

# MTC ACTIVE TRANSPORTATION ORIGIN-DESTINATION STUDY

DECEMBER 2022



# ACKNOWLEDGMENTS

MTC and Caltrans District 4 partnered to conduct this study.



## MTC PROJECT MANAGEMENT TEAM

Toshi Shephard-Ohta, Nicola Szibbo, Joel Shaffer, Libby Nachman, and Lily Brown

## SUPPORT STAFF

Laura Krull, Michelle Go, Kara Oberg, Shimon Israel, Angela Louie, Lee Huo, James Go, Cathy Chea, Ingrid Supit, Pamela Kwan, and Stefanie Hom



## CALTRANS DISTRICT 4 PROJECT MANAGEMENT TEAM

Sergio Ruiz and Greg Currey

## SUPPORT STAFF

Michael Beck, Andrew Chan, and Jasmine Stitt



Alta designed and administered the survey, analyzed the results, and produced the report.



Accel recruited and managed intercept survey staff.



Steer administered the incentive raffle prize program used in this study.

## FOCUS GROUP MEMBERS

Bike East Bay

Caltrans

City of East Palo Alto

City of Fremont

City of Menlo Park

City of Richmond

City of San Rafael

Golden Gate Bridge

Golden Gate National Recreation Area (GGNRA)/National Park Service (NPS)

Marin County Bicycle Coalition

Napa Valley Bicycle Coalition

Napa Valley Forward

Napa Valley Transportation Authority

Napa Vine Trail Coalition

Rails to Trails

Rich City Rides

San Francisco Bicycle Coalition

Silicon Valley Bicycle Coalition

TAM

Trail for Richmond Action Committee (TRAC)

West Contra Costa Transportation Advisory Committee (WCCTAC)

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# 01 EXECUTIVE SUMMARY

  
**Hungry?**  
Quick Survey Ahead!  
UTAH STATE UNIVERSITY  
THE RUCKELSHAUSEN  
CENTER FOR FOOD

# EXECUTIVE SUMMARY

The Metropolitan Transportation Commission (MTC) supports many programs that encourage people to get out of their cars and walk, bike, or roll for an active, healthier community and environment. To make informed decisions about where to invest new infrastructure, MTC and local jurisdictions need accurate data about where people currently walk and bicycle.

Information about the number of trips taken every day by foot, bicycle, or emerging micromobility devices (e.g., e-scooter) is currently limited by scarce, isolated, and sometimes unreliable counter technology. The counts that are available lack detail on where people are coming from, where they are heading to, their preferred routes, the purpose of their trip, and their motivation for taking the trip by active modes over other means of transportation.

To help address this challenge, the MTC Active Transportation Origin-Destination Study has the following goals:


- ▶ **Pilot a survey** to learn about active transportation users' origins, destinations, route preferences and incentives for biking/e-biking adjacent to four major commute corridors:
  - ◆ Richmond-San Rafael Bridge Path
  - ◆ Dumbarton Bridge Path
  - ◆ Golden Gate Bridge Path
  - ◆ Napa Vine Trail
- ▶ **Compare permanent counter data to observed data** to assess if permanent counters are providing accurate and reliable information.
- ▶ **Develop a list of low-cost, quick implementation projects** that MTC and local jurisdictions can undertake to encourage active transportation.
- ▶ **Gather and apply lessons learned** from this study for future modification and replication.


The graphic on the following page explains the survey process used in this study.





Golden Gate Bridge Path

## SURVEY HIGHLIGHTS

 **738** people completed the survey.

 **87%** of trail users who responded to the survey ride bicycles on the trails, and 82% access the trails via bicycle as well. With the average starting and ending point being 3.7 miles from the trail, the majority of users surveyed are not driving to the trails.

 **23%** of respondents reported they drove alone on the same corridor at least once a week, indicating the potential for higher mode shift.

 When asked what would motivate them to bike more often, the majority (57%) of respondents said safer and more comfortable bike facilities like dedicated bike lanes or separated bike paths.

# STUDY PROCESS

## 1 DEVELOPING THE SURVEY (PAGE 12)



The project team developed a survey to understand corridor users' origins, destinations, routes, and transportation concerns and preferences.

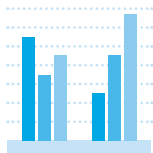


## 2 COLLECTING THE DATA (PAGE 22)



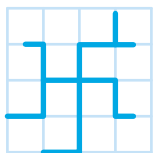
At eight locations across four study corridors, the project team collected 738 survey responses.

## 3 ANALYZING THE DATA (PAGE 30)



### SURVEY ANALYSIS

The survey asked about mode choice, trip purpose, safety concerns, desired improvements, and motivations for using the trails. Respondents also reported demographic information like age, gender, and race or ethnicity.



### NETWORK ANALYSIS

To develop and select recommendations for quick-build, or low-cost project opportunities, the project team used a combination of three different network analysis approaches:



**User-Defined Routes:** Based on trip routes respondents drew on the survey map.



**Comfortable Path (Level of Traffic Stress-Adjusted):** Reflects the routes of riders who choose segments with more comfortable conditions, even if it means traveling further overall.



**Shortest Path:** Selects the shortest route, regardless of the levels of traffic stress along the way, to simulate more confident riders.

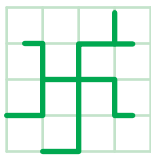


## IDENTIFYING QUICK-BUILD OPPORTUNITIES (PAGE 34)



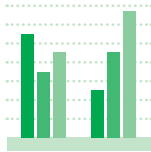
### GUIDING QUESTIONS

- ◆ What qualifies as quick-build?
- ◆ How can we ensure opportunity is equitably distributed?
- ◆ What types of improvements do people want?
- ◆ Where do these factors overlap?
- ◆ Where will improvements serve the most users?



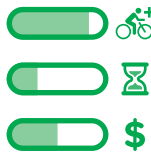
### PROJECT LOCATION

Drawing on the network analysis results, we sought to address high-stress barriers on popular routes.



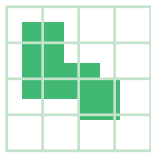
### PROJECT TYPE

Next, the project team considered survey respondents' priorities and concerns to select project types that address safety barriers and encourage people to walk and bike more.



### PROJECT FEASIBILITY

We identified the feasibility of quick-build solutions, such as striping a bicycle lane or installing wayfinding signage, to improve major trail corridors.



### PROJECT DISTRIBUTION

Finally, to consider improvements in an equitable manner, we prioritized quick-build opportunities in Equity Priority Communities.<sup>1</sup>



### PROJECT RECOMMENDATION

All these considerations influenced the final project recommendations.

<sup>1</sup> Equity Priority Communities are census tracts that have a significant concentration of underserved populations, such as households with low incomes and people of color. For more information, see: <https://mtc.ca.gov/planning/transportation/access-equity-mobility/equity-priority-communities>



# INTRODUCTION





Shared use paths around the Bay Area, such as the San Francisco Bay Trail pictured above, are designed to be comfortable for all ages and abilities. Photo credit: Karl Nielsen

## PROBLEM STATEMENT

The Metropolitan Transportation Program (MTC) envisions a Bay Area where many more people walk, bike, and roll on safe, accessible, and connected streets, paths, and trails. To make strategic investment decisions in infrastructure and encouragement programs, MTC and partner agencies need specific data about where people travel by active modes, where they want to go, and what would encourage people to shift from driving to more sustainable travel options. Current technology, whether permanent counters installed on trails or Big Data provided by mobile devices, only tells a portion of the story. MTC aims to find out where people are going on regional active transportation corridors, their preferred routes, the purpose of their trip, and their motivation for traveling by active modes over other means of transportation.

## SURVEY GOALS

To help address this challenge, the MTC Active Transportation Origin-Destination Study has the following goals:




-  ▶ **Pilot a survey** to learn about active transportation users' origins, destinations, and route preferences on major commute corridors.
-  ▶ **Compare permanent counter data to observed data** in order to assess if permanent counters are providing accurate and reliable information.
-  ▶ **Develop a list of low-cost, quick implementation projects** that MTC and local jurisdictions can undertake to encourage more sustainable transportation.
-  ▶ **Gather and apply lessons learned** from this study for future modification and replication.

# OVERVIEW

MTC is frequently called upon to be the architect, steward, and educator of the Bay Area’s complex mobility system. This means not only leading planning efforts for the region but creating regional strategies, as well as developing the necessary tools and resources to make those strategies feasible and effective for diverse jurisdictions across a large geography. MTC has created several initiatives: Bay Bridge Forward, Dumbarton Forward, Napa Valley Forward, and Richmond-San Rafael Forward. These Forward Commute Initiatives are designed to move more people in fewer vehicles through key travel corridors, improve commute times, and reinforce the larger statewide effort to reduce greenhouse gas emissions.<sup>1</sup> Building off the initiatives, this study will pilot and refine survey methods, analysis, and strategies to improve the movement of people across the region in a more sustainable way.

MTC’s Design and Project Delivery Team partnered with Caltrans and Alta Planning + Design (Alta) to investigate how the following long-distance bridge and greenway corridors can better serve the region as active commuting corridors and/or bike highways:

## STUDY CORRIDORS

- ▶ Richmond-San Rafael Bridge Path 
- ▶ Dumbarton Bridge Path 
- ▶ Napa Vine Trail 
- ▶ Golden Gate Bridge Path<sup>2</sup>

<sup>1</sup> For more information on the MTC Forward Commute Initiatives, see: <https://mtc.ca.gov/operations/programs-projects/forward-commute-initiatives>.

<sup>2</sup> While not part of the MTC Forward Commute Initiatives, the Golden Gate Bridge has high bicycle and pedestrian use that aligns with the study goals.

By intercepting people walking, bicycling, using bikeshare, and traveling on emerging micromobility devices (i.e. e-scooters and e-bikes), MTC gathered valuable information on trip origins, destinations, and motivations that guide choices and preferred routes. While not comprehensive for every major corridor in the Bay Area, this study focused on four corridors where MTC has a strategic interest with the Forward Commute Initiatives or high bicycle/pedestrian use. The project team designed and administered the survey so that Spanish and Chinese languages (the two most commonly spoken in the Bay Area) were not a barrier to participation. The survey was available in English, Spanish, and Chinese and Spanish speaking staff were at each intercept location. An online option expanded survey sample size and increased the statistical significance of the intercept surveys. Observed screenline counts<sup>3</sup> were compared to permanent count data provided by MTC to understand volume at certain locations, by mode, by direction, and peak hour trends.

A planning-level conditions assessment evaluated physical site constraints, intersections, access points, wayfinding, and amenities. The study includes a list of prioritized projects that can be built quickly and at relatively low cost in partnership with local jurisdictions, trail agencies, and bridge authorities. The study identifies key locations on each corridor for low-cost, quick infrastructure implementation based on their potential for significantly increasing the frequency of current users and attracting new users to the corridor. The study piloted survey design, delivery, and analytical methods that can be refined and replicated in the future.

<sup>3</sup> Screenline counts are conducted by counting the number of pedestrians or bicyclists who pass across an invisible “line” across a roadway, path or sidewalk.

# CHALLENGES DUE TO COVID-19

The survey was conducted in the spring of 2022 in the midst of the COVID-19 pandemic. While interest in interacting with strangers face-to-face was low, the number of people spending time outdoors and on trails was high, which created both an opportunity and a challenge for deploying the survey. The survey was originally scheduled to take place in October 2021, but the rapidly rising number of new cases and threat of wildfire smoke delayed the deployment to the following spring. The virus was not as widespread as the peak period in January 2022; however, precautions were in place to minimize contact and spread of the virus:



- ▶ Survey safety protocols adhered to state and respective county public health department restrictions for outdoor gatherings.



- ▶ All surveying was conducted outdoors.



- ▶ Intercept surveyors wore masks and each survey site had free masks and hand sanitizer available.



- ▶ Respondents could choose to complete the survey six feet apart from the surveyor or complete it on their own using a tablet.



- ▶ Survey tablets were sanitized between each use.



- ▶ Respondents could also choose to take a business card with a URL to complete the survey from their home.



Survey station located on the west side of the Dumbarton Bridge Path.



# SURVEY INSTRUMENT DESIGN & METHODOLOGY



*More than 1,000 people travel across the Golden Gate Bridge by foot or bike each weekday.*

## **SURVEY DESIGN**

The survey was designed to be both efficient and effective. The survey design team created a focus group of Bay Area trail users and advocates who could advise MTC on ways to reach the most people as part of this study. Participants included members of MTC staff, local trail/bicycle coalitions, hiking/biking clubs, parks agencies, Caltrans, and local city and county governments and transportation departments. Making a concerted effort to seek input from marginalized groups, the team made targeted efforts to include participation from female, people of color, and Spanish and Chinese-speaking members. The assembled focus group gave critical feedback early in the process about details like timing, site selection, and question content and wording.

The survey took about two minutes to complete and filled some key information gaps for MTC. These information gaps included trail user origin and destination, as well as trip type, motivation, and demographic data. Origin and destination locations

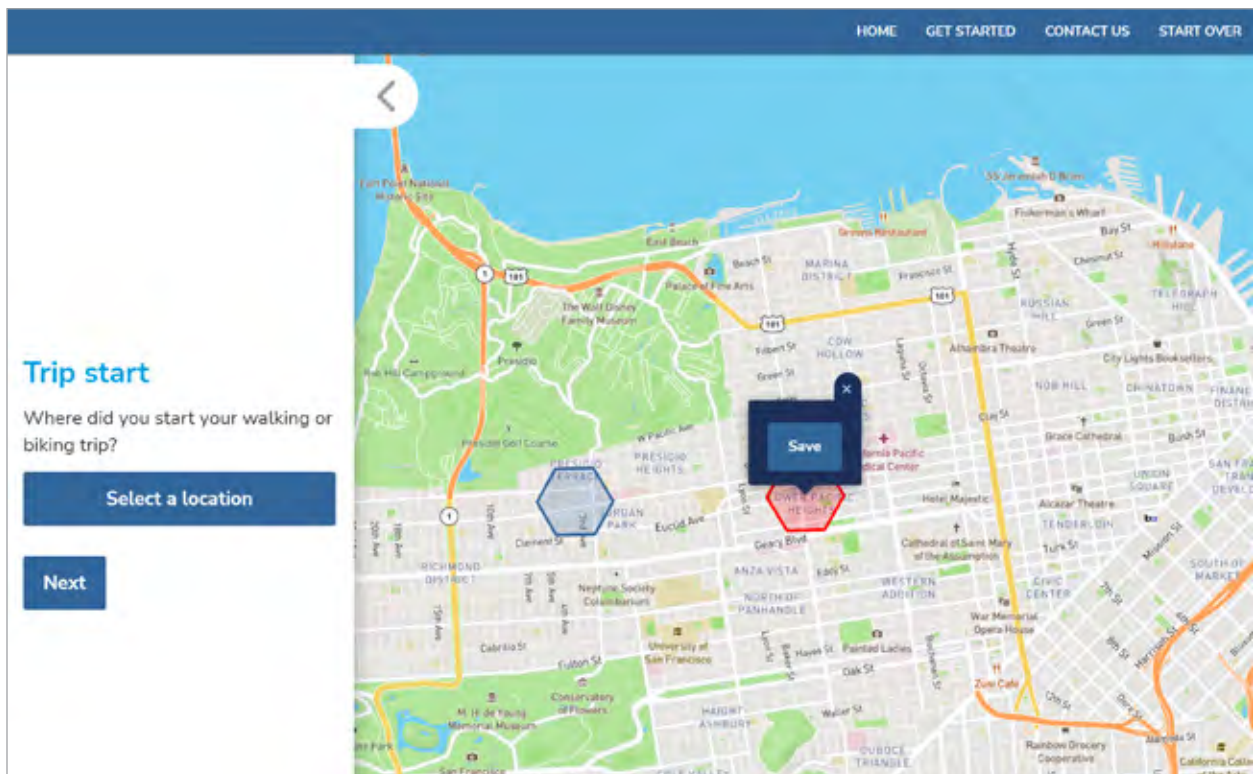
provide useful transportation network data to MTC, but the survey design team also aimed to discover what kind of trips users made and why. Whether people use a route because it is fast or scenic, or because it is on their way to school or errands, the network, design, and access solutions moving forward will vary accordingly. The survey was also designed to gather information on what types of incentives might encourage people to bicycle more often or use e-bikes. Demographic data also helps with the identification of those whose needs are not being met and provides a baseline for the equitable use of each corridor. Although there is personal information embedded when asking for identifiers, the demographic data gathered complies with MTC's personally identifiable information policy.

## SURVEY STRUCTURE

### Part I: Core Survey Questions

The survey used multiple-choice questions for the majority of the content. The survey started by asking if the respondent lives or works in the Bay Area. This question filtered the respondents who are visitors from the residents and workers who are the focus of the survey. The survey then asked which corridor the respondent was visiting when they received the survey.

Next, the survey asked how respondents started and ended their trip, along with the route they used to get to the corridor from their start location. The survey used a map feature for the actual origins and destinations of people using the corridors. A hexagonal grid overlaid the interactive touch-screen map, allowing users to select approximate locations. This grid was more user- and mobile-friendly than placing points on a map, offered greater specificity than simple zip code collection, and mitigated privacy and security concerns. It also was less time intensive than asking for the nearest cross streets and then having to reproduce those points manually.



Respondents indicated their starting location (origin) and destinations using an interactive survey tool.

The survey then asks four multiple-choice questions about the mode of transport, if it was electrically powered, whether the origin was a home location, and the main purpose of the trip. The survey asks two questions about what type of incentive would encourage the user to bike or bike more often and the amount the respondent would be willing to spend to purchase an e-bike. These questions were asked to gather information for MTC as it considers transportation demand management initiatives as part of the Forward Commute Initiatives. The core survey concludes by asking for demographic information on race, age, gender, and employment status. All personally identifiable information in the survey was redacted by the survey analysis consulting firm before sharing responses with MTC staff in compliance with MTC's Executive Director's Management Memorandum No. 323.

## Part II: Additional Optional Questions

To learn more about respondents' behavior and motivations, five additional questions were developed. These were not part of the core survey questions to keep the time to complete the survey to a minimum. Staff asked respondents if they had a few additional minutes to complete Part II. Additional questions asked:

- ▶ Why the respondent used their primary mode of transportation
- ▶ How often they drove alone, carpooled/ vanpooled, or used transit on that same corridor
- ▶ The seasons they use the corridor
- ▶ Safety concerns
- ▶ Suggestions for improving the experience of people using active modes.

The full survey is shown in [Appendix A: Origin-Destination Survey](#).

## ACCESSIBILITY

Once the survey questions were developed and vetted by the focus group, accessibility became a major survey consideration. Although cost, availability, and digital connectivity created hurdles for MTC, the final surveys provided opportunities for increased participation by using both digital tablets and paper surveys. The online survey was formatted to comply with Section 508 of the Rehabilitation Act (29 U.S.C. § 794d), which enabled people with visual disabilities to participate. The survey was also available in English, Spanish, and Chinese. Language access extended to external signage and the multilingual abilities of survey staff.



*Signage and survey materials were available in English, Spanish, and Chinese*

## VISIBILITY

To encourage users to stop their trip to take the survey, MTC attracted trail users at each survey location in the following ways:

- ▶ Set up a ten-foot-by-ten-foot **shade structure** (easy-up tent) in highly trafficked areas
- ▶ Installed **six yard signs** to promote giveaway items
- ▶ Installed **two large A-frame posters** with a stylized stop sign
- ▶ Stationed **intercept staff** at and ahead of the survey station in bright reflective vests

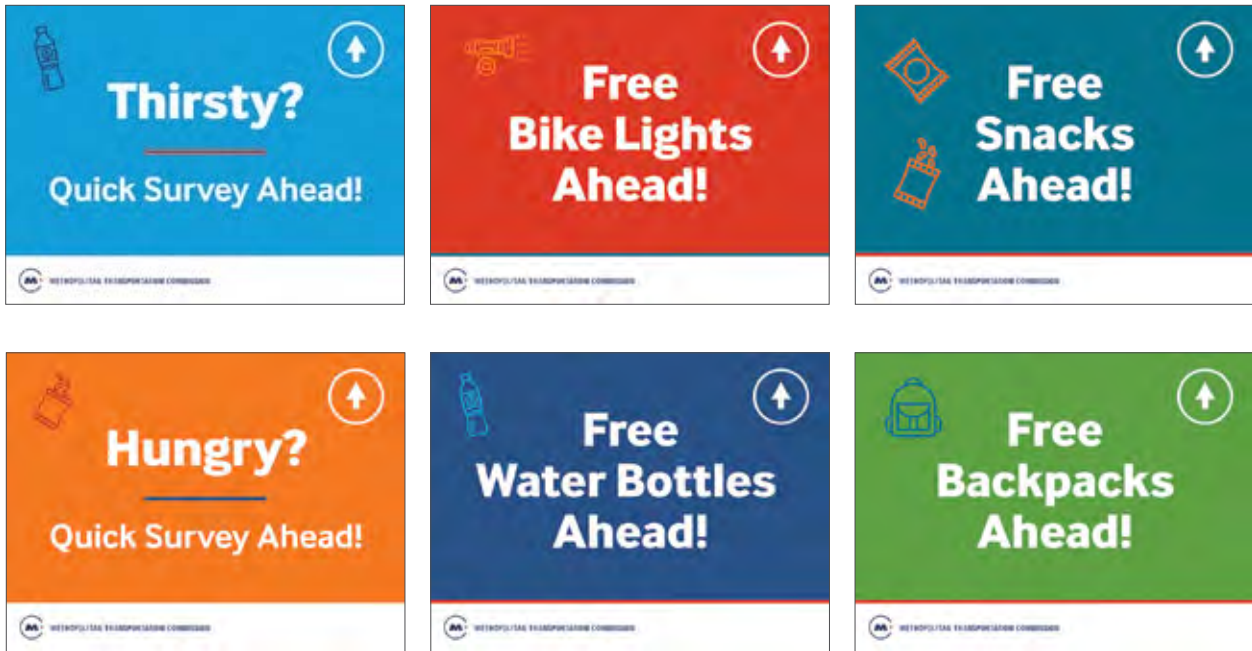
To further incentivize taking the survey, snacks and relevant equipment—like bike lights, backpacks, and reusable water bottles—were available for free to those who stopped and took the survey. Additionally, a \$100 Amazon or Apple gift card raffle prize was advertised to encourage survey participation. To boost participation in Part II of the survey, respondents were given the opportunity to receive a second entry into the drawing.

Any survey takes valuable time from respondents. To increase the response rate, MTC distributed business card handouts with the survey URL so that trail users who did not have time to stop could have the option of taking the survey at a later time from their own computers; 26% of respondents completed the survey in this method.



*Each survey location provided snacks, water, and incentive giveaway items such as reusable water bottles, bike lights, and drawstring backpacks (not pictured here). Additionally, hand sanitizer was available for use before and after respondents completed the survey on a digital device.*





MTC installed six colorful yard signs to advertise incentives and encourage survey participation in advance of each survey location.



MTC distributed business cards to encourage participation from trail users who did not have the time to complete the survey in the field.



*Yard signs installed in advance of survey locations.*

## STATISTICAL SIGNIFICANCE

It should be noted that the survey's design and implementation avoided many bias pitfalls, though not all. As the survey did not randomly sample the entire population, some sampling bias was inevitable. By setting up consistent locations, times of day, and days of the week, the survey implementation team minimized this bias. Additionally, the survey team established target sample sizes at each location, determined by total volumes of bicycle and pedestrian traffic estimated from previous counts. The bigger the sample size, the lower the margin of error, and so responses needed to hit that minimum number for accuracy. And lastly, the team compared raw counts to historical counts to make sure there were not any major discrepancies.



Survey station located on the north side of the Golden Gate Bridge Path.

## USER COUNTS

In addition to administering the survey, MTC counted trail users for comparison against permanent counters installed nearby. Staff performed screenline counts to tally all users who crossed in front of the survey station and recorded those tallies in 15-minute increments during the full survey period. The counts identified trail use categories:

- ▶ Bicycles (including e-bikes)
- ▶ Pedestrians (including wheelchairs)
- ▶ Others (skateboard, unicycle, roller skates, scooter, etc.)

For bicycle and pedestrian categories, staff also indicated observed gender. There is the possibility some trail users were misgendered in the counts.

To test the effectiveness of getting users to complete the survey, staff indicated how many users:

- ▶ Did not stop or otherwise engage with staff
- ▶ Took a business card, but did not otherwise stop
- ▶ Stopped to complete the survey, but did not complete additional questions
- ▶ Stopped to complete the survey and completed additional questions

Each count form also included the weather during the survey period.

A copy of the survey count form is included in [Appendix B: Survey Count Form](#). For more information, see [Appendix C: Permanent Counter Comparison Methodology & Results](#).



# SURVEY PRETESTING

MTC performed four pre-survey pilot tests, one on each study corridor, prior to the full deployment. MTC conducted counts and pre-tested the survey in the field and online using digital tablets, handouts with links to the online survey, and a paper version of the survey as backup. During the pre-test, staff asked survey participants their preference: whether they wanted to complete the survey on their own or answer the questions and have staff fill in the answers. MTC evaluated the effectiveness of participant recruitment strategies, data retrieval methods, use of incentives to encourage the participation of targeted population groups, nonresponse issues for often-problematic survey questions, and the quality of any geographic data collected. The findings from the pre-testing of the survey helped inform the final survey instrument and survey approach. For example, the pretesting phase demonstrated the need to print additional paper surveys particularly for locations where cell signal was low (e.g. Napa Vine Trail North and both locations at Golden Gate Bridge). Additionally, the pretesting helped the team understand which incentives worked best for attracting trail users (bike lights and water). The least popular giveaway items were water bottles and granola bars.



*Napa Vine Trail users completing a survey as part of the testing phase in March 2022.*

**Table 1** Pre-Survey Test Dates

CORRIDOR	DATE	TIME PERIOD
Dumbarton Bridge	Tuesday, March 1, 2022	4:00 PM to 6:00 PM
Richmond-San Rafael Bridge	Friday, March 4, 2022	11:00 AM to 1:00 PM
Napa Vine Trail	Monday, March 7, 2022	11:00 AM to 1:00 PM
Golden Gate Bridge	Tuesday, March 8, 2022	10:30 AM to 12:30 PM



# SURVEY DEPLOYMENT

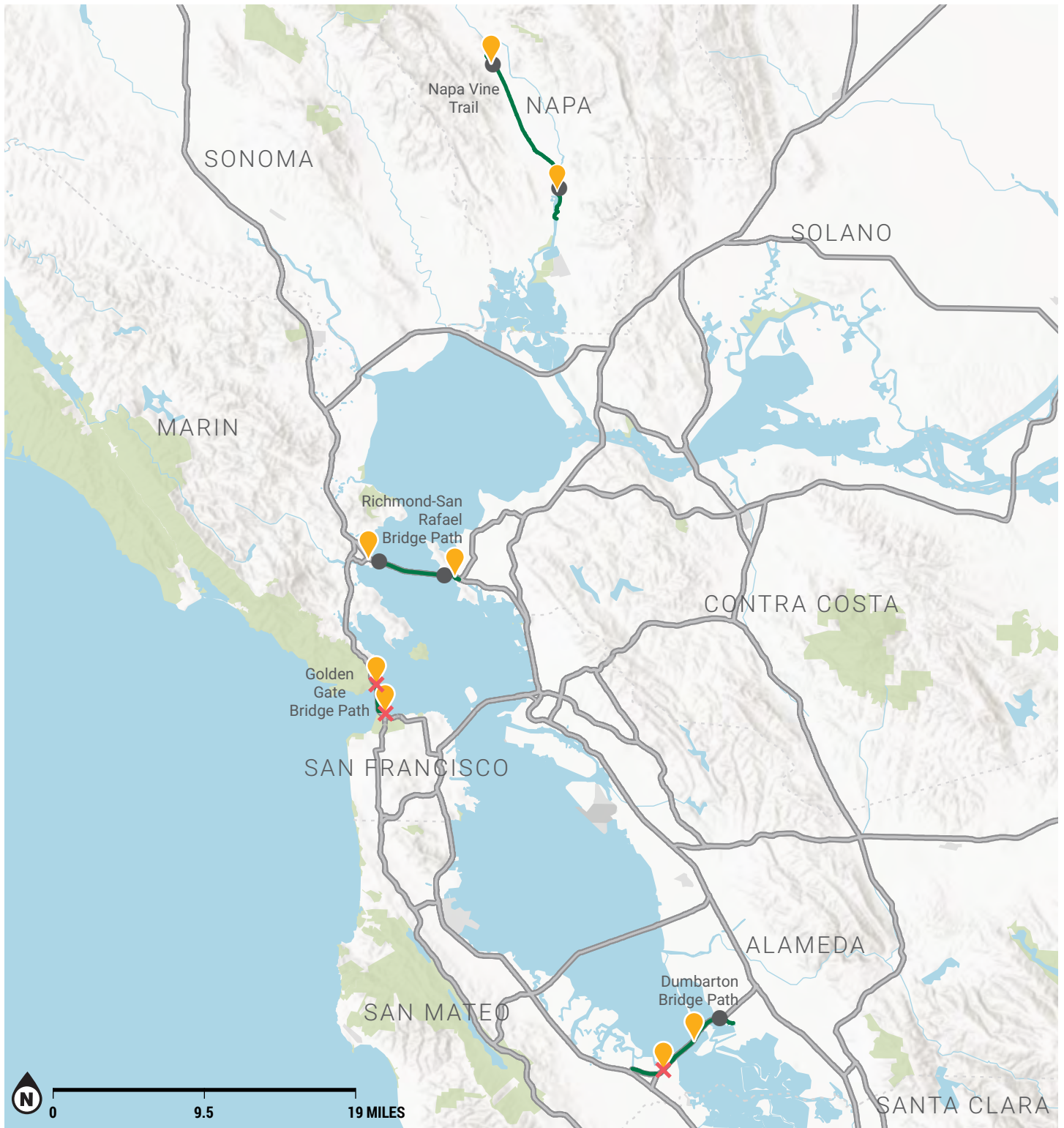


*Survey station located on the west side of the Dumbarton Bridge Path.*

## **SURVEY LOCATIONS**

Survey responses were collected at two positions on each of the four corridors, for a total of eight survey locations. Each corridor was surveyed on one weekday and one Saturday or Sunday. The specific days of the weeks and times of day for surveying were selected to cover peak use periods for each respective corridor based on historical data.

In total, there were 738 responses from trail users. Surveys were collected from 9:00 AM to 3:00 PM or 11:00 AM to 5:00 PM on one weekday and one weekend day for each corridor from April 23 to May 1, 2022. The survey was administered in conjunction with permanent counter validation, so locations were chosen near existing Eco-Counters but with a primary goal of maximizing the number of survey responses.



## SURVEY LOCATIONS

### MTC ORIGIN-DESTINATION STUDY

#### LEGEND

- Study Corridor
- Intercept Survey Location
- Automatic (Ecocounter)
- ✗ No Ecocounter Data Available for Count Period



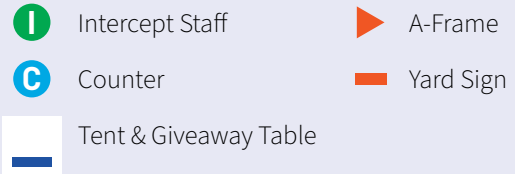
## RICHMOND-SAN RAFAEL BRIDGE

### Survey Period 1

- ▶ Tuesday, April 26, 2022, from 9:00 AM to 3:00 PM

### Survey Period 2

- ▶ Saturday, April 23, 2022, from 9:00 AM to 3:00 PM



### East Setup - Richmond



### West Setup - San Rafael








## DUMBARTON BRIDGE

### Survey Period 1

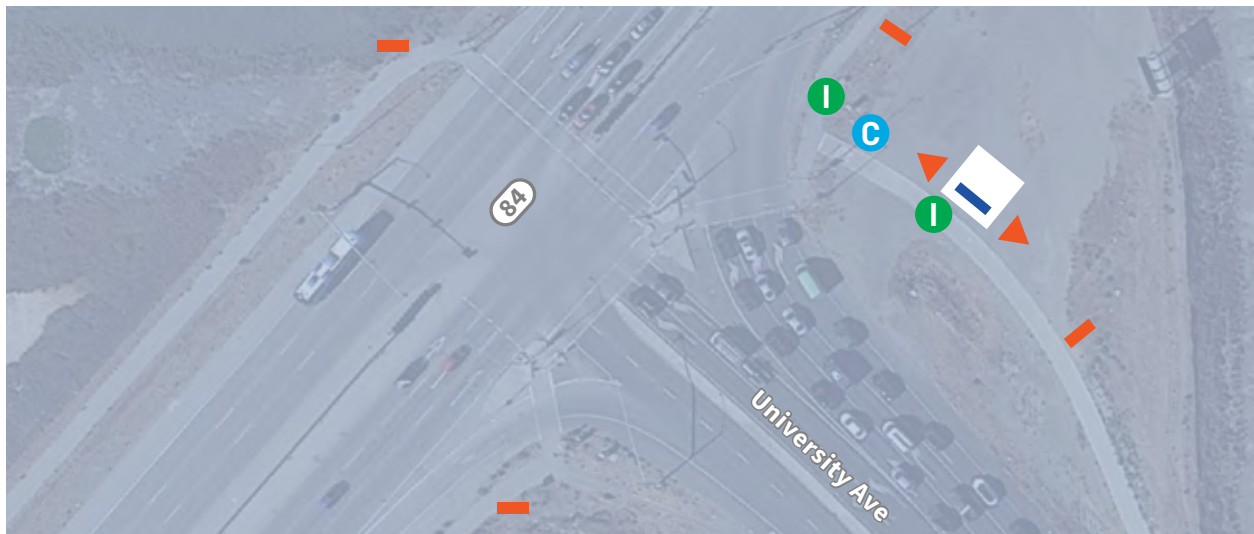
- ▶ Friday, April 22, 2022, from 12:00 PM to 6:00 PM

### Survey Period 2

- ▶ Sunday, April 24, 2022, from 9:00 AM to 3:00 PM

	Intercept Staff		A-Frame
	Counter		Yard Sign
	Tent & Giveaway Table		

### West Setup – Menlo Park



### East Setup – Fremont








## NAPA VINE TRAIL

### Survey Period 1

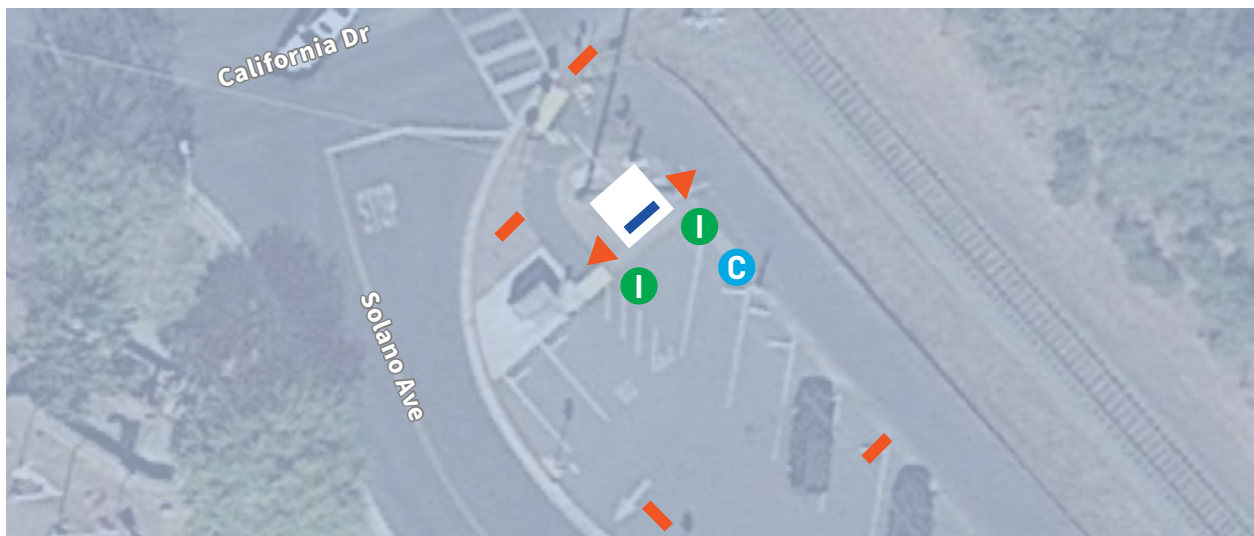
- ▶ Monday, April 25, 2022, from 11:00 AM to 5:00 PM

### Survey Period 2

- ▶ Saturday, April 30, 2022, from 9:00 AM to 3:00 PM

- |   |   |
|---|---|
|  Intercept Staff       |  A-Frame   |
|  Counter               |  Yard Sign |
|  Tent & Giveaway Table |   |

### North Setup – Yountville



### South Setup – Napa



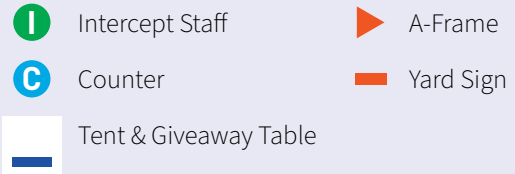
## GOLDEN GATE BRIDGE

### Survey Period 1

- ▶ Friday, April 29, 2022, from 11:00 AM to 5:00 PM

### Survey Period 2

- ▶ Sunday, May 1, 2022, from 9:00 AM to 3:00 PM



### Northwest Setup - Sausalito



### Northeast Setup - Sausalito



### South Setup - San Francisco





Golden Gate Bridge Path



 **Thirsty?** 

Quick Survey Ahead!

WYOMING TRANSPORTATION DIVISION

# SURVEY RESULTS

# SURVEY RESULTS

Respondents were asked trip-specific questions like mode choice and trip purpose, as well as broader questions about their experience with the trails like top safety concerns, desired improvements, and what could motivate them to use the trails more. To compare differences in responses by demographic groups, the respondents reported basic demographic information like age, gender, and race or ethnicity. Because of small sample sizes for some racial and ethnic groups, respondents of color are at times reported as an aggregated group. Most questions allowed users to select all applicable responses; thus, the reporting percentages may not sum to 100%.

## SURVEY ANALYSIS

The survey results indicate that while the majority of respondents are bicycling for health and recreation, up to 15% of people reported using the trail corridors to commute. **Trail users are commuting at the same rate as all trips taken in the Bay Area.**<sup>1</sup> Four out of five trail users are arriving to the corridor by bicycle, which may correlate with the reported median distance to their origin or destination as less than four miles away. By bicycle, this distance can be covered in approximately 16 to 22 minutes (and even quicker by e-bike). Based on the survey responses, we can conclude that most people are biking from home using the local street network to reach the trail instead of driving to a trailhead or bringing their bikes on transit. Nearly a quarter of trail users traveled on the same corridor at least once a week by driving alone. Opportunistically, MTC and local partners may be able to convert some of these trail users to bicycling more frequently (instead of

driving) by addressing the most commonly cited challenges—lack of comfortable bikeways leading to trail access points and lack of adequate end-of-trip amenities. MTC should support investments in more comfortable (separated) bikeways in the street network leading to the trail corridors, improve major roadway crossings, and support investment in secure bicycle parking, showers, and changing facilities. While the survey respondents were disproportionately white (66%) and male (71%), between 12% and 25% of the origin and destination points identified in the survey were located within Equity Priority Communities.

**Adding lighting and wayfinding signage was disproportionately favored by respondent of color when compared to white trail users.**

### Main Takeaways

- ▶ **Trail users are commuting at the same rate** as all trips taken in the Bay Area.
- ▶ **Trail users are using the local street network** to reach the trails from nearby locations.
- ▶ MTC and local jurisdictions have an opportunity to **convert weekly drive-alone trips** taken on the same corridor by the same trail users **to more bicycling trips.**
- ▶ Providing more **comfortable bikeways, end-of-trip amenities, more lighting, and better wayfinding** are the best methods to increase the likelihood that more people, including Black, Indigenous, and people of color will use these corridors for active transportation.

<sup>1</sup> Federal Highway Administration. (2020). 2020 NextGen NHTS National Passenger OD Data, U.S. Department of Transportation, Washington, DC. Available online: <https://nhts.ornl.gov/od/>.

# KEY STATISTICS



## ORIGIN AND DESTINATIONS

The median distance to where people start or end their trip is **3.7 miles away** from each corridor.



## TRIP PURPOSES

Nearly 9 in 10 survey respondents reported **health, recreation, and fitness** to be their main trip purpose and mode choice motivation. Of the trails surveyed, the Dumbarton Bridge and Richmond-San Rafael Bridge paths reported the highest percentage of trail users commuting to or from work (15%). As a point of comparison, 16% of all trips in the Bay Area in 2020 were for commuting purposes.<sup>1</sup>



## MODE CHOICE

The overwhelming majority (87%) of trail users surveyed **ride bicycles on the trails**, and 9% are e-bikes. 82% also access the trail via bicycle, meaning few people drive a vehicle with their bicycles to the trailhead. The Dumbarton Bridge and Napa Vine trails saw the highest percentage of trail users driving to access trails (24% and 19%, respectively).



## MODE SHIFT MOTIVATIONS

When asked what would motivate them to bike more, the majority (57%) of respondents said **safer and more comfortable bike facilities** like dedicated bike lanes or separated bike paths. 26% said that having **secure bike parking** or other amenities like **showers and changing rooms** at their destination would motivate them to bike more often.



## E-BIKE REBATE

The average respondent was willing to spend **up to \$2,000 of their own money** in exchange for an e-bike rebate; however, 9% already own an e-bike, and 45% indicated they have no interest in owning one at this time.



## OTHER TRAVEL MODES

Respondents reported how often they travel on the same corridor each week using the following modes of transportation:

- ▶ Drove alone: 23%
- ▶ Carpool/vanpool: 6%
- ▶ Transit: 9%

<sup>1</sup> U.S. Department of Transportation, Federal Highway Administration, 2020 NextGen National Household Travel Survey National OD Data, <https://nhts.ornl.gov/od/>.





## CONCERNS

Across all corridors, the most frequently cited safety concern while accessing trails was **crossing major roadways** (71% of all respondents), followed by **high motor vehicle speeds** (31%). A higher percentage of respondents on the Dumbarton Bridge and Richmond-San Rafael Bridge paths cited a **lack of bike lanes** as a primary concern than the survey average (24 and 31%, respectively, compared to 15% for all respondents). Respondents who are taking nondiscretionary<sup>2</sup> trips more frequently cited high motor vehicle speeds and lack of bike lanes than

<sup>2</sup> Nondiscretionary trips take place at a fixed location and regular schedule such as trips to work or school. Discretionary trips include shopping, family/personal business, visits with friends/family, social/recreational, and medical/dental purposes.



respondents traveling solely for recreational or social purposes.

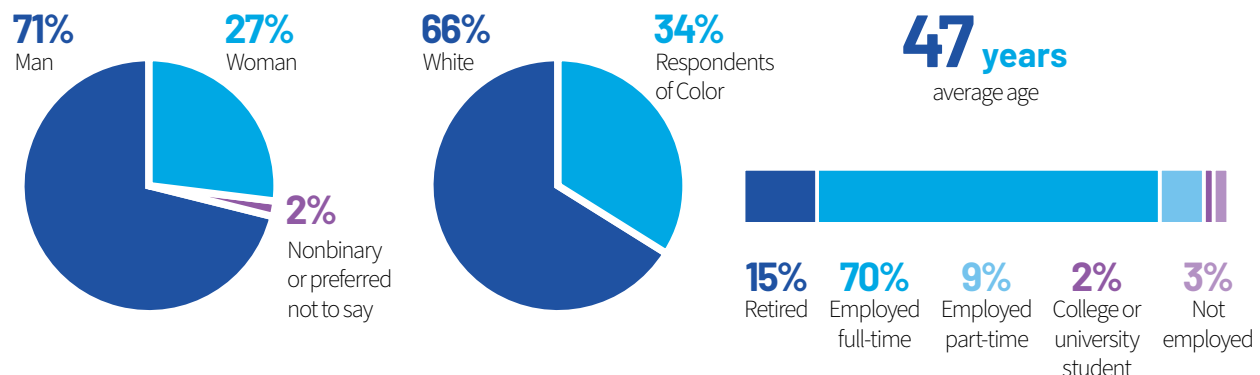
## REQUESTED IMPROVEMENTS

The most commonly requested improvements to existing trail facilities were **improved path surface quality** (58%), the installation of **physical barriers to separate from vehicle traffic** (47%), and the creation of **designated spaces for pedestrian and bicycle trail users** (45%).

Calls for wider paths and increased capacity were more common on the Golden Gate Bridge Path (54% of respondents), and 60% of Richmond-San Rafael Bridge Path users requested physical barriers to separate from vehicle traffic. Respondents of color disproportionately requested improved lighting, wayfinding, and signage compared to white respondents.

## DEMOGRAPHICS

The respondents taking the survey were:



For more information, see [Appendix D: Origin-Destination Survey Response Analysis](#).

# REGIONAL RESULTS & RECOMMENDATIONS

## NETWORK ANALYSIS

The survey included a location-based section where respondents reported their trip origin, destination, and route. We asked respondents to draw their routes on a map and identify their trip origin and destination (if not round trip). Due to technical difficulties with the survey instrumentation, only about 20% of survey routes were viable for analysis. All origin and destination points were collected, allowing the project team to estimate where each trip may have traveled along the network.

The project team simulated two route choices for each origin-destination pair to supplement the drawn responses:



**Comfortable Path:** In this scenario, riders elect to ride on segments with more comfortable conditions, even if it means traveling further overall. Novice bicyclists likely take these routes.



**Shortest Path:** In this scenario, riders elect to ride on the shortest path, regardless of the level of traffic stress along the way. Advanced bicyclists likely take these routes.

This analysis informed quick-build opportunities for each corridor. For more information on this analysis, see [Appendix E: Origin-Destination Network Analysis](#).

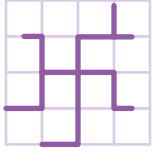


*Richmond-San Rafael Bridge Path. Photo credit: Karl Nielsen*



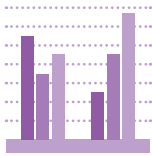
*Survey station located in Yountville on the Napa Vine Trail.*

## QUICK-BUILD IDENTIFICATION PROCESS



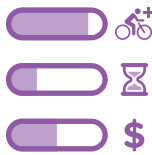
### Step 1. Project Location

Drawing on the network analysis results, we looked for opportunities to address high-stress barriers on popular trail access routes.



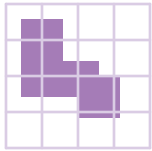
### Step 2. Project Type

Next, the project team considered the priorities and concerns stated by users at each trail location to select project types that address safety barriers and encourage people to bike more.



### Step 3. Project Feasibility

The project team evaluated opportunities to improve major bikeway corridors by looking at quick-build or low-cost solutions. These opportunities include striping a bicycle lane, adding traffic calming, or installing wayfinding signage.



### Step 4. Project Distribution

Finally, to consider improvements equitably, we prioritized identifying quick-build opportunities in areas designated by MTC as Equity Priority Communities.



### Step 5. Project Recommendations


Planning-level project recommendations were ultimately selected based on a qualitative review of the considerations mentioned above. Coordination with local jurisdictions and detailed engineering analysis should be conducted as the next steps.

The following section describes the specific corridor survey results, network analysis, and quick-build recommendations.



Photo credit: Karl Nielsen

## RICHMOND- SAN RAFAEL BRIDGE PATH

 **236 SURVEYS  
CONDUCTED**

### Survey Period 1

- ▶ Saturday, April 23, 2022, from 9:00 AM to 3:00 PM

### Survey Period 2

- ▶ Tuesday, April 26, 2022, from 9:00 AM to 3:00 PM

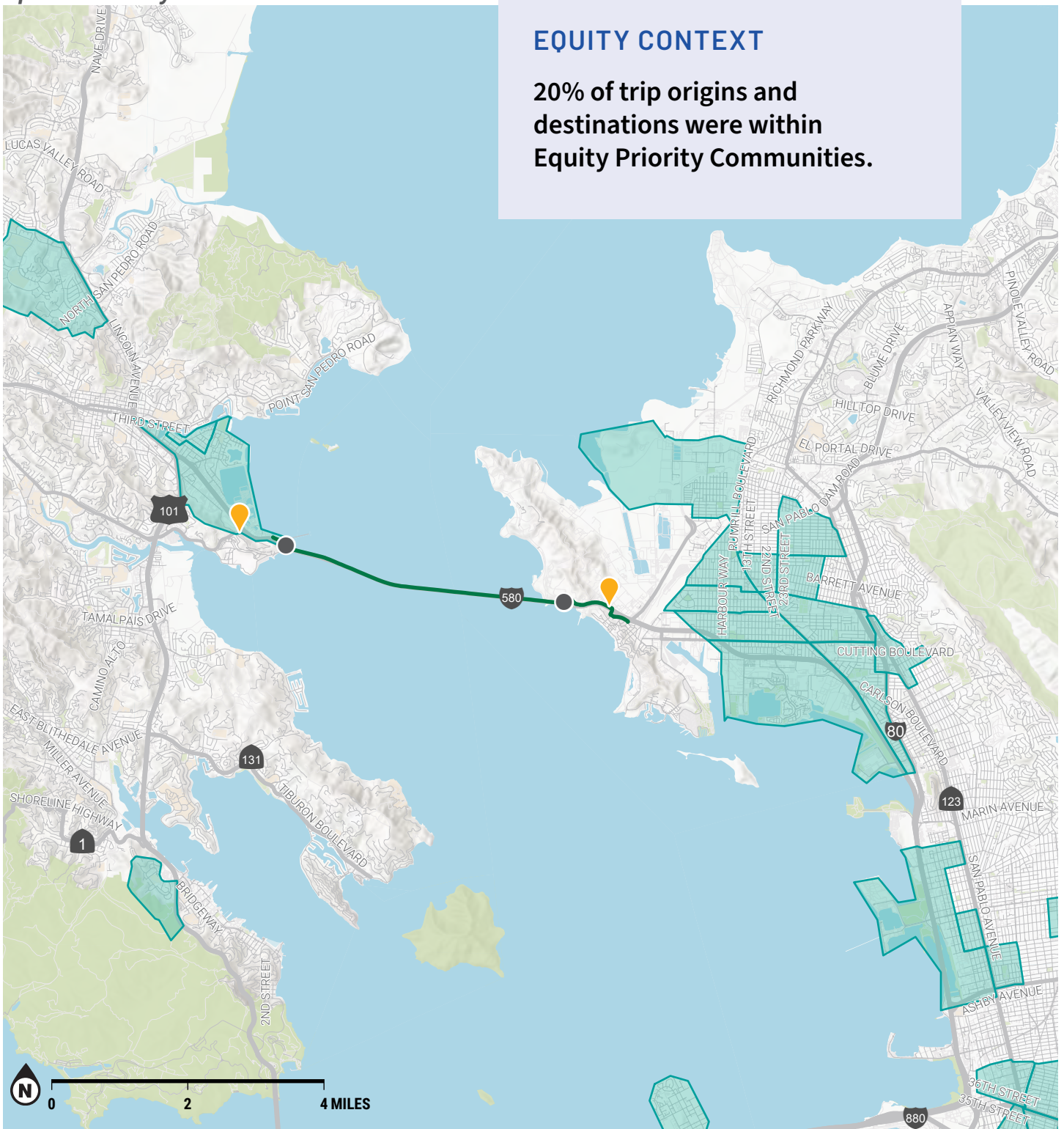
### Survey Key Points

- ▶ Survey respondents on the Richmond-San Rafael Bridge Path tended to be **older, white, and male** when compared to the demographics of the surrounding area.
- ▶ **Less than 10% of people accessing the trail did so via car**, and only 5% of respondents walked or jogged on the Richmond-San Rafael Bridge, the lowest of all trails considered.
- ▶ **A larger percentage of respondents than the survey average reported using the trail for essential travel purposes** like commuting to or from work, running errands, or attending appointments.
- ▶ **Twenty percent of origins and destinations were within Equity Priority Communities.**

# Spatial Survey Results

## EQUITY CONTEXT

20% of trip origins and destinations were within Equity Priority Communities.



### COUNT & SURVEY LOCATIONS

- Survey/Manual Counter Site
- Automatic Ecocounter
- Richmond-San Rafael Bridge Path
- Equity Priority Community (with reported origins or destinations)

## Trail Counts

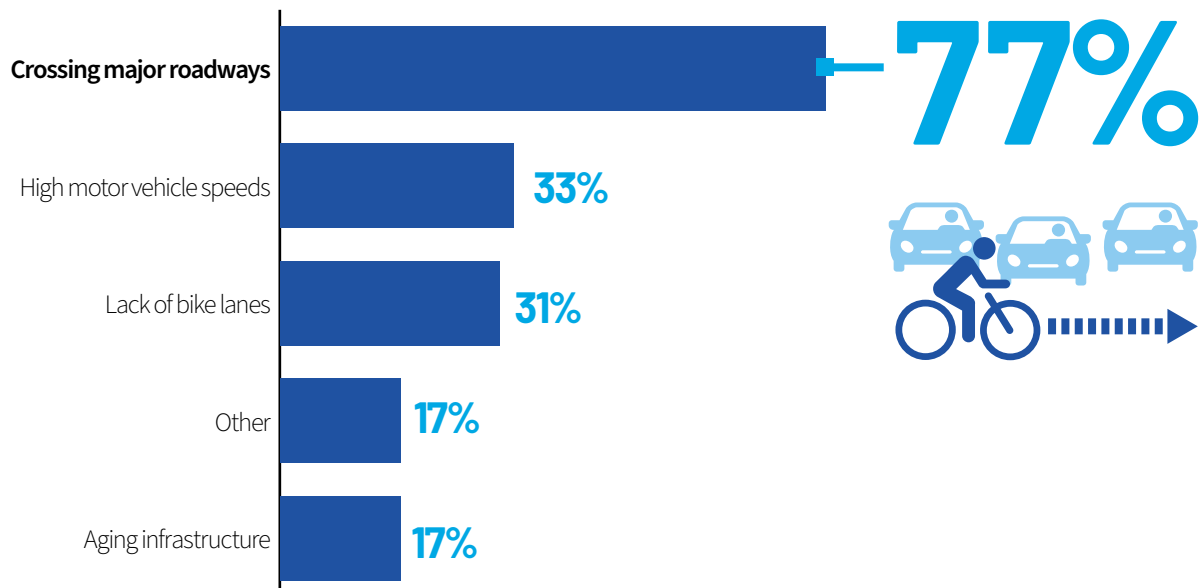
Two permanent Eco-Counters record trail user activity at each end of the Richmond-San Rafael Bridge Path. On the west side, the Sir Francis Drake Boulevard Eco-Counter tallies the number of cyclists on the trail and was validated to be performing with no significant issues by the manual counts collected for the same time period. On the east side, the Richmond Eco-Counter tallies both cyclists and pedestrians, though it appears to be significantly overcounting cyclists when compared to manual counts conducted over the same time period. Pedestrian volumes were too low during the manual count collection to statistically validate the pedestrian counter.

## Primary Safety Concerns

Crossing major roadways was again the top safety concern, as it was selected over 75% of the time. Twice as many respondents on the Richmond-San Rafael Bridge Path cited a lack of bike lanes as a primary safety concern compared to the average of respondents from all trails. Many respondents specifically identified debris on the trail and roads leading to the bridge as a safety hazard, as well as tricky railroad crossings.



What is your primary safety concern when accessing the corridor? (n=86)



## Motivations to Bike More

Nearly half of respondents said nothing would be required to encourage them to bike more often, as they already bike frequently, but for those that do not currently bike often, **safer and more comfortable infrastructure** was the most commonly selected response. To respondents, this often looked like protection from noise, wind, debris, and vehicle emissions along the bridge, and more physical barriers to separate active users from vehicle traffic, particularly leading up to bridge access points on both ends.

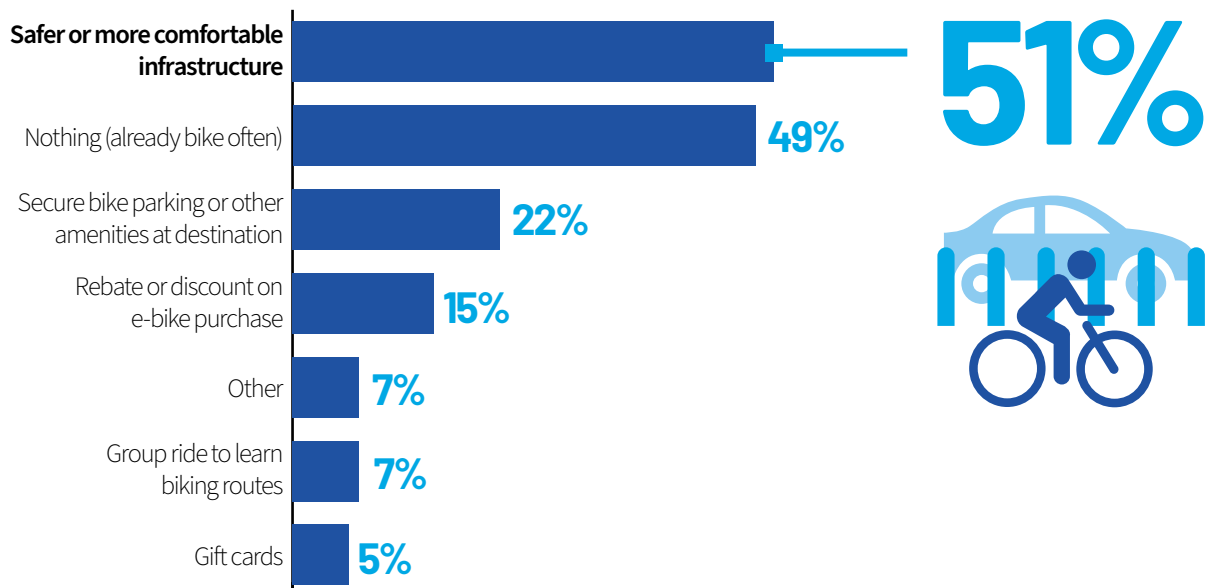
## Network Analysis Results

On the east side of the bridge, survey respondents reported trip origins and destinations as far south as Newark, with concentrations in Oakland, Berkeley, and east Richmond. Many trail connections travel along South Garrard Boulevard via West Ohio Avenue or West Cutting Boulevard via Hoffman Boulevard, with longer connections to the San Francisco Bay Trail traveling south toward Berkeley. On the west side, respondents reported traveling from inland origins near Fairfax and San Rafael, as well as south along the Hwy 101 corridor. Many routes connect via Sir Francis Drake Boulevard toward Larkspur or Andersen Drive toward downtown San Rafael.

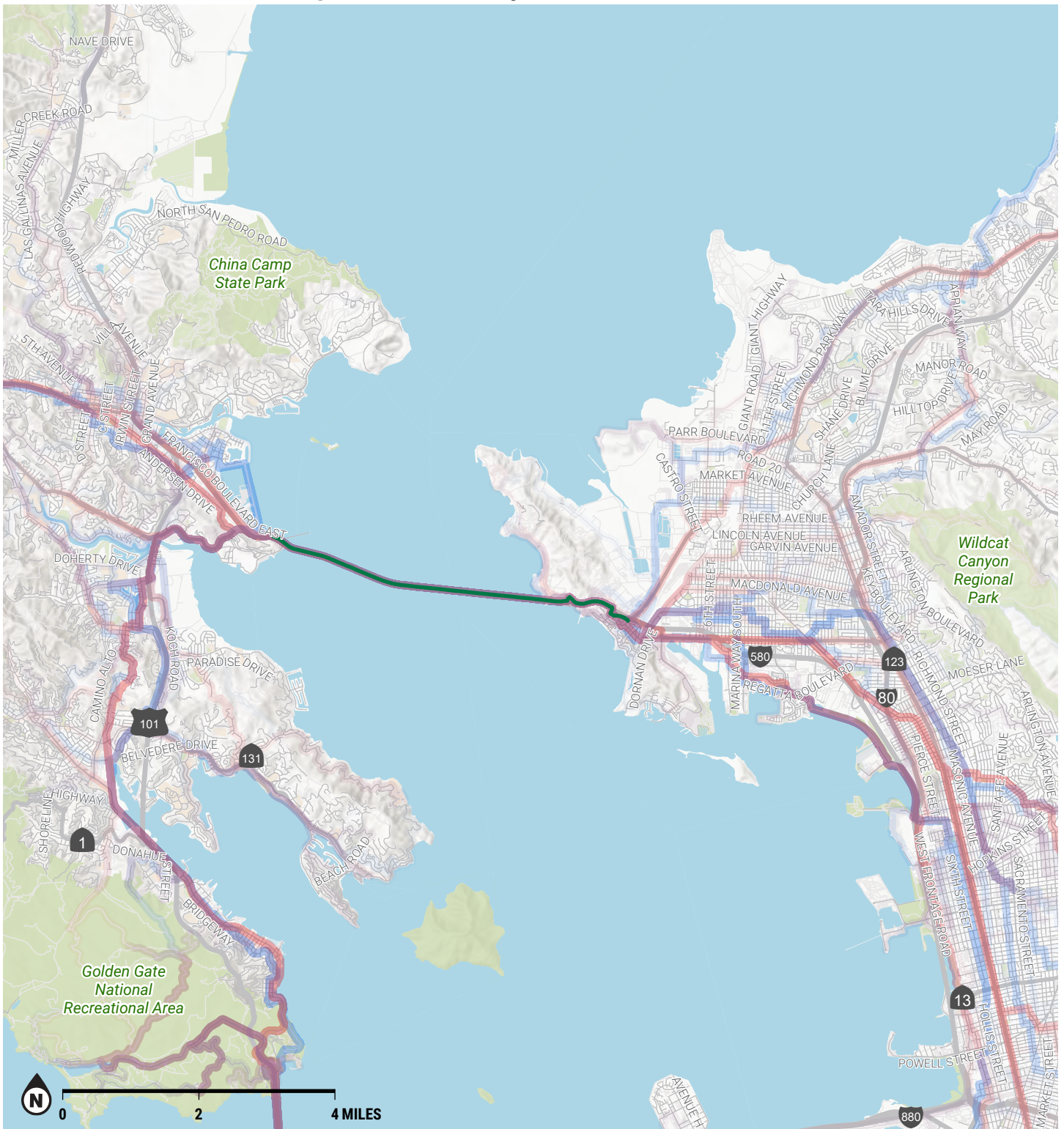
The following two maps show the network analysis for shortest and most comfortable routes to the corridor and quick-build opportunities.



*What would encourage you to bike or to bike more often? (n=150)*



# Richmond-San Rafael Bridge Network Analysis



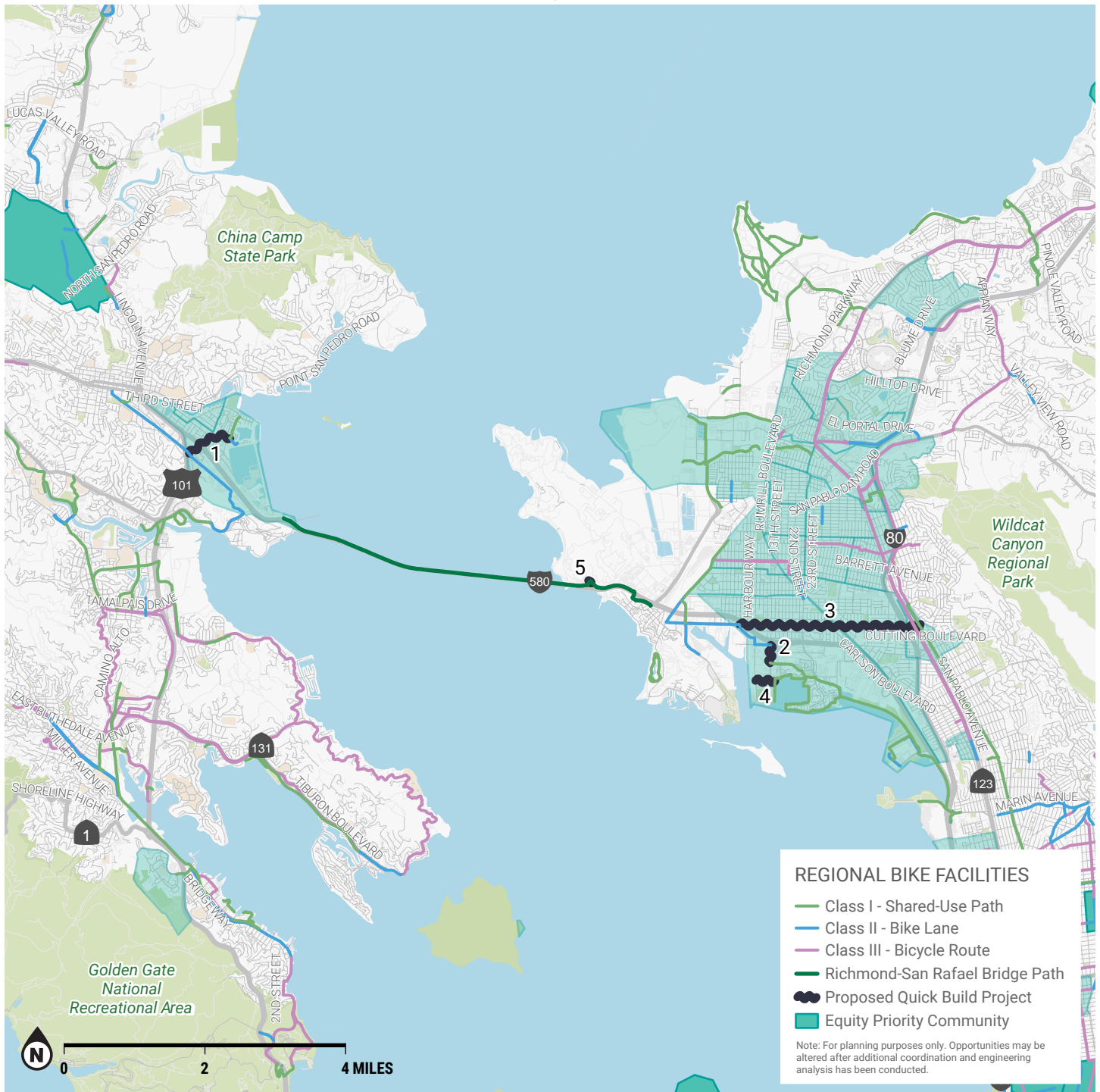
## NETWORK ANALYSIS RESULTS

- Shortest Path
- Comfortable Path (LTS-Adjusted)
- Paths Overlap
- Richmond-San Rafael Bridge Path

On the east side of the bridge, many trail connections travel along S Garrard Blvd via W Ohio Ave or W Cutting Blvd via Hoffman Blvd with longer connections to the San Francisco Bay Trail traveling south towards Berkeley. To the west, many routes connect via Sir Francis Drake Blvd towards Larkspur or Andersen Dr towards downtown San Rafael.



# Richmond-San Rafael Bridge Quick-Build Project Identification



ID	Street Name	Improvement Type	Opportunities
1	Bellam Blvd	Corridor	Bike lane study for gap closure between Baypoint Village Dr and Anderson Dr. Wayfinding signage to Cal Park Hill Pathway.
2	Marina Way S	Corridor	Gap closure via striped bike lane.
3	Cutting Blvd	Corridor	Gap closure via striped bike lane.
4	Hall Ave	Corridor	Better wayfinding at roundabout. Wider bike lane.
5	Stenmark Dr on-ramp	Spot	Crossing improvement, higher visibility crosswalk and shark-teeth yield markings.



## DUMBARTON BRIDGE PATH



**54 SURVEYS  
CONDUCTED**

### Survey Period 1

- ▶ Friday, April 22, 2022, from 12:00 PM to 6:00 PM

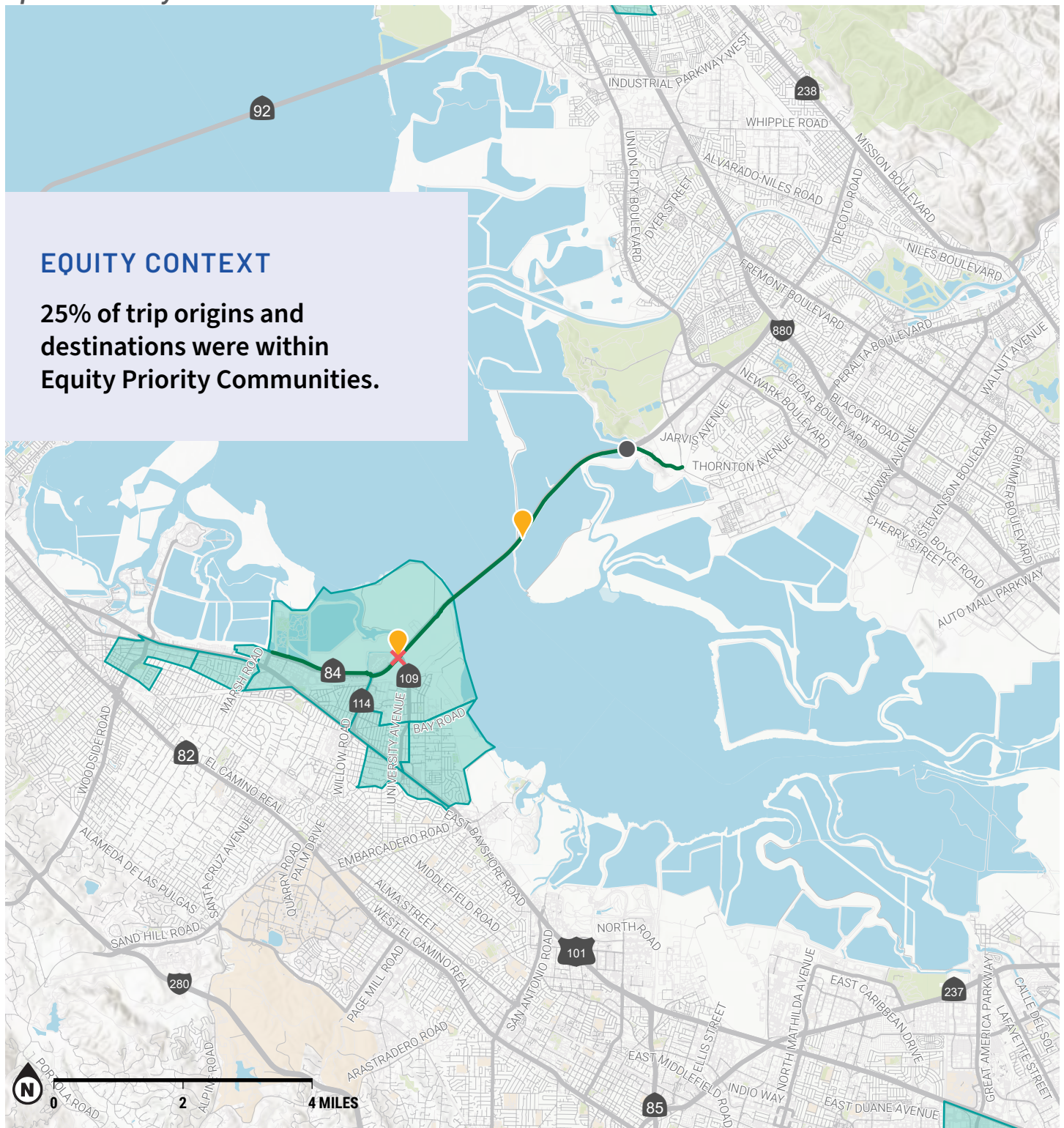
### Survey Period 2

- ▶ Sunday, April 24, 2022, from 9:00 AM to 3:00 PM






### Survey Key Points

- ▶ Survey respondents from the Dumbarton Bridge Path were far **more diverse** than the overall respondent pool.
- ▶ **Over half of respondents self-identified as a person of color**, compared to one-third of the general survey population.
- ▶ About a quarter of respondents reported accessing the trail via car, higher than any other trail.
- ▶ Though 78% of trail respondents rode their bicycles on the Dumbarton Bridge Path, only 65% of respondents biked to the trail.
- ▶ **Fifteen percent of respondents reported their primary trip purpose as commuting to or from work, higher than any other trail surveyed.**
- ▶ **Almost 25% of origins and destinations were located in Equity Priority Communities**, nearly entirely in East Palo Alto.

## Spatial Survey Results



### COUNT & SURVEY LOCATIONS

-  Survey/Manual Counter Site
-  Automatic Ecocounter
-  No Ecocounter Data Available for Count Period
-  Dumbarton Bridge Path
-  Equity Priority Community (with reported origins or destinations)

## Trail Counts

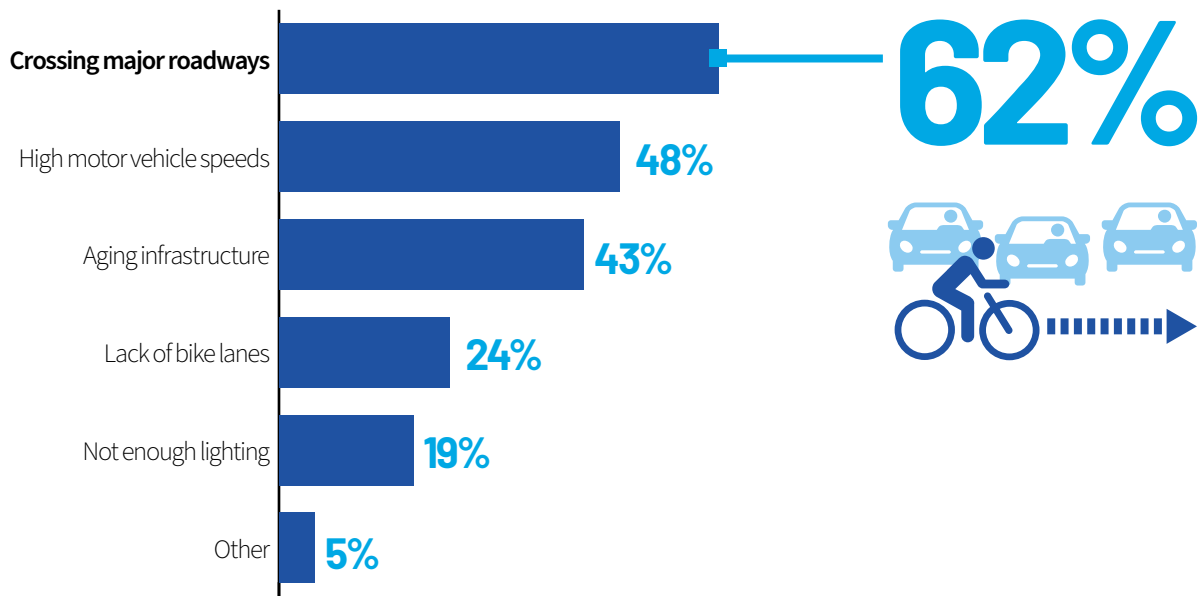
Permanent counters on each side of the bridge count bicycle and pedestrian trail users. A comparison between the manual count conducted on the bridge's east side and the nearby Dumbarton (Newark) Eco-Counter suggests the bicycle counter is functional with no significant issues, but further analysis is required to evaluate the accuracy of the pedestrian counter. Though the pedestrian count volumes were significantly different, this may be a result of the considerable distance between the two counter locations and the fact that pedestrians may have turned around before reaching the manual count location.

## Primary Safety Concerns

Respondents on the Dumbarton Bridge trail were more likely than other trail users to cite high vehicle speeds and a lack of bike lanes as primary safety concerns when accessing the corridor. However, [crossing major roadways](#) was the most frequently cited concern (62%). Respondents remarked on conflicts between pedestrians and bicyclists on the bridge and requested a wider path to accommodate both modes on the trail better.



What is your primary safety concern when accessing the corridor? (n=21)



## Motivations to Bike More

Nearly 60% of respondents said that **safer or more comfortable infrastructure**, including improving road crossings and better delineating bike lanes from vehicle traffic, would encourage them to bike more. Excluding respondents that already bike often, no other response was selected by more than 10% of respondents. Themes in desired facility improvements included increasing trail capacity and allowing separate spaces for pedestrians and bicyclists.

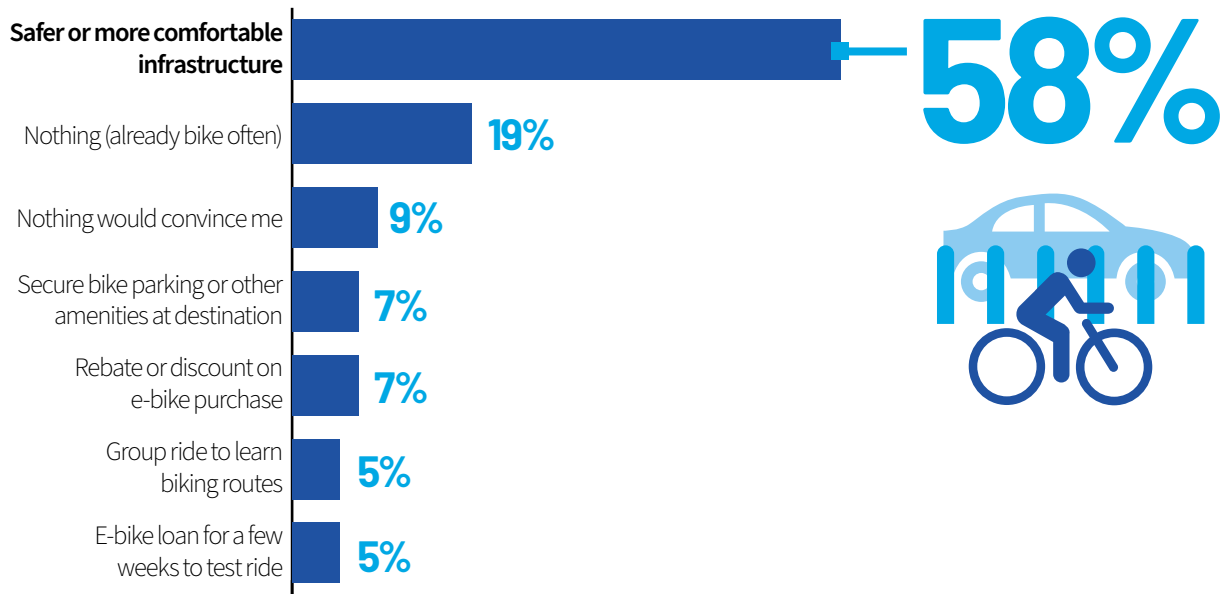
## Network Analysis Results

On the west side of the bridge, respondents traveled to the path from cities along the bay, including East Palo Alto, Menlo Park, Redwood City, and Mountain View. To the east, people reported origins and destinations within nearby nature areas like Coyote Hills Regional Park, the San Francisco Bay National Wildlife Refuge, and the urban areas of Fremont and Newark.

The following two maps show the network analysis for shortest and most comfortable routes to the corridor and quick-build opportunities.



*What would encourage you to bike or to bike more often? (n=43)*



# Dumbarton Bridge Network Analysis

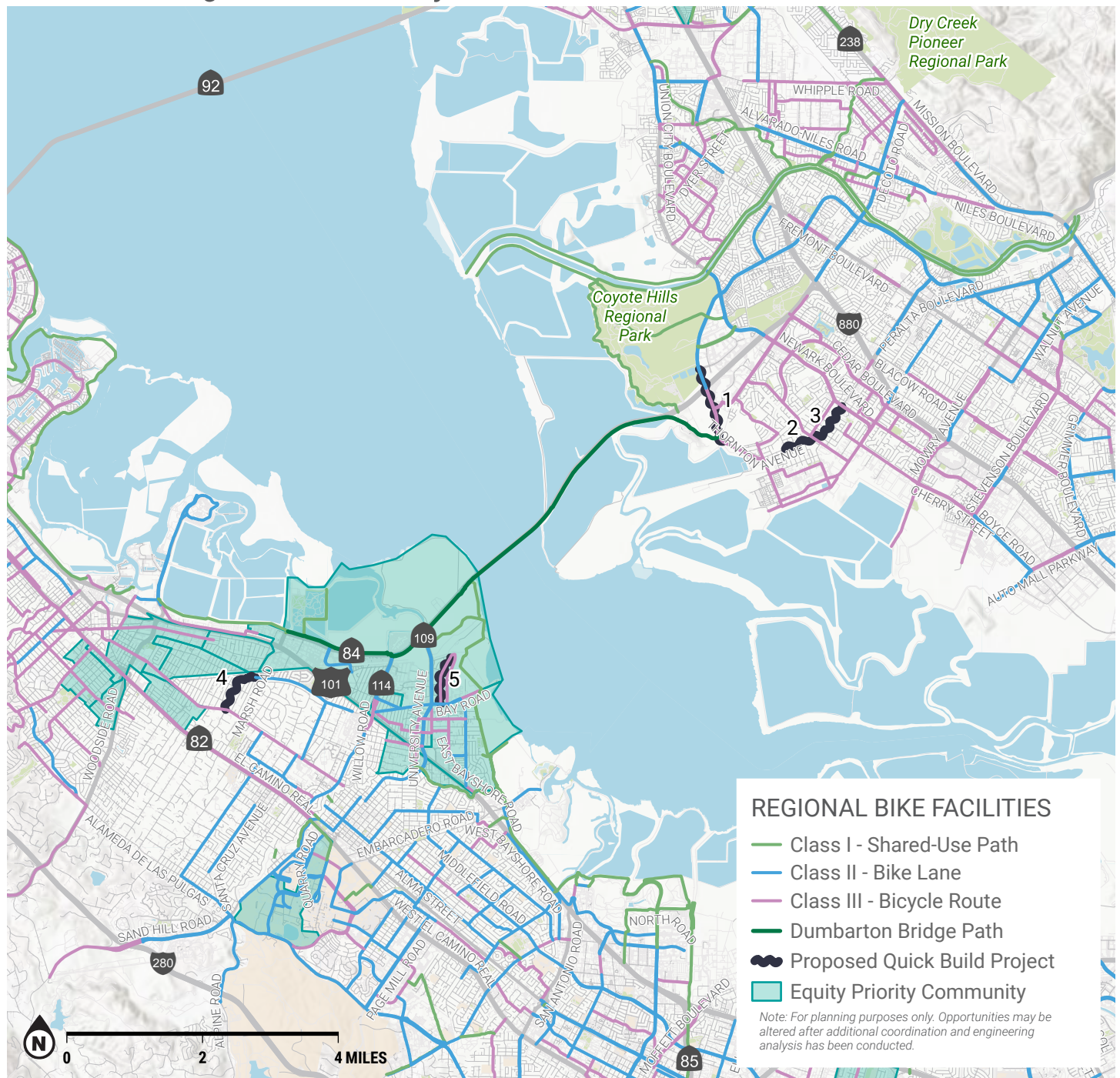


## NETWORK ANALYSIS RESULTS

- Shortest Path
- Comfortable Path (LTS-Adjusted)
- Paths Overlap
- Dumbarton Bridge Path

On the east side of the bridge, common routes to the trail include traveling along Thornton Ave from both the north and south, with connections traveling north along Union City Boulevard. On the west side, routes access the trail along Willow Rd and University Ave, though Comfortable Path options may route along parallel, low-stress options. Many routes cross Hwy 101 to access the trail.

# Dumbarton Bridge Quick-Build Project Identification



**REGIONAL BIKE FACILITIES**


- Class I - Shared-Use Path
- Class II - Bike Lane
- Class III - Bicycle Route
- Dumbarton Bridge Path
- ⦿ Proposed Quick Build Project
- Equity Priority Community

Note: For planning purposes only. Opportunities may be altered after additional coordination and engineering analysis has been conducted.

ID	Street Name	Improvement Type	Opportunities
1	Thornton Ave	Corridor	MTC is coordinating with the City of Newark to convert existing painted bike lanes (Class II) to a separated bikeway (Class IV) between Hickory St and Gateway Blvd. A future opportunity could be to extend further to Dumbarton Cir.
2	Thornton Ave	Corridor	Extend painted buffered bike lane from Spruce St to connect to bike facilities on Sycamore St.
3	Thornton Ave	Corridor	Create painted buffered bike lane to connect Sycamore St and Newark Blvd bike facilities.
4	Palmer Lane	Corridor	Wayfinding and traffic calming. Bike boulevard designation to provide low stress connection from Middlefield Rd to Bay Rd.
5	Fordham St	Corridor	Wayfinding and traffic calming. Bike boulevard designation to provide low stress connection from Bay Rd to Rutgers St. Explore opening gate for direct access to Bay Trail.



## GOLDEN GATE BRIDGE PATH

 **349 SURVEYS CONDUCTED**

### Survey Period 1

- ▶ Saturday, April 29, 2022, from 11:00 AM to 5:00 PM

### Survey Period 2

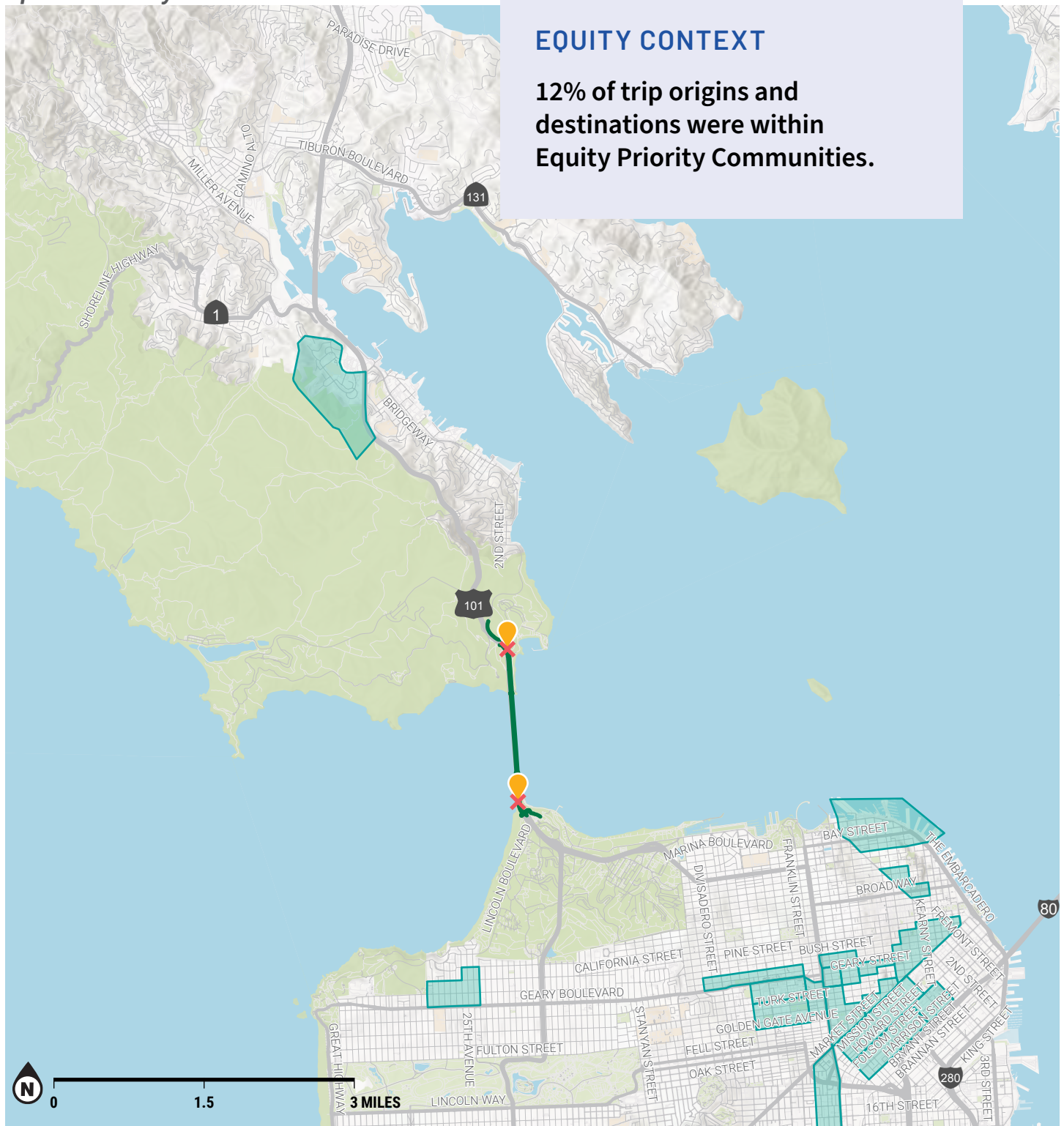
- ▶ Tuesday, May 1, 2022, from 9:00 AM to 3:00 PM

### Survey Key Points

- ▶ Over half of the respondents on the Golden Gate Bridge Path were **under 35** (younger than other study corridors), but similar to other trails, they tended to be more often white and male compared to the average population.
- ▶ **Less than 4% of respondents reported accessing the Golden Gate Bridge Path via car**, lower than any other trail, and a greater percentage reported using a mobility assistance device like a wheelchair to access the path.
- ▶ On the path, nearly 9 in 10 respondents rode their bikes, and less than 10% of respondents reported that their trip was made for nondiscretionary purposes.
- ▶ **Twelve percent of origins and destinations were within Equity Priority Communities**, primarily in downtown San Francisco.







## Spatial Survey Results



### EQUITY CONTEXT

12% of trip origins and destinations were within Equity Priority Communities.

### COUNT & SURVEY LOCATIONS

-  Survey/Manual Counter Site
-  No Ecocounter Data Available for Count Period
-  Golden Gate Bridge Path
-  Equity Priority Community (with reported origins or destinations)

## Trail Counts

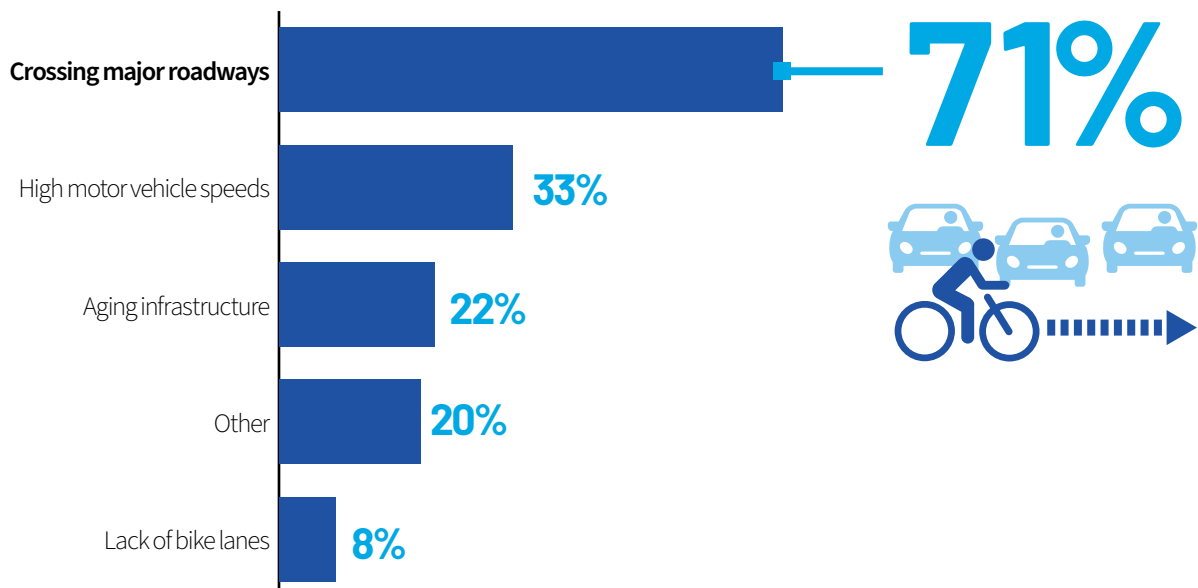
There are currently no functioning permanent counters on the Golden Gate Bridge Path, but staff counted an average hourly volume of 240 and 340 path users on the south and north sides of the bridge, respectively.

## Primary Safety Concerns

Similar to the other trails, [crossing major roadways](#) was overwhelmingly the top safety concern for respondents accessing the path, followed by high motor vehicle speeds. In the comments, respondents cited crowded paths with conflicting user speeds as safety concerns, along with the presence of construction materials on the bridge.



What is your primary safety concern when accessing the corridor? (n=199)



## Motivations to Bike More

Two-thirds of respondents said **safer or more comfortable infrastructure** would encourage them to bike more often, and one-third cited access to secure bike parking or other amenities at their destination. Compared to all survey respondents, Golden Gate Bridge Path respondents placed increased levels of importance on widening paths for increased capacity and creating separate, designated spaces for bicycles and pedestrians. Additionally, nearly half of respondents said installing physical barriers to separate from vehicle traffic was among the most essential facility improvements.

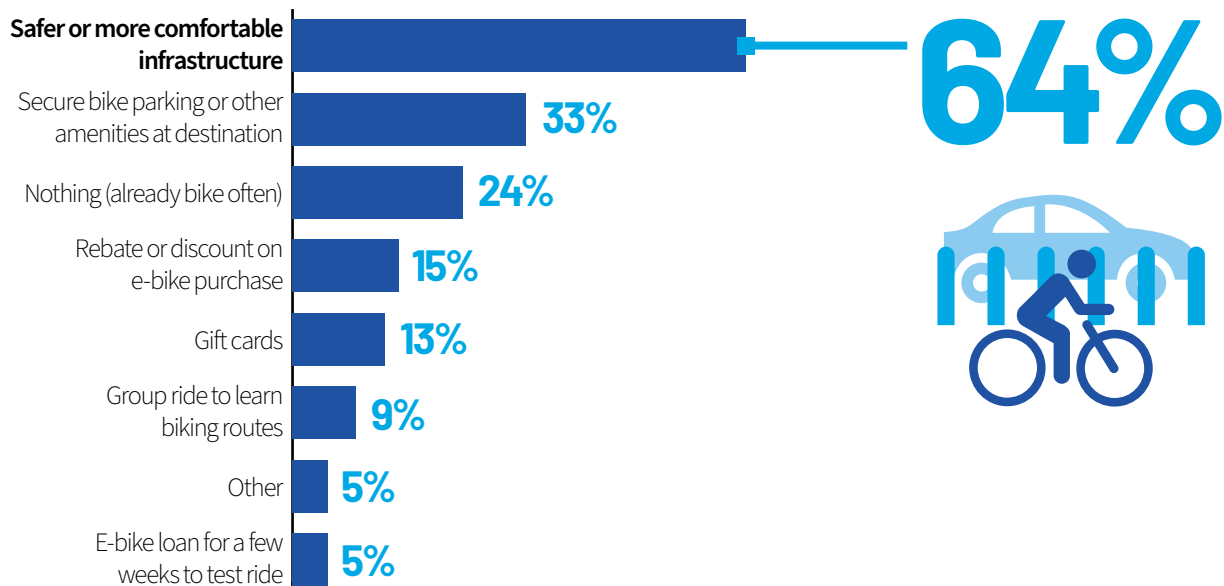
## Network Analysis Results

Most respondents traveling on the Golden Gate Bridge reported trip origins and destinations in San Francisco, recreational areas just north of the bridge like the Marin Headlands, and Sausalito, with a handful of riders traveling to and from the Napa Valley area. The survey results show many people accessing the Golden Gate Bridge via The Embarcadero and Marina Boulevard or along Arguello Boulevard via Fell Street. On the north side of the bridge, the survey results show that most people opt for the shortest path option along Alexander Avenue when connecting to the Sausalito area. Many trips also connect to and from the Marin Headlands recreation area.

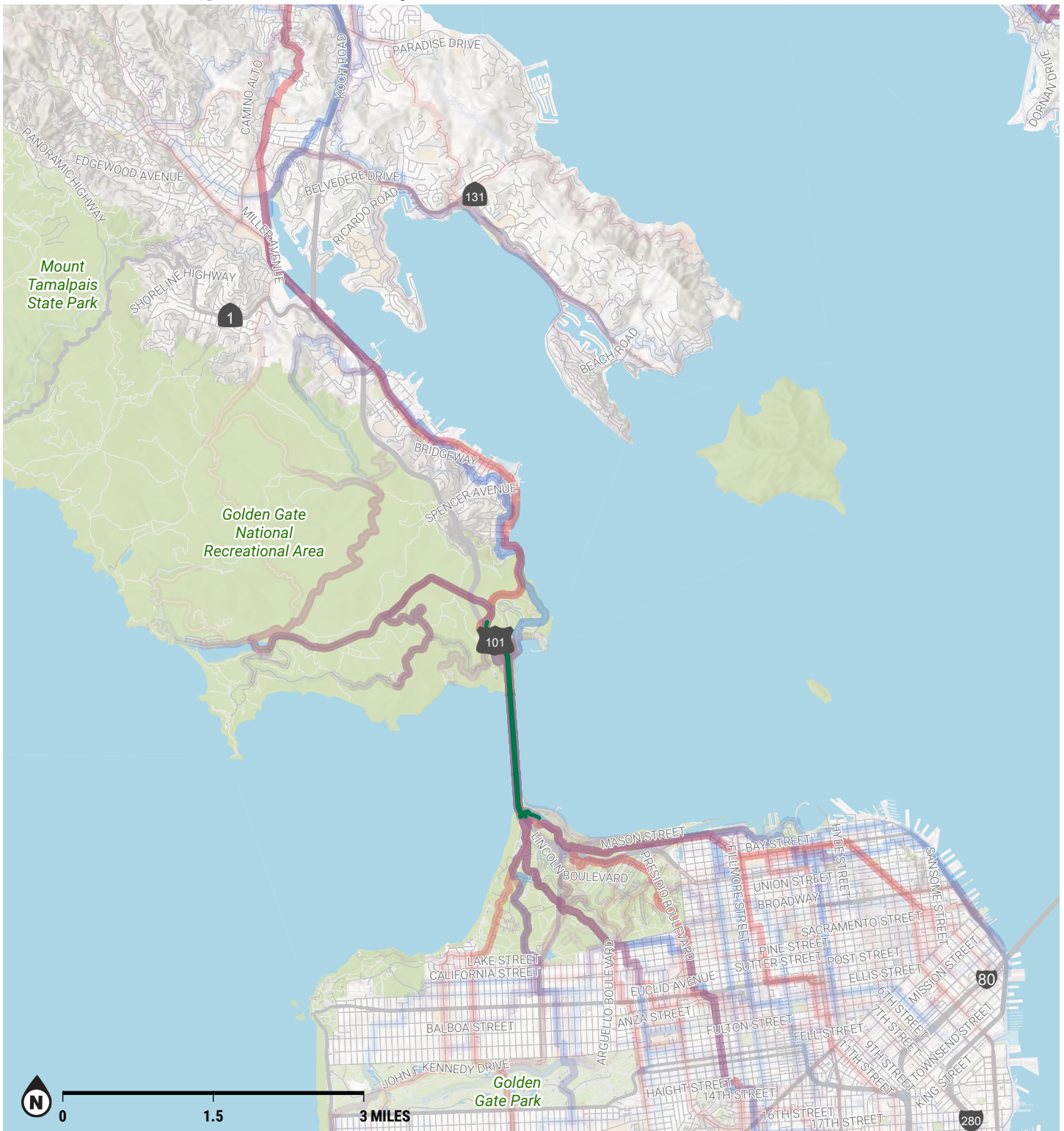
The following two maps show the network analysis for shortest and most comfortable routes to the corridor and quick-build opportunities.



*What would encourage you to bike or to bike more often? (n=292)*



# Golden Gate Bridge Network Analysis

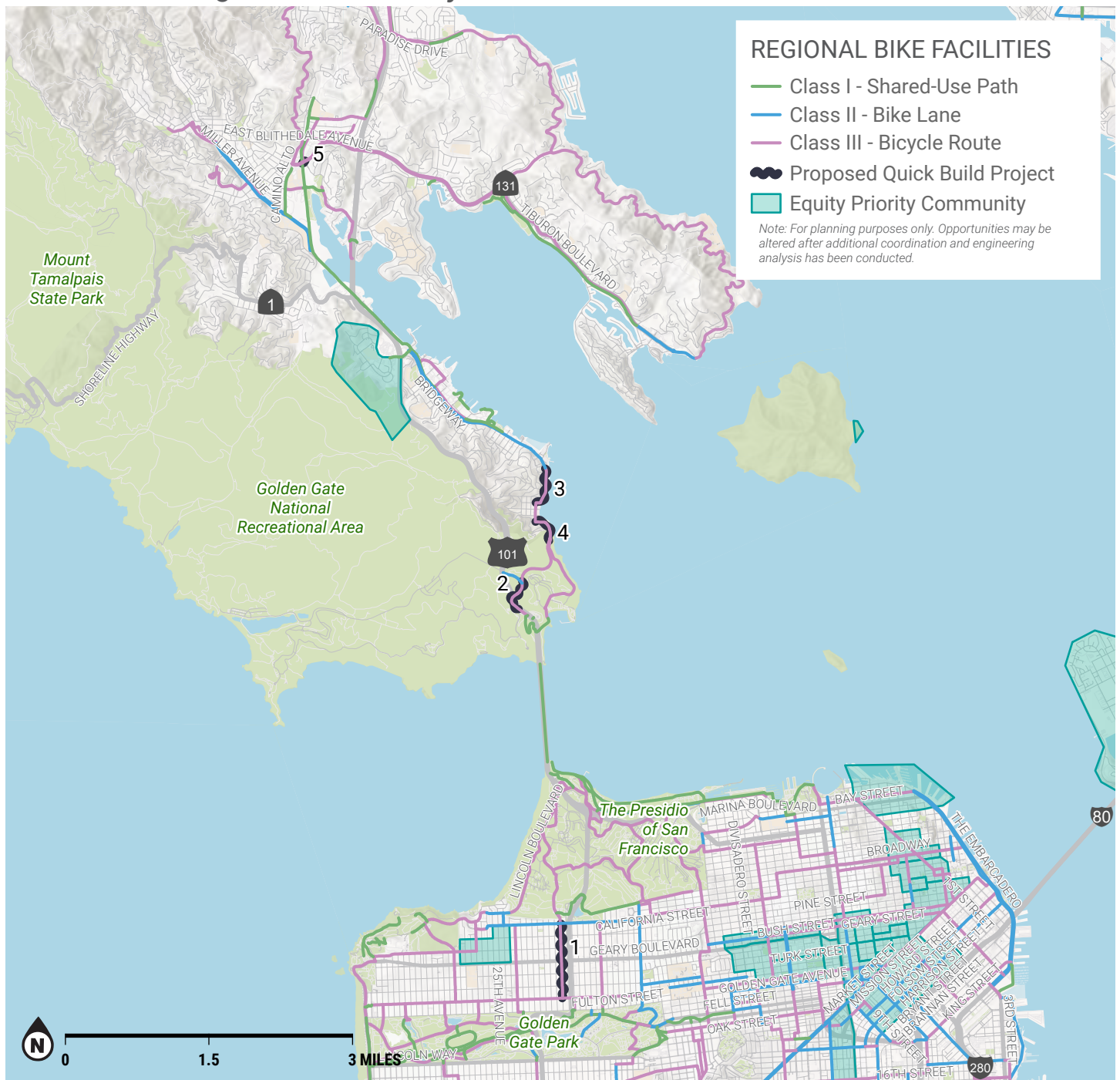


## NETWORK ANALYSIS RESULTS

- Shortest Path
- Comfortable Path (LTS-Adjusted)
- Paths Overlap
- Golden Gate Bridge Path

The survey results show many people accessing the Golden Gate Bridge via The Embarcadero and Marina Blvd, or along Arguello Blvd Via Fell St. On the north side of the bridge, the survey results show that most people opt for the Shortest Path option along Alexander Ave when connecting to the Sausalito area. Many trips also connect to and from the Marin Headlands recreation area.

# Golden Gate Bridge Quick-Build Project Identification



**REGIONAL BIKE FACILITIES**

- Class I - Shared-Use Path
- Class II - Bike Lane
- Class III - Bicycle Route
- Proposed Quick Build Project
- Equity Priority Community

Note: For planning purposes only. Opportunities may be altered after additional coordination and engineering analysis has been conducted.

ID	Street Name	Improvement Type	Opportunities
1	15th Ave	Corridor	Bike facility upgrade from Class III to striped, advisory, or directional bike lanes. Expand traffic calming measures.
2	Alexander Ave / South St	Corridor	Striped bike lane, traffic calming. Connect the northern terminus of the trail to existing Bunker Rd and Conzelman Rd facilities.
3	Bridgeway	Corridor	Wayfinding, bike facility upgrade to striped bike lane. Consider removing center turn lane.
4	Alexander Ave	Bikeway Study	Gap closure, implement physical traffic calming measures to slow vehicle traffic coming down the hill from the off-ramp.
5	E Blithedale Ave / Roque Moraes Dr	Spot	Stripe stopbars on E Blithedale Ave traveling east, install signage for no right turn on red.



## NAPA VINE TRAIL

 **95 SURVEYS  
CONDUCTED**

### Survey Period 1

- ▶ Monday, April 25, 2022, from 11:00 AM to 5:00 PM

### Survey Period 2

- ▶ Saturday, April 30, 2022, from 9:00 AM to 3:00 PM

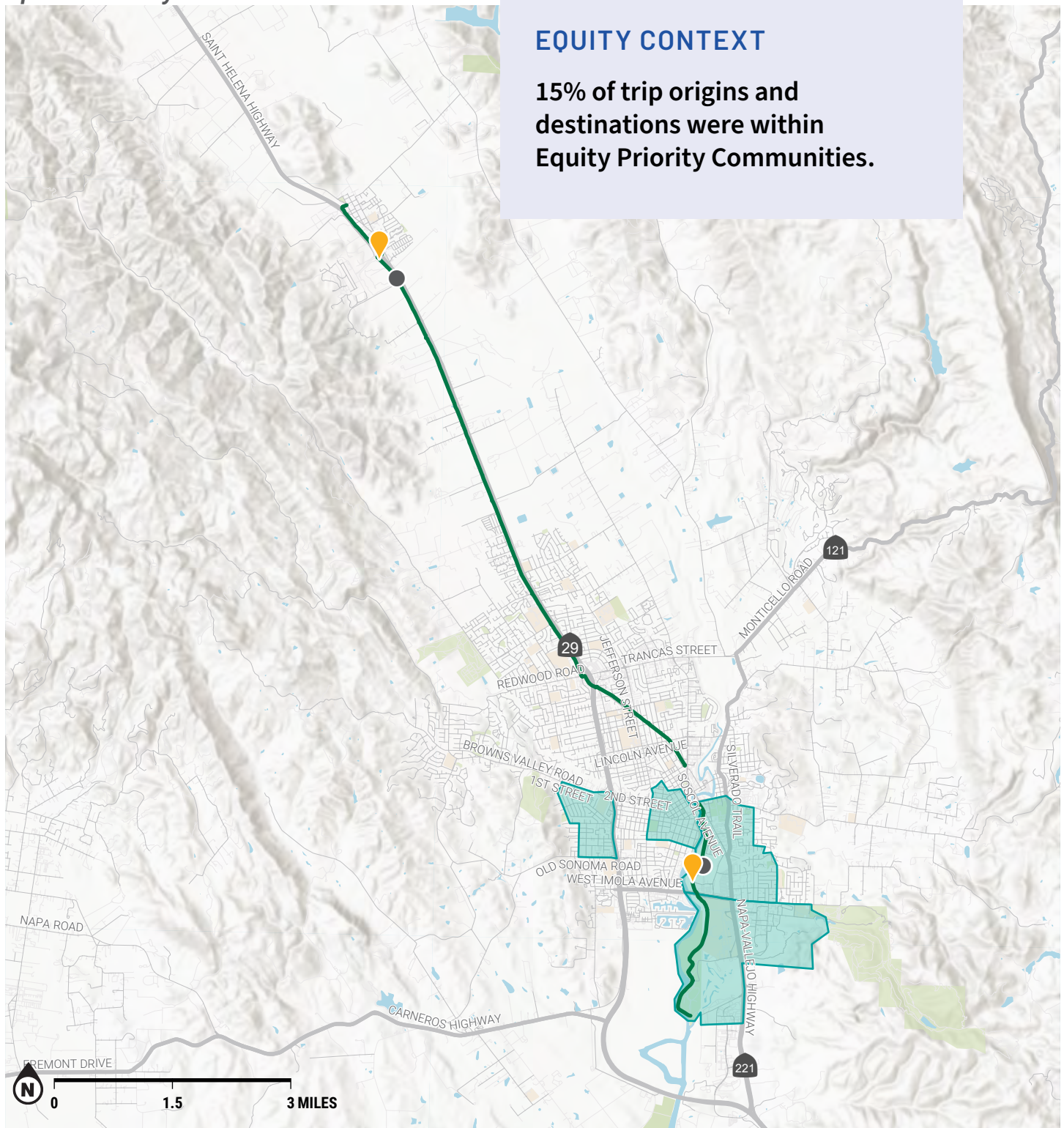
### Survey Key Points

- ▶ **The Napa Vine Trail respondent demographic skews older and has a much higher representation of retirees than the other trails studied**, as well as the highest percentage of people who reported walking or jogging on the trail (38%).
- ▶ **Nineteen percent of respondents reported driving to the Napa Vine Trail, and about half of those then rode a bicycle on the trail**, and the other half walked or jogged.
- ▶ Only 5% of respondents reported their primary trip purpose as commuting to or from work.
- ▶ Ninety-one percent of respondents were using the trail for fitness or recreation at the time of the survey.
- ▶ **Fifteen percent of origins and destinations were located in an Equity Priority Community**, primarily in downtown and southern Napa.





## Spatial Survey Results

### EQUITY CONTEXT

15% of trip origins and destinations were within Equity Priority Communities.



### COUNT & SURVEY LOCATIONS

-  Survey/Manual Counter Site
-  Automatic Ecocounter
-  Napa Vine Trail
-  Equity Priority Community (with reported origins or destinations)

## Trail Counts

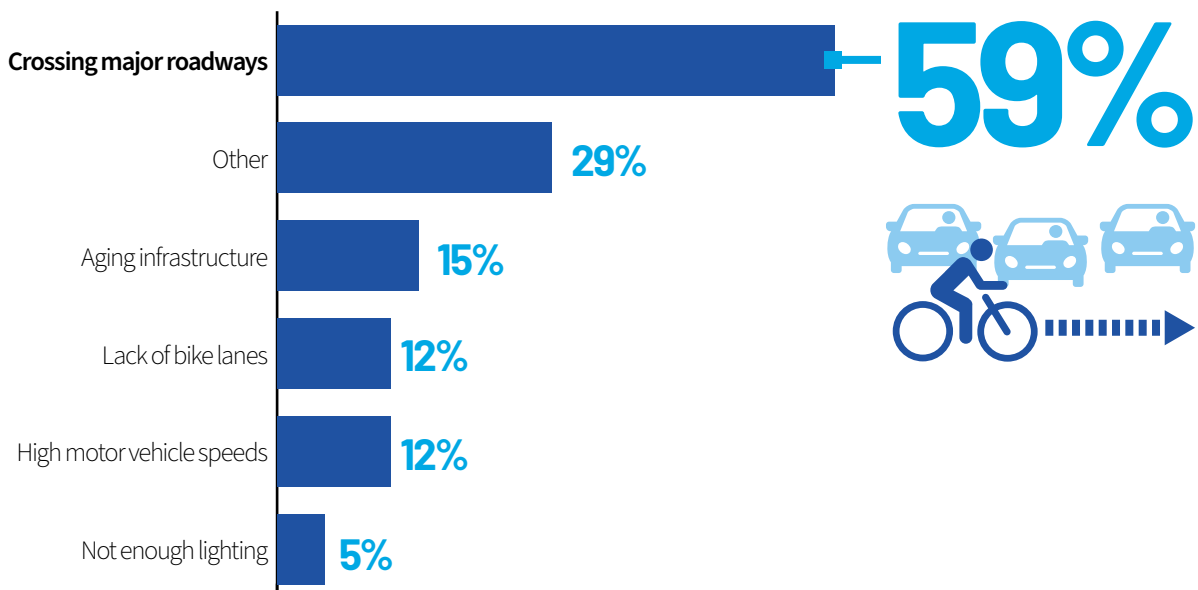
Two permanent Eco-Counters record bicycle and pedestrian counts near the northern and southern terminus of the trail. A comparison with manual counts conducted simultaneously suggests the permanent counters are functioning correctly with no issues in reporting bicycle and pedestrian volumes. In the past year, the Oak Knoll North counter on North Napa Vine Trail reported a daily average of 380 cyclists and 66 pedestrians. During the same time period, the Tulocay Creek counter on South Napa Vine Trail reported a daily average of 216 cyclists and 174 pedestrians.

## Primary Safety Concerns

Though it was still the most frequently cited, far fewer respondents than other trails cited a need for safer or more comfortable infrastructure to encourage them to bike more. Half of the respondents said [improving path surface quality](#) was among the most significant improvements, along with separating bicycle and pedestrian traffic or widening paths to increase capacity. In the comments, many respondents noted the presence of people experiencing homelessness along the trail, as well as conflicts between pedestrians and fast-moving e-bikes.



What is your primary safety concern when accessing the corridor? (n=41)





## Motivations to Bike More

One-third of respondents said that **safer or more comfortable infrastructure** would encourage them to bike more. Specifically, in the comments, several respondents called out repaving trail surfaces or improving lighting on the trail. For those that do not already bike often, secure bike parking and other destination amenities were the second most frequently cited motivator, followed by financial incentives like gift cards or cost-offsetting on an e-bike purchase.

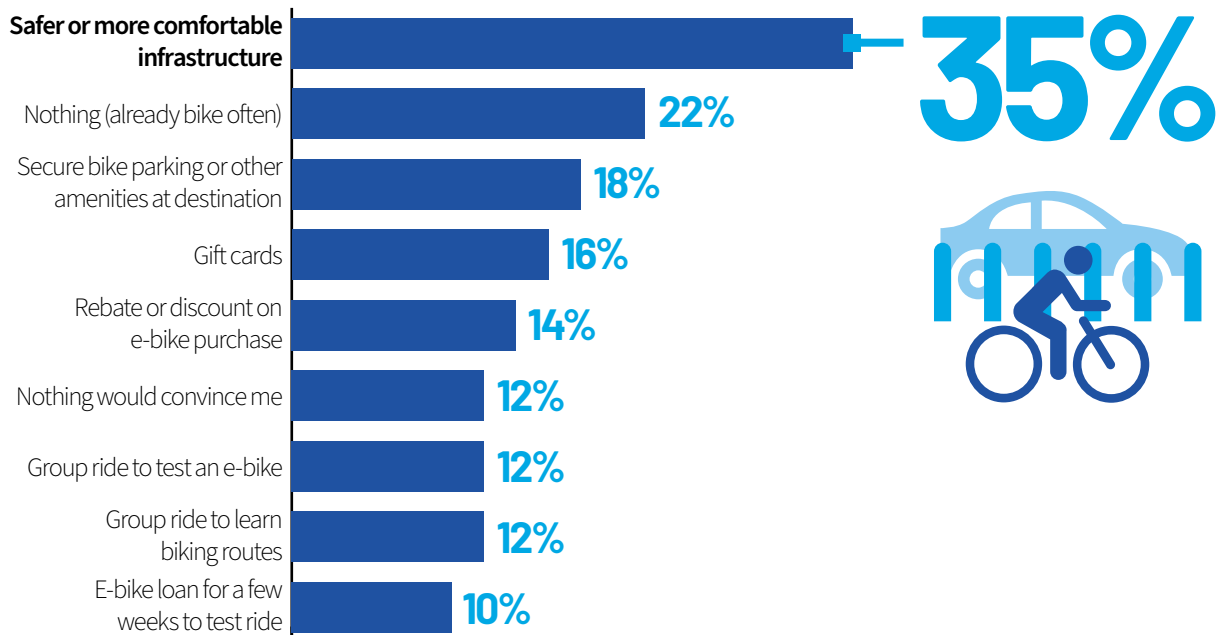
## Network Analysis Results

Most survey respondents identified trip origins and destinations within Napa and Yountville, including a small number that accessed the trail at a midway point or traveled from areas surrounding the two towns. A handful of respondents reported traveling from cities around the bay, including downtown San Francisco, Berkeley, and Newark. In Napa, common trail access routes travel along California Boulevard, Solano Avenue, and Main Street through the downtown business district. At the trail's northern terminus, respondents travel along Washington Street to access the strip of businesses or continue to Yount Street or St. Helena Highway.

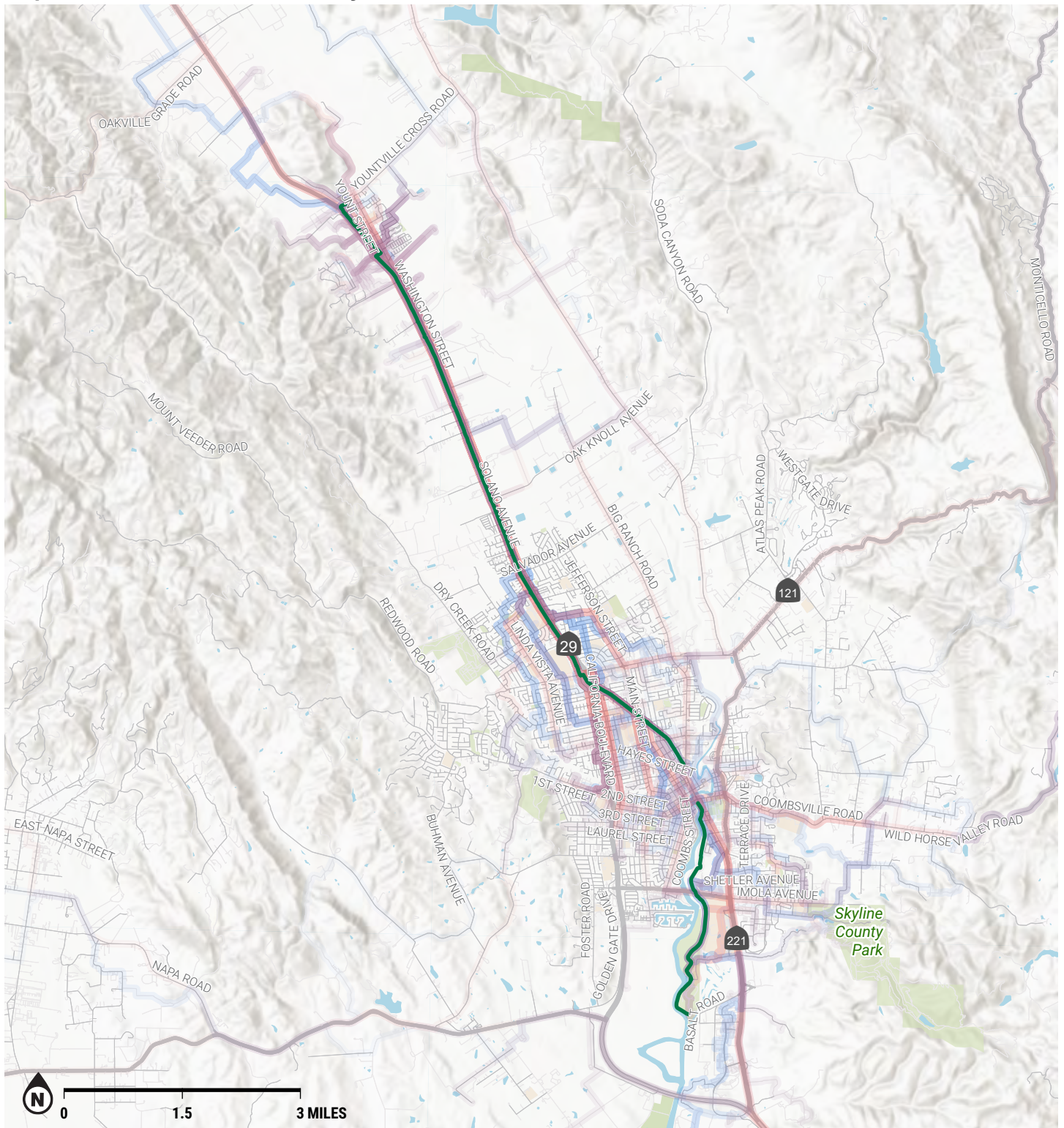
The following two maps show the network analysis for shortest and most comfortable routes to the corridor and quick-build opportunities.



What would encourage you to bike or to bike more often? (n=49)



# Napa Vine Trail Network Analysis

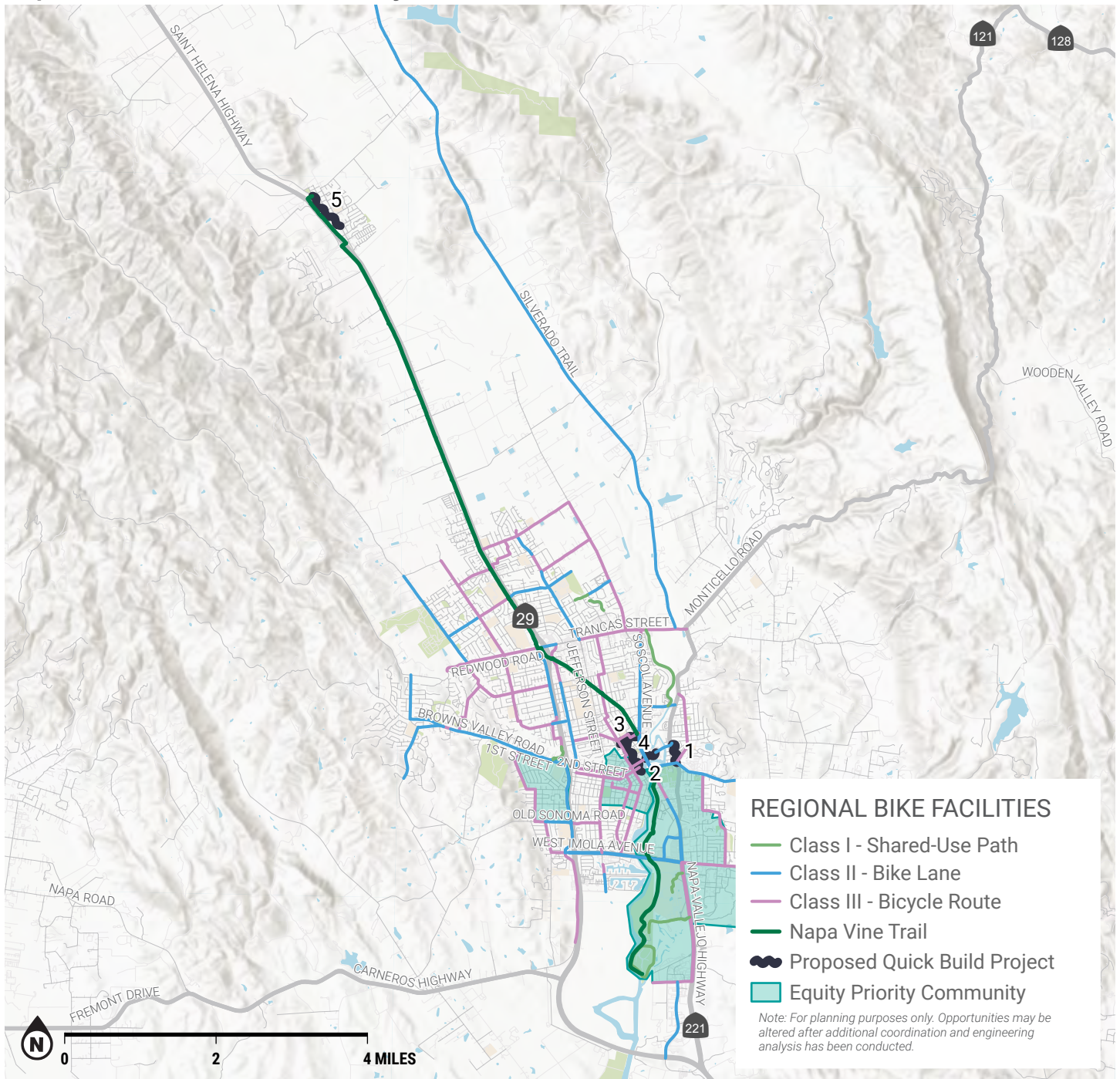


## NETWORK ANALYSIS RESULTS

- Shortest Path
- Comfortable Path (LTS-Adjusted)
- Paths Overlap
- Napa Vine Trail

In Napa, common trail access routes travel along California Boulevard, Solano Ave, and Main St through the downtown business district. At the northern terminus of the trail, respondents travel along Washington St to access the strip of businesses, or continue to Yount St or St. Helena Hwy.

# Napa Vine Trail Quick-Build Project Identification



ID	Street Name	Improvement Type	Opportunities
1	Silverado Trail	Corridor	Gap closure with striped bike lane where width allows and sharrows on tight right of way.
2	1st St	Corridor	Gap closure with striped bike lane where width allows and sharrows on tight right of way, intersection improvements.
3	Vallejo St	Corridor	Traffic calming on existing bike boulevard and wayfinding signage to connecting trail.
4	Main St	Corridor	Traffic calming and bike boulevard designation. Wayfinding signage to connecting trail.
5	Washington St	Corridor	Traffic calming, install additional bicycle parking.



# 07 LESSONS LEARNED & FUTURE OPPORTUNITIES

# LESSONS LEARNED

## LESSON #1: BE SEEN.

Utilize yard signs, A-frame posters, pop-up tents, handouts, snacks, and incentive giveaways at high-trafficked areas to encourage survey participation in the future.

While it is challenging to isolate which techniques or materials were most effective, the combination of incentives, signage, location, and staff presence contributed to the number of surveys collected. The **most popular incentive giveaway items** were **bike lights and bottled water**, while the least popular items were water bottles and granola bars. The survey deployment resulted in the following:

TRAIL USER ACTIONS	% OF TRAIL USERS
<b>Stopped</b> to complete the survey, <b>AND</b> completed extra questions	<b>14%</b>
<b>Stopped</b> to complete the survey, but did <b>NOT</b> complete extra questions	<b>2%</b>
Took a handout but did <b>NOT</b> otherwise stop	<b>3%</b>
Did <b>NOT</b> stop or otherwise engage with staff	<b>81%</b>

Although not a randomized sample and therefore susceptible to selection bias, our sample size (738 responses) allows us to be 95% confident that the responses collected in the survey represent the sentiments of the total population of trail users plus or minus 4%.<sup>1</sup>

<sup>1</sup> The total population of trail users is based on the trail users counted during the survey period and may be skewed by the large volume of users on the Golden Gate Bridge. The space, equipment, and staff resource constraints limited the number of surveys that could be completed simultaneously at that location, and therefore many users did not stop or otherwise engage with staff.



Survey staff wearing high visibility neon vests at survey stations in the north side of the Golden Gate Bridge Path and the west side of the Dumbarton Bridge Path.



## LESSON #2: TAKE MY CARD.

While only 3% of the users took a business card handout with a URL link to the survey, that action resulted in 26% of the completed surveys. Providing a method for completing the survey at home is a best practice that should be replicated.

## LESSON #3: MAKE IT SIMPLE.

We received some feedback from community members on how to improve future data collection opportunities. First and foremost, community members felt the survey was too long and cumbersome to complete on the spot. To help improve future data collection exercises, simplify the survey and do not ask users to draw routes (collect only origin and destination points). This would help reduce the amount of time active transportation users spend completing surveys.

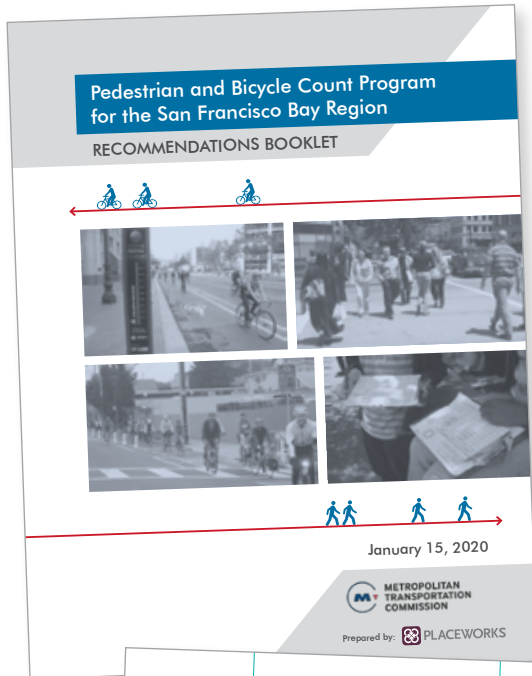
## LESSON #4: STAFF UP.

Providing additional staff to administer the survey may also improve response rates and feedback received. Surveyors noted a high number of people not stopping to complete the survey because the staff was not available to administer it, particularly at locations experiencing the highest volume of pedestrian and bicycle traffic including Golden Gate (north and south) and Napa Vine Trail (north). Working with an experienced temporary staffing agency helped us understand how to most effectively structure the survey administration to support recruitment, training, transporting, feeding, and compensating survey staff.

## LESSON #5: ANTICIPATE INTERNET CONNECTIVITY ISSUES.

In areas where wireless connectivity was an issue, additional printed copies of the survey should be considered. Additional staff to help with post-survey processing should also be considered to streamline the input of paper surveys from areas with low cellular connectivity.

# FUTURE OPPORTUNITIES



## SURVEY MORE.

Expand this program to include other trail corridors that may include, but are not limited to, the SMART Path (Sonoma and Marin Counties), Linear Park Trail (Solano County), Ironhorse Trail (Contra Costa and Alameda Counties), Ohlone Greenway (Contra Costa and Alameda Counties), and the Guadalupe River Trail (Santa Clara County).

## SURVEY AGAIN.

Return to the same corridors after quick-build and larger infrastructure projects are implemented. MTC will be able to measure the impact on travel behavior and attitudes by conducting before and after surveys.

## CONSIDER BUILDING A REGIONAL COUNT PROGRAM.

Continue to implement the [Pedestrian and Bicycle Count Program for the San Francisco Bay Region Recommendations Booklet](#) (2020). Recommendations could be updated with the NACTO White Paper, [Making Bikes Count: Effective Data Collection, Metrics, & Storytelling](#) (2022). The regional count program may also want to partner with “Big Data” providers such as Streetlight Data or Replica to augment permanent and intercept counts/surveys. San Diego developed a regional bicycle and pedestrian count program that can serve as a case study for the Bay Area. To learn more, see [Appendix F: Case Study - San Diego Regional Bike & Pedestrian Counter Network](#).



# APPENDICES



**A**

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**Origin-Destination Survey**

**D**

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**Origin-Destination Survey  
Response Analysis**

**B**

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**Survey Count Form**

**E**

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**Origin-Destination Network Analysis**

**C**

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**Permanent Counter Comparison  
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**F**

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**Case Study - San Diego Bike &  
Pedestrian Counter Network**



# APPENDIX A: ORIGIN- DESTINATION SURVEY

# ORIGIN-DESTINATION SURVEY

Welcome! The Metropolitan Transportation Commission is collecting information to improve bicycle/ pedestrian access, connectivity and safety and prioritize future funding to encourage sustainable mode shift in the region. We would like to hear about your experience using this trail.

Your privacy is important to us. Any information that you share will not be shared with any external parties. Location based questions are based off the nearest 1,000 feet and will not ask for an address to preserve privacy. Data stored from question responses will be stored in secured servers that will only be accessed by the project's IT team.

For more information or if you have any questions, please contact Nicola Szibbo at [nszibbo@bayareametro.gov](mailto:nszibbo@bayareametro.gov) or (415) 490-8554.

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## Part I

Do you live or work in the Bay Area?

- Yes
- No

What corridor were you visiting when you received this survey?

- Napa Vine Trail
- Dumbarton Bridge Path
- Richmond-San Rafael Bridge Path
- Golden Gate Bridge Path

## Core Survey Questions

We'll start by asking questions about how you started and ended your trip. Answers will be collected by clicking on the interactive map.

- ▶ Where is your home located?
- ▶ Where did you start your trip (if different from home)?
- ▶ Where did you end your trip if different from start location?
- ▶ What route did you take to this corridor from your start location? Describe the roads and routes you used.

## Now we will ask a few multiple-choice questions.

Which mode of transportation did you use on this corridor?  
(Choose all that apply)

- Walk/Jog
- Mobility assistive device
- Bike
- Scooter
- Skateboard
- Roller skates/Inline skates
- Other:

Was your bike or scooter powered electrically?

- Yes
- No

Did you start your trip at home, or at a different location?

- Home
- Different location

What's the main purpose of this trip? (Choose all that apply)

- Fitness/Recreation
- Go to/from work
- Go to/from school
- Errands/Appointments
- Dining/Shopping
- Social/Visiting Family or Friends
- Other:

**We have a few questions about programs to encourage commuting/transportation bicycling on this corridor to decrease the number of vehicle trips.**

What would encourage you to bike or to bike more often on this corridor? (check all that apply)

- A rebate or discount on the purchase of an e-bike
- An e-bike loan for a few weeks to test ride
- Gift cards
- A group ride to help learn biking routes for this corridor
- A group ride to test out an ebike
- Safer/more comfortable infrastructure (e.g. dedicated bike lanes or separated bike paths)
- Secure bike parking or other amenities at destination
- Other:
- Nothing, I already bike often on this corridor
- It is not practical or nothing would convince me

If a rebate or discount on an e-bike would encourage you to bike or bike more often on the corridor, what is the most you would be willing to spend on an e-bike?

- Up to \$500
- \$500-\$1,000
- \$1,000-\$2,000
- \$2,000+
- I already own an e-bike
- I have no interest in owning an e-bike

**Thank you for your input. We would like to hear from people that reflect the Bay Area's diverse communities. Could you please answer some demographic questions to help us understand who we are reaching? We use this information to help improve our public engagement methods.**

How would you describe your race or ethnicity (check all that apply)?

- White
- Hispanic or Latino
- Middle Eastern or North African
- Black or African American
- American Indian or Alaskan Native
- Chinese
- Filipino
- Asian Indian
- Vietnamese
- Korean
- Japanese
- Native Hawaiian
- Samoan
- Chamorro
- Other Pacific Islander
- Some other race or ethnicity:

What is your age?

- Under 12 years old
- 12-17 years old
- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75 years or older

Gender: How do you identify?

- Woman
- Man
- Nonbinary
- Prefer not to say
- Prefer to self-describe: \_\_\_\_\_

Which of the following categories apply to you at the moment?

- Employed full time (35 hours per week or more)
- Employed part time (less than 35 hours per week)
- Retired
- College/University student
- Not employed

Thank you for taking the survey! We know your time is valuable and appreciate it. Your input will help MTC plan thoughtful and equitable investments in active transportation around the Bay Area.

Please share your email address if you would like to be entered into a raffle for a chance to win a \$100 Amazon or Apple gift card! Your email address will not be shared with any 3rd party and will only be used to contact you if you are selected as a winner. Entering the raffle by providing an email address is not required to submit the survey.

Email address:

Want to double your chances of winning a raffle prize? We have a few more questions that shouldn't take more than 5 minutes to answer. If you want to double your chances of winning a prize, click "Continue to Part II."

## Part II

What is the primary reason you chose your mode of travel?

- Cheapest
- Fastest
- Most convenient
- Health/Recreation
- Environmental reasons
- No other options
- Other: \_\_\_\_\_

How often do you use the following modes on this location?

- ▶ Drive Alone
  - Daily
  - Weekly
  - Once a month
  - Every 2–3 months
  - 2–3 times per year
  - Never or not applicable
- ▶ Carpool/Vanpool
  - Daily
  - Weekly
  - Once a month
  - Every 2–3 months
  - 2–3 times per year
  - Never or not applicable
- ▶ Transit
  - Daily
  - Weekly
  - Once a month
  - Every 2–3 months
  - 2–3 times per year
  - Never or not applicable

When do you usually visit this corridor?

- All year
- Summer
- Fall
- Winter
- Spring
- 2 or more seasons
- I don't usually visit this path

What is your primary safety concern when getting to this corridor? (Choose all that apply)

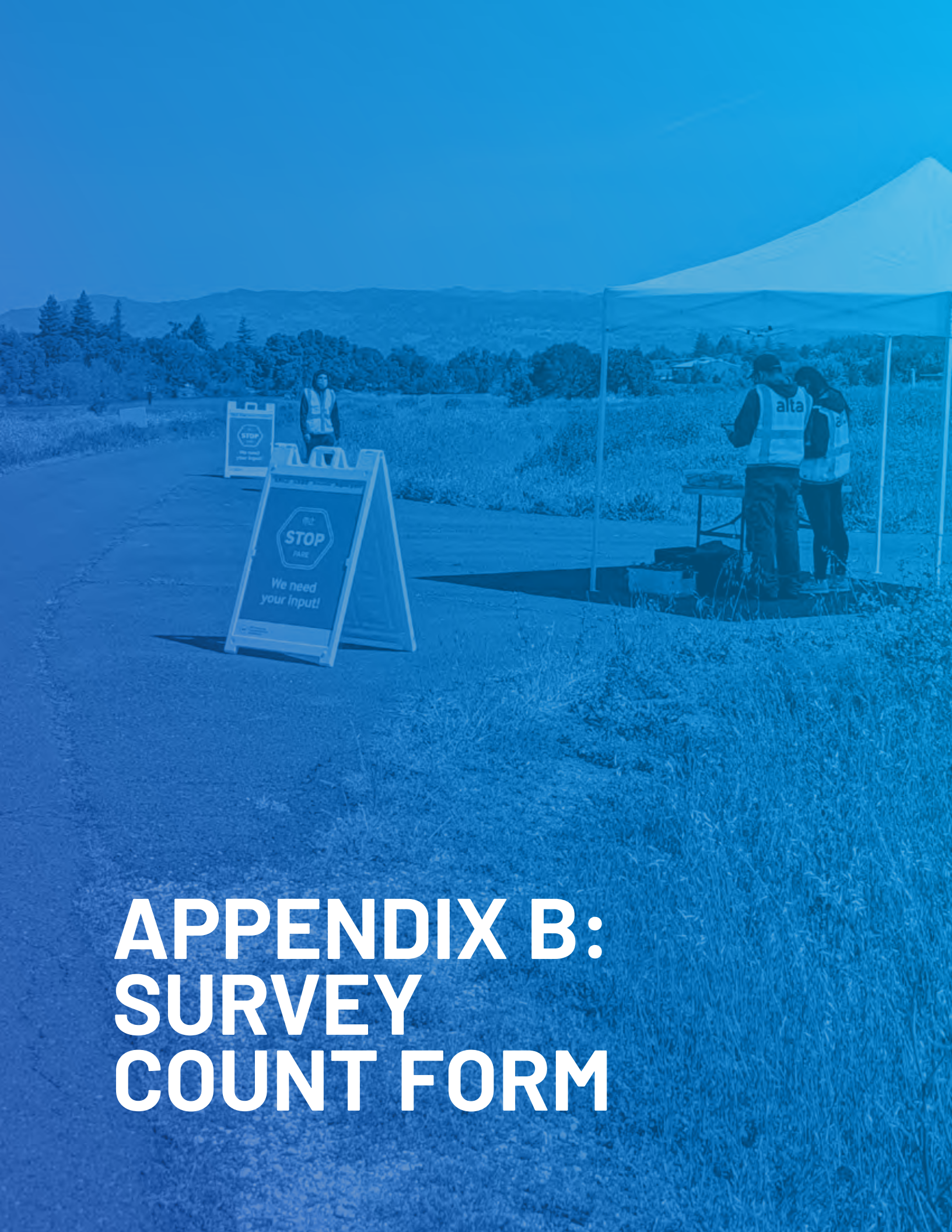
- Crossing major roadways as a pedestrian
- Crossing major roadways as a bicyclist
- Crossing major roadways along this corridor
- High motor vehicle speeds
- Not enough lighting
- Aging infrastructure
- Other:

Which of these facility improvements to access this corridor are most important to you? (Choose all that apply)

- Improving the quality of bike/pedestrian path surfaces
- Installing wayfinding and signage
- Adding overhead lighting
- Widening paths to increase capacity
- Creating designated space for bicycles and pedestrians to avoid user group conflicts
- Installing physical barriers to separate bike/ped space from vehicle traffic
- Other:

Do you have anything else to add?

**Thank you!**




# APPENDIX B: SURVEY COUNT FORM









# APPENDIX C: PERMANENT COUNTER COMPARISON METHODOLOGY & RESULTS

To: MTC

From: Grace Young, David Wasserman, Jeff Knowles, Alta Planning + Design

Date: October 31, 2022

Re: Permanent Counter Comparison Methodology and Results

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## Permanent Counter Comparison

Observed screenline counts were compared to permanent count data provided by MTC to understand volume at certain locations. This information can be helpful to understand travel patterns and the accuracy of remote counting technology (EcoCounters) installed on trails spread around the Bay Area. This memorandum describes the process for validating numbers reported by eight permanent automated bicycle and pedestrian counters around the San Francisco Bay Area. Alta staff conducted manual counts of pedestrians and bicyclists at locations near the permanent counters in 15-minute intervals for six hours on two separate days between April 23<sup>rd</sup> and May 1<sup>st</sup>, 2022. The data collected by the automated counters during the same time period was downloaded from the EcoCounter web interface for the five active permanent counters and compared to the manual results to determine any locations where automatic counts significantly differ from manual counts. The remaining three permanent counter locations do not have data available as the two on the Golden Gate Bridge have been broken for several years and the one on the west side of the Dumbarton Bridge did not collect data during the analysis period.<sup>1</sup>

## Methodology

Both manual and automatic count data were aggregated by hour for comparison to account for the time difference in the count as trail users traveled between the permanent counter and the location of field survey collection, and to generate a distribution of count observations for pair-wise comparisons. These aggregated counts were then compared using a paired t-test<sup>2</sup> to determine if the permanent counter results were statistically significantly different from manual count results collected during the same time period. The output of this test is a p-value which allows us to determine if the counts are significantly different ( $p < 0.05$ ) or are statistically equivalent ( $p > 0.05$ ).

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<sup>1</sup> Based on discussions with MTC staff and data requests made in coordination with MTC.

<sup>2</sup> A [paired t-test](#) is a statistical test that determines whether the average difference between two pairs of measurements is zero or not. The underlying assumptions of this test are that observations are independent and approximately normally distributed. Hour-to-hour counts are roughly independent because the number of trail users in one hour does not directly affect the number of trail users in the next hour. However, factors like weather and time of day may be related to count volumes. For the purposes of this analysis, we consider the comparison between counters to be roughly independent, but this type of repeated observation likely violates the assumption of independence in the strictest sense.

## Considerations

The methodology outlined does basic statistical tests and box and whisker plots are employed to compare manual vs. automatic counts. For the most accurate counter validation, manual counts would be taken from the exact location of the automatic counter. In some cases, however, this introduced a tradeoff between count accuracy and maximum survey responses. Survey locations were selected primarily prioritizing the latter. Counters where there are significant offsets in distance from manual count location and automatic counters are explicitly called out in our analysis. The strength of any conclusions from this analysis should be weighed against the quality of the data for purposes of count validation. This analysis may just highlight areas for further investigation or more detailed validation.

## Results

For each of the five permanent counters with available data during the period of collection, the results are summarized and discussed in the following sections. A map of permanent counter and corresponding manual count locations is shown in **Figure 1**. Note that the manual and permanent counter locations for the East Dumbarton Bridge are over a mile apart on the trail, introducing potential error in count comparison. Manual count locations were selected to maximize the likelihood of trail users to stop and complete the origin-destination survey and required there to be enough space for a tent station staging. Raw counts are reported in **Appendix A**. A summary of results is presented in **Table 1** and the distribution in differences between counts is visualized in **Figure 2**. The colored box in **Figure 2** shows the interquartile range of differences between automatic and manual counts and highlights the median with a vertical line. Outliers beyond the extended quartile whiskers are shown as grey diamond markers.

Table 1. Summary of Comparison of Manual and Automatic Counts.

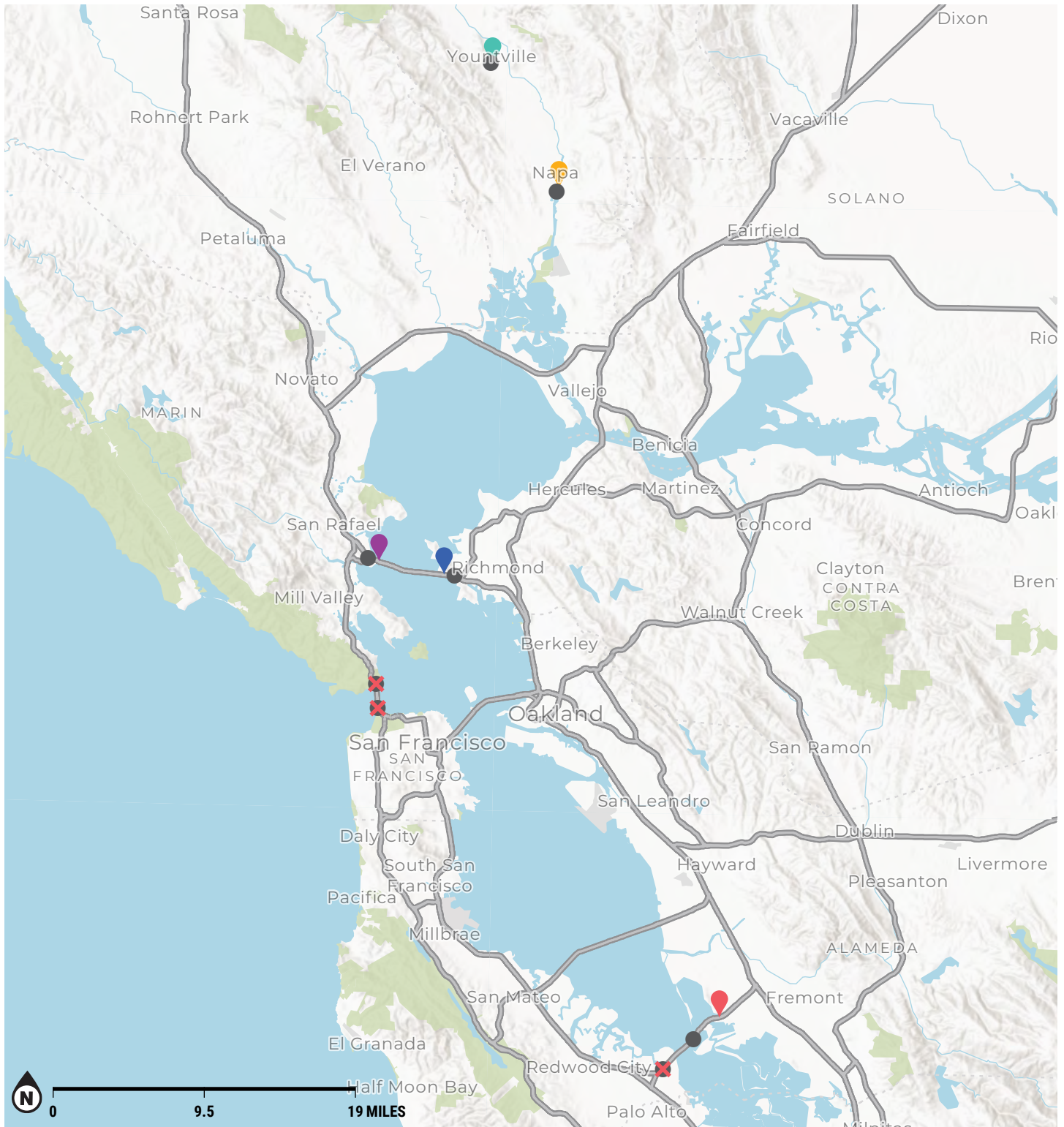
Counter Location	Trail User Type		
	All users	Cyclists	Pedestrians
South Napa Valley Vine Trail/Tulocay Creek	Statistically equivalent	Statistically equivalent	Statistically equivalent
North Napa Valley Vine Trail/Oak Knoll North	Statistically equivalent	Statistically equivalent	Statistically equivalent
East Richmond-San Rafael/Richmond	Significantly different	Significantly different	Statistically equivalent <sup>1</sup>
West Richmond-San Rafael/Sir Francis Drake Blvd	Statistically equivalent	N/A <sup>2</sup>	N/A <sup>2</sup>
East Dumbarton Bridge/Dumbarton (Newark)	Significantly different <sup>3</sup>	Statistically equivalent	Significantly different <sup>3</sup>

1. Limited conclusions due to very small sample size (fewer than 15 total pedestrians recorded).

2. The Sir Francis Drake Blvd counter does not differentiate between cyclists and pedestrians in the reported count volumes.

3. Count locations were offset by about two miles, which is a likely explanation of the discrepancy for pedestrians with manual count locations being further into the bridge. Many pedestrians are likely walking out part of the bridge span and not reaching the automatic counter.

Figure 1. Manual Count and Permanent Counter Locations.



**COUNT LOCATIONS**

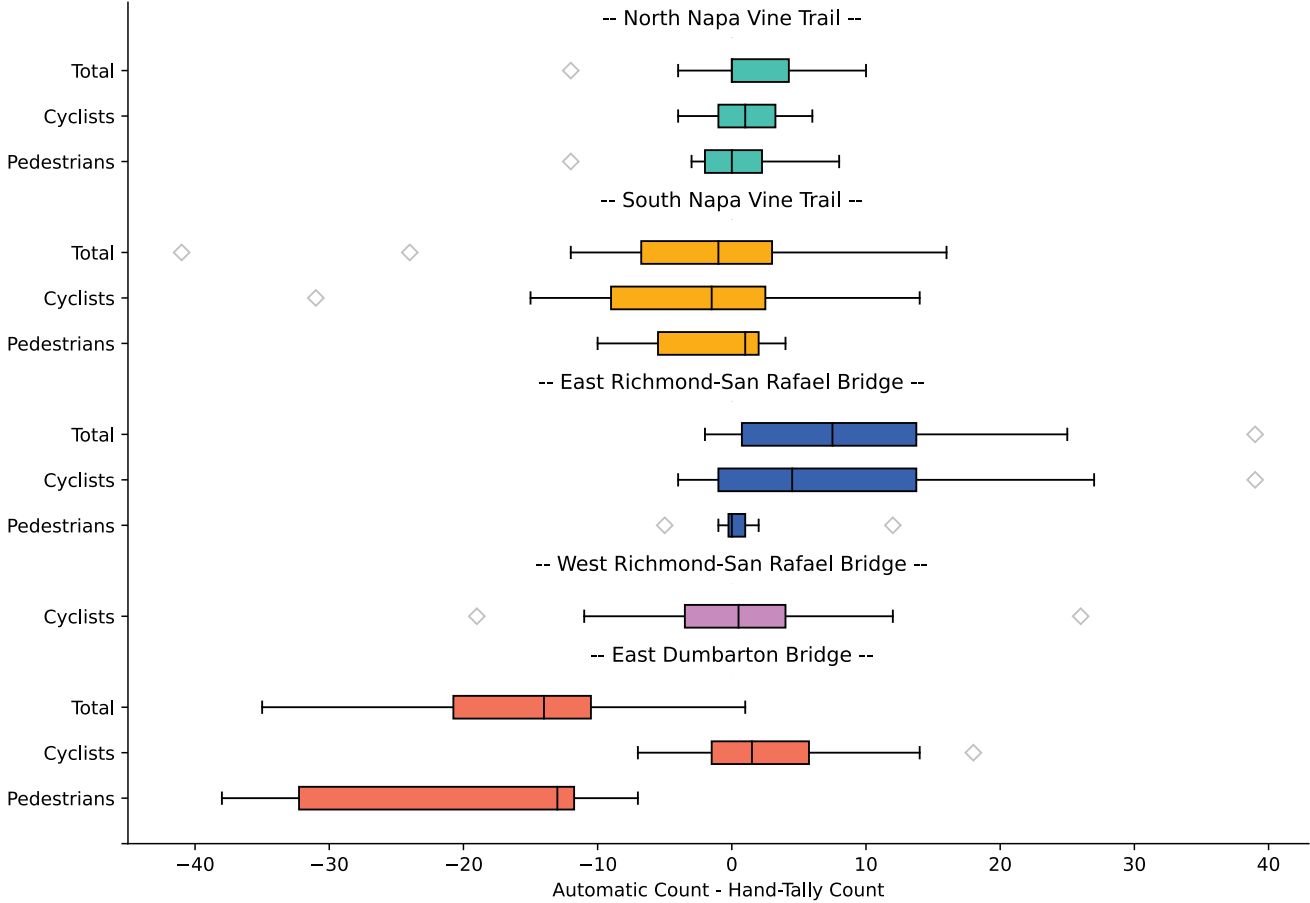
**MTC ORIGIN-DESTINATION STUDY**

**COUNT TYPE**

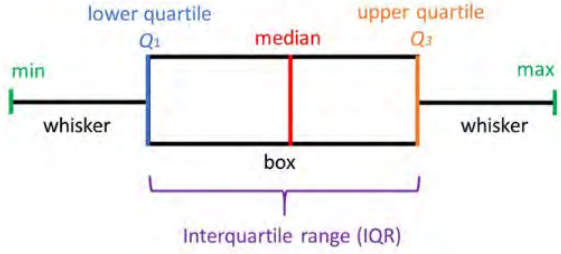
- Manual
- Automatic (Ecocounter)
- North Napa Vine Trail
- South Napa Vine Trail
- East Richmond-San Rafael Bridge
- West Richmond-San Rafael Bridge
- East Dumbarton Bridge
- ✗ No Ecocounter Data Available for Count Period



Figure 2. Box-and-Whisker Plot Showing the Median and Interquartile Range of Differences in Automatic Versus Manual Hourly Count Volumes.



The boxes and lines shown in Figure 2 indicate the statistical values as shown in the diagram below. Grey diamonds indicate outlier values.



South Napa Valley Vine Trail

Staff collected manual counts on the Napa Valley Vine Trail near the Tulocay Creek Bridge permanent counter on April 25, 2022 from 11 am – 5 pm and April 30, 2022 from 9 am – 3 pm. **Figure 3** details the exact location of the manual and automatic counters. The Tulocay Creek Bridge counter reports total trail users, broken down into cyclists and pedestrians. Results of a paired t-test comparing the hourly volumes of manual and automatic counts are shown in **Table 2**.



Figure 3. Permanent and Manual Counter Location on the South Napa Valley Vine Trail.

Table 2. Comparison of Manual and Automatic Counts Near the Tulocay Creek Bridge Counter on South Napa Valley Vine Trail.

Trail user type	Statistical Comparison	
	P-Value	Interpretation
All users	0.5	Difference in counts is statistically indistinguishable
Cyclists	0.3	Difference in counts is statistically indistinguishable
Pedestrians	0.9	Difference in counts is statistically indistinguishable

**The Tulocay Creek Bridge counter is performing well with no significant issues in accurately reporting cyclist and pedestrian count volumes.**

**North Napa Valley Vine Trail**

Staff conducted manual counts on the Napa Valley Vine Trail near the Oak Knoll North permanent counter on April 25, 2022 from 11 am – 5 pm and April 30, 2022 from 9 am – 3 pm. **Figure 4** details the exact location of the manual and automatic counters. The Oak Knoll North counter reports total trail users, broken down into cyclists and pedestrians. Results of a paired t-test comparing the hourly volumes of manual and automatic counts are shown in **Table 3**.

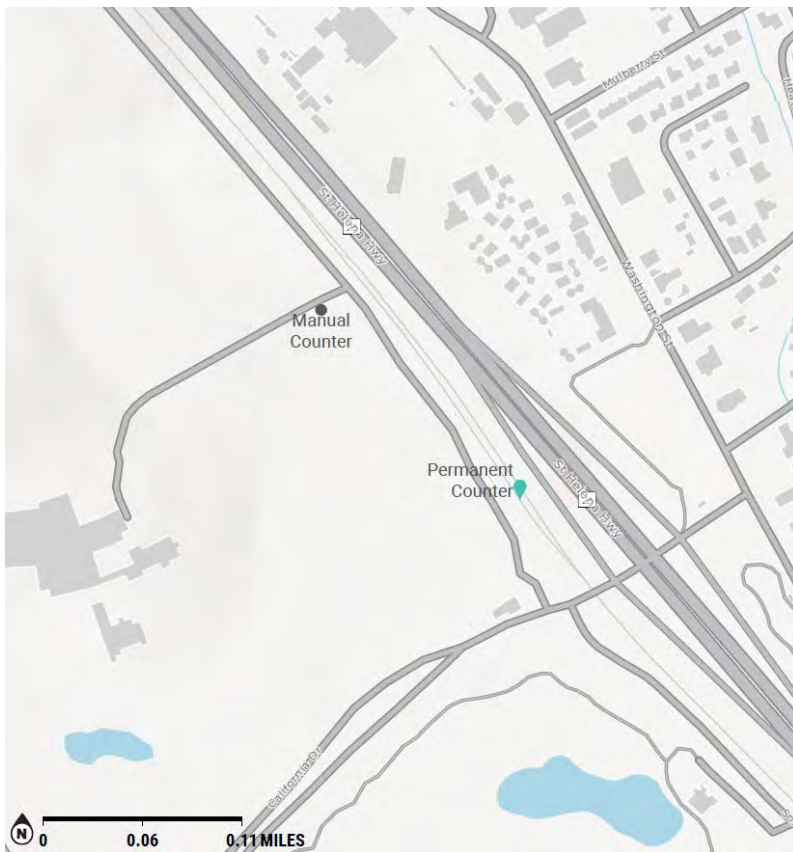


Figure 4. Permanent and Manual Counter Location on the North Napa Valley Vine Trail.

Table 3. Comparison of Manual and Automatic Counts Near the Oak Knoll North Counter on North Napa Valley Vine Trail.

Trail user type	Statistical Comparison	
	P-Value	Interpretation
All users	0.3	Difference in counts is statistically indistinguishable
Cyclists	0.3	Difference in counts is statistically indistinguishable
Pedestrians	0.3	Difference in counts is statistically indistinguishable

**The Oak Knoll North counter is performing well with no significant issues in accurately reporting cyclist and pedestrian count volumes.**



**East Richmond-San Rafael Bridge Path**

Staff conducted manual counts on the east side of the Richmond-San Rafael Bridge Path near the Richmond permanent counter on April 23, 2022 and April 26, 2022 from 9 am – 3 pm. **Figure 5** details the exact location of the manual and automatic counters. The Richmond counter reports total trail users, broken down into cyclists and pedestrians. Results of a paired t-test comparing the hourly volumes of manual and automatic counts are shown in **Table 4**.



Figure 5. Permanent and Manual Counter Locations on the East Richmond-San Rafael Bridge Path.

Table 4. Comparison of Manual and Automatic Counts Near the Richmond Counter on the East Side of the Richmond-San Rafael Bridge.

Trail user type	Statistical Comparison	
	P-Value	Interpretation
All users	0.01	Counts are significantly different
Cyclists	0.03	Counts are significantly different
Pedestrians	0.5	Difference in counts is statistically indistinguishable*

\*Very small sample size (fewer than 15 pedestrians recorded)

**The Richmond counter tends to over count the number of cyclists using the trail, particularly during periods of higher-volume use.** Pedestrian volumes are too low to draw definitive conclusions from.

**West Richmond-San Rafael Bridge Path**

Staff conducted manual counts on the west side of the Richmond-San Rafael Bridge Path near the Sir Francis Drake Boulevard permanent counter on April 23, 2022 and April 26, 2022 from 9 am – 3 pm. **Figure 6** details the exact location of the manual and automatic counters. The Sir Francis Drake Boulevard counter reports only cyclists, as there is a known issue with the pedestrian counter located too close to vehicle traffic, creating false and inaccurate counts. Results of a paired t-test comparing the hourly volumes of manual and automatic counts are shown in **Table 5**.



Figure 6. Permanent and Manual Counter Locations on the West Richmond-San Rafael Bridge Path.

Table 5. Comparison of Manual and Automatic Counts Near the Sir Francis Drake Boulevard Counter on the West Side of the Richmond-San Rafael Bridge.

Trail user type	Statistical Comparison	
	P-Value	Interpretation
Cyclists	0.8	Difference in counts is statistically indistinguishable

**The Sir Francis Drake Boulevard bicycle counter on the west side of the Richmond-San Rafael Bridge is performing well with no significant issues in accurately reporting trail user count volumes.**

**East Dumbarton Bridge Path**

Staff conducted manual counts on the east side of the Dumbarton Bridge Path near the Dumbarton (Newark) permanent counter on April 22, 2022 from 12 pm – 6 pm and April 24, 2022 from 9 am – 3 pm. **Figure 7** details the exact location of the manual and automatic counters. The Dumbarton (Newark) counter total trail users, broken down into cyclists and pedestrians. Results of a paired t-test comparing the hourly volume of manual and automatic counts are shown in **Table 6**.



Figure 7. Permanent and Manual Counter Locations on the East Dumbarton Bridge Path.

Table 6. Comparison of Manual and Automatic Counts Near the Dumbarton (Newark) Counter on the East Side of the Dumbarton Bridge.

Trail user type	Statistical Comparison	
	P-Value	Interpretation
All users	0.001	Counts are significantly different
Cyclists	0.2	Difference in counts is statistically indistinguishable
Pedestrians	0.001	Counts are significantly different

**There are significant differences between the manual and automatic pedestrian volume on the east side of the Dumbarton Bridge.** These differences may be a result of the large distance between the two counter locations and the fact that more pedestrians may turn around before crossing the bridge. **The cyclist counter shows no significant issues.**

## Appendix A: Raw Manual and Automatic Counts

### Tulocay Creek Bridge / South Napa Valley Vine Trail

Day	Start Hour	Manual Counts			Automatic Counts			Difference (Manual – Automatic)		
		Total	Cyclist	Pedestrian	Total	Cyclist	Pedestrian	Total	Cyclist	Pedestrian
25	11 am	37	18	19	37	21	16	0	-3	3
	12 pm	23	10	13	23	10	13	0	0	0
	1 pm	24	19	5	24	21	3	0	-2	2
	2 pm	20	13	7	20	15	5	0	-2	2
	3 pm	24	16	8	28	22	6	-4	-6	2
	4 pm	28	19	9	28	18	10	0	1	-1
30	9 am	57	22	35	63	21	42	-6	1	-7
	10 am	69	39	30	65	35	30	4	4	0
	11 am	53	39	14	57	35	22	-4	4	-8
	12 pm	48	30	18	53	34	19	-5	-4	-1
	1 pm	42	21	21	30	21	9	12	0	12
	2 pm	26	24	2	36	28	8	-10	-4	-6

### Oak Knoll North / North Napa Valley Vine Trail

Day	Start Hour	Manual Counts			Automatic Counts			Difference (Manual – Automatic)		
		Total	Cyclist	Pedestrian	Total	Cyclist	Pedestrian	Total	Cyclist	Pedestrian
25	11 am	84	70	14	43	39	4	41	31	10
	12 pm	34	30	4	37	29	8	-3	1	-4
	1 pm	34	31	3	33	29	4	1	2	-1
	2 pm	39	37	2	38	37	1	1	0	1
	3 pm	36	30	6	34	27	7	2	3	-1
	4 pm	19	18	1	22	19	3	-3	-1	-2
30	9 am	94	82	12	82	67	15	12	15	-3
	10 am	150	136	14	145	129	16	5	7	-2
	11 am	107	104	3	123	118	5	-16	-14	-2
	12 pm	105	92	13	81	77	4	24	15	9
	1 pm	90	81	9	90	88	2	0	-7	7
	2 pm	60	53	7	65	63	2	-5	-10	5

## Richmond / East Richmond-San Rafael Bridge Path

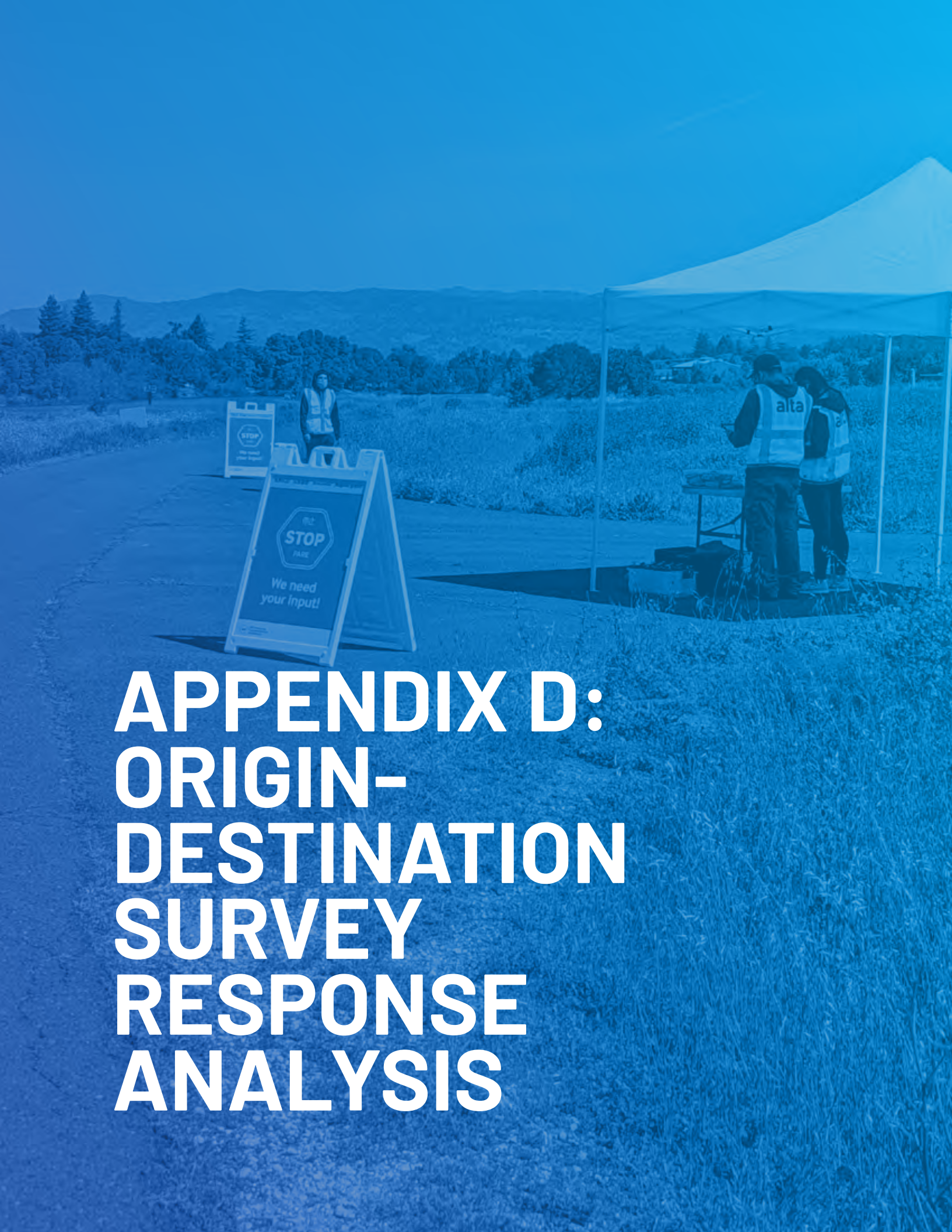
Day	Start Hour	Manual Counts			Automatic Counts			Difference (Manual – Automatic)		
		Total	Cyclist	Pedestrian	Total	Cyclist	Pedestrian	Total	Cyclist	Pedestrian
23	9 am	34	33	1	42	42	0	-8	-9	1
	10 am	36	36	0	75	75	0	-39	-39	0
	11 am	50	45	5	72	72	0	-22	-27	5
	12 pm	50	50	0	57	57	0	-7	-7	0
	1 pm	52	52	0	62	62	0	-10	-10	0
	2 pm	33	32	1	58	57	1	-25	-25	0
26	9 am	22	21	1	23	23	0	-1	-2	1
	10 am	14	13	1	12	9	3	2	4	-2
	11 am	18	17	1	18	16	2	0	1	-1
	12 pm	9	9	0	9	8	1	0	1	-1
	1 pm	6	5	1	9	7	2	-3	-2	-1
	2 pm	19	17	2	30	16	14	-11	1	-12

## Sir Francis Drake Boulevard / West Richmond-San Rafael Bridge Path

Day	Start Hour	Manual Counts			Automatic Counts	Difference (Manual – Automatic)
		Total	Cyclist	Pedestrian	Total (Cyclists Only)	Cyclist
23	9 am	14	11	3	14	-3
	10 am	19	17	2	29	-12
	11 am	37	37	0	63	-26
	12 pm	57	55	2	62	-7
	1 pm	36	34	2	37	-3
	2 pm	41	41	0	22	19
26	9 am	19	15	4	4	11
	10 am	14	12	2	12	0
	11 am	16	14	2	11	3
	12 pm	9	9	0	4	5
	1 pm	10	10	0	7	3
	2 pm	2	1	1	2	-1

## Dumbarton (Newark) / East Dumbarton Bridge Path

Day	Start Hour	Manual Counts			Automatic Counts			Difference (Manual – Automatic)		
		Total	Cyclist	Pedestrian	Total	Cyclist	Pedestrian	Total	Cyclist	Pedestrian
22	12 pm	14	7	7	15	15	0	-1	-8	7
	1 pm	21	12	9	12	11	1	9	1	8
	2 pm	18	4	14	5	4	1	13	0	13
	3 pm	19	5	14	8	7	1	11	-2	13
	4 pm	20	7	13	1	0	1	19	7	12
	5 pm	14	2	12	6	5	1	8	-3	11
24	9 am	51	15	36	32	29	3	19	-14	33
	10 am	73	33	40	40	38	2	33	-5	38
	11 am	63	27	36	48	45	3	15	-18	33
	12 pm	52	17	35	17	14	3	35	3	32
	1 pm	41	18	23	15	12	3	26	6	20
	2 pm	16	4	12	5	5	0	11	-1	12



# APPENDIX D: ORIGIN- DESTINATION SURVEY RESPONSE ANALYSIS

To: MTC  
From: Grace Young, David Wasserman, Jeff Knowles, Alta Planning + Design  
Date: October 31, 2022  
Re: MTC Origin-Destination Web Survey Responses

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## Web Survey Responses

The following memorandum presents the results of the online survey collected via public outreach at eight locations on four trails in the Bay Area: Dumbarton Bridge Path, Golden Gate Bridge Path, Napa Vine Trail, and the Richmond-San Rafael Bridge path. The survey collected 738 total responses from trail users from 9 am to 3 pm or 11 am to 5 pm on one weekday and one weekend day from April 23<sup>rd</sup> to May 1<sup>st</sup>, 2022. Respondents were asked about mode choices, trip purpose, and their concerns, desired improvements, and motivations. Most questions allowed users to select all applicable responses, and thus the reporting percentages may not sum to 100 percent. Nearly half of all surveys were collected on the Golden Gate Bridge Path (349 surveys), followed by 237 on the Richmond-San Rafael Bridge Path, 95 on the Napa Vine Trail, and 54 on the Dumbarton Bridge Path. The survey was available in English, Spanish, and Chinese (Mandarin). Each corridor also had at least one surveyor who was fluent in Spanish during each survey period. One survey was collected in Chinese and no surveys were collected in Spanish. The full list of questions is included in Appendix A: Survey Questions.

### Key Takeaways

- **Trip Purposes:** Nearly 9 in 10 survey respondents reported health, recreation, and fitness to be their main trip purpose and mode choice motivation.
  - Of the trails surveyed, the Dumbarton Bridge and Richmond-San Rafael Bridge Trails reported the highest percentage of trail users commuting to or from work (15%).
- **Concerns:** Across all trails, the most frequently cited safety concern while accessing trails was crossing major roadways (71% of all respondents), followed by high motor vehicle speeds (31%).
  - A higher percentage of respondents on the Dumbarton Bridge and Richmond-San Rafael Bridge Trails cited a lack of bike lanes as a primary concern than the survey average (24 and 31%, respectively, compared to 15% for all respondents).
  - Respondents taking non-discretionary trips more frequently cited high motor vehicle speeds and lack of bike lanes than respondents traveling solely for recreational or social purposes.
- **Mode Shift Motivations:** When asked what would motivate them to bike more, the majority (57%) of respondents said safer and more comfortable bike facilities like dedicated bike lanes or separated bike paths.
- **Requested Improvements:** The most commonly requested improvements to existing trail facilities were improved path surface quality (58%), the installation of physical barriers to separate from vehicle traffic (47%), and the creation of designated spaces for pedestrian and bicycle trail users (45%).
  - Calls for wider paths and increased capacity were more common on the Golden Gate Bridge Path (54% of respondents) and 60% of Richmond-San Rafael Bridge Trail users requested physical barriers to separate from vehicle traffic.
  - Self-reported respondents of color disproportionately requested improved lighting, wayfinding and signage compared to white respondents.
- **Mode Choice:** The overwhelming majority (87%) of trail users ride bicycles on the trails and accessed the trail via similar modes.
  - The Dumbarton Bridge and Napa Vine Trails saw the highest percentage of trail users driving to access trails (24 and 19%, respectively)

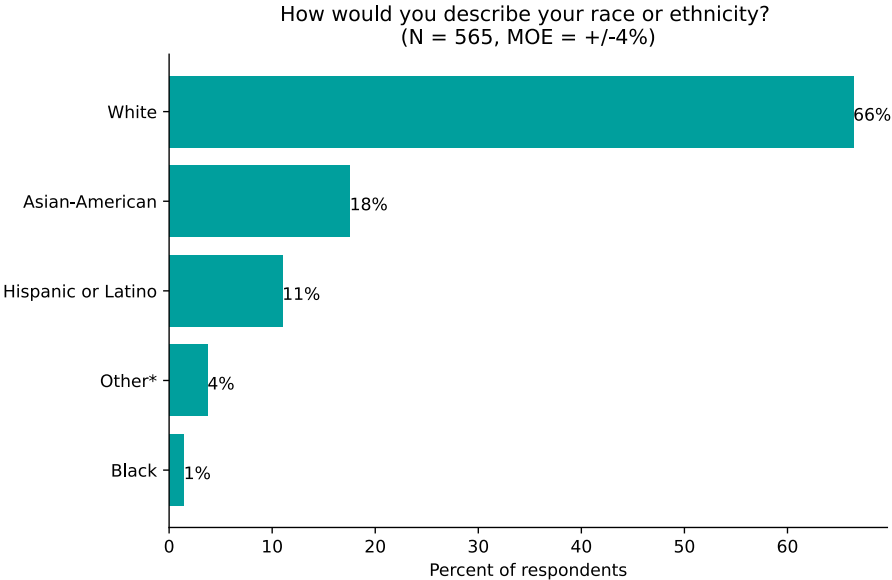


## All Respondents

### Reported Demographics

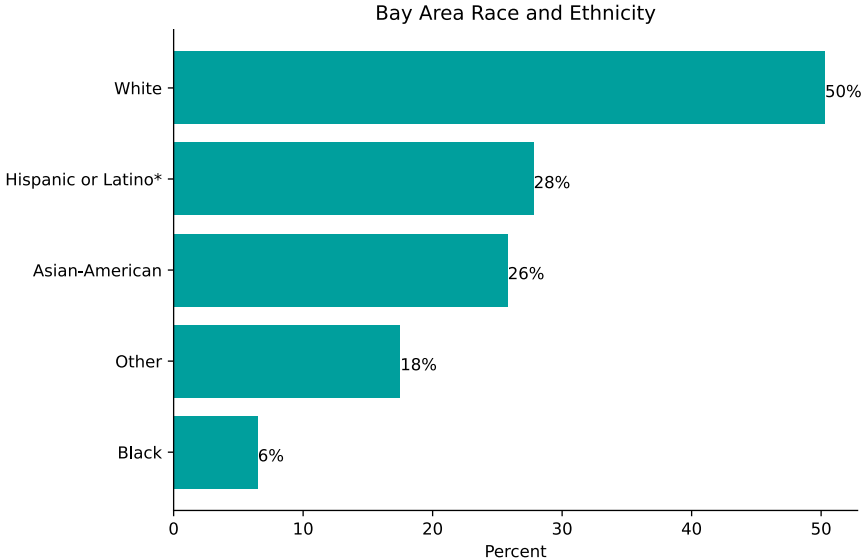
The survey collected demographic data to compare differences in responses by demographic group. Providing demographic information was completely voluntary and reported directly by the respondent themselves. The surveyors did not make assumptions. Respondents of MTC's origin-destination survey are majority white, employed full time, male, and under the age of 65. Compared to demographic profiles of the MTC region, survey respondents are disproportionately white. Black, Asian-American, and Hispanic or Latino racial and ethnic identities are underrepresented. Due to the small sample sizes of these racial and ethnic groups, there is not enough data to draw conclusions about each identity group and thus are treated together as respondents of color. While approximately half of the population identifies as a woman, over 70% of respondents are male-identifying. The most common age group to respond to the survey is 25-34 year-olds (33%).

Figure 1. Reported Racial or Ethnic Identity of All Survey Respondents.



\*Other includes self-identified 'Other' (1.8%), Middle Eastern or North African (0.7%), Other Pacific Islander (0.7%), Samoan (0.4%), and American Indian or Alaskan Native (0.2%).

Figure 2. Bay Area Racial or Ethnic Identity (Source: 2020 5-Year ACS Estimates).



\*Hispanic or Latino ethnicity reported separately from race.

Figure 3. Reported Age of All Survey Respondents.

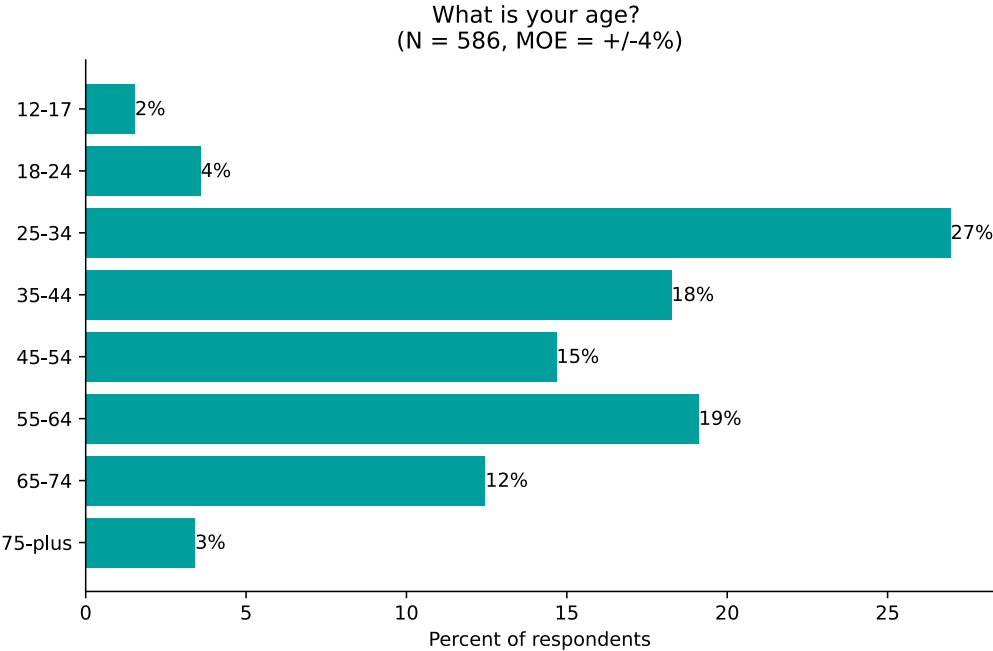


Figure 4. Bay Area Age Characteristics (Source: 2020 5-Year ACS Estimates).

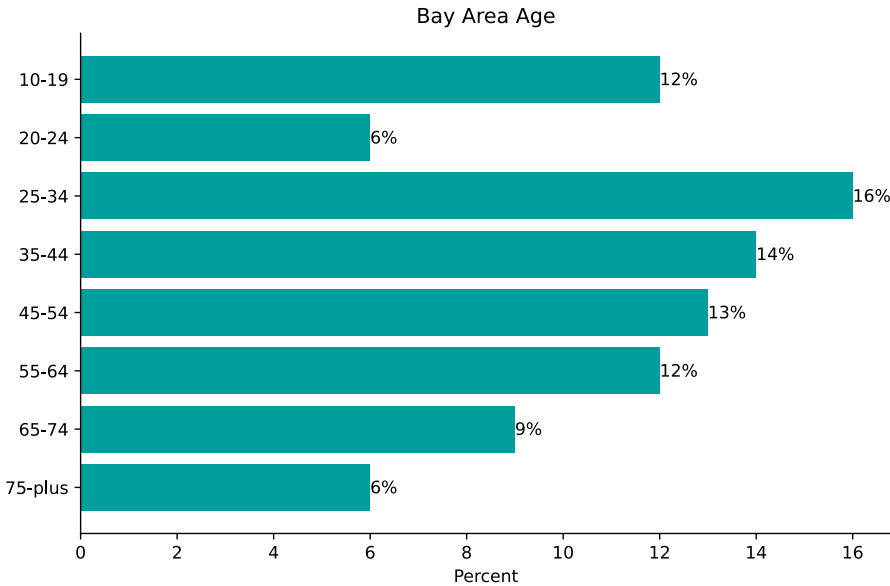


Figure 5. Reported Gender of All Survey Respondents.

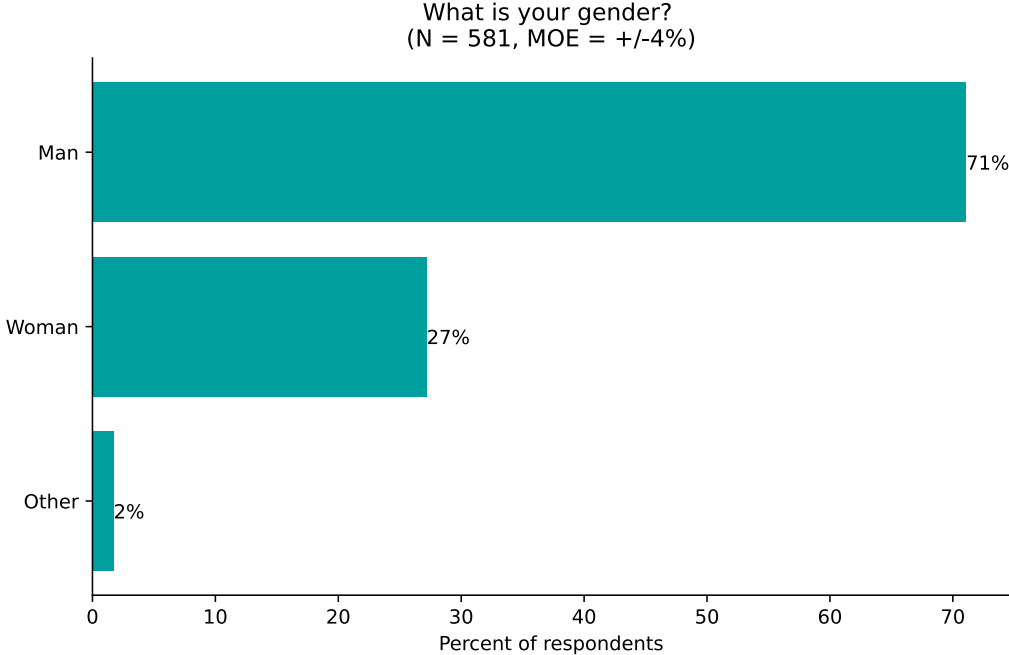


Figure 6. Bay Area Sex Characteristics (Source: 2020 5-Year ACS Estimates)

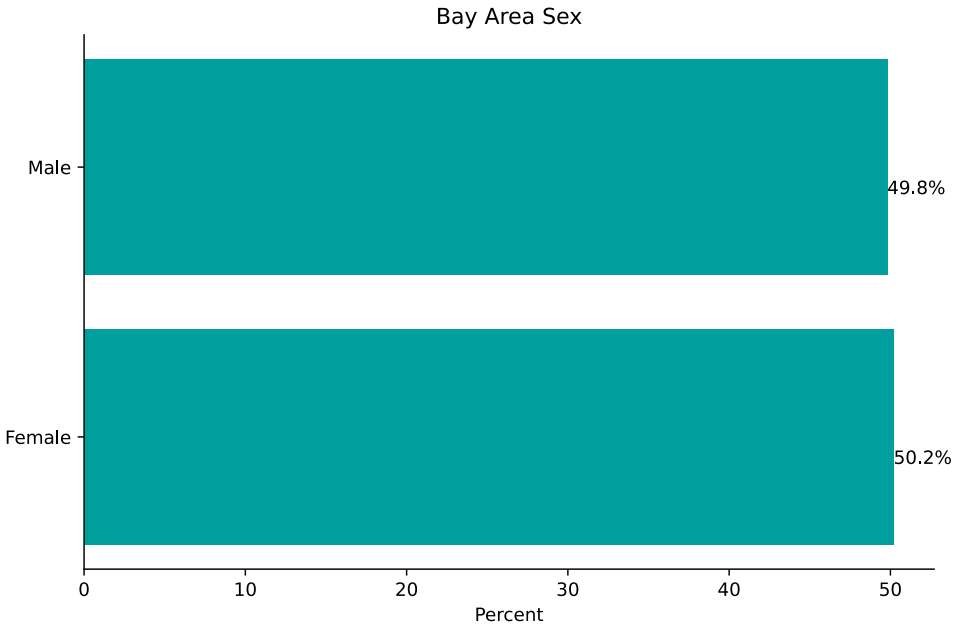
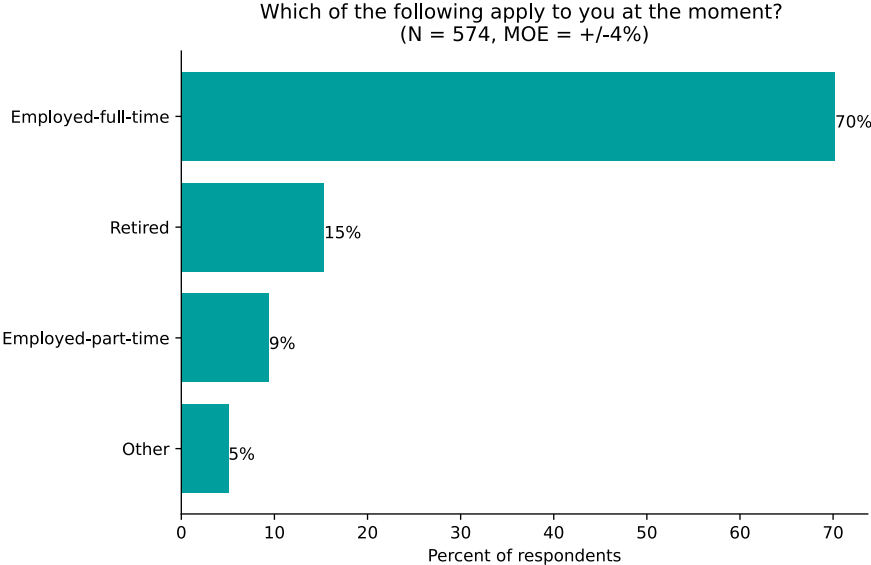


Figure 7. Reported Employment Status of All Survey Respondents.



Mode Choice

The vast majority of survey respondents reported riding bicycles on the corridors, followed by walking or jogging as the next most popular answer with 14%. About 10% of all respondents reported driving to the corridor, half of which then rode a bicycle and half of which walked or jogged.

Figure 8. Reported Mode of Transportation While on the Corridor of All Respondents.

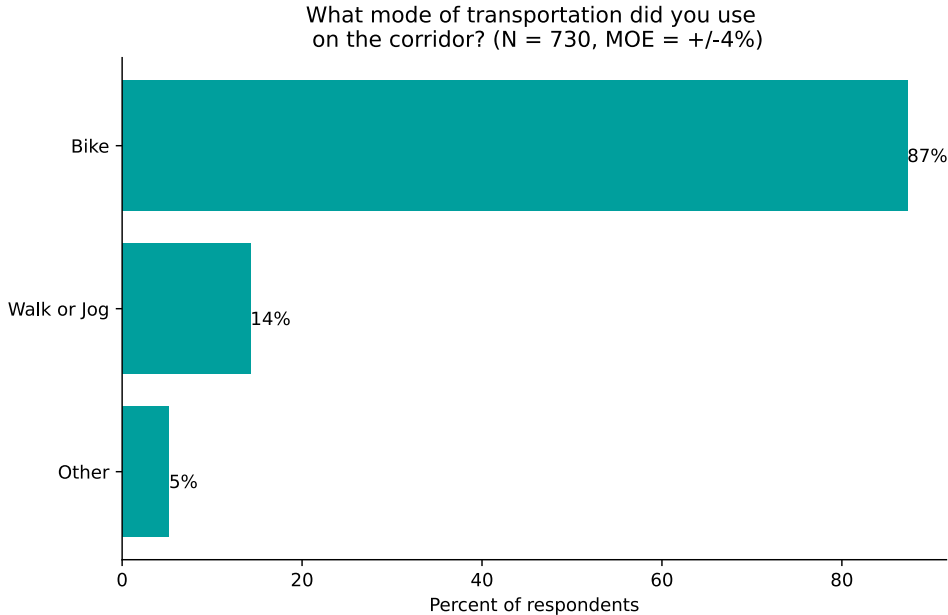
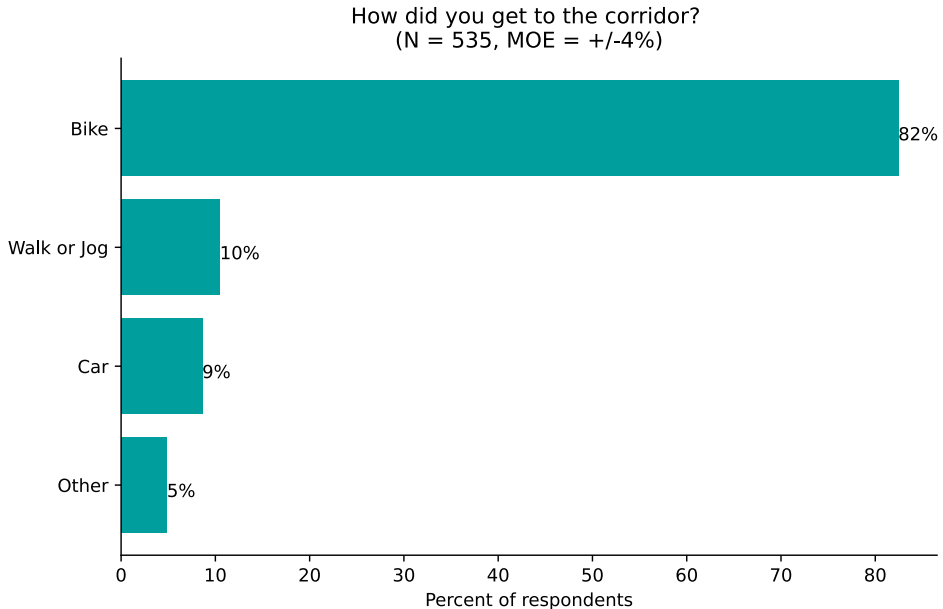
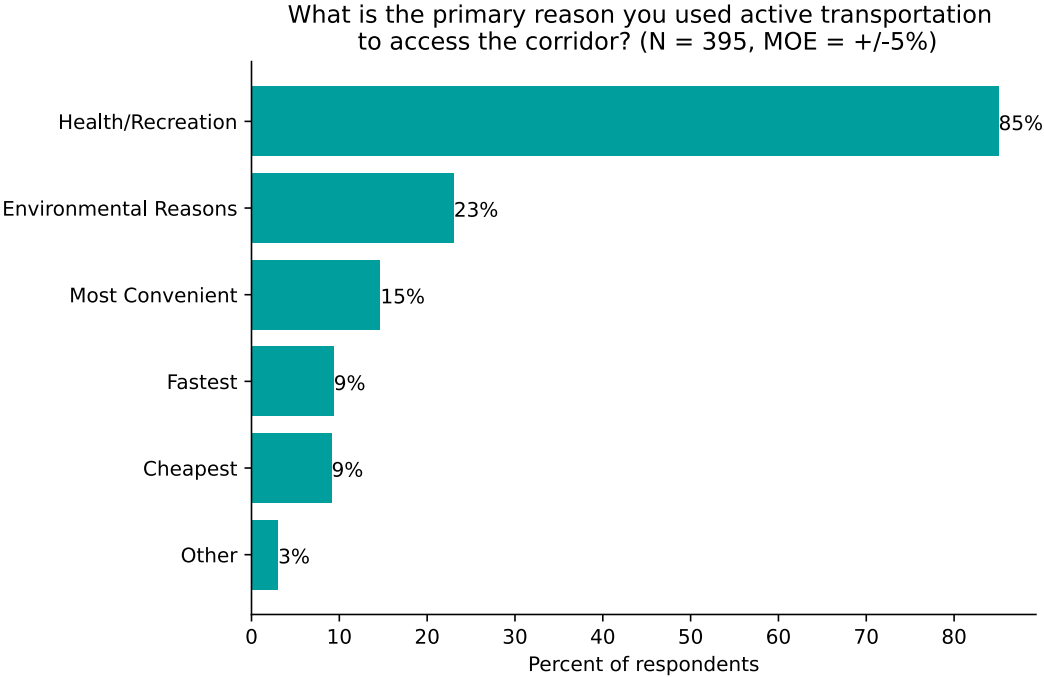


Figure 9. Reported Mode of Transportation Taken to the Corridor of All Respondents.



For those respondents using active transportation modes to access the corridors, 85% reported health or recreation to be the primary reason for their mode choice. About a quarter of respondents were motivated by environmental reasons.

Figure 10. Primary Motivation for Traveling to the Corridor via Active Transportation Mode for All Respondents.



Trail Usage

In line with the motivations for active transportation mode choices, 9 in 10 survey respondents cited fitness or recreation as the main purpose of their trip. Approximately 8% of respondents use the corridors to commute to or from work. Most respondents are all-season users; 84% reported using the trail year-round.

Figure 11. Reported Trip Purpose of All Respondents.

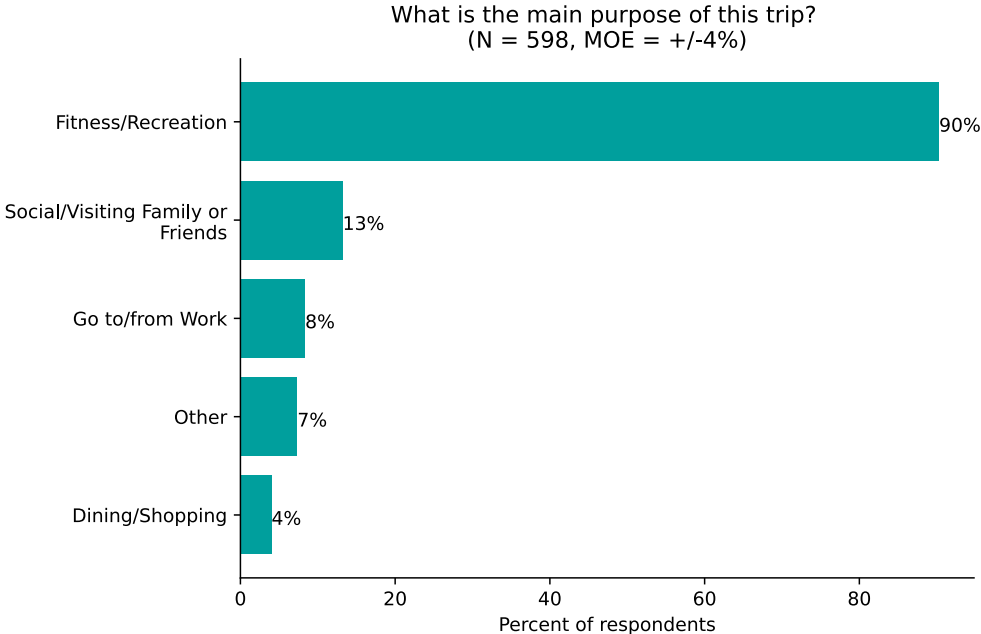
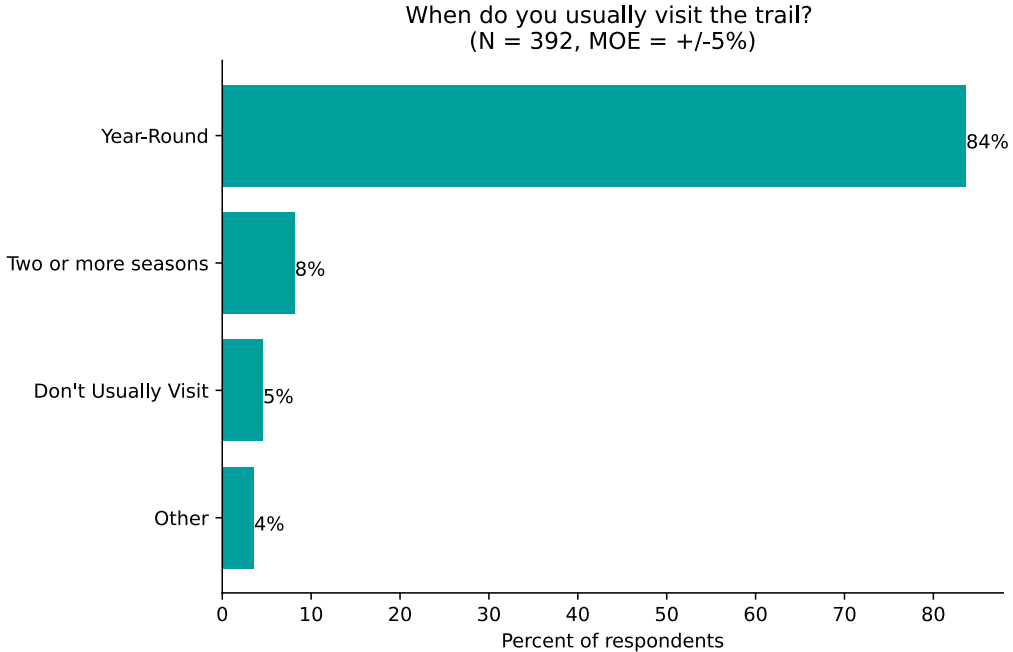


Figure 12. Time of Year that All Respondents Visit Trails.

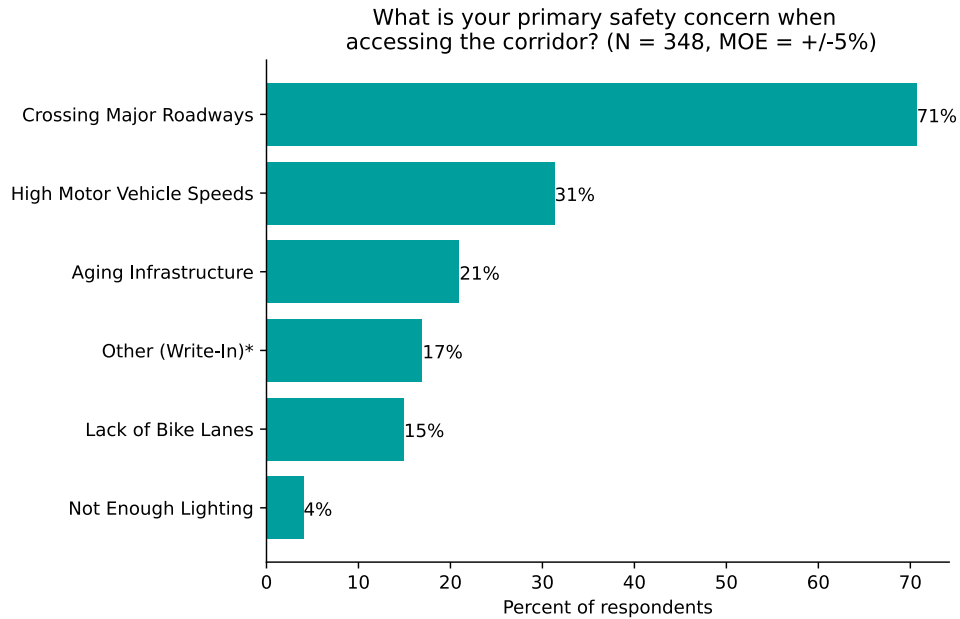




**Concerns, Improvements and Motivations**

Considering respondents from all trails, most reported crossing major roadways as the primary safety concern while accessing the corridor (71%), followed by high motor vehicle speeds (31%), and 15% cited a lack of bike lanes.

Figure 13. Primary Safety Concerns of All Respondents.



\*Write-in responses included debris on corridor, conflicts with other corridor users, and the presence of people experiencing homelessness along the corridor.

Respondents making non-discretionary trips were much more concerned about high motor vehicle speeds and a lack of bike lanes than respondents traveling for solely social or recreational purposes, though crossing major roadways remained the primary safety concern for both groups.

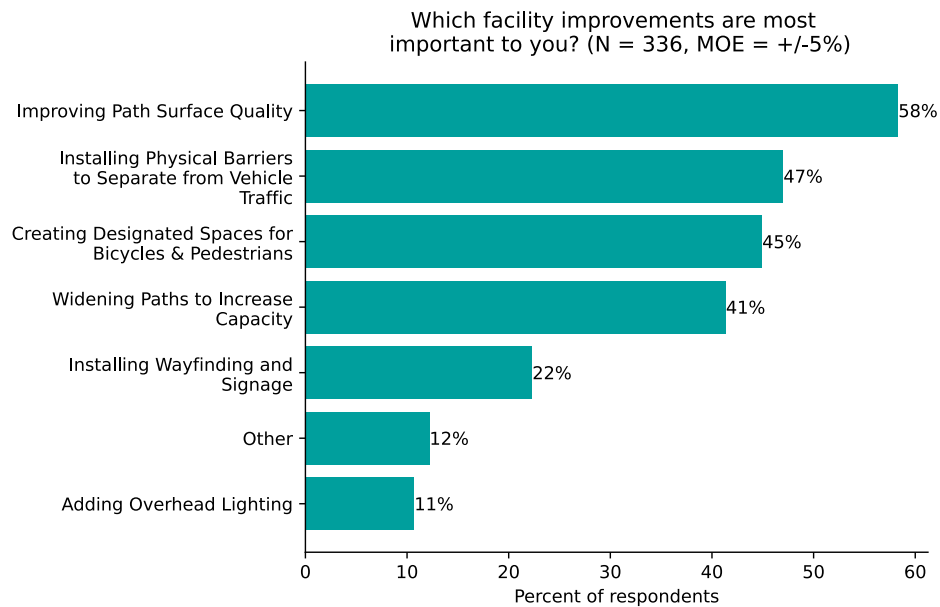
Table 1. Primary Safety Concerns by Trip Purpose.

Primary Safety Concern	Trip Purpose*			
	Discretionary		Non-Discretionary	
Crossing Major Roadways	215	72%	31	63%
High Motor Vehicle Speeds	87	29%	22	45%
Aging Infrastructure	63	21%	10	20%
Other	50	17%	9	18%
Lack of Bike Lanes	36	12%	16	33%
Total respondents	299		49	

\*Discretionary trips are those made solely for social or recreational purposes.

More than any other response, 58% of respondents felt that improving the quality of path surfaces was among the most important improvements for trail/path access, along with installing physical barriers to separate from vehicle traffic and providing increased capacity for bicyclists and pedestrians to have their own designated spaces.

Figure 14. Most Important Facility Improvements for All Respondents.



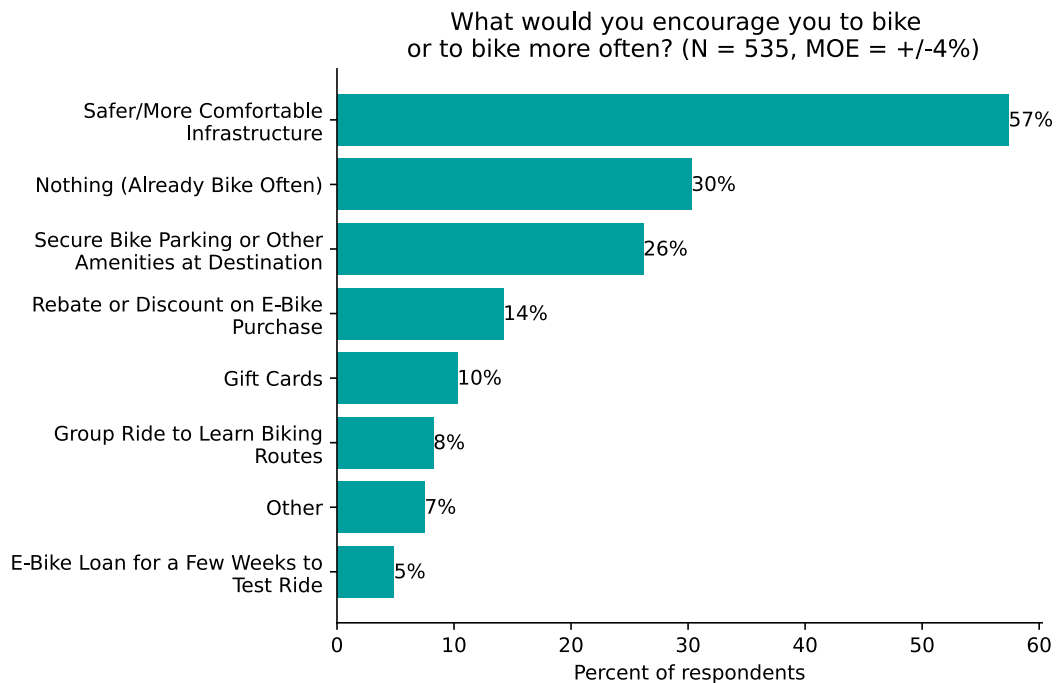
The types of improvements that are important to respondents vary slightly between white respondents and respondents of color. While improving path surface quality was the number one requested improvement for both groups, 14% more white respondents cited this among the most important than respondents of color. Compared to their white peers, respondents of color placed higher importance on lighting, wayfinding and signage.

Table 2. Most Important Facility Improvements by Demographic Groups.

Facility Improvements	Race/Ethnicity				Age						Gender					
	White Only		Respondents of Color		Under 35		35-64		65+		Woman		Man		Other	
Improving Path Surface Quality	133	63%	50	49%	64	23%	97	24%	32	33%	44	19%	144	27%	8	24%
Installing Physical Barriers to Separate from Vehicle Traffic	106	50%	46	45%	53	19%	84	21%	19	19%	42	19%	112	21%	4	12%
Creating Designated Spaces for Bicycles and Pedestrians	93	44%	47	46%	55	20%	78	20%	14	14%	45	20%	98	18%	8	24%
Widening Paths to Increase Capacity	87	41%	43	42%	67	24%	60	15%	9	9%	46	20%	85	16%	8	24%
Installing Wayfinding and Signage	43	20%	25	25%	22	8%	37	9%	12	12%	24	11%	47	9%	4	12%
Other	20	10%	18	18%	7	3%	23	6%	10	10%	12	5%	28	5%	1	3%
Adding Overhead Lighting	19	9%	17	17%	12	4%	21	5%	2	2%	14	6%	22	4%	0	0%
Total Respondents	210		102		280		400		98		227		536		33	
Margin of Error		±7%		±10%		±6%		±5%		±10%		±7%		±4%		±17%

Over half of respondents said that safer or more comfortable infrastructure like dedicated bike lines or separated bike paths would motivate them to bike more, along with about a quarter that cited secure bike parking or other amenities at their destination. Nearly half of respondents are not interested in owning an e-bike. About a third of respondents who are interested and don't already own one would spend between \$1,000 and \$2,000 on an e-bike purchase.

Figure 15. Motivations of All Respondents to Bike More.



Respondents of color were less likely than their white counterparts to report that they needed no additional motivations to bike more, reporting increased desires for educational group rides, rebates or discounts on e-bike purchases, or gift cards. When considering motivations by trip purpose, nearly one-third of non-discretionary trip takers reported that a rebate or discount on an e-bike purchase would encourage them to bike more, as well as increased secure bike parking. White and respondents of color reported nearly the same fraction of non-discretionary trip purposes (14% and 16%, respectively).

Table 3. Motivations to Bike More, by Race/Ethnicity and Trip Purpose of Respondent.

Facility Improvements	Race/Ethnicity				Age						Gender					
	White Only		Respondents of Color		Under 35		35-64		65+		Woman		Man	Other		
Safer or More Comfortable Infrastructure	196	58%	94	57%	119	38%	148	36%	31	31%	80	35%	212	36%	15	43%
Nothing (Already Bike Often)	115	34%	38	23%	35	11%	86	21%	37	37%	34	15%	124	21%	4	11%
Secure Bike Parking	87	26%	48	29%	56	18%	65	16%	15	15%	38	17%	95	16%	7	20%
Rebate or Discount on E-Bike Purchase	47	14%	29	18%	33	11%	38	9%	4	4%	25	11%	49	8%	2	6%
Gift Cards	31	9%	22	13%	27	9%	24	6%	3	3%	13	6%	39	7%	3	9%
Group Ride to Learn Routes	22	6%	20	12%	23	7%	20	5%	0	0%	15	7%	27	5%	2	6%
E-Bike Loan or Trial Period	17	5%	8	5%	9	3%	14	3%	3	3%	8	3%	17	3%	1	3%
Nothing Would Convince Me	15	4%	7	4%	6	2%	11	3%	6	6%	13	6%	11	2%	1	3%
Group Ride to Test E-Bike	7	2%	7	4%	5	2%	8	2%	2	2%	3	1%	12	2%	0	0%
Total Respondents	339		165		313		414		101		229		586	35		
Margin of Error	±5%		±8%		±6%		±5%		±10%		±6%		±4%	±17%		

Table 4. Motivations to Bike More, by Trip Purpose of Respondent.

Encourage to Bike More	Trip Purpose*			
	Discretionary		Non-Discretionary	
Safer or More Comfortable Infrastructure	268	59%	39	51%
Nothing (Already Bike Often)	133	29%	29	38%
Secure Bike Parking	116	25%	24	31%
Rebate or Discount on E-Bike Purchase	52	11%	24	31%
Gift Cards	47	10%	8	10%
Group Ride to Learn Routes	36	8%	8	10%
E-Bike Loan or Trial Period	22	5%	4	5%
Nothing Would Convince Me	20	4%	5	6%
Group Ride to Test E-Bike	15	3%	0	0%
Total Respondents	458		77	
Margin of Error	±5%		±11%	

\*Discretionary trips are those made solely for social or recreational purposes.

About half of respondents reported no interest in owning an e-bike, consistent across racial groups. Of those interested in purchasing an e-bike, over half were willing to spend over \$1,000 of their own money. Eleven percent of white respondents already own an e-bike, compared to 5% of respondents of color.

Figure 16. E-Bike Spending Limit of All Respondents.

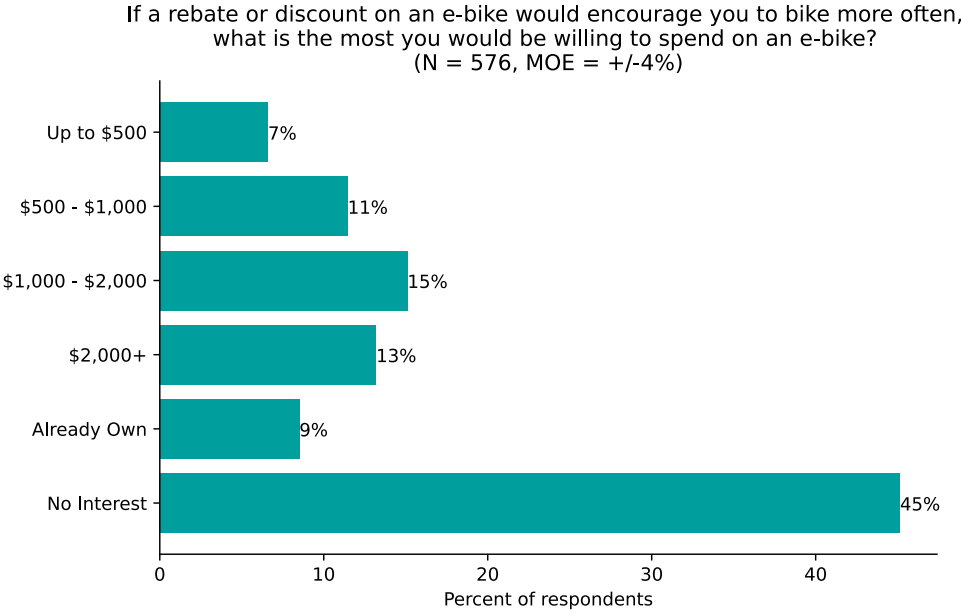


Table 5. E-Bike Spending Limit by Demographic Group.

Facility Improvements	Race/Ethnicity				Age						Gender					
	White Only		Respondents of Color		Under 35		35-64		65+		Woman		Man		Other	
Up to \$500	21	6%	14	8%	16	9%	19	6%	2	2%	13	9%	21	5%	4	13%
\$500 - \$1,000	39	11%	27	15%	35	20%	26	9%	5	5%	27	18%	35	9%	4	13%
\$1,000 - \$2,000	58	16%	27	15%	31	18%	41	14%	14	15%	11	7%	73	18%	3	10%
\$2,000+	45	12%	26	14%	17	10%	44	15%	14	15%	11	7%	62	16%	3	10%
Already Own	39	11%	10	5%	6	3%	30	10%	12	13%	15	10%	34	9%	0	0%
No Interest	159	44%	78	43%	70	40%	134	46%	44	48%	72	48%	172	43%	16	53%
Total Respondents	339		165		175		294		91		149		397		30	
Margin of Error	±5%		±7%		±7%		±6%		±10%		±8%		±5%		±18%	

## Trail-Specific Takeaways

Each respondent is associated with the specific trail on which they were traveling during survey collection. The following results discuss trail-specific results where they differ from overall survey responses. Full trail-specific results are available in **Appendix B - Full Survey Results by Corridor**.

### Dumbarton Bridge

Surveys were collected on the Dumbarton Bridge path on April 23<sup>rd</sup> and 26<sup>th</sup> from 9 am to 3 pm. Respondents from the Dumbarton Bridge path were far more diverse than the overall respondent pool. Less than half of respondents reported their race or ethnicity as white, compared to two-thirds of the general survey population. About a quarter of respondents reported accessing the trail via car, higher than any other trail. Though 78% of trail respondents rode their bicycle on the Dumbarton Bridge trail, only 65% of respondents biked to the trail.

Fifteen percent of respondents reported their main trip purpose as commuting to or from work, higher than any other trail. Additionally, respondents on the Dumbarton Bridge trail were more likely to cite high vehicle speeds and a lack of bike lanes as primary safety concerns when accessing the corridor.

### Golden Gate Bridge

Surveys were collected on the Golden Gate Bridge path on April 29<sup>th</sup> from 11 am to 5 pm and May 1<sup>st</sup> from 9 am to 3 pm. Less than 4% of respondents reported accessing the Golden Gate Bridge trail via car, lower than any other trail, and a greater percentage reported using a mobility assistance device like a wheelchair to access the trail. Compared to all survey respondents, Golden Gate Bridge trail users placed increased levels of importance on widening paths for increased capacity and creating separate, designated spaces for bicycles and pedestrians.

Two-thirds of respondents said safer or more comfortable infrastructure would encourage them to bike more often, and one-third cited access to secure bike parking or other amenities at their destination.

### Napa Vine Trail

Surveys were collected on the Napa Vine Trail on April 25<sup>th</sup> from 11 am to 5 pm and April 30<sup>th</sup> from 9 am to 3 pm. The Napa Vine Trail respondent demographic skews older and has a much higher representation of retirees than the other trails studied, as well as the highest percentage of people who reported walking or jogging on the trail (38%).

Nineteen percent of respondents reported driving to the Napa Vine Trail, and about half of those then rode a bicycle on the trail and the other half walked or jogged. Far fewer respondents than other trails cited a need for safer or more comfortable infrastructure to encourage them to bike more.

### Richmond-San Rafael Bridge

Surveys were collected on the Richmond-San Rafael Bridge path on April 23<sup>rd</sup> and April 26<sup>th</sup> from 9 am to 3 pm. Only 5% of respondents walked or jogged on the Richmond-San Rafael Bridge, the lowest of all trails considered. A greater percentage of respondents than the survey average reported using the trail for essential travel purposes like commuting to or from work, running errands, or attending appointments.

Survey respondents on the Richmond-San Rafael Bridge trail cited a lack of bike lanes as a primary safety concern in accessing the trail more than twice as frequently than the average of respondents for all trails, along with more frequent calls for physical barriers to separate active users for vehicle traffic (60% of respondents).



## Appendix A - Survey Questions

Welcome! The Metropolitan Transportation Commission is collecting information to improve bicycle/pedestrian access, connectivity and safety and prioritize future funding to encourage sustainable mode shift in the region. We would like to hear about your experience using this trail.

Your privacy is important to us. Any information that you share will not be shared with any external parties. Location based questions are based off the nearest 1,000 feet and will not ask for an address to preserve privacy. Data stored from question responses will be stored in secured servers that will only be accessed by the project's IT team.

For more information or if you have any questions, please contact Nicola Szibbo at [nszibbo@bayareametro.gov](mailto:nszibbo@bayareametro.gov) or (415) 490-8554.

Do you live or work in the Bay Area?

- Yes
- No

What corridor were you visiting when you received this survey?

- Napa Vine Trail
- Dumbarton Bridge Path
- Richmond-San Rafael Bridge Path
- Golden Gate Bridge Path

### Core Survey Questions

We'll start by asking questions about how you started and ended your trip. Answers will be collected by clicking on the interactive map.

1. Where is your home located?
2. Where did you start your trip (if different from home)?
3. Where did you end your trip if different from start location?
4. Where is your place of work located?
5. What route did you take to the [corridor] from your start location?

Now we will ask a few multiple-choice questions.

6. Which mode of transportation did you use on the [corridor]? (Choose all that apply)
  - Walk/Jog
  - Wheelchair
  - Bike
  - Scooter
  - Skateboard
  - Roller skates/Inline skates
  - Other: \_\_\_\_\_
7. Was your bike or scooter powered electrically?
  - Yes
  - No
8. What's the main purpose of this trip? (Choose all that apply)
  - Fitness/Recreation
  - Go to/from work

- Go to/from school
- Errands/Appointments
- Dining/Shopping
- Social/Visiting Family or Friends
- Other: \_\_\_\_\_

We have a few questions about programs to encourage commuting/transportation bicycling on [corridor] to decrease the number of vehicle trips.

9. What would encourage you to bike or to bike more often on [corridor]? (check all that apply)

- A rebate or discount on the purchase of an e-bike
- An e-bike loan for a few weeks to test ride
- Gift cards
- A group ride to help learn biking routes for
- A group ride to test out an ebike
- Safer/more comfortable infrastructure (e.g. dedicated bike lanes or separated bike paths)
- Secure bike parking or other amenities at destination
- Other \_\_\_\_\_
- Nothing, I already bike often on [corridor]
- It is not practical or nothing would convince me

10. If a rebate or discount on an e-bike would encourage you to bike or bike more often on the corridor, what is the most you would be willing to spend on an e-bike?

- Up to \$500
- \$500-\$1,000
- \$1,000-\$2,000
- \$2,000+
- I already own an e-bike
- I have no interest in owning an e-bike

- Thank you for your input. We would like to hear from people that reflect the Bay Area's diverse communities. Could you please answer some demographic questions to help us understand who we are reaching? We use this information to help improve our public engagement methods.

11. How would you describe your race or ethnicity (check all that apply)?

- White
- Hispanic or Latino
- Middle Eastern or North African
- Black or African American
- American Indian or Alaskan Native
- Chinese
- Filipino
- Asian Indian
- Vietnamese
- Korean
- Japanese
- Native Hawaiian
- Samoan
- Chamorro
- Other Pacific Islander
- Some other race or ethnicity: \_\_\_\_\_

## 12. What is your age?

- Under 12 years old
- 12-17 years old
- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75 years or older

## 13. What is your gender?

- Woman
- Man
- Nonbinary
- Prefer not to say
- If you prefer to enter your own gender identity, please do so here: \_\_\_\_\_

## 14. Which of the following categories apply to you at the moment?

- Employed full time (35 hours per week or more)
- Employed part time (less than 35 hours per week)
- Retired
- College/University student
- Not employed

Thank you for taking the survey! We know your time is valuable and appreciate it. Your input will help MTC plan thoughtful and equitable investments in active transportation around the Bay Area.

Please share your email address if you would like to be entered into a raffle for a chance to win a \$100 Amazon or Apple gift card! Your email address will not be shared with any 3<sup>rd</sup> party and will only be used to contact you if you are selected as a winner. Entering the raffle by providing an email address is not required to submit the survey.

Email address: \_\_\_\_\_

Want to double your chances of winning a raffle prize? We have a few more questions that shouldn't take more than 5 minutes to answer. If you want to double your chances of winning a prize, click "Continue to Part II."

## 15. How did you get to the [corridor]? (Check all that apply)

- Car
- Dropped off in a car
  - Ridehailing like Uber or Lyft
  - Friend, family, other
- Took transit (bus or train)
- Active transportation
  - Walk/Jog
  - Wheelchair
  - Bike
  - Scooter
  - Skateboard
  - Roller skates/Inline skates
  - Other: \_\_\_\_\_

## 16. Was your bike or scooter powered?

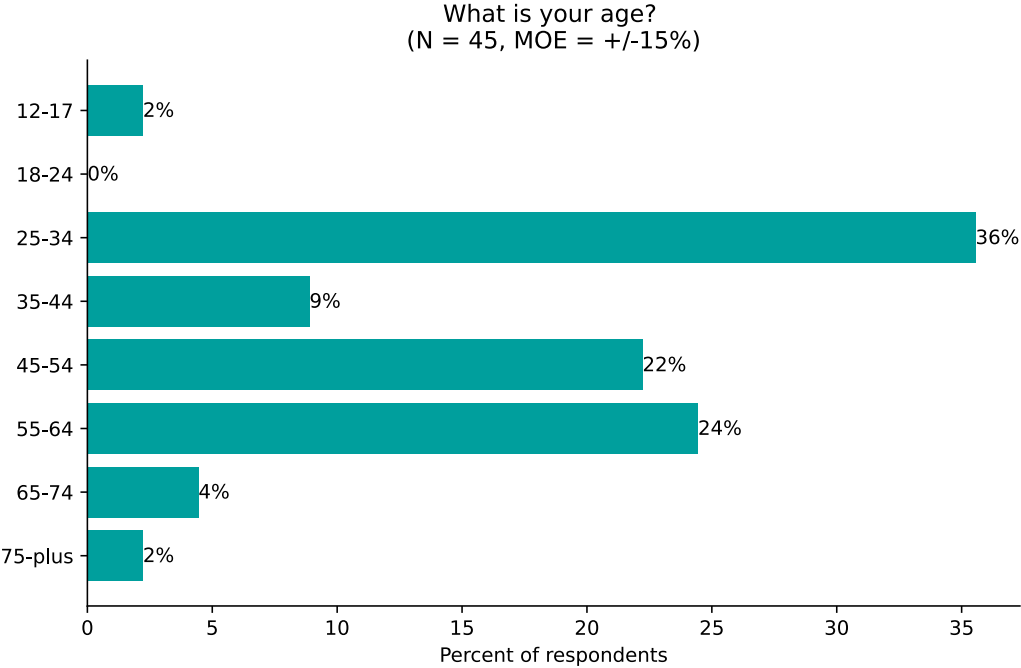
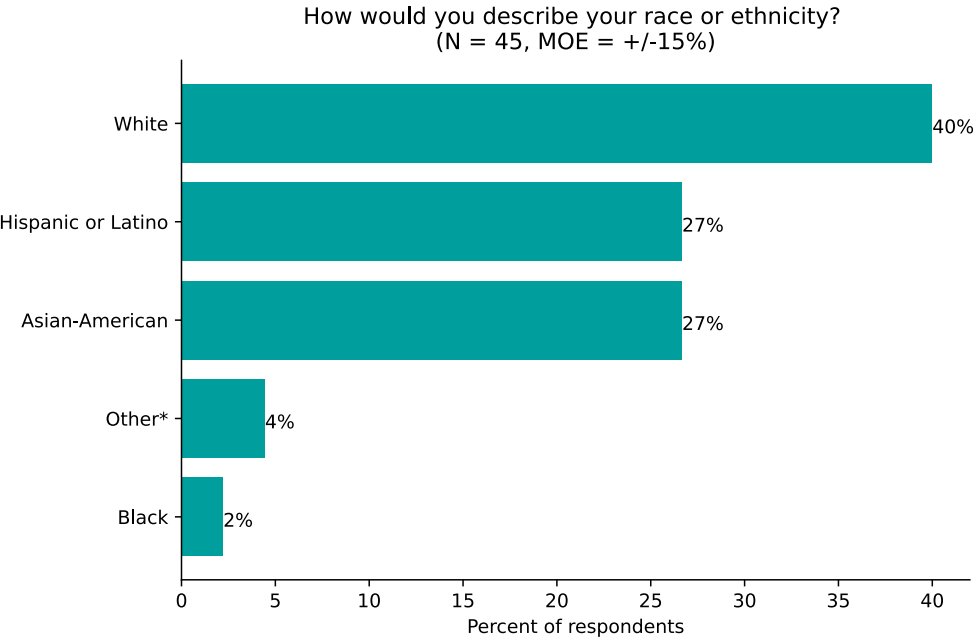
- Yes

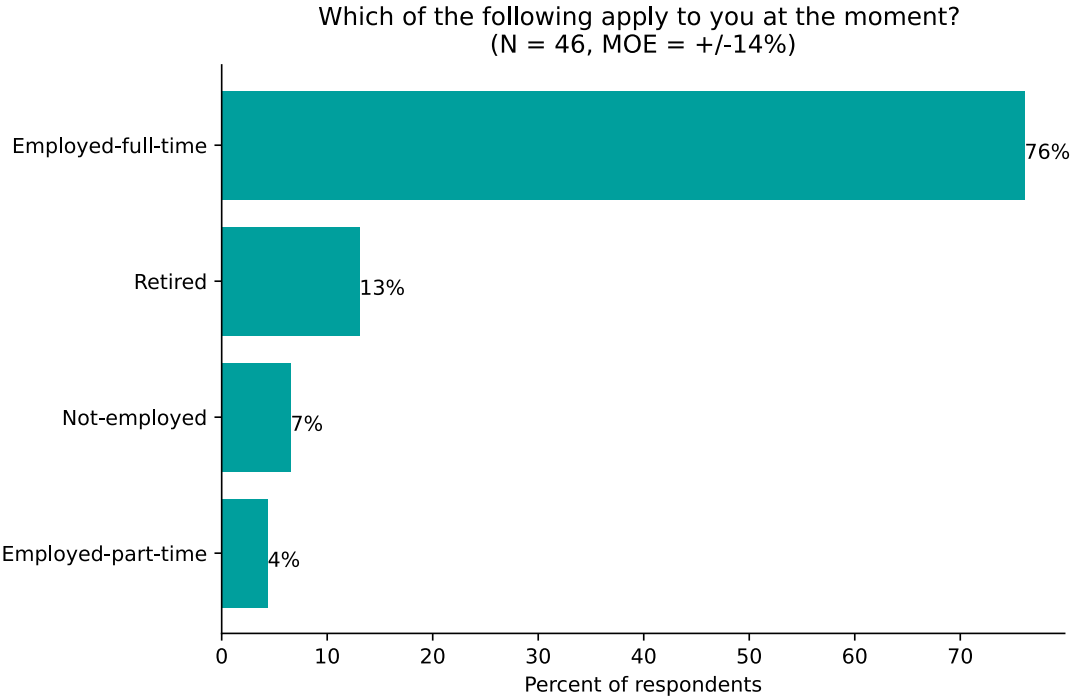
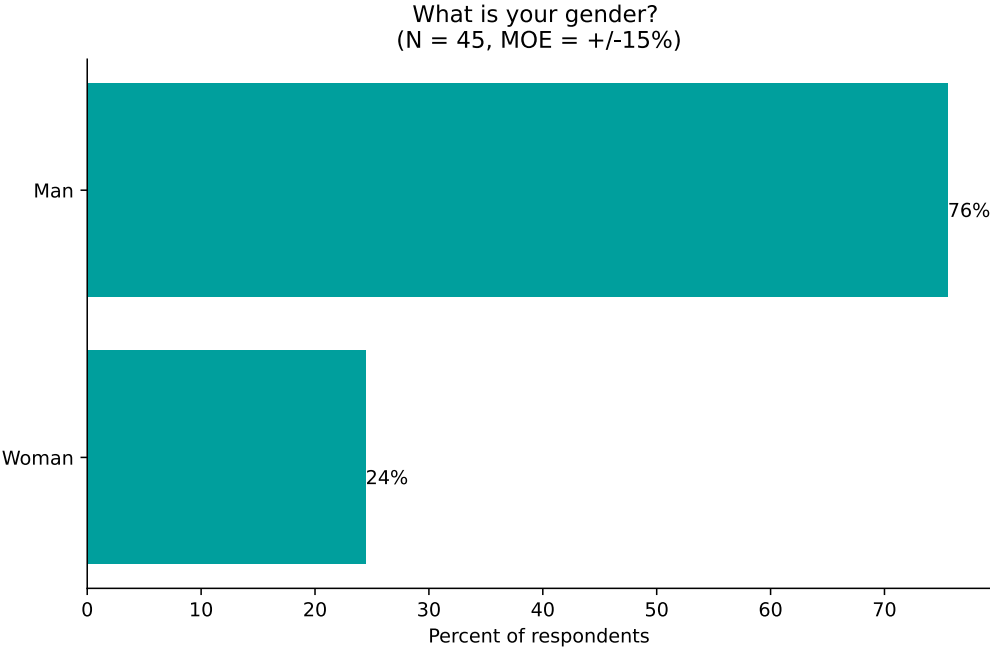
- No
17. If you selected active transportation for the last question, what is the primary reason you used active transportation to get here instead using other ways of getting here?
- Cheapest
  - Fastest
  - Most convenient
  - Health/Recreation
  - Environmental reasons
  - No other options
  - Other: \_\_\_\_\_
18. When do you usually visit [corridor]?
- All year
  - Summer
  - Fall
  - Winter
  - Spring
  - 2 or more seasons
19. What is your primary safety concern when getting to the [corridor]? (Choose all that apply)
- Crossing major roadways as a pedestrian
  - Crossing major roadways as a bicyclist
  - Crossing major roadways along the [corridor]
  - High motor vehicle speeds
  - Not enough lighting
  - Aging infrastructure
  - Other: \_\_\_\_\_
20. Which of these facility improvements to access the [corridor] are most important to you? (Choose all that apply)
- Improving the quality of bike/pedestrian path surfaces
  - Installing wayfinding and signage
  - Adding overhead lighting
  - Widening paths to increase capacity
  - Creating designated space for bicycles and pedestrians to avoid user group conflicts
  - Installing physical barriers to separate bike/ped space from vehicle traffic
  - Other: \_\_\_\_\_
21. Do you have anything else to add? (open paragraph)

## Appendix B - Full Survey Results by Corridor

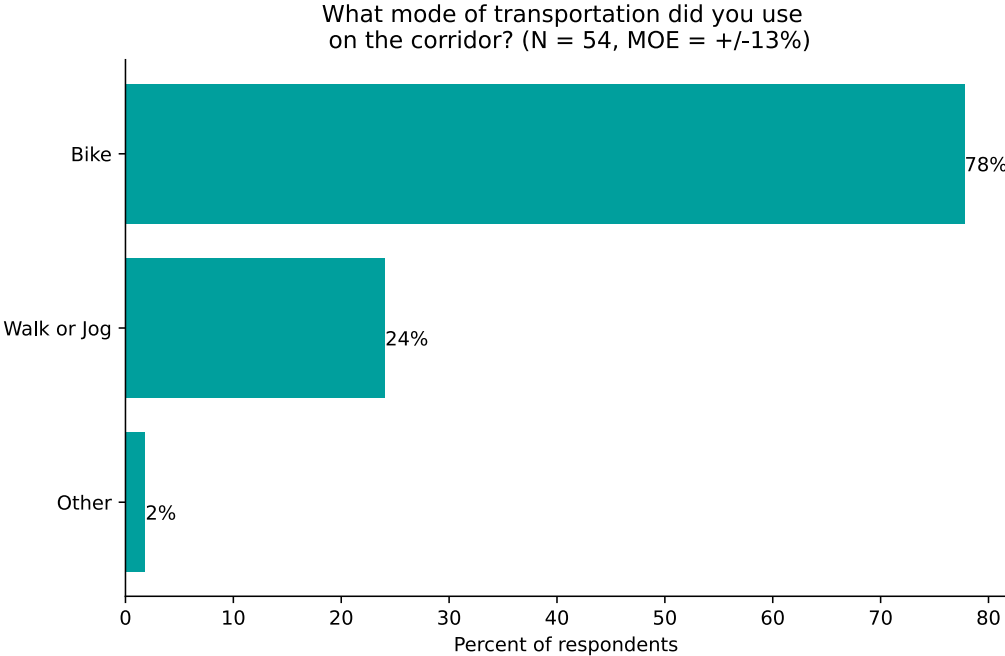
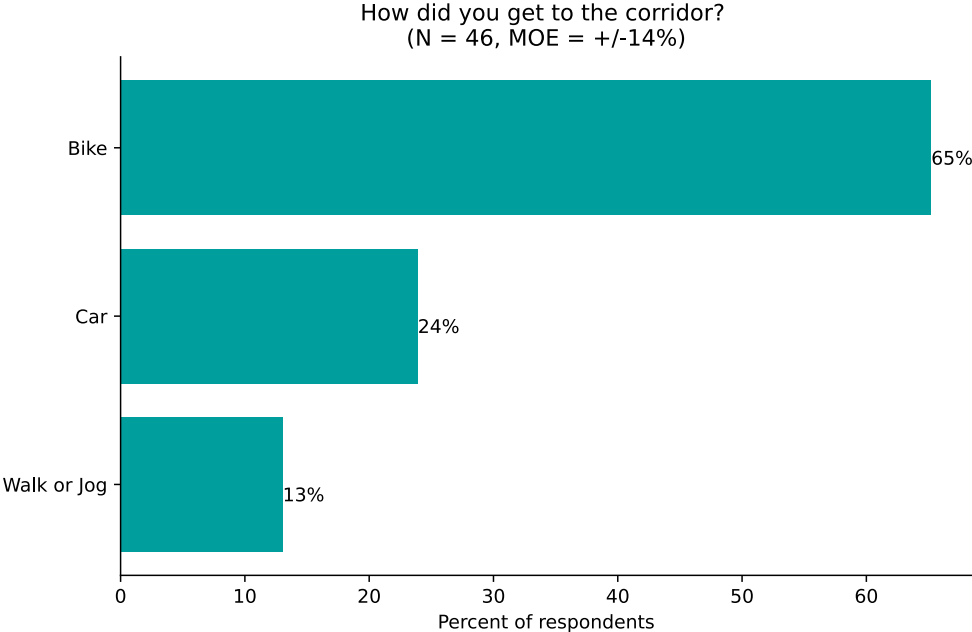
### Dumbarton Bridge

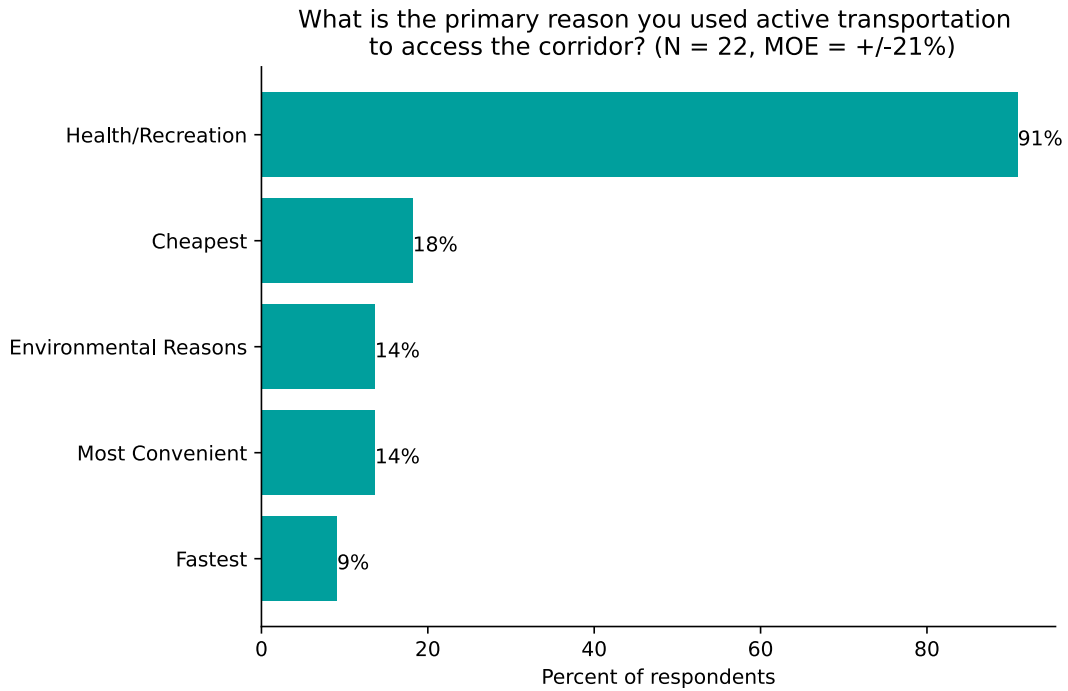
#### Demographics



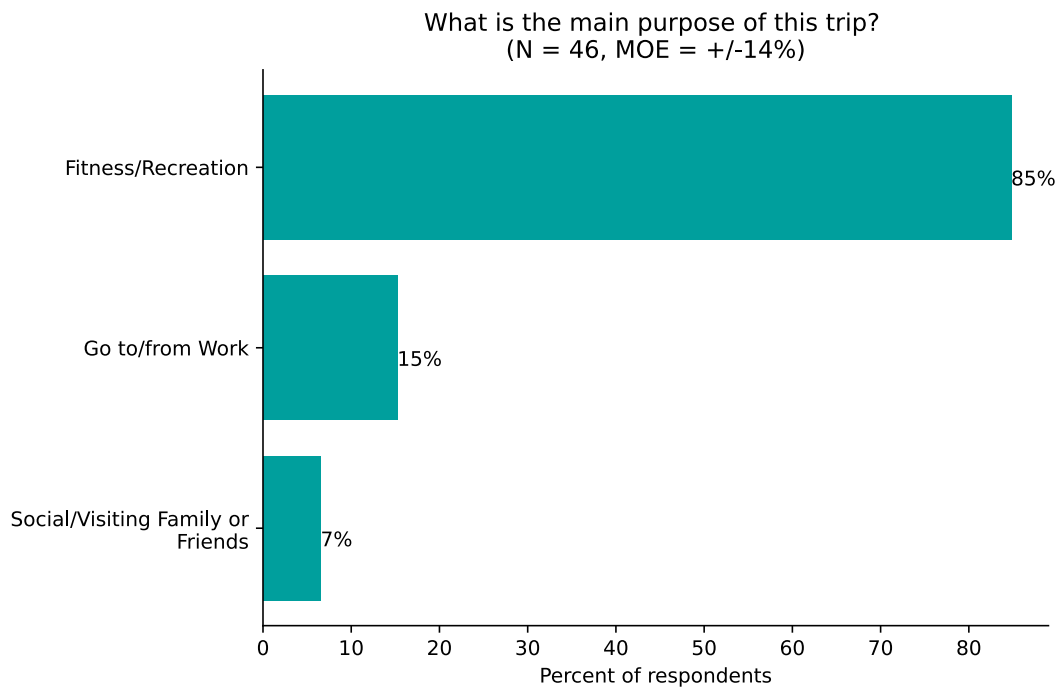


Mode Choice

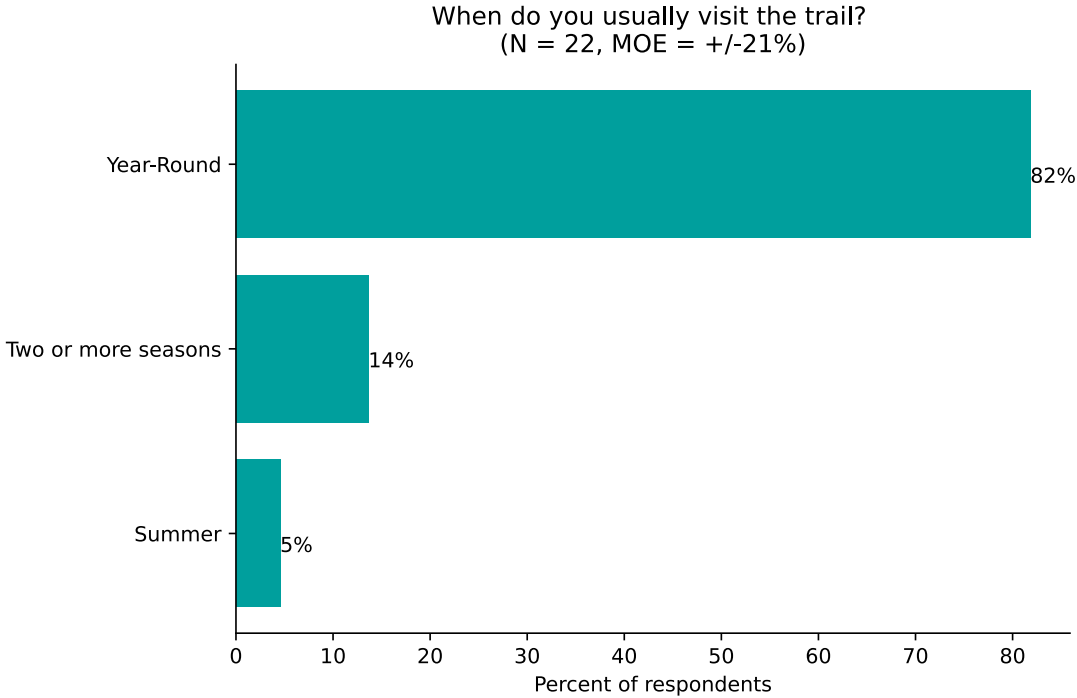




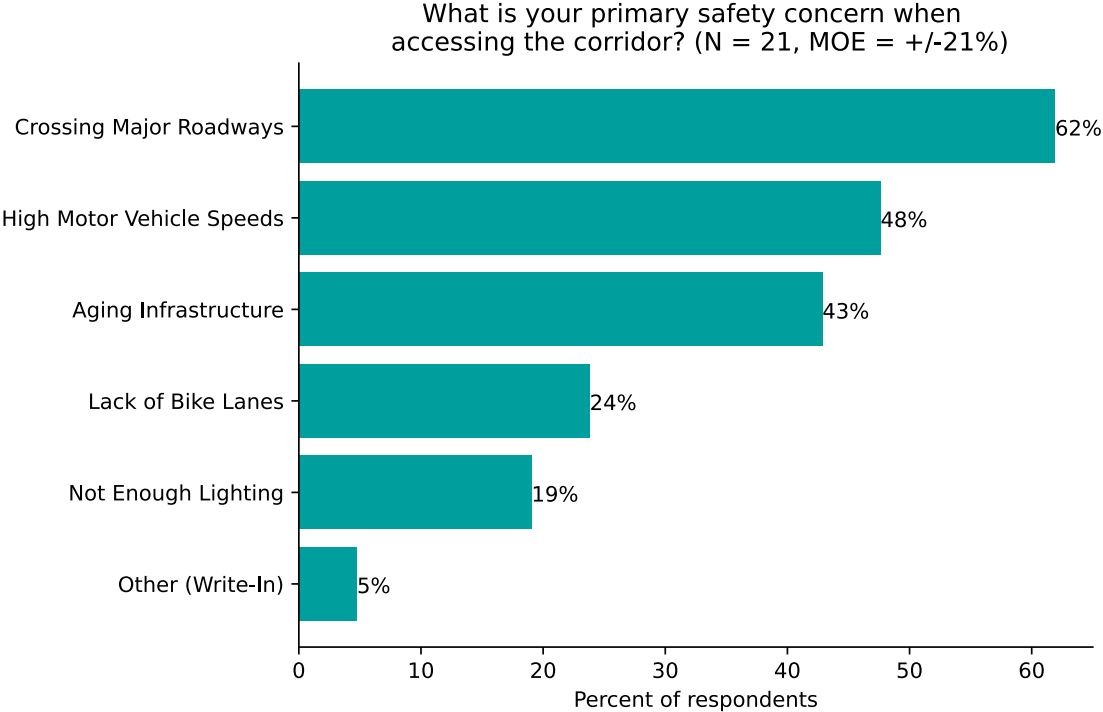
Trail Usage



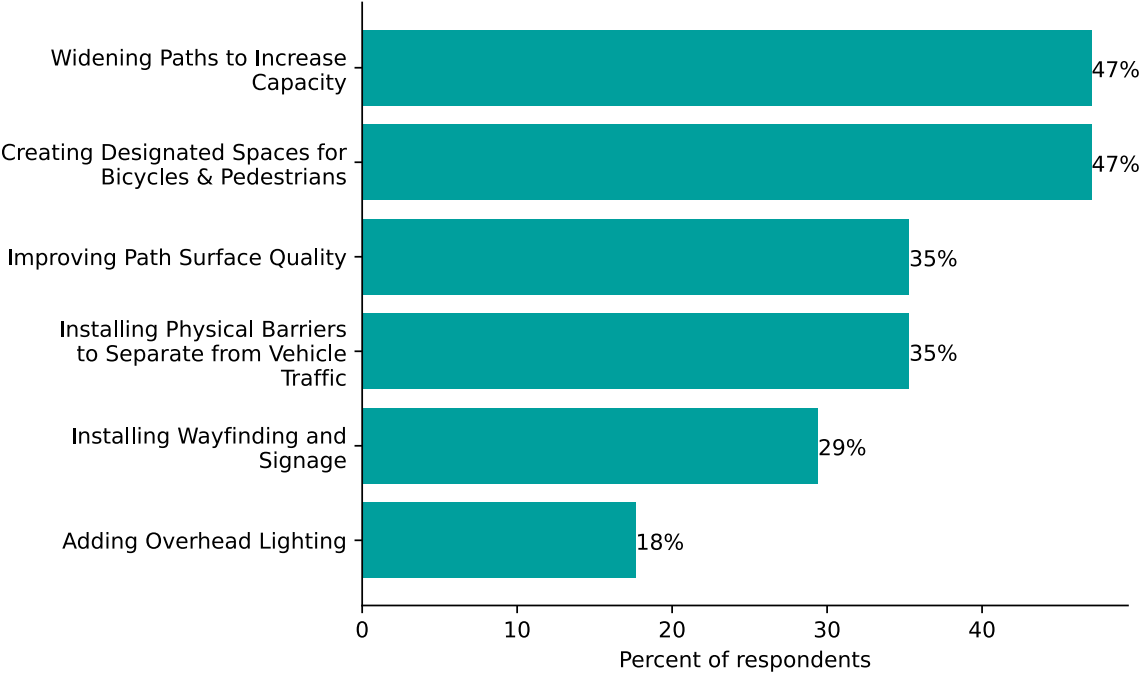




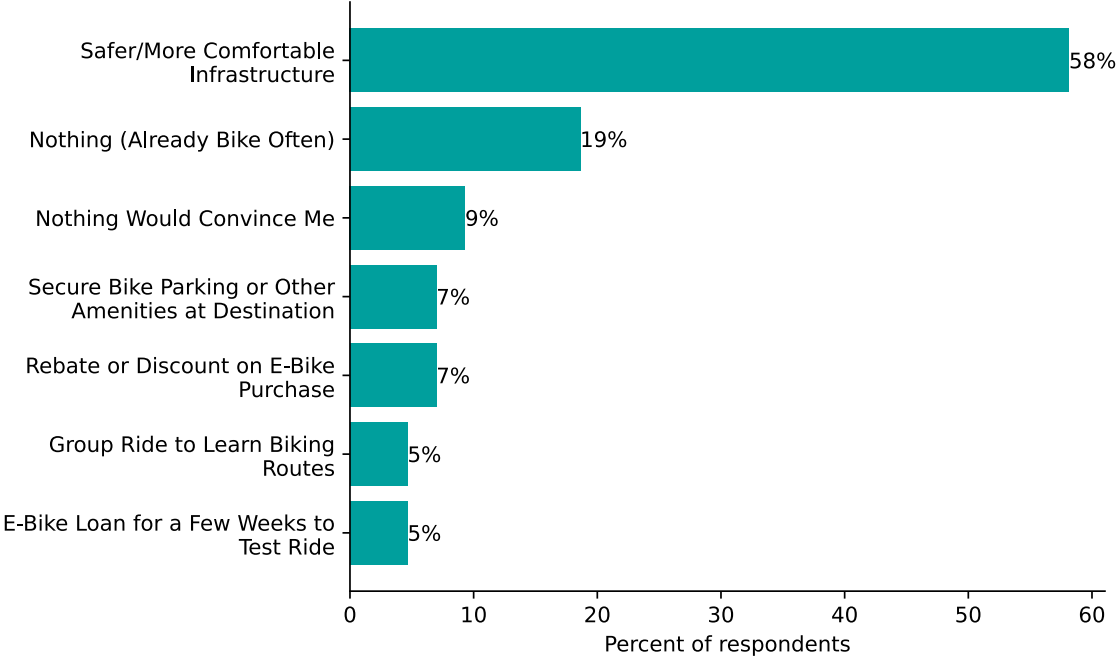
Concerns, Improvements and Motivations



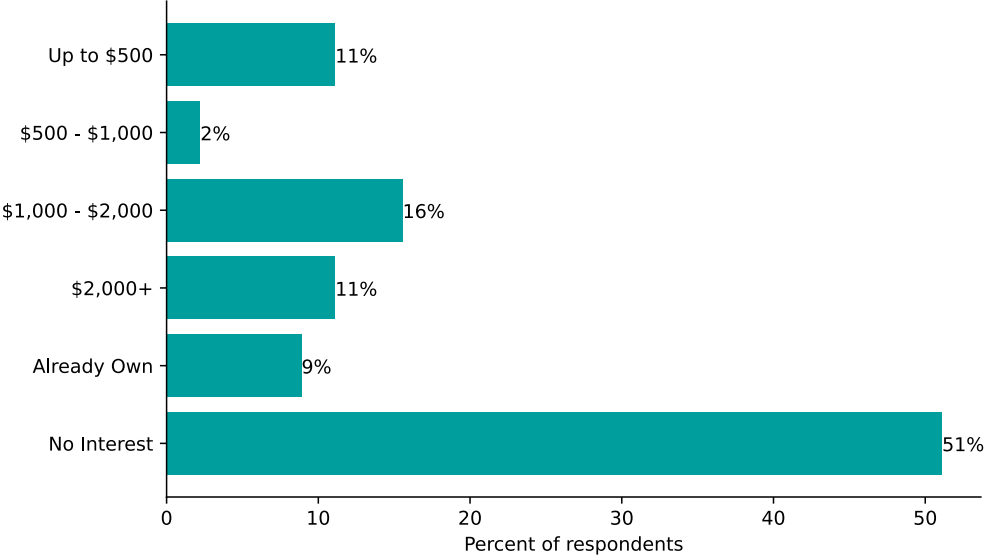
Which facility improvements are most important to you? (N = 17, MOE = +/-24%)



What would you encourage you to bike or to bike more often? (N = 43, MOE = +/-15%)

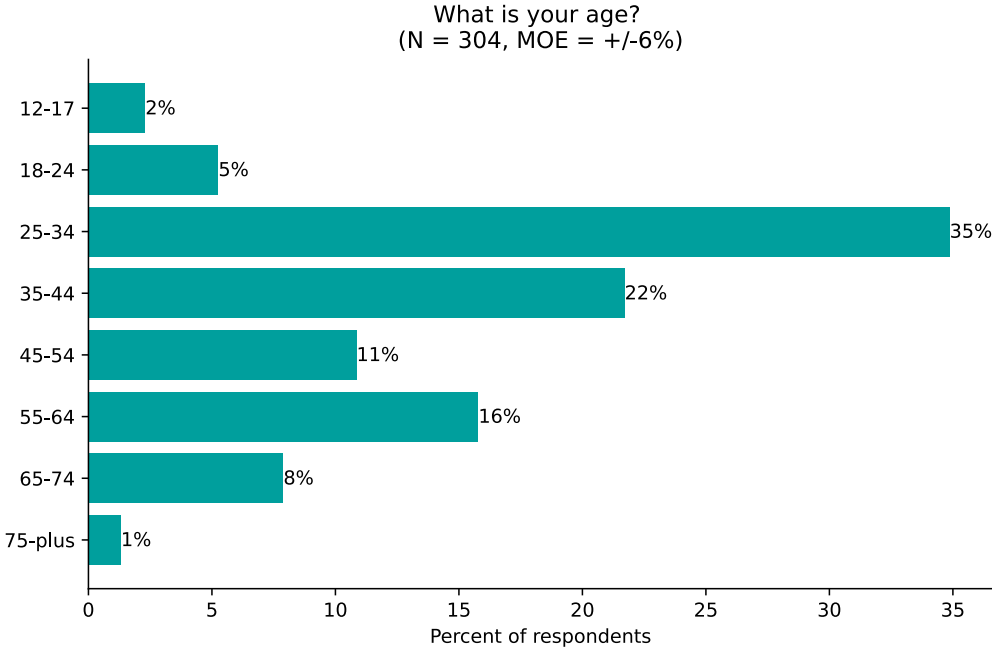
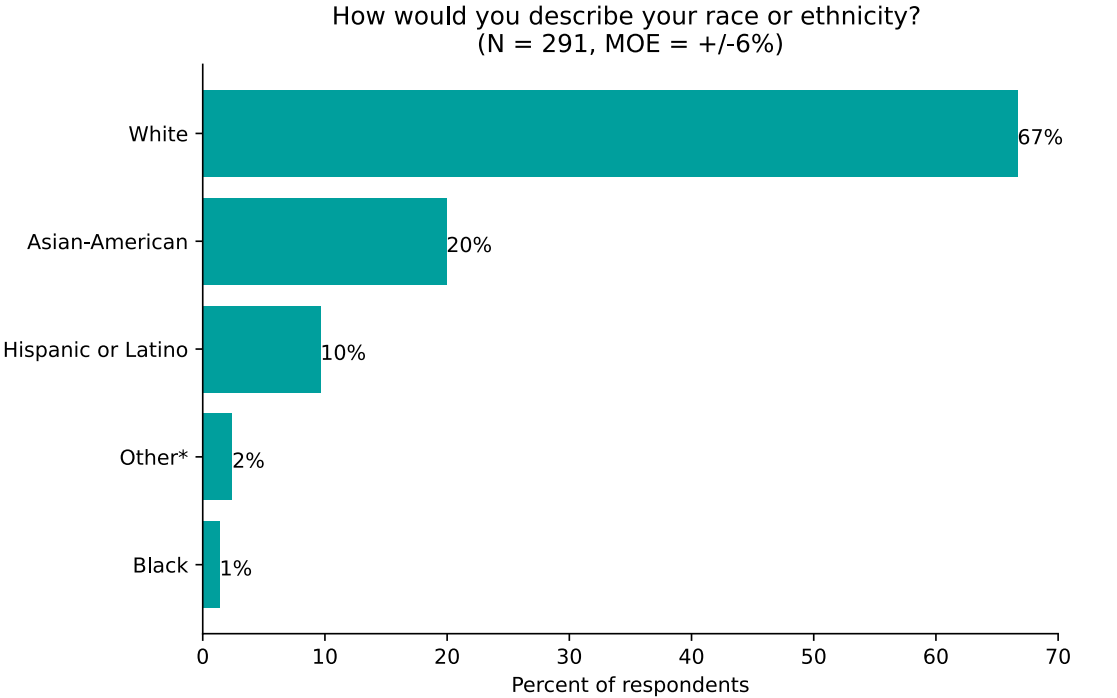


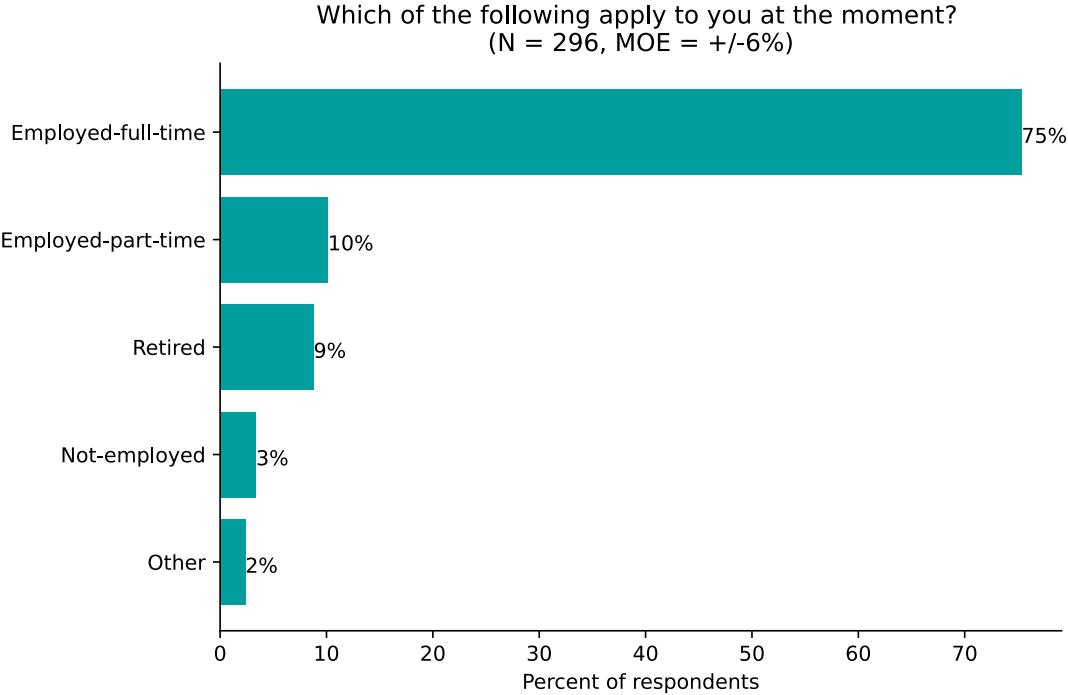
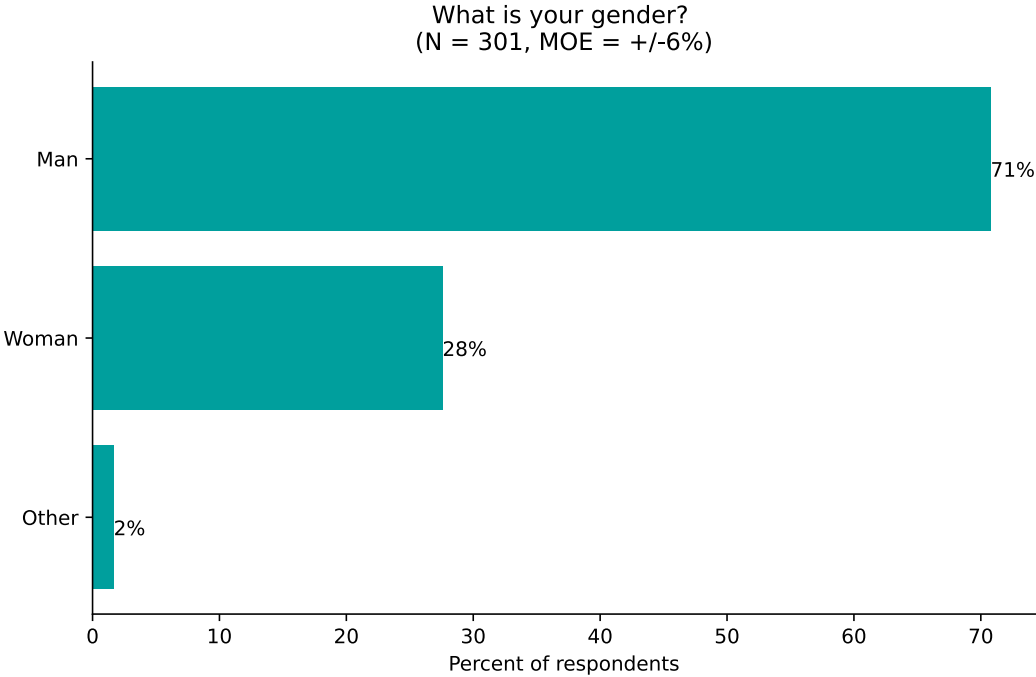
If a rebate or discount on an e-bike would encourage you to bike more often,  
what is the most you would be willing to spend on an e-bike?  
(N = 45, MOE = +/-15%)



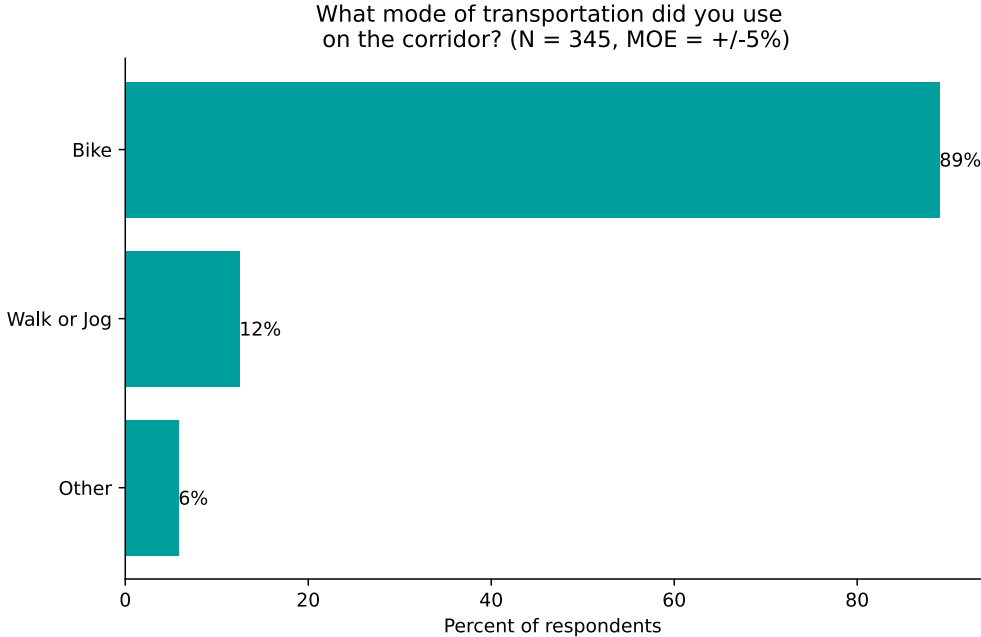
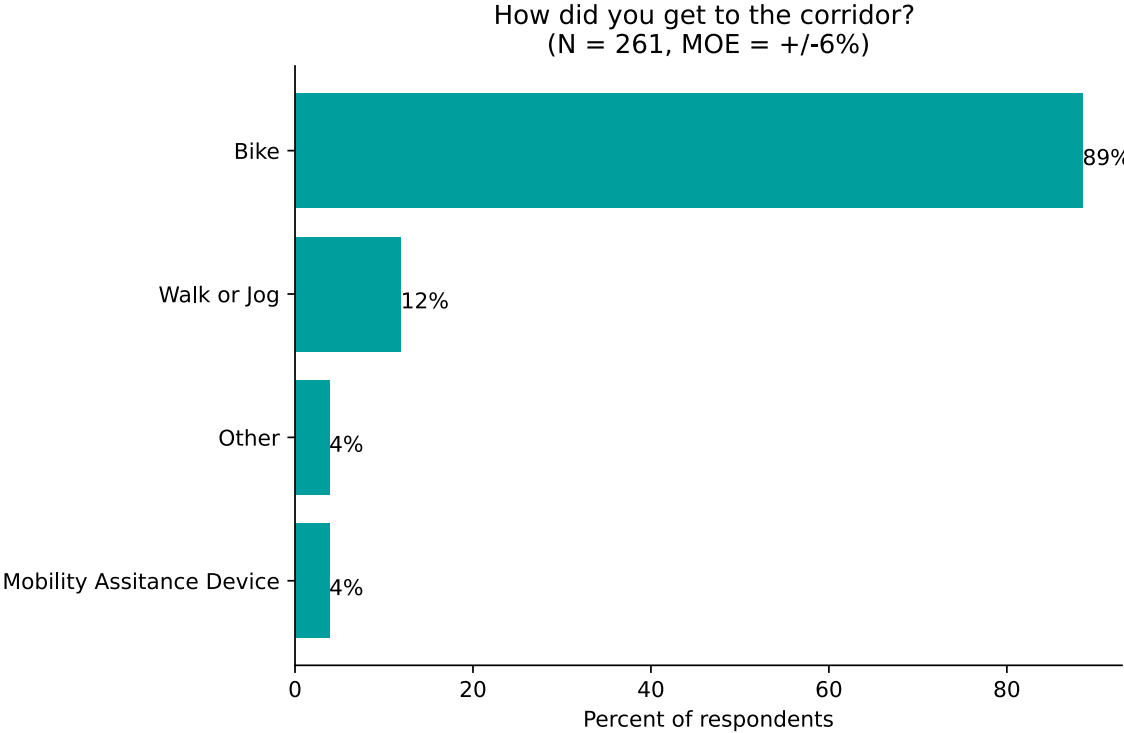
Golden Gate Bridge

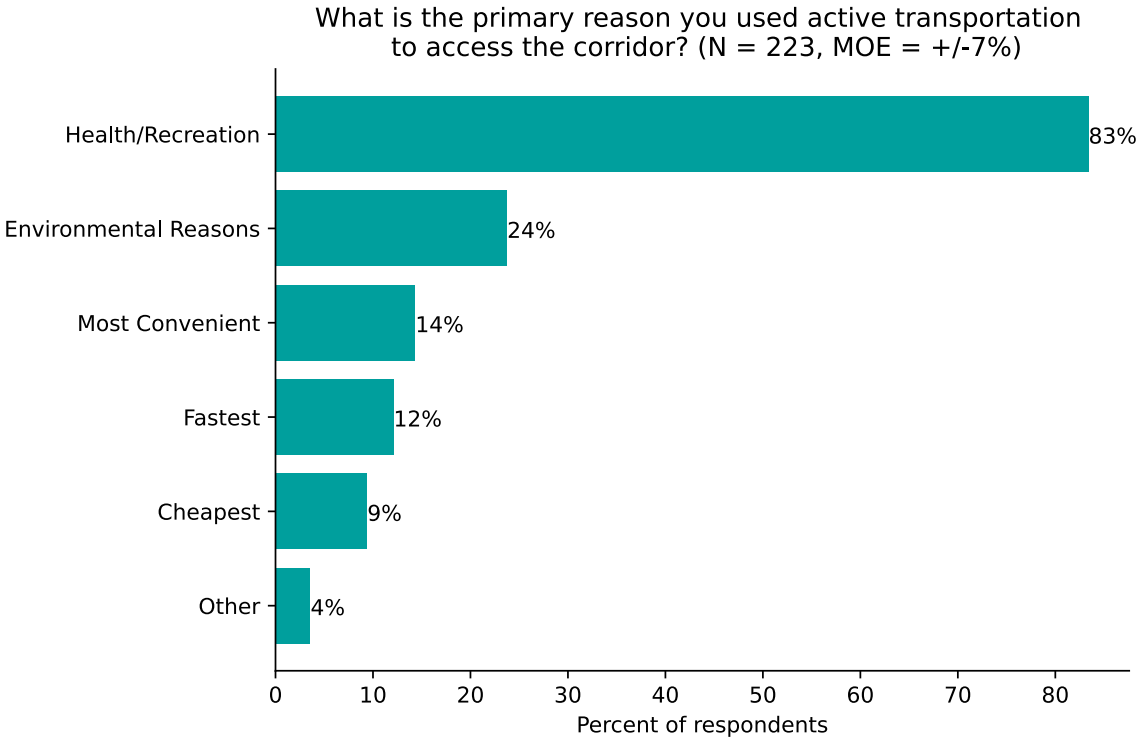
Demographics



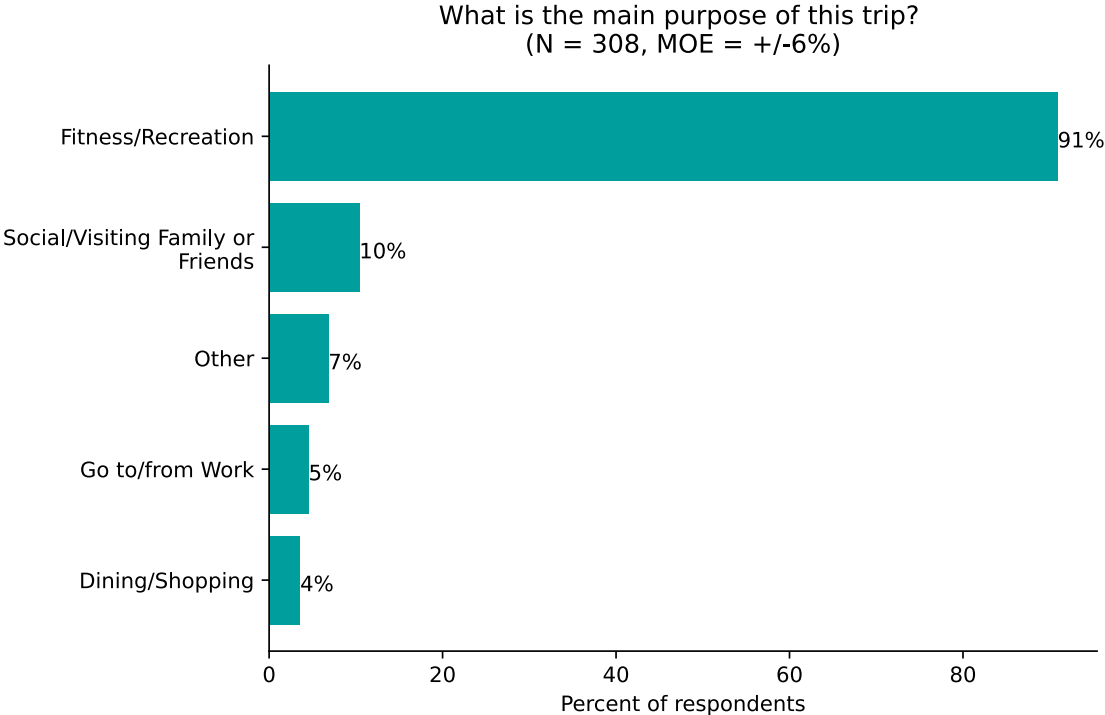


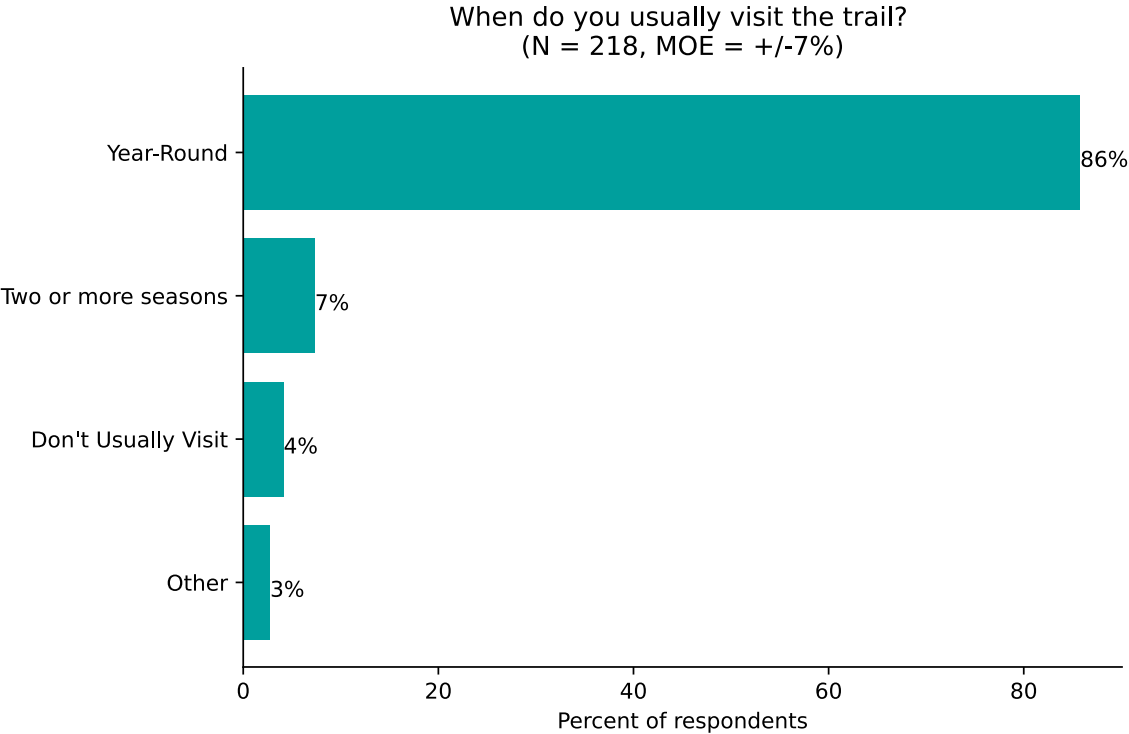
Mode Choice



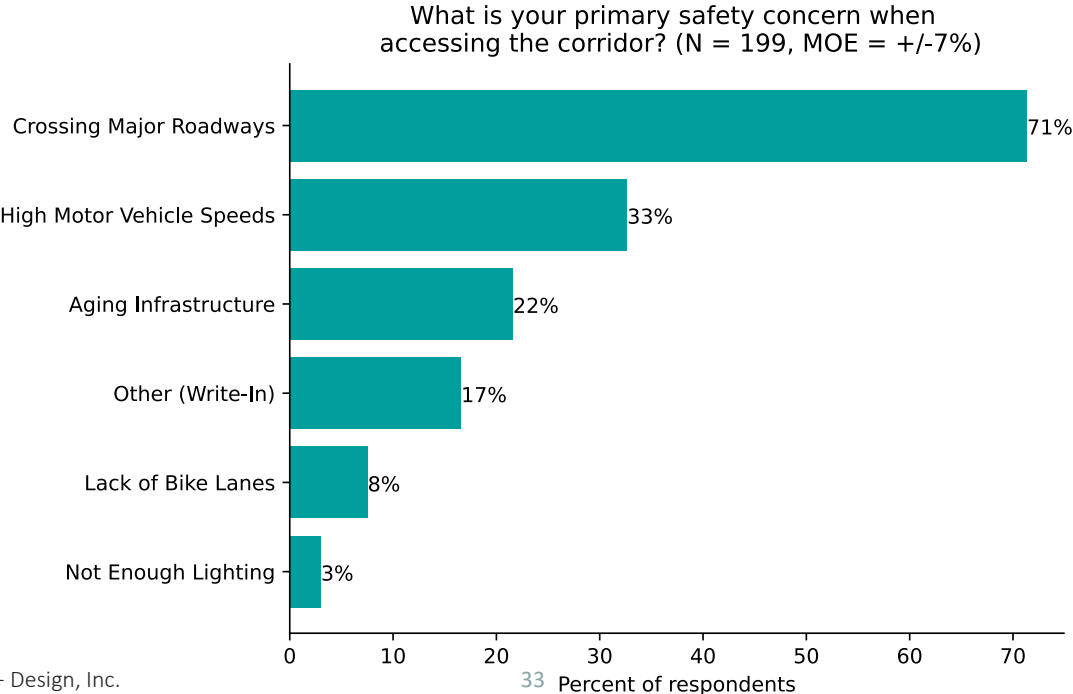


Trail Usage

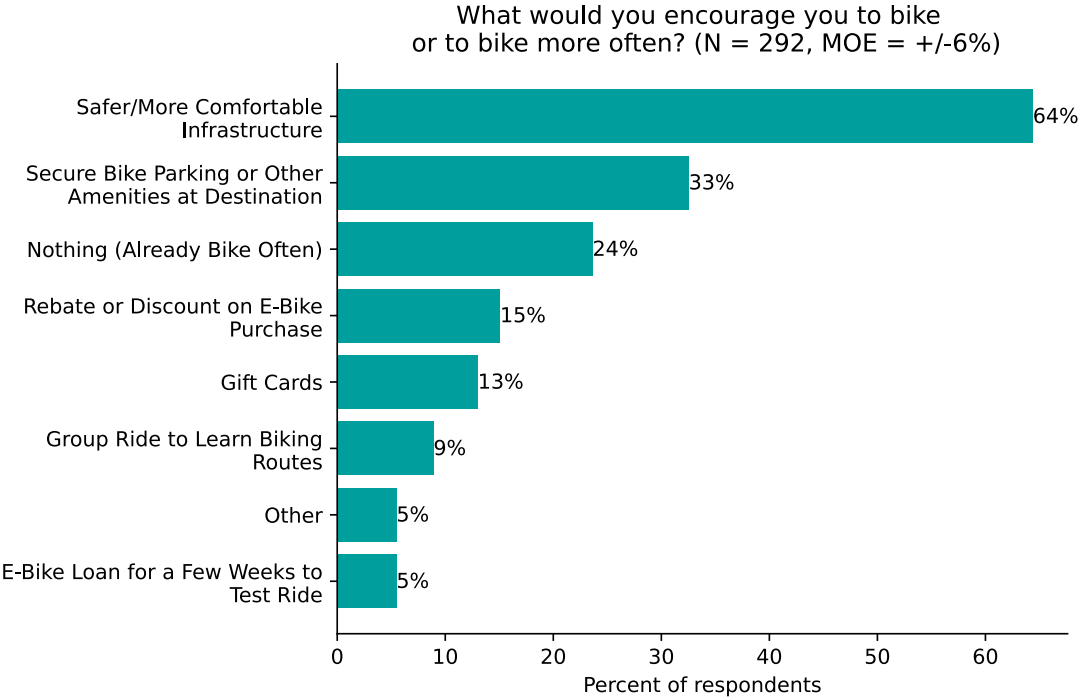
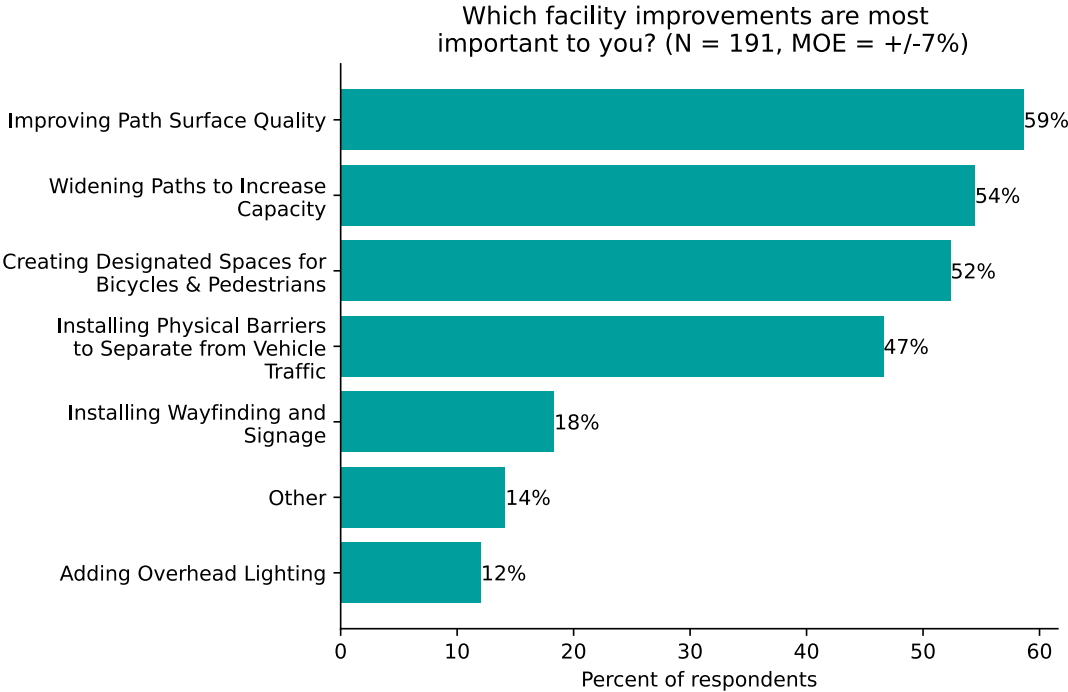




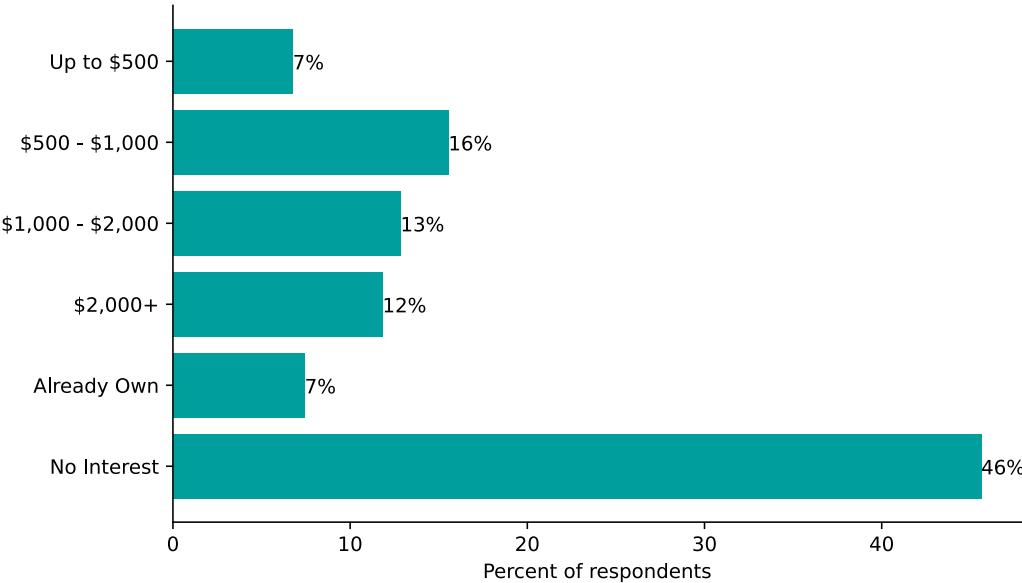
Concerns, Improvements and Motivations





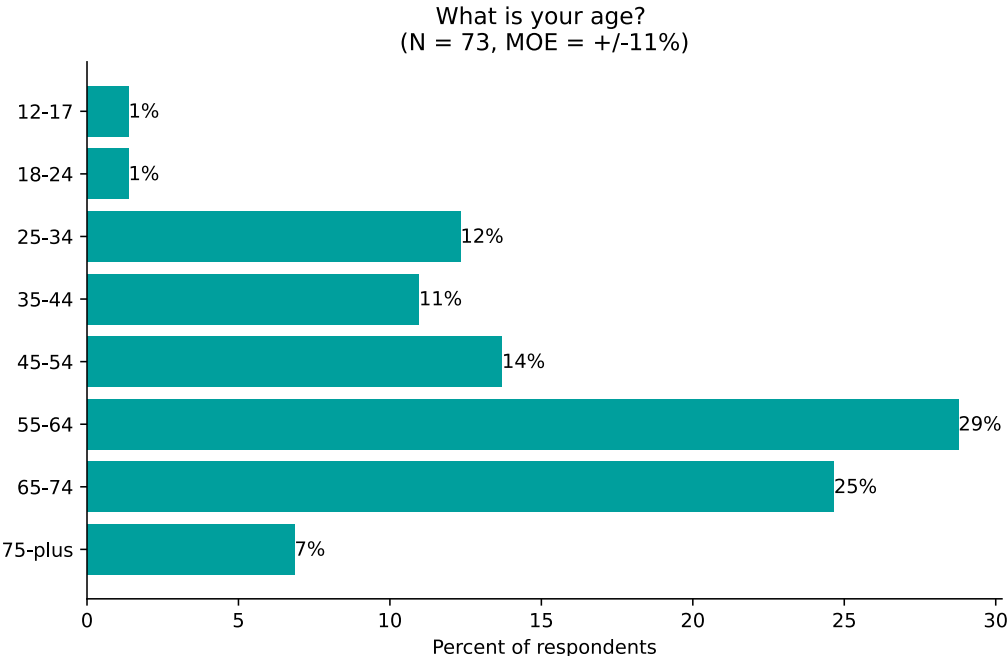
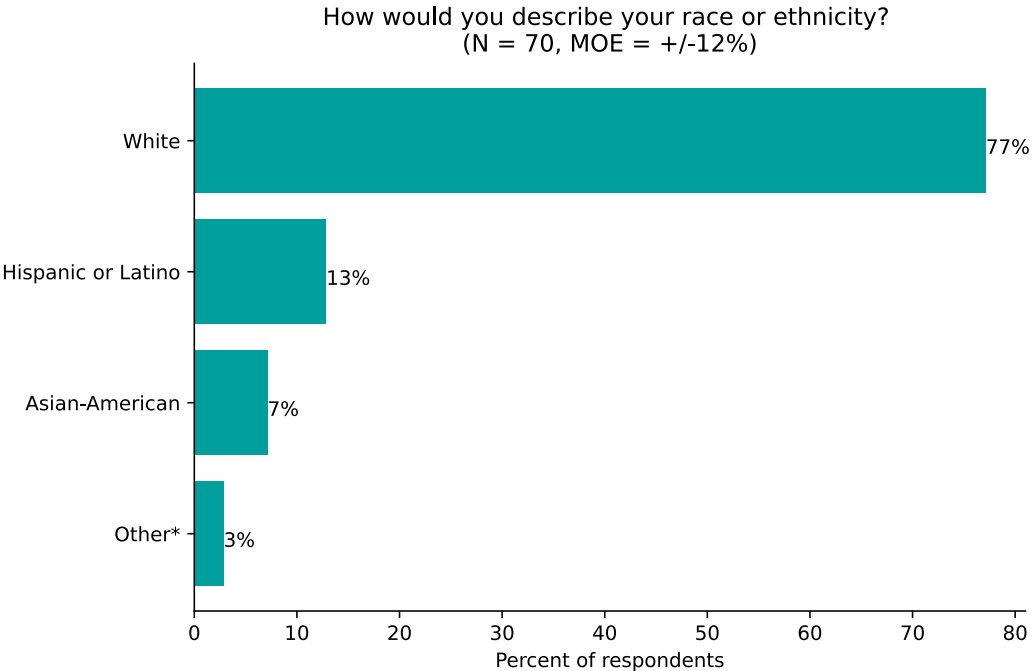


If a rebate or discount on an e-bike would encourage you to bike more often,  
what is the most you would be willing to spend on an e-bike?  
(N = 296, MOE = +/-6%)

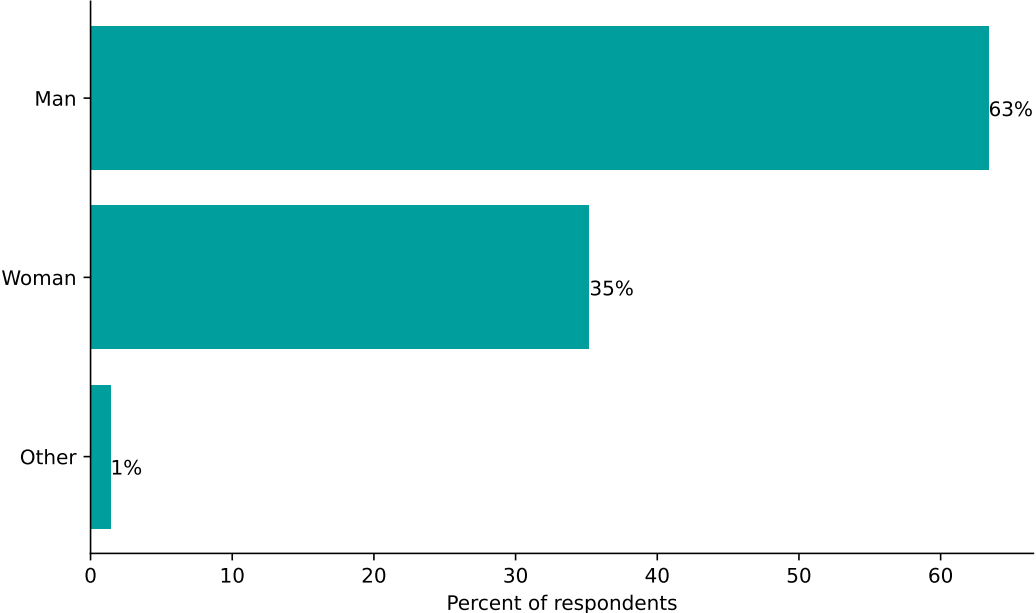


Napa Vine Trail

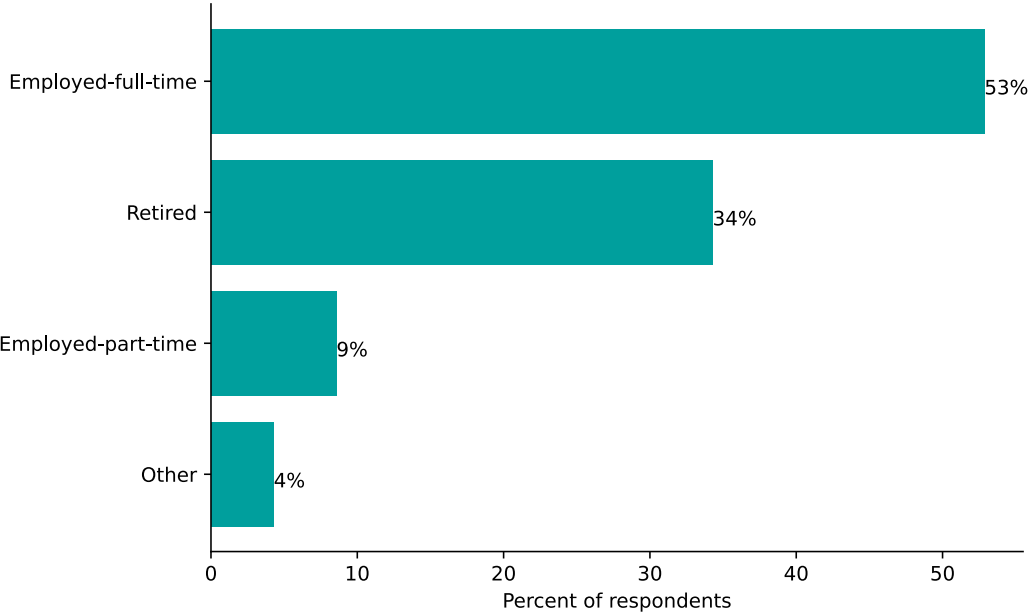
Demographics



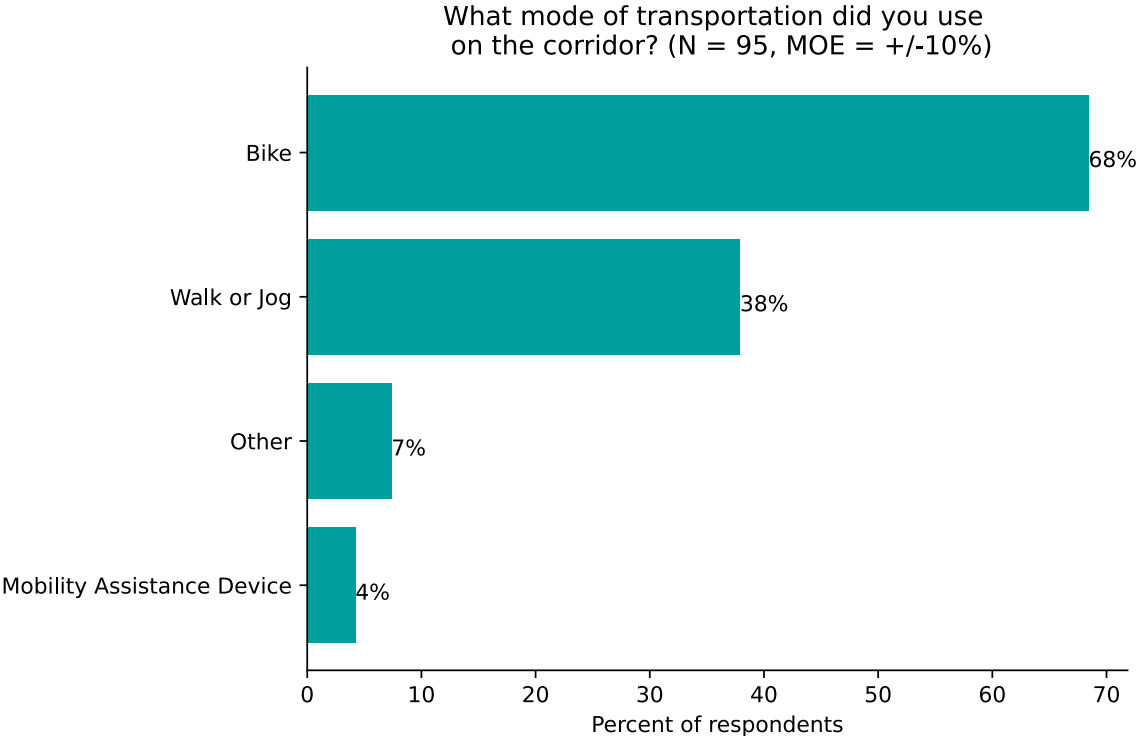
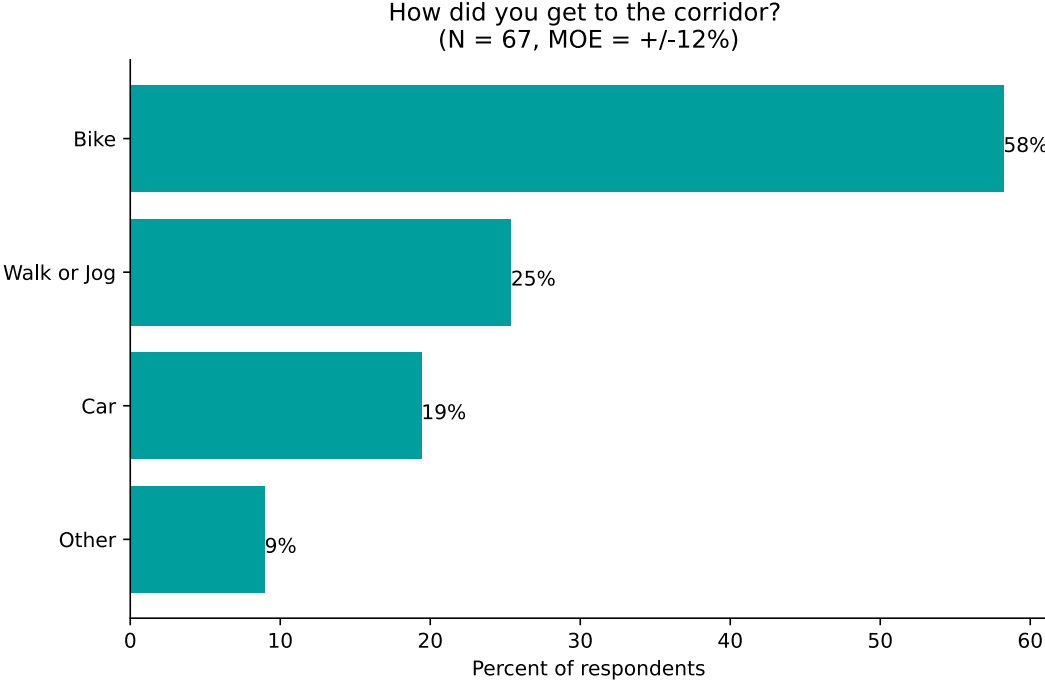
What is your gender?  
(N = 71, MOE = +/-12%)

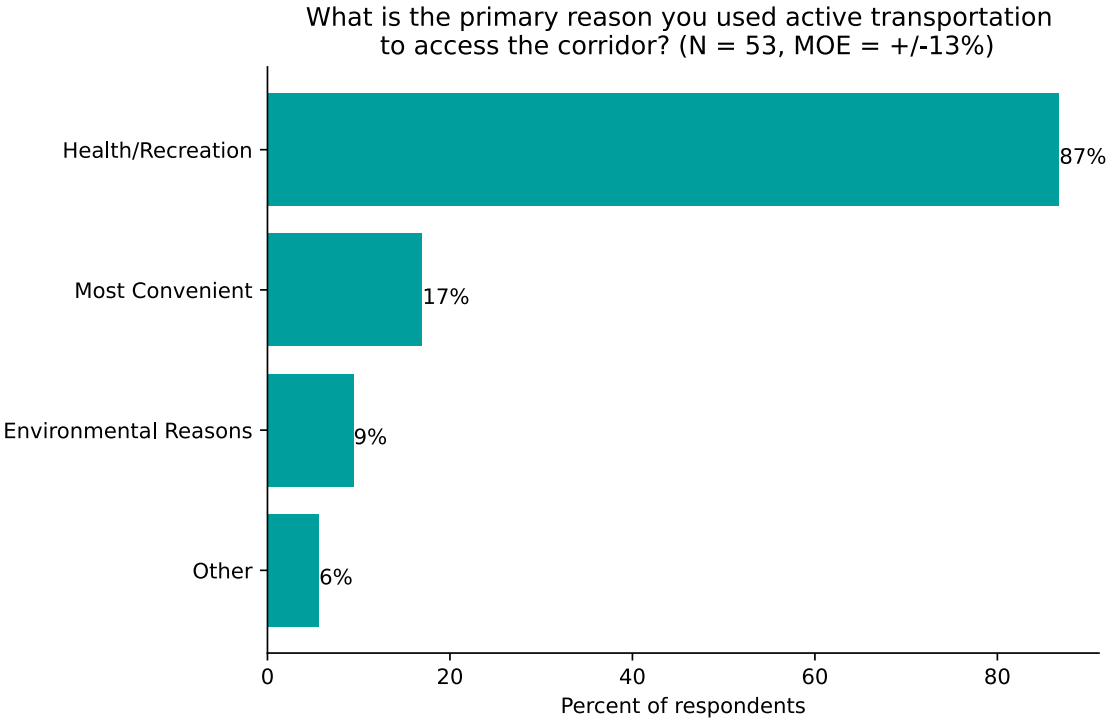


Which of the following apply to you at the moment?  
(N = 70, MOE = +/-12%)

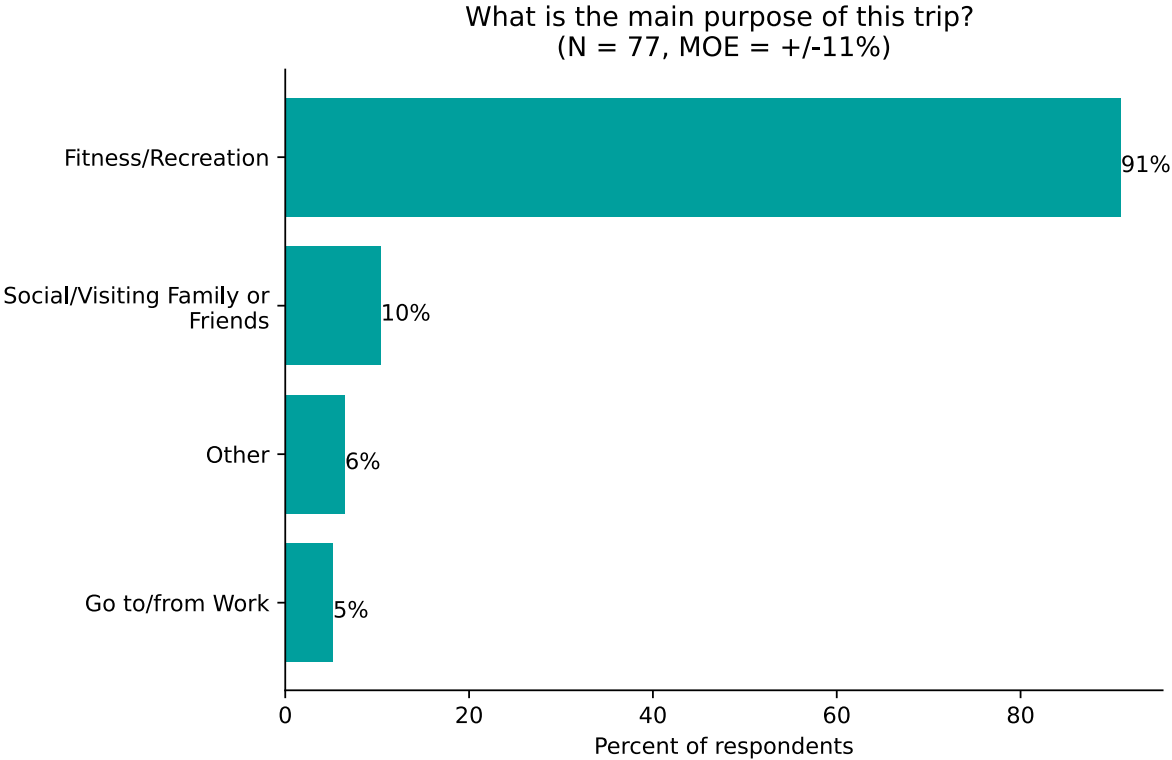


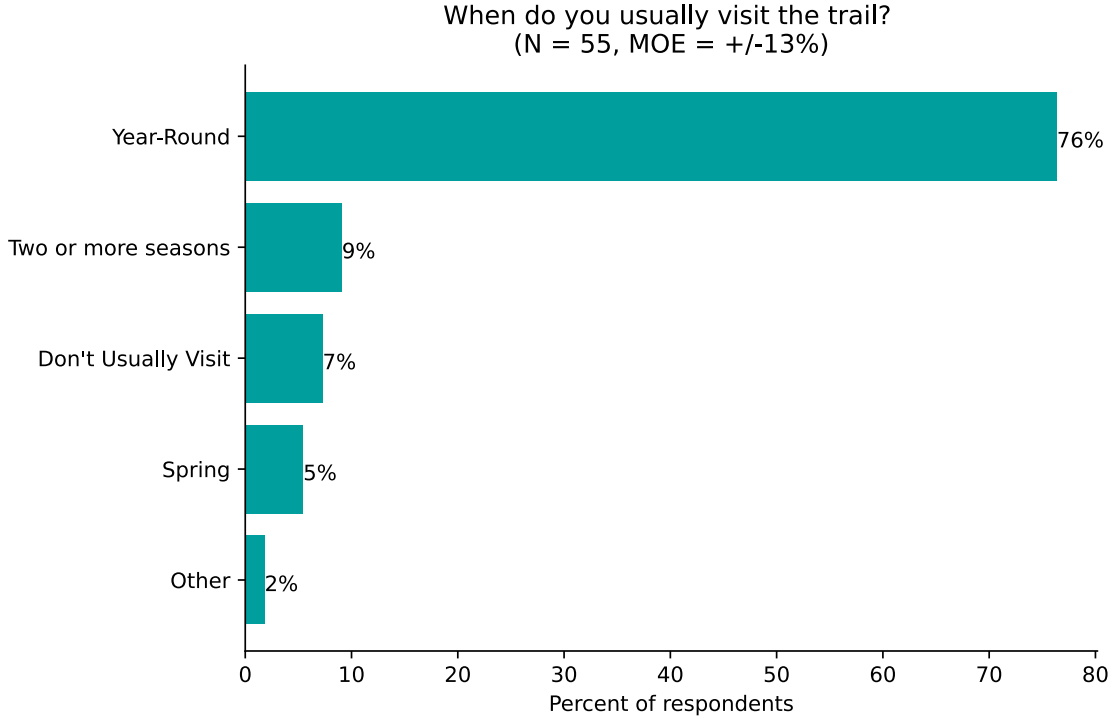
Mode Choice



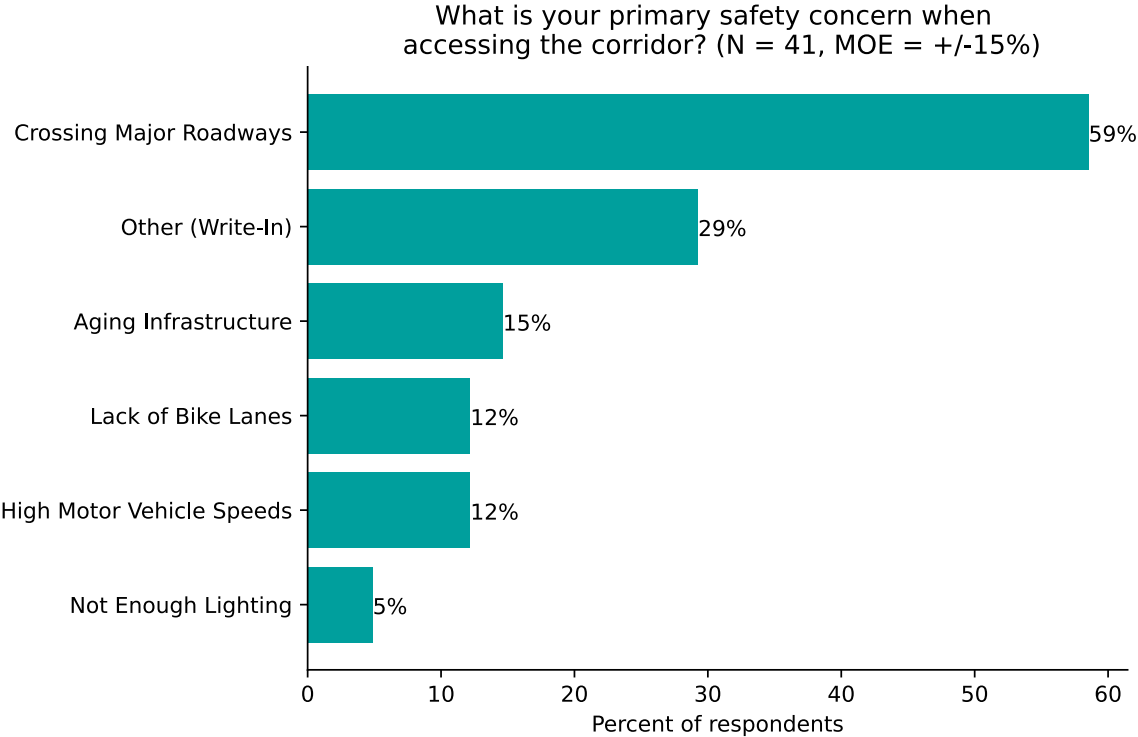


Trail Usage

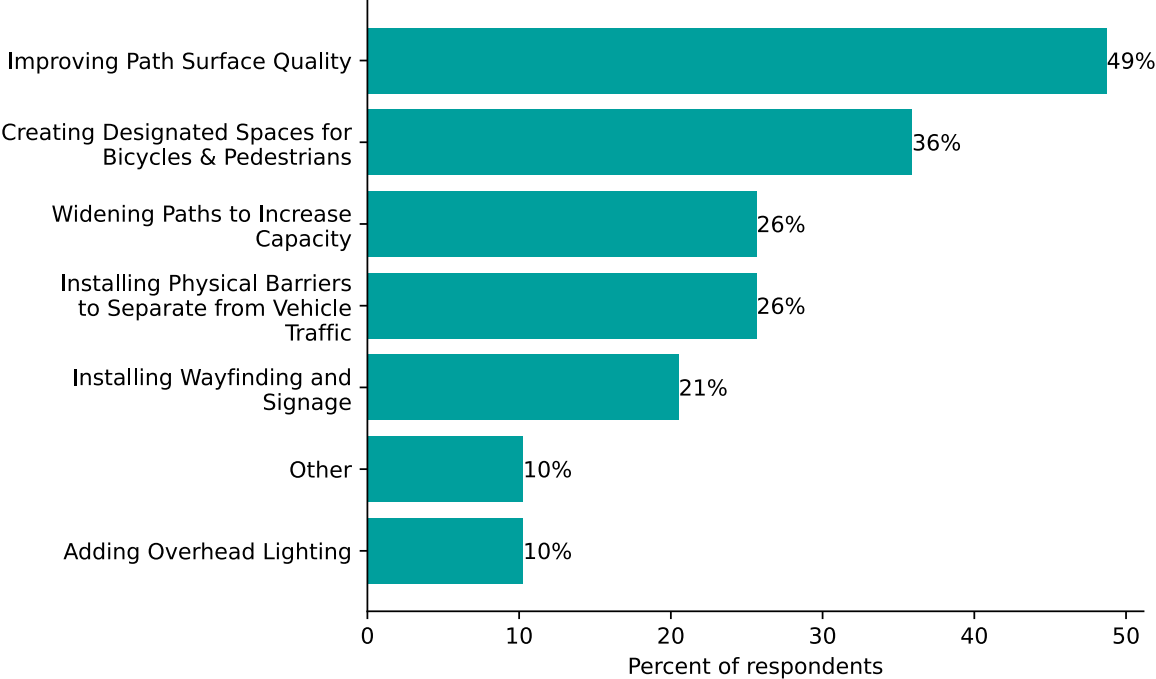




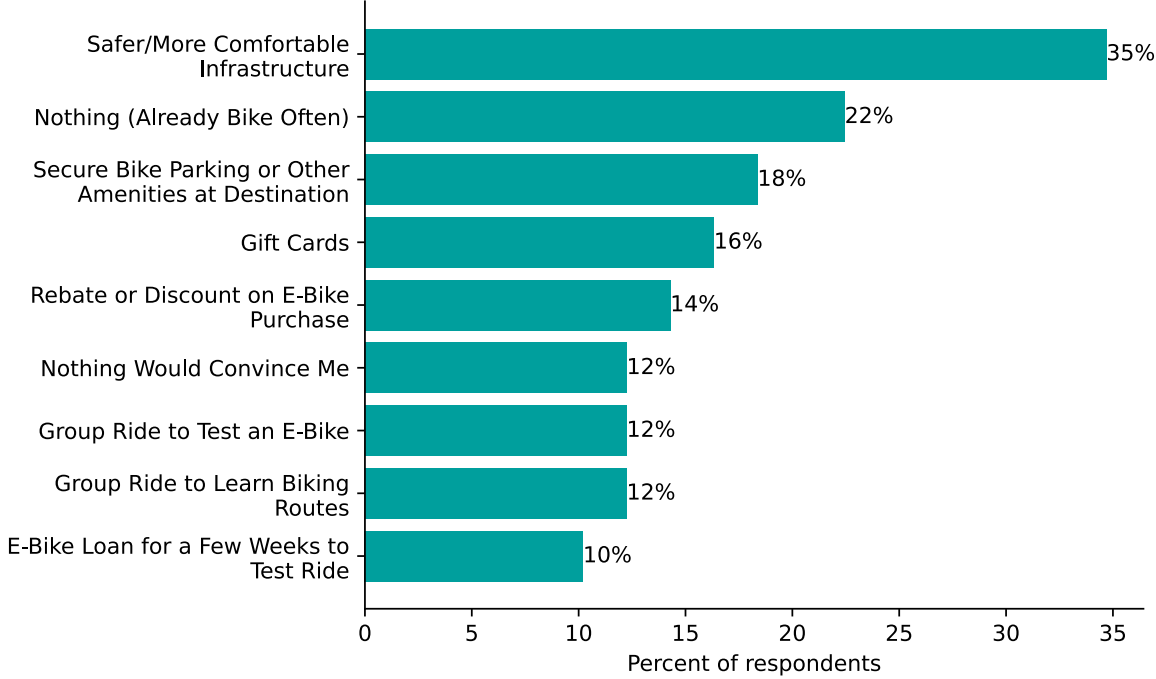
Concerns, Improvements and Motivations



Which facility improvements are most important to you? (N = 39, MOE = +/-16%)

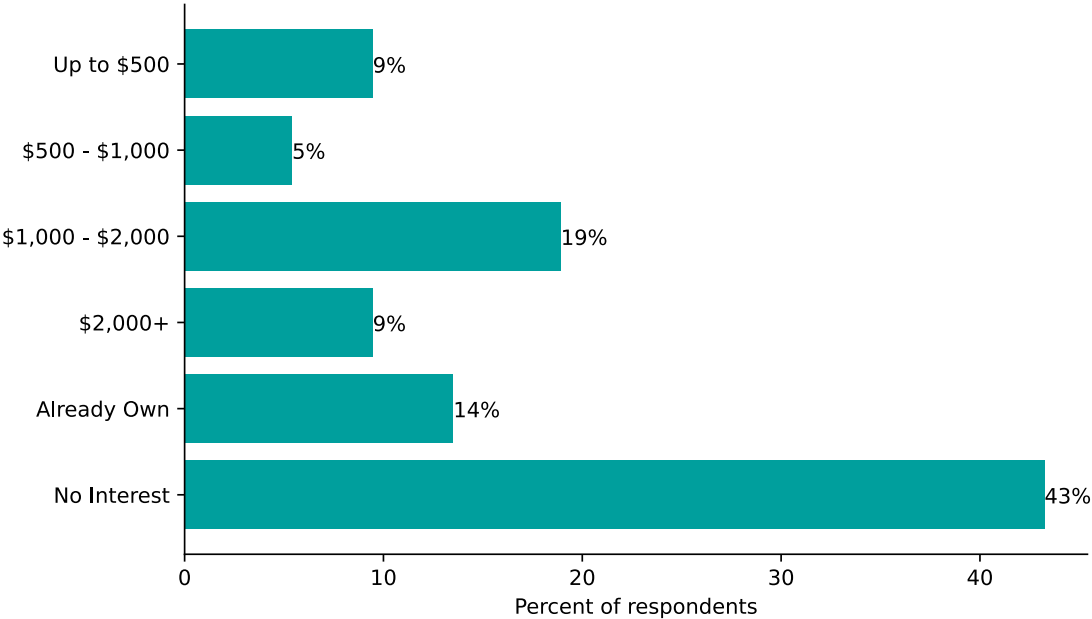


What would you encourage you to bike or to bike more often? (N = 49, MOE = +/-14%)



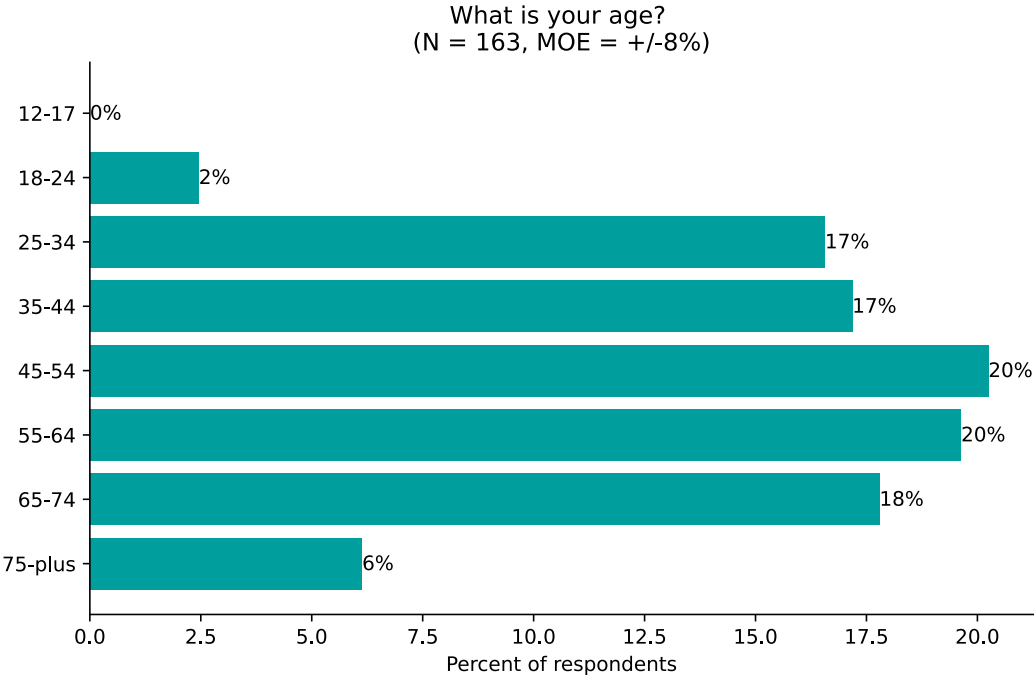
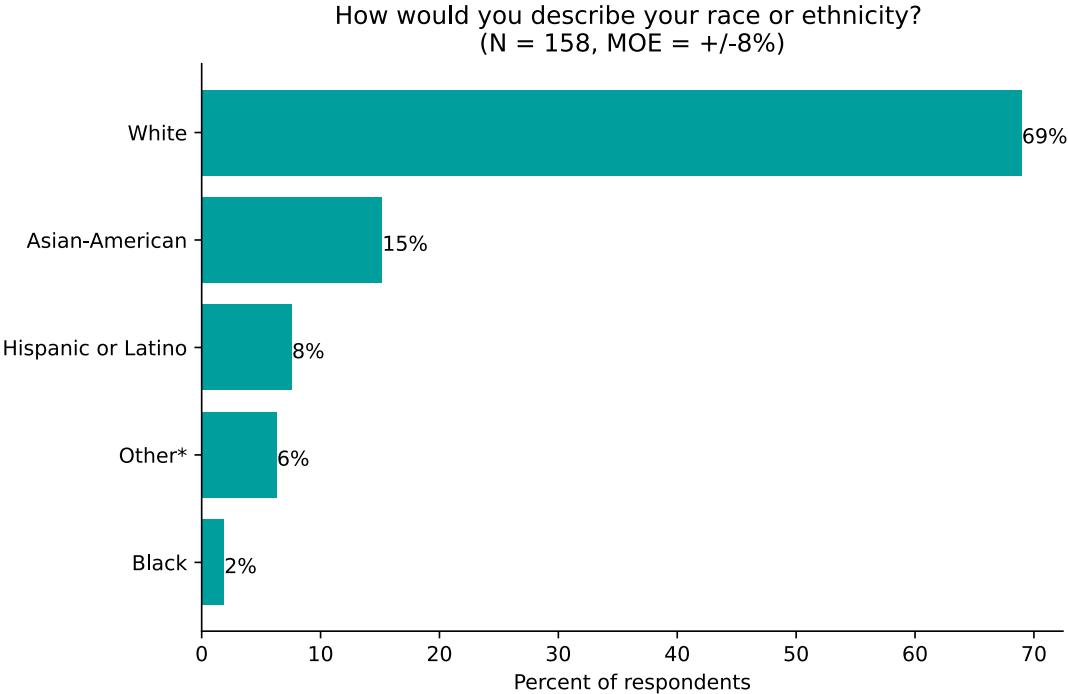


If a rebate or discount on an e-bike would encourage you to bike more often,  
what is the most you would be willing to spend on an e-bike?  
(N = 74, MOE = +/-11%)

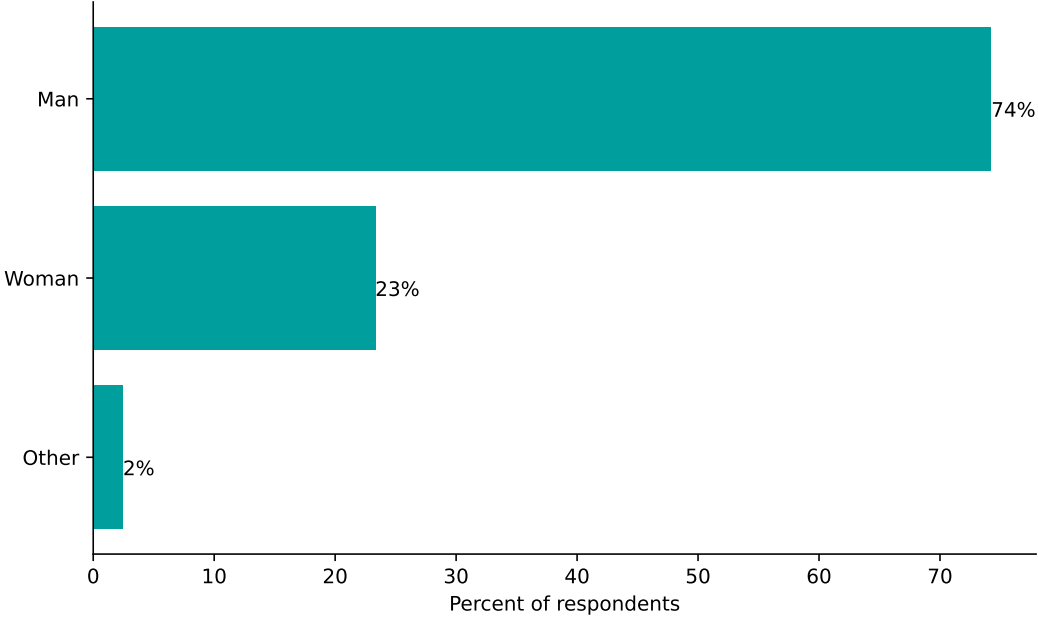


Richmond-San Rafael Bridge

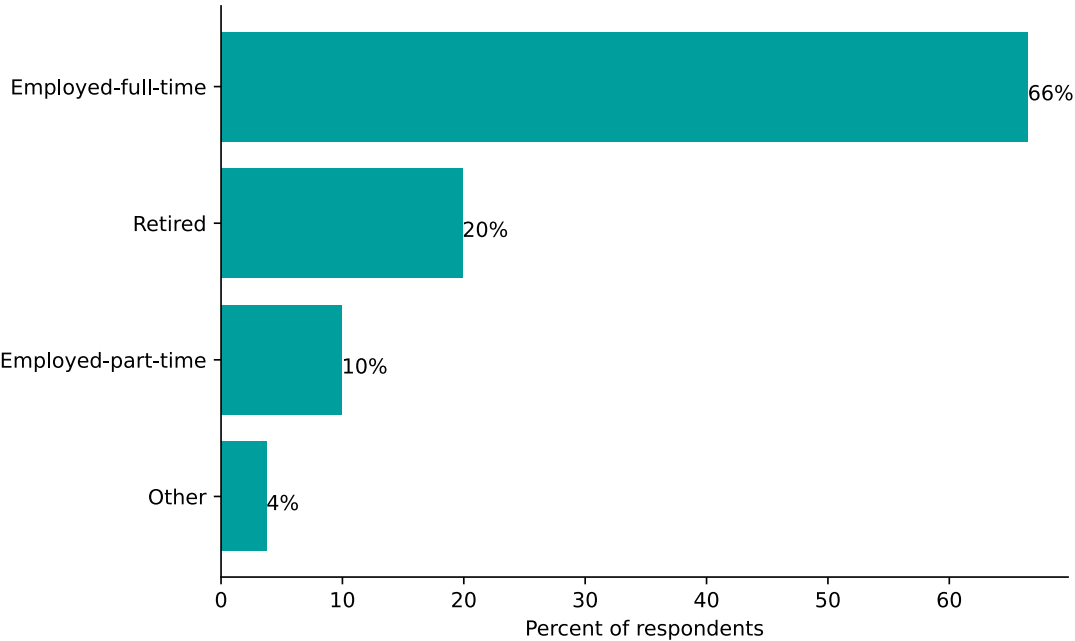
Demographics



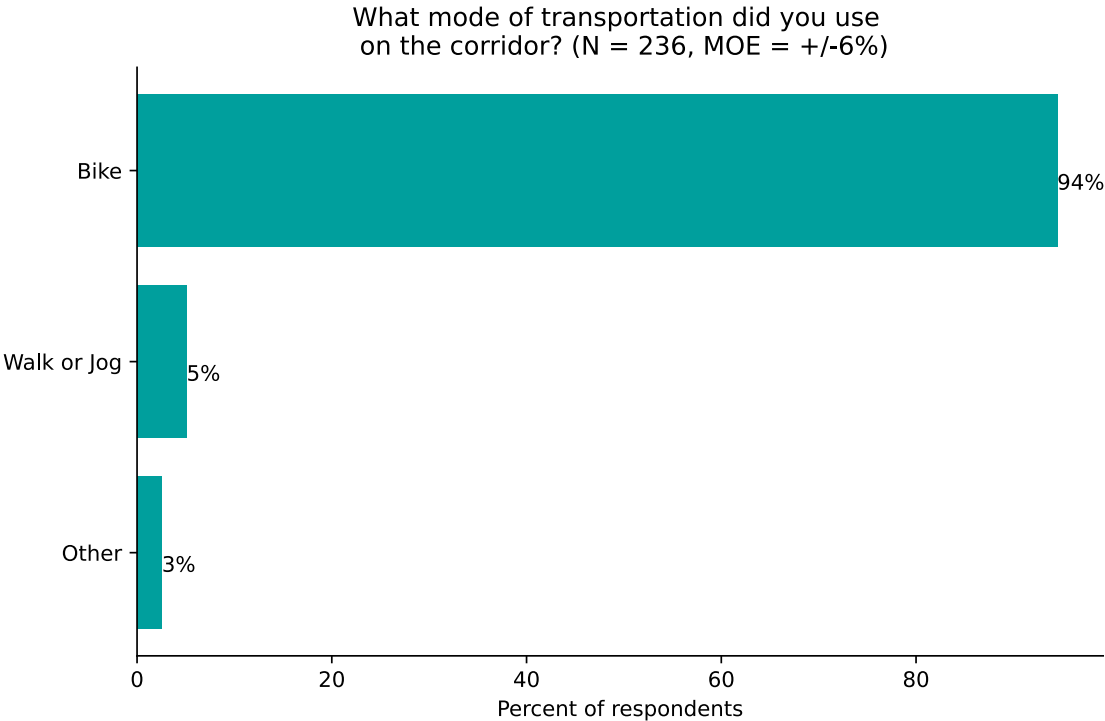
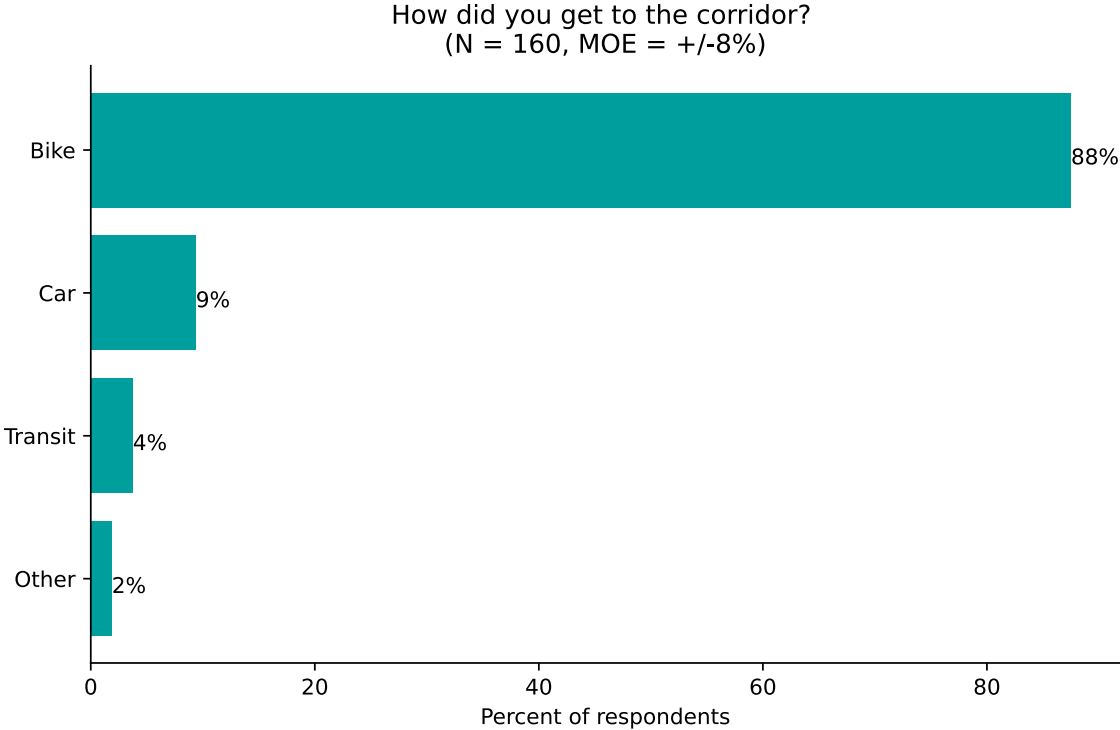
What is your gender?  
(N = 163, MOE = +/-8%)



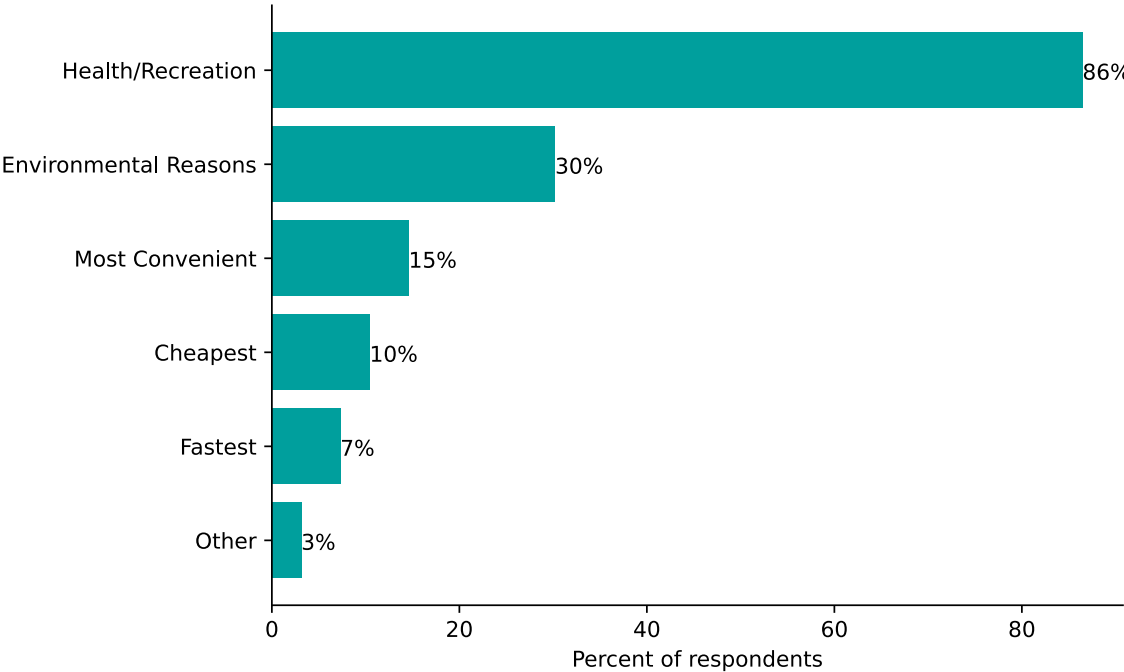
Which of the following apply to you at the moment?  
(N = 161, MOE = +/-8%)



Mode Choice

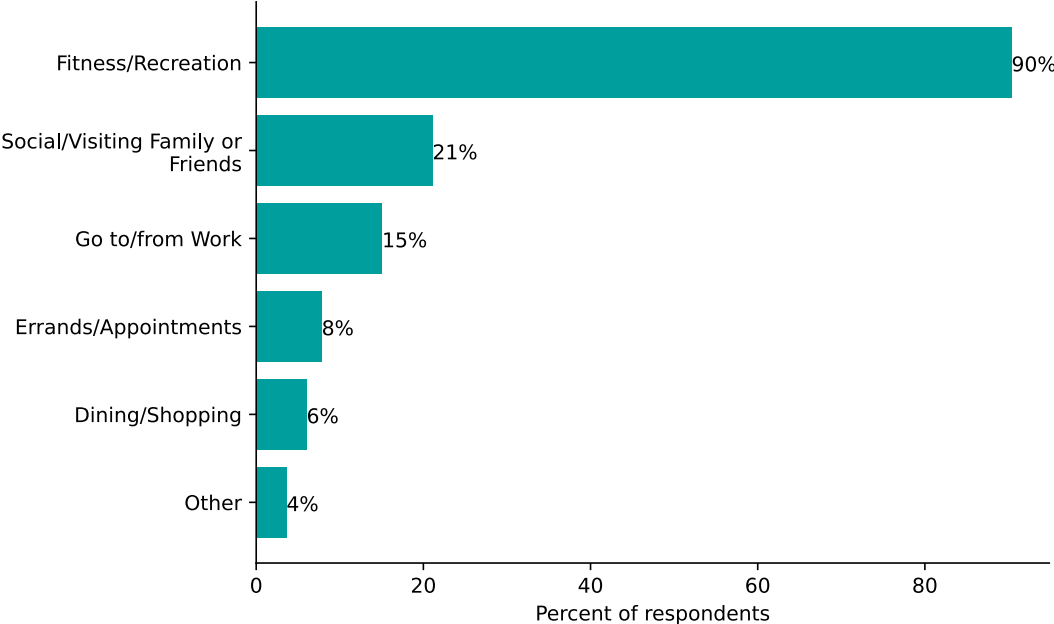


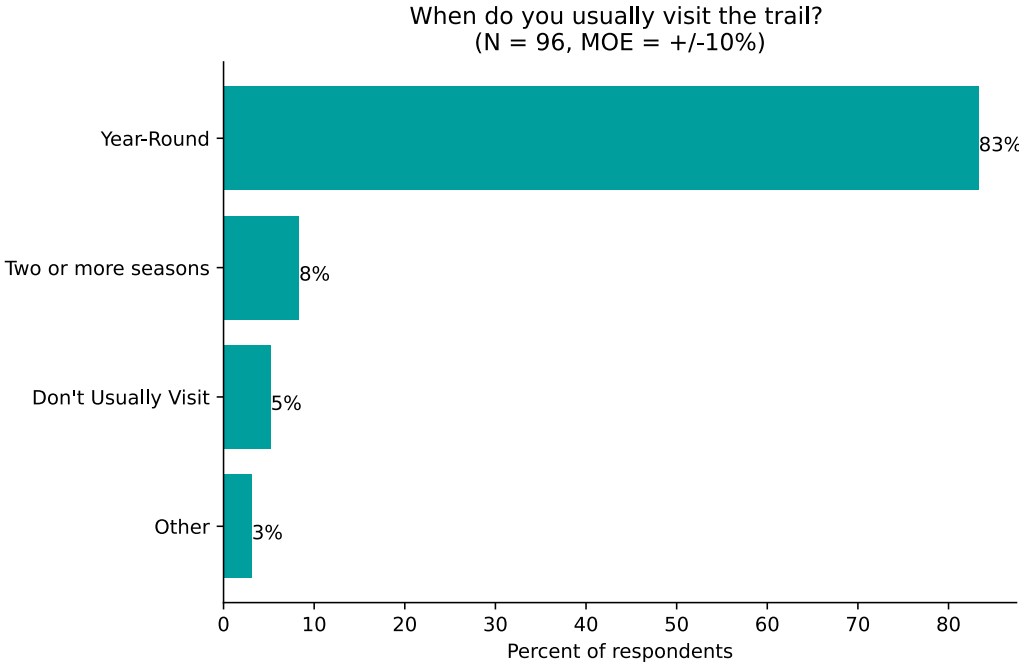
What is the primary reason you used active transportation to access the corridor? (N = 96, MOE = +/-10%)



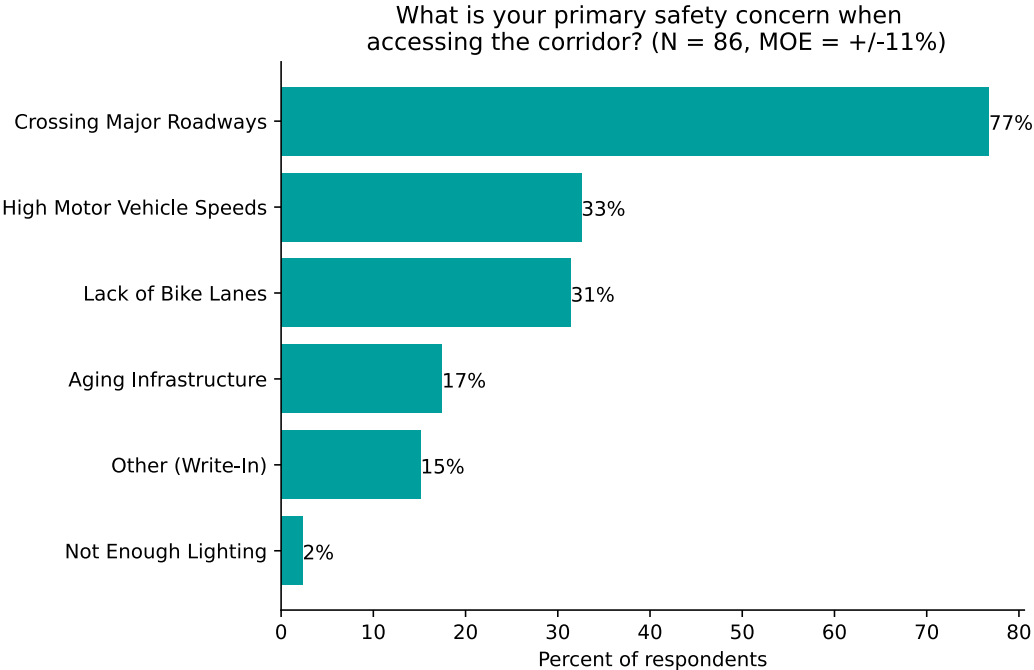
Trail Usage

What is the main purpose of this trip? (N = 166, MOE = +/-8%)

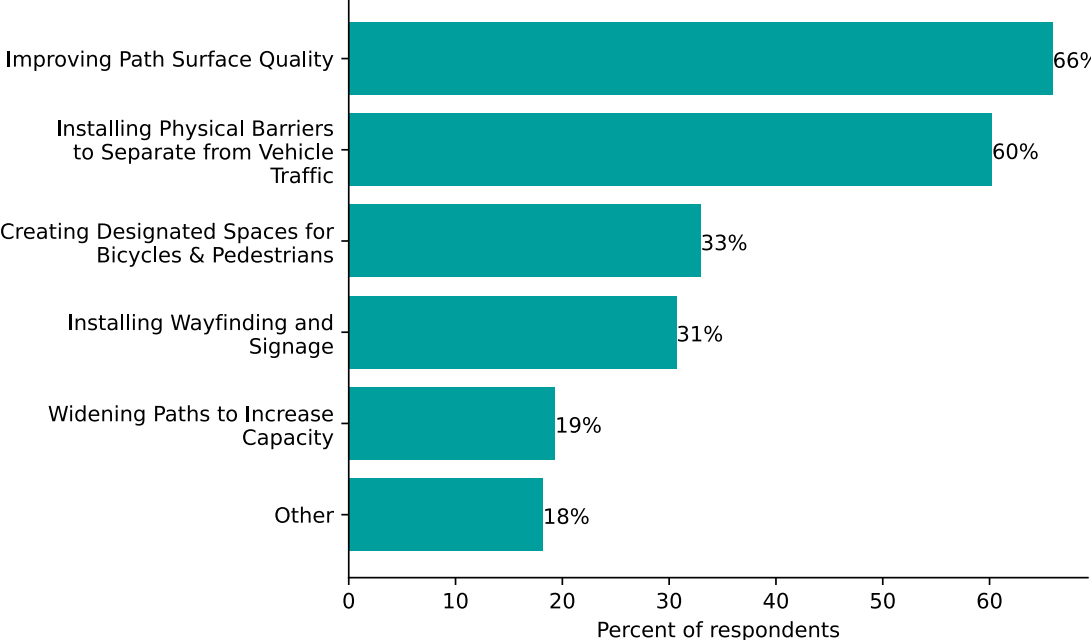




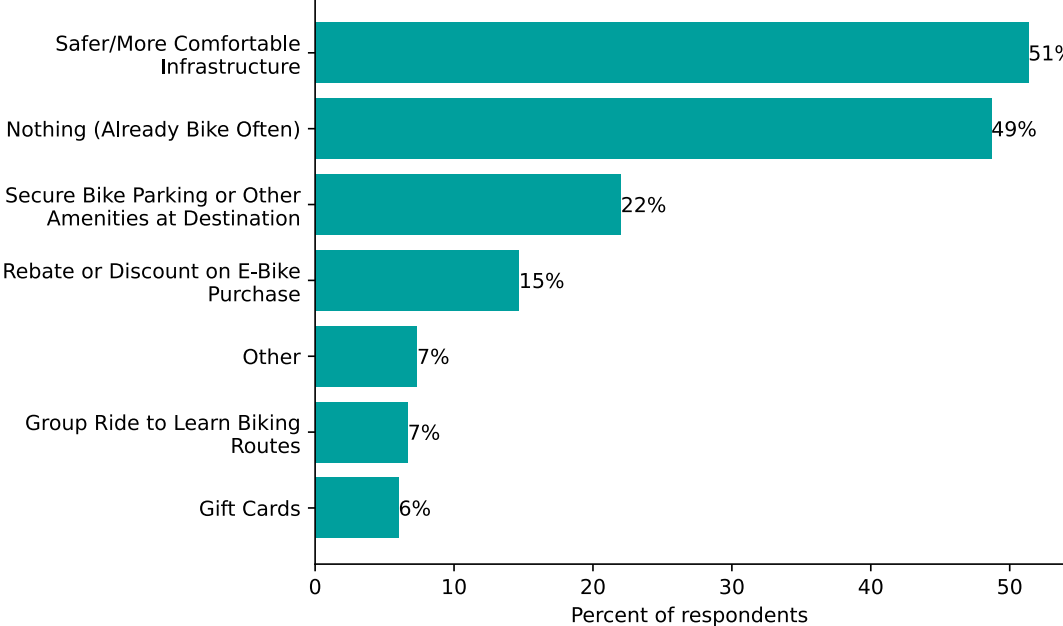
Concerns, Improvements and Motivations



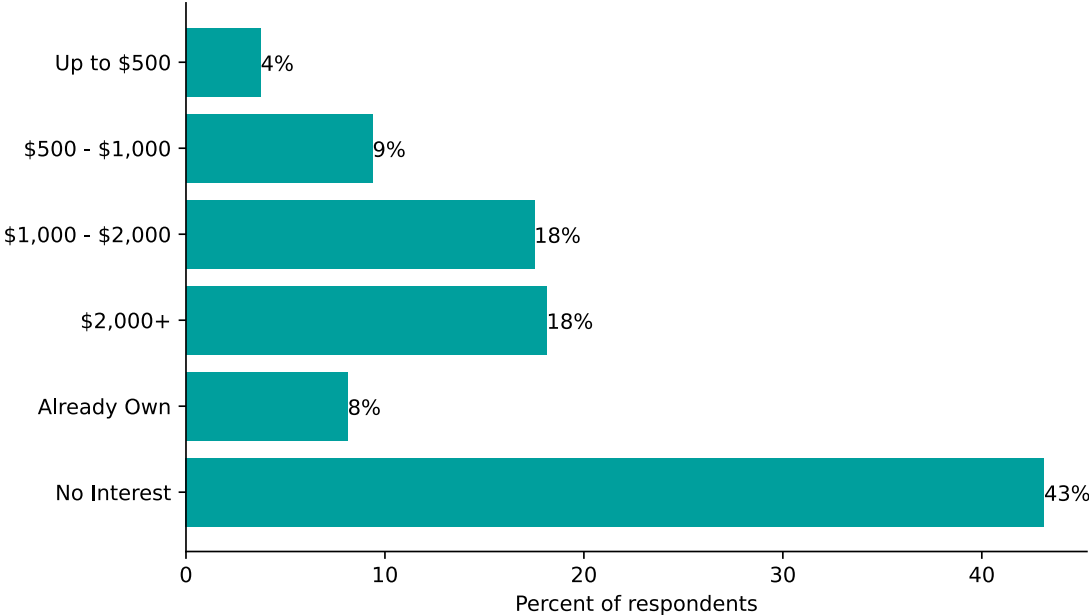
Which facility improvements are most important to you? (N = 88, MOE = +/-10%)




What would you encourage you to bike or to bike more often? (N = 150, MOE = +/-8%)



If a rebate or discount on an e-bike would encourage you to bike more often, what is the most you would be willing to spend on an e-bike?  
(N = 160, MOE = +/-8%)







# APPENDIX E: ORIGIN- DESTINATION NETWORK ANALYSIS

To: MTC

From: Grace Young, David Wasserman, Jeff Knowles, Alta Planning & Design

Date: October 31, 2022

Re: Origin-Destination Survey Network Analysis

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## Origin-Destination Survey Network Analysis

As part of the public survey, Alta collected information on the origin and destination of trips made by trail users on the Golden Gate Bridge, Dumbarton Bridge, Richmond-San Rafael Bridge, and Napa Valley Vine Trails. This data helps to understand the feeder routes that trail users follow to access the four trails of interest. The surveying apparatus was designed to allow respondents to draw their route along the network, but many users experienced difficulty operating the survey collection devices and much of the provided routing information had to be discarded. The user-reported trip origins and destinations were preserved, however.

To supplement the data received, the project team created a network based on OpenStreetMap data and cross-checked it with MTC bicycle network data. Using this GIS-based network, the team then calculated routes between the provided origins and destinations for two criteria:

- **Shortest path** routes estimated travel routes for active transportation users by calculating the path with the shortest network travel time.
- **Comfortable path (LTS-adjusted)** routes avoided roads with high levels of traffic stress (LTS) or, if unavoidable, calculated the route travel time based on the assumption that bicyclists would walk along high-stress roads. High LTS is defined as LTS 3 or 4.

Road segments identified through the comfortable path analysis as unavoidable high LTS corridors are reasonable considerations for infrastructure improvements to close the gaps on existing comfortable path feeder routes. Frequently, however, comfortable path routes are considerably more circuitous than the shortest path, as active mode users must go out of their way to find comfortable facilities to travel on. Providing infrastructure improvements to high LTS segments on the shortest path routes would create more direct, comfortable connections to bridge paths and trails.<sup>1</sup> Roadway grades were not considered when calculating shortest path or comfortable path.

The following memorandum describes the methods used to identify potential locations for infrastructure improvements along trail access feeder routes.

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<sup>1</sup> Chester Harvey, Kevin Fang, and Daniel Rodriguez, "Evaluating Alternative Measures of Bicycling Level of Traffic Stress Using Crowdsourced Route Satisfaction Data" (San Jose, CA: Mineta Transportation Institute, 2019).

### Collected Survey Responses

There were 764 collected trip routes from the online survey, about three-fourths of which were invalid due to failures in the survey collection apparatus. Only the Golden Gate and Richmond-San Rafael Bridge trails had a suitable sample size for analyzing patterns from user-drawn trip routes. The maps of raw collected survey results are shown for each respective study corridor in **Figures 1** through **4**.

Figure 1. Raw Survey Reported Trip Routes for the Golden Gate Bridge Trail.



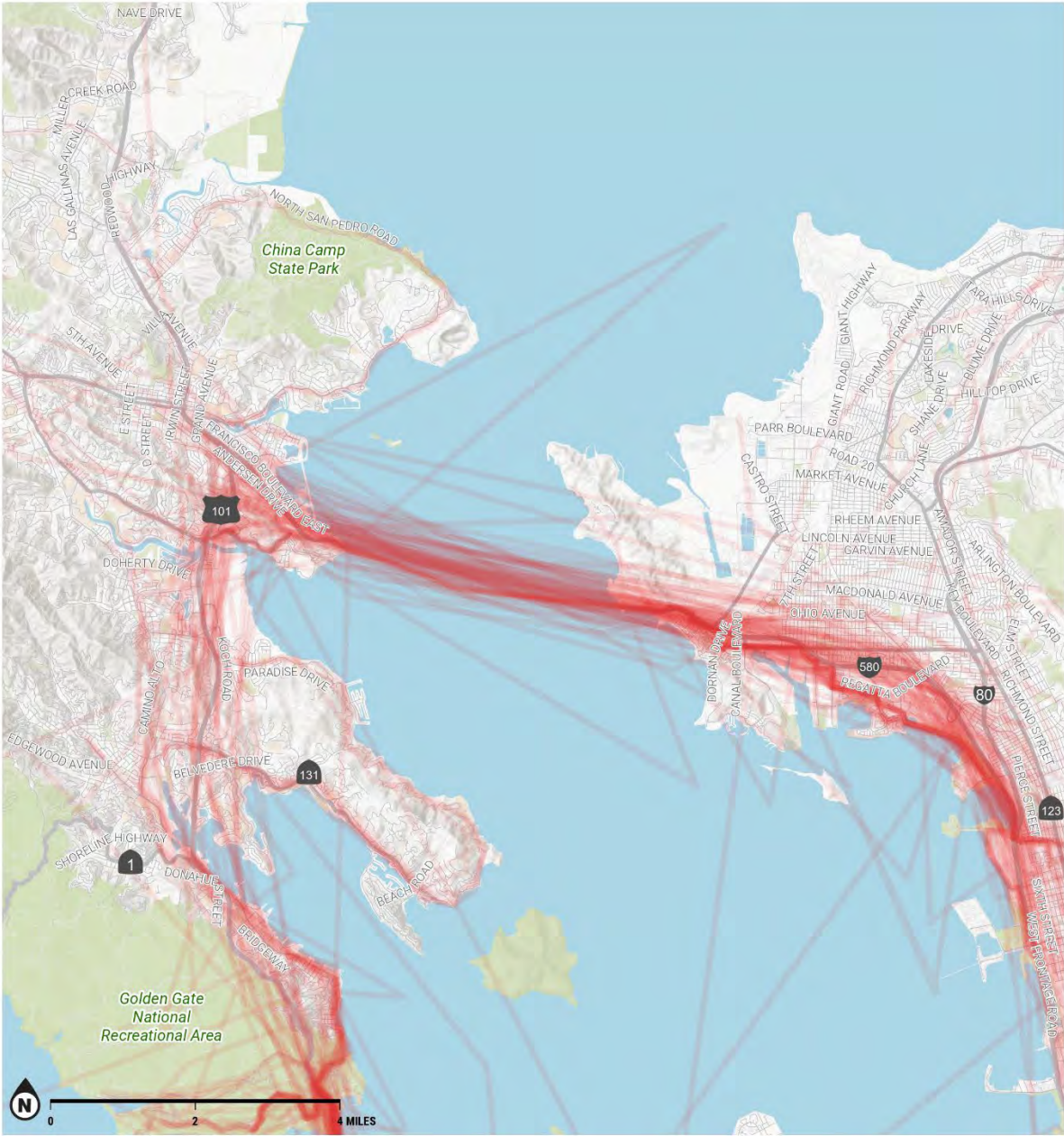
**RAW SURVEY ROUTE RESPONSES**

MTC ORIGIN-DESTINATION STUDY  
GOLDEN GATE BRIDGE



REPORTED SURVEY ROUTE  
— Raw Survey Route

Figure 2. Raw Survey Reported Trip Routes for the Richmond-San Rafael Bridge Trail.

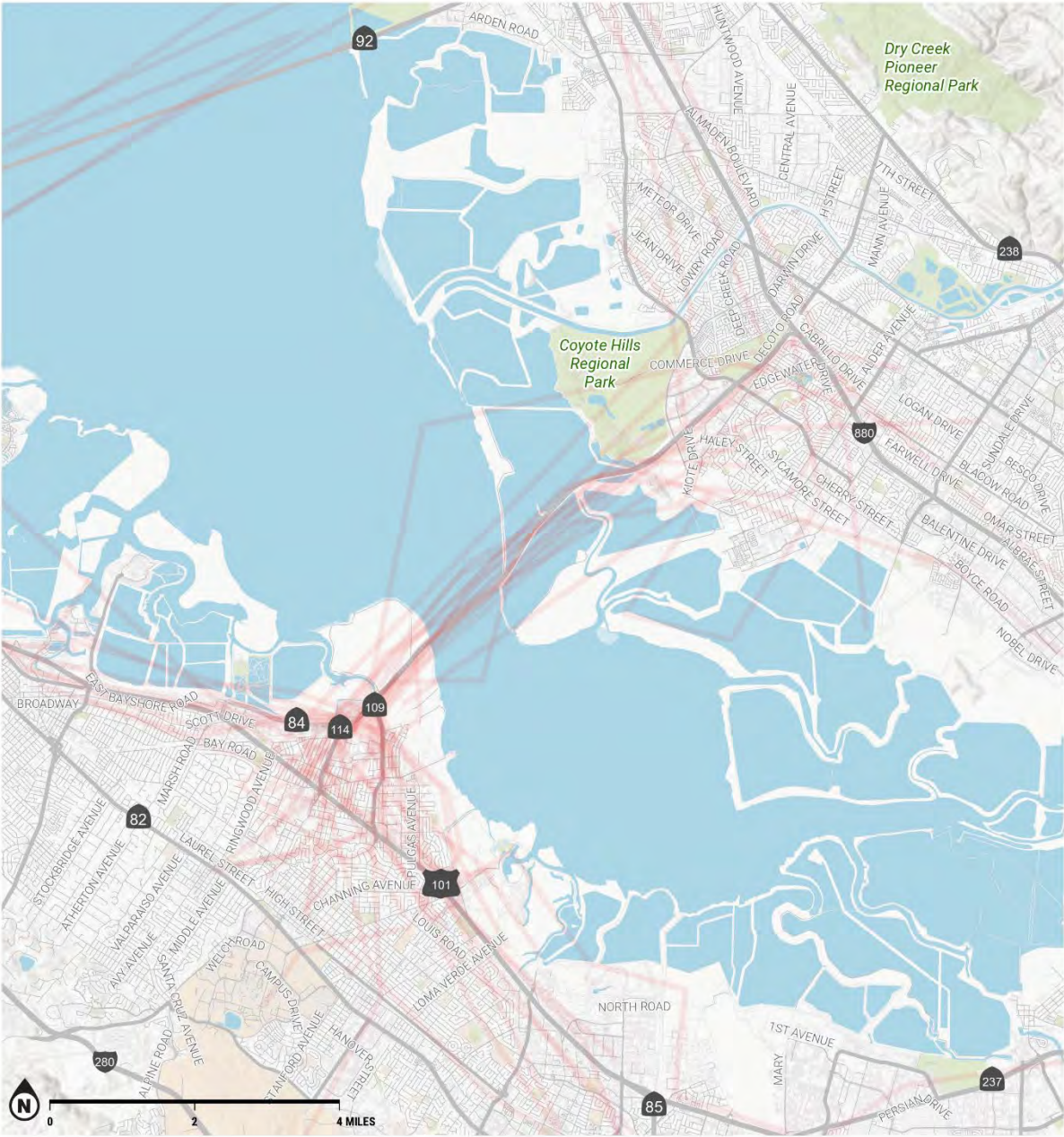


RAW SURVEY ROUTE  
RESPONSES  
MTC ORIGIN-  
DESTINATION STUDY  
RICHMOND-SAN RAFAEL BRIDGE

REPORTED SURVEY ROUTE  
Raw Survey Route



Figure 3. Raw Survey Reported Trip Routes for the Dumbarton Bridge Trail.



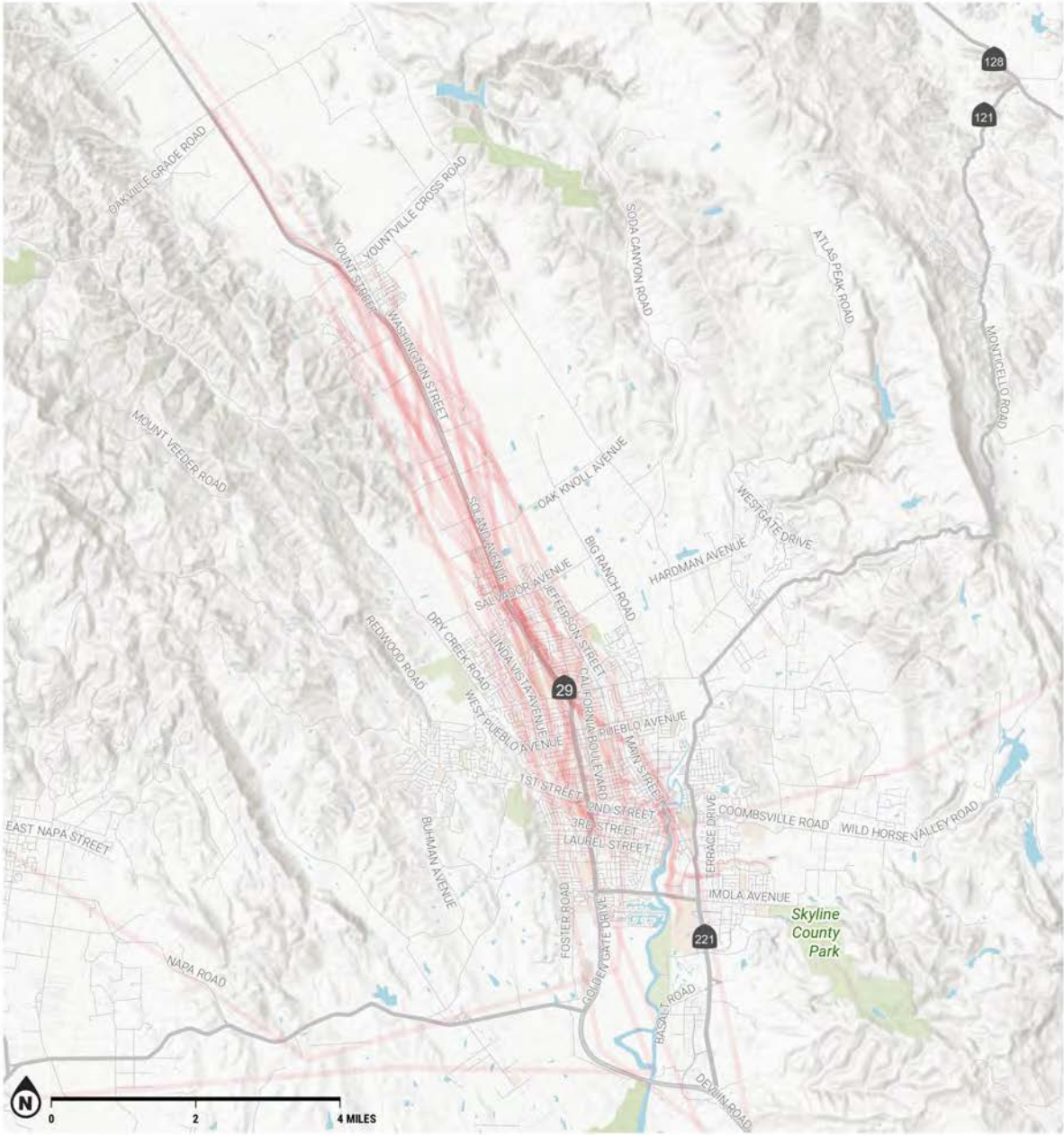
**RAW SURVEY ROUTE  
RESPONSES**

MTC ORIGIN-  
DESTINATION STUDY  
DUMBARTON BRIDGE



REPORTED SURVEY ROUTE  
— Raw Survey Route

Figure 4. Raw Survey Reported Trip Routes for the Napa Valley Vine Trail.



**RAW SURVEY ROUTE RESPONSES**

MTC ORIGIN-DESTINATION STUDY  
NAPA VALLEY VINE TRAIL



REPORTED SURVEY ROUTE  
Raw Survey Route

## Network Analysis

The project team conducted a network analysis designed to reconstruct survey routes based on the reported origins and destinations of survey respondents. Using street network data from OpenStreetMap, cross-checked for accuracy with MTC's bicycle network data, the team constructed a GIS representation of the road network and calculated routes between each origin and destination pair for two routing methods:

- **Shortest path** routes estimated travel routes for active transportation users by calculating the path with the shortest network travel time.
- **Comfortable path** routes avoided roads with high levels of traffic stress (LTS) or, if unavoidable, calculated the route travel time based on the assumption that bicyclists would walk along high-stress roads.

A qualitative comparison between the raw survey data and estimated routes demonstrates rough alignment between the calculated routes and user-drawn routes.

**Figure 5** through **Figure 8** show the shortest path routes in red and comfortable path routes in blue as estimated for trips accessing each respective study corridor. Where the routes overlap, the line is purple. The road network surrounding each trail access point is shown in **Appendix A**, visualized by high and low bicycle travel stress segments.



Figure 5. Calculated Routes for Survey Origin-Destination Pairs Utilizing the Golden Gate Bridge Trail.

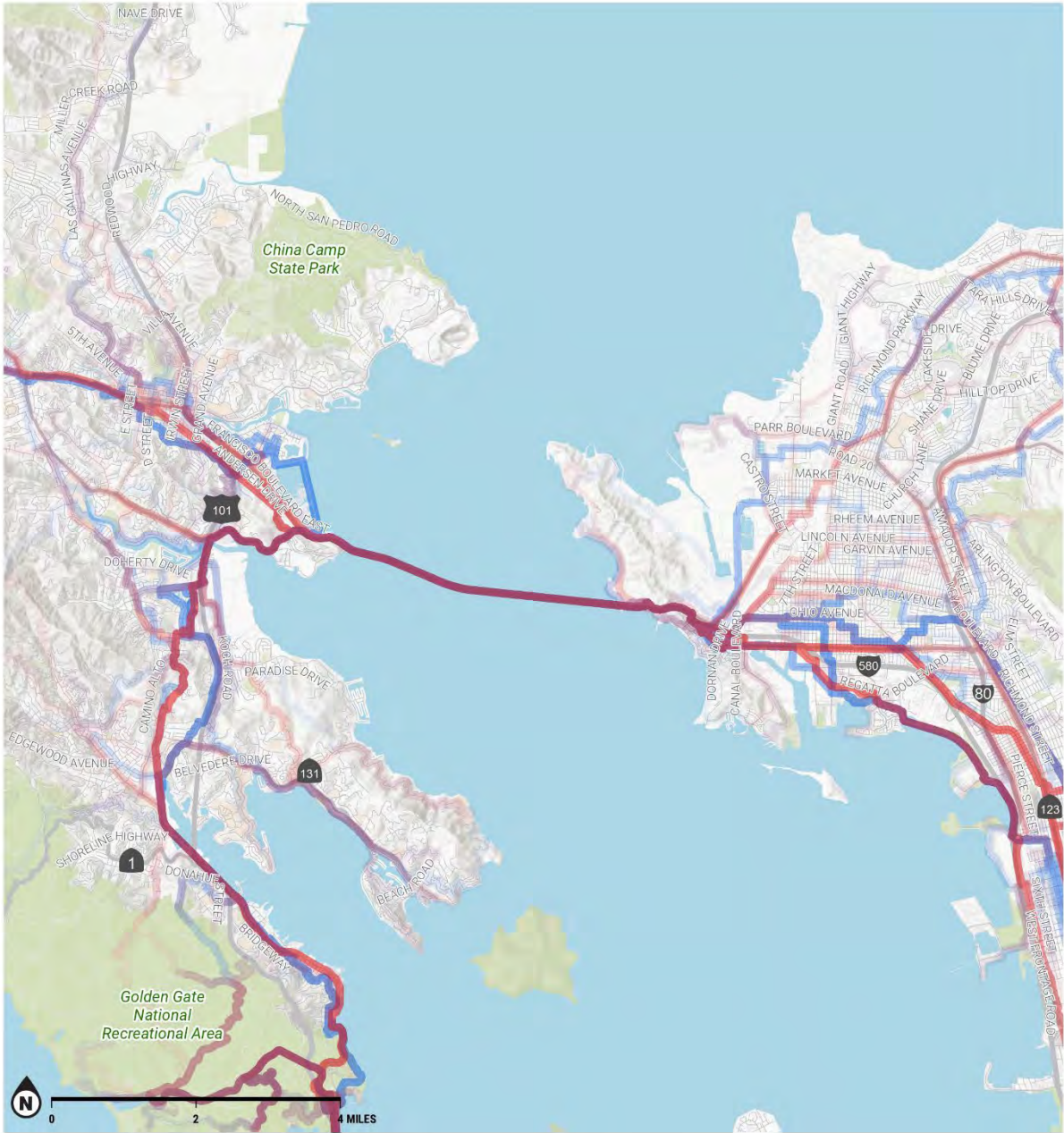


**NETWORK ROUTE ANALYSIS**  
**MTC ORIGIN-DESTINATION STUDY**

GOLDEN GATE BRIDGE  
**alta**

- BICYCLE ROUTE TYPE**
- Shortest Path
  - Comfortable Path (LTS-Adjusted)

Figure 6. Calculated Routes for Survey Origin-Destination Pairs Utilizing the Richmond-San Rafael Bridge Trail.



**NETWORK ROUTE ANALYSIS**

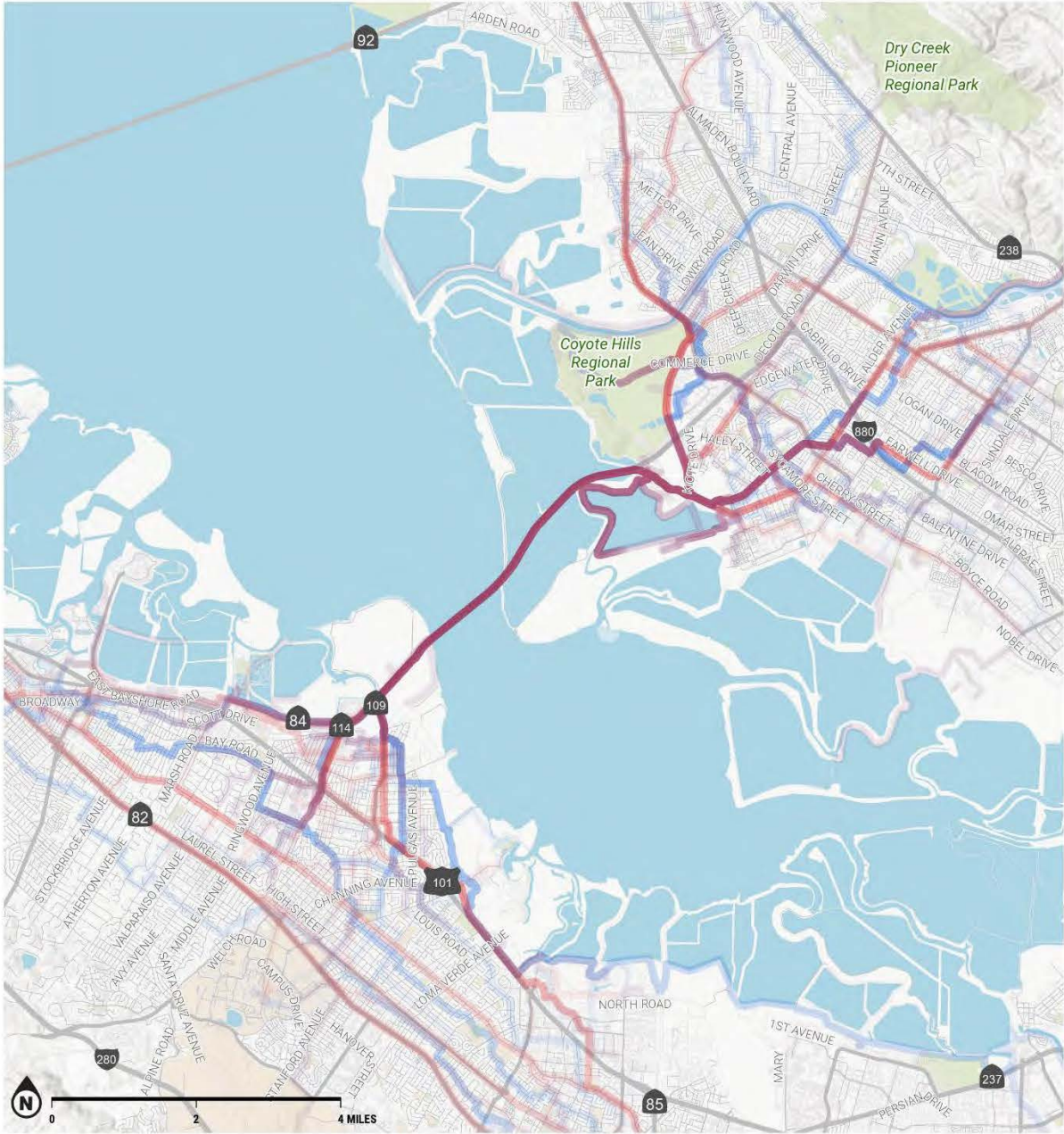
**MTC ORIGIN-DESTINATION STUDY**

**RICHMOND-SAN RAFAEL BRIDGE**



- BICYCLE ROUTE TYPE**
- Shortest Path
  - Comfortable Path (LTS-Adjusted)

Figure 7. Calculated Routes for Survey Origin-Destination Pairs Utilizing the Dumbarton Bridge Trail.



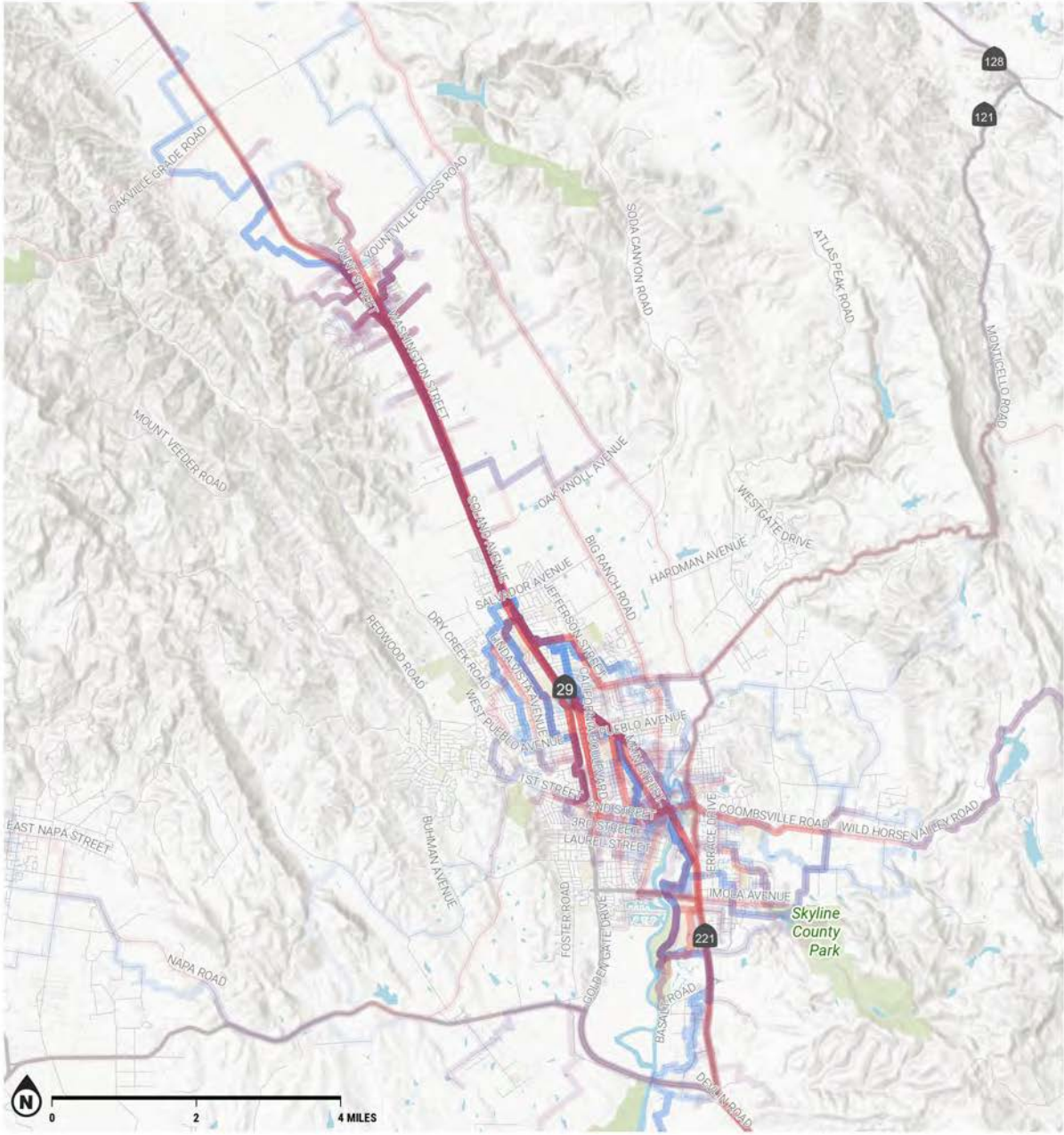
**NETWORK ROUTE ANALYSIS**  
**MTC ORIGIN-DESTINATION STUDY**

DUMBARTON BRIDGE



- BICYCLE ROUTE TYPE**
- Shortest Path
  - Comfortable Path (LTS-Adjusted)

Figure 8. Calculated Routes for Survey Origin-Destination Pairs Utilizing the Napa Valley Vine Trail.



**NETWORK ROUTE ANALYSIS**  
**MTC ORIGIN-DESTINATION STUDY**  
**NAPA VALLEY VINE TRAIL**



- BICYCLE ROUTE TYPE**
- Shortest Path
  - Comfortable Path (LTS-Adjusted)

## Feeder Route Barrier Analysis

In order to identify the barriers that trail users face while accessing the four study trails, the project team then identified high-stress road segments located along both the calculated shortest path and comfortable path feeder routes. High-stress segments along otherwise comfortable feeder routes indicate the potential to close a gap in existing infrastructure. However, comfortable path routes are often considerably longer than the shortest path routes, meaning trail users seeking comfortable travel options must go out of their way to ride on low-stress routes.

This is well illustrated by the feeder route barrier analysis conducted on access routes on the east side of the Richmond-San Rafael Bridge (**Figure 7**). The Richmond Greenway Trail, a comfortable and low-stress option, runs east-west just north of Ohio Ave. Following a parallel path but about a quarter mile south, Cutting Blvd runs from Interstate 80 to S Garrard Blvd near the trail's eastern access point. A trail user originating from a point along Cutting Blvd could choose to travel north to ride comfortably along the separated bicycle facility, adding about a half-mile to their trip, or ride the direct route along Cutting Blvd, saving distance but riding in unprotected bike lanes or in mixed traffic on a four-lane road. Out of direction travel can be an inconvenience to all travelers, but different types of travelers and trip purposes will be more tolerant than others.

The maps in **Figure 9** through **Figure 12** show high-stress segments that fall along the shortest path (red) and comfortable path (blue) routes. Segments that are purple indicate it is both the shortest and most comfortable path. The thickness of the line indicates the number of reconstructed survey routes that travel along that segment.

Figure 9. Feeder Route Barrier Analysis for the Golden Gate Bridge Trail.



**FEEDER ROUTE  
BARRIER ANALYSIS**  
MTC ORIGIN-  
DESTINATION STUDY  
GOLDEN GATE BRIDGE

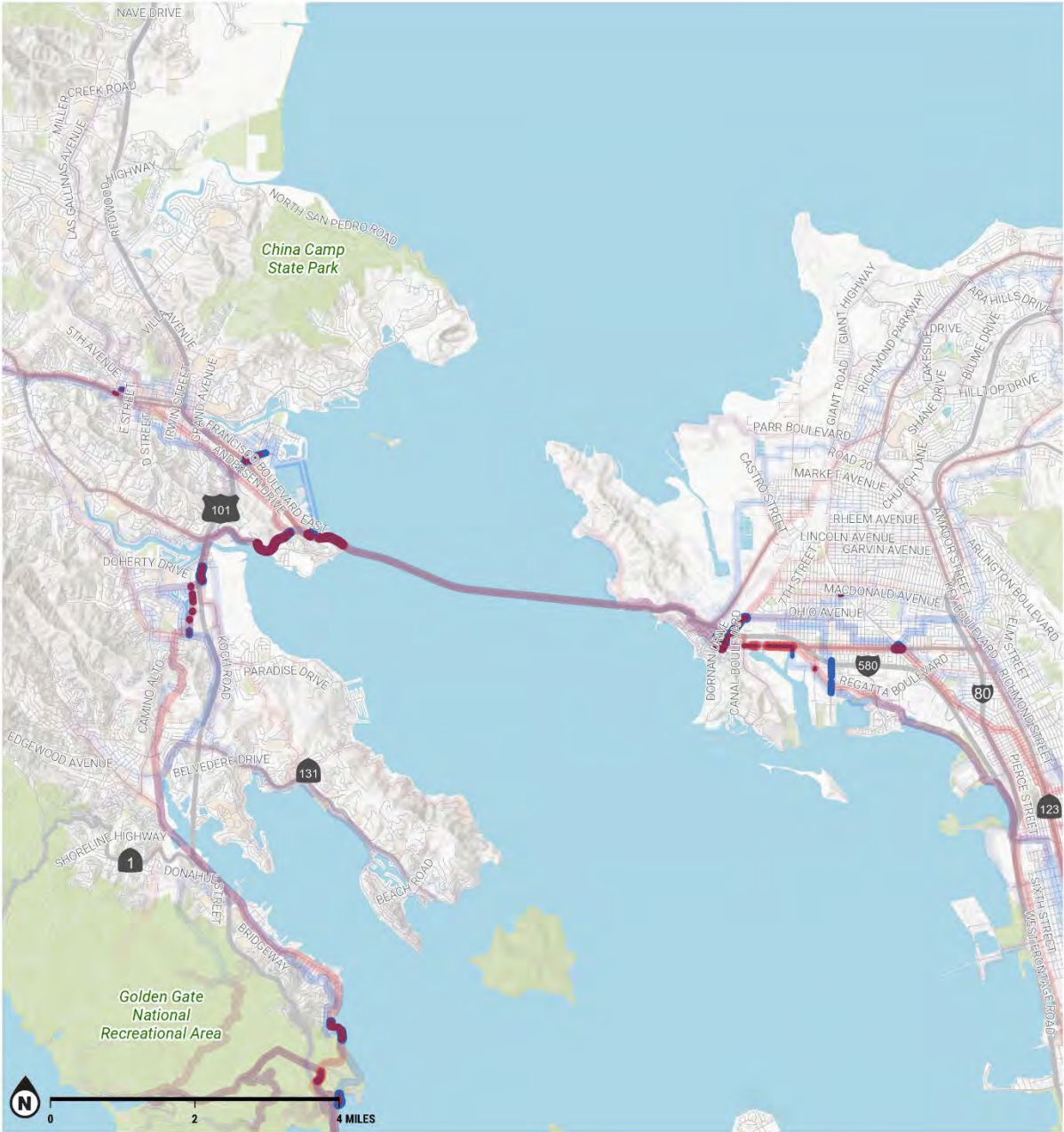


- HIGH STRESS FACILITIES**
- On Shortest Path Routes
  - On Comfortable Path (LTS-Adjusted) Routes\*

Line thickness indicates the number of survey trips routed along the segment. Only segments with 10 or more trips are visualized.

\*Comfortable Path routes may travel along high stress segments when there is no other route option, or when biking on the low stress facility option would take more time than walking along the high stress segment.

Figure 10. Feeder Route Barrier Analysis for the Richmond-San Rafael Bridge Trail.



**FEEDER ROUTE  
BARRIER ANALYSIS**

**MTC ORIGIN-  
DESTINATION STUDY**

**RICHMOND-SAN RAFAEL BRIDGE**

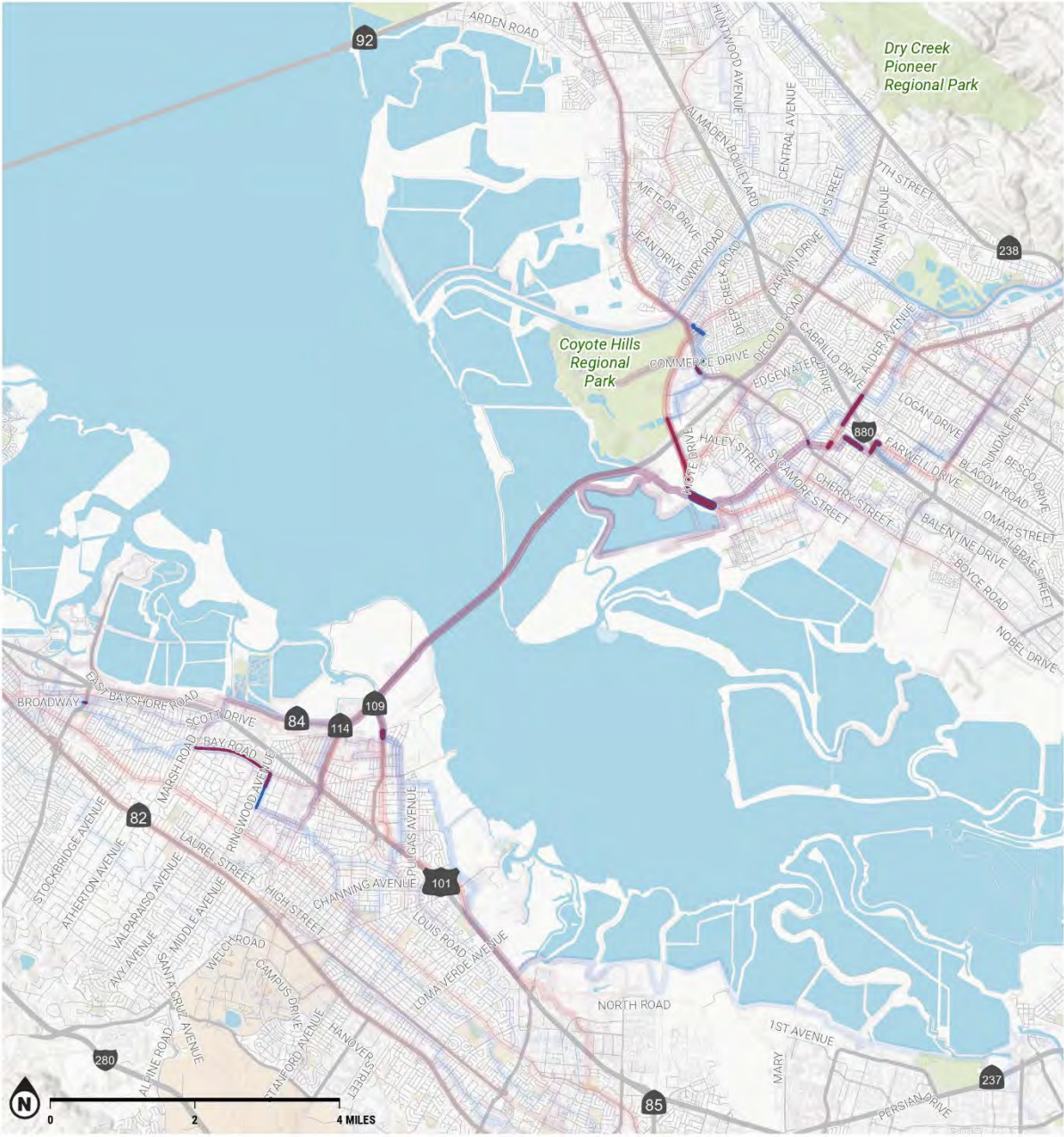


- HIGH STRESS FACILITIES**
- On Shortest Path Routes
  - On Comfortable Path (LTS-Adjusted) Routes\*

Line thickness indicates the number of survey trips routed along the segment. Only segments with 10 or more trips are visualized.

\*Comfortable Path routes may travel along high stress segments when there is no other route option, or when biking on the low stress facility option would take more time than walking along the high stress segment.

Figure 11. Feeder Route Barrier Analysis for the Dumbarton Bridge Trail.



**FEEDER ROUTE  
BARRIER ANALYSIS  
MTC ORIGIN-  
DESTINATION STUDY  
DUMBARTON BRIDGE**



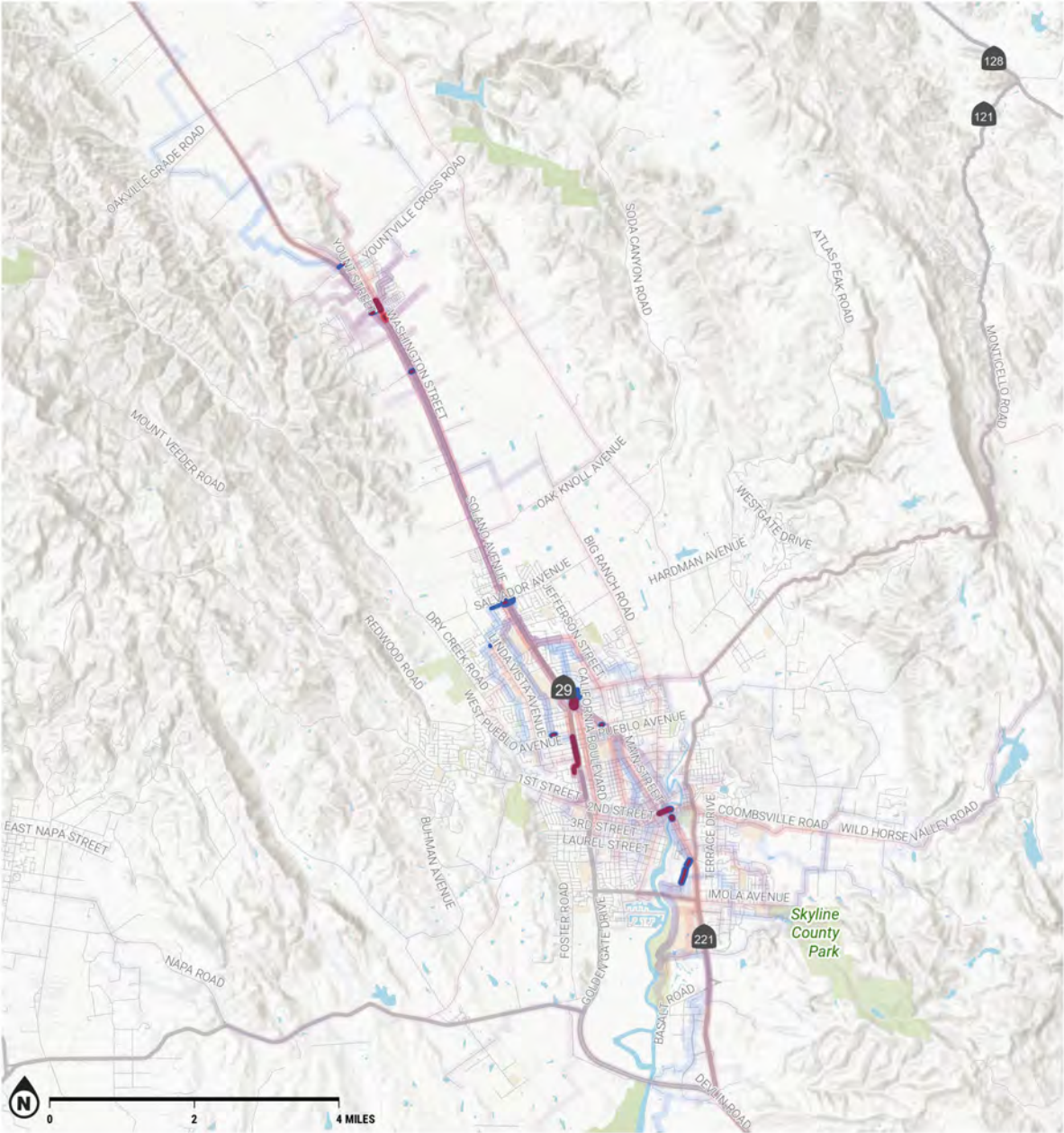
- HIGH STRESS FACILITIES**
- On Shortest Path Routes
  - On Comfortable Path (LTS-Adjusted) Routes\*

Line thickness indicates the number of survey trips routed along the segment. Only segments with 10 or more trips are visualized.

\*Comfortable Path routes may travel along high stress segments when there is no other route option, or when biking on the low stress facility option would take more time than walking along the high stress segment.



Figure 12. Feeder Route Barrier Analysis for the Napa Valley Vine Trail.



**FEEDER ROUTE  
BARRIER ANALYSIS**

MTC ORIGIN-  
DESTINATION STUDY

NAPA VALLEY VINE TRAIL



- HIGH STRESS FACILITIES**
- On Shortest Path Routes
  - On Comfortable Path (LTS-Adjusted) Routes\*

Line thickness indicates the number of survey trips routed along the segment. Only segments with 10 or more trips are visualized.

\*Comfortable Path routes may travel along high stress segments when there is no other route option, or when biking on the low stress facility option would take more time than walking along the high stress segment.

## Quick-Build Project Identification

Quick-build project locations were informed by the results of the network analysis, results and comments from the web survey, and supplemented by virtual site visits using aerial and street view imagery. There are many locations that were shown to be potential high-priority gap closure locations that were not included as they did not seem like feasible projects for quick build implementation. The types of projects identified ranged from spot improvements to gap closures, and bike studies to evaluate longer-term corridor improvements. Many of the recommended quick-build projects delineate bicycle pathways through intersections or improve wayfinding based on survey responses and virtual review. The project team identified 20 locations for quick-build projects among the four corridors. The projects and brief descriptions are shown in **Figure 13** through **Figure 16**.

Figure 13. Quick-Build Projects for the Golden Gate Bridge Trail.

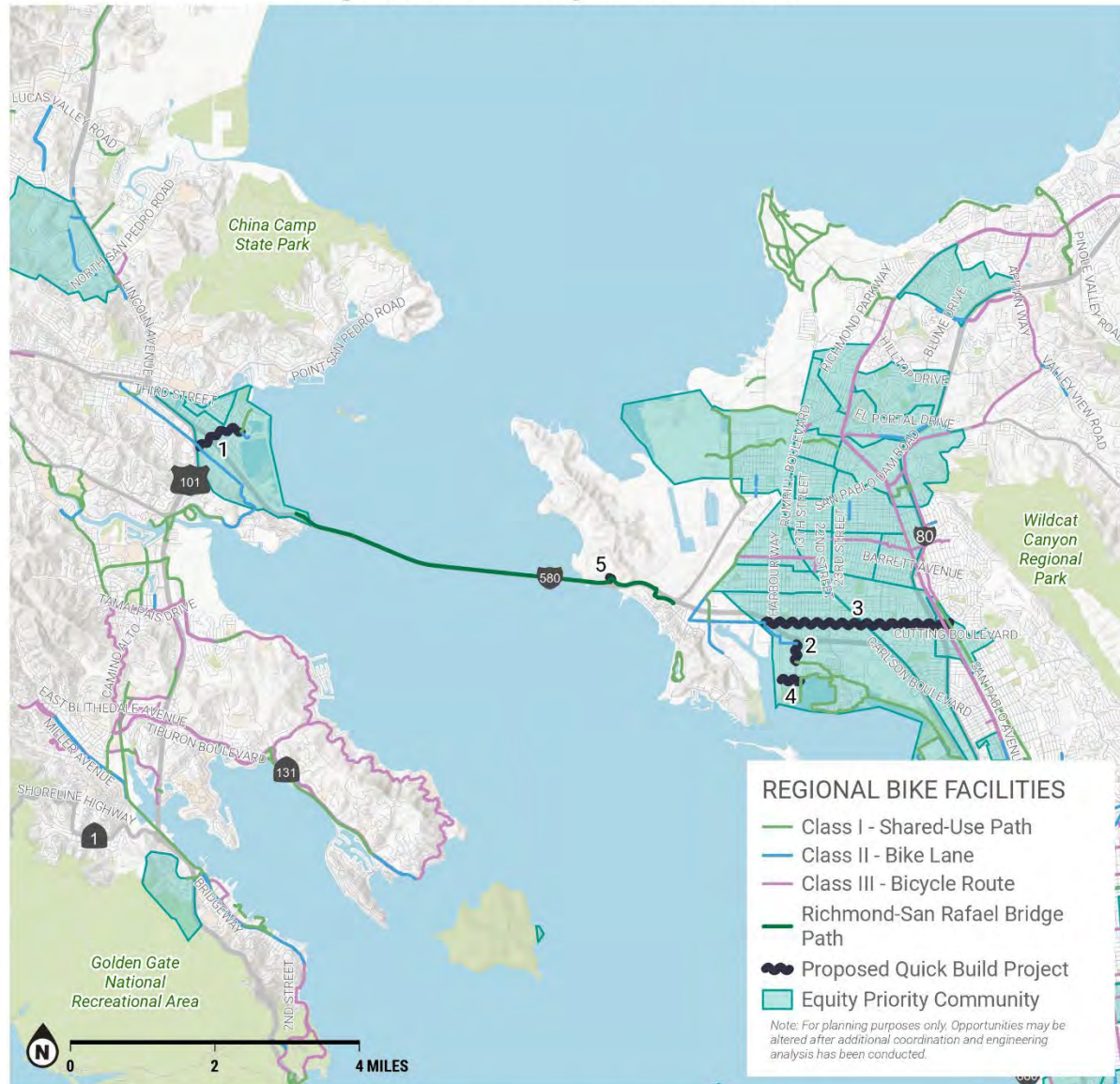
Golden Gate Bridge Quick-Build Project Identification



ID	Street Name	Improvement Type	Opportunities
1	15th Ave	Corridor	Bike facility upgrade from Class III to striped, advisory, or directional bike lanes. Expand traffic calming measures.
2	Alexander Ave / South St	Corridor	Striped bike lane, traffic calming. Connect the northern terminus of the trail to existing Bunker Rd and Conzelman Rd facilities.
3	Bridgeway	Corridor	Wayfinding, bike facility upgrade to striped bike lane. Consider removing center turn lane.
4	Alexander Ave	Bikeway Study	Gap closure, implement physical traffic calming measures to slow vehicle traffic coming down the hill from the off-ramp.
5	E Blithedale Ave / Roque Moraes Dr	Spot	Stripe stopbars on E Blithedale Ave traveling east, install signage for no right turn on red.

Figure 14. Quick-Build Projects for the Richmond-San Rafael Bridge Trail.

**Richmond-San Rafael Bridge Quick-Build Project Identification**



ID	Street Name	Improvement Type	Opportunities
1	Bellam Blvd	Corridor	Bike lane study for gap closure between Baypoint Village Dr and Anderson Dr. Wayfinding signage to Cal Park Hill Pathway.
2	Marina Way S	Corridor	Gap closure via striped bike lane.
3	Cutting Blvd	Corridor	Gap closure via striped bike lane.
4	Hall Ave	Corridor	Better wayfinding at roundabout. Wider bike lane.
5	Stenmark Dr on-ramp	Spot	Crossing improvement, higher visibility crosswalk and shark-teeth yield markings.

Figure 15. Quick-Build Projects for the Dumbarton Bridge Trail.

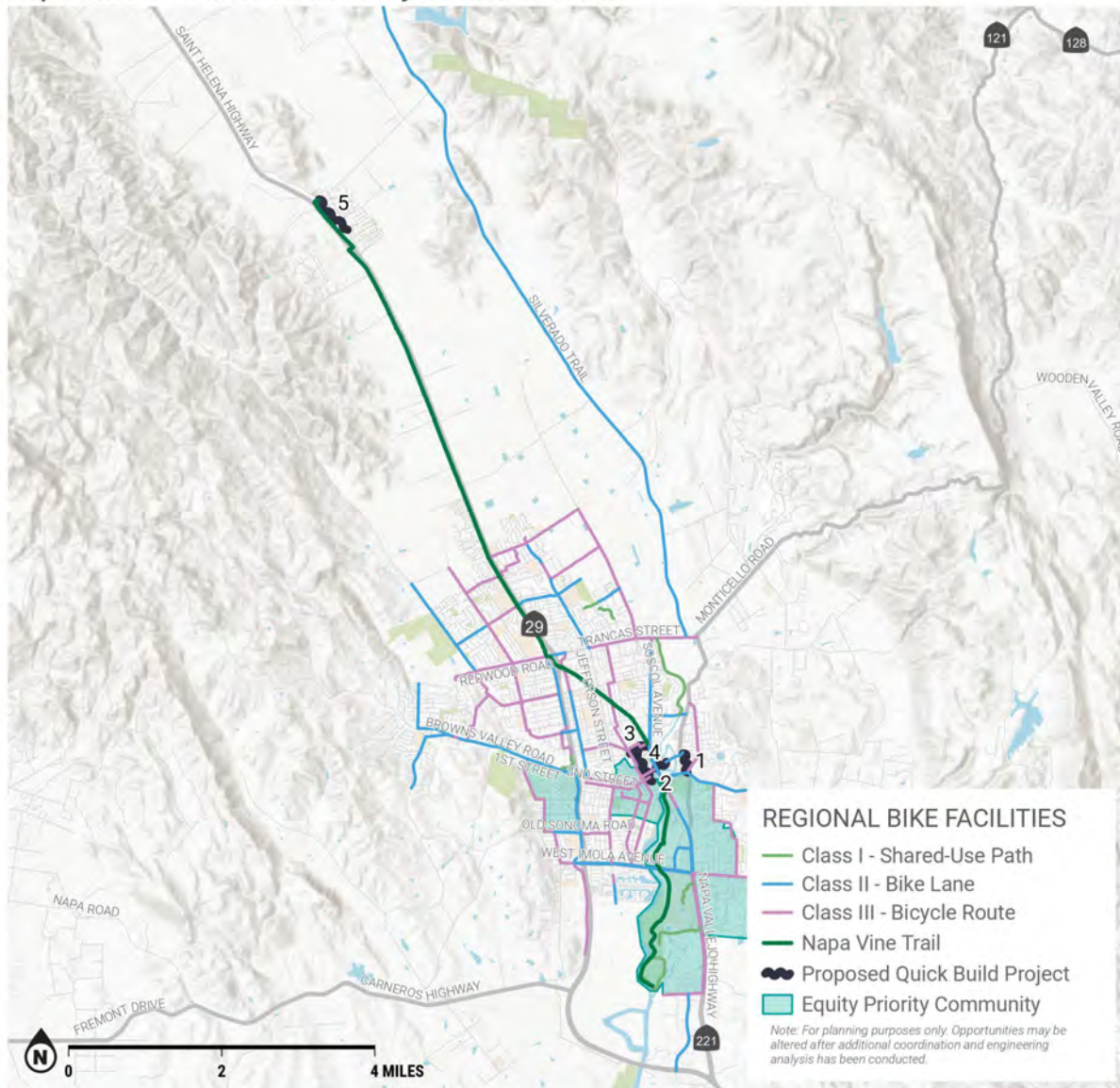
Dumbarton Bridge Quick-Build Project Identification



ID	Street Name	Improvement Type	Opportunities
1	Thornton Ave	Corridor	MTC is coordinating with the City of Newark to convert existing painted bike lanes (Class II) to a separated bikeway (Class IV) between Hickory St and Gateway Blvd. A future opportunity could be to extend further to Dumbarton Cir.
2	Thornton Ave	Corridor	Extend painted buffered bike lane from Spruce St to connect to bike facilities on Sycamore St.
3	Thornton Ave	Corridor	Create painted buffered bike lane to connect Sycamore St and Newark Blvd bike facilities.
4	Palmer Lane	Corridor	Wayfinding and traffic calming. Bike boulevard designation to provide low stress connection from Middlefield Rd to Bay Rd.
5	Fordham St	Corridor	Wayfinding and traffic calming. Bike boulevard designation to provide low stress connection from Bay Rd to Rutgers St. Explore opening gate for direct access to Bay Trail.

Figure 16. Quick-Build Projects for the Napa Valley Vine Trail.

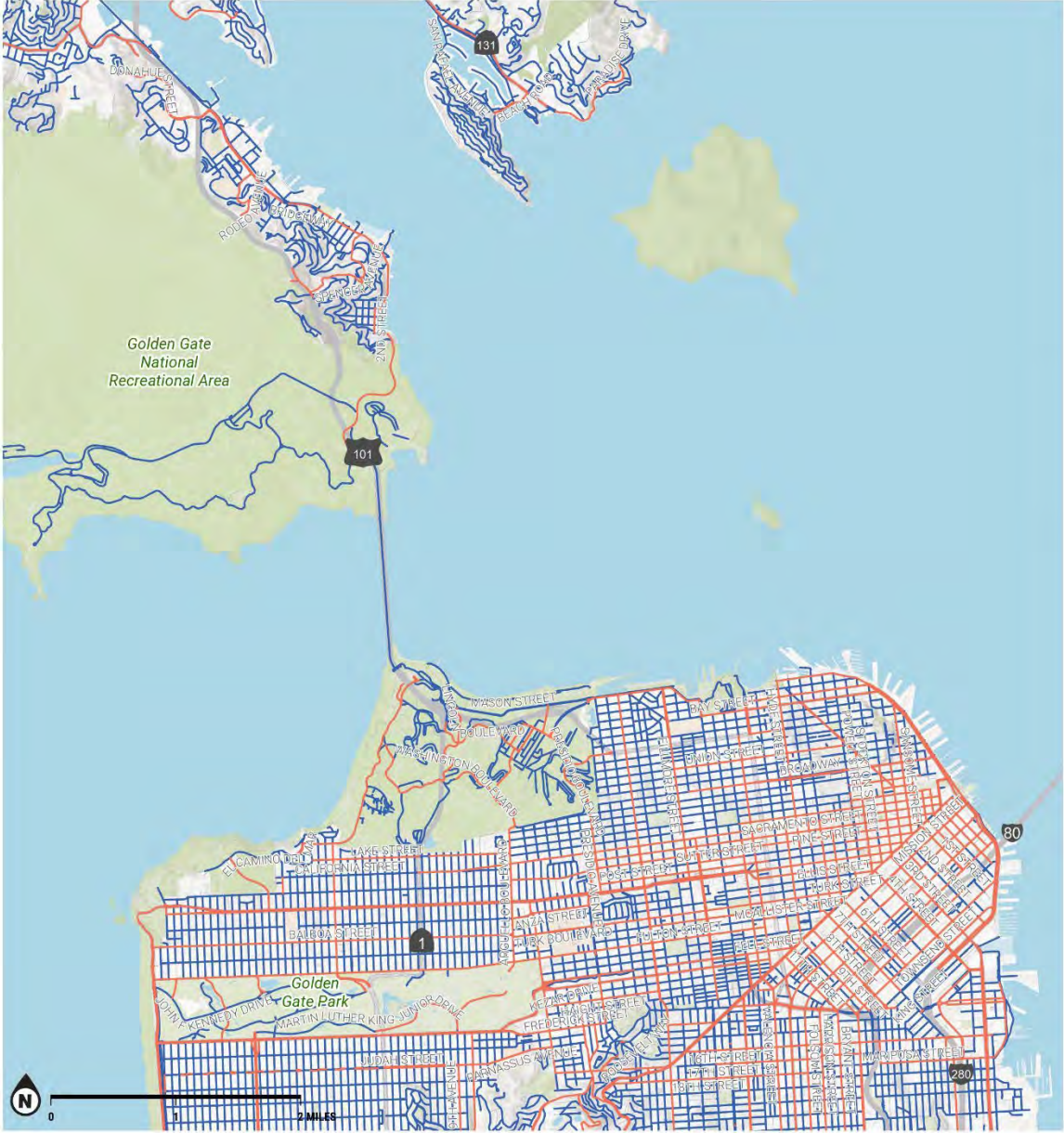
**Napa Vine Trail Quick-Build Project Identification**



ID	Street Name	Improvement Type	Opportunities
1	Silverado Trail	Corridor	Gap closure with striped bike lane where width allows and sharrows on tight right of way.
2	1st St	Corridor	Gap closure with striped bike lane where width allows and sharrows on tight right of way, intersection improvements.
3	Vallejo St	Corridor	Traffic calming on existing bike boulevard and wayfinding signage to connecting trail.
4	Main St	Corridor	Traffic calming and bike boulevard designation. Wayfinding signage to connecting trail.
5	Washington St	Corridor	Traffic calming, install additional bicycle parking.

# Appendix A: Bicycle Level of Traffic Stress Near Trail Access Points

Golden Gate Bridge Trail



**BIKE LEVEL OF TRAFFIC STRESS (BLTS)**

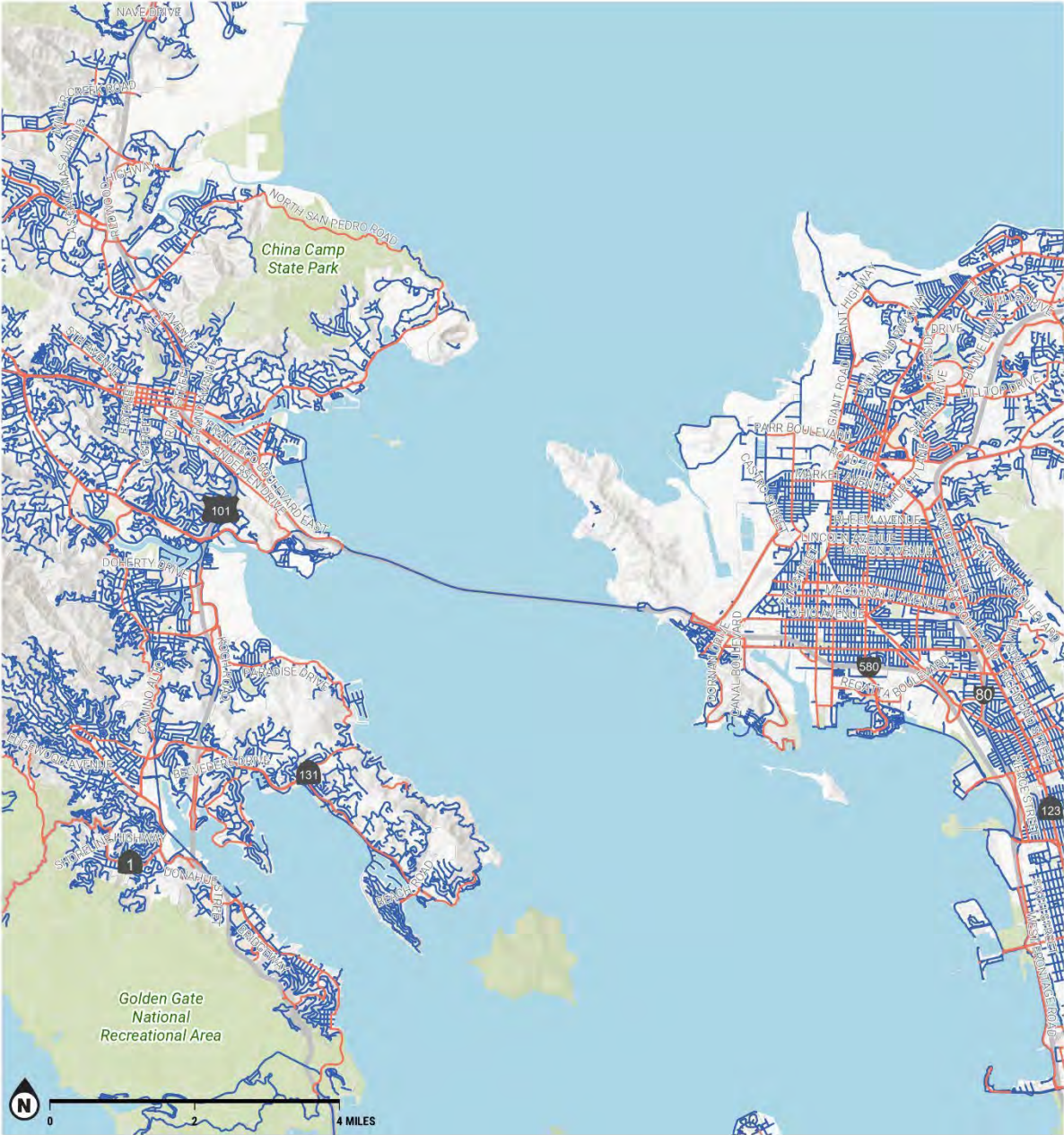
**BIKE LEVEL OF TRAFFIC STRESS**  
— Low Stress  
— High Stress

MTC ORIGIN-DESTINATION STUDY

GOLDEN GATE BRIDGE



Richmond-San Rafael Bridge Trail



**BIKE LEVEL OF TRAFFIC STRESS (BLTS)**  
MTC ORIGIN-DESTINATION STUDY

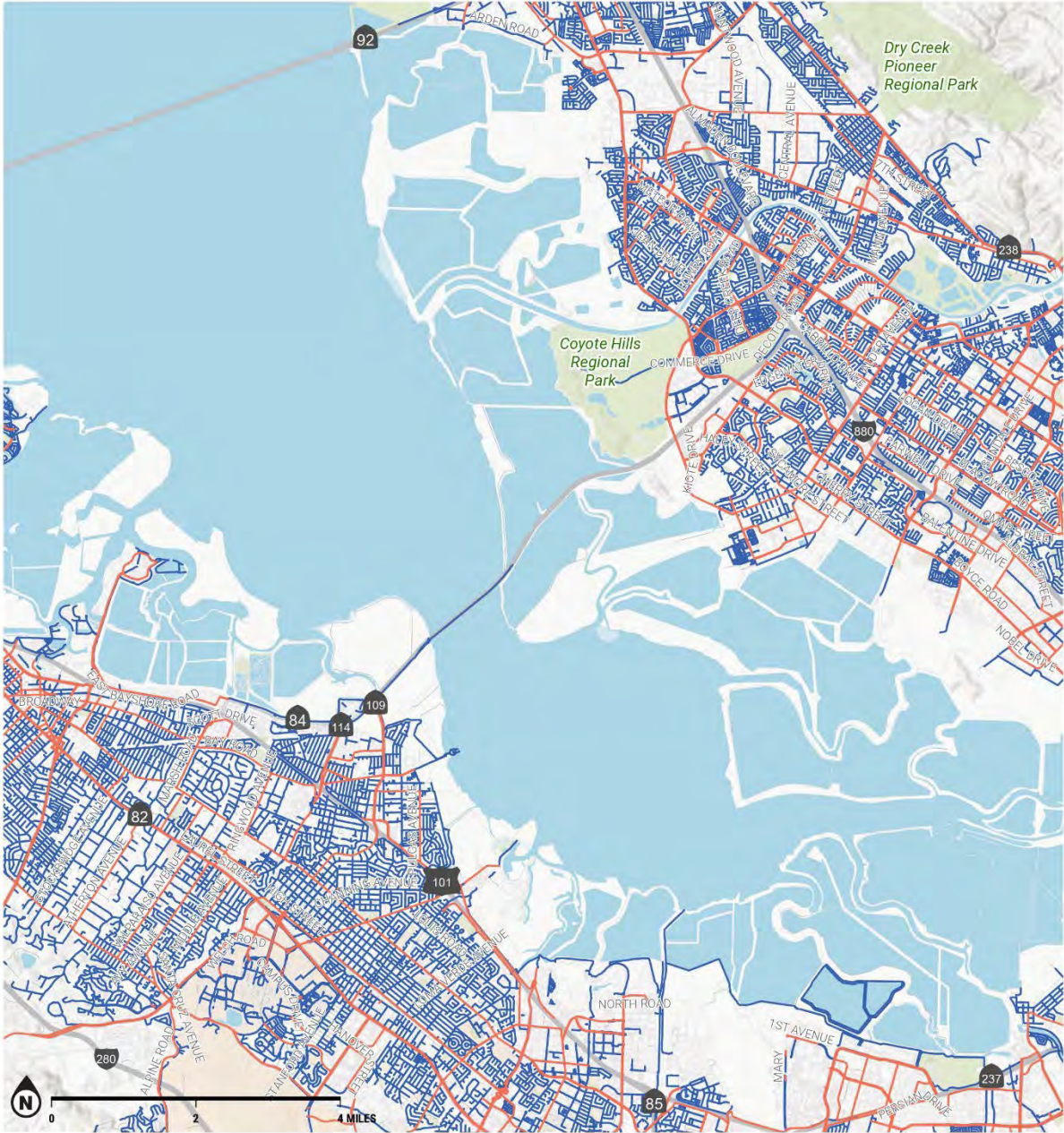
BIKE LEVEL OF TRAFFIC STRESS  
— Low Stress  
— High Stress

RICHMOND-SAN RAFAEL BRIDGE





Dumbarton Bridge Trail

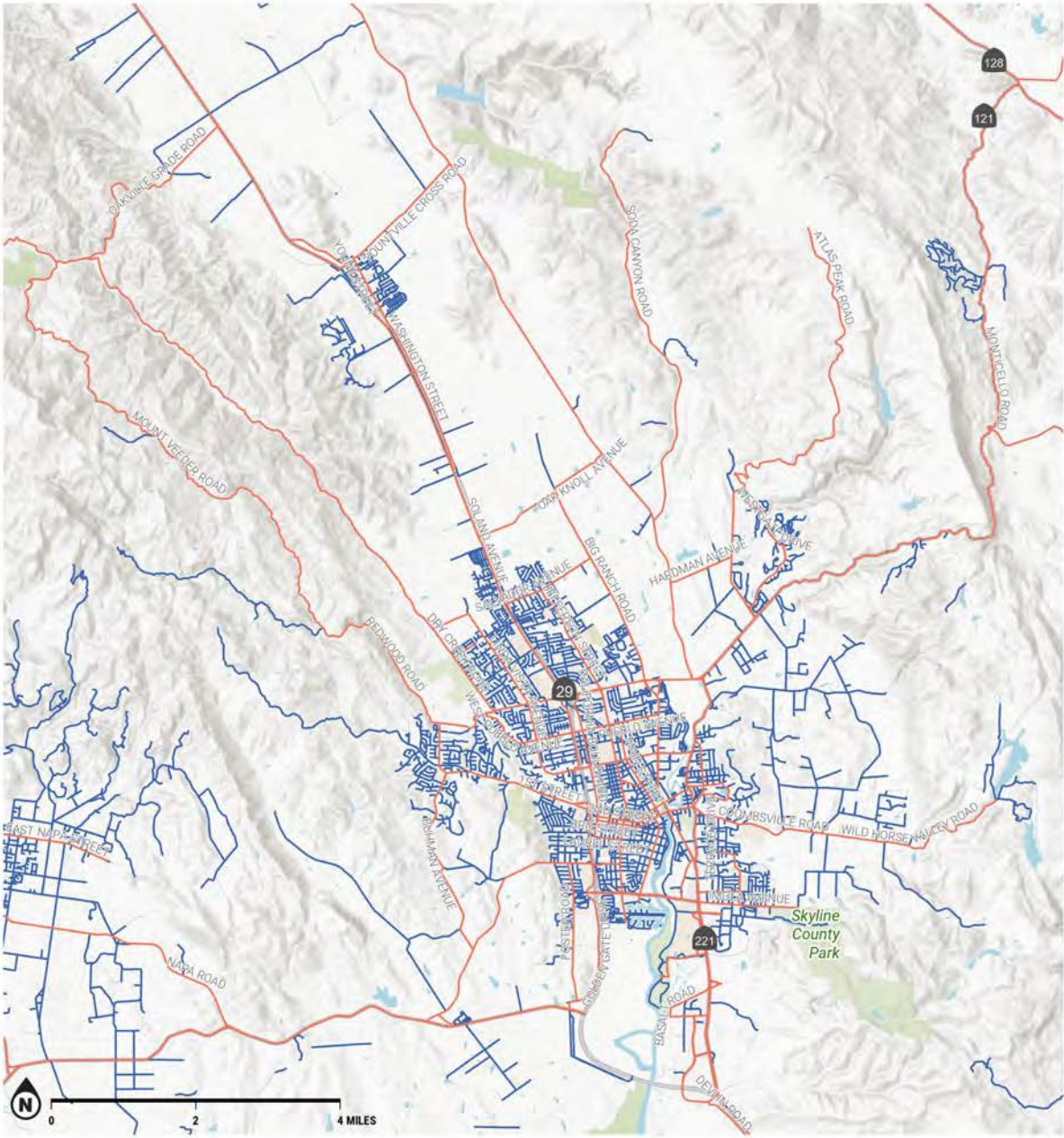


**BIKE LEVEL OF TRAFFIC STRESS (BLTS)**  
MTC ORIGIN-DESTINATION STUDY  
DUMBARTON BRIDGE

BIKE LEVEL OF TRAFFIC STRESS  
— Low Stress  
— High Stress




Napa Valley Vine Trail



**BIKE LEVEL OF TRAFFIC STRESS (BLTS)**  
**MTC ORIGIN-DESTINATION STUDY**  
**NAPA VALLEY VINE TRAIL**

**BIKE LEVEL OF TRAFFIC STRESS**  
 — Low Stress  
 — High Stress





**APPENDIX F:  
CASE STUDY  
- SAN DIEGO  
REGIONAL BIKE  
& PEDESTRIAN  
COUNTER  
NETWORK**



## Case Study

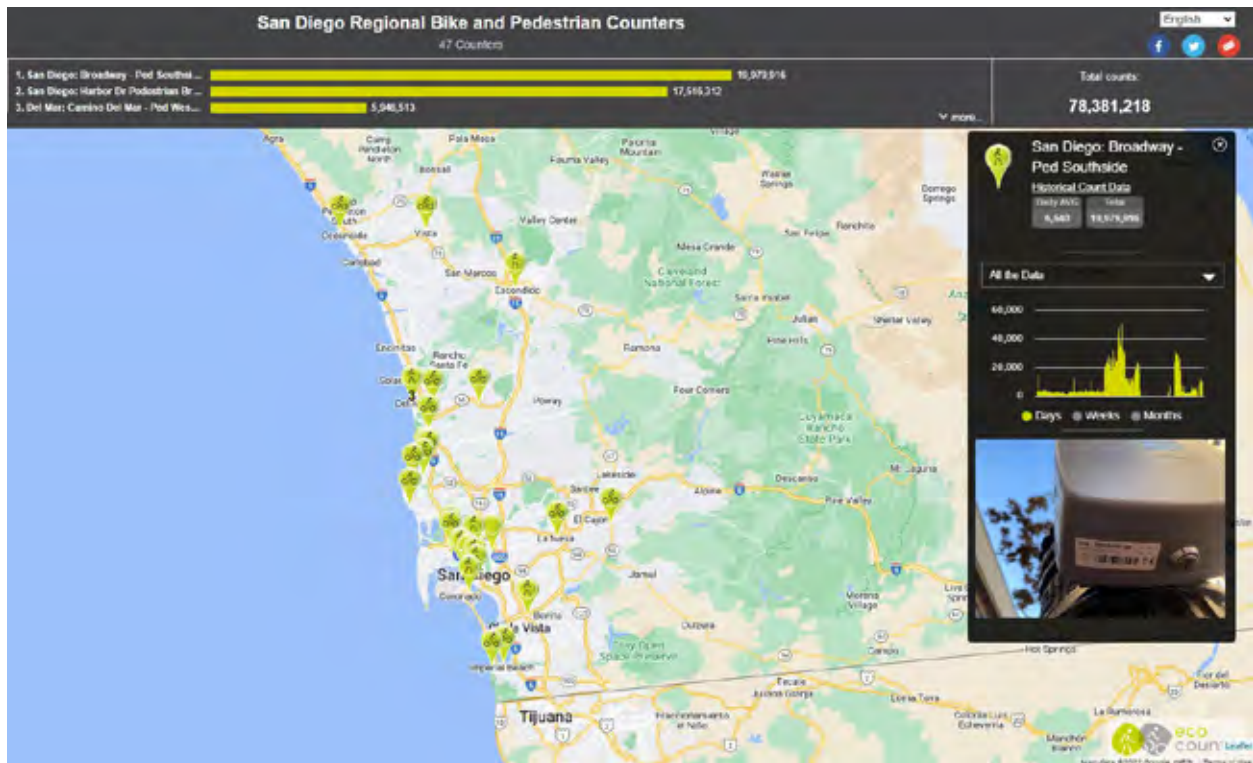
# SAN DIEGO REGIONAL BIKE & PEDESTRIAN COUNTER NETWORK

## Background

The San Diego Regional Bike and Pedestrian Counter Network is a regional active travel monitoring program that serves both as a health intervention and as a benefit to local and regional planning agencies responsible for planning and funding transportation projects. By establishing a network of automated bicycle and pedestrian count stations along the planned regional bicycle network, the region is able to link active transportation data collection and performance monitoring to regional transportation planning efforts. Furthermore, to allow for a robust analysis of biking and walking behaviors, there are three types of counters in operation—some count people biking (Zelt), others count people walking (Pyro), and some count both people walking and biking (Eco-Multi). It is important to note that the program's success was in large part due to the purchase and installation of multiple units all at once, rather than growing slowly over time.

## Purpose

The San Diego Association of Governments (SANDAG) developed the network to gather more robust data on active travel patterns to help demonstrate the need for bicycle and pedestrian facilities. Usually, local agencies collect nonmotorized travel data on a routine basis with in-person counts. This method often undercounts nonmotorized trips, making it more difficult to secure funding for active transportation facilities. Therefore, the motivation for this program was to implement a systematic measurement of cycling and walking to better understand the effectiveness of nonmotorized interventions to secure funding for bicycle and pedestrian facilities. Planning and implementation of the San Diego counting program grew out of collaboration between the County of San Diego Health and Human Services Agency chronic disease staff, San Diego State University city planning researchers, and SANDAG transportation planning professionals.



The San Diego Regional Bike and Pedestrian Counter Network website displays real-time information for 54 counters spread across the region.

## Lessons Learned

The San Diego Regional Bike and Pedestrian Counter Network reported increased bicycling rates at the onset of the COVID-19 pandemic. During the start of the stay at home order, daily volumes increased an average of 42% across the network during the five months in 2020, compared to the same time in 2019. This data served as the foundation for the Shared Streets pilot project, which gave cities throughout the region the opportunity to designate temporary roadway modifications to create safe and healthy spaces for people of all ages and abilities to bike, walk, run, scoot, use a wheelchair, and move during the pandemic. SANDAG awarded 11 jurisdictions funds to help implement temporary Shared Streets pilot projects. The jurisdictions awarded proposed a range of activities such as closing residential streets to through traffic, enhancing signage to alert vehicles of shared streets conditions and closures, and creating space for local business patrons to walk, bike, and dine outside while maintaining physical distance.

## Funding

The network was initially funded by a grant from the Centers for Disease Control and Prevention and is a collaborative effort between SANDAG, San Diego State University, and the County of San Diego Health and Human Services Agency.



Metropolitan Transportation Commission

**DPD**

design & project delivery

