ECON 488 Section 1

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Policy Draft

Transportation Group

Topic: High-Speed Rail

As the United States is taking strong strides forward to continue its technological expansion as a country, it continues to lack the dominating force of high-speed rails that are prevalent in several First World countries. Over the past 70 years, the United States has had multiple policies geared at the idea of a national rail system, yet implementation has been lackluster. Currently, the United States has an energetic desire to turn into the global leader in high-speed rail, which comes with a hefty price and other implications. This project will answer our research question: what are the cost-benefits of implementing a high-speed rail system in various segments of the United States?

The history of passenger rail in the United States begins with its rise in popularity through the 1800s and its continued strength until the end of the second world war. However, after WWII, popularity declined significantly (Historical Statistics, n.d.). Union Station, in Washington, DC, experienced 84% fewer intercity passengers by 1965 compared to 1945 (State Rail, 2017). Much of this decline has been attributed to the Federal-Aid Highway Act of 1956, which allowed for the construction of 41,000 miles of interstate highways at a cost of $26 billion (History.com Editors). That is about $270 billion in today's dollars. This highway funding, along with the freedom promised by a personal or family automobile, moved Americans away from rail travel. In contrast to the United States, countries in Europe developed their existing rail lines at the end of the second world war and continued to invest in rail travel.

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Looking at countries outside the U.S. it is evident to start with Japan. Since its opening in 1964, Japan's Shinkansen continues to grow and serve as the paragon for high-speed rail systems worldwide. It was built out of a need to reduce serious congestion on roads between Tokyo and Osaka – a corridor of 45 million people, 5 million smaller than the Boston DC corridor—and has since expanded to cover most of Japan. One of the most used routes is the Tokaido line, which connects the 85 million people between Tokyo and Kyoto and reduces a 5-hour car ride to a 2-hour 18-minute train ride. Our policy brief is concerned with the cost-benefit analysis of building a high-speed rail system within the United States, so it is interesting looking at the Shinkansen's varied profitability—not all lines break even. In 1987 the Japanese National Railway service was privatized and broken into six regional rail companies which have allowed the companies to operate commercial and real estate businesses. These rail companies manage revenue-generating shopping centers, restaurants, and hotels providing them with additional sources of revenue outside of ticket sales—something to take into consideration for building a high-speed rail network within the U.S. The Shinkansen reaches a top operating speed of around 320 km/ h which is comparable to France's TGV (Trains à Grandes Vitesse) and China's HSR (High-Speed Rail) and transported around 370 million passengers in 2019 throughout Japan.

After the early success of Japan's bullet train, a lot of European countries followed suit, and in 1981 France opened its first TGV (Trains a Grandes Vitesse) line connecting Pairs to Lyon. Unlike Japan, France's high-speed rail is run by SNCF (la Société Nationale des Chemins de Fer Français), a state-owned enterprise, and consequently, they rely on more subsidies and government aid to keep ticket prices low. Shifting to one of the fastest developed high-speed rail systems today, China's HSR network is expected to reach over 38,000 km (about 23612.11 mi)

by 2025, and 45,000 km (about 27961.7 mi) in the longer term, far more rail lines than in the rest of the world combined (Environmental and Energy Study Institute, 2018). The Chinese government started planning in the 1990s and trains started operating in 2008. Being run by an authoritarian government, China has not run into the political gridlock and citizen backlash the U.S. is experiencing, and this is one of the reasons for these relatively fast developments. Now China's high-speed rail is reported to carry more than twice as many passengers as its domestic airlines, which bodes well for investment returns.

With high-speed rails finally getting a proper introduction into the United States, a company named Brightline has begun its construction on a new rail that connects the 260-mile distance between Las Vegas and Los Angeles. This high-speed rail will reach speeds of up to 180 miles and cut travel time to around 3 hours, two times faster than it currently is to drive. 50 million one-way trips occur annually between the two of these destinations while a substantial number, 85%, of them are by car or bus transport (Brightline West, 2021). The implementation of this new public transport will connect to Metrolink (Southern California's passenger rail system), as well as eventually add additional rail routes to Palmdale. At full operations, the rail system is expected to attract around 20-24% of the 50 million one-way trips between LV and LA (Brightline West, 2022). The price of tickets will cater to currents gas and parking prices, as well as fluctuate as the economy pivots.

Not only would the high-speed rail benefit individuals, but also the environment and the world. To start, the train will be all-electric, meaning there will be zero emissions that are produced. This to scale is cutting back 400,000 tons of CO_2 pollution, or a reduction of 3-million cars (Brightline West, 2022). There will be fewer citizens on the roads, promoting public safety,

as well as assisting lower-income individuals who cannot afford private transport, let alone pricey plane tickets (Yale School of the Environment, 2013). The trains will include free Wi-Fi, food/drink selection, fully handicap accessible, as well as luggage assistance. Brightline estimates there will be 40,000 jobs created in construction with 1,000 new permanent jobs with Brightline, $10 Billion in economic impact, with $1 billion (about $3 per person in the US) in tax revenue (Brightline West, 2022). As well as the previously mentioned zero emissions, which equates to a reduction of nearly 3-million cars off the road. Negatively, the plan is expected to take until 2026 to be fully running, costing between 8 and 12 billion dollars (about $37 per person in the US).

Another high-speed rail that has been argued about over the years is a plan to connect San Francisco to Los Angeles, 520 miles of rails, with train travel time expected to take only three hours. This implementation is only phase 1, as phase 2 will expand from Sacramento to San Diego, around 800 miles. After the second implementation, the rail will feature 24 different stations (California High-Speed Rail Authority, 2022). This system would reach speeds of over 200 miles an hour and eventually expand to Sacramento and San Diego. This project was originally introduced in the 1980s but has always been tucked under the rug as it was never a priority. The new estimate of this project is around $105 billion (about $320 per person in the US), $5 billion more than the estimate was two years prior, while in 1999 the project was estimated at only $25 billion. In recent years, there have been minor advancements for the pathway of this project to be worked on until a train-friendly administration would push it forward. Fortunately, with the Biden administration, these actions may begin sooner than later.

The hopes for this system are to be testing the railway by 2025 with full usage by 2029. The rail will also feature full ridership in 2033. The benefits of this system are interesting as they suggest around $11 billion in economic output over the next 20 years and $4.4 billion of labor income. For the costs of building this new infrastructure, some benefits do rival those of an airline company. In comparison, as of 2019, to build the infrastructure to move 7,500 individuals per direction per hour, an airport costs between $122 billion and $199 billion, while high-speed rails are only between $63 billion and $98 billion (California High-Speed Rail Authority, 2022). The distance for car travel between San Francisco and Los Angeles is a total of 320 miles, while the High-Speed rail system is 520 miles. Based on the IRS, they rate 58.5 cents per mile driven, while breaking down the ticket price per mile of the rail we see a lower number by around a sixth of the cost. The fee of $55 (California High-Speed Rail Business Plan, 2008) for the rail system can be broken down to about 10.6 cents per mile traveled (IRS, 2021). There will always be a need for the use of air travel for international trips and long-distance travel, yet the usage of high-speed rails will dominate in short-to-medium distance travel. A major beneficial feature of the project is the eco-friendly train will reduce CO2 emissions by up to 151,000 pounds per year by 2040, which is equivalent to roughly 32,000 passenger vehicles driven for one year (California High-Speed Rail Draft Plan, 2022). With this project becoming more serious, there has been construction throughout the years for when the project becomes fully implemented. There have been over 7,300 jobs already created, and it is estimated that there will be over 130,000 jobs created throughout the construction process (California High-Speed Rail Draft, 2022).

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It is not surprising that the two largest U.S. states are looking into high-speed rail investments, Texas being a prime candidate given its flat landscape and growing urban cities. Currently, Amtrak has three routes in Texas, two going through Dallas and one through Houston but none connecting Houston to Dallas—the first and third largest cities in Texas, respectively. The only options between the two are to take a three-and-a-half-hour greyhound bus ride, drive, or take a 90-minute flight, and with around 100,000 people (Moss & Qing, 2012) commuting at least once a week, it is suboptimal. In 2014 the Texas Central Railway, a private railroad company, unveiled its proposal to build a high-speed railway connecting the two with a stop at Brazos Valley, near Texas A&M. Texas A&M is the second-largest university in the US and the largest in Texas with an enrolment of over 70,000 students and has over 20% (Texas A&M University Enrollment Profile Spring, 2017) of all incoming students coming from the Houston Area (an hour 45-minute drive) --the largest proportion of students from one area. The 240-mile high-speed rail line is claimed to offer a travel time of 90 minutes with convenient departures every 30 minutes during peak periods each day, and every hour during off-peak periods with certain night hours reserved for maintenance. Like the California high-speed rail proposal, Texas Central emphasizes the economic prosperity, increased safety, and environmental benefits that this proposed railway brings.

The Federal Railroad Association's Draft Environmental Impact Statement (DEIS) completed a review of Texas Central's proposal in 2020 and predicted that the train would remove 14,630 vehicles per day on I-45 between Houston and Dallas, thereby saving 81.5 million gallons of gasoline and reducing CO2 emissions by 101,000 tons per year. Not only would removing vehicles from I-45 save on CO2 emissions, but it also has the potential to

improve highways safety on one of the deadliest interstates in the United States. Texas Central's high-speed rail will be built on elevated tracks, meaning there will be no direct intersection between vehicles, pedestrians, and the rails, preventing any common rail-vehicular accidents. The FRA found that the property assessment values within a half-mile of the proposed stations would increase between $71.4 million and $161.1 million, and once operational, the rail line will create over 1,500 new jobs, with Texas Central predicting an economic impact of about $36 billion over the next 25 years.

The estimated hard costs of the project are currently $20 billion (Texas Central, 2021), but like all major projects, they will most likely increase. Apart from funding, its largest challenge has been finding agreements amongst the farmers whose lands will be used or near the proposed railroad—one case (James Miles v. Texas Central) is predicted to halt Texas Central's construction plans. Being a private company, it is unclear whether Texas Central has the right to use eminent domain to build their tracks on private land, something that has held them back and delayed their timeline until a decision has been reached.

One of the most promising possible high-speed rail routes is the Northeast Corridor. It is a route that would stretch from Washington, DC to Boston, MA, and it would move through major cities such as Baltimore, Philadelphia, and New York City (Home, n.d.). The route is especially promising because an existing rail route is already in place, and it would only have to be upgraded to include more of that route consisting of high-speed rail. It is also a very population-dense region of the US, including 17% of the US population, while consisting of only 2% of US land area (Northeast Corridor, 2014). Notably, the route is Amtrak's only profitable

route, generating about half a billion in profit, which the company then uses to subsidize other unprofitable routes (Scheyder, 2015).

That route is currently served by the only high-speed rail route in the US, the Acela line, reaching speeds of up to 150 mph (Bach, 2019); however, this speed is only attained for 32 miles (Shepardson, 2021). This route also accounts for 12 million passengers each year, which is 40% of Amtrak's total traffic (Shepardson, 2019). A US government commission proposed a $117 billion plan to remake some of the route, which would cut about an hour of travel time from Washington to Boston and would make other repairs and improvements to rail travel (Shepardson, 2021). The plan would include increasing the length of high-speed rail along the Northeast Corridor to 132 miles and would increase the speed from up to 150mpg to up to 160mph (Shepardson, 2021).

Taking a step back to look at high-speed rail across the United States, U.S. Secretary of Transportation Pete Buttigieg is hoping the United States will become the world leader in high-speed rail, but with only one 32-mile mixed high-speed route currently (The Acela), the U.S. has a lot of groundwork to make up. To reach this standard, the United States would need 22,000 miles of high-speed rails and a budget of around $4 trillion (about $12,000 per person in the US). It is not to say whether this is immediately worth it or not, but through our research and cost-benefit analysis, we can come to an informed decision.

Looking at the benefits, high-speed electric trains will cut down on the CO2 pollution in the United States—in 2014 over 14% of U.S. CO2 emissions were from the transportation sector (EPA, 2014). The Brightline train, for example, is estimating replacing 3 million cars on the

road, a reduction of 400,000 tons of C02 emissions. The trains will provide a safer, faster way for the public to travel, while potentially assisting lower-income individuals with this task. This reduction of cars will not only cause less congestion but also avoid many roadside accidents. In the first nine months of 2021, there were 31,720 vehicular car accident deaths, a 12% increase when compared to all of 2020. With the average workweek in America being 40 hours, we can see how much work can be done while on the rail, by looking into time that is currently dedicated to driving, a loss of work per week. The average time saved between the four rail systems focused on in this paper is 2.375 hours (1 hour for NEC, 3.5 hours for Texas, 5 hours between two California lines). That is now time one saves from their typical route that can now be dedicated to working. Additionally, the total time lost to driving these four routes on average is 5.875 hours (7.5 hours on NEC, 5 hours for Texas, 11 hours for two California lines). Based on the median minimum wage in 2020 at $16.36 an hour (Statista, 2020), any rider will have the ability to earn $57.26 in their day by doing work during the time saved per day. This does not include the benefit of work that can be done while on the rail system itself. The listed benefits of a High-Speed rail system in this paper are just a fraction of the positive impacts. Even with the high initial costs that scare away numerous individuals or politicians, eventually, high-speed electric trains will be a cheaper way to travel than the alternatives like new airports or expanding highways.

As with any large-scale development project, several costs need to be considered before moving forward. The three projects combined—California, Texas, and Northeast Corridor—are projected to cost at least $254 billion upfront, and that is not accounting for any unforeseen challenges which will most likely cause this to increase further. In comparison, we estimate the

economic benefit to be at least $270 billion, which is found when adding the savings in driving costs along the NEC and the expected economic benefits of the rails in California and Texas. However, when discounting future benefits our calculation shows that expected benefits would be lower, at $156 billion. This was found by averaging the expected $270 billion in benefits over all 20 years, which is a benefit of $13.5 billion each year. Then each year is discounted using the Office of Management and Budget's recommended 7% discount rate, with the final year being discounted by 7% 20 times. Summing the years together yields a total benefit of $156 billion in today's dollars.

However, unforeseen challenges like political gridlock, lobbying from airline competitors, oil companies, and other concerned organizations continue to slow the development of building a high-speed rail network within the United States. Whether it be over the use of eminent domain or the disagreement regarding the allocation of funds, any high-speed rail company will have to navigate the divided political realm if they hope to get their railway approved. In addition to these challenges, one of the largest questions surrounding the feasibility of high-speed rail is the difficulty of anticipating future demand. In Japan, the best high-speed rail country to date, only 25% of travel is through these rail systems, while another 70% is with automobiles (O'Toole, 2021). The United States is known to be a car-centric country, so railway companies will have to find a way to push themselves into being a competitive alternative—something they may be able to do by offering medium distance routes of 200-500 miles. Regardless it is impossible to know for certain what ridership will be for these railways, and with the upfront costs as high as they are this is something to consider.

Considering these costs and benefits, our recommendation is to implement high-speed rail in limited regions of the US including the rail systems proposed in California, Texas, and along the Northeast Corridor. These areas are some of the most population-dense regions of the US and have the urban areas required for sufficient demand. To rank our recommendations, we believe the first advancement for high-speed rail should be the NEC because it has proven to be an already profitable route throughout history as well as having the infrastructure already in place making upgrades relatively easy. Following the NEC, we believe the Texas Central Railway project has the second-highest possibility of being successful and turning a profit. Texas' flat, open landscape and rapidly expanding population, especially around the three proposed stops (Dallas, Brazos Valley, and Houston) make it a prime candidate for high-speed rail. Being one of the fastest economic growing states with no current railway connecting Dallas and Houston, the need for a rail system is large, and when combined with the economic output from this railway projected to be $ 36 Billion, it shows extreme potential. Ranked third after Texas Central is the Las Vegas to Los Angeles route in California which is projected to cut down on 400,000 pounds of C02 emissions per year, remove 3 million vehicles annually, and produce $10 Billion in economic output over the next 20 years. Finally, we have the San Francisco to Los Angeles route ranked last because while it does bring in $10 Billion in economic output, and reduce emissions by 151,000 pounds of C02 annually, it costs over 10 times as much as the other routes at over $100 billion. While this route shows promise with the previously stated safety, economic, and environmental benefits, the NEC and Texas projects have additional benefits—like higher demand, easier track implementation, and cheaper upfront costs—that make them more likely to be successful overall. Outside the three regions stated in our policy brief, we also

recommend looking into the implementation of high-speed rail in other population-dense regions of the US, like Florida and the Pacific Northwest. After a sizeable high-speed rail line is built, there is a high chance for a "domino effect" with other lines soon following behind, as seen throughout the world with Japan's success encouraging other countries in Europe and Asia to follow. We believe that the benefits of decreased driving costs, decreased emissions, increased safety, and jobs created would exceed the large up-front costs to implement high-speed rail and the costs to operate and maintain those systems. High-speed rail has proven to work all over the world, and California, Texas, and the Northeast Corridor all show tremendous potential to be the frontrunners of implementation in the United States.

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