



The City of Pasadena:
Circulating without a Car

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by

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Introduction

Discussion of the Issue

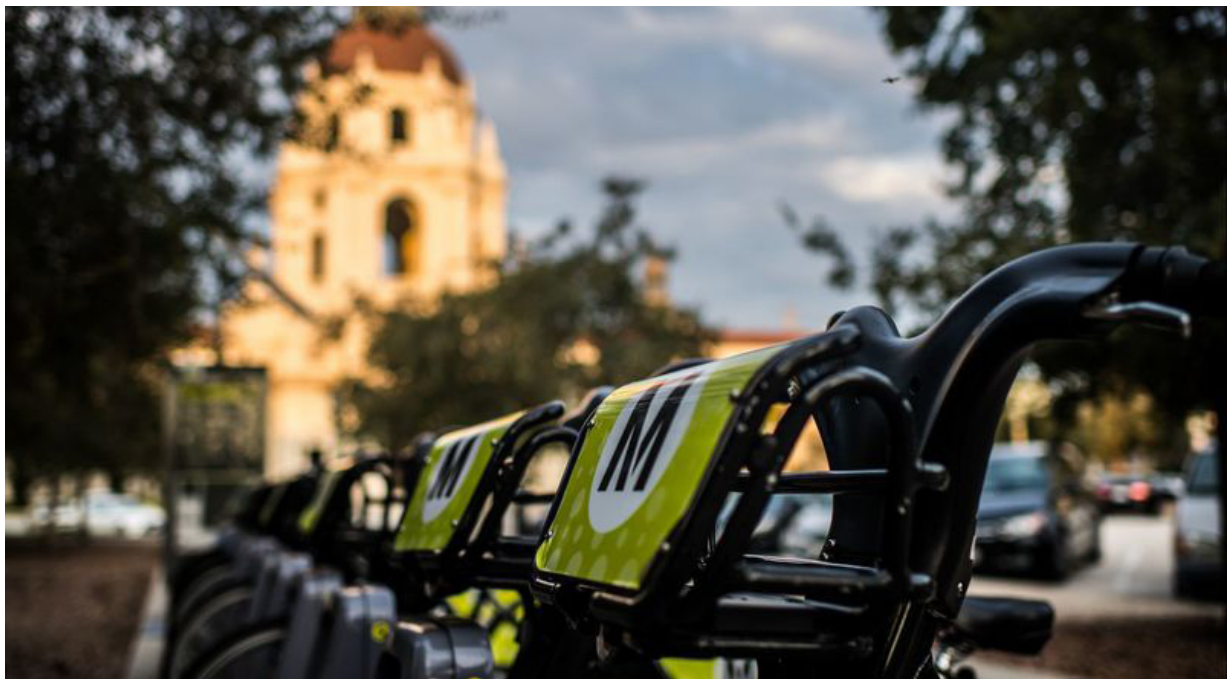
The City of Pasadena is a city in California located northeast of downtown Los Angeles. The City is striving to create a community where people can get around without a reliance on cars. To accomplish this, a Bicycle Transportation Action Plan has been adopted in hopes of improving the current bicycle infrastructure and promoting more reliance on biking as a main mode of transportation throughout the City. The goals outlined in the plan are as follows (City of Pasadena, 2015):

1. Create an environment where people can circulate without a car.
2. Increase the number of bicyclists in Pasadena by encouraging people to use their bicycles instead of driving.
3. Increase the safety of bicycling in Pasadena.
4. Increase opportunities for traffic safety education for all travel modes and age groups in Pasadena.
5. Promote the health of Pasadena residents by providing opportunities to bicycle for commuting, recreating, shopping, and visiting.
6. Facilitate the economic viability of Pasadena by making Pasadena an attractive place to live, shop, and operate a business.

These goals are all conducive to creating a very bike-friendly city; however, changes to the infrastructure available and the knowledge on safe bike riding is necessary to make a difference on a city-wide scale.

A bike share program by LA Metro was implemented into the City in the summer of 2017. The program installed more than 30 bike stations giving the city about 375 bikes for people to rent out. It was intended to be a transportation option for residents to get to local destinations that may be too far to walk but too short or inconvenient to drive. Although the program was a good idea, there were several flaws with it that ultimately caused it to fail and be removed only a year after its implementation. This report will analyze this program and present these issues to lead to possible solutions or improvements to the bike infrastructure in the City that could better accommodate this program.

Despite the plans presented in the Bicycle Transportation Action



Source: Gabriel S. Scarlett/Los Angeles Times

Plan, Pasadena continues to work to become a bike-friendly city. Old Town Pasadena, which is a very lively business district of Pasadena, is just a short ten miles from downtown Los Angeles. Many people are drawn to the area for events such as the Rose Bowl, Rose parade, and Rose Bowl Flea Market. Because of these events and its close proximity to Downtown LA, traffic is a prevalent issue and a greater reliance on bikes can help relieve this problem.

Pasadena is taking action to further promote reliance on bicycles in several ways; however, they may be at a halt until some issues with the bicycle infrastructure are prioritized and altered. These issues include the lack of bike lanes on streets that people ride their bikes on and safety concerns with other modes of transportation. These issues may be deterring people from changing the way they choose to get around the City. This makes it difficult for the City to achieve its goals set forth in the Bicycle Transportation Action Plan. If Pasadena can make some small changes and improvements to its bike infrastructure that is already in place, the city will promote healthier lifestyles, provide safer biking options and benefit the environment. This senior project will provide an analysis of the current bike

Project Goals

infrastructure in the City of Pasadena and the Metro Bike Share program that was removed. This data collection and analysis will act as a basis for a proposal of improvements to the current infrastructure that would allow for the success of a bike share program and will present design guidelines for the proposed improvements. These proposed improvements would ultimately guide the City of Pasadena to achieving their vision for the city's transportation system.

Review of Relevant City Documents

The City of Pasadena adopted the Bicycle Transportation Action Plan in August of 2015. The purpose of the plan is to present goals, objectives, actions and timelines for achieving a bike friendly environment in the City. The plan also recommends strategies involving education, engagement, and evaluation that could be used to increase the safety and use of bicycles throughout the City. A Bikeways and Feasibility study was also presented in the plan to evaluate the possibility of implementing certain bike infrastructure, such as bicycle boulevards, on roadways throughout the City. The plan continues by giving an overview of the existing conditions in the City.

The Mobility Element of the General Plan, commonly known as the Circulation Element, presents a vision that creates “an integrated and multimodal transportation system that provides choices and accessibility for everyone living and working in the City” (City of Pasadena, 2015). The purpose of the element is to provide “measures for the implementation of the City’s Guiding Principle” of becoming a city where people can circulate without cars (City of Pasadena, 2015). Many of the policies presented in the General Plan are very relevant to increasing bicycle use and improving bicycle infrastructure. Policy 1.7 reads “Design streets to achieve safe interaction for all modes of travel particularly for pedestrians and bicycle users” and policy 2.8 “Maintain

existing and identify new opportunities for bicycle infrastructure” (Pasadena Department of Transportation, 2015). The document presents three main objectives as follows: 1. Enhance Livability, 2. Encourage walking, biking, transit and other alternatives to motor vehicles, and 3. Create a supportive climate for economic viability.

Relevance to Planning

This senior project demonstrates knowledge learned through the City and Regional Planning curriculum at Cal Poly SLO. It completes the process of performing a visit to the study area, provides an analysis of this visit, presents background information on the study area and the topic issue, and ultimately uses this information to develop a plan and recommendations for the City.

Existing Conditions of Bike Infrastructure

The City of Pasadena has approximately 82 miles of bike facilities including 21 miles of class II bike lanes and 61 miles of bike routes. 34 miles of these bike routes are enhanced bike lanes with a white edge line, bike route and “Share the Road” signage. The City also has several streets that are designated as “Roseways” which are considered class III bikeways and are streets that are comfortable to ride a bicycle because of low traffic volumes. Some of the major streets throughout the City are lacking bike lanes or routes as shown in figure 1. This creates a disconnect within the system and increases concerns for safety.

Bike Routes in Pasadena, CA

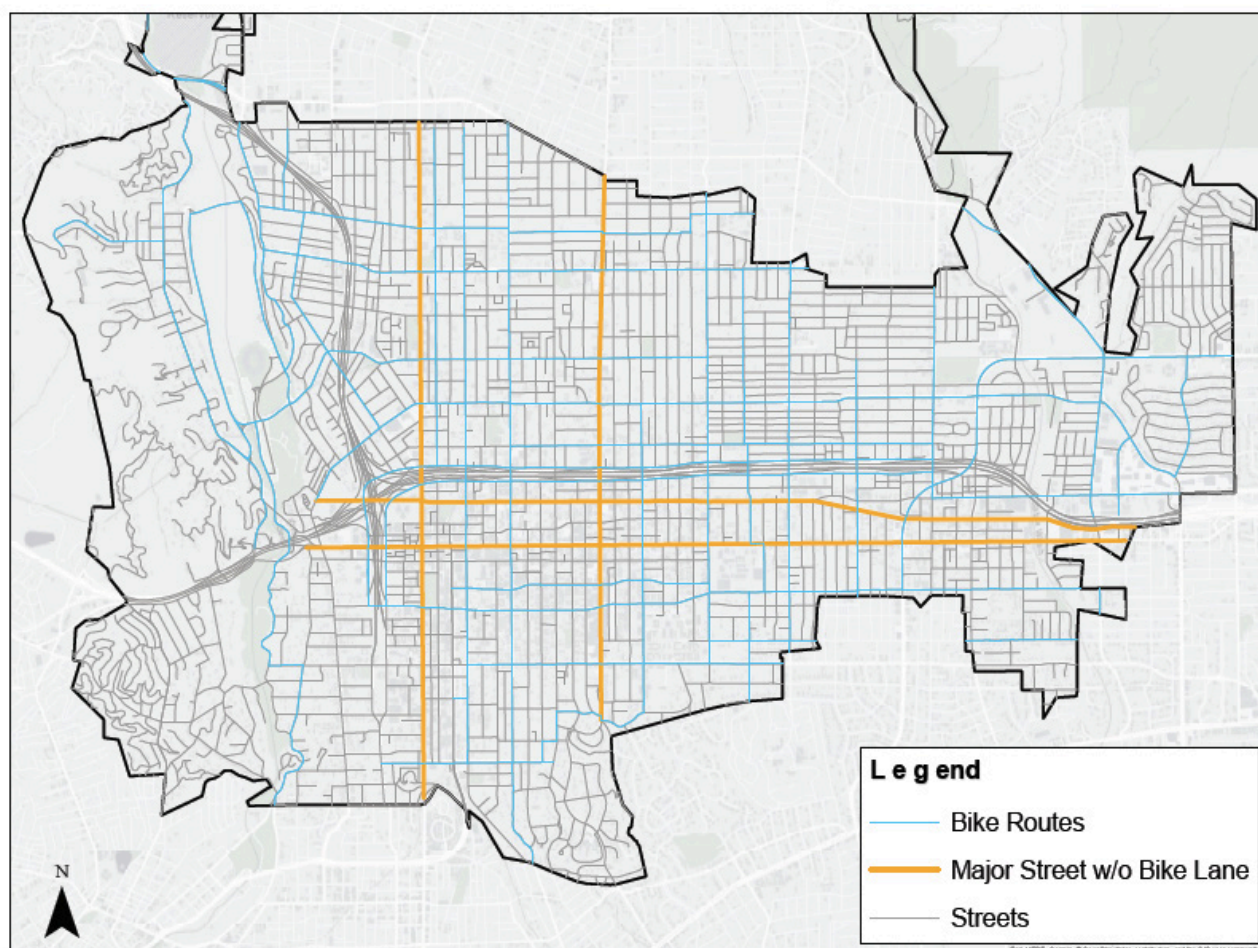


Figure 1

Bicycle Parking

There are two types of bike parking provided throughout the City. Long-term parking allows users to park bicycles for hours at a time and typically provide high security. Short term parking allows users to park conveniently and usually in an area that is visible from their destination. There are over 1,000 short term bike racks, 400 of which were recently added to further promote bicycling. Many of the Metro Gold Line stations have bike racks and long-term storage in the form of bike lockers or bike rooms. The rapid transit system for the City and the LA County Metropolitan Transportation Authority bus system have bicycle racks on most of the buses in their fleets. The Metro Gold Line light rail system runs through the City and gives access to stations along the 210 Freeway. There are about 50 racks and 50 lockers or spaces in bike rooms at stations along the Metro Rail line.

Bike Rack Locations in Pasadena, CA

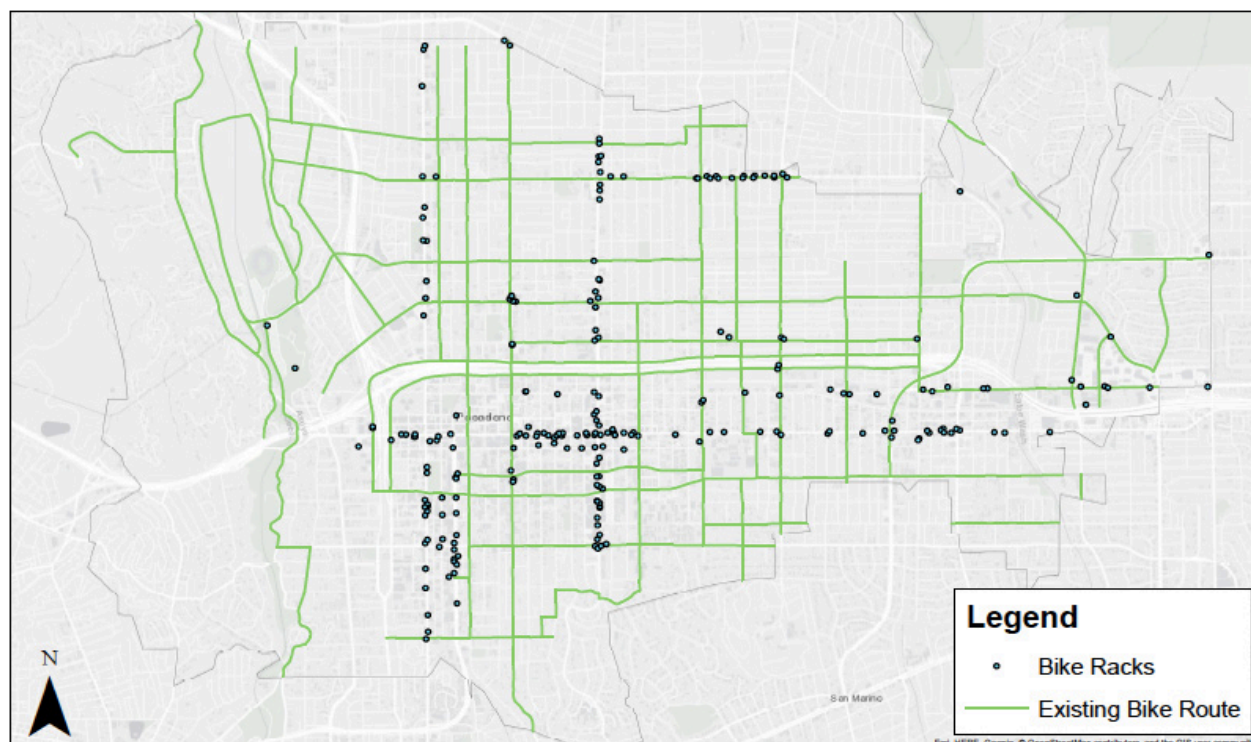


Figure 2

Traffic Collisions

A risk of using a bicycle as your main mode of transportation is safety and conflict issues with other modes. In 2014, there were 92 bike-related injuries in the City. Figure 3 displays the locations of where traffic collisions have occurred with bicycles throughout the City. The map also indicates bike routes and major streets without bike lanes to show the location of bike infrastructure or the lack thereof. A large amount of the collisions have occurred on these major streets because they are located in greatly visited areas that have high traffic volumes.

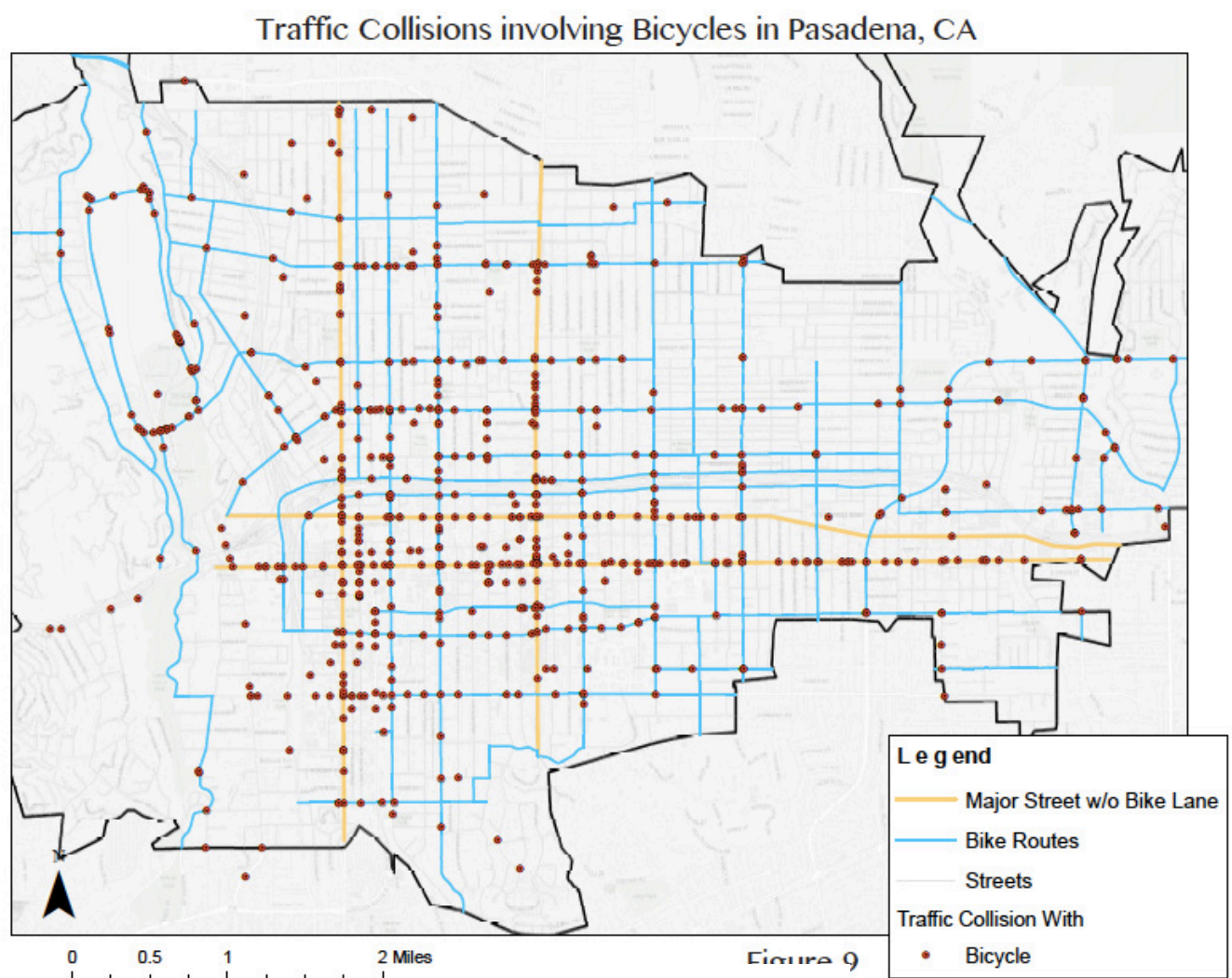


Figure 3

Analysis of Pasadena's Metro Bike Share Program

Overview

The Los Angeles County Metropolitan Transportation Authority, otherwise known as Metro, identified Pasadena as one of the cities to participate in the implementation of a Regional Bike Share Program for Los Angeles County. Phase I was launched in July of 2016. The program in Pasadena was planned in a 2015 Regional Bike Share Implementation Plan for Los Angeles County as Phase II of the implementation (Fehr Peers, 2015). This phase would implement 34 stations and 490 bikes in Old Town Pasadena and surrounding areas. The bike share program came to the City in July of 2017 and implemented 32 stations. Overall the entire program across Los Angeles up until March of 2019 has produced “729,537 trips, 2,279,624 miles traveled and reduced CO2 emissions by 2,165,643 pounds” (Metro Bike Share, 2019).

The program continues to be active in Downtown LA, Central LA, Port of LA and the Westside. The program was contracted for Pasadena until October of 2018; however, due to funding it could only operate until the end of July 2018. The “average monthly cost for the program was about \$98,000 per month” even after farebox revenues were deducted (Rivera, 2018). These revenues are meant to help with the costs of construction and maintenance of the service. Metro had higher expectations for the program estimating a 60% farebox revenue return when in actuality the program brought an average of a 7.5% return, one

of the lowest rates of the Metro bike share programs in the county.

The bike share was intended to be a transportation option for residents to get to local destinations that may be too far to walk but too short or inconvenient to drive as well as to get to the Metro rail line locations scattered throughout Pasadena. The program seemed to be very successful shortly after its implementation with 14,768 trips in the first quarter of the program (July 2017 - September 2017). Metro was offering free rides for the initial months of the program and beginning in September the number of rides being taken decreased substantially as seen in Table 1. This decrease in use shows that a concern for cost may have been an issue for the program among other issues.

Table 1: Metro Bike Share Program Use

Quarter of Use	Number of Trips
2017 July - September	14,768
2017 October - December	8,865
2018 January - March	7,587
2018 April - June	9,616
2018 July - September	5,994
Total	46,830

Discussion of Potential Issues

Metro had high expectations for the bike share program in Pasadena as it was Phase II of the implementation process. It was projected to have high levels of use and high rates of revenue return; however, the program was removed entirely from the City only a year after implementation with all 32 stations now listed as inactive on the Metro bike share website. This section will provide a discussion and analysis of potential factors that may have lead to the program's failure.

Sufficient funding was a main issue for the continuation of the program. Metro had projected a 60% farebox revenue return; however, the program was only receiving 5 to 10 % returns due to limited use. If the projections had been correct, the City would have received "\$1,729,094 in revenue in the first two years of operations" (Dock, 2018). Due to the low levels of revenue return, the average monthly cost for the program was about \$98,000 per month which would only allow the City to fund the program until July of 2018 as opposed to the end of the contract in October. The agreement with Metro required Pasadena to cover 65% of the operating costs of the program but due to low ridership levels and lack of sponsorships the City was not able to continue funding for the program.

The low ridership levels were a main issue for the program as they brought in limited revenue for funding. These low levels of use may have been attributed to a variety of factors including economic

concerns and bicycle infrastructure. The cost of the program may have been a deterrent for people looking to use the service, especially for a low price. A single 30-minute ride cost \$3.50, which is double the cost of using the Metro rail or bus systems. A monthly pass could be purchased for \$20 for rides up to 30 minutes; however, a ride longer than 30 minutes cost an additional \$1.75 for each additional 30 minutes. A \$40 yearly pass could be purchased, which allowed 30 minute or less rides for \$1.75 and additional charges for longer rides. When public transportation such as the Metro rail is less expensive than the bike share program, people are going to be less inclined to bike as it is typically a slower mode of transportation and it can bring about greater safety concerns for the rider.

“Supportive biking infrastructure, station placement, and proximity to stations remain among the strongest influences on bike share use” (Bopp, Sims & Piatkowski, 2018, p. 129). As discussed earlier, the City has a system of bikeways including Class II and III facilities. Only $\frac{1}{4}$ of these bikeways are class II bike lanes so most of the time bicyclists are sharing the road with vehicular traffic. An issue that may have impacted rider usage of the program was the decision of where the stations were to be placed throughout the City. Figure 4 displays the relationship of the bike share station locations and the bike routes in the City. There is a strong disconnect between the placement of the stations and streets with infrastructure for bicyclists. It is understandable that it may not be possible to place every station

directly next to a bike lane; however, “planners should ensure that bike share program areas are well served by a strong bike lane network” (NACTO, 2016, p.10).

Metro Bike Share Locations in Relation to Bike Routes

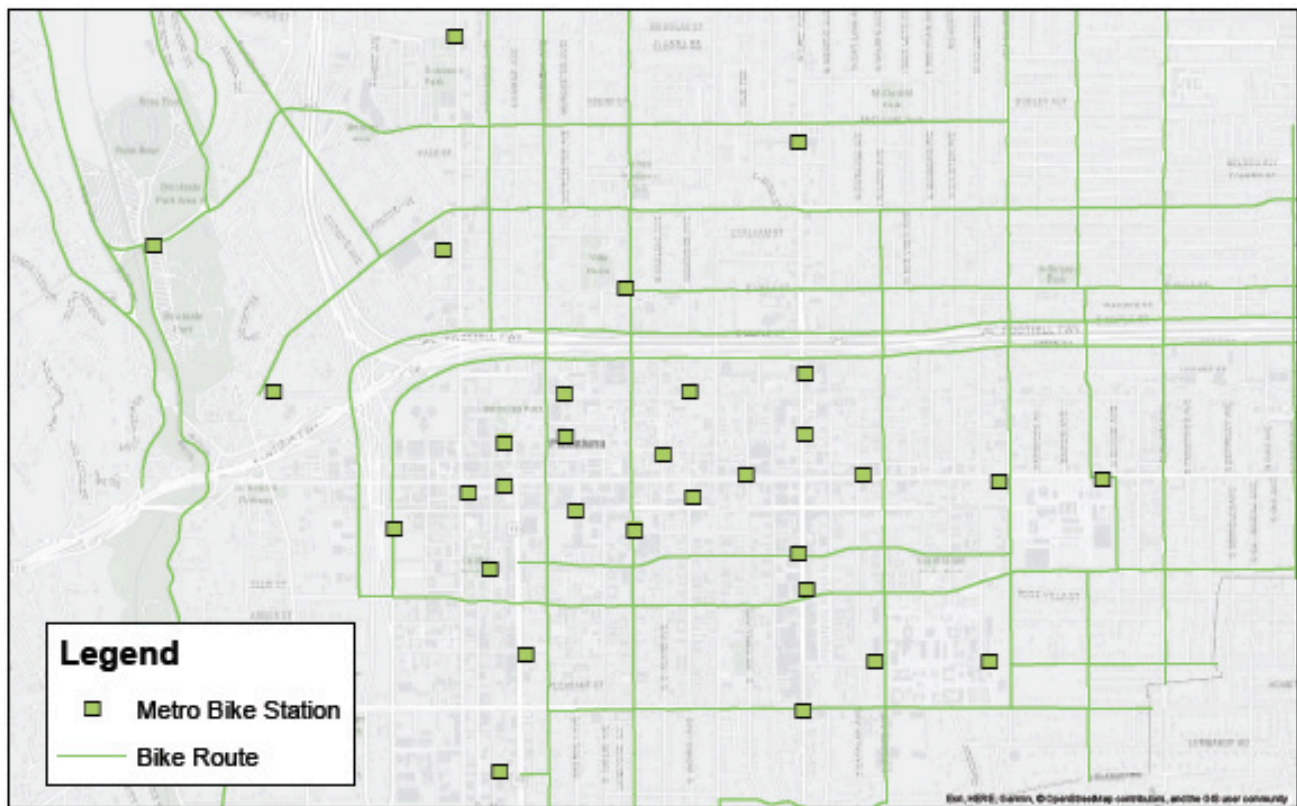


Figure 4

One of the main purposes of the program was to allow Metro rail line users to complete part of their trips by bicycle; however, this was not necessarily possible at all of the Metro rail stations within the City. A program that fosters “a transit-biking connection allows for great options for travel with minimal environmental impact and greater positive health outcomes” (Bopp, Sims & Piatkowski, 2018, p. 138). Figure 5 shows the relationship between the Metro bike stations and the Metro rail stations. Two of the six Metro rail stations within the City do not have any bike stations located near them. This may

Metro Bike Share Locations in Relation to Metro Stations

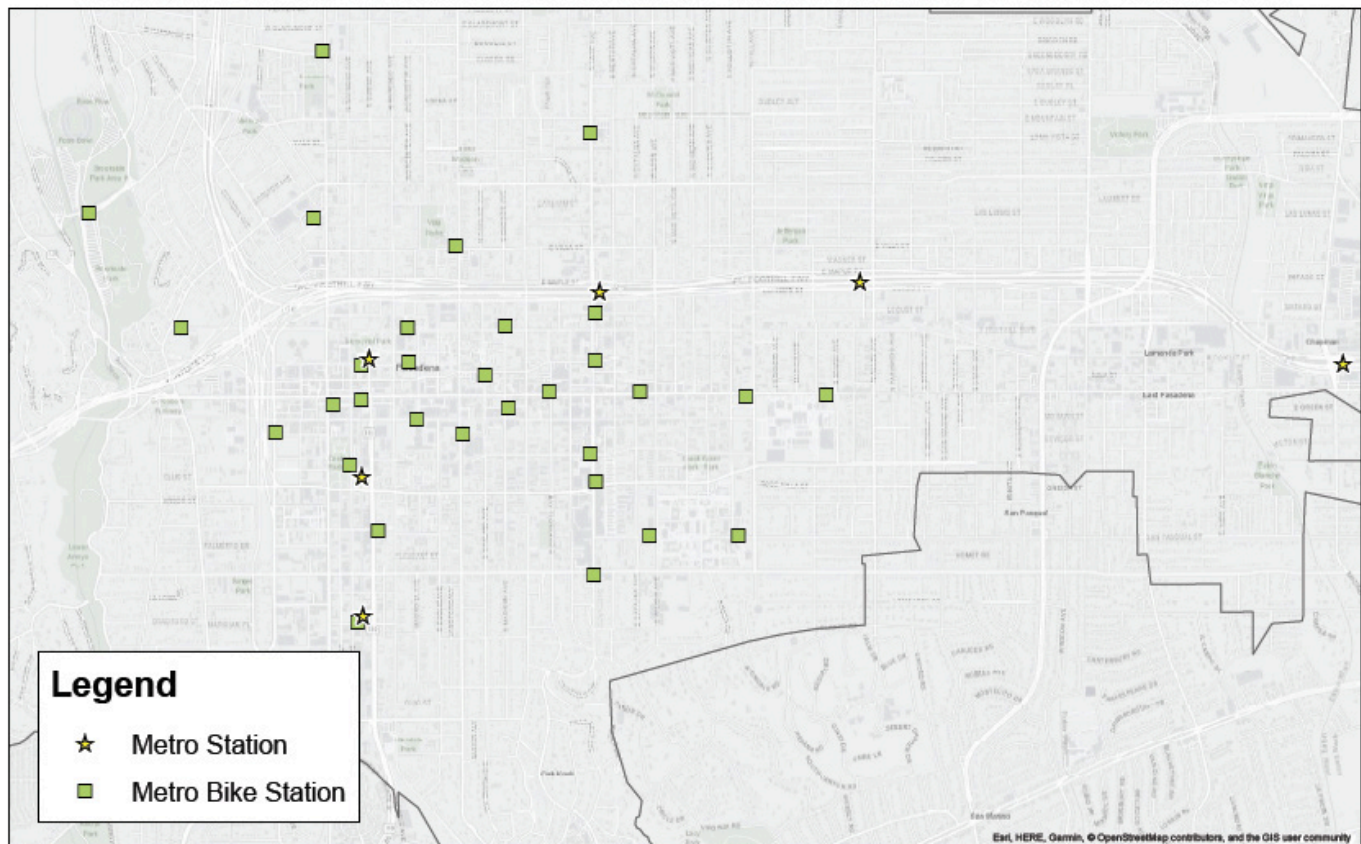


Figure 5

have had an impact on the idea that Metro rail users would use the bike share as part of their travel. Not only is it important for the stations to be located close to public transportation but also that they are located within relatively close proximity to the other bike share stations. “Placing bike share stations uniformly close together over a large area is one of the best ways to ensure that a city’s bike share system will be a real transportation option for a wide demographic of users”; therefore, increasing the level of ridership (NACTO, 2015, p. 2). The stations in Pasadena were located densely in the center; however, as you move outwards the proximity of the stations greatly declines. Some of the stations on the outskirts of the system are about a mile or more from the nearest station. This creates a disconnect within the system and decreases the likelihood of riders.

Case Studies

Capital Bike - Washington, D.C.

Capital Bikeshare has been serving Washington, D.C. and parts of Montgomery County, Maryland since 2008. The program is run by a private company known as Motivate. It receives some of its funding through the Federal Highways Administration and the Virginia Department of Rail and Public Transportation. The system has more than 3,700 bikes in its fleet and over 440 stations. The bikeshare recently launched the CaBi Plus electric-assist pilot, which offers bikes that give users a boost while they ride. The amount of CaBi Plus bikes provided accounts for “only 2% of the total CaBi fleet, but 4% of trips” (Sussman, 2018).

The location of stations is strategically thought out to promote greater levels of ridership. The program has been integrated with the public transit system by having the largest stations located near Metro stations and major bus stops. This allows riders to easily access public transportation without having to rely on a car. As of 2014, there were 4 stations per square mile, which has likely increased by today (NACTO, 2015, p. 4).

The bikeshare offers several different payment and membership

options as shown in Table 2. The program had 31,667 members in 2016 with each member saving an estimated annual cost of \$631 on personal travel costs.

Table 2: Capital Bike Prices

Type of Pass	Cost
Single Trip	First 30 minutes free; \$2 each additional 30 minutes
24-hour	\$8
3 day	\$17
Monthly	\$28 for unlimited 30 minute rides; additional \$1.50 for rides longer than 30 minutes
Annually	\$85

Citibike - New York City, NY

Citibike is a privately owned bike share system that is located in New York City. It serves Manhattan, Queens, Brooklyn and Jersey City. As well as Capital Bikeshare, Citibike is run by the private company Motivate. The program was implemented in 2013 with 332 stations and 6,000 bikes. As of March 2019, there were 757 active stations and 12,793 bikes (Motivate, 2019). The total annual membership was at 150,929 users. The month of March alone produced 1,351,725 trips with an average of 43,604 trips per day.

The system is set-up strategically so that stations are placed near large public transportation services and popular tourist attractions. The most popular stations include ones near Central Park and the Port Authority. The system has strong service levels of cleaning and inspection, bicycle maintenance and bicycle availability. Providing these services and maintenance is key to keeping riders happy and willing to continue

use of the system.

The program brings in a large amount of revenue from membership and sponsorship. In the month of March, it brought in \$4,737,225.81 of revenue. The program gives riders a good variety of pass options which are listed in Table 3 below.

The program continues to expand and bring in more users each month making it one of the largest bike-

Table 3: Citibike Prices

Type of Pass	Cost
Single Trip	First 30 minutes \$3; \$3 each additional 30 minutes
24-hour	\$12
3 day	\$24
Annually	\$169; unlimited 45 minute rides

share systems in the U.S. and even the world. The system added electric bikes to their fleet; however, they were removed shortly after the expansion due to issues with the braking capabilities of the bikes.

Copenhagen, Denmark

Bicycling is one of the main forms of transportation in Copenhagen, Denmark. Getting around by bike “accounts for a quarter of all personal transport in Denmark for distances of less than five kilometers” (Denmark). Bicycling has been an important part of the culture since the 1880s. The bicycle became an important symbol for Denmark as it symbolized equality and freedom. The 1950s changed the biking culture as automobiles became a focus for urban planners; however, Copenhagen returned to a focus on bicycles and pedestrians

in the 70s. The City introduced “Car Free Sundays” and a popular shopping street, Stroget, became pedestrian only.

Developing effective and safe bicycle infrastructure is a main focus of urban planners in Denmark. They are expanding “cycle superhighways”, which are cycle routes that “create better conditions for cyclists, and connect work, study and residential areas, making it a lot easier for commuters to bike to and from work instead of taking a car” (Denmark). These cycle superhighways are strategically placed near public transportation to make it more accessible and convenient. To be considered a cycle superhighway, the bikeway must contain certain aspects such as safe intersections and traffic lights that allow time for cyclists to safely cross. The city of Copenhagen has around 248 miles of bikeways that are all separated from cars and sidewalks. A very iconic bicycle feature in Copenhagen is known as The Bicycle Snake which was opened in 2014. The bikeway is 230 meters long and is a bridge over the harbor. The path is used by more than 20,000 riders each day and is exclusively for bicyclists. Prior to the implementation of this bikeway, bicyclists had to stop their ride and carry their bikes up and down the stairs. This bikeway allows for greater flow of bike traffic and separates bicyclists from pedestrians reducing the risk of conflict between these two modes of transportation.

Bike System Proposal

The City of Pasadena shall consider the following recommendations of improvements to the current bicycle infrastructure.

The California Streets and Highways Code (SHC) Section 890.4 offers definitions of the four bikeway classifications defined in California.

The City currently has Class II and Class III bike lanes; however, the City should consider implementing Class I bikeways and update some of the Class III bike lanes to Class II. Streets that lack bicycle infrastructure should be considered for the implementation of bikeways of any class.

Table 4 defines each class of bikeways.

Table 4: Bikeway Definitions

Class Type	Definition
I	Bike paths or shared use paths, which provide a completely separated right-of-way designated for the exclusive use of bicycles and pedestrians with crossflows by motorists minimized.
II	Bike lanes, which provide a restricted right-of-way designated for the exclusive or semiexclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and crossflows by pedestrians and motorists permitted.
III	Bike routes, which provide a right-of-way on-street or off-street, designated by signs or permanent markings and shared with pedestrians and motorists.
IV	Cycle tracks or separated bikeways, which promote active transportation and provide a right-of-way designated exclusively for bicycle travel adjacent to a roadway and which are separated from vehicular traffic. Types of separation include, but are not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

After analysis, new bikeways have been proposed for streets that are currently lacking bike infrastructure and have high levels of traffic collisions. Implementing bike lanes in these areas will promote more use of bicycling as the main mode of transportation and will reduce the likelihood of conflicts between different modes of transportation. Figure 6 shows the proposed locations of bikeways. These are preliminary recommendations. After further analysis, additional bikeways may be proposed.

Proposed Bike Routes after Analysis

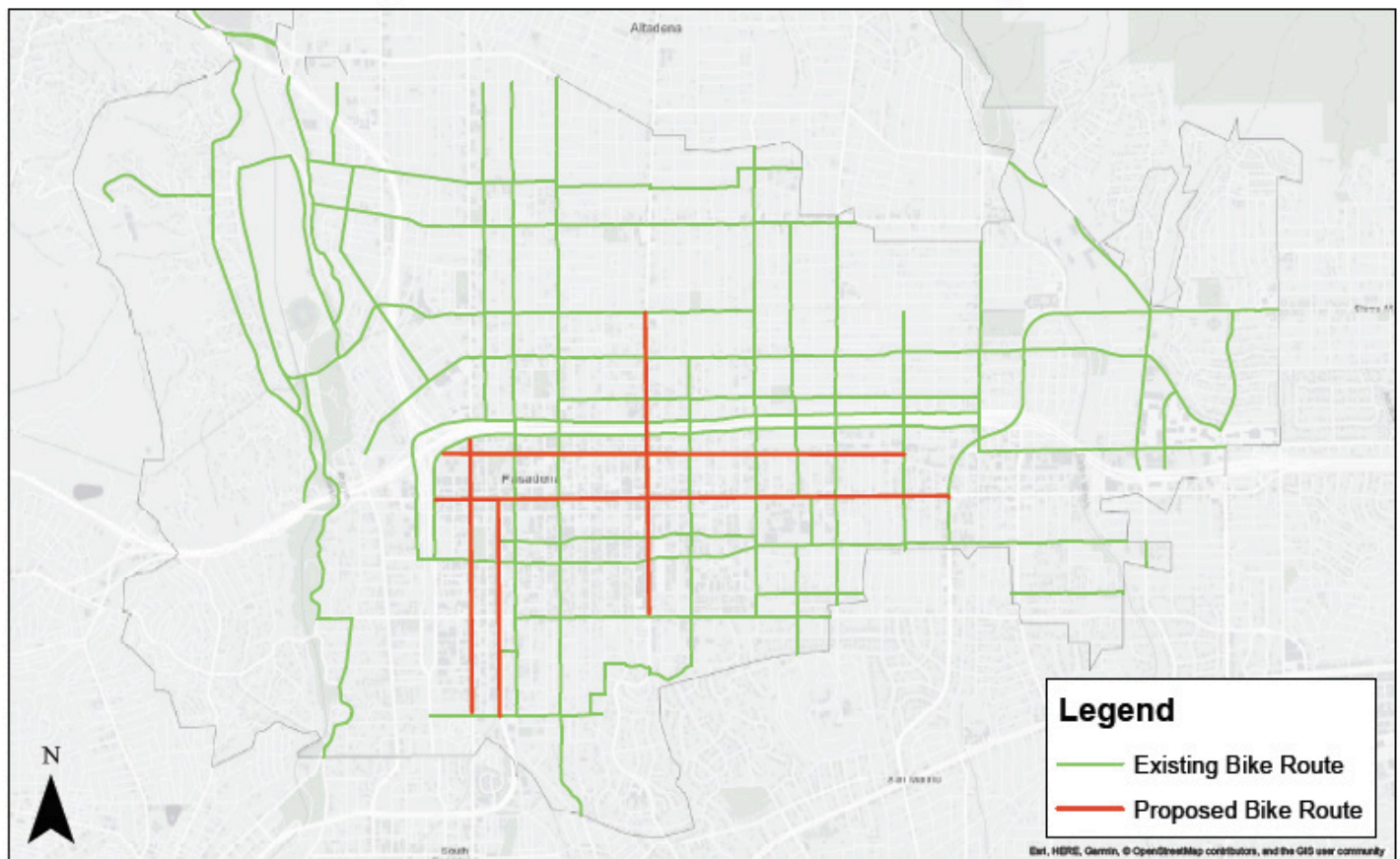


Figure 6

Design Guidelines

The following design guidelines are based on the analysis of the current bicycle infrastructure and the determined need for improvements.

Bikeways

Class I - Bike paths or shared use paths, which provide a completely separated right-of-way designated for the exclusive use of bicycles and pedestrians with crossflows by motorists minimized.

Class I bikeways shall be implemented throughout the City to provide a safe, protected experience for riders. This higher level of security allows for a greater demographic of users that feel comfortable to ride. This is important for Pasadena as they are trying to promote the option of bicycling to more people.

Class II - Bike lanes, which provide a restricted right-of-way designated for the exclusive or semi exclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and crossflows by pedestrians and motorists permitted.

Bike lanes provide a designated space for bicyclists to ride at their “preferred speed without interference from prevailing traffic conditions and facilitate predictable behavior and movements between bicyclists and motorists” (NACTO). With class II bikeways, bicyclists are riding alongside automobile traffic without any protected barriers so it is important that bike lanes are very visible so that motorists are aware of the presence of bicyclists.

Class III - Bike routes, which provide a right-of-way on-street or off-street, designated by signs or permanent markings and shared with pedestrians and motorists.

Some streets within the City have relatively low speeds and traffic volumes so they can be safe environments for bicyclists without much needed infrastructure. These streets are considered bicycle boulevards and can be enhanced into safer environments using a range of design features such as pavement markings and speed management measures.

1. Signs and Pavement Markings

Signs and pavement markings are important for class III bikeways to ensure that bicyclists are noticed by drivers on the road. The greater the prevalence of signs and pavement markings the greater the awareness that different modes of transportation must share these roadways. Wayfinding signs are also helpful in areas with class III bikeways as they are typically located on more localized streets and may not be the location of popular destinations as they have few businesses and services located along them. Signs can also “brand the bicycle boulevard to raise awareness of the designated routes and to encourage new users” (NACTO).

Wayfinding Signs and Pavement Markings



Figure 7: NACTO, <https://nacto.org/publication/urban-bikeway-design-guide/bicycle-boulevards/signs-and-pavement-markings/>

Best Applications

- along all bicycle boulevards
- at intersections where bicycle boulevards cross another bikeway or turn onto another street

2. Speed Management

Managing the speed of vehicles on bicycle boulevards is important for the safety and promotion of bicycling. Several measures can be taken to reduce the speed along bicycle boulevards. These measures improve comfort for bicyclists and benefit pedestrians and residents by reducing traffic speeds in these areas. They also decrease the likelihood of crashes by giving drivers a longer response time. For the safety of bicyclists, bicycle boulevards

should have a maximum speed of 25 mph. Simply changing the speed limit on a street is mostly ineffective in reducing speeds as drivers may not notice or change their behaviors. Speed management and street design techniques are necessary.

Vertical Deflection

Vertical speed control measures can be used to reduce speed by adding slight pavement elevations to roadways.

Raised Crosswalk

Extends fully across the street and is typically 3 inches high.

Speed Hump (Figure 8)

3 to 4 inches high and 12 to 14 feet long.



Figure 8: NACTO, <https://nacto.org/publication/urban-bikeway-design-guide/bicycle-boulevards/speed-management/>

Horizontal Deflection

Horizontal speed controls can also be used to slow down motorists. These speed controls are either a narrower roadway path or a travel lane that is not simply straight.

Curb Extensions (Figure 9)

Extend into the sidewalk or curb into the parking lane at an intersection. Curb extensions reduce the crossing distance for pedestrians, can increase the amount of space available for street furniture and trees and can act as stormwater management features.



Figure 9: NACTO, <https://nacto.org/publication/urban-bikeway-design-guide/bicycle-boulevards/speed-management/>

Traffic Circles

Raised islands placed at intersections that reduce vehicle speeds by narrowing turning radii, narrowing the travel lane and obscure the visual corridor along the roadway.

Best Applications

- Bicycle boulevards that have vehicle speeds higher than speed limits
- High use pedestrian crossings of a bicycle boulevard
- Streets where community feels that traffic speeds are too high

Intersections

The design of an intersection with bicycle facilities is crucial to reduce conflict between bicyclists and vehicles. Well-designed intersections will heighten the level of visibility, denote clear rights-of-way and create awareness of different modes.

Bike Boxes (Figure 10)

A bike box is a designated area at the head of a traffic lane at a signalized intersection. It provides greater visibility of bicyclists to drivers and provides priority for bicyclists at signalized crossings of major streets.



Figure 10: NACTO, <https://nacto.org/publication/urban-bikeway-design-guide/intersection-treatments/bike-boxes/>

Best Applications

- At signalized intersections with high volumes of bicycles and/or motor vehicles
- Streets where they may be right or left-turning conflicts between bicyclists and motorists

Bicycle Signals (Figure 11)

Bicycle signals increase the safety of bicyclists when crossing intersections by “clarifying when to enter an intersection and by restricting conflicting vehicle movements” (NACTO). They prioritize bicycle movements at intersections. Bicycle signals have three lenses similar to that of traffic signals that have green, yellow and red bicycle symbols.



Figure 11: NACTO, <https://nacto.org/publication/urban-bikeway-design-guide/bicycle-signals/bicycle-signal-heads/>

Best Applications

- At complex intersections that may otherwise be difficult for bicyclists to navigate.
- At intersections with high numbers of bicycle and motor vehicle crashes.
- Where bike paths cross streets, especially when needed bicycle clearance time is different from pedestrian clearance time

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