

ATTACHMENT

BICYCLE SAFETY STUDY FOR THE GOLDEN GATE BRIDGE

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1. Introduction

This report presents a study of bicycle safety issues on the Golden Gate Bridge (Bridge) sidewalks including the rules of operation, bicycle and pedestrian user counts, bicycle collision history, and bicycle speeds. The report provides recommendations to reduce accidents on the Bridge sidewalks – solo bicycle, bicycle-bicycle, and bicycle-pedestrian. The study area of this report includes both the east and west sidewalks between the north and south entry gates; other sections of pathway or roadway approaching the Bridge (e.g. Conzelman Road) are not included in this study.

2. Existing Conditions

Bridge Sidewalk Conditions & Regulations

The sidewalks on the Golden Gate Bridge allow for bicycle and pedestrian access across the Bridge, subject to certain regulations on different times and days of the week. The sidewalks are approximately 10 feet wide across most of the span. The 10-foot effective width is reduced at light poles and at other areas where maintenance equipment is stored along the outside railing. At their narrowest point the sidewalks are 5.5 feet wide around the Bridge pylons, shown in Figure 1. At the Bridge towers the sidewalks narrow to approximately 7.5 feet in width. The sidewalks are separated from the adjacent vehicular travel lanes by a curb and a steel safety barrier. The rise in elevation across the Bridge roadway is 84.4 feet.¹

Bridge Access Rules

Signs are posted at each sidewalk entry point that define the schedule for bicycle and pedestrian use on the two sides of the Bridge. Figure 2 and Figure 3 show the existing signs posted on the east and west sides displaying the sidewalk rules. These rules are intended to provide safe travel and separation for non-motorized users. Bicyclists and pedestrians use different sides of the Bridge during most peak periods. Skateboards, skating,



Figure 1: A narrow section of the sidewalk adjacent to a pylon on the east side



Figure 2: Golden Gate Bridge Rules and Restrictions Sign –East Side

¹ <https://www.goldengate.org/bridge/history-research/statistics-data/faqs/> Accessed on 2/7/2020

and scooters are not permitted on the sidewalks.² More details regarding the access rules are in the following two sections.

Pedestrians

Pedestrians and wheelchairs are allowed only on the east sidewalk, which is open daily. Roller blades, skateboards, and roller skates are not permitted. Dogs are not permitted on the sidewalk except for service animals. Pedestrians are allowed on the east sidewalk from 5 AM to 6:30 PM during Pacific Standard Time, and from 5 AM to 9 PM during Pacific Daylight Time. Hours are enforced by automatically-controlled gates that open and close at the appropriate times.

Bicycles

Bicyclists currently have toll-free access to the Bridge's sidewalks at all times. Bicyclists are instructed to yield to pedestrians and are advised to use caution in the areas of the towers where sight distances are constrained and there is limited space to maneuver. Motor-driven cycles and motorized bicycles (mopeds), as defined by California Vehicle Code sections 405 and 406, may be pushed or ridden on the bridge sidewalks, provided the engines or motors are not in operation and the motor-driven cycle or motorized bicycle is propelled by human power only. The District's Master Ordinance currently does not address electric bicycles, as defined by California Vehicle Code section 312.5 (established in 2016). District officials report their intention to address electric bicycles from a policy perspective as part of this greater effort to study and improve safety on the Bridge sidewalks.

Bicycle access is as follows:

Pacific Daylight Time (second Monday in March to first Sunday in November)

Weekdays

- Bicyclists use the east sidewalk between 5 AM to 3:30 PM, sharing it with pedestrians and the west sidewalk from 3:30 PM to 9 PM.
- Bicyclists use the east sidewalk 9 PM to 5 AM via remotely controlled security gates located at both ends of the sidewalk. Cyclists press the "buzzer" located near the closed security gate. After security staff identifies the cyclist on a security camera, the gate is opened remotely. Cyclists repeat this procedure to exit through the security gate at the other end.

Weekends and Holidays

- Bicyclists use the west sidewalk from 5 AM to 9 PM.
- Bicyclists use the east sidewalk from 9 PM to 5 AM, using remotely controlled security gate system described above.



Figure 3: Golden Gate Bridge Rules and Restrictions Sign – West Side

² <https://www.goldengate.org/bridge/visiting-the-bridge/bikes-pedestrians/> Accessed on 2/7/2020

Pacific Standard Time (*first Sunday in November to second Monday in March*)

Weekdays

- Bicyclists use the east sidewalk between 5 AM to 3:30 pm, sharing it with pedestrians and the west sidewalk from 3:30 PM to 6:30 PM.
- Bicyclists use the east sidewalk 6:30 PM to 5 AM via remotely controlled security gates located at both ends of the sidewalk. Cyclists press the "buzzer" located near the closed security gate. After security staff identifies the cyclist on a security camera, the gate is opened remotely. Cyclists repeat this procedure to exit through the security gate at the other end.

Weekends and Holidays

- Bicyclists use the west sidewalk 5 AM to 6:30 PM.
- Bicyclists use the east sidewalk from 6:30 PM to 5 AM, using the remotely controlled security gate system described above.

Existing Bicycle and Pedestrian Count Data

To better understand the safety issues on the Golden Gate Bridge, the Bridge District performed a series of bicycle and pedestrian counts on the Bridge. The counts were conducted using a “screenline” methodology where all bicyclists and pedestrians were counted when entering the Bridge as they crossed an imaginary line perpendicular to the sidewalks at each of the four Bridge entry points. Only people entering the Bridge were counted (i.e. traveling north from the San Francisco side, or traveling south from the Marin side). Counts were conducted on a Saturday (September 12, 2015), a Sunday (September 13, 2015), and two weekdays (Tuesday, September 15, 2015 and Wednesday, September 16, 2015). Counts were collected on all four days on the east side of the Bridge from 5:00 AM to 9:00 PM and on the west side of the Bridge from 4 PM to 9:00 PM during the weekday and from 5:00 AM to 9:00 PM during both weekend days. This methodology took account of the fact that not all pedestrians or bicyclists cross the Bridge in its entirety on the sidewalks. While some bicyclists and pedestrians enter at one end and leave from the other, others enter from the south and leave from there too.

Peak Hour

Table 1 presents the peak hour times and counts of bicyclists and pedestrians on both sides of the Bridge, as well as the daily total number and percentage of bicyclists on the Bridge for the four days surveyed. Findings include:

- The San Francisco side of the Bridge (both east and west sidewalks) has higher overall volumes of people entering the Bridge sidewalks. This is likely due to the higher concentration of visitors accessing the Bridge from San Francisco. Nearly 64 percent of visitors during peak hour on the west side of the Bridge entered from the south. 58 percent of visitors during peak hour on the east side of the Bridge entered from the south.
- The highest hourly volumes counted on one sidewalk were on the east sidewalk on Tuesday from 11:30 AM – 12:30 PM, a time when the west sidewalk is closed to bicyclists. 431 (38.2 percent) of east sidewalk users at this time were bicyclists.

- A small number of bicyclists use the east sidewalk when the west sidewalk is open, and a small number of pedestrians use the west sidewalk
- Peak hours on the east sidewalk are between 1:00 PM and 4:30 PM on weekends and on weekday mornings, when there are high volumes of both pedestrians and bicyclists.
- Peak hours on the west sidewalk are evening commute hours (4:00 PM – 5:00 PM) and midday weekends (11:30 AM – 12:45 PM).
- There are nearly twice as many daily users on the Bridge sidewalks on the weekend than during weekdays. This differential is consistent for both pedestrians and bicyclists.

Table 1: Golden Gate Bridge Peak Hour Bicycle and Pedestrian Use

East Sidewalk							
Day	Time	Peak Hour			16 Hour Total		
		Pedestrians	Bicyclists	Both	Pedestrians	Bicyclists	Both
Weekday	11:30 AM - 12:30 PM	697 (61.8%)	431 (38.2%)	1,128	4,591 (67.2%)	2,240 (32.8%)	6,831
Saturday	3:30 PM - 4:30 PM	983 (99.8%)	2 (0.2%)	985	8,147 (99.7%)	26 (0.3%)	8,173
Sunday	1:15 PM - 2:15 PM	1,120 (99.6%)	4 (0.4%)	1,124	7,545 (99.4%)	42 (0.6%)	7,587

West Sidewalk							
Day	Time	Peak Hour			16 hour Total		
		Pedestrians	Bicyclists	Both	Pedestrians	Bicyclists	Both
Weekday	4:00 PM - 5:00 PM	9 (3.8%)	229 (96.2%)	238	28 (3.8%)	718 (96.2%)	746
Saturday	11:30 AM - 12:30 PM	40 (4.9%)	782 (95.1%)	822	213 (3.7%)	5,536 (96.3%)	5,749
Sunday	11:45 AM - 12:45 PM	21 (2.3%)	892 (97.7%)	913	225 (3.8%)	5,753 (96.2%)	5,978

Daily Volumes

Pedestrian and bicycle volumes vary on the Golden Gate Bridge throughout the day. Figure 4 and Figure 5 present weekday bicycle and pedestrian volumes on the east and west sidewalks in half-hour increments. Bicycles and pedestrians have similar use patterns on weekdays.

Figure 6 and Figure 7 present Sunday bicycle and pedestrian volumes on both sides of the Bridge divided into half-hour increments. Sunday volumes are presented because Sunday peak hour counts were higher than Saturday's (Table 1). Large volumes of pedestrians enter the Bridge in the mornings around 9:00 or 10:00 AM, depending on the day, and volumes remain high until 7:30 PM. Both pedestrian and bicycle volumes are high during the afternoon, and bicyclists have a prominent peak period on the west sidewalk at midday on weekends.

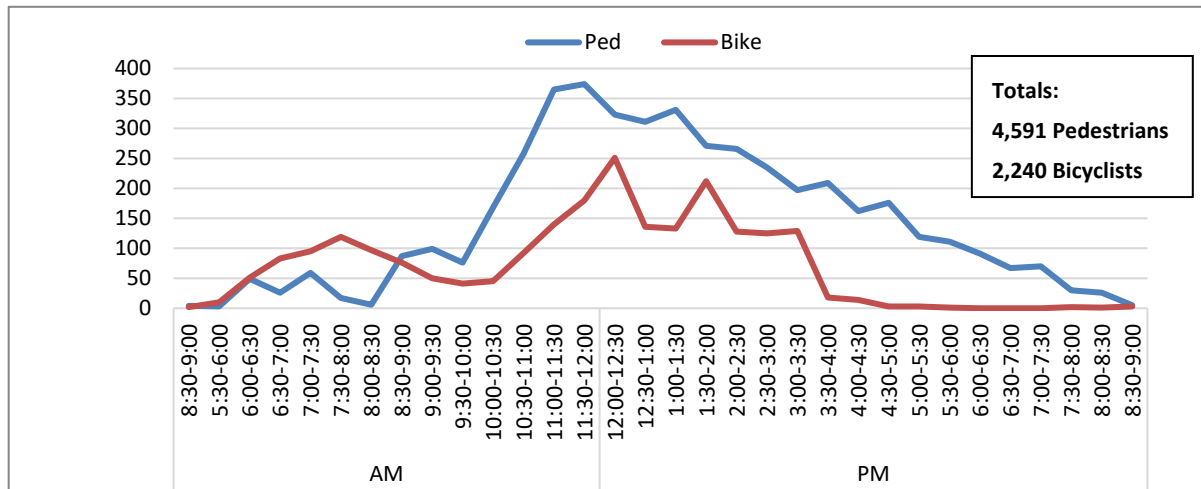


Figure 4: Weekday East Sidewalk Pedestrian and Bicycle Volumes

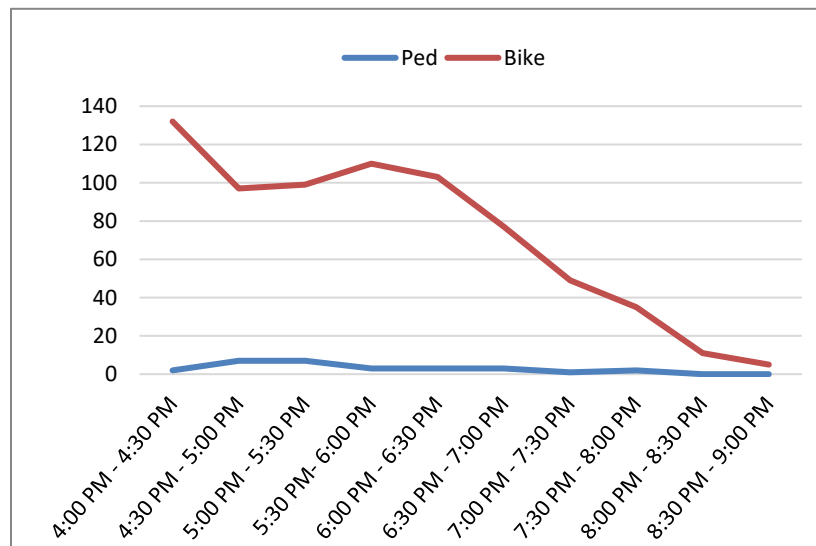


Figure 5: Weekday West Sidewalk Pedestrian and Bicycle Volumes

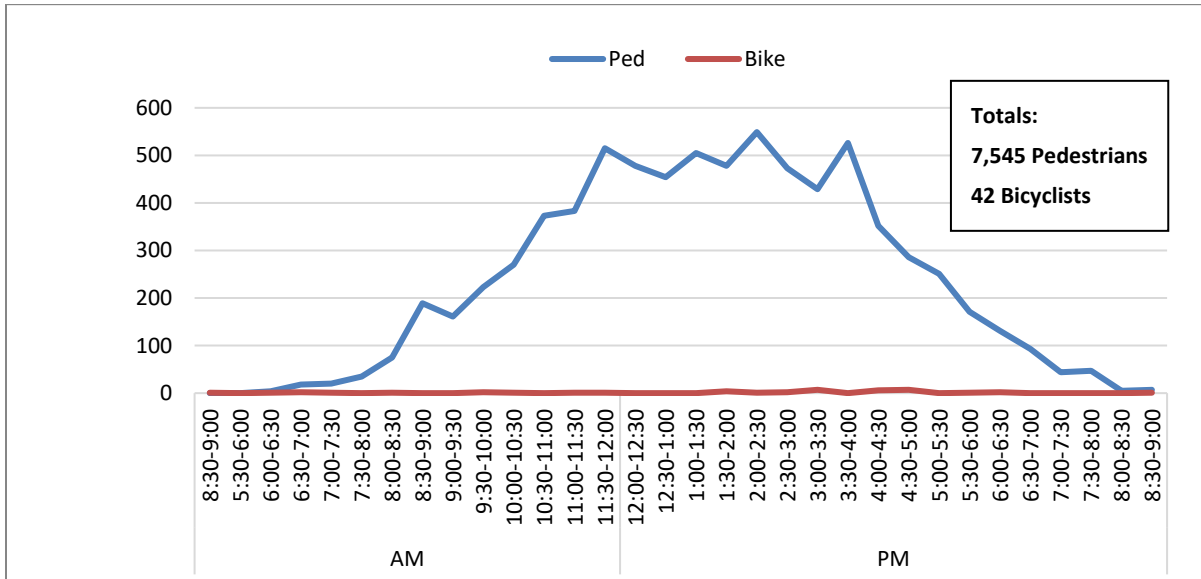


Figure 6: Sunday East Sidewalk Pedestrian and Bicycle Volumes

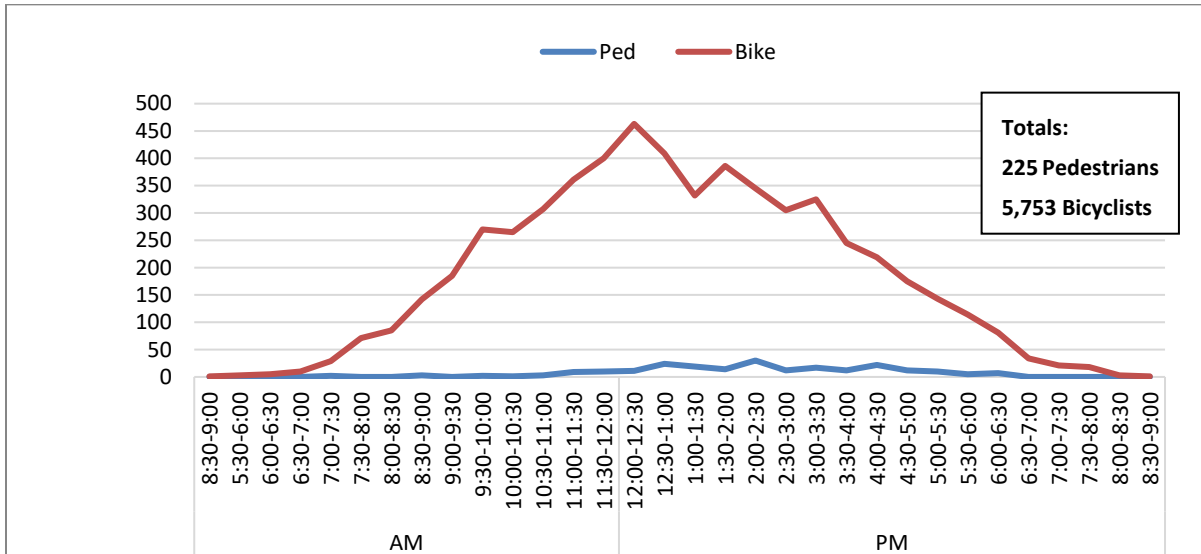


Figure 7: Sunday West Sidewalk Pedestrian and Bicycle Volumes

Existing Bicycle Speeds

Bicycle speeds are measured, displayed and recorded by radar speed signs located on the Bridge sidewalks. Bicycle speed survey data was gathered from the speed sign located on light pole 30 on the west side of the Bridge which captures the downhill speeds of cyclists traveling northbound to Marin County and a second speed sign located on light pole 111 on the east side of the Bridge which captures downhill speeds of cyclists traveling southbound towards San Francisco.

The Bridge District provided the following four reports of data captured by the speed signs:

- Two reports containing 24 hours of speed data captured on Monday, July 1, 2019 for each side of the bridge, aggregated by hour of day.
- One report containing speed data captured from June 3, 2019 to June 30, 2019 on the west sidewalk, aggregated by hour of day.
- One report containing speed data captured from June 12, 2019 to June 30, 2019 on the east sidewalk, aggregated by hour of day.

The speed signs occasionally capture the speeds of non-bicyclists, including vehicles traveling at high speeds over the bridge. Speeds of bicyclists traveling at speeds lower than 8 mph are not recorded by the signs. These factors are likely to artificially raise the average recorded speeds, especially on the east side of the Bridge during peak hours when it becomes crowded with tourists and bicyclists are forced to travel particularly slow. It should be noted that despite these issues with the data, the average recorded speeds are consistent with those collected in a 2011 speed study, which did not use radar to gather speed data and the samples sizes are large and the estimated number of errant data points are low at less than 1%. The following speed analysis focuses on the multi-week reports, which provide a more complete picture of average bicyclist speeds for each hour of the day.

Speed of bicyclists on the west and east sides of the Golden Gate Bridge vary. Generally, bicyclists travel faster on the bicycle-only west side than on the east sidewalk shared with pedestrians. Speeds also vary by section of the Bridge, slower on the up slopes and faster on the down slopes. Based on observations, the highest speeds and greatest potential for speed-related collisions comes from road cyclists (i.e., non-tourist, experienced recreational cyclist) who may travel up to 10 mph faster on average than other types of bicyclists. These faster riders generally account for about 10 percent of bicyclists on the Bridge, with higher percentages at certain times, such as Saturday mornings when many group rides leave from San Francisco and head into Marin.

West Side Bicycle Speeds

The west side of the Golden Gate Bridge is open to bicyclists on weekdays from 3:30 PM to 6:30 PM and on weekends from 5:00 AM to 6:30 PM during Pacific Standard Time. Weekday and weekend closing hours on the west side of the Bridge are extended to 9 PM during Pacific Daylight Time. Generally, bicyclists travel faster on the west side than the east side of the Bridge because there are no pedestrians affecting the flow of bicycle traffic. The greatest potential conflict arises when the bicyclists traveling at higher speeds attempt to pass bicyclists riding at slower speeds. This can include groups of bicyclists passing other groups of bicyclists and can occur in both the northbound and southbound directions. This is especially challenging when the pathway narrows at the pylons and towers.

Speeds of bicyclists riding downhill towards Marin County are measured and recorded by the radar speed sign at light pole 30. Table 2 shows the hourly average speeds recorded from June 3, 2019 to June 30, 2019. It is important to note that these recorded averages may be slightly higher than actual travel speeds as the speed signs do not record bicyclists traveling below 8 mph, and because the signs occasionally record the speeds of vehicles traveling over the bridge at high speeds. The overall average speed on the west sidewalk for the data period was 17 mph and the 85th percentile speed for the period was calculated to be 20 mph.

Table 2: Bicyclist Speeds on the West Side of the Bridge

Hour	Average Speed
5:00 AM - 6:00 AM	17 mph
6:00 AM - 7:00 AM	17 mph
7:00 AM - 8:00 AM	17 mph
8:00 AM - 9:00 AM	18 mph
9:00 AM - 10:00 AM	17 mph
10:00 AM - 11:00 AM	17 mph
11:00 AM - 12:00 PM	17 mph
12:00 PM - 1:00 PM	15 mph
1:00 PM - 2:00 PM	17 mph
2:00 PM - 3:00 PM	16 mph
3:00 PM - 4:00 PM	17 mph
4:00 PM - 5:00 PM	18 mph
5:00 PM - 6:00 PM	18 mph
6:00 PM - 7:00 PM	18 mph
7:00 PM - 8:00 PM	17 mph
8:00 PM - 9:00 PM	21 mph

East Side Bicycle Speeds

The east side of the Bridge is open to bicyclists on weekdays from 5:00 AM until 3:30 PM, and every night during the hours that the west side of the Bridge is closed. Bicyclists using the east side of the Bridge during the day must share the sidewalk space with pedestrians. The greater number of users creates congestion, and this “friction” forces bicyclists to travel at slower speeds for much of the Bridge span. The greatest potential conflict occurs when faster moving bicyclists attempt to pass other cyclists or pedestrians. Pedestrians and bicyclists, including slower moving tourists and faster moving tourists and recreational bicyclists, must occupy the same area on the Bridge. The chance for conflict is greatest at the pylons and towers where the path width is constrained, and when bicyclists are traveling down slope and their speeds are highest. Like the west side, speeds vary by section of the Bridge, slower on the up slopes and faster on the down slopes. Bicyclists typically ride slower than 10 mph on the up slopes, but may travel up to approximately 28 mph on the down slopes.

Speeds of bicyclists riding downhill towards San Francisco are measured and recorded by the radar speed sign at light pole 111. Table 3 shows the hourly average speeds recorded from June 12, 2019 to June 30. It is

important to note that these recorded averages may be slightly higher than actual travel speeds as the speed signs do not record bicyclists traveling below 8 mph, and because the signs occasionally record the speeds of vehicles traveling over the bridge at high speeds. The overall average speed on the east sidewalk for the data period was 13 mph and the 85th percentile speed for the entire period was calculated to be 17 mph.

Table 3: Bicyclist Speeds on the East Side of the Bridge

Hour	Average Speed
12:00 AM - 1:00 AM	13 mph
1:00 AM - 2:00 AM	16 mph
2:00 AM - 3:00 AM	17 mph
3:00 AM - 4:00 AM	16 mph
4:00 AM - 5:00 AM	16 mph
5:00 AM - 6:00 AM	16 mph
6:00 AM - 7:00 AM	17 mph
7:00 AM - 8:00 AM	15 mph
8:00 AM - 9:00 AM	14 mph
9:00 AM - 10:00 AM	11 mph
10:00 AM - 11:00 AM	11 mph
11:00 AM - 12:00 PM	10 mph
12:00 PM - 1:00 PM	11 mph
1:00 PM - 2:00 PM	10 mph
2:00 PM - 3:00 PM	9 mph
3:00 PM - 4:00 PM	9 mph
East side closed to cyclists from 3:30 to 9:00 PM	
9:00 PM - 10:00 PM	16 mph
10:00 PM - 11:00 PM	17 mph
11:00 PM - 12:00 AM	15 mph

The average speeds are higher at night and in the early morning, but drop off as the sidewalk becomes congested with tourists and pedestrians. Note that the average speeds on the east side of the bridge are generally lower than those on the west side of the bridge, especially as large numbers of people visit the bridge from the morning to peak hours in the afternoon.

Bicycle and Pedestrian Collision Analysis

The Golden Gate Bridge District maintains record of all bicycle collisions occurring on the Bridge that result in Bridge Patrol Officers being dispatched and responding to render aid. This section reviews the most recent collision data available from Golden Gate Bridge staff. Collisions included in this analysis are only those that occurred on the Bridge sidewalks, and not on connecting paths, roads or parking areas adjacent to the Bridge. Between 2010 and 2019, there were 241 reported collisions involving bicyclists on the Golden Gate Bridge sidewalks. These 241 collisions resulted in 258 injuries. 140 of the collisions (58 percent of total) resulted in at least one party being transported by ambulance for off-site medical care.

The most common type of bicycle collision on the Bridge sidewalks were solo bicycle collisions. There were approximately 19 times as many solo bicycle collisions as there were bicycle-pedestrian collisions during the study period. A nearly equal amount of collisions occurred on each side of the bridge.

Annual Collision Trends

Figure 8 shows the number of bicycle related collisions on the Golden Gate Bridge from 2010 - 2019. During 2013-2015 there were a higher number of collisions than other years during the study period.

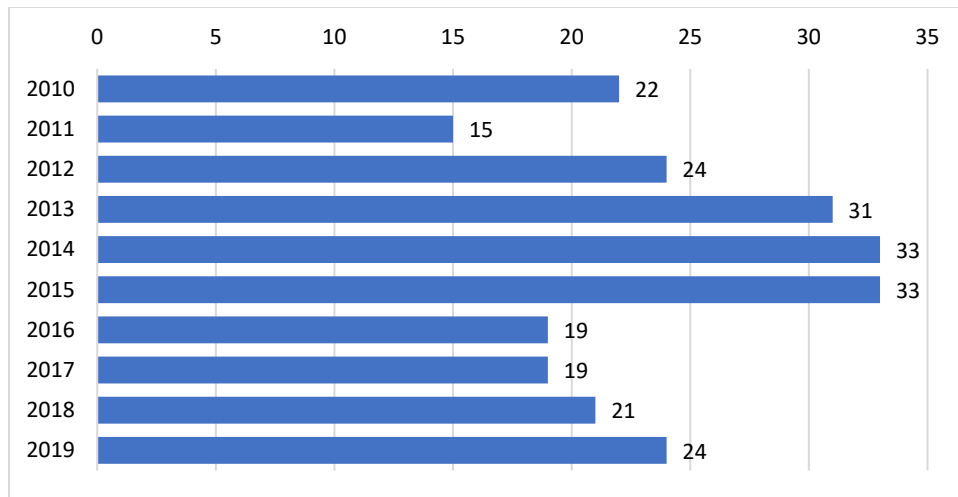


Figure 8: Bicycle Related Collisions on the Golden Gate Bridge

Collisions by Month

Figure 9 shows the number of bicycle collisions on the Bridge by month, from 2010-2019. With the exception of January, there were fewer reported collisions during the winter months. There were 12 reported collisions in November, December, and February, and 14 in March, while all other months had 20 or more collisions.

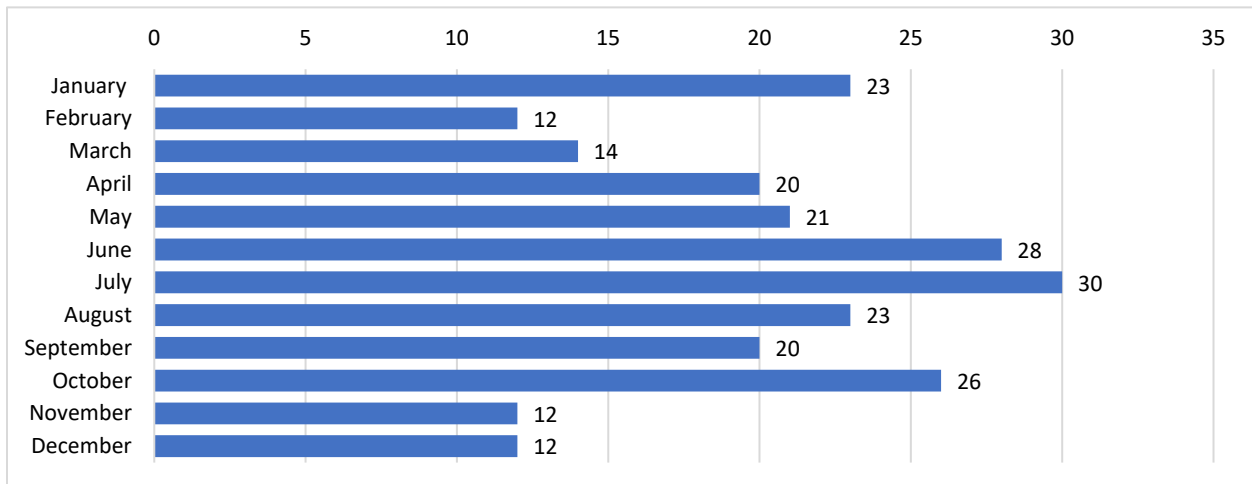


Figure 9: Bicycle Related Collisions on the Golden Gate Bridge by month

Collisions by Hour

Figure 10 below shows the number of collisions by hour of day. The highest frequency of these collisions occurred between 11:00 AM and 5:00 PM over the ten-year span. The increase in number of collisions in midday to late afternoon is likely due to the higher volumes of users present on the Bridge during these times.

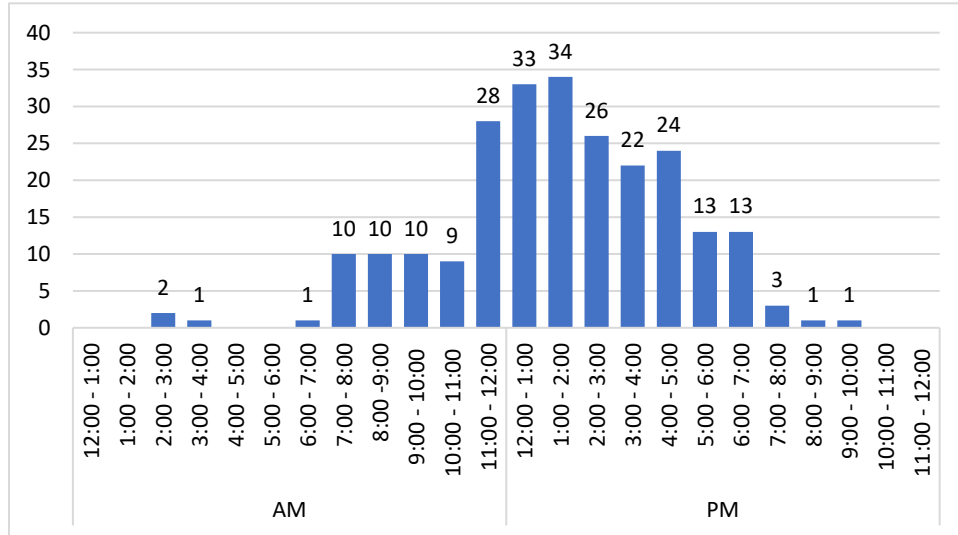


Figure 10: Bicycle Related Collisions on the Golden Gate Bridge Hourly Frequency

Role of Speed in Collisions

Figure 11 shows that speed was recorded as a factor in nearly 21 percent of collisions, “not a factor” in 2 percent of collisions, and “unknown” for the majority (77 percent) of collisions. It is important to note that all of the reported bicycle collisions involved at least one injury. Many bicycle collisions on the Bridge sidewalks occur at low speeds, are minor, do not involve any serious injury, and are never reported. Bicycling at slower speeds reduces stopping distance, and increases the amount of time bicyclists and pedestrians have to react and avoid collisions. In this sense, speed is a factor in all collisions.

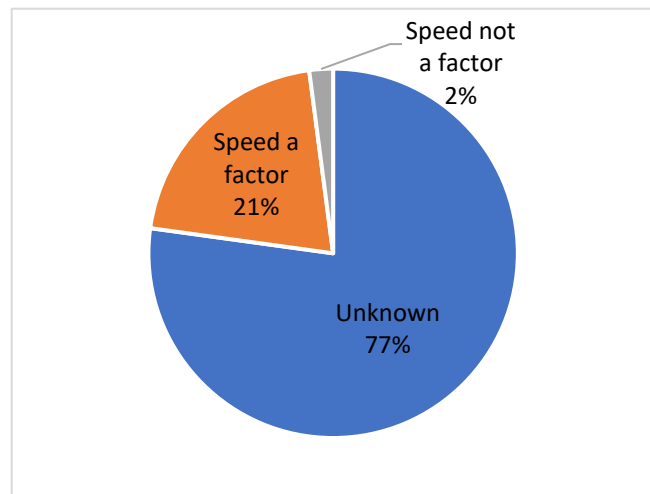


Figure 11: Proportion of crashes where speed was a recorded factor

Collisions Requiring Medical Treatment

The only record of crash severity in the data provided by the Bridge District whether or not a victim(s) was transported by ambulance for off-site medical care. Ambulances are called when a collision results in a more serious injury and victims require immediate medical care. Transportation by ambulance away from the scene is indicative of more severe injuries as compared to on-scene medical treatment and release. Figure 12 shows that victims were transported by ambulance as a result of 58% of recorded collisions between 2010 and 2019.

Figure 13 shows that a victim was transported by ambulance more often than not in collisions where speed was recorded as a factor in the collision. Higher speed collisions often result in injuries that are more severe.

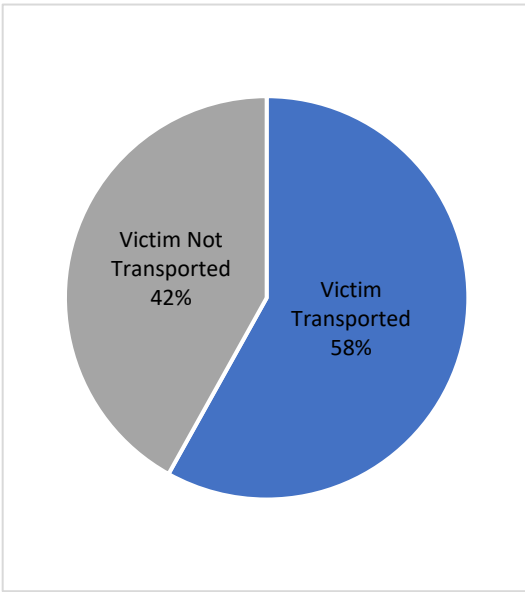


Figure 12: Proportion of recorded collisions where a victim was transported by ambulance

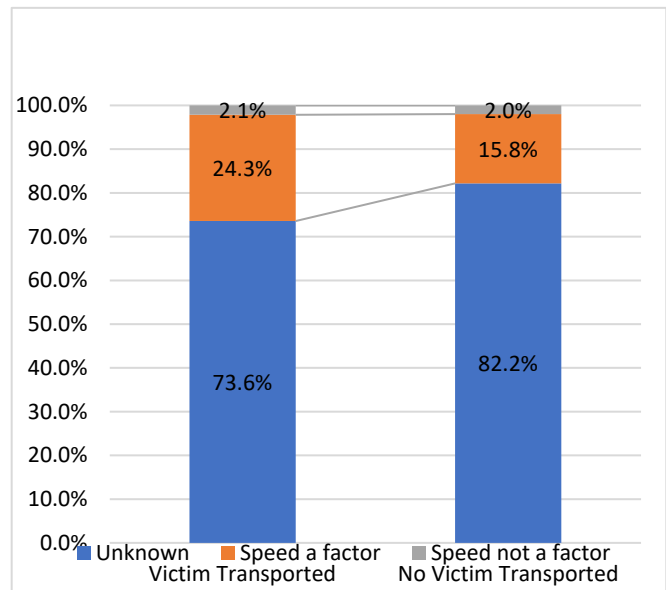


Figure 13: Proportion of collisions where speed was a factor, comparing collisions where a victim was transported by ambulance to collisions where no victim was transported by ambulance

As shown in the prior section, the west side is closed to pedestrians, and with less congestion the average bicyclist speed is higher than on the east side. Higher speeds likely lead to a higher rate of collisions that result in a severe injury requiring an ambulance. Figure 14 shows that a victim was transported by ambulance in a higher number and proportion of crashes on the west side than the east side of the Bridge.

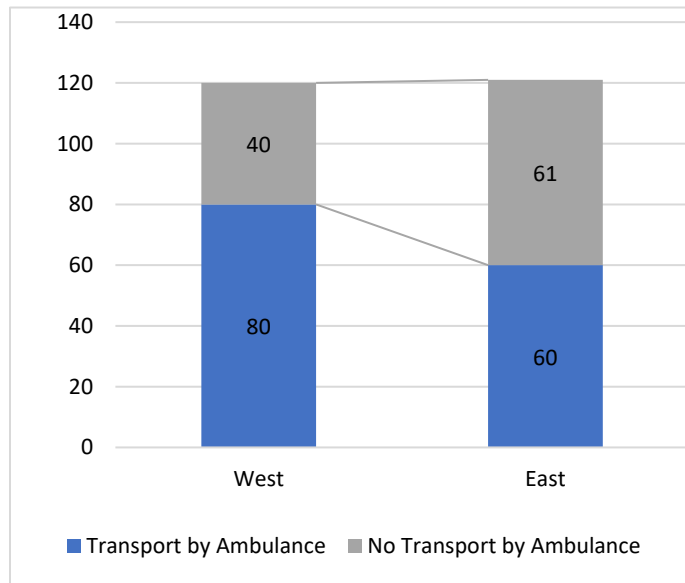


Figure 14: Number of collisions on the east and west sidewalks of the Bridge, broken down by whether or not transportation by ambulance resulted.

Collision Location

The officer responding to a collision pinpoints the incident to the nearest Golden Gate Bridge light pole. Even-numbered light poles are on the west side and odd-numbered light poles are on the east side.

Figure 15 shows the number of collisions occurring on each section of the bridge, based on the Bridge side and light pole numbers listed in the collision data. As shown, a nearly equal number of crashes happen on each side of the bridge. There were 121 collisions on the east sidewalk, and 120 collisions on the west sidewalk during the study period. The highest number of collisions (10 collisions) occurred at light pole 26, which is a point on the Bridge where the sidewalk narrows at one of the north end pylons, and which is also adjacent to a mid-bridge entrance/exit to the Marin Headlands. These factors likely cause greater conflict amongst Bridge users. Figure 16 shows a photo of the sidewalk narrowing at light pole 26.

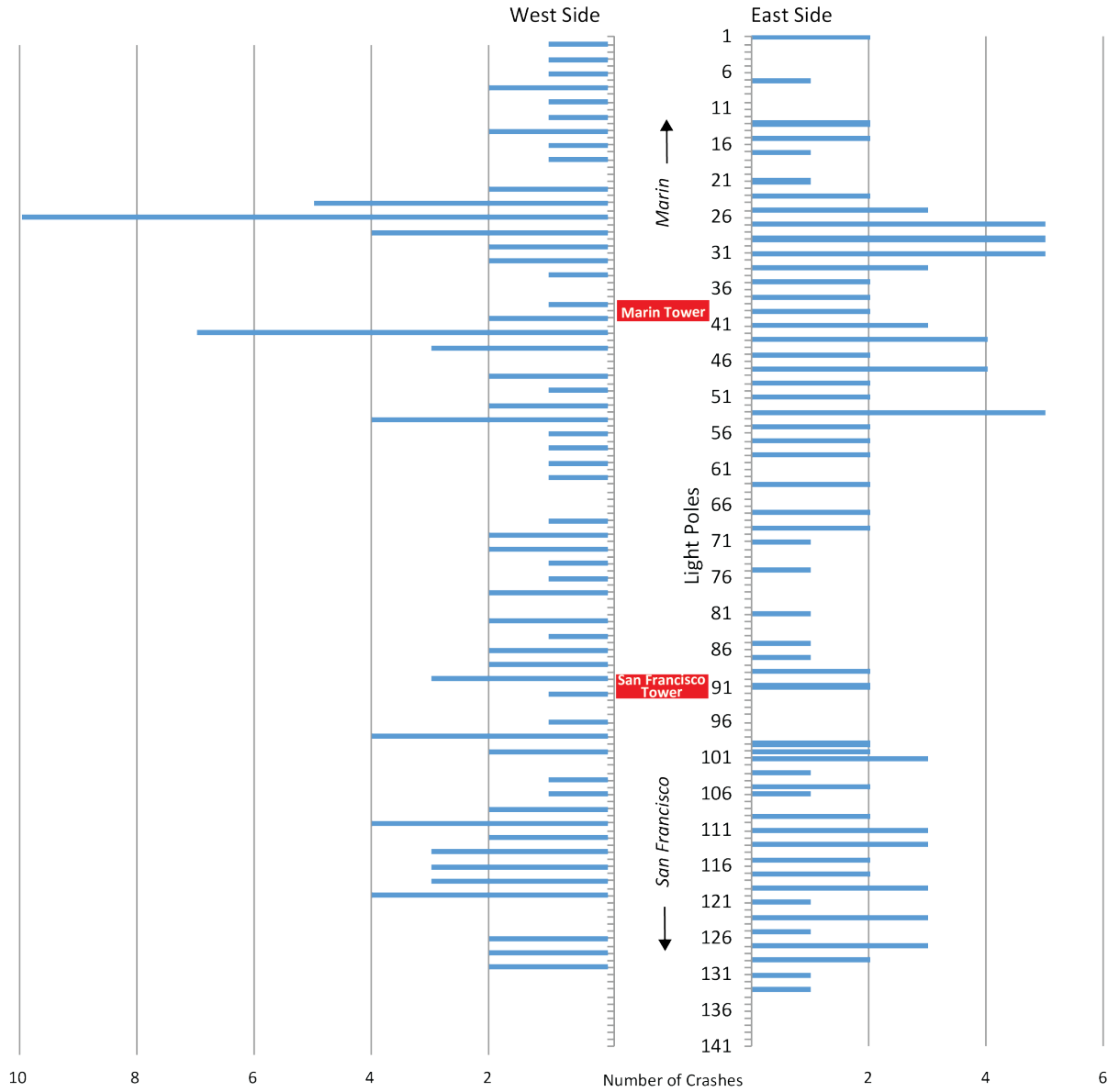


Figure 15: Bicycle Collisions at Light Poles

Seven collisions, the second highest number, occurred at light pole 42, which is adjacent to the Marin Tower, a point in the Bridge where visibility is reduced as the sidewalk wraps around the tower. The need for bicyclists to navigate around the tower may result in more collisions. Five collisions occurred near light poles 27, 29, and 31, which are on the east side of the Bridge and near the North end Pylons where the sidewalk narrows. This constrained sidewalk configuration could result in more user conflicts. Many incidents also occur at the south end of the Bridge, especially between light poles 111 and 127. There are obstacles here that may result in increased collisions: The sidewalk narrows around the south end pylons between light posts 113 and 120 and then the sidewalk turns to navigate around the Toll Plaza. Pedestrian activity is also highest on this section of the Bridge, which might explain increased conflict on the east side of the Bridge.

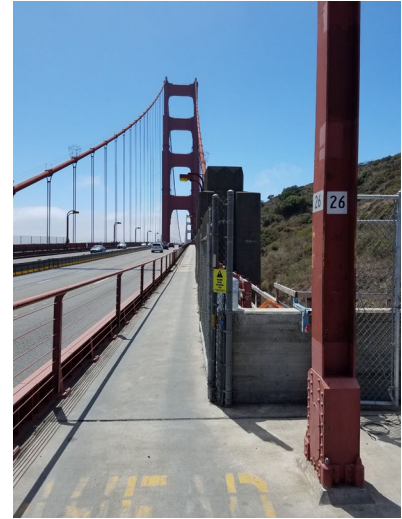


Figure 16: The sidewalk narrows at light pole 26.

Collision Type

Of the 241 reported collisions between 2010-2019, 144 of these were solo bicycle collisions; 65 were bicycle-bicycle collisions; 28 were bicycle-pedestrian collisions; 2 were bicycle-motorist collisions; and, 2 were unknown or other types of collisions. Figure 17 shows the number of collisions categorized on each side of the Bridge, segmented by type. Bicycle-bicycle collisions happen 150 percent more frequently on the west sidewalk than on the east sidewalk.

About 93 percent of bicycle/pedestrian collisions occurred on weekdays, and all but four of these incidents occurred on the east sidewalk. During the weekends bicycles have full use of the west sidewalk so there are far fewer interactions with pedestrians on the east side of the Bridge as a result.

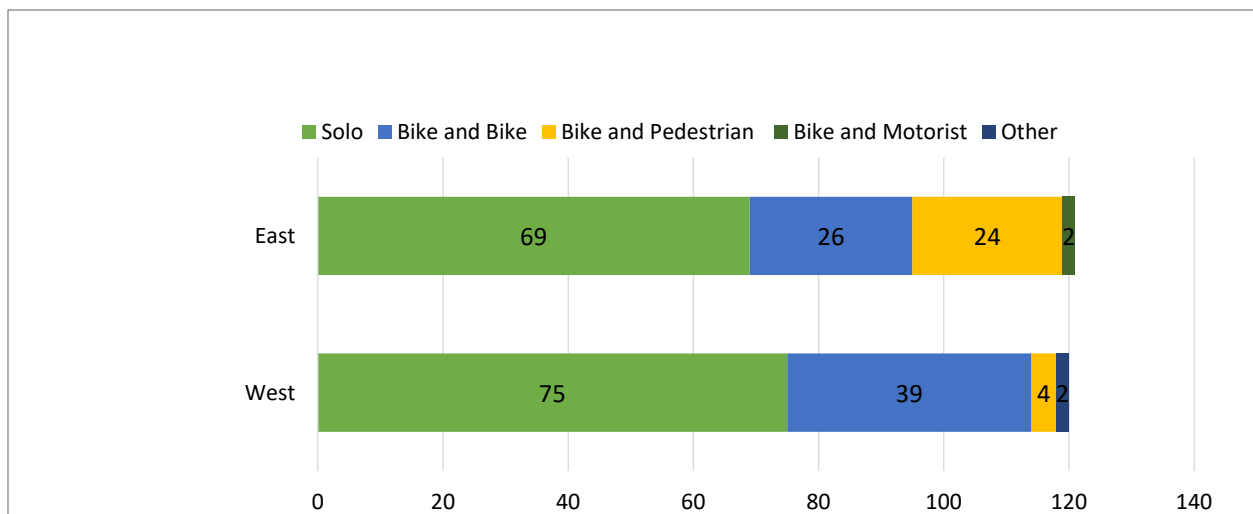


Figure 17: Number of collisions on each side of the bridge, segmented by collision type.

3. Safety Recommendations

Five recommendations are proposed to enhance safety for bicyclists and pedestrians on the Bridge. These recommendations are: establishing a bicycle speed limit, separating cyclists and pedestrians with the use of signs and pavement markings, continuing the use of radar speed signs, incorporating e-bikes into the District’s Master Ordinance, and continuing the restriction of other user groups. Discussions for each of these recommendations are described in this section.

Recommendation 1: Establish Bicycle Speed Limit

There is currently no bicycle speed limit posted on the Golden Gate Bridge sidewalks. Based on our observations and measurements of existing bicyclist speeds, this report recommends a speed limit of 15 mph. Although modern bicycles, especially e-bikes, are capable of speeds much greater than this, the narrow sidewalks coupled with high mixed-use congestion (mix of bicycles and pedestrians, as well as a mix of slower and faster cyclists), opposing traffic flows, and often high winds and other unfavorable weather conditions support a speed limit of 15 mph. This is consistent with the speed limits on other shared use pathways adjacent to the Bridge, around the Bay Area, and nationally. Additionally, a 15 mph speed limit is consistent with the 85th percentile speeds observed in the speed study and is not likely to limit the ability of commuters to traverse the span by bicycle quickly during favorable weather and traffic conditions. The 15 mph speed limit should be posted on both existing entrance signs to the sidewalk. Signs should also be posted on Bridge signs not interfering with the existing motorist speed limit signs. Additionally, the speed limit should be stenciled clearly on the sidewalk, as shown in Figure 20. Around the towers the speed limit should be decreased to 5 mph, also clearly signed. At all times, people should continue to travel at speeds that are safe for the conditions of the trail.

Recommendation 2: Continue Signage and Pavement Markings Delineating Space

Signage and pavement markings will help to delineate specific space on the sidewalk for bicyclists and pedestrians. Currently, during the times of the day when the sidewalk is shared, pedestrians tend to walk on the outside (water side) of the sidewalk and bicyclists tend to ride on the inside (traffic side), no matter what direction they are traveling. The greatest potential for conflict occurs where this “informal” segregation breaks down. Groups of pedestrians may walk across the entire pathway width and blocking bicyclists or bicyclists may weave from right to left through pedestrians

Many multi-use paths address such safety conflicts by segregating users, either providing completely separate pathways for bicyclists and pedestrians, or striping separate space for users on the same path (e.g. bikes stay left, pedestrians stay right). Obviously with the Golden Gate Bridge there is no additional space to add a new path, and the 10-foot sidewalk width is not sufficient to stripe a centerline or other division for its entire length.

We recommend the use of pavement markings placed at intervals that illustrate the general separation of bicycles to the inside and pedestrians to the outside. While this would not create a “defined” space as would an unbroken dividing stripe, it would reinforce the informal bikes inside / pedestrians outside segregation that currently occurs and results in the smoothest observed flows.

This segregation is observed only on the straightaways; there is such heavy congestion around the towers with pedestrians standing on both sides and extremely limited sightlines that the area is seen as a special zone of mixed, extremely slow speed bicyclist travel.

Signage

Continued use of signage is recommended on the Golden Gate Bridge to help inform bicyclists and pedestrians where they should be while using the sidewalk. Figure 18 presents the signs currently in use.



Figure 18: Current Bridge Bicycle/Pedestrian Separation Signage



Figure 19: Existing Bicycle Sign on the Bridge Towers

These are recommended for the light posts, similar to how the existing BICYCLISTS SLOW signs are posted (Figure 19). If needed, the color of the signs can be modified to match the existing yellow bicycle sign placards.

Pavement Markings

Pavement markings are recommended on the shared bicycle and pedestrian sidewalk. The pavement markings, or stencils, inform bicyclists and pedestrians where they should be while on the sidewalk. The markings, as Figure 20 presents in a photo simulation, reflects the same division as the recommended signs- the inside of the sidewalk for bicyclists and the outside for pedestrians. The bicycle section of the sidewalk is split from the pedestrian section with a white solid line that extends only the length of the markings. The markings should be placed approximately every 500 feet on sections of the sidewalk that are 10 feet wide.



Figure 20: Recommended Pavement Markings

Recommendation 3: Continue Radar Speed Signs

In early 2020, Bridge Communications Technicians upgraded the existing radar speed signs to Wi-Fi enabled units that continually upload speed data observations to a cloud-based data storage and reporting solution. The project also included the addition of four new speed signs at mid-span so that cyclists receive feedback

regarding their speed of travel and observations are recorded at those locations as well. We recommend continued maintenance and utilization of the speed signs going forward. This will offer cyclists feedback on their speed of travel as most bicycles do not have speedometers and continued monitoring of observed speed data will provide insight regarding traffic patterns and safety conditions on the Bridge sidewalks.

Recommendation 4: Electric Bicycles

Electric bikes or e-bikes are growing in popularity, and many bicycle rental companies now offer and promote e-bikes for use by visitors riding across the Golden Gate Bridge and many recreational cyclists and commuters have adopted e-bikes to extend their range of travel and enhance the cycling experience. Currently the Bridge does not specifically regulate e-bikes because the District's ordinances were crafted prior to the advent and popularization of the technology.

The State of California regulates e-bikes based on three different classifications, although local jurisdictions can adopt their own regulations. Under the State law Class 1 e-bikes are pedal-assist with a top motor-assisted speed of 20 mph, and can be operated on any multi-use path or roadway in California. Class 2 e-bikes have a throttle that can be operated without pedaling, a top motor-assisted speed of 20 mph, and are also allowed on any bike path or roadway. Class 3 e-bikes are pedal assist with a top motorized speed of 28 mph, and can only be operated in on-street facilities (bike lanes, routes, or cycle tracks) and are prohibited on multi-use paths.

Consistent with other jurisdictions, the District should allow only Class 1 and Class 2 e-bikes on the Bridge sidewalks, meaning pedal-assist bikes with a top speed of 20 mph. However, because e-bikes look similar regardless of which Class of bike they are, it is important to consider the reality of enforcement. It would be nearly impossible for a law enforcement officer to discern whether a person was riding a Class 1 pedal-assist or a Class 3, since the only difference is the top speed. Therefore having a mechanism to regulate the speeds of bicycles through an established bicycle speed limit will be important to the practical management of e-bikes on the Bridge and ensuring that bicyclists are maintaining speeds compatible with the conditions on the sidewalk.

Recommendation 5: Other User Groups and Devices

The Bridge currently prohibits rolling type pedestrian conveyances such as roller / inline skates, skateboards, and scooters along with animals such as dogs (except service animals) and horses. These prohibitions should continue as these user groups are not compatible with the high levels of pedestrian and bicycle use experienced on the Bridge sidewalks. Our research into multi-use trail regulations of unicyclists yielded no results; this user group is simply so unique and infrequent that trail and pathway management agencies do not regulate them as a special group. In terms of safety, a "tall bike" (a custom built bike where the seat is situated at a height that may be 5 or more feet off the ground) poses a safety risk to the user from toppling over safety railings. Because the safety rail stands 4'6" tall, prohibition of bicycles or unicycles whose seats are more than 4 feet off the ground might make sense so that no riders topple over the safety railing. Consistent with the District's stated policy of encouraging alternative forms of commute and recreational travel, we recommend that Bridge officials continue to monitor technology developments and potentially adjust ordinances to allow future alternative technologies, beyond e-bikes, to use the Bridge if they prove to be viable alternatives to personal auto travel and can be accommodated safely on the sidewalks.

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