

Date: April 11, 2024

To: City of Bloomington, Minnesota & Bloomington Public Schools

CC: Ariel Weygandt

From: Jack Teske

Subject: Analytical Report on Bike Infrastructure around Jefferson High

I have attached a report on the absence of bike infrastructure around Thomas Jefferson High School. I used academic literature, case examples, an interview, satellite imagery, and internet articles to suggest why Jefferson High School would benefit from having bike lanes around it. The report covers the health, environmental, and safety benefits biking and bike infrastructure bring to students. I also examine how far students would be willing to commute and bike through adverse weather. Lastly, I explore the costs associated with building bike infrastructure.

I also use my experience as a 2022 Jefferson High School alumni to discuss my findings and apply them to Jefferson's situation. I used satellite imagery to put the commute ranges into perspective. Additionally, I discuss how the other benefits, such as health, environmental, and economic benefits, would positively affect Jefferson's student base.

If you seriously consider my findings, I hope you will find and agree that biking advocacy will bring the school district many benefits. Students will be healthier and safer, and help the environment surrounding them.

Thank you for reading my report, and I hope to hear back from you. I can be reached via my email at teske134@umn.edu. If you run into any questions, email me and I would be more than happy to clarify with additional information.

Bike Infrastructure Implementation For Thomas Jefferson High School



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Abstract

This report examines the benefits, viability, and need of bike lanes around Thomas Jefferson High School in Bloomington, Minnesota. It examines pre-existing literature to analyze biking and bike infrastructure's health, environmental, and safety benefits. Next, it addresses the plausibility of bike commuting for students living around the school, and finds that students can commute and that unmet demand exists. It also addresses the concern about biking during the winter and shows it is possible. It then briefly examines the costs of building bike infrastructure by using government and academic data sources. Lastly, the report relates all the benefits to the student body, finding many good reasons why they would benefit from bike lanes such as improved health, actively fighting climate change, and opening avenues for future bike lane developments. The health and community benefits are powerful, and the city should look into adding bike lanes around the school.

1 - Introduction

This report examines the viability of biking around Thomas Jefferson High School in Bloomington. Currently, no bike paths directly connect with the school. The lack of bike lanes is concerning as it emits an extremely viable method of healthy transportation.

Reviewing studies on the subject has shown that biking helps students exercise, improve their mental states (leading to improved school performance), and reduce greenhouse gas (GHG) emissions. All these benefits are explained in the results section, where varied sources examine the benefits and concerns with biking and bike infrastructure. Additionally, a satellite survey reveals that thousands of houses currently sit in a one- to three-mile radius surrounding the school. Students in this zone must take buses or cars to school, despite the short distance. If they choose to bike, they must compete with pedestrians on narrow sidewalks or bike amongst car traffic on shoulderless roads. Neither option is ideal, with both potentially leading to injuries, and the latter being potentially deadly. Creating bike infrastructure, like dedicated paths, would make biking to school viable and safe for students.

2 - Methodology

The research method heavily relied upon pre-existing literature. However, the sources have many different origins. Academic sources established how researchers have examined the problems uniquely. Some of these studies include collecting data and analyzing the results (examine Garber et al., 2023 for example). Digital sources were also used, like the Not Just Bikes YouTube channel, to source information with high viewership and scrutiny. To relate the problem closer to Jefferson students, I also conducted an interview with a Jefferson alumnus who lives close to the school. Lastly, using all the above, the on-the-ground situation was examined by using satellite imagery of the affected area. All these sources help paint the background of an addressed topic and back up hypotheses with sourced facts and data. My personal experience of being a Thomas Jefferson High School student also allows the infill of information where needed.

3 - Results

3.1 - Benefits of Biking/Bike Infrastructure

3.11 - Health benefits

Studies have found that active forms of commuting help students reach physical fitness quotas (Lindqvist et al., 2019, p. 1). Out of the active forms of commuting analyzed by studies (walking and cycling), cycling directly correlated to cardiovascular fitness, while walking did not (Larouche et al., 2014, p. 206). The difference between the two methods is due to the higher speeds and intense physical exertion of biking over walking. Cardiovascular fitness increases heart health and general well-being. On top of the physical benefits biking brings, the U.S. Centers for Disease Control and Prevention (2022) explains that students who are more “physically active tend to have better grades, school attendance, cognitive performance (e.g., memory), and classroom behaviors.”

3.12 - Environmental benefits

Bikes do not use gas, so they do not emit GHG into the atmosphere when used (University of California, Los Angeles, 2021). Additionally, cars use other fluids that contribute to pollution, such as antifreeze, brake fluid, and oil. Another commonly forgotten type of pollution is noise pollution. According to the European Environmental Agency, noise pollution can lead to “annoyance, stress reactions, sleep disturbance, poor mental health and wellbeing, impaired cognitive function in children, and negative effects on the cardiovascular and metabolic system.” Cars can produce noise in a few obvious ways, including horns, screeching brakes, and alarms. But, in addition to these causes, most sound pollution is caused “by tires and engines running continually at high speeds” (Harnapp & Noble, 1987, p. 221). Since all cars currently need tires, and most also need engines, there is no practical way to reduce the noise emitted from them other than reducing overall car use.

3.13 - Safety benefits

Diverse types of biking infrastructure exist, but two prominent ones are painted bike lanes and dedicated bike lanes. Painted bike lanes merely use paint to distinguish bike lanes from car lanes. These painted lanes are integrated into roads like car lanes, while permanent barriers separate bicyclists from road traffic in dedicated lanes. Types of barriers in dedicated lanes could include curbs, bullions, or walls. Painted lanes have been found to increase bike-car collision rates over unpainted roads, while dedicated lanes lower bike-car accidents (Garber et al., 2023, p. 1). The reasons for the increased incidence rates are unknown by the study, but the

researchers propose that it may be due to the painted bike lanes giving cyclists a false sense of confidence. The fact that 961 cyclists died by motor vehicle collision in 2021 alone (Insurance Institute for Highway Safety, 2023) illustrates the dangers of poorly implemented bike infrastructure.

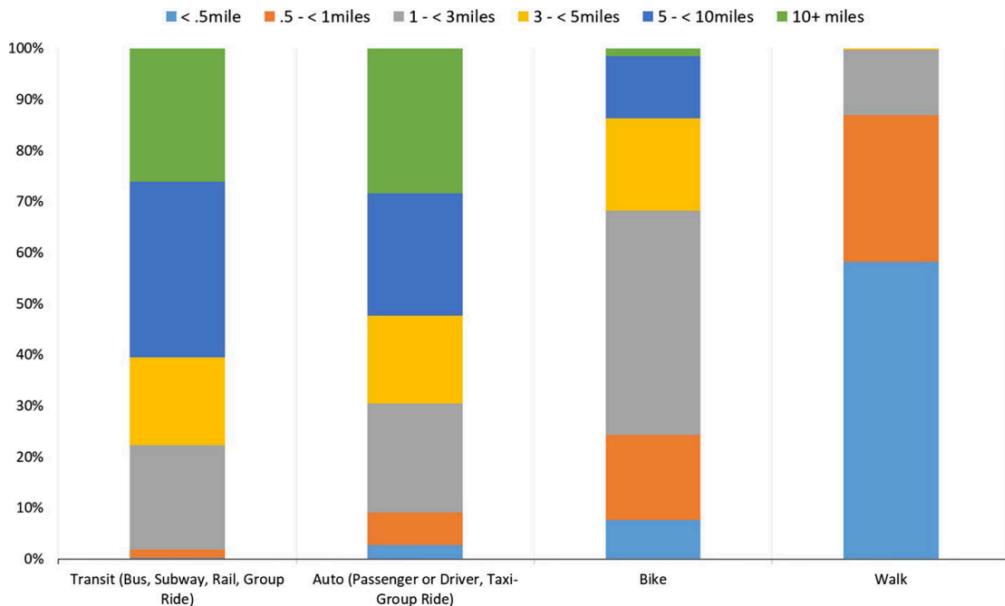
3.2 - Plausibility of Bike Commutes

3.22 - Bike Commute Distances

Figure 1 shows the distances traveled by different modes of transportation. The data for Figure 1 comes from New York City's Department of Transportation (Aziz et al., 2017, p. 1215). Since the data originates from New York City, we can acknowledge that transport behaviors will vary from Bloomington, MN. For example, cars would likely take longer in the New York cityscape, while Bloomington cars could travel farther quickly due to less road congestion. However, transportation like bikes and walking are more intrinsically bound transport methods. No matter where you live, not many people would be willing to walk ten miles for a commute. So, it is fair to take the data from this bar chart (especially for cycling) and apply the distances to Thomas Jefferson High School. Figure 1 shows us that the largest segment of cyclists uses their bikes to travel between one and three miles, with another chunk on either end (one-half to one mile or three to five miles). We can also note that most walks are under a mile, with most being under half a mile.

Figure 1

Distance Traveled by Each Mode of Transportation (In New York City)



3.22 - Interview With Former Student

An interview with former Jefferson student Gabriel Fox gives insight into the current situation around the school (see the appendix for the full interview). Gabe lives approximately one mile away from the school, but never biked to school. He explains that no dedicated bike paths around his neighborhood existed for him to get to Jefferson. Instead, he says he relied on car transport from his parents (later driving himself when aged 16) and walking. When asked if he would have biked if paths existed, he said he would. He also mentioned one of the main obstacles that prevented him from biking was that the school needed more places to store his bike. Lastly, when asked about winter cycling, he seemed skeptical and complained of the cold. However, he noted that he had walked to school during the winter.

3.23 - Winter Viability for Bike Commuting

The viability of winter biking can be confirmed by observing northern European cities. Bikers in cities like Copenhagen, Oulu, and Lund bike during the winter (Jaffe, 2016). Research has found that cold does not affect the amount of winter cycling (Slaughter, 2021). Instead, the conditions of bike paths and the safety of the paths affect winter biking rates more than the temperature. Help to understand the former could be to realize that bike paths can also be cleared of snow, just like roadways in America are cleared by snowplows. Again, the latter can be explained for nearly the same reasons as in Section 1.3. If people do not feel safe biking during the warmer months, of course, they will not feel safe biking during winter. Safety aside, another misconception non-bikers have about biking during winter is that bikers will be freezing

throughout their rides. But when bikers wear any appropriate gear, Slaughter noted that they heat up rather quickly, with many people being surprised at how hot they become.

3 - Implementation of Bike Infrastructure

3.23 - Bike Infrastructure Cost

Finding the exact budgets for bike and road infrastructure is difficult to determine without survey work. Things like terrain, property rights, labor, materials, current traffic impacts, and workforce availability affect prices. However, the price differences between road and bike paths would remain consistent, no matter where they are built. The U.S. Department of Transportation states that “the cost of installing a bike lane is approximately \$5,000 to \$50,000 per mile, depending on the condition of the pavement, the extent of removing and repainting of lane lines, the need to adjust signalization, and other factors” (n.d.). The price involved with building bike lanes is high, but when prices are compared to road development, the prices no longer seem as massive. For instance, a four-lane road, like 102nd Street and France Avenue, costs an estimated four to six million dollars per mile (Elswick, 2016). Another cost benefit of bike lanes is that maintenance costs are much lower. Based on data from the Portland Bureau of Transportation, bike lanes can recoup more than triple their cost by reducing the amount of maintenance needed when compared to roadways (Anderson, 2014). And, as noted in Section 1.1, health benefits gained by cyclists also reduce the healthcare load of the city, saving money and extending lives.

4 - Discussion

4.1 - Benefits of Biking and Bike Infrastructure Applied

4.11 - Health Benefits for Students

The research answers the question of what the health benefits of cycling are. The sources show that physical health is important for everybody, especially teenagers. Instilling physical activity as a daily normal allows students to carry the same normal throughout the rest of their adult lives. Currently, Thomas Jefferson High School does not require a physical education class after most students' Sophomore year. The lack of a four-year physical education requirement means that when some students finish their two years, they do not continue with any exercise. Creating bike lanes for students to commute on would be an effortless way for many students to keep up physical activity without sacrificing time they would otherwise spend doing something

else. With as little exercise as cycling, students would benefit from better classroom performance, causing improved test scores.

4.12 - Environmental Benefits for Students

Since American cars emit around 1.5 billion tons of GHG annually and create excessive noise pollution, we must find alternatives for transportation (Department of Transportation, n.d.). Research shows that bikes, where feasible, are a desirable alternative to cars because they do not emit GHGs and do not create nearly as much noise as cars. Bloomington Public Schools have recognized the urgency of climate change and have embarked on projects to combat and raise awareness of the problem. It is common knowledge that cars contribute to climate change. Creating bike infrastructure would allow the district to show to their students that they genuinely care about the issue, while giving students the means to fight against the problem. Adding bike lanes would also reduce the noise pollution around the school, allowing students a quiet environment to concentrate on academics.

4.13 - Importance of Safety Around Jefferson Area

Bike safety is a common concern for people to have with biking. The goal was to find out how to make cycling as safe as possible. It was also necessary to establish how dangerous cycling can be when cities implement poor infrastructure. The research showed that the main deadly danger when biking is automobile conflict. Currently, Bloomington has bike paths that put users in direct conflict with vehicles (example shown in Figure 2). Keeping the community safe is undoubtedly the foremost concern when implementing any infrastructure. To keep students and other users safe, barricaded or raised bike paths would be essential, as would avoiding painted bike lanes, like Figure 2, is necessary. Added safety would make students more likely to bike, as they would not fear for their lives when they biked to school.

Figure 2

Example of Poor Bicycle Lane Implementation in Bloomington

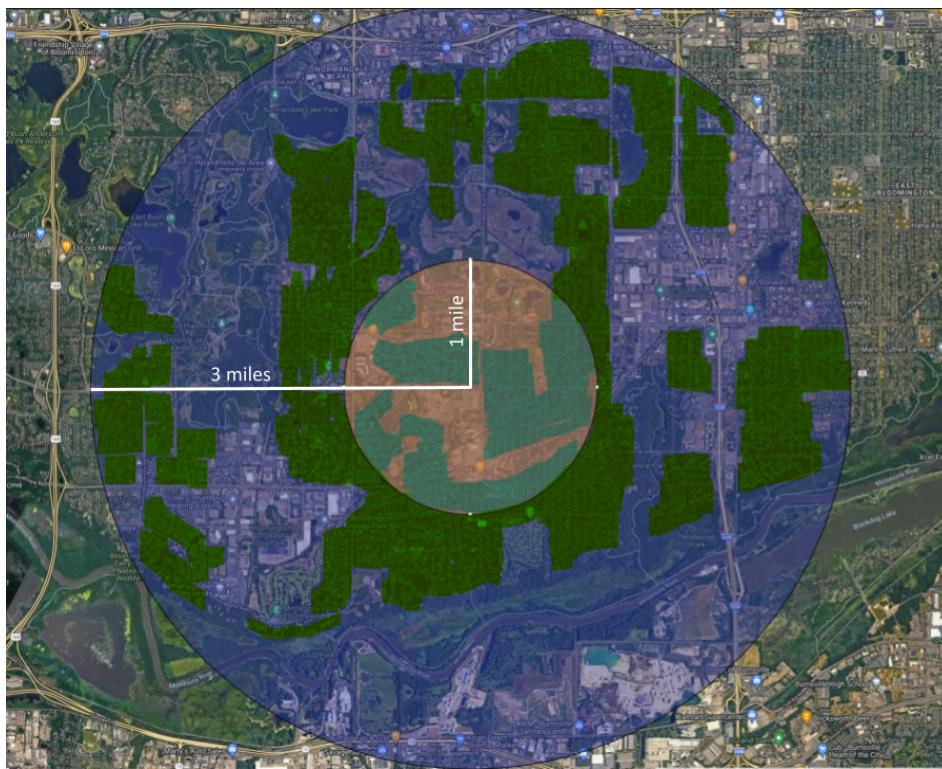


4.2 - Current Situation and Potential Around Jefferson

4.2.1 Service Area Around the School

Figure 3

Distance Ranges, with Housing Highlighted Green and Blue

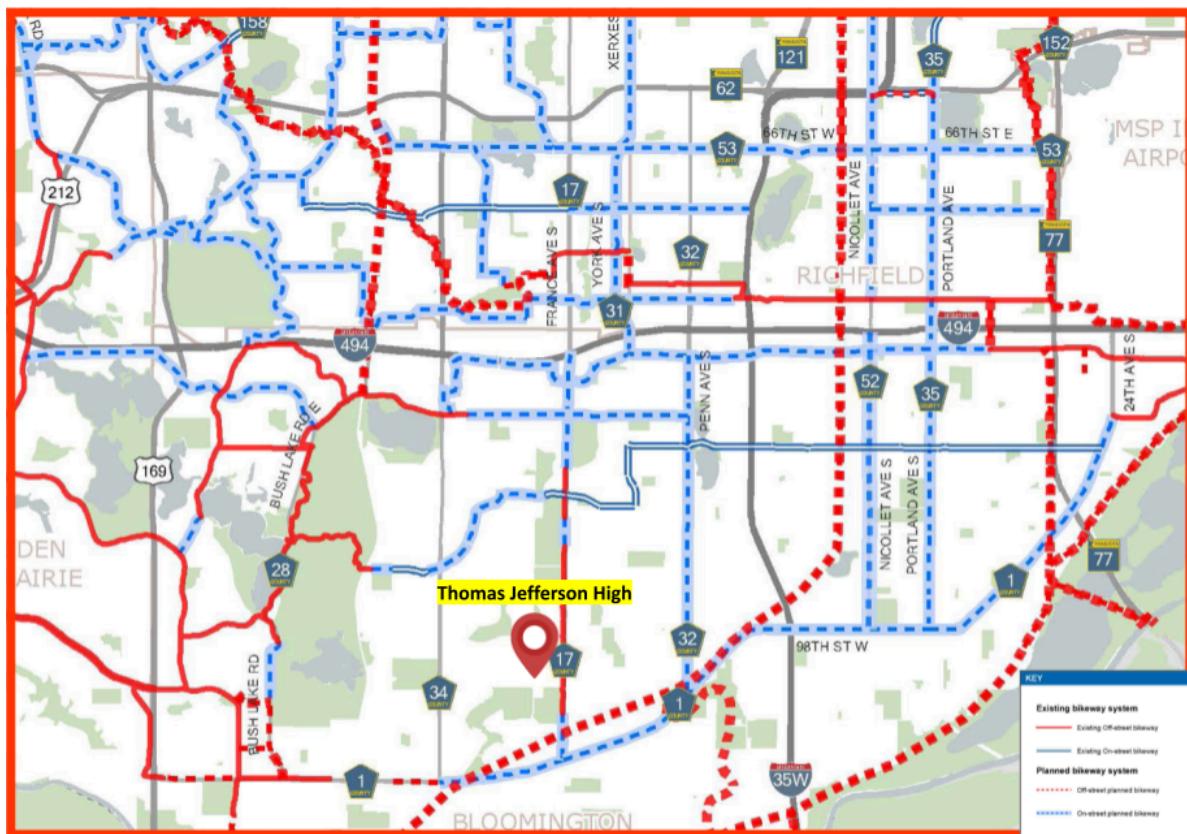


Using the data from Figure 1 allows us to map a range around Jefferson High School. A map permits us to see if suitable demand for biking exists. Figure 3 displays the average bike commute ranges from Figure 1, superimposed upon the area around the school. The small orange circle has a radius of one mile, while the large blue circle shows a three-mile radius.

Coloring in both circles illustrates the amount of housing surrounding Jefferson High School. All highlighted houses are potential service zones for bike lanes. Some bike lanes already exist around these houses, but they do not lead to the school. Looking at the City of Bloomington's Alternative Transportation Plan website shows a map (Figure 4), with all the currently existing bike infrastructure (City of Bloomington). It also displays any planned bike routes with dashed lines. The map illustrates that Jefferson High School exists in an isolated zone, with only one path serving only the northern and southern areas. The supply for bikers around the school exists, but currently, there are no paths to connect these houses to Jefferson High School. The absence of bike paths makes commuting to school via bicycle nearly impossible for students, and subsequently reduces accessibility.

Figure 4

Map of Existing Bike Paths



4.22 - Winter Cycling in Minnesota and Interview Analysis

Determining whether winter cycling would be possible for students was crucial, as a substantial portion of Bloomington's school year is snowy. As the interview with Gabe showed, students are also unaccustomed to biking during winter. However, the findings showed that cycling during the winter is possible. With the correct infrastructure and management during the winter,

students can bike. Bloomington already has a robust snowplow unit that maintains the streets through snowstorms. Any implemented bike lanes would require similar treatment, and as other similar-latitude cities have shown, people may cycle throughout the winter. Another concern people have with winter is the cold, so examining how cold temperatures impact biking was necessary. Since students already walk to school throughout the winter, biking may also be possible. Wearing the proper winter gear is the key to comfortable winter cycling.

4.3 - Costs of Infrastructure

4.31 - Bike Infrastructure Cost and Benefits for Bloomington

In 2024 alone, Bloomington plans to spend over 18 million dollars on pavement management, with one million dollars of the budget focused on walking and biking trails (Government Finance Officers Association, 2023, p. 140). Regarding the cost of maintaining the roads, implementing new bike routes would still require only a fraction of the pavement management budget. Additionally, if the city implemented useful and proper bike paths, the streets could be used less, as people would switch to bikes for a separate set of benefits they do not get from cars. Less road use means slower degradation of road surfaces and less money spent repairing them.

5 - Conclusion

My research has shown that implementing bike lanes for students to school does have tangible benefits. Some of these benefits include, but are not limited to:

- Increasing cardiovascular health
- Increasing psychological health and school performance
- Reducing GHG emissions
- Reducing noise pollution
- Being cheaper than driving
- Offering safety from motor vehicles
- Being available year-round

Considering these findings, it is recommended to implement bike lanes to serve Jefferson High School students. However, another report or survey would need to be conducted to find the ideal methods and specific costs associated with constructing bike lanes in the relevant area. But what is clear is that bike lanes must be implemented safely to avoid deadly encounters between cyclists and automobiles. The research has shown that protected bike lanes are the best way to achieve biker safety.

Overall, students are the ones to gain the most from adopting bike infrastructure, but they are not the only ones who would use bike lanes. Much of Bloomington is starved for bike infrastructure, so building new lanes would inevitably see use by community members other than students. If this project is successful, it could pave the way for more bike-related plans in the future. Other schools in the city could be served, connecting communities. Kids could also visit their friends across town, and families could use bikes to travel to the grocery store. All of this is to say that just because the project starts with Jefferson, does not mean it ends there.

References

- Anderson, M. (2014, November 19). *Study: Dollar for dollar, bike infrastructure pays off better than road maintenance*. BikePortland. Retrieved April 11, 2024, from <https://bikeportland.org/2014/11/19/study-dollar-dollar-bike-infrastructure-pays-better-road-maintenance-113616#comments>
- Aziz, H.M. A., Nagle, N. N., Morton, A. M., Hilliard, M. R., White, D. A., & Stewart, R. N. (2017, February 6). Exploring the impact of walk–bike infrastructure, safety perception, and built-environment on active transportation mode choice: a random parameter model using New York City commuter data. *Transportation (Dordrecht)*, 45(5), 1207-1229. Springer Link. <https://doi.org/10.1007/s11116-017-9760-8>
- Centers for Disease Control and Prevention. (2022, July 26). *Physical Activity Facts / Healthy Schools / CDC*. CDC Healthy Schools. Retrieved April 11, 2024, from <https://www.cdc.gov/healthyschools/physicalactivity/facts.htm>
- Department of Transportation. (n.d.). *Adding Bicycle Lanes*. Road Design. Retrieved April 11, 2024, from <https://safety.fhwa.dot.gov/saferjourney1/library/countermeasures/10.htm>
- Elswick, F. (2016, January 5). *How Much Does It Cost to Build a Mile of Road? - Midwest Industrial Supply*. Midwest. Retrieved April 11, 2024, from <https://blog.midwestind.com/cost-of-building-road/>
- Garber, M. D., Watkins, K. E., Flanders, W. D., Kramer, M. R., Lobelo, R.L. F., Mooney, S. J., Ederer, D. J., & McCullough,: E. (2023, August 11). Bicycle infrastructure and the incidence rate of crashes with cars: A case-control study with Strava data in Atlanta. *Journal of Transport & Health*, 32, 1. ScienceDirect. <https://doi.org/10.1016/j.jth.2023.101669>
- Government Finance Officers Association. (2023, January 1). *Annual Budget 2024*.
- Harnapp, V. R., & Noble, A. G. (1987). Noise Pollution. *GeoJournal*, 14(2), 217-216. SpringerLink. <https://doi.org/10.1007/BF00435812>

- Insurance Institute for Highway Safety. (2023, May). *Bicyclists*. Fatality Facts 2021 Bicyclists. Retrieved April 11, 2024, from
<https://www.iihs.org/topics/fatality-statistics/detail/bicyclists>
- Jaffe, E. (2016, January 26). *How to Keep Cyclists Riding Even in the Snowy Winter*. Bloomberg. Retrieved April 11, 2024, from
<https://www.bloomberg.com/news/articles/2016-01-26/how-to-keep-cyclists-riding-even-in-the-snowy-winter>
- Larouche, R., Saunders, T. J., John Faulkner, G. E., Colley, R., & Tremblay, M. (2014). Associations Between Active School Transport and Physical Activity, Body Composition, and Cardiovascular Fitness: A Systematic Review of 68 Studies. *Journal of Physical Activity & Health*, 11(1), 206–227. <https://doi.org/10.1123/jpah.2011-0345>
- Lindqvist, A.-K., Löf, M., Ek, A., & Rutberg, S. (2019). Active School Transportation in Winter Conditions: Biking Together is Warmer. *International Journal of Environmental Research and Public Health*, 16(2), 234-. <https://doi.org/10.3390/ijerph16020234>
- Slaughter, J. (Director). (2021). *Why Canadians Can't Bike in the Winter (but Finnish people can)* [Film]. YouTube. <https://youtu.be/Uhx-26GfCBU>
- University of California, Los Angeles. (2021, May 13). *How Riding a Bike Benefits the Environment*. UCLA Transportation. Retrieved April 11, 2024, from
<https://transportation.ucla.edu/blog/how-riding-bike-benefits-environment>
- U.S. Department of Energy. (n.d.). *Reduce Climate Change*. Fuel Economy. Retrieved April 11, 2024, from <https://www.fueleconomy.gov/feg/climate.shtml>

Appendix

Interview

Note: this interview was conducted through a Google Form.

Q: *What is your name and did you go to Jefferson?*

A: My name is Gabriel Fox and I graduated from Jefferson in 2022.

Q: *How far away from Jefferson High School do you live?*

A: I live about a mile or so away from it.

Q: *Do any bike paths near you connect to Jefferson?*

A: No bike paths have been made around my neighborhood. There are only sidewalks and residential streets.

Q: *How did you get to school usually?*

A: I mostly drove after I got my license, but before I got my license my parents drove me to school or I walked with my brothers to school. I never biked to school.

Q: *Would you have biked if there were bike paths?*

A: I probably would have because it is much quicker than walking. I don't know how many places there were to put the bike away while I was in class.

Q: *Why didn't you use the sidewalks or streets to bike?*

A: The sidewalks were always busy with people walking to school and the streets had too many cars going fast.

Q: *What do you think of biking during winter?*

A: I think it would be hard with the cold. But I used to walk to school during the winter, so I could probably manage.