II - DATA COLLECTION HANDBOOK:

Network Priority Tool

Prepared for the Silicon Valley Bicycle Coalition

Project 190821 - Bike Project Prioritization
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1. Introduction

Over the last many decades, methodologies and techniques for tracking vehicle data have been developed, utilized and standardized to legitimize road network design and planning for motor vehicles as a mode of transportation. Techniques like the 85th percentile rule create a framework for traffic engineers and City officials to set speed limits for motor vehicles on our roads, tracking of AADT or Average Annual Daily Traffic allow planners to know how many cars and trucks use different road segments at different times of day. All of this data collection creates a framework that makes planning for motor vehicle travel legitimate and visible. The same regiment and framework of data collection and utilization must be created to create more legitimacy for bicycle travel in our cities. Many of the world’s leading bicycle cities in Europe have developed these systems over the last many decades, and now North American cities need to step up to do likewise.

This guidebook provides SVBC with two elements to evaluate and promote bicycle projects and planning in the Peninsula and South Bay. The first section of this guidebook describes the public and open data used in the Bicycle Project Prioritization Tool, including; where data has been sourced from and the methods of data processing or compiling done to create multi-county datasets.

The second section of the guidebook is a toolkit for local data gathering with SVBC staff and community volunteers. The toolkit summarizes the topics discussed as part of the data collection workshop held on December 7, 2019 in Sunnyvale. It describes the potential for cycling data counting methodologies and observations to improve intersection and bicycle infrastructure design as well as near-term opportunities to implement data gathering methods. This toolkit is intended to assist SVBC’s staff and community volunteers in on-going advocacy efforts by providing resources for promoting longitudinal data collection through data partnership with other organizations and techniques to communicate data in public campaigns that promote cycling, bicycle-friendly street design and infrastructure improvements.
2. The Bike Project Prioritization Tool Datasets

In order to provide SVBC staff and community volunteers with a replicable data tool the following section details the steps taken to develop a comprehensive data library of datasets used in the project prioritization tool. The goal of the data library is to provide all of the base data to replicate the tool's use in communities beyond Sunnyvale. Any data clean-up or processing was done to make a comprehensive two-county base dataset. In the event of significant change to data the steps under the Methodologies for Processing Data section will help others process new and updated datasets.

The data library is focused on the following key elements to assess bicycle projects:

- Measures of equity, which requires demographic data for evaluation
- Places that induce travel demand, that is destination data
- Harm reduction, data at locations that require high standards of safety i.e. crash sites or schools
- Physical and operational elements of streets themselves, defined as street network data

The entirety of the Data Library including data sets that were sourced but not used in the project evaluation stage are linked in Appendix B.

Summary of Datasets

**Demographic Data**
- Population Estimates
- Primary Language Spoken at Home
- Household Annual Income
- Households with Children & Caretakers
- Marital Status
- Household Availability of Vehicles
- MTC Communities of Concern

**Harm Reduction Data**
- Traffic Crashes
- Safe Routes to School Evaluations
  (for Sunnyvale only)

**Destination Data**
- Job Locations & Densities
- Public & Private Schools
- VTA Transit Centers for Regional Buses
- VTA Light Rail Stops
- BART Stations (existing and proposed in SMC and SCC)
- Caltrain Rail Stations (SMC and SCC)
- Landmarks (SMC)
- Points of Interest (SCC)

**Street Network Data**
- Streets
- Elevation data
- Bicycle facilities
- Highway average annual daily traffic (AADT)
Open Public Data

Cities, counties, planning and transportation agencies in Silicon Valley provide a significant amount of open data, much of it geocoded to specific locations, streets or groupings of city blocks into Census block groups, tracts or zip codes. These open data sources yield consistently updated data for bicycle project evaluation and as such the following describes the providing agency, frequency of data updates and data formats. All publicly available data has been stored under Raw Data in the data library.

1. Demographic Data

Demographic data is primarily sourced from the U.S. Census Bureau at two scales: individual-level estimates or household estimates. The American Community Survey provides more specifics on the demographic factors that affect equity than the short-form decennial Census, as such it is the primary source for demographic data. The dataset listed below covers both San Mateo and Santa Clara counties.

Population Estimates

Population estimates within each census block group from the US Census Bureau.

Source Agency: U.S. Census Bureau
Data Source: American Community Survey Census Block Group Data Table # B01003
Data Format(s): .csv file format
Data Processing Needed: Joining the GIS shapefile of TigerLine boundaries using the GeoID.
Frequency of Data Update: Five-year estimates from the American Community Survey are created annually, the next range will be 2014-2018 and released in 2020.

Primary Language Spoken at Home (Estimates of Individuals)

Estimates of the number of people by language spoken primarily at home within each census block group from the US Census Bureau.

Source Agency: U.S. Census Bureau
Data Source: American Community Survey Census Tract Data Table # B16007
Data Format(s): .csv file format
Data Processing Needed: Joining the GIS shapefile of TigerLine boundaries using the GeoID.
Frequency of Data Update: Five-year estimates from the American Community Survey are created annually, the next range will be 2014-2018 and released in 2020.
Household Annual Income

Estimates of the number of households for specified ranges of annual income within each census block group from the US Census Bureau.

Source Agency: U.S. Census Bureau

Data Source: American Community Survey Census Block Group Data Table # B19001

Data Format(s): .csv file format

Data Processing Needed: Joining the GIS shapefile of TigerLine boundaries using the GeoID.

Frequency of Data Update: Five-year estimates from the American Community Survey are created annually, the next range will be 2014-2018 and released in 2020.

Households with Children under 18 and their Caretakers’ (Parent or Related Person) Marital Status

Estimates of the number of households with parents or related adults caring for children under 18 years old within each census block group from the US Census Bureau.

Source Agency: U.S. Census Bureau

Data Source: American Community Survey Census Block Group Data Table # B11004

Data Format(s): .csv file format

Data Processing Needed: Joining the GIS shapefile of TigerLine boundaries using the GeoID.

Frequency of Data Update: Five-year estimates from the American Community Survey are created annually, the next range will be 2014-2018 and released in 2020.

Household Availability of Vehicles

Estimates of the number of households with access to cars within each census block group from the US Census Bureau.

Source Agency: U.S. Census Bureau

Data Source: American Community Survey Census Tract Data Table # B08201

Data Format(s): .csv file format

Data Processing Needed: Joining the GIS shapefile of TigerLine boundaries using the GeoID.

Frequency of Data Update: Five-year estimates from the American Community Survey are created annually, the next range will be 2014-2018 and released in 2020.
MTC Communities of Concern (2018)

These are census tracts defined by the Metropolitan Transportation Commission (MTC) as Communities of Concern (tract geography), which is based on eight ACS 2012-2016 tract-level variables:

- Minority (70% threshold)
- Low-Income (less than 200% of Fed. poverty level, 30% threshold)
- Level of English Proficiency (12% threshold)
- Elderly (10% threshold)
- Zero-Vehicle Households (10% threshold)
- Single Parent Households (20% threshold)
- Disabled (12% threshold)
- Rent-Burdened Households (15% threshold)

If a tract exceeds both threshold values for Low-Income and Minority shares OR exceeds the threshold value for Low-Income AND also exceeds the threshold values for three or more variables, it is a Community of Concern.

Source Agency: The Metropolitan Transportation Commission
Data Source: MTC developed the dataset based on census-tract level data from the American Community Survey.
Data Format(s): .shp (GIS file), .csv, .kml (Google Earth file), geodatabase (GIS file)
Data Processing Needed: None
Frequency of Data Update: To be determined at MTC's discretion.
2. Destination Data

Data on destinations in the two-county area has been sourced from several sources, national, state, county and city levels. Destinations within Sunnyvale were mapped based on input from the project team. The following data are listed in descending order of their geographic coverage (i.e. two-county, single county, and city level). Destinations data also includes transit hubs where bike-to-transit connectivity needs are served.

Job Locations & Density of Work Sites

Estimates of the number of jobs at each job site from the quarterly jobs and housing survey by the US Census Bureau.

Source Agency: U.S. Census
Data Source: Longitudinal Employment and Housing Dynamics Survey
Data Format(s): .shp and .kml
Data Processing Needed: None.
Frequency of Data Update: Quarterly

Caltrain Rail Stations

Locations of train stations served by Caltrain.

Source Agency: County of San Mateo
Data Source: San Mateo County GIS Open Data
Data Format(s): GIS Shapefile (.shp), GIS Geodatabase (.gdb), AutoCAD (.dxf/.dwg), Google KML (.kml), GeoJSON (.json)
Data Processing Needed: Merging into a single data file for all transit facilities
Frequency of Data Update: Not applicable.

Landmarks (San Mateo County & Santa Clara County)

Includes government buildings, civic centers, libraries, and parks.

Source Agency: County of San Mateo
Data Source: San Mateo County Information Services & County of Santa Clara Open Data Portal
Data Format(s): GIS Shapefile (.shp), GIS Geodatabase (.gdb), AutoCAD (.dxf/.dwg), Google KML (.kml), GeoJSON (.json)
Data Processing Needed: Merge data into a single data file with other points of points of interest in the two counties.
Frequency of Data Update: Daily
BART Stations

Locations of train stations served by BART.

Source Agency: Bay Area Rapid Transit
Data Source: BART Stations and Lines
Data Format(s): .kml (Google Earth file)
Data Processing Needed: Merging into a single data file for all transit facilities
Frequency of Data Update: As needed for new transit construction

BART Future Stations (Santa Clara County)

Includes the 2020 Phase 1 Extension to Berryessa and future Phase 2 extension to the City of Santa Clara.

Source Agency: Santa Clara Valley Transportation Authority (VTA)
Data Source: VTA Open Data
Data Format(s): .shp (GIS file), .csv, .kml (Google Earth file)
Data Processing Needed: Merging into a single data file for all transit facilities
Frequency of Data Update: As needed for new transit construction

VTA Transit Centers for Regional Buses (Santa Clara County)

Locations of transit centers served by VTA and regional buses.

Source Agency: Santa Clara Valley Transportation Authority (VTA)
Data Source: VTA Open Data
Data Format(s): .shp (GIS file), .csv, .kml (Google Earth file)
Data Processing Needed: Merging into a single data file for all transit facilities
Frequency of Data Update: As needed for new transit construction

VTA Light Rail Stops (Santa Clara County)

Locations of train stations served by VTA’s Light Rail service.

Source Agency: Santa Clara Valley Transportation Authority (VTA)
Data Source: VTA Open Data
Data Format(s): .shp (GIS file), .csv, .kml (Google Earth file)
Data Processing Needed: Merging into a single data file for all transit facilities
Frequency of Data Update: As needed for new transit construction
Public Schools (San Mateo County)

Locations of public schools in San Mateo County.

Source Agency: County of San Mateo
Data Source: San Mateo County GIS Open Data
Data Format(s): .shp (GIS file), .csv, .kml (Google Earth file)
Data Processing Needed: Merging into a single schools dataset.
Frequency of Data Update: Unknown, last update was 2016

Public Schools (Santa Clara County)

Locations of public schools in Santa Clara County.

Source Agency: County of Santa Clara
Data Source: Santa Clara County Information Services Department GIS Data Portal
Data Format(s): .shp (GIS file), .csv, .kml (Google Earth file)
Data Processing Needed: Merging into a single schools dataset.
Frequency of Data Update: Unknown, last update was 2016

Private Schools (Santa Clara County)

Locations of private schools in Santa Clara County.

Source Agency: County of Santa Clara
Data Source: Santa Clara County Information Services Department GIS Data Portal
Data Format(s): .shp (GIS file), .csv, .kml (Google Earth file)
Data Processing Needed: Merging into a single schools dataset.
Frequency of Data Update: Unknown, last update was 2016

Cycling Counts (San Mateo County)

Locations of the 2016 Bicycle Survey, including counts of riders and classification of riders’ gender.

Source Agency: County of San Mateo
Data Source: County of San Mateo Databhub
Data Format(s): .shp (GIS file), .csv, .kml (Google Earth file)
Data Processing Needed: Geocoding based on intersection information.
Frequency of Data Update: Unknown, last update was 2016
3. Harm Reduction Data

Harm Reduction data includes not only information of crash statistics for the two-county area but also locations where safety is of the highest concern including schools, with data from safe routes to school evaluations by SVBC.

Traffic Crashes

Crash reports involving pedestrians or bicyclists compiled by the University of California - Berkeley from police reports across the Bay Area.

Source Agency: University of California Berkeley SafeTREC
Data Source: Traffic Injury Mapping System (TIMS) query for San Mateo and Santa Clara County Bicycle and Pedestrian Crashes
Data Format(s): .csv
Data Processing Needed: Geocoding the crash sites using latitude and longitude information.
Frequency of Data Update: Annually

Safe Routes to Schools Evaluations (Sunnyvale)

Safe routes to school evaluations by SVBC staff and community volunteers created between 2018 - 2020, ongoing project. Data includes information on intersection stop controls, signals and crosswalks around schools in the Sunnyvale School District.

Data Source: Sunnyvale School Data INTERNAL
Data processing needed: Crosswalk locations merged for all evaluations.
4. Street Network Data

Street network data includes all the publicly available information that can be gathered regarding the physical attributes, design and operation of roadways in the two counties - street grade (slope), presence of cycling facilities, and traffic volumes and average travel speeds being the most relevant. This open data may have gaps or classifications that may be less nuanced that will be used in the tool's evaluation of street design, for example Class II bike lanes may include roadway shoulders even if no delineated space or markers for cycling are on the street itself.

Streets (San Mateo County)

Source Agency: County of San Mateo
Data Source: San Mateo County Information Services
Data Format(s): GIS Shapefile (.shp), GIS Geodatabase (.gdb), AutoCAD (.dxf/.dwg), Google KML (.kml), GeoJSON (.json)
Data Processing Needed: Merging with streets in Santa Clara County, Bicycle network attributes and street grade (slope) calculations
Frequency of Data Update: Unknown

Streetsedge (Santa Clara County)

Streets in Santa Clara County include assigned Speed Limits for street segments.

Source Agency: County of Santa Clara
Data Source: County of Santa Clara Open Data Portal
Data Format(s): GIS Shapefile (.shp), GIS Geodatabase (.gdb), Google Earth (.kml/.kmz), GeoJSON (.json)
Data Processing Needed: Merging with streets in San Mateo County, bicycle network attributes and street grade (slope) calculations
Frequency of Data Update: Quarterly

Digital Elevation Model

Digital elevation grid layer for the Bay Area used to calculate the slope of street segments - i.e. street grade.

Source Agency: Stanford University Libraries
Data Source: Earthworks Library
Data Format(s): GeoTIFF (QGIS/ArcGIS viewable)
Data Processing Needed: For use in conversion of elevation information into slope for street segment ends.
Frequency of Data Update: Unknown
Contour Lines

*Elevation contours for the Bay Area used to check street segment slopes.*

Source Agency: United States Geological Survey (USGS)
Data Source: [USGS National Map](https://nationalmap.gov/) files used - ELEV_San Francisco_CA_E_1x1 and ELEV_San Francisco_CA_W_1x1grids
Data Format(s): .shp, .jpg
Data Processing Needed: None.
Frequency of Data Update: Unknown

Annual Average Daily Traffic (AADT) on State Highways

*AADT data for state highways were sourced from CalTrans for 2017, the most recent year available.*

Source Agency: CalTrans
Data Source: [CalTrans Traffic Census Program](https://www.dot.ca.gov/states/trafficsafety/trafficdata/caltrans-traffic-census-program.html)
Data Format(s): .pdf, .xlsx
Data Processing Needed: Geocoding the AADT latitude and longitude information based on milepost numbers and summarizing by Ahead or Back AADT values, more detail below.
Frequency of Data Update: Annually for two years prior (e.g. 2017 data released in 2019)

MTC Regional Bicycle Facilities (Bay Area)

*Class I - III bicycle facilities in the nine-county Bay Area.*

Source Agency: [The Metropolitan Transportation Commission](https://www.mtc.ca.gov/)
Data Source: [MTC Open Data Catalog](https://opendata.mtc.ca.gov/)
Data Format(s): .shp, .kml, .xlsx
Data Processing Needed: Using the attributes of the file to create a composite street segments file with coding for existing grade I, II and IV bicycle facilities to note traffic separated and non-traffic separated facilities.
Frequency of Data Update: Periodic data collection from county agencies.
VTA Cross County Bikeways (Santa Clara County)

Existing bikeways in the county and physical barriers to cycling access, cross county bikeway corridors, and priority corridors for cycling investments identified in the 2018 Countywide Bicycle Plan.

Source Agency: Santa Clara Valley Transportation Authority (VTA)
Data Source: VTA Open Data
Data Format(s): .shp (GIS file), .csv, .kml (Google Earth file)

Data Processing Needed: Using the attributes of the file to create a composite street segments file with coding for existing grade I, II and IV bicycle facilities to note traffic separated and non-traffic separated facilities.

Frequency of Data Update: Based on regional planning initiatives.

City-Level Data

Often open data that can be sourced lacks a finer grained resolution of the experience of city streets from the seat of a bicycle. And key to helping prioritize bicycle projects in the communities SVBC collaborates with is defining the best all ages and abilities (8 to 80) design strategies for streets. There are two key factors that both the Danish and Dutch use to determine what level of protected travel from traffic bicycle users need, vehicular speed and traffic volumes. The traffic volumes of a street dictates the degree of separation bicycle users need from traffic, more cars equals a greater need for protection from traffic. And travel speeds of vehicles correlate with a higher degree of protection for bicycle users as well - faster moving cars means slower users, those on bikes and walking, need to be removed from the flow of fast moving cars. The question - is there enough space for bicycle infrastructure? - is secondary to the question: is this street safe for everyone from 8 to 80 years old to ride a bike? If a corridor is a key link to connect a city or town then those corridors need safe all ages and abilities bicycle infrastructure. The key determinants of what will be safe infrastructure for all ages and abilities is how fast and how many cars are moving along that street.

If at all possible the most recent data of traffic volumes, AADT (annual average daily traffic) or ADT (average daily traffic) should be sourced from city and county transportation agencies. As well as sourcing any data of average traffic speeds or recent studies of travel speeds on streets by the city. Cities and counties often complete speed studies to update speed limits.
Data requested from the City of Sunnyvale

● Average Travel Speeds on local streets, from any recent speed studies.
● Average Annual Daily Traffic on local streets.

Potential Data Substitutions

When there is a lack of data for observed traffic volumes and average travel speeds, other correlated metrics can often be used to build similar models and arguments:

1. Number of travel lanes on each street, including turning lanes, as a proxy for high traffic volume streets.
2. Travel lane widths as a proxy for travel speeds.

Often the number of travel lanes, or roadway capacity, is highly correlated with traffic volumes. And excessively wide lanes, greater than 11 feet wide (3.3 meters) are highly correlated with higher travel speeds, every additional meter of width increases travel speeds by 9.4 mph on average.1

Whenever possible if there is any average annual daily traffic (AADT) or average daily traffic statistics (ADT), the later of which can be converted to AADT, and some speed data available for a city within two years, the following assumptions can help fill data gaps.

Basic Data Assumptions for Data Gaps:

1. For streets with no AADT estimate or counts: substitute AADT volumes from a street of similar size/purpose elsewhere in the municipality, ideally the geographically closest street possible.
2. For streets with no average speed data: use AADT volumes as the primary design recommendation if available or substitute with lane widths as the guideline for the level of protection from traffic
3. Narrow residential streets with no AADT or average speed data: often can be assumed to be safe if lane widths are narrow, less than 11 feet, and sidewalks sufficiently wide.
4. Highways and limited access routes: are always assumed unsafe

If counts of Average Daily Traffic (ADT) are provided they can be converted to AADT based on the following:

● Daily Average Traffic (weekday) = Total Vehicles Counted / Hours of Traffic Counting *24
● AADT = Daily Average Traffic * Seasonal Adjustment Factor

State DOT or the FHWA often produce seasonal adjustment factors for certain cities. The evaluation handbook will discuss in more detail the thresholds for AADT and travel speeds as well as any data substitutions that can be used to define the level of protection from motor vehicle traffic for bicycle infrastructure.

Lastly, to augment publicly available data on destinations, data gathering may need to be done for local destinations for shopping and daily activities. For example, in the City of Sunnyvale there was no open data set that included all libraries, civic centers and shopping districts. To generate this dataset, Copenhagenize worked with SVBC to create a list of destinations and map them.

Local Destinations (Sunnyvale)

Locations of local destinations; shopping districts, libraries, civic centers, religious or community centers and developed with SVBC staff.
Source: Developed by Copenhagenize and SVBC
Data Mapping: Working map
Data Format(s): .kml (Google Earth file)

Local biking and planning data must also be collected for the City in question:

City of Sunnyvale Existing Bikeways (Sunnyvale)

Source Agency: City of Sunnyvale
Data Source: Sunnyvale Bike Map
Data Format(s): .jpg
Data Processing Needed: Visual identification and refinement to street segments within Sunnyvale for proper classification of facility before design elevation process in the bike project prioritization tool.
Frequency of Data Update: Based on regional planning initiatives.

Proposed 2020 Bikeway Corridor Plan (Sunnyvale)

Presentation of draft corridors for the City’s Active Transportation Plan on December 5, 2019
Data Source: City of Sunnyvale ATP Website
Data Format(s): .pdf
Data Processing Needed: Visual identification and refinement to street segments within Sunnyvale for proper classification of facility before design elevation process in the bike project prioritization tool.
Frequency of Data Update: TBD on Final Active Transportation Plan public release.
3. Methodologies for Processing Datasets

The following section details the methods used to process the open and city supplied data into complete multi-county datasets and formats that include summary statistics that will be analyzed for the Bike Project Prioritization Tool.

Demographic Data

Merging the five-year American Community Survey estimates into one table required the following steps for census block group based data and census tract level data, respectively. The resulting data files are stored under Demographic datasets in the data library. Summary statistics for key metrics used in the evaluation tool are described and calculated according to the information below.

A. Census Block Group Data Tables and Summary Statistics

For Census block group data, including population, commuter modeshares, single caretaker households, and household income - the block ID was used to create a single summary table.

1. Estimates from the tables identified in data sources were directly sourced.
   1. Total Population (Field Name: TOT_POP_est) = total estimated population of the Census block group.
   2. Total Households (Field Name: TOT_HH_est) = total estimated households of the census block group.

2. The following metrics were calculated.
   1. Percentage of households in the census block group with single parents or related family members caring for children under 18 years of age. Field name: PercentHH_SingleCT

      Calculation: Sum of Households with Male Single Parents, Male Single Related Caretaker, Female Single Parents, Female Single Related Caretaker / Total Number of Households in the block group * 100

   2. Household Income levels are based on research of housing and cost-of-living costs in the Bay Area. Federal and Statewide Poverty guidelines do not reflect the housing cost realities of the South Bay. Income levels are classified in the following way:

      i. Low Income is defined as households in which the income is 1) less than that needed to support basic needs - $25,000 for a family of 4 - according to statewide guidance but is
effectively a precarious financial condition for many families or individuals in high housing cost areas or 2) the majority of households at the income level are spending 40% or more of their income on housing costs.

ii. Middle Income is defined as households where the majority of households spend 20-40% of their income on housing costs.

iii. High Income is defined as households where the majority of households spend less than 20% of their income on housing costs.

These levels are based on the Public Policy Institute of California and MTC’s Vital Signs report,

The following abbreviated field names have been used in data tables:

1. HH_Income_less25k, total number of households in the Census block group with less than $25,000 in annual income. Approximately equal to the classification of income level to meet basic needs for a family of 4 in California statewide.

2. HH_Income_25-50k, total number of households with $25,000 - $50,000 in annual income. These are income levels at which the housing cost burden is 40-50% of income for the majority of households in these income brackets, based on MTC Vital Signs reporting.

3. HH_Income_50-75k = total number of households with $50,000-$75,000 in annual income. This is the level at which housing costs are typically 30-40% for the majority of households in income brackets.

4. HH_Income_75-100k = total number of households with $75,000-100,000 in annual income. This is the level at which housing costs are typically 20-30% for the majority of households in income brackets.

5. HH_Income_100kplus = total number of households with greater than $100,000 in annual income. This is the level at which housing costs are typically less than 20% for the majority of households in this income bracket.

3. Commuter mode share was not used in the final project evaluation but could be used to track the success of Active Transportation Plan implementation moving forward.

Calculations:
Total Workers Carpooling (field name: Carpool) = Sum of 2 person + Carpool, 3 person + carpool, etc.

Bike mode Share (field name: Percent_Bike) = Total number of workers per block group commuting by bike / Total Number of Workers in the block group *100

3. The table was exported as a .csv and then joined with the census block boundaries in QGIS (possible to do in ArcGIS if available) using the GeoID field and the Join Attributes by Field Tool.
B. Census Tract Data Tables and Summary Statistics

1. For Census tract data, which includes household automobile access and the primary language spoken at home, the census tract ID was used to create a single summary table.

2. The following metrics were calculated.
   
   1. Limited or no access to a motor vehicle
      
      1. Percent of households in the census tract who do not own or have access to a car (field name: Percent_HH_NoCarAccess) = Total number of households per census tract without a car / Total Number of Households *100
      
      2. Percent of households in the census tract with only 1 car available, excluding single person/worker households (field name: Percent_HH_LowCarAccess) = Total number of non-single person households with one car / Total Number of Households *100

   2. Census tracts with non-English speaking communities.
      
      1. PercentPop_Non-EnglishLangAtHome = percentage of population in Census tract where another language than English is predominantly spoken at home.
      
      2. PercentPop_Under18_Non-EnglishLangAtHome = percentage of population in Census tract, who are under 18 years of age and speak a language other than English at home.
      
      3. PercentPop_65plus_Non-EnglishLangAtHome = percentage of population in Census tract, who are over 65 years of age and speak a language other than English at home.
      
      4. MajorityPop_Non-EnglishSpeakingAtHome = Census tracts where the majority of the population (>50%) speak a language other than English at home.
      
      5. DominateNon_EnglishLang = categorical assignment of the non-English languages that are spoken at home by the highest number of non-English speaking residents speaking that language group.
         
         1. Spanish
         
         2. Asian or Pacific Islander Languages
            
            1. Non-exhaustive list of examples: Chinese, Vietnamese, Tagalog, Korean, Japanese, Samoan, Hawaiian, Maori

         3. Indo-European Languages
            
            1. Non-exhaustive list of examples: Arabic, Hindu, Urdu, Pakistani Russian, Greek, Persian, Scandinavian languages (Dutch, Danish, Swedish, etc.), romance languages other than Spanish (i.e. Portuguese, French, Italian)

4. The table was exported as a .csv and then joined with the census tract boundaries in QGIS (possible to do in ArcGIS if available) using the GeoID field and the Join Attributes by Field Tool.
Destination Data

The following data sources were merged into single GIS files (.shp and .kml) to create categories of destinations using the Merge Vector tool in QGIS (also available in ArcGIS).

1. Transit Hubs (files titled TransitHubs)
   a. Caltrain Rail Stations
   b. BART Stations
   c. BART Future Stations (Santa Clara County)
   d. VTA Transit Centers for Regional Buses (Santa Clara County)
   e. VTA Light Rail Stops (Santa Clara County)
   f. The two public/private transit centers adjacent to Sunnyvale - Lockheed Martin and DeAnza College

2. Primary & Secondary Schools (file titled Schools)
   a. Private Schools (Santa Clara County)
   b. Public Schools (Santa Clara County)
   c. Schools (San Mateo County)

3. Universities (files titled University)
   a. Universities were geocoded in Google maps then saved as a KML file.

Job locations were available as points from the US Census Bureau Longitudinal Employment and Housing Dynamics Survey. This survey is completed on a quarterly basis, the data was sourced from OnTheMap for the annual data of 2017, for all four quarters.

To calculate job density the data table downloaded from OnTheMap was joined with Census Block boundaries using the Join Attributes by Location, summing the jobs within each Census block group. The following formula was used: Job Density (jobs/square mile) = SumJobs / LandArea

As stated previously, for each municipality the tool is run in, landmarks and destinations for shopping, errands, health care, and community spaces will need to be created as there is not one combined dataset publicly available.
Harm Reduction Data

Bicycle and pedestrian traffic crash data from TIMS was pulled for the most recent three years 2016-2018. Since the data is provided as separate police records the following steps were taken to clean records and summarize the data as three-year traffic crash counts by location. Some crash records did not include geocodable longitude and latitude information. These records had addresses or misspelled street names (e.g. Borden v. Boren) likely leading to geocoding errors before UC Berkeley uploaded them.

1. Missing latitude and longitudes were found by searching information in the location field, which often included addresses in Google Maps. Data was found for 40 records in the 2018 dataset, 62 in 2017 data, and 73 in 2016 data. Anything with CL or city lamp post was not found since there is no easily accessible data set for this.
2. A pivot table was done in Google Spreadsheets to total the crash counts for each location and by crash type (pedestrian, bicyclist, injury or death).
3. The table was then exported as a .csv and georeferenced in QGIS during import using the coordinates (latitude = x, longitude = y).

_Bike_PedCollisions_2016_2018_ is the resulting dataset of crashes between motor vehicles and pedestrians and bicycle users.
Street Network Data

Three interim datasets were created from existing open data files that will help in the evaluation of priority projects. First, an exclusion of all highways, freeways and interstates that prohibit bicycles for a bicycles-allowed street network. Second, merge bicycle network data from each county and join with the composite street network dataset. Also, creating a trails dataset to join to create a complete bicycle-access network dataset. Thirdly analyzing the slope. The resulting final datasets in Street_Network include street names, street grades and information on the type of bicycle facility available.

A. Removing Limited Access Highways

To exclude all grade-separated highways from an analysis for bicycle connectivity the following steps were done:

1. Merger of the two streets datasets from each county using Merge Vectors tool in QGIS
2. Removal of the following limited access highways (Interstates 280, 380, 690, 880; US Hwy 101, State Routes 85,87, 237, 92 and 17 south of Los Gatos)
   a. Steps to remove limited access highways from dataset - counties name streets differently so there are two steps):
      i. In table view in QGIS Select features by equation for SMC streets = "NAME" IN ('US HIGHWAY 101','STATE HIGHWAY 85','STATE HIGHWAY 87','STATE HIGHWAY 237','STATE HIGHWAY 92', 'RAMP')
      ii. For the SCC streets Select features by equation with ="streetlabe" IN ('280', [rest of list])
      iii. Delete features from the merged two-county street dataset
   b. Likewise remove the highway on-ramps/cloverleafs for these street segments with following selections and then deleting selected features:
      i. For each highway remove the on-ramps/cloverleafs with a select features by equation as follows: "streetname" LIKE ('%101%') for Highway 101. And so on for%280% ' %380% ' %880% ' %690% ' %85% ' %87% ' %287%' %92%
      ii. Note: the streetname field includes things such as WB from 101 to NB 17 for cloverleaf or on-off ramp segments using the wildcard % symbol allows for selecting all the associated 101 on/off ramps.
B. Protected and Painted Bicycle Facilities Data Layer

To exclude all sharrowed or signed bike routes from the data set the following data queries were done. Exclude all Class 3 routes (bike routes/sharrows) from files using query builders for each data layer in QGIS

- Regional Bicycle Facilities layer from MTC
  - First select by facilities within San Mateo County Boundaries using Select by Location tool.
  - Definition query: "class" < > '3'

- Bike Paths Lanes Routes Santa Clara County
  - "CLASS_TYPE" NOT IN ('Bike Boulevard', 'Bike Route (Shared Roadway)')

- Cross County Bikeways VTA - only include existing facilities
  - "STATUS" = 'completed' AND "BIKECLASSN" IN ('1','2','4')

Using the Merge Vector Layers tool in QGIS combine all the bicycle facilities into one file and remove redundancies if necessary. Join bicycle facilities layer to the streets network layer using Join Attributes by Location tool.

Creating a bicycle trails dataset took significant clean-up as the regional route data was poorly geocoded. Redundant segments were checked again satellite imagery and removed.

1. Merge trails from VTA, MTC and Santa Clara County data for the Class I facilities, sometimes listed as off-street trails, by using select features by equation for each dataset then merging selected features into a single GIS file [add link to data library]

2. In Editor in QGIS select links and delete them if visually two redundant segments are side by side. Here's and example just east of Baylands Park:

   ![Redundancy in the trails GIS data shows with overlapping green & purple segments](image)

The final trails layer was joined to the street network using the Merge Vector Layers tool in QGIS.
C. Calculate Street Grade (Slope)

After a single bicycle-allowed network layer is created the following steps were taken to calculate the slope of street segments (street grade). Using the 30m Digital Elevation Model (DEM) from Stanford slope values are calculated from the elevation at the endpoints of each line segment.

1. Using the "Drape (set Z value from raster)" tool to add elevation from the DEM to the vertices. This converts the 2-D road network to three dimensions.
   a. Z values are stored as the Z coordinate of each vertex but need to be called to be viewed.

2. Using the Field Calculator to calculate slope value (percent grade) for each street segment:
   a. Calculate a new field Street_Slope or Street_Grade
   b. Enter \( \frac{\text{abs}(z(\text{start_point}($geometry)) - z(\text{end_point}($geometry)))/\text{length} \times 100} \)

   Method Originally Sourced from GIS Stackexchange

Note: the streets and trails data were already highly segmented and most street lengths are a few hundred feet so given that the DEM is a 30m grid size (approx. 100 feet) the streets were not further segmented but this can be done using the Explode lines tool to split each line segment smaller segments if necessary.

D. AADT for Caltrans Highways

To import the 2017 highway AADT data into GIS software an older 2014 AADT GIS dataset was sourced from Stanford University. A unique ID for joining the 2017 table data was created in Google Sheets using the concatenate function.

Formula: =Concat (County Abbreviation - Highway Route # - PostMile Prefix Post Mile #).

For some locations the 2017 data was missing and 2016 data was substituted. The resulting field “AvgAADT” is an average of the available data. “AvgAADT” is the average of back and ahead AADT if both are available otherwise it is Back or Ahead AADT if only one was provided.

Caltrans reports Back AADT and Ahead AADT are defined in the following table:

<table>
<thead>
<tr>
<th>Shapefile/KML Column Name</th>
<th>Full Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017_B_PeakHr</td>
<td>2017 Peak Hour Traffic for Back direction</td>
</tr>
<tr>
<td></td>
<td>“Back” Defined as: Back AADT, Peak Month, and Peak Hour usually represents traffic South or West of the count location.</td>
</tr>
<tr>
<td>2017_B_PeakMo</td>
<td>2017 Peak Month Traffic for Back direction</td>
</tr>
<tr>
<td></td>
<td>“Back” Defined as: Back AADT, Peak Month, and Peak Hour usually represents traffic South or West of the count location.</td>
</tr>
</tbody>
</table>
| _17BackAADT          | 2017 AADT for Back direction  
|                     | “Back” defined as: Back AADT, Peak Month, and Peak Hour usually represents traffic North or East of the count location. |
| 2017_A_PeakHr       | 2017 Peak Hour Traffic for Ahead direction  
|                     | Defined as: Ahead AADT, Peak Month, and Peak Hour usually represents traffic North or East of the count location. |
| 2017_A_PeakMo       | 2017 Peak Month Traffic for Ahead direction  
|                     | Defined as: Ahead AADT, Peak Month, and Peak Hour usually represents traffic North or East of the count location. |
| _17AheadAADT        | 2017 AADT for Ahead direction  
|                     | Defined as: Ahead AADT, Peak Month, and Peak Hour usually represents traffic North or East of the count location. |

This point data for AADT was joined using the *Join attributes by location* to the street network file resulting in the files titled *StateHighways_AADT2016_2017*.

All GIS Data

Before exporting all shapefiles to KMLs for Google Earth the *Batch Project* tool was used to transform shapefiles from the project coordinate system NAD 83 State Plane (EPSG: 102643) to the geographic coordinate system WGS 84 (EPSG:4326).
4. Local Bicycle Data Gathering Toolkit

Data Collection Strategies

Beyond the numerous existing datasets that can be collected, treated and used to make a case for better bicycle network planning and design, there are tried and tested bicycle data collection techniques that allow arguments to be made to bolster advocacy and give narrative an edge. Through collecting new data, the narrative in question can be curated and energy can be directed to ensure that the data collected directly helps to answer existing questions or bolster existing arguments. This section will take a look at a number of strategies that SVBC can employ independently with staff and volunteers, larger methodologies and technologies that can be used in concert with local authorities or in partnership with a larger organization, as well as a number of observational techniques that can be deployed in local municipalities.

A. Independent SVBC Data Collection

To begin, we present a number of easy-to-do bicycle data collection methodologies that SVBC can work on internally to build up a local data framework in the coming years.

- **Manual Counts**
  Counting bicycles is a powerful tool for storytelling, showcasing patterns and trends, and demonstrating legitimacy in the use of bicycles or growth of use over time. Developing a counting framework that consistently counts bicycles in strategic places can allow for comparison of location or time frame and allows for more flexibility in storytelling options. A successful framework first and foremost requires investing in people for reliability and strategic flexibility. Utilizing a team of volunteers at strategically timed intervals throughout the year, placed at strategically important locations in the city, allows the data collector to create a rich and robust data set that can be followed over time for patterns and stories to emerge. The development of a reliable volunteer or staff group requires proficient organization, solid training for consistency among counters, and the development of counting shifts and tools that work for the local context.
CASE STUDY: In Copenhagen, a framework of manual counting has been in place for decades. Teams of contract staff are placed at strategic locations across the city and observe traffic for 3 hour shifts as to not tire out too much. At each location, counters choose a straight line of sight (referred to as a screenline) and count all modes of transport that cross that line of sight, including bicycles and cargo bikes. All counts are logged in a handheld digital reader with tactile buttons to make clicking as easy as playing a video game. Workers are often teenagers in search of a part-time job or retirees looking to help out the city with necessary data collection. Collecting data in this consistent way over decades has created a huge bank of data to craft narratives from patterns and comparisons.

- Intercept Surveys
While counting allows for the collection of hard numbers to build an argument and create narratives of cycling growth over time on certain corridors, one cannot gain an understanding of perception and safety through counts. Small, several-question surveys can be disseminated to passers-by along a certain corridor quite easily in order to gain a better understanding of these more subjective data points. Intercept surveys work very well during events like open streets, or upon the launch of a new facility. These surveys can take the form of postcards with an access link to a digital survey or can simply be a 2 minute conversation between interceptor and road user. There are also many ways that stories can be created through the collection of this data, by asking bicycle users before and after the construction of a new facility their perspectives or inquiring into how shop owners believe customers access their businesses. The opportunities are endless and simply require some strategic planning, organizational tact of interceptors and a little bit of creativity in writing the surveys.
Intercept survey in Copenhagen asking bicycle riders to check out a

- **Bike Audits & Infrastructure Rides**

  A site audit is typically conducted on an individual site, but can be extended to include a street or travel route in order to better understand the experience on the ground. Often these can be described as “bike audits” whereby a group of attendees (led by a local expert) assess a specific place or route. Questionnaires can be used in order to guide the participants’ observations of the environment before a facility is built. Following the completion of the project, they can be repeated to gauge the impact of the improvements.

  When site audits are performed as a group it has a greater impact on understanding the situation on the ground. When used before and after implementing a project, there is a benchmarking effect that also provides insight for future project work. And if led by a researcher and/or user of the site, additional insight can be gleaned from their personal or professional experience. SVBC has significant experience running infrastructure rides and this can be bolstered with a consistent questionnaire and methodology for conducting the rides before and after bicycle facility construction.
B. Methodologies in Collaboration with Local Authorities

In tandem with local authorities, there are a number of technology-aided methodologies for data collection to deploy that count and collect ongoing bicycle data, allowing for an incredibly rich dataset to draw from. A collaboration between municipal governments collecting bicycle count data on public property such as right-of-ways, with advocacy building a narrative and compelling arguments with that open data, can together have a great impact on legitimizing urban cycling and changing hearts and minds. There are a number of technologies for different solutions and problems, but it is important to keep in mind that in areas with very low existing cycling numbers, running an automatic counter for a longer period of time will allow for more data collection and in turn better narrative development.

- **Mobile, Automatic Counting Technology**
  A great complement to intercept surveys in before-after studies on newly constructed facilities is the mobile counter that automatically counts bicycle traffic over a longer time period of time than a manual counting shift. Many cities across North America are investing in a handful of counting boxes that are equipped with pneumatic rubber tubes strung across the lane of bicycle travel. The tubes are left for days or weeks and each pressure hit of bicycle wheels on the counter registers as a unique bicycle rider. These are a completely non-invasive and easy-to-install way to collect medium-term data, while also having the flexibility to move them around from place to place within a count strategy over one season. The data from these counters can be extrapolated to longer periods of time when used in tandem with permanent counters and the yearly patterns they collect.

  ![Mobile counters like pneumatic tube counters offer rich data and flexible strategies](image.png)

- **Permanent, Automatic (and Sometimes Visible) Counting Technology**
  A growing number of cities are investing in permanent counters that lie hidden in the pavement, counting day and night, year-round. The vast majority of these counters use a magnetic loop that registers the metal of the bicycle wheels as it passes over. Many cities simply choose to use these loops at a number of hidden locations to build year-long
models and document different patterns along utilitarian or recreational bicycle facilities. These patterns can then be used as a framework for extrapolating spot counts done either by manual or automatic means. This allows for a larger cross-comparison of bicycle counts across the city’s territory, and stronger story-telling options. In many cases, a digital totem is installed adjacent to the permanent counter to show the passing rider what number they are for the month or year. This serves as a powerful storytelling tool for every passerby whether by bike, on foot or in a car. The digital totem and counter placed at strategic locations, near city hall, or a busy farmers market, can really showcase the legitimacy of bicycles in numbers.

A digital totem next to a permanent counting loop in Long Beach, CA

- **Longitudinal data collection**
  The case of Copenhagen demonstrates how a strategy of permanent and temporary counting methodologies performed consistently over decades can build a foolproof narrative to invest in and build a cycling city year after year. Since the 1970s, counts have been performed across the city, with yearly counting always performed at locations organized in the shape of two rings around the city - an inner loop around the core (called the Lakes Cross Section), and an outer loop at the municipal boundary. Over time, the
The City of Copenhagen implemented permanent counters at these locations and continued to monitor bicycle and motor vehicle traffic at locations along these two rings across the territory of the city. Through longitudinal data collection at consistent locations, the City of Copenhagen was able to demonstrate in 2015, for the first time in history, that there were more bicycles than cars circulating in the city. This powerful message was picked up by international media and helped cement the city as the cycling capital of the world. This was possible in part due to a consistent tracking of data over decades, showcasing growth in bicycle use as infrastructure investment and construction began to expand across the city and out of the 1960s motor age. In essence, consistent growth and tracking allowed for more growth and in turn more tracking, until Copenhagen became the bicycle mecca it is today. All of this data from count locations is contained in an online open data map portal on the City’s website that citizens, researchers and members of a diversity of organizations can use to build their own compelling narratives.

Count locations and 40-year results from Copenhagen's longitudinal data tracking

Copenhagen’s open data map allows users to access count data all over the city.
C. Developing Rich Data through Observation

"It is far easier, simpler to create spaces that work for people than those that do not — and a tremendous difference it can make to the life of a city."

- William H. Whyte, The Social Life of Small Urban Spaces

Inspired by the pioneering work of urbanists like William H. Whyte and Jane Jacobs in the U.S. and Jan Gehl in Denmark, the practice of observation as a data collection tool for pedestrian behavior and public space design has brought many cities today to think about new methodologies. By looking for behavioral patterns on-the-ground, the planner and designer can learn a lot about how the infrastructure might be adapted to favor the needs of the vulnerable user. In this section, a number of observational ideas are presented for bicycle data collection that members and partners of SVBC might use to continue to build stronger narratives in their bicycle advocacy efforts, buttressed by additional behavioral data from observational activities.

- **Observing Desire Lines as Traces of Urban Democracy**

  As a powerful methodological tool for behavioral bicycle data collection in the urban environment, observational techniques that track Desire Lines can help advocates describe and demonstrate what is happening on the ground and convey that narrative to city staff, elected officials and the general public. The concept of the Desire Line can be observed physically in the urban environment through green spaces, where informal paths have been created that do not follow the officially designed and built infrastructure of a walkway or bikeway.

  *Desire Lines show how citizens choose to move, when infrastructure may not suit them*
To use this concept as a useful methodology, Copenhagenize Design Co. has developed a series of Desire Lines Analyses over the last decade to log, categorize and understand these movements of citizens on their bicycles. This methodology is generally performed at an intersection, or any point in the street network where there is the greatest potential of conflict and need for design that protects the most vulnerable of road users, while ensuring efficient and comfortable movement through the city. In all Desire Lines Analyses, an intersection is filmed for an extended period of time and the footage is logged afterward in order to map all observed behavior. Morning and evening rush hour periods are always captured as well as sufficient footage of midday activity which can often be more erratic and perplexing. Observed bicycle users are grouped into three categories:

1. **Conformists**: These are bicycle users that follow all rules of the road
2. **Recklists**: These are bicycle users that recklessly break a rule, without any seemingly justifiable reason
3. **Momentumists**: These are bicycle users who behave in a somewhat ambiguous way. For example, they may not stop 100% at a stop sign to maintain their momentum, or stop ahead of a stop line at a red light to get ahead of a car and remain visible for safety.

*Desire Lines in Montreal study show on strong conformist movement and many others*

Once all bicycle movements have been mapped, they can be categorized into movement typologies, each of which can be given a title of conformist, recklist or momentumist. Through this process, a narrative of how many bicyclists break the rules can be developed and explained – more often than not showcasing that the vast majority of
bicycle users follow the rules, a small handful act recklessly, while there is always a contingent that are in a grey area. It is this last group that creates an interesting conversation – the behavior of the momentumists allows for a discussion about why these movements are being observed at a particular intersection, and how spot changes to the design of the intersection might turn these users into conformists.

![Pie chart showing 31% Momentumists, 67% berri and cherrier, and 2% other]

Results from Montreal study showed 31% of movements fell into the “Momentumist” category, which elicit a discussion on how the design might improve this behavior.

SVBC and Copenhagenize hosted a Data Collection Workshop in December 2019 in Sunnyvale to test out the Desire Lines Analysis methodology on videos of cyclists moving through intersections in Copenhagen, Montreal and Barcelona. Participants identified each type of bicycle user and presented their findings to the group as a means of developing the skill set to perform the analyses in local contexts. The workshop schedule and worksheets from the event are included in the Appendix for future use.

![Image of workshop participants discussing]

Participants of the Data Collection Workshop discuss desire line observations.
D. Potential Data Collection Efforts for 2020

To date, SVBC has undertaken data collection efforts to define safe routes to schools in the Sunnyvale School District. There are opportunities to expand this work and incorporate bicycle counting, cycling behavior observations and intercept surveys in the following ways:

■ Safe Routes to School Audits
  Building and expanding upon the existing work in Sunnyvale, SVBC could expand efforts to other school districts. Using the tools learned during the December 7, 2019 workshop, counts and cycling behavior monitoring, SVBC’s membership can use observations of cycling and walking at school entrances or key intersections near schools to galvanize investment in safer infrastructure. Intercept surveys could be given to parents to provide feedback with their children. A brightly colored postcard with survey information and stickers as a Thank You for families walking and cycling to school would be a creative way to make intercept surveys more fun for a younger audience.

■ Bike to Work Day Intercept Surveys & Cycling Counts
  Like SVBC’s Bike to Work Day events in the past, commuter coffee & snack stations with short intercept surveys provide an opportunity to gauge existing and new cycling commuters on their way to work. If a link to a web survey is provided on a Thank You! postcard, it can be easily passed to folks on their way past the station. In survey-fatigued communities, “thank you” messaging encourages people to reply to surveys.

Bike to Work day is a “peak” bicycle travel event, there is an opportunity for robust Desire Lines observations during morning and afternoon rush hours, due to larger numbers of people cycling. The annual event is also an opportunity to start a longitudinal cycling count data set for spring cycling rates at key locations across the region.
Intersection Redesign Evaluations
As Active Transportation Plans are implemented in cities throughout San Mateo and Santa Clara counties, intersections will be redesigned for cycling. San Jose’s recent Better Bikeways is a prime example where significant changes were made to existing bicycle facilities and several downtown intersections were redesigned with cycling in mind. These types of intersection redesigns are ideal for the Desire Lines analysis tool - by observing cycling behaviours before the changes and after the intersection redesign, SVBC can showcase how safer infrastructure results in safer cycling behaviors.

Evaluating Problem Locations
Beyond intersections that will or have undergone significant improvements, SVBC likely has a number of places where SVBC members and communities have expressed safety concerns about cycling. Crash statistics may also reveal where conflict points arise from poorly designed cycling infrastructure or roadways that lack infrastructure but are high demand cycling routes. These locations can serve as sites to prioritize a desire lines analysis during peak travel times or Bike to Work Day. By gathering and bringing the data to the local municipality on how an intersection can be improved to limit reckless behaviour, SVBC sets safety priorities and shifts roadway engineering conversations towards more bicycle-friendly intersection design.
Developing Data Partnerships

Throughout Silicon Valley, many organizations maintain open datasets, including universities, and local and county governments. As shown in Section 2 of this Guidebook, the data gathered from these organizations often lacks specifics on the number of people bicycling at specific locations. When cycling count data is collected, the surveys are infrequent. Building on existing work, like the San Mateo County annual bicycle count, SVBC can help build long-lasting bicycle data practices in the region that serve to not only create a full account of cycling demand but also measure growth in bicycling and its important role in meeting social mobility, safety and environmental goals. Two key strategies can further this effort:

1. **Develop data partnerships with local research groups**

Potential data partnerships with local universities include San Jose State University's Mineta Transportation Institute and the Department of Urban and Regional Planning. Both institutions have faculty and students whose interests overlap with the work of this data tool as well as creating community-oriented sustainable transportation.

Anually, the Mineta Transportation Institute seeks proposals between the consortium's faculty and outside organizations for projects that serve overlapping objectives of SVBC's bicycle project prioritization tool and data gathering efforts. These objectives are:

- A. “Create a safer, more reliable, and more resilient surface transportation system that improves equity through increased access to jobs, housing, services, and other opportunities.
- B. Reduce the impact of transportation on climate change by identifying feasible alternative modes and fuels and effective ways to reduce vehicle miles traveled.
- C. Extend surface transportation access to people of all abilities and socioeconomic levels, connecting people to where they live, work, and play.”

Additionally the work of the Bicycle Project Prioritization Tool is highly adaptable for collaboration with the Department of Urban and Regional Planning department chair, Dr. Laxmi Ramasubramanian, whose research places a focus on community participation in developing collaborative geographic information science (GIS)-based planning tools.

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2 Mineta Transportation Institute, 2020. [https://transweb.sjsu.edu/sites/default/files/pdfs/emerging-leaders-seed-grant-application.pdf](https://transweb.sjsu.edu/sites/default/files/pdfs/emerging-leaders-seed-grant-application.pdf) and [https://transweb.sjsu.edu/csutc/about](https://transweb.sjsu.edu/csutc/about)

3 San Jose State University, Department of Urban and Regional Planning Faculty & Staff, 2020. [http://www.sjsu.edu/urbanplanning/facstaff/index.html](http://www.sjsu.edu/urbanplanning/facstaff/index.html)
2. Co-advocate with cities for open data practices by private bicycle service providers

Beyond local university research groups SVBC has a potential role to partner with city agencies to advocate for open data sharing practices by private bike- and scooter-share service providers. These companies collect a vast amount of data on where two-wheeled transportation is highest. Cities, including Los Angeles have made data sharing a requirement in service agreements, resulting in operators having their licenses suspended when they do not comply. Private transportation operators claim that data on scooter and bikeshare pick-up and drop-off locations are a breach of user privacy, yet, LA Metro is using the anonymized data to evaluate ridership and increase scooter- and bike-share parking across the City. Rider information is never linked to trip data on pick-up and drop-off locations. As cities in Silicon Valley renegotiate the terms of scooter- and bike-share services, SVBC can help bolster non-motorized transportation by advocating open data partnerships that allow ridership information to be shared that supports better bicycle and scooter transportation infrastructure.

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Telling a Story with Bicycle Data

At the tail-end of the bicycle data collection process, facts and figures have been amassed, trends and patterns identified and observations have been noted down. Now is the time to do something with this data and turn it into advocacy, argument and narrative. In this final section, we showcase a number of communications techniques used in order to disseminate the outcome of data collection – and translate it into easy-to-understand stories for decision makers and the general public.

■ With decades of data in the vault and continual, ongoing efforts for new data collection in practice at the City of Copenhagen, a biannual “Bicycle Account” is published to share the outcomes of two years of cycling in the city. Survey responses are tracked and compared to past years and future benchmarks for success, new investments are showcased and future plans are outlined. This is all packaged in a small, easy-to-read and visually compelling booklet of 15-20 pages that is available in both print and digital formats. The latest version from 2018 can be seen here.

Modal shifts from temporary projects are shown in the Copenhagen Bicycle Account

Data from the new suburban cycle routes are also featured in the Bicycle Account
In Calgary, Canada, a protected bicycle network pilot was built and maintained for a one-year period on 3 streets in the downtown core. A number of counts, surveys and observations were performed throughout the pilot and countless “meme-able” graphics from the data outcome were created and shared across social media. The graphics showed the positive benefits and observations of the pilot project, the small negative outcomes for drivers to combat misconceptions, and the hard data of what was done. These graphics helped bolster the project and gain a successful city council vote to make the network permanent, with growing ridership every year. A number of the graphics can be seen below:

In a Desire Lines Analysis performed by Copenhagenize Design Co. in Barcelona, observations, conflicts and near-misses between bicycles and vehicles were catalogued over a 7 hour filming session of a few local intersections. These observations and trend analyses were able to show that on average, there was a vehicle obstructing the bicycle lane every 9 minutes, often leading to a potentially dangerous situation for cyclists passing through the intersection. This bite-sized observed trend, communicated in a very easy-to-understand sentence made a big impact with City staff and became the most important outcome of the study, demonstrating that there was in fact a real issue in the bicycle lane design that needed fixing to keep citizens safe.