Bike and Pedestrian Safety Planning: Excelsior/Outer Mission District

A Senior Project

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Bachelor of Science

By

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Table of Contents

List of Figures

List of Tables

Executive Summary

San Francisco's Outer Mission and Excelsior districts host a vibrant community of small business owners and residents from a variety of backgrounds and cultures. The neighborhood is known for its diversity and sense of community. However, lack of adequate infrastructure and high-speed roadways has created great safety concerns within the community. In the last five years, the Excelsior/Outer Mission area had 828 collisions, nine of which were fatal (Transbase, n.d.). San Francisco Municipal Transportation Agency (SFMTA) has identified nearly 14 miles of streets in the project area that are on the City's high injury network, meaning collisions there are highly concentrated (Vision Zero, 2020).

These high numbers illustrate the need for better street design to protect the lives of pedestrians and bicyclists in the area. This project addresses these concerns and investigates how to create a street system that allows all modes of transportation to travel safely. This guide recommends safety improvements for the wide variety of street types within the project area with the goal of increasing walking and biking throughout the area.

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01. Background

1.1 Background

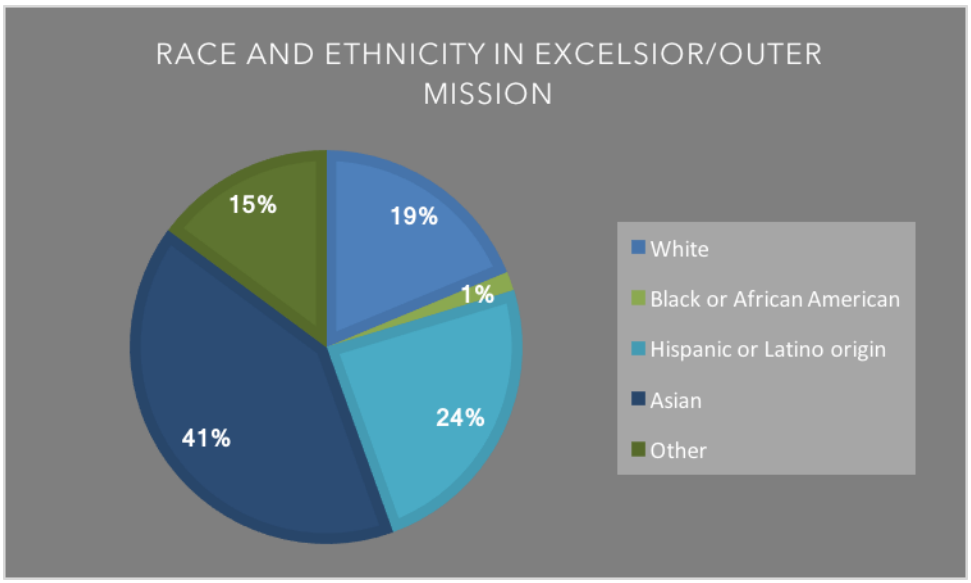
Demographics

The Outer Mission and Excelsior is an extremely diverse community of residents and business owners. In a survey by the San Francisco Planning Department, community members said "race, class, and gender diversity" are what make this place special (SF Planning, 2017). Diversity and culture ranked first and third respectively as the top assets of the area in the survey. Known as a majority minority community, the population comprises of mostly minority racial groups. 51% of the area's 63,896 residents identify as Asian, and 31% are of Hispanic or Latino origin (U.S. Census Bureau, 2017). Compared to San Francisco, which is 47% white, only 24% of the population within the Excelsior/Outer Mission area identifies as white. Additionally, 71% of the area's population speaks a language other than English at home, whereas only 44% of the entire population of San Francisco speaks a language other than English at home (U.S. Census Bureau, 2017).

While this diversity leads to an incredibly strong and lively community, the plurality of the Excelsior/Outer Mission district population creates barriers to involvement in City processes. For example, community members may be unable to participate in community outreach events if there are not language options that are available to them. Currently, 37.5%

of community members speak English "less than very well," meaning community outreach events or planning information is likely not accessible for over a third of the population (U.S. Census Bureau, 2017). Furthermore, 16% of the population in the area does not have citizenship status in the U.S. and may be hesitant to participate in government processes (U.S. Census Bureau, 2017).

Figure 1.1: Race and Ethnicity: Excelsior & Outer Mission Area



(U.S CENSUS BUREAU, 2017)

Equity

In addition to being a majority minority community, the population comprises of largely working-class families. Only 28% of the area's population over 25 achieved a bachelor's degree or higher, compared to 56% of the City's 25 and over population (U.S. Census Bureau, 2017). The Center for Poverty Research at University of California, Davis reports that lower education levels are highly correlated with a higher risk of poverty. In the United States, the

rate of poverty for those who held a college degree in 2010 was 5%, while the rate of poverty for those who did not attend college was 15% (DeNavas-Walt and Proctor, 2014). Within the Excelsior/Outer Mission district, 7.9% of the population is 100% below the United States poverty line. This is compared to 6.4% of the general San Francisco population (U.S. Census Bureau, 2017).

However, adjusting for the exorbitantly high living expenses in San Francisco may have some effect on the determined poverty line. Perhaps more telling is the area's median household income level compared to the City overall. Contrasting with the City's median household income of $136,788, the median household income within the Excelsior/Outer Mission is only $79,375 (U.S. Census Bureau, 2017) (OPD&R, 2019). The Department of Housing and Urban Development determined that in 2019 "low income" families in San Francisco are those that make less than $129,150 a year, and those making under $80,600 are considered to be "very low income" (HUD exchange, 2019). Under these standards, most of the households within the project area are considered very low income.

Just as demographics can affect how involved the City is in solving safety issues within a community, wealth can also play a big part in how the City addresses safety concerns in an area. Unfortunately, less affluent areas historically receive less attention than their wealthier counterparts (Leahy, A & Takesian, Y., n.d.).

RESIDENTS WAITING FOR THE BUS (ROBIN - BUSINESS INSIDER, 2017)

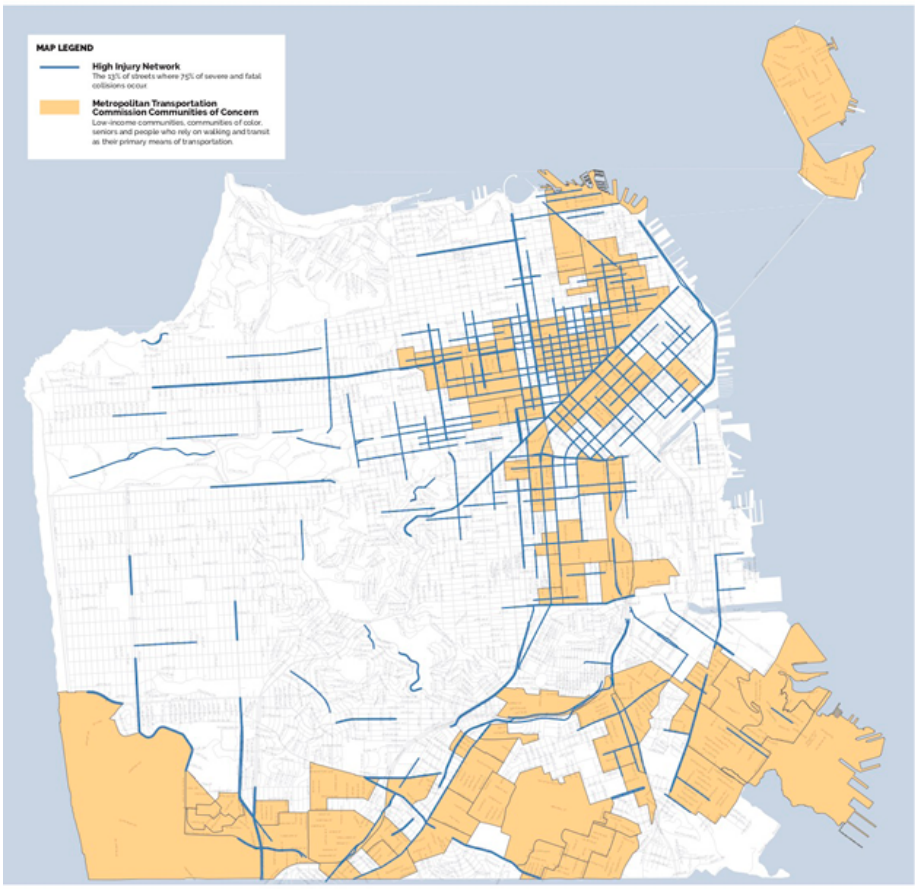
Implications for Safety

People of color and low-income families are disproportionally affected by traffic collisions. In areas where High Injury Networks (HIN) have been identified, large portions of the network lay in Communities of Concern, or disadvantaged and vulnerable communities (SFCTA, 2017) (Ferrier, 2018). In San Francisco, 51% of the HIN is located within Communities of Concern. Similarly, Sacramento reports 35% of its HIN is in Communities of Concern, and Denver calculated 44% of pedestrian deaths occur in Communities of Concern (Ferrier, 2018). These figures point to a major trend of high collision rates in vulnerable communities.

There are likely many reasons why collisions disproportionately affect Communities of Concern. Less wealthy, lower educated, and more diverse populations like these may not have

the political and social power often granted to wealthier neighborhoods to motivate necessary infrastructure and safety improvements. They are also historically denied the same services and support as their wealthier counterparts (Leahy, A & Takesian, Y., n.d.). Infrastructure improvements and the built environment are often overlooked in poorer neighborhoods while social issues are over-policed and highly scrutinized, especially when the population in the poorer neighborhoods is mostly composed of people of color (Shelton, 2018). Additionally, language and cultural barriers may lower a person's likelihood of participating in the planning process and advocating for needed improvements. People who do not have legal citizenship or are not comfortable speaking English may be deterred from reporting collisions that they are involved in. This lack of reporting can downplay the severity of the safety concerns in the area, thus dis-incentivizing City involvement and worsening safety conditions.

Figure 1.2: High Injury Network and Communities of Concern



(VISION ZERO, 2020)

1.2 Existing conditions

Neighborhood conditions

To combat disenfranchisement in the City, the San Francisco Planning department recently launched a new initiative called "Invest in Neighborhoods" (SF Planning, 2017). As part of the neighborhood strategy for the Excelsior and Outer Mission districts, the Planning department conducted a series of outreach events to better understand the community's

vision for and perceived challenges within the neighborhood.

The results paint a picture of a vibrant community that has not received the necessary attention of lawmakers and planners. The biggest identified challenges are the poor sidewalk conditions and the litter in public spaces. When asked to rank and prioritize improvements, cleanliness, described as "cleaner streets & sidewalks, without litter and debris; even and smooth sidewalks and roads", was continuously chosen as the element that would best improve the street experience. On large maps, as shown in figure 1.3, community members pointed out several areas within the community where illegal dumping was prominent and called for illegal dumping enforcement and more garbage cans (SF Planning, 2017). Walk through assessments show that sidewalks are cracked and in need of repairs and crosswalks at highly trafficked intersections are faded or low visibility. Poor sidewalk conditions can put pedestrians in unsafe situations, such as forcing them to step out into streets against oncoming traffic. Cracked or uneven sidewalks can also pose risks to less able-bodied people who may face more difficulty maneuvering such surfaces. In general, poor sidewalk conditions and the presence of litter discourage people from walking (Sallis, Millstein, & Carlson, 2011). This can make those who do choose to walk more vulnerable, as pedestrian traffic levels are positively correlated with pedestrian safety (Litman, 2019).

Figure 1.3: Challenges Identified by Outreach Participants

(SF PLANNING, 2017)

Aside from cleanliness, outreach participants also stressed a need for better pedestrian and bike infrastructure and street beautification. They asked for safer crosswalks and bike lanes as well as more trees along major corridors. San Francisco Planning reported that "community members emphasized the need for safe bike paths and parking." (SF Planning, 2017). These requests are consistent with the state of street conditions in the Excelsior/Outer Mission district. There is a lack of adequate bike infrastructure which forces bicyclists to either bike on the sidewalk, putting pedestrians at risk, or bike alongside cars putting themselves at risk. Assessments from SFMTA show that on major streets in the Excelsior/Outer Mission neighborhood (where speed limits are 25 or 35 mph), vehicles reach speeds up to 45 mph

(SFMTA; 2013, 2016, & 2019). On a shared roadway where vehicles move at such high speeds, bicyclists often feel uncomfortable and at risk (NACTO, 2017). Similarly, safer crosswalks delineate spaces for pedestrians to safely cross busy intersections. Well-marked crosswalks increase vehicle yield rates and can help to reduce pedestrian and vehicle collisions at intersections (FHWA, 2005). Site assessments show that there are many crosswalks in the neighborhood that are unmarked or low visibility, thus spurring the request for safer crosswalks.

LOW VISIBILITY CROSSWALKS IN THE EXCELSIOR/OUTER MISSION (CARLSSON - FOUND SF, 2014)

Community members also called for streetscape improvements. Though participants clarified that "streetscape improvements should depend on the design aesthetic [and] must

accurately reflect diversity of community'" (SF Planning, 2017). In fact, streetscape improvements, which were defined as "well-designed and maintained streetscapes that improve walking and biking experiences, balance the needs of different users, and create more enjoyable and visually pleasing streets" ranked high out of 16 choices (SF Planning, 2017). The outreach reflects the community's need for friendlier, safer, and more comfortable streets that suit all modes of transportation. Sidewalks with more street furniture and vegetation encourage people to walk and bike and can increase comfort when doing so.

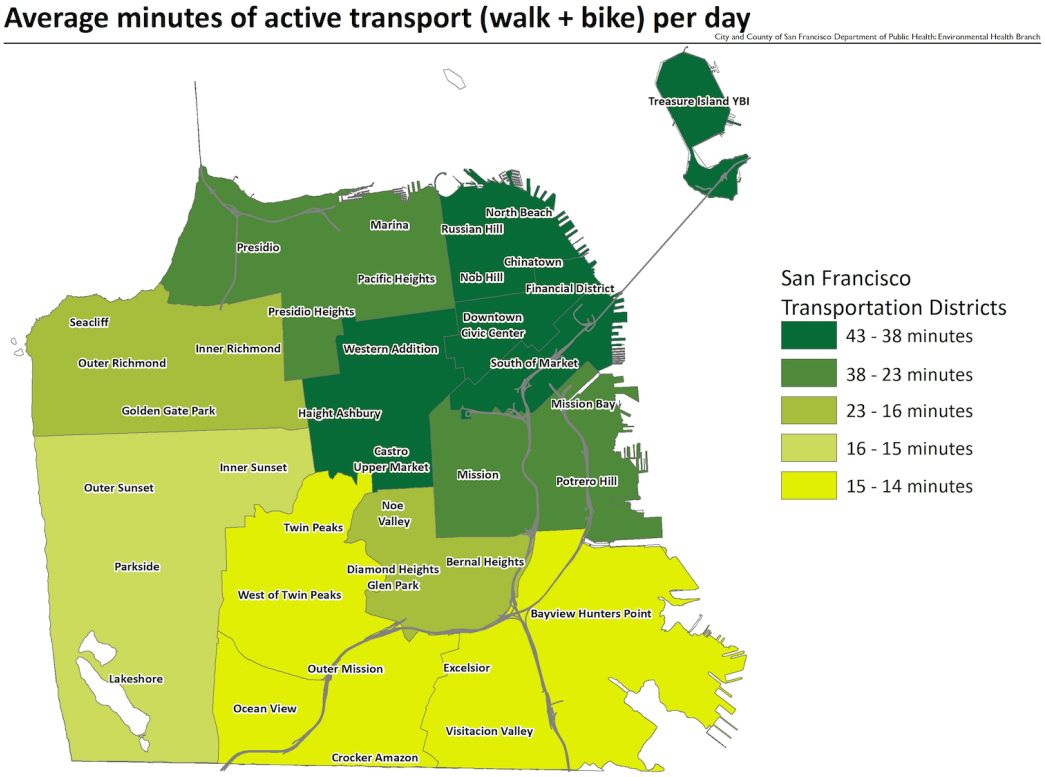
Current levels of active transportation

Fewer people in the Excelsior/Outer Mission District walk to work than within San Francisco overall. In 2017, the percentage of residents who walked to work was 2% within the site but 11% for the entire City (U.S. Census Bureau, 2017). This difference could be because of the poor walking conditions and safety hazards discussed in the previous section (Sallis, Millstein, & Carlson, 2011). There are also land use barriers that make walking to work more difficult within the area. The Excelsior/Outer Mission district is largely separated from the major job centers in San Francisco, which makes walking an inconvenient option for most commuters. Additionally, this number only counts work commute trips, which make up 5% of all walking trips according to the U.S National Household Travel Survey (Litman, 2019). Walking is more common in trips for other purposes rather than work commute. The same survey revealed that 31% of all trips that were less than a mile involved walking, and walking made up 10% of all personal trips, and about half of all recreational trips (Litman, 2019).

Furthermore, walking is often the preferred first and last mile option that people within the area use to get to and from the bus or train stop (Chidambara, 2019). A large portion of residents (34%) in the area take public transportation to work (U.S. Census Bureau, 2017). There are a host of transit options in the neighborhood including San Francisco Muni buses, Muni trains, and BART (SFMTA a, 2020). These public transportation options provide an easy and affordable way to travel to the major job hubs in San Francisco and the greater Bay Area. The use of public transportation proves that walking is a common mode of transportation within the community.

Walking and adequate walking infrastructure are especially essential to those who do not own a car. In 2016, 30% of households in San Francisco did not own a car (Maciag, 2017). However, lack of car ownership disproportionately affects low income household because they may have more difficulty affording a car. In the country as a whole, low income households are almost nine times as likely to not own a car, and households that rent their home are six times more likely to not own a vehicle (Bureau of Transportation Statistics, 2017). The average household in the Excelsior/Outer Mission area is low income and 36% of the population rents, therefore car ownership is likely much lower compared to wealthier areas. Safety and infrastructure improvements are even more necessary for these populations where walking may be their only transportation option.

Figure 1.4: Minutes of Active Transportation by District



(SF DEPARTMENT OF PUBLIC HEALTH, N.D.)

City's initiative

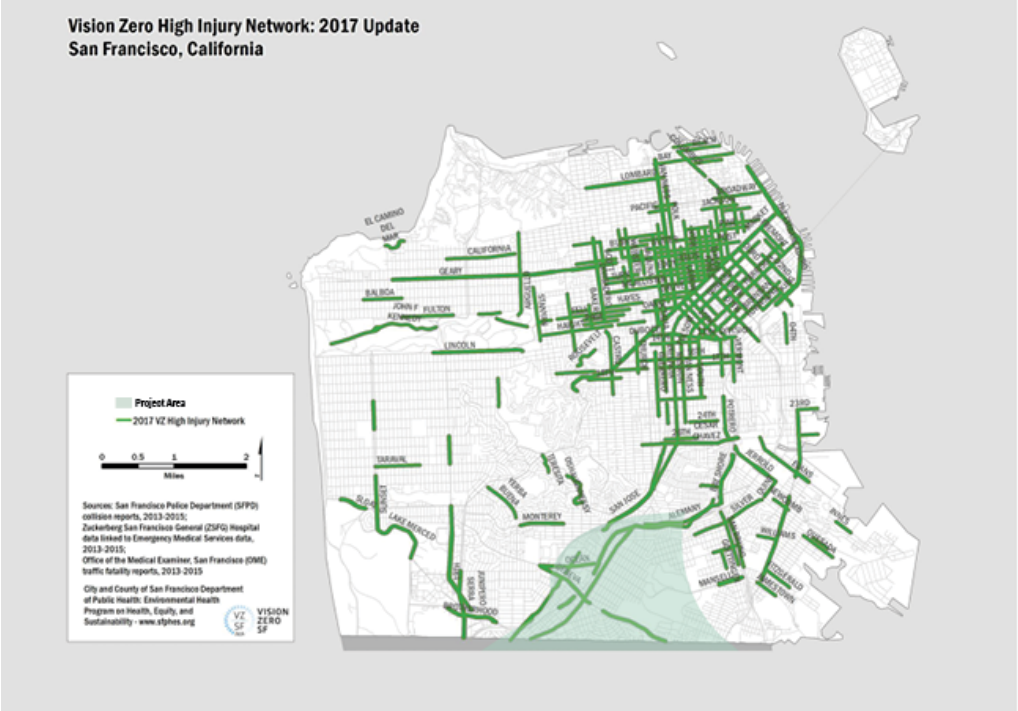
To further encourage active transportation within the community and increase pedestrian and bicycle safety, the San Francisco Municipal Transportation Agency (SFMTA) is working on a series of projects in the area. Currently underway are three separate projects on Mission, Alemany, and Geneva streets that when implemented, can help to improve pedestrian and bicycle safety (SFMTA, 2020). As part of the City's Vision Zero initiative, the projects involve simple street improvements such as painted safety zones, continental crosswalks, and speed bumps that quickly solve safety problems in the short term (SFMTA b,

2019). Also, in the works is a neighborhood traffic calming project to reduce vehicle speeds and lower collision rates within the Excelsior/Outer Mission area (Carr, 2020).

Safety conditions

The existing SFMTA projects within the Excelsior/Outer Mission area are part of a larger effort to reduce collisions in San Francisco. Coined Vision Zero, the initiative is a collaborative citywide effort to reduce collisions in San Francisco with the aim of zero fatalities by 2024 (Vision Zero SF, 2020). This is in response to the record high levels of collisions within the City which rose to just over 3 thousand collisions and 23 fatalities in 2018 (Transbase, n.d.). Committed to creating a safer city, San Francisco adopted the first Vision Zero Action Strategy in 2014, which is updated every year with the goal of "creating a culture that prioritizes traffic safety" leading to a safer and more livable city (Vision Zero SF, 2020). As part of the strategy, City agencies map collision data and identify a "High Injury Network" showing the streets where collisions are most concentrated. In 2017, the High Injury Network (HIN) revealed that 75% of all collisions in San Francisco were happening on only 13% all streets. 51% of these HIN corridors were in Communities of Concern, which includes the Excelsior/Outer Mission area (Ferrier, 2018). All three of the main corridors as well as several smaller streets in the Excelsior/Outer Mission area are also part of the High Injury Network.

Figure 1.5: High Injury Network and Project Area



(SFMTA, 2017)

In general, collisions in this neighborhood are high on and off HIN streets. In the past five years (from 2014 to 2018), 828 collisions occurred in the Excelsior/Outer Mission area, making up 5% of all collisions in San Francisco (Transbase, n.d.). Of these more than 800 collisions, 56 were severe and nine were fatal. These nine fatalities make up nearly 11% of all of San Francisco's collision related fatalities (Transbase, n.d.).

A large portion of all collisions in the Excelsior/Outer Mission occurred on Geneva St., Mission St., and Alemany Blvd., all three of which are part of the HIN. Of the reported collisions on these streets, 31% (143) involved a bicyclist or pedestrian. Bicyclists and pedestrians were the victims of all traffic related fatalities (Transbase, n.d.). Moreover, records show that the large majority (76%) of collisions on these corridors occur at intersections where the most

common causes of most collisions are drivers proceeding straight (53%) or turning left (18%). This speaks to the dangers that pedestrians and bicyclists face when traveling through this neighborhood and navigating intersections and indicates a need for greater safety improvements.

1.3 Project need

High collision numbers combined with the poor walking conditions demonstrate the need for better street design. Despite the City's Vision Zero message that "even one loss of life on our roads is still one too many," there have been numerous collision related fatalities in the Excelsior/Outer Mission and very few safety improvements (Vision Zero SF, 2020).

The City's Vision Zero effort is aimed at identifying and prioritizing areas in San Francisco that are most affected by collisions. Streets with the highest concentrations of collisions are added to the City's High Injury Network (HIN). These streets are only 13% of the City's street network but account for 75% of all collisions citywide and are the City's top priority locations for street improvements (Vision Zero SF, 2020). The four major corridors in the Excelsior/Outer Mission district as well as some arterial streets in the area are on the HIN as shown in figure 1.6. The high concentration of high injury network streets in the Excelsior/Outer Mission illustrate the need for better and safer street improvements.

Figure 1.6: High Injury Network and Collision Heat Map in Excelsior/Outer Mission

(TRANSBASE, N.D.)

Other major cities are facing similar problems on their streets. In New York City, the Department of Transportation (DOT) added pedestrian crossing improvements and left turn visibility measures to decrease collisions at highly trafficked intersection in Brooklyn. The intersection, at the corner of Kossuth Pl. and Broadway St., was the location of eleven pedestrian or bicycle related collisions from 2013 to 2017 (NYCDOT, 2020). The Excelsior/Outer Mission has many intersections with similar collisions and collision rates. For example, the intersection of Mission and Geneva which has a comparable lane and intersection configuration, had eighteen pedestrian and bicycle collisions in the past four years (2014-2018) (Transbase, n.d.). New York City DOT's actions at similar streets in New York support a need for improvements in the areas of the Excelsior/Outer Mission that have corresponding collision levels.

In Seattle, the Department of Transportation implemented several corridor-wide safety

projects on streets with the highest numbers of collisions. These corridors had estimates of collision numbers ranging from 200 to 300 collisions since 2012 (SDOT, 2015). In the Excelsior/ Outer Mission, all major corridors have collision numbers within this range, justifying a need for major street safety improvements.

Though both examples are from different cities with differing conditions, these case studies reveal an overarching pattern in transportation planning throughout the country. As collision rates continue to worsen, local government agencies have been taking drastic steps, often under Vision Zero, to improve safety conditions on streets for pedestrians and bicyclists. The projects discussed here have several similarities to the conditions in the Excelsior/Outer Mission illustrating a need for comparable treatments in the study area.

1.4 Project significance

The goal of this project is to increase levels of active transportation such as walking and biking in San Francisco, but for citizens to do so safely. By removing various safety problems within the area, people are more likely to walk and bike. This is important because active transportation has numerous health, environmental, economic, and social benefits for the community.

Regarding health, walking and biking help achieve the recommended 30 minutes of moderate physical activity a day. In a study comparing 300,000 commuters, researchers found that 50% of people who walk to work and 90% of people who bike to work meet the recommended daily physical activity requirements (Celis-Morales, 2017). This physical activity, in turn, reduces the risk of heart problems, diabetes, obesity, dementia, colon cancer, anxiety,

and depression regardless of the intensity of exercise (Harvard Health Publishing, 2018). In fact, just 20-30 minutes of walking or biking can reduce the risk of heart failure by 21% for men and 29% for women, and lower the risks of lung, breast, and colon cancer by a minimum of 20% (DMC City Loop, 2017).

Figure 1.7: Health Benefits of Walking and Biking

(Alta Planning and Design, 2017)

Active transportation also has various mental health benefits. Health economists found a positive correlation between time spent walking and biking and improved mental health (Martin et al, 2014). Studies also show higher levels of mental wellbeing for those who travel actively and find significant improvements in mental wellbeing for those who switch to active transportation modes. Active transportation can also reduce the risks of age-related mental

health issues such as dementia and cognitive decline (Litman, 2019).

Increased levels of active transportation can even improve the mental health of those driving. As more people shift to walking and biking, less people are getting in their cars thus reducing overall vehicle miles traveled (VMT). This, in turn, reduces congestion and lowers time spent in the car (Litman, 2019). Since time spent in the car is negatively correlated with mental health, active transportation can indirectly increase the mental health of those still driving (Litman, 2019). In the same health economics study referenced above, reports of "being constantly under strain or unable to concentrate" were 13% higher for those who drove to work compared to those who traveled actively (Martin et al, 2014). By reducing congestion and thus time spent in the car, active transportation can have resounding mental health benefits for those still driving.

Decreased VMT positively affects many other aspects of the community as well. One such area is pedestrian and bicycle safety. Best summarized in the popular advocacy phrase, "safety in numbers," active transportation safety increases as the number of pedestrians and bicyclists increase. For one, as more people walk and bike, drivers become more aware and more cautious (Litman, 2019). Second, just as better infrastructure encourages walking and biking, more walkers and bikers inspire community investment in better and safer infrastructure (Litman, 2019).

Fewer VMT also helps the environment. Vehicles pollute immensely and contribute to poor air quality and greenhouse gases in communities. According to the California Air Resources Board (CARB), vehicle emissions make up 37.3% of total greenhouse gas emissions in California (CARB, 2014). Reducing vehicle use would decrease greenhouse gas emissions and

improve air quality.

Vehicles, especially single occupancy vehicles, are also extremely inefficient. They take up more space and cause more wear-and-tear on roadways than any other mode of transportation. Unfortunately, roads (especially those build for cars) are environmentally costly to construct and maintain. On average, the US produces 400 million tons of asphalt, with each ton polluting by 570 lbs of CO_2 annually (Currey et al, 2015). By decreasing VMT, communities can help save energy and reduce pollution associated with building and maintaining roadways.

Active transportation can also help communities save in other ways, including financially. Some researchers estimate the value of active transportation equals $7 billion when accounting for air quality and physical activity (Litman, 2019). A study looking at Portland found that Portland's $138-605 million bicycle facility saved $388-594 million in healthcare costs, $143-218 million in fuel, and $7-12 billion in longevity value for the City. In the end, the investment resulted in a net gain for the City (Litman, 2019). When looking at the medical costs resulting from pedestrian and bicycle collisions, a study in 2004 shows that it cost the US $2.5 billion in healthcare costs for the pedestrian and bicycle collisions in 2000 (Miller et al, 2004). As collision rates rise and medical costs rise, the cost on society continues to grow.

Individually, community members can save on vehicle costs by walking and biking. By using a car less or not at all, households can save on gas, vehicle operating costs, mileage-related depreciation, vehicle ownership, and parking costs (Litman, 2019). The Bureau of Transportation Statistics estimates the average total costs of owning and operating a car amounts to roughly $9,282 per 15,000 miles per person (Bureau of Transportation Statistics, 2019). This amount of saving would be greatly beneficial to individuals and the community.

In multiple ways, shifting to more active forms of transportation can improve the health, safety, and wellbeing of communities. Increasing infrastructure to make walking and biking safer and more appealing alternatives is so important because it can increase levels of active transportation and thus greatly benefit the overall wellbeing of a community.

PERSIA AND MISSION STREET (SFMTA, N.D.)

02. Typology

2.0 Introduction

This chapter discusses five typical types of treatment based on various safety and street conditions, which include complete streets, neighborhood greenways, shared streets,

parklets, and pedestrian plazas. This typology of treatment types is derived from various case studies that attempt to deal with safety problems on similar street types. The case studies reveal that treatment types should vary based on the differing field conditions on streets.

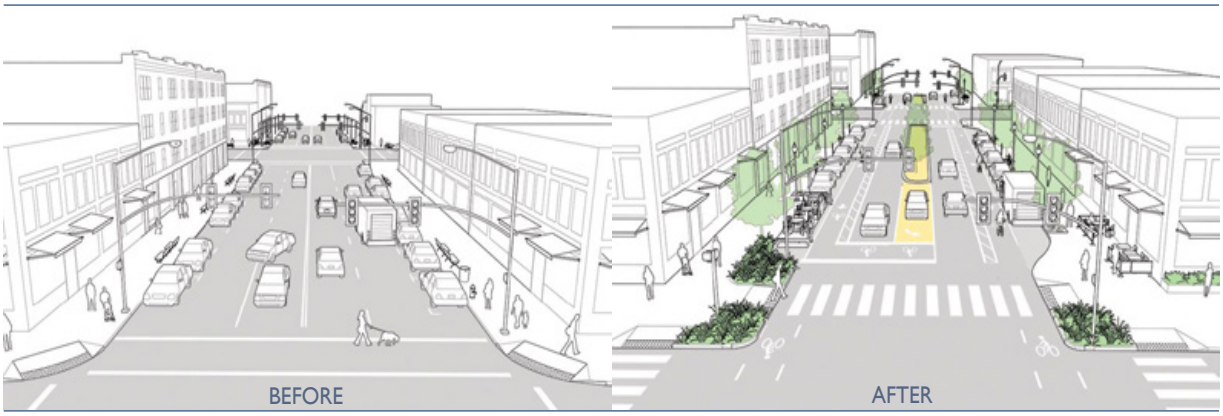
2.1 Complete Streets

Definition

Complete streets are designed to support all modes of transportation. All users, including people of different ages and abilities, should feel safe and comfortable on these streets (U.S. DOT, 2015).

Complete streets can take on many forms depending on the specific conditions at a location, but most complete street improvements focus on reallocating space to give more of the right of way to pedestrians and bicyclists. This often includes designating separated spaces for each mode which can be achieved by restriping to allocate more protected spaces for bicyclists and pedestrians and increase visibility at intersections. Paint may be used to create buffered bike lanes and high visibility crosswalks at low cost. In the long run, cities can invest in capital improvements such as sidewalk widening, curb extensions, medians, and protected bike lanes to further improve bike and pedestrian safety. Figure 2.1 is an illustration of how a street may be transformed to complete streets. Table 2.1 is a handy checklist of operating features in the key design elements that comprise complete streets.

Figure 2.1: Complete Street Transformation



(NACTO, N.D.)

TABLE 2.1: CHECKLIST OF FEATURES IN ELEMENTS OF COMPLETE STREETS

Treatment Type	Elements	Walkable	Sustainable	Safe Intersection	Bike Friendly	Space reallocation	Traffic calming	Loading/ Parking
Complete Streets	Bike boxes			X	X			
	Bike signals			X	X			
	Bus only lanes					X	X	X
	Curb extensions/bulb-outs/painted safety zones	X		X		X	X	
	Dedicated turn lanes/turn restrictions			X		X		
	Designated loading zones					X		X
	High visibility continental crosswalks	X		X				
	Improved corner sight distance (daylighting and stop bars)	X		X	X			
	Medians and pedestrian refuge islands	X	X			X	X	
	Midblock crossings	X					X	
	Painted bike lanes/sharrows			X	X	X	X	
	Parklets and bike corrals (bike parking)	X			X	X		X
	Pedestrian head starts and separated signaling	X		X				
	Protected bike lanes (through intersections)			X	X	X	X	
	Restriping			X	X	X	X	
	Street furniture	X						
	Tree coverage and sustainable landscaping	X	X			X	X	
	Wide sidewalks	X				X	X	

Field Conditions

Main arterial streets and boulevards are thoroughfares that connect the neighborhood

to other areas of the City and serve as commercial and social centers of the neighborhood. Typically, these streets have high volumes of vehicle, bicycle, and pedestrian traffic. The streets have many wide vehicle lanes, but inadequate space for pedestrians and bicycles. High vehicle speeds combined with unclear lane markings and confusing intersections create dangerous conditions for all users, particularly pedestrians and bicyclists. Collisions at intersections are notably high and severe injuries and fatalities due to collisions occur at high rates on these streets. Complete Streets are best implemented on main arterial streets and boulevards.

ALEMANY BLVD. (SFCTA, N.D.)

Precedents and Outcomes

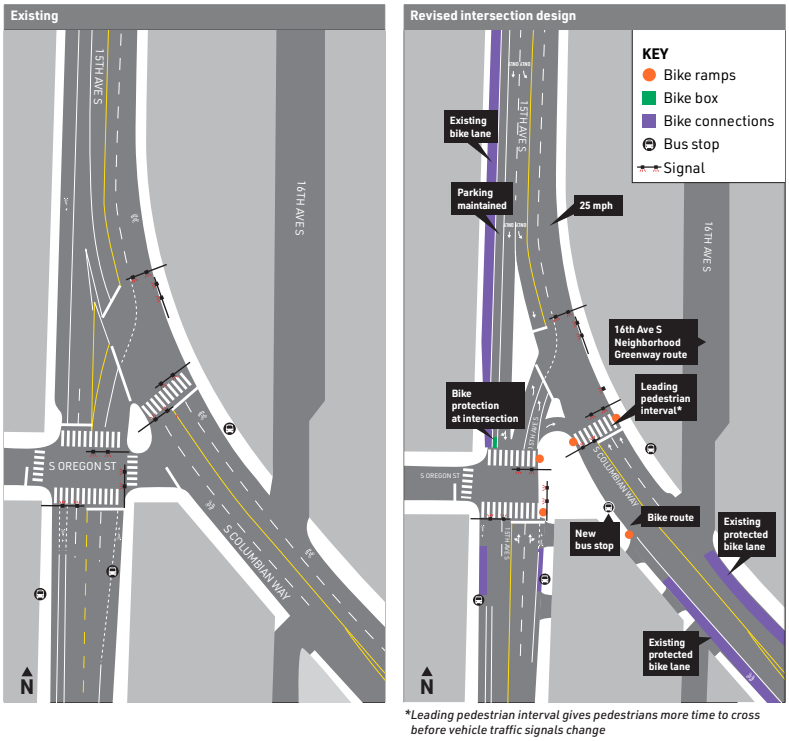
Complete streets are a widely accepted treatment to improve safety conditions and

encourage walking and biking along major streets. Seattle's 15th Avenue, New York City's W 178th Street, Washington DC's Pennsylvania Avenue, and Valencia Street in San Francisco are excellent examples of complete streets treatments on main arterial streets. In these precedent studies, planners saw major safety improvements after the implementation of complete streets. In one study, complete street treatments eliminated all vehicle and bike interactions. Additionally, over 80% of bicyclists and many pedestrians reported feeling safer after the complete street improvements. Not only do complete streets cause an increase in pedestrian and bicycle levels, but vehicle volumes decreased.

15th Ave. | Seattle Department of Transportation

The project on 15th Avenue in Seattle focused on improving legibility and comfort for all users. Prior to construction, the streets had poor pavement conditions and faded lane markings, making the area confusing and dangerous. Improvements included repaving and restriping as well as adding new parking protected bike lanes and widening sidewalks. Signal improvements and high visibility crosswalks were added at intersections to increase pedestrian safety.

Figure 2.2: 15th Ave Proposal



(SDOT, 2020)

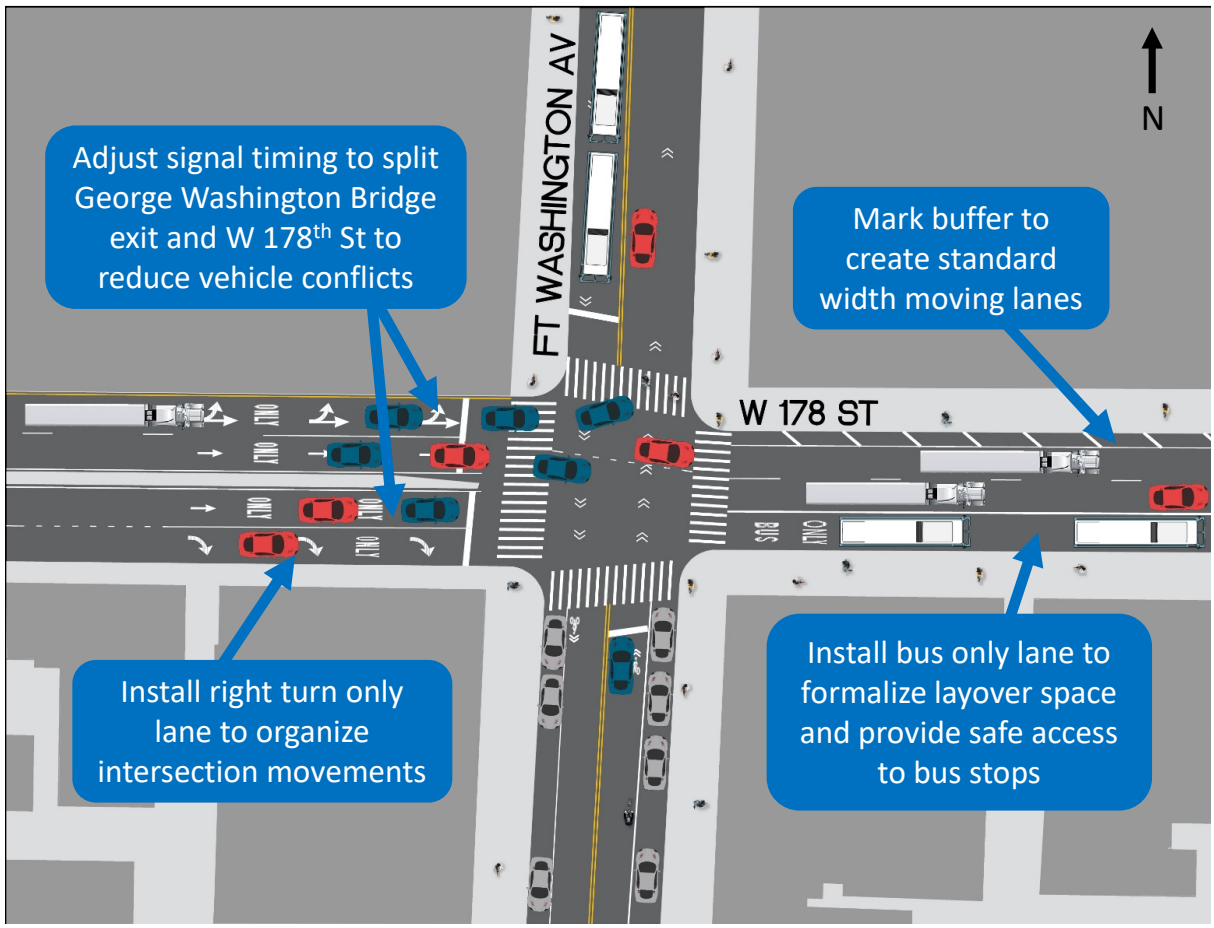
W 178th St. | New York City Department of Transportation

Before improvements, W 178th Street had four unclearly marked lanes and extremely long crossing distances. High vehicle volumes and speeds created constant vehicle conflicts and extremely unsafe conditions for pedestrians. In five years (2013-2017), 59 collision-related injuries occurred along the two-block corridor. The City identified that pedestrians crossing intersections were particularly at risk, noting that 72% of all pedestrian injuries occurred while a pedestrian was crossing with the signal. They also found that left turning vehicles were the cause of pedestrian injuries 83% of the time, likely because of high turning speeds and lack of clarity at intersections.

To remedy these dangerous conditions, the City restriped the roadway to add separated turning lanes (and signals) and improve clarity at the intersection. The plan also proposed adding buffers along the sidewalk to increase comfort and safety for pedestrians. At intersections, a new painted pedestrian plaza, painted medians, and pedestrian refuge islands help to protect pedestrians while crossing.

New York City DOT has found that these improvements are largely successful throughout the city. Similar refuge islands and shortened crossings at Madison Ave. and E 135th St. reduced collision injuries by 63%. At the intersection of Hoyt Ave. South and 29th St., clear lane designations caused a 42% decrease in injury crashes, and at Gerritsen Ave. and Whitney Ave., dedicated left turn lanes reduced injury crashes by 40%.

Figure 2.8: 178th St. Proposal



(NYCDOT, 2020)

Valencia St. | *San Francisco Municipal Transportation Agency*

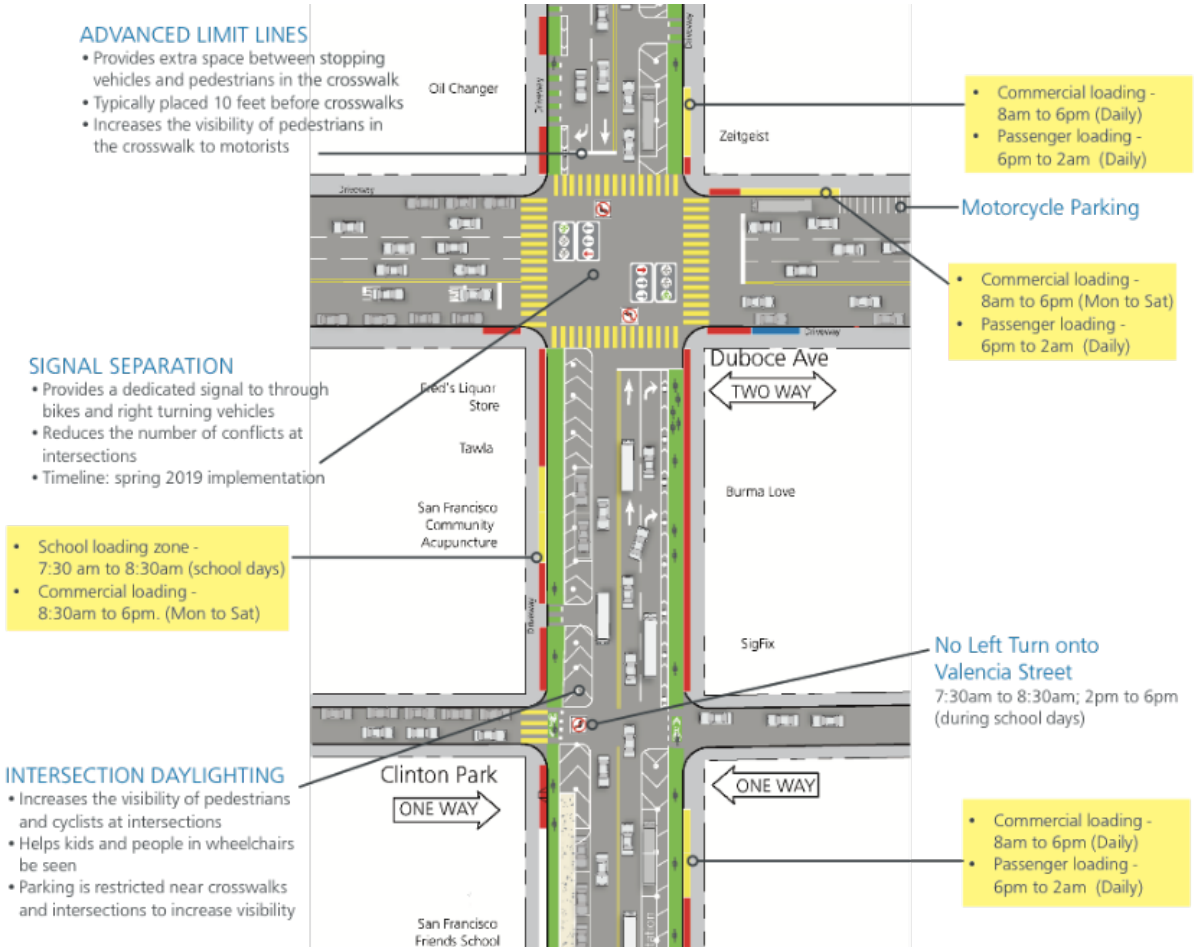
Over two thousand bicyclists commute along Valencia on an average weekday, yet bike lanes along Valencia Street are poorly marked. Instead, bicyclists are faced with wide vehicle lanes, poor loading conditions, and high vehicle speeds that cause high rates of vehicle-bike collisions each year. From 2012 to 2016, 268 reported collisions occurred along this corridor, placing Valencia on the City's High Injury Network. The City found that dooring, or the act of opening vehicle doors into the bicycle right of way was the most common (40%) cause of

collisions.

In response, the City implemented a pilot program with protected bike lanes. Parked cars or safe hit posts were used to create physical barriers between the cars and bicyclists. Other bicycle infrastructure such as bike boxes and mixing zones further improved bike safety. Additional loading improvements to prevent cars from parking in the bike lane as well as pedestrian safety measures were added.

These measures were first piloted on a small section of Valencia Street and were found to be overwhelmingly successful, prompting the City to initiate similar treatments on the rest of the street. Evaluations found a 99% decrease in vehicle-bike interactions and 100% reduction in close calls or near dooring incidents. 82% of bicyclists and 30% of pedestrians reported feeling safer after the improvements were installed. Moreover, the complete streets treatment caused an increase in bike volumes by 49% and a 10% decrease in vehicles.

Figure 2.4: Valencia St. Proposal



(SFMTA, 2018)

Pennsylvania Ave. | *Washington D.C. Department of Transportation*

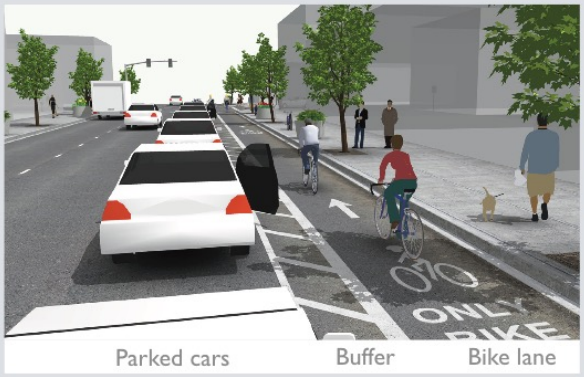
This street acts as a main thoroughfare in Washington D.C. with high vehicle and bicycle traffic volumes. The street is made up of eight lanes, resulting in incredibly dangerous and uncomfortable conditions for the bicyclists to travel on.

In response to high collision rates, the City constructed a two-way buffered cycle track in the median. The track caused a 200% increase in bike volumes and a decrease in vehicle

levels. 61% of bicyclists reported feeling safer and 74% of bicyclists said that the cycle track made riding easier.

PENNSYLVANIA ST. PROPOSAL (ITE, 2019)

SAFE BIKE INFRASTRUCTURE



Parking protected bike lane (NACTO, n.d.)

Parking protected bike lane (Human Streets, 2017)

PROTECTED BIKE LANES create space and physical barriers between vehicles and bicyclists to increase safety and comfort. Safe hit post, buffers, and parked cars are all widely accepted forms of protected bike lanes.

Bike box (NACTO, n.d)

BIKE BOXES provide space at the front of intersections for bicyclist to safely wait for signal changes. The box increases visibility and reduces vehicle-bike conflicts particularly when cars are turning.

2.2 Neighborhood Greenways

Definition

Neighborhood greenways are safe and calm residential streets that give space to all users. Though these streets incorporate separated spaces for all users, bikes and pedestrians are the priority. Treatments are meant to increase right of way for cyclists and pedestrians and improve safety and comfort. Neighborhood greenways reestablish these streets as local streets, not cut-throughs, with traffic calming measures. They can provide connections to schools, parks, transit, and other public spaces. Figure 2.5 is an illustration of treatments that transform a street to a neighborhood greenway. Table 2.2 is a handy checklist of operating features in the key design elements of neighborhood greenways.

TABLE 2.2: CHECKLIST OF FEATURES IN ELEMENTS OF NEIGHBORHOOD GREENWAYS

Treatment Type	Elements	Walkable	Sustainable	Safe Intersection	Bike Friendly	Space reallocation	Traffic calming	Loading/ Parking
Neighborhood Greenways	Bike boxes/bike lanes			X	X	X		
	Bioswales/landscaping	X	X			X	X	
	Chicanes		X			X	X	
	Curb extensions, bulb-outs	X		X		X	X	
	High visibility continental crosswalks	X		X				
	Narrowing vehicle right of way	X			X	X	X	
	Pavement treatment, sharrows	X		X	X		X	
	Raised crosswalks (raised intersections)	X		X			X	
	Speed humps						X	
	Street furniture	X						
	Striping				X	X	X	
	Traffic circles	X		X	X	X	X	
	Traffic diversions	X		X	X	X	X	
	Wayfinding and signage	X		X	X			

Figure 2.5: Curb Extension for Narrow Pedestrian Crossing

(NACTO, n.d.)

Field Conditions

Neighborhood streets often have medium levels of traffic. Though neighborhood streets are designed to provide local access to residents, these streets are commonly used by vehicles for cut-through, or as alternatives to main streets. Neighborhood streets are usually in mixed use areas, though the primary land use on these streets is residential. As is typical of residential streets, speed limits are relatively low, however actual vehicle speeds are still high. These high speeds combined with high levels of pedestrian and bicycle traffic often cause conflicts and unsafe conditions. Collisions involving pedestrians and bicyclists are particularly

high on these streets. Neighborhood greenways represent a good solution to improving safety on neighborhood streets.

NEIGHBORHOOD STREETS (SF BIKE COALITION, 2018)

Precedents and Outcomes

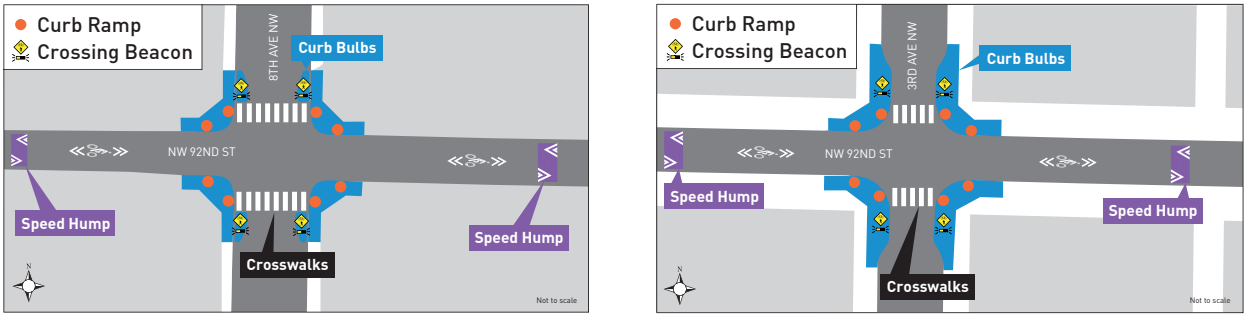
Neighborhood greenways appear in many cities including Seattle, Portland, San Francisco, and Berkeley. Cities noted increases in overall bike and pedestrian safety and decreases in collision rates. Neighborhood greenway related traffic calming measures resulted in extreme reductions in vehicle speeds, lowering to under 20 mph in some areas. On streets where neighborhood greenways were implemented, bike ridership levels increased greatly,

and vehicle levels decreased. This increase in street activity caused improvements in economic vitality.

North Seattle Greenways | Seattle Department of Transportation

As part of their larger Neighborhood Greenways initiative, Seattle DOT designed and constructed a series of traffic calming measures to reduce vehicle speeds and levels on neighborhood streets. In addition to crosswalk and pavement signage improvements (such as sharrows), the project also included curb bulb-outs at intersections to slow traffic speeds and shorten crossing distances for pedestrians.

Figure 2.6: North Seattle Proposal



(SDOT, 2017)

N Willamette Blvd. | Portland Department of Transportation

N Willamette Boulevard was a cut-through street, with vehicle volumes reaching about 275 cars in the peak hour, far above local street capacity. Additionally, average speeds were nearly 10 mph over the speed limit creating dangers for pedestrians and bicyclists.

To redirect cars back onto main thoroughfares, Portland put several traffic diverters at intersections. Made with a combination of paint, signage, and temporary planters, the diverters prevent vehicle traffic from continuing straight, forcing them to turn back to main streets. By cutting off blocks of street, these areas can no longer be used for cut-through. Speed humps and stop signs were installed to slow vehicle speeds.

Evaluations found that four out of five streets decreased their 85 percentile speeds. In fact, after implementation 85 percentile speeds were around 20 mph on all streets, with the highest being 23 mph.

Figure 2-7: North Willamette Traffic Diverters

(PDOT, 2020)

Page St. | *San Francisco Municipal Transportation Agency*

Page Street is a popular street corridor for bicyclists commuting downtown. However, high vehicle speeds and poor vehicle yielding behaviors made Page Street a very dangerous place for cyclists. Between 2013 and 2017 34 collisions occurred on Page St., 32% of which involved a bicyclist.

In response, SFMTA improved bicycle conditions by painting bike boxes and sharrows on the pavement. To slow traffic, the City added sustainable landscaping, speed humps, and curb extensions. The project also included a raised intersection at an intersection with extremely high pedestrian volumes. Traffic diversion was added at Page and Webster to prohibit cars from using Page Street for cut-through.

Figure 2.8: Raised Intersection Proposal

(SFMTA, 2018)

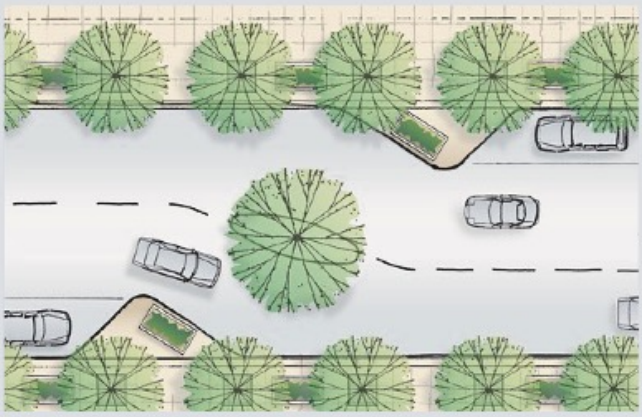
Berkeley | *City of Berkeley*

The City of Berkeley, a leader in neighborhood greenway design, initiated several greenway projects throughout the city. Designs included chicanes, traffic circles, traffic diversions, speed humps, and pavement markings to reduce vehicle volumes and speeds. A study by Eric Minikel of Massachusetts Institute of Technology evaluated the projects to determine how such improvements impacted safety conditions. When comparing similar Berkeley streets, bike boulevards (another name for neighborhood greenways) had lower collision rates by up to .77 points. The study also found reductions in vehicle volumes.

Figure 2.9: City of Berkeley Bike Boulevard

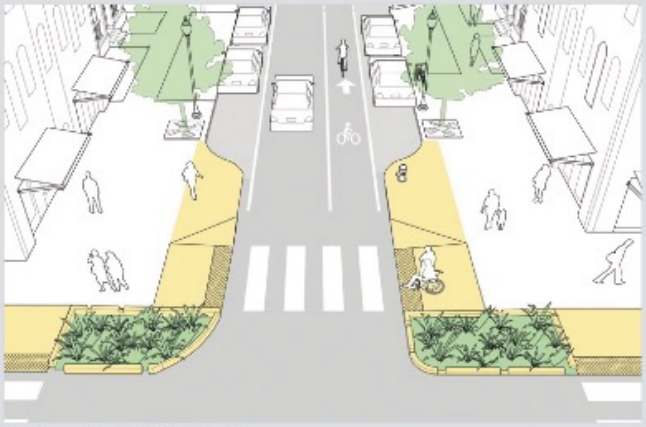
(CITY OF BERKELEY, 2018)

TRAFFIC CALMING



Chicane (SF Better Streets, 2015)

Streets can be designed to encourage drivers to drive at lower speeds. CHICANES are a very popular strategy. On a chicanes obstruct the right of way forcing vehicles to move in a slower, curved path rather than a straight one. This can be achieved with curb extensions, planters and landscaping, islands, or with strategically placed parked cars.



Pinch-point (NACTO, n.d)

PINCH-POINTS pinch the vehicle right of way, narrowing the vehicle lane and lowering traffic speeds. These are particularly effective at the beginning of neighborhood greenways to slow vehicle speeds immediately as they enter. Bulb-outs, or a wider section of curb are an excellent way to achieve a pinch-point while also reducing crossing distances for pedestrians and encouraging safer vehicle turning.

2.3 Shared Streets

Definition

Derived from the Dutch word, "woonerf" which means "street for the living," shared streets are active spaces that give priority to pedestrians. As stated in the title, shared streets share the right of way with all users without designating formal spaces for different modes. Appropriate signage and pavement treatments alert motorists that pedestrians have priority on these streets. Figure 2.10 is an illustration of how a local street may be transformed to a shared street. Table 2.3 is a handy checklist of operating features in the key design elements that comprise shared streets.

Figure 2-10: Shared Street Transformation

Neighborhood Street to Shared Street

(NACTO, N.D.)

TABLE 2.3: CHECKLIST OF FEATURES IN ELEMENTS OF SHARED STREETS

Treatment Type	Elements	Walkable	Sustainable	Safe Intersection	Bike Friendly	Space reallocation	Traffic calming	Loading/ Parking
Shared Streets	Bioswales/landscaping	X	X			X	X	
	Chicanes	X	X		X	X	X	
	Curb extensions/painted safety zones	X		X		X	X	X
	Designated parking (to chicane road)	X			X		X	X
	Low speed limits	X			X		X	
	Pavement treatments — textured, colored, or raised pavement	X	X			X	X	
	Pinchpoints (esp at entrance)			X		X	X	
	Raised crosswalks (raised intersections)	X		X			X	
	Safe hit posts					X	X	X
	Street furniture	X						
	Wayfinding and signage — clear entrance	X			X	X	X	

Field Conditions

Compared to neighborhood streets, narrow residential streets and alleyways are narrower and tend to have very low traffic volumes and parked cars. These streets are used for local access only and are primarily trafficked by pedestrians and bicyclists rather than vehicles. Despite high pedestrian volumes, these streets have very little designated space for pedestrians often causing them to walk in the vehicle right of way. Walking in the streets puts pedestrians at risk of collisions and result in high pedestrian-vehicle interaction rates. Shared streets are best placed on such narrow residential streets and alleyways. Where pedestrians and cars are already sharing the right of way, planners can formally create shared streets to facilitate street sharing more safely.

MONETA WAY (GOOGLE, 2015)

Precedents and Outcomes

In places where shared streets were implemented, such as Winthrop Street in Cambridge, 6 1/2 Avenue in New York City, or 45th Avenue in Seattle, planners found that pedestrian-vehicle interactions significantly decreased. Vehicle and pedestrian behaviors responded well to these new types of streets, with vehicles giving way to pedestrians most of the time and pedestrians comfortably walking in the full right of way. Such improvements also caused increases in street life and economic vitality, even on neighboring streets.

Winthrop St. | City of Cambridge, MA

Winthrop Street is extremely narrow with low traffic volumes. The uneven and narrow sidewalks caused many pedestrians to walk in the street. In response, the City removed the sidewalks and installed concrete pavers along the entire street. Speed limits were lowered to

10 mph. They also updated the lighting and added street furniture to improve pedestrian comfort. The result was well received, especially by restaurants who saw increased levels in foot traffic.

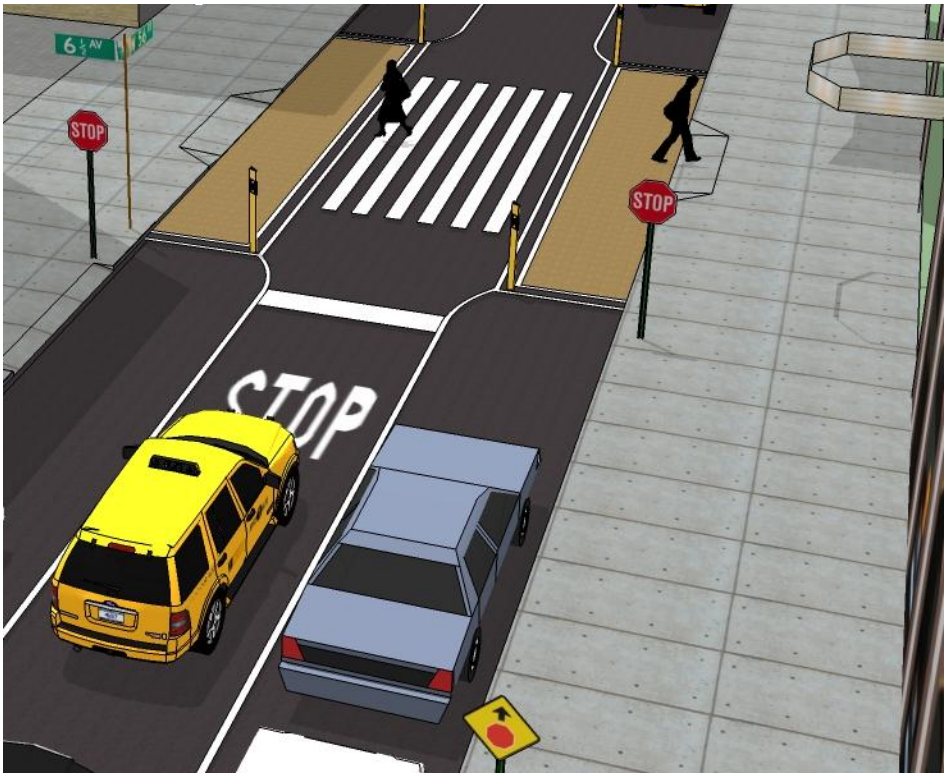
WINTHROP ST. (NACTO, N.D.)

6 1/2 Ave. | *New York City Department of Transportation*

6 ½ Avenue is a narrow alleyway. Though it has high pedestrian volumes and crosses major streets, there were no crosswalks and low vehicle yield rates. The City added several necessary pavement markings and physical barriers at intersections to improve pedestrian safety. This is an excellent example of how to treat intersections where shared streets meet

main streets. Painted curb extensions protected by safe hit posts give more protected space to pedestrians and slow traffic by narrowing the roadway. The City also added high visibility crosswalks and painted stop bars and the words "STOP" on the pavement to reinforce stop signs. As a result, vehicle-pedestrian interactions reduced from 95% to 5%.

Figure 2.11: 6 ½ St. Proposal



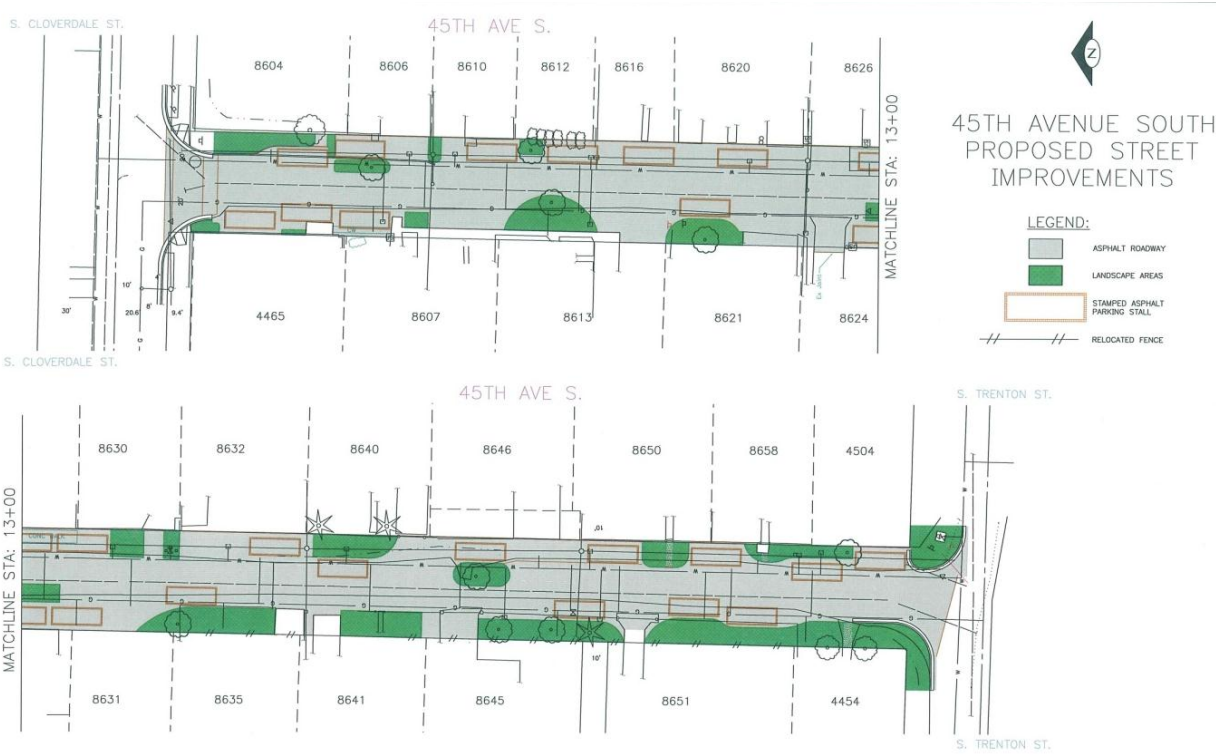
(NYCDOT, 2012)

45th Ave. | Seattle Department of Transportation

45th Avenue is a residential street in Seattle that served as the pilot test which inspired Seattle's Home Zone shared streets program. Prior to improvements 45th Avenue was only 40

feet wide and had no sidewalks. Instead of adding sidewalks, which is a costly procedure, the City created a shared street. Stamped parts of asphalt delineated parking spots, chicaning the street and slowing traffic. New trees and landscaping were added to increase pedestrian comfort.

Figure 2.12: 45th Ave Proposal



(SDOT, 2009)

London | London Department of Transport

A study for the London Department of Transport on shared streets in London found that shared spaces where pedestrian and vehicle rights of way are not separated are more effective at lowering vehicle speeds than various traffic calming measures. When looking at

vehicle-pedestrian interactions, vehicles in shared spaces were more likely to yield to pedestrians. Vehicles yielded 56% of the time when pedestrians were in the street versus only yielding 4% of the time to pedestrians on the edges.

LONDON SHARED STREET (RNIB, 2018)

PAVEMENT TREATMENT

Different pavement treatments help to communicate different uses of space. This can be achieved using color or texture as a low cost way to expand pedestrian and bicycle spaces. Decorative pavements are also a good way to incorporate elements of art and local culture into design.

Pavement markings are particularly helpful in alerting drivers of upcoming cautions. For example, sharrows let drivers know that they are sharing the road with cyclists and encourage them to be alert. Stop bars can reinforce stop signs, while crosswalks remind drivers that pedestrians may be crossing. For pavement markings, the more visible the more effective they can be. So, it is important that markings are big and bold, and are continually maintained to avoid faded signage.

Decorative pavement (DDOT, 2019)

2.4 Parklets

Definition

Parklets serve as additional pedestrian spaces by repurposing parking spaces for pedestrian use. These mini parks provide seating and other amenities for pedestrians. As temporary installments, parklets are a great way to incorporate unique community characteristics and art into the streetscape. In addition to an increase in economic value, parklets provide safe spaces for customers to relax which clears the sidewalk for pedestrians who may have been forced to walk in the street otherwise. Figure 2.13 is an example of a parklet in San Francisco. Table 2.4 is a handy checklist of operating features in the key design elements of a parklet.

Figure 2-13: A Parklet in San Francisco

PARKLET IN SF (SFIST, 2014)

TABLE 2.4: CHECKLIST OF FEATURES IN ELEMENTS OF PARKLETS

Treatment Type	Elements	Walkable	Sustainable	Safe Intersection	Bike Friendly	Space reallocation	Traffic calming	Loading/ Parking
Pedestrian Only Spaces	Appropriate drainage		X					
	Artwork	X						
	Corner aprons			X		X	X	
	Defined edges — walls, safe hit posts, movable planters	X	X	X	X	X	X	X
	Designated loading zones or times	X				X		X
	Landscaping	X	X			X	X	
	Lighting	X						
	Movable seating	X						
	Street furniture	X				X		
	Textured, pigmented pavements (pavement murals)	X	X			X	X	

Field Conditions

Parklets are a good solution for areas that lack adequate public spaces for pedestrians. On narrow sidewalks or where there is limited pedestrian right of way parklets can provide additional outdoor spaces for customers. They are best utilized in areas with high pedestrian traffic volumes and active ground floor businesses.

PEDESTRIAN AND BUSINESS ACTIVITY IN THE EXCELSIOR/OUTER MISSION (BUSINESS INSIDER, 2017)

Precedents and Outcomes

Realizing the benefits of parklets, the transportation departments of Seattle and San Francisco have initiated largely successful parklet programs. These programs have found that parklets cause an increase in pedestrian and biking levels and generate business for local stores and restaurants. Most users reported that parklets improve safety in the neighborhood and represent good use of neighborhood space.

Parklet and Streatery Program | Seattle Department of Transportation

The street-eatery (Streatery) program supports local businesses by providing guidance and streamlining the permitting process for constructing parklets for outdoor eating space. An evaluation from 2015 and 2016 found that parklets were very popular with both residents and businesses. 84% of users felt that they "provided useful neighborhood public spaces," and 49% of people surveyed reported that parklets made the neighborhood feel safer than prior conditions. Businesses noticed significant increases in foot traffic (83%) and in sales (67%) because of parklets. Overall, walking, biking, and transit use increased by 67%.

Pavements to Parks Program | San Francisco Municipal Transportation Agency

San Francisco also has a similar program to help with the parklet construction process. Though every parklet is unique, their guidelines recommend that parklets have adequate signage and street furniture. The guide also notes the use of textured or pervious pavements to establish these spaces as pedestrian priority areas.

Evaluations found that parklets caused a 4% increase in pedestrian activity in the area and that two out of three pedestrians felt safe in the parklets.

MERAKI MARKET IN SF (JENSEN ARCHITECTS, N.D.)

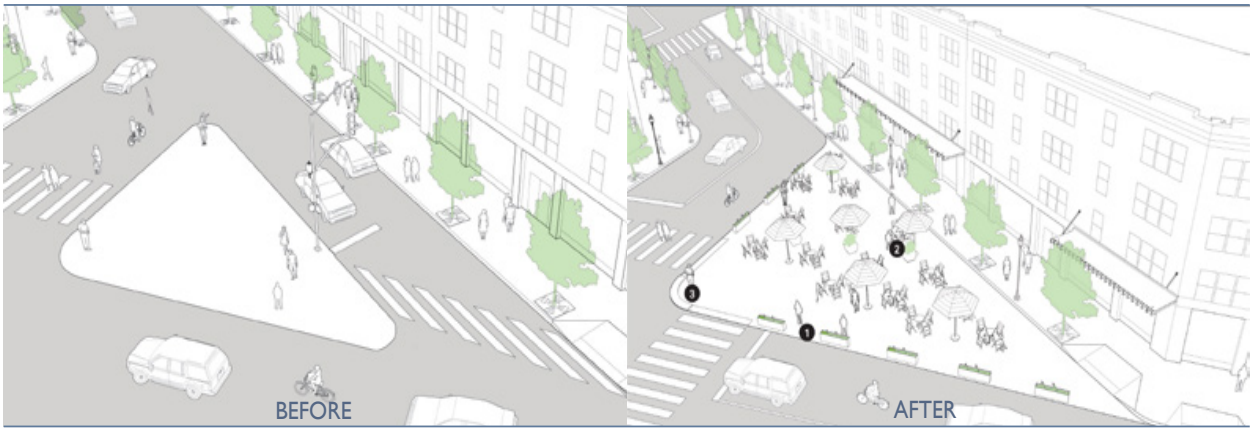
2.5 Pedestrian Plaza

Definition

Pedestrian plazas reconfigure the roadway, using colored pavement and physical barriers, to designate specific places for pedestrians. The plazas help clarify intersections and connect pedestrians to nearby sidewalks. Figure 2.14 is an illustration of how an irregular intersection may be transformed to a pedestrian plaza. Table 2.5 is a handy checklist of operating features in the key design elements that comprise pedestrian plazas.

Figure 2.14: Pedestrian Plaza Transformation

Irregular Intersection to Pedestrian Plaza



(NACTO, N.D.)

TABLE 2.5: CHECKLIST OF FEATURES IN ELEMENTS OF PEDESTRIAN PLAZAS

Treatment Type	Elements	Walkable	Sustainable	Safe Intersection	Bike Friendly	Space reallocation	Traffic calming	Loading/ Parking
Pedestrian Only Spaces	Appropriate drainage		X					
	Artwork	X						
	Corner aprons			X		X	X	
	Defined edges — walls, safe hit posts, movable planters	X	X	X	X	X	X	X
	Designated loading zones or times	X				X		X
	Landscaping	X	X			X	X	
	Lighting	X						
	Movable seating	X						
	Street furniture	X				X		
	Textured, pigmented pavements (pavement murals)	X	X			X	X	

Field Conditions

Pedestrians may have long crossing distances at irregular or unclear intersections where vehicle speeds are high. Pedestrian plazas can be a helpful addition to increase legibility, slow vehicular speeds, and improve pedestrian safety at irregular intersections.

Precedents and Outcomes

Madison Square/Flatiron Plaza in New York City and San Jose-Guerrero Park in San Francisco are two examples where cities converted underutilized street space at confusing intersections into pedestrian plazas. Both locations saw significant reductions in collisions particularly with pedestrians. In addition, pedestrian plazas caused decreases in travel speeds and increases in active transportation levels.

IRREGULAR INTERSECTION IN EXCELSIOR/OUTER MISSION (GOOGLE, N.D.)

Madison Square/Flatiron Plaza | *New York City Department of Transportation*

High vehicle volumes and unclear intersection markings made this intersection extremely dangerous prior to improvements. In addition, high pedestrian volumes were forced to cross long distances further increasing safety risks. To improve pedestrian safety, reduce vehicle volumes, and clarify the intersection, the City filled in the unused space with paint and planters to create a pedestrian plaza.

After the installation of the plaza, collisions reduced by 30%. Travel speeds decreased by 9%, while bike volumes increased by 160% in the area.

San Jose and Guerrero Park | *San Francisco Municipal Transportation Agency*

The intersection of San Jose and Guerrero streets is irregular in shape resulting in a

triangle of unused space in the middle of the intersection. High vehicle speeds and a lack of undefined sidewalks caused several collisions between 2008 and 2018 all of which involved pedestrians. Deemed unsafe, the City proposed a pedestrian plaza in the unused space.

In a first phase version of construction, the City installed planters and logs to define the edges of the plaza. A mural was painted on the pavement to differentiate the plaza from the vehicle right of way. Movable seating and other furniture were added. The next phase of the plaza, to be finished later in 2020, includes more permanent elements to secure the space for pedestrians.

SAN JOSE AND GUERRERO PLAZA

STREET FURNITURE

Elements such as seating, greenery, or lighting can help to improve pedestrian comfort. Adding these touches can encourage greater levels of walking and increase feelings of safety for pedestrians.

Movable seating (City Lab, 2012)

03. Case Studies

3.0 Introduction

Many of the streets in the Excelsior/Outer Mission can be placed in the categories identified under the Typology described in the preceding chapter. This chapter compares the potential treatments based on precedents to the City's plans to improve high accident locations along three main streets (Alemany Blvd., Geneva Avenue, Mission St.) and several smaller neighborhood streets throughout the Excelsior/Outer Mission district.

3.1 Alemany Blvd.

Field Conditions

Alemany Boulevard serves as a main connector of the study area to downtown and several other neighborhoods of San Francisco. It is a heavily trafficked four lane road, which sees over 17,000 vehicles daily (SFMTA, 2019). On the section that sits within the project area, the annual vehicle miles traveled (VMT) is just above 20 million (SFMTA, 2019) (Transbase, n.d.).

Despite the street's popularity, maintenance on Alemany has been neglected. The striping is faded and difficult to see, particularly for crosswalks. In addition to low visibility crosswalks, some intersections lack necessary traffic signals. This may have contributed to the

high proportion of intersection collisions on Alemany. 90% of all reported collisions between 2014 and 2018 along Alemany occurred at intersections (Transbase, n.d.).

Besides high vehicle volumes and poor conditions, vehicle speeds are particularly high. 85% of vehicles travel at 37 mph or higher on Alemany Blvd (SFMTA, 2019). This combination of high volumes and speeds, and inadequate safety infrastructure causes high collision rates. In five years from 2014 to 2018, 205 collisions occurred on Alemany within the study area (between Junipero Serra Blvd. and Mission St.), one of which was fatal (Transbase, n.d.).

Treatment

Based on precedent studies, the physical and operation conditions as well as the level of safety concerns require a Complete Street treatment. Complete Streets often involve reallocating parts of the road for bikes and pedestrians by way of bulb-outs and bike lanes in addition to bus lanes. Vehicle safety improvements such as dedicated turn lanes or signal separation help to reduce collisions between vehicles.

SFMTA's Alemany Corridor Safety Project proposal matches many of the key features of a Complete Street. The project is in its beginning phases; project planners are still gathering information and drafting plans; and the initial open house outreach event was held in December 2019. Although no plans have been released, SFMTA has shared possible treatments to administer (Chong, 2019) organized by different phases. In the near term, many improvements can be achieved with paint such as the painted safety zones, high visibility crosswalks, and adding red curbs at intersections to improve corner sight distance

(daylighting). In the long term, capital improvements are to replace some of the temporary paint. The painted safety zones are to be filled in with concrete to become bulb-outs, and medians that were marked with paint might become physical concrete medians (Chong, 2019).

Compared to other complete street projects studied, the Alemany Corridor Safety Project matches an appropriate number of key features as seen in Table 3.1. The table lists a wide suggestion of possible improvements, which can be applied depending on specific conditions and needs. Most projects install on average six of the suggested elements. The Alemany project, includes seven elements so far.

Many of the elements not checked include bicycle improvements. Project planners refer to the inclusion of "bikeway enhancements" in the midterm. This includes painting the existing bike lanes green and adding better bike infrastructure at intersections (Chong, 2019). It is possible bike infrastructure is part of the final design, but if not, the minimal bike improvements is likely due to the low amount of collisions (5%) that involve a bicyclist on Alemany (Transbase, n.d.). Often, bicyclists opt to take Mission St., which has some bike lanes. Under existing conditions, parts of Alemany have some Class II bike lanes that are adjacent to automobile lanes.

Other elements not checked include landscaping and street furniture. In San Francisco, such components are constructed over time but are not part of the initial plans. Landscaping and tree planting often usually involves a partnership with Public Works in San Francisco. Street furniture such as parklets and outdoor seating, though heavily supported by the City, are ultimately the responsibility of local businesses.

TABLE 3.6: ALEMANY BLVD. COMPARISON TABLE

Case Studies										
Street Type	Field Conditions		Treatment							
	Street Conditions	Safety Conditions	Precedent Treatment Type	Precedent Elements	Precedents				Planned or Constructed Treatment	Evaluation
					15th Ave, Seattle DOT	W 178th St, New York City DOT	Valencia St, SFMTA	Pennsylvania Ave, D.C DOT		
Alemany Blvd. (Junipero Serra to Mission (Rousseau))	High vehicle and pedestrian traffic levels (17,873 vehicles daily) ~ 20,027,590 VMT High vehicle speeds (85% speed is 37 mph in a 35 mph zone) Wide lanes Faded striping Lack of sidewalks or narrow sidewalks Lack of traffic lights or crosswalks at some intersections Main connection to Downtown via highway and many neighborhoods across SF	High collision rates - 205 from 2014 to 2018 ~ 1 fatality Vehicle-Vehicle collisions are 80% of all collisions 90% of collisions occur at intersection	Complete Streets	Bike boxes			X			Matches key features ~ Does not include many bike improvements ~ Based on preliminary Alemany designs ~ Street furniture and landscaping not included in SFMTA plans
				Bike signals						
				Bus only lanes		X				
				Curb extensions/bulbouts/painted safety zones	X				X	
				Dedicated turn lanes/ turn restrictions	X	X	X	X	X	
				Designated loading zones			X			
				High visibility continental crosswalks	X				X	
				Improved corner sight distance (daylighting and stop bars)			X		X	
				Medians and pedestrian refuge islands	X	X				
				Midblock crossings						
				Parklets and bike corrals (bike parking)			X			
				Pedestrian head starts and separated signaling		X		X	X	
				Painted bike lanes/sharrows	X	X	X		X	
				Protected bike lanes (through intersections)	X		X	X		
				Restriping	X	X		X	X	
				Street furniture						
				Tree coverage and sustainable landscaping						
				Wide sidewalks		X	X			

Recommendations

The Alemany project meets the requirements for a complete street, but further improvements can be made to increase safety for all users. Planners should focus on improving traveling conditions for bicyclists by upgrading the existing bike lanes to buffered or protected bike lanes. Though the planned bike lane coloring can help with visibility, vehicle speeds are high on Alemany, so separated or protected bike lanes would further improve safety and user comfort. To ensure bike network connectivity, bike lanes should be added where they currently do not exist.

To further improve safety for pedestrians, designs should take advantage of the already existing medians to create pedestrian refuge islands. Pedestrian refuge islands provide

pedestrians with a safe place to wait in the middle of the roadway. This is particularly helpful for less able-bodied pedestrians who may take longer to cross the street.

The median can also be upgraded to incorporate landscaping and other placemaking elements such as seating and art. This provides additional public space for residents and helps to establish the sense of place and neighborhood identity that residents requested in early outreach events (see 01. Background). Decorative crosswalks or other street furniture elements can further instill a sense of place.

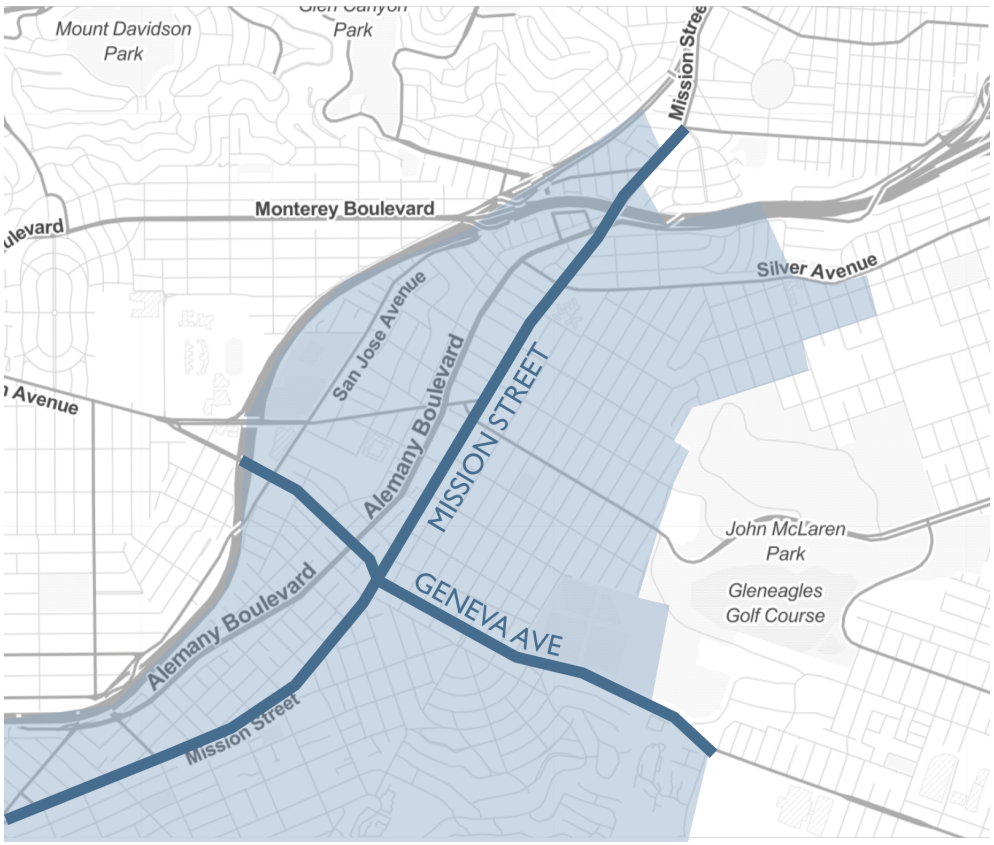
ALEMANY BLVD. (GOOGLE, N.D.)

3.2 Geneva Ave. and Mission St.

Field Conditions

Geneva Ave. intersects with Mission St. in the center of the Excelsior/Outer Mission neighborhood. Both streets run directly through the center of the Excelsior/Outer Mission district, as Figure 3.1 shows, serving as a main thoroughfare for the neighborhood as well as a commercial and social hub for residents. Several high ridership bus lines run down Geneva and Mission and the streets connect to major BART stations and MUNI train lines.

Figure 3.9: Map of Project Area with Geneva Ave. and Mission St.



(TRANSBASE, N.D.)

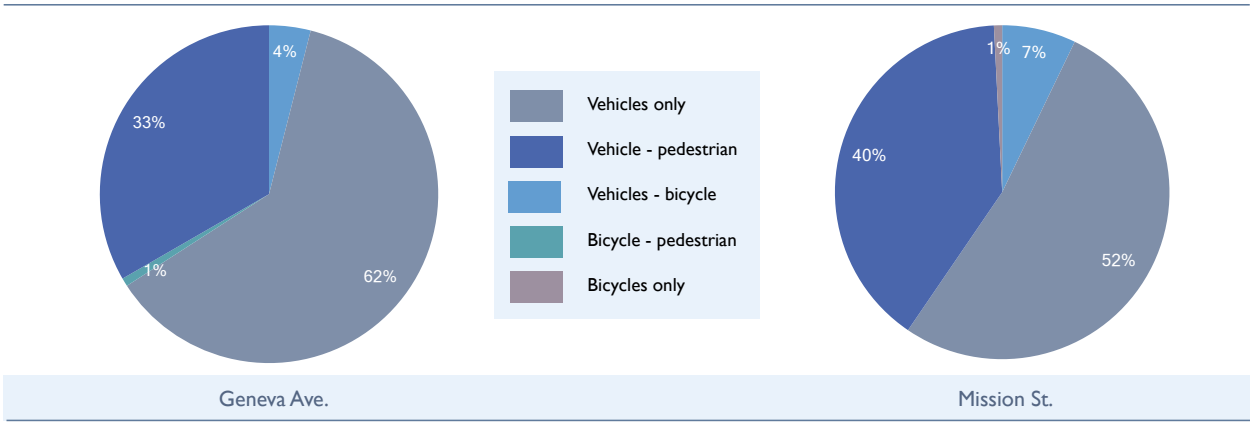
These streets have four vehicle lanes and wide sidewalks, to support commercial activity, carry people through the neighborhood and transit stations, and connect residents to the neighboring districts and downtown San Francisco. However, sidewalks in the area need repairs and cleaning. Though most intersections have boldly striped sidewalks that increase visibility, the markings are faded, making them difficult to see. Similarly, striping to designate lanes and clarify intersections is also faded. This is particularly problematic for the bicyclists as faded bike lanes are difficult for drivers to see and adhere to, which can, often put bicyclists in dangerous situations.

This danger is exasperated by high vehicle volumes and speeds. Daily, more than 23 thousand vehicles drive down Geneva adding to a VMT of over 10 million yearly (SFMTA, 2013) (Transbase, n.d.). Mission St. sees nearly 15 thousand vehicles daily and has an annual VMT of 6 million (SFMTA, 2016) (Transbase, n.d.). In addition, the 85th percentile speeds on these roads (32 mph on Geneva and 30 mph on Mission) are significantly higher than the 25 mph speed limit. (SFMTA, 2013) (SFMTA, 2016).

These unsafe conditions are reflected in the high collision rates. In five years from 2014 to 2018, 126 collisions occurred along Geneva Avenue and Mission Street each, totaling 252 collisions including 3 deaths (Transbase, n.d.). Pedestrians are particularly at risk. Of these collisions, pedestrians were involved 33% and 40% of the time on Geneva Ave. and Mission St. respectively as Figure 3.2 shows. 85% of collisions involved pedestrians crossing an intersection on Geneva. On Mission, left turning was also a major cause of collisions; one in four collisions involved a vehicle making a left turn (Transbase, n.d.).

MISSION AND GENEVA (WALKSF, N.D.)

Figure 3.2: Distribution of Collisions by Travel Mode on Geneva Ave. and Mission St.



(TRANSBASE, N.D.)

Treatment

With conditions like these, a Complete Street project is recommended based on precedent studies. Complete streets focus on increasing safety for all users. Coincidentally, this is one of the goals of the Mission/Geneva Safety Project by SFMTA. The other two goals outlined are to improve transit reliability and enhance the business district through loading improvements (Dreger, n.d.).

The project is in its final stages of planning and was scheduled to begin construction in spring 2020. This commitment to supporting all users including vehicles and busses is what makes this project a Complete Street project plan. Unlike most precedent projects studied, which applied an average of six features, this project plans to incorporate eleven of the suggested elements as Table 3.2 shows. This comprehensive plan includes some of the efficient, but less common components such as bus only lanes and designated loading zones. This is part of the project's conscious effort to increase bus efficiency and enhance local businesses (Dreger, n.d.). In addition, the Mission/Geneva project also applies some of the most common improvements such as turn restrictions, protected bike lanes, and bulb-outs to increase pedestrian and bicycle safety.

There were only a few elements that were not included in the plans. Although some of these can be important to creating a complete street, such as high visibility crosswalks or wider sidewalks, most of the two corridors already have these features from earlier projects. Even though they are not part of the current plans, they will exist in the finished product.

Table 3.7: Geneva Ave. and Mission Street Comparison Table

Case Studies										
Street Type	Field Conditions		Treatment							
	Street Conditions	Safety Conditions	Precedent Treatment Type	Precedent Elements	Precedents				Planned or Constructed Treatment	Evaluation
					15th Ave, Seattle DOT	W 178th St, New York City DOT	Valencia St, SFMTA	Pennsylvania Ave, D.C DOT		
Geneva St. (Ocean Ave. to Moscow St.)	High vehicle and pedestrian traffic levels (23,400 vehicles daily) ~ 10,676,250 VMT High vehicle speeds (85% speed is 32 mph in a 25 mph zone) Wide lanes (4 lanes) Faded striping Narrow class 2 bike lane Poor sidewalk conditions Main throughoughfare throughout the neighborhood Connects to neighborhing Ocean View district Major commercial corridor	High collision rates - 126 from 2014 to 2018 ~ 1 fatality Vehicle-pedestrian collisions are 33% of all collisions 85% at intersections	Complete Streets	Bike boxes			X		X	
				Bike signals						
				Bus only lanes		X			X	
				Curb extensions/bulbouts/painted safety zones	X				X	Matches key features
				Dedicated turn lanes/ turn restrictions	X	X	X	X	X	~ More features than most projects (11 versus average 6)
				Designated loading zones			X		X	~ Bus improvements as well as bike and pedestrians features
				High visibility continental crosswalks	X					~ Some improvements such as sidewalk widening and high visibility crosswalks already exist
				Improved corner sight distance (daylighting and stop bars)			X		X	
				Medians and pedestrian refuge islands	X	X			X	
				Midblock crossings						
				Parklets and bike corrals (bike parking)			X		X	
				Pedestrian head starts and separated signaling		X		X	X	
				Painted bike lanes/sharrows	X	X	X			
				Protected bike lanes (through intersections)	X		X	X	X	
				Restriping	X	X		X		
				Street furniture						
				Tree coverage and sustainable landscaping						
				Wide sidewalks		X	X		X	
Mission St. (Geneva St. to Trumbull)	High vehicle and pedestrian traffic levels (14,820 daily) ~ 6,382,974 VMT High vehicle speeds (85% speed is 30 mph in a 25 mph zone) Wide lanes (4 lanes) Faded striping Poor sidewalk conditions Main throughoughfare throughout the neighborhood Connects to neighborhing Inner Mission district Major commercial corridor	High collision rates - 126 from 2014 to 2018 ~ 2 fatalities Vehicle-pedestrian collisions are 40% of all collisions A quarter of all collisions involved a vehicle turning left	Complete Streets	Bike boxes			X		X	
				Bike signals						
				Bus only lanes		X			X	
				Curb extensions/bulbouts/painted safety zones	X				X	Matches key features
				Dedicated turn lanes/ turn restrictions	X	X	X	X	X	~ More features than most projects (11 versus average 6)
				Designated loading zones			X		X	~ Bus improvements as well as bike and pedestrians features
				High visibility continental crosswalks	X					~ Some improvements such as sidewalk widening and high visibility crosswalks already exist
				Improved corner sight distance (daylighting and stop bars)			X		X	
				Medians and pedestrian refuge islands	X	X			X	
				Midblock crossings						
				Parklets and bike corrals (bike parking)			X		X	
				Pedestrian head starts and separated signaling		X		X	X	
				Painted bike lanes/sharrows	X	X	X			
				Protected bike lanes (through intersections)	X		X	X	X	
				Restriping	X	X		X		
				Street furniture						
				Tree coverage and sustainable landscaping						
				Wide sidewalks		X	X		X	

Similarly, elements such as landscaping or street furniture might also be part of the end state despite not being included in the proposed plans. Due to the organizational structure of SFMTA, these responsibilities fall on Public Works and local businesses. However, the projects commitment to enhancing businesses and improving pedestrian safety likely means that the

City is likely to heavily support the implementation of landscaping, street furniture, and parklets along the two corridors.

Recommendations

The comprehensive design of the Geneva Avenue and Mission St. safety improvement projects preclude any major additional recommendations. However, the implementation of landscaping, street furniture, and parklets along the two corridors would welcome additions.

3.3 Neighborhood Wide

Field Conditions

Alemany, Geneva, and Mission are important and prominent streets in the Excelsior/Outer Mission district, but they do not reflect the conditions of most streets in the area. Many streets in the Excelsior/Outer Mission area are much more residential and serve as local connections to neighborhood amenities and residences. These streets are mostly two lanes wide, although lane striping or other markings are usually faded or nonexistent. Similarly, pedestrians and bicyclists may also lack such necessary infrastructure as adequately wide sidewalks, street furniture, crosswalks and signals, bike lanes, and share the street (sharrows) markings.

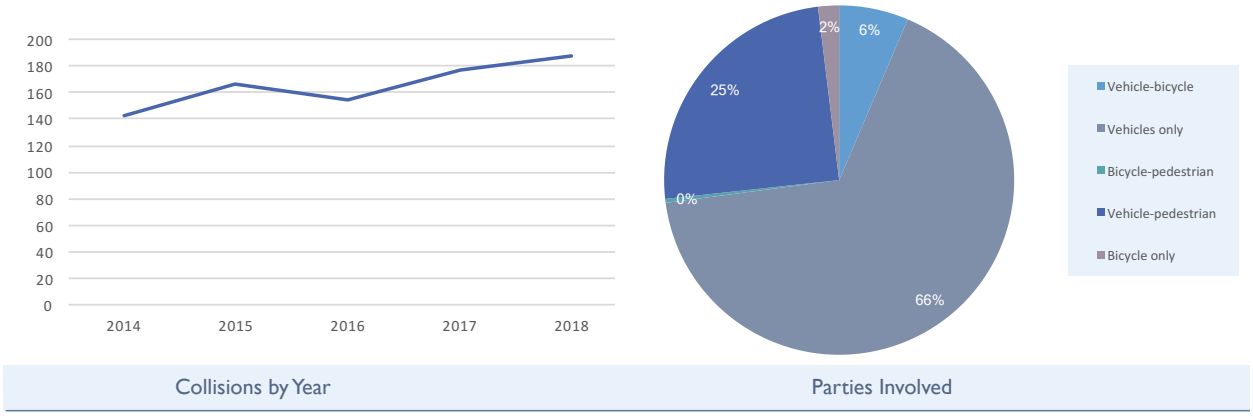
STREET IN EXCELSIOR/OUTER MISSION (LEE-GARDNER, 2020)

Despite their inability to safely support high vehicle volumes or speeds, some of these streets are commonly used for cut-through movements, or as alternatives to main streets. This results in high vehicle speeds instead of the 20 to 25 mph speed limits (Carr, n.d.).

These high speeds in combination with high pedestrian volumes cause high collision rates. Neighborhood wide, 828 collisions occurred between 2014 and the end of 2018 (Transbase, n.d.). Among these collisions, nine resulted in fatalities comprising two bicycle fatalities and seven pedestrian deaths. A quarter of all collisions occurred between pedestrians

and vehicles (Transbase, n.d.). Figure 3.3 depicts the distribution of collisions by mode on neighborhood streets. It also reveals an upward trend in collisions of the previous five years.

Figure 3.3: Distribution of Collisions by Travel Mode on Neighborhood Streets



(TRANSBASE, N.D.)

Treatment

The field conditions in the Excelsior/Outer Mission neighborhood are conducive for both Neighborhood Greenways and Shared Streets depending on the specific street. However, SFMTA's Neighborhood Traffic Calming project focuses solely on Neighborhood Greenways. As stated in its name, the project involves several traffic calming measures that help to reduce traffic speeds and volumes, but does not go as far as to make streets safe enough to be fully shared, as a Shared Street does. As far as neighborhood greenways go, the project proposal includes nearly all the improvements identified under precedent cases. Pedestrian safety measures such as high visibility crosswalks, bulb-outs, decorative crosswalks, and raised

intersections are included in the designs. Additionally, extra traffic calming tools like traffic circles, traffic diverters, and speed humps are to be installed (Carr, n.d.).

Unfortunately, the project does not involve any bike infrastructure. One reason for this could be the lower vehicle volumes and speed limits on the neighborhood streets that could reduce the need for designated bike lanes. Additionally, bike ridership is not especially high in the neighborhood; biking and all other forms of micro-mobility make up less than 3% of all work commute trips (U.S Census Bureau, 2017). Collision data shows that bikes were involved in collisions 8% of the time (Transbase, n.d.). Low bike and vehicle volumes and relatively low bike collision rates reduced the need for bike-specific infrastructure on neighborhood streets.

SFMTA's project is part of a larger Excelsior/Outer Mission Plan by the San Francisco Planning Department (SF Planning, 2018). The project includes a policy goal to promote complete streets. One strategy under this goal is to look for opportunities to repurpose right of way for public use, such as pedestrian plazas and parklets (SF Planning, 2018). Though it does not outline specific elements or locations, there are areas in the neighborhood that would be conducive for such improvements as supported by this policy.

The planning department as part of the Excelsior/Outer Mission plan also created a Streetscape design guide (SF Planning, 2020). The document outlines specific design elements for pedestrian bulb-outs based on extensive research and community outreach. Landscaping and street furniture improvements were recommended. In addition, there are guidelines on preferred lighting treatments (SF Planning, 2020). Lighting is not included in the list in Table 3.3.

Table 3.8: Neighborhood Wide Comparison Table

Case Studies									
Street Type	Field Conditions		Treatment						
	Street Conditions	Safety Conditions	Precedent Treatment Type	Precedent Elements	Precedents				Planned or Constructed Treatment	Evaluation
					North Seattle, Seattle DOT	N Willamette, Portland DOT	Page St., SFMTA	Berkeley, City of Berkeley		
Neighborhood Wide	High pedestrian traffic	828 collisions between 2014-2018	Neighborhood Greenways and Shared Streets	Bike lanes/bike boxes	X		X	X		
		~ 9 were fatal (2 bicyclists and 7		Bioswales, landscaping			X		X	
	High vehicle speeds, but low speed limits	pedestrians)		Chicanes				X		
		1 out of 4 collisions is between a vehicle		Curb extensions, bulb-outs	X		X		X	
	Faded striping	and pedestrian		High visibility crosswalks	X	X			X	Matches nearly all features
				Narrowing vehicle right of way						No bike improvements
	Lack of crosswalks, signals	75% of collisions occurred at intersections		Pavement treatment and signage (sharrows)			X	X	X	
	Poor sidewalk conditions			Raised crosswalks (raised intersections)			X		X	
	Lack of street furniture			Speed humps	X	X	X	X	X	
	Used as cut-throughs			Street furniture					X	
				Striping	X					
				Traffic circles				X	X	
				Traffic diversions	X	X	X	X	X	
				Wayfinding and signage	X	X		X	X	

Recommendations

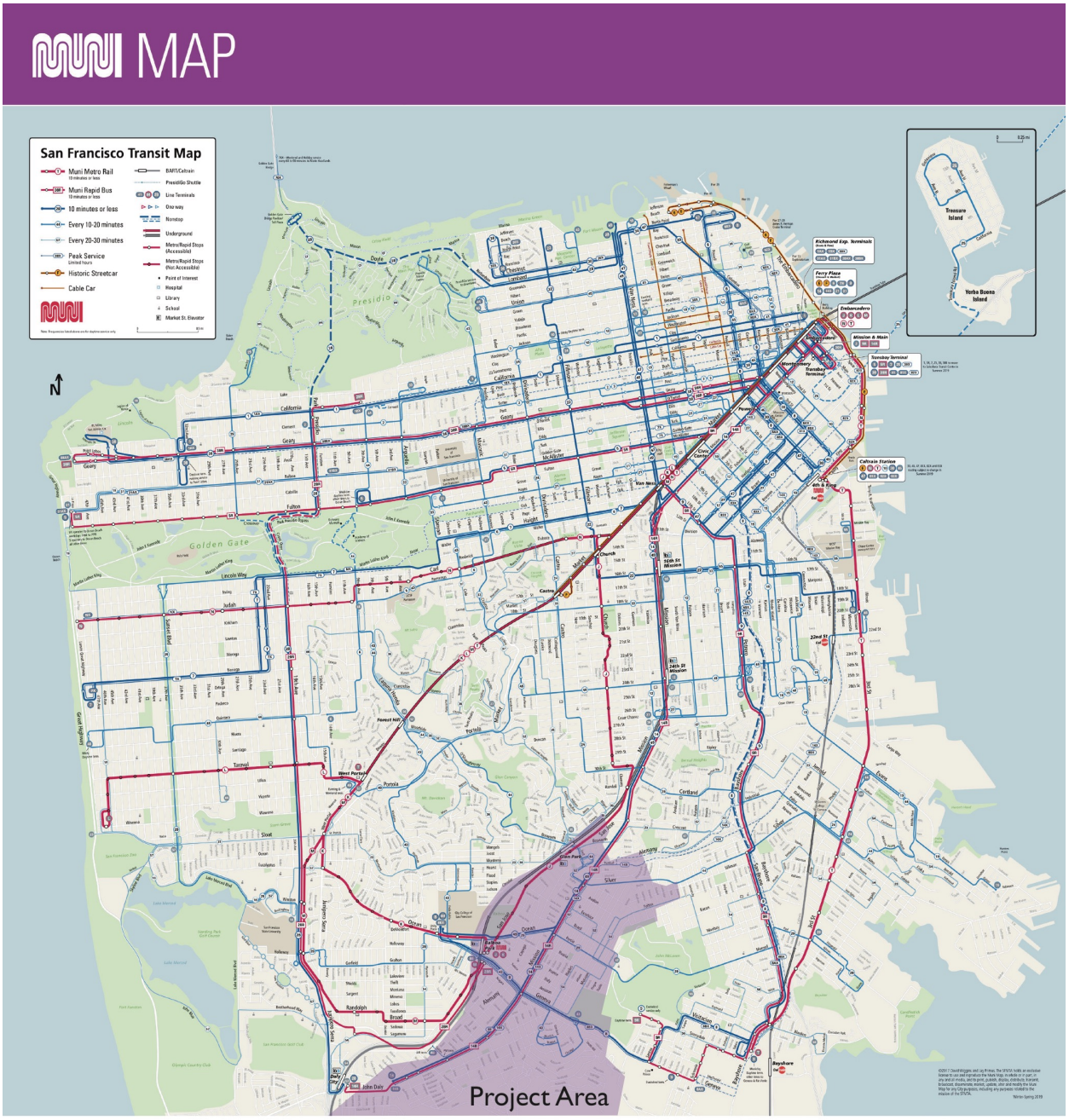
This project covers a wide range of suggested elements that can increase safety for pedestrians and bicyclists. However, even bolder measures could be taken to further ensure safety for bicyclists and pedestrians.

The project could include infrastructure such as visible signage and sharrows to caution drivers that bicyclists may be sharing the road. For pedestrians, SFMTA should identify specific streets in the area that match the conditions necessary for a shared street. Such streets should be converted to shared streets to prioritize pedestrians and further improve pedestrian safety. Similarly, along streets that do not match the perfect grid format, pedestrian plazas can be added to increase intersection clarity and create a safe and inviting place for pedestrians.

Additionally, the project, which covers improvements throughout the neighborhood, should focus more on connecting corridors rather than individual spot treatments. Balboa BART station (a major transit hub) and Glen Park BART station are both located along the

western boundaries of the study area as Figure 3.4 shows. Neighborhood streets that connect to these areas, as well as other neighborhood amenities such as John McLaren Park and Crocker Amazon Playground should have additional safeguards to improve conditions for pedestrians and bicyclists. The bold treatments planned for other streets within the project area can be applied to connections to transit and parks. Additional placemaking measures such as parklets, pedestrian plazas and pavement markings can also be included along these corridors.

Figure 3.4: Map of MUNI Routes in SF



(SFMTA, 2019)

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Appendix

Comparative Demographics

Excelsior/Outer Mission and City Demographics Compared			
Category	**Characteristic**	**San Francisco**	**Project Site**
Population/ age	Population	864,263	63,896
	Median age	38.3	42.7
Tenure	Renter occupied housing	37.3%	36.0%
	Owner occupied housing	62.7%	63.4%
Finance	Median Household Income	136,788	79,375
	Percent below poverty line	6.4%	7.9%
	Unemployment rate	5.4%	6.5%
Origins and language	Speak only English at home	56.2%	28.9%
	Speak a language other than English at home	43.8%	71.1%

Excelsior/Outer Mission and City Demographics Compared			
Category	**Characteristic**	**San Francisco**	**Project Site**
	Foreign born	34.8%	52.1%
Education Level (Population 25 and over)	High school graduate or higher	87.9%	78.4%
	Bachelor's degree or higher	55.8%	28.2%
Commute to work	Car, truck, or van - drove alone	34.3%	47.0%
	Car, truck, or van - carpooled	6.8%	10.7%
	Public transportation (excluding taxicab)	34.0%	34.4%
	Walked	11.1%	2.1%
	Other means	7.1%	2.7%
	Worked at home	6.7%	3.0%

Typology

Typology of Street Types and Treatments							
	Field Conditions		Treatment			Precedents & Outcomes	
Street Type	Street conditions	Safety conditions	Treatment Type	Description	Elements	Precedent Locations	Outcomes
Main thoroughfares and boulevards	High vehicle, pedestrian, and bicycle traffic High vehicle speeds Wide and multiple lanes Unclear lane markings/striping Confusing intersections High vehicle speeds Wide and multiple lanes Unclear lane markings/striping Confusing intersections	High pedestrian and bicycle collision rates High severe injury and fatality rates High intersection collisions	Complete Street	Streets design supports all modes of transportation. All users feel safe and comfortable	Wide sidewalks Street furniture Tree coverage and sustainable landscaping High visibility continental crosswalks Dedicated turn lanes Protected bike lanes (through intersections) Medians as parks Curb extensions/bulbouts/painted safety zones Pedestrian refuge islands Pedestrian head starts and separated signaling Bus only lanes Bike boxes Restriping Parklets and bike corrals Designated loading zones Midblock crossings Improved corner sight distance (daylighting and stop bars) Bike signals	15th Ave - Seattle DOT W 178th St - New York City DOT Valencia St - San Francisco Municipal Transportation Agency Pennsylvania Ave - Washington D.C DOT	Increase in bike and pedestrian safety - 99% decrease in mid-block vehicle/bike interactions - 100% reduction in close calls or near-dooring incidents Reported feeling safer - 82% of people riding bikes - 30% of people who walk - (30% of people who drive felt that their safety decreased somewhat or greatly.) Increase in bike ridership levels (40%), decrease in vehicle traffic (10%) Lowered speed limits Reduce congestion Increase economic vitality

Typology of Street Types and Treatments							
	Field Conditions		Treatment			Precedents & Outcomes	
Street Type	Street conditions	Safety conditions	Treatment Type	Description	Elements	Precedent Locations	Outcomes
Neighborhood streets	Low vehicle traffic High pedestrian, and bicycle traffic High vehicle speeds, but low speed limits Used as cut-throughs High vehicle speeds, but low speed limits Used as cut-throughs High AT traffic levels	High pedestrian and bicycle collision rates High vehicle speeds	Neighborhood Greenway	Safe, calm residential streets. Shared by all users. Prioritize bikes and pedestrians. Connections to schools, parks, transit, etc.	Wayfinding and signage Pavement signage, sharrows Traffic diversions Traffic circles Bike boxes Curb extensions, bulb-outs Raised crosswalks (raised intersections) Bioswales, landscaping Striping Speed humps Stop signs on through traffic High visibility continental crosswalks Narrowing vehicle right of way Chicanes	North Seattle - Seattle DOT N Willamette - Portland Bureau of Transportation Page St - SFMTA Berkeley - City of Berkeley/Minikel	Increase in bike and pedestrian safety Lowered collision rates (by average .4 up to .77) Lowered speeds 83% of streets saw 85 percentile speed decrease 85 percentile speeds around 20 mph Increase in bike ridership levels, decrease in vehicle traffic Increase economic vitality

Typology of Street Types and Treatments							
	Field Conditions		Treatment			Precedents & Outcomes	
Street Type	Street conditions	Safety conditions	Treatment Type	Description	Elements	Precedent Locations	Outcomes
Narrow streets/Alleys	Low vehicle traffic Lack of sidewalks or narrow sidewalks Narrow streets Mixed use buildings with minimal sidewalks Residential local access street Pedestrians walking in the street	High pedestrian/vehicle interaction rates Lack of space for pedestrians in right of way	Shared Street	Based on the Dutch word "woonerf" which means "street for living". Give priority to peds by creating a shared space. No formal distinctions of space for different modes.	Wayfinding and signage — clear entrance Pavement treatments — textured, colored, or raised pavement Painted curb extensions Raised crosswalks (raised intersections) Bioswales, landscaping Designated parking to chicane road Low speed limits Chicanes Street furniture Safe hit posts	Winthrop St - City of Cambridge, MA 6 1/2 Ave - New York City DOT 45th Ave - Seattle DOT London - London Department of Transport	Pedestrian-vehicle interactions reduced From 95% to 5% (NYCDOT) 56% of vehicles give way to peds at shared streets (Compared to 4%) Vehicle speeds reduced (shared streets more successful at reducing speeds than individual measures) Pedestrians use whole space Increased street life (economic vitality)

Typology of Street Types and Treatments							
	Field Conditions		Treatment			Precedents & Outcomes	
Street Type	Street conditions	Safety conditions	Treatment Type	Description	Elements	Precedent Locations	Outcomes
Lack of public space for pedestrians	High ped volumes Low vehicular traffic volumes Narrow sidewalks (sidewalks in poor conditions) Local business activity (first floor activity) Lack of public space	High pedestrian-vehicle interaction rates Lack of space for pedestrians in right of way	Parklets	A parklet is a temporary conversion of curbside parking spaces for new small public parks.	Textured, pigmented pavements (pavement murals) Planters Defined edges — walls, safe hit posts, movable planters Street furniture Landscaping Artwork Lighting Designated loading zones or times Appropriate drainage	Parklets and Streatery Program - Seattle DOT Pavements to Parks Program - SFMTA	Increase feeling of safety 61% pedestrians reported feeling very safe in parklet 84% think they "provide useful neighborhood public spaces" 49% make the neighborhood feel safer Increase in walking and biking levels 4% increase in pedestrian activity 83% increase in foot traffic 67% increase in walking, biking, and transit 67% sales increase

Typology of Street Types and Treatments							
	Field Conditions		Treatment			Precedents & Outcomes	
Street Type	Street conditions	Safety conditions	Treatment Type	Description	Elements	Precedent Locations	Outcomes
Irregular intersections	High vehicle speeds Unclear intersection/irregular shape Long crossing distances Underutilized space on street	High pedestrian-vehicle interaction rates High vehicle speeds Unsafe/confusing intersections	Pedestrian Plaza	A Pedestrian Plaza is a reconfiguration of underutilized street spaces for pedestrians use.	Textured, pigmented pavements (pavement murals) Planters Defined edges — walls, safe hit posts, movable planters Street furniture Movable seating Landscaping Artwork Lighting Corner aprons Appropriate drainage	Madison Square/Flatiron Plaza - New York City DOT San Jose-Guerrero Park - SFMTA	Collision reductions - Collision reductions — 29% decrease in total collisions, 34% fewer injuries, 18% decrease in pedestrian - “Plazas have been proven to enhance local economic vitality, pedestrian mobility, access to public transit, and safety.” — NACTO - 35% decrease in pedestrian injuries - 63% decrease in motorist and passenger injuries Reduced travel speeds (by 9%) Bike volumes increase by 160%