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Connecting Eastern and Western Massachusetts with High-Speed Rail

Connecting Eastern and Western Massachusetts with High-Speed Rail

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Abstract

Beginning in 1964, countries globally began to invest in high-speed rail infrastructure and development of high-speed rail networks. The United States, despite being one of the leading countries, is lagging behind. In recent years, there has been increased efforts by Massachusetts leaders to strengthen the connection between eastern and western Massachusetts. This Capstone project aims to look at the positive negative aspects of building a high-speed rail between Boston and Pittsfield, and its potential impact on the economy and environment.

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Chapter 1: Introduction

The development of high-speed rail system remains a salient issue within the United States and worldwide. High-speed rail is not a new technology by any means, as the first high-speed rail system was built in Japan in 1964 and has been in operation ever since, expanding to nine active in-service lines with three more lines in development (Nunno, 2018). Twenty years after Japan built the first high-speed rail network, France became the first European country to make this technology available to the public in 1981 (Nunno, 2018). Since then, many more European countries have joined France in building not only an intercity high-speed rail network, but more importantly, they are all connected to create an intercontinental Trans-European rail network. This Trans-European rail network is also yet completed, as there are still plans underway to expand more of the rail services to European countries without or with limited high-speed rail services.

Another country with major development in its high-speed rail network in the past thirty years is China. The plans went underway in 1990s, and by 2008, China was operating its first high-speed rail line (Nunno, 2018). Fast-forward to today, China currently operates the biggest high-speed rail network in the world, with nearly 16,700 miles of high-speed rail lines connecting big cosmopolitan cities to developing towns and cities, particularly western China, and like other countries, they still have more plans to expand their high-speed rail network (Nunno, 2018). The United States, on the other hand, completely lags behind in terms of high-speed rail network development. The United States currently does not have any train line that satisfies the requirements to be a high-speed rail line. The fastest train that is in operation is the Acela Express, operated by Amtrak, which can run up to 150mph, but on average it only runs at 66mph (Nunno, 2018). Although there are a few states who currently have high-speed rail plans in the works, such as California and Texas, nothing has yet to be realized.

This Capstone project is an attempt at looking at developing a high-speed rail network for the state of Massachusetts. While Greater Boston is connected to the city of Boston via a robust public transportation system of trains, subways and buses, there are less available options for public transportation from central and western Massachusetts to Boston. As seen in the Massachusetts Bay Transportation Authority (MBTA) Commuter Rail in Figure 1, the farthest west that the Commuter Rail provides service to is the city of Worcester via the Framingham/Worcester Line. Figure 2 shows the Amtrak map for the Lake Shore Limited line, which is a 19-hour trip from Boston to Chicago and vice versa, and offers stops at Worcester, Springfield, and Pittsfield. This is the only train line that connects eastern Massachusetts to western Massachusetts. While it runs daily, it only offers service once a day, and the trip from Pittsfield to Boston, and vice versa, takes roughly 4 hours. On the same line, travelers can also choose to go from Pittsfield to Springfield and vice versa as well as Pittsfield to Worcester and vice versa. Amtrak does not sell tickets from Worcester to Boston for the Lake Shore Limited Line, which could have been beneficial for travelers as the Amtrak train is faster than the Commuter Rail train. For Springfield-Boston trip, travelers can choose between the once-a-day two-hour-and-a-half train ride on this line, or a roughly four- to five-hour trip with an interchange at New Haven, Connecticut, which travelers would then be able to experience two Amtrak lines: Northeast Regional and Hartford. It is evident that there is a lack of convenient and flexible options for traveling by train from eastern to western Massachusetts and vice versa.

Figure 1

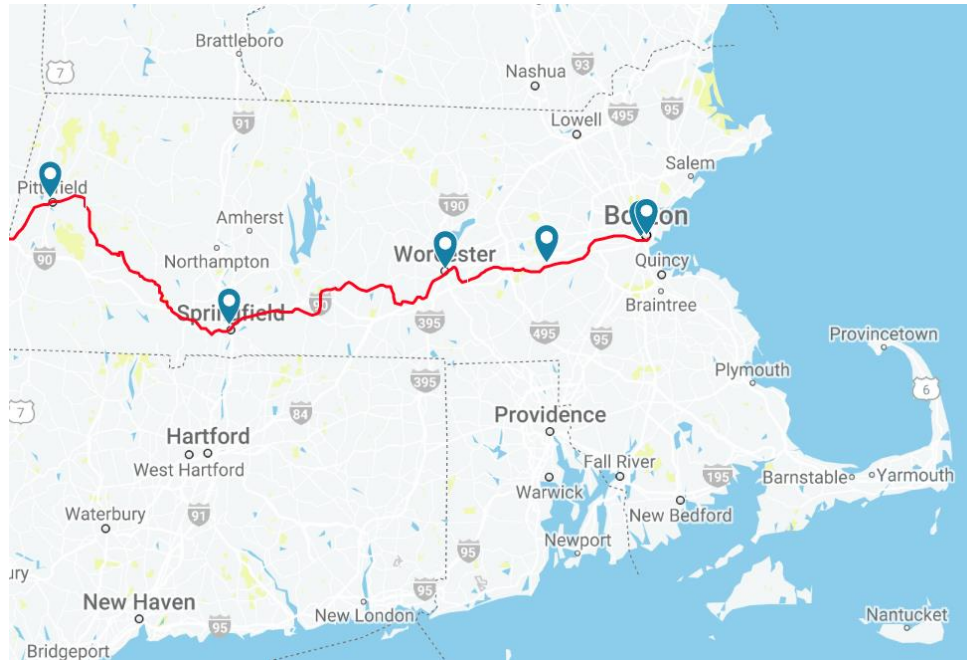
Map of MBTA Commuter Rail Lines



Note. The map was retrieved from MBTA website, n.d., (<https://www.mbta.com/schedules/commuter-rail>).

Figure 2

Amtrak Lake Shore Limited Line in Massachusetts



Note. The image was retrieved from Amtrak website, n.d., (<https://www.amtrak.com/lake-shore-limited-train>).

Building a train line to fill this gap will bring benefits to both eastern and western Massachusetts. Historically, eastern Massachusetts, specifically the Boston area, has always been the economic hub of the state and with the largest concentration of the state population, and therefore not only is wealthier respectively to taxes generated, but it also receives the most federal and state funding to invest in its infrastructures and other social programs (America Counts Staff, 2021; Data Analytics and Resources Bureau, 2023). The COVID-19 Pandemic has caused a global economic crisis and exacerbated people's living conditions, and further exposed the cracks in our social safety nets. It has also caused a rise in unemployment rates across the state, and while they have gotten better in the past couple of years, the rates still have not returned to what they once were pre-pandemic. Other costs of living have also increased due to global supply chain issues,

and there have been rising concerns relative to inflation. At the same time, there was and still is the looming threat of an environmental crisis caused by climate change.

This project seeks to research the impact of building a high-speed rail network in the state of Massachusetts to connect eastern and western Massachusetts. This project acknowledges that these issues cannot be addressed by just a single solution, and building a high-speed rail network will not automatically solve these problems. Rather, this project seeks to understand how building a high-speed rail network can alleviate some of the concerns of existing social issues and fill some of the existing gaps in our current social safety nets.

Chapter 2: Literature Review

There exists vast research on the development of high-speed rail networks and how they affect local and national economic development through tourism, their environmental impact, and flexibility in mobility for workers as well as tourists. Murphy and Allard (2015) explained that there has been a shift in the migration patterns of high-income and low-income people, with many high-income people moving into the newly invested urban centers of big cities, causing lower-income people to be priced out of the housing market there and leading them to move into the suburbs for affordable housing. With the financial crisis and other economic challenges, people also lost jobs or they're unable to find jobs with living-wages, causing them to sink more and more into poverty.

Currie and Sorensen (2019) further expanded on the points made by Murphy and Allard (2015) through their research on spatial inequity and environmental justice of urban neighborhoods, in particular the impact of sprawl development of neighborhoods which reenforces segregation by neighborhoods. However, the article also talked about how transportation policies

played a role in creating this spatial equity with neighborhoods that are located in areas with major transportation investments having more community resilience in the times of economic crisis (Currie and Sorensen, 2019, p. 479). On the other hand, Murphy and Allard (2015) also discussed how,

Even in those suburban places where service organizations do exist, the lack of adequate public and private transportation options for many low-income households makes it difficult to access programs of support. Indeed, studies have found that physical proximity to social services is critical for their use and that the probability low-income households will make use of social services increases the closer that they are located to service providers (p. 21).

These two studies raised the important point which is the development of a high-speed rail network alone will not adequately address the existing social problems, as long as some of the current structures which disallow low-income people to access opportunities, programs and organizations that would help them to have a better life. This is also something important to keep in mind when conducting studies on potential impact of high-speed rail network, especially in the United States, where transportation policies have not always been in the best interest of the people and served as tools for class segregation and as challenges to people who struggle with poverty.

Heuermann and Schmieder (2019) focused their research on the impact of high-speed rail network expansion on worker's mobility. They found in their research,

...evidence suggests that reductions in travel time in the German railway network have not only led to an increase in commuter numbers of about 91,500 between 1999 and 2010, but have also raised the share of workers commuting to work by train. In particular, high-speed

trains as one specific mode of transportation exhibit a substantial potential to support a modal shift toward the use of trains as a means of commuting (p. 363).

The expansion of high-speed rail network in Germany has helped to reduce commuting time for workers and, “a reduction in travel time by 1% raises the number of commuters between regions by 0.25%,” and as a result, smaller cities in the periphery of big cities are able to attract people from big cities’ labor workforces, and this in turn helped to strengthen their own labor workforce (Heuermann and Schmieder, 2019, p. 364).

In contrast, Ma and Liu (2022) did their research on the economic impact of China’s high-speed rail network expansion, which has been the fastest and most expansive project globally. Their findings showed a mix of positive and negative effects,

...there is an optimal range for the promoting effect of HSR construction on per capita GDP... Among different geographical locations, China's HSR network has had the greatest promoting effect on the economy of Western China, as the introduction of HSR has greatly reduced travel times in this region. The positive promoting effect on Central China is the smallest because the HSR network makes its urban economic development more vulnerable to the influence of the eastern region and causes the polarization effect to be greater than the diffusion effect (Ma and Liu, 2022, p. 202).

The high-speed rail network expansion does not have equal economic impact on all regions, and this is an interesting and important finding that Massachusetts government officials should consider when they consider developing a high-speed rail network in the state, so that both central and western regions of the state can see the full benefits of high-speed rail network. Another issue that should be considered is the impact of the opening of high-speed rail lines on local housing

market, as Chen and Haynes (2015) have also noted in their research that the costs of housing tend to rise with the opening of high-speed rail line.

Marie Delaplace et al. (2014) did a study on the impact of high-speed rail network in on tourism in France and Italy and found that,

...the HSR system has affected the choice of Paris and Rome differently. The two cities belong to two different countries in which the history of HSR service is very different; in France TGV is considered a real transport mode alternative while in Italy it is a relatively new system which still needs a campaign of promotion to be well accepted among the users and therefore the tourists (p. 174).

Similarly, Guirao et al. (2016) analyzed the impact of high-speed rail network in Spain and did find positive impact on local tourism for both Spain and China. On the other hand, Hiramatsu (2018) studied how high-speed rail network impacted tourism industry in Kyushu, Japan and came to similar findings: high-speed rail network does have a positive impact on tourism industry, and more importantly it has a positive effect not only on the areas where the high-speed rail stations are located, but nearby areas will also experience a positive impact on the economy due to spillover effects (p. 698).

Feliu (2012) analyzed the relationships between local and state stakeholders and the development of high-speed rail network in European countries, as well as the impact of this relationship and development on local economy. An interesting observation was made in this article is that,

... it is difficult to find a city project that goes outside the strict municipal boundaries of the city to a location in the surrounding conurbation. Despite promises of supramunicipal

cooperation, the reality is that small municipal areas that border on the main city and that very often share common facilities with it (e.g., industrial estates, residential districts, stations, and development zones) do not participate in the networks of stakeholders (Feliu 2012, p. 299).

Furthermore, the benefits that high-speed rail brings to the municipality, such as a boost in tourism and economic recovery, often are limited to the area where the high-speed rail is installed, and the municipality's non-urban area as well as surrounding towns and cities do not enjoy these benefits. Feliu (2012) also cautioned against conflict between local and supralocal stakeholders. These conflicts are presented often in two forms: "different territorial interests" and "a lack of dialogue or a desire to impose a solution" (Feliu, 2012, p. 301). If not resolved, these conflicts can either stop the project from happening, or bring about changes which do not produce the most beneficial outcomes for the municipality.

Hernandez and Jimenez (2014) looked at the economic effects of the high-speed rail on local budgets in Spain. The authors noted that, "Specifically, in Spain, HSR lines are mostly financed by the central government, and cofinanced with European funds, while most of the economic effects occur at the regional or local level" (p. 211). As the local government does not shoulder the financial burden of funding the development for high-speed rail and still get to benefits from increased economic activities, this funding policy has a positive effect on the local budgets and "this effect is most noticeable in those municipalities located within a 5 km radius of an HSR station" (Hernandez & Jimenez, 2014, p. 217). Hernandez and Jimenez (2014) also noted that a potential problem with this funding policy would be the tunnel effect.

Last but not least, Huang et al. (2023) looked at the environmental impact of high-speed rail network in China. They found that,

At the national level, HSR operation tends to improve air quality, which mainly attributes to HSR's spillover effect... However, at the regional level, the effect of HSR on air quality is spatially heterogeneous... Moreover, the impact of HSR on different air pollutants varies across regions. It depends on the local socio-economic conditions and the HSR's differential socio-economic effects in these regions (p. 11).

While high-speed rail network does have a general positive impact on air quality, it is important to put in consideration for each regional region, as air quality and the environment directly affect people's health, and everyone deserves to have clean air no matter where they reside. Huang et al. (2023) raised a good point that increased in worker's mobility and accessibility also means companies and factories are able to move to places where the economy is not as developed and costs of living and operations are lowered, and inadvertently worsens the air quality of those places. Therefore, it is important for local and state governments to consider this effect of high-speed rail network and put in place legislatures that will mitigate this issue.

Chapter 3: Current Development and Research of High-Speed Rail in the United States

Recently, there has been a lot of talk about building an East-West passenger rail service. It comes as no surprise that the project to build a passenger rail service to connect eastern and western Massachusetts has been in the works for many years. The state of Massachusetts began exploring this project in 2013 by commissioning the Northern New England Intercity Rail Initiative (NNEIRI) study, which was completed in 2016 and it, "recommended that eight (8) new daily round-trip trains be established between Boston and New Haven on the Inland Route as part of a larger effort to increase intercity passenger rail service in the region," but unfortunately, "MassDOT chose not to move forward with any of the recommendations from the NNEIRI study for reasons that were never fully explained" (Trains in the Valley, 2023).

Two years later, MassDOT took a second chance and commissioned the East-West Passenger Rail Study, and the bidding process began in 2018 and the study finished in 2021 with recommendation for “three possible build alternatives with up to nine (9) new round-trip trains between Boston and Springfield and Pittsfield on this corridor” (Trains in the Valley, 2023). However, MassDOT only identified two corridors for consideration with the Federal Rail Administration (FRA), and subsequently, they applied for funding from the FRA “for a corridor improvements project between Springfield and Worcester” (Trains in the Valley, 2023). The two corridors which are currently being considered are the Inland Route that was also recommended by the NNEIRI study, as well as a train line from Boston to Albany, and both would be operated by Amtrak as part of their existing rail lines (Trains in the Valley, 2023).

The East-West Passenger Rail Study also explored options relative to building high-speed rail between Boston and Pittsfield and according to the study,

The Boston-Albany rail mainline’s overall corridor alignment and geometry are not compatible with very high-speed passenger service. Therefore, a high-speed rail service would require a fully-separated corridor that utilizes an entirely new alignment. The I-90 corridor was the only feasible corridor identified that would enable the connections required and allow a straighter alignment with significantly higher speeds, while limiting the environmental and community impacts relative to those that would be associated with a new high-speed rail alignment in the East – West Corridor. It should be noted that this approach would still have much higher capital cost and much greater environmental and property impacts than any of the alternatives that make use of the existing rail corridor (Rail and Transit Division, 2021, p. 39).

They also found that in order to install high-speed rail that would be comparable to existing high-speed rail globally, with the maximum speed of 160 mph, the entire corridor will have to be electrified (Rail and Transit Division, 2021, p. 41). Figure 3 shows the proposed high-speed rail line between Boston and Pittsfield, which

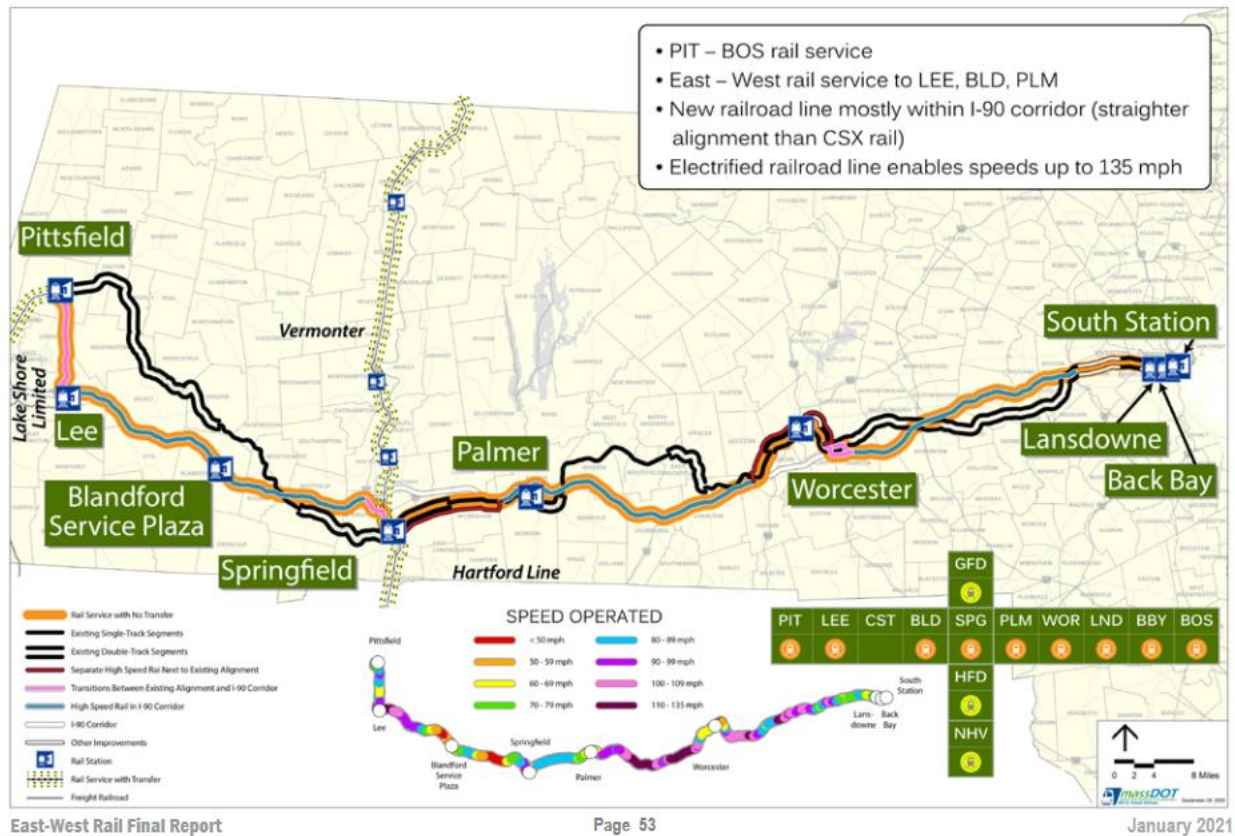
would allow for a significant rise in maximum permitted speeds from 50 to 150 mph, with trips between Pittsfield and Springfield taking under an hour (0:59). Between Springfield and Worcester, Alternative 6 could enable maximum permitted speeds to increase from 60 to 150 mph, and between Worcester and Route 128/Riverside, maximum permitted speeds could increase from 80 to 150 mph (Rail and Transit Division, 2021, p. 54).

This proposed high-speed rail service would also greatly reduce the time it takes to go from Boston to Pittsfield. As mentioned above, current trips from Boston to Pittsfield and vice versa by train are roughly four hours, but with the proposed high-speed rail, there would be, “90-minute savings relative to existing conditions and end-to-end travel times under two and a half hours (2:18)” (Rail and Transit Division, p. 54). In the end, this proposed high-speed rail service was rejected, as it, “would require a greater level of effort and coordination to secure any federal, state, and local permits that may be necessary to advance the project. Given the much greater increase in cost and impacts relative to the increase in benefits, Alternative 6 was not advanced for further evaluation” (Rail and Transit Division, p. 72).

Figure 3

East-West Passenger Rail Study Proposed High-Speed Rail Option

Figure 4-9 – Alternative 6 – High-Speed Passenger Rail, Pittsfield – Boston, with New Rail Alignment in Separate I-90 Corridor



Note. This image is from “East-West Passenger Rail Study Final Report, Chapter 4: Alternative Developments and Analysis” by Rail and Transit Division, Massachusetts Department of Transportation, 2021, (<https://www.mass.gov/doc/chapter-4-alternatives-development-and-analysis-0/download>)

It is also important to acknowledge that currently, there are ongoing efforts across the United States to build the first high-speed rail network in the country. The states of California and Texas both have plans underway, however, progress has been slow and there is no end in sight as the completion dates keep getting delayed. California’s high-speed rail line connecting Los Angeles to San Francisco originally had the completion date set to be in 2020, and was expected

to cost \$33 billion, now they are looking at a 2030 completion date, with the estimation that the rail will end up costing \$113 billion (Vartabedian, 2022). The reason was attributed to “political horse-trading”, as political deals and lobbying added stops to the original proposal that made the project more complicated and challenging, and caused the project to break ground at neither end of the line but in the middle where there is ongoing resistant to the state’s land seizures (Vartabedian, 2022). On the other hand, the state of Texas also set the completion date for its high-speed rail line connecting Dallas to Houston to be in 2020, but currently the project is in limbo as the state struggles to acquire land, and the expected cost has increased from \$12 billion to \$30 billion (Melhado, 2022).

Chapter 4: Methods

This project serves as a case study for high-speed rail network, and I began my research through Google Scholar, where I was able to find a lot of works that were published academic journals related to Transportation, Urban Planning, Environmental Studies, and more. However, it was challenging to access articles through Google Scholar, as many were hidden behind paywalls. I then switched to using Clark University’s databases, and most of the papers I was able to read were found through Clark University’s library portal. I also found that websites of advocacy organizations can be useful in finding general, as they compiled data on the topic of interest, such as the Environmental and Energy Study Institute and Trains in the Valley.

The majority of the sources that I reviewed during this project were academic journals. As mentioned above, I also found that advocacy organizations also do a lot of helpful work, such as creating fact sheets on the current status of high-speed rail networks development in the U.S. as well as in other countries. I believe that academic journal sources are most impertinent to my research because while there are many anecdotes relative to the experience and the impact of

implementing high-speed rail in a city, research carried out using scientific methods and analysis provide the most concrete evidence to the benefits and impact of high-speed rail network. On the other hand, as research can be expensive and requires time, it was also challenging to find academic journal articles on recent social issues, such as the impact of the COVID-19 Pandemic. For these topics, I searched for news articles from news outlets. Additionally, in order to get information concerning the schedule of the Amtrak Lake Shore Limited train line, I utilized the ticket search function, as well as the route search function on the Amtrak Schedules & Timetables page on the Amtrak website.

Chapter 5: Results

Through literature review of existing research on high-speed rail networks in the world, from Europe to Asia, there is strong evidence which supports the claim that high-speed rail networks do bring positive impacts to regions that have high-speed rail services. It has been observed that high-speed rail network does increase mobility and accessibility to the job market for students, and it allows for people to have more flexibility in maintaining their lifestyle. The research also shows that high-speed rail network does have a positive impact on the economy and tourism industry, as well as a net positive impact on the environment.

On the other hand, building a high-speed rail network also does produce externalities as well. Realistically, it is very possible that building a high-speed rail network would bring about gentrification and rising housing and living costs, as people who are priced out from big cities such as Boston would travel along the high-speed rail line to find more affordable housing. As Huang et al. (2023) have discussed in their research, the positive impact on the environment does not occur equally in all regions, and in less developed regions, the expansion of the high-speed rail network can have an adverse effect as it allows corporations and factories to move in, who

sometimes can be sources of pollutions. For these salient issues, it is important that additional legislation is adopted as preventative measures, as well as providing frameworks for local governments to address any problems that may arise as an externality of the high-speed rail network.

While the research done by Ma and Liu (2022) focused on China's high-speed rail network expansion, I thought that their research could be valuable to Massachusetts because at a glance, without getting into the details of political system differences, China and Massachusetts were similar in that they both have a very wealthy, well-developed eastern region where the economic hubs are located, a growing central region, and an undeveloped western region. It was interesting, and important, to learn how the expansion of the high-speed rail has a smaller impact on the central region of China, as the state of underdevelopment and spatial proximity of the central region to the eastern region caused resources to move east, stunting the economic growth of the central region in return (Ma and Liu, 2022, p. 198). Similar to the other externalities of high-speed rail network, it would be important to ensure the central region of Massachusetts receives supportive economic development and investment.

The research into the high-speed rail projects of the states of California and Texas revealed the common issue that has stalled the progress of both projects: acquiring land to build the rail. However, the East-West Passenger Rail Study has shown that acquiring land would not be an issue for Massachusetts, because there is existing rail infrastructure that would make it possible for the state to build a high-speed rail and incorporate it into existing rail services. The main challenges of building high-speed rail in the state were coordination for federal, state, and local permits, and the project would have a high cost. As both the cases of California and Texas have shown, the

proposed budget was not the final budget, and as the building of the rails drags on, the costs continue to increase.

Chapter 6: Conclusion

Research into high-speed rail network development, especially within the United States, has been an eye-opening experience. Before starting this Capstone project, high-speed rail was a peripheral interest to me. For a long time, I have wondered why the United States lags behind globally in the development of a high-speed rail network despite available federal funding, and this research has shown that due to the unique political structure of the United States, developing new high-speed rail is much more challenging, and much more expensive as well. I did not expect to be able to find detailed research on the feasibility of building high-speed rail within Massachusetts, and it is regrettable that the proposal was ultimately passed on due to costs and forecasted challenges in acquiring permits from all government levels, especially just months before the Biden administration announced increased funding for rail investment. However, I think the most important issue at the table is to increase passenger rail services from east to west, and while high-speed rail development is not on the table for the near future, it is always possible that one day it will be back for consideration.

Between now and then, I would propose for the state and local governments to explore legislations that would address social issues that may be exacerbated by the externalities of high-speed rail development, and these issues are also prominent social issues that all level of governments are trying to address. Housing availability and costs continue to be a major issue after the COVID-19 Pandemic, and local and state governments should explore methods to increase accessible and affordable housing, such as inclusionary zoning and rent control. They should also invest more in green and clean energy, green spaces, and working towards carbon neutral and net-

zero infrastructures. Furthermore, local and state governments should invest more in other modes of public transportation, such as electrifying buses and implementing bus rapid transit systems. As I have said before, just building a high-speed rail network does not mean all these existing issues will automatically be solved. The impact of a high-speed rail will be amplified with other infrastructures in place.

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Appendix

Appendix A: Project Charter

1. Project Overview

1.1 Introduction

This project aims to explore the feasibility of developing a high-speed rail network in the United States, beginning in Massachusetts, where there is already an established and well-funded rail network. The inspiration for the project arose during the COVID-19 Pandemic, after witnessing people's living situations further being exacerbated by the economic crisis that was caused by the pandemic, as well as governmental policies that weakened the societal safety net. There was and is also the looming threat of an environmental crisis caused by climate change. Therefore, the project seeks to analyze whether the development of a high-speed rail network will alleviate some of these issues.

1.2 Major Stakeholders

The primary stakeholder for the research project is me, An Pham, who will be doing most of the research and writing. I am being supported by Clark University faculty members Mary Piecewicz and Robert Spellane, as well as Andrew Haggarty, the Research and Instruction librarian for Clark University.

2. Project Goal and Scope

2.1 Project Goal

The high-level goals of the project are:

- To research the challenges that have been preventing the development of high-speed rail networks to be realized
- To research the potential impact of high-speed rail network on social and environmental issues

2.2 Project Scope

In Scope:

- Research academic and non-academic literatures on high-speed rail networks and their impact on social and economic issues in Europe and Asia
- Research academic and non-academic literatures on the history of the development of railroads in the United States and current social and economic issues in the United States that can potentially be addressed through a high-speed rail network

Out of Scope:

- To develop a step-by-step report of how a high-speed rail network can be built
- To develop a funding plan for a high-speed rail network project

3. Assumptions

- A high-speed rail network will bring net positive impact on social and economic issues in the United States.
- There is high interest in high-speed rail network, and it will have adequate number of passengers if it was built.
- It is possible to build a high-speed rail network in a relatively short time (at least under ten years).

4. Constraints

The literature review of this project is constrained by accessibility, as some articles are restricted by paywall but are unable to be borrowed through Clark University online library. The literature review is also restricted by time, as the MPA program is a two-year program, and I do work full time as well, so I do not have time to read all the sources, especially big sources such as books. Furthermore, I do not have scientific skills nor means to execute a scientific testing on the impact of high-speed rail on the environment. If any numbers were to be cited, it would be through a first or secondary source. I am also not trained in economics, so I will not be able to calculate the costs as well as create a funding plan for this project.

5. Risks

One of the risks of this project is not being able to find adequate number of quality sources that can properly back up the theses that I will be making. This goes hand-in-hand with the constraints of the project, as I do not have time to read all of the available academic sources – some of which is also not accessible unless you have a lot of monetary resources. Furthermore, I am also working full-time and have also been tasked with taking on more responsibilities at work, therefore in order to prevent the risk of not finishing the project on time, I will have to rearrange my schedules and make sure that I am on top of the assignments and research. The research project may also be made redundant if the United States government announced plans for high-speed rail network development in the next couple of months, but the risk that this will happen is relatively low.

6. Measures of Success

Project Outcomes	Measure of Success
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<p>Research and Analysis</p>	<p>Number of sources meet requirements</p> <p>Sources provide trustworthy data, information, and sound analysis of said data and information</p> <p>Sources are applied and analyzed fairly without being intentionally misrepresented to present a different view of the issue(s)</p>
<p>Submission</p>	<p>Project is finished and submitted on time</p> <p>Project meets standard and fulfills all requirements</p>
<p>Stakeholder/Researcher</p>	<p>Primary stakeholder/researcher develops deeper understanding towards high-speed rail network development</p> <p>Primary stakeholder/researcher learns necessary and applicable skills for the workplace</p> <p>Primary stakeholder/research will be able to graduate from the program</p>

Appendix B: Literature Review

Research Topic <DEVELOPING HIGH SPEED RAIL NETWORK FOR THE UNITED STATES>

Define your research topic

More than 20 countries worldwide have built high speed rail infrastructure, where trains can run at the speed of at least 200 miles per hour. The United States, despite being one of the leading developed countries, is lagging behind – our fastest train has a maximum speed of 150 miles per hour but averages around 66 miles per hour. The U.S. Senate has just passed a \$1 trillion infrastructure bill, and \$66 billion will be provided to Amtrak to invest into passenger rail service. High speed rail infrastructure is an important investment for our future with its ability to increase job accessibility and productivity, provide a boost to the economy, and lessening carbon footprint and greenhouse gas emissions from travelers.

Despite continuous efforts to create a high-speed rail infrastructure in the U.S., from the High-Speed Ground Transportation Act of 1965 to funding by the American Recovery and Reinvestment Act of 2009, a high-speed rail network still has not been realized. Multiple factors contribute to this failure: high construction and maintenance costs; and special interest groups such as the automobile and oil industries who successfully lobbied against high-speed rail, enabled by a political system that is greatly influenced by money.

With an impending climate change crisis and rising unemployment rates brought on by COVID-19 Pandemic, as well as rising poverty rates in the suburbs, it is imperative to act, and a high-speed rail network will be a useful tool to combat against these issues. As building and maintenance costs are a major concern for the U.S. legislature and the public, it is important to analyze the cost, funding, and mechanism to build high-speed rail networks by other countries in order to find the best practices so that the U.S. can develop standardized policies and procedures to begin this project.

Questions:

- What are the effects of high-speed trains on...
 - ...the environment?
 - ...the economy?
 - ...the efforts to increase equality and equity for marginalized communities?
- What is the relationship between car culture to the social issue of...
 - ...climate change crisis?
 - ...unemployment and poverty?

- Historically, what were the challenges that prevented the development of a high-speed rail network in the United States?
- What are the costs associated with building a high-speed rail, and how are they funded?
- Is it possible to use the normal railway tracks for high-speed rail, and if not, what would be the best method to build high-speed rail infrastructure?

Introduction to Literature Review

The purpose of the literature review is to look at all the academic research and major works that have been done on the topic. After all the relevant sources have been compiled, it is necessary to draw connections between these sources in order to create building blocks and form the basis for the topic thesis. As relates to my current project, I am looking at all the accessible relevant research papers done on existing high-speed rail networks in the world. However, just looking at this single aspect is not enough, so I'm also planning on and trying to find reliable sources for other topics such as the current status of the climate change crisis, the current situation concerning poverty and equity, etc. In other words, I am also researching sources that will provide the necessary context to make my argument more convincing.

Literature Review Components

Through Google Scholar, I was able to find a lot of works that were published academic journals related to Transportation, Urban Planning, Environmental Studies, etc. I was surprised at the number of academic journals dedicated to the topic of Transportation, as I was expecting to find articles in Science journals or Sociological journals. Clark University also has many databases that serve specific topics; I was recommended the Geobase data by Andrew from Clark Library, which I have also found to be very helpful in finding accessible journal articles, as many of the articles that I found on Google Scholar are hidden behind paywalls. I also found that websites of advocacy organizations can be useful in finding general, compiled data on the topic, such as the Environmental and Energy Study Institute. I am also planning on looking at the work that has been done by the U.S. High Speed Rail Association, and hopefully I'll be able to gather more relevant data.

Types of Published Documentation – Academic and Commercial

The majority of the sources that I have reviewed are academic journals. As mentioned above, I also found that advocacy organizations also do a lot of helpful work, such as creating fact sheets on the current status of high-speed rail networks development in the U.S. as well as in other countries. I believe that academic journal sources are most impertinent to my research because while there are many anecdotes relative to the experience and the impact of implementing high-speed rail in a city, research carried out using scientific methods and analysis provide the most concrete evidence to the benefits and impact of high-speed rail network.

Investigation: Theories, Models and Research Studies

Richard Nunno (2018) from the Environmental and Energy Study Institute created a fact sheet which provides a general picture of the development of high-speed rail network in the world. They also offered explanations as to why the United States has been lagging behind in high-speed rail network development compared to other countries. In another academic paper, Murphy and Allard (2015) theorized that there is a rise in poverty in the suburbs,

A central factor driving the trend in rising suburban poverty is changes in the economic conditions and labor markets of metropolitan areas. Indeed, much of the rise in suburban poverty appears to be explained by downward mobility among longtime suburban residents. Some have fallen below the poverty line because of job loss or a decline in their earnings. Others are aging and finding themselves living on a reduced income (20).

Murphy and Allard (2015) went on to explain that there has been a shift in the migration patterns of high-income and low-income people, with many high-income people moving into the newly invested urban centers of big cities, causing lower-income people to be priced out of the housing market there and leading them to move into the suburbs for affordable housing. With the financial crisis and other economic challenges, people also lost jobs or they're unable to find jobs with living-wages, causing them to sink more and more into poverty. Currie and Sorensen (2019) further expanded on the points made by Murphy and Allard through their research on spatial inequity and environmental justice of urban neighborhoods, in particular the impact of sprawl development of neighborhoods which reenforces segregation by neighborhoods. However, the article also talked about how transportation policies played a role in creating this spatial equity with neighborhoods that are located in areas with major transportation investments having more

community resilience in the times of economic crisis (Currie and Sorensen, 479). On the other hand, Murphy and Allard (2015) also discussed how

Even in those suburban places where service organizations do exist, the lack of adequate public and private transportation options for many low-income households makes it difficult to access programs of support. Indeed, studies have found that physical proximity to social services is critical for their use and that the probability low-income households will make use of social services increases the closer that they are located to service providers (21).

These two studies raised the important point which is the development of a high-speed rail network alone will not adequately address the existing social problems, as long as some of the current structures which disallow low-income people to access opportunities, programs and organizations that would help them to have a better life. This is also something important to keep in mind when conducting studies on potential impact of high-speed rail network, especially in the United States, where transportation policies have not always been in the best interest of the people and served as tools for class segregation and as challenges to people who struggle with poverty.

Marie Delaplace et al. (2014) did a study on the impact of high-speed rail network in on tourism in France and Italy and found that

...the HSR system has affected the choice of Paris and Rome differently. The two cities belong to two different countries in which the history of HSR service is very different; in France TGV is considered a real transport mode alternative while in Italy it is a relatively new system which still needs a campaign of promotion to be well accepted among the users and therefore the tourists (174).

As the United States is a vast country with different areas having different history and transportation policies, I believe it can be said that the United States falls somewhere between France and Italy. On the west coast, especially California, was built with the intent to make it a car-friendly state, and as a result, the sprawl development is very common for its municipalities, along with the problems that resulted in this type of spatial urban planning.

Feliu (2012) analyzed the relationships between local and state stakeholders and the development of high-speed rail network in European countries, as well as the impact of this relationship and development on local economy. An interesting observation was made in this article is that,

... it is difficult to find a city project that goes outside the strict municipal boundaries of the city to a location in the surrounding conurbation. Despite promises of supramunicipal cooperation, the reality is that small municipal areas that border on the main city and that very often share common facilities with it (e.g., industrial estates, residential districts, stations, and development zones) do not participate in the networks of stakeholders (Feliu, 299).

Furthermore, the benefits that high-speed rail brings to the municipality, such as a boost in tourism and economic recovery, often are limited to the area where the high-speed rail is installed, and the municipality's non-urban area as well as surrounding towns and cities do not enjoy these benefits. Feliu (2012) also cautioned against conflict between local and supralocal stakeholders. These conflicts are presented often in two forms: "different territorial interests" and "a lack of dialogue or a desire to impose a solution" (Feliu, 301). If not resolved, these conflicts can either stop the project from happening, or bring about changes which do not produce the most beneficial outcomes for the municipality.

Last but not least, Hernandez and Jimenez (2014) looked at the economic effects of the high-speed rail on local budgets in Spain. The authors noted that, "Specifically, in Spain, HSR lines are mostly financed by the central government, and cofinanced with European funds, while most of the economic effects occur at the regional or local level" (211). As the local government does not shoulder the financial burden of funding the development for high-speed rail and still get to benefits from increased economic activities, this funding policy has a positive effect on the local budgets and "this effect is most noticeable in those municipalities located within a 5 km radius of an HSR station" (Hernandez & Jimenez, 217). Hernandez and Jimenez (2014) also noted that a potential problem with this funding policy would be the tunnel effect.

Conclusions

I think these six articles are not adequate enough to answer all of the questions I have created in order to provide a detailed background and context of the social issues in the United States, which

could potentially be addressed by the development of a high-speed rail network. Furthermore, more background on the development of high-speed rail network also needs to be researched, e.g., how much did it cost, how was it funded, how long did it take to complete, etc. On the other hand, these articles did bring my attention to potential challenges to the efficiency of a high-speed rail network in the United States, and that only building the high-speed rail is not enough to effectively tackle the social issues we currently have. Furthermore, without efficient local public transportation infrastructure and/or urban planning, the benefits of a high-speed rail network will only be enjoyed by the immediate area around the train station. In conclusion, I think this is a good start for the Capstone research, however, there is still a lot more research to do in the future.

Methods for Investigating My Research Topic

At first, I used Google Scholar to find article relating to my research topic. However, I ran into a lot of challenges with paywalls and I switched to using Clark University database. I couldn't find anything relevant when I first used Clark University database, so I emailed Andrew from Clark University Libraries and he found some articles to get me started, as well as recommending Clark University's Geobase and Interlibrary Loan service. I try to limit the published dates of the articles to be around 2015 to present, as I think a lot of older research papers may contain outdated data. If I do come across a relevant older research paper, I typically will look at the papers that have cited it and try to see whether there have been any other recent publications that are also related to my topic. When I read a journal article, I will typically also look at the works that they have cited to see whether there are anything else that are of interest. Aside from the six sources I have cited in this literature review, I do have many more sources I have not been able to get through yet because of the paywalls, so I will be using the Interlibrary Loan to get access to these articles.

Lessons Learned

First of all, in the process of doing the Literature Review, I learned how to organize my sources in a way that makes sense chronologically and thematically. I also learned how to relate my sources to each other and finding common threads to create a coherent picture for the topic. Developing the research topic is necessary, and more importantly, when doing a Literature Review, I should use the research topic as a guide for my research in order to prevent from focusing only one aspect of the topic; this is something I will be keeping in mind as I do more research. Through conducting the Literature Review, I discovered that existing research mainly focused on the economic impact

of high-speed rail network, and I have not been able to find an adequate academic journal article which focuses solely on the carbon emission of high-speed rail (versus other modes of transportation). This is a topic that I hope to do more research on, as it is crucial for the development of the argument as to the pertinence of developing a high-speed rail network in the United States.

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Appendix C: Lessons Learned

MPA 3999 Capstone provides the means for students to learn new skills relative to project management and problem-solving. Through innovative LinkedIn video series, students can learn new approaches and new methods to be a lead for a project, as well as how to evaluate and apply problem-solving techniques to challenges that may arise at work. Students also get the opportunity to apply the theoretical knowledge through creating a project charter for their Capstone research project.

As I have mentioned in the respective reflection journals for the Project Management series, the Problem-Solving Techniques Series, as well as the supplementary video on Collaboration, all the assigned materials in class this semester have been a treasure trove of knowledge. For each assignment, I was able to pick up new knowledge/information, and even new ways of thinking about issues and how to approach problems differently than before. One information that has stuck with me the most was taught through the Problem-Solving Techniques Series, where the instructor had instructed that you should not neglect your intuition, and decisions should be made by a balancing of intuition and logic.

On the other hand, the one information that has stuck with me from the Project Management Series has been the idea that the final steps of project management is to make the employees understand and accept the proposed changes, and ultimately help them to transition to said changes. Even when you are the leader of a project, communications and collaboration are still the important keys to ensure that the project will be successful. The video on Collaboration also emphasizes on having good communications with the people who you are working on the project with, and one of the keys to collaborate with people is to communicate your quirks to them

to eliminate any barriers and challenges arising from misunderstandings so your collaboration work can occur more smoothly.

Creating the project charter for the Capstone project has given me the opportunity to take a more introspective look, not only into the project itself, but also at my strengths and weaknesses, the people who are supporting me as well as the potential impact of my project on other people. As my Capstone project is only a research project that uses mainly secondary sources, I think the project charter's capability was also limited by this, as the main stakeholder for the project is me, and there are many parts of the project charter where I did not have to do because they were not applicable to the Capstone project.

However, I believe that the project charter format will be most helpful in an office setting. The project charter will help you to understand your team and your project more, and it also helps you to create a list of goals for you to strive toward and work to fulfill them. It is also important to identify the constraints and the risks that go with them, as well as the risks that you may encounter while doing the project, then you can also make tentatively plans to address these risks, so if they do happen, you already have a plan to quickly address them. Overall, I believe that creating the project charter allows you and your teammates to essentially creating a list of actions to follow, as well as plans to prevent disruptions from happening so that the team can smoothly finish the project.

Appendix D: Status Reports

Capstone Project Name: Connecting Boston to Worcester and Beyond with High Speed Rail Network

Student Name: An Pham

Date: February 20, 2023

Accomplished to date:

For the first month of the last semester, I have decided to narrow down my Capstone thesis to explore the development of high-speed rail network in the state of Massachusetts. As a result, the first month of the semester has been dedicated to going through the sources that I have found last year and double checking to see if they are still relevant to the project at hand. I have also found more sources that would be relevant to the project. I have mostly finished the outline for the Capstone paper, which have also been helpful in determining which areas need more sources.

Issues/Concerns:

There are no major issues or concerns at the moment.

Plans for next 30 days:

My plan for the next 30 days is to get started on the rough draft, and hopefully finish the rough draft by the end of March. I am planning on dedicating a couple of hours per day to write at least 2 pages for the rough draft, and at this pace, I should have the rough draft ready by the deadline I have set for myself.

Capstone Project Name: Connecting Boston to Worcester and Beyond with High Speed Rail Network

Student Name: An Pham

Date: April 10, 2023

Accomplished to date:

I had been working on the draft for the Capstone. During the drafting process, I came to realize that there were more angles that I have not looked at during my research phase so I also went to search for more sources. Currently, I am working on the final draft for the Capstone project.

Issues/Concerns:

My current concern is the length of the paper in total. I am aiming for around 20-25 pages but not sure if I would be able to reach it.

Plans for next 30 days:

I am currently sticking to my goal of writing one page a day, but understandably there will be fluctuations in capacity due to work and other personal events.

Capstone Project Name: Connecting Eastern and Western Massachusetts with High-Speed Rail

Student Name: An Pham

Date: May 1, 2023

Accomplished to date:

I have finished writing the main body of the text.

Issues/Concerns:

I'm worried about the presentation for this Capstone.

Plans for next 30 days:

Finish the Capstone project.

Finish the presentation slides.

Graduation!