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The physical and perceived barriers to bicycling in San Francisco. Exploring the link between gentrification and sustainable transportation

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ABSTRACT OF THESIS submitted by:
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San Francisco is a cosmopolitan city which has flourished in the past two decades. With its transit first policy, San Francisco is filled with alternative transportation methods and continues to grow its mobility network. We see this especially with bicycling infrastructure and the Plan Bay Area 2050 report. With transportation it is important that people be considered especially because of the history of racism and classism in transportation and sustainable development in the United States. Furthermore, because urban revitalization contributes to gentrification and displacement, increasing San Francisco's livability must consider the communities it will threaten. The data and findings of this research show that the city has undergone drastic changes that have increased its livability, but who can live in San Francisco has also changed. The fragmented network of bicycle infrastructure and the displacement that follows gentrification create a barrier of access to sustainable infrastructure and amenities in the city. Through interviews and maps this link is explored to understand the barriers of cycling and the contributors to gentrification in San Francisco.

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Keywords: San Francisco, bicycle infrastructure, gentrification, displacement, mobility, revitalization of urban spaces, sustainable development, sustainable transportation

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List of Abbreviations

BART Bay Area Rapid Transit

CEQA California Environmental Quality Act

LOS Level of Service

SFBC San Francisco Bicycle Coalition

SFMTA San Francisco Municipal Transport Agency

SRO Single Room Occupancy

TDM Transport Demand Management

US United States

VMT Vehicle Miles Traveled

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1 Introduction

1.1 Cycling in San Francisco

San Francisco is a cosmopolitan city in Northern California that ranked 7th most livable in the United States (US) according to the 2022 World Population Review. The city's features include an agreeable climate, bustling economy, and one of the best public transportation systems in the US. Sustainable transportation in San Francisco is one of its more famous features, even an attraction, as it is accessible and reliable, with the influx of residents. And despite its iconic slopes, San Francisco is often ranked among the top 10 for most bikeable cities in the US. Cycling in San Francisco has a unique historical significance and continues to be a popular form of transportation in the city. However, it does not account for a considerable amount of non-recreational trips. This is uncharacteristic of a city such as San Francisco. Objectively the city is very cyclable (Dill and Voros 2007) as it is only 7 miles by 7 miles with most trips made within a 5-mile distance, a 30-minute bike ride for an average adult (Henderson 2013) and subjectively San Francisco has an agreeable attitude for cycling. The population is generally progressive, environmentally conscious, and prioritizes physical activity (Dill and Voros 2007). Cycling is also an equitable form of transportation as it is accessible and affordable (SFMTA 2013), nearly anyone can own and ride a bike!

The main cycling lanes in San Francisco serve a utilitarian purpose and do serve a fair portion of the city (Miranda-Moreno et al. 2013) due to the city's relatively small boundary. At first the City of San Francisco was using a system popular in the US called level of service (LOS) when deciding on the implementation of new cycling lanes. LOS was considered to ensure that the infrastructure will not interfere greatly with the flow of traffic, and if it does that it is rationalized

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(Henderson 2013). However, the City of San Francisco has a transit-first policy enacted in 1973 which says decisions must prioritize mobility in alternative forms before private automobiles which is a direct contradiction of the LOS (Henderson 2013). In response to this, alternative methods of transport are prioritized in city planning in San Francisco. Implementing sustainable transport such as bicycle infrastructure is made easier if not encouraged by this policy. However, the city's small boundary and limited road space raise questions for planners of how new infrastructure, like bike lanes, improves mobility and for who.

1.2 Plan Bay Area 2050

In October 2021, the Association of Bay Area Governments alongside Metropolitan Transportation commission, released the Plan Bay Area 2050 document which highlights housing, the economy, transportation, and the environment to be improved across the Bay Area focusing on creating a more equitable and resilient community (Association of Bay Area Governments and Metropolitan Transportation Agency 2021). Documents and statements such as these are not lonely in San Francisco's history. Initiatives to 'clean up' and 'improve' the San Francisco Bay Area are often stated to increase livability in each neighborhood. San Francisco is among a handful of cities in the US whose residents consider sustainable transport over single occupancy vehicles, though the city still has its fair share of cars. The Plan Bay Area 2050 report is especially special regarding transport, because it considers cycling within its framework as to improve the livability of the city. The last time something like this was seen was with the San Francisco Bicycle Plan drafted in 1996 by the San Francisco Department of Parking and Transportation. The Plan Bay Area 2050 report includes increasing cycling in the city to 20% of all rides similar to that of major European cities (Association of Bay Area Governments and

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Metropolitan Transportation Agency 2021; Henderson 2013). Yet once again, statements like these are not lonely in San Francisco's history. In the 1996 San Francisco Bicycle Plan, the need for infrastructure to support cycling as a viable means of utilitarian transportation were highlighted because cycling infrastructure at this time was primarily recreational (SFMTA 2012). Though delivered with positive intent, the San Francisco Bicycle Plan in its draft was criticized by activists for not providing infrastructure for a significant neighborhood that was used for cycling, the Mission District, especially because this neighborhood was primarily home to low-income Latine communities (Stehlin 2015). The Plan Bay Area 2050 report differs in this way as it specifically addresses low-income and marginalized communities. In an analysis for Plan Bay Area 2050, it was "found that investing in active transportation infrastructure can open new destinations for people with low incomes and people with disabilities at a fraction of the price of higher-cost public transit infrastructure. Equity considerations will be front and center in the regional Active Transportation Plan, including partnerships with community-based organizations to identify priorities" (Association of Bay Area Governments and Metropolitan Transportation Agency 2021). However, patterns and trends seen with sustainable development especially in the form of cycling and displacement through gentrification are not mentioned at all.

Gentrification is an epidemic occurring in San Francisco which has translated to a dying middle class and decreased diversity due to displacement. It is important to understand trends in which privileged populations often shape cities by attracting investment especially when it contributes to the inequitable distributions of transportation (Flanagan, Lachapelle, and El-Geneidy 2016; Henderson 2013). There are unintended consequences to the revitalization of urban spaces that are not only a result of but contribute to gentrification, displacement, and inaccessibility for low-

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income communities (Checker 2011). The idea that a sustainable lifestyle is not for everyone is very prevalent in the US and seen in many cities even those with progressive ideology. Though investment from local or state government seems positive, like in the case of Plan Bay Area 2050, it may contribute to further gentrification, displacement, and exclusivity. Localizing communities of color and preventing or mitigating the displacement of these communities may be a more logical course of action. To address the issues that prevent low-income communities and communities of color from cycling (Community Cycling Center 2012), San Francisco must address the issues that displace these communities and the needs of the people being impacted.

Some infrastructure decisions have already been made to reclaim space in the city for alternative transportation and easier bicycling. In April 2022, San Francisco Board of Supervisors and County Transportation officials voted and passed the decision to have JFK Drive in Golden Gate Park remain car free as it was throughout the pandemic (NBC Bay Area Staff 2022). This decision was praised and criticized by community members (NBC Bay Area Staff 2022). Advocates against JFK being car-free filed a ballot that would restore car access because JFK would be inaccessible to disabled communities (Schneider 2022) and would cause congestion in the city as residents go back to work and school (NBC Bay Area Staff 2022). Also, the museums in the area reported lowered foot traffic which was another cause for JFK to have car access (Schneider 2022). However, 70% of residents support JFK being car-free (Schneider 2022) especially due to the nearly parallel car accessible street nearby. This change in city planning shows how polarizing these decisions can be because of who is served by bicycle infrastructure.

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My research will address the following questions regarding the plans in place to increase cycling in San Francisco to be comparable to major European cities. I first ask who is cycling? Who is being served by this infrastructure? What are the current physical and perceived barriers of access to cycling infrastructure in San Francisco? Why is it that in many major European cities cycling accounts for between 10 and 15 percent of all daily trips (Henderson 2013) but in San Francisco it accounts for only about 4% (SFMTA 2013; 2019)? And lastly how can bicycling increase in the city equitably?

1.3 Aims and Objectives

The aim in this thesis is to identify the link between access to sustainable transport and gentrification through the cycling initiative in San Francisco. I also want to provide insight into the lower levels of bicycling occurring in the city. To identify this link, I will be assessing historic and current trends of gentrification and cycling in the city through policy documents, literature, and news articles around this topic. I will also be using geospatial visualization of gentrification, cycling infrastructure and locations in which cycling is occurring the most in the city. This is supplemented with interviews to analyze the attitudes of community members in San Francisco and their relationship with gentrification, sustainable transport and bicycling in the city.

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My objective is to identify the physical and perceived barriers to cycling in the city and expose a potential barrier linked to gentrification. I want to identify the barriers of access to cycling that keep it from being a significant method of transportation in San Francisco especially for low-

income communities. My findings will offer research and evidence-based suggestions for furthering cycling infrastructure in the city. This will allow for the equitable and accessible implementation of sustainable transport for communities at risk of displacement through gentrification.

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2 Literature Review

2.1 Sustainable Transportation

San Francisco is among a few cities in the US to offer sustainable transportation as a viable means of commute. Sustainable transportation is critical in the environmental movement as transportation is the largest and fastest growing end-use of energy (United Nations 2020). In 2012, San Francisco was awarded by the Department of Economic and Social Affairs the Sustainable Transport Award for being a model on working successfully with businesses and the community to phase in and scale up sustainable transport policies (United Nations 2012). San Francisco government initiated two major sustainable transport efforts, "SFpark" and "Pavement to Parks", that gained international attention (United Nations 2012). Shortly after gaining this recognition, San Francisco began "upgrading and expanding its bike network to attract riders […], setting an ambitious target of 20% of all trips by bicycle by 2020" (United Nations 2012). Though significant improvements to the cycling infrastructure have occurred, bicycles accounted for 4.2% of all trips to work in 2020 from the 3.2% in 2009 according to the 2022 U.S. Census Bureau and San Francisco Municipal Transportation Agency (SFMTA).

2.2 The Politics of Cycling

San Francisco is a socially and politically progressive city. Under the guise of historically leftist politicians, activists, and institutions making their mark in the city, San Francisco actually maintains three major ideologies: progressive, neoliberal, and conservative (Henderson 2013). Transportation in San Francisco becomes a point of contention with these three ideologies ruling its outcome. US political will is the major barrier standing in the way of serious change in the

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transportation sector toward promoting cycling (Henderson 2013) but in San Francisco it seems different.

Cycling was initially prioritized in San Francisco by progressive, environmental activists and members of the community (SFBC 2022). Activists often linked motorized vehicle usage to climate change and with its high accessibility cycling promoted equity in the city. With the niche but mutual goal in mind, the San Francisco Bicycle Coalition (SFBC) was founded in 1971 to create an alliance toward making San Francisco a more bike friendly city (SFBC 2022). Yet, progressives and the SFBC are often reactive rather than proactive when it comes to issues of transportation (Henderson 2013). In the case of the increasing transit prices or adding freeways, progressives are great at stopping inequitable or unsustainable changes but have difficulty moving forward from there (Henderson 2013). Critical Mass was a defining factor that ended the loop of inability to progress cycling and its infrastructure in San Francisco when in September 1992, a small group of cyclers wanted to reclaim public spaces and revive a sense of community in the city (Carlsson et al. 1994). Though not necessarily political at first, Critical Mass took on the ideology of the progressive activist when the gathering caught popularity and became a demonstration for protests against oil-induced warfare in Iraq (Henderson 2013). The identity of the cycler even shifted to the "young, professional workers who worked in the support of the postindustrial, high-tech economy, including programmers, office managerial and support staff, accountants as well as nonprofit employees, artists, and students" (Henderson 2013). While this demographic is progressive in its claims, it aligns well with the neoliberal ideology, strengthening the SFBC's role in politics and ability to have initiatives passed. When the SFBC pushed to increase cycling infrastructure in the city adversity formed with conservative

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ideologists who felt shamed by progressives (Henderson 2013) for not wanting to give up motorized vehicles and the infrastructure that made this form of transportation easier.

However, the conservative notion that infrastructure is only established for capital gain (Henderson 2013) can convince even the car obsessed to support some cycling infrastructure. After the Critical Mass melee and political upwelling that followed, the city finally approved a road diet and bicycle lanes for Valencia Street, a request lobbied for almost a decade before this (Henderson 2013; SFMTA 2012). This becomes a factor of interest when following the success in infrastructure implementation. Support was shown by shop-owners making Valencia Street a retail and entertainment hotspot in the city to this day (Henderson 2013; Stehlin 2015). If profit is the gauge for success (Smith 1979) cycling infrastructure is a mode to achieve it. The unifier in this case, is the intersection of sustainable development and capital gain which properly defines cycling infrastructure not only in San Francisco but in many major cities in the US (Snyder 2013; Poirier 2018). This is also the indication of the cyclical link between investments and gentrification. As more low-income residents realize and question the contradictory and selective nature of sustainable policy, the ideology of sustainable transport at times equates to inequity (Checker 2011).

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2.3 Gentrification

In 2017, San Francisco was ranked number one in a study conducted on gentrification in America with data from the U.S. Census (NCRC 2020). Gentrification, a form of displacement in which new residents of usually young adults with a higher average income and education, in San Francisco can most likely be attributed to the dot com boom in the 1990s (Schwarzer 2005).

As a multiethnic and cultural urban space, income and race-based discrimination plays a significant role in San Francisco's history. San Francisco was a location of refuge for many low-income communities of color when 20th century US housing policies contributed to racial segregation (Stehlin 2015). The city reflected a diverse working class while White communities congregated in the suburbs (Menendian and Gambhir 2018). However, the allure of the city changed when the once mercantile and industrial city became a service-oriented hotspot for the tech industry (Schwarzer 2005), providing jobs but also creating chaos with rent, transportation, and displacement. The city that was once abandoned by wealthy communities became attractive to them. And when capital depreciation plays such a strong role in lowering prices of a building or neighborhood (Smith 1979), historical disinvestment has a strong influence on the ability for these young gentrifiers to rejoin urban life (Flanagan, Lachapelle, and El-Geneidy 2016). Suburbanization quickly shifted to re-urbanization.

The trends in San Francisco of gentrification are that of a virus. Each neighborhood next to the other starts as working class and transitions to upper-middle class where it is difficult to find any home for less than a million dollars, like in the case of Telegraph Hill and Noe Valley (Schwarzer 2005). Alongside this, San Francisco has been experiencing gentrification more intensely due to the city's geographic isolation, rent control and lack of public funded affordable housing (Schwarzer 2005).

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According to Smith (1979) there are two main drivers of gentrification and the revitalization of urban spaces: culture and capital. The dot com boom shifted both. Techies homogenized culture

in San Francisco with wealth flushing through the real estate market, displacing small businesses and longtime renters (Brahinsky 2014). It was easy for techies to make San Francisco their home because of its geographic relation to Silicon Valley where the tech industry was growing. Transportation becomes involved because the Silicon Valley has access to the Caltrain which links to the Peninsula. While Caltrain acts as a sustainable transport and is available for anyone, it is a higher cost commuter railroad line and runs through wealthier cities of the Bay Area and Silicon Valley (Stehlin 2015). This is in direct contrast with the Bay Area Rapid Transit (BART) subway which services the East Bay where many communities were displaced to due to gentrification.

To prevent San Francisco from becoming a sleeper city for techies, rent control was enacted. While rent control helped many tenants save thousands of dollars, it also encouraged landlords to stop renting out coveted apartments and convert them to condominiums and single-family homes (Brahinsky 2014; Murphy 2017). Rent control in turn attracted higher income individuals and fueled gentrification (Murphy 2017) rather than mitigating its harmful effects. Even with anti-eviction regulations, the Ellis Act which legally allowed all tenants to be evicted for landlords to no longer be in the rental business, essentially real estate flipping, displaced many San Francisco residents (Brahinsky 2014; Stehlin 2015). These housing policies and the landlord-tenant dynamic played a huge role in the inevitable gentrification of the city and increase in the 'techie' demographic.

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The techie changed the face of San Francisco in the form of environmental consciousness. To keep the tech industry "green," corporations invested in sustainable transport around the city

exclusively for its employees to have an easier commute (Brahinsky 2014). This initiative faced push back from community members because the private buses used public infrastructure. However, the city still allowed the buses to use the public bus stops. (Brahinsky 2014). Alongside this 'techies' infiltrated the biking scene in San Francisco. Many companies will donate to charity if their employees bike to work, and will provide racks, lockers, and mechanics to encourage bicycling (Bernstein 2012). Efficient mobility is prioritized by not only this demographic but also their employers.

Not only were policies being enacted that did not protect tenants in San Francisco, but gentrification in the city is also driven by corporations with little to no support from the city or state in the form of affordable housing. When gentrification begins occurring in cities, there is a small window of action to prevent its harmful effects which in many cases is to implement affordable housing within the new developments (Checker 2011). In an attempt to mitigate this failure of the city, Plan Bay Area 2050 offers support for low-income communities through affordable housing (Association of Bay Area Governments and Metropolitan Transportation Agency 2021). There is ongoing action against gentrification in the city seen in Chinatown. Chinatown remains a working-class immigrant community. Many factors that contribute to this like non-governmental organizations and public funded support but it is also thought to be attributed to racial capitalization (Naram 2017). Racial capitalization occurs when the novelty of an ethnic minority becomes attractive for a city to residents or tourists (Naram 2017). In the case of San Francisco, Chinatown offered a safe, affordable, interesting, and attractive location for residents and tourists. This was reason enough for the city to prevent major displacement of this

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working class neighborhood through single room occupancy (SRO) units and increased affordable housing in the area (Naram 2017).

Bayview-Hunters Point is another neighborhood that has resisted serious gentrification. These neighborhoods, which are in the southeast region of San Francisco, have the city's largest Black community, due to historical segregation in the city (Menendian and Gambhir 2018). This neighborhood has a history of neglect and contamination through industrial activity leading to poor health in the community (García-Lamarca and Gray 2021). This is an ongoing cruel act of environmental racism in which a community of color is facing unsustainable conditions effecting their liveliness. However, residence fear that with the revitalization of their neighborhood will bring gentrification, and they will no longer be able to afford their homes arriving at a conundrum in which they have to choose between their health or displacement through gentrification (García-Lamarca and Gray 2021). Increasing livability in an urban space creates this paradox for low-income communities and especially communities of color.

Though increased livability drives gentrification, environmental activism and sustainable policy do not cause gentrification; gentrification and displacement are unintended consequences of movements to increase sustainability (Checker 2011). With this pattern so often occurring, the Plan Bay Area 2050 document recognizes this trend to some extent. There are mentions of historic and new potential for displacement through increased livability of the city and San Francisco Bay Area. Yet there is no mention of displacement through gentrification or the pattern of sustainable development and increased gentrification. The Plan Bay Area 2050 document has no mention of gentrification at all. This omission regarding the plan to increase

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livability through sustainable initiatives, puts low-income communities at further risk of displacement in an actively gentrified and exclusive city.

2.4 Drivers of cycling investment

Following the perfect storm of gentrification in San Francisco was city funded investments to increase the city's livability. However, cycling infrastructure does far more to low-income communities than improve their neighborhood's livability. In San Francisco when the reason to implement the infrastructure is prevalent enough for change, it is already too late for low-income communities because they have most likely been displaced by gentrification (Brahinsky 2014). In a case study from Portland, Oregon, when assessing the perspective of people of color in the neighborhood, the consensus was that bicycles were seen as a symbol of gentrification and negative change because of the indication of displacement (Community Cycling Center 2012).

Sustainability in a sense has become a strategy to attract commercial and residential investment (Checker 2011). In the case of San Francisco, transportation infrastructure is highly politicized, and there are many reasons why investments are made where they are made. For instance, on Valencia Street, the activist push was the driving factor toward investment (Stehlin 2015). As the oldest bicycle advocacy group in San Francisco, the SFBC became a powerful driver of cycling infrastructure, due to its presence on the street and in the government (SFBC 2022). However, upgrades to the infrastructure on Valencia Street (and in many popular cyclable areas in the city), in the form of bicycle parking and GreenWave streets, were influenced by the economic success cyclers brought (Stehlin 2015; Henderson 2013). And though Valencia Street was already undergoing gentrification, this infrastructure was attractive to the demographic of gentrifiers

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which supplemented the business boom in this neighborhood (Stehlin 2015; Snyder 2013). This exhibits the trend of environmental gentrification in which the successes of environmental justice movements are appropriated to increase the revitalization of an urban space and displaces low income residents (Checker 2011).

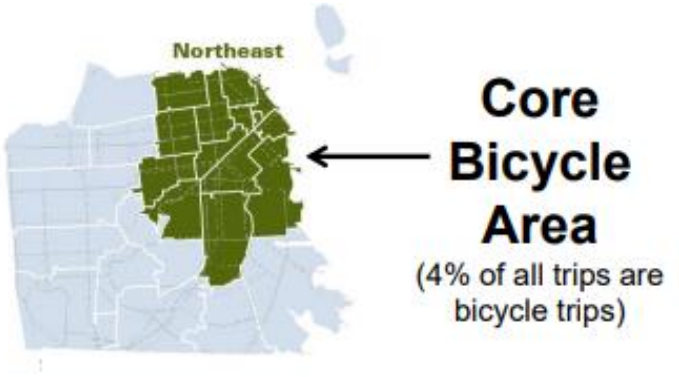

FIGURE 1. | https://www.sfmta.com/sites/default/files/reports-and-documents/2018/01/san_francisco_transportation_trends_2.3.15.pdf

It is important to note that while the Mission District is a portion of the city where cycling is occurring the most, the entire Northeast region is a cycling hub (Figure 1). And in this case cycling here can most likely be attributed to the jobs that exist in this region especially in Downtown San Francisco which is the urban core of the city, a conglomerate of corporate headquarters, and a hub for businesses (McGovern 2014). This region also reflects the location of the 'techie'. The systems in place made riding a bicycle easier for this demographic. For example, the private buses are simply more welcoming to cyclers by allowing riders to bring a bike on the bus as opposed to public transit commuters who at peak hours can be shoulder to shoulder with the riders alongside them. A similar trend is seen with the Caltrain versus BART networks which was an initial contributor to varying access to cycling based on transit. Though the number of BART riders that access most stations by bike has increased (SFMTA 2019), the comfortability and accessibility for cyclists does not compare to Caltrain riders (Stehlin 2015).

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By these means, ‘techies’ changed the face of the city, not only by contributing to reinvestments but also barriers of access.

2.5 Barriers of use

San Francisco is a unique city because while it has the potential to be extremely bike friendly, barriers exist that prevent a significant increase of cycling to predicted levels. The most significant physical barrier in San Francisco is the hilly topography. This rules out cycling as a transportation option for a broad range of people to consider based on ability and accessibility. (SFMTA 2019). Many San Franciscans deal with the hills as a physical barrier with electric bikes and the e-bike share program. However, these programs and technology can be inaccessible and unaffordable and even with access to this technology, the fragmented network leads to potentially unsafe riding in certain areas (SFMTA 2019). Safety is unsurprisingly a major concern for riders as San Francisco is congested with drivers, pedestrians, and new developments. This leads to issues regarding limited right-of-way, general lack of awareness of drivers, and limited dedicated spaces for biking.

Biking has also been contentious among people of color and working-class communities. Though the demographic of people of color nationally bike more or want to bike more (People for Bikes and Alliance for Biking and Walking 2015) different trends are seen in actively gentrified cities. Portland, Oregon is a famous case of high levels of bicycling and gentrification. A report was conducted to see whether there was interest to bike within low-income communities and communities of color as well as what barriers were preventing them from biking in the city. This was because, cycling was occurring at a very low rate in the city and

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mostly amongst young white males (Community Cycling Center 2012). The report concluded that while many people of color showed interest in cycling, the barriers that prevented them from doing so were personal ability and a negative perception of utilitarian cycling (Community Cycling Center 2012). There are simple solutions to improving people's comfort and ability to cycle. The SFBC coordinates initiatives like group rides for women and non-binary people and bike classes for adults in a variety of languages (SFBC 2022). However, perception is a different fear to address and with professional planners being disproportionately white (People for Bikes and Alliance for Biking and Walking 2015), many low-income communities and communities of color ask who is this infrastructure actually serving (Community Cycling Center 2012). There are identities often associated with bicycling that are not relatable to these underserved communities (Streeter 2010; Community Cycling Center 2012). Among these identities is gentrifiers as utilitarian cyclists and bike enthusiasts. Bike lanes have been called the "white stripes of gentrification" because of a pattern in which increased cycling infrastructure contributes to the displacement of low-income communities and thus only serves the demographic of gentrifiers (Streeter 2010; Flanagan, Lachapelle, and El-Geneidy 2016). Because the revitalization of urban spaces often equates to capital gain for businesses and high market prices for residences (Stehlin 2015), low-income communities will associate bike lanes with gentrifiers. Refusal to support or use bike lanes due to perception turns into inability to use bike lanes because of displacement.

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2.6 Success of European cities

Most analysis of cycling infrastructure suggests that when implemented, cycling increases. This was exactly the case for many major cities in Denmark, Germany, Switzerland, and the

Netherlands (Pucher, Komanoff, and Schimek 1999). Similar to San Francisco all these countries have experienced a high standard of living, rising incomes, growing auto-ownership, and rapid suburbanization in the past four decades and yet cycling fails to thrive in San Francisco the way it does elsewhere (Pucher, Komanoff, and Schimek 1999). Also, many of these countries have similar topography to and less agreeable weather than San Francisco. With the city's transit first policies, environmental consciousness, and small boundary area, San Francisco theoretically should have cycling levels comparable to these European cities (Henderson 2013). However, a major difference arises when looking at the demographic of cyclers. In a study conducted on the factors affecting bicycling demand, it was found that white, middle-aged, and male respondents are the primary demographic of cyclers (Dill and Voros 2007) and the same can be said for many major cities implementing this infrastructure (Stehlin 2015; Flanagan, Lachapelle, and El-Geneidy 2016). However, it is different in these major European cities. Take Denmark for example, which has no significant variance in demography of cyclers between women and men, white and people of color, or low-income and high-income (People for Bikes and Alliance for Biking and Walking 2015). This is because Denmark made it a priority to implement equitable cycling infrastructure by using low-speed side streets and using protected bike lanes more consistently throughout cities. Denmark also integrated state driven gentrification rather than San Francisco's real estate flipping and corporate driven gentrification. (People for Bikes and Alliance for Biking and Walking 2015). Not only did this make cycling a comfortable and efficient option but destigmatized it as undignified allowing for its equitable integration into the city.

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3 Methodology

3.1 Geospatial visualization

The city of San Francisco will be used for the boundary line with the unit of analysis as per census tract. San Francisco is an interesting case as it has historically experienced and is currently experiencing gentrification. It is also racially and ethnically diverse with varying significant racial and ethnic demography in each district. While San Francisco is becoming increasingly exclusive, there are communities of low-income working-class residents.

Cycling infrastructure will be identified as bike lanes, GreenWave bike streets, and bicycle parking structures. The data for this infrastructure is provided by SFMTA. The SFMTA is a department of the City and County of San Francisco that manages the ground transportation in San Francisco which includes bikeway infrastructure.

I will be using data on gentrification provided by the Urban Displacement Project. I decided to use this project's mapping of gentrification because this project aims to highlight displacement and exclusion as an effect of gentrification. This data is especially useful because it accounts for population density which would influence the number of cyclists in each census tract. The focus of the study will be on the 'Advanced gentrification' tract which is defined by the Urban Displacement Project as:

- Moderate, mixed moderate, mixed high, or high-income tract in 2018
- Housing affordable to middle high, mixed moderate, and mixed high-income households in 2018
- Marginal change, increase, or rapid increase in housing costs

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- Gentrified in 1990-2000 or 2000-2018

(Chapple, Thomas, and Zuk 2021)

3.2 Qualitative research

To understand the perception of cycling in San Francisco I chose to conduct semi-structured, non-suggestive interviews. I decided to use a qualitative method of research for my primary data to understand people's attitudes towards transportation in San Francisco, especially regarding cycling and bicycle infrastructure. The semi-structured, non-suggestive interview allowed for me to receive necessary information while participants can comfortably expand with their own stories and nuances of the topic.

Due to the inability to travel to the US interviews are conducted over video chat, voice recorded, and transcribed. To analyze the data, I used the coding method. Interviews conducted consisted of many varying themes and opinions, so coding was the most efficient way to analyze the interviews. This is because coding is used to index or map data to draw out relevant information pertaining to the research question and the themes that relate to it (Elliott 2018). I was able to conduct manual coding after the interviews that related to seven and six major themes and questions for the community members and the city planner respectively.

I chose to interview participants in three categories: people who ride bikes, people who do not ride bikes, and a San Francisco sustainable transport city planner. First, I interviewed community members of San Francisco. To find participants I used the snowball sampling method. I will be using this method to understand the community perspective from a few residents of San

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Francisco. Since I have the constraint of time in searching for candidates for my interviews, snowball sampling is my most viable method. I reached out to a contact that I have in the area who connected me with their neighbors and coworkers. Some interviewees then reached out to their coworkers and neighbors. This method was most efficient for me to find as many subjects as possible in the time constraint. Also, this method creates the identity of a community. Our neighbors and coworkers create a community and therefore offer a cohesive outlook of what is mutually occurring in the city. Community members living and working in San Francisco will share their experiences commuting and their relation to cycling in the city. Since my topic focuses on gentrification as a barrier of access to bicycling, the community perspective is an important aspect to understand. Second, I interviewed a San Francisco City Planner that has specific insight regarding sustainable transportation. I used purposeful sampling to interview the city planner that does relevant work in sustainable transportation.

Local San Franciscans interviewed:

1. Claire (she/her) is a young adult professional. She has lived in San Francisco for about 10 years. She lives in Potrero Hill and works in Chinatown. She uses public transit for her commute.
2. Michelle (she/her) is a young adult who moved to the city approximately a year ago. She lives in Portola Valley and works in Chinatown. She uses public transit for her commute.
3. JB (he/him), a young adult, has been visiting San Francisco nearly his whole life and started living and working in the city about five years ago. He lives in the Mission and works in Mission Bay. He is a cyclist but also takes public transit for his commute.

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4. Anna (she/her) is a 27-year-old who has lived in the city nearly her whole life besides a few years for school and when she lived in China. She lives in Portola Valley and works in Chinatown. She takes public transit for her commute.
5. Emily (she/her) is a 26-year-old woman who is a third generation SF native. She lives on the border of the Mission and Noe Valley and works in the Tenderloin. She cycles and takes public transit for her commute.
6. Madeline (she/her) is a 23-year-old SF native. She currently lives in the Outer Mission and works in SoMa but grew up in the Excelsior District. She usually cycles for her commute but in some cases drives. She also works in marketing for a parks and public spaces nonprofit, so I asked her a few more questions under the themes of the urban planner.
7. Fei (she/they) is a 24-year-old who had been living in San Francisco, the Mission and Sunset, for 6 years but recently moved out of the city to the East Bay. They work in Chinatown mainly but often must work in the southeast of San Francisco i.e., Crocker, Ocean, Merced, Ingleside Heights, etc. They will normally take public transit for their commute but occasionally drives.

The general themes of the questions for community members regarded:

- Standard information including age (range), gender/pronouns, and occupation.
- Neighborhood of residence and work.
- Thoughts on whether their neighborhood is being gentrified and the indicators that show this.

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- The importance of transportation to them and their preferred form of transport for work and leisure.
- Whether or not they choose to cycle and why.
- The barriers of access to choosing cycling in San Francisco.

Justin Kran is the associate planner for the City and County of San Francisco I was able to interview. He is responsible for the Transport Demand Management (TDM) program which works to reduce vehicle miles traveled (VMT) from a developmental side. He works with large real estate development projects in making sure they are reducing single occupancy vehicle commuting to the city standard.

The general themes of the questions for the city planner regarded:

- Standard information on the role he performs regarding sustainable transport in the city and the programs he works on.
- The reasons of implementation and investments for various transport infrastructure.
- The actors/interests involved/considered in the implementation process and the actors/interests left out.
- Public opinion of bicycling and bicycling infrastructure.
- Social issues that are present, may arise, or should be considered in the implementation of bicycling infrastructure.

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3.3 Ethics

Central European University's ethical research guidelines were taken into consideration. To properly give consent, each participant was made aware of the purpose and goals of my research. Consent was given through a signed research consent form before the interview. Before recording, I also asked for oral consent. I decided to only use the first name of participants defined as community members, even if they had given consent for their full names, as to avoid sharing unnecessary personal details. I was given written and verbal consent to use the full name of the associate city planner as per CEU's ethical research guidelines.

3.4 Limitations

Due to time and distance constraints, I was unable to travel to San Francisco to conduct in person interviews. This changes the dynamic of the interview to more of a question-and-answer style rather than a free-flowing conversation.

Because of snowball sampling method all the participants were young adults that live or work in the same or nearby neighborhoods which skews the data.

The definition of bicycling infrastructure considers more than just the data that I have used (bike lanes, bicycle parking, and GreenWave Streets). However, bicycle infrastructure like bike share and electric bike locations were not available via a reputable source and so I decided to not use it in my thesis.

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4 Results

4.1 Geospatial Visualization

I first downloaded the data for the bike infrastructure, which included bike lanes, bicycle parking, and GreenWave streets, from the SFMTA website. SFMTA had its data in shapefiles already, so I was able to open them onto ArcGIS. I overlayed the bicycle infrastructure on a base map to have general view of it in San Francisco.

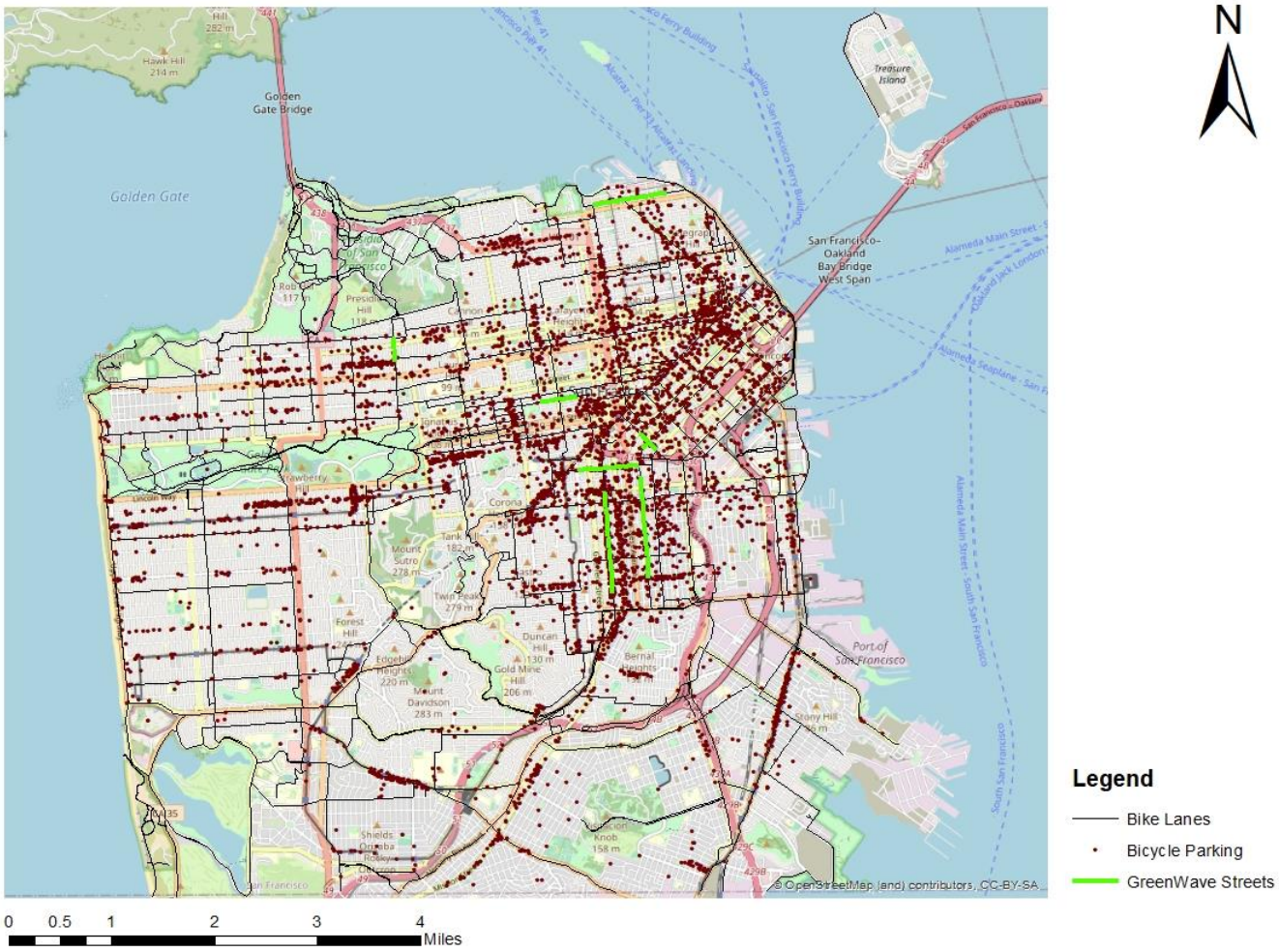

Figure 2. Bicycle infrastructure in San Francisco defined by bike lanes, bicycle parking, and GreenWave Streets

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I requested access to the Urban Development Project's database for the Bay Area and downloaded this data into ArcGIS. This data was already defined by tract so I just coded each "Stage of Gentrification" by the following: 0 as High Student Population, 1 as Low-Income/Susceptible to Displacement, 2 as Ongoing Displacement, 3 as At Risk of Gentrification, 4 as Early/Ongoing Gentrification, 5 as Advanced Gentrification, 6 as Stable Moderate/Mixed Income, 7 as At Risk of Becoming Exclusive, 8 as Becoming exclusive, and 9 as Stable/Advanced Exclusive. I then overlayed the cycling infrastructure data to visualize the relation between the two in the city.

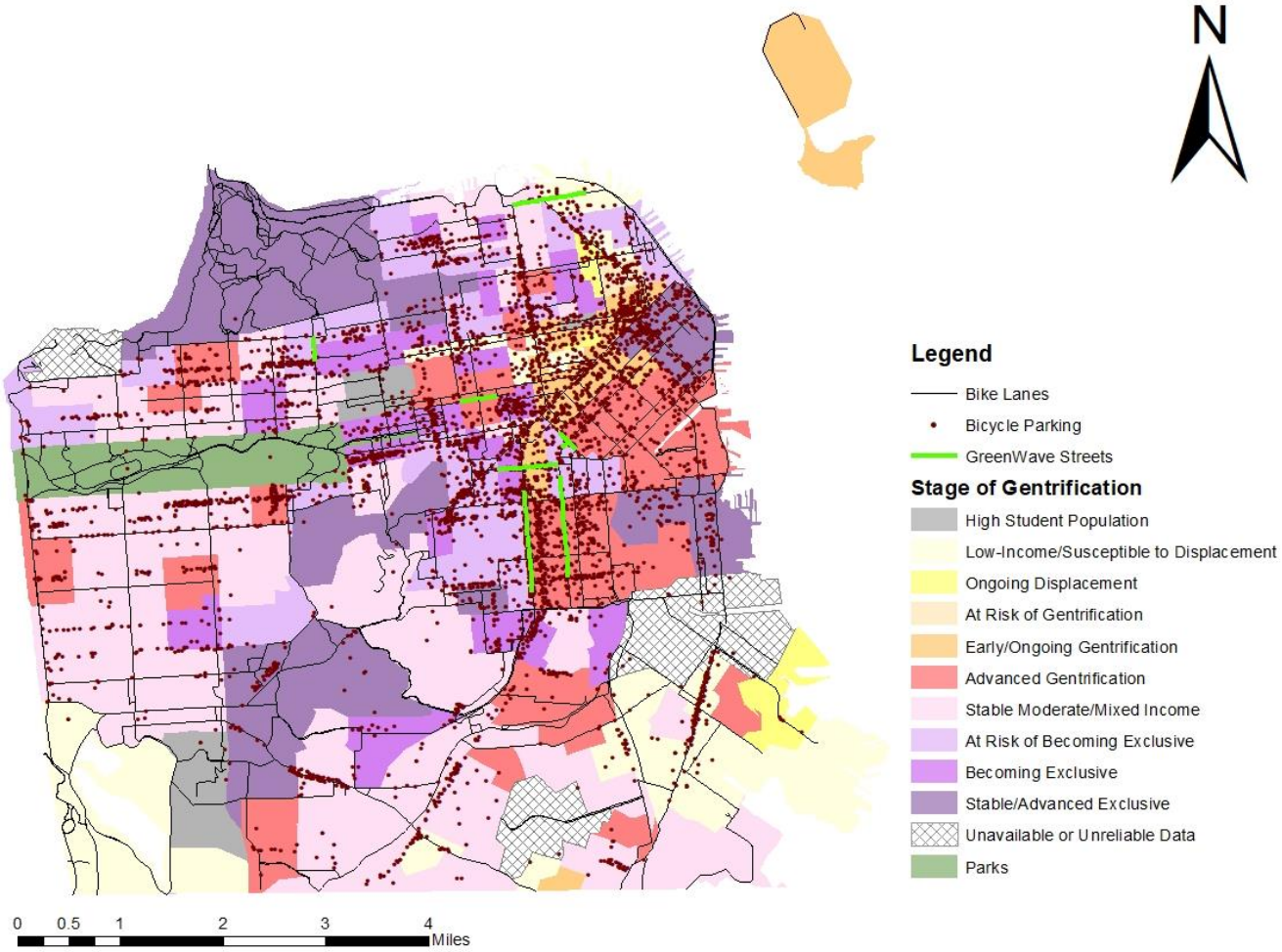

Figure 3. Gentrification levels and cycling infrastructure in San Francisco.

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This map indicates patterns of cycling infrastructure in locations of varying levels of gentrification and exclusivity. Advanced gentrification is occurring mostly in the eastern region of San Francisco which includes the Mission District. Bicycling parking structures are primarily located in the northeastern region in which varying levels of gentrification is occurring. Bike lanes are distributed throughout the city, but the frequency and consistency of lanes increases in the same northeastern region of San Francisco. The network of bicycle lanes is the weakest in low-income/susceptible to displacement tracts and stable moderate/mixed income tracts. GreenWave streets are located in actively gentrifying or gentrified tracts apart from one which is downtown in a low-income/susceptible to displacement tract. Thirty percent of all tracts in San Francisco is already considered exclusive (Chapple, Thomas, and Zuk 2021). However there still is a significant number of census tracts, stable and mixed/moderate, that are not experiencing the pressure of the housing market and remain working-class (Chapple, Thomas, and Zuk 2021).

I collected the data for San Francisco's topography from the City and County of San Francisco's database. The elevation contours were in a shapefile, so I was able to open it into ArcGIS. I then changed the symbology to reflect 5 intervals using the natural breaks distribution of elevation.

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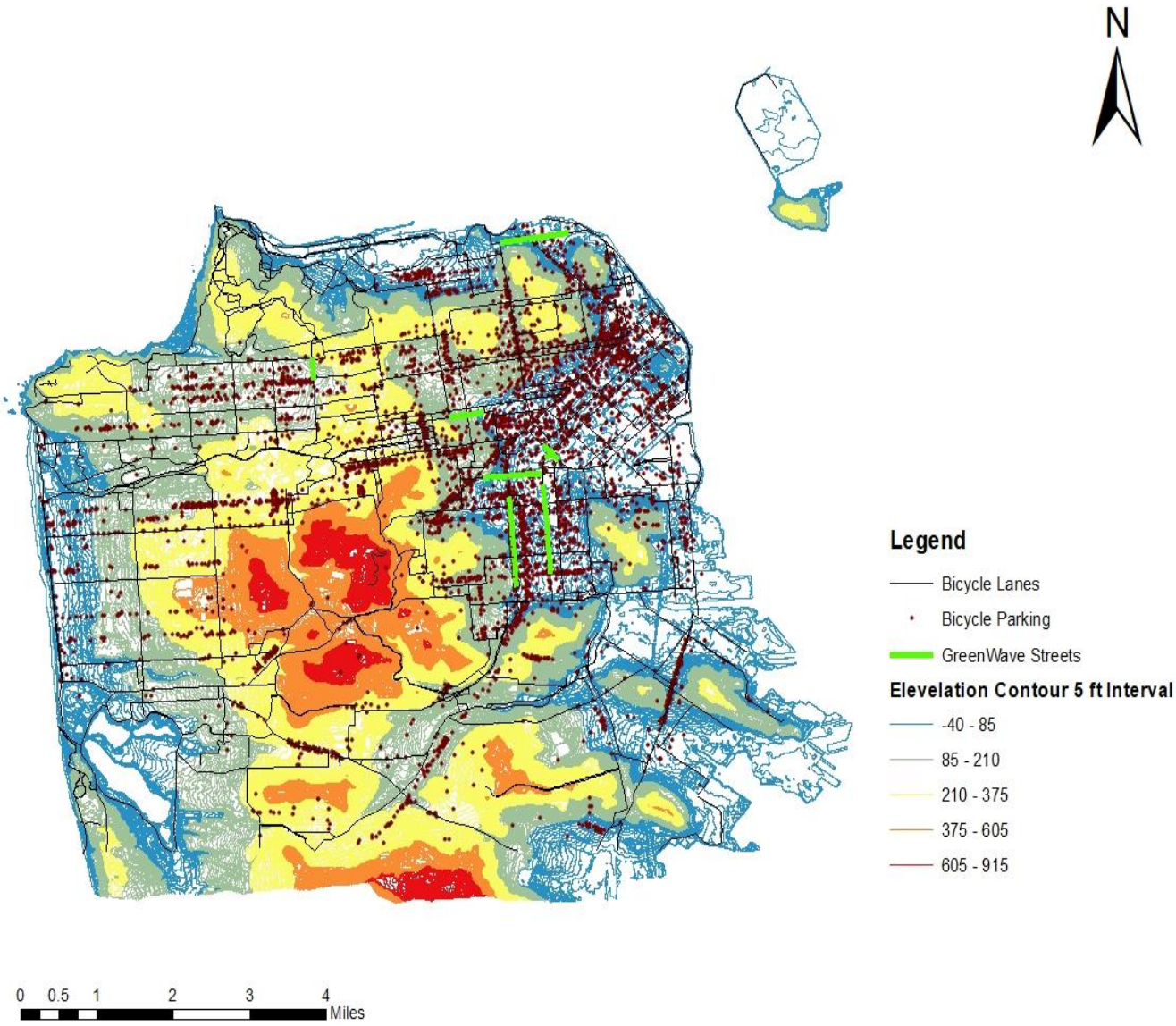

Figure 4. Topology, bike lanes, bicycle parking, and GreenWave streets in San Francisco.

This map shows the infrastructure for cycling does occur in the flattest areas of the city. However, it is important to note that this area symbolized in blue on the map is defined as between -40-85 ft. For the distance traveled in these areas have a gain of approximately 1 which

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is considered ‘easily’ steep and bikeable for the average able-bodied adult but not necessarily “flat”.

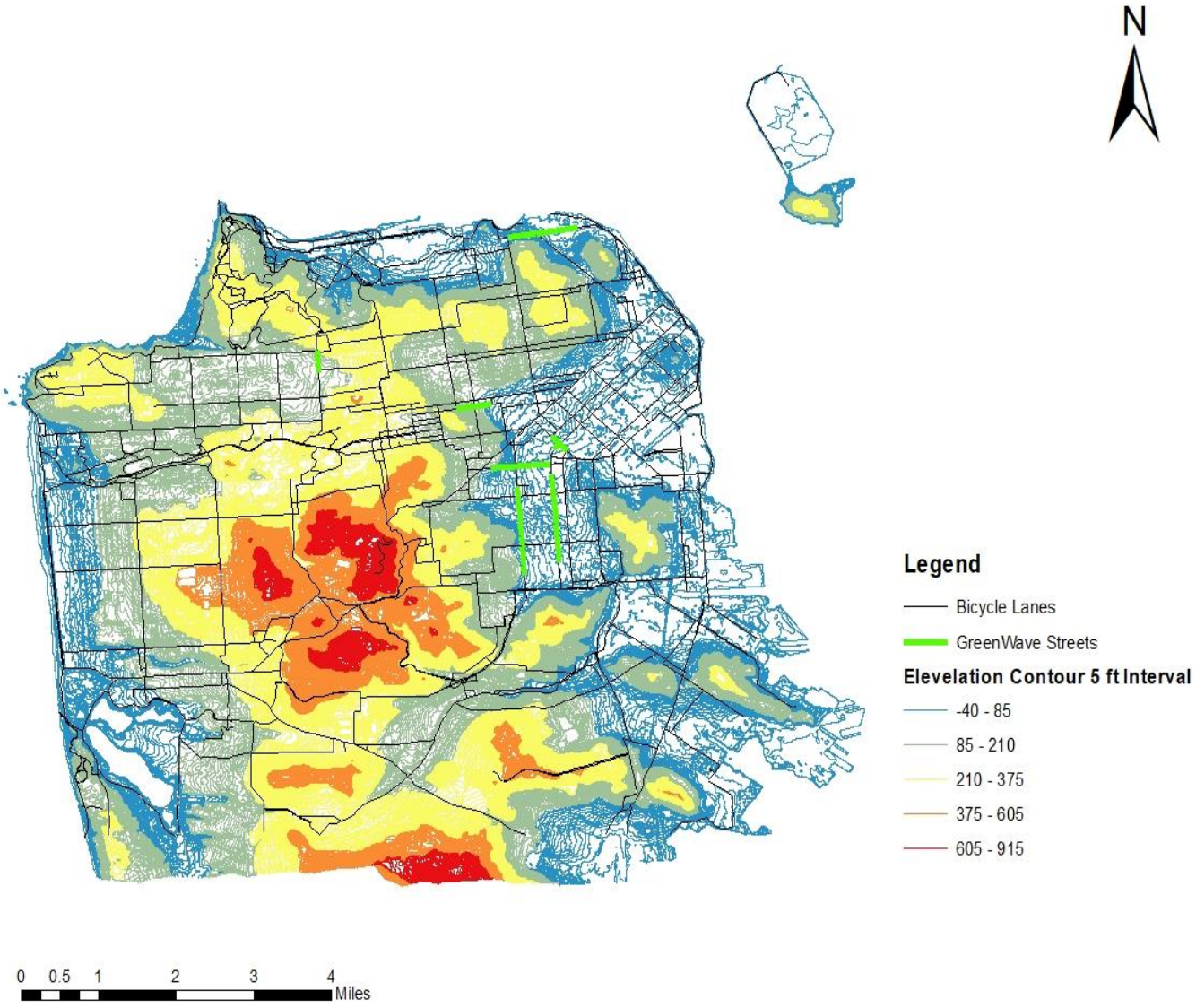

Figure 5. Topology, bike lanes, GreenWave streets. This map shows the topology more clearly.

Less bike lanes in the western region of the city are likely attributed to the variances in topography. The westmost region of San Francisco when referring to the base map shows this is along the coast and may not be a utilitarian cycling location. Therefore, even though it is

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relatively flat, the lack of infrastructure in this area could be attributed to other reasons such as less need for utilitarian purposes.

4.2 Interviews

4.2.1 Community Members

The participants in the study were very familiar with the occurrence of gentrification in the city. I found that each participant felt that at least one of their neighborhoods (residence or work) was being gentrified. For example Fei was mentioning some of the locations they have lived and work in such as the Mission and Chinatown but also Crocker, Ocean, Merced and Ingleside Heights. When I asked if they felt that any of these neighborhoods are being gentrified, they replied "Yes. All of them actually." JB, Madeline, and Emily all mentioned their perception of gentrification in the city as they recalled the Mission being predominantly people of color and working class in their childhood and have noticed the transition to a whiter more upper-class space as adults. One interesting finding is these cyclists are longtime residents or SF natives. Though they are not identified as a typical gentrifiers, some recognized their contribution to gentrification. Madeline even notes that though she is a San Francisco native "[she sees] it even literally in [herself] now that [she works] as a young urbanite, [she] is essentially a yuppie now that [works] remotely and [has] moved to the Mission." This aligns with the data from the maps the majority of San Francisco is experiencing some level of ongoing gentrification or exclusivity.

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The indicators of gentrification according to community members was based mostly on the demographic shift of their neighbors from people of color to young, white families. This trend is regularly seen with gentrification with revitalization of an urban space and a mass 'return to the

city' (McGovern 2014). JB mentioned he specifically remembers "particularly the Mission and the Sunset being more people of color" and Anna saw that the people taking the bus in Mission Bay tended to be not just whiter but younger and visibly a techie. Another big indicator often mentioned was the addition of commercial development which aligns with the theory of capitalist driven gentrification (Smith 1979). According to Emily there has been an increase in expensive restaurants and stores and these developments are "right next to the projects, so you know that those people who live [there] are probably not going and eating at those restaurants and shopping at those stores." In a residential sense, Claire and Michelle often saw digital locks and the renovation of units. Anna noticed more sale and rent signs and even mentioned her and her housemate's looming eviction. All community members familiar with Chinatown found that it has not faced as severe gentrification and is actively resisting it unlike the surrounding neighborhoods. Claire noticed Chinatown's fight against gentrification through community organization and the existence of SRO buildings. There was an obvious active resistance to gentrification in Chinatown (Naram 2017) which participants saw as a positive because it kept the working class community intact.

Those who did not cycle felt that the reasoning was mainly personal. That they themselves were not skilled enough cyclists and that city cycling was simply too dangerous due to the cars. Non-cyclers felt that infrastructure was prevalent, however, it was often not in their area of work and residence and therefore not a viable option for them. Skill is generally not addressed in much of the literature I was reading. Though, the SFBC does hold events in order to improve people's comfortability with cycling (SFBC 2022). Cyclists, however, felt differently. Though the infrastructure does not fully create a safe environment to bicycle, being comfortable with their

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own bike paths makes this form of transportation to commute more viable. However, straying from their paths makes cycling difficult. To hang out with friends or go to the grocery store, cycling is less preferred. Emily says that "Google Maps is not [her] friend, [she] hasn't found really a good app, or GPS mapping service that is really bike friendly." The city can begin to addressed this issue by improving the fragmented bike network (SFMTA 2019). Topography was also a major barrier not only mentioned by non-cyclists but cyclists as well. Emily and Fei said that they would not characterize San Francisco as "that bikeable" or "a bike town" because of the hills.

Six out of seven participants said that transportation was an important factor in their search for residence. Cyclers needed to be in areas with direct bike lanes for their commute and non-cyclers needed to be near public transit. Parking was not a major factor in any of the participants' decision in finding a home because parking was knowingly scarce, and driving was not the primary commute method for any participants.

Participants often felt that bicycle infrastructure was driven by convenience of topography, but also coincided with new condos and tech jobs. The Bicycle Coalition in San Francisco was also mentioned by many participants as an actor that drives infrastructure. Claire mentions that the SFBC "is very vocal and a pretty active political entity, and [she thinks it] is able to put a lot of pressure on the city and have been able to get a lot of bike lanes put in." The SFBC has been a major actor in increasing bike infrastructure from some of the first lanes in the city (Stehlin 2015). Cycling infrastructure also increased significantly during the pandemic with "the addition of slow streets" and in general "San Francisco has added more bike lanes" according to Emily.

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There has also been a stark increase in electric bicycling in the city which has been a notable change for many participants regarding accessibility to cycling. Michelle, a non-cyclist, attempted biking in the city one time due to the bike share system, and Madeline, an avid cyclist, uses the electric bicycles from time to time for leisure rides.

Though there was no strong identity attached to cyclers, techies and gentrifiers do make up a significant and vocal portion of the bicycling community in San Francisco (Bernstein 2012). There was also recognition that the cycling movement would come from young professionals because of the progressive nature of cycling (Henderson 2013). Emily identified two major identities of cyclists, the enthusiasts and those who do it for commuting purposes. These two identities rule what infrastructure is deemed important. Emily states that an enthusiast "might not care about parking because they are doing a long ride for exercise. They are not going to leave their bike while they go to work." All the participants that are bikers also were observant to the variety of bikes in the city. There were the expensive bikes versus the more regular bikes and each rider rides differently. In this way, there was an equal recognition of the people that are not necessarily attached to any identity and would bike regardless of infrastructure because of necessity. While there was an abundance of techies biking, noted by many of the participants, there is a lot of "regular working-class people of color who bike as well" noted by Fei.

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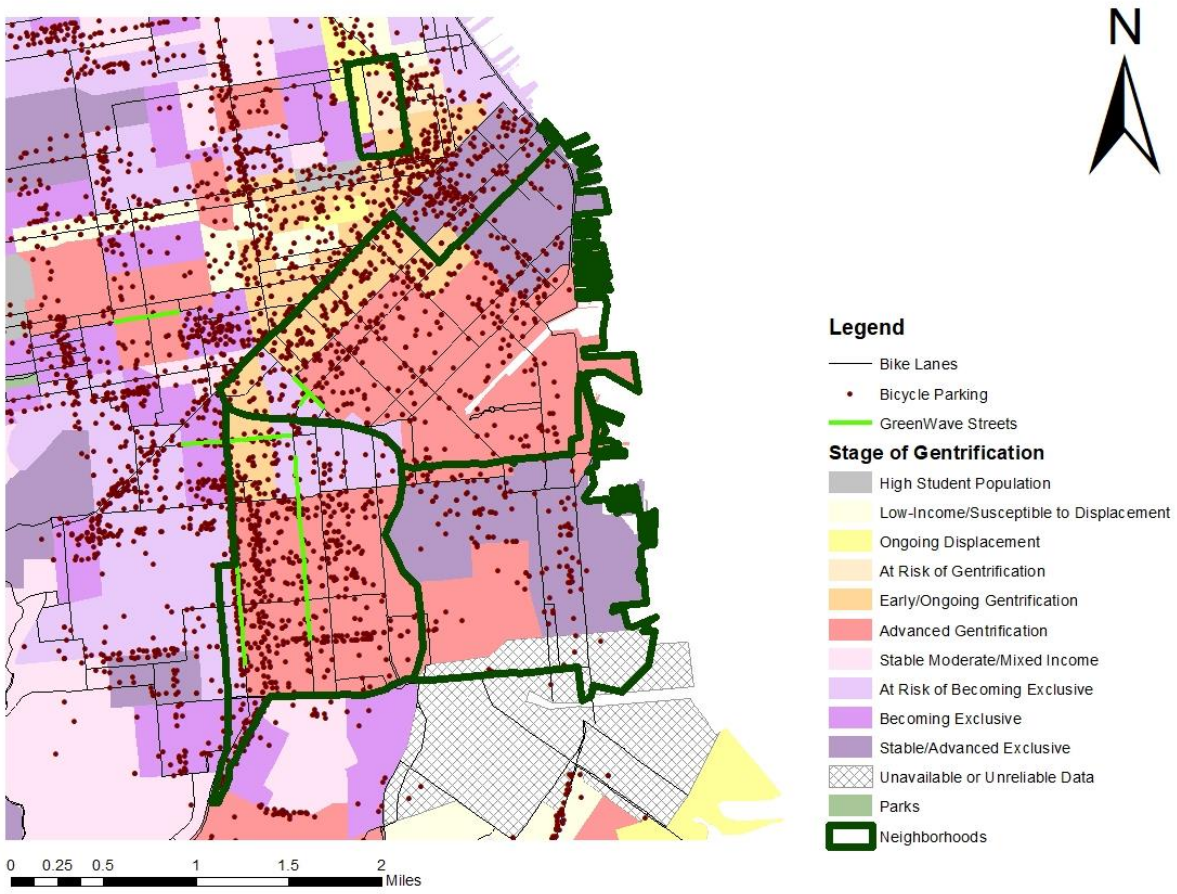

Figure 6. Claire, Michelle, Anna, Fei *work* in Chinatown (northmost 'neighborhood'); Claire *lives* in Potrero Hill (northeast 'neighborhood'); Michelle and Anna *live* in Portola Valley (in between southmost 'neighborhoods').

Claire, Michelle, Anna, and Fei are all non-cyclers that work in Chinatown. Claire has health issues that make cycling quite difficult, so she uses public transport. Michelle, Anna, and Fei felt their skill level with cycling made it a difficult option. Michelle and Fei were particularly wary about street biking and riding alongside cars. They both also mentioned simply enjoying public transport as a method of transportation. Anna did mention that if she were to come to a point where she felt confident biking she would like to. But in her current situation, considering skill

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and location, it is not possible. This is supported by Figure 6 as Portola Valley and Chinatown do not have many bike lanes which would make this route difficult for a skilled cyclist nonetheless someone who may not be comfortable cycling.

Claire has noticed the addition of bike lanes everywhere in the city over the past seven years but less so in her area of residence Potrero Hill and her area of work Chinatown. She attributes this to the hills, that these parts of the city are just not physically cyclable and so it does not make sense for there to be the same infrastructure as in other parts of the city. The inclines also make biking a scarier option for Anna, Michelle, and Fei too. Their personal biking skills and physical capabilities do not match the requirements for city biking combined with such topography. This raises the point of those against increased cycling infrastructure that biking is not inclusive of most people. However, it also shows the necessity of programs that address these concerns of community members for example the adult lessons provided by the SFBC (SFBC 2022).

Fei has a unique perspective because they had to move out of the city to the East Bay. Even though they live farther away now making driving a more serious option, Fei often cannot drive to work because parking is too expensive. However, they live in a location that does have access to public transportation by walking so they prefer this method to anything else. Their walk to and from the BART station is enjoyable for them in that it is relatively flat, and they get to explore their neighborhood. I asked if they would ever consider biking to the BART station at the least, but they felt that it would take away from experiencing their neighborhood.

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Anna has mixed opinions on cycling infrastructure in the city. She grew up in the city and sees that bicycling infrastructure takes away from car parking, which is a necessity for many members of the city, low-income people included. She also feels as though the painted lanes are not safe enough, that the physical barriers would make biking feel like more of an option for her. She felt quite conflicted about the infrastructure in this way saying the solution to this paradox would be “just don’t have a car but also you need a car.” This indicates the negatives about phasing out car friendly infrastructure and implementing bike friendly infrastructure as it causes problems and further congestion when not done smoothly. Because of the limited space and congestion in the city it may seem like there is no option but to phase out one transportation option for another but there may be an alternative solution to this such as integrating dual purpose infrastructure.

This also raises the fact that driving is becoming more expensive and exclusive in the city as well. Fei mentions she cannot commute by driving because of the cost of parking while Anna recognizes the need to drive for many working-class people. This shows that phasing out car infrastructure like parking, whether it is through bike lane infrastructure or increasing the cost of driving, though environmentally conscious contributes to the exclusivity of the city (Checker 2011).

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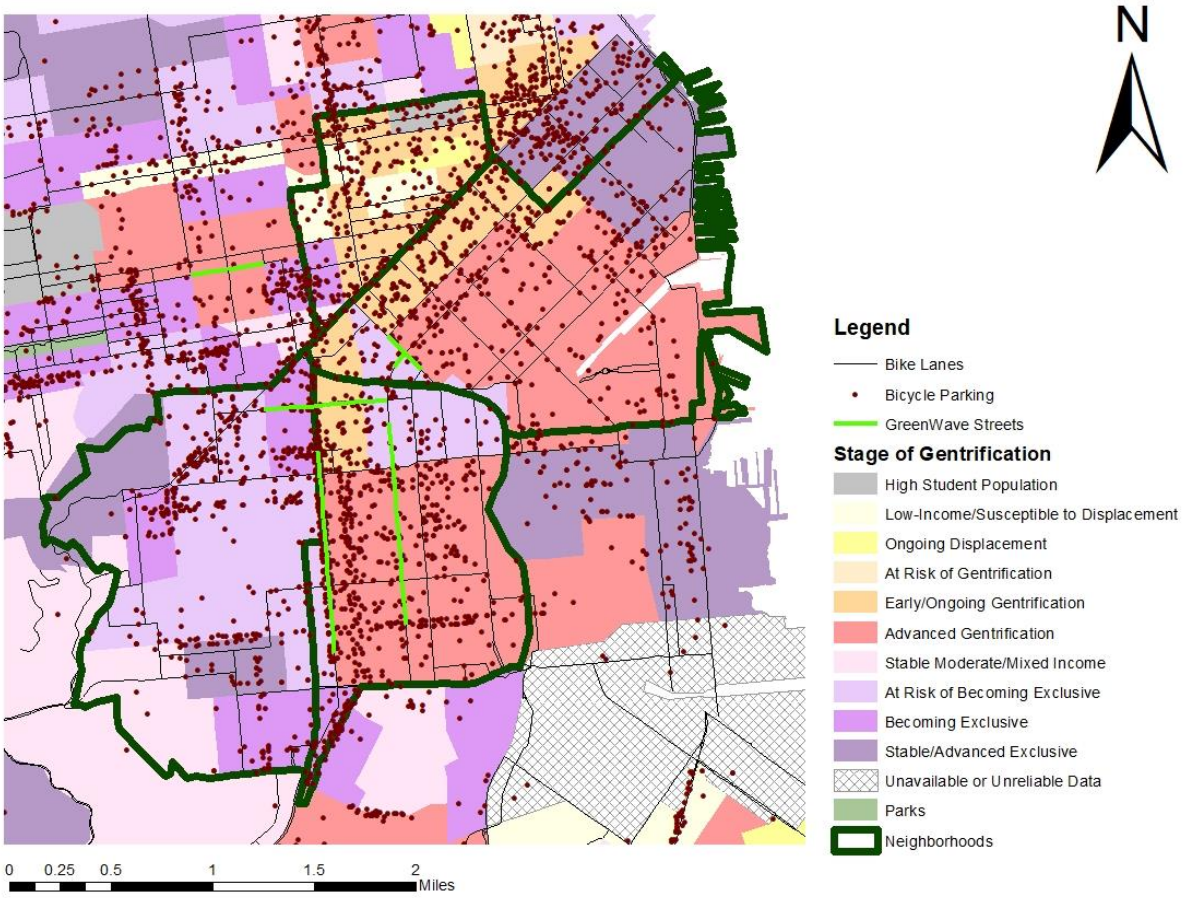

Figure 7. Fei and JB *live* in the Mission (southern central 'neighborhood'); Emily *lives* on the border of the Mission and Noe Valley (southern western 'neighborhood'); JB *works* in Mission Bay (eastmost 'neighborhood'); Emily *works* in the Tenderloin (northeast 'neighborhood')

Fei notes the bike parking structures mentioning the fancier apartments have bike lockups which encourages cycling more. However, in her living situation in the city, she would have to carry her bike up a flight of stairs to bring it in her home to a safe location which makes this option less viable. The Mission does have plenty of bike lanes, GreenWave streets, and slow streets according to JB, Fei, and Emily. These actively gentrifying areas that are now increasing

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sustainable transport amenities such as bicycle infrastructure give context to the notion of environmental gentrification (Checker 2011).

Having access to safe bike routes and even bus lines was very important to JB when considering housing. Especially because San Francisco can be so car centric (Henderson 2013), having a bikeable street like Valencia is very important even if it can be busy and congested. Cars and hills make the biggest barrier to cycling in terms of safety. In this way, JB finds that there is still a way for biking infrastructure to improve.

Emily has gotten into a few accidents on her bike, so she feels that not knowing the bike routes prevents her from riding. She must plan ahead in order to feel safe on her ride. Since things have opened more with the progression of the pandemic, there is more congestion on the road and potential for danger. Bike navigation is difficult even for someone who knows the city well. For Emily, the pandemic made cycling a safer option. There were less cars on the road and the city was implementing more cycling infrastructure as well, including slow streets. She often commuted to work by bicycle because the pandemic made commuting via public transport feel unsafe and she does not have her license to drive herself. Now that things are a bit safer regarding public transport, she has become accustomed to the adrenaline bicycling gives her and the comfort she has found on her bike routes. Emily also commends electric bikes because she feels that though the city is small, public transit is just "not great" and driving is "not nice." Electric bikes fill a niche that is needed for mobility in San Francisco. They entice the urbanist, remove the annoyances of biking (like finding safe parking), and make hills less daunting. However, it's expensive and not widely available yet (SFMTA 2019).

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A major barrier for JB and Emily from using their bikes for leisure riding is the fear of bike theft. Emily knows she can bring her bike inside at work and at home; in any other case, even if there are clear bike lanes and straightforward paths, if there was nowhere that felt safe to park her bike, it was not a viable option. She does not always feel comfortable locking her bike on the street as "most of the people [she knows] … have gotten a bike stolen in the city." She said the SFBC was aware of this issue but there was difficulty knowing how to resolve the problem. JB has had a bike stolen already and with a new bike does not want to risk unsafe bike parking. However, Emily also notes that in certain situations or locations, she knows that "[her] bike is not the most expensive one that's being parked there, which makes [her] feel more comfortable." This is interesting for her to say because it adds context to the fact that there are working class cyclists and there are people that invest a lot into bikes (People for Bikes and Alliance for Biking and Walking 2015). It also reiterates the needs of different cyclists and who is being served with safe parking infrastructure like in luxury apartments.

JB also finds a link between wealthy residents, gentrification, and cycling in the city because "sustainable modes of transport... specifically biking... [is a] financial investment. Also, because "people are being displaced into regions further and further from [transit accessible] ...areas that are now less conducive for other sustainable modes of transportation like biking and cycling."

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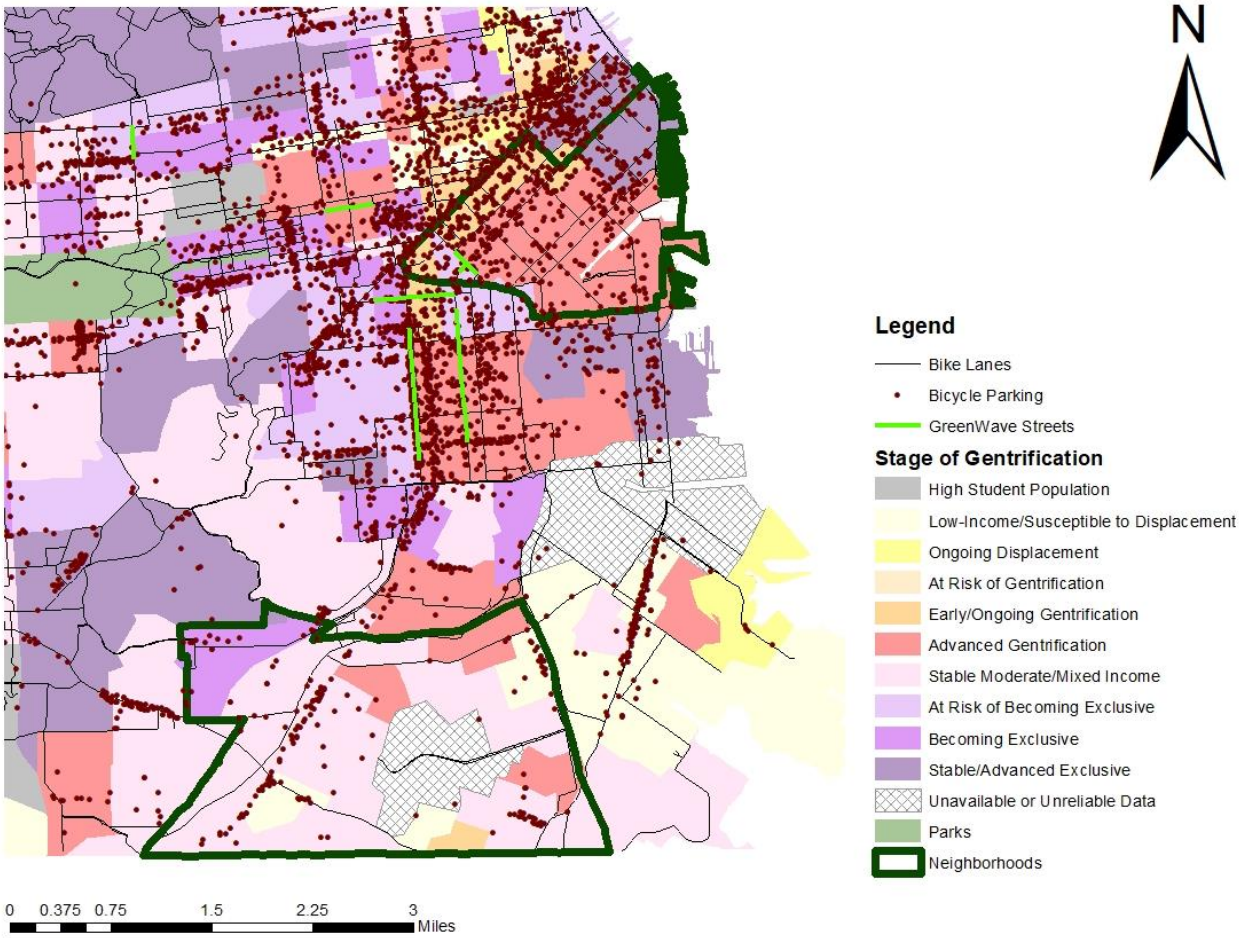

Figure 8. Madeline *lives* in the Outer Mission (southmost 'neighborhood'), Madeline *works* in SoMa (northmost 'neighborhood').

Though Madeline has the longest, distance-wise, commute, she prefers to cycle to work unless she must bring things in that are not possible to carry on a bike. Biking is convenient for her as she has the Wiggle, a span of bike lanes, to get to where her family lives and has only a 15-minute bike ride from her work. On the other hand, driving can be inconvenient as there is only 'two-hour' parking around her workplace. Biking allows her flexibility that a car simply cannot provide. She also just finds that biking is the best way for her to get around as it offers physical exercise and time outside which aligns with the general ideology of the San Franciscan urbanite

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(Henderson 2013). Madeline also finds biking convenient because so many of her friends and the things she would want to do for leisure are in areas accessible by bike lanes. She says, “I think the places that I go, there tend to be relatively good bike infrastructure, because I choose to bike to those places, because that infrastructure is there.” This often makes her feel especially safe on her commute and rides for leisure as well. However, the infrastructure is not always kept up to biking standards. Madeline mentioned riding down Cesar Chavez and the experience being “terrible because you’re just worried about getting glass in your tires the entire time.” This is in the southeast corner of the city which she talks about as being historically underdeveloped and cut off by freeways.

This aligns with the historical neglect and racial segregation Bayview-Hunters Point has faced (Menendian and Gambhir 2018; García-Lamarca and Gray 2021) causing environmental racism to occur (García-Lamarca and Gray 2021). In general, this area does not have great walking, biking, or public transit infrastructure. According to the maps this region is in the low-income/susceptible to displacement stage of gentrification (Map 6). This brought Madeline to mention the inconveniences of cycling in San Francisco saying that places like Chinatown can be difficult because of the cars, hills, and lack of infrastructure. She does mention that the hills can be made a non-issue by electric bikes but as of recent they are too expensive to be considered completely accessible.

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4.2.2 Transport Demand Management

Justin Kran offered the perspective of a planner in the sustainable transport field working for the Transport Demand Management (TDM) program. San Francisco is quickly growing and a large

economic center, therefore focus on alternative transportation amenities in new developments is important for the environment and to reduce current and potential congestion in the city. In Kran's line of work, infrastructure investment is based on a new development's contribution to vehicle miles traveled (VMT) in the city. This requires an assessment of the new developments' number of parking units. Based on a point system, the TDM program will give the development a certain amount by which there must be an implementation of a variety of transportation amenities to reduce VMT by single occupancy vehicles. The transportation amenities are given different points and can be implemented to suit the establishment. For example, an apartment complex will have car shares while an office building will have daycares so that residents do not need to own cars or working parents can cut trips. Among these amenities is bicycle infrastructure which can be as simple as street bicycle parking to a secured bicycle storage, or even bicycle repair stations. Because of the increased interest in bicycling in the city with updated technology such as electric bicycles, Kran's program is currently in the early process of updating the TDM program regarding cycling infrastructure to consider this form of mobility's growing popularity.

4.2.3 Drivers of investment

In San Francisco, zoning code requires some level of bicycle parking to be implemented in every building. To obtain more points toward the TDM program, developers can install above the required minimum. However, Justin recognizes that "some of the bicycle infrastructure is rated a little bit lower" even though "in [the] city bicycles are relatively popular" because studies show that amenities such as transit subsidies and vanpool programs are more successful and therefore

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rated higher. In this sense Kran works a lot with the community to make sure that public interest is considered within transport implementation.

The transit first policy, a moral framework, in San Francisco also helps push through cycling infrastructure. Many streets are being closed off to private automobiles and becoming dedicated cycleways such as portions of Market Street. Since the pandemic there has also been an implementation of slow streets now throughout the city (Figure 9) which constituents are in favor of. So much so that there are plans for more (Figure 9). This is due to 50% of renters in the city being non-car owners and almost 1/3 of households not having a vehicle. This also gives context to almost 4% of the population being cyclists in the city and 16% commute by bike at least twice a week (Kran). Slow streets are also a general reclaim of public space, in residential areas, in the city and function as more than a means to promote alternative transportation (Barnett 2020). Slow streets create a safe space for pedestrian and cyclists which would address major concerns of some of the participants interviewed regarding cars.

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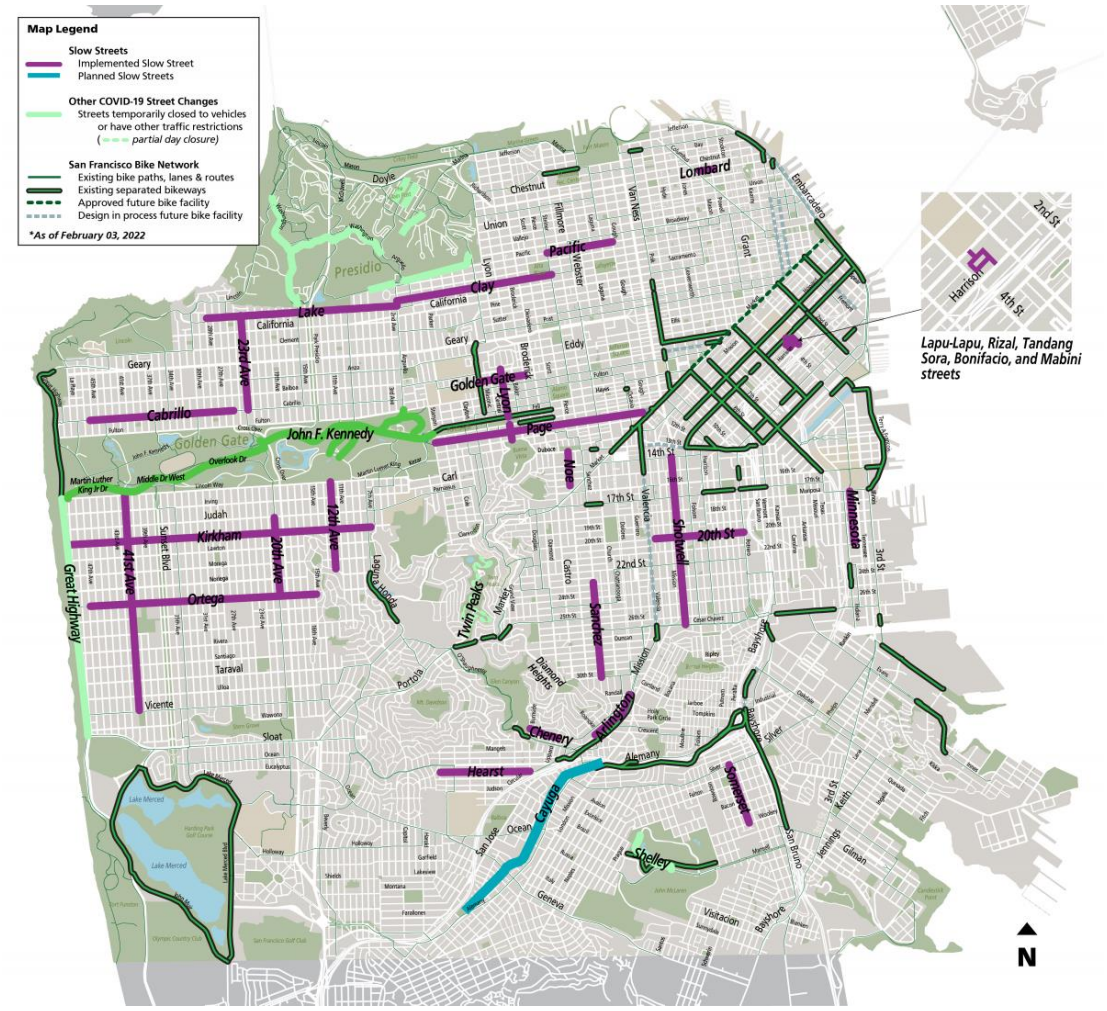

Figure 9| https://www.sfmta.com/sites/default/files/reports-and-documents/2022/05/bikereport2022_final.pdf

Policy that promotes environmentally friendly development also helps the implementation of bicycle infrastructure, for example the California Environmental Quality Act (CEQA). Justin mentioned CEQA a few times because the policy does benefit sustainable infrastructure in California and especially the city where there is a transit first policy.

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4.2.4 Barriers to infrastructure and investment

Bicycle infrastructure is also unique in that there are a lot of variances in the infrastructure itself as well as the organizations involved. Class one bicycle parking is for more permanent users i.e., employees, residents of a building, etc. A minimum number of spaces is required by SFMTA to be provided by new developments and developers can decide to exceed that number to decrease their impact to VMT. Class two bicycle parking is short term, for grocery shopping or going to the gym and is under the Department of Public Works. The variance in oversight, public or private, causes barriers for equal access infrastructure and investment.

The public perception of bicycling is good according to Kran, but there can be pushback to this infrastructure. Small business owners are concerned when parking is taken because they do not see that less parking space does not necessarily mean less business. Topography is also a major barrier to people's attraction to cycling in the city but "technology updates [are] going to improve cycling a lot." This is relevant especially to Kran as the TDM program will be updating their planning code to consider infrastructure for electric bikes. In many cases with transportation, there is a very vocal minority that fails to accept sustainable infrastructure as they feel it infringes on their right to a vehicle itself. This vocal upper class has been seen preventing plenty of equitable, sustainable infrastructure. For example, a street in Golden Gate Park, JFK, was closed off to vehicles, becoming a very contentious decision. Many older affluent residents of the neighboring areas were angry that they lost a road to the pandemic and now permanently. Kran wants to work with the public and support the return of public spaces, but some neighborhood groups often have too much authority in the city.

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Kran mentions the city's heavy immigrant population that is at times disregarded. Many factors play a role in their voices not being heard such as culture, language, and age. There are also traditionally low-income neighborhoods or heavy homeless populations, for example Bayview, Tenderloin, and the Filmore. While there are interest groups and organizations helping these communities, they do not have as much authority in the public realm.

4.2.5 Social dimensions

To Kran "income inequality in the city, just housing affordability and income inequality pretty much trickled down into every aspect of life." The housing crisis in San Francisco "decimated livability in the city." So, while Justin works to improve infrastructure in the city, if it is not an affordable place to be then not everyone is able to benefit. "Filmore and Bayview…the last holdouts of poor, minority neighborhoods, don't really get a lot of attention, they're ignored"

Kran also mentions that many lower-income people live outside of the city and therefore are not necessarily able to benefit from alternative transportation investments. In this way a major barrier to the infrastructure is income or more closely affordability of the city. Even within the city, a lot of poor people live in Bayview which has decreased accessibility to transportation amenities. A lot of people in this community "disproportionately own vehicles when they can't afford them" whereas people in "nicer neighborhoods have better access and more transit options." Kran reflects on this by saying "a lot of times living in America [and] not owning a car by choice is more of a luxury than anything."

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The solution may be to just develop a massive amount of affordable housing units in and around the city (Brahinsky 2014). However, development in San Francisco and California in general is so difficult because of regulations by CEQA. Justin sees many issues with CEQA in that it is easily and oftentimes misused to shutdown good-intended projects. This is seen with the public involvement process by which someone with money at their disposal can hire lawyers to claim CEQA and slow down the process for certain infrastructure. In this sense the environment is politicized and used as a mechanism to de-link sustainability from justice (Checker 2011). Also, affordable housing in San Francisco is often privatized creating a more difficult condition preventing massive amounts of affordable housing because these units are not as profitable than market price (Brahinsky 2014; Smith 1979). With caution, the solution seems clear to Kran, but the implementation of his idea is not so simple.

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5 Discussion

5.1 Physical and Perceived Reality

The maps show that bicycle infrastructure is implemented in actively gentrified tracts but also aligns heavily with simply flatter areas of the city. The maps show that increased cycling infrastructure is occurring at a higher rate in the gentrified or exclusive tracts. Low-income tracts and tracts susceptible or undergoing displacement do not have nearly as much infrastructure and the bike network is more fragmented. According to the maps the residences of some participants are in the hillier areas of San Francisco. This would make utilitarian cycling illogical because it makes cycling difficult for certain legs of their commutes. For example, Michelle and Anna live in a moderately hilly area with fewer bike lanes and parking compared to other interviewees. This coincides with their statements regarding barriers to cycling for them. All the participants that work in Chinatown also must deal with topography not conducive to cycling according to the maps. Chinatown is one of the few neighborhoods that is, according to the stage of gentrification map, low-income/susceptible to displacement, ongoing displacement, and at risk of gentrification. This coincides with Claire's statements when she says, "Chinatown is fighting gentrification." It also gives more context to racial capitalization and the city preventing much gentrification from occurring (Naram 2017). Poor cycling infrastructure in the area is also supported by Madeline's anecdote of how she had biked in Chinatown but was not nearly as comfortable than in other areas she frequents. She mentioned that had there been more lanes and infrastructure as well as other people cycling in the area, she may be more inclined to visit the area with her bike. The lack of bike lanes in the area is most likely because of the topography but other factors can be considered.

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Displacement through gentrification has trickled down into every aspect of San Francisco (NCRC 2020; Chapple, Thomas, and Zuk 2021) which was prevalent in the interviews. Each resident was familiar with the term and concept. Each interviewee also mentioned that their own or a neighborhood they were familiar with was experiencing some form of gentrification which also coincides with the maps. Gentrification is also something Justin Kran, a city planner, is attempting to address. Kran also showed personal concern when he mentions the Plan Bay Area 2050 report. He shows appreciation for the work attempting to be done but notes that such long-term ideas do not reap benefits for current community members. By nature of gentrification, the people who would need the benefits that Plan Bay Area 2050 will bring, may no longer be in the Bay Area to benefit. Kran also shows concern in that affordable housing in the city and the greater Bay Area cannot be made fast enough due to development barriers including CEQA. In this sense the natural bridge to desegregate by class and allow people of all income levels to benefit from increased the livability in the city is improve mobility for low-income residents in San Francisco and around the Bay Area (Henderson 2013). This should be especially the case for sustainable development in the city as it is a focal point for improvement in the Plan Bay Area 2050 report. However, an unintended consequence of sustainable development contributes to gentrification and displacement in the city, creating a paradox. We see this with cycling as it is meant to increase mobility in the city in a accessible and inexpensive way but it is not necessarily the case.

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Cars are the biggest factor that makes cyclists feel unsafe and has turned participants away from bicycling. Ideally avoiding cars completely would make cycling a more viable option. The solution to this would be to increase the infrastructure of alternative transportation methods so

that single occupancy vehicles are not more convenient (Cervero and Landis 1992). More options would equate to less cars in the city as people would choose alternative methods of mobility. Driving in the city is already difficult which many participants expressed in the scarce and expensive parking, traffic, and general congestion. Emily spoke about how she does not have a license because it is simply not necessary for her needs in the city and not a requirement for San Francisco unlike many other major cities in the US It feels very natural that San Francisco could be more car-free though it is still so car-centric. The slow streets program is a perfect example of how the city has addressed the fear of riding alongside cars. Emily mentioned that since the pandemic and the addition of slow streets, cycling was a more comfortable option for her. More slow streets would most likely cause ridership to increase in the city as this infrastructure limits traffic in some corridors and creates a safe space for pedestrians and cyclists (Barnett 2020). However, because of the historic and current displacement (Checker 2011; Chapple, Thomas, and Zuk 2021), less cars must be paired with more sustainable infrastructure everywhere (People for Bikes and Alliance for Biking and Walking 2015). That is, residents of the places where low-income communities have been displaced should not lose mobility and access to the city but unfortunately this is a natural pattern of sustainable development and the anti-car movement. When parking and streets are closed off to single occupancy vehicles, equal, equitable, and accessible infrastructure must be added to serve all communities especially currently underserved demographics.

The maps showed that bicycle infrastructure is implemented in actively gentrified places which aligns with Fei's statement that "bougee" apartments have locations to lock up bikes. It also aligns with Kran's work regarding new developments requirement to implement alternative

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transport infrastructure and a minimum amount of bicycle parking. Also, these developments are often inaccessible and do not have a fair number of affordable units furthering the disparity of mobility. Kran mentions how many units will be renovated by a private company that is required to implement affordable housing, but they will often only add a few affordable units while an extreme amount is still at market rate. This also plays into the issues with corporate or privatized driven gentrification versus state driven gentrification (People for Bikes and Alliance for Biking and Walking 2015).

Another barrier in the implementation of bicycle infrastructure is the fear from small businesses that less single occupancy vehicle occupancy spaces will equate to less business mentioned by some of the community members and Kran. This is a contradiction to the historical drivers of cycling infrastructure, like in the Mission, when lanes were put in business boomed (Henderson 2013; Stehlin 2015).

Another important feature to note is regarding GreenWave streets which are often implemented after bike lanes are deemed successful and are an improvement to current infrastructure. GreenWave streets make biking safer and more convenient. This infrastructure is mostly in gentrified areas which follows the trend that implies that lanes in gentrified locations have done well and therefore are invested in and improved. A feature like GreenWave streets are the slow streets which began to be heavily implemented during the pandemic. Similarly, slow streets make bicycling safer as they are areas with no single occupancy vehicles. These improvements require investment which aligns with revitalization of urban spaces contributing to gentrification and vice versa (Checker 2011; Stehlin 2015).

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5.2 Social implications

Sustainable development must reflect the needs of all members of a city's demographics. Sustainability should not be inherently elitist especially because low-income people are often forced into a more sustainable lifestyle while privileged populations choose it (Checker 2011). Kran supports this by saying that "a lot of the times living in America, not owning a car by choice is more of a luxury than anything" and that "a lot of poor people in certain neighborhoods, like Bayview, San Francisco, … their access to transportation amenities [is not] as good." He goes on to say that people "who are able to live in nicer neighborhoods and have better access, there's more dedicated bike lanes that are safer, there's more transit options." This is also reflected by Madeline's anecdote of the bike lanes on Cesar Chavez, which is near Bayview, and how it often has glass on it, making it unsafe to bike. Even if there is bike infrastructure in these areas it is not maintained in the same way as in more central locations of the city. Biking and gentrification reflect this when low-income people are displaced to locations that do not have the same opportunities as urban centers. Therefore, after enjoying a centralized lifestyle which leads to a more sustainable lifestyle, low-income communities are forced to relocate and use a less sustainable form of transportation, oftentimes a car, and do not have access to sustainable amenities. This is supplemented by an increasingly exclusive urban center becoming more environmentally friendly by implementing infrastructure that only promotes alternative methods to single occupancy vehicles for now wealthier neighborhoods.

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5.3 Why long-term initiatives fail to address community needs

The Plan Bay Area 2050 does seek to address some of these concerns raised by community members such as the lack of affordable housing and increasing alternative transportation options and scope. This includes more cycling infrastructure and improvements to existing infrastructure to make biking a safer option for a wider range of residents. However, according to Kran, some of these things are not happening fast enough to make a meaningful difference. A lot can happen in a decade and relevant changes need to occur quicker to address the harmful effects of gentrification.

The important thing to note is that sustainable development and infrastructure that promotes alternatives to single-occupancy vehicles is generally positive. However, we are seeing a pattern of further marginalization of underserved communities; the same trend occurs with grocery stores, schools, etc (Trounstine 2018). The revitalization of urban areas often leaves low-income communities fragmented and underserved. Mobility is an amazing opportunity to reform these fragmented networks and reintroduce displaced people to their communities. Yet this is often not the case.

At the rate gentrification is occurring in the city, a lot can happen before policy is implemented (McGovern 2014) to address the issues marginalizing these communities. Kran draws attention to this sentiment and raises the point that sustainable development is good. The city is taking steps to become more environmentally conscious which aligns with the progressive nature of its residents (Henderson 2013). However, this must be supplemented by equitable sustainability which can be addressed by increased affordable housing units. The negative pattern is also

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amplified by the privatization of affordable housing (Smith 1979) and can be broken by relying on increased public funded development. Increasing transportation infrastructure and having it implemented everywhere throughout the city is also important in addressing the fragmented networks of mobility especially with cycling infrastructure (People for Bikes and Alliance for Biking and Walking 2015).

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6 Conclusion

As San Francisco considers expanding its sustainable transportation infrastructure, my research contributes to the equitable implementation by analyzing bicycle infrastructure in the city. San Francisco is an interesting case because it is undergoing rapid gentrification and has a rich multiethnic and cultural history. People should always be considered when it comes to mobility especially when there is a history of racism in transportation and sustainable development in the US. Furthermore, because urban revitalization contributes to gentrification and displacement, increasing San Francisco's livability must consider the communities it will threaten.

Sustainable transportation and encouraging alternatives to single occupancy vehicles are critical to environmental consciousness and the city's ecological footprint. According to the literature, there is a link between sustainable transportation, specifically bicycle infrastructure, and gentrification. This link is also made harsher as a result of capital investment which contributes to further displacement.

I conducted semi-structured interviews with San Francisco residents to learn about their commutes and access to cycling infrastructure, as well as their personal experiences with gentrification in their neighborhoods. I supplemented the participants' experiences with geospatial visualization, using maps created by ArcGIS with information from the U.S. Census, SF government database, and the Urban Displacement Project. In addition, I interviewed a San Francisco city planner specializing in transportation management, who provided a unique and informed perspective on bicycle infrastructure and gentrification in the city.

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The data and my findings show that the city has undergone drastic changes that have increased its livability, but who can live in San Francisco has also changed. This creates a barrier of access to sustainable infrastructure and amenities in the city such as bicycle infrastructure. I also discovered that some community members are uneasy about cycling because of the current level of infrastructure and congestion with cars and pedestrians. Even the cyclists have stated that, while their bike routes for their commutes are good, there is much that could be done to improve their experiences. This demonstrates the need for more bicycle infrastructure and that bicycling can be a viable method of utilitarian transport in the city. However, because every participant mentioned gentrification or the threat of it in either their home or work neighborhood, it is critical that the city address displacement as it continues to build infrastructure.

Long-term solutions, such as the Plan Bay Area 2050 report, which addresses some of the negative effects of gentrification may not be implemented quickly enough to avoid inevitable displacement of low-income communities. More needs to be done, such as developing public affordable housing with access to sustainable transport. This will ensure that low-income communities can afford to live in the city and that they are well integrated in the city by their access to mobility. For San Francisco to phase in more sustainable transportation alternatives, the city must consider the implications when removing a form of mobility, even single occupancy vehicles.

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