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*Paper Prepared for the C40 Cities Climate Leadership Group*

*Summer 2018*

## **Women and Cycling: A Case Study of the Use of San Francisco Bike Lanes**

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### **Abstract**

This paper presents a case study of the use of San Francisco bike lanes with a focus on women. Bike counts and intercept surveys of cyclists at three locations in San Francisco's SoMa District were complemented by focus groups with cyclists, particularly women cyclists, and brief interviews with non-cyclists. Consistent with other US studies, we find that white men are disproportionately represented among the cyclists we observed, and that women bike less and bike shorter distances. However, at least in the SoMa sample, women are more likely to bike to work than men. Cyclists included people of all income groups and ages in the sample ranged from 18 to 75.

Women who cycle cite the freedom it gives them to travel on their own schedule and the exercise benefits it delivers as major reasons for cycling. Both men and women noted cost savings. Women feel more secure on a bicycle than on transit or walking, but fear of injuries from a bike collision or fall and concerns about bike theft are deterrents to cycling for women. While women cyclists have been able to handle dress and grooming considerations, non-cyclists see these considerations as barriers.

Under-representation of women, Asians and Hispanics reflects cultural and social factors and is not just a matter of travel conditions. Women from these groups commented that "people like me" don't cycle. Overcoming gender and ethnic/racial biases will require investment in partnerships with the communities of concern to complement investments in protected bike lanes and secure parking.

**Key words:** cycling, women, bike lanes

## Executive Summary

Cities across the globe are seeking ways to improve their transportation systems in ways that support a strong economy, a healthy environment, and social equity. Bicycling is a mode of transportation that offers benefits on all three dimensions. Infrastructure requirements are modest financially and physically, and a large portion of the population can afford a bike. Much of the population is capable of riding a bicycle and it is a way for them to build exercise into daily life. Lifecycle environmental costs are minimal, especially when compared to those of motorized transport. In many cities, cycling is as fast as transit or automobiles, and many trips are within an easy half hour ride by bike. Yet cycling remains a small portion of overall travel in most cities; its growth is deterred by heavy traffic, lack of safe routes and secure bike parking, and rider fear of crashes.

The City and County of San Francisco, California (pop. 884 thousand) is a major commercial, residential and cultural center for the San Francisco Bay Area, a multinucleated metropolitan region of 7.7 million. San Francisco has been encouraging cycling as part of its efforts to reduce greenhouse gas emissions, relieve traffic congestion and transit crowding, and encourage active living. Investments in bike lanes have helped boost the bike mode share to about four percent, but it has been difficult to obtain a much higher bike mode share.

One concern is that cyclists are disproportionately men. If bike use is to grow, it will be necessary to support greater bike use among women. This study used a combination of intercept surveys, focus groups, and pedestrian interviews conducted in the South of Market (SoMa) district in June 2018 to better understand who is cycling, their views on the pros and cons of riding a bike in the city, the role of bike lanes in supporting cycling, and reasons for not cycling. The study addresses the following questions:

1. How many people are using the SoMa bike lanes? What are their socioeconomic and demographic characteristics and how does this compare with the city and district?
2. What modal alternatives would be available to cyclists using the SoMa bike lanes? What are the implications for traffic congestion, transit crowding, and greenhouse gas emissions?
3. How important are the bike lanes to cyclists' decisions to bike rather than use another mode? Does this vary with gender, age, race/ethnicity, or other demographics?
4. What concerns do travelers have about cycling and bike lanes? Does this vary with gender, age, race/ethnicity, or other demographics?
5. What other steps could be taken to encourage cycling, especially by underrepresented groups?

Findings include the following:

1. Forty-nine percent of San Francisco residents are women, but women are only 29% of the cyclists observed in the SoMa bike lanes. This is consistent with other city data on cycling.
2. Eleven percent of the women using the SoMa bike lanes live in another city and use transit and bicycle to access their San Francisco activities.
3. More than two-thirds of the women cyclists using the SoMa bike lanes ride their bicycles every day.
4. Women cyclists using the SoMa bike lanes ranged in age from 19 to 67.
5. Women cyclists using the SoMa bike lanes come from households with incomes ranging from under \$20,000 to over \$250,000 and almost all have an automobile available for their travel.

6. Women of Asian descent and especially women of Hispanic/Latino descent are underrepresented among the cycling population,
7. A higher portion of women than men cycle midday (so studies that only report peak period journeys will miss them.)
8. Women using the SoMa bike lanes cycle for work more than men do, but are more likely to bike to work midday than are men.
9. Both men and women cyclists are strong supporters of protected bike lanes and would like to see more of them.
10. Heavy traffic, speeding, and hostile drivers are concerns for both men and women, but women are especially worried about these issues.
11. Bike theft is a major problem and a deterrent to cycling, and more secure bike parking at residences, workplaces, and other major trip destinations would encourage more cycling.
12. Many of the focus group participants report having been in an injury accident on their bicycle.
13. Women who don't ride a bike on city streets are afraid of being hit by a car or falling and breaking a bone.
14. While women cyclists don't see dress and grooming expectations as a significant barrier to cycling, women who don't cycle said these issues are barriers to cycling.
15. Some of the women who don't bicycle feel say that "people like me" don't cycle, suggesting the need for socio-cultural approaches to bike promotion.

Recommended ways to increase participation of women and minorities in cycling include the following:

1. Continue to expand the network of protected bike lanes and strive for a standard design so that rules of the road are clear.
2. Educate drivers and cyclists about the role of cycling and the rules for sharing the road. Increase enforcement against parking in bike lanes.
3. In addition to bike lanes, invest in secure bike parking throughout the city, since bike theft is a major concern and raises the cost of cycling. Both public and private parking is needed
4. Form partnerships with employers, merchants, schools, and cultural centers to improve bike parking and other facilities that support cycling. Work with non-governmental organizations to offer assistance with bike selection, rider training, repair classes, and cycling buddies for beginner riders.
5. Mobilize communities of concern to address encourage and support fuller participation in the city's bike programs by the entire community.
6. Changing the public narrative from "cyclists are mostly young, fit males" to "cycling is for everyone" to encourage women and minorities to cycle more.

## Introduction and Overview

Cities across the globe are seeking ways to improve their transportation systems in ways that support a strong economy, a healthy environment, and social equity. Bicycling is a mode of transportation that offers benefits on all three dimensions. Cycling infrastructure costs are modest and the cost of a bicycle is affordable. A large portion of the population can afford a bike and is capable of using one. Riding a bicycle is a way to build exercise into daily life. Lifecycle environmental costs are minimal, especially when compared to those of motorized transport. In many cities, cycling is as fast as motorized transport, and many trips are within an easy half hour ride by bike. Yet cycling remains a small portion of overall travel in most cities; its growth is deterred by heavy traffic, lack of safe routes and secure bike parking, and rider fear of crashes.

The C40 Cities Climate Leadership Group (C40) aims to enable cities to develop and implement policies and programs that generate measurable reductions in greenhouse gas emissions and climate risks. C40 is committed to ensuring that cities take direct actions within their city limits to contribute to keeping the world within 1.5°C of warming compared with pre-industrial temperatures. In support of this mission and to accelerate city achievements, C40 has launched programs that articulate the benefits of climate action and support cities in quantifying and communicating those benefits.

In the transport field, C40 cities are committed to streets that are safe and accessible for everyone, and envision a future where most trips are made by walking, cycling, and shared transport. Because walking and cycling are (near) zero emission modes of travel, they are especially important strategies for climate action, and they have important co-benefits including better user health, reduced air and noise pollution, and greater affordability and inclusion.

The City and County of San Francisco is a member of the C40 group and its Department of the Environment (SF Environment) is partnering with the C40 Cities Climate Leadership Group to conduct a case study as part of C40's [Women4Climate](#) initiative. The San Francisco case study is one of a number of such studies commissioned by the C40 Cities Network, led by Paris Mayor Anne Hidalgo. The overall project is being coordinated by an academic team at University College London (UCL).

This paper is the result of a partnership between UC Berkeley faculty and students and the staff at the San Francisco Department of Environment, with funding for the UC team members provided by C40. The paper examines the use of bike lanes in the South of Market (SoMa) district of San Francisco. San Francisco has been working to increase its bike mode share by investing in bike lanes and parking and supporting bike sharing services. The bike mode share has indeed grown, but one concern is that cyclists are disproportionately men. We therefore undertook this study not only to understand how the SoMa bike lanes are being used but to investigate women's perspectives on bike lanes and cycling in general, with the objective of identifying ways to increase women's engagement in cycling. The study also examines issues of race, ethnicity and affordability associated with bicycling as there are indications that here too there are gaps, and it is the city's intent to promote bicycling as a transportation option available to the entire community.

To investigate these issues, the study team carried out counts of the bikes using the South of Market (SoMa) bike lanes and used intercept surveys to document cyclists' frequency of use, trip purposes, approximate trip lengths, residence, gender, race/ethnicity, income level, and age. We held a series of focus groups to explore cycling and the role of bike lanes in more detail. We also carried out an intercept survey of pedestrians in the SoMa area to gain additional insights into non-cyclists' views on

cycling. All field work was carried out in June 2018 during daytime hours midweek. During this period the weather was mild and there were no unusual traffic incidents, although as is typical in the city, sports events, construction and emergency services did on occasion affect traffic flows.

UC team members took the lead on the design of the surveys and focus groups and also led the field work and focus group sessions and interviews. SF Environment proposed locations for data collection along the bike lanes, helped carry out the intercept surveys, and handled arrangements and note-taking for the focus groups. The work complements and adds detail to a previous study examining the climate action benefits of bike lanes as well as other health, safety, economic and environmental benefits (Arup, 2017.)

## **Background on Cycling**

Cycling has been widely promoted as a low carbon, low environmental impact transport mode. It is a mode of travel that is potentially accessible to a wide range of users because of its affordability and relative ease of use for much of the population. Cycling has positive health benefits for users, so long as the cycling environment is safe (Pucher et al., 2010; Pucher and Buehler, 2010; Pucher and Buehler, 2016.) Cycling also can be an efficient transport mode in urban environments; it requires only modest investments in infrastructure compared to those of other modes, and speeds are sometimes competitive with those by auto, especially when traffic congestion is present (Dill et al., 2003). Cycling thus can contribute to efforts to combat global warming while also producing a broad range of social, economic and environmental benefits.

Cycling rates as high as 30-50% have been reported for cities in the Netherlands and Denmark (Pucher and Buehler, 2008.) In the US, however, despite a reported 60% increase in cycling to work over the past decade, cycling rates remain low. The US Census, which reports mode share for the journey to work, shows that the Western US has the highest rate of bike commuting, at 1.1%; the South has the lowest rate at 0.3% (McKensie, 2014.) However, there is considerable variation among cities. College towns Davis, CA, Berkeley, CA and Boulder, CO, and Cambridge, MA reported bike mode shares for commuting of 16.6%, 9%, 9%, and 7%, respectively (LAB, 2017). Among larger US cities, Portland, OR's bike commute share is estimated at 6.3%; Washington, DC's is 4.6%(US Census, 2016; LAB, 2017).

As the data on commute mode shares indicate, many studies of cycling focus solely on the journey to work, even though work trips are a small portion of total daily travel. In the US, for example, home-to-work trips account for about 16% of total trips and 27% of distance travelled. However, work trips are linked to many other trips made on the way to or from work or during the workday, so that the choice of mode to work can shape how other trips are made as well. In addition, because most work trips occur during peak periods, they are a major contributor to congestion (McKucken and Srinivasan, 2003). Thus, despite its declining share of travel, the trip to work remains an important economic, social and environmental issue and appropriate focus for investigation.

Nevertheless, the majority of trips are made for shopping, personal and work-related business, eating out, and family and personal errands, and many of these trips are under 5 miles long – distances that most cyclists, traveling 10-14 mph, can cover in 20-30 minutes or less. In addition, non-work trips are a large share of travel of women, retirees, and those who are unemployed. Regional and local travel surveys do collect data on all types of trips, but for modes that are a small portion of the total, as is the case with cycling, a random sample typically produces too few data points to be usable for deeper categorical analyses. Special studies are often needed.

The physical conditions under which bike trips are made influence the rate of cycling observed in cities around the world. Harsh weather and difficult topography deter some riders but not others, and relatively high ridership can be found in snowy, rainy, and hilly cities (Buehler and Pucher, 2012.) Cycling is aided by proactive investments in bike infrastructure (Dill and Carr, 2003, Buehler and Pucher, 2012) and traffic-calmed streets (Pucher and Dijkstra, 2000.) Deterrents to cycling include heavy and fast traffic (Akar et al., 2013; Mitra and Nash, 2016), narrow roads (Ward, 2008) and aggressive drivers (Garrard et al., 2012; Sanders, 2015.) Policies ranging from the provision of bike parking to employer dress codes can support or deter cycling (Shephard, 2008.)

Social and cultural factors also affect cycling. Early experience appears to be a factor in willingness to cycle, as cycling as a youth has been found to be positively associated with cycling as an adult (Emond et al., 2006.) In the US, Canada, and Australia, women are considerably less likely to cycle than are men (Mitra et al., 2018.) Overall, the US rate of bicycle commuting for men averages 0.8% while for women the rate is less than half that, at 0.3% (US Census, 2014). Gender roles have been implicated in this gap, including women facing a larger number of personal, work-based, and household-based constraints on time (McGuckin and Nakamoto, 2005.) Women have also been found to be more risk-averse than men (Damant-Sirois and El-Geneidy, 2015) and less confident about their abilities to accurately assess traffic conditions (Bernhoft and Carstensen, 2008), factors that work against cycling. Some studies have found that men are less concerned about safety than are women (Krizek et al., 2005), especially older women (Bernhoft and Carstensen, 2008.) Studies further have found that women cyclists have significantly more positive associations with protected lanes with some physical separation from traffic than men do (Dill and McNeil, 2013), and prefer off-road bicycle paths (Garrard et al., 2008, Baker, 2009.) Other studies conclude that both men and women have a strong preference for protected bike lanes as well as personal safety concerns about cycling (Heesch et al., 2012.)

It is notable that the gender gap in cycling is not universal – in such countries as Denmark, the Netherlands, and (increasingly) Germany, Sweden, and Belgium, men and women cycle at roughly the same rates (Pucher and Buehler, 2008.) More compact cities and more extensive bike lane networks are clearly a factor in these differences, suggesting that barriers to cycling may be susceptible to reduction through mixed-use development and the creation of protected bikeways and safer streets (Saelens et al., 2003.) On the other hand, at least in the US, there also are ethnic and racial gaps in bicycle use, with African Americans and people of Asian and Hispanic descent cycling 50-70% less than white Americans (Pucher et al., 2011). Such findings suggest that in addition to the built environment, cultural factors deserve a closer look. In this regard Jensen notes that there are local mobility cultures that influence choices and Bonham and Wilson (2012) point out that decisions to cycle are made as part of a “repertoire of mobility practices” that include building social relationships as well as serving utilitarian purposes. Steinbach et al. (2011) show that such cultural practices vary across gender, income and ethnic groups, where cycling carries different symbolic meanings. This suggests that interventions to encourage cycling need to respond to social and cultural concerns in addition to infrastructure.

### **Case Study Background: Bike Lanes in San Francisco’s SoMa District**

The City and County of San Francisco is located northern California, encompassing the tip of the San Francisco Peninsula between the Pacific Ocean and the San Francisco Bay as well as Treasure Island. In 2017 the population was estimated at 884,363, up from about 806 thousand in the 2010 Census. With a land area of about 47 sq. mi. (121.5 sq. km.), the city is the second densest in the US, behind New York. The population is racially and ethnically diverse, with about 40% white, 36% Asian, 15% Hispanic or Latino, 5% black, 4% mixed, and 1% Native American, Hawaiian, or Pacific Islander. About 35% of the population is foreign born and in 44% of San Francisco households, a language other than English is

spoken at home. Forty-nine percent of the population is female, 13.4% are under 18 years of age, and 15.4 percent are 65 or over (US Census, 2017).

San Francisco is part of the nine-county San Francisco Bay Area, a multinucleated region of 7.7 million people. The metropolitan area also encompasses the cities of San Jose (1.035 million people) and Oakland (pop. 425,000) as well as numerous smaller cities and towns interlaced with farms, ranches, orchards and vineyards. Increasingly, economic activity is further linked across a megaregion of some 14 million people, 21 counties and 164 cities, extending east to Sacramento and the northern San Joaquin valley and south into the Monterey Bay Area. Within these larger conurbations, San Francisco is a major commercial, financial, and cultural center, leading the region in both high-income and low-income jobs. The Bay Area's Metropolitan Transportation Commission estimates that there were nearly 670 thousand jobs in San Francisco in 2015 (MTC, 2018), swelling the daytime population to over a million people. About half of the city's jobs are filled by commuters from other counties to the South, East, and North; in turn, over a fifth of San Francisco's employed residents commute to another county.

While the city is one of the most prosperous in the world, with a median household income of almost \$88,000 and per capita income averaging nearly \$56,000, over 10% of the population is in poverty. Jobs-housing imbalance and housing affordability are serious problems in San Francisco. Transportation is also a problem for many. Automobile users are often stuck in traffic, and transit riders often find themselves packed into overcrowded vehicles. But walking, biking and transit account for over half of all trips in the city, and about a third of the city's residents do without a car (US Census, ACS). Likewise, many commuters to the city come by rail, bus, ferry, or carpool.

With many trips in the city under 4 miles in length, bicycling would seem to be a suitable travel mode for many, and SFMTA's automated counting stations recorded in excess of 44,000 bikes/average weekday in 2016. However, bicycles currently account for only 4% of the commute trips and 2% of trips for all purposes in San Francisco. The mode share varies with land use and topography; mode shares of 9-10% are reported for areas of the city that are higher density and less hilly. Improved bike facilities also have boosted bike counts; for example, the addition of bike sharing stations has been accompanied by nearby bike count increases of as much as 10% (SFMTA, 2018.)

Bike safety is a concern. According to one source, the most common types of bike accidents are falls due to poor pavement conditions, getting doored, sideswiped or pushed off the road, getting hit at a driveway or side street intersection, and motor vehicle failure to yield (Bay Area Bicycle Law, 2016.) Between two and seven cyclist fatalities have occurred each year for the past decade (SFMTA, 2016), with many more injuries. In response, in addition to repairing and cleaning pavements, the city has been investing in improved bike facilities and safer street designs with lower speeds as part of its VisionZero plan. Bikeway improvements are a major element of the plan. In 2016, the city had a bike network covering over 400 of its 1000 miles of streets and highways, but about half of the bike network shared right of way with motor vehicles and only 13 miles of the bike network were protected bikeways (SFMTA, 2017.) Efforts to increase the number of protected bike lanes are underway, although the changes frequently controversial, since bike lanes sometimes compete for limited road space with bus stops, car parking, and delivery vehicle and ride-match loading and unloading.

The South of Market (SoMa) district has been the recipient of a number of bike lane improvements, including the recent installation of new bike facilities along busy Market and Folsom Streets. The area, formerly a warehouse and light manufacturing zone, has been in transition over the past several decades. Many of the warehouses have been converted to clubs, bars, live-work studios, and lofts, as well as offices for the burgeoning tech industry. Affordable housing occupies some of the district. New projects have included museums and cultural centers, ATT Park (home of the SF Giants), as well as new

office and housing towers, big box retail, hotels and restaurants. SoMa is also a major regional and city transit hub, served by BART, Caltrain, Muni Metro and numerous bus lines.

Today the mixed use, mixed income district has tens of thousands of jobs and residents – the exact numbers and demographics depend on which neighborhood boundaries are used. For example, in SoMa zip code 94103, the 2016 population was about 25,000, 41% of whom were female, and median household income was about \$48,000. In the eastward-adjacent zip code 94107 – which also juts south from the area – the 2016 population was almost 30,000, with females constituting 48% of that total, and the median household income was \$135,000. Zip code 94105, between 94107 and the Bay, had a population under 7,000, of whom 45% were female, and a median household income of \$203,000 (City-Data.com, June 2018.) The area also has a number of major streets with heavy traffic and high crash rates, and many residents and workers see bike lane improvements as a necessary step in improving safety and supporting the city’s goals of greenhouse gas reduction and zero traffic deaths.

Among the questions we sought to answer, using the SoMa bike lanes as the focal point for the investigation, are the following:

6. How many people are using the SoMa bike lanes? What are their socioeconomic and demographic characteristics and how does this compare with the city and district?
7. What modal alternatives would be available to cyclists using the SoMa bike lanes? What are the implications for traffic congestion, transit crowding, and greenhouse gas emissions?
8. How important are the bike lanes to cyclists’ decisions to bike rather than use another mode? Does this vary with gender, age, race/ethnicity, or other demographics?
9. What concerns do travelers have about cycling and bike lanes? Does this vary with gender, age, race/ethnicity, or other demographics?
10. What other steps could be taken to encourage cycling, especially by underrepresented groups?

## Research Approach

We used a combination of bike counts, surveys and focus groups to investigate the use of bike lanes in the SoMa district of San Francisco, with particular attention to gender, race and ethnicity, and income as well as mobility issues. The work was carried out as follows.

**1. Study design and human subjects review board approval:** We drafted surveys and interview guides, designed a research protocol, and obtained the review and approval of UC Berkeley’s Committee for the Protection of Human Subjects. The study design included two surveys: a brief intercept survey to collect information on SoMa bike lane users and their bike trips, and a lengthier survey for administration to focus group participants. The study design also included a set of questions on cycling for pedestrians in the SoMa area and an open-ended focus group interview guide.

The cyclist intercept survey included questions about the cyclist’s current trip purpose (work, school, shop, social/recreational, tourism, exercise, other), trip origin (street/cross street or well-known site, city, zip code) and trip destination, as well as frequency of cycling (daily, a few times a week, a few times a month, once a month or less) and frequency of use of the SoMa bike lanes. Five sociodemographic questions also were asked: gender, age, home zip code, income (by income range) and race/ethnicity. No information that would allow an individual to be identified was included in the survey.

The purpose of the focus groups was to investigate attitudes toward cycling, flag barriers to cycling, assess the importance of bike lanes in shaping attitudes and behaviors, and identify ways to overcome or reduce barriers to cycling. The sessions were designed to begin with a survey (10 min.) and proceed with a discussion (50 min.) The survey aimed to gather more extensive data than could be collected during an intercept survey. It drew questions from a 2016 nationwide bike survey (Corona Insights, 2016; Forsyth et al. 2011), with modifications and additional questions to better match the needs of this study. The questions covered sociodemographic data and information on bike use, and also inquired about attitudes toward cycling and concerns about cycling. The discussion guide outlined questions and probes on cycling frequency, frequency of other modes used, bicycle network issues, percent of time bike lanes are used when available and route choices where bike lanes are not available, health and safety concerns, as well as factors that have influenced the participant's decision to cycle, and potential barriers to bike use. We drew from the literature in selecting these topics for discussion (see, e.g., Garrard, 2003; Handy and Xing, 2011, Pucher and Buehler, 2010, Pucher et al., 2011, Garrard et al., 2012.)

The focus group recruitment strategy included inviting intercept survey participants to come to a focus group meeting and sending out an invitation to participate in focus groups to several community groups. In the recruitment process the study team purposely oversampled women and made an effort to recruit focus group participants of diverse racial, ethnic, and economic backgrounds. Finally, because the views of those who are not regular cyclists in the city were also sought, an additional recruitment strategy involved intercepting pedestrians and inviting their participation.

**2. Initial reconnaissance and selection of intercept sites:** Staff at San Francisco Dept. of Environment, in consultation with city bike experts, recommended several sites along SoMa bike lanes as potential locations for intercept surveys and bike counts. During the first week of June 2018, UC Berkeley researchers visited five candidate bike lanes in the SOMA district of San Francisco, 4<sup>th</sup> and Townsend, 5<sup>th</sup> and Folsom, 8<sup>th</sup> and Howard, 11<sup>th</sup> and Howard, and 8<sup>th</sup> and Folsom, in order to assess the sites' suitability for the bike counts and cyclist intercept surveys. The intent was to locate sites where it would be possible to safely intercept cyclists while they were stopped either at traffic lights or at bike parking locations. In assessing the candidate sites for the intercepts, the research team noted bike lane design and usage, adjacent traffic volumes and speeds, the share of buses and trucks, pedestrian volumes, area land uses, the level and types of commercial and retail activity along the street, and auto-oriented uses such as gas stations and car repair, driveways, and parking lots. Local construction was also noted.

The researchers also used the initial reconnaissance as a pretest for the field work portions of the study design. Team members carried out baseline counts of cyclists at key locations along each street, pretested the intercept survey, and invited cyclists and pedestrians to focus groups. No problems were encountered with the field work procedures and the initial data checks indicated that respondents completed the full survey and had no apparent difficulty with any of the questions.

Based on the reconnaissance, the 4<sup>th</sup> and Townsend, 5<sup>th</sup> and Folsom, and 8<sup>th</sup> and Howard sites were selected for the intercept surveys. The 4<sup>th</sup> and Townsend location is close to the Caltrain commuter rail station linking San Francisco, residential communities in San Mateo Counties, and Silicon Valley and is a magnet for commuter trips in both directions. While construction in the area has left the bike lane ill-defined, there is a bike parking station as well as considerable pedestrian and transit activity in the area. The 5<sup>th</sup> and Folsom bike lane is located along a heavily used commuter route with transit, trucks, and

firetrucks in the mix. The protected bike lane attracts numerous cyclists, and the area also has numerous pedestrians. The 8<sup>th</sup> and Howard bike lane is in an area with a high level of pedestrian activity around local shops, cafes, and a supermarket, as well as commuters. Traffic was both lighter and slower than at the other locations.

**3. Intercept survey and bike count:** Surveys and bike counts were carried out at the three selected sites on three consecutive weekdays (one day per site) June 12-14, 2018, during the hours of 8-10 am, 11 am – 1 pm, and 3-6 pm – 7 hours per site. One member of the research team kept track of total bikes passing the intercept location while other team members intercepted and surveyed cyclists. The surveyor approached a stopped adult cyclist at random, provided a brief oral description of the survey, offered a one-page description of the project and protections for human subjects, and provided a survey on a clipboard with a pencil to those who consented to complete the survey. Surveyors also offered to fill out the cyclist's responses if the cyclist preferred. When a survey was completed, the surveyor approached another stopped bike. Only adults age 18 or more were eligible to participate.

Team members also kept track of refusals, defined as a cyclist who stopped or slowed and communicated with a field worker but did not complete a survey. (We acknowledge that the actual refusal rate may be higher, as some cyclists may have declined to slow or stop as a way of avoiding the survey.) The bike count and refusal rate information allow the calculation of a survey sampling rate.

Field workers were available to orally survey the participants in Spanish or Chinese as well as English. However, this option was not used by participants, most of whom filled out the survey themselves. The survey took approximately one minute to complete and almost all respondents did so in that amount of time.

Survey data were entered into a spreadsheet and checked for consistency and reasonableness. A total of 433 usable surveys were collected, with a dozen of those surveys missing a few items. Four surveys were discarded, either too much data was missing or the responses were nonsensical (one case only.)

**4. Focus group recruitment:** We offered the opportunity to participate in the focus groups to cyclists who were intercepted along the SoMa bike lanes, including a few who stopped for the field workers but preferred not to fill out the short survey. We also offered focus group participation to pedestrians in the same areas who engaged in a short interview and stated that they occasionally ride a bike. In addition, we announced the focus groups to organizations representing diverse communities of interest in San Francisco. Respondents who affirmed that they had ridden a bicycle in San Francisco at least once in the previous year were eligible to participate. Sixty-one people volunteered for a focus group; due to scheduling conflicts and space limitations, the final number of participants was 46.

**5. Focus group sessions:** The research team organized four one-hour sessions with 8-15 participants each. The focus groups were held over the lunch hour or just after regular working hours (5:30 pm) in easily accessible conference rooms in San Francisco. Focus group participants used first names only during the discussion and were asked to treat any personal information discussed as confidential. A light meal was provided.

At the start of each session, each participant was asked to sign in and was given the one-page summary of the study and a protections for subjects consent form for signature. The session participants then filled out a 20-question survey covering demographics and affiliations (9 questions), activity engagement

(1 question), bike use (7 questions), other transportation use (1 question), and attitudes toward cycling (2 questions.).

An open-ended conversation about cycling, structured around topics in the focus group interview guide, followed. The conversations covered:

- frequency of cycling in San Francisco and elsewhere
- likes and dislikes about cycling in San Francisco
- benefits of cycling (e.g., affordability, exercise / health benefits, convenience)
- social aspects of cycling (e.g., workplace attitudes/ dress codes; shower issues; participation/ views of friends and family)
- concerns about cycling, (e.g., traffic safety, personal safety, bike theft concerns)
- importance of bike lanes in cycling and views of different types of bike lanes
- degree of deterrent due to weather, topography, distance
- perspectives on the available bike network; bike lane preferences
- bike parking and storage - home and destination
- recommendations for improving likelihood of cycling

Each participant received a \$50 gift card honorarium at the end of the session.

## **Results**

### **Intercept Surveys**

During the initial reconnaissance on Tuesday and Wednesday, June 5 and 6, 2018, 87 surveys were collected at 4<sup>th</sup> and Townsend and 5<sup>th</sup> and Folsom. The main purpose of this initial data collection was to verify that the survey procedures were workable. No problems were encountered and data checks indicated that respondents completed the full survey and had no apparent difficulty with the questions.

The survey was continued in the same fashion the following week, Tuesday, Wednesday and Thursday, June 12-14, 2018. Data were collected at each site in succession, for seven hours per day, during the morning peak (8-10 am), midday (11-1 pm), and evening peak (3-6 pm) periods.

The survey procedure was as follows. One field worker kept a count of bikes using the bike lane while other field workers conducted the survey. Other field workers would approach a cyclist stopped at a light or in the process of bike parking or unlocking and request that they complete a brief, 10-question survey on cycling. The field worker then would either administer the survey or, if the cyclist requested, provide the survey on a clipboard for the cyclist to fill out. When a survey was completed the field, the field worker approached the next available cyclist. Field workers also kept track of refusals, defined as a cyclist who stopped or slowed and communicated with a field worker but did not complete a survey. (We acknowledge that the actual refusal rate may be higher, as some cyclists may have declined to slow or stop as a way of avoiding the survey.)

### **Bike Count and Intercept Survey Findings**

Table 1 shows the approximate number of bike trips using the lane during the count period, the number of surveys collected, the approximate refusal rate, and the estimated sampling rate for the survey. A

9.3% sampling rate was obtained. We call the counts trips rather than cyclists because we observed some cyclists using a particular lane more than once on the survey day.

The bike counts are for the seven hours of observation and not for the full day. Within each day, counts varied substantially by time of day at each site, with about half of the bikes observed in the evening peak and about 15% midday. A comparison of the survey period counts to the initial reconnaissance counts also indicates substantial day-to-day variation. Counts differed week to week by over 50% at 4<sup>th</sup> and Townsend and 8<sup>th</sup> and Howard but by only about 3% at 5<sup>th</sup> and Folsom. During the survey period the weather was mild and the major special event in the area that may have affected traffic and bike use was home games for the San Francisco Giants baseball team. We are unaware of other special events or unusual interruptions that might explain the high variation in observed bike counts. A longer count and observation period would likely provide insights into this, but resources were not available for a larger study.

Table 1. SoMa Bike Count and Intercept Survey Data -- June 2018

Location	Bike Count	% of total	Intercepted	% of count	# Surveys	% tot. surveys	Refusals	% refused
4th and Townsend	1725	37%	269	16%	192	44%	77	40%
5th and Folsom	1404	30%	74	5%	57	13%	17	30%
8th and Howard	1525	33%	258	17%	184	42%	74	40%

Notes: bike counts 1 weekday per site, am peak, midday and pm peak only-7 hrs.; refusals were intercepted but did not fill out a survey

Among the 433 respondents, 68.7% were male, 28.6% were female, 0.7% prefer another gender designation, and 1.8% did not answer. The San Francisco population, in comparison, is 49% female. The average age of the sample was 38 and the median was 35, with a range of 18 (the minimum allowed to participate in the survey) to 75.

Race and ethnicity of the SoMa cyclists are shown in Table 2. Cyclists show a much higher percentage of whites than is present in the San Francisco population as a whole, about the same percentage of African-Americans, and considerably fewer Asians or Latinos.

Table 2. Race / Ethnicity of SoMa Cyclists

	No.	Sample	SF Pop.
White or Caucasian alone	251	58.0%	40.5%
Black or African American alone	26	6.0%	5.5%
Hispanic or Latino	34	7.9%	15.2%
Asian or Asian American	86	19.9%	35.9%
Native American or Pacific Islander	4	0.9%	0.4%
Other	9	2.1%	0.7%
Mixed	18	4.2%	4.3%
Did not answer	6	1.4%	
Total	434	100.2%	102.5%

Census data for household income indicates that San Franciscans had a median household income of about \$88,000 in 2016. Table 2 shows the income distribution reported by the sample as a whole and by females. The median household income of the same lies in the \$100-150 thousand range, perhaps 40-50% higher for cyclists than for the city as a whole. Note, however, that both very low-income and very high-income household members are cycling.

Table 3. Income of SoMa Cyclists

	<20k	20k to <40k	40k to <60k	60k to <100k	100k to <150k	150k to <200k	200k to <250k	250k +	Total	did not answer
sample	48	23	19	75	79	53	29	44	370	63
	13%	6%	5%	20%	21%	14%	8%	12%	100%	
females	10	4	4	27	29	12	7	10	103	21
	10%	4%	4%	26%	28%	12%	7%	10%	100%	
cum. %	13%	19%	24%	45%	66%	80%	88%	100%		

Table 4 shows the residence location of the cyclists using the SoMa bike lanes. Of the 430 respondents that provided this information, 14 could not be matched to an official US Postal Service zip code to determine the city of residence. The remaining 416 respondents included five from out of state, four from other California regions, and two from the Bay Area megaregion outskirts. San Francisco was the residence for 58.8% of the survey respondents, with 29.4% coming from San Mateo and Santa Clara Counties and 8.7% coming from the East Bay. The high number of out-of-town residents using these bike lanes reflects the fact that the SoMa bike lanes serve both the Caltrain station at 4<sup>th</sup> and Townsend (serving the Peninsula) and the BART stations located along Market Street (linking to the East Bay.)

Table 4. Residence of SoMa Cyclists

Residence Location	No. Respondents	Percent
out of state	5	1.2%
other CA region	4	1.0%
megaregion	2	0.5%
San Francisco	244	58.8%
Oakland	14	3.4%
Other East Bay	12	2.9%
Berkeley	10	2.4%
San Jose	20	4.8%
Palo Alto	12	2.9%
San Mateo	11	2.7%
Mountain View	10	2.4%
Redwood City	16	3.9%
Other Peninsula / San Mateo Co	29	7.0%
Other Santa Clara Co	24	5.8%
North Bay	3	0.7%
Total	416	100.2%

Trip purpose is shown in Table 5. For this question, respondents could check all trip purposes that applied to their cycle trip, and the 412 cyclists who answered this question listed 523 trip purposes. Reflecting the focus on the morning (9-11 am) and evening (3-6 pm) peak periods in the study, 67% of the reported trips were to/from work for the sample as a whole and another 4% were to/from school. Respondents noted the following “other” trips: making deliveries (two respondents reported that this is their job), going to a business appointment, eating out, going to a medical/dental appointment, and going to a bank or teller machine.

Table 5. Trip Purpose, SoMa Cyclists

purpose	sample	women
work	68%	75%
school	4%	3%
shop	8%	6%
tourism	2%	1%
exercise	8%	6%
other	9%	6%

It is notable that for women, a higher proportion of trips were for work and a lower proportion for other purposes than for the sample as a whole. A closer look indicated that women were more likely to go to work after 10 am and accounted for about 40% of trips during the midday. Ending the survey at 6 pm may have missed after-work linked trips by women who started work later in the day.

Survey respondents also were asked to list the start and end point of the trip they were making. Based on this data, together with home zip code data, it appears that almost a quarter of the bike trips using the SoMa bike lanes started or ended outside of San Francisco. The cyclists entered the city’s bike network at the Caltrain station, the Transbay Terminal, or a BART station along Market St. In a number of cases the respondent noted this explicitly; in other cases we inferred it from a trip end address. At least 130 SoMa bike trips were linked to transit in this fashion.

We used the two San Francisco trip ends to calculate trip distances. The distances are approximate because in many cases a reported trip could have taken alternative routes to reach the destination (using several different streets in addition to the SoMa bike lanes) and we did not collect this route choice information. Instead, we used Google Maps bike distances and when more than one route was offered, took the shorter route. Based on this we estimate that the average bike trip length for cyclists using the SoMa bike lanes, not counting any cycling that was done outside of San Francisco, was about two miles, with a range of 0.25 miles to about 8 miles (for a trip from Mission Bay to San Francisco State University.)

### Focus Group Findings

Four focus groups were held, one in a community college classroom in the Bayview district and three in conference rooms on Market Street at the edge of the SoMa district. The 47 participants included 36 women; one focus group was women only.

The survey administered at the start of the focus group provided information on participants’ socioeconomic characteristics as well as their travel patterns, use of bicycles, and attitudes toward cycling. The average age of participants was 35, with women having an average age of 46; the overall age range was 25-74. One fifth of the participants lived outside of San Francisco. Participants’ household size averaged 2.4 but only 11% had a child under 18 in the household and 32% lived alone. Eighty-three percent were employed full time or part time, with 6% retired and 6% unemployed and looking for work. Household income ranged from under \$20,000 a year (9%) to over \$250,000 (21%), with a median

household income just over \$100,000. The participants were 55% white, 15% black, 9% Latino, 9% Native American/Pacific Islander, 6% other, and 6% mixed.

All of the participants reported that they owned a bike – many commented that they owned several -- and all had cycled in San Francisco in the past year. The frequency of bike usage was high, with respondents reporting an average of 166 days a year biking for transport and 53 days a year biking for fun. On average the participants reported biking for about 65 minutes a day. The only discretionary activities that engage participants more than cycling are visiting websites and social media (although participants reported reading almost as frequently as they cycle.)

Trip purposes for cycling included, in order of frequency, running errands, biking for social and recreational purposes, going to and from work and school, and biking to public transit. Most of the respondents reported that bicycling was their primary mode of travel but some of the women in the sample bike only for recreational purposes and some of the men only bike to work. Respondents also reported walking, using a motor vehicle, or using transit as their primary mode of travel for an average of 3-4 trips a week.

Responding to attitude questions on a 1-5 scale, where 1 is “not at all” and 5 is “very much”, nearly all participants felt strongly that biking is convenient (4.57) and that they would like to bike more often (4.28). However, nearly all also reported that they worry about getting hit by a motor vehicle (4.13). They wear helmets to try to reduce the danger to themselves (4.28).

Most respondents are familiar with San Francisco’s bike lane system (4.64) but a minority are satisfied with them (2.45). A slight majority reported that they feel safer than they did a year ago, and several added comments to the effect that expansion of the protected bike lane system was why they felt safer. A somewhat larger share said they would likely bike more if more lanes were physically separated (3.87).

Asked whether various conditions were deterrents to cycling (1=yes), most felt that traffic (.79), poor road conditions (.77), and hostile drivers (.60) were problematic, while relatively few felt that weather (.26), topography (.26), work or family commitments (.19), lack of a person to bike with (.11), trip distances (.09), or bike speeds (.02) were barriers.

The women in the focus group surveys reported biking somewhat less than the sample as a whole, both in terms of days a year (158) and minutes per day (61). They were somewhat more likely to make trips for errands and to escort children and somewhat less likely to make work trips by bike.

In the discussion sessions of the focus groups, participants elaborated on their views of cycling. They like the convenience, speed, flexibility and freedom of cycling and most felt that they were traveling as fast as they would in a motor vehicle, or in some cases, faster. Many commented that driving in the city and searching for parking is stressful whereas cycling seems “energizing”, “liberating”, “almost meditative.” Several participants, men and women, commented that cycling was their primary mode of transportation and several added that they did not own a car. Saving money on parking as well as time looking for it was a frequently cited reason for biking.

Women frequently mentioned that riding a bike was a good source of exercise and strength-building and that they felt safer on a bicycle than on transit or walking because they could just zoom away from a hostile situation or other danger. An equally important reason for many women was camaraderie: they cycled with friends or family, or participated in an organization that combined happy hours or other get-togethers with bike rides.

On the other hand, women also expressed stronger concerns about their ability to handle hills, aggressive drivers, potential conflicts with trucks and buses, and even aggressive cyclists. On the latter point, several women complained that male cyclists had refused to advise them on fixing a bike or had done so condescendingly; a few had also had conflicts with male cyclists who wanted the slower woman cyclist to

get out of the way. These concerns lead some women to ride mostly in parks and other recreation areas where leisurely travel is more accepted.

While both men and women ride bikes for a variety of trip purposes, women in the focus groups were somewhat less likely to ride to work. This was in contrast to the findings from the bike lane intercept surveys, where a higher percentage of women reported that their trip purpose was going to or from work. One reason that women in the focus group said they did not ride to work was concern about traffic, particularly along stretches of the journey where there is no protected bike lane. Some of the women reported that they ride mostly on weekends for recreation because they are uncomfortable riding during rush hours when they make many other trips.

For women who use their bikes for work, shopping and errands, finding the right equipment was a major issue; several commented that they had had to search for quite a while to find an appropriate bag for carrying dress clothes for work as well as a duffle for storing their riding clothes and helmet, bike seat removed to prevent theft, small tool kit, etc.

Many of the participants did not find rain to be a major deterrent to cycling, stating that they had rain gear that kept them dry. On the other hand, about a third of the participants, men and women, said they did bike less in bad weather. San Francisco's hilly terrain was seen as somewhat of a problem by a few of the participants, but others commented that they had found ways around the hills and could go almost anywhere in the city on the routes they had figured out.

Concerning dress codes, men felt that this had become less of an issue than in the past "because the Bay Area ethos is relaxed," as one put it. Women, however, resoundingly said that expectations concerning dress and appearance were indeed a barrier to cycling. Both dress and "helmet hair" were mentioned as deterrents.

A major concern for both men and women is bike theft. Many of the participants had had a bike stolen, or parts stolen off their bikes, even though the bikes were locked up. Several commented that even in a private garage, bikes are stolen with some frequency. Most felt that there was little chance that a bike thief would be caught and prosecuted or that their bike would be recovered. Participants prefer to bring their bikes into their homes (sometimes parking them in their living rooms) or into their offices, where this is permitted. Some reported that they use bike-sharing rather than their own bike when they are going somewhere that lacks secure bike parking, so that they don't risk losing their own bike. A common complaint was that there is very little signage indicating where off-street bike parking can be found.

Safety is another major concern. Many of the participants had been in a bike crash and several had received injuries that required months of recovery. While they resumed cycling, some do less now because they are concerned about their physical ability to recover again should they have another crash. Older women were especially concerned about the risk of falls or collisions leading to broken bones.

Regarding bike lanes, all of the participants said they use them when they are available. However, most also felt that the many different designs that have been deployed in San Francisco are confusing for cyclists and drivers alike. The participants had mixed views about sharing a lane with buses or with pedestrians but disliked lanes that made them feel "trapped" between traffic and a fence or in danger of being doored by a parked car. In one focus group session, this led to a discussion of the need for driver education regarding rules of the road for cyclists, the meaning of various bike-related pavement markings, etc. In another session, the discussion focused on strategies cyclists can use to make themselves visible (or audible) to drivers and to avoid dangers on narrow streets and streets with fast traffic. Focus group participants were especially leery about Uber drivers, stating that they frequently speed, park in the bike lanes, and fail to yield right of way. In addition, both men and women commented that construction has frequently disrupted bike lanes, with little apparent attention to the consequences.

Asked what they would recommend to encourage more cycling in San Francisco, men tended to emphasize education and enforcement while women tended to suggest introducing women to cycling

through social networks, for example by setting up social events at which women could try cycling in a relaxed environment or by creating buddy systems through which an experienced woman cyclist rides with a novice until the latter is comfortable with riding in traffic. Women-led bike training classes and bicycle repair classes were also recommended. In addition, women recommended more attention to culturally-specific inducements for cycling, for example, working with Asian, Latina, and African American groups to encourage cycling. Commenting that if people don't see others like themselves cycling, they are not likely to start doing so. Both men and women advocated a more complete network of protected bike lanes.

### **Pedestrian Intercepts**

The initial intent of the pedestrian intercepts was to recruit infrequent cyclists to the focus groups. However, as it became clear that the cyclists the study team was observing were largely male and predominantly white, we also realized that discussions with non-cyclists, however brief, could inject greater diversity of views into the study. We therefore used intercepts of pedestrians to ask the following questions:

- 1) Do you ever ride a bicycle in San Francisco? How about elsewhere?
- 2) Why do you not ride a bike in San Francisco?
- 3) Will you please state your gender, age, and your race or ethnicity?

We approached 76 pedestrians in the three study areas where bike surveys were done and 46 of them agreed to discuss these questions. While this sample is small, it does provide insights into barriers to cycling.

The 46 pedestrians included men and women in equal numbers; all were in the 25-55 age range. Four preferred not to state their race/ ethnicity but among the other 42, 45% were white, 20% Asian, 10% Hispanic 10% mixed, 5% black, 5% Pacific Islander, and 5% other.

Of the 46 respondents, 40 had not ridden a bicycle since they were children and had no interest in doing so. Their primary reason for not wanting to cycle was overwhelmingly a concern about their physical abilities to do so safely (all of the women mentioned this and 15 of the 23 of the men did so.) The second most common reason for not cycling was a concern that they needed to be immaculately groomed and professionally dressed at work and would need to shower and change to achieve this (15 of the men and 20 of the women). A third reason given was lack of time; the 13 women and 10 men who commented in this fashion saw cycling as slower than taking a train and an Uber or driving. Finally, five of the men and six of the women found the question ludicrous – comments included, “You’ve got to be kidding”, “My family would kill me if I didn’t get run over first”, and “I leave that for younger people.” Probing, we learned that these respondents saw cycling as the domain of young male tech workers and felt that it was not a possibility, socially as well as physically, for themselves. This was especially the case for Asian women and Latinas.

### **Summary of Findings and Discussion**

**To summarize, this study of San Francisco’s SoMa bike lanes and their users found the following:**

1. Forty-nine percent of San Francisco residents are women, but women are only 29% of the cyclists observed in the SoMa bike lanes. This is consistent with other city data on cycling..
2. Eleven percent of the women using the SoMa bike lane live in another city and use transit and bicycle to access their San Francisco activities.
3. More than two-thirds of the women cyclists using the SoMa bike lanes ride their bicycles every day.
4. Women cyclists using the SoMa bike lanes ranged in age from 19 to 67.

5. Women cyclists using the SoMa bike lanes come from households with incomes ranging from under \$20,000 to over \$250,000; the median income for women was
6. Women of Asian descent and especially women of Hispanic/Latino descent are underrepresented among the cycling population,
7. A higher portion of women than men cycle midday (so studies that only report peak period journeys will miss them.)
8. Women using the SoMa bike lanes cycle for work more than men do, but are more likely to bike to work midday than are men.
9. Both men and women are strong supporters of protected bike lanes and would like to see more of them.
10. Heavy traffic, speeding, and hostile drivers are concerns for both men and women, but women are especially worried about these issues.
11. Bike theft is a major problem and a deterrent to cycling, and more secure bike parking at residences, workplaces, and other major trip destinations would encourage more cycling.
12. Many of the focus group participants report having been in an injury accident on their bicycle.
13. Women who don't ride a bike on city streets are afraid of being hit by a car or falling and breaking a bone.
14. Some of the women who don't bicycle feel say that "people like me" don't cycle, suggesting the need for socio-cultural approaches to bike promotion

The bike counts and surveys show that San Francisco's SoMa bike lanes are well utilized and much appreciated by their users. But as is the case for bike lanes in many other cities in the US, the cyclists are more likely to be male and white than the general population. In San Francisco, Asians and people of Latino/Hispanic ancestry are large shares of the total population but are significantly under-represented among cyclists. On the other hand, cyclists come from a range of incomes, and include members of affluent households as well as the poor. Finally, cyclists travel for a variety of trip purposes, but women make more off-peak trips, both for work and nonwork purposes, than men do.

While some use bicycles as their principal mode of travel, many of the users of SoMa bike lanes are linking to transit and many use transit or auto for some of their trips. Likewise, while some bike trips are within typical walking distances (under a mile), most were 2-3 miles in length and some were considerably longer. Some San Francisco bike users do not own a car, but most do have a car available and use it sometimes. This indicates that cycling mostly serves a different market than walking, is a complement to transit, and most likely replaces a considerable number of auto trips that would be made if cycling were not an option. Together with the bike counts, this indicates that if cyclists were to drive instead of ride their bikes, an entire lane of additional street capacity would be needed during peak hour just for the SoMa bike lane traffic. In addition, greenhouse gases would increase substantially. Thus cyclists are reducing greenhouse gases and other environmental damage and forestalling worse traffic congestion and transit crowding than already occurs.

Bike lanes are important to cyclists' decisions to bike rather than use another mode and cyclists prefer protected bike lanes, which they consider more comfortable to use and believe are safer than sharrows or marked but unprotected lanes. However, the cyclists that participated in this study find the wide variety of bike lane designs deployed in San Francisco perplexing and frustrating and in their assessment, neither cyclists nor motorists are clear about what the rules of the road are around bike lanes of different types. But bike lanes are not the only issue: bike theft and a lack of, or poor quality, bike parking are other major problems.

Gender and culture also enter into the decision on whether or not to bike. Social expectations about dress and grooming remain issues despite the apparent "relaxed" attitude in many parts of the Bay

Area, and this is more so for women than for men. Age may be a limiting factor, since older people were more cautious about where and when to cycle if they would do so at all, and again, women are more concerned about age-related vulnerabilities. Gender roles not only affect the types of trips that women make but also the amount of time they have available for travel and cycling. And there are hints that cycling is viewed by some as a young, white, largely male activity to the exclusion of Asian and Latinos, especially women.

## **Conclusions and Recommendations**

What steps could be taken to increase participation of women and minorities in cycling? This study leads us to the following conclusions and recommendations:

- 1 – Both men and women see protected bike lanes as important, use them when they are available, and support expansion of the protected bike lane network. Continuing to expand this network wherever possible is likely to increase cycling, especially if a standard design can be developed so that rules of the road are clear.
- 2- Interventions to educate drivers as well as cyclists about the role of cycling, the meaning of various pavement markings etc. appear to be needed, along with greater enforcement of lane violations such as parking and loading in the bike lanes.
- 3- In addition to bike lanes, investments in secure bike parking throughout the city would support cyclists and encourage more cycling, since bike theft is a major concern and raises the cost of cycling. Both public and private parking is needed
- 4- Initiatives to support cycling could include partnerships with employers, so that cyclist have safe bike parking, lockers, and places to clean up and change if need be, as well as collaborations with non-governmental organizations that can offer support to those interested in cycling in the form of assistance with bike selection, rider training, repair classes, and cycling buddies for beginner riders.
- 5 – In many instances, low rates of participation in cycling by women and people of Asian and Latino descent reflect social and cultural roles and expectations rather than limitations imposed by travel time or distance constraints. Mobilizing communities of concern to address these issues in partnership with the city would be an important complement to current programs.
- 6 – Changing the public narrative may be necessary to encourage women and minorities to cycle more. Providing a more inclusive imagery of cyclists and a deeper acknowledgement of their contributions to the community would be important steps forward.

## **References**

Arup, October 2017. San Francisco: Benefits of SOMA cycle lanes. Report prepared for C40 Cities Climate Leadership Group.

Ak, G., Fischer, N., & Namgung, M. (2013). Bicycling choice and gender case study: The Ohio State University. *International Journal of Sustainable Transportation*, 7(5), 347-365.

City-Data.Com, 2018. San Francisco, CA Zip Code Map – Locations, Demographics. Accessed June 29, 2018. <http://www.city-data.com/zipmaps/San-Francisco-California.html>

Corona Insights, July 2017. U.S. Bicycling Participation Study: Report of findings from the 2016 survey. Commissioned by PeopleForBikes.

Forsyth, Ann, "Measuring Walking and Cycling Using the PABS (Pedestrian and Bicycling Survey) Approach: A Low-Cost Survey Method for Local Communities" (2010). Mineta Transportation Institute Publications. Book 9. [http://scholarworks.sjsu.edu/mti\\_all/9](http://scholarworks.sjsu.edu/mti_all/9)

Arup, October 2017. San Francisco: Benefits of SOMA cycle lanes. Report prepared for C40 Cities Climate Leadership Group.

Alexander, K. (2017). *SF Gate*. [online] Available at: <https://www.sfgate.com/bayarea/article/Bay-Area-population-growth-slows-some-counties-11021334.php> [Accessed 28 May 2018].

Bay Area Bicycle Law, 2016. Five most-common-types-of-bike-accidents-san-francisco. <https://bayareabicyclerlaw.com/5-most-common-types-of-bike-accidents-san-francisco/>

Buehler, R. and Pucher, J., 2012. Cycling to work in 90 large American cities: new evidence on the role of bike paths and lanes. *Transportation*, 39(2), pp.409-432.

Baker, L. (2009). How to get more bicyclists on the road. *Scientific American*, 301, 28-29.

Bernhoft, I. M., & Carstensen, G. (2008). Preferences and behaviour of pedestrians and cyclists by age and gender. *Transportation Research Part F: Traffic Psychology and Behaviour*, 11(2), 83-95.

Bonham, J., & Wilson, A. (2012). Bicycling and the life course: The start-stop-start experiences of women cycling. *International Journal of Sustainable Transportation*, 6(4), 195-213.

Buehler, R. and Pucher, J., 2012. Cycling to work in 90 large American cities: new evidence on the role of bike paths and lanes. *Transportation*, 39(2), pp.409-432.

Centers for Disease Control and Prevention (2016). Leading Causes of Death. United States Government.

Corona Insights, July 2017. U.S. Bicycling Participation Study: Report of findings from the 2016 survey. Commissioned by PeopleForBikes.

Damant-Sirois, G., & El-Geneidy, A. M. (2015). Who cycles more? Determining cycling frequency through a segmentation approach in Montreal, Canada. *Transportation Research Part A: Policy and Practice*, 77, 113-125.

Dill et al. 2003,. "Bicycle Commuting and Facilities in Major U.S. Cities: If you BUild Them, Commuters Will Use Them - Another Look" (2003). *Journal of the Transportation Research Board*. Volume 1828. <https://trrjournalonline.trb.org/doi/abs/10.3141/1828-14>

Dill, J. and McNeil, N., 2013. Four types of cyclists? Examination of typology for better understanding of bicycling behavior and potential. *Transportation Research Record: Journal of the Transportation Research Board*, (2387), pp.129-138.

Emond, C., Tang, W., & Handy, S. (2009). Explaining gender difference in bicycling behavior. *Transportation Research Record: Journal of the Transportation Research Board*, (2125), 16-25.

Forsyth, Ann, et al. 2011,. "Measuring Walking and Cycling Using the PABS (Pedestrian and Bicycling Survey) Approach: A Low-Cost Survey Method for Local Communities" (2010). Mineta Transportation Institute Publications. Book 9. [http://scholarworks.sjsu.edu/mti\\_all/9](http://scholarworks.sjsu.edu/mti_all/9)

Garrard, J., 2003. Healthy revolutions: promoting cycling among women. *Health Promotion Journal of Australia*, 14(3), pp.213-215.

Garrard, J., Rose, G. and Lo, S.K., 2008. Promoting transportation cycling for women: the role of bicycle infrastructure. *Preventive medicine*, 46(1), pp.55-59.

Garrard, J., Handy, S. and Dill, J., 2012. Women and cycling. *City cycling*, pp.211-234.

Handy, S.L., Xing, Y. and Buehler, T.J., 2010. Factors associated with bicycle ownership and use: a study of six small US cities. *Transportation*, 37(6), pp.967-985.

Heesch, K. C., Sahlqvist, S., & Garrard, J. (2012). Gender differences in recreational and transport cycling: a cross-sectional mixed-methods comparison of cycling patterns, motivators, and constraints. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 106.

Jensen, O. B. (2009). Forward: mobilities as culture. In P. Vannini (Ed.), *The cultures of alternative mobilities: routes less travelled*. Farnham: Ashgate.

Krizek, K. J., Johnson, P. J., & Tilahun, N. (2005). Gender differences in bicycling behavior and facility preferences. *Research on Women's Issues in Transportation*, 2, 31-40.

Mitra, R., & Nash, S. (2018). Can the built environment explain gender gap in cycling? An exploration of university students' travel behavior in Toronto, Canada. *International Journal of Sustainable Transportation*, 1-10.

McKenzie, B. (2014). *Modes Less Traveled: Bicycling and Walking to Work in the United States, 2008-2012* (No. ACS-25). US Department of Commerce, Economics and Statistics Administration, US Census Bureau.

Mitra, R., Lea, N. S., Cantello, I., & Hanson, G. (2016). *Cycling Behaviour and Potential in the Greater Toronto and Hamilton Area*.

Pucher, J. and Buehler, R., 2008. Making cycling irresistible: lessons from the Netherlands, Denmark and Germany. *Transport reviews*, 28(4), pp.495-528.

Pucher, J., Buehler, R., Bassett, D.R. and Dannenberg, A.L., 2010. Walking and cycling to health: a comparative analysis of city, state, and international data. *American journal of public health*, 100(10), pp.1986-1992.

Pucher, J. and Buehler, R., 2010. Walking and cycling for healthy cities. *Built Environment*, 36(4), pp.391-414.

Pucher, J., Buehler, R., Merom, D. and Bauman, A., 2011. Walking and cycling in the United States, 2001–2009: evidence from the National Household Travel Surveys. *American journal of public health*, 101(S1), pp.S310-S317.

Pucher, J. and Buehler, R., 2016. Safer cycling through improved infrastructure.

Pucher, J. and Dijkstra, L., 2000. Making walking and cycling safer: lessons from Europe. *Transportation Quarterly*, 54(3), pp.25-50.

Saelens, Brian E., James F. Sallis, and Lawrence D. Frank, 2003. "Environmental correlates of walking and cycling: findings from the transportation, urban design, and planning literatures." *Annals of behavioral medicine* 25, no. 2 (2003): 80-91.

San Francisco Metropolitan Transportation Authority (SFMTA), Bike Metrics.  
<https://www.sfmta.com/bicycle-ridership-data-1>

Sanders, R.L., 2015. Perceived traffic risk for cyclists: The impact of near miss and collision experiences. *Accident Analysis & Prevention*, 75, pp.26-34.

Shephard, R.J., 2008. Is active commuting the answer to population health?. *Sports Medicine*, 38(9), pp.751-758.

Steinbach, R; Green, J; Datta, J; Edwards, P (2011) Cycling and the city: a case study of how gendered, ethnic and class identities can shape healthy transport choices. *Social science & medicine* (1982), 72(7). pp. 1123-30.

Ward, M. (2018). Cycling's gender gap: women less likely to choose 'unsafe' commute, *The Sydney Morning Herald*. Accessed online on 14<sup>th</sup>

Garrard, J., Rose, G. and Lo, S.K., 2008. Promoting transportation cycling for women: the role of bicycle infrastructure. *Preventive medicine*, 46(1), pp.55-59.

Garrard, J., 2003. Healthy revolutions: promoting cycling among women. *Health Promotion Journal of Australia*, 14(3), pp.213-215.

Garrard, J., Handy, S. and Dill, J., 2012. Women and cycling. *City cycling*, pp.211-234.

Handy, S.L. and Xing, Y., 2011. Factors correlated with bicycle commuting: A study in six small US cities. *International Journal of Sustainable Transportation*, 5(2), pp.91-110.

Heesch, K.C., Sahlqvist, S. and Garrard, J., 2012. Gender differences in recreational and transport cycling: a cross-sectional mixed-methods comparison of cycling patterns, motivators, and constraints. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), p.106.

League of American Bicyclists (LAB), 2017. Where We Ride: Analysis of Bicycle Commuting in American Cities, Report on 2016 American Community Survey Data.

McGuckin, N.A. and Srinivasan, N., 2003. *Journey to Work in the United States and Its Major Metropolitan Areas--1960-2000* (No. FHWA-EP-03-058).

Metropolitan Transportation Commission (MTC) 2018. San Francisco Employment. Vital Signs: <http://www.vitalsigns.mtc.ca.gov/jobs>

Pucher, J. and Buehler, R., 2010. Walking and cycling for healthy cities. *Built Environment*, 36(4), pp.391-414.

Pucher, J., Buehler, R. and Seinen, M., 2011. Bicycling renaissance in North America? An update and re-appraisal of cycling trends and policies. *Transportation research part A: policy and practice*, 45(6), pp.451-475.

Pucher, J., & Buehler, R., 2008. Making cycling irresistible: lessons from the Netherlands, Denmark and Germany. *Transport reviews*, 28(4), 495-528.

Rose, E., Gallivan, F. and Lara, L., 2016. Survey-Based Evaluation of Bike-to-Work Day in the San Francisco Bay Area. Transportation Research Board Annual Meeting Compendium of Papers (No. 16-3852).

San Francisco Municipal Transportation Agency (SFMTA), 2016. 2015 SFMTA Transportation Factsheet. <https://www.sfmta.com/sites/default/files/reports/2016/2015%20SFMTA%20Transportation%20Factsheet.pdf>

US Census Bureau Quick Facts, San Francisco County 2017.

US Census Bureau American Fact Finder, Commuting Characteristics 2016 Estimates, San Francisco County 2016. <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>

US Census Bureau Longitudinal Employer-Household Dynamics (LEHD) Data. <https://lehd.ces.census.gov>

