Factors Constraining High-Speed Rail Implementation in the United States

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

In Japan, the Shinkansen glides smoothly at 200 miles per hour, a silver streak shooting through mountains and cities. In China, bullet trains rapidly move through the landscape connecting cities all over the country in a matter of hours. In Spain, the AVE train bursts through the countryside at over 180 miles per hour, turning a six-hour drive into a two-hour journey. Yet in the United States, passengers travel along outdated rail tracks, enduring slow, bumpy commutes that take twice as long as flights. The implementation of a high-speed rail system in any country is often cited as a solution for addressing traffic congestion, reducing carbon emissions, and fostering innovation in public transportation. However, the United States seems to think otherwise as they have not particularly rushed to successfully implement a high-speed rail line to reap these benefits. Known for its technological innovation, why has the United States fallen so far behind in the race for high-speed rail? Given logistical and economic challenges explored in this paper, the United States may not be the ideal candidate to see the benefits of such a system anytime soon.

In this paper, I will analyze the economic, legislative, and geographical factors that have hindered the successful implementation of high-speed rail in the United States. In addition, I will focus on two key high-speed rail projects in the United States: Amtrak's Acela in the Northeast Corridor and California's High-Speed Rail Project. I will discuss relevant background and economic and technical information of these two projects to further enhance my research as both act as key high-speed rail projects in the United States. To provide a comparative perspective, I will also discuss Japan's Shinkansen - one of the world's most successful high-speed rail systems. By contrasting Japan's success with the U.S.'s difficulties, I will highlight the structural and societal barriers that make high-speed less viable in the United States, ultimately answering

the research question: *what factors are contributing to the delay in the United States' approval and implementation of a high-speed rail system?* This delay can be attributed to a range of factors, including economic concerns such as uncertain ridership, legislative hurdles like political opposition, and geographical challenges posed by low-density areas where high-speed rail is less practical.

Background and Context

High-speed rails (HSR) serve as an alternative mode of travel to cars and airplanes and are often the fastest option for journeys spanning a few hundred miles, outperforming conventional rail, driving, and flights. The International Union of Railways defines high-speed rail as new rail lines capable of reaching speeds up to 155 mph or upgraded existing lines operating at speeds up to 136 mph (Project Drawdown, 2020). As of 2020, there were over 34,797 miles of HSR tracks worldwide (Project Drawdown, 2020), carrying approximately 484 billion passenger-miles annually in 2021, though ridership saw a significant decline due to the COVID-19 pandemic (Global High-Speed Rail Passenger Traffic, 2019).

However, implementing HSR is highly expensive, often leaving countries in long-term debt. To be successful, HSR must compete with well-established transportation industries, particularly automobiles and air travel, which both receive significant infrastructure investments. Countries that have managed to be successful typically rely on their high population density and strong ridership to offset the costs to ensure long-term viability.

In 1964, while many countries were focused on expanding automobile and air travel, Japan took a bold and innovative approach to transportation. Japan launched the world's first high-speed rail system, the Shinkasen, a 320-mile line connecting Tokyo to Osaka. It is capable of going up to a speed of 200 mph. Overcoming Japan's challenging terrain, the project

introduced a revolutionary concept: a rail system dedicated exclusively to high-speed passenger travel. Unlike conventional rail lines, the Shinkansen was built using a wider gauge to accommodate a higher center of gravity and ensure stability at high speeds, making it incompatible with Japan's existing rail network—a controversial decision that initially faced significant backlash. Despite early skepticism, the Shinkansen quickly proved its success. By 1970, just six years after its debut, it had carried over 80 million passengers. Today, it transports approximately 1 million people daily, with 400-meter trains departing every three minutes (Mustard, 2018). While it may no longer hold the title of the world's fastest high-speed rail, the Shinkansen remains globally renowned for its punctuality, safety, and reliability, having a perfect safety record with no fatal accidents. Its success not only transformed Japan's transportation landscape, but it also set a global standard, showing high-speed rail can be a viable and influential mode of travel.

In the United States, the closest thing to high-speed rail is Amtrak's Acela Service on the Northeast Corridor. The first Acela Express launched in the late 2000s, featuring two aerodynamically designed power cars at each end of a six-car set, reaching speeds up to 150 mph (Railfan-Joe, 2020). While this may seem fast, it is significantly slower than the Shinkansen. In addition, Acela operates on conventional tracks rather than dedicated high-speed rail tracks and stops at standard train stations. Because the Northeast Corridor was not designed for sustained high-speed travel, Acela cannot maintain its top speed for the entire route that reaches from Washington D.C. to Boston. It slows down on tracks shared with freight and other regional service trains, limiting its high-speed operation distance to just 53 miles of its 457 mile route. As a result, its overall speed drops to just 65 mph (*Amtrak "Acela" - America's "Bullet Train,"* 2023).

To compete with international high-speed rail networks, the U.S. needed a bold initiative - a brand new high-speed rail system with dedicated tracks, something never before attempted in the country. In 1996, California took the lead, establishing the California High-Speed Rail Authority to oversee HSR development. In 2008, California voters approved a bond measure to fund California's well-known High Speed Rail Initiative. Phase 1 aims to connect San Francisco to Los Angeles in under three hours, with trains exceeding 200 mph. Phase 2 plans to extend its service to Sacramento and San Diego.

As of 2025, 119 miles of track are under active construction in the Central Valley, and 422 miles of the 500 miles of Phase 1 have been environmentally cleared. The California Authority has acquired most of the necessary right-of-way parcels, and Central Valley design work is nearly complete (*About California High-Speed Rail*, n.d.). However, nearly 20 years after its approval, no full segment of the HSR system has been completed. The slow progress is due to multiple factors. This paper will examine these obstacles to understand why the United States continues to struggle with high-speed rail implementation.

HSR holds strong public support in the United States, with 72% of American voters favoring the creation of a nationwide HSR network, where 46% strongly support it. In the western states, where projects like the California High-Speed Rail Initiative and Brightline West are underway, public approval is similarly high with a 71%-14% favorability rating. Voters recognize the transformative impact HSR could have on daily life. 58% of Americans say reducing traffic congestion and flight delays makes them more likely to support funding for high-speed rail. 57% cite the impressive safety record of bullet trains in Japan, which have reported zero fatalities, as a reason to support investment, especially when contrasted with more than 40,000 annual deaths from car accidents in the U.S. Additionally 60% of voters support

HSR funding after learning it offers faster travel times than air travel, and 56% increase their support when considering the thousands of jobs that HSR construction, maintenance, and operation would create (*As Congressional Support for High-Speed Rail Grows, New Poll Finds Clear Majority of Voters Want Nationwide High-Speed Rail Network*, 2024). This support highlights the importance for discussing the impact of HSR on society and the barriers preventing its implementation.

Despite this widespread public backing, the U.S. has struggled to implement high-speed rail on a national scale. Understanding the economic, political, and geographical challenges that delay HSR development is crucial to bridging the gap between public demand and government action. As more Americans recognize the benefits of high-speed rail, it is essential to educate the public on the obstacles hindering its progress and explore potential solutions to move forward.

Methods & Theoretical Framework

The research methodology for this paper includes a meta-analysis, which examines quantitative data from sources such as the Bureau of Transportation Statistics and other databases to assess economic and geographical factors impacting high-speed rail in the United States. Additionally, I conducted content analysis by using news articles and video media to explore legislative challenges and public discourse surrounding HSR projects. The paper incorporates statistical data on economic, legislative, and geographical trends to highlight the systematic difficulties the U.S. faces in implementing high-speed rail. To maintain clarity and depth, a selective approach was taken in choosing global HSR case studies. For instance, the California HSR initiative was chosen over the Brightline West project due to its larger scale and status as the first state-led high-speed rail project in the nation. Similarly, Japan’s Shinkansen was

analyzed instead of China's extensive network to contrast the U.S. with the earliest example of a successful HSR system, illustrating how far behind the U.S. remains.

The analysis is framed within the infrastructure studies framework, which examines the complex relationship between society and transportation infrastructure. I will also apply the concept of path dependence, highlighting how the U.S.'s early adoption of mainly automobiles and aviation has shaped transportation policy in a way that constrains HSR development. Additionally, the analysis draws from STS (Science and Technology Studies) sensibilities, including sociotechnical analysis, which emphasizes how HSR technology and human decision-making influence one another. Policymakers, businesses, and the public all play a role in shaping HSR adoption, just as the technology affects broader transportation behaviors. Furthermore, the social construction of technology (SCOT) concept is used to analyze how legislative pushback, political interests, and transportation choices - each shaped by relevant social groups - have framed HSR as an impractical solution for the U.S. These relevant social groups include policymakers, private industry stakeholders, transportation planners, and the public, who interpret the risks and rewards of HSR differently. For example, while environmental advocates may see HSR as a sustainable alternative to car and air travel, others, such as highway lobbyists, may view it as a threat to existing systems. These competing perspectives help contextualize why, despite widespread public support, the United States continues to struggle with HSR implementation.

Findings & Analysis

Economic

One of the primary obstacles to the successful implementation of high-speed rail systems in the United States lies in the economic feasibility and sustainability of such infrastructure.

Building a high-speed rail network would require a substantial investment, which, when examined from an economic perspective, appears to be an impractical endeavor. While a HSR system could represent an innovative advancement in transportation, the financial burden it would place on the country's finances and the potential net economic loss, based on available data and logistical factors, cannot be overlooked.

Since 2018, Amtrak has been the only intercity passenger rail operator, with its Acela train in the Northeast Corridor qualifying as high-speed. This makes Amtrak and its high-speed rail system a useful precedent for comparison. Amtrak has seen relatively stagnant ridership numbers from 2013 to 2023, typically ranging in the low $30 millions. Ridership significantly dropped during the COVID-19 pandemic, further highlighting the fragile state of rail-based passenger travel in the United States (*Amtrak - Ridership 2022*, 2024). The U.S. has an exceptionally low rate of rail usage compared to countries like Japan, where 70% of all passenger travel was by rail as early as 1964, which was the year of the Shinkansen's inauguration ("Japan Passenger Transport by Mode from 1950"). In contrast, only 0.1% of all passenger travel in the U.S. occurs via Amtrak, further deepening concerns about the lack of sufficient demand for high-speed rail ("U.S. Passenger-Miles", 2020). This lack of sustained growth in ridership points to a critical issue: the limited market for high-speed rail.

This limited market for rail travel can be paired with its higher operating costs, resulting in even more hesitancy for HSR growth. For example, Amtrak's Acela charges more than 90 cents per passenger-mile, more than double the cost of flying (O'Toole, April 2021). Airfares in 2019 averaged 13.8 cents per passenger-mile, making air travel far more affordable ("Average Passenger Revenue per Passenger-Mile", 2020). The high price of high-speed rail travel combined with the small market for passengers creates a major challenge. Given that ridership is

already limited, the cost of construction, operation, and maintenance would likely never be paid back through ticket sales alone. This raises serious concerns about whether HSR could ever generate enough revenue to cover its costs or deliver economic benefits. Overall, the low ridership and high ticket prices limit the market potential for high-speed rail, making it a risky and unsustainable investment for the government.

Another key issue is the high cost of building a HSR system and where the funding of this money will exactly come from. When comparing the financial burdens of the HSR to the success of the Interstate Highway System, the construction of the interstates, which spans 48,500 miles, cost approximately $530 billion in present-day dollars, averaging $11 million per mile (Hale, 2016). In contrast, HSR systems, such as California's planned 220 mph tracks, have an average cost of over $100 million per mile, with the total cost of a single segment expected to exceed $100 billion (O'Toole, April 2021). In general, the California Initiative was projected to be around $33 billion in 2008 (CNBC, 2023). However, the cost now is estimated to be around $128 billion dollars. The main reason behind the increase in project estimation is due to land acquisition problems. The country values private property rights, where private individuals own land. As a result, landowners want to overcharge the value of their property to the public project. This often leads to many negotiations to get a fair market value, essentially delaying the project even more. Furthermore, the price to complete environmental clearing without steel or cement in the ground costs $1.3 billion dollars (CNBC, 2023). Despite the problem with land acquisition and price of just environmental clearing, the project never had full funding for completion. As a result, the state government and leaders of the project are struggling economically to gain resources to get the project completed within its desired time frame.

Moreover, countries that have invested in HSR suffer from significant debt. For example, Japan acquired $400 billion in debt from its rail system, despite having sufficient ridership numbers (O'Toole, March 2021). In the U.S., where federal taxes and highway fees contribute to a large portion of the costs for highway infrastructure, funding for high-speed rail would likely have to come from deficit spending. This raises concerns about the long-term economic impact for the U.S., especially when existing rail systems are already backlogged with $176 billion in maintenance needs, and Amtrak's Northeast Corridor alone is facing a $52 billion maintenance backlog (O'Toole, April 2021). If the U.S. cannot even maintain its current rail systems, it raises the question of whether the country could successfully sustain a more expensive and demanding high-speed system.

The overall problem is that HSR infrastructure is really expensive even after its implementation is complete, whether that's because funding is limited or paying back the cost is potentially unachievable. This money needs to come from somewhere to make HSR a net positive project. Some would look to reallocate funding from another department to public transit. However, it is important to not look at zero-sum solutions rather to promote transit-oriented development (TOD). This is where the government promotes denser urban development around HSR stations, which in turn increases property value and tax revenue to help fund and sustain the rail system. In addition, it encourages new commercial and business hubs near HSR corridors to generate additional tax revenue and private investments that can be allocated to the rail infrastructure.

Legislative

The United States has been caught in a cycle of legislative gridlock and policy whiplash, swinging between advancing HSR initiatives and defunding them. The Biden Administration

allocated over $3 billion to support California's HSR project, signaling strong executive support. However, this progress was quickly challenged under the 2025 Trump Administration. U.S. Transportation Secretary Sean Duffy, appointed by President Trump, launched a federal review of the California HSR project, threatening to withdraw funding and potentially shutting it down altogether. Duffy justified the review by pointing out that after 17 years and $16 billion spent, "no rail has been built" (Arcand & Jeunesse, 2025). Republican Congressman Kevin Kiley of California echoed this sentiment, calling the project a "disaster" and crediting Secretary Duffy and President Trump for giving lawmakers the opportunity to put an end to it (Arcand & Jeunesse, 2025). Supporters argue that the project has created jobs and stimulated California's economy, but even within the state, doubts remain about whether it will ever be completed. President Trump is vocal in his opposition calling it "the worst-managed project I think I've ever seen," a stance backed by Elon Musk and the Department of Government Efficiency (Molnar, 2025). With nearly two decades of setbacks and financial drain, the California HSR project faces an uncertain future, further delaying the development of HSR technology in the U.S.

A recent event involving general passenger rail usage highlights the interaction between legislative opposition in an urban center, which can represent a broader picture of the struggle that pertains to HSR. On January 5, 2025, New York City implemented congestion pricing for vehicles entering the city, leading to an increase in public transit ridership. Compared to January in the previous year, Long Island Rail Road saw an 11% increase in riders, while Metro-North ridership rose by 7%. This suggests that policies discouraging car use can shift commuters toward public transit. However, this too faced pushback from the Trump administration, with U.S. Transportation Secretary Sean Duffy announcing plans to revoke federal approval for congestion pricing (Brown & Troutman, 2025). This case presents two key takeaways: First, if a

policy like congestion pricing, which can potentially have a significant effect on increasing ridership, encounters significant political resistance, the opposition to a more complex and expensive high-speed rail system would likely be even stronger. Second, the event raises the question if making car travel less convenient could be a key solution in increasing passenger-rail reliance in highly-dense areas.

Overall, the development of high-speed rail in the United States is heavily influenced by shifts in political leadership and party policies. A clear pattern has emerged in which Democratic and Republican administrations approach high-speed rail and public transportation policy differently. Democratic leaders typically advocate for expanding and investing in high-speed rail, viewing it as a long-term infrastructure improvement in hopes to enhance mobility, reduce carbon emissions, and stimulate economic growth. In contrast, Republic leaders often prioritize other projects, arguing that high-speed rail is not the most efficient use of public funds. This political divide leads to inconsistent funding and policy gridlock, creating a cycle in which progress made under an administration is often stalled or reversed by the next. This prevents the long-term planning and sustained investment necessary for a successful high-speed rail system. Without bipartisan cooperation, high-speed rail in the United States will continue to face delays and uncertainty. Addressing this issue requires both political parties' support and prioritization at the federal and state levels.

Geographical

Beyond political and financial roadblocks, the country's geography also presents challenges for HSR. The U.S. spans 3.8 million square miles, with its population distributed as follows: 31% urban, 55% suburban, and 14% rural as of 2016 (Country Comparison Japan : United States, n.d.; Pew Research Center, 2018). Since urban areas occupy a small fraction of the

total landmass, vast stretches of rural and suburban land would need to be crossed without contributing significantly to ridership since HSR primarily serves to connect major cities while bypassing smaller communities. This creates a challenge: while tracks must be laid through these less populated areas, low demand for HSR in those regions could result in poor return on investment. Given that rural and suburban areas make up most of the country, this geographic reality poses a major obstacle to the viability of HSR.

Urban residents are the most frequent users of public transit, with 21% relying on it regularly, compared to 6% of suburban residents and just 3% of rural residents (Monica Anderson, 2016). The Northeast, home to Amtrak's Acela and major metropolitan areas like New York-Newark-Jersey City, Washington-Arlington-Alexandria, Boston-Cambridge-Newton, and Philadelphia-Camden-Wilmington, has the highest public transit usage, with 25% of adults using it regularly (Rosenberg, 2024; Monica Anderson, 2016). This figure is more than double the national average of 11% (Monica Anderson, 2016). These dense urban centers make public transit, such as passenger rail, more practical due to walkability and high costs associated with car ownership along with high housing expenses. This shows that a higher population density, found in urban regions, is important for a high-speed rail to succeed.

Japan serves as a prime example of how high population density contributes to the success of high-speed rail. With an overall population density of approximately 855 people per square mile - nearly ten times that of the United States at approximately 91 people per square mile - Japan's urban centers are densely populated, creating a strong demand for efficient mass transportation (*Country Comparison Japan : United States*, n.d.). The Shinkansen system thrives in this environment because it connects major metropolitan areas such as Tokyo, Osaka, and Nagoya, where public transit is already heavily relied on. Unlike the U.S., where suburban and

rural areas dominate much of the land, Japan's compact urban development ensures high ridership, which makes HSR a practical and economically viable transportation option. Japan can act as evidence that there is a correlation between urban density and feasibility of HSR, reinforcing the idea that increasing urbanization in the U.S. could enhance the sustainability and viability of similar high-speed initiatives.

Conclusion

The slow progress of high-speed in the United States, shown by the struggles of California's High-Speed Rail Initiative and Amtrak's Acela Service, stems from a combination of economic, legislative, and geographical challenges. Constructing and maintaining an HSR system requires an immense financial commitment, yet the U.S. lacks the necessary funding at both state and federal levels. Even if such funding were secured, repaying the investment would pose another challenge due to the country's public transportation habits. Unlike Japan with well-established rail networks, the U.S. does not have the ridership demand needed to generate sufficient revenue to cover the costs, where the dominance of alternative transportation modes such as driving and flying contribute to the low demand.

Legislative roadblocks further complicate the situation. The political landscape in the U.S. is deeply divided on public transportation policy, with shifting administrations often reversing or stalling progress. High-speed rail remains vulnerable to partisan disagreements, which can also be demonstrated by broader struggles in public transit like congestion pricing. Without stable, long-term support, securing consistent funding and policy backing remains nearly impossible. Additionally, the nation's geographic structure presents another obstacle. Unlike countries where dense urban centers support high-speed rail, the U.S. is characterized by sprawling suburban and rural areas. This makes it difficult to design an HSR network that

efficiently connects population centers while ensuring sufficient ridership. The necessity of building rail lines through sparsely populated regions further increases costs without guaranteeing passenger demand.

Right now, large-scale HSR expansion in the U.S. is not a viable option without significant structural and policy changes. While reallocating funds from other sectors, such as defense, could provide financial relief, such shifts are politically controversial and unlikely to gain widespread support. A more practical approach would be to invest in urban development, creating denser, more interconnected cities that naturally support high-speed rail. Expanding transit-oriented development around major transportation hubs could increase property values, attract businesses, and generate new revenue streams to help fund HSR projects. Moreover, improving walkability and reducing reliance on private vehicles could shift public habits, increasing the demand for efficient rail systems.

To make high-speed rail a reality in the United States, the focus must first be on reshaping the urban landscape. By strategically linking major population centers and fostering environments where public transportation is the preferred mode of travel, HSR could evolve from an impractical ambition into an essential part of the country's infrastructure. With increased ridership and public interest, private and government investments would follow, creating a self-sustaining cycle of development and expansion. The challenge of HSR in the U.S. is not just about building tracks, it is about reimagining the way Americans move, live, and interact. If the nation can embrace this shift, high-speed rail could become more than just a distant ambition, it could redefine transportation in the country.

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