

**Potential of Existing and Proposed Bicycle Facilities to Link Multiple Origin and Destination Needs for Non-motorized Travel in San Luis Obispo**

A Senior Project

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California Polytechnic State University – San Luis Obispo

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Bachelor of Science in City and Regional Planning

By

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## Approval Page

**Title:** Potential of existing and proposed bicycle facilities to link multiple origin and destination needs for non-motorized travel in San Luis Obispo

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## Executive Summary

The purpose of this study is to investigate the potential of linking multiple origins and destinations for efficient non-motorized travel in San Luis Obispo, California. The city currently has seventy-five miles of bicycle infrastructure with the intention to add thirty-five more miles to create a more functional bicycle network and foster an increase in bicycle trips taken.

Many cities in the United States are following their European counterparts in the push towards more sustainable forms of transportation by promoting bicycling, walking, and the use of public transit. Recently, we have seen an increase in both local and national legislative efforts to fund the creation of safer pedestrian and bicycle infrastructure around the country. This shift to more active forms of transportation—particularly bicycle transportation—can result in countless benefits to health and wellness, local economies, and the environment we live in.

This study explores San Luis Obispo's bicycle infrastructure to determine the current operational value and potential for the optimization of non-motorized routes between employment centers, recreation centers, and residential areas. To legitimize the idea of commuting by bicycle within the community, the infrastructure the City provides should be accessible by all residents, regardless of location.

The results of this research can be used to guide City officials in identifying locations in town that are not well served by bicycle infrastructure. In the long run, this can inform future infrastructure deployment, encourage an active dialogue with residents about the transportation needs of the community, and ultimately create a healthier San Luis Obispo.

# I. Introduction

## Study Purpose

The purpose of this project is to analyze the configuration of existing and proposed bicycle infrastructure in San Luis Obispo, California, highlighting routes that connect to job sites, recreation facilities, and residential neighborhoods. This study examines if the bicycle infrastructure has the potential to facilitate and increase connections to various sites within the City using non-motorized travel.

## Motivation for Study

This senior project stemmed from my desire to research the potential of existing and proposed bicycle infrastructure as a service to the residents of San Luis Obispo. Employed as a Transportation Intern by the Public Works Department in the City of San Luis Obispo, I completed a variety of projects to improve the streets for pedestrians, bicyclists, and drivers. In this role, I also assisted the Active Transportation Manager, who oversaw projects for the City relating to bicycle and pedestrian infrastructure and circulation. I also had the opportunity to aid in the latest update of the Active Transportation Plan for the City of San Luis Obispo. I focused on community outreach to survey city residents to ask them why they enjoyed biking in town and to explore barriers to service. After completing the project, I hoped to research the topic of biking in San Luis Obispo more deeply and developed the idea to find the potential of existing and proposed infrastructure based on a variety of factors that relate to accessibility between job sites, recreation centers, and residential neighborhoods. Ultimately, my goal was to look for ways to encourage an expansion of non-motorized travel for constituents in San Luis

Obispo, given the infrastructure that already exists and the infrastructure that is planned for the community.

### Relevance to Planning

Transportation planning is an essential sector in the planning community. Its most basic purpose is to optimize the movement of people and goods around a designated region or regions. Without the intentional creation and management of transportation systems, cities would not be able to function effectively. Improving access to an area by building transportation infrastructure not only reduces vehicular congestion, but accessibility attracts new residents and businesses, ultimately sparking economic development (ACI USA Inc , 2017). It has been proven time and time again that these networks are a major factor in the financial success of an area as they “link residents with employment, public services, shopping, social networks, and businesses to labor, consumer, buyer, and supplier markets” (Walzer, 2009).

The effort to create more bicycle infrastructure in the United States is increasingly visible within active transportation planning as general interest in sustainability and sustainable transportation has grown. As climate change drastically alters the environment around us, effective transportation planning can be especially valuable in mitigating these changes. Several legislative efforts have been made relating to reducing vehicle miles travelled, creating complete streets, and providing more funding for active transportation efforts. All the literature is related to methods of transportation planning, and planning for the future.

## Problem Statement

It is widely acknowledged that society has become too dependent on the personal vehicle, and people rarely consider riding a bicycle or walking to work. In 2018, eighty-five percent of employed Americans over the age of sixteen commuted to work via car, truck, or van. Fewer than one percent of those surveyed commuted to work via bicycle (US Census, 2018).

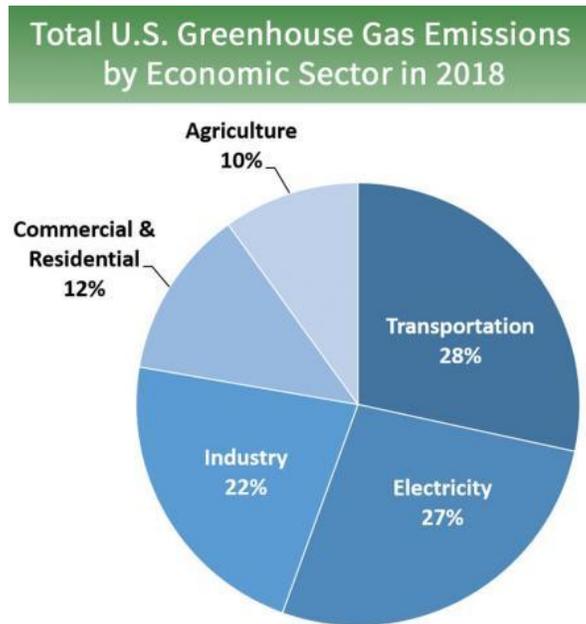
Comparatively, during the same year, almost seventy-six percent of people commuted to work via car, truck, or van in San Luis Obispo while eight percent of people rode a bicycle (US Census, 2018). Although San Luis Obispo has a much higher bicycling commuter population, that percentage could be much higher with denser, more connected bicycle infrastructure.

About one hundred million Americans use a bicycle each year, but only about seven percent of them use one at least twice a week. Forty-five percent of these hundred million made at least one bicycle trip for transportation in the previous year (Schmitt, 2015). A little more than half of the people who biked made only recreational trips or trips that were not necessary.

According to the United States Environmental Protection Agency (EPA), greenhouse gas emissions from the transportation industry accounted for about twenty-eight percent of total emissions in the U.S. in 2018. The transportation exceeded the electricity, industrial, and agricultural sectors in greenhouse gas emissions as shown in Figure 1.1 (United States Environmental Protection Agency, 2018). These levels are only exaggerated by passenger cars, light-duty trucks, and freight trucks, which are all driven by millions of people a day. This has sparked a movement to reduce the number of vehicle miles traveled by removing people from

their personal vehicles and encouraging the use of public transportation, or more active forms such as walking or cycling.

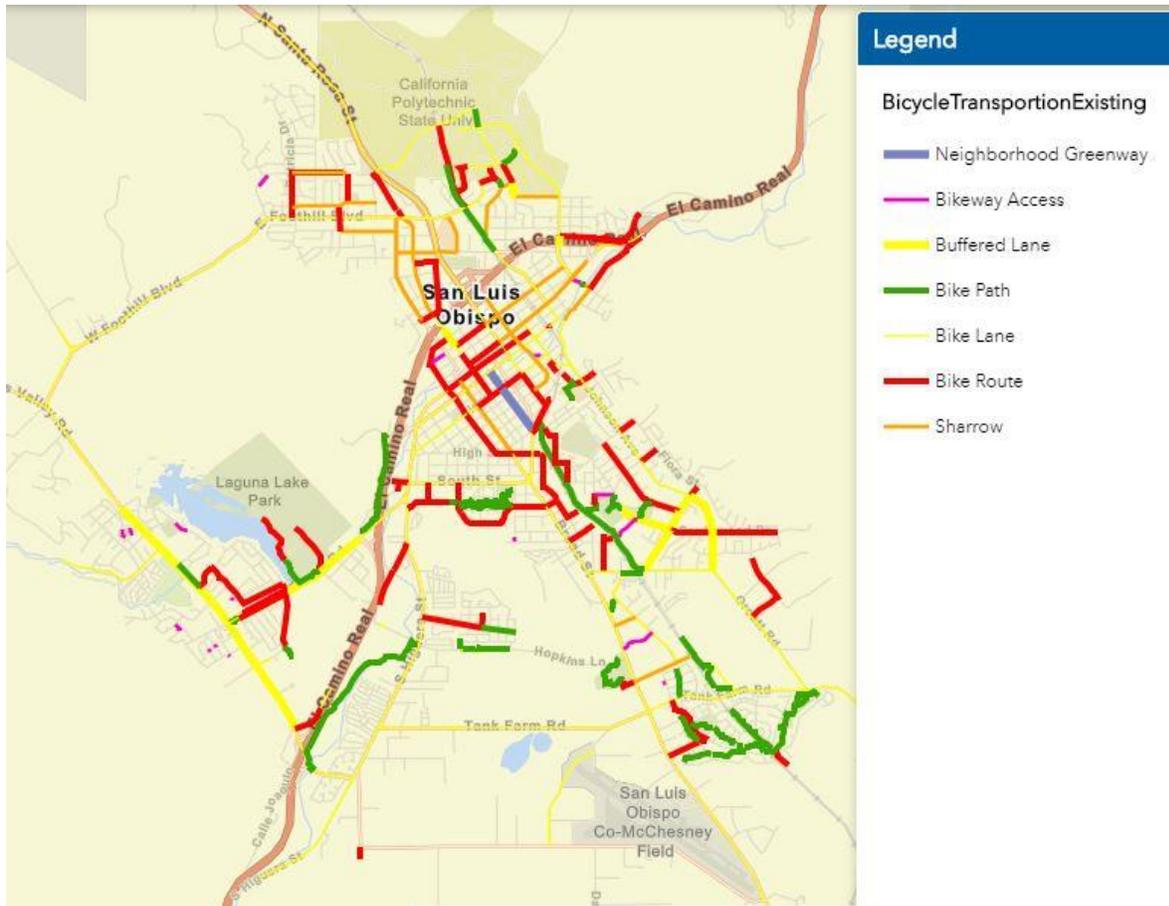
Figure 1.1: Greenhouse gas emission by economic sector



Source: United States Environmental Protection Agency, 2018

Although San Luis Obispo is generally bicycle-friendly, not every neighborhood is well-served by the existing network of bicycle routes. Much of the existing infrastructure consists of disjointed bicycle lanes and paths that do not effectively connect residents to job centers and recreation facilities. Figure 1.2 shows the existing bike network in San Luis Obispo. While it covers the center of the town and some main commuter roads, many potential routes have been disregarded. Much of the paths do not connect to one another, which discourages inexperienced riders from using bicycles to meet their travel needs. Many commuters feel that some heavily trafficked roads in San Luis Obispo are not safe enough to ride, especially without the appropriate bicycle infrastructure.

Figure 1.2: Existing Bicycle Infrastructure in San Luis Obispo



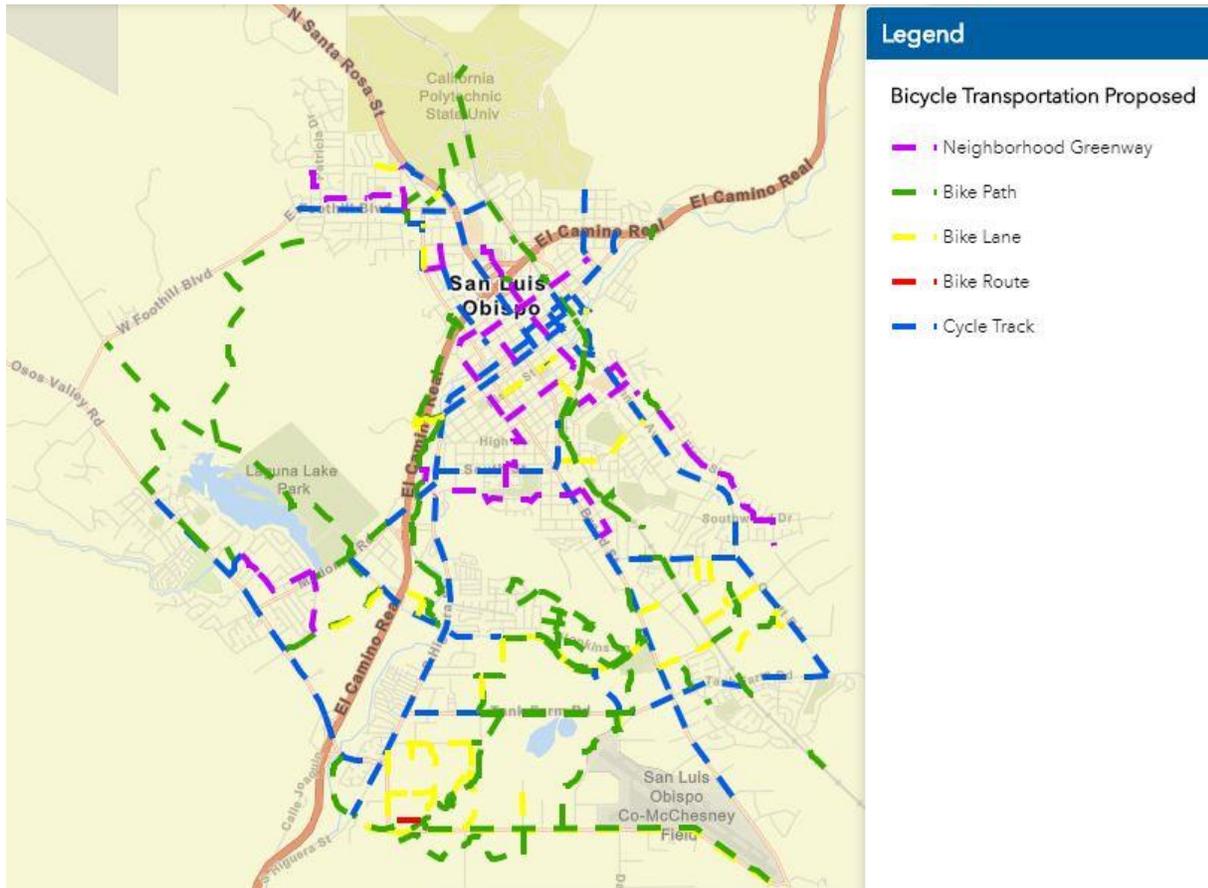
Source: City of San Luis Obispo, 2020

The southern and western portions of San Luis Obispo, despite being mostly residential and commercial, are deeply lacking in bicycle infrastructure. This makes it difficult for residents in these areas to travel across town for work especially considering the high traffic speeds of the roads that serve them. For example, Foothill Boulevard, Los Osos Valley Road, and Tank Farm Road all have speed limits ranging from thirty-five to fifty miles per hour, which make it nearly impossible for casual bicyclists to commute comfortably.

As a result of these findings, the San Luis Obispo Active Transportation Manager is proposing the creation of thirty-five additional miles of bicycle infrastructure within the City to better

connect the existing infrastructure, as highlighted in Figure 1.3. These additions would include a variety of improved bicycle paths and lanes, neighborhood greenways, cycle tracks, and a very small portion of bicycle routes. The proposed infrastructure alone shows a much wider bicycle network than the existing network. It also highlights the introduction of infrastructure to busier roads, which many people may not feel confident using if not deployed to be bicycle friendly.

Figure 1.3: Proposed Bicycle Infrastructure in San Luis Obispo

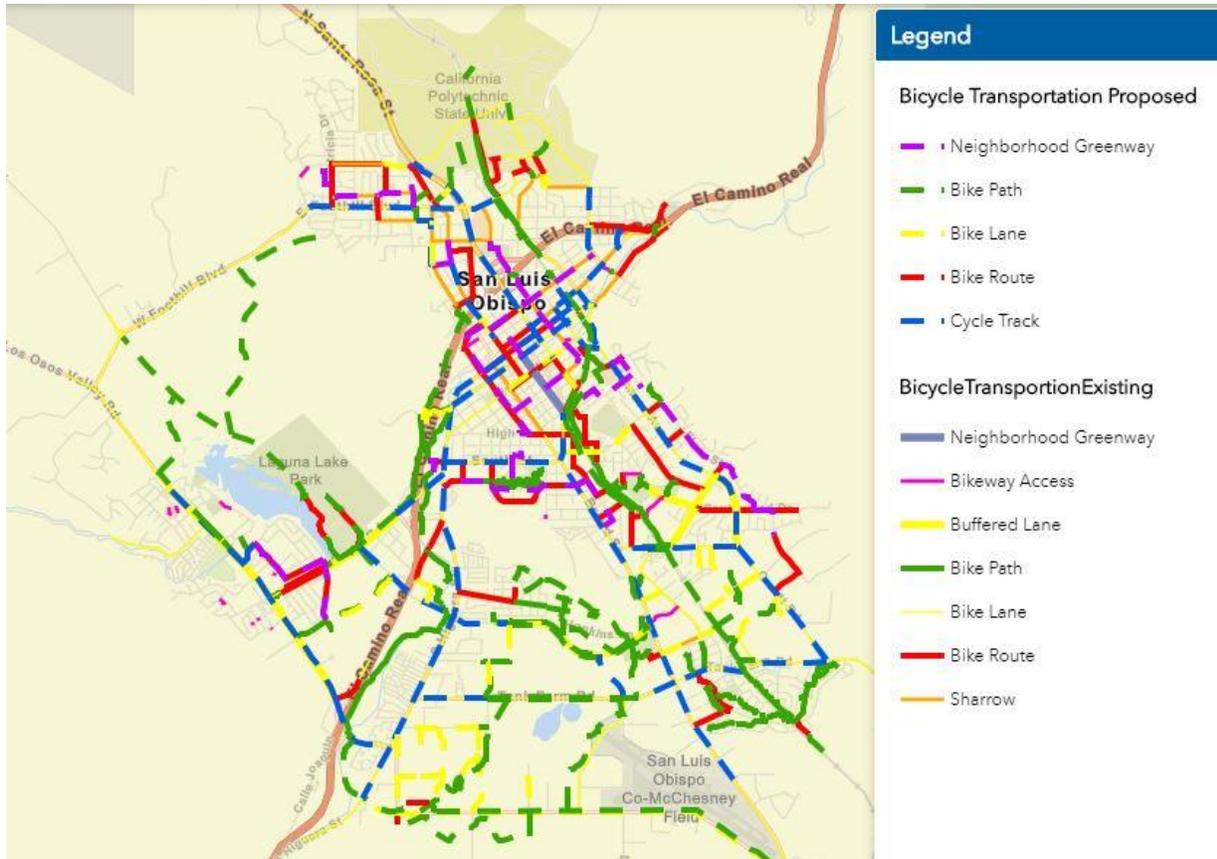


Source: City of San Luis Obispo, 2020

The combination of proposed and existing bicycle frameworks shows the potential for a more efficient, connected bicycle network. The map in Figure 1.4 shows this scenario in which San Luis Obispo has denser infrastructure. Any major roads that residents may have felt unsure

about commuting on previously would become inclusive of all transportation, especially by bicycle. These high-trafficked roads would also connect with local collectors and minor arterials. Some of the existing infrastructure is shown to be safer and more separated from vehicle traffic in the proposed network.

Figure 1.4: Existing and Proposed Bicycle Infrastructure in San Luis Obispo



Source: City of San Luis Obispo, 2020

San Luis Obispo has been making active efforts to prioritize non-private vehicle travel within the City. Similarly, state and federal officials have introduced a series of legislation, encouraging communities to reduce automobile use in favor of active transportation, citing its many benefits to overall mental and physical health, the economy, and the environment. Exercising releases serotonin, a hormone that promotes positive well-being and happiness through improvement

in mood and is only reinforced by the World Health Organization's (WHO) recommended thirty minutes of moderate-intensity physical activity each day. Economically, the maintenance of and parking costs for a bicycle are only about one percent that of a vehicle (Queensland Government, 2020). Lastly, and on a more global scale, encouraging biking over the use of cars would reduce greenhouse gas emissions and air pollutants, which ultimately minimizes contributions to global climate change (Rydoze, 2016).

## II. Background

### San Luis Obispo

The City of San Luis Obispo is a medium-sized town in the state of California, with a population of about 47,000 residents, located halfway between Los Angeles and San Francisco. People aged eighteen to twenty-four make up the largest percentage of the population at thirty-five percent due to the presence of the county's largest public university, California Polytechnic State University. Comparatively, people aged sixty-five or older make up only twelve percent of the City's population. Most residents identify as Caucasian, at almost eighty-five percent. About six percent of the population identify as Asian, four percent identify as two or more races, and two percent identify as Black or African American. The median household income in San Luis Obispo is \$52,740, and the employment rate is almost sixty percent (United States Census Bureau, 2020).

San Luis Obispo was named a bicycle friendly community by the League of American Bicyclists (LAB) in 2007 and was recognized at the Gold Level most recently in 2019. With this ward, LAB acknowledges the City's commitment to improving conditions for cyclists through investments in bicycle education programs, bicycle events that promote and encourage cycling, and pro-bicycle policies. This recognition is also due to the existing bicycle network's seventy-five miles of bicycle paths, bicycle lanes, and on-street facilities, as well as the creation of over 150 secured bicycle parking spaces (City of San Luis Obispo, 2020).

## Bicycle Infrastructure

The layout of any locality's bicycle infrastructure can vary from place to place, but the features they support remain consistent. The most traditional feature of these networks is a bicycle lane, which is a dedicated lane for bicycles to ride safely alongside automobile traffic. In many cities, bicycle lanes are painted green to communicate to drivers that a specific portion of roadway has been set aside for bicyclists. Similarly, a neighborhood greenway is a type of bikeway on a low-speed street which has been optimized for bicycle traffic. Bicycle paths, however, are separate from streets and are typically shared with pedestrians. They are often located along creeks, railroad rights-of-way, or freeways with a limited number of cross streets.

A bicycle route is a street designated for bicycle travel, but still shares the roadway with motor vehicles moving at a reduced speed. These streets provide better connectivity than others and are typically identified to drivers by signage. A more exclusive type of bikeway is the cycle track, which has elements of a separated path and on-road bicycle lane. It is located on the road but is made to look different from both the sidewalk and street, separated by a barrier. Lastly, a sharrows, which requires the least amount of interruption to install, has pavement markings that indicate shared-use lanes. The markings are intended to encourage bicyclists to ride clear of the "door zone" and to alert drivers to expect people on bicycles to fill the full lane. Figure 2.1 provides a visual representation of the different types of bicycle infrastructure.

Figure 2.1: Bikeway Classifications



Source: City of Pasadena, 2015

## Literature

Several senate bills and acts signed into law in the past ten years have focused on providing funding to local governments to encourage more active transportation within their jurisdictions. These are meant to fund and make bicycle infrastructure more accessible, prioritize the safety of bicyclists and pedestrians, and recognize the environmental benefits of biking. This legislation also aims to create more equity in the transportation system. Ultimately, those who cannot afford their own private vehicles and may rely on more active forms of transportation can feel safe while commuting. With the change in focus within California from “level of service” to “vehicle miles travelled,” in evaluating development proposals, this focus towards active transportation can reduce greenhouse gas emissions, create more opportunities

for all forms of transportation, and diversify land uses. The following subsections identify some of the key legislation related to non-motorized travel.

#### SB 743 (2018)

The intent of SB 743 is to “more appropriately balance the needs of congestion management with statewide goals related to infill development, promotion of public health through active transportation, and reduction of greenhouse gas emissions.” When implemented, “traffic congestion shall not be considered a significant impact on the environment” within CEQA transportation analysis (Governor’s Office of Planning and Research, 2020). For transportation projects, lead agencies for roadway capacity projects have the discretion, consistent with CEQA and planning requirements, to choose which metric to use when evaluating transportation impacts.

#### SB 375 (2008)

SB 375 seeks to reduce greenhouse gas emissions from vehicle trips by changing development growth patterns in a way that reduces overall driving distances. The bill entails integrating land use, regional transportation plans, and housing allocation to decrease emissions from automobiles and light trucks. Under this legislation, the California Transportation Commission is required to update and maintain guidelines for travel demand models used in the development of regional transportation plans. These guidelines must, at a minimum, take into account the following factors: (1) the relationship between land use density, household vehicle ownership, and vehicle miles traveled; (2) the impact of enhanced transit service on vehicle ownership and vehicle miles traveled; (3) changes in travel and land development likely to result from highway and passenger rail expansion; (4) mode splitting (between automobile, transit, carpool, bicycle

and pedestrian trips); and (5) speed and frequency of transit service. Prior to adopting the Sustainable Communities Strategy (SCS), the Metropolitan Planning Organization (MPO) is required to quantify the reduction in greenhouse gas emissions projected to be achieved by the SCS and set forth the difference, if any, between the amount of that reduction and the target for the region established by the Air Resource Board (ARB). If the SCS fails to meet the reduction targets, then the MPO is required to prepare an alternative planning strategy.

#### [SB 127 \(2019-2020\)](#)

Senate Bill 127 concentrates on transportation funding, specifically for active transportation and complete streets. This bill prioritizes implementing safe and connected facilities for pedestrians, bicyclists, and transit users on all State Highway Operation and Protection Program projects. It also would require the implementing department to include complete streets elements in the asset management plan and adopt performance measures that include conditions of bicycle and pedestrian facilities, accessibility and safety for pedestrians, bicyclists, and transit users. The plain language performance report developed by the department, in consultation with the commission, must now include a description of pedestrian and bicycle facilities on each project, including the number, extent, and type of elements. With the commencement of the 2022 State Highway Operation and Protection Program, while undertaking a capital improvement project on a state highway or on a local street crossing a state highway funded by the State Highway Operation and Protection Program, new pedestrian and bicycle facilities, or improvement to existing facilities will be included. These improvements would be prioritized to emphasize safety and reduce fatalities and severe injuries, including

fatalities and injuries of pedestrians, bicyclists, and transit users on the state highway system (SB-127, 2020).

#### [SB 99 \(2013-2014\)](#)

Senate Bill 99 created the Active Transportation Program in the Department of Transportation, which is funded by federal and state transportation funds in the annual Budget Act. These include one hundred percent of the available federal Transportation Alternatives Program funds and federal Recreational Trails Program funds, \$21,000,000 of federal Highway Safety Improvement Program funds, and fuel tax revenues from the Highway Users Tax Account and the State Highway Account. It provides for funds to be allocated to eligible projects by the California Transportation Commission. Forty percent is made available for programming by metropolitan planning organizations in urbanized areas with a population greater than 200,000, ten percent for small urban and rural regions, and fifty percent on a statewide basis. The bill requires the commission to develop guidelines and procedures, including project selection criteria, for the program in consultation with various agencies and interested parties.

Additionally, the commission will adopt a two-year program of projects for the program, with subsequent four-year programs thereafter. The bill eliminates the Bicycle Transportation Account, the Bikeway Account, and the Safe Routes to School Program as separate programs.

#### [Fixing America's Surface Transportation Act \(2015\)](#)

In December of 2015, Former President Barack Obama signed into law "Fixing America's Surface Transportation ACT," or "FAST Act.". It was the first federal law in over ten years to provide long-term funding certainty for surface transportation infrastructure planning and investment. The bill authorized the use of \$305 billion over fiscal years 2016 through 2020 for

highway, highway and motor vehicle safety, public transportation, motor carrier safety, hazardous materials safety, rail, and research, technology, and statistics programs (The Fast Act, 2019). The FAST Act maintains safety as its focus, from keeping intact the established structure of highway-related programs to continuing efforts to streamline project delivery—and, for the first time, creating a dedicated source of federal dollars to freight projects. With the enactment of the FAST Act, states and local governments may move forward with critical transportation projects with the confidence that they will have a federal partner over the long term.

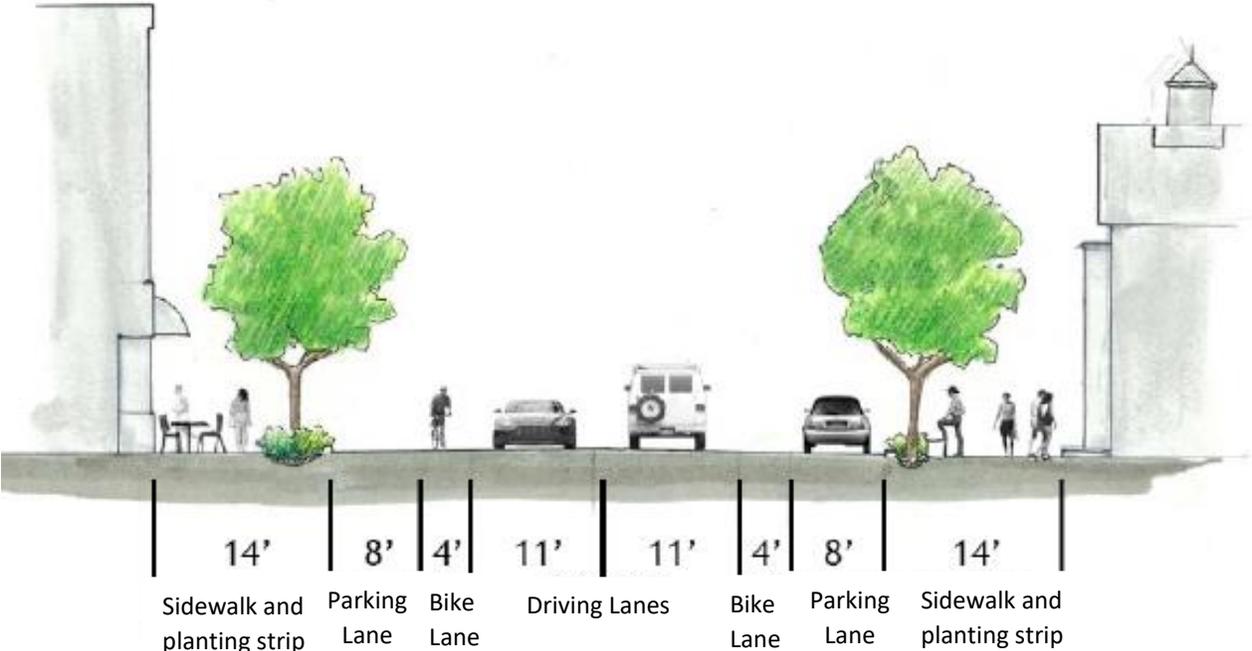
#### Complete Streets Act of 2019

The Complete Streets Act (S.2077) was presented to the U.S. Senate in July of 2019 by Massachusetts Senator Edward Markey. He proposed that five percent of annual federal highway funds be directed towards Complete Streets projects, requiring states to create a program to provide technical assistance and award funding for communities to build Complete Streets projects, and directing localities to adopt a Complete Streets policy that meets a minimum set of standards to access that dedicated funding (Complete Streets Act, 2020). Unlike a state program, a federal Complete Streets law could dedicate more resources to studying and ensuring safety.

Complete Streets are streets for everyone. They are designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities. Complete Streets make it easy to cross the street, walk to shops, and bicycle to work, as shown in Figure 2.2. They can lower congestion and make it safe for people to walk to and from transit stations. One key program that encourages Complete Streets is “Vision Zero,”

which aims to make traffic fatalities and serious injuries obsolete. The goal is to integrate all forms of transportation without increasing traffic conflict. Excellent, integrated road infrastructure can reduce vehicle crashes and increase safety.

Figure 2.2: A Complete Street



Source: Green Accents, 2014

### III. Study Methodology

#### Bicycle Facility Maps

Two sources were used to collect information about bicycle infrastructure: (1) the City of San Luis Obispo's online Geographic Information System (GIS) mapping software, and (2) the City of San Luis Obispo Bicycle Transportation Plan of 2013. The GIS software offers basic mapped plans of existing and proposed bicycle infrastructure, while the Bicycle Plan identifies more comprehensively the City's bicycle plan policies, programs, maps, tables, and projects, plus descriptions about each planned bicycle lane.

#### Census Data and Employment Centers

Data from the Longitudinal Employer-Household Dynamics (LEHD) program, provided by the Center for Economic Studies at the U.S. Census Bureau, was used to compile the city's Census information. This program combines public-use information with federal, state, and Census Bureau data on employers and employees to assist local authorities in making informed decisions about the economy. The online LEHD resource "On The Map" proved especially useful in identifying employment centers within San Luis Obispo

In retrieving job and employee profiles, data from the whole of San Luis Obispo County was requested to accommodate any bicycle lanes leading outside city limits. To retrieve all employee information, a specified area slightly larger than the City of San Luis Obispo was selected to study. Next, the "Analysis on Study Area" was performed on the highlighted work areas to reveal locations of employment. "Area Profile" was chosen for all employees because this study focuses specifically on people working and living in San Luis Obispo. Finally, under

“Job Type”, “All Jobs” was chosen because this study examines all employment centers within the city. Once the outputs were obtained, the focus area was compared with the available bicycle facility maps. All employment information was from the last available year (2017).

### Recreation Centers

To collect information about recreation centers in San Luis Obispo, two sources were consulted. The first was Google Maps, which provided the locations of parks and open spaces within the city through a public bird’s-eye view. The second source was the Open Space and Trails ArcGIS map from the official San Luis Obispo website. This interactive link outlined exact locations of designated open space in the city, along with short descriptions of the features of each location.

### Land Use/Zoning Map

Two sources on the official City of San Luis Obispo website, namely the city’s zoning map and interactive parcel viewer, were used to collect information about its zoning and land use. The zoning map provided a generalized view of the city with a descriptive legend indicating each use and zone by color. By comparison, the interactive parcel viewer gave a clearer and more descriptive image of these area designations as it was searchable by specific addresses.

## IV. Analysis and Findings

### Analysis

Map overlay is the dominant analytic technique used in this study. It involved the overlay of existing and planned bicycle networks over land use maps of interest (job centers, recreational facilities, and residential neighborhoods) to visually assess levels of bike connectivity.

### Job Centers

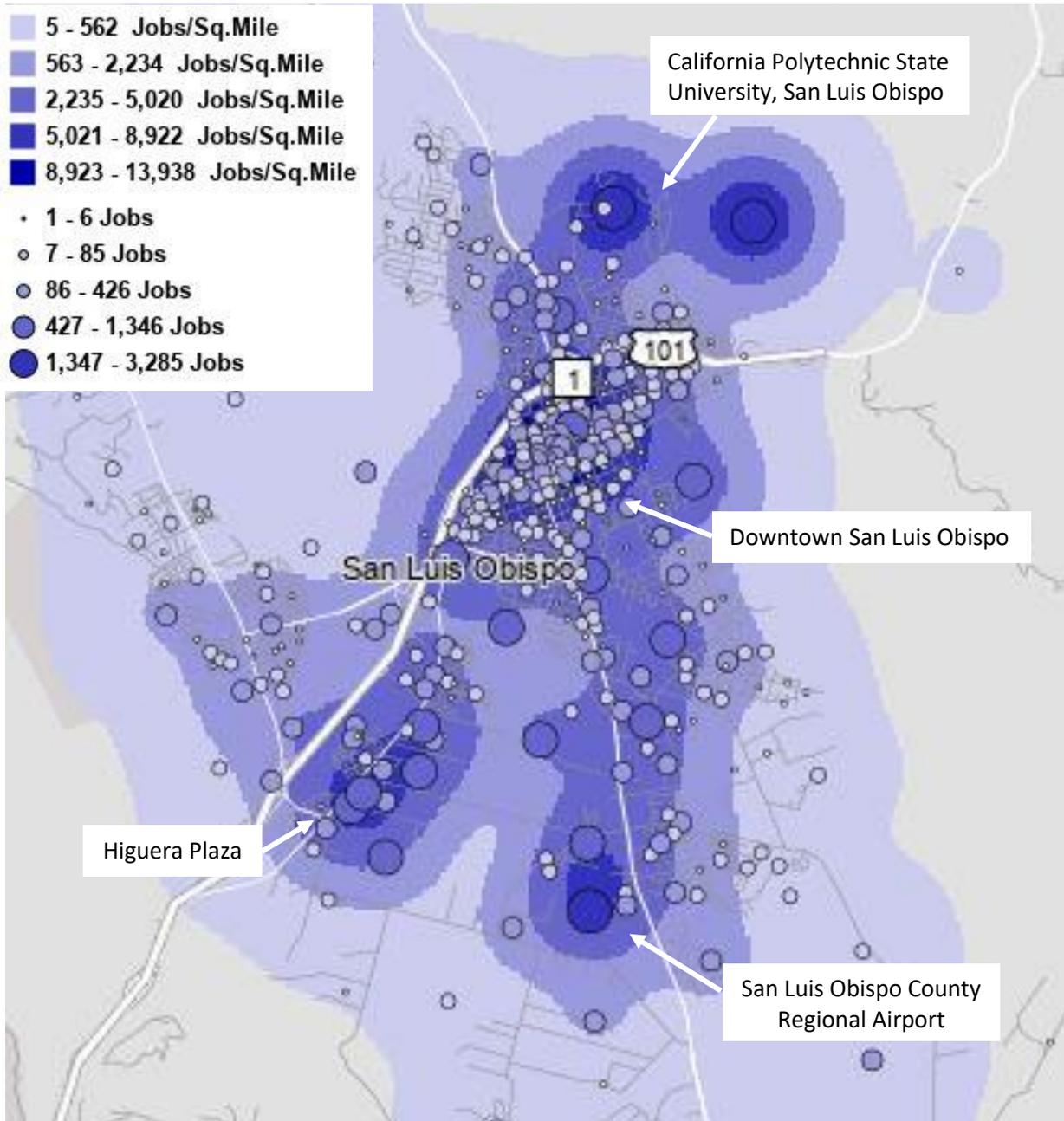
Figure 4.1, provided by LEHD's online resource "On The Map," displays major employment centers within San Luis Obispo. These centers are in the northeast, center, south, and southwest sections of the study area. The darker the blue shading, the higher the concentration of jobs in an area.

The northern area on the map, outlined by large, dark blue shading, represents the campus of California Polytechnic State University, San Luis Obispo. The University and Cal Poly Corporation are two of the largest employers in San Luis Obispo County. Conversely, the center of the study area is not represented by any single employer because it covers much of downtown San Luis Obispo, which is home to many different restaurants, retail businesses, and hotels. Downtown San Luis Obispo is by far the largest employment center in the City, and therefore, should be easily accessible by those employed in the City.

The San Luis Obispo County Regional Airport (SBP) is signified by the dark blue circle in the southeast corner. The airport is managed by the County of San Luis Obispo. In the southwest region of the map is Higuera Plaza, a staple shopping center in the City. It is the location of

popular grocery stores, “Trader Joe’s” and “Food 4 Less,” plus other storefronts and eateries such as “Starbucks,” “Round Table Pizza,” a veterinary hospital, and much more.

Figure 4.1: San Luis Obispo Employment Area Profile Analysis



Source: On The Map, 2020

Residents of San Luis Obispo have options to commute to work by way of private automobiles, carpooling, ridesharing, walking, bicycling, or use of public transportation. However, despite a clear public interest to commute more sustainably, only about eight percent of them do so by bicycle. To highlight the potential of increased bicycle facilities optimizing non-motorized travel, graphics of the existing infrastructure and that of the proposed additions were superimposed onto the City's employment analysis and concentration map. From this example, the existing bicycle infrastructure links much of the city to the four main employment centers in San Luis Obispo. It also connects many of the other job sites in town, represented by the large blue shading. Figure 4.2 depicts level of connectivity.

Figure 4.3 shows the existing bike infrastructure with the proposed additions over the employment concentrations map. It reveals more comprehensive connections between job sites and other destinations within the city than the existing infrastructure. This graphic shows minimal gaps in service, which would connect residents to places of employment and encourage those who live and have jobs within the city to use bicycles to get to work.

Figure 4.2: San Luis Obispo Employment Analysis with Existing Bike Infrastructure

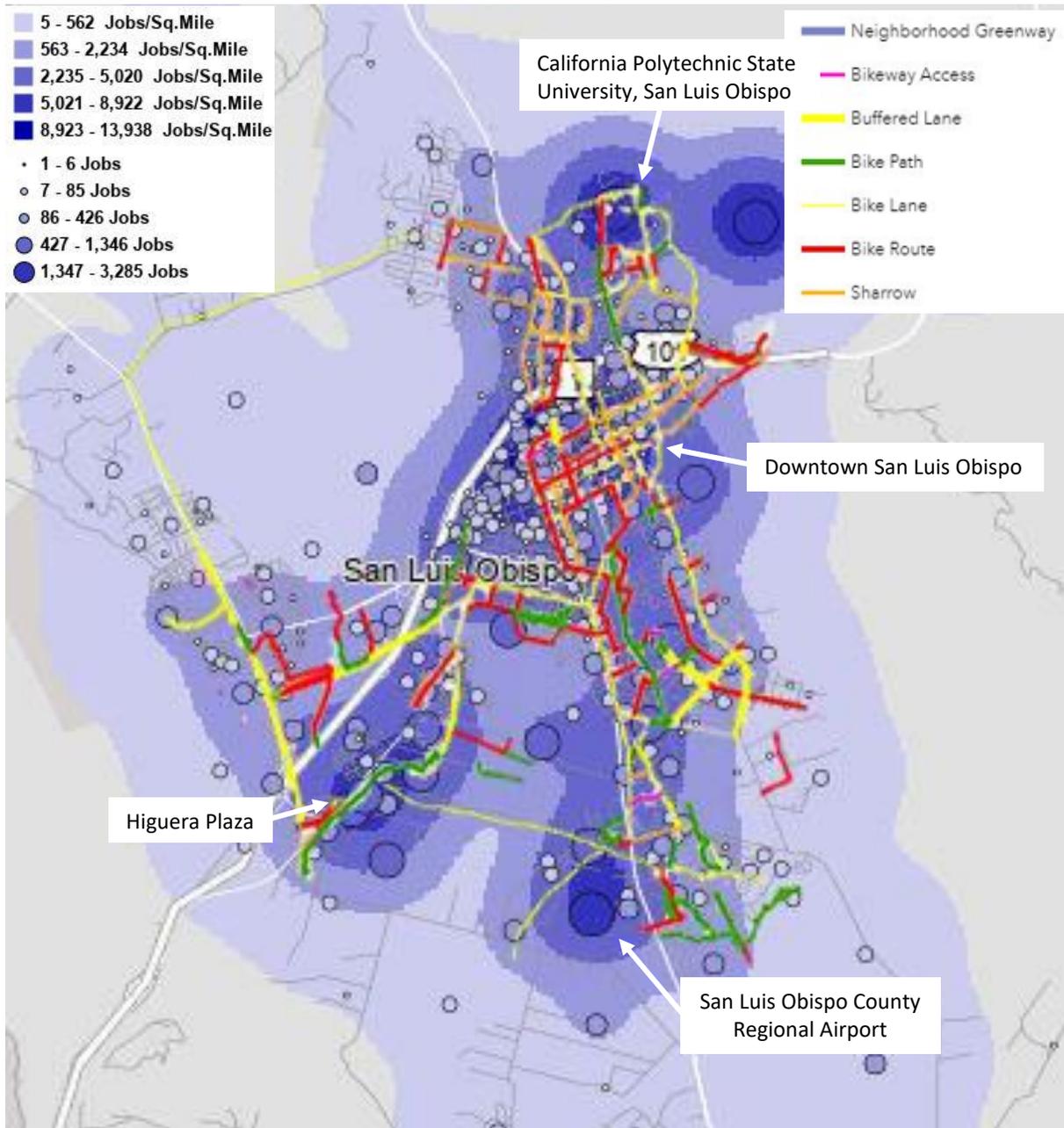
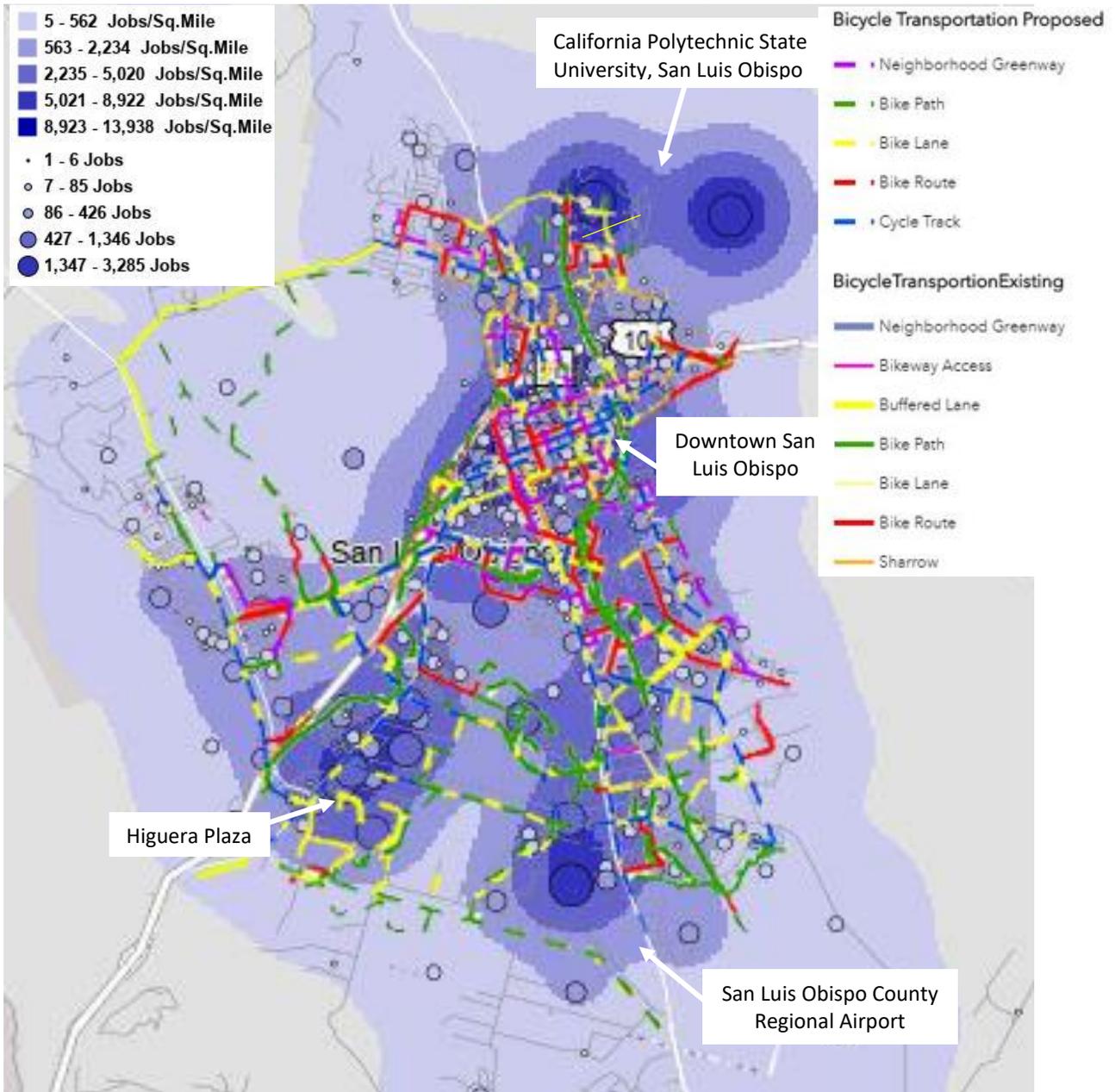


Figure 4.3: San Luis Obispo Employment Analysis with Existing and Proposed Bike Infrastructure



## Recreation Centers

Recreation, and therefore access to it, is an important part of life for many people living in San Luis Obispo. Public parks and recreation spaces are necessary for improving the overall health and wellness of people of any age, ability, or socio-economic background. Providing more safe ways to get to these recreation centers is vital for all members of the community.

Figure 4.4 shows all the outdoor recreation centers in San Luis Obispo. Laguna Lake Park and Open Space features a dog park, disc golf course, and hiking trails with outdoor exercise courses. Bishop Peak Natural Reserve and Cerro San Luis include miles of hiking trails and views of the City from the peaks. Irish Hills and Johnson Ranch Open Spaces are attractive to both hikers and mountain bikers, while Islay Hill and Terrace Hill are neighborhood open spaces that favor more casual recreation on flatter ground. In essence, each park in San Luis Obispo has something unique to offer to those living in the City.

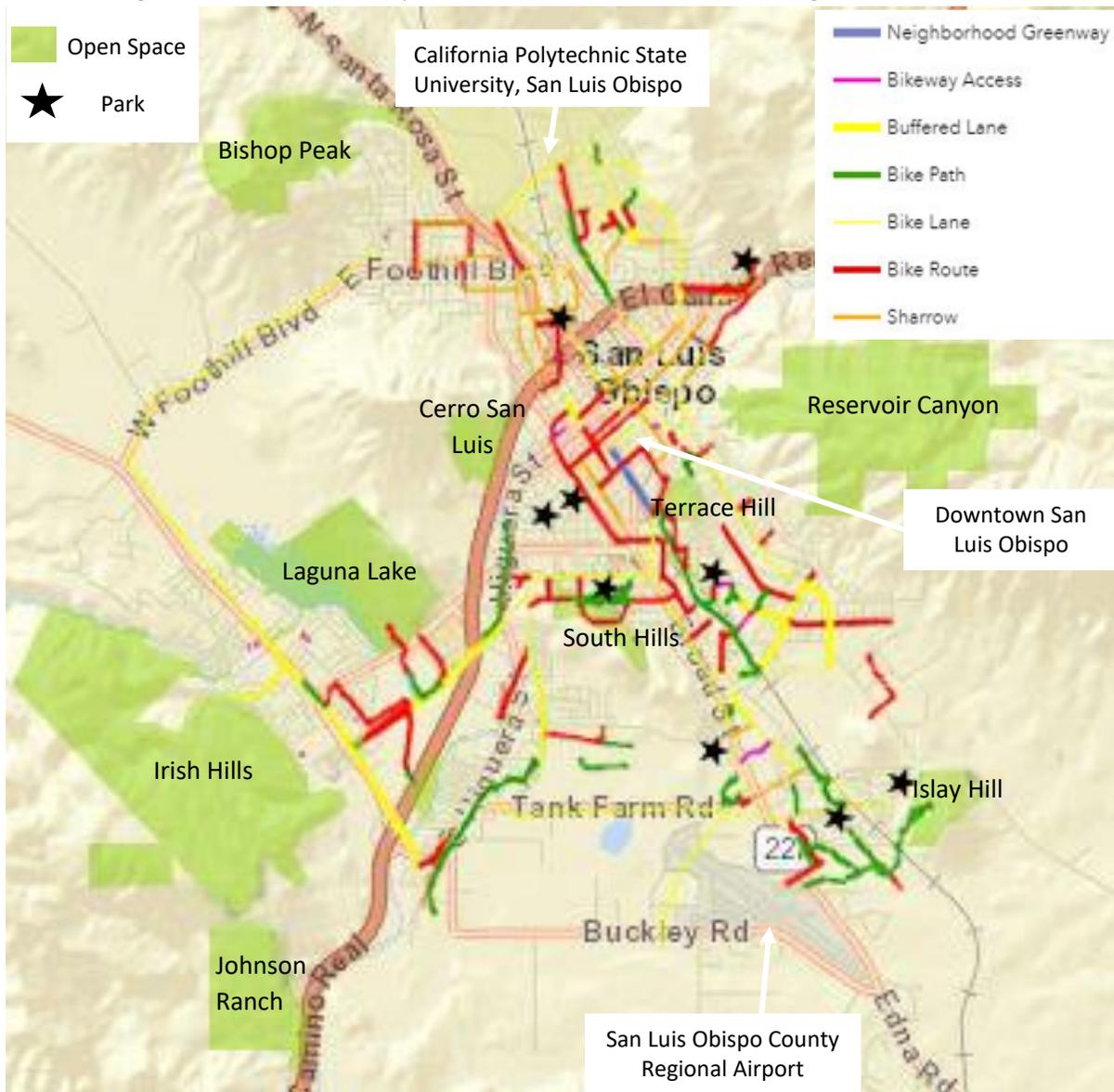
Bicycle infrastructure in San Luis Obispo was superimposed on the map of recreation centers to examine how the existing infrastructure connects any given origin to these destinations. Figure 4.5 shows that existing bicycle lanes do in fact serve all parks and most open spaces in the city, which are represented on the map by stars and green shapes, respectively. One major inadequacy, however, was revealed through this analysis—many of the bike lanes do not actually reach significant residential neighborhoods. This proves that usefulness of the existing infrastructure may be limited to those living close to downtown, those more comfortable riding a bicycle without designated infrastructure (also known as confident riders), or those originating from non-residential locations.

Figure 4.4: San Luis Obispo Recreation Centers



Source: Open Space and Trails, 2020

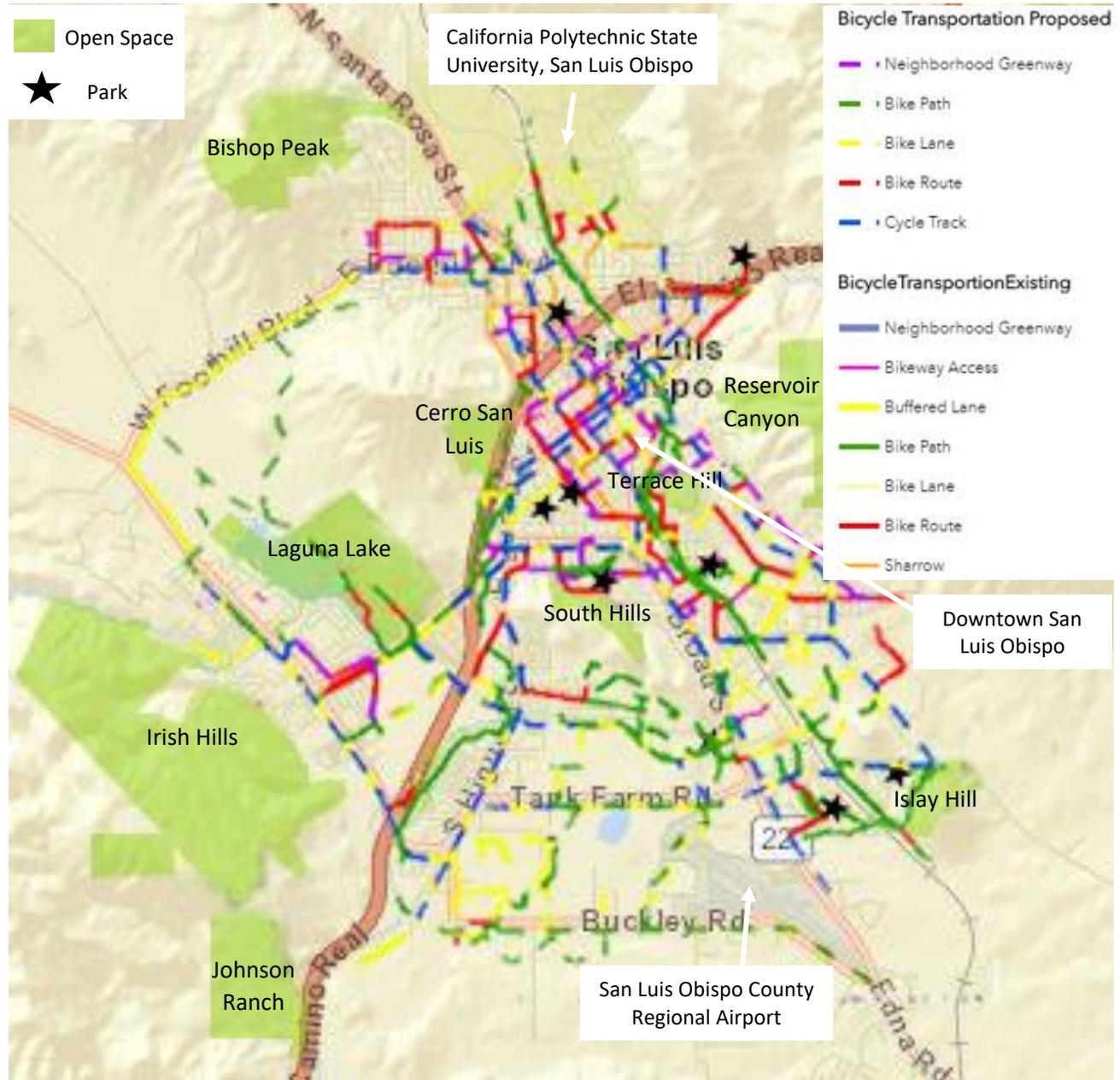
Figure 4.5: San Luis Obispo Recreation Centers with Existing Bike Infrastructure



Like the employment map, the recreation centers map modified to include both existing and proposed bicycle infrastructure shows the potential for a well-connected network within the City. Although the existing infrastructure alone does connect all parks and most open spaces, the map in Figure 4.6 shows that it provides access to recreation areas from all corners of town. However, even with the proposed bicycle network, Reservoir Canyon is not immediately served.

The infrastructure directly opens into each open space in San Luis Obispo except for Reservoir Canyon.

Figure 4.6: San Luis Obispo Recreation Centers with Existing and Proposed Bike Infrastructure

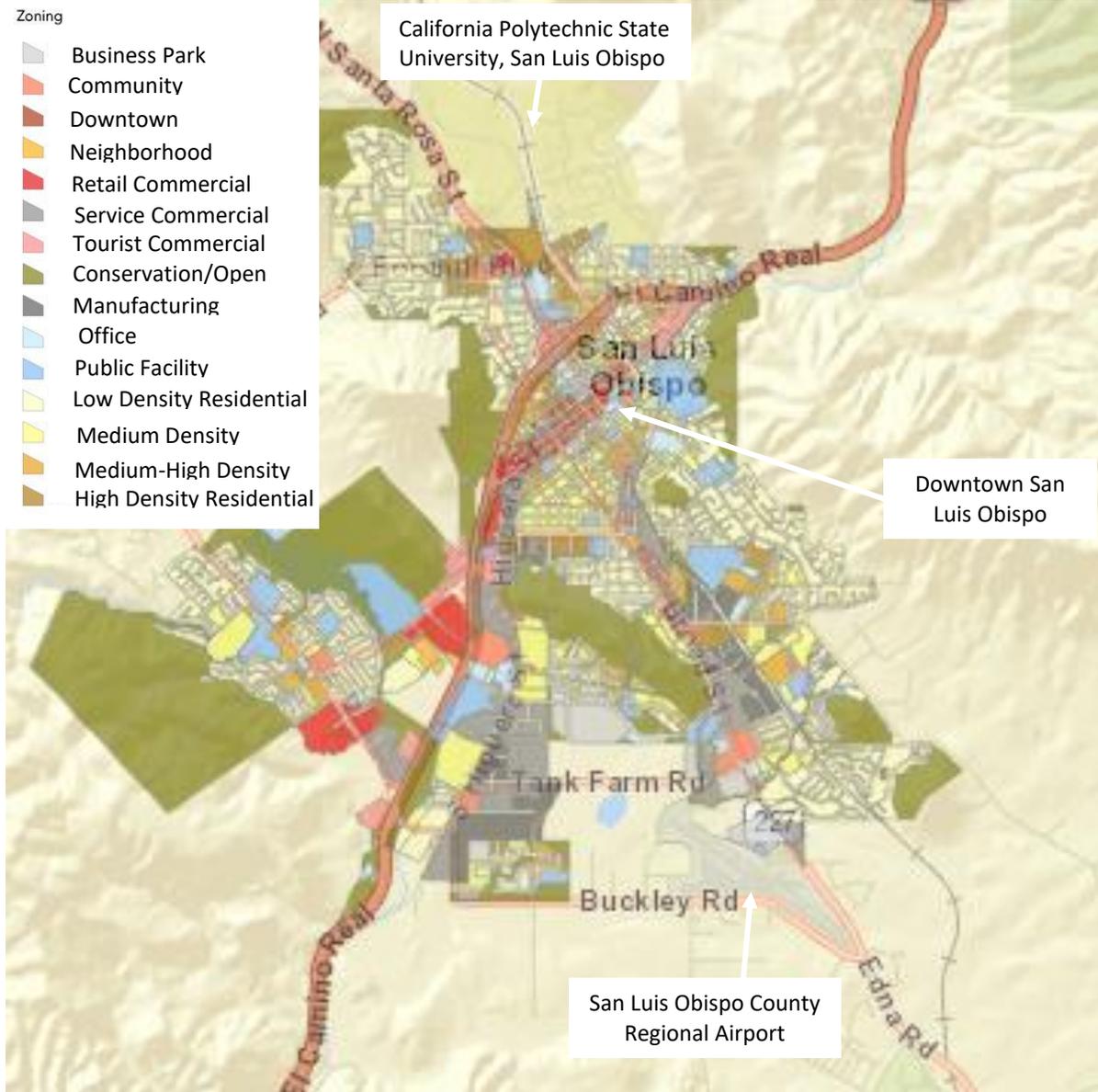


Bishop Peak Open Space appears to not be accessible by bicycle infrastructure either; however, it is served by the County of San Luis Obispo. Highway 1, which is located next to Bishop Peak

Open Space, is served by a Class III bicycle lane with a Class I bicycle lane proposed for the future. This means that currently, there is no separation between cyclists and cars driving upwards of seventy-five miles per hour. People on bicycles have a high chance of suffering severe injuries or death if hit by an automobile on Highway 1. However, the proposed Class I infrastructure would remedy this and make bicyclists feel safer. Now that it has been determined both employment and recreation centers are well served by the future bicycle infrastructure, one more step is to do the same analysis for residential housing districts in San Luis Obispo. If neighborhoods lack designated bicycle accessibility, people are much less likely to ride bicycles to their places of work or recreation centers. By extending the geographic range of potential non-vehicle travel, the city can help urban neighborhoods develop. The land use map of San Luis Obispo shows the zoning districts within the City, differentiated by color as Figure 4.7 shows. Residential land uses are represented by the bottom four colors on the legend (tan, yellow, light brown, and dark brown).

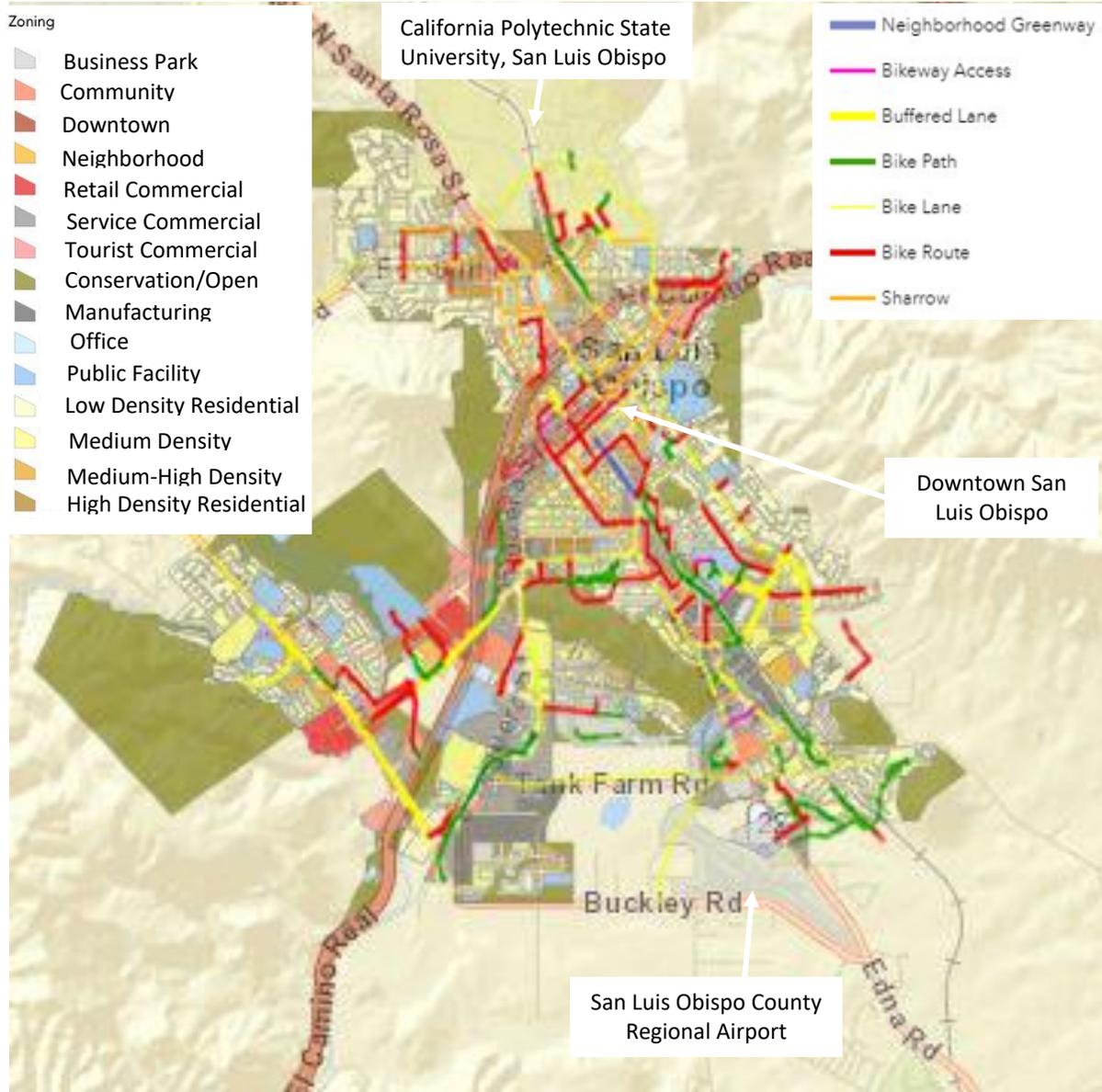
Figure 4.8 shows the land use map with the City's existing bicycle infrastructure superimposed. Residential housing areas cover the northwest portion of the city (adjacent to Highway 1 and California Polytechnic State University), the eastern portion, the central portion, the southeast portion, the southwest portion, and area north of the airport. Although the existing bicycle infrastructure technically does reach all these areas, much of it is not dense enough to meet the needs of those who reside in the neighborhoods.

Figure 4.7: San Luis Obispo Land Use Map



Source: City of San Luis Obispo Parcel Viewer, 2020

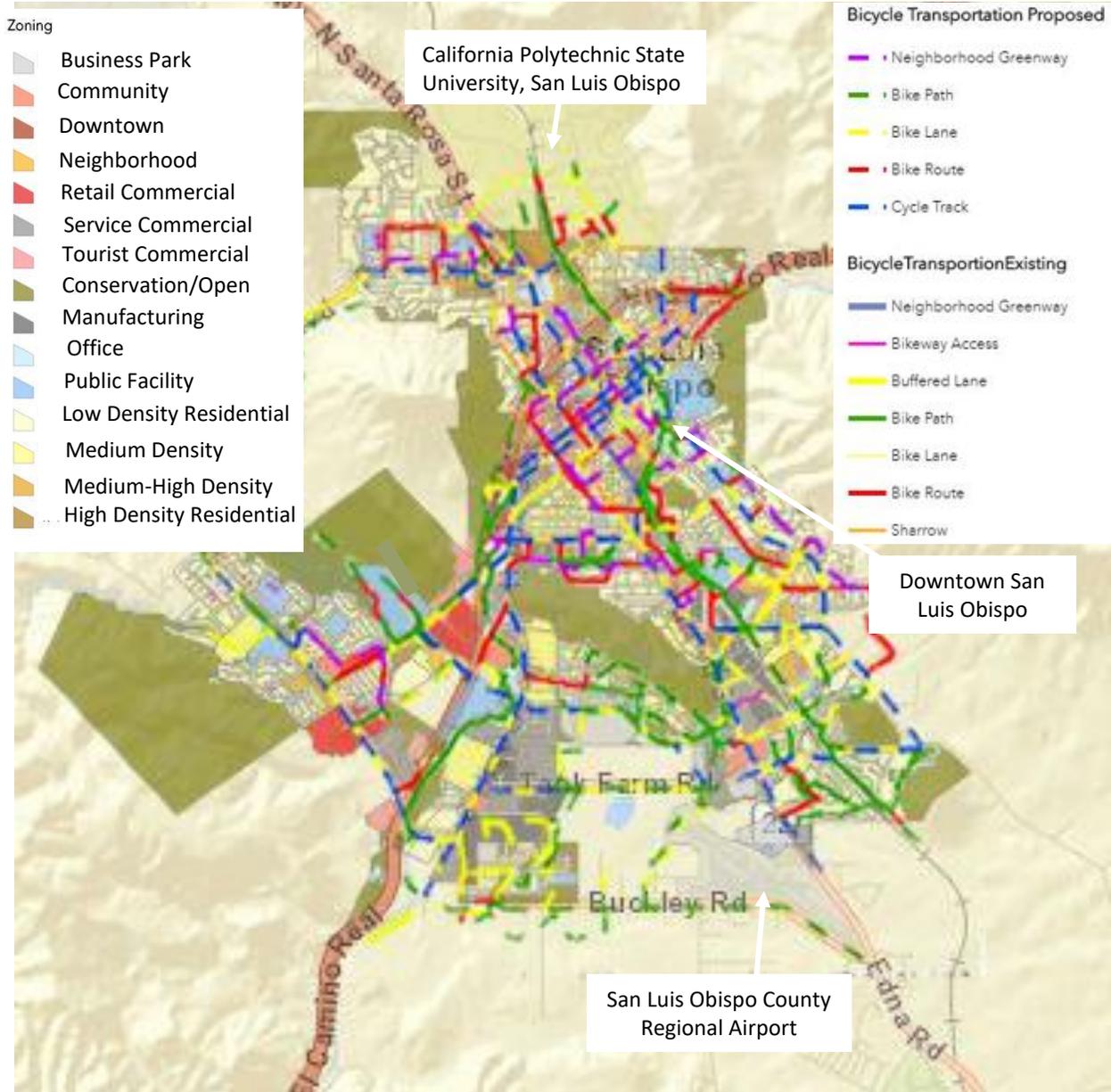
Figure 4.8: San Luis Obispo Land Use Map with Existing Bike Infrastructure



The land use map with both existing and proposed bicycle infrastructure shows a much denser and more connected network. Figure 4.9 displays how these neighborhoods can be better served by bicycle infrastructure, particularly on the eastern side with the addition of more bicycle lanes on subsidiary streets. This provides opportunities for people living on these streets to easily access existing infrastructure on major roads. Infrastructure in the southeast portion of

the city would also experience a significant increase in efficiency and the creation of more routes in and out of the neighborhoods. Notably, the already well-served residential neighborhoods in central San Luis Obispo would see necessary improvements to the network for even greater quality non-motorized access.

Figure 4.9: San Luis Obispo Land Use Map with Existing and Proposed Bike Infrastructure



Although the proposed infrastructural additions would facilitate a more connected network, there is much more that can be done, particularly in the neighborhoods next to the University and in the southwest portion of San Luis Obispo. In these areas, it would be important to consider that smaller local roads without heavy traffic are appealing to less confident riders, and the addition of bicycle infrastructure may be less vital.

## Findings

Although the existing bicycle infrastructure in San Luis Obispo is somewhat disjointed and does not serve the city at its most efficient potential, it does connect most of the recreation and job centers. It also reaches the general vicinities of residential areas and covers some heavily trafficked streets close to homes. Confident riders who are willing to commute by bicycle to work and to parks and open spaces would easily be able to do so. However, the city needs to consider riders who are less confident, such as the elderly, children, and people who do not regularly ride the bicycle in terms of connecting neighborhoods, employment centers, and recreation centers.

## V. Conclusions and Recommendations

Ultimately, there is a high potential for the proposed bicycle infrastructure to link multiple origin and destination needs for non-motorized travel in San Luis Obispo. Whether a bicycle riders in San Luis Obispo feel confident or not to bike, they can get around town safely once the appropriate infrastructure is constructed.

The main recommendation to the City of San Luis Obispo would be to create a connection to Reservoir Canyon. Although more confident riders may be willing to access it without infrastructure in place, not every resident would feel that way. The second recommendation is to create infrastructure on more lightly trafficked streets in residential neighborhoods.

Although almost all general areas in San Luis Obispo are served by bicycle infrastructure, not everyone may be confident enough to ride on roads to reach the larger network.

The City of San Luis Obispo has done a great job in planning for the future of sustainable transportation. Although much of the proposed infrastructure is not yet built, City officials are constantly requesting feedback from the community to evaluate how to best serve them. San Luis Obispo's bicycle infrastructure can serve as a source of inspiration for other cities looking to implement more bicycle infrastructure. When planning for and building active transportation infrastructure, it is important to consider where people ride their bicycles versus where they favor walking. As time progresses and all of the proposed infrastructure is constructed, there will arise the inevitable cycle of needing more infrastructure to be proposed and built. Society is ever-evolving and adapting to accommodate needs at large. So as the use of the bicycle

changes, San Luis Obispo should be ready to provide new routes. That is how the image of the City's bicycle-friendly and transportation-optimized future would be sustained.

## References

- ACI USA Inc. (2017, June 5). The Importance of Transportation Planning in Your Town. Retrieved February 9, 2020, from <https://acicorporation.com/blog/2017/06/05/importance-transportation-planning-town/>
- City of Pasadena. (2015, August 17). Bicycle Transportation Action Plan. Retrieved May 12, 2020, from <https://ww5.cityofpasadena.net/transportation/wp-content/uploads/sites/6/2016/05/Pasadena-Bike-Action-Plan-08-17-2015.pdf>
- City of San Luis Obispo. (2020, February). ATP Bike Network Update. Retrieved April 2, 2020, from <http://slocity.maps.arcgis.com/apps/webappviewer/index.html?id=eb1da93e7fc2494e933d3a044d4f90ed>
- City of San Luis Obispo. (2020). Biking in San Luis Obispo. Retrieved April 2, 2020, from <https://www.slocity.org/government/department-directory/public-works/programs-and-services/bicycling>
- City of San Luis Obispo. (2013, November 5). Bicycle Transportation Plan. Retrieved February 12, 2020
- City of San Luis Obispo Parcel Viewer. (2020). Retrieved May 19, 2020, from <http://slocity.maps.arcgis.com/apps/webappviewer/index.html?id=3e0adee3aabd4805bd13f0d4705a4193>
- Complete Streets Act of 2019. (2020). Smart Growth America. Retrieved February 4, 2020, from <https://smartgrowthamerica.org/program/national-complete-streets-coalition/complete-streets-act-of-2019/>
- Governor's Office of Planning and Research. (2020). Transportation Impacts-SB 743. Retrieved February 4, 2020, from <http://opr.ca.gov/ceqa/updates/sb-743/>
- Green Accents. (2014). Car Doors are Bad. Retrieved May 18, 2020, from <https://greenaccents.wordpress.com/tag/bike-lanes/>
- MAP-21 - Moving Ahead for Progress in the 21st Century Act. (2016, February 18). Federal Motor Carrier Safety Administration. Retrieved February 4, 2020, from <https://cms8.fmcsa.dot.gov/mission/policy/map-21-moving-ahead-progress-21st-century-act>
- On the Map. (2020). Work Area Profile Analysis. Retrieved April 15, 2020, from <https://onthemap.ces.census.gov/>

Open Space and Trails in the City of San Luis Obispo, CA. (2020). Retrieved May 10, 2020, from <http://slocity.maps.arcgis.com/apps/MapTour/index.html?appid=ff49a00d62b943e8a4e7fab1edb962c2&webmap=da021201efb74eca9fe5e1272bc0c780>

Queensland Government. (2020, January 26). Benefits of Riding. Retrieved March 5, 2020, from <https://www.qld.gov.au/transport/public/bicycle-riding/benefits-of-riding>

Rydoze. (2020). 101 Benefits of Cycling. Retrieved March 20, 2020, from <https://www.rydoze.com/cycling-benefits/>

SB-99 Active Transportation Program. (2013, September 26). California Legislative Information. Retrieved February 4, 2020, from [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201320140SB99](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB99)

SB-127 Transportation Funding: Active Transportation: Complete Streets. (2020, February 4). California Legislative Information. Retrieved September 14, 2019, from [https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill\\_id=201920200SB127](https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200SB127)

Schmitt, A. (2015, March 4). Survey: 100 Million Americans Bike Each Year, But Few Make It a Habit. Retrieved April 14, 2020, from <https://usa.streetsblog.org/2015/03/04/survey-100-million-americans-bike-each-year-but-few-make-it-a-habit/>

The FAST Act. (2019, December 5). U.S. Department of Transportation- Federal Highway Administration. Retrieved February 4, 2020, from <https://www.fhwa.dot.gov/fastact/>

United States Census Bureau. (2020). San Luis Obispo city, California. Retrieved April 12, 2020, from <https://data.census.gov/cedsci/profile?q=San Luis Obispo city, California&g=1600000US0668154>

United States Census Bureau. (2018). Commuting Characteristics by Sex: San Luis Obispo. Retrieved April 18, 2020, from [https://data.census.gov/cedsci/table?q=San Luis Obispo city, California&g=1600000US0668154&tid=ACSST5Y2018.S0801&layer=VT\\_2018\\_160\\_00\\_PY\\_D1&cid=DP05\\_0001E&vintage=2018&t=Commuting](https://data.census.gov/cedsci/table?q=San Luis Obispo city, California&g=1600000US0668154&tid=ACSST5Y2018.S0801&layer=VT_2018_160_00_PY_D1&cid=DP05_0001E&vintage=2018&t=Commuting)

United States Census Bureau. (2018). Commuting Characteristics by Sex: United States. Retrieved April 18, 2020, from <https://data.census.gov/cedsci/table?q=COMMUTING%20CHARACTERISTICS%20BY%20SEX%20&tid=ACSST1Y2018.S0801&t=Commuting>

United States Environmental Protection Agency. (2018). Sources of Greenhouse Gas Emissions. Retrieved April 18, 2020, from <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

Walzer, N., & Henriksen, M. (2009). Role of Transportation in the Comprehensive Economic Development Strategy Process: A Nationwide Scan. National Association of Development Organizations Research Foundation: Center for Transportation Advancement and Regional Development. Retrieved from <https://www.nado.org/wp-content/uploads/2011/08/cedsreport.pdf>