As a part of the San Mateo Bicycle Master Plan update, Toole Design conducted a needs and demand analysis that included:

- Bicycle Network Analysis, including a Level of Traffic Stress analysis and Connectivity analysis
- Potential Demand Analysis
- Collision Analysis

This memo presents the findings from these analyses.

KEY TAKEAWAYS

The following are the key findings from the analyses:

1. Today, San Mateo’s bicycle network is mainly comprised of high-stress bikeways due to a lack of comfortable, connected north-south and east-west connections; bicycle crossings over Highway 101, State Route 92, and arterials; and low-stress connections to trails.

2. The areas of highest potential demand for bicycling are around Downtown San Mateo, the Hillsdale Caltrain station, and the Hayward Park Caltrain station.

3. Most bicycle-vehicular collisions in San Mateo occur on arterial roadways with collision hotspots near San Mateo High School, Downtown San Mateo, between the Hillsdale and Hayward Park Caltrain stations, and at the Highway 101 and Hillsdale Boulevard junction.
BICYCLE NETWORK ANALYSIS

Overall, the purpose of the Bicycle Network Analysis (BNA) is to identify the areas of San Mateo that are not currently well-served by a low-stress bicycle network.

WHAT IS A LOW-STRESS NETWORK?

Most people in the U.S.—between 50 and 60 percent—have little tolerance for interacting with motor vehicle traffic while bicycling unless volumes and speeds are low (see Figure 1).¹ This group of riders is referred to as “Interested but Concerned,” reflecting both their interest in bicycling for transportation as well as concerns about safety and comfort when interacting with motor vehicle traffic.²

Figure 1. Level of Traffic Stress and Bicycle Riders

This framework of rider types was used to assess the existing bicycle network and will be used to select recommended facility types for the 2019 Bicycle Master Plan.

BICYCLE NETWORK ANALYSIS PROCESS

The BNA is a two-step process:

1. **Level of Traffic Stress (LTS) analysis** – The LTS analysis is used to categorize roadways and streets according to perceived stress level for cyclists, from low stress to high stress. In practical terms, the low-stress network is intended to correspond with what is comfortable for a typical adult with an interest in riding a bicycle but who is concerned about interactions with vehicular traffic (i.e., the Interested but Concerned bicyclist). This analysis was performed based on the City’s existing street and bicycle network conditions as of December 2018.

2. **Connectivity analysis** – This Connectivity analysis identifies the level of connectivity provided by the low-stress network. This includes analyzing how connected each census block is to a variety of

---

² Studies, such as the Dill et al., referenced above, show that approximately one-third of the adult population is not currently interested in bicycling or able to bicycle.
destinations\(^3\) in the community, and how connected each census block is to other census blocks on an unbroken low-stress connection.

The results of this analysis will be used to identify major barriers, to develop the proposed bicycle network, and subsequently to prioritize the bicycle project list.

**BICYCLE NETWORK ANALYSIS: LEVEL OF TRAFFIC STRESS**

**Methodology**

For bicyclists, the degree of traffic stress when riding on streets is influenced by numerous factors. Level of traffic stress (LTS), as developed by researchers at the Mineta Transportation Institute, is the industry standard for assessing comfort and connectivity. Toole Design updated those methods to include traffic volumes and presence of street parking for vehicles as additional factors that impact level of traffic stress. The six factors used to determine if a roadway is high or low stress in this methodology are:

- Traffic speed
- Traffic volume (using estimated volumes or number of lanes as a proxy)
- Number of through lanes
- Presence of street parking for automobiles (including parking width)
- Type of bicycle facility
- Presence of a centerline

The project team used these factors to evaluate the LTS of three different facility categories for the entire street network in San Mateo:

1. Separated facilities (such as trails or shared use paths)
2. Mixed traffic (including bike facilities like sharrows, or bike routes, as well as no bicycle facility)
3. Bike lanes

The project team gave trails a default low-stress score, since by their nature trails are separated from the roadway and thus have lower degrees of traffic stress.

LTS also evaluates the intersection stress. Wider, high speed streets create high-stress barriers when there is no intersection control. Intersection stress is important because a high-stress crossing can be a barrier to an otherwise low stress segment. The four factors used to determine if an intersection is high or low stress in this methodology are:

- Intersection control (none/yield, rectangular rapid flash beacon, and signalized, HAWK, four way stop, or priority)
- Number of crossing lanes
- Crossing speed limit
- Median island

The assumptions used for this analysis, as outlined in the Assumptions Memo dated November 14, 2018, are shown in Table 1.

\(^3\) Destinations are taken from Open Street Map (OSM) data and include population, jobs, schools, colleges, universities, doctors, dentists, hospitals, pharmacies, supermarkets, social services, parks, community centers, retail, transit.
## Results

For this analysis, the project team grouped streets into two categories:

- Low stress (LTS 1 and LTS 2)
- High stress (LTS 3 and LTS 4)

The LTS results for San Mateo show that the City is comprised primarily of high-stress bicycle facilities bikeways (see Figures 2 and 3).

San Mateo has 42 miles of bicycle facilities that are high-stress, and 38 miles of bicycle facilities that are low-stress, of which 19 miles are Class I paths. This slight majority of high stress bicycle facilities (53%) indicates that the majority of the bicycle facilities are not comfortable for all users.

While 59 percent of streets are designated as low-stress, most of these are neighborhood streets without an existing bicycle facility (see Table 2) that are not typically utilized by bicyclists. These neighborhood streets often have low-speed, low-volume vehicular traffic, but they often do not connect to one another or require crossing large high stress barriers to connect with other areas of the city.

The remaining 41 percent of streets, which include many frequently used by people bicycling, are considered high stress for bicyclists based on this analysis. The streets designated high-stress may or may not currently have bicycle facilities – 30 percent of the high-stress network has existing bicycle facilities, but these facilities do not provide adequate separation from vehicular traffic. Lack of separation creates a network that is not comfortable for bicyclists of all ages and abilities. For example, Alameda de las Pulgas is designated as a Class III bike route; however, Alameda de las Pulgas is an arterial road which creates a high-stress segment due to volume and speeds of vehicles.

The LTS results indicate that while many residents have a low-stress street outside their front door, most people would not feel comfortable bicycling beyond the limits of their immediate neighborhood because it is either:

- Surrounded by high-stress streets, or
- Separated from nearby neighborhoods by a high-stress crossing at a major street

Furthermore, many key destinations including the Hillsdale Shopping Center, Aragon High School, San Mateo Central Park and all three Caltrain stations are located on high-stress streets.
Table 2. Existing High- and Low-Stress Street Network

<table>
<thead>
<tr>
<th>Low-Stress Network</th>
<th>Miles</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streets with No Bicycle Facility</td>
<td>166 miles</td>
<td>82% of low-stress streets</td>
</tr>
<tr>
<td>Streets with a Bicycle Facility</td>
<td>38 miles</td>
<td>18% of low-stress streets</td>
</tr>
<tr>
<td>Total Low-Stress Network</td>
<td>204 miles</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High-Stress Network</th>
<th>Miles</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streets with No Bicycle Facility</td>
<td>101 miles</td>
<td>70% of high-stress streets</td>
</tr>
<tr>
<td>Streets with a Bicycle Facility</td>
<td>42 miles</td>
<td>30% of high-stress streets</td>
</tr>
<tr>
<td>Total High-Stress Network</td>
<td>143 miles</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Overall Street Network

<table>
<thead>
<tr>
<th></th>
<th>Miles</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Stress</td>
<td>204 miles</td>
<td>59% of high-stress streets</td>
</tr>
<tr>
<td>High Stress</td>
<td>143 miles</td>
<td>41% of high-stress streets</td>
</tr>
<tr>
<td>Total Network</td>
<td>347 miles</td>
<td></td>
</tr>
</tbody>
</table>

Street Network

The San Mateo bicycle network has significant high-stress barriers (see Figure 2).

Major Network Barriers

While bicyclists do not expect motorways such as Highway 101 or State Route 92 to be low-stress or used by bicyclists, these roadways still present barriers when crossing and break up the low-stress network. There are currently four crossing along Highway 101: two Class III facilities, one Class II facility and one Class I facility. The existing crossings are not evenly dispersed along the length of the highway, and most are high-stress experiences. The low-stress crossings (3rd Avenue Class I path and Monte Diablo Ave bridge) have their own access challenges for bicyclists as well.

State Route 92 also has limited crossings between the Peninsula Golf and Country Club and Highway 101. Currently there are two existing Class III facilities One of these crossings is at Delaware Street, but this intersection is a Class III bike route, offering no additional infrastructure for cyclists. This is one of the most direct north-south connectors, but this intersection is a high stress crossing and could be a barrier to cyclists using that route. Other major barriers include the Caltrain tracks, El Camino Real, and Alameda de las Pulgas.

Downtown San Mateo

Downtown San Mateo, especially south of the San Mateo Caltrain station, is a "high-stress island" that contains many high-stress streets and is surrounded by high-stress streets. Downtown is one of the few areas in San Mateo that lacks access to a low-stress bikeway.

Waterways

Water bodies also act as barriers. The Seal Slough has only two low-stress crossings, which limits connectivity to the trail network in the east of the city.

Existing Bicycle Network

To understand the existing network, the level of traffic stress is first analyzed along the bicycle network. This helps provide a broad picture of what it is like to bike on the existing bicycle network in San Mateo.
Lack of North-South and East-West Connections

Currently, San Mateo has no continuous north-south or east-west low-stress bicycle connections; the cross-town bikeways that do exist are high-stress. Therefore, bicyclists cannot ride across the city without riding on a high-stress street at some point during their trip (see Figure 3).

For example, Delaware Street/Pacific Boulevard is the north-to-south corridor that connects to the three Caltrain stations in San Mateo. Delaware Street/Pacific Boulevard from Peninsula Avenue to 42nd Avenue has segments of both Class II bike lanes and Class III bike routes, and some segments are low-stress; however, most of the corridor is high-stress which creates a lack comfortable, low-stress connections to the Caltrain stations. In the east-west direction, there are a limited number of streets that are not bisected by State Route 92 or Highway 101. Hillsdale Boulevard offers a direction connection across the city but is high-stress.

Arterial Intersections

Another barrier for bicyclists is crossing arterial roadways because these are often points of conflict between bicyclists and motorists. Intersections often lack separated bicycle facilities, and particularly on arterials, the number of travel lanes can result in long exposure times. For example, Hillsdale Boulevard from Glendora Drive to S Norfolk Street has Class II bike lanes on some segments and is designated as a Class III bike route on other segments. This bikeway also crosses two high-stress arterials (Alameda de las Pulgas and El Camino Real) which creates a high-stress environment for riders, and the lack of protection on the Class III bike route segment is considered high-stress for Interested but Concerned riders.

Trails

As mentioned earlier, trails are considered low-stress because they are off-street and separated from motor vehicle traffic. Within San Mateo, trail access is located along the San Francisco Bay to regional trails such as the Bay Trail. While the trail segments themselves are low-stress, connections to the trails from the existing bicycle network are limited and often high-stress, especially at intersections, such as at J Hart Clinton Drive. This may limit a bicyclist’s ability to access the trails by bike, therefore encouraging people to drive to trailheads.
SAN MATEO BIKE PLAN: Level of Traffic Stress - Bicycle Facilities

<table>
<thead>
<tr>
<th>Transit</th>
<th>Other</th>
<th>Bicycle Level of Traffic Stress (Bicycle Facilities)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail Lines</td>
<td>Parks</td>
<td>High Stress</td>
</tr>
<tr>
<td></td>
<td>Schools</td>
<td>Low Stress</td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Level of Bicycle Traffic Stress – Bicycle Facilities
BICYCLE NETWORK ANALYSIS: CONNECTIVITY

Methodology
The BNA approach provides an understanding of where connectivity challenges exist. The BNA evaluates the connectivity of each census block to other census blocks within biking distance (which correlates to 1.67 miles, the distance an average rider would travel in ten minutes biking ten miles per hour). The BNA then assesses the number and types of destinations available within each of those blocks.¹

Defining Connectivity
The BNA assumes a census block connects to any street that either follows its perimeter or serves its interior. Two census blocks are only considered “connected” if an unbroken low-stress street connects them; therefore, even a short high-stress segment or high-stress intersection can negate a potential connection.

The BNA also considers detours; if a low-stress route deviates more than 25 percent when compared to the shortest potential direct route, then a low-stress route is not considered to be available.

Based on the information about which census blocks are connected, the BNA calculates the total number of destinations accessible on the low-stress network. Then, the BNA compares this with the total number of destinations that are within biking distance, regardless of whether they are accessible via the low-stress network.

Assigning Points
Points are assigned on a scale of 0-100 for each destination type based on the number of destinations available on the low-stress network and the ratio of low-stress destinations to all destinations within biking distance. The scoring places higher value on the first three low-stress destinations by assigning points on a stepped scale, and then are prorated for additional destinations. After the first few low-stress destinations, points are prorated up to 100.

For example, a census block encompasses five parks; however, low-stress connections are available to only one park. The scoring takes into account the ratio of low-stress accessible destinations to all destinations of that type within an area. Within each destination type, the first destination counts for the most points, and the remaining destinations count for a proportion of the remaining points.

Destination Categories
The BNA looks at six categories for assessing connectivity:

1. Population
2. Opportunity⁵ (i.e. jobs and education)
3. Core Services⁶
4. Recreation⁷
5. Retail
6. Transit

For categories that include more than one destination types, the category score is calculated by combining the scores of each destination type. For census blocks where a destination type is not reachable by either high- or low-stress routes, that destination type is not included in the calculations. For example, if a city has no institute of higher education, the “opportunity score” will exclude the higher education destination type so the score is

¹ For the BNA, destination data is pulled from Open Street Map and population data is pulled from the US Census.
⁵ Includes employment, K-12 education, technical/vocational schools, and higher education.
⁶ Includes doctor offices/clinics, dentist offices, hospitals, pharmacies, supermarkets, and social services.
⁷ Includes parks, recreational trails, and community centers.
unaffected by its absence. This means that areas of a city with a denser concentration of destinations are not scored more highly than those with more dispersed destinations.

Results
The LTS analysis is a key input into network connectivity. Areas with low connectivity often have high-stress streets bounding the census blocks. This limits how many destinations are accessible via the low-stress network (see Figure 5).

Overall, San Mateo has many areas with low-connectivity due to the presence of major barriers, such as Highway 101, State Route 92, arterials such as El Camino Real, collector roads, the Seal Slough, the Caltrain tracks, and other barriers (see Figure 4). For example, the shopping center at the junction of 92 and El Camino Real has very low connectivity because the freeway and the arterial separate the shopping center from the low-stress bicycle network.

Street networks also influence connectivity—areas within the city that have a traditional street grid (such as south of 4th Avenue and Delaware Street, and north of 10th Avenue and Delaware Street) have more permeability in the network and are inherently better connected.

Areas of low or high connectivity throughout San Mateo are not evenly distributed. The two areas of highest connectivity are:

- **San Mateo Park neighborhood -** *Mainly local, low-stress bikeways with few high-stress barriers*
- **Mariners Point –** *Well-connected to the trail network with a low-stress crossing over the Seal Slough. This area is an important recreational destination that has good internal connectivity.*

The areas of lowest connectivity are:

- **Borel Square, strip mall and development next to Peninsula Temple Beth El, and existing Concar Drive shopping center –** *Limited crossings of Highway 101 and SR 92, which makes these roadways barriers to connectivity.*
- **Hillsdale Shopping Center and San Mateo Medical Center –** *Limited crossings exist over the Caltrain tracks and Highway 101.*
SAN MATEO BIKE PLAN: Bicycle Network Connectivity and Level of Traffic Stress

- Transit
- Rail Lines
- Caltrain Stations
- Schools
- Level of Traffic Stress (All Streets)
- BNA Connectivity (0-100)
- High Stress
- Low Stress

Figure 5. Bicycle Network Connectivity and Level of Traffic Stress
POTENTIAL DEMAND ANALYSIS

Potential Demand Analysis is used to determine where there is a high potential for people to bicycle.

Methodology

The analysis is based on a number of assumptions and professional judgement, and results in a composite score of these assumptions. The goal of the Potential Demand Analysis is to use these factors to identify patterns and areas with high potential for bicycle demand based on development patterns and demographic factors. However, the analysis is not meant to be predictive of actual bicycle activity. Key destinations are considered in the BNA rather than in the Potential Demand Analysis.

As outlined in the Assumptions Memo, a potential demand score is calculated by weighing the following factors:

- Intersection density
- Population density
- Transit access
- Job density
- Percent of households below the poverty line
- Population under 18 density

The potential demand is calculated at the census block geography. Each factor is calculated separately and then the factors are weighed individually to create a composite score. Table 4 provides a description of factor calculations, data source, and weight.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Calculation</th>
<th>Data Source</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersection Density</td>
<td># intersections with &gt; 3 legs</td>
<td>OSM street network</td>
<td>26%</td>
</tr>
<tr>
<td>Population Density</td>
<td>Total population/census block area</td>
<td>2016 ACS 5-year estimates</td>
<td>18%</td>
</tr>
<tr>
<td>Transit Access</td>
<td>Located within ¼ mile of a train station</td>
<td>CalTrans</td>
<td>18%</td>
</tr>
<tr>
<td>Job Density</td>
<td>Total employment/census block area</td>
<td>2014 Origin-Destination Employment Statistics (LODES), from the Longitudinal Employer-Household Dynamics (LEHD)</td>
<td>15%</td>
</tr>
<tr>
<td>Percent of Households Below Poverty Line</td>
<td>Households below poverty line/total households in census block group</td>
<td>2016 ACS 5-year estimates</td>
<td>15%</td>
</tr>
<tr>
<td>Population Under 18 Density</td>
<td>Population under 18/census block group</td>
<td>2016 ACS 5-year estimates</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

Results

The high-demand areas for bicycling are illustrated in Figure 6 and include three general areas:

- Downtown San Mateo
- Hillsdale Caltrain station
- Hayward Park Caltrain station
The Potential Demand factors are distributed unevenly throughout San Mateo per the following:

- **Intersection density.** Since most of the San Mateo street network is based on a grid pattern, there is a high intersection density throughout the city.

- **Population density.** Population levels are highest in north San Mateo and near Downtown. With some peaks, population density is otherwise fairly level in the area south of SR 92.

- **Transit access.** San Mateo has three transit stations, which are spaced approximately 1 mile apart through the middle of the city.

- **Job density.** Generally, employment locations are located along SR 92 and El Camino Real. High employment density is located around Downtown, at the Bridgepointe Shopping Center (near SR 92 and Foster City), San Mateo Community College, and the Hillsdale Shopping Center.

- **Percent of households below the poverty line.** A high percentage of households below the poverty line are located in north San Mateo with other areas of concentration in the area around Hillsdale and Hayward Park Caltrain stations.

- **Population below 18 density.** The locations with high populations under 18 are concentrated near schools. The highest concentration is located in the neighborhoods within a half mile of San Mateo High School.
COLLISION ANALYSIS

Bicycle master plans have many functions, one of which is identifying projects and methods for reducing and eliminating bicycle-vehicle collisions. The first step to reducing and eliminating collisions is understanding the current environment – the who, when, what, and how of bike collisions.

To better understand San Mateo’s current collision environment, data was obtained from the City of San Mateo. The project team reviewed five years of collision data (from 2013-2017). The data is from police reports, so an unreported collision would not appear in the data. Near misses are also not included in this data, but certainly impact how comfortable a person feels biking and subsequently how likely they are to bike.

For a map of the collision locations, see Figure 7.

---

8 Typically, collision data is pulled from the University of California-Berkeley’s Safe Transportation Research and Education Center which maintains the Transportation Injury Mapping System (TIMS); however, San Mateo collision data was unavailable from TIMS for 2013, 2015, and 2016.
To better understand San Mateo’s bicycle collision history, the following section provides an overview of collision severity, seasonality, geographic distribution, and primary collision factors.

**COLLISION SEVERITY**
In general, bicycle collisions are more likely to be severe than collisions involving only motor vehicles since bicyclists are more exposed than occupants of motor vehicles. In San Mateo from 2013-2017, 205 bicycle collisions occurred, none of which were fatal. Of the collisions, 90 resulted in visible injuries, seven had severe injuries, and 21 were property damage-only (see Figure 8).

![Figure 8. Collision Severity for Bicycle Collisions](image)

**SEASONALITY**
Most collisions in San Mateo occur between late spring and fall, with a slight peak in October and May (see Figure 9). This could be related to recreational bicycling that occurs in the summer and in the temperate spring and fall months. A slight increase in October and November could be due to daylight savings and shorter days.

![Figure 9. Bicycle Collisions by Month 2013-2017](image)
GEOGRAPHIC DISTRIBUTION
Geographically, bicycle collisions are not evenly distributed throughout San Mateo. As shown in Figure 10, San Mateo has four collision hotspots which include:

- **San Mateo High School.** Collisions near San Mateo High School are concentrated along Poplar Avenue and near the intersection of East Poplar Avenue and Delaware Street.

- **Downtown San Mateo.** Downtown has a high number of collisions, with the majority of bicycle collisions are located on existing Class III bike routes.

- **Between Hillsdale and Hayward Park Caltrain Stations.** Collisions between Hayward Park and Hillsdale Caltrain stations are located along El Camino Real and at 25th Avenue. 25th Avenue connects to Delaware, a low-stress, north-south bicycle connection and alternative to Alameda de las Pulgas.

- **Junction between Highway 101 and Hillsdale Boulevard.** A large number of collisions are seen along Hillsdale Boulevard leading up to, and crossing, Highway 101.

Bicycle Facilities
- Class 1 Existing
- Class 2 Existing
- Class 3 Existing

Bicycle Collisions (by number injured)
- 1
- 12

No Injury Crash
Transit
Rail Lines

Other
- Parks
- Schools
- Water

Figure 10. Bicycle Collisions (2013-2017) Heatmap
Bikeways and Street Types

Identifying the locations of collisions on streets with bikeways can help assess whether a facility type is the right choice for the street. However, it is expected that bicycle collisions may occur on streets with bikeways because bicyclists are more likely to ride on streets with bikeways. Without bicycle volume data, it is not possible to normalize collisions by bicycle volumes on each street.

The presence of bikeways also affects how bicyclists and motorists interact since some facilities (such as Class IV separated bike lanes) provide more separation between bicycles and motor vehicles. Other facilities, such as Class III bike routes offer no separation.

Between 2013-2017, over 30 percent of the collisions in San Mateo occurred on streets with bikeways (see Table 5). The collision analysis indicates that Class III bike routes have the highest percentage of collisions for streets with bikeways; however, Class III bike routes are the most common bikeway in San Mateo, and they have the highest number of lane miles.

The collisions on trails were at junctions of the trail and the on-street network.

### Table 5. Bicycle Collisions by Bikeway Type

<table>
<thead>
<tr>
<th>Bicycle Facility Type</th>
<th>Number of Bicycle Collisions</th>
<th>Percent of Total Bicycle Collisions</th>
<th>Percent of Road network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trails (Class I)</td>
<td>3</td>
<td>1%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Bike Lanes (Class II)</td>
<td>24</td>
<td>12%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Bike Routes (Class III)</td>
<td>44</td>
<td>21%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Streets without Bikeways</td>
<td>134</td>
<td>66%</td>
<td>90%</td>
</tr>
<tr>
<td>Total</td>
<td>205</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Additionally, arterials have the highest number of bicycle collisions (see Table 6). These facilities are typified by higher speeds, higher traffic volumes, and more travel lanes. This aligns with research that shows that bicycle collision rates rise significantly with higher vehicle speeds.\(^9\)\(^,\)\(^10\)\(^,\)\(^11\) As noted earlier, arterials are also where many destinations, such as retail and job centers, are located, so a higher number of bicycle riders is not surprising.

### Table 6. Bicycle Collisions by Road Type

<table>
<thead>
<tr>
<th>Road Facility Type</th>
<th>Number of Bicycle Collisions</th>
<th>Percent of Total Bicycle Collisions</th>
<th>Percent of Road Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial</td>
<td>115</td>
<td>56%</td>
<td>8%</td>
</tr>
<tr>
<td>Collector</td>
<td>38</td>
<td>19%</td>
<td>5%</td>
</tr>
<tr>
<td>Local</td>
<td>33</td>
<td>16%</td>
<td>18%</td>
</tr>
<tr>
<td>Other(^12)</td>
<td>19</td>
<td>9%</td>
<td>69%</td>
</tr>
<tr>
<td>Total</td>
<td>205</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

---


\(^12\) Other includes some crashes that were not within 20 feet of a road, or crashes that were on freeways or ramps.
PRIMARY COLLISION FACTORS

Primary collision factors define the main cause of collisions. In San Mateo, six primary collision factors accounted for over 70 percent of the bicycle collisions (see Table 7). These primary factors included:

- Automobile right of way violation
- Other hazardous movement
- Improper turning
- Wrong side of road
- Traffic signals and signs
- Unsafe speed

The hierarchy of factors in San Mateo varies slightly from those typically seen in California. In California, the typical top three primary collision factors—regardless of whether the collisions involve bicyclists—are “unsafe speeds,” “automobile right of way,” and “improper turning.” The “wrong side of road” violation is a top factor unique to bike collisions.

The following is a description of the most common collision types in San Mateo:

- **Automobile Right of Way** refers to when another mode (bike or pedestrian) is in the ROW/path of an oncoming vehicle because of not yielding correctly. An example collision might be a bicyclist not stopping at a stop sign and getting hit by a driver proceeding straight through the intersection.

- **Other Hazardous Movement** encompasses other movements not specified by other primary collision factor categories.

- **Improper Turning** refers to making a turn without the necessary cautions. An example of a collision caused by improper turning is the “right hook,” in which a driver turns right without checking and/or yielding for a bicyclist in the bike lane to the right of their vehicle.

- **Wrong Side of Road** implies that one of the users was going the incorrect direction for the lane. In most bike collisions, this means that the bicyclist was riding in the opposite direction of travel. The most likely collision scenario is if the driver is making a right turn, they look to the left to check for vehicle traffic and then start turning right, not seeing a bicyclist coming from the right.

<table>
<thead>
<tr>
<th>Primary Collision Factor</th>
<th>Number of Collisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto R/W Violation</td>
<td>34</td>
</tr>
<tr>
<td>Other Hazardous Movement</td>
<td>29</td>
</tr>
<tr>
<td>Improper Turning</td>
<td>24</td>
</tr>
<tr>
<td>Wrong Side of Road</td>
<td>23</td>
</tr>
<tr>
<td>Traffic Signals and Signs</td>
<td>21</td>
</tr>
<tr>
<td>Unsafe Speed</td>
<td>19</td>
</tr>
<tr>
<td>Unknown</td>
<td>12</td>
</tr>
<tr>
<td>Unsafe Starting or Backing</td>
<td>7</td>
</tr>
<tr>
<td>Unsafe Lane Change</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
</tr>
<tr>
<td>Not Stated</td>
<td>5</td>
</tr>
<tr>
<td>Improper Passing</td>
<td>5</td>
</tr>
<tr>
<td>Primary Collision Factor</td>
<td>Number of Collisions</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Driving Under Influence</td>
<td>4</td>
</tr>
<tr>
<td>Other Than Driver</td>
<td>3</td>
</tr>
<tr>
<td>Ped R/W Violation</td>
<td>3</td>
</tr>
<tr>
<td>Other Improper Driving</td>
<td>2</td>
</tr>
<tr>
<td>Ped or Other Under Influence</td>
<td>1</td>
</tr>
<tr>
<td>Following Too Closely</td>
<td>1</td>
</tr>
<tr>
<td>Impeding Traffic</td>
<td>1</td>
</tr>
<tr>
<td>Pedestrian Violation</td>
<td>1</td>
</tr>
</tbody>
</table>

**CONCLUSION**

The data presented in this memorandum will be used to develop the proposed bicycle network recommendations and the support program recommendations. The City of San Mateo can also use these findings to support the implementation of new projects and use of City funds on bicycle infrastructure.