemic once again achieving 2019 ridership volumes. Information about the full annual KTX + SRT passenger volume for 2024 is not yet available, (as of July 14, 2025) however, data for the first quarter (January to March) of 2024 has been reported:

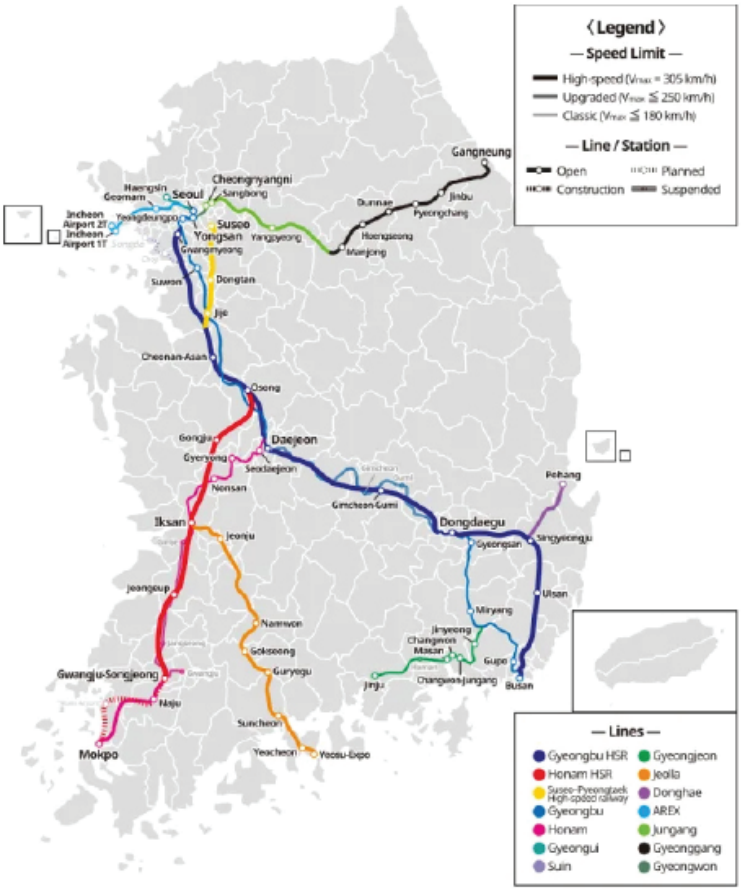
- Q1 2024 KTX passengers: 19.26 million.
- Q1 2024 SRT passengers: 6.43 million.
- Total KTX + SRT passengers in Q1 2024: 25.69 million.

This marks a record high for the first quarter of the year, attributed to pent-up travel demand after the COVID-19 pandemic and expanded train routes. Based on the strong first-quarter performance, it is likely that the total KTX and SRT passenger numbers for 2024 will also reach a record high surpassing previous years.

AVE HIGH-SPEED RAIL NETWORK

Alta Velocidad Española (AVE) is the high-speed rail service operated by Renfe, the Spanish state railway company. The first AVE high-speed rail service was inaugurated in 1992 connecting the cities of Madrid, Córdoba and Seville. After many years of consecutive growth, the number of passengers transported by AVE dropped abruptly from almost 22.4 million in 2019 to 7.6 million in 2020 due to the COVID-19 pandemic. In 2021, the high-speed rail passenger traffic recovered, reaching almost 12.3 million passengers. Passenger volumes began exceeding pre-pandemic figures in 2022, when nearly 23.6 million passengers were recorded. In 2024, AVE high-

^ *Renfe's international AVE high-speed rail service connecting France and Spain has exceeded one million passengers since its launch in summer 2023. Operating from hubs in Lyon and Marseille, the service links around 15 destinations across both countries and is set to expand with a new route to Toulouse in the second quarter of 2025.*



speed trains carried approximately 39 million passengers, setting a new ridership record for the network. The surge was driven by expanded service, including the rollout of S-106 trains with more seating capacity and improved connections between Madrid, Catalonia, Valencia, and Murcia. AVE is part of Renfe's broader high-speed division, which also includes Avlo, Alvia, Euromed, and Intercity. AVE trains operate at speeds of up to 193 mph (310 km/h), allowing for fast and convenient travel between cities. For example, the journey time from Madrid to Barcelona is less than 3 hours. The average commercial speed of services over the Spanish high-speed network is 138 mph (222 km/h), which is higher than the average speed found on high-speed train networks in countries such as Japan or France. In comparison, the average speed of Amtrak's Acela train in the Northeast Corridor is around 70 mph (110 km/h) on its entire route between Washington, D.C. and Boston. The AVE's punctuality and reliability are also key features that make it a popular choice for long-distance travel in Spain. Spain's AVE network continues to grow in popularity thanks to its speed, reliability, and expanding reach.

TAIWAN

Taiwan High-Speed Rail (THSR) is the high-speed railway of Taiwan consisting of one line that runs approximately 350 km (217 mi) along the west coast, from the capital Taipei to the southern city of Kaohsiung. The railway opened in January 2007 reaching almost 90 percent of Taiwan's population. Construction and operations are managed by Taiwan High-speed Rail Corporation (THSRC). In 2019, THSR carried more than 67.4 million passengers. Since the outbreak of the COVID-19 pandemic in early 2020, passenger volumes declined in 2020 to 57.2 million riders and falling to 43.4 million riders in 2021. With various

health control measures having been relaxed, ridership began to recover slowly since July 2022. Ridership in 2022 was 54.1 million passengers or just about 80 percent of the pre-pandemic volumes. Ridership has fully recovered in 2023, with over 73.1 million annual riders riding THSR trains setting a record.

THSR experienced another record-breaking year in 2024, carrying a total of 78.25 million passengers. This marks a significant 7 percent increase compared to 2023, surpassing the previous record and demonstrating THSR's crucial role in domestic transportation. THSR's success in 2024 is reflected in its consistently high daily passenger volumes. The average daily passenger volume in 2024 was 214,000, exceeding the 2023 average of 200,000 passengers per day. In November 2024, the average daily volume reached 224,000 passengers, a 7 percent increase from the same period in 2023. The increase in passenger volume is attributed to several factors:

- *Economic growth and regional development.*
- *Outward migration from urban areas.*
- *Competitiveness in the intercity transportation market.*

The trend for THSR passenger volume in 2025 is expected to be positive, continuing the growth observed in previous years.

Here's a breakdown of the key factors influencing this trend:

INCREASED PASSENGER VOLUMES AND DEMAND: The observed upward trend in overall travel demand indicates continued demand for high-speed rail travel in Taiwan. THSR introduced a significant service expansion starting July 1, 2025, adding 25 weekly trains, bringing the total to 1,128 weekly services. This expansion is a direct response to increased passenger volumes, especially during peak travel days like Fridays and Sundays. The added services are strategically designed to cater to the growing demand for weekend travel and intercity visits. This proactive approach to managing peak demand is likely to lead to smoother and more efficient travel experiences for passengers, further boosting ridership.

Despite some global economic uncertainties, THSR has consistently shown steady growth in passenger numbers and revenue. The company is also investing in future improvements, with new, more advanced trains expected to be delivered in late 2026 and rolled out for commercial operation in 2027. These long-term investments in capacity and infrastructure suggest a positive outlook for the future of THSR.

Based on the recent service expansion and the strong performance in 2024, THSR is expected to continue its growth trajectory in passenger volume throughout 2025.

IN THE SPOTLIGHT

...you should get to know us

THORSTEN KRENZ

Principal, Deutsche Bahn E.C.O. North America Inc.

I have a strong knowledge of the railway industry and recently worked as the CEO of ONxpress Operations Inc. in Toronto, where I led the largest transit capital expansion in Ontario's history for Metrolinx's GO Expansion – OnCorr project. "I am delighted to contribute to shaping the future of mobility in the United States. Germany and the U.S. can learn a great deal from each other in making rail systems more efficient, cost-effective, and resilient. Smart regulation and forward-looking policy frameworks are essential to enabling innovative rail strategies on both sides of the Atlantic."

LUCIE ANDERTON, CENV

Director of Sustainability, International Union of Railways (UIC)

With a background in Infrastructure from Network Rail and 20 years in rail sustainability, I am excited to take on the role of coordinator for the North American region of UIC. My early career focused on managing environmental issues in major infrastructure projects, and I later led social sustainability policy. "North America is full of rail opportunities. My priority now is to explore the challenges we face and use international cooperation to create a lively dialogue that turns insight into action."

TOMOYUKI MINAMI, PE, PMP

Team Manager, Technology and Research, Central Japan Railway Company (JRC)

As the General Manager of the Overseas High Speed Railway Consulting and Coordination in the Tokyo office. I have played a crucial role in the Texas HSR project's advancement as the engineering manager for the Japanese team that supplies the Shinkansen systems. The federal regulation process will need to address the safety aspects to meet the new high-speed rail system safety standards based on O&M procedures and Japanese Shinkansen technology. "The Shinkansen safety record is unparalleled and there are many lessons learned that can be shared worldwide."

MELISSA DUMOND

Vice President, Kimley-Horn and Associates, Inc.

I work with clients at federal, state, and local levels to improve transit and passenger rail services, aiming for an integrated transportation network. These efforts help communities tackle major issues like affordable housing and sustainable development. "I enjoy helping clients make smart choices about using existing infrastructure effectively, negotiating with railroads and public partners, finding creative funding solutions, and improving environmental outcomes through meaningful mitigation."

KEY LESSONS – SPAIN vs CALIFORNIA

Compare the inconsistent federal support for the California high-speed rail program that has politicized project implementation creating irregular funding in California to the continuous support for the Spanish network development by successive Governments.

Although Spain is larger than California, the population density is about the same. The California economy is 2.5 times larger than the GDP of Spain. California has an economic competitive advantage (Los Angeles and San Francisco are highly ranked in the hierarchy of global cities). These advantages are the result of their direct linkage to other domestic and international cities through excellent hub airports, ocean and inland marine facilities, rail connections and the confluence of major interstate highways. But many of the inland communities in the San Joaquin Valley do not enjoy the same global connectivity.

CALIFORNIA	SPAIN
Population 39,529,000	Population 49,315,950
Population density 253.5 per square mile	Population Density 252.4 per square mile
Gross domestic product $4.1 trillion	Gross domestic product $1.73 trillion
Miles of high-speed rail 0 (171 miles under construction)	Miles of high-speed rail 2,485 miles (4,000 km)

Currently, California's inland cities are underserved by the existing transportation network, which is limited to I-5 skirting the inland cities and smaller regional airports that are losing service. High-speed intercity rail passenger service linking the inland cities with Los Angeles and San Francisco will have a positive impact on influencing economic development patterns, creating a more sustainable future and with less fiscal impact than continued dependence on the highway and air system alone.

The key insight from Spain was to develop a high-speed rail network that connected its outlying smaller cities to Madrid, which is another global gateway. To compete in a global economy and maintain its

current competitive advantages, California must remain highly connected to the global economy and elevate the ranking of its inland cities in the hierarchy of global communities by improving their transportation linkages to Los Angeles and San Francisco like what Spain did in connecting Madrid to its outlying cities. California is planning to connect its rural Central Valley cities to Los Angeles and San Francisco, in addition to connecting its two largest cities and eventually connecting them to Sacramento and San Diego. It will form the backbone of an integrated public transportation network as outlined in its groundbreaking 2018 State Rail Plan, which was recently updated in 2024.

Photo Credit: Renfe Operadora

Viva España!

Spain was able to finance its high-speed rail system through a combination of national, European Union and public/private partnerships. The European Union provided about 25-30 percent of total investment in the Spanish AVE system. If the US federal government provided the same level of consistent support to California, the California high-speed rail line connecting the inland cities to Los Angeles and San Francisco could be built quicker saving time and money.

MONTREAL AND TORONTO

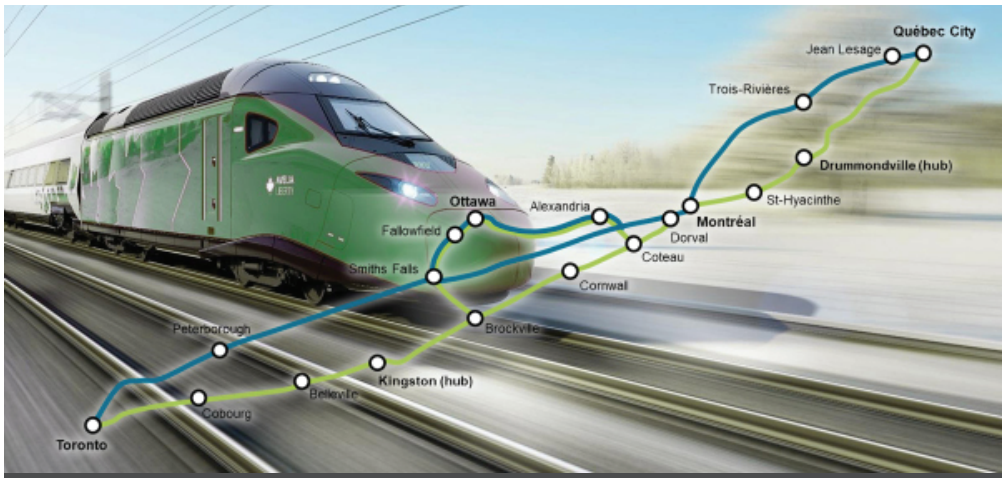
Canada is moving forward with its first high-speed rail network, called "Alto", designed to connect major cities between Toronto and Quebec City, and the largest planned effort in decades. While focused on Ontario and Quebec, supporters believe this project will have benefits for the entire country, drawing on resources, skills, and services from various regions.

The Canadian government has officially announced the development of this high-speed rail, which is not only about transportation but also economic growth. Early studies suggest that the Alto corridor could add about 24.5 billion CAD annually to the GDP, roughly 1.1% of the national economy. This increase is comparable to Canada's agriculture, forestry, and fishing sectors.

Construction of the rail network will take about ten years, providing over 50,000 jobs in areas like engineering, construction, IT, and finance. Once operational, the project aims to boost tourism and urban development, significantly reducing travel times—for instance, between Montreal and Toronto, it would take around three hours.

The rail project is expected to promote real estate development near its stations, leading to around 60,000 new residential units and additional tax revenue for local governments. There will also be a decrease in car usage and short flights, helping reduce road congestion and saving time valued at approximately 570 million CAD annually.

Learning from international examples, like Japan's Shinkansen and Spain's Madrid–Toledo line, suggests high-speed rail greatly influences labor markets and employment growth. Alto could dramatically reshape Canada's intercity travel, impacting competitiveness and regional development if successfully completed.



The cadence team, made up of SYSTRA, CDPQ Infra, AtkinsRéalis, Keolis, SNCF Voyageurs and Air Canada, was selected at the beginning of 2025 by the Canadian government, after a procurement process lasting several years, to carry out the High Frequency Rail project, renamed Alto, between the cities of Quebec and Toronto during the 2030s.

In Memoriam

FRANCES (FRAN) R. HOOPER

Frances "Fran" Hooper, a respected figure in public transportation and advocate for women in the field, passed away on September 24. She started her career in Fairfax County, VA, managing the budget for the Washington Metropolitan Area Transit Authority (WMATA) and later worked in various leadership roles at WMATA, Dallas Area Rapid Transit (DART), and NJ TRANSIT.

In 1997, she joined APTA, holding several managerial positions until retiring in 2006. Post-retirement, she founded Fran Hooper Consulting LLC and served on various committees related to transportation. Her legacy lives on through the Fran Hooper Scholarship, which supports students in rail engineering and public transportation. Please consider donating to her scholarship here.

The Fran Hooper Scholarship at the APTA Foundation: https://secure.givelively.org/donate/american-public-transit-foundation/in-memoriam-frances-fran-hooper

BUDAPEST TO SERBIA

Hungary will open its section of the high-speed rail link to Serbia in February, aiming to modernise travel between Budapest and Belgrade as part of the broader effort to enhance transportation infrastructure in the region. This project, involving Hungarian, Chinese, and previously Russian contractors, is expected to cut journey times from eight to under three hours and enable speeds of up to 200 km per hour, although construction has faced delays due to safety incidents and public criticism in Serbia.

HSR TRAVEL ACROSS UAE

Etihad Rail is set to launch passenger services in the UAE by 2026, connecting 11 major cities with train speeds of up to 200 km/h. This initiative will significantly reduce travel times, promoting sustainable options. The rail network follows the establishment of freight services in February 2023, aligning with the UAE's long-term transportation vision. Improved connectivity is expected to alleviate road congestion and stimulate economic growth. Features include comfortable seating, free Wi-Fi, and integration with Dubai's metro and other transport modes, enhancing the overall travel experience.

CONNECT

EGYPT'S FIRST HSR LINE

Egypt has embarked on a transformative high-speed rail initiative, formalized through a contract between the National Authority for Tunnels, El Sewedy Electric, and Deutsche Bahn International Operations to operate and maintain a 2,000-kilometer electrified network using Siemens Mobility trains, integrating the project within the Vision 2030 plan to modernize national transport infrastructure at a cost of $23 billion. The system, anticipated to be the world's sixth largest upon completion, will connect the Mediterranean and Red Seas, major cities, ports, and tourist destinations via 60 stations across three routes, aiming to serve 90% of the population and halve travel times. With Siemens Mobility leading construction alongside Orascom Construction and The Arab Contractors, the consortium will deliver comprehensive technology, rolling stock, signaling, and civil works, while the 15-year operations contract entails extensive Egyptian workforce training. Supervision and engineering contracts for the remaining lines have been awarded to French firms Egis and Systra. Largely funded by European institutions and German guarantees, the high-speed rail network is projected to revolutionize Egypt's transit and logistics sector, supporting broad economic growth and sustainable development.

LESSONS-LEARNED FROM HIGH-SPEED & INTERCITY RAIL

Contributed by: Thorsten Krenz, DB E.C.O.

Imagine, German Intercity Express (ICE) trains running through the U.S. No need to dream, it actually happened. Back in 1993, Amtrak and Deutsche Bahn (DB) teamed up to evaluate the viability of high-speed rail travel in the U.S. To prove the point, an eight-car ICE 1 trainset crossed the Atlantic for a series of test runs to explore the operational potential and passenger reception. The trainset included two power cars along with one first class car, two second class cars, a restaurant car, and a service car.

This 6-month tour showcased ICE technology, although powered much of the way by special diesel locomotives because the lack of U.S. electrified lines.

Fast forward three decades to today, and the U.S. is still working to implement a true high-speed rail service.

Meanwhile, the world didn't wait. Countries invested and high-speed train service has evolved around the globe. Looking abroad shows that high-speed rail works, runs well and is extremely established. Even new players showed up at the game, with China expanding its high-speed rail network to a staggering 31,000 miles this year. Only 17 years after their first high-speed passenger line opened in 2008.

In the U.S., by contrast, people sometimes think a fast train is one that shows up at all. Sadly, most Americans still associate train travel with delays, patchy service and outdated stations. Or something their grandparents rode once upon a time.

In a world, that's increasingly urban, interconnected and carbon-conscious, how we move people and freight matters more than ever. When done correctly few solutions beat high-speed rail, when it comes to safe, efficient, sustainable and fast travel.

Let me take you on a journey – a historical, technical and political one – through the development of Germany's high-speed rail. No worries, we are going through it at a correspondingly fast pace.

A SHORT RIDE THROUGH GERMAN RAIL HISTORY

Germany's love affair with rail began 190 years ago. In 1835 the first train ran between Nuremberg and Fürth in Bavaria. High Speed rail in Germany as we know it kicked off in 1985 with the first test runs of DB's ICE prototypes. By 1991 the first commercial ICE line was up and running. Yet, the story of high-speed rail started decades earlier. In the 1960's and 1970's, Germany invested in electrifying train tracks, research in modern rolling stock technology and building new rail infrastructure.

To prioritize such investments in rail at a time when railways struggled and personal vehicles, and planes were overtaking rail's market share was not easy. To the point that – when looking at the federal budget numbers – Helmut Schmidt, the German Chancellor at that time famously quipped: "Germany can only afford one of two things – either the Federal Armed Forces or the Federal Railway".

But Germany doubled down and the investment in rail paid off. When the ICE service launched in 1991, it wasn't just a technological leap – it was a statement. And it didn't begin with shiny trains – it began with people. The idea was simple: bring city centers closer together, make transfers easier, connect people, boost the local economies all while providing an attractive alternative to short-haul flights and trips in personal vehicles.

Today, four generations of ICE trains with more than 400 trainsets link over 180 cities, operating up to 186mph, even cross border travel in Europe is seamless.

ICE trains are used by millions of passengers every day – not because they have to, but because they prefer it.

MORE THAN SPEED — IT'S A SYSTEM

Japan's Shinkansen pioneered high-speed rail. France's TGV stuns the world with speed; Germany's ICE stands out for network integration, blending high-speed, regional, local and even freight rail on the same network– a necessity for a highly decentralized nation. Although German ICE can set speed records too, as the current top speed of 405 km/h (251.6 mph) on the Erfurt-Leipzig/Halle route shows.

In general, ICE trains don't just run fast. The service is all about connectivity. Offering seamless transfers, coordinated schedules and tickets that work across local and long-distance trains. Arrive at Frankfurt airport, board a high-speed train right at the terminal, be downtown in any major city within hours and use the city's metro or bus system to get to your final destination, all with one ticket – no car needed.

This holistic, interoperable approach is key, because rail is not just a mode of transportation or infrastructure it's a national public service. With a strong focus on accessibility – elevators, signage, staff to assist – it's an experience tailored to the traveler.

This tailored experience might be one of the reasons why rail in Europe and Asia and their linked public transportation systems are so attractive to customers, and so widely used. The secret ingredient for successful public transportation is to put the passenger first and create a passenger-centered network. Passengers should be treated as guests, not like disturbing factors to be processed. Passengers are not inconveniences, but the purpose of the business.

Too often, in the U.S., the system works the other way around, and demands that passengers adapt to it. The common practice of restricting passengers' access to platforms and instead letting them wait inside stations before boarding a train is a good example. Additionally, transfers can be confusing and long gaps between trains make rail feel like an afterthought. So, how can the U.S. catch up? Here are five recommendations:

1. START WITH THE PASSENGER, NOT THE PROJECT

Don't ask only "How fast can we go?" Ask, "How does this particular service make travel better for real people?" Or to adapt a famous quote for the occasion: Build railways *FOR* the people, *BY* the people.

2. DESIGN FOR EVERYDAY USE

High-speed trains shouldn't be for special trips for tourists or business travelers. They should serve families, students, seniors, commuters — everyone. Make the train rides accessible and intuitive. And run them frequently, not once a day but multiple times an hour.

If high-speed rail is to succeed, it can't just exist – it must outperform. It needs to beat planes on downtown-to-downtown travel time, beat cars on comfort and be price-

competitive across the board. That's how you convert car drivers and frequent flyers into train passengers.

3. THINK SEAMLESS

Modern passengers expect door-to-door mobility. That means smart, integrated tickets across the whole travel chain, unified schedules, and stations that are true mobility hubs — not lonely platforms in vast parking lots. A passenger should be able to step off a train and right onto a bus, bike, or local metro.

4. INVEST IN TRUST

Rail systems like in Germany, France, Switzerland, and especially Japan succeed because people trust it. That trust comes from reliability, comfort, and steady public investment. Long term infrastructure investment underpins sustainable high-performance mobility and logistics. And don't stop with one high-speed line and say: "mission accomplished". Every project needs to fit into a connected strategy framework – planned out over a long period of time, with public buy-in and steady multi-year funding. Rail isn't just a product — it's a promise!

Little extra tip: high-speed rail doesn't always require new – but it does require better. Not every high-speed line needs to be built from scratch. In Germany many ICE routes use modernized legacy tracks – electrified, straightened and optimized for speed to lower costs, speed up delivery and avoid the painful slog of clearing the right-of-way and getting permits. So sweat the assets you already have as much as you can and focus on getting more capacity out. Some simple switches are digital signaling or timetable-based improvement. When it comes to infrastructure, stay away from too much custom design and fragmented standards.

5. SELL THE EXPERIENCE

High-speed rail isn't just about engineering and technology. It's about reclaiming time. It's reading a book, working, maybe taking a nap, enjoying the view out of big windows, being able to walk around without being forced into a seat with a seat belt on, arriving refreshed and on time. That's travel as it should be – not a stress test.

NEXT STOP: THE U.S.

The U.S. is a country with a vast potential to create a high-speed rail network that matches its ambitions, it just has yet to arrive at the station. So, here's the dream:

You wake up in downtown Chicago, stroll a few blocks to the station, grab a fresh coffee, board a sleek train with reliable Wi-Fi and with quiet zones to relax and arrive in downtown St. Louis two hours later – no TSA lines, no boarding groups, no stuck middle seat, no turbulence, no traffic jams or forced stops to get gas. Just you, a window seat and 186mph of pure bliss. Sounds good, right? It's time to stop waiting.

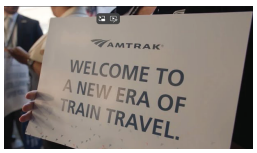
AMERICA, ALL ABOARD FUTURE!

Amtrak NextGen

Acela Train Sets Debut in Northeast Corridor Service

Contributed by: Lisa Matta, Wi-tronix, Joaquin Castro-Balbi, Harvard University, Ibro Muftic, Parsons

The much-anticipated debut of the Amtrak Next Generation (NextGen) Acela equipment occurred on Wednesday, August 27, 2025 with a ceremonial run from New York to Boston. The trip departed New York at 2 PM with stops at New Haven, CT and Providence, RI before pulling into South Station around 6:45 PM. Revenue service started the next day with two roundtrips scheduled between Boston and Washington, DC. Eventually 28 NextGen Acela sets will be operating in NEC service.



As a preliminary event to APTA's TRANSform Conference in Boston, a group of attendees were able to ride the NextGen Acela train on Saturday, September 13th at a discounted ticket price thanks to the generosity of Alstom. Attendees boarded Train 2250 at the Moynihan Train Hall in New York City and rode it to Boston South Station. Prior to departure, Amtrak provided a tour of the new Moynihan Train Hall which opened in 2021 after its transformation from the James A. Farley Post Office Building. Tour guides shared the vision of a modern transportation hub, while maintaining as much of the original architecture as possible, including the amazing large dome glass roof. This new station is not only more visually appealing but is also optimized for a smooth flow, resulting in faster boardings.

The Acela train departed at about 12:10 PM in revenue service with one of the 5 business cars fully reserved for APTA attendees. Representatives of Alstom and Amtrak discussed the development and debut of the train set with the group and fielded questions. On Sunday, conference attendees had the opportunity to tour a new trainset, stepping aboard NextGen Acela 2130 at South Station. Tours hosted by representatives of Alstom and Amtrak, explored first class, business class, and the café car. The guides outlined the NextGen Acela project and fielded questions about maintenance, features, and other American rail manufacturing projects. The Alstom/Amtrak team provided excellent tours and shared valuable insights into what it takes

to build, operate, and maintain both the Northeast Corridor's (NEC) critical infrastructure and high-speed trains.

One of the APTA attendees, Lisa Matta, who rode the Saturday trip from New York, offered her feedback on the new equipment:

During the Saturday trip from New York to Boston aboard Amtrak's latest high-speed trainset, I had the opportunity to experience firsthand the impressive engineering and thoughtful design that went into this modern rail system. The ride was exceptionally smooth, thanks to the articulated couplers between cars and the active tilting mechanism that allows the train to gracefully lean into curves. Although we reached speeds of up to 161 MPH, these high-speed segments were limited due to constraints in the existing infrastructure.

One of the most noticeable improvements was the ease of movement between cars—even at high speeds. The automatic door system, which opens as passengers approach, eliminates the need to press a button, a welcome upgrade from older trainsets. Business class seating was spacious and comfortable, with power and USB outlets available at every seat. Ample luggage space was provided, with bags either stored overhead or in designated areas at the end of each car, ensuring visibility and convenience.

Midway through the journey, the train experienced a penalty brake application due to a dropped signal. Amtrak personnel quickly addressed the issue, and the train came to a smooth stop with minimal delay. The restart was equally seamless.

The onboard restrooms were notably spacious and fully ADA-compliant, featuring an automated door obstruction system that reopens the door if an object is detected—an excellent accessibility feature. The train configuration included a first-class car, five business class cars (including a quiet car), and a Café car offering both hot and chilled selections. The staff were friendly and attentive, and the food received positive feedback—my salad was particularly enjoyable.

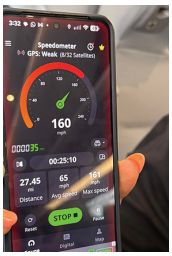
One unexpected aspect of the trip was that the passenger information screens were not yet fully operational, as they were undergoing final quality checks. Without real-time station or speed updates, I used a mobile app to track our velocity. This became a source of excitement among fellow APTA attendees, who gathered around my screen as we approached top speed. At one point, we neared 160 MPH, the train began to decelerate, prompting a collective "aww" from the car—a lighthearted moment that added to the camaraderie of the trip. Fortunately, we later reached the 160 MPH mark.

On Sunday, I had the opportunity to tour the trainset and gain deeper insights into its design and functionality. As a supplier to Amtrak, my small group was given exclusive access to the locomotive cab and equipment area—a rare and memorable experience not possible during regular service.

Other conference attendees who rode the train Saturday or toured it on Sunday were favorably impressed. One comment heard several times was how much smoother the ride experience was compared to the original Acela equipment. Other comments were about the larger windows, the more comfortable seats and brighter appearance of the interiors.

BACKGROUND

On August 26, 2016, Amtrak announced a new contract with French TGV builder Alstom worth over $2 billion. This contract was to supply and maintain 28 brand new trainsets, replacing Amtrak's previous Acela Express trainsets. Just over nine years later, these trainsets entered service on the NEC. The process of establishing supply chains, managing the pandemic, and performing extensive corridor testing may have taken longer than expected, but the new trains provide a strong foundation for Amtrak's continued commitment to transporting passengers efficiently, frequently, and sustainably up and down the NEC. The introduction of these trainsets represents more than



just new vehicles and faster speeds. Amtrak's NextGen Acelas represent the significant potential for growth along the NEC and everywhere else critical intercity corridors can be electrified.

HISTORY

Amtrak's Northeast Corridor has long been a vital link connecting several of America's largest cities. With Amtrak taking over services on the NEC in 1971, passengers have been taking trains to business meetings, as part of their daily commute, or for vacations and other leisure activities. During Amtrak's early years of operation, several attempts were made at higher speed service. The Metroliner fleet of electric multiple units (pre-Amtrak) operated primarily between Washington and New York and the short lived Turbotrain operated New York to Boston service. In December 2000, responding to high-speed rail systems developing around the world, Amtrak inaugurated the Acela Express, a faster, more premium service. These run as dedicated trainsets stopping at select stations along the NEC. In 2014, based on the success of the Acela trains, Amtrak began plans for the next generation of high-speed trainsets for NEC service. In 2016, the RFP led to a contract with Alstom for the new trainsets.

To manufacture these trainsets, Alstom modernized its rail plant in Hornell, New York. This site was established in the 1880s by the New York and Erie Railroad. As a manufacturing and repair center, the Hornell site boosted and supported the city's growth and prosperity. After a combination of significant shipping of products shifted to trucking, dieselization requiring less maintenance, and a 1972 hurricane destroying significant portions of the railroad connecting Hornell southeastward, the Erie's successor filed for bankruptcy and shut down the repair shops. Hornell's manufacturing industry and population declined severely as a result. Alstom began leasing the site to manufacture and refurbish rail vehicles, eventually leading to the manufacturing of the NextGen Acelas.

DEVELOPMENT

The development of the NextGen Acelas was far from simple. To begin, Alstom had to develop a network of American parts suppliers, which eventually consisted of over 180 businesses across 29 states. Also, the company initially struggled with meeting Federal Railroad Administration (FRA) modeling requirements and with manufacturing challenges. The COVID-19 pandemic also slowed production, though manufacturing employees were classed as essential workers, and continued to work. All the while, Amtrak upgraded portions of the NEC to enable higher speeds and greater reliability.

Alstom's investment into the project totaled over $87 million at the Hornell site and benefited manufacturing around the nation. This investment revitalized portions of Hornell's local economy and modernized manufacturing assets.

FUTURE

Today, the NextGen Acelas are permitted to travel at up to 160 mph on limited sections of the NEC, though these trainsets are capable of reaching 186 mph. As speed restrictions are lifted with the repair, maintenance, and replacement of old infrastructure, these trainsets are expected to reach higher speeds where track geometry allows.

The larger fleet size of 28 trainsets compared to the legacy fleet of 20 will enable Amtrak to both increase service capacity and to improve reliability. Maintenance can be performed more regularly while keeping a higher proportion of trainsets in service. The trainsets also have a 27% increase in passenger capacity from 304 to 386 seats, which will help Amtrak meet increasing demand.

The new trainsets also boast an active-tilt system, an articulated coupling structure, and stronger internet connectivity. Tilting the train slightly when running on curves allows the trainsets to safely take these curves at higher speeds. Each trainset couples its cars with one set of wheels between cars, rather than the more traditional bogeys (pairs of wheelsets) under each end of every car. This coupling method has been proven to improve safety and stability.

The NextGen Acelas are a welcome replacement to help Amtrak maintain its premium Acela service, but they also represent a greater pattern of progress. Alstom has leveraged its Hornell plant to secure several other contracts, boosting American manufacturing, aligning national and local priorities. NextGen Acelas will improve passenger connectivity and regional access as travel demand grows and as Corridor infrastructure improves the trainsets will run at higher speeds. The launch of Amtrak's NextGen Acelas marks a critical point in the development of American passenger rail.

SPAIN'S HSR NETWORK

Contributed by: Kenneth G. Sislak, AECOM

Spain has the most extensive high-speed rail network in Europe and the second largest in the world behind China. The 2,485-mile (4,000 km) Spanish AVE high-speed rail network connects major cities like Barcelona, Seville and Malaga with Madrid. As you might deduce from these city pairs, the network was designed to be Madrid centric. The first high-speed line opened in 1992 connecting Madrid, Córdoba and Seville. The high-speed rail network uses standard gauge track, allowing for connections to other European high-speed rail lines.

ADIF AV owns and maintains the high-speed rail infrastructure. AVE trains are operated by Renfe, the national passenger rail operator in Spain, but other companies such as Ouigo España and Iryo compete on the Madrid–Barcelona and other routes in accordance with the European Union legislation. French TGV services run from the border to Barcelona under the TGV in Oui brand. Alvia and Euromed trains are also operated by Renfe and can use both Iberian gauge and standard gauge lines offering high-speed services across the whole Spanish network.

The Spanish network continues to evolve and grow. The network is divided into five main corridors: Northwest, Northeast, East, South and Mediterranean. See the map below. There are twelve main lines in operation, as well as two spur lines, connecting the cities of Toledo with the Madrid–Seville main line and Huesca with the Madrid–Barcelona main line. Two more lines, one along the Mediterranean Corridor and one towards Extremadura are partially in operation for Alvia/Euromed services. These lines are still under construction.

KEY PROJECTS & EXPANSION

The following is a summary of recent developments in high-speed rail in Spain — key projects, investments, challenges, and outlook. The summary is followed by some key insights and lessons learned from the continuing development of the Spanish high speed rail network.

Mediterranean Corridor & Almería–France Link - The Mediterranean high-speed corridor — which aims to provide a continuous high-speed rail link from Almería to France without requiring a transfer in Madrid — is advancing, with full operation targeted by around 2027. The section from Murcia to Almería is under construction (several sections), with track bed, electrification, stations and signaling works in progress.

Huelva – Seville High-Speed Link - A 95-km corridor is planned between Huelva and Seville. This line is intended to be standard-gauge, capable of speeds up to 350 km/h. The goal is to cut travel time between the two cities to about 25 minutes.

Y Vasca (Basque High-Speed Network) - The so-called "Y Vasca" line will connect the three main capitals of the Basque Country (Bilbao, San Sebastián / Donostia, Vitoria-Gasteiz). It is being financed in part by a loan from the European Investment Bank (EIB).

Burgos–Vitoria Section of the Atlantic Corridor - ADIF AV awarded a contract (approx. €391 million) for the track bed of the Pancorbo–Ameyugo section between Burgos and Vitoria in the Atlantic Corridor. This is an important link in the north that also forms part of cross-border connectivity with France.

Palencia–León Double-Tracking - To boost capacity for the Asturias region, the Palencia–León high-speed section is being doubletracked, with a project budget of about €95.2 million.

Cross-Border Spain–Portugal Link

Plans have been announced to connect Porto (Portugal) and Vigo (Spain) with a high-speed rail link, targeted for completion by 2032.

MODERNIZATION

There's a project to convert the Encina–Xàtiva–València line into standard gauge, modernize track and tunnels, install ERTMS level 2, electrification, etc., to integrate with freight traffic and improve links in the Valencian region.

Investments & Funding

The Spanish government and ADIF AV are mobilizing long-term investment to improve interoperability, safety, resilience (especially against climate events), etc. The European Investment Bank (EIB) is playing a big role with loans for the Y Vasca project, for modernization of Renfe's rolling stock and for infrastructure upgrades.

OUTLOOK

The outlook for Spanish high-speed rail is excellent. By 2027–2032 many of the major corridor projects listed above (Mediterranean link Almería-France, Spain-Portugal link, Burgos-Vitoria etc.) are expected to be either completed or significantly advanced. Complex engineering challenges through mountainous regions of the country have slowed progress.

Continued investment in interoperability (standard gauge, ERTMS), resilience, and maintenance will be essential to ensure reliability and to reduce delays or service disruptions. As competition in high-speed passenger services increases, there may be pressure on train operating companies to optimize pricing, frequency, and service quality.

Key Insights

The Spanish high-speed rail system continues to serve as a model for the United States. It took strong and consistent government commitment to allow Spain to develop its high-speed railway network. Successive Spanish governments (both Socialist and Conservative) have treated high-speed rail development as a national infrastructure and economic development priority and not as a partisan issue.

WHAT GREAT TRAINS AND STATIONS TEACH US

Contributed by: ERIC EIDLIN, AICP - City of San José, Department of Transportation

Since the current federal administration took office, the future of passenger rail nationwide has grown more uncertain. This is especially the case in California, home to the largest and most developed high-speed rail (HSR) project in the nation.

Recent federal actions to claw back funding for the state's high-speed rail project have destabilized that project. At the same time, the privately funded Brightline Los Angeles to Las Vegas high-speed line has hit technical and funding challenges. This has added to doubts about the prospects for high-speed rail in the U.S.

Yet in spite of these difficulties, public support for HSR in many corners of the country remains strong, particularly in California. An August 2025 POLITICO poll found that 62% of voters still back continued funding for the project, even after the loss of $4 billion in federal grants. To be fair, this support could be as much of a reflection of distaste for the federal government and its actions in California as much as support for California High-Speed Rail. Nevertheless, there does seem to be strong support for the concept of high-speed rail, at least in select corridors in the U.S.

As evidence of this strong support in California, the government of California recently renewed its commitment to stable and long-term for high-speed rail by extending the allocation of revenues from the state's carbon tax program, now called "Cap-and-Invest" through 2045, providing $1 billion annually for high-speed rail. While far from enough to complete the system, it signals long-term commitment.

And a long-term commitment is precisely what will be needed to deliver high-speed rail in California and elsewhere in the U.S. It may be worth mentioning the French term for megaprojects here, as it seems particularly apt. The French speak of "projets de longue haleine." This translates directly as "projects of long breath" … or projects requiring the ability to hold one's breath… and/or to keep breathing… projects that require steadfast commitment and stamina.

Many Americans – particularly those who have recently traveled to Europe or Asia and who have traveled by high-speed train there – have returned home to the U.S. with questions as to why we can't have the same here. On a recent study trip that I led to Spain and France, many of the bright participants of the trip asked this very question.

We also spent a lot of time observing and thinking about what is so great about high-speed rail - and considering why it is a worthwhile investment for the U.S.

Below, I summarize in short form the key lessons that the group drew from the study trip. Note that this is a shorter form of an article that will be published later this fall by the Mineta Transportation Institute.

These key lessons include the following:

Lesson #1. High-speed rail is a superior mode of travel for many trips and for many reasons.

Lesson #2. Great stations facilitate mobility across scales, from the local, to the regional, to the state, national, and even global levels.

Lesson #3: Great Stations shape the neighborhoods and broader urban areas around them.

Lesson #4. Great stations provide reasons for people to pass through them whether they are train passengers or not. Also, rail and mass transit thrive on density, which is not the case for autos or airplanes.

Lesson #5. Building with the future in mind is essential. When planning a station, you should start with the least flexible elements first such as tracks and platforms.

Lesson #6. The presence of strong national actors leads to better station management and a more unified passenger experience.

Lesson #7: Rail and rail projects benefit from comprehensive and colorful PR campaigns that focus on communicating project benefits.
Lesson #8: Spain and France build transportation megaprojects faster and cheaper than the U.S.
Lesson #9. Not all impacts high-speed rail take form immediately. Some elements of stations and cities take time to evolve.

OVERVIEW

In early summer 2025, I had the privilege to lead a group of twelve curious students and working professionals on a twelve-day study tour through France and Spain – the two European countries with the most extensive high-speed rail networks. We started in Paris and ended in Madrid via Strasbourg, Lyon, Barcelona, and Zaragoza, logging over 1,700 miles of high-speed rail travel. We met with professionals, academics, and politicians in both places. The trip focused on how high-speed rail (HSR) networks define not just the way people move around cities and regions, but the cities and regions themselves. The group came home to the U.S. with a number of key lessons for intercity and high-speed rail network planning in the U.S. I summarize some of the key lessons that we learned below.

COMPARING FRANCE AND SPAIN

France's TGV (Train à Grande Vitesse) pioneered European high-speed rail in 1981 with the Paris–Lyon corridor. The network now spans 2,800 km and carried about 130 million passengers in 2024—the busiest in Europe. With the incredible success of high-speed service in France, many conventional intercity lines are now being phased out in favor of faster service.

Spain's AVE (Alta Velocitat Española) began in 1992 between Madrid and Seville with a very successful "starter line" that succeeded in garnering public and political support to construct a national high-speed rail system. In just two decades, Spain has built Europe's largest HSR network—3,973 km—though with lower ridership density than France (≈ 39 million passengers in 2024). Recent EU-supported liberalization opened tracks to new operators—Renfe, OuiGo España, and Iryo—spurring competition, lower fares, and 22% ridership growth from 2023 to 2024.

By comparison, the U.S. remains far behind despite growing public interest and projects such as California HSR and Brightline West. Persistent cost overruns, delays, and weak governance continue to hold back progress.

LESSONS ON DISTANCE AND CORRIDOR POTENTIAL

HSR is most competitive for journeys of 100–500 miles, especially near the 300-mile "sweet spot." At these distances, it is faster than driving and comparable or superior to air travel once airport access and security times are included. Suitable U.S. corridors include Boston-New York-Washington, Chicago-St. Louis-Kansas City, San Francisco-Los Angeles, Dallas-Houston, and Portland to Vancouver, B.C. through Seattle. In all of these corridors, true HSR could replicate the convenience the group observed in Europe.

Lesson #1. High-speed rail is a superior mode of travel for many trips and for many reasons.

A first fundamental lesson that the group learned is that HSR offers a comfortable, time-efficient alternative to air and car travel for 100- to 500-mile trips. Rail also offers city-center-to-city-center convenience, minimal security delays, productive travel time, and less stress than travel by car or plane. The group found the ability to move around, eat, and work while traveling by train a clear advantage over traveling in cramped airplanes or long drives.

Day trips such as Paris–Strasbourg (1 hr 45 min vs 5 hours by car) and Barcelona–Zaragoza–Madrid (2.5 hours total vs. 6.25 hours by car) demonstrated how HSR enables productive multi-city itineraries within a single day—something that would be impossible by car or plane. HSR can support larger "commute sheds" – particularly in the post-COVID era where many workers no longer need to travel to the office every day – allowing people to live farther from expensive metropolitan centers while retaining access to urban jobs and amenities, all with low-emission travel.

On the next page you will find the group's jam-packed itinerary for their day trip from Paris to Strasbourg.

Lesson #2. Great stations facilitate mobility across scales, from the local, to the regional, to the state, national, and even global levels.

The group noted that great stations facilitate mobility across different geographic scales – seamlessly linking urban neighborhoods to regional, national, and even global transportation networks. For cities, they act both as civic gateways as well as critical local connectors between neighborhoods divided by tracks. They also bring together multiple modes serving different geographies all under one roof, while simultaneously supporting urban life around them.

Figure 2 – Lyon Part-Dieu is an important case study in all of these respects. Originally designed in the auto-oriented "thirty glorious years" postwar years – roughly 1950 to 1980 – the station has been thoroughly redesigned to prioritize pedestrians, bikes, and other "gentle modes" around the station, as shown here. In addition to being one of the busiest train stations in all of France, the area surrounding the station has become the most significant employment district in France outside of the

Figure 1- Strasbourg Main Station at Night with study group's itinerary, which shows a very productive day.

Paris region.

Lesson #3: Great Stations shape the neighborhoods and broader urban areas around them.

A third key observation that the group made – both in Spain and France – was that station development and redevelopment projects in both countries double as broader urban regeneration initiatives. Key examples demonstrate the redevelopment of entire city districts include Lyon Part-Dieu and Barcelona La-Sagrera.

Other examples where European cities have "healed" the scars of old rail infrastructure include Paris Rive Gauche's rail overbuild, the Saint-Denis-Pleyel "bridge station," and Issy-les-Moulineaux's activation of spaces under a rail viaduct.

Lesson #4. Great stations provide reasons for people to pass through them whether they are train passengers or not. Also, rail and mass transit thrive on density, which is not the case for autos or airplanes.

Great stations are not just places to catch a train. They are destinations in their own rights. They offer amenities such as shops, dining, and cultural landmarks, which make them welcoming places where people want to spend time.

This takes advantage of a key feature of rail infrastructure, which is that it is space-efficient. While rail and mass transit thrive on density, this is not the case for autos or airplanes. Rail and mass transit is able to move many people to and through dense urban places without requiring much space. This makes rail uniquely compatible with cities, whose very purpose is to facilitate exchange by bringing people, goods and services closer together.

Also, a basic principle in mass transit planning is that mass transit works best in places where you have many people traveling between the same origins and destinations. By clustering development around transit and by giving people more reasons to pass through stations – by making them part of people's daily orbits – you are further concentrating origins and destinations, which heightens the utility of rail and mass transit.

In order for stations to make the most of the distinct advantages that they offer in terms of spatial efficiency, they need to prioritize pedestrians, cyclists, and transit users over vehicles as primary means of station access. This is clearly demonstrated by Lyon Part-Dieu, shown below, which puts these modes closest to the core of the station. Other examples include Strasbourg Main Station and Barcelona Sants in its future redesigned station.

This is not something that you would want to encourage with cars or airplanes, modes that require much more space to move people and that cease to be able to function when there is too much congestion. This is the precise opposite with rail and mass transit – provided good track and station design they perform best when there is congestion. Congestion means more riders, which can support more service and greater frequen-

Figure 2- ^ Lyon Part-Dieu. Originally designed in the auto-oriented "thirty glorious years" postwar years – roughly 1950 to 1980 – the station has been thoroughly redesigned and one of the busiest train stations in all of France.

Figure 3 – Paris Charles-de-Gaulle Airport serves as a key air-rail hub with a high-speed train station that connects travelers to various locations in France and Europe. HSR has increasingly taken the place of domestic flights under 600 miles. In 2023, France passed a law banning direct domestic flights when a high-speed train option exists that takes 2.5 hours or less.

cies of service.

Often, stations include more everyday amenities to make them part of the everyday orbits of people. Putting childcare, parcel lockers, grocery stores at stations embeds stations in daily urban life.

Lesson #5. Building with the future in mind is essential. When planning a station, you should start with the least flexible elements first such as tracks and platforms.

It's critical to identify the least flexible elements first. The most critical and permanent decision is where to locate the station in the first place. Once you decide where a station goes, that choice is essentially permanent - you can't just pick it up and move it later.

Lyon Part-Dieu and Barcelona La Sagrera are examples of new inner city central stations whose locations were carefully chosen to improve high-speed rail operations, while also expanding the reach of intercity and high-speed rail, and to maximize the benefits of the investments in transportation by developing densely around these new stations.

Tracks and platforms are other fundamental components of stations that can't easily be moved or resized once built. Once platforms are built, their widths set, and tracks laid around them, this becomes a fixed element that cannot easily be modified. Everything else must adapt around them. This has been a big constraint in Lyon, where Part-Dieu Station, which was initially designed to accommodate 35,000 daily passengers but now sees 140,000 on a daily basis. Expanding station capacity has been challenging, in part because of design decisions regarding platform widths that are difficult to revisit today.

Lesson #6. The presence of strong national actors leads to better station management and a more unified passenger experience.

The presence of strong national actors in Spain and France leads to better station management and a more unified passenger experience. This unified passenger experience is what is necessary for a great station to function as it should as suggested in Lesson #2: a place that facilitates mobility across scales – from the national to local.

The French Railway's Gares & Connexions oversees all 3,000 stations in the country, managing design, maintenance, retail, and passenger experience, including wayfinding and signage. Profitable stations cross-subsidize unprofitable ones, ensuring consistent quality across the network.

Spain's ADIF manages infrastructure and stations separately from Renfe's operations, enabling open-access competition. ADIF coordinates with regional bodies on major projects (for example the Barcelona Sagrera Alta Velocidad Project).

This centralized oversight contrasts sharply with the U.S., where fragmented agency control often yields inconsistent design, signage, and user experience. Stronger national coordination—similar to that provided by SNCF or ADIF—could vastly improve passenger experience and station performance.

Lesson #7: Rail and rail projects benefit from comprehensive and colorful PR campaigns that focus on communicating project benefits.

Some of the European experts who we met during our trip who were familiar with the U.S. shared the observation that public engagement seemed to be something that the U.S. might do better than most European nations- at least from the standpoint that U.S. project sponsors tend to meet frequently with community members

Figure 4 – ^ Lyon is one of the clearest examples of this, with the Part-Dieu Station being one of the busiest train stations in France and the station area around it having become the most significant office district in France outside of Paris. Lyon Part-Dieu's surrounding district houses 20,000 residents and 60,000 jobs, with plans for more housing and mixed-use development.

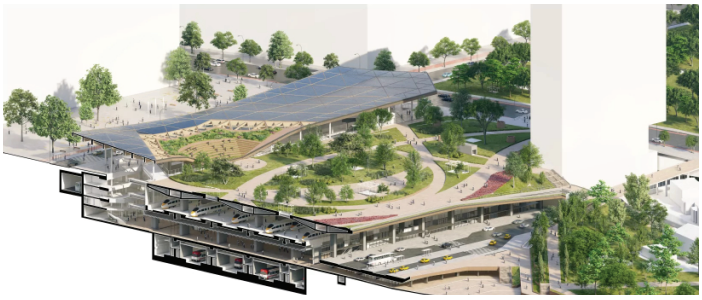


Figure 5- ^ Barcelona La Sagrera transforms an obsolete freight yard into a new mixed-income community linked by green space and transit. Rail and roads will be placed below grade, while new parkland will be created above the tracks. The station gives the future 180,000 residents who will live in this vicinity direct access to new open space while removing physical barriers to circulation.

Figure 6 - ^ At San Denis-Pleyel on the north side of Paris, the station acts like a bridge, connecting a working-class area with a growing business district on the other side of the tracks.

Figure 7 - ^ Gare St. Lazare in Paris shows how stations can become destinations through retail and dining. With 80 shops spread across three levels and over 100,000 square feet of retail space, it functions as much like a shopping center as a station. People come not only to catch trains, but also to shop, eat, and spend time, making it an integral part of daily life. A Foot Locker located in this mall grosses four times the amount of an average Foot Locker store per square foot, highlighting the benefits of locating retail adjacent to rail.

and hold many public meetings to gather robust public input on their projects.

The study trip group reflected on this input, acknowledging that our project sponsors may do a lot of public engagement. U.S. public officials working on large projects perhaps also seem more approachable to the general public than their counterparts in Spain and France.

Importantly though, the fact that there is so much uncertainty around the delivery of the U.S. rail megaprojects may lead some to suggest that U.S. engagement – while it may lead to close coordination and good relationships between project staff and the public – may ultimately not be that effective. If the ultimate goal of public engagement is to gather important feedback that will help shape and advance critical transportation projects that a majority of the public support, then one might argue that perhaps Americans might trade less wide-ranging public engagement on projects in favor of more decisive action and progress on projects.

Long-time NPR reporter Dan Brekke of KQED San Francisco, who recently announced his retirement, did an exit interview in which he reflected upon his many years covering transit issues, including transportation megaproject delivery. He shared his impression that in order for U.S. project sponsors to garner more public support for their projects, they need to deliver them more quickly and cost-effectively. It seems that the U.S. may have a thing or two to learn from France and Spain.

Figure 8 - ^ Madrid Principe Pío is similar to St. Lazare in that it includes a shopping mall attached to a station hub. It also includes a theater where people can watch live performances housed within one of the historic station buildings.

Figure 9 - Lyon Part-Dieu opened in the early 1980s, expecting 35,000 daily passengers. Today, it serves over 140,000, four times that amount. The narrow platforms from decades ago still limit capacity. Crowding can lead to safety risks, as the photo shows.

In both France and Spain, project sponsors invest in comprehensive and colorful PR campaigns that highlight the benefits of rail, and they do it in ways that engage the public and build excitement. These are tools we could adapt in the U.S. to help build momentum for major rail investments.

Lesson #8: Spain and France build transportation megaprojects faster and cheaper than the U.S.

Members of the study trip were shocked by the low price tags of rail infrastructure projects.

The world leader in efficient and cost-effective subway rail construction is Madrid. Between 1994 and 2007, the Madrid Metro network nearly tripled in size, expanding from about 71 miles (114 km) in 1995 to approximately 197 miles (317 km) by 2007, adding 126 miles of track and numerous stations.

This significant expansion was part of an ambitious plan that included building a 25-mile circular line and a direct metro line to the airport, alongside other upgrades, making it one of the fastest-growing metro systems in the world at the time.

Over this time period, the cost per mile of the metro expansion was $95 million. By contrast, there are many U.S. transit expansion projects that have cost many times this amount per mile.

Madrid may well be the world champion for cost-effectiveness, but even projects deemed expensive by European standards appear to be a relative bargain by U.S. standards.

Other projects that seemed to offer good value by American standards include the Grand Paris metro expansion program, a program that will double the track mileage of the Paris Metro by 2030. It includes a total of 125 miles of new track– 90 percent of which will be underground. This network expansion will also include 68

new stations. The current cost estimate for this is $49B or $390M per mile.

Though this is expensive by European standards, its cost pales in comparison to American projects like BART to San Jose, a 6-mile tunnel project that is estimated at $12.7B. This equates to $2.125B per mile. This is 5.5 times more expensive than the Grand Paris Express and roughly 23 as much per mile as the Madrid Metro. We won't go through all of the reasons here.

One key difference though appears to be the existence of purpose-designed entities that are set up to carry out these projects. These public entities tend to have high levels of in-house capacity and are able to effectively direct projects.

When looking at model projects and programs like the Madrid Metro, a few other key factors stand out. One is the availability of sufficient and stable funding. Another is the use of tried-and-true construction methods, as well as modular station design.

Lesson #9. Not all impacts high-speed rail take form immediately. Some elements of stations and cities take time to evolve.

The impacts of high-speed rail are not instantaneous or all-encompassing. Cities don't automatically reshape and optimize development around a high-speed line when it begins operation. It can take years, sometimes decades, for them to evolve.

If we look at the cases of Part-Dieu and Sants again, we're reminded it took those station a few decades to evolve from when they were originally built to the transformations that they are undergoing now. Lyon Part-Dieu was built in 1983, and its redevelopment began in the early 2010s. Barcelona-Sants was completed in the mid-1970s, and began its project in 2023, about half a century later.

The case of Zaragoza is an important one in this respect. We visited Zaragoza during this trip because we felt that it was similar in some ways to the cities in California's Central Valley where HSR is currently being constructed.

Cities like Fresno and Bakersfield, for example, are similar

Figure 10 - ^ Strong involvement by the national rail operators in the overall customer experience, including on issues of wayfinding, makes for a more seamless and coherent passenger experience than is typical in the U.S.

Figure 11 - ^ San Jose Diridon Station is representative of many stations in the U.S., where the lack of a dominant regional, statewide, or national rail operator is evident in the lack of integrated passenger information. One might characterize the U.S. experience as "bottoms up" station management.

to Zaragoza in the sense that they both occupy strategic midway locations between California's major economic centers (megaregions) along California's HSR route.

Upon arrival in Zaragoza, our first impression was that the station was very impressive. The spacious station building with its striking glass and metal roof was filled with ample natural light. It was easy to find one's way around the station. As we stepped outside, the station neighborhood felt very much unfinished. It also felt very far from the central city.

When the site was selected for Zaragoza Delicias, there were high hopes that development would sprout up around the underdeveloped area. However, development around the station site has been slower than expected due to the economic and real estate crisis following the 2008 Expo. Station area development that was planned in that timeframe did not materialize and has not yet returned.

Additionally, it seems in Zaragoza that prioritization of car access over other more sustainable and space-efficient modes around the station have made it hard to integrate the station into the existing urban fabric. At Zaragoza, the easiest way to access the station is via underground car parking, which lets out directly onto station platforms. Taking the bus to downtown, by contrast, means walking

Figure 12 - ^ Publicity for the Grand Paris Express, Paris' regional metro expansion program. At left, the text on this ad would translate as follows: "We start construction early in the day today in order to allow you to sleep in a little longer tomorrow." At right, approachable and user-friendly maps and graphics give a clear sense of project benefits.

out of the far end of the station and crossing a wide roadway used by cars and taxis.

When assessing the development of Zaragoza Delicias, it is important to bear in mind that Zaragoza was built much later than stations such as Barcelona-Sants and Lyon Part-Dieu, stations that were both built with auto-oriented assumptions. Now, forty years after their initial construction, these later two stations are undergoing transformations to bring them out of the auto age into a more pedestrian and people-friendly present. Perhaps we can hope that Zaragoza Delicias will undergo a similar transformation in the coming years and its station area matures.

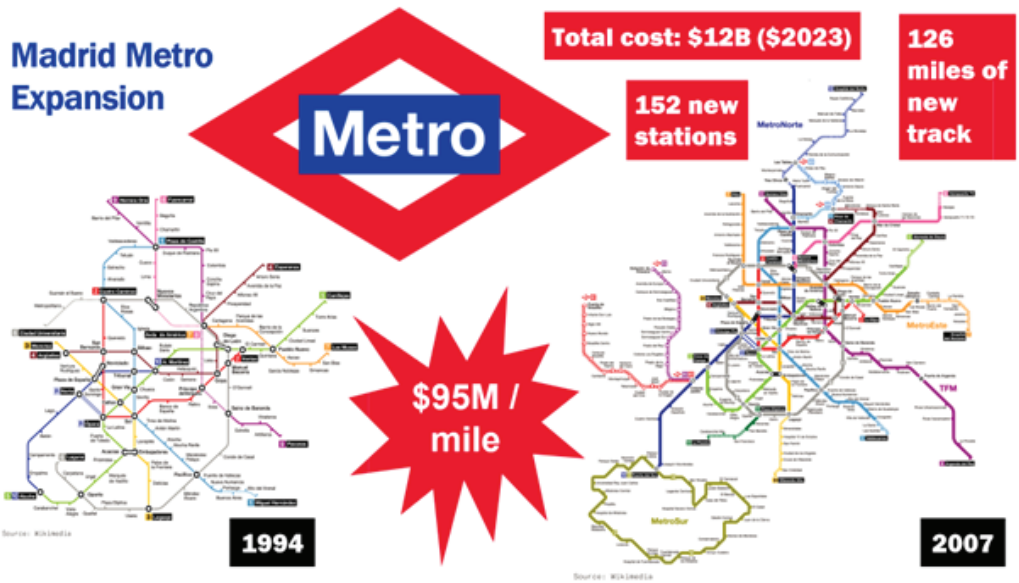
KEY TAKEAWAYS FOR THE U.S.

Our group's experience in Spain and France showed that high-speed rail (HSR) can be a highly competitive mode of travel, particularly in corridors of 100–500 miles, where it offers door-to-door travel times that rival air and automobile travel, while providing greater comfort and a travel experience that is superior overall. In these countries, great stations play a pivotal role in facilitating mobility across all scales. They enable strong local pedestrian connections between surrounding neighborhoods and ensure seamless integration between regional, statewide, and national rail networks. Some stations even function as intermodal air–rail hubs, linking rail systems directly with international air routes. Beyond their transportation function, great stations shape the neighborhoods and broader urban areas around them, often becoming destinations in their own right. They attract people not only as travelers but also as visitors, creating vibrant public spaces where rail and mass transit thrive on the density that benefits them—unlike autos or airplanes, which depend on dispersed, low-density networks.

High-speed rail does not transform cities overnight; many of its economic and urban effects unfold gradually as communities adapt to new patterns of mobility. For that reason, getting the least flexible design elements right from the start—especially station location, track configuration, and platform layout—is essential. France and Spain also show the value of strong and consistent leadership by national rail authorities in station design on issues ranging from passenger facilities to wayfinding. This is something that remains uncommon in the more fragmented U.S. context.

While public engagement may be less extensive in Spain and France than in the U.S., it often includes effective, visually compelling communication that emphasizes long-term project benefits—a focus U.S. project sponsors could adopt more fully. Finally, France and Spain have demonstrated an ability to deliver large transportation projects more quickly and cost-effectively.

In summary, our experience in Spain and France revealed a broader theme: that in the U.S., we have often missed opportunities to realize the full potential of large rail and transportation megaprojects. These missed opportunities are not only about schedules and budgets, but also about the broader community and city-building benefits such projects can deliver—from economic development to urban design and placemaking. Yet, the examples of France and Spain show that these outcomes are within reach when projects are approached with clear vision, strong coordination, and a broader view of benefits that extends beyond transportation to include economic development, urban design, and placemaking. Finally, our trip also highlighted the need for the U.S. to deliver megaprojects more efficiently to realize their full potential as engines of urban and regional transformation.



High-Speed Rail Station Planning in FRANCE and SPAIN
STUDY TOUR

SPECIAL TOPICS -
GRADUATE LEVEL COURSE DATES:
MAY 26 - JUNE 7, 2026

APPLICATION DEADLINE: FEBRUARY 2, 2026

ASHA W. AGRAWAL AND ERIC EIDLIN announce that they will be leading a San Jose State University study-abroad class in summer '26 to study high-speed rail station planning and design in Europe.

The graduate level course is open to working professionals who have completed a four-year degree. This course offers you a first-hand view of successful rail station mega-projects in Spain and France, two countries that are world leaders in high-speed rail development.

You will reflect on how practices from the two countries can be applied in the US.

The class will pay particular attention to large rail station hubs where different transportation services intersect. Through site visits and meetings with local experts, participants will learn how stations in Spain and France are planned, designed, and built, as well as the critical role they play in both neighborhood and regional development.

Along the way, you will experience Spanish and French culture by meeting local residents, observing public space usage in various cities and rail stations, and enjoying Spanish and French cuisine, language, historical sites, and notable landmarks. The itinerary includes visits to: Madrid, Zaragoza, and Barcelona, Spain, as well as Avignon, Lyon, Paris, and Strasbourg, France.

You'll find more program details HERE.
If you have questions about the course, feel free to contact Eric Eidlin (eric.eidlin@sjsu.edu).

TOKAIDO SHINKANSEN

OPERATIONS, SYSTEMS, AND WORKFORCE DEVELOPMENT FOR A STRONG SAFETY CULTURE

CENTRAL JAPAN RAILWAY COMPANY

Contributed by: Hironobu Sunami, General Manager, Consulting and Coordination Office – Overseas High-Speed Railway Project

Central Japan Railway Company (JR Central) is one of the passenger railway operators established in 1987 following the division and privatization of the nationwide network formerly operated by Japanese National Railways. The service area of JR Central is located in the central region of Japan and includes the nation's three largest metropolitan areas: Tokyo, Nagoya, and Osaka. Although this area covers only 23.7% of Japan's total land area, it is home to 61.5% of the population and generates 65.8% of the country's nominal GDP (See Figure 1). Focusing specifically on these three metropolitan regions, their combined GDP reaches approximately ¥320 trillion, accounting for 57% of Japan's total GDP—a figure that exceeds the GDP of France.

JR Central operates 552 kilometers of high-speed rail via the Tokaido Shinkansen, along with 1,418 kilometers of conventional railway lines. In fiscal year 2024, the company recorded passenger revenue of ¥1.4325 trillion, which is equivalent to approximately USD 9.55billion, assuming an exchange rate of ¥150 to the

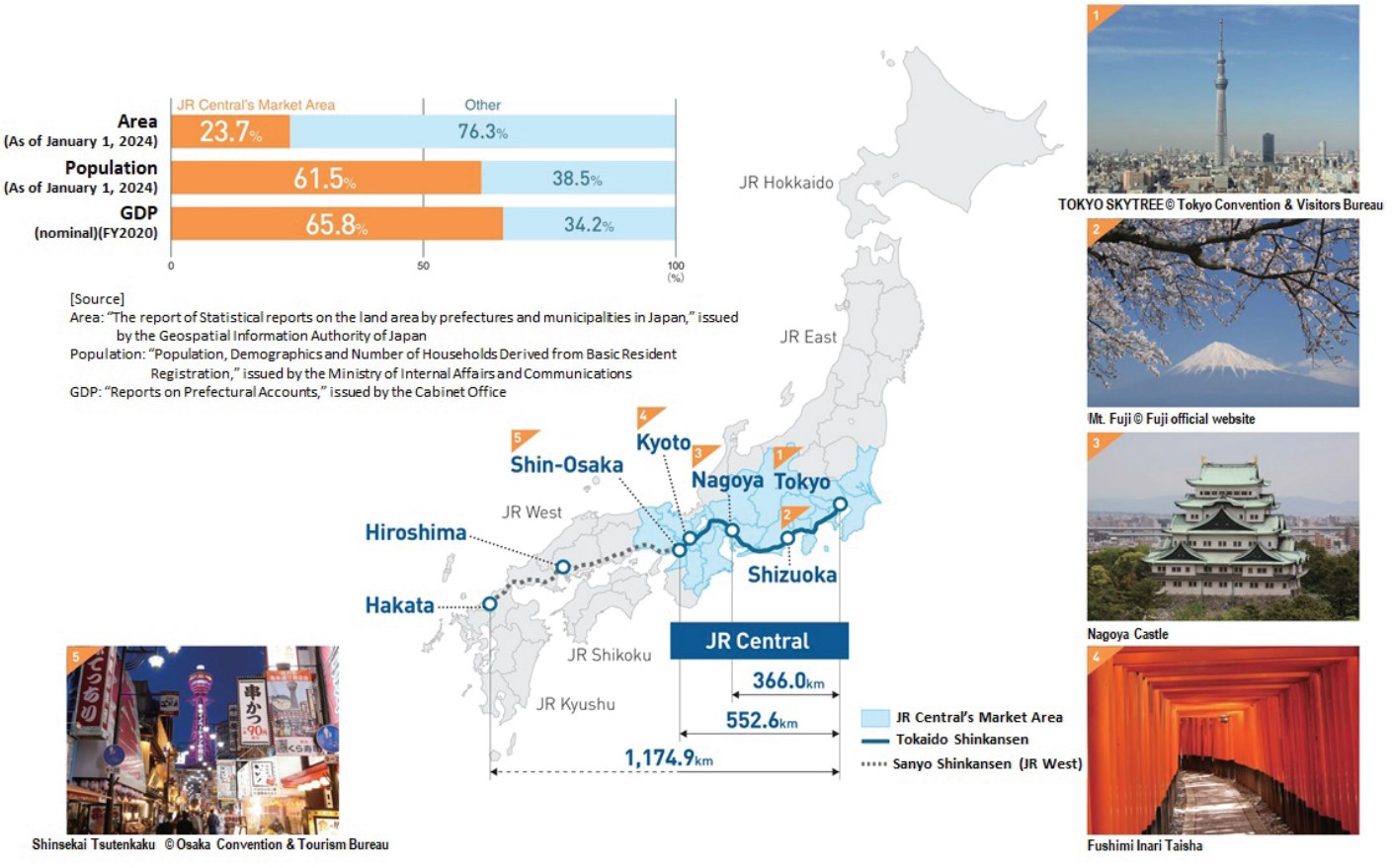


Figure 1 - ^

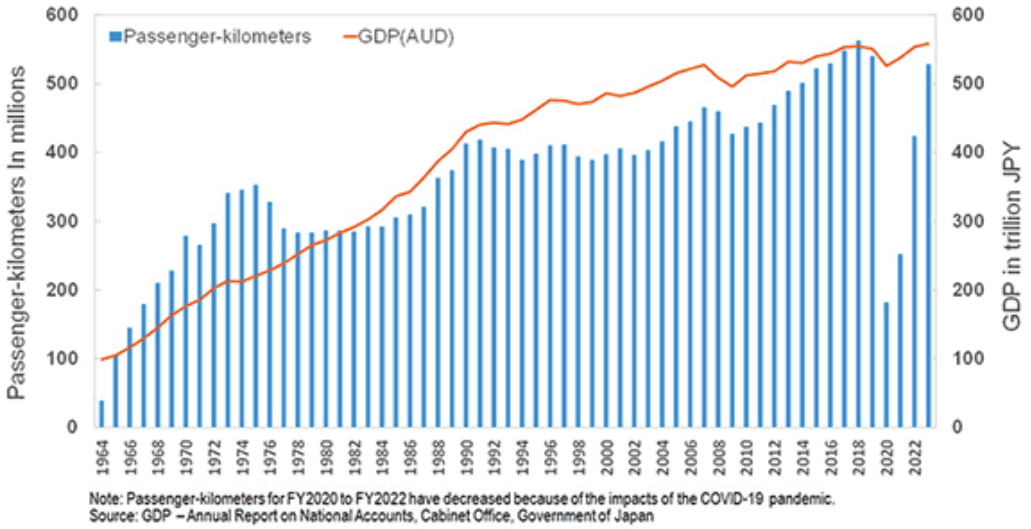


Figure 2 - ^

dollar. Approximately 93% of this revenue was derived from the Tokaido Shinkansen.

Since its opening on October 1, 1964, the Tokaido Shinkansen has served over 7 billion passengers over more than half a century, supporting Japan's economic growth. Currently, an average of 383 trains run each day, serving approximately 460,000 passengers daily, with an average delay time of just 1.4 minutes per train. Remarkably, since its inauguration, there have been no accidents resulting in fatalities or injuries of passengers on board—a record we take great pride in. There is a strong correlation between the Tokaido Shinkansen's transportation volume and Japan's GDP, highlighting the significant impact it has had on the Japanese economy (Figure 2). The next topic is the share of passengers by destination between the Tokaido and Sanyo Shinkansen (Osaka to Hakata, operated by JR West) and air travel. For routes such as Tokyo to Hiroshima, where the Shinkansen travel time is approximately 3 hours and 46 minutes, rail remains the preferred mode of transportation. However, for longer distances—such as Tokyo to Hakata—air travel holds a dominant share. This trend is commonly referred to as the "four-hour rule," which suggests that when total travel time is under four hours, passengers tend to opt for the Shinkansen, whereas for journeys exceeding four hours, air travel becomes the more attractive option. (Figure 3)

Figure 3 - ^

The Tokaido Shinkansen is an exceptionally environmentally friendly mode of transportation. When compared with an airplane (B777-200) in terms of energy consumption and CO_2 emissions per seat between Tokyo and Osaka, the Shinkansen uses approximately one-eighth the energy and emits only about one-twelfth the CO_2, demonstrating its outstanding environmental performance.

EVOLUTION OF OUR SYSTEM AND OPERATION

Since JR Central was established in 1987, the company has made significant efforts to improve its operations in support of Japan's economic growth. A major milestone was reached in 1992 with the introduction of the Series 300, which featured a lightweight aluminum body, bolsterless bogies, and VVVF (Variable Voltage Variable Frequency) control units. These innovations increased the maximum speed from 220 km/h to 270 km/h, reducing the Tokyo–Osaka travel time to 2 hours and 30 minutes—a 19-minute improvement.

Further advancements followed in 2007 with the launch of the Series N700, equipped with a tilting mechanism that shortened the journey to 2 hours and

25 minutes. Today, the latest Series N700S achieves a minimum travel time of 2 hours and 21 minutes, reflecting JR Central's ongoing commitment to technological innovation (Figure 4).

Currently, the Tokaido Shinkansen operates three types of services: Nozomi, Hikari, and Kodama, which mean "hope," "light," and "echo," respectively.

-Nozomi is the fastest, stopping only at major stations in the three metropolitan areas.

-Hikari offers an intermediate level of service between Nozomi and Kodama

-Kodama is an all-stop service.

Another example of our efforts is the number of trains in operation. Before privatization, the maximum number of trains departing from Tokyo per hour was 10. Since then, this number has steadily increased to meet growing demand. Today, JR Central is capable of operating up to 17 trains per hour, consisting of 12 Nozomi, 2 Hikari, and 3 Kodama services. As will be discussed later, one of the defining features of the Tokaido Shinkansen is its operation on a dedicated high-speed rail line, designed exclusively for Shinkansen services. This feature not only ensures high levels of safety and reliability, but also allows for flexible scheduling to accommodate passenger demand (Figure 5).

PRINCIPLE OF OUR SYSTEM AND OPERATION

Since its inauguration in 1964, the Tokaido Shinkansen has operated high-speed rail services without a single accident resulting in fatalities or injuries to passengers or crew members on board. This exceptional safety record is underpinned by two distinctive principles. The first is a system architecture designed to achieve the principle of crash avoidance. The second is a total system approach that enables integrated management of all components of the system and personnel. The former represents principles from a tangible, technical perspective, while the latter reflects principles from a management perspective, encompassing human factors, organizational structure, and operational control.

The principle of crash avoidance can be achieved through two fundamental elements: a dedicated high-speed line and an automatic train control (ATC) system. The Tokaido Shinkansen was the world's first dedicated high-speed railway. Its dedicated track does not allow joint operations with conventional passenger or freight trains. Additionally, train operations are conducted unidirectionally on double-track sections. This operational framework, combined with the ATC system described later, eliminates the possibility of collisions with other passenger or freight trains, as well as collisions between high-speed trains. The elimination of grade crossings is also a critical aspect of the crash avoidance principle. By removing level crossings from the right-of-way (ROW), the system ensures that unauthorized entry by motor vehicles and pedestrians is structurally precluded, thereby preventing collision incidents (Figure 6). Furthermore, the entire length of the corridor is secured with fencing and equipped with an intrusion detection system to maintain the integrity of the ROW and protect it from external threats.

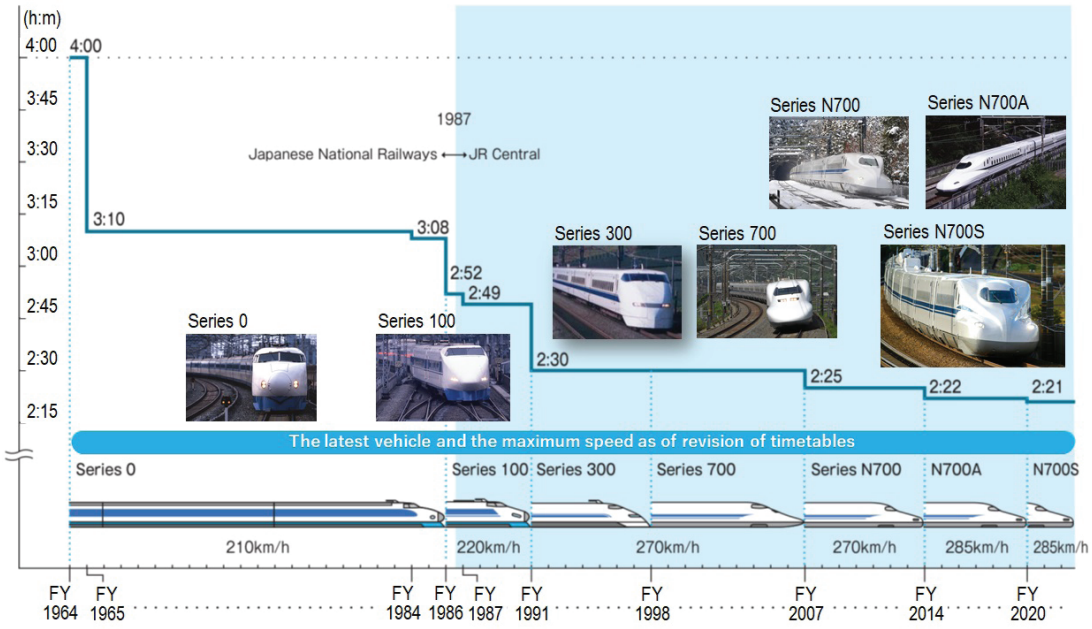


Figure 4 - ^

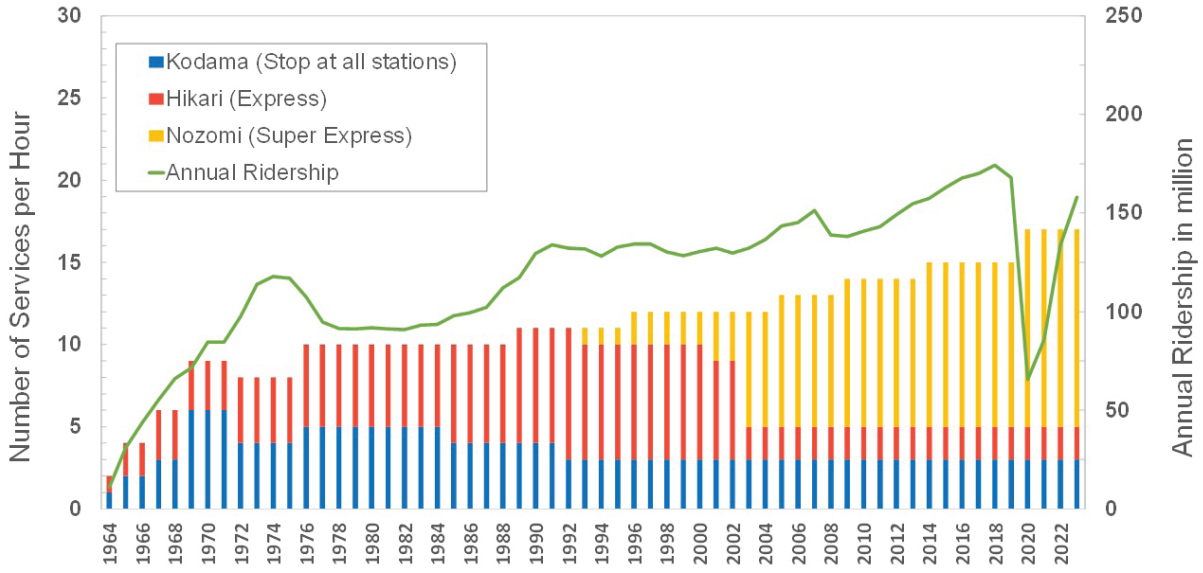


Figure 5 - ^

Strict temporal separation is enforced for maintenance-of-way (MOW) activities to ensure that collisions with passenger trainsets cannot occur. By scheduling right-of-way (ROW) maintenance exclusively outside of revenue service hours, maintenance activities within the ROW are completely separated from passenger train movements, thereby ensuring the safety of maintenance personnel. On the Tokaido Shinkansen, a "sweeper vehicle" is operated daily prior to the commencement of revenue service to verify the safety of the ROW. This vehicle is equipped to inspect the lower construction clearance envelope and is staffed with trained onboard personnel who monitor for potential issues along the ROW, such as damaged fencing, minor obstructions, and the structural integrity of the track (Figure7).

The ATC system is one of the two key components of the crash avoidance principle. It ensures the prevention of train-to-train collisions and overspeed derailments. Trainsets are protected from such incidents at all speeds, including down to zero km/h. The ATC system is composed of both ground and on-board equipment.

Figure 7 - ^

The ATC on-board equipment calculates braking curves based on the information received from the ATC ground equipment, train speed, and the position of the trainset. Furthermore, the ATC system is extended into trainset maintenance facilities to avoid low-speed collisions during shunting operations, thereby maintaining safety even in non-revenue.

In addition to the crash avoidance principle, the concept of the total system approach is equally critical. High-speed rail systems such as the Tokaido Shinkansen are composed of multiple subsystems, including rolling stock, track and civil structures, signaling, power supply, telecommunications, and station facilities. In the case of the Tokaido Shinkansen, all these subsystems are centrally managed by the operation division. This integrated management framework enables system-wide optimization. For example, the crash avoidance principle allows for the design of lightweight rolling stock. When all subsystems are managed under a unified organizational structure, it becomes possible to optimize civil infrastructure accordingly, thereby reducing construction costs and improving overall system efficiency.

Moreover, alongside the integrated management of technical subsystems, the centralized oversight of human resources involved in operation and maintenance is also a vital aspect. Ensuring that personnel are properly trained, coordinated, and managed contributes significantly to the safety and reliability of the entire railway system. This centralized management of the entire railway system enables us to achieve safe and highly reliable operations. Within this framework, employee training is regarded as a critical pillar of our strategy for ensuring safety.

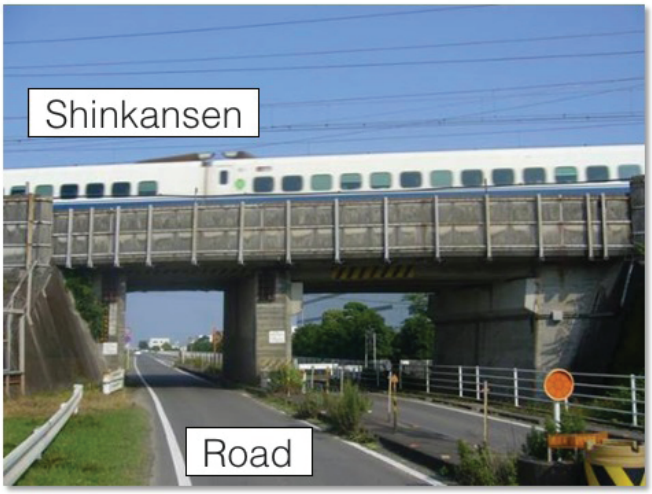


Figure 6 - ^

HUMAN RESOURCE DEVELOPMENT STRATEGY

Education and training constitute one of the key components of the total system approach. Fundamentally, JRC provides three types of training to its personnel: Group Training, On-the-Job Training, and Self-Development. While a wide range of training programs is offered, particular emphasis is placed on cultivating safety culture. Safety culture represents a fundamental values, attitudes and behaviors in which safety is placed as the highest priority. The "Safety Manifesto" serves as an illustrative example of safety culture. It represents a shared set of values deeply embedded across all levels of JRC personnel.

1. Safety is the highest mission of the transportation services.

2. Ensuring safety begins with rigorous performance of one's duties and strict adherence to regulations, which is built up through constant practice.

3. Thorough communication with diligent confirmation is most important to ensure safety.

4. Each employee must perform their duties beyond their designated responsibilities and work together to ensure safety.

5. When in doubt, employees must evaluate the circumstances thoroughly without overlooking anything, and adopt the safest measure identified.

At the General Training Center, group training sessions are conducted with teams composed of members from diverse professional backgrounds, where the meaning

Main Building

Simulator for Station Staff and Conductors

Training Tracks

Figure 8 - ^

JR 700 Series Shinkansen - Arriving at JR Tokyo

and implications of the Safety Manifesto are thoroughly discussed. This process facilitates value alignment and fosters an understanding of the importance of teamwork. Furthermore, the Safety Manifesto is prominently displayed in every workplace within JR Central, where its spirit is continuously upheld and passed on. (Figure 8 and 9).

OVERSEAS EXPANSION OF HIGH-SPEED RAILWAY SYSTEMS

Finally, we would like to introduce the overseas expansion initiative of high-speed railway systems. JR Central believes that the overseas deployment of its high-speed railway system will be a meaningful project that enables manufacturers to maintain and strengthen their technology and skills through the expansion of the international high-speed railway market, and it also leads to the stable provision of equipment, and the technological innovation and cost reduction of railway-related equipment. This initiative is essential for JR Central in fulfilling its long-term mission of maintaining and developing Japan's main transportation artery.

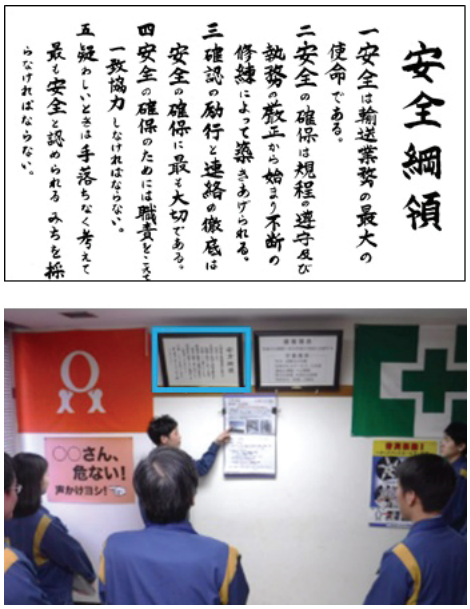
As part of our overseas initiative, we are providing technical consulting services for the Texas Project, which aims to introduce the Tokaido Shinkansen system between Dallas and Houston, two major cities in Texas. Concurrently, we are coordinating with Japanese manufactures in preparation for core system procurement.

In response to a request from the Taiwan High-Speed Rail Corporation, which operates Taiwan's high-speed rail system based on the Japanese system, we began providing technical consulting to them in 2014 and have completed ten individual projects to-date. Furthermore, we are supporting the procurement of new rolling stock based on the N700S model, which Taiwan High-Speed Rail Corporation decided to procure in 2023.

Beyond the projects mentioned here, we believe that our extensive knowledge and expertise in railway management and operations can be applied to a wide range of initiatives.

If you are interested in exploring potential collaboration, please feel free to contact JR Central.

Figure 9



SUMMARY

This report outlines the development, operation, and global outreach of the Tokaido Shinkansen, operated by Central Japan Railway Company (JR Central). Established in 1987, JR Central serves Japan's three largest metropolitan areas—Tokyo, Nagoya, and Osaka—accounting for over 60% of the nation's population and GDP. The Tokaido Shinkansen, a 552-kilometer high-speed rail line, has transported over 7 billion passengers since its inauguration in 1964, maintaining an exceptional safety record with no accidents resulting in fatalities or injuries of passengers on board. Technological advancements have continuously improved travel times and operational efficiency, with the latest Series N700S achieving a minimum Tokyo–Osaka journey time of 2 hours and 21 minutes. Safety is ensured through a crash avoidance system and a total management approach integrating technical subsystems and human resources. JR Central emphasizes safety culture through various initiatives, including a company-wide Safety Manifesto and structured training programs.