Student Perception of Access to the California High-Speed Rail

Daniel A. Escajeda

ABSTRACT

In this study, I investigated the potential perceived benefits of the California High-Speed Rail, with respect to the utilization by registered students at the University of California, Berkeley. Specifically, I assessed how an infrastructure project of this magnitude and marketed efficiency would impact student travel decisions. Sample data was collected by creating qualitative surveys,, resulting in 179 responses received. The study is divided into three parts: the frequency and reasons students take long-distance trips, the mode of transportations that is used most often to go on these trips, and their preferred modes of transportation for such trips. My central research question was determining probability of student utilization once the High-Speed Rail once is built. I used Python and Microsoft Excel to analyze the results and found that a considerable number of students would use this rail system if available. The potential benefits of using the High-Speed Rail include saving time and money, improved air quality, and reduced greenhouse gas emissions. As the state of California seeks to emerge itself as a leader against the climate crisis, this study seems to underscore how the younger generation takes into consideration their individual actions to assist, if provided alternative options. The study concludes with suggestions for further possible research and suggest that students could actualize several advantages by using the California High-Speed Rail.

KEYWORDS

California, alternative transportation, UC Berkeley, cost-benefit analysis, accessibility

INTRODUCTION

In the past twenty years, gasoline prices in California have nearly tripled. During 2022, citizens of California have seen gas prices skyrocket to above $6 per gallon (EIA 2022). The average in-state tuition cost for public universities has risen 175% since 2003 (US News 2023). Students are paying the most amount of money for their education, then ever before in United States history. According to the UC Berkeley Demographics and Diversity Report, roughly 85% of undergraduate students come from California. More than 25% of undergraduates receive the Pell Grant (those whose families have a low to moderate income). These transportation costs and increases in tuition tend to affect the lower and middle classes more than the upper class, however, all groups are still affected to a certain extent. Balancing goals of economic responsibility and environmentally-conscious decisions can be challenge, when it concerns transportation.

University students make long-distance trips, across California, for multiple reasons. Some reasons include visiting friends and family, going on vacation, traveling for work and/or school, etc. Typical modes of transportation are driving by car, flying, or traveling by commuter bus, however, very few travel by train. To travel about 350 miles in the state of California, the cost of gasoline ranges from $50-$150, depending on the type of vehicle. Flying one way typically costs about $90 but can be as low as $50 or as high as $200. Bus prices are the cheapest averaging about $50 one way. According to a survey conducted by CapitalOne, about 83% of Generation Z respondents said their number one cause of stress is their finances. From the remaining population, about 73% said the same thing. Daily, students are mentally affected by strict deadlines for classes, severe mental health issues, maintaining relationships, etc. The cost and amount of time of necessary (and optional) travel could be alleviated by the High-Speed Rail (HSR) system once construction finishes.

Citizens of California voted on Proposition 1A in 2008, which allocated $10 billion to fund the project and set standards for the HSR system. Standards included: setting the minimum speed to 200 mph, keeping the travel time from San Francisco to Los Angeles under two hours and forty minutes, and making the HSR financially self-sustaining. Riders could enjoy a quick commute across California and potentially finish work and other tasks while riding. The economy too would benefit from completing the construction. 100,000 jobs would have been created during construction (Deakin 2011). Over the course of 25 years, about 450,000 jobs could potentially be

created (Deakin 2011). The air quality through California would improve, foreign oil dependency would decline, and greenhouse gas emissions could reduce significantly (Deakin 2011).

Presently in 2023, there is a lack of knowledge of the possible benefits regarding ridership. When it comes to mass transit projects, it is difficult to predict the future and the effects it will have on the average citizen. Undergraduates make up more than half of the workforce, so it would be beneficial to see how these students are affected by the HSR. These students could be a great assistance, if ever needed, to building and innovating the HSR.

The goal of my research is to analyze the potential effects of utilization by students of the California High-Speed Rail. I will conduct surveys across the University of California - Berkeley campus to gather more information regarding students' opinions. Using Microsoft Excel and the coding program Python, I will compare the models of information that are generated. Some possible topics to study will be the number of long-distance trips (100+ miles) that students make per year, their usual mode of transportation for long-distance trips, and their preferred mode of transportation.

The aim of this thesis is to gather a more comprehensive understanding of the thought process that students make when deciding how to travel across the state of California. My central research question asks if students would utilize the HSR once the construction of the system is finally built. My research I conducted is explained in three subsections that are vital to answering this central question. To start, I investigated how often students go on long-distance trips and where they go. Next, I learned what is the main mode of transportation that students use to go on these trips. Finally, I studied whether giving students the option to travel on the HSR would affect their mode choice. I also explored the reason why they chose their preferred mode of transportation. To find out how students would answer, I created a primarily qualitative survey using Google Forms and distributed it to my peers who study at the University of California, Berkeley. I received a total of 179 responses.

METHODS

The population that I mainly focused on was undergraduate students, since these are the students that I interacted with most. However, graduate students, Post-doctoral scholars, and faculty were also able to respond. I received 8 responses from graduate/PhD students and none

from faculty or post-docs. To answer my research questions, I asked 17 qualitative and quantitative questions. To distribute the survey, I first asked my closest peers to complete the survey and to ask others to take it as well. I created a posting on a social media platform, Instagram, asking those who attend the University of California, Berkeley to complete the survey. Finally, I was able to present my survey in two classes containing 50 to 100 students and asked them to complete the survey. To incentivize the possible respondents, I stated that for every 100 people that answered the survey, they would have the chance to win a $25 Amazon gift card. I entered their emails into a random name picker website to choose the respondent. Over the course of a month, I was able to receive 179 student responses, which would allow me to create viable visualizations to interpret my data.

In the survey, I asked general questions to learn the demographics of these students, such as asking about the income bracket of their families, the year they are currently enrolled in, or their academic focus (major of study). I also asked questions to assist in answering my central research question. Some of the questions include asking the number of long-distance trips students take in California each year, their typical mode of transportation, and their preferred mode of transportation. Students also reported the reasons why they take these trips and the reasons why they chose their preferred mode of transportation.

Long-Distance trips

First, I wanted to investigate the number of long-distance trips students went on each year and where they travel to. To answer these questions, I asked, “How many times per year do you go on long-distance (100+ miles each way) trips within California?” I also asked, “What are your typical reasons for making a long-distance trip?” The options to choose from: Never, occasionally (1-3 times), Sometimes (4-5 times), Often (6-9 times), and Very Often (10+ times). Some people don’t make trips that are more than 100 miles, so if they didn’t, they wouldn’t have to answer the follow-up question. I assumed the number of trips that students would make would vary, but the reasons for the trips would be mainly to see family and friends and to go on vacation.

To create the visualizations needed, I asked a peer, that is a Data Science major, to assist me. We first downloaded the CSV file from Google Forms and uploaded it to Jupyter Notebook, a computing platform accessible on the internet. We used the coding language Python to analyze

this data. We imported the pandas and Seaborn packages for python, which are used for data manipulation and analysis (McKinney 2008). Using Python, we were able to discover how often students, of each income bracket, went on long-distance trips.

To learn about the reasons why these students went on these long-distance trips, I used Microsoft Excel. I used the same CSV file from before to create a bar chart with the count of each choice offered to the respondents. However, I only received 172 responses since some students don't travel more than 100 miles.

Typical mode of transportation

I then investigated the mode of transportation students typically use to travel across California. In my survey, I asked, "When you make a long-distance trip (100+ miles each way) in California, what mode of transportation do you typically use?" Students, who complete long-distance trips), were given the options: Train, Air, Bus, Car (alone), and Car (with others). The number of responses decreased to 170 for an unknown reason. I predicted that many students would travel across the state with other people in a car with other people, however, air travel would be a close second.

To the visualizations that I needed, I used the same method as before. We used Python to create bar charts that would show us the number of students for each mode option. We decided we wanted more information for each group, so we also looked at the income brackets of these students.

Preferred mode of transportation

Finally, I wanted to learn if their mode choice would be different if given the option to travel using the HSR. In the survey, I asked, "If you could choose, what mode of transportation would you prefer to use for your long-distance trips?" Students were given the options: Train, High-Speed Rail, Air, Bus, Car (alone), and Car (with others). This time 172 responses were received. I followed up this question by asking, "Why do you prefer this mode of transportation?" Participants were given multiple options to choose from including, that their option would save

time and money, it is easier to use, they could share the cost of travel with other people, it would use less energy, and a few other options. I received 171 responses for this question. I predicted that there would be roughly the same number of students who would travel on the HSR and by air. I also predicted the main reasons people would choose their preferred mode of transportation because it would save them time and money and it would be more convenient for them.

Again, we created visualizations using the same methods as before. To find the number of students of each mode option, we created bar charts in Jupyter Notebook. We compared their preferred mode of transportation to their income level to give us more information. To understand why students choose their mode of transportation, I used Microsoft Excel to create a bar chart containing the counts of each option.

RESULTS

Long-Distance trips

Out of the 179 respondents, 34.1% stated that they complete 1-3 long-distance trips in California every year, 25.1% said they go 4-5 times, 21.2% answered they take 6-9, 14.5% said they go 10 or more times, and 5% never go on long-distance trips. When looking at all the income brackets, these results are comparable across most of the groups. In almost every income group, students who go on long-distance trips lead above the other options except of the $0 - $40,000 range, where more students in that group go on 4-5 trips per year.

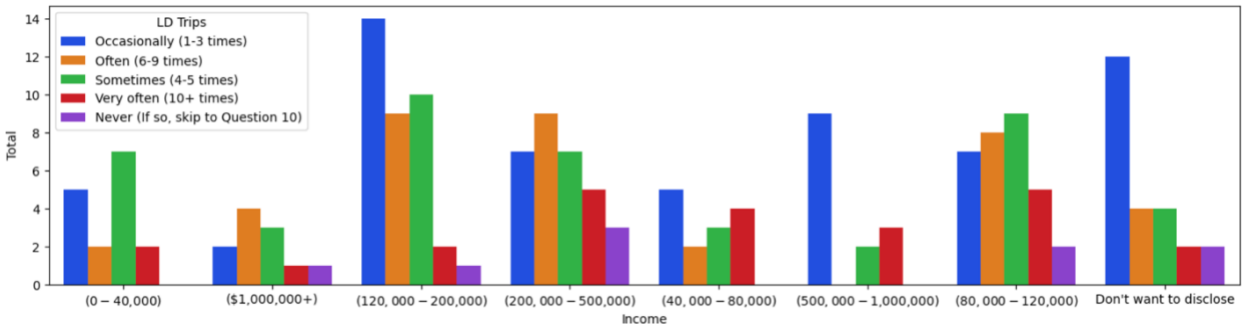

Figure 1. Number of long-distance trips compared to respondents' income bracket. Provided by Bryce Szarzynski using Python.

When looking at the responses for why these students go on long-distance trips, many students go on long-distance trips to go on vacation or for recreational purposes (72.1%) as well as to visit family and friends (66.3%). However, a large majority also take these trips to return to UC Berkeley (54.7%) or to return home (51.2%). Still, about ⅕ (19.8%) of students go on long-distance trips for their student organizations, 6.4% go for academic activities, 3.5% travel for work, and 1.2% travel for other reasons such as to visit their doctors.

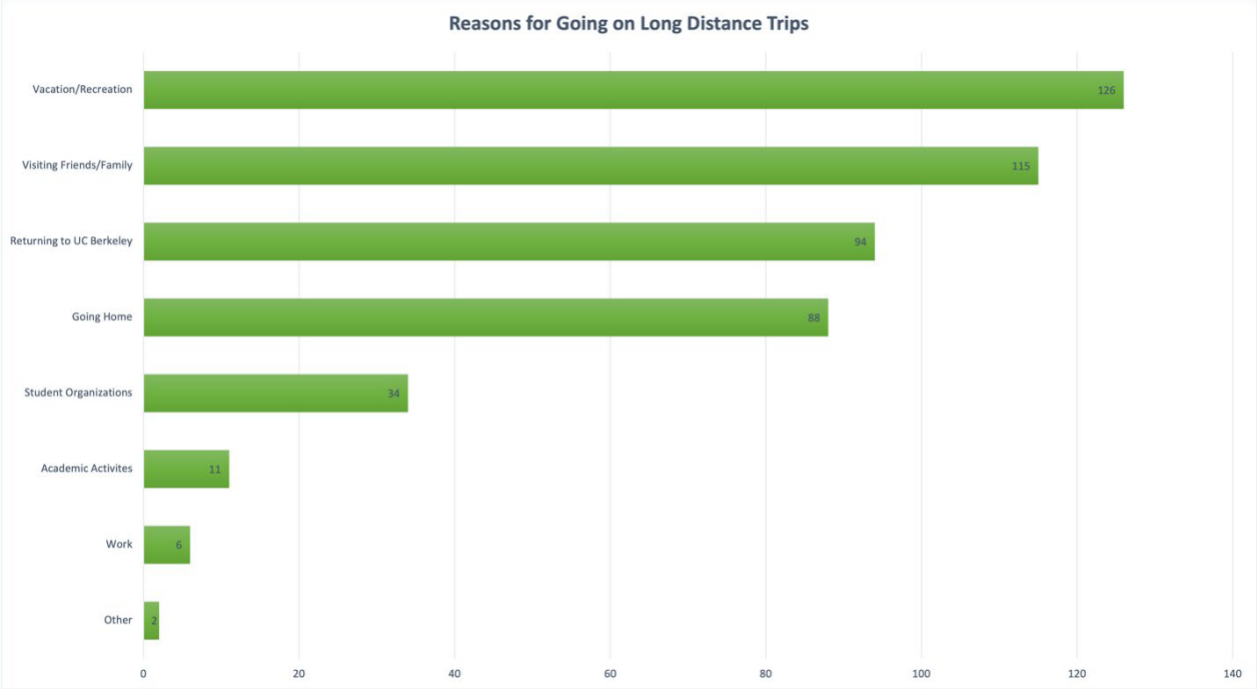

Figure 2. Respondents' reasons for going on Long-Distance Trips.

Typical mode of transportation

Next, when asking students what their typical mode of transportation is when going on these long-distance trips, many students answered that they travel by car with others (47.1%) and followed by air travel (34.1%). 15.9% answered that they traveled in a car alone, 2.4% said they travel by train, and 0.6% travel by bus. Figure 3 shows that the lower classes ($0 - $40,000) tend to travel by air more than the upper class ($200,000+), while the middle class ($80,000 - $200,000) and about evenly split between these two modes.

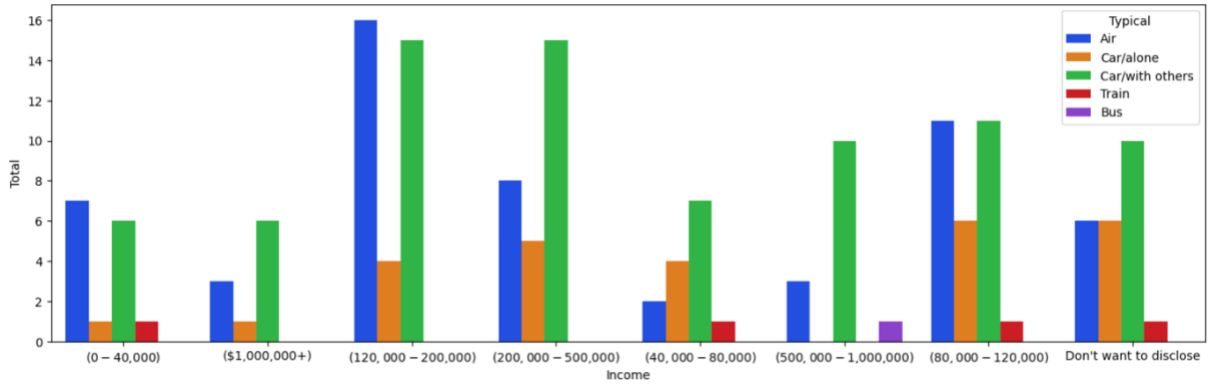

Figure 3. Respondents' typical modes of transportation compared to their income bracket. Provided by Bryce Szarzynski using Python.

Preferred mode of transportation

Finally, when students were given the option to travel by on the HSR, almost half (49.4%) of the respondents said they would prefer to travel on the HSR. Air travel followed with 23.3%, 18.6% would prefer to travel by car with others, 5.2% said they would prefer to travel by car by themselves, and 3.6% would prefer to travel by train. None of the respondents said they would prefer to travel by bus. In Figure 4, the HSR led in every income group with travel by air being the next best choice in almost every income bracket.

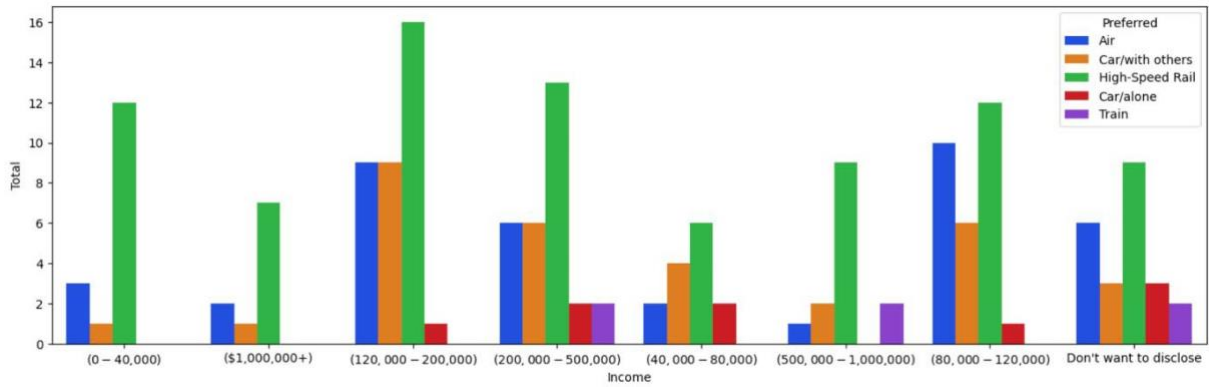

Figure 4. Respondents' preferred modes of transportation compared to their income bracket. Provided by Bryce Szarzynski using Python.

Figure 5 illustrates the factors that influenced the choices among surveyed students regarding preferred mode of transportation. The results show that many people said they chose

their mode because it saves time (62.6%) or because it's easy to use (60.2%). Comfortability was the third most important reason for 47.4% of respondents. Saving money was also a significant consideration with 46.8% choosing this reason. About a third of respondents said they prefer their mode because it is less tiring (36.8%), they can bring more luggage with them (33.3%), or they have more time to be productive (32.2%). Respondents chose other reasons such as more leg room or they prefer the scenery, however, they received significantly less votes compared to the other reasons listed.

Figure 5. Respondents' reasons for choosing their preferred modes of transportation.

DISCUSSION

From this study, I was able to discover that many students travel across the state of California every year for a variety of reasons. To add on, more than ¾ of students travel either by car with other people or by air travel. However, when asking them if their mode of transportation would change if all modes of transportation were available, including the HSR, almost half of the respondents answered that they would travel using the HSR. Respondents preferred different modes of transportation than their typical mode of transportation for many different reasons, but saving time and ease of use were the top choices. Overall, I believe that it is reasonable to state

that the HSR would greatly benefit students in California, since many students would use the HSR system over other modes of transportation.

Long-Distance trips

When looking at the data, I can say that I was right about my assumptions that the number of times that students go on long-distance trips will vary. However, it was surprising to learn that students don't go on more long-distance trips per year. When taking into consideration that many students travel for vacation or recreational purposes, go home for holidays and to visit friends and family, and must return to UC Berkeley, I would assume that many students would take at least 4-5 long-distance trips per year in California, if not 6-9 trips. Only about 40% of students travel these many times though. When taken into consideration that in 2022, 64% of students admitted to UC Berkeley, I would expect this number to be higher.

As I expected, the main reasons for students taking long-distance trips in California was for vacation or recreation and visiting friends and family was the second most chosen reason. Unsurprisingly, the third and fourth most chosen reasons for traveling in California were to return to UC Berkeley and to go home. I did find it interesting that 1.2% of students completed a long-distance trip to have access to their healthcare, as 100+ miles is a far distance to visit one's doctor.

Typical mode of transportation

Again, my prediction for students' typical mode of transportation was correct as almost half of students (47.1%) travel by car with other people when going on long distance trips and about a third (34.1%) travel by plane. 15.9% of respondents said they typically travel in a car by themselves. To gather more information about my respondents, I also asked the question, "Do you have access to a car?" I specified that this meant if students owned a car rather than using a company like ZipCar, a rental car company. When I asked this, 64.8% of respondents answered that they have access to a car. I compared the responses of this question to students' typical mode of transportation; it makes sense that 63% of students typically travel by car for a long-distance trip. Furthermore, plane tickets to travel within the state of California are very reasonable, typically

ranging from $50 to $150 one way. Not every student can afford to pay $100 to $300 to travel in California, so it is understandable that air travel is the second most chosen mode of transportation.

Preferred mode of transportation

Surprisingly, my prediction regarding students' preferred mode of transportation was incorrect. I predicted that students would prefer to travel using the HSR as much as air travel, however, I was pleasantly surprised to discover that students would prefer to use the HSR more than air travel. About half (49.4%) of students answered that they would prefer to travel on the HSR and only 23.3% would prefer air travel as well as 18.6% of students answering that would prefer to travel in a car with others. It is shocking to see that so many students say that they have an interest in using the HSR even though construction hasn't finished. The ticket prices for the HSR have not been estimated yet, which will play a significant role in determining if a person will use the mode of transportation.

When looking at the reasons why people choose their preferred mode of transportation, the main two reasons were that their mode would save them time and it would be easy to use. I predicted that saving time and the mode being convenient to use would be the main reasons why people would prefer one mode over another, however, I also assumed that the amount of money to use the mode would be very important when choosing their preferred mode. Saving money was the fourth most important factor after the mode being comfortable. It's interesting to see that students value time and comfortability over their money when choosing the mode of transportation that they would use to travel in California.

Limitations and future directions

After looking over my data that I collected, I realized that I have four issues with how I conducted my research. The first issue was how I presented my thesis topic to students when I went to classrooms. During my topic presentation, I would tell students that I was researching if students would utilize the HSR if given the opportunity once construction is finished. By doing this, the students who responded to my survey mostly likely had a bias opinion about their preferred mode of transportation causing the HSR to be favored. This may be the reason why

nearly half of the respondents would prefer to use the HSR compared to the other modes. My second issue is that I didn't ask the reasons why students choose their typical mode of transportation. I asked this for the preferred modes of transportation, and it would have been useful to learn more about the respondents. My third issue was asking the reason why people choose their preferred mode of transportation for every mode. Instead, I should have limited to people who answered they would prefer to use the HSR and asked, "If you chose the HSR, why do you prefer this mode of transportation?" This would have helped me to learn why people would choose the HSR over other modes of transportation. Finally, as a student studying environmental science, I have limited skills in the data science field. When my peer, Bryce Szarzynski, and I were creating the visualizations needed, we found it difficult to reformat the labels for the x-axis. As seen in the figures, the income brackets are not in numerical order, and we could not figure out how to fix this issue.

This study was limited to the students who attend the University of California, Berkeley. The closest proposed station to UC Berkeley for the California High-Speed Rail would be roughly 13 miles away, according to the High-Speed Rail Authority. This study has shown that students would use the HSR as a main mode of transportation to travel in California. I believe it would be interesting to research other students from schools near proposed HSR stations. If half of the students who responded would prefer to use the HSR over other modes, would this number be different for UCLA, Fresno State University, San Jose State University?

Conclusion

In conclusion, my research suggests that students would travel using the High-Speed Rail once construction is completed. Regardless of the number of trips that a student makes in California every year, they have expressed interest in the HSR as a viable mode of transportation. Students account for many factors when deciding how to travel throughout the state, with them valuing their time and accessibility the most. Typically, most students travel in a car with other people or by air for their long-distance trips, but if they had the chance, many would prefer to use the HSR. It is reasonable to conclude that the HSR would greatly benefit students in California as this mode would hopefully alleviate some stress that students deal with constantly.

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