SR 87 Technology Corridor Study

October 2018

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

Santa Clara Valley Transportation Authority

Solutions that move you

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Chapter 4, Google bikes: Newland, Cameron, “Google Rolls Out Ebikes To Their Mountain View Campus,” Overvolted.com (http://overvolted.com/google-rolls-out-ebikes-to-their-mountain-view-campus/)

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EXECUTIVE SUMMARY

Over the next 30 years, Santa Clara County is projected to grow by roughly 642,000 residents and 303,000 jobs—increases of 36 percent and 33 percent, respectively. A transportation system that provides fast, efficient, and multimodal connectivity with minimal impact to the environment is paramount for sustainable growth in the county.

State Route (SR) 87, in the heart of San Jose, acts as a primary artery for the capital of Silicon Valley, connecting residential neighborhoods in the south to key employment centers in downtown San Jose, north San Jose's golden triangle area, and nearby cities. The 10-mile freeway provides direct access to Mineta San Jose International Airport and Diridon Station, a transit hub that serves several regional rail lines, Caltrain commuter rail, and VTA buses and light rail. The freeway also provides direct access to many attractions in downtown San Jose, including the SAP Center. Three important freeways intersect SR 87: SR 85 in the south, Interstate 280 in the middle, and US 101 in the north. A five-mile section of VTA's light rail runs in the freeway median, and two major bicycle trails run parallel to the freeway.

SR 87 is a critical conduit for commuters and visitors to the area; ensuring that traffic flows at an acceptable level of service is important for sustainable economic growth in the region. Growing levels of congestion on the freeway during peak hours along with upcoming development projects that include the Diridon Station upgrades, BART Phase II extension through downtown San Jose, land development projects along SR 87, and Google's transit village in downtown San Jose pose challenges as well as opportunities for forward-thinking transportation planning.

In addition to the realization that it is no longer sustainable to build our way out of congestion by expanding freeways, the room for such expansion no longer exists. The SR 87 corridor study aims to identify technology-based improvements and innovative solutions that can be implemented along SR 87 to maximize use of the existing infrastructure and lead to lower levels of solo driving and higher use of other available modes of travel along the corridor. The study is being undertaken as a partnership between VTA and the City of San Jose.

Objectives and Scope

The key objectives of the study are to

- Provide a high-level assessment of technology-based improvements that could address traffic congestion at a lower cost than infrastructure modifications, such as adding new lanes and redesigning interchanges.
- Encourage commuters away from solo driving and toward alternate modes of travel, such as carpooling, riding transit, and bicycling.
- Improve mobility for all modes by better using existing infrastructure and available technology
- Improve bicycle and pedestrian routes by enhancing connectivity and safety.
- Identify potential near-term enhancements for 2016 Measure B funding.

The scope of the study includes the SR 87 freeway mainline and system interchanges; transit within the corridor, including light rail and buses; and active modes such as bicycle trails and pedestrian facilities. Chapter 1 of the study discusses the study area, objectives and scope. Figure 1 shows the SR 87 study corridor.

Existing Conditions and Issues

SR 87 has two general purpose lanes and one high-occupancy vehicle (HOV) lane in both the northbound and southbound directions, with auxiliary lanes on some segments. The corridor has three system, or freeway-to-freeway, interchanges at SR 85, I-280, and US 101. Average annual daily traffic volumes along SR 87 vary from 169,000 vehicles per day at Lelong Street, just south of the I-280 interchange, to 87,000 vehicles per day at Airport Parkway at the northern end of the freeway.[1] According to the San Jose Mercury News, traffic on major Bay Area freeways has grown 80% since 2010.[2] SR 87 has become one of the Bay Area's most congested corridors.

SR 87 Mainline

Northbound traffic is heavy during the morning peak hours, with seven general purpose lane segments and six HOV lanes segments, out of 10 freeway segments, operating at severe levels of congestion that are classified as LOS F. In the southbound direction, traffic is heavy in the afternoon peak hours, with all segments operating at LOS E or better.

Use of the HOV lanes is increasing. During the northbound morning peak period, the HOV lane is reaching its capacity of 1,650 vehicles per hour. Bottlenecks have been observed in the northbound direction during the morning peak hours at Capitol Expressway, Almaden Expressway, Santa Clara Street, and the US 101 on-ramp. Southbound, during the afternoon peak hours, bottlenecks have been observed at the SR 87/US 101/Charcot Avenue interchange, Taylor Street, and the I-280 interchange area near downtown San Jose. Bottlenecks at these different spots are attributed to high volumes of traffic entering the mainline near the freeway-to-freeway interchanges, lane drops, and weaving and merging between closely spaced on- and off-ramps.

Transit

The SR 87 corridor is well connected to transit facilities. VTA light rail transit runs along the freeway median, with transit stations at Branham, Almaden, Capitol Expressway, and Curtner, and then connects to downtown destinations. Diridon and Tamien are nearby multimodal stations that provide connections to other rail networks that include Caltrain and the Altamont Commuter Express, and will connect to the upcoming BART Phase II extension through downtown San Jose. In addition, the VTA bus system connects residential areas in the south and mid-corridor to work locations in downtown San Jose, in the golden triangle area, and in cities adjacent to San Jose. Although the transit network is well-connected, ridership levels are low, due to the public's concerns primarily with trip times and first-last mile connectivity..

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[1] Caltrans Traffic Census Program, 2016.

[2] Erin Baldassari, "Traffic on major Bay Area freeways has grown 80 percent since 2010," *San Jose Mercury News*, September 18, 2017 (https://www.mercurynews.com/2017/09/18/report-traffic-on-major-freeways-has-grown-80-percent-since-2010/)

Figure 1. SR 87 Study Corridor

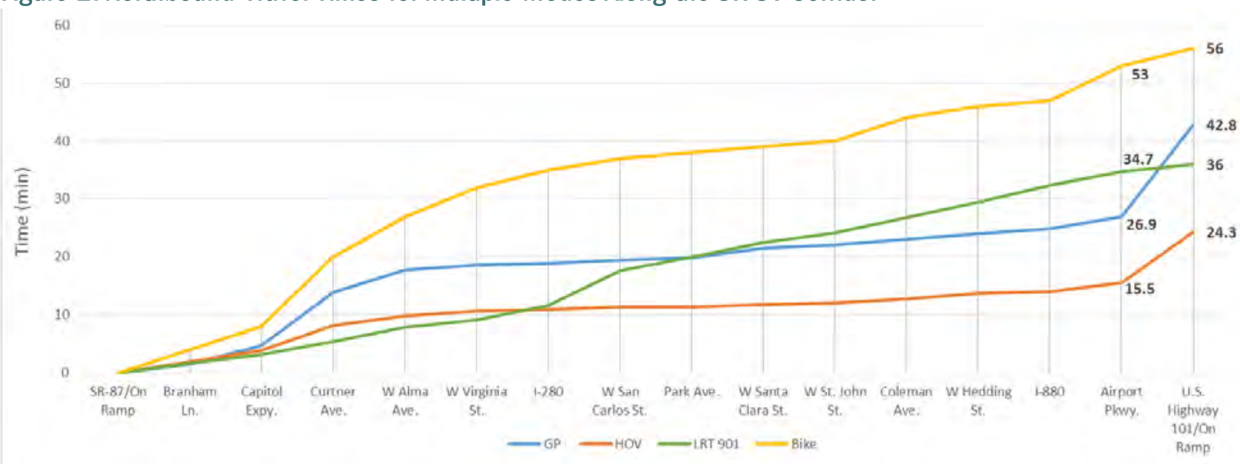
Bicycle and Pedestrian Facilities

Within the study area, there are several existing and planned trails and on-street bikeways. Two major trail systems, the SR 87 Bikeway and Guadalupe River Trail, run parallel to the freeway and serve north San Jose, central San Jose/downtown, and south San Jose. Though these trail systems provide low-stress bicycling parallel to SR 87, good on-street connections to the trails are limited. The surrounding street network is severed by high-stress roadways, creating small islands where people feel comfortable bicycling. A comprehensive and continuous low-stress bicycle network is needed. In addition to closing these gaps in the network, limited lighting and wayfinding/signage are issues that need to be addressed to increase the use of this mode of transport.

This study also identifies the need to improve pedestrian access to transit stations by providing safe pathways and adequate lighting and signage in the half-mile walkshed area around transit stations.

Figure 2 compares the vehicle travel time on northbound SR 87 from the on-ramp at SR 85 to US 101 in both general purpose (GP) and HOV lanes with the travel time for light rail trains (LRT) and bicycles during the 7:00 AM to 9:00 AM peak period.

Figure 2. Northbound Travel Times for Multiple Modes Along the SR 87 Corridor



Source: Swiftly LRT Travel time – Average of Weekdays in October 2017
VTA GP and HOV Travel Runs – May 3, 2017
Bicycle travel is 10 mph (assumption)

As shown in the figure, for long distances, the LRT travel time is comparable to that of vehicles using the GP lane—contrary to the popular notion among commuters that LRT is slower. The inconsistency of weekday traffic and significant slow-downs due to accidents add to the level of uncertainty in travel times of personal vehicles and provide an opportunity to promote LRT and bicycles as more consistent and environmentally friendly travel modes by making them more accessible (first-last mile connectivity), safe, and easy to use.

Technology

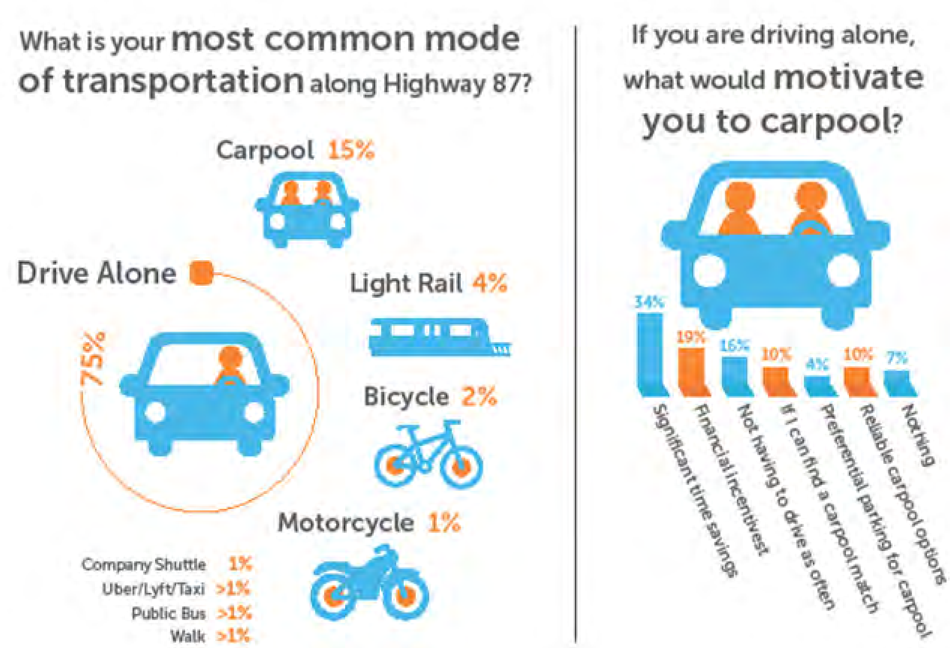
Map applications that provide real-time traffic information and access to ridesharing services, such as Uber and Lyft, self-driving cars, and other intelligent transportation system innovations could affect transportation and traffic on SR 87 in the future. Many of these technologies present interesting and sometimes unforeseen opportunities and challenges. Transportation demand management and the growing reliance on multiple modes of travel made possible through technology will become imperative and increasingly cost efficient as technology continues to evolve.

Community Input

VTA conducted a month-long survey in April and May 2018 to seek input from commuters in the SR 87 corridor. About 1600 people participated and provided feedback. Participants were asked questions about their travel (time of day, origin, destinations), transit and alternate mode use, support for various potential improvements along the corridor, and some demographic information (age, employment, income level).

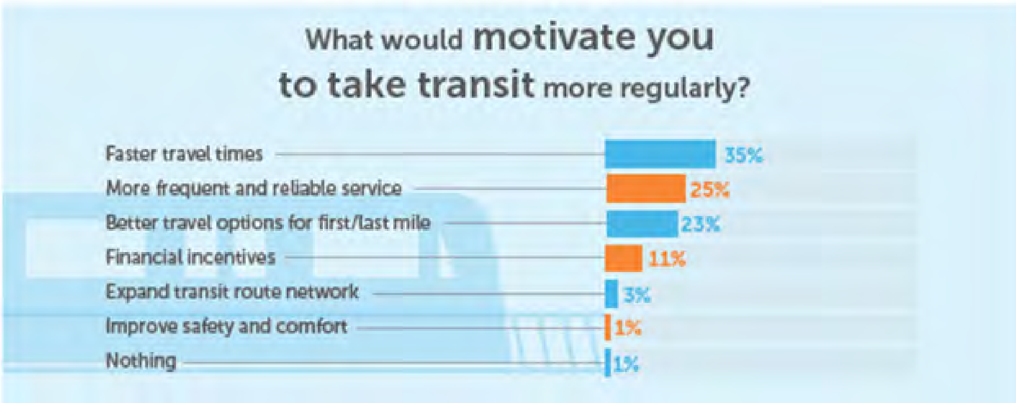
The majority of commuters travel to the golden triangle area in the north, and most traffic originates around residential areas close to Blossom Hill in the south. Solo drivers make up 75% of the participants; 15% of participants carpool, 4% take light rail, and only 2% use bikes. About 35% of participants were interested in carpooling if there were significant time savings (Figure 3).

Figure 3. Summary of Community Survey Results on Mode Choice



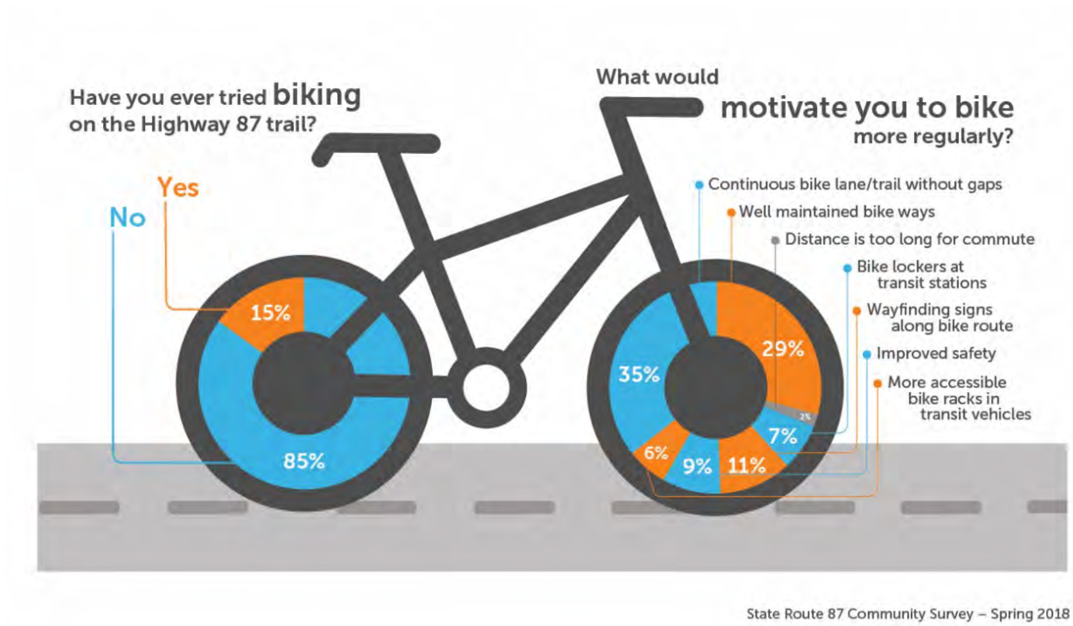
Many survey participants felt that a faster transit option along the corridor (i.e., faster light rail and more express buses) would motivate them to take transit (Figure 4).

Figure 4. Summary of Community Survey Results on Transit Use



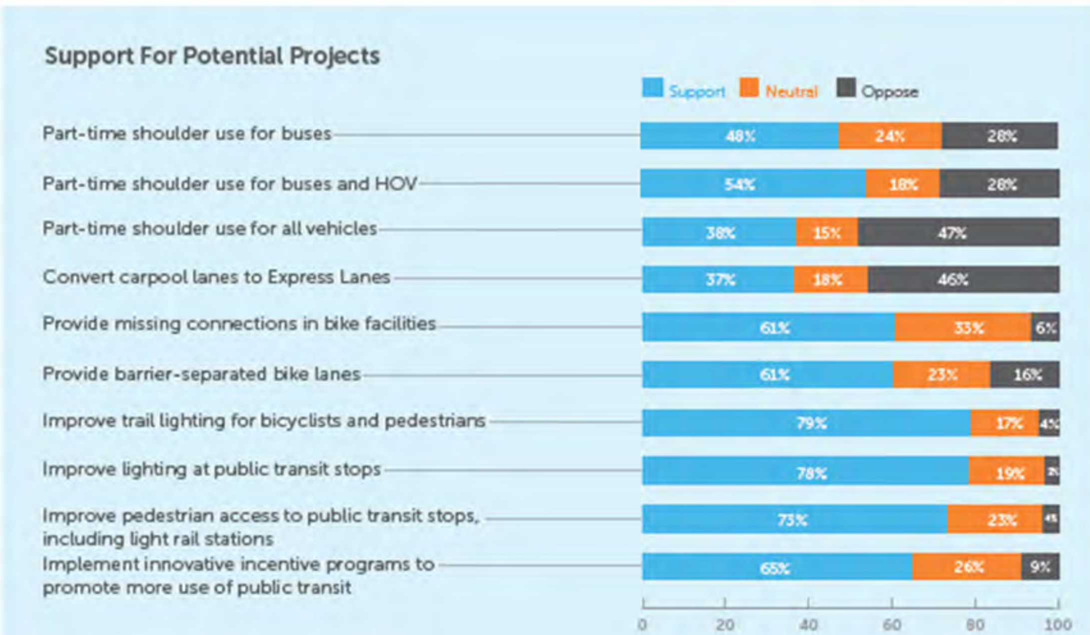
Significant hurdles to using bike trails, as expressed by participants, are the lack of connectivity along the corridor to the Guadalupe River Trail and concerns about safety at some points along the trail where there are homeless encampments and inadequate lighting. (Figure 5).

Figure 5. Summary of Community Results on Bicycle Use



There was general support for most potential improvement projects. When asked about using the existing freeway shoulder as a part-time lane during peak hours, the majority of survey respondents supported part-time use for buses and carpools. Converting HOV lanes to express lanes and opening the shoulder to all vehicles received more opposition than support. There was strong support (>60%) for improving bike trail connectivity through closing gaps in trails along the corridor and providing barrier-separated bike lanes on surface roads. Commuters overwhelmingly supported (>70%) improving lighting along bike and pedestrian paths as well as at transit stops. Clear public support (>60%) for innovative incentive programs for promoting public transit gives transportation planners further impetus to focus planning toward more efficient multimodal improvements over expensive freeway infrastructure projects. Figure 6 summarizes the level of public support for proposed improvements in the corridor.

Figure 6. Summary of Community Survey Results on Potential Projects



Potential Improvements

Potential improvements are categorized into four groups:

- Efficient use of freeway capacity
- Technology-based improvements
- Transportation demand management strategies
- Multimodal improvements

Efficient Use of Freeway Capacity

The key projects considered in this category were converting the US 101 southbound to SR 87 southbound ramp to two lanes; converting shoulders into part-time lanes, both on the freeway mainline and ramps; and converting HOV lanes to express lanes.

There is sufficient room on the US 101 southbound to SR 87 southbound ramp to convert it from a single lane to two lanes to relieve congestion during evening peak hours; this project has been designed and is awaiting construction funding. Use of shoulders as part-time lanes and converting HOV lanes to express lanes are discussed below.

Part-time Lane/Part-time Shoulder Use

Part-time shoulder use (PTSU) is a strategy being used in many regions as an efficient way to increase capacity on-demand or for buses and carpools during peak hours. The term used by the California Department of Transportation (Caltrans) to describe part-time shoulder use is "part-time lane" (PTL), which is the term used in the rest of this discussion.

The feasibility of implementing a PTL depends on the availability of sufficient shoulder width along the freeway as well as safety considerations. On SR 87, shoulder widths vary in different segments. The presence of LRT in the freeway median, pillars supporting system interchange connector ramps, and bridges are all factors that affect the feasibility of PTL on SR 87.

According to the Federal Highway Administration's guidelines, a minimum of 10 feet is needed for a low-quality PTL. Low-quality means that buses and trucks are not allowed and lower limit speed restrictions apply. Shoulders that are 12 feet or wider may be considered for a high-quality PTL. For this assessment, northbound SR 87 was divided into five segments and southbound, into three segments. Figure 7 shows where using PTL along the SR 87 corridor could be feasible according to FHWA guidelines.

On the northbound side, a PTL is not feasible in the following segments without widening the structure:

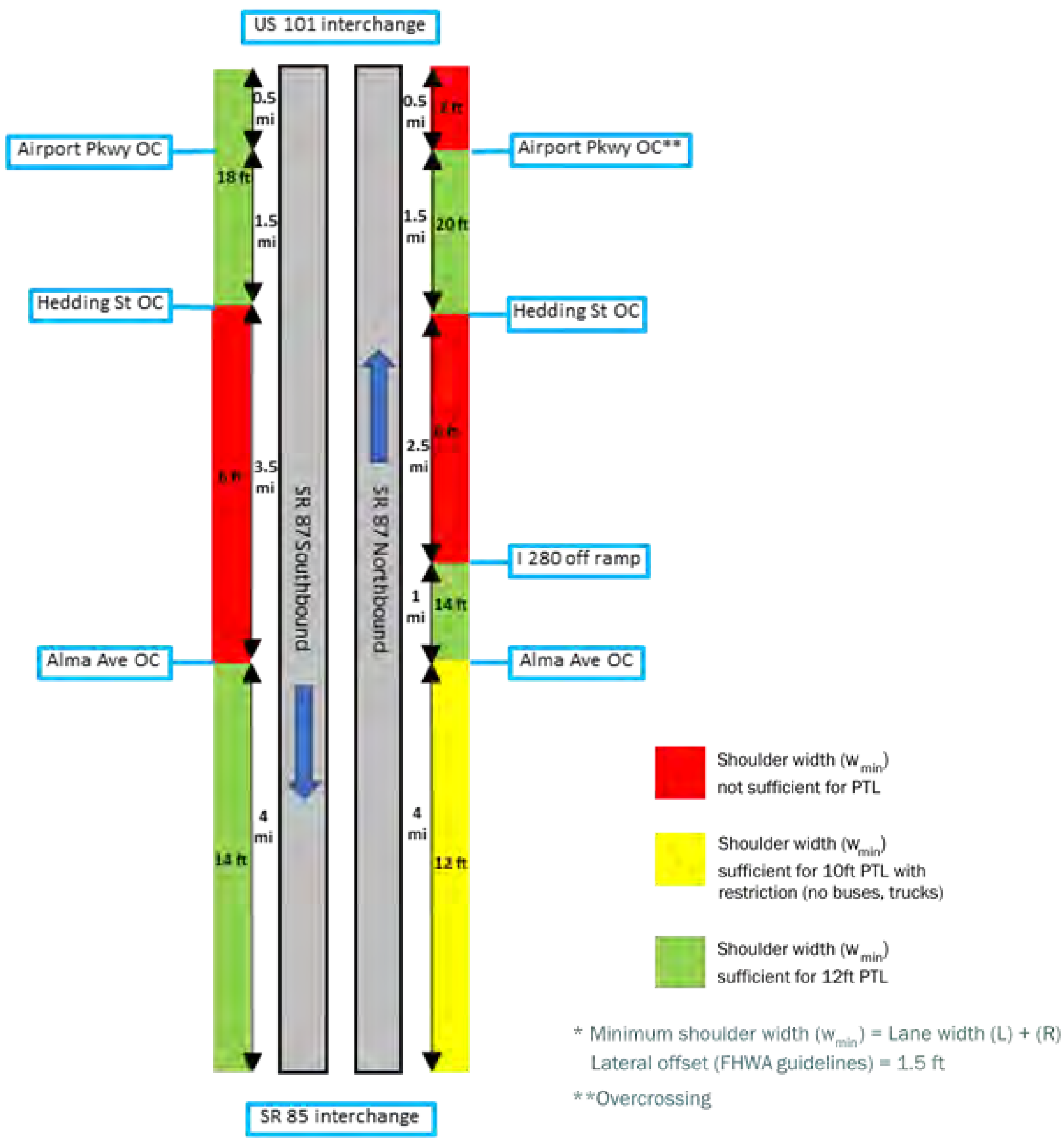
- I-280 interchange to the Hedding Street overcrossing—the available shoulder width is not sufficient.
- Airport Parkway to the US 101 interchange—the available shoulder width is not sufficient.
- SR 85 interchange to the Alma Avenue overcrossing—there are areas where the total shoulder width on the left and right combined will result in a PTL width of about 10 feet; however, this is considered low quality and would require speed and vehicle restrictions (no buses or trucks).

The segment where a PTL would be very helpful in relieving congestion is between the Alma Avenue overcrossing and I-280 off-ramp where there is sufficient shoulder width to create a 12-foot PTL, which if placed on the right side could create an additional path for vehicles taking I-280 from northbound SR 87. Another feasible segment is from the Hedding Street overcrossing to the Airport Parkway overcrossing, which has a minimum combined shoulder width of 20 feet.

In the southbound direction, a PTL is not feasible from the Alma Avenue overcrossing to Hedding Street overcrossing because of insufficient shoulder width. However, shoulders on the rest of the southbound mainline are wide enough to consider PTL use.

Among the interchanges, an assessment was done for the I-280 interchange (all connector ramps) and the Charcot Avenue to SR 87 southbound ramp where significant congestion is seen during peak hours. All connector ramps of the I-280 interchange in both directions are feasible for a PTL. Shoulders on the Charcot Avenue to SR 87 southbound ramp also are recommended for PTL use. Implementation of a PTL requires assessments to ensure that shoulders have structural integrity, eliminate utility conflicts, determine vehicle detection methods as needed, and assess whether requirements for pull-out areas can be met.

Figure 7. Feasibility of Part-Time Lane on Segments of SR 87 (Freeway Mainline)*



Express Lanes

Express lanes on freeways can help meet the transportation needs of a growing population. Converting HOV lanes to express lanes could optimize existing capacity and improve operations through downtown San Jose, both in the northbound and southbound directions. As the HOV lane on SR 87 northbound is heavily used during the morning peak hours, the SR 87 corridor may benefit from changing the HOV 2+ lane (two or more occupants per vehicle) to an express lane with HOV 3+ occupancy (three or more people). Implementing such a change along with express lanes could be another approach to improving corridor mobility. Additionally, implementation of express lanes could be feasible in the southbound direction where there is adequate capacity in the HOV lane.

Results from the community survey conducted as part of this corridor study show that about 37% of survey participants support the conversion of HOV lanes to express lanes. About 46% are opposed, and 17% are neutral. This result could be due to the already existing high usage levels of the HOV lanes (particularly in the northbound direction) including the presence of carpool-eligible stickered vehicles. The existing carpool sticker program is set to expire in January 2019, but a new program is set to pick up from that point to the end of September 2025. How these changes affect available capacity in the HOV lanes should be monitored relative to the ability to implement express lanes as a new mobility option. More evaluation of express lanes beyond what was performed in this study would be needed to more fully understand the feasibility of express lanes for SR 87. A feasibility study for express lanes including for SR 87 has been conducted by the VTA, but that study was in 2005 and would need to be updated.

Technology-Based Improvements

Several technology-based improvements were considered and evaluated.

Adaptive Ramp Metering

Adaptive ramp metering is a lower cost approach to providing congestion relief than making capital improvements. SR 87 has ramp meters at almost all interchanges, which can be dynamically programmed to adapt to levels of traffic.

Mobility as a Service (MaaS)

The lack of an integrated traveler information source and a single travel planning tool appears to be a barrier for using alternative transportation modes, yet an increase in the number of multimodal trips could significantly reduce congestion on SR 87. Creation of a mobile app that combines various services to provide comprehensive information on transit, parking availability, bike and pedestrian paths with information on locker availability, carpool ride matching, cloud-based trip planning, etc., would help commuters conveniently choose, plan, and pay for multimodal trips in real time.

ITS Infrastructure

Intelligent Transportation Systems (ITS) infrastructure includes a backbone corridor communications network, changeable message signs, sensors, and monitoring/control stations. Adding changeable message signs near key interchanges where there is congestion could help commuters get real-time information on travel time for various modes, and thereby encourage them to use alternate modes. Planning for the future changes in traffic and transportation as a result of new technologies, like self-driving cars, requires creating backbone corridor communications infrastructure. Once the ITS infrastructure is created on SR 87, it could be used for speed harmonization techniques near bottleneck areas to reduce collisions and facilitate more uniform traffic flow.

Transportation Demand Management

Options to manage demand—extending carpool hours, increasing the carpool occupancy requirement to three or more people, promoting carpool use by providing incentives, and reducing downtown parking spaces to encourage more transit use—were considered and recommended for further assessment.

Multimodal Improvements

The study considered improvements to bike and pedestrian access along the SR 87 corridor and transit improvements to encourage people to shift from solo driving to alternate modes of transportation. These include:

First-Last Mile Options

One of the common barriers for transit use is first-last mile connectivity. Several potential improvement ideas and proposals were considered to address first-last mile connectivity. On-demand shuttles through public-private partnerships to integrate schedules, ticketing, routing, and communication through mobile apps with transit providers like Chariot could facilitate increased use of transit. Another proposal is a partnership with rideshare companies, like Uber and Lyft, to provide subsidized connectivity to and from home or office and transit stations. Other options include providing bike share and electric scooters and facilities to encourage bike use, like bicycle lockers at transit stations.

Bicycle and Pedestrian Improvements

San Jose's Better Bikeways program, the SkyLane project, the Communications Hill Trail, and projects recommended in the Countywide Bicycle Plan were some of the projects that were adopted into plans and will benefit the SR 87 corridor. In addition, specific potential improvement projects that were considered as part of the study are electronic bicycle lockers at transit stations, wayfinding signage, and real-time electronic signage and electronic bicycle counters at trail heads.

Transit Improvements

Transit improvements like providing a transit link to Mineta San Jose International Airport, the affordable fare program, etc., are part of projects in the Metropolitan Transportation Commission's Regional Transportation Plan that would improve mobility on the SR 87 corridor. VTA is undertaking ongoing LRT studies for safety, speed and reliability enhancements in various locations— along North First Street, in downtown San Jose, and in key, low-speed zones and specific spot locations throughout the system. [3]

[3] Light Rail Safety and Speed Pilot Project: http://www.vta.org/projects-and-programs/transit/light-rail-speed-and-safety

Recommendations

Potential improvement projects were assessed on a set of parameters using a weighted sum approach and then prioritized based on the scope, dependencies, and benefits. Table 1 lists the recommended projects to effectively plan and implement improvements along the SR 87 corridor.

Table 1. Recommended High-Priority Projects

Recommendations	Ideas to Encourage Mode Shift	Technology Based Improvement	Cost ($M) 2017	Timeline Near 1-3 yrs. Mid 3-7 yrs. Long > 7 yrs.
PTL - Connector Ramps - Charcot Avenue to SR 87 SB (HOV only) (A1)	√	√	3.0	Near
PTL - Connector Ramps - I-280 SB to SR 87 SB (HOV only) (A2)	√	√	3.0	Near
PTL - Connector Ramps - SR 87 SB to I-280 NB (HOV only) (A3)	√	√	3.0	Near
MaaS (Mobility as a Service) (App) (TI1)	√	√	2.0	Near
Technology infrastructure enhancements (backbone corridor communications) (TI2)		√	8.0	Near
CMS - SR 87/Narvaez Ave-Capitol Expressway (P&R availability, LRT travel time) (TI3)	√	√	1.0	Near
CMS - SR 87 SB near Diridon Station (P&R availability, LRT travel time) (TI4)	√	√	1.0	Near
CMS - SR 87 SB near Diridon Station (P&R availability, LRT travel time) (TI5)	√	√	1.0	Near
Promote carpool use by providing employer incentives (TDM1)	√		0.5	Near
Extend carpool hours to provide travel time reliability all day long (TDM2)	√		0.5	Near
First-Last Mile trip completion alternatives to promote transit use (TDM3)	√		1.0	Near
Public-private partnership for micro transit like Uber, Lyft (T1)	√		2.0	Near
Employer Incentive Programs to Increase Employee Transit Use (T2)	√		0.5	Near
Transit on Demand (e.g., Chariot) (T6)			0.5	
Electronic bicycle lockers at transit stations (B1)	√	√	0.1	Near

Recommendations	Ideas to Encourage Mode Shift	Technology Based Improvement	Cost ($M) 2017	Timeline Near 1-3 yrs. Mid 3-7 yrs. Long > 7 yrs.
Wayfinding, signage around transit centers (B2)	√	√	0.05	Near
Real-time electronic signage and counter at trail heads (B3)	√	√	1.0	Near
Wayfinding signage along trails (B4)	√	√	0.05	Near
Lighting along SR 87 Trail (B5)	√	√	0.50	Near
Pedestrian access improvements within 1/2 mile walkshed around Virginia, Tamien, Curtner, Capital, Branham, Ohlone/Chynoweth LRT stations (P1-P6) (range of cost is for each location)	√		0.05 to 5.0	Near
PTL - Connector Ramps - SR 87 NB to I-280 NB (HOV only) (A4)	√	√	3.0	Mid
PTL - Connector Ramps - I-280 NB to SR 87 NB (HOV only) (A5)	√	√	3.0	Mid
PTL NB - Alma Avenue to I-280 off-ramp (all vehicles-right shoulder) (A6)		√	5.0	Mid
PTL - Connector Ramps - I-280 NB to SR 87 SB (HOV only) (A7)	√	√	3.0	Mid
PTL - Connector Ramps - I-280 SB to SR 87 NB (HOV only) (A8)	√	√	3.0	Mid
Adaptive Ramp metering (TI6)	√	√	1.5	Mid
CMS - US 101 SB to SR 87 SB (LRT travel time) (TI7)	√	√	1.0	Mid
Convert HOV 2+ to HOV 3+ (TDM 7)	√		0.5	Long

Conclusion and Next Steps

SR 87 is a critical transportation corridor connecting major freeways and destinations. This study took a comprehensive look at existing conditions along the corridor and identified potential improvements that are within the scope of technology-based solutions for improving traffic operations and promoting multimodal use over solo driving. Some of the potential improvement ideas require further study and cost-benefit analyses to identify specific projects. It is recommended that the top priority improvements be included in local and regional transportation plans for further study, leading to programming, development, and implementation. While potential improvements were evaluated and ranked into tiers, it is recommended that the best suited improvement from any tier be advanced for further detailed studies, design, and implementation to achieve the expected operational improvements in the corridor.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STUDY OVERVIEW

The State Route (SR) 87 Corridor study is a partnership between the Santa Clara Valley Transportation Authority (VTA) and City of San Jose to identify technology-based improvements and innovative solutions that will maximize the use of existing infrastructure without infrastructure modifications such as adding new lanes and redesigning interchanges. This study encompasses the SR 87 freeway mainline and interchanges, adjacent transit routes, and bicycle and pedestrian facilities.

1.1 Study Scope

The scope of this project is as follows:

- Collecting data collection to analyze the existing conditions along the SR 87 corridor through field observations, data sources (e.g., California Department of Transportation (Caltrans) Performance Measurement System (PeMs), INRIX, Caltrans data), travel time runs)
- Developing potential improvements, alternatives, and strategies with conceptual level analysis (micro-simulation or other detailed modeling was not used for traffic operations evaluation)
- Developing evaluation criteria and assessing potential improvement ideas
- Involving the community through a survey
- Preparing a report with recommended improvements

1.2 Study Area

SR 87 is a 10-mile-long freeway in the heart of San Jose and acts as the main artery for the capital of Silicon Valley, connecting residential centers in the south to key employment centers in the north, downtown, San Jose Mineta International Airport, the SAP Center, and Diridon Station. There are three important freeway interchanges along SR 87: SR 85 in the south, Interstate 280 (I-280) in the middle, and US Route 101 (US 101) in the north. The corridor is well connected to other transportation modes, such as light rail trains (LRT), which run through part of the freeway, and a multiuse trail system (Guadalupe River Trail) just west of the corridor. Figure 1-1 illustrates the study corridor.

Figure 1-1. Study Corridor and Project Limits

1.3 Study Objectives

The objectives of the SR 87 corridor study are to

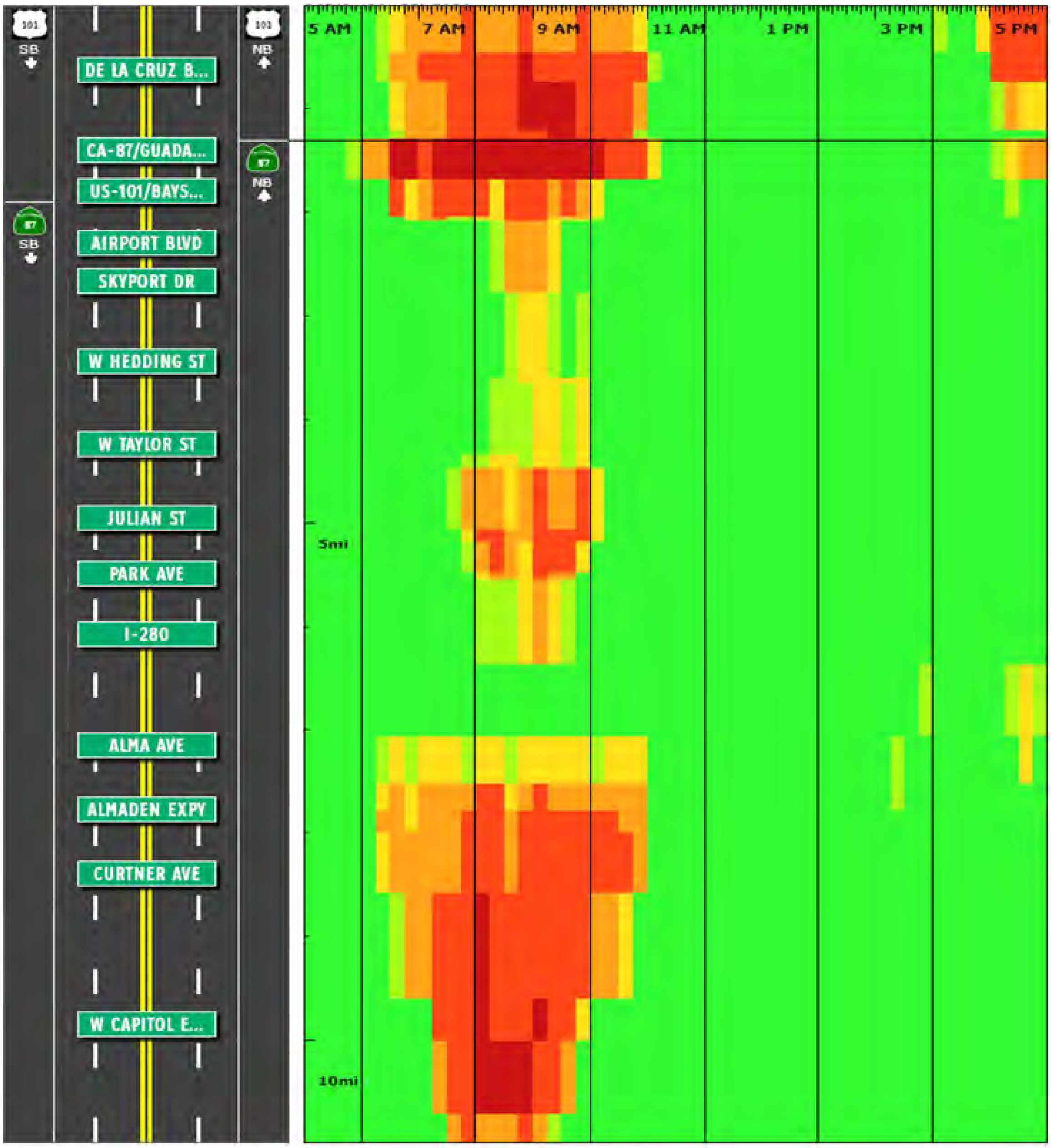
- Provide a high-level assessment of technology-based improvements that could address traffic congestion in the corridor.
- Encourage use of alternate modes of travel.
- Encourage commuters away from solo commuting.
- Improve mobility by better using the existing infrastructure.
- Improve bicycle and pedestrian ways and safety to enhance use of bicycle and pedestrian facilities.
- Provide near term enhancements for 2016 Measure B funding.

The location of SR 87 limits options to widen the freeway to alleviate peak hour congestion. This limitation, however, presents opportunities to explore ways to increase the efficiency of the existing infrastructure through the use of demand management tools, technology, and incentives to shift drivers to other viable modes of travel. Over 90% of the commuters along the SR 87 corridor use cars as their primary mode of transportation; about 75% of them are solo drivers. If improvements to other alternative modes can be successfully implemented to encourage solo drivers to forgo their cars and shift to another mode, the volume of traffic on the corridor could be similar to what we see during a minor holiday, such as Columbus Day.

Traffic count data for the SR 87 corridor during minor holidays show that traffic volumes drop by 10%, with a corresponding reduction in congestion. The heat maps in figures 1-2 and 1-3 illustrate a comparison of travel speeds between a normal commute day and a minor holiday, with the red and orange areas depicting areas of congestion (speeds of less than 40 mph) for both conditions.[1] The heat map from the minor holiday (Columbus Day 2016) has fewer red and orange areas near the Capitol Expressway and downtown areas. Traffic volumes for these two days indicate that a 10% reduction in traffic volume would amount to about 500 fewer vehicles per hour. This shows that small improvements can go a long way toward reducing congestion.

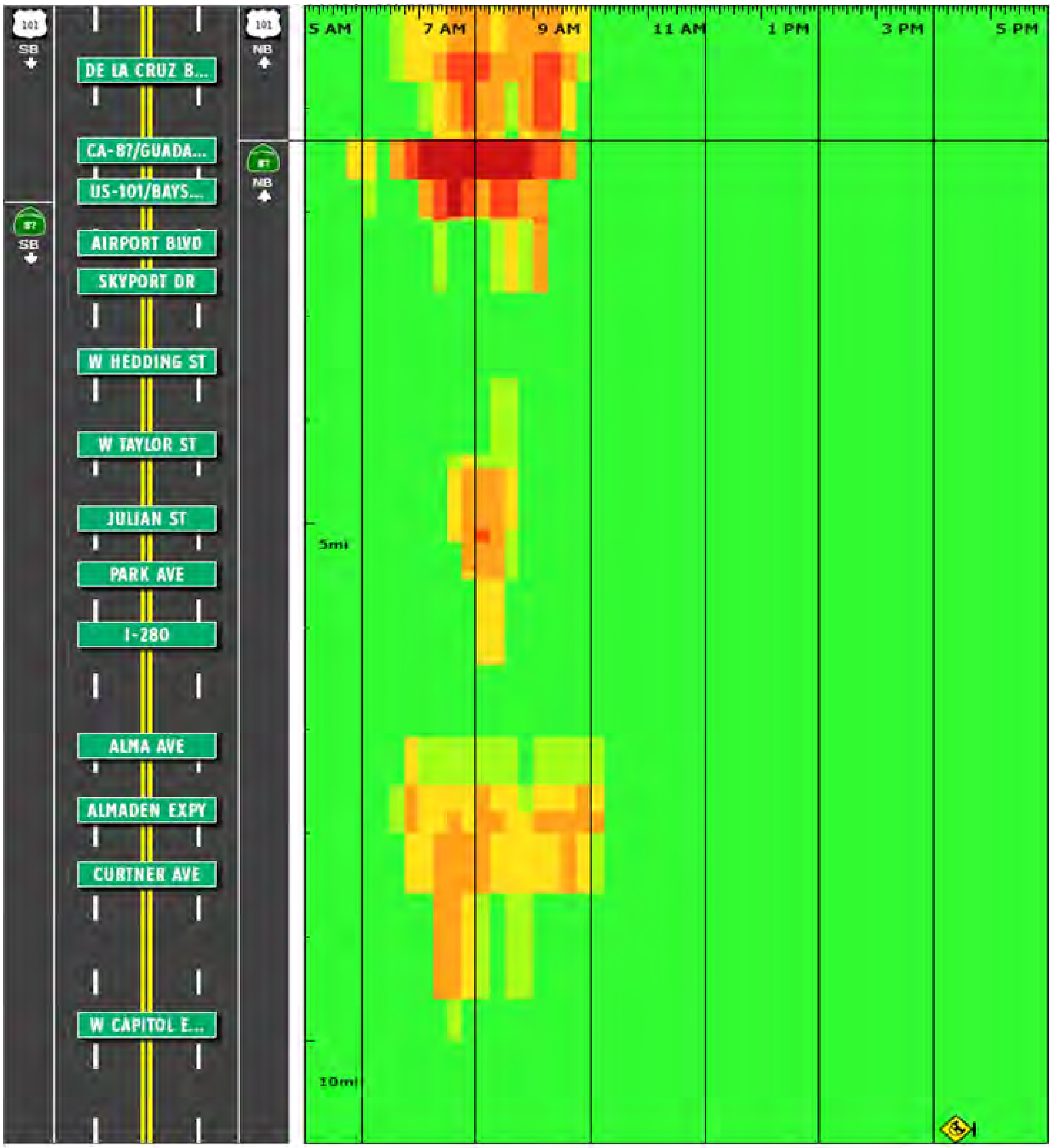
[1] INRIX: September 12, 2016, and October 10, 2016

Figure 1-2. SR 87 Northbound Morning Commute Hours, Monday, September 12, 2016 (Regular Day)



Source: INRIX Heat Map

Figure 1-3. SR 87 Northbound Morning Commute Hours, Monday, October 10, 2016 (Minor Holiday)



Source: INRIX Heat Map


Almaden Expwy 1 1/4
Curtner Ave 2
Capitol Expwy 3 1/2

2

EXISTING CONDITIONS

The State Route (SR) 87 corridor is a ten-mile multimodal corridor serving motorists, transit riders, cyclists, and pedestrians. The corridor has the following physical characteristics:

- SR 87 begins at SR 85 in the south and ends at US 101 in the north, as shown in Figure 2-1. The corridor has three system, or freeway-to-freeway, interchanges at SR 85, I-280, and US 101, and 11 interchanges providing access to mostly local roadways in the City of San Jose. The older portion of the freeway between SR 85 and I-280 was built in the 1970s, and the new section north of I-280 was completed in 2004.
- SR 87 has one carpool, or high-occupancy vehicle (HOV) lane, two general purpose (GP) lanes in each direction, and auxiliary lanes in some segments, as shown in Figure 2-2.
- In 1991, the VTA opened an LRT line south of downtown that traverses in the median of SR 87 for about 5.1 miles. The LRT system in downtown and through north San Jose was built in 1987.
- The Highway 87 Bikeway, a 4.1-mile bicycle path runs parallel to the freeway. The north end of the path traverses along the west side of SR 87 from the SR 87/ US 101 interchange in the north and ends around Branham Lane.
- Surrounding land uses along corridor comprise residential neighborhoods in the south and large employment centers in downtown San Jose and at the north end of corridor. The golden triangle area is a large employment center in the north of the corridor between US 101, SR 237, and I-880 in San Jose, Santa Clara, Sunnyvale, and Milpitas.
- Travel and congestion on the corridor show a distinct travel pattern with highly directional flows in the morning (AM) and evening (PM) peak periods. The Mineta San Jose International Airport at the Skyport Drive interchange, San Jose State University near downtown San Jose, the SAP Center, and the San Jose McEnery Convention Center, near the Santa Clara Street interchange, are other major destinations that contribute to congestion on the corridor.
- Environmental resources within the corridor may include archaeological resources, special-status plant or animal species, and parklands, among others. Any physical roadway improvements within the SR 87 corridor may adversely affect existing environmental resources. Refer to Appendix C.

SECTION CONTENTS

- Existing Freeway Conditions
- Bicycle & Pedestrian Facilities
- Transit Services & Facilities
- All Modes Travel Time & Speed Comparison

Figure 2-1. Study Corridor Map

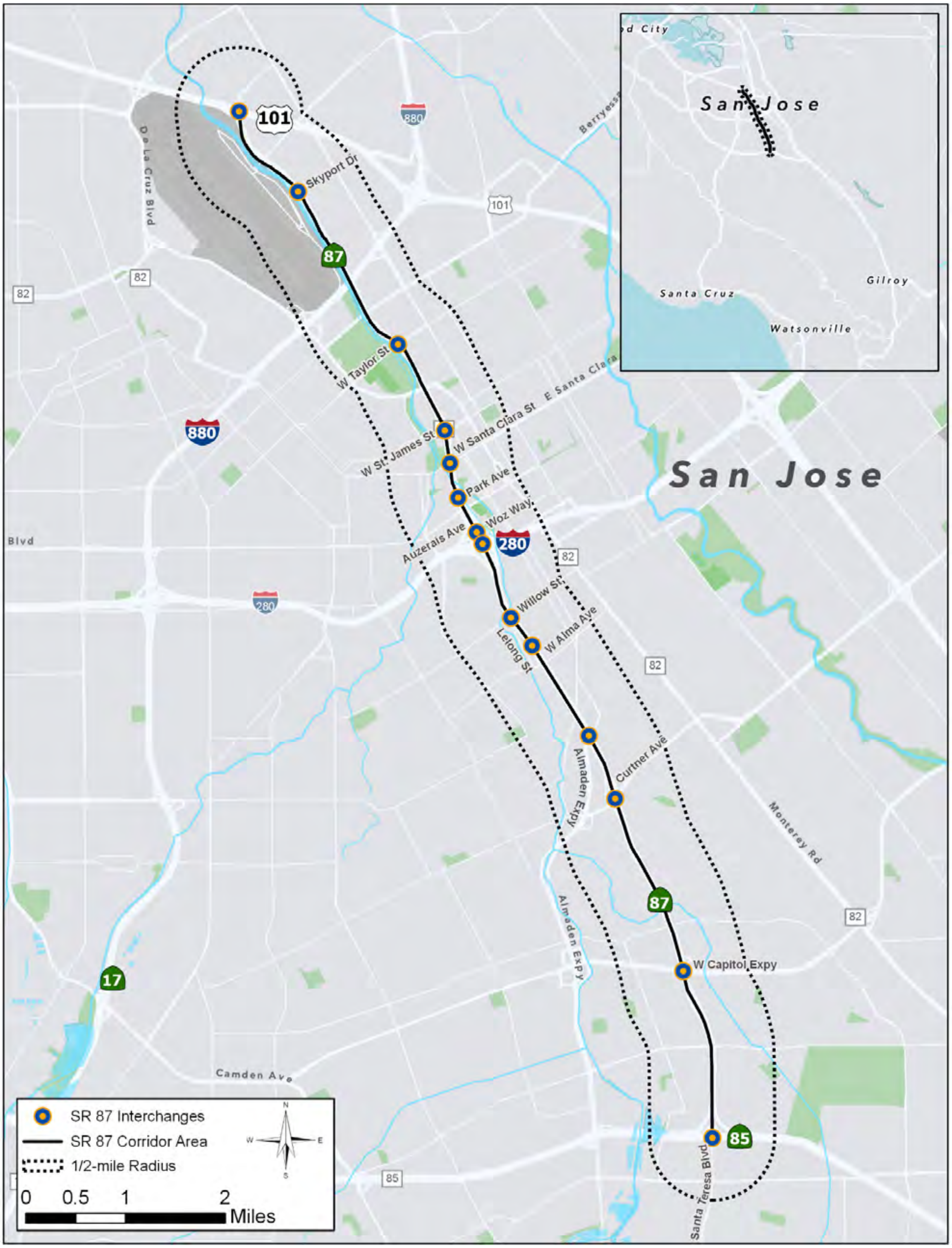
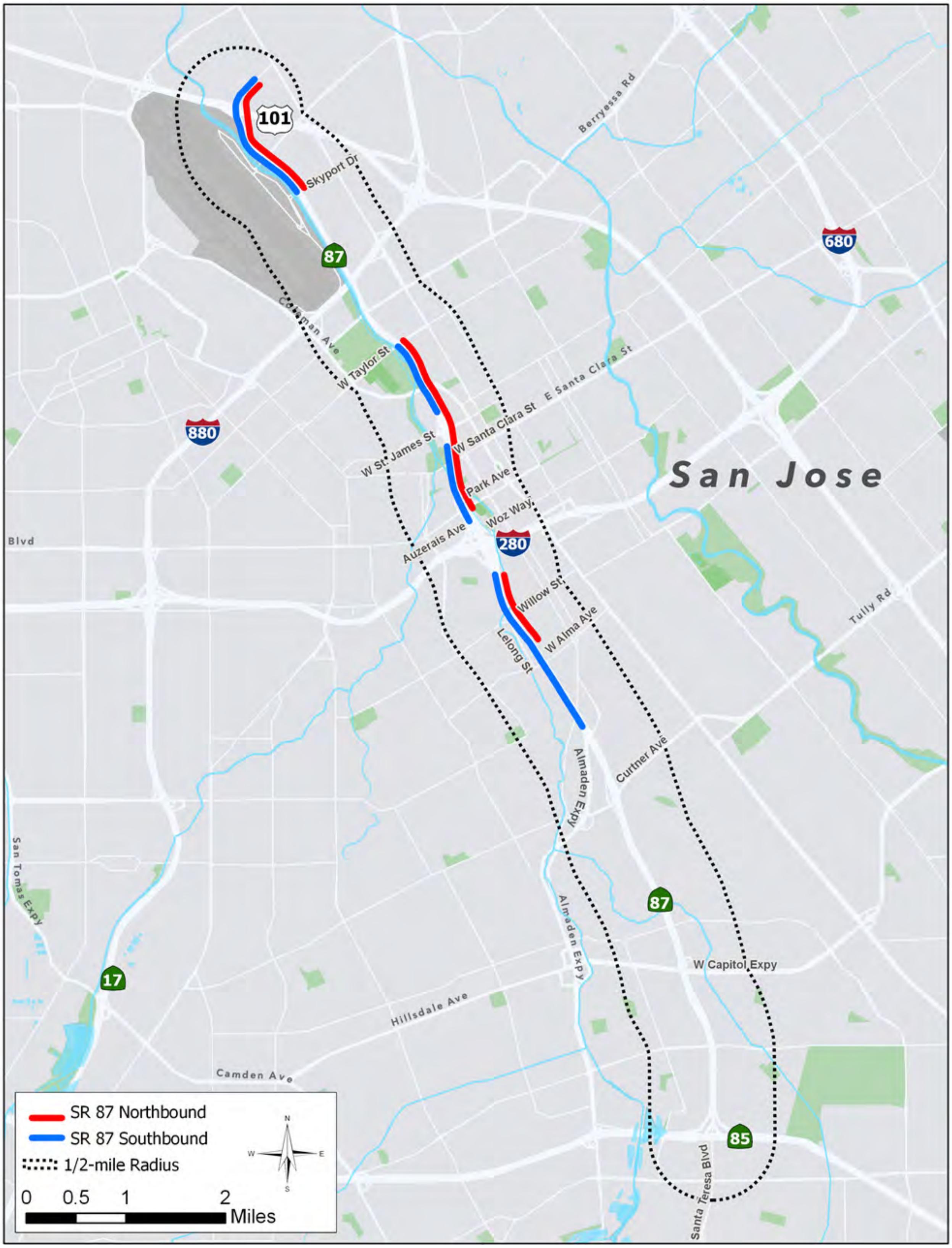


Figure 2-2. Existing Auxiliary Lanes



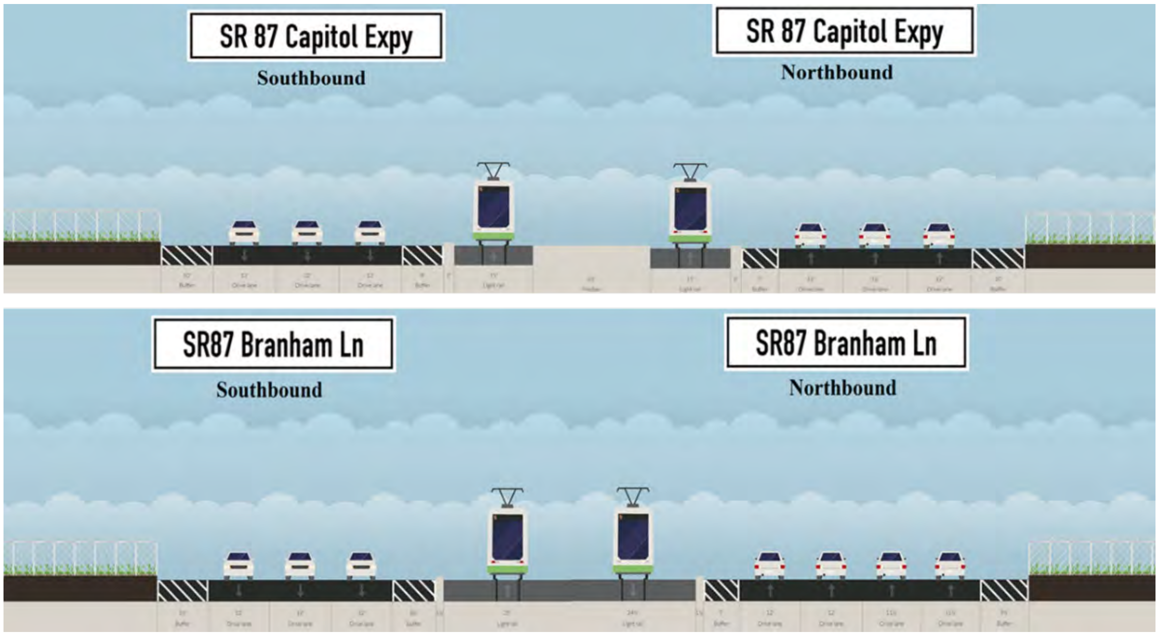
2.1 Existing Freeway Conditions

This section describes the physical attributes of the freeway mainline and interchanges, and the technology currently being used to manage traffic on SR 87. This discussion is followed by a detailed analysis of traffic volumes, speeds, and congestion.

2.1.1 SR 87 Mainline

SR 87 begins at SR 85 in the south and ends at US 101 in the north (refer to Figure 2-1). The SR 87 mainline has one HOV lane, two general purpose lanes, and auxiliary lanes in some segments (refer to Figure 2-2). The corridor has 11 interchanges providing access to mostly local roadways in the City of San Jose and three system interchanges, as further described in Section 3.1.2. An LRT line runs in the median of SR 87 for about 5.1 miles. Figure 2-3 shows a typical cross section of the freeway.

Figure 2-3. Typical Cross Section of the SR 87 Mainline



2.1.2 System Interchange Configuration

SR 87 has three system interchanges: SR 87/SR 85, SR 87/I-280 and SR 87/US 101. Each interchange, including type, lane configuration, and use of transportation technologies, is described in the following sections.

SR 87/SR 85 System Interchange

The SR 87/SR 85 interchange is located in a dense residential neighborhood at the southern end of the corridor (Figure 2-4). The ramps connecting the two freeways are controlled by meters, and all but one have HOV bypass lanes.

Figure 2-4. SR87/SR85 System Interchange

SR 87/I-280 System Interchange

The SR 87/I-280 interchange is located in the densest area of San Jose. Downtown, San Jose State University, the SAP Center, and the San Jose McEnery Convention Center are some of the main attractions near this interchange (Figure 2-5). This is a complete interchange, connecting to and from all directions on both freeways.

Figure 2-5.
SR 87/I-280
System Interchange

SR 87/ US 101 System Interchange

The SR 87/US 101 interchange is located at the northern end of the freeway in an area dominated by offices and businesses (Figure 2-6). It is near and provides access to the Mineta San Jose International Airport. SR 87/US 101 is a partial interchange, as there is no connection from northbound US 101 to SR 87. The interchange has one HOV bypass lane on the northbound SR 87 ramp to northbound US 101.

Figure 2-6.
SR 87/US 101 System
Interchange

2.1.3 Other Interchanges

In addition to the three system interchanges, SR 87 has 11 interchanges. These are listed in Table 2-1 along with information on ramp meters, HOV bypass lanes, and over- and under-crossings.

Table 2-1. SR 87 Freeway Interchanges

Freeway Segment	Ramp Metering (Yes/No)	On-Ramp HOV Bypass Lane (Yes/No)	Crossings* OC (overcrossing) UC (undercrossing)
SR 87/ SR 85 Interchange	NB – No SB – Yes	NB – No SB – Yes	Chynoweth Avenue OC Branham Lane UC
Santa Teressa Blvd	NB – Yes	NB – No	OC
Capitol Expressway	NB – Yes SB – No	NB – No SB – No	Hillsdale Avenue OC Canoas Creek OC Carol Drive OC Hill Pond Drive OC
Curtner Avenue	NB – Yes SB – Yes	NB – Yes SB – No	OC
Almaden Expressway	NB – Yes SB – No Ramp	NB – Yes SB – No	Almaden Road OC
Alma Avenue	NB – Yes SB – No Ramp	NB – Yes SB – No	Willow Street OC Guadalupe River OC Caltrain Railroad UC Guadalupe River OC Virginia Street UC
SR 87/ I-280 Interchange	NB – No SB – No	NB – No SB – No	LRT OC Auzerais Avenue OC San Carlos Street OC
Park Avenue	NB – Yes	NB – Yes	San Fernando OC Santa Clara Street OC
Julian Street/ Saint James Street	NB – Yes SB Loop – Yes SB Diagonal – Yes	NB – Yes SB – No	Bassett Street OC LRT OC Ryland Street OC Coleman Avenue OC
Taylor Street	NB – Yes SB – Yes	NB – Yes SB - Yes	Hedding Street OC I-880 OC
Skyport Drive	NB – Yes SB – Yes	NB – Yes SB – Yes	Airport Parkway OC
SR 87/ US 101/ Charcot Avenue	NB – Yes US 101 SB – No Charcot to SB SR 87 – Yes	NB – Yes US 101 SB – No Charcot to SB SR 87 – Yes	Charcot Avenue OC

* Streets and other facilities that SR 87 either crosses over or under

2.1.4 Transportation Technology Elements

Various transportation technologies are used on SR 87 to manage and monitor traffic. The following sections describe the current technologies, and

Ramp Metering

Ramp metering is the most prevalent technology used on SR 87. With operational ramp meters at most locations, SR 87 is one of Santa Clara County's most complete corridors. Metering on the corridor is active in the morning peak period in the northbound direction and in the evening peak period in the southbound direction (Figure 2-7). A few select freeway-to-freeway connector ramps either have meters that are currently inactive or do not have meters because of severe congestion and queuing on these ramps.

The ramps without meters are as follows:

- I-280 SB to SR 87 NB
- I-280 NB to SR 87 NB
- SR 87 SB to I-280 SB
- US 101 SB to SR 87 SB

Traffic Surveillance Cameras (Closed Circuit Television)

The California Department of Transportation (Caltrans) operates and maintains ten video traffic surveillance cameras along the SR 87 freeway. These cameras are used for remote video monitoring using ISDN (Integrated Services Digital Network) transmission.

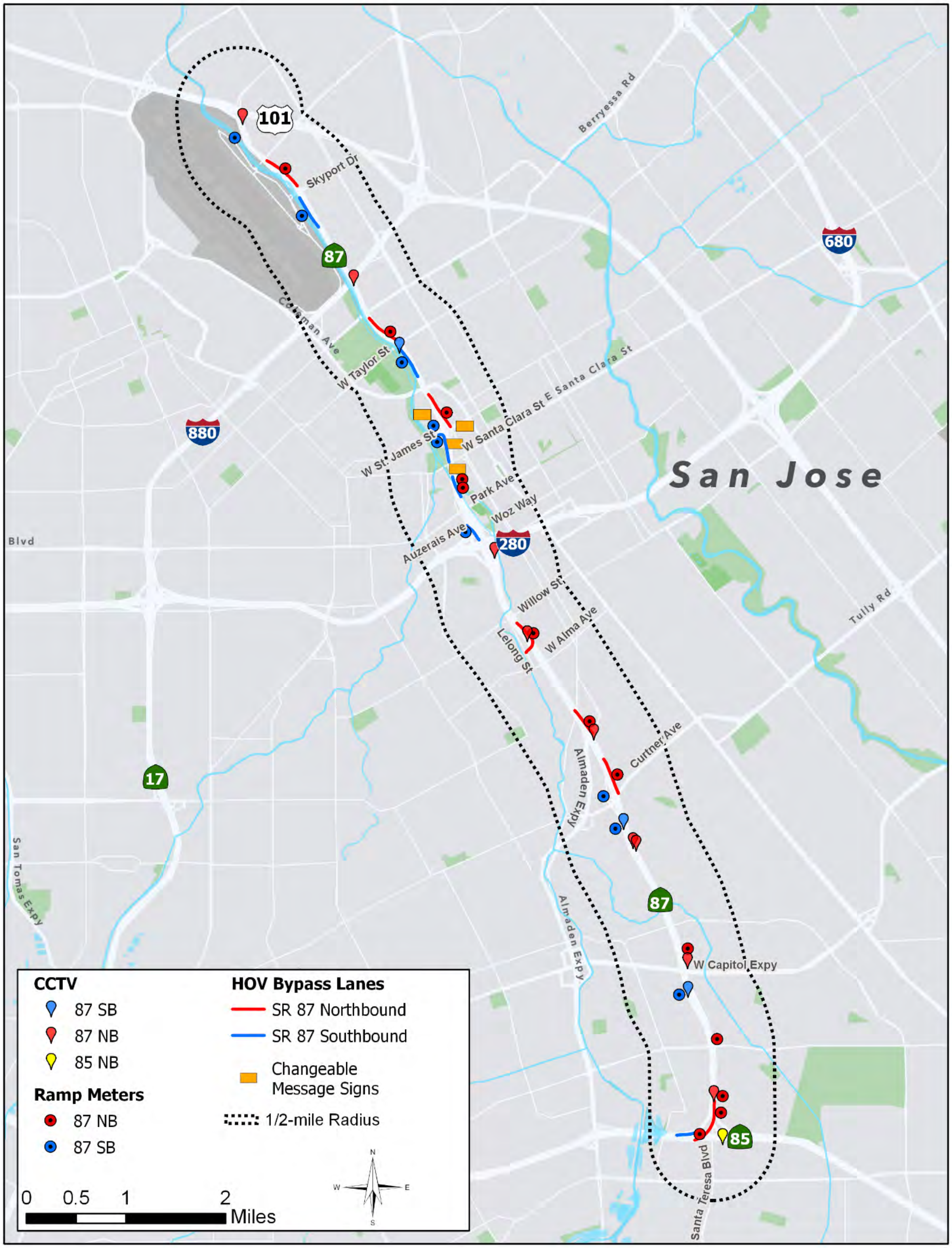
Changeable Message Signs

Changeable message signs are electronic signs that provide traveler information. There are four changeable message signs on SR 87 that are operated and maintained by the City of San Jose near the SAP Center close to downtown San Jose. The four signs provide motor information, such as guidance to parking facilities for the SAP Center.

Figure 2-8 shows the location of existing technology along SR 87.

Figure 2-7. Taylor Street On-Ramp to Southbound SR 87

Figure 2-8. Existing Technologies Along SR 87



2.1.5 Freeway Traffic Operating Conditions

The existing operating conditions on the corridor were assessed using available information from various sources, as shown in Table 2-2.

Table 2-2. Data Sources Used to Assess Operating Conditions

Type of Data	Description/Source	Date
Travel times and speeds	VTA Travel Time Runs – GPS Based	May 2017
Traffic volumes and heat maps	INRIX, Caltrans PeMs (with good detector health)	May 2016, 2017 October 2017
AADT	Caltrans Traffic Census Program	2016
Bottleneck locations and queues	Field Observations — GPS trackers VTA Travel Runs INRIX Heat Maps	May 2017
LOS data	VTA 2016 Monitoring and Conformance Report	October 2016
Roadway geometrics/ ramp metering locations	Google Earth Field Observations	2017
HOV lane usage	Caltrans HOV report	2014
Truck percentage	Caltrans Truck Volumes (Traffic Census Program)	2016
Incident data	SWITERS	2011–2016
Transit data	Swiftly	2017, 2018
Bicycle information	City of San Jose Parks, Recreation & Neighborhood Services	September 2017

Traffic Volumes

Traffic volumes along SR 87 vary depending on direction, with heavy traffic in the northbound direction during the morning peak period and in the southbound direction in the evening peak period. Average annual daily traffic (AADT) volumes (both directions combined) range from 169,000 vehicles per day at Lelong Street to 87,000 vehicles per day at Airport Parkway. The observed AADT volumes are comparable to those on other State routes in the county, such as SR 85 and SR 237.

Carpool Lane Usage

The number of vehicles using carpool lanes has been increasing every year, and HOV lanes are now reaching their capacity of 1,650 vehicles per hour. HOV decals, which allow eligible single-occupant vehicles (like zero emissions electric vehicles) in the HOV lanes, were introduced in 2011 in California. The VTA's community survey results and field observations show that a considerable number of stickered vehicles using the HOV lanes are being driven by solo drivers. The percentage of vehicles using HOV lanes during both the morning and evening peak hours is summarized in Table 2-3.

Table 2-3. SR 87 Carpool Lane Usage

Direction Peak Hour	HOV Lane Limits	Percentage of Traffic using HOV Lane
Northbound AM	SR 85 to I-280	27%
	I-280 to US 101	30%
Southbound PM	US 101 to I-280	24%
	I-280 to SR 85	22%

Source: Peak Hour at Julian St (North of I-280), Branham Ln (South of I-280) from Caltrans PeMs, May 2017

Truck Percentages

SR 87 is a designated truck route.[1] Table 2-4 summarizes the percentages of vehicles on various segments of SR 87 that are trucks; these range from a low 0.32% to a high 3.7% and are comparable to the truck percentages on other freeways in the Bay Area. Fewer trucks use the southern end of corridor because of restrictions on SR 85 between the US 101 south interchange and I-280 interchange.

Table 2-4. SR 87 Truck Volumes

Freeway Segment	Vehicle Volume	Truck Volume	Truck Percentage
San Jose, Jct. SR 85	119,000	381	0.32%
Curtner Ave	133,000	2,261	1.70%
Almaden Expressway	149,000	3,814	2.56%
San Jose, Jct. I- 280	169,000	4,039	2.39%
San Jose, Jct. I-280	123,000	4,552	3.70%
Jct. US 101	86,000	2,580	3.00%

Freeway Mainline Level of Service

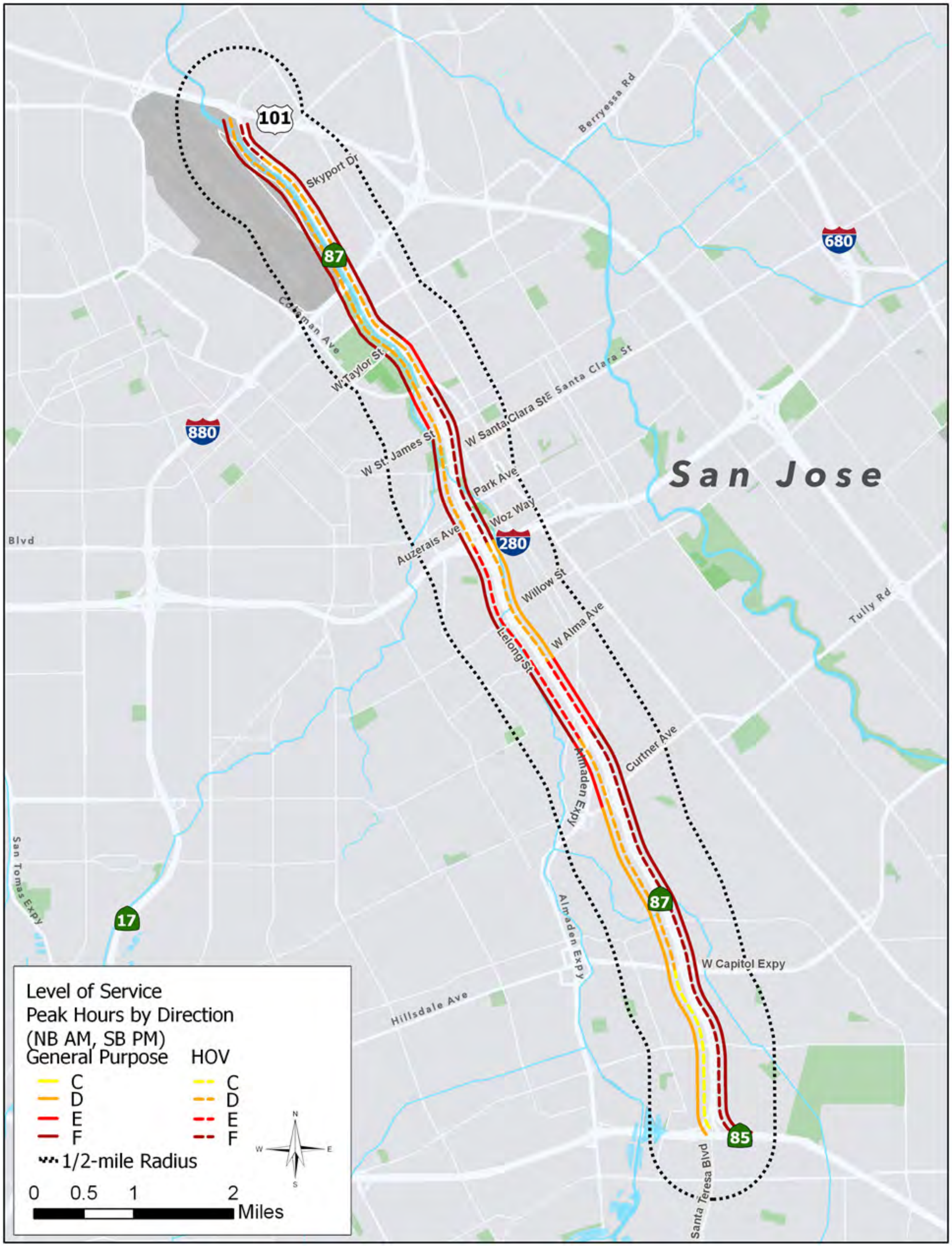
The VTA conducted a level of service (LOS) qualitative analysis on the mainline to assess its performance in terms of vehicle speed and congestion. SR 87 is a highly congested corridor with numerous freeway segments operating at LOS F.[2] The following operating conditions were observed:

- Northbound, 7 of 10 GP lane segments and 6 of 10 HOV lane segments operate at LOS F in the morning peak hour.
- Southbound, 6 of 10 GP lane segments operate at LOS F in the evening peak hour. All 10 HOV lane segments operate at LOS E or better.

Figure 2-9 illustrates LOS levels along the SR 87 mainline.

1. "Truck" is defined as a vehicle with more than two axels.
2. LOS standards use the letters A through F to rate roadway performance, with A being the best and F being the worst.

Figure 2-9. SR 87 Freeway Level of Service



Freeway Mainline Travel Times, Speeds, and Congestion

The VTA conducted field observations and collected travel time information and speed data from "big data" sources, such as Caltrans' Performance Measurement System (PeMs) and INRIX, to identify the locations of bottlenecks on the corridor. The field observations were used to verify the information from the data sources and to provide specific details on peak hour operations. The data sources and field observations revealed that congestion exists throughout both the entire morning and evening peak periods, which are between 6:00 AM and 9:00 AM and 3:00 PM and 7:00 PM, respectively.

The peak hours for the corridor are between 7:00 AM and 8:00 AM and 5:00 PM and 6:00 PM. In the AM northbound direction, both the GP lanes and HOV lane operate in congestion with speeds ranging from 17 to 21 mph and from 23 to 40 mph, respectively. In the PM southbound direction, GP lanes operate in congestion between US 101 and Curtner Avenue, with speeds ranging from 22 to 33 mph. However, the PM HOV lane is less congested, with speeds ranging from 39 to 52 mph. Table 2-5 summarizes the peak hour travel speeds on the mainline freeway segments.

Table 2-5. Peak Hour Operations on SR 87

Direction	Segment		Distance	Peak Hour	Travel Time (min)		Average Speed (mph)	
	Begin	End	(miles)		GP	HOV	GP	HOV
NB	SR 85 Interchange	I-280	5.156	AM	17:56	13:25	17	23
				PM	6:22	6:00	49	52
	I-280	US 101	4.064	AM	11:43	6:09	21	40
				PM	3:57	3:40	62	64
SB	US 101	I-280	4.064	AM	3:47	3:56	70	62
				PM	10:54	8:21	22	39
	I-280	SR 85 Interchange	5.156	AM	4:38	4:31	67	68
				PM	9:24	5:56	33	52

Existing Bottlenecks and Queues

The following section describes the location of the bottlenecks and queues in both the morning and evening peak periods by direction.

NORTHBOUND MORNING PEAK

Congestion in both the GP and HOV lanes during the morning peak period is due to high volume of vehicles in the northbound direction. The average speed for the entire length of freeway in the GP lanes is about 20 mph. The HOV lane operates at 30 mph, except between the Almaden Expressway and San Carlos overcrossings.

Figure 2-10 illustrates the travel speed profile from the field observations of both GP and HOV lanes. Figure 2-11 shows the INRIX heat map for a typical weekday in May 2017. The INRIX data and field observations show bottlenecks at Capitol Expressway, Almaden Expressway, the Santa Clara Street/I-280 merge, and the US 101 off-ramp.

Figure 2-10. Morning Travel Speeds in General Purpose & HOV Lanes on Northbound SR 87

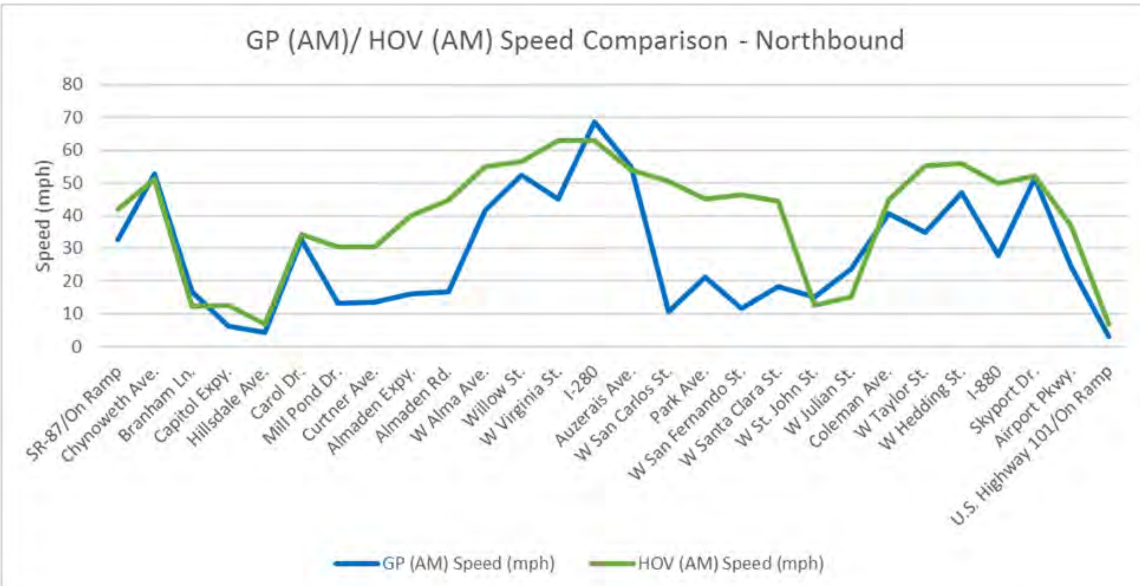
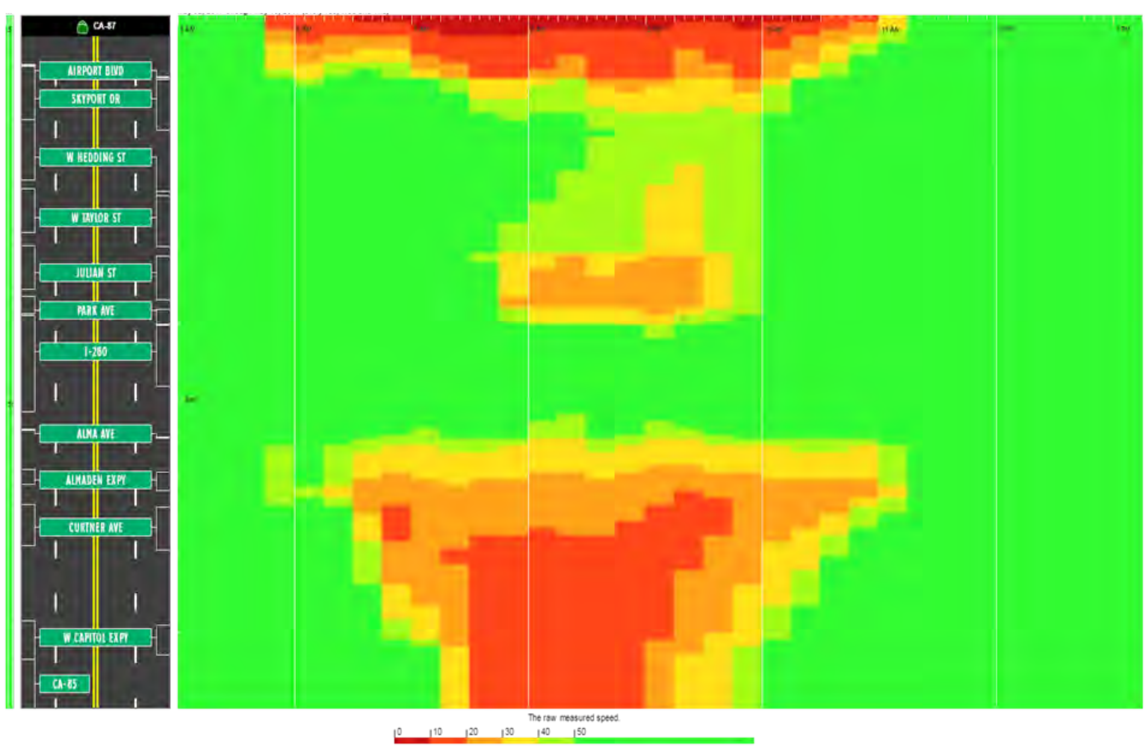


Figure 2-11. Average Weekday Morning Travel Speeds (MPH) on Northbound SR 87, May 2017



Source: INRIX, Averaged by 15 Minutes, May 2–18, 2017

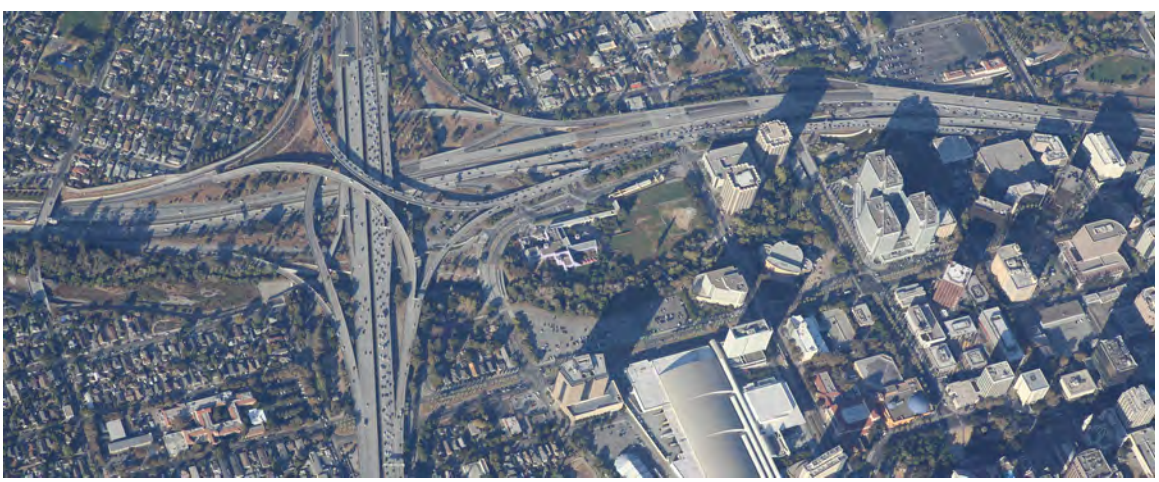
Capitol Expressway: Congestion at Capitol Expressway is attributed to a high volume of traffic entering from SR 85 and from Capitol Expressway, and a reduction in capacity, due to a lane drop at Hillsdale Ave (Figure 2-12).

Figure 2-12. Morning Congestion Near Capitol Expressway

Almaden Expressway: Congestion at Almaden Expressway is attributed to a multitude of factors: backup from the I-280 off-ramp, a high volume of traffic entering from Almaden Expressway, and right lane overload caused by heavy merging and weaving between closely spaced on- and off-ramps. Queuing is observed on both Almaden Expressway as far back as Curtner Avenue (over ½ mile) and on the freeway mainline as far back as the SR 85 interchange (over 3 miles).

Santa Clara Street/I-280 Merge: The next bottleneck occurs in the downtown San Jose area just north of the merge with I-280. The congestion at this location is mainly attributed to a large number of vehicles entering the mainline from both northbound and southbound I-280. Backups are observed as far back as the middle of the SR 87/I-280 interchange and on both the northbound and southbound I-280 connectors extending back onto I-280 freeway mainline (Figure 2-13).

Figure 2-13. Morning Congestion at the SR 87/I-280 Interchange



Another factor adding to the congestion at this location is the off-ramp to Santa Clara Street and Auzerais Way via a collector-distributor road that exits from the freeway mainline at the middle of the I-280 interchange. The collector-distributor road first provides access to Auzerais Way and continues on to collect incoming traffic from the northbound and southbound I-280 connector ramps to SR 87. The off-ramp to Santa Clara Street is located within the merge with these two connector ramps, and the combined flows continue northbound to merge onto the SR 87 mainline. The location of the off-ramp to Santa Clara Street creates a complex weave section with up to five streams of traffic crossing each other in a short distance, as follows:

Freeway to Interchange Ramp:

- Northbound I-280 to Santa Clara Street
- Southbound I-280 to Santa Clara Street
- Northbound SR 87 collector-distributor road to Santa Clara Street

Freeway to Freeway Connector Ramps:

- Northbound I-280 to northbound SR 87
- Southbound I-280 to northbound SR 87

US 101 On-Ramp: Northbound SR 87 terminates by branching off to northbound US 101 and N. First Street-Charcot Avenue, with high volumes evenly splitting off to both destinations. There is minimal backup to N. First Street-Charcot Avenue, due an auxiliary lane between the Skyport Drive and N. First Street-Charcot Avenue off-ramp. Although the off-ramp to northbound US 101 has two GP lanes and one HOV lane, backup on the off-ramp is caused by ramp metering at the terminus of the ramp to manage congestion on the US 101 mainline.

SOUTHBOUND EVENING PEAK

The southbound SR 87 GP lanes are congested between Skyport Drive and Curtner Avenue. Vehicle speeds start gradually increasing south of Almaden Expressway and continue increasing south of Curtner Avenue. The average speed for the entire length of freeway in the GP lanes is about 24 mph. The HOV lane operates above 50 mph, except at the Willow Street and Hillsdale Avenue overcrossings.

Figure 2-14 shows the field-observed travel speed profile for GP and HOV lanes in May 2018. Figure 2-15 shows the INRIX heat map for typical weekday in 2016. The INRIX data and field observations show GP lane bottlenecks at three locations: the SR 87/US 101/Charcot Avenue interchange, where I-880 crosses SR 87, and at the I-280 interchange area near downtown.

Figure 2-14. Evening Travel Speeds in General Purpose & HOV Lanes on Southbound SR 87

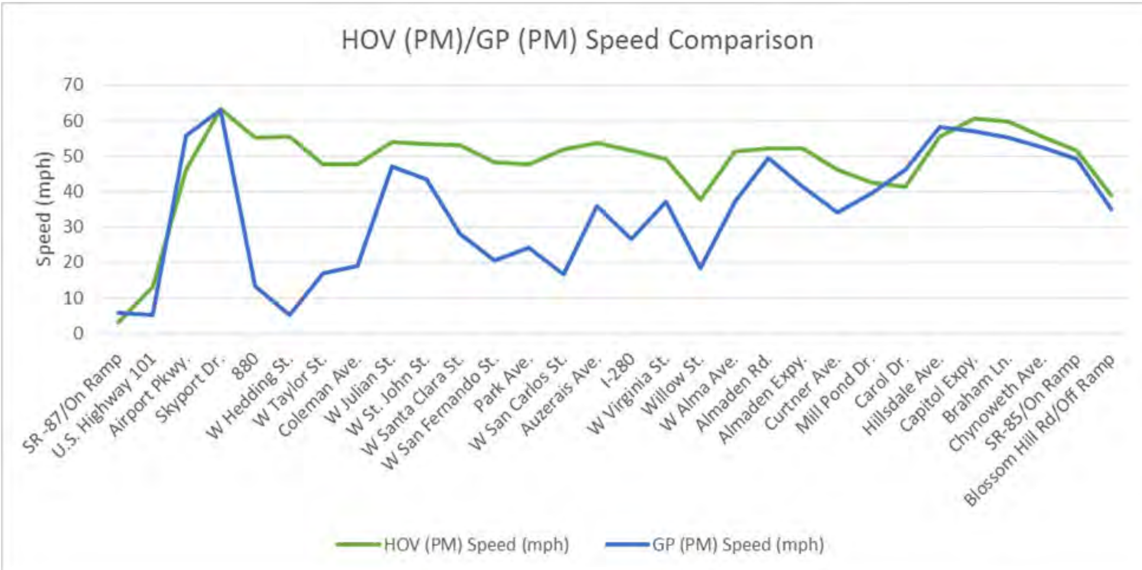
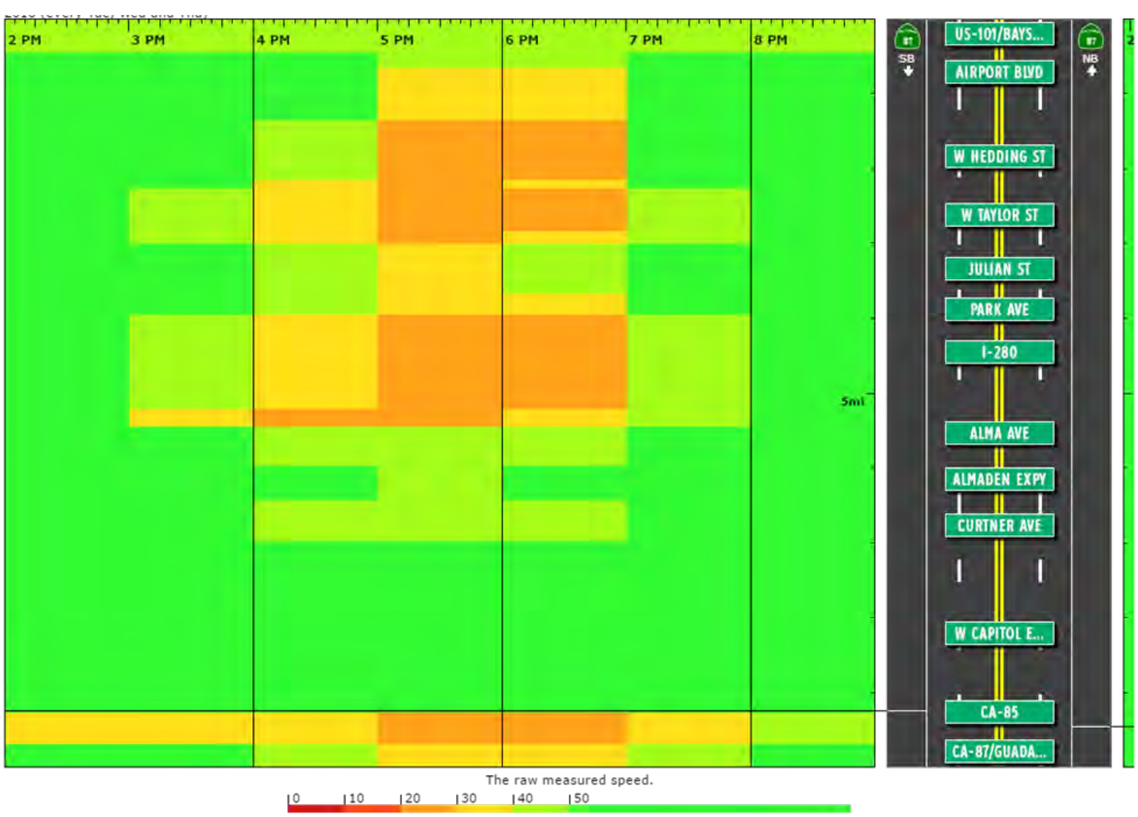


Figure 2-15. Average Weekday Evening Travel Speeds (MPH) on Southbound SR 87, 2016



Source: INRIX, Averaged by 1 Hour, 2016

US 101: The traffic flows at the northern end of the freeway corridor are fed by two high-demand on-ramps, one from southbound US 101 and one from N. First Street-Charcot Avenue. Backups occur on both ramps (Figure 2-16).

Figure 2-16. Evening Congestion Near Mineta San Jose International Airport (SR 87/US 101/Charcot Avenue)

On southbound US 101, queuing occurs at the diverge point of the off-ramp to southbound SR 87 from the US 101 mainline. This single-lane off-ramp does not have enough capacity to meet the demand, causing backups that extend to between Lawrence Expressway and the Mathilda Avenue interchange on the US 101 mainline.

Queuing on the N. First Street-Charcot Avenue on-ramp is mainly due to active ramp metering on this on-ramp to manage traffic on the southbound SR 87 mainline.

I-880: The crossing of I-880 is unique in Santa Clara County because it is the only crossing of two major freeways without any freeway-to-freeway access. This area is congested even though there is no interchange. The congestion is attributed to the discontinuity in lanes on the freeway mainline (a lane drop) at just south of Skyport Drive.

I-280: The southernmost bottleneck occurs just south of the I-280 merge with northbound SR 87. The congestion at this location is mainly attributed to a high number of vehicles entering the mainline from both northbound and southbound I-280. Backups are observed from the merge with I-280 back to somewhere between the Park Avenue and Julian Avenue overcrossings and on both the northbound and southbound I-280 connectors extending back onto I-280 freeway mainline (Figure 2-17).

Figure 2-17. Right-Lane Overload on Northbound SR 87 Approaching the I-280 Ramp

Another factor adding to the congestion at this location is the off-ramp to Alma Street-Leong Street via a collector-distributor road that exits off the freeway mainline at the middle of the I-280 interchange. The collector-distributor road exits off the SR 87 mainline and continues parallel for a short distance then merges with connector ramps from both northbound and southbound I-280, becoming a two lane on-ramp to SR 87. The off-ramp to Alma Street-Lelong Street is located before the on-ramp merges onto the SR 87 mainline. The location of access to Alma Street-Leong Street creates another complex weave section with up to four streams of traffic crossing each other in a short distance, as follows:

Freeway to Interchange Ramp:

- Northbound I-280 to Alma Street-Lelong Street
- Southbound I-280 to Alma Street-Lelong Street

Freeway to Freeway Connector Ramps:

- Northbound I-280 to SB SR 87
- Southbound I-280 to SB SR 87

2.2 Bicycle & Pedestrian Facilities

Providing high quality alternative modes of transportation for commuters along SR 87 is one possible key solution to reduce traffic congestion on SR 87 and maximize the capacity of existing roadway infrastructure. Bicycle commuting is a potential transportation alternative along SR 87, as two major trails exist near this corridor: the Highway 87 Bikeway and Guadalupe River Trail.

Safe, connected, convenient bicycle and pedestrian infrastructure around SR 87 also provides important first-last mile connections to and from local and regional rail and bus services that operate in the area, potentially reducing vehicle trips on SR 87. Planning for first-last mile connections should consider not only better pedestrian and bicycle infrastructure but also bicycle parking at transit stops; accommodation for bicycles on buses, light rail cars, and commuter trains; shared mobility devices such as bike share or scooter share; and clear signage and wayfinding for pedestrians and bicyclists.

This section describes existing bicycle and pedestrian facilities and current deficiencies in terms of safety and connectivity.

2.2.1 Existing Bicycle Trails and Bicycle Lanes

Various types of bicycle facilities currently serve or are planned in areas around the SR 87 corridor; these include multi-use paths or trails, cycle tracks, bike lanes, or signed bike routes, as described in Table 2-6. Two major trails, the Highway 87 Bikeway and the Guadalupe River Trail, run parallel to the freeway and serve North San Jose, central San Jose and downtown, and south San Jose, although both trail systems have deficiencies such as gaps, limited lighting, and limited wayfinding/signage. The Guadalupe River Trail connects the San Francisco Bay Trail in the North San Jose/Alviso area to Virginia Avenue south of downtown. The Highway 87 Bikeway connects Willow Street and areas around Tamien Station to Chynoweth Avenue north of SR 85. Existing bicycle facilities around SR 87 are shown in Figure 2-16.

Table 2-6. Types of Bicycle Facilities

Type of Bicycle Infrastructure	Description
Bicycle Paths/ Trails (Caltrans Class I)	Completely separated from streets. Provide two-way bicycle travel. Often shared with pedestrians.
Cycle Tracks (Caltrans Class IV)	Bicycle lane physically separated from motor vehicle traffic by a vertical barrier, such as an adjacent parking lane, median, or raised curb. May be one-way or two-way. Can be raised or level with auto travel lanes.
Bicycle Lanes (Caltrans Class II)	Provide dedicated roadway space for bicyclists, separate from motor vehicle traffic and parking lanes. Designated using striping, pavement markings and signs. Includes standard and buffered bike lanes.
Bicycle Routes/Sharrows (Caltrans Class III)	Streets specifically designated for bicyclists to share with motor vehicle traffic. Designated using signs. Bicyclists ride in the travel lane with motorists or on the shoulder. May include shared lane pavement markings (sharrows) or warning signage. Bicycle boulevards are an enhanced type of bicycle route: low-speed, low-volume streets optimized for bicyclists using traffic calming infrastructure, such as traffic circles.

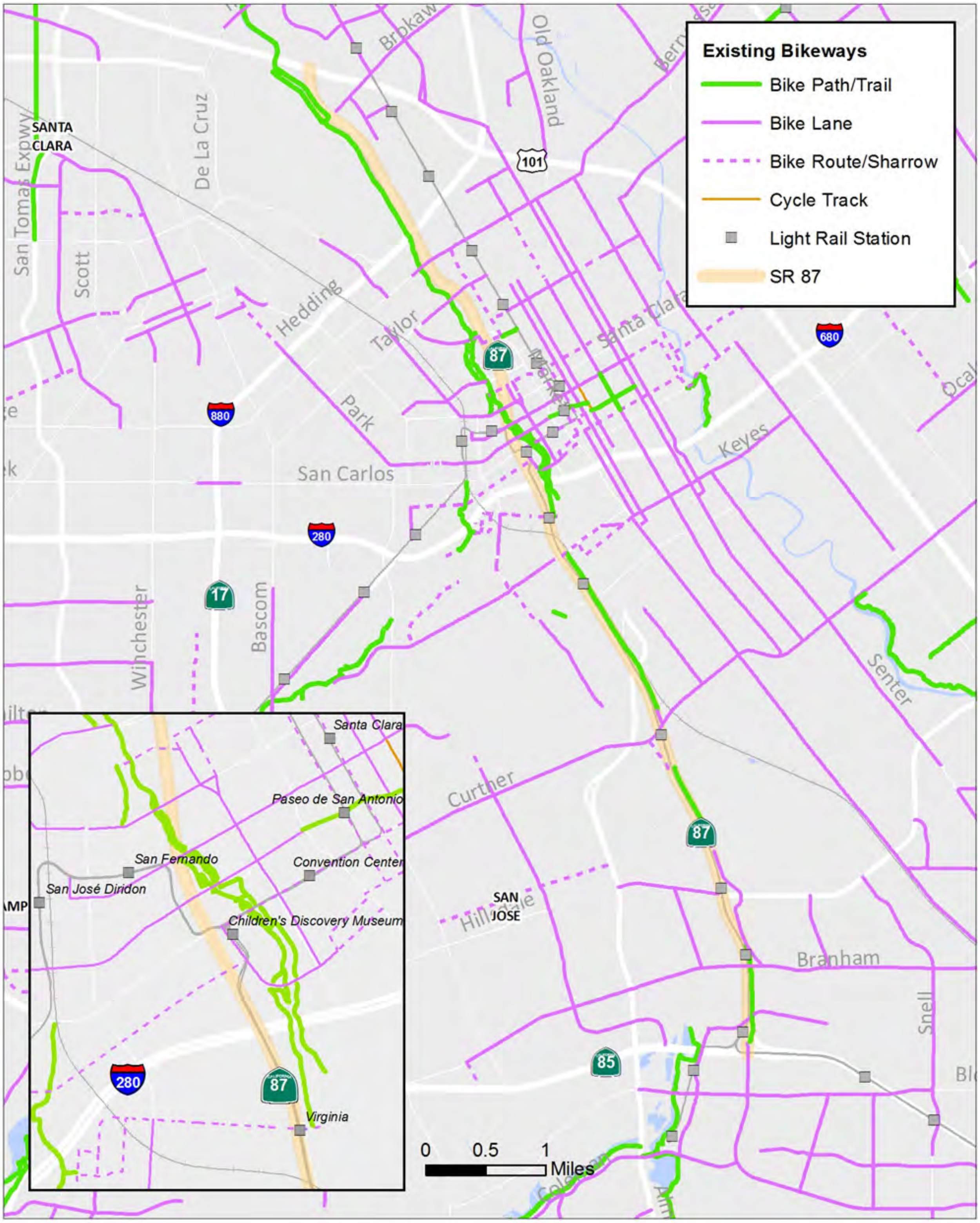
The Guadalupe River Trail is widely used by bicycle commuters. The City of San Jose collects trail counts every year for reporting and planning purposes. Table 2-18 shows bicycle and pedestrian counts collected at three locations along the Guadalupe River Trail in September 2017.

Table 2-7. Bicycle and Pedestrian Counts at Three Locations Along Guadalupe River Trail

Count Station (high volume sites only)	12-Hour Count	Annual Average Daily Traffic	Annual Volume
Guadalupe at River Park Towers	724	765	279,375
Guadalupe at Coleman Avenue	996	1,058	386,309
Guadalupe at River Oaks Pkwy	2,376	2,408	878,946

Source: City of San Jose Parks, Recreation, and Neighborhood Services, September 2017

Figure 2-18. Existing Bicycle Facilities Around SR 87



Bicycle Level of Traffic Stress (LTS) Analysis

As a part of the VTA's 2018 Countywide Bicycle Plan, VTA staff analyzed the level of bicycle traffic stress (LTS) for all roads in Santa Clara County. This LTS analysis considered the posted speed, number of lanes of traffic, and type of bikeway provided. Streets are graded on a scale, with 1 being the lowest stress and 4 being the highest stress. Table 2-8 describes the LTS categories.

Table 2-8. Bicycle LTS Categories

LTS Score	Definition
LTS 1	Most children feel comfortable bicycling.
LTS 2	The mainstream adult population feels comfortable bicycling.
LTS 3	Bicyclists who are considered "enthused and confident" but still prefer having their own dedicated space feel comfortable bicycling.
LTS 4	Only "strong and fearless" bicyclists feel comfortable. These roads have high speed limits, limited or non-existing bicycle lanes and signage, and large distances to cross at intersections.

Figure 2-19 shows the LTS analysis for areas around SR 87. As the map indicates, there is good north–south bicycle access along SR 87: trails such as the Guadalupe River Trail and the Highway 87 Bikeway are very low stress (LTS 1). However, it is very difficult to get to and from the trails without having to travel along or cross a high or very high stress road (LTS 3 or LTS4). Major barriers to the trails include streets with high traffic volumes and high speed limits. such as Story Road, Hillsdale Avenue, and Blossom Hill Road west of Almaden Expressway, all of which scored LTS 4. Improving these roads to provide low-stress bicycle connections to the trail system along SR 87 can increase the number of bicycle commuters, and ensure the City receives the full benefit of its significant investment in the trail system.

Islands of Connectivity

Another way to look at bicycle access around SR 87 is to see how far one can travel on local roads and trails before having to cross a high-stress road (LTS 3 or LTS 4). As described in the prior section, LTS 3 and LTS 4 roads divide neighborhoods into small low-stress "islands of connectivity." As a part of the Countywide Bicycle Plan, using GIS tools, staff identified small islands of low-stress areas. A map of the analysis results around SR 87 is shown in Figure 2-20. Each continuous, connected low-stress network is represented by a different color. The map illustrates how roadways along SR 87 are divided into small, isolated islands. There is no comprehensive and continuous low-stress bicycle network.

Figure 2-19. Level of Traffic Stress Scores for Roads Around the SR 87 Corridor

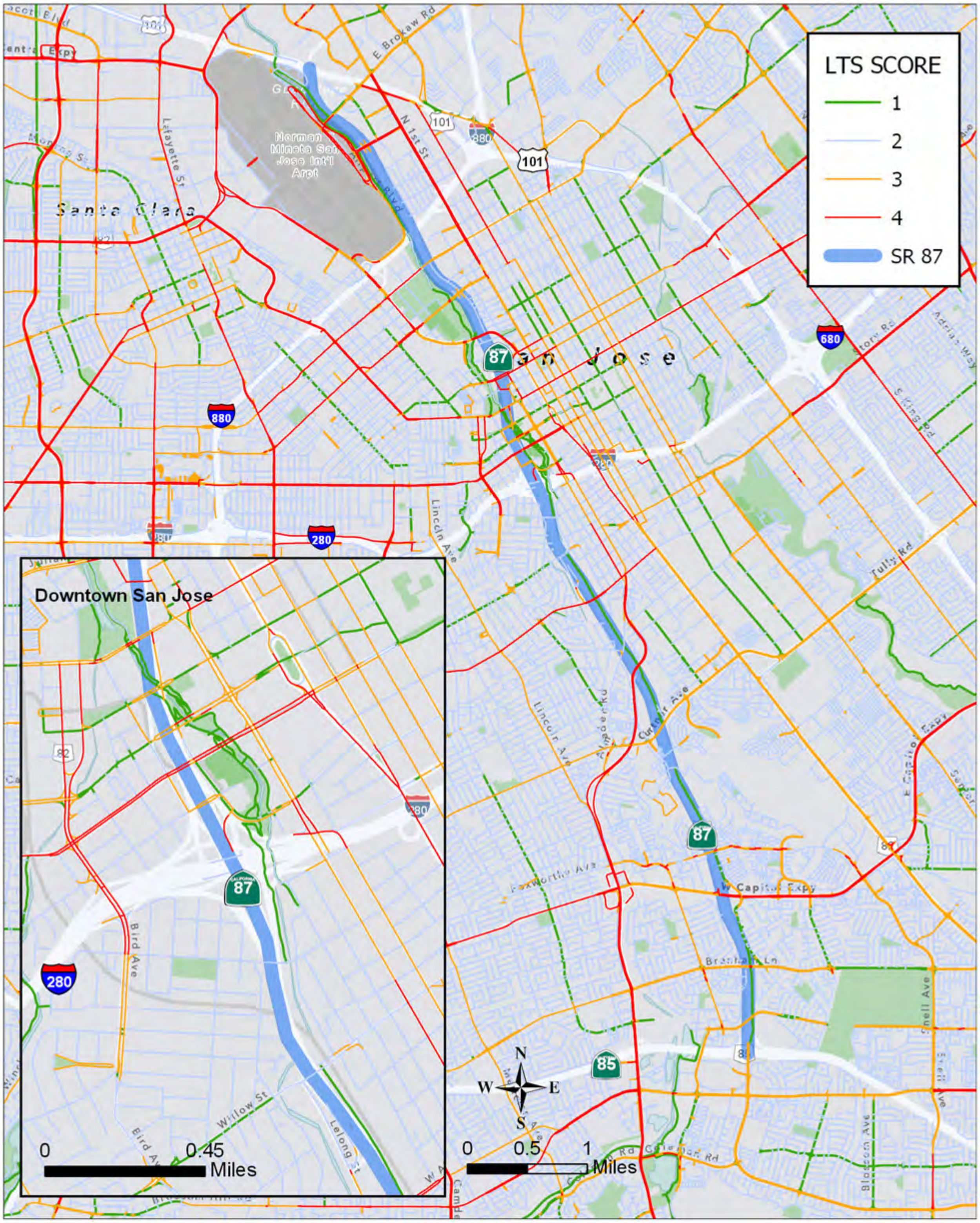
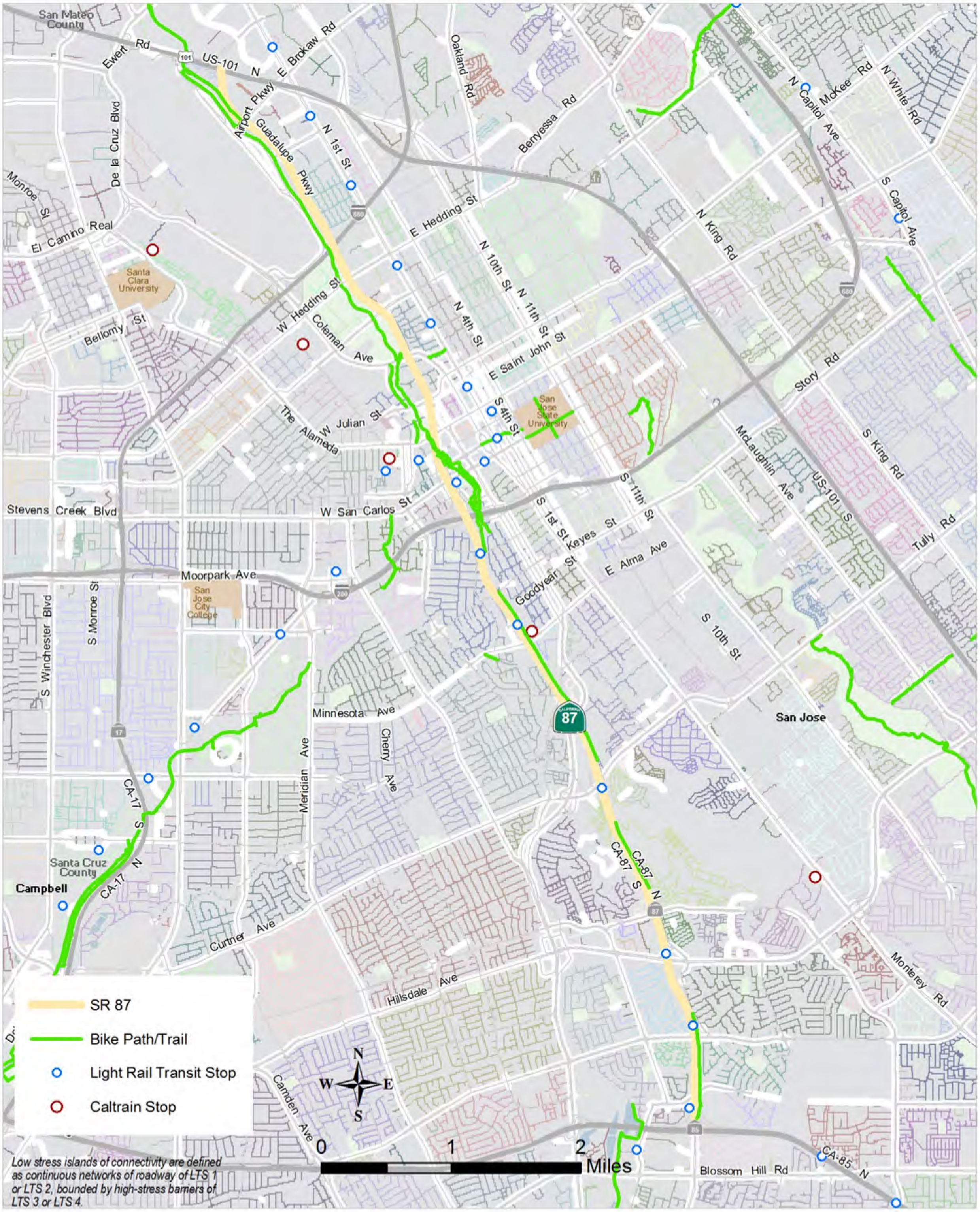


Figure 2-20. Islands of Connected, Comfortable, Low-Stress (LTS 1 or LTS 2) Bicycling Streets



Bicycle and Pedestrian Collisions History

According to the Statewide Integrated Traffic Records System (SWITRS), in the five-year period between 2011 and 2016, 597 bicycle-vehicle and pedestrian-vehicle collisions occurred within one mile of the SR 87 corridor (Table 2-9). Out of these 597 bicycle and pedestrian collisions, 27 were fatal and 39 involved severe injury.

Table 2-9. Number of Bicycle-Vehicle and Pedestrian-Vehicle Collisions within One Mile around the SR 87 Corridor (2011–2016)

Severity of Injury	Bicycle Collision	Pedestrian collision	Total
Fatality	5	22	27
Severe Injury	18	21	39
Other Visible injury	135	94	229
Complaint of Pain	160	142	302
Total	**318**	**279**	**597**

Figure 2-21 is a hotspot analysis map of collisions within the SR 87 corridor study area. The map indicates areas with the greatest density of bicycle collisions:

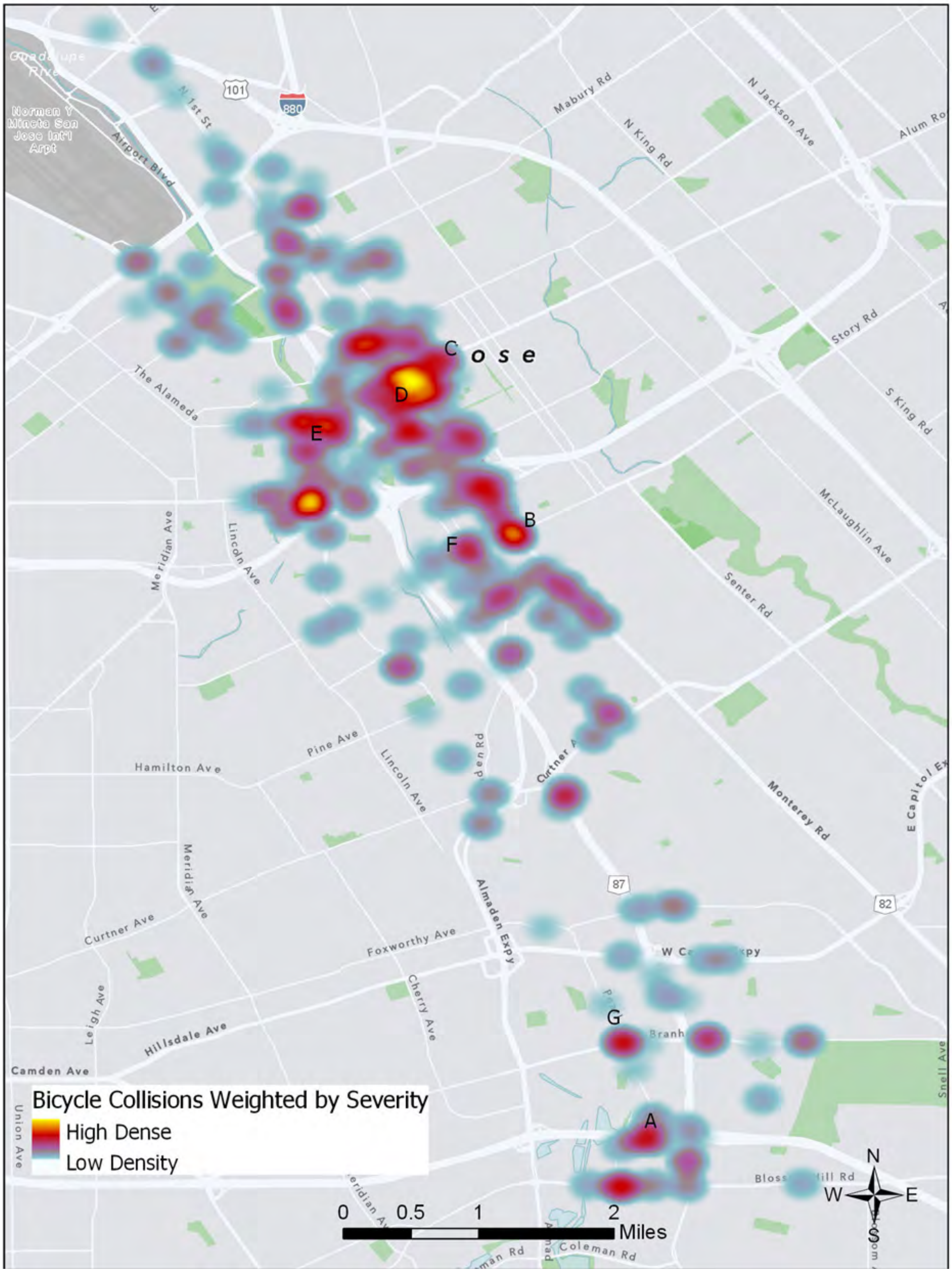
A. Blossom Hill @ Winfield Boulevard
B. Monterey Road @ Story Road
C. Santa Clara Street @ 6th Street
D. San Fernando Street @ 1st Street
E. Bird Avenue @ Auzerais Avenue
F. Keyes Street @ 1st Street
G. Branham Lane @ Pearl Avenue

Figure 2-22 shows areas with the greatest density of pedestrian collisions:

a. Monterey Road around Phelan Avenue
b. Curtner Avenue @ Little Orchard Street
c Santa Clara Street @ 1st Street and 2nd Street
d. San Fernando Street @ 3rd Street
e. San Salvador Street @ 2nd Street

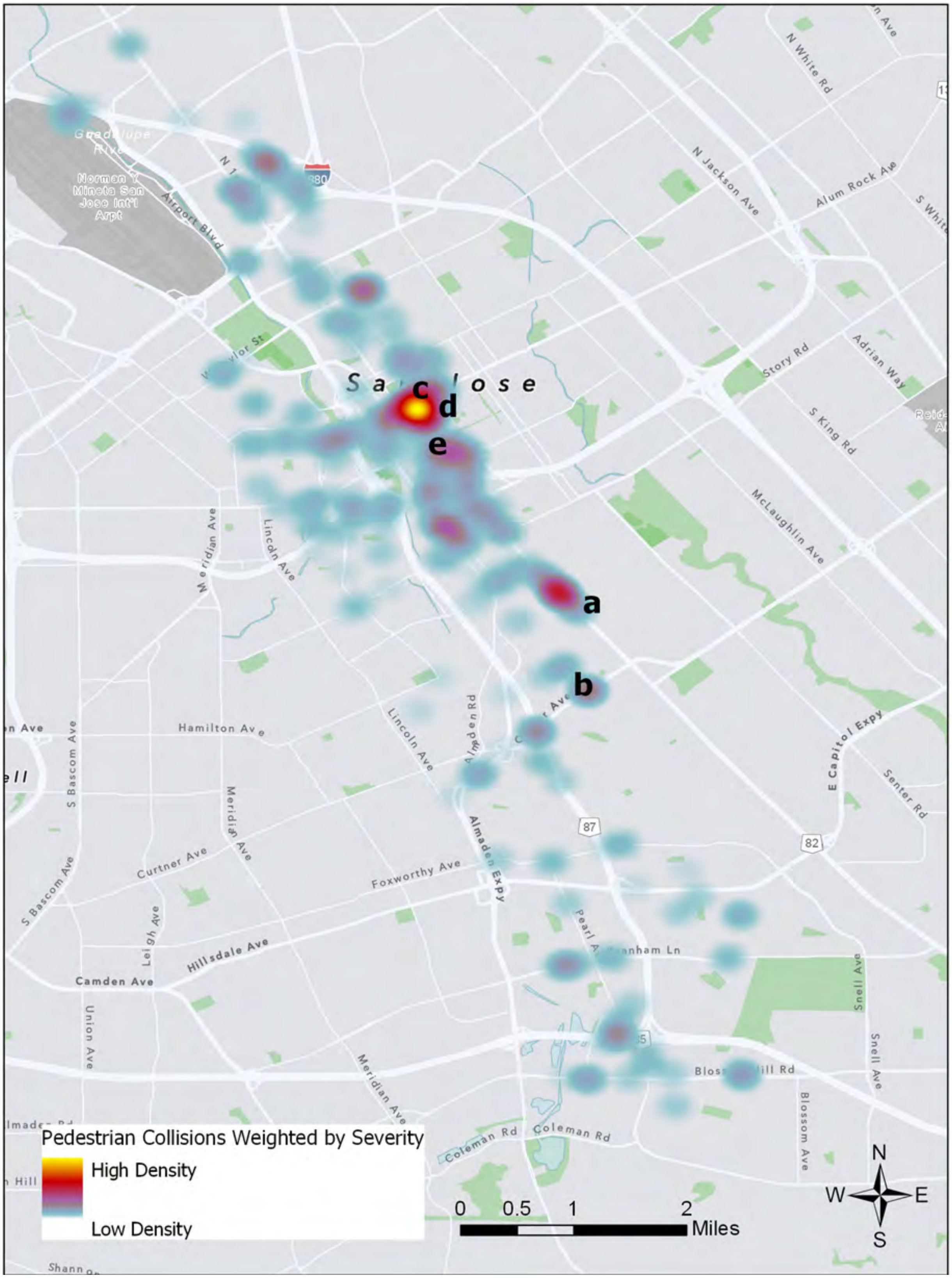
The high density of bicycle and pedestrian collisions at these areas compared to other parts of the county or city may be due to high walking and biking activity or hazardous conditions, or both. Infrastructure improvements to address deficiencies such as lack of lighting during dark hours, wide intersection crossings, inadequate markings at intersections, lack of bicycle lanes, etc., could potentially decrease the number of bicycle and pedestrian collisions. Educational and encouragement programs also play an important role in changing driving, biking, and walking behavior.

Figure 2-21. Bicycle Collisions Around SR 87 (2011–2016), Weighted By Collision Severity



Source: SWITRS

Figure 2-22. Pedestrian Collisions Around SR 87 (2011–2016), Weighted By Collision Severity



Source: SWITRS

Homeless Encampments Along the SR 87 Corridor

The locations of homeless encampments along SR 87 were identified in August 2018. Among the survey responses, a commonly mentioned request was to enhance safety by moving out homeless encampments along the bike trail.

In general, homeless encampments have been observed sporadically along the trails, with higher concentrations near Almaden Expressway and Alma Avenue in San Jose, as shown in Figure 2-23. Some encampments were observed near the Park Avenue on- and off-ramps to SR 87.

The observed locations of homeless encampments are not static, and their conditions are dependent on timely cycles of removal. The public can report locations and request services from both the City of San Jose and Caltrans:

- For removal of litter and homeless encampments along the bicycle trails and local streets, go to http://www.sanjoseca.gov/index.aspx?NID=3156. Or contact the Homeless Concerns Hotline by calling 408-975-1440, or by email homelessconcerns@sanjoseca.gov to report a concern related to homelessness in San Jose.
- To request litter removal from the State highway system, the public can report electronically using the following link: http://www.dot.ca.gov/hq/maint/msrsubmit/.

2.2.2 Existing First-Last Bicycle Connections

Bike Share

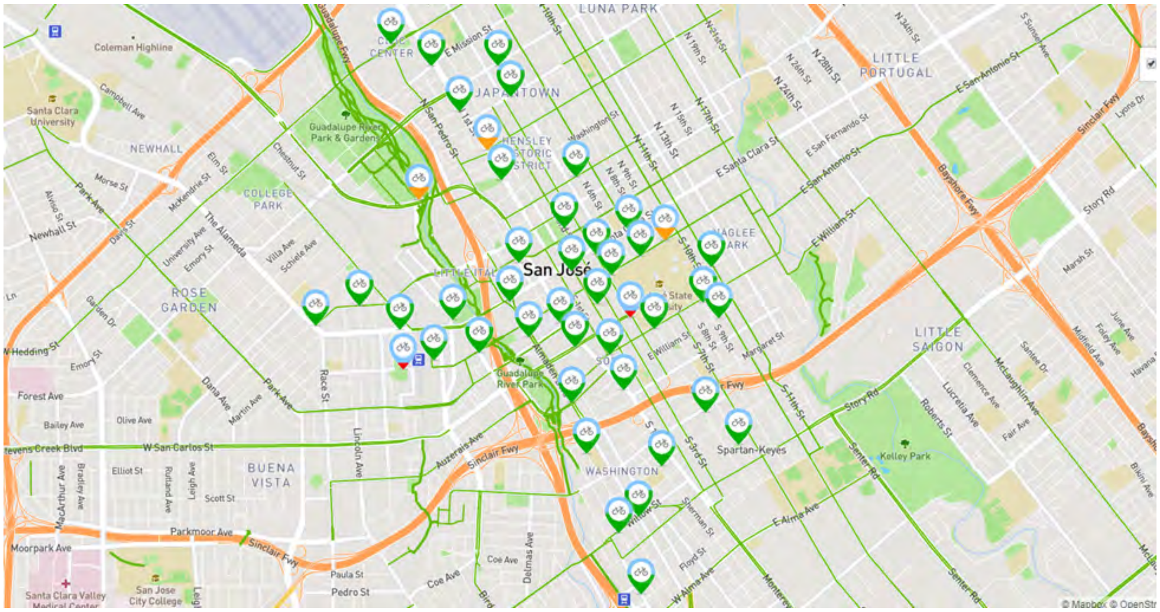
In the past few years, bike share has been introduced as a first-last-mile connection. Two bike share vendors currently operate in San Jose. Ford GoBike provides both docked and dockless bike share and is part of a larger Bay Area deployment, which includes bikes in San Francisco, Oakland, Berkeley, and Emeryville. Most of Ford GoBike's system is docked, but the vendor is piloting dockless bike share in north San Jose. Currently, Ford GoBike operates 24 docking stations around downtown San Jose and plans to add 18 more in the next two years, extending beyond Japantown in the north, The Alameda in the west, the eastern side of San Jose State in the east, and to Willow Street on the south side of downtown. Figure 2-24 shows the location of existing Ford GoBike docking stations around the study area.

Electric Scooters and Bikes

Starting in March 2018, electric bike (e-bike) and electric scooter (e-scooter) vendors began placing dockless e-bikes and e-scooters in downtown. LimeBike provides e-bike and e-scooter service all over the city, and Bird provides e-scooter service mostly in downtown (Figure 2-25). San Jose is in the process of developing a permit to regulate dockless personal mobility devices.

Figure 2-23. Observed Homeless Encampments Along SR 87

Figure 2-24. Ford GoBike Bike Share Docking Stations Around Downtown San Jose



Source: Ford GoBike

Figure 2-25. Bird Scooters in Downtown San Jose

Source: AP

Bicycle Accommodation in Transit Cars and at Transit Stations

Bicycle-transit commuters need to be able to take their bicycles on-board transit vehicles or have access to secure bicycle parking in transit stations. All VTA buses and trains and Caltrain trains allow bicycles on-board.

Currently, two types of bicycle lockers are available in VTA and Caltrain transit stations: keyed lockers assigned to an individual user and first-come, first-served electronic lockers. Table 2-10 lists the number of secure bicycle lockers at transit stations near the SR 87 corridor. Providing adequate amounts of secure bicycle parking at transit stations could be an incentive for commuters along SR 87 to choose bike-transit as their mode of transportation.

Table 2-10. Bicycle Parking at Transit Stations Around the SR 87 Corridor

Station	Number of Electronic Lockers	Number of Keyed Lockers
Branham LRT Station	10	-
Tamien LRT Station	10	-
Tamien Caltrain Station	-	18
Ohlone LRT Station	10	10
Blossom Hill LRT Station	-	10
Curtner LRT Station	-	12
Capitol LRT Station	-	24
Almaden LRT Station	-	20
San Fernando LRT Station	-	3
Oakridge LRT Station	-	10
Diridon Caltrain Station	-	48
College Park Caltrain Station	-	-

2.2.3 Pedestrian Facilities and Access to Transit Stops

Better walking access to transit stops could encourage more commuters to take transit. One major goal of this study is identifying ways to shift the travel mode along SR 87 to more walking, biking, and transit. Currently, the multi-use trails such as the Guadalupe River Trail accommodate both bicyclists and pedestrians. For the purpose of this study, the existing pedestrian conditions were evaluated in a half-mile walkshed distance around VTA's light rail stations.

A walkshed is the actual walkable boundary around a certain destination. A walkshed is often defined by a half-mile or one-mile distance, and is often shown by an irregular shape instead of a circle because it depicts the actual walking distance instead of a linear distance and excludes barriers such as freeways. Figure 2-26 shows the half-mile walkshed and half-mile linear distance around Gish Light Rail Station.

Figure 2-26. Comparison of Half-Mile Walkshed Area and Half-Mile Radius Around Gish Light Rail Station

In the SR 87 study area, the pedestrian environment around VTA light rail stations is diverse. Stations north of downtown San Jose are surrounded by commercial land uses along major streets such as First Street and residential neighborhoods behind the commercial zone. Stations in downtown areas are surrounded by office and commercial buildings and multi-family houses. Stations south of I-280 are mainly surrounded by lower density residential neighborhoods.

Within the walkshed, different types of pedestrian deficiencies on roadways were identified. These include missing sidewalk, long distances between crosswalks, inadequate lighting—especially under the freeway, and a lack of medians at large intersections. Chapter 6 includes more detail about the identified deficiencies.

2.3 Transit Services & Facilities

This section describes available transit services and park and ride facilities along the SR 87 corridor and includes an analysis of transit operating speeds, ridership, and on-time performance.

2.3.1 Available Transit Services

The main public transit service offered along the SR 87 corridor is light rail operated by the VTA that runs in the median of the SR 87 freeway for about 5.3 miles between the SR 85 and I-280 interchanges. North of I-280, the LRT mainline connects at Woz Way and San Carlos Street to First Street, where it runs parallel to SR 87 up to the SR 87/US 101 interchange. In addition to LRT, several transit routes run along SR 87, and these are

- VTA Express Buses – 168 and 182 (routes partially run along SR 87)
- VTA Regular Buses – 64, 66, 68, and 82 (routes partially run along SR 87)
- Caltrain
- Altamont Commuter Express (ACE)[3]

[3] Caltrain and ACE are heavy commuter rails, running partially along SR 87: Caltrain, from Blossom Hill Station to San Jose Diridon, and ACE, from San Jose Diridon to Santa Clara Station and onward to the northeast. Both rail systems, although important for transportation in the region, do not significantly influence commuter patterns along SR 87 due to their long-distance commute purpose. Therefore, the focus of this report will be on the local transit routes, such as VTA light rail and express and regular buses.

2.3.2 Transit Service Performance

This section summarizes the operating speeds of transit services along the SR 87 corridor as well as occupancy and ridership. The data presented in this section is based on available information from the following sources:

- http://www.vta.org/getting-around/light-rail-service-overview
- https://dashboard.goswift.ly/vta/live-map
- http://api.transitime.org/web/reports/index.jsp?a=vta
- http://www.vta.org/getting-around/vta-ridership
- http://data.vta.org/datasets/ridership
- VTA Transit Sustainability Policy: Appendix A – Service Design Guidelines. February 2007
- VTA Transit Service Guidelines. April 2018
- VTA Transit Sustainability Policy: Light Rail Transit Service Guidelines. February 2007
- VTA Transit Sustainability Policy: Express Bus Transit Service Guidelines. February 2007
- VTA Transit Sustainability Policy: Local Bus Transit Service Guidelines. February 2007

Figure 2-27 shows existing transit along the SR 87 corridor.

Operating Speeds

This section describes the operating speeds of the available transit services on the SR 87 corridor, including the constraint on speeds and actual measurements of speeds.

LIGHT RAIL VEHICLES

The travel speed of LRTs varies depending on the time of day, whether the rail track is separated from the rest of the roadway, and intersecting streets. Constraints on LRT travel speeds include the grade crossings at 17 signalized intersections along the corridor, even with the implementation of Transit Signal Priority (TSP).[4] LRT speeds are also constrained by the requirements of the California Public Utilities Commission (CPUC). The CPUC requires certain safety enhancement devices in the corridor (e.g., fencing along the trackway, controlled or clearly defined access points for pedestrians crossing the trackway, etc.). LRT travel speeds and intervals between LRTs (headways) are

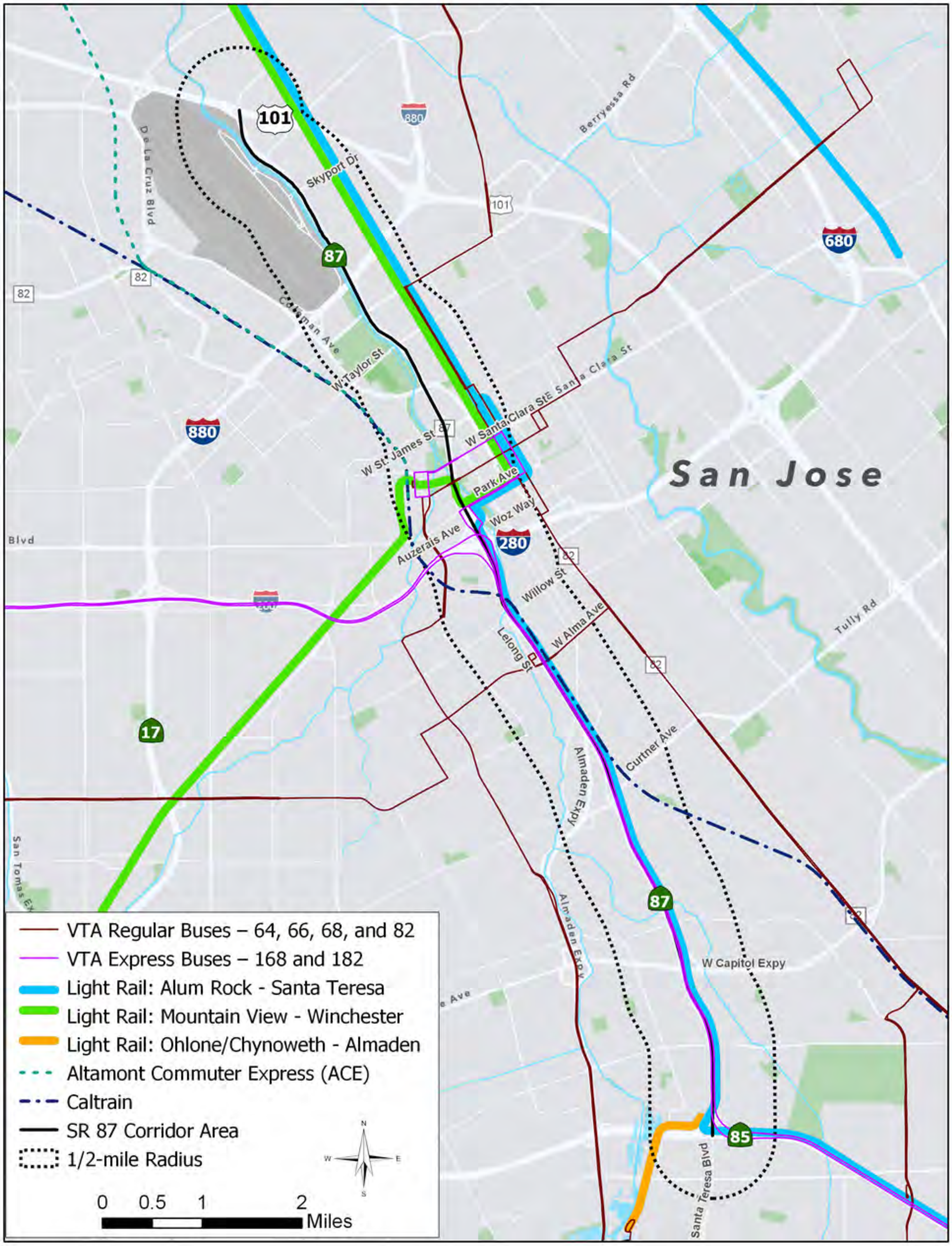
Maximum allowed travel speed:
Freeway median: 55 mph
Downtown center plaza: 10 mph

Average operating travel speed: 25 mph

Average combined **h**eadway:
Peak: 5-10 minutes
Off-peak: 15 minutes
Night/weekend: 30 minutes

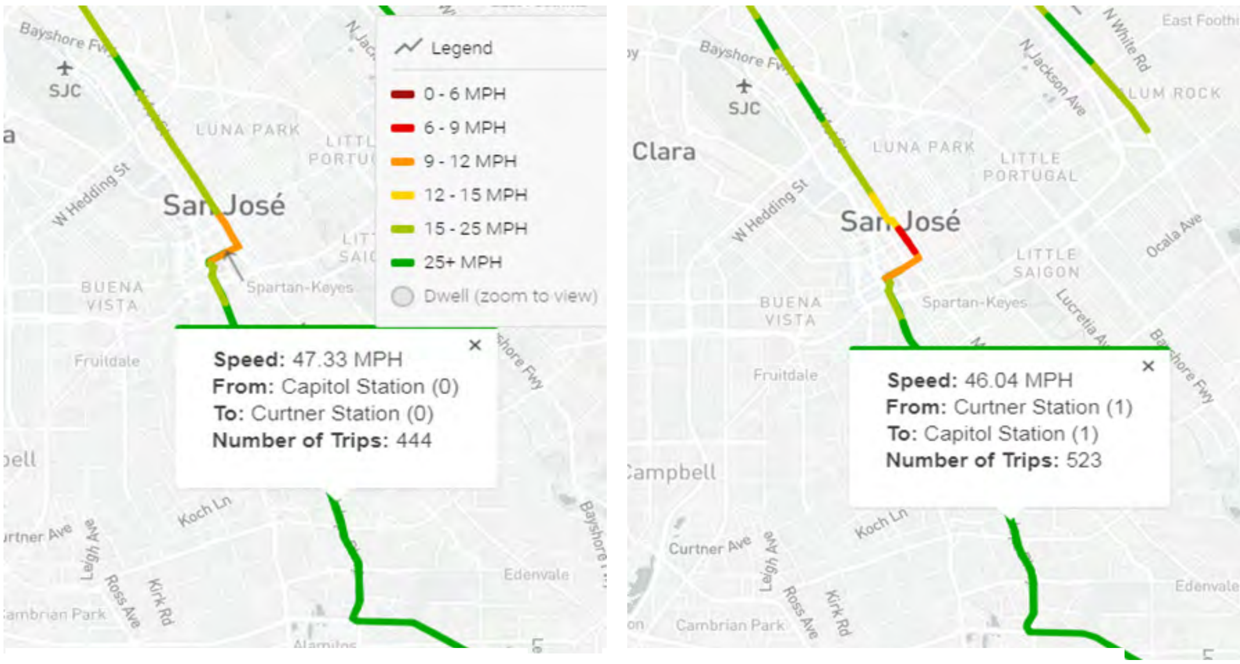
[4] Transit Signal Priority (TSP) is technology that modifies the normal signal operation process to reduce the dwell time of LRTs at traffic signals.

Figure 2-27. Existing Transit Routes Along the SR 87 Corridor



LRT 901, which runs in the corridor, reaches its highest speed south from I-280, where it runs within the median of SR 87, completely separated from traffic. Traveling northward through downtown from the Children's Discovery Museum to St. James Park station, trains must slow down to an average of 6 to 10 mph as the tracks run at-grade with the busy sidewalks. North of St. James Park, the trains speed up to 25+ mph, as they run through the separated median of N. First Street and use TSP technology, which allows them to decrease the wait time before crossing the intersection. To visualize typical peak period travel speeds for LRTs, VTA staff retrieved route speed maps from Swiftly using 7:00 AM to 9:00 AM for the morning peak period and 4:00 PM to 6:00 PM for the afternoon peak period.[5] Figure 2-28 shows the average weekday travel speeds for LRT 901 between Capitol Station and Curtner Station.

Figure 2-28. LRT 901 Average Weekday Travel Speed Profile



Northbound Morning Peak   Southbound Afternoon Peak

EXPRESS BUS

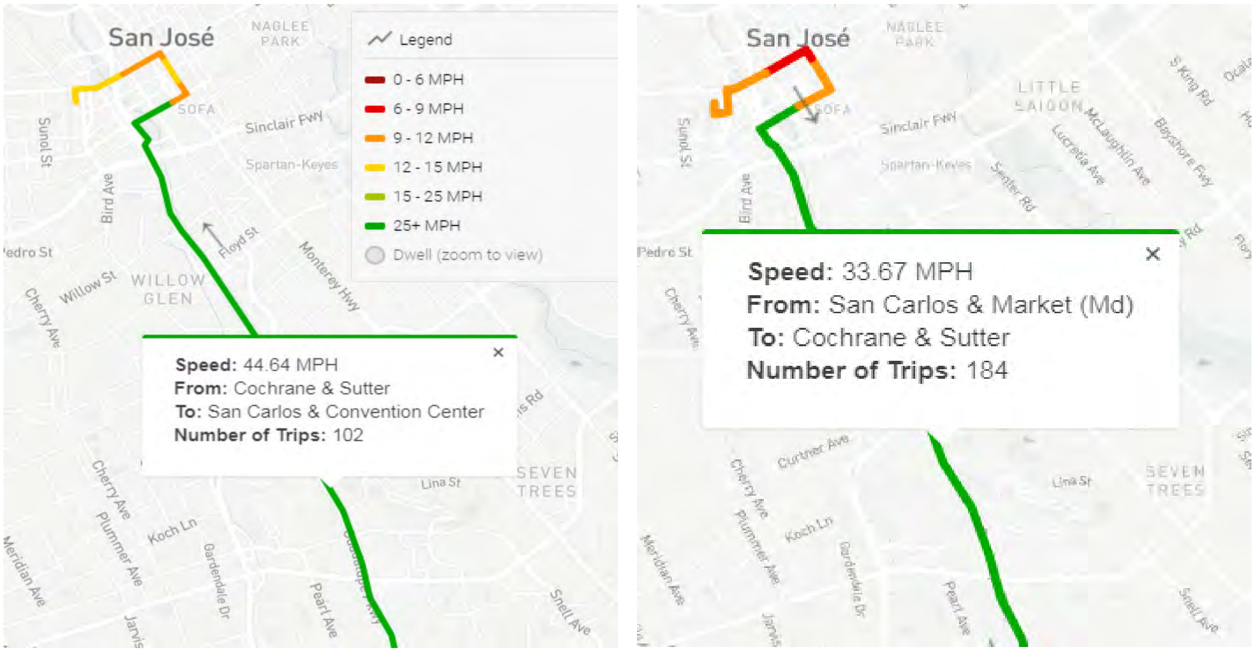
VTA express buses 168 and 182 run partially along the SR 87 corridor. The maximum and average travel speeds and headways for the express buses are

Maximum travel speed: limited to the posted travel speed for the roadway
Average operating travel speed: 25–50 mph
Average combined headway: 15–60 minutes

5 Swiftly is an online transit data portal that provides API sources and data analysis tools of a number of public transit agencies in the United States.

Express buses run in freeway carpool lanes, and their peak hour speed is limited to the speed in these lanes. Express bus 168, for example, allows riders to board at the Morgan Hill Caltrain Station and get off at the Convention Center and Downtown San Jose stops. Figure 2-29 shows the typical peak hour travel speeds of express bus 168.

Figure 2-29. Bus 168 Average Weekday Travel Speed Profile



Northbound Morning Peak　　Southbound Evening Peak

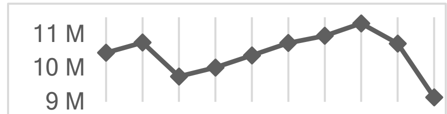
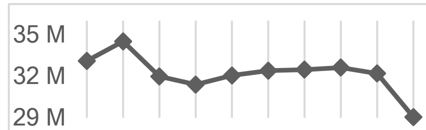
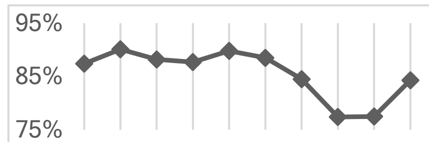
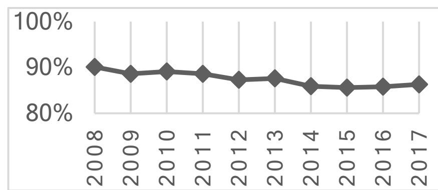
LOCAL BUS

Local buses 64, 66, 68, and 82 run partially along SR 87. The maximum and average travel speeds and headways for the local buses on the corridor are as follows:

Maximum travel speed: limited to the posted travel speed for the roadway
Average operating travel speed: 20 mph
Average Headway: 5–60 minutes

Table 2-11 summarizes transit performance and ridership in 2016 and 2017.

Table 2-11. VTA Bus and LRT Ridership and On-time Performance

Transit Performance	2016	2017	Trend (Yearly)
Light Rail Annual Ridership (millions)	10.72	9.13	
Bus Annual Ridership (millions)	32.20	29.06	
Light Rail Annual On-time Performance	77.5%	84.3%	
Bus Annual On-time Performance	85.8%	86.3%	

Source: Annual FY 2018 Transportation Systems Monitoring Program (TSMP) Draft Report, September 2018

Occupancy and Ridership

The passenger vehicle capacity, seated and standing, for each transit vehicle type operating on the corridor is as follows:

> Light Rail: 64 seated and 150 standing per coach
> Express Bus: 50–60 (40-ft standard coach) and 80–90 (60-ft articulated coach)
> Local Bus: 50–60 (40-ft standard coach)

Table 2-12 shows the average occupancy of LRTs during the peak hours on a typical weekday, based on the seated capacity.

Table 2-12. Average Weekday Peak-Period Occupancy, Shown as a Percentage of Total Seated Capacity

Station	Northbound		Southbound	
	AM	PM	AM	PM
Ohlone-Chynoweth	41%	28%	13%	30%
Branham	45%	28%	18%	42%
Capitol	49%	29%	18%	45%
Curtner	51%	30%	19%	50%
Tamien	46%	28%	20%	53%
Virginia	47%	28%	18%	48%
Children's Discovery Museum	46%	27%	17%	49%

The seating occupancy of LRTs on the stretch between the Ohlone-Chynoweth and Children's Discovery Museum stations barely exceeds 50% at any time. This guarantees commuters a comfortable ride even during the morning and evening rush.

Figures 2-30 and 2-31 further showcase transit ridership along SR 87. The figures show the aggregated ridership (both northbound and southbound) on LRT 901 for November and December 2016. As shown, the major origin and destination is downtown San Jose in both northbound and southbound directions. A relatively high ridership can also be observed at stations south of I-280, such as Ohlone/Chynoweth, Capitol, Curtner, and Tamien, located next to the relatively dense residential neighborhoods and park-and-ride lots.

Figure 2-30. Passenger Ridership per Station for 901 LRT Northbound, Nov. and Dec. 2016

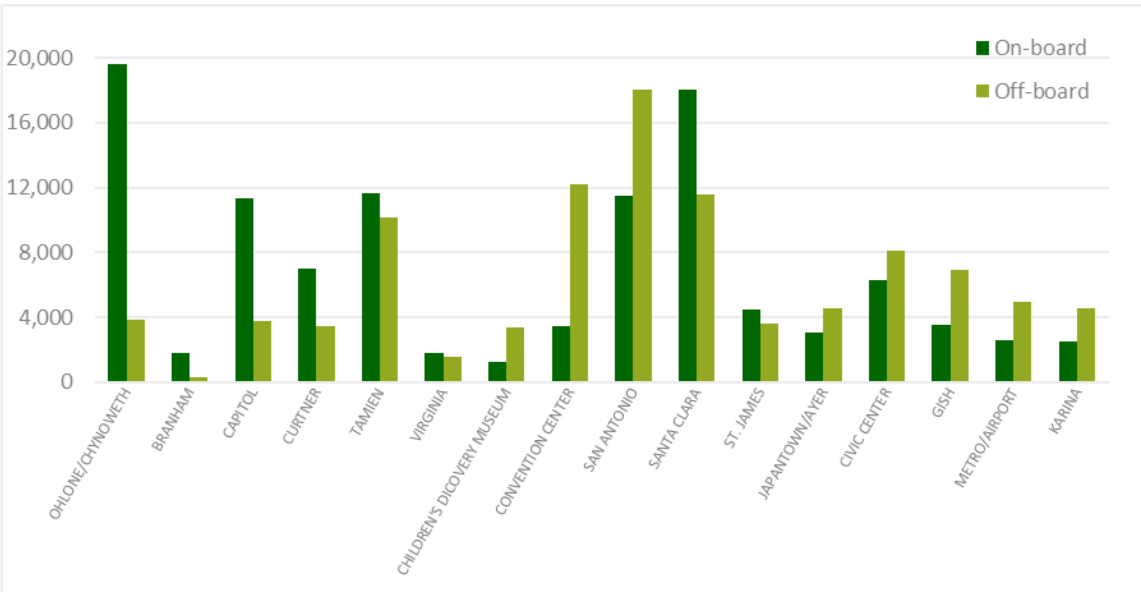
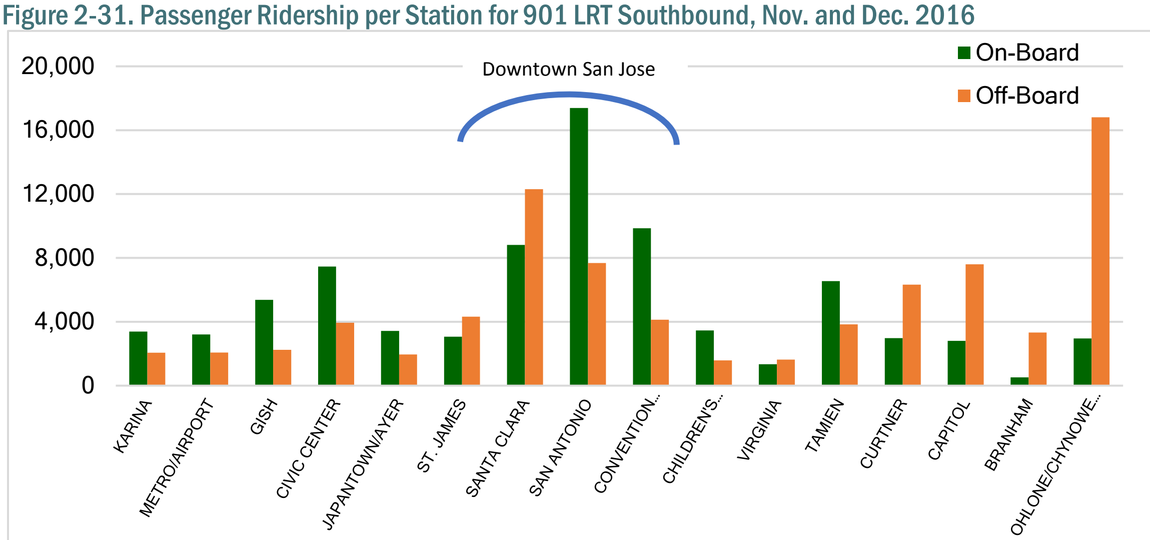


Figure 2-31. Passenger Ridership per Station for 901 LRT Southbound, Nov. and Dec. 2016



2.3.3 Park-and-Ride Facilities

VTA offers park-and-ride lots to commuters choosing to use transit for a part of their trip. Park-and-ride lots allow commuters to leave their vehicles next to major transit routes or hubs generally free of charge and board a transit vehicle to complete their trip. Park-and-ride lots next to Caltrain stations, such as Diridon, offer daily parking for a fee.

In Santa Clara County, there are 38 VTA park-and-ride lots located near major transit centers and stations. Out of these 38, 21 lots are located within the City of San Jose with eight of them along SR 87. Table 2-13 and Figure 2-32 show the park-and-ride lots, their capacity, and locations.

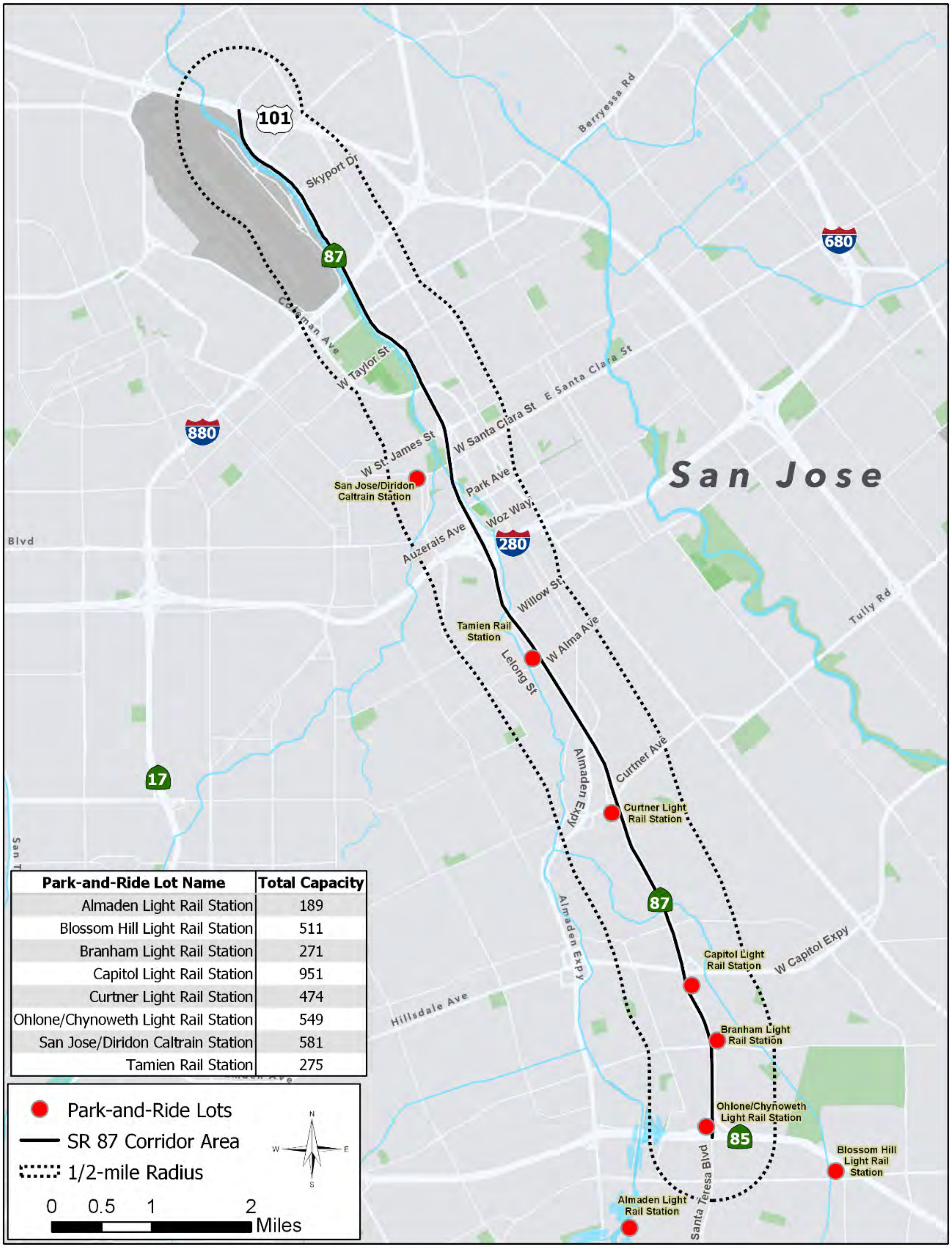
It is apparent that not all park-and-ride lots are well used. From the eight lots located along SR 87 only three—Ohlone-Chynoweth, Diridon, and Tamien—are filled almost to capacity during the typical weekday; all others are heavily underused.

Table 2-13. Park-and-Ride Lots in the SR 87 Corridor

Park-and-Ride Lot Name	Total Capacity	Weekday Occupancy	% Occupancy	Breakdown		Pick-up Drop-off	Bicycle Lockers	Bicycle Racks	Transit Served
Almaden Light Rail Station	189	26	13.8%	Standard	138	7	10	0	13, 64, Light Rail
				Airport Parking	26				
				Compact	29				
				Motorcycle	0				
				Handicap	8				
				Handicap (Van)	0				
Blossom Hill Light Rail Station	511	208	40.7%	Standard	385	17	8	7	27, Light Rail
				Airport Parking	28				
				Compact	116				
				Motorcycle	0				
				Handicap	6				
				Handicap (Van)	4				
Braham Light Rail Station	271	48	17.7%	Standard	167	No	12	14	Light Rail
				Airport Parking	26				
				Compact	96				
				Motorcycle	8				
				Handicap	4				
				Handicap (Van)	4				

Park-and-Ride Lot Name	Total Capacity	Weekday Occupancy	% Occupancy	Breakdown		Pick-up Drop-off	Bicycle Lockers	Bicycle Racks	Transit Served
Capitol Light Rail Station	951	82	8.6%	Standard	928	13	12	7	37, 70, Light Rail
				Airport Parking	18				
				Compact	0				
				Motorcycle	0				
				Handicap	10				
				Handicap (Van)	0				
Curtner Light Rail Station	474	57	12.0%	Standard	420	No	12	0	26, Light Rail
				Airport Parking	24				
				Compact	54				
				Motorcycle	10				
				Handicap	7				
				Handicap (Van)	0				
Ohlone/ Chynoweth Light Rail Station	549	522	95.1%	Standard	531	4	22	24	13, 102, Light Rail
				Airport Parking	20				
				Compact	0				
				Motorcycle	21				
				Handicap	18				
				Handicap (Van)	0				
San Jose / Diridon Caltrain Station	581	539	92.8%	Standard	529	No	24	0	22, 63, 64, 65, 68, 168, 180, 181, 522, ACE, Caltrain, Amtrak, Light Rail
				Airport Parking	0				
				Compact	38				
				Motorcycle	0				
				Handicap	12				
				Handicap (Van)	2				
Tamien Rail Station	275	251	91.3%	Standard	262	3	18	1	25, 82, Caltrain, Light Rail
				Airport Parking	21				
				Compact	0				
				Motorcycle	16				
				Handicap	8				
				Handicap (Van)	2				

Figure 2-32. Park-and-Ride Lot Locations Along SR 87



Park-and-Ride Lot Name	Total Capacity
Almaden Light Rail Station	189
Blossom Hill Light Rail Station	511
Branham Light Rail Station	271
Capitol Light Rail Station	951
Curtner Light Rail Station	474
Ohlone/Chynoweth Light Rail Station	549
San Jose/Diridon Caltrain Station	581
Tamien Rail Station	275

2.4 All Modes Travel Time & Speed Comparison

In May 2017, VTA staff conducted vehicle travel runs along SR 87 for GP lanes and HOV lanes and compared travel times for various modes using the travel times recorded during these runs, average LRT travel times obtained from Swiftly, and an average bicycle travel speed of 10 mph (Table 2-14).

For the travel time comparisons shown in the table, the SR 87 corridor was divided into two sections: SR 85/SR 87 interchange to I-280 (Children's Museum LRT station) and I-280 to the SR 87/US 101 interchange. This was done to account for the disparity in LRT travel speeds between these two sections, i.e., south of the intersection with I-280, LRTs run in the SR 87 median and are separated from the mainline, and north of I-280, LRTs run on city streets at grade, making frequent stops and traversing intersections.

As shown in the table, in the morning northbound direction, a significant amount of travel time can be saved by riding light rail compared with driving in the GP lane. In the evening southbound direction, light rail travel time is comparable to solo driving. However, factors that include inconsistency of weekday traffic and significant slow-downs caused by accidents add to the level of uncertainty in travel time for vehicles. Light rail and bicycles can be considered more consistent and, therefore, more reliable travel modes because they are less affected by day-to-day fluctuating conditions.

Table 2-14. Travel Time and Speed Comparison for Single and Carpool Vehicles, LRT and Bicycle Modes

Segment	Distance (mi)	Available Transit Modes	Bicycle Routes		Average Peak Hour Travel Time (min)				Average Peak Hour Speed (mph)			
85/87 Interchange to I-280	5.2	LRT 900, 901	Narvaez Ave to the trail along SR 87 to Guadalupe Trail		NB		SB		NB		SB	
			(5.8 mi)		AM	PM	AM	PM	AM	PM	AM	PM
		Express buses: 168, 182 (partial route on SR 87)		Vehicle (GP)	17:56	6:22	3:47	10:54	29.5	56.7	55.9	42.9
				Vehicle (HOV)	13:25	Same as GP	3:56	8:21	38.8	Same as GP	65.5	50.5
		Buses: 64, 66, 68, 82		LRT 901	11:12	11:12	11:18	11:10	36.7	37.1	35.9	35.4
		(partial route along SR 87)		Bicycle	33:00:00	33:00:00	33:00:00	33:00:00	10	10	10	10
I-280 to 87/101 Interchange	3.8	LRT 900, 901	Guadalupe River Trail (4.2 mi)		NB		SB		NB		SB	
		(along First St.)			AM	PM	AM	PM	AM	PM	AM	PM
				Vehicle (GP)	11:43	3:57	4:38	9:24	27.5	62.9	55.2	28.2
				Vehicle (HOV)	6:09	Same as GP	4:31	5:56	40.7	Same as GP	63.5	49.3
				LRT 901	19:54	20:54	22:00	22:54	15.8	15.3	14.6	13.9
				Bicycle	23:00	23:00	23:00	23:00	10	10	10	10


87

3
COMMUNITY INPUT

Community input is an essential part of corridor studies. For the SR 87 corridor study, VTA staff conducted an extensive online survey of people living and commuting along the corridor. The survey was designed to gather public input to understand existing commuting issues and behaviors and support levels for potential solutions to reduce solo driving—and in turn address traffic congestion—along SR 87.

Key objectives of the survey were to gain a better understanding of:

- Travel patterns on SR 87
- What motivates people to use alternatives to solo driving
- Support levels for various projects that could address existing traffic congestion

SECTION CONTENTS

3.1 Summary of Key Findings

The survey garnered a high level of response and participation. The following are key findings from this survey:

- There was support for many of the potential improvements proposed for the corridor.
- Survey participants were more favorable towards part-time lane use as a solution for carpool and bus use rather than for use by all types of vehicles.
- Reduced travel times in high occupancy vehicle (HOV) lanes, reliable carpool options and financial incentives would increase carpool use.
- Better first-last mile options would result in greater transit use.
- Well-connected and well-maintained bike lanes would encourage more people to use a bicycle as their commute mode.

3.2 Process

VTA collected survey responses for a month from March 14 to April 15, 2018. VTA community engagement staff led the public outreach to publicize the survey with various interest groups and community members including but not limited to the following:

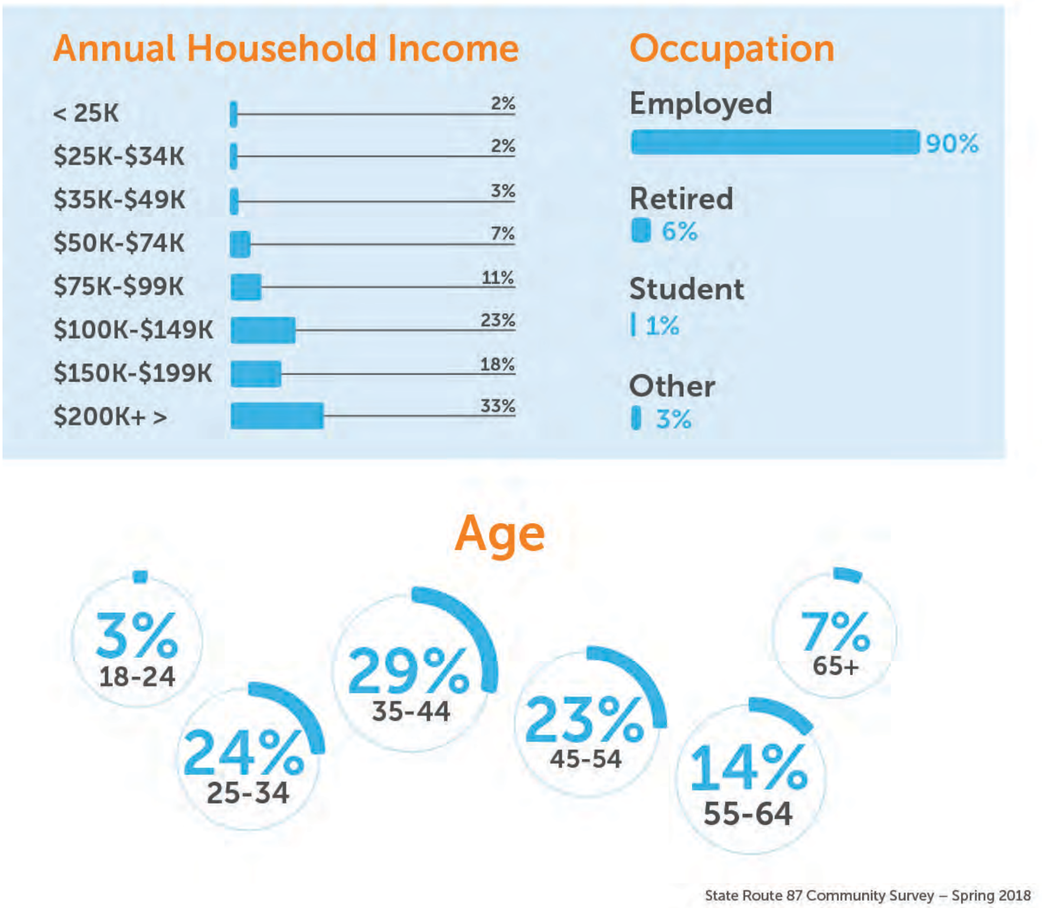
- Nextdoor, Facebook, Twitter, LinkedIn, VTA webpage
- Neighborhood associations
- Schools like Mission College, San Jose State University, and Santa Clara University
- Several companies, including those that participate in VTA SmartPass, and companies that have transportation demand management strategies
- Government organizations and council members
- VTA Board of Directors and committee members
- Various transportation groups
- Study stakeholders – City of San Jose, California Department of Transportation, and Santa Clara County

Participants were asked about their SR 87 travel habits, including the locations where they live and where they work, the time of day they travel, and their common destinations. Because not everyone who commutes along the SR 87 corridor does so by driving, VTA staff made a conscious effort to reach out to people using other modes of travel to commute, such as VTA light rail (e.g., the Santa Teresa–Alum Rock line), carpool, corporate shuttles, biking (e.g., along the Guadalupe River Trail), and walking. Along with information about their commute, survey participants were asked to weigh in on a series of potential ideas for enhancing commuting options along SR 87. In addition, participants were given an opportunity to provide their own ideas or suggestions for addressing traffic congestion and/or improvements to make non-solo driving options more viable. Appendix A has the list of survey questions.

3.3 Participation and Demographics

Over 1600 individuals provided responses to the survey over the one-month period. Over 3,000 individuals viewed the survey. Participants took an average of 8.44 minutes to answer the survey. Figure 3-1 shows the distribution of survey participants' age, work status, and income level.

Figure 3-1. Survey Participant Demographics



3.4 Survey Results

The survey results are grouped into three main categories:

1. Geographical data: Typical origin destination of individual trips
2. Weekday travel patterns
3. Rating of potential corridor improvements

3.4.1 Geographical Data

The survey included origin-destination questions like where you live and “where you work or study. Figure 3-2 illustrates the geographical distribution of the survey participants by where they live. This figure shows that greater numbers of respondents reside in the southern part of SR 87, which is characterized by dense residential neighborhoods. In terms of residential areas, the highest levels of survey responses were received from the Communications Hill, downtown San Jose, and the San Jose Japantown neighborhoods.

Figure 3-3 illustrates the geographical distribution of the survey participants by where they work. This figure shows that greater numbers of job destinations are in the northern part of SR 87. Higher levels of survey responses were received from downtown San Jose and the job-rich golden triangle area between SR 237, US 101, and I-880.

Figure 3-4 illustrates the geographic distribution of survey responses associated with the companies respondents work for. The top ten companies associated with the most responses are listed in Table 3-1.

Table 3-1. Geographic Distribution of Survey Respondents

Number of Respondents	Company Name
30	Santa Clara Valley Transportation Authority
24	Event Center
22	eBay Building 10/11
20	San Jose City Hall
19	Alphabet Inc./Google Inc.
18	The Tech Museum of Innovation
18	Airport Place Metro Plaza
12	San Jose McEnery Convention Center
12	NVIDIA Building B
11	Adobe World Headquarters

Figure 3-2. Home Location Density – All Modes

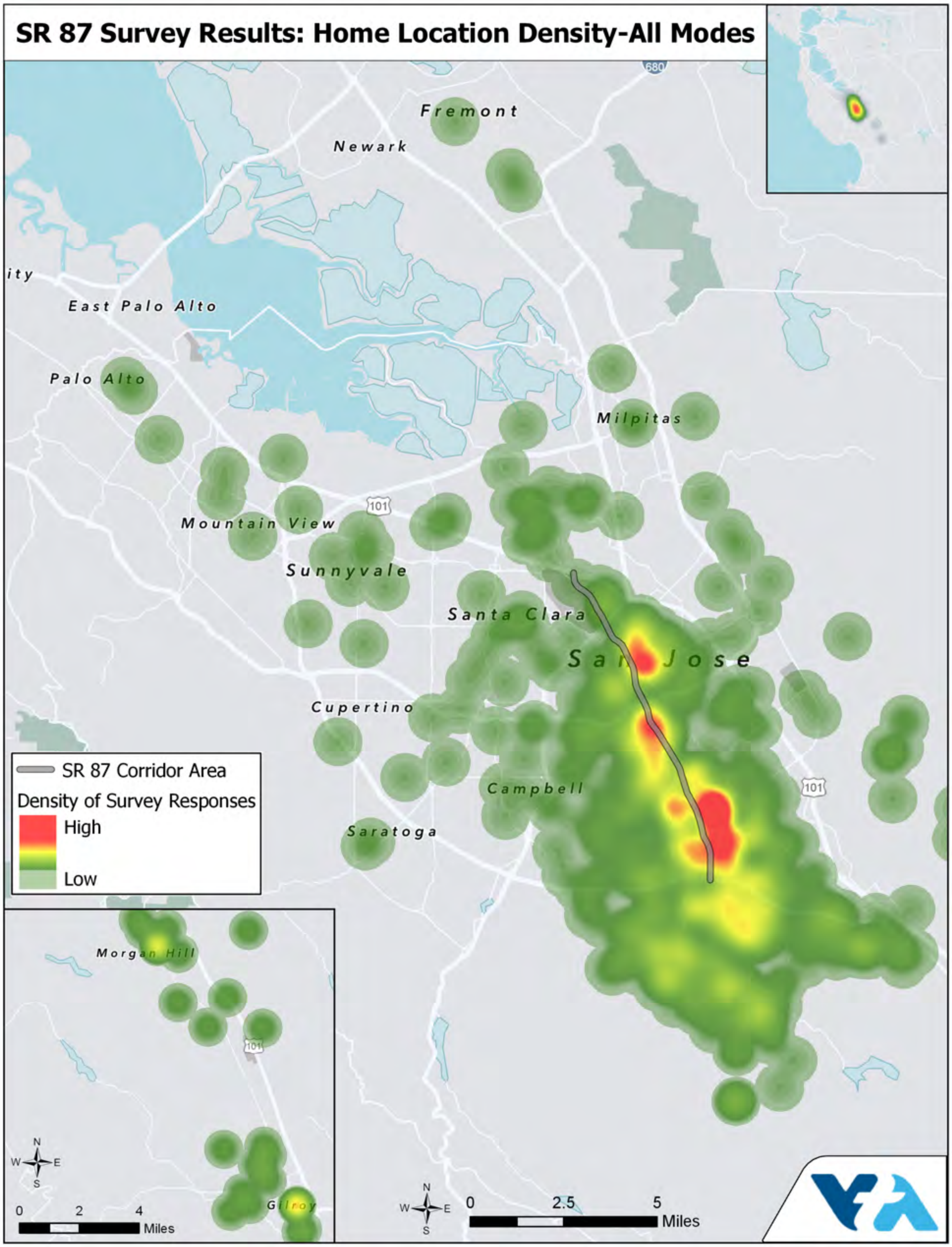


Figure 3-3. Work Location Density – All Modes

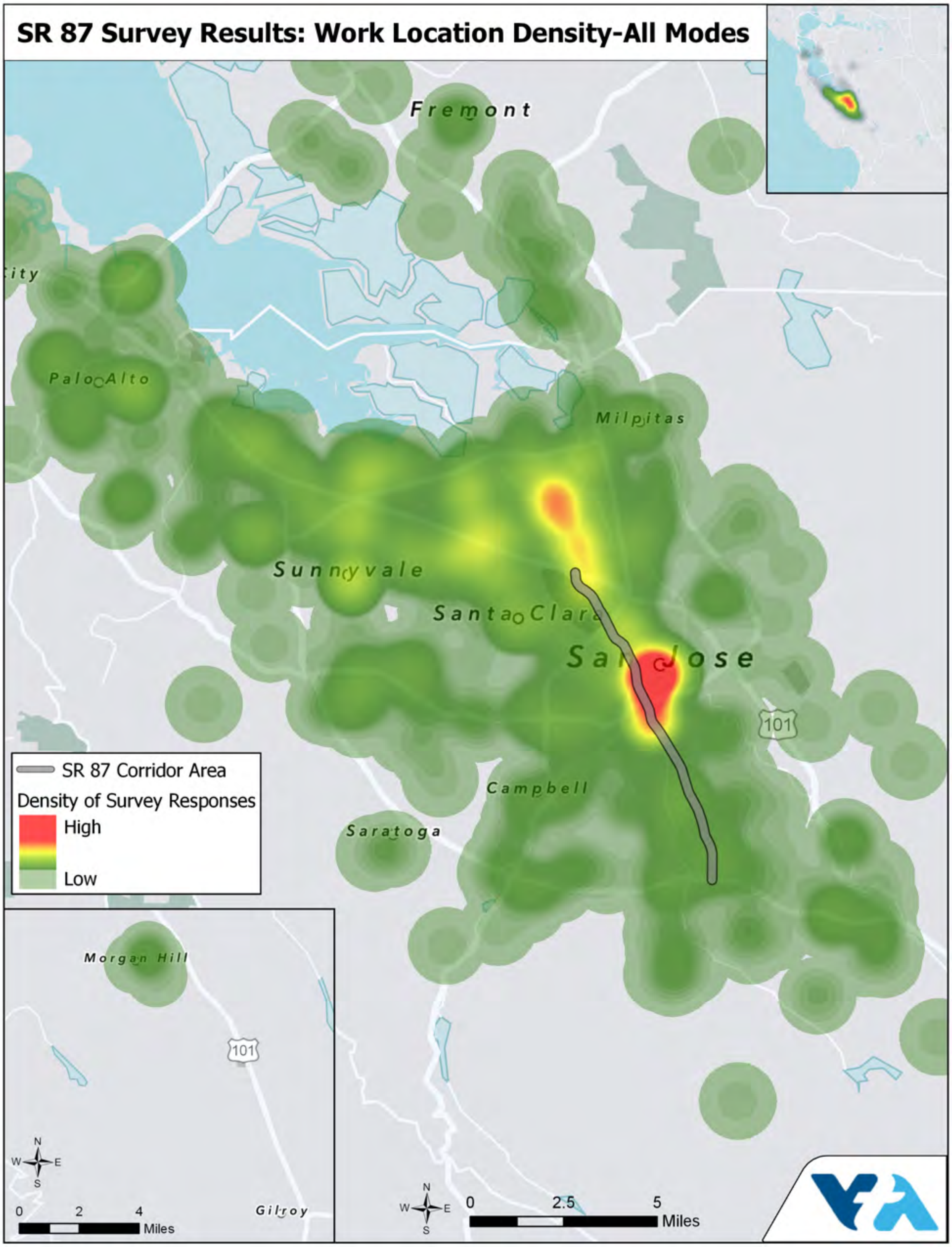
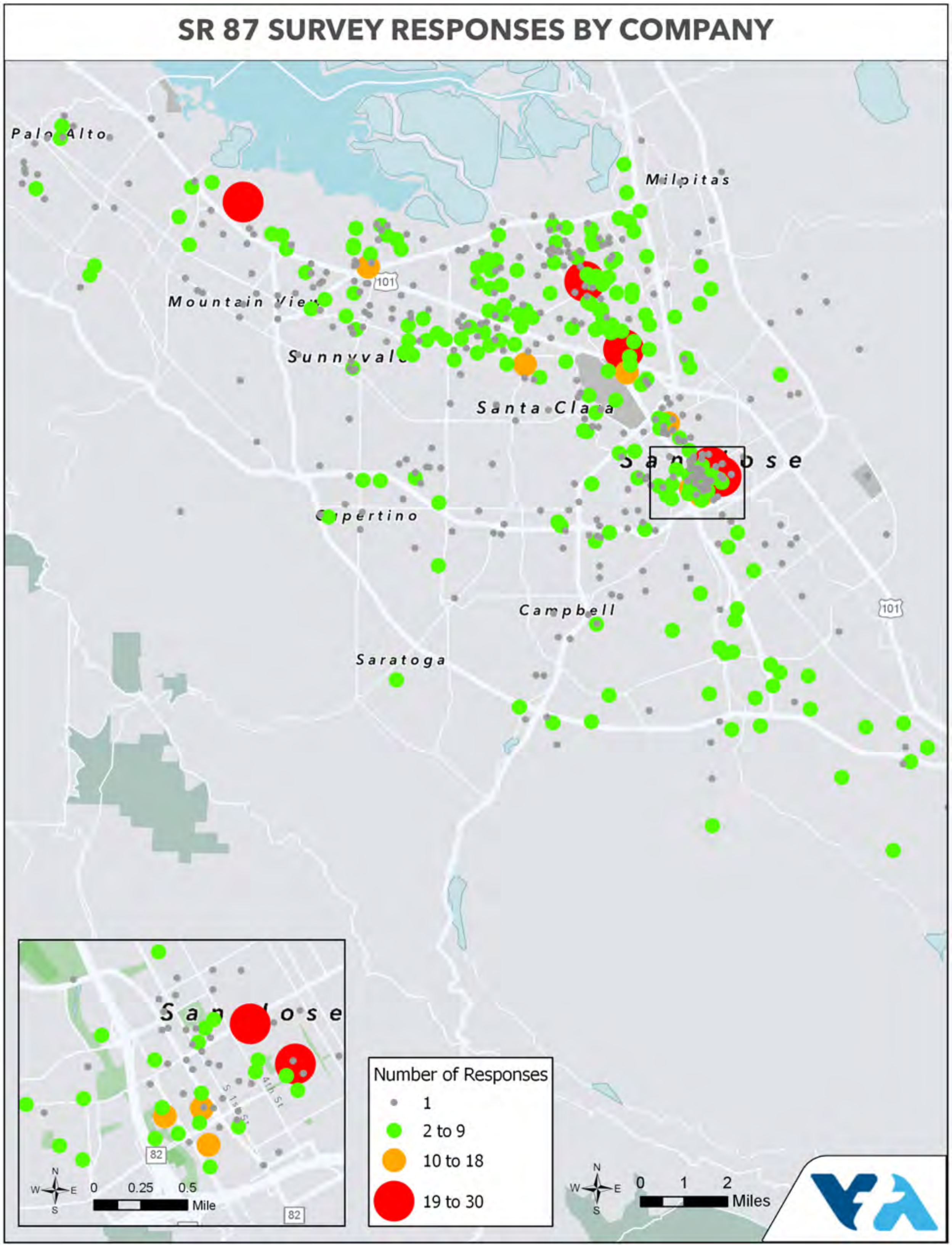


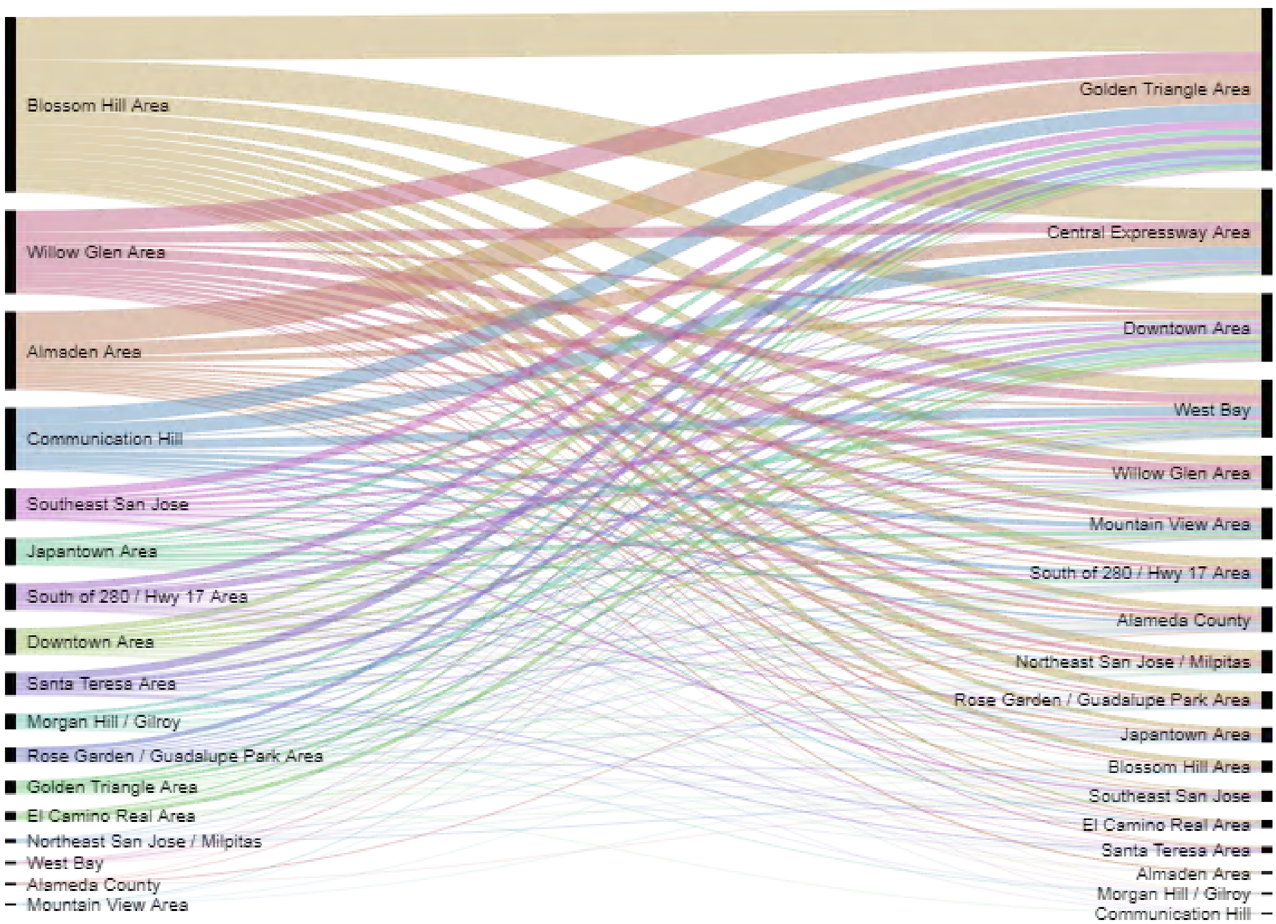
Figure 3-4. Survey Responses by Company



Figures 3-5 to Figure 3-8 are alluvial diagrams that show the flow between the origin destinations of the survey respondents based on neighborhood zones shown in Figure 3-9. Trip origins are listed on the left, and trip destinations are listed on the right. Thicker lines indicate larger volumes of trips. Thinner lines indicate smaller volumes of trips. These diagrams provide insights into the level of demand for each zone.

Figure 3-5 illustrates that high volume of trips are originating in the Blossom Hill neighborhood near SR 87/ SR 87 interchange, which is a highly residential area. The figure shows a high volume of trips to the golden triangle area, which is a large employment zone.

Figure 3-5. Home (Origin - Left) to Work (Destination - Right) Based Trips



Figures 3-6 shows the volume of trips originating from the Communications Hill area.

Figure 3-6. Communications Hill as Origin (left)

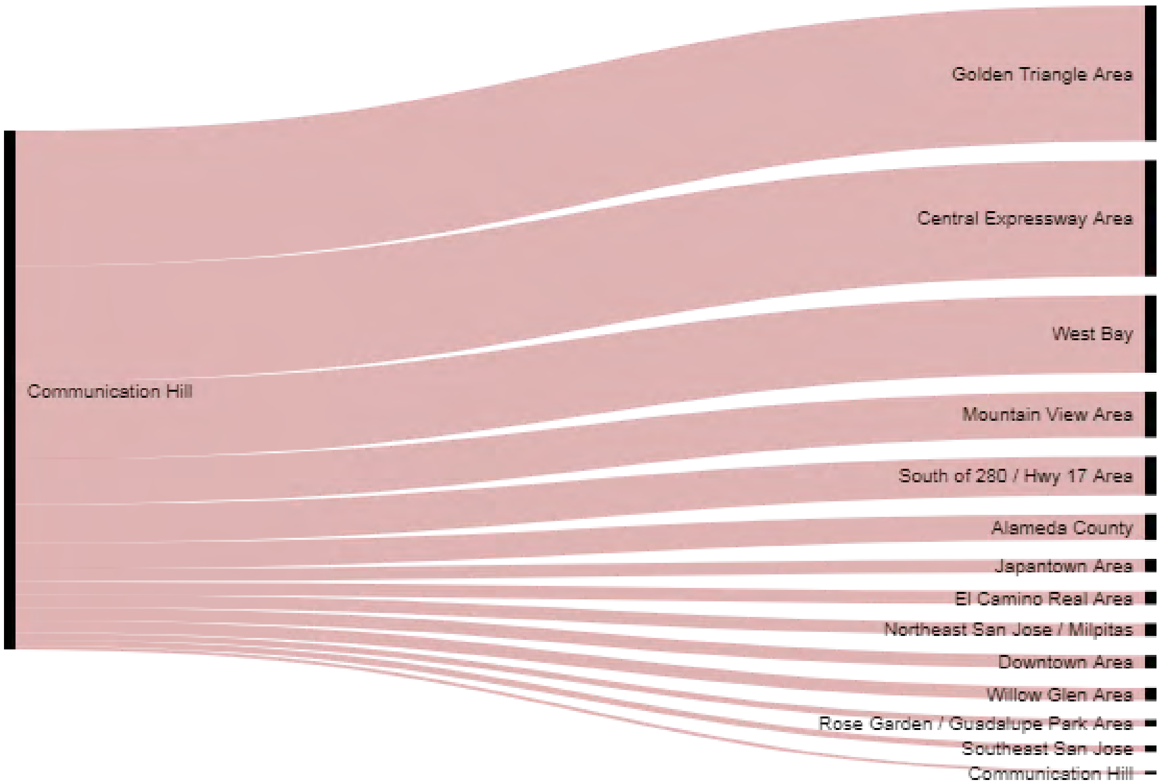


Figure 3-7 shows trips originating from various neighborhoods into downtown San Jose. Figure 3-8 shows the trip volumes ending in the golden triangle area (between US 101, I-880, and SR 237).

Figure 3-7. Downtown San Jose as the Destination (Right)

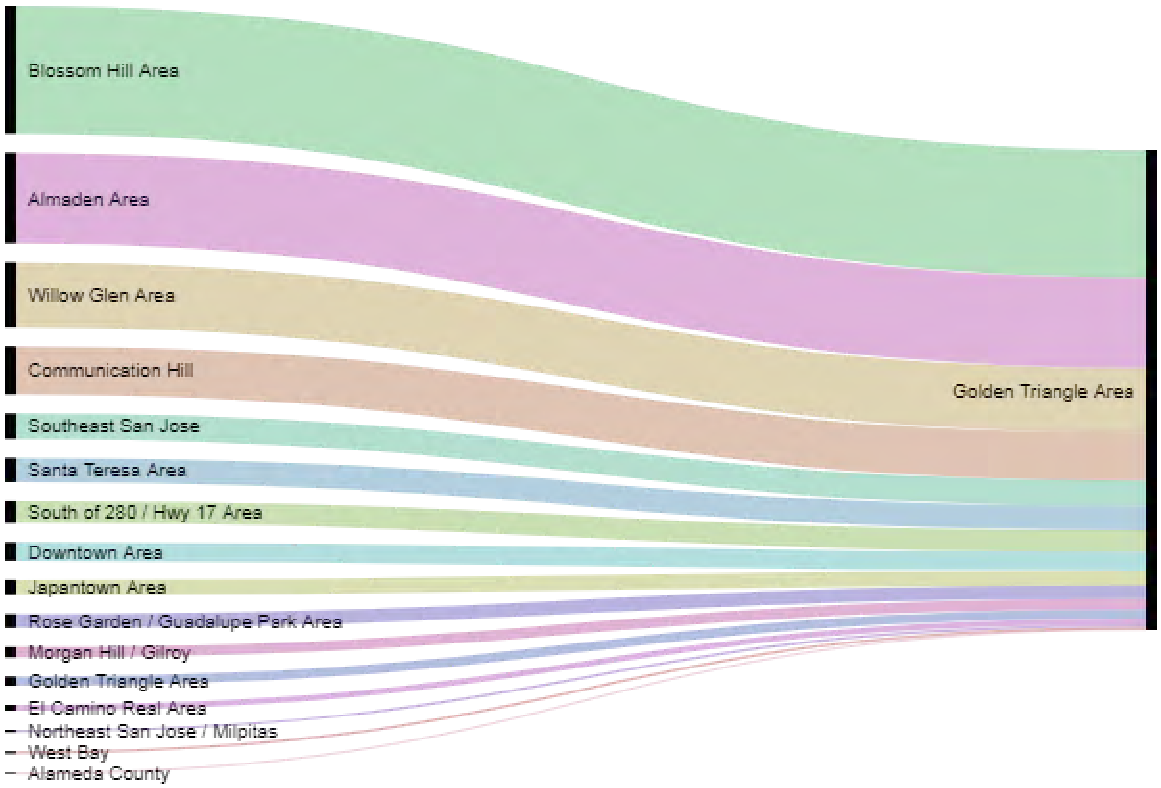


Figure 3-8. Golden Triangle Area as the Destination (Right)

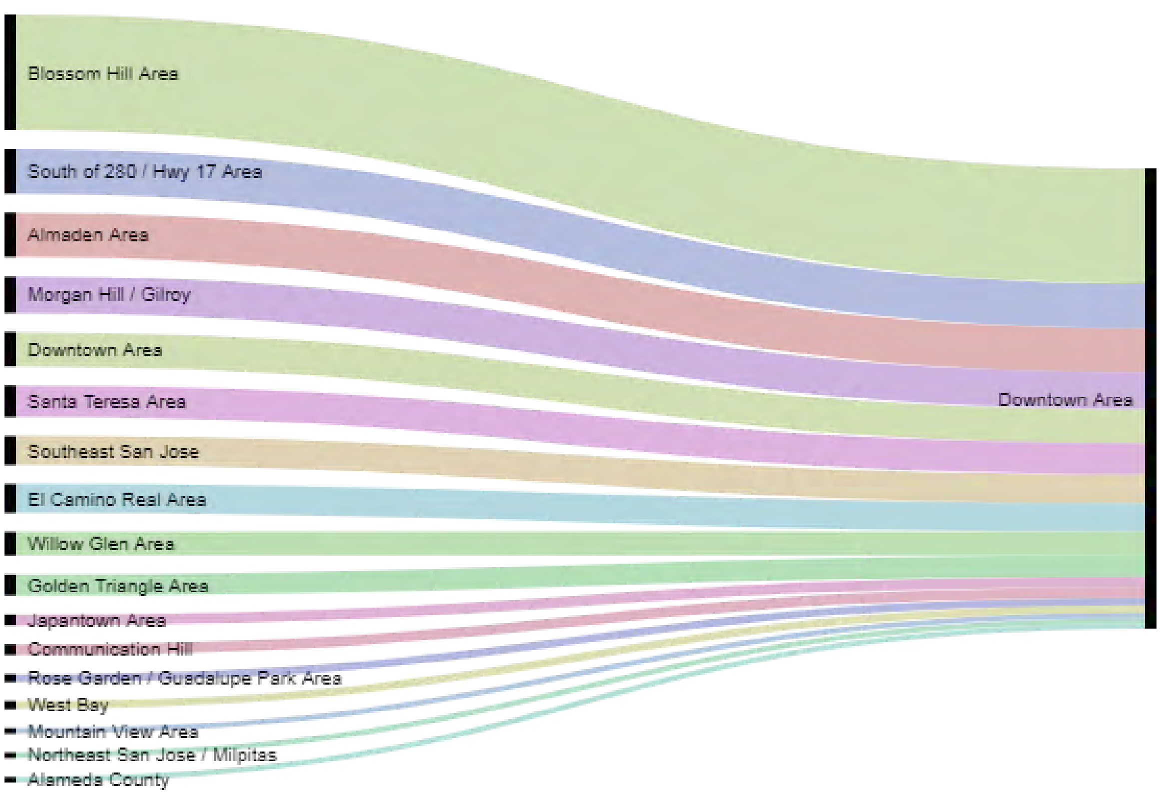
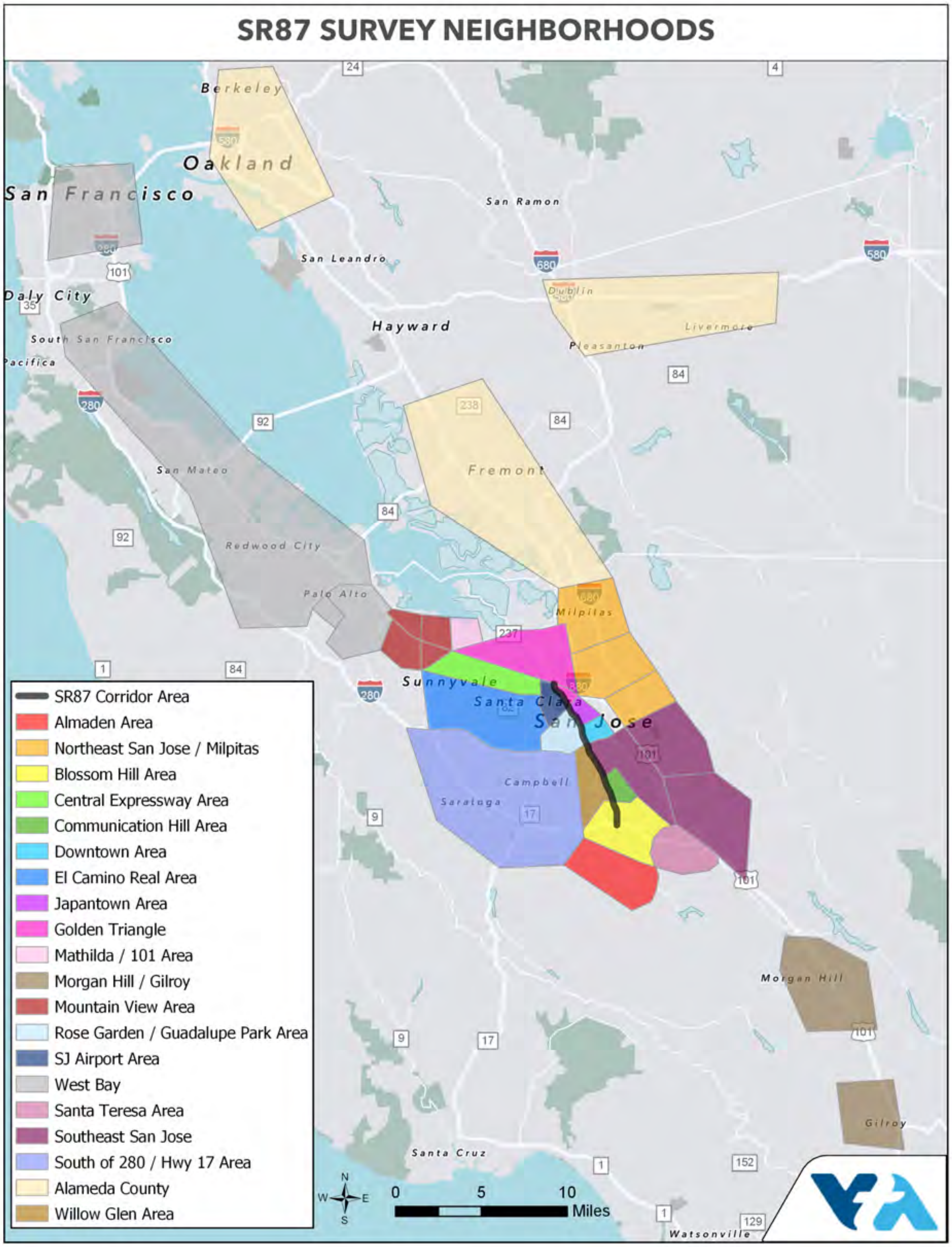


Figure 3-9 shows the various neighborhood zones represented in the alluvial diagrams.

Figure 3-9. Neighborhood Zones for Origin Destination Alluvial Diagrams

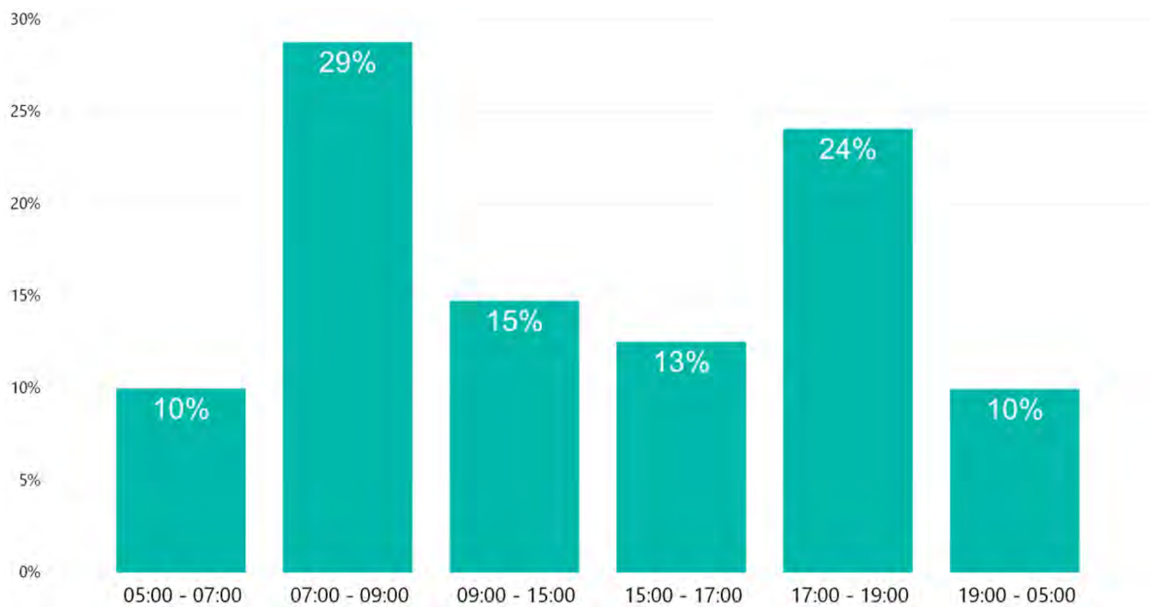


3.4.2 Weekday Travel Patterns

Participants provided their typical hour of travel, primary commute mode, and other modes used. If their commuting mode was using an automobile or solo driving, then the follow-up questions in this category asked how they could be motivated to try other modes of transportation.

Figure 3-10 shows a typical weekday travel pattern based on survey responses. The highest number of respondents commute during the usual morning northbound and evening southbound commute hours.

Figure 3-10. Weekday Travel Patterns on SR 87



Driving

Most of the survey respondents commute by car alone. This group made up 76% of all respondents, as shown in Figure 3-11. The next largest group of respondents, 15%, are carpooling, followed by light rail transit commuters at 4%.

A follow-up question for solo drivers asked what would motivate them to carpool or to try other modes of transportation. As shown in Figure 3-12, about 33% would carpool if they were to save time traveling, which means that improvements such as part-time lane use to accommodate carpoolers could benefit traffic on SR 87. About 36% (16% + 10% + 10%) of respondents would carpool if they could find a carpool match. Promoting and creating more awareness of easy-to-use ride share opportunities and incentives for employees to carpool could motivate more carpooling (and result in fewer solo drivers) on the route.

Figure 3-11. Most Common Modes of Transportation Used Along SR 87

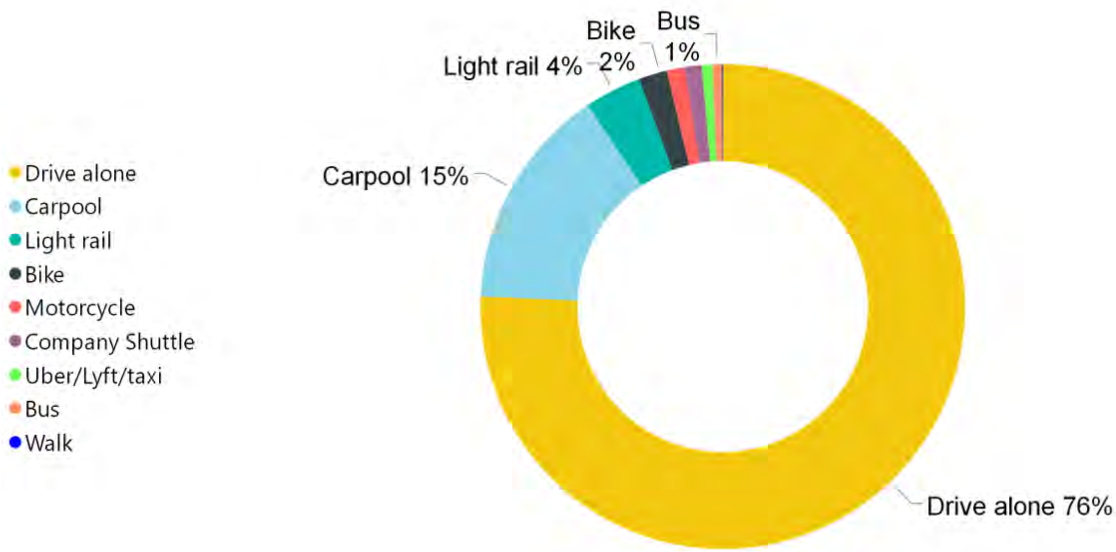
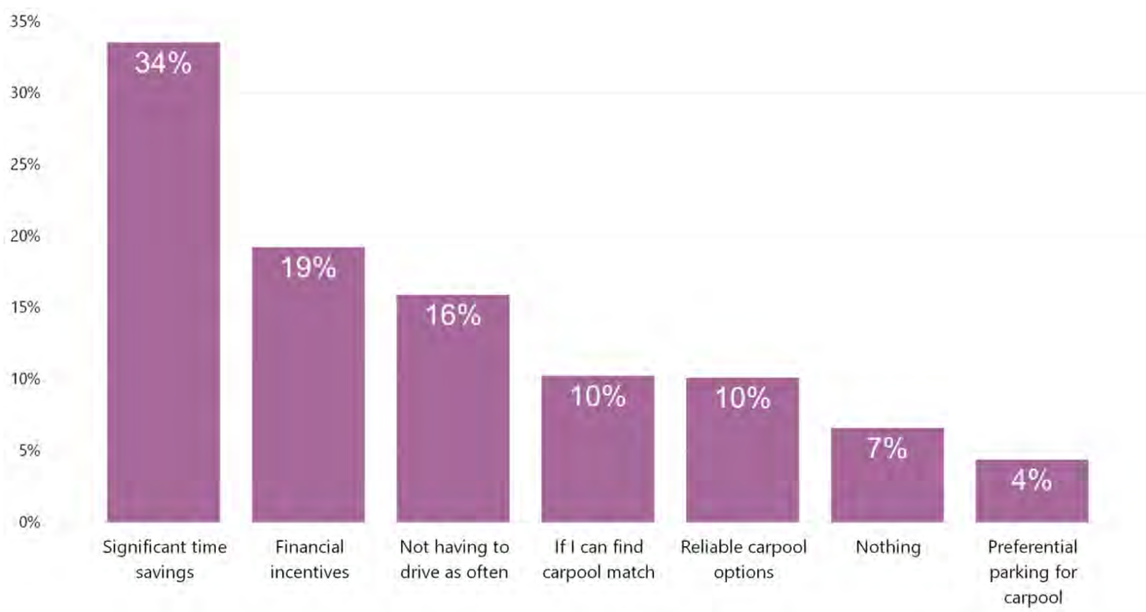
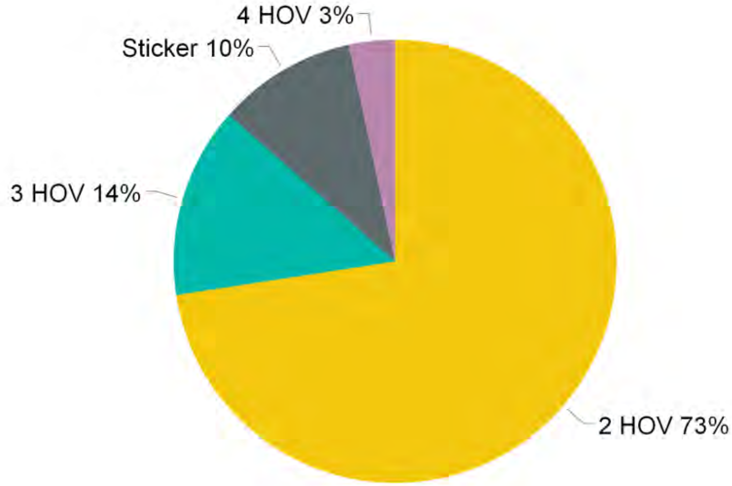


Figure 3-12. Motivating Factors Influencing Solo Drivers to Carpool



As Figure 3-13 shows, the majority of HOV users (about 73%) had two people in the car including the driver. Only 10% of HOV users have eligible carpool stickers and were driving solo in the HOV lane. About 18 (1.13%) respondents said they commute via company shuttle. These respondents said that if there were no shuttle option, their preference would be to drive alone. This would seem to indicate that shuttles alone or in conjunction with other commute options such as public transit help reduce solo driving.

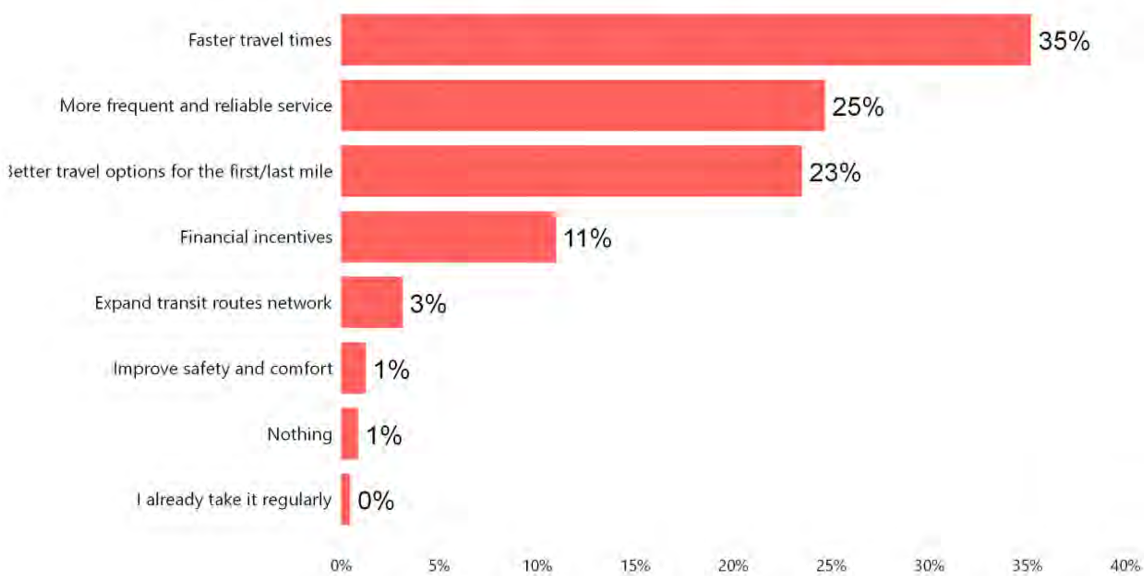
Figure 3-13. Number of People per Vehicle Among HOVs



Transit

Based on the survey results, about 4% of respondents take light rail transit and less than 1% take public buses. This is comparable to the average transit use levels in Santa Clara County, based on Metropolitan Transportation Commission's Vital Signs 2016. Figure 3-14 illustrates what would motivate respondents along SR 87 to use transit more often.

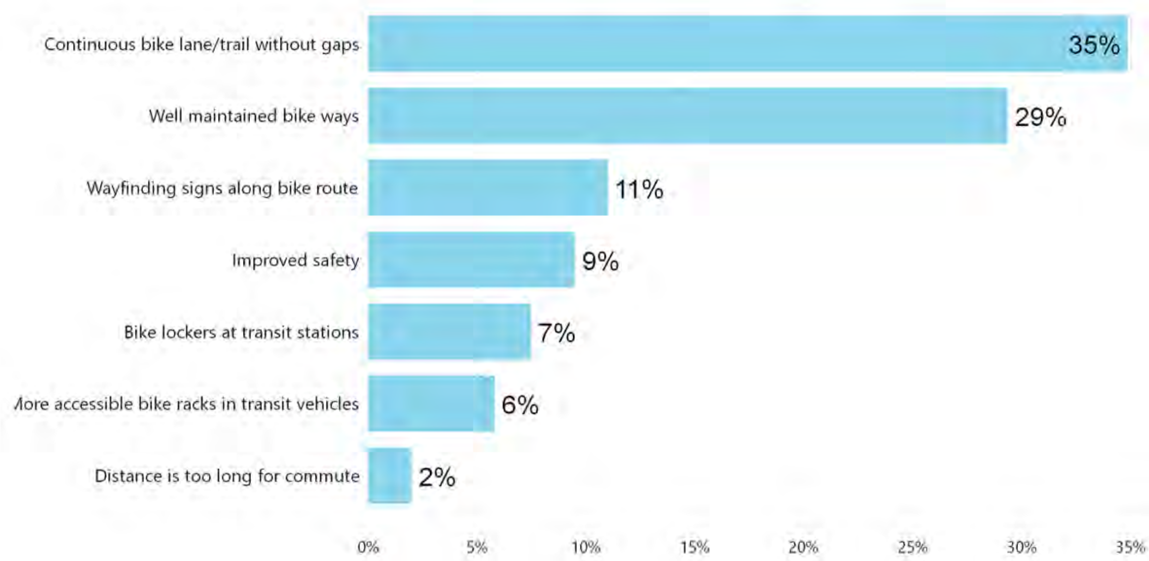
Figure 3-14. Motivating Factors Influencing Respondents to Ride Transit



Biking

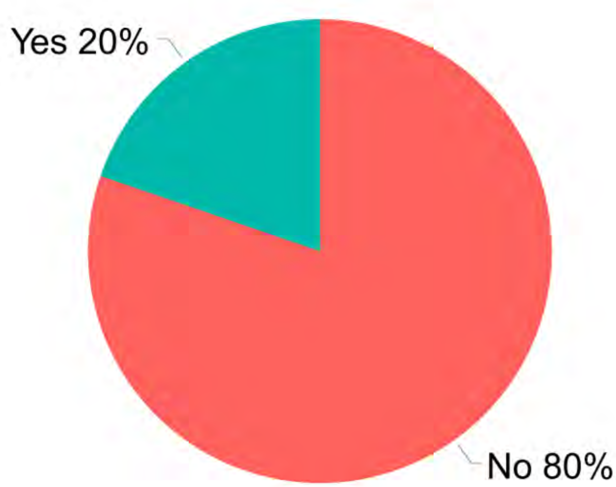
Only about 2% of respondents use a bicycle as a mode of transportation. Among those who are not biking along the corridor, when asked what would motivate them to bike to work, a majority of respondents felt that well-connected and well-maintained bike lanes would encourage more people to use a bicycle as their commute mode (Figure 3-15).

Figure 3-15. Factors Influencing Respondents to Bicycle More Regularly



The survey asked respondents if they have tried biking along the SR 87 Bikeway, which is parallel to SR 87. About 85% (1,460 respondents) have not tried it, as shown in Figure 3-16. Increasing awareness of existing trails may bring more bicyclists to the corridor.

Figure 3-16. Percentage of Respondents Who Have Biked Along the SR 87 Bikeway



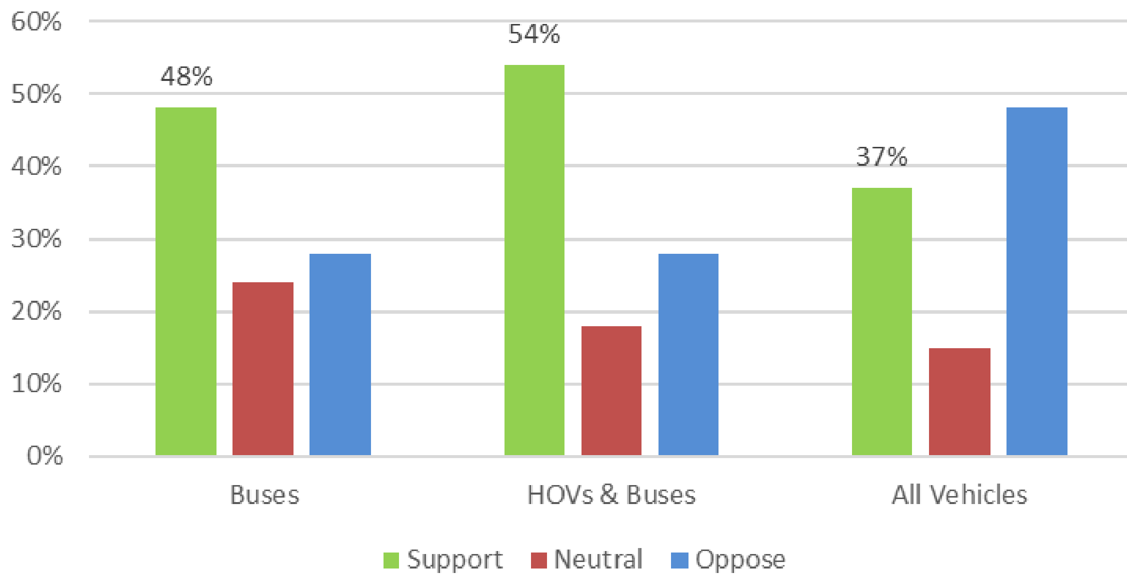
3.4.3 Public Support for Potential Projects

Survey participants were presented with a series of potential improvement projects and asked whether they would support each initiative. There was general support for most potential projects.

Part-Time Lane Use

As illustrated in Figure 3-17, the highest level of support for part-time use of the freeway shoulder for traffic is for HOVs and buses, with the lowest level of support to use the shoulder for all vehicles. The survey explained to respondents that part-time lanes may eliminate the use of the shoulders for emergency parking purposes when they are used for traffic purposes.

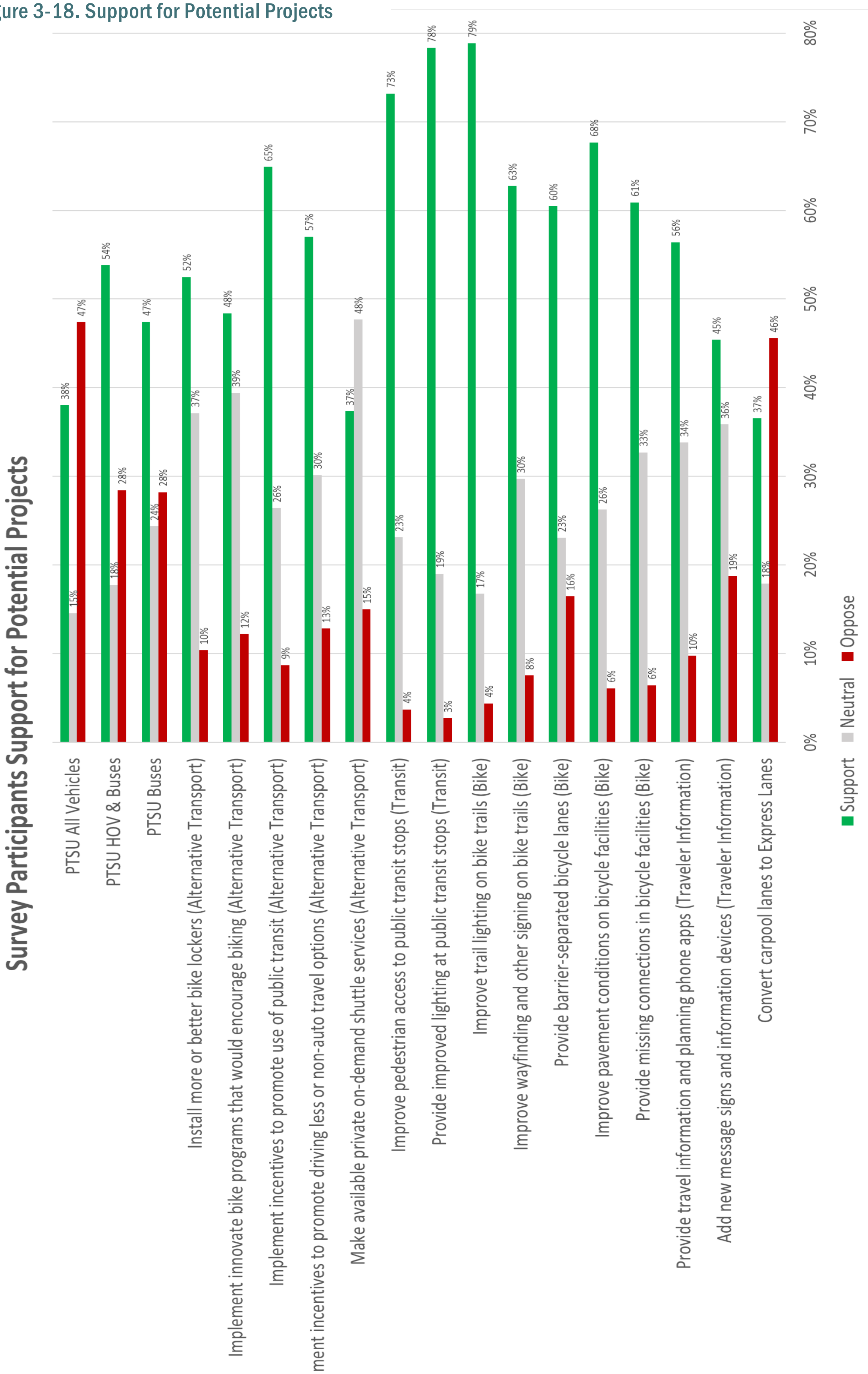
Figure 3-17. Support for Part-Time Lane Use



Other Proposed Improvements

As shown in Figure 3-18, there was general support for most of the proposed types of improvements. Even though the percentages of respondents describing themselves as transit or bike commuters are low, there was strong support for improving transit and bike facilities to make these commute options more viable. Part-time lanes for all vehicles and converting carpool lanes on SR 87 into express lanes did not garner much support.

Figure 3-18. Support for Potential Projects



3.4.4 Ideas & Suggestions

In addition to rating potential improvements, participants were asked to provide their own ideas or suggestions for improving congestion along SR 87. Listed below are some common issues and ideas shared by the participants. Figure 3-19 shows commonly mentioned words used to describe how to improve the SR 87 corridor.

Freeways

- Improve system interchange connections – southbound US 101 to southbound SR 87; I-280/SR 87 connections
- High violation rate in carpool lanes – more enforcement is required
- Change HOV lanes to Express Lanes
- Make the shoulder an HOV3+ lane
- Improve access from Narvaez to SR 87
- Improve and extend ramp metering

Transit

- Faster transit services
- Create transit hubs for LRT, Caltrain, etc.; connect hubs with express trains; high speed bus routes between hubs
- Provide safer ways to reach train stations
- Provide LRT that bypasses downtown to north San Jose
- Provide a real-time map for buses & trains
- Provide transit connection to Mineta San Jose International Airport

Bicycle & Pedestrian Routes

- Provide fully connected and protected bike lanes
- Improve bike lanes along SR 87
- Enhance safety by moving out homeless encampments along the bike trail
- Address bikeway underpasses that flood after rains
- Add more lighting along route

Other Ideas

- More telecommute support
- Educate to encourage ride share
- On-demand shuttle services

Figure 3-19. Words Commonly used by Respondents to the Community Survey

4

FUTURE CHANGES IN THE CORRIDOR

Over the next 30 years, Santa Clara County will grow by roughly 637,000 residents and 303,500 jobs—increases of 31 percent and 43 percent, respectively.[1] Changes in land use for both employment and residential developments, policies on land use, and new technologies such as map applications for traffic info (Waze), ride sharing apps (Uber, Lyft), and self-driving vehicles are changing and will continue to change travel behavior and traffic in the corridor.

SECTION CONTENTS

- Land Use
- Transit
- Transportation Technology

4.1 Land Use

Many of the employment and residential development projections for San Jose show considerable development along SR 87 due mainly to its connectivity to the Mineta San Jose International Airport, its proximity to downtown, and the availability of transit along the corridor. Figure 4-1 shows significant development along the SR 87 corridor.

New developments could result in an increase in traffic volumes between US 101 and the I-280/SR 87 interchange. However, as shown in the map in Figure 4-2, a model in which employment and residential centers are located close to each other near SR 87 would result in fewer vehicles on the road during peak commute hours and, consequently, reduced green-house gas emissions, while increasing the use of transit and other modes of travel, as long as improvements are made to connect the new developments to multimodal facilities.

1 Valley Transportation Plan (VTP) 2040

Figure 4-1. Land Use Changes in San Jose

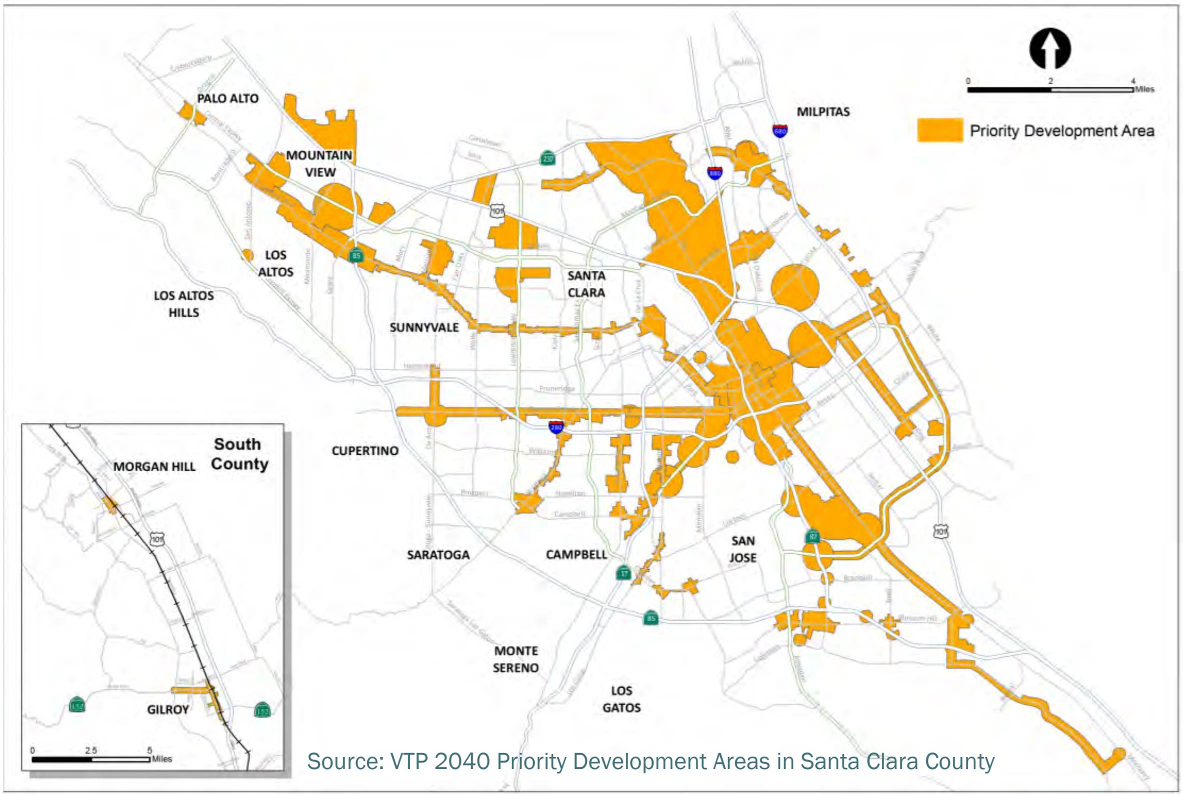


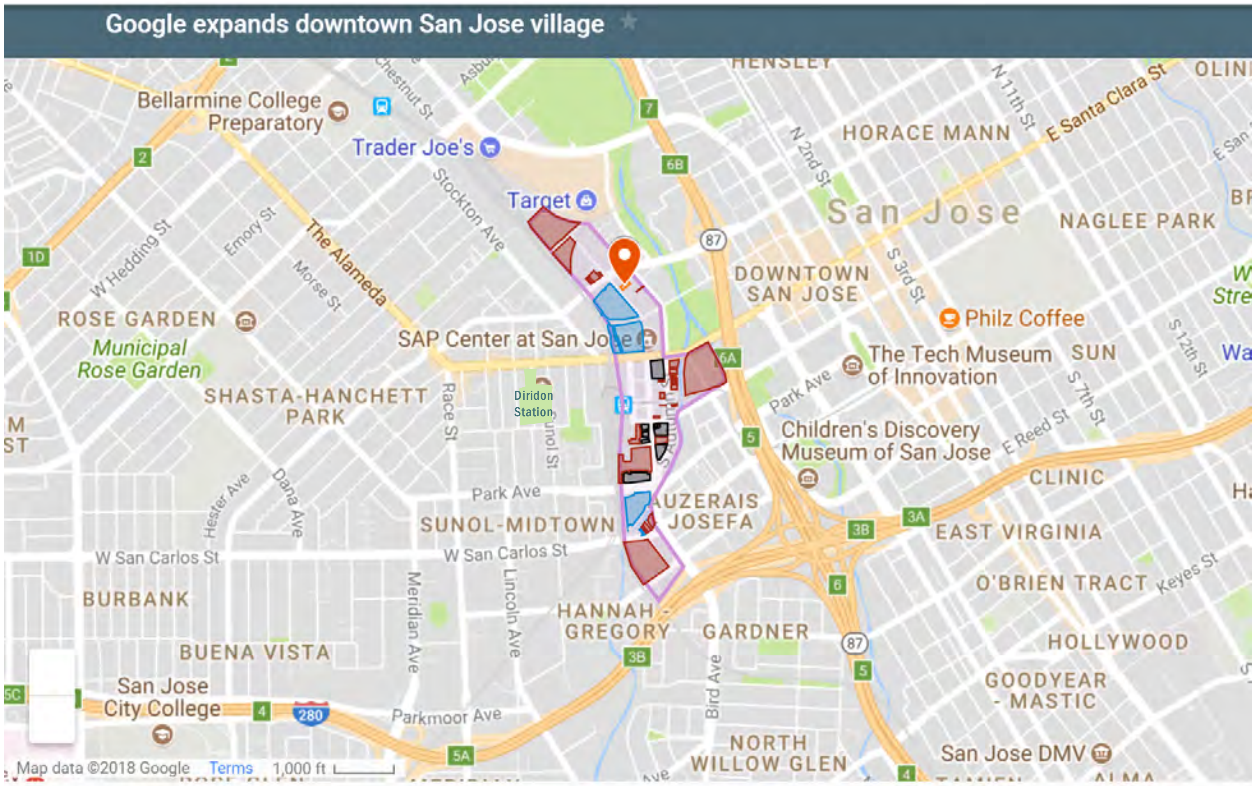
Figure 4-2. Residential & Employment Center Locations for Intensified Growth

Source: VTP 2040

GOOGLE TRANSIT VILLAGE

Google transit village is a major development being planned near the SR 87 north corridor. It is being proposed as an integrated mixed-use community of offices, residences, retail, restaurants, open spaces, and amenities, totaling 6 million to 8 million square feet near the existing Diridon Station and the SAP Center. An estimated 15,000 to 20,000 of Google's workers could be employed in offices in the development. Figure 4-3 shows the proposed area and its proximity to SR 87.

Figure 4-3. Google Transit Village in Downtown San Jose



Source: San Jose Mercury News, April 18, 2018

Other developments and employment growth among major employers like Apple and Adobe in the vicinity could increase congestion on SR 87 unless the development plans ensure transit, bicycle, and pedestrian access as a main path to work.[2]

2 Apple has been acquiring land in north San Jose, and the City of San Jose has granted Apple development rights for up to 4.1 million square feet of office space over the next 15 years, which could accommodate up to 20,000 people. (The Registry: https://news.theregistrysf.com/apple-takes-16-35-additional-acres-in-san-jose/)
Adobe Systems is building a new 18-story office tower in San Jose, which will expand its downtown headquarters and have room for 3,000 additional employees. (San Jose Business Journal: https://www.bizjournals.com/sanjose/news/2018/08/16/adobe-new-san-jose-downtown-office-tower-adbe.html)

4.2 Transit

Several major transit projects are being considered close to the SR 87 corridor; these include Diridon Station redevelopment, BART Phase II, and California High-Speed Rail. In general, the transit changes are expected to trigger mixed-use development that reduces the need for increasing capacity on SR 87 to address population and employment growth in surrounding areas.

4.2.1 Diridon Station Redevelopment

Currently, Diridon Station connects regional rail services (Altamont Corridor Express (ACE), Amtrak Capitol Corridor, and Amtrak Coast Starlight), VTA light rail and buses, Greyhound interstate bus service, and Union Pacific Railroad.

A major renovation of the station is expected to be completed around 2027. The new station plan includes modernizing the station as a central hub and grand destination as a gateway to Northern California, with expanding connectivity to BART, future high-speed rail, and regional rail. The overall station area plan encompasses approximately 250 acres in downtown San Jose west of SR 87, roughly bordered by the Guadalupe River and Delmas Avenue to the east, Interstate 280 to the south, Sunol Avenue and the Caltrain railroad right-of-way to the west, and Lenzen Avenue and the Union Pacific railroad right-of-way to the north. This development includes high dense office/light industrial, retail/mixed use, residential and hotel. Transit investments at Diridon include Caltrain electrification, VTA's BART Phase II extension, and implementation of the ACE forward and Capitol Corridor Vision long-range plans.[3]

4.2.2 BART Silicon Valley Phase II

VTA's BART Silicon Valley Phase II is a six-mile, four-station extension that will expand BART operations from Berryessa/North San Jose through downtown San Jose to the city of Santa Clara. BART Phase II will include three underground stations: Alum Rock/28th Street, Downtown San Jose, and Diridon, and one at-grade station: Santa Clara. Figure 4-4 shows the alignments of the recently completed Phase I extension and the future Phase II extension. VTA is currently considering west and north options for the Downtown San Jose BART and Diridon stations, as described below.

Downtown San Jose Station – West Option

The west option for the station would be located between Market and Third Streets in downtown San Jose. The Downtown San Jose Station would consist of below-ground concourse and boarding platform levels. Bicycle facilities at the station would include storage; exact amenities, however, will be determined through access planning as part of the Diridon Integrated Station Concept Plan.

3 Capital Corridor Vision Plan: https://www.capitolcorridor.org/vision-plan/
ACEforward: https://www.acerail.com/About/Public-Projects/ACEforward

Figure 4-4. BART Silicon Valley Phases I and II Alignments & Stations

Diridon Station – North Option

The north option would be located adjacent to the south side of West Santa Clara Street, between Autumn Street and the existing Diridon Station. This station would consist of below-ground concourse and boarding platform levels. Pedestrians will access the Diridon Caltrain and light rail stations and Autumn Street via a street-level sidewalk and possibly a safe/protected walkway. This station would also include bicycle facilities.

Depending upon the availability of funding for the project, initial revenue service on the BART Phase II extension is targeted to begin in 2026.

4.2.3 California High-Speed Rail

The California High-Speed Rail system will connect eight of the ten largest cities in California, including San Jose and San Francisco to the rest of the state. The San Francisco to San Jose Project Section is part of the first phase of the system, which is currently under construction in the Central Valley.

High-speed rail is planning to stop at the Diridon Station. The City of San Jose and the VTA will work together to develop a station area plan that will serve San Jose, Santa Clara County, and surrounding areas. This joint effort will guide the design of the high-speed rail station to help the city promote economic development, encourage station area development, and enhance connectivity to other modes of transportation. According to the California High-Speed Rail Authority's Draft 2018 Business Plan, service through San Jose is scheduled to begin in 2029.

4.3 Transportation Technology

Advances in intelligent transportation systems will be seen in automation, connected vehicles, data analytics, security, and interoperability. Rapid innovations in technology related to traffic and transportation will present interesting and perhaps unforeseen opportunities and challenges for the SR 87 corridor.

4.3.1 Map and Traffic Apps

The ubiquitous use of map and traffic apps like Waze, Google Maps, and Apple Maps and their ability to provide alternate faster routes to drivers to avoid congestion has had an adverse effect on traffic on the local roads surrounding SR 87. In a University of California at Berkeley study published as part of an IEEE conference on intelligent transportation systems,[4] the authors showed through simulations the negative impact on traffic of high levels of automatic rerouting. For example, when an incident causing congestion on a freeway happens, automatic rerouting to local side streets that are not designed to handle heavy traffic results in worse congestion. According to a 2015 Pew Survey,[5] 90 percent of Americans with smartphones use apps for driving directions.

4.3.2 Ridesharing Apps

Ridesharing apps like Uber and Lyft work by connecting nearby drivers with passengers looking for rides. Initially, it was assumed that passengers using this service would have otherwise used taxis, rental cars, or their own vehicles, thereby cutting traffic and reducing emissions. Some cities even mandated that rideshare vehicles be low emissions vehicles. However, some studies, like the study by Boston's Northeastern University,[6] have shown that, contrary to initial assumptions, transportation network companies cause more traffic congestion by taking ridership from transit and alternate modes of transportation, such as biking. Because of convenience, more people rely on these services rather than transit. Through appropriate policy changes and public-private

[4] Negative externalities of GPS-enabled routing applications: A game theoretical approach. 2016 IEEE 19th International Conference on Intelligent Transportation Systems: https://ieeexplore.ieee.org/document/7795614/?reload=true

[5] Americans increasingly use smartphones for more than voice calls, texting. 2015 Pew Research Center: http://www.pewresearch.org/fact-tank/2016/01/29/us-smartphone-use/

[6] https://www.citylab.com/transportation/2018/01/to-measure-the-uber-effect-cities-get-creative/550295/

partnerships with transportation network companies to provide first-last mile options and carpooling, ride sharing apps can become useful tools in the SR 87 corridor transportation planning.

4.3.3 Autonomous Vehicles

Technological advances in sensors, control systems, artificial intelligence, and data analytics are making autonomous vehicles a reality. Apart from the expected impact on transportation, there are effects on traffic, which will require changes in how intelligent transportation systems are designed around autonomous vehicles. For example, a study by a team of researchers from multiple universities demonstrated that the presence of a few autonomous cars in traffic dominated by human drivers can help dissipate the stop-and-go waves that cause congestion because of human reactions to events like sudden lane changes and braking. [7] Today, many newer cars have elements of autonomous control, and as this technology progresses, we will begin seeing the development of vehicle-to-vehicle communications systems and vehicle-to-infrastructure communication systems. Future technology infrastructure along SR 87 should be designed to accommodate advances in technology that help maximize full use of the freeway capacity and streamline traffic flows to improve travel times.

[7] Raphael E. Stern et al., "Dissipation of stop-and-go waves via control of autonomous vehicles: Field experiments," Transportation Research Part C: Emerging Technologies, Volume 89, April 2018.

5

POTENTIAL IMPROVEMENTS

This section describes potential improvements to meet the goals of improving mobility for all modes of transportation in the SR 87 corridor. The identification and evaluation of potential improvements are based on multiple inputs: the analysis of the existing conditions for the various transportation facilities (the freeway, local roadways, bike and transit facilities), feedback and ideas from the community via an online survey, and focused stakeholder meetings.

SECTION CONTENTS

5.1 Efficient Use of Highway Capacity

Physical constraints, high cost, and environmental considerations make capacity enhancements to address congestion on the SR 87 corridor, such as widening the freeway, difficult as well as counter to the objectives of this study. However, there are solutions that will help better use existing freeway capacity, such as part-time shoulder use and express lanes.

5.1.1 Part-Time Shoulder Use/Part-Time Lane

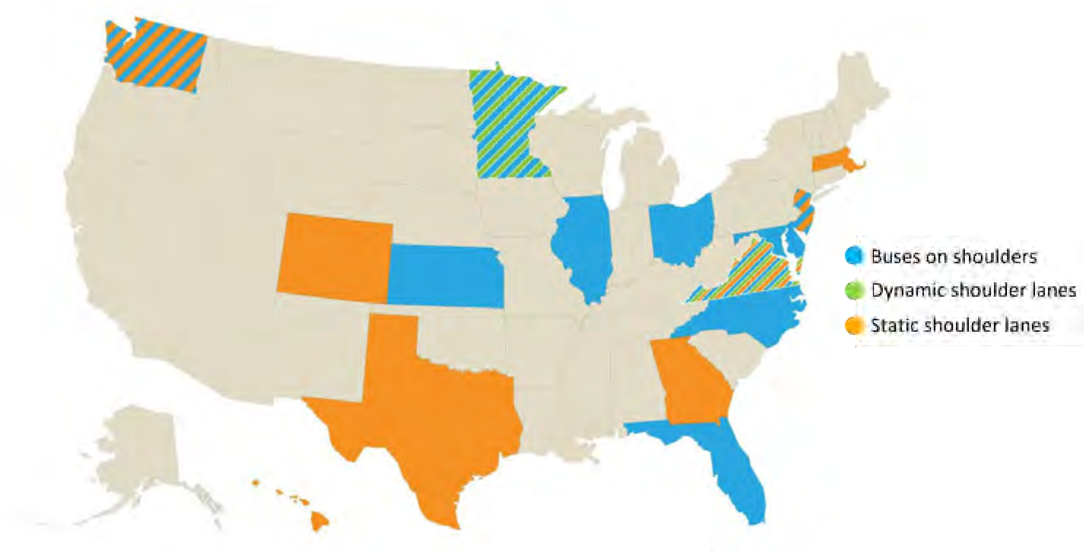
According to Federal Highway Administration (FHWA) guidelines, part-time shoulder use is a transportation system management and operation strategy that allows use of the left or right shoulder as a travel lane during some, but not all, hours of the day and is typically restricted to certain classes of vehicles. It is a possible strategy for addressing congestion and reliability issues within the transportation system and can be particularly cost-effective when adding lanes is infeasible, undesirable, or cost-prohibitive. The terminology used by the California Department of Transportation (Caltrans) to describe part-time shoulder use is "part-time lane," which is the term used in the rest of this discussion.

A part-time lane (PTL) may fulfill any number of functions, such as

- Reduce peak-period recurring congestion.
- Take the place of a conventional add-a-lane capacity improvement.
- Serve as an interim treatment while a conventional widening or expansion project works through the planning, design, construction process.
- Increase bus ridership by improving bus travel time and reliability.
- Provide short-term benefits for a minimal cost compared to ultimate solution.

States are increasingly considering PTL as a strategy to improve capacity when traditional road widening is not feasible. Applications for PTL have grown to cover a wide variety of circumstances; the strategy has been implemented in more than 16 states as of 2016,[1] as illustrated in Figure 5-1.

Figure 5-1. States Implementing Part-Time Lane as a Congestion Management Strategy



The New Jersey Department of Transportation Route 1 congestion relief project is a pilot project that used the shoulder as a travel lane during the morning and evening peak periods beginning in June 2017. The pilot project was successful, and the department is in the process of making this program permanent. The department evaluated data over a six-month period and found that the average speed increased from 13 mph to 31 mph and average throughput increased from 5,600 vehicles to 6,000 vehicles during the peak period.[2]

While PTL can be the most cost-effective solution to alleviate congestion in constrained right-of-way conditions, minimum geometric clearance, visibility, and pavement requirements must be met before it can be implemented. Additionally, us of PTL may affect emergency response and may be difficult to enforce.

[1] Jim Hunt, Pete Jenior, and Greg Jones, "Providing A Shoulder to Drive On," Federal Highway Administration Research and Technology, Vol. 80, No. 5, March/April 2017. (https://www.fhwa.dot.gov/publications/publicroads/17marapr/01.cfm)
[2] State of New Jersey Department of Transportation press release, February 26, 2018. (https://www.nj.gov/transportation/about/press/2018/022618.shtm)

FHWA guidelines to implement PTL operations are as follows:

- A 10-foot width is required for a low-quality PTL, which has an hourly capacity of about 1200 vehicles and needs to be closed to buses and trucks. A lower speed limit restriction is required for these lanes.
- A 12-foot width is required for high-quality PTL, which has an hourly capacity of about 1600 vehicles.
- A minimum shoulder width of 1.5 feet needs to be allowed on one side if PTL is being implemented on the other side.

The FHWA generally consolidates numerous uses of PTL into three types:

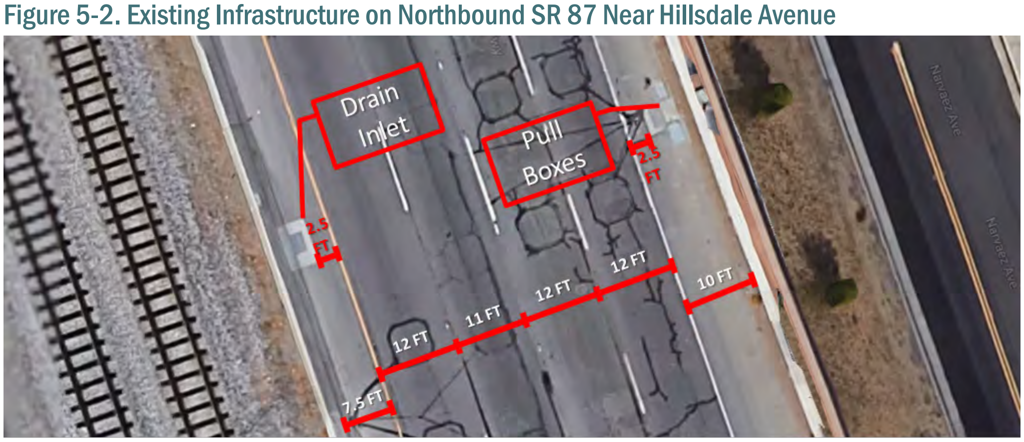
- Bus-only use of shoulder (referred to as "Bus on Shoulder," or BOS) to improve bus travel time and reliability
- Static PTL for most vehicles during predetermined hours of operation
- Dynamic PTL for most vehicles, based on need and real-time traffic conditions

Part-Time Lanes on SR 87

The SR 87 freeway is a directionally congested corridor, with northbound traffic in the morning peak period and southbound traffic in the evening peak period as the primary flow directions that are congested. Congestion is seen predominantly between Chynoweth Avenue and Almaden Expressway, at the SR 87/I-280 interchange near downtown San Jose, and at the SR 87/101 interchange. Implementing PTL in these sections can benefit congestion by using the existing highway capacity during rush hour.

Many factors influence the feasibility of PTL on SR 87, such as available shoulder widths, the width of bridges, the presence of bridge columns near the shoulders, utilities (e.g., drain inlets), and traffic monitoring systems (e.g., detector loops, pull boxes). Some of these typical influencing factors are shown in Figure 5-2.

Figure 5-2. Existing Infrastructure on Northbound SR 87 Near Hillsdale Avenue



VTA staff explored the feasibility of converting shoulders to PTL on the SR 87 mainline and connector ramps. Based on FHWA guidance, the width of PTL in the shoulder should be between 11.5 feet and 13.5 feet.

The left and right shoulder widths along SR 87 vary considerably, with widths ranging from 2 feet to 16 feet. Therefore, some segments of the freeway cannot meet FHWA guidelines. Areas that are not feasible for implementation of PTL are as follows:

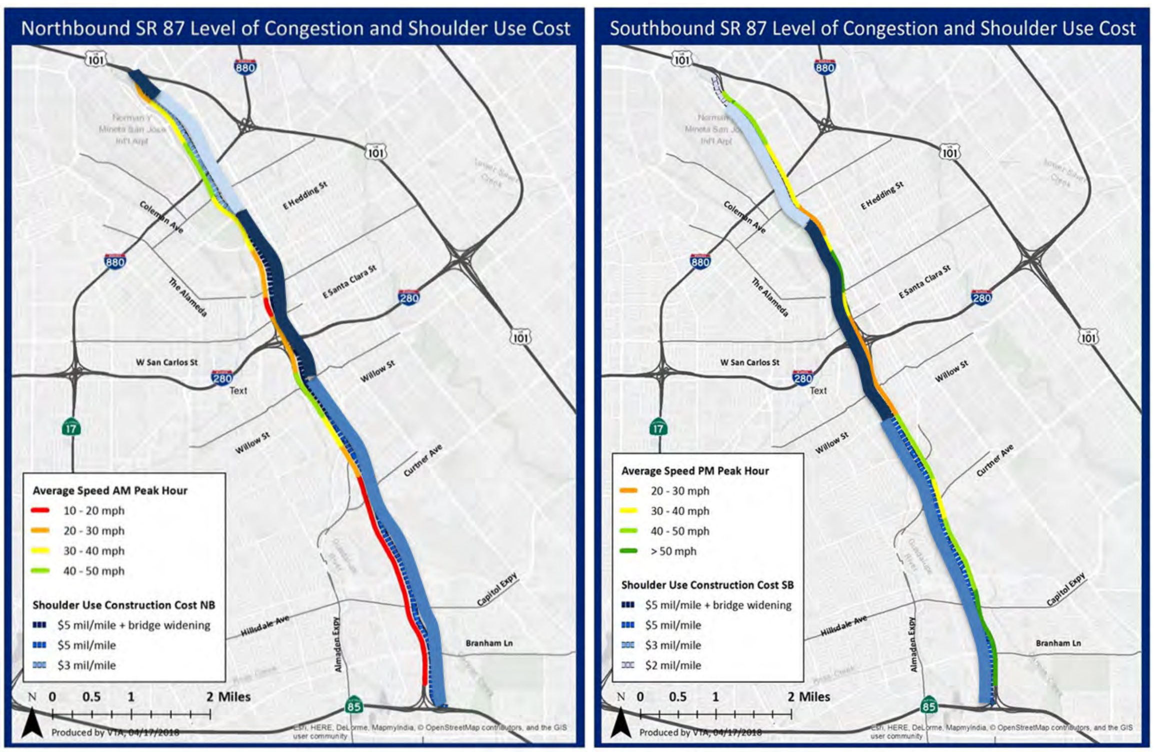
- Use of the left shoulder for about 5.5 miles between SR 85 and the I-280 interchange is not feasible and is cost-prohibitive because of light rail tracks in the median.
- A major pinch point for PTL is the SR87/I-280 interchange structure.

A more detailed discussion of possible locations follows in the next section.

FEASIBILITY OF IMPLEMENTING PART-TIME LANES ON THE SR 87 MAINLINE

The SR 87 mainline was divided into segments for purpose of evaluating the feasibility and cost of implementing PTL. Figure 5-3 shows a high-level view of PTL feasibility and cost and existing operating conditions.

Figure 5-3. SR 87 Mainline Part-Time Lane Feasibility and Operating Conditions by Segment

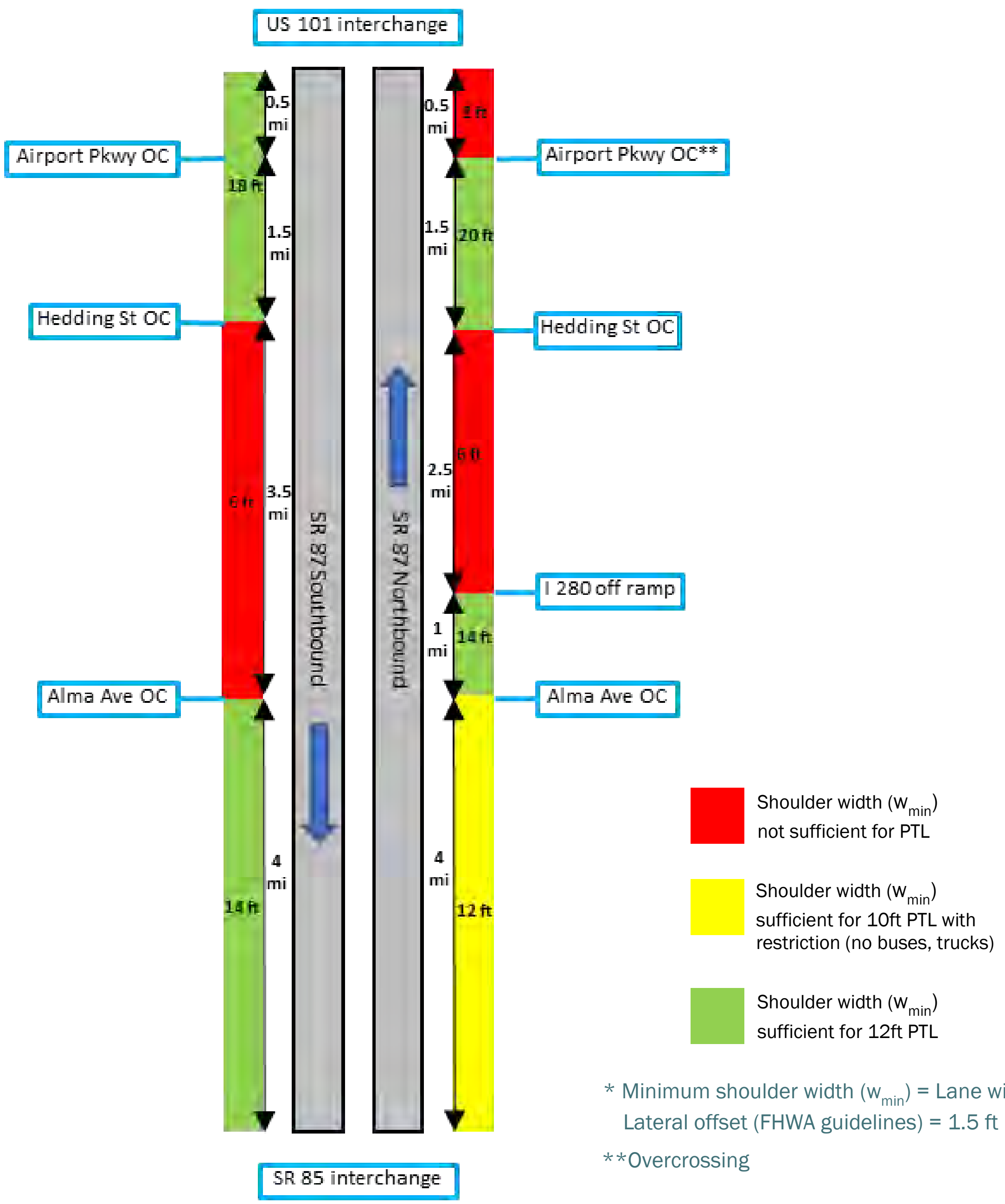


Northbound SR 87 was divided into five segments and southbound SR 87 was divided into three segments, based on the shoulder widths and the feasibility of converting them to usable part-time travel lanes. Each segment was assessed for feasibility, use type, benefit, and projected cost. Measurements for shoulders are from SR 87 as-built drawings.

Figure 5-4 shows the feasibility of implementing PTL along the specific segments. The color coding shows the potential of each segment to meet the FHWA guidance, as follows:

- **Red** colored segments do not meet FHWA guidance for minimum width (11.5 feet).
- **Yellow** colored sections do meet FHWA guidance for minimum width (11.5 feet), but trucks and buses would be restricted from using the lane and operating speeds would be reduced.
- **Green** colored sections exceed FHWA guidance for minimum width (11.5 feet), and trucks and buses may use the lane with minimal restrictions.

Figure 5-4. SR 87 Mainline Part-Time Lane Assessment Based on FHWA Guidance*



* Minimum shoulder width (w_{min}) = Lane width (L) + (R) Lateral offset (FHWA guidelines) = 1.5 ft

**Overcrossing

Table 5-1 summarizes the assessment. For each segment, minimum left shoulder widths along the segment, minimum right shoulder widths, and minimum combined shoulder widths (right + left) were identified. The minimum combined widths may not be the sum of the minimum left width and minimum right width because those individual minimums may not be at the same locations.

Table 5-1. Part-Time Lane Feasibility Along the SR 87 Mainline

Segment	Shoulder Widths	Assessment
NB, from SR 85 to Alma Avenue (4 miles)	▪ Min left width: 4ft ▪ Min right width: 8 ft ▪ Min total width (right & left combined): 12ft	▪ This segment has congestion during AM peak and benefits from PTL. ▪ Since each side the min shoulder width is less than 10 feet, restriping is required to create PTL. ▪ With minimum total shoulder width above 12 ft, there is room to create PTL while leaving 1.5 ft on one side. Since only a 10-ft PTL may be feasible in this section, there would be restrictions on vehicle types (no buses and trucks) and speeds. ▪ If the PTL is used for HOV only, then placing PTL on the left side adjacent to existing HOV lane is recommended. ▪ If the PTL is used for all vehicles, then placing it on the right side is recommended to avoid interference with existing HOV lane.
NB, Alma Avenue to I-280 off ramp (1 mile)	▪ Min left width: 4ft ▪ Min right width: 8 ft ▪ Min total width (right & left combined): 14ft ▪ There is a UPRR (Union Pacific Rail Road) over crossing in this segment which is a constraint	▪ There is right lane overload between Alma and the I-280 off-ramp. Adding PTL in this segment benefits the upstream congestion along the SR 87 mainline as well as on Almaden Expressway ▪ Since on each side the min shoulder width is less than 10 ft, restriping is required to create PTL. ▪ With minimum total shoulder width of about 14 ft, there is room to create PTL while leaving 1.5 ft on one side. Since 12 ft PTL may be feasible in this section, buses and trucks may be allowed too. ▪ In this section, placing PTL on the right shoulder to directly connect to I-280 off ramp and minimize weaving is recommended.
NB, I-280 off ramp to Hedding Street (2.5 miles)	▪ Min left width: 4ft ▪ Min right width: 4 ft ▪ Min total width (right & left combined): 6ft ▪ near I-280 interchange ▪ Constraints in this segment due to bridge columns and barrier separation at on and off ramps	▪ Adding PTL in this section requires major reconstruction of interchanges and flyovers, which will be cost prohibitive for the benefit in congestion relief. ▪ No PTL is recommended in this segment.

Segment	Shoulder Widths	Assessment
NB, Hedding Street OC to Airport Parkway (1.5 miles)	▪ Min left width: >10ft ▪ Min right width: >10ft ▪ Min total width (right & left combined): 20ft	▪ This segment has lower congestion levels than other segments in NB direction during AM peak hours. ▪ Available shoulder widths allow for converting shoulders to PTL with no or minimum restriping. ▪ PTL can be added for HOV and buses on the left side or all vehicles on the right side.
NB, Airport Parkway to 101 interchange (0.5 miles)	The shoulder widths are around 2 ft in some areas in this segment. The freeway ends in this segment and splits into two parts one merging into Hwy 101 and the other into Charcot avenue.	Operationally and geometrically, adding a PTL in this segment is not recommended.
SB, Airport Parkway to Hedding Street (1.5 miles)	▪ Min left width: >10ft ▪ Min right width: 8 ft ▪ Min total width (right & left combined): 18ft	▪ This segment has lower congestion levels for the most part, but congestion increases near Hedding street during PM peak hours. ▪ PTL can be added for HOV and buses on the left shoulder. If PTL is added on the right shoulder, the cost of project will be higher. ▪ HOV lanes currently are underused and adding another lane during peak hours may not provide much benefit unless traffic levels increase in the future.
SB, Hedding Street to Alma Avenue (4.8 miles)	▪ Min left width: 0 ft ▪ Min right width: 4 ft ▪ Min total width (right & left combined): 6 ft	▪ Adding PTL in this section requires major reconstruction of interchanges and flyovers, which will be cost prohibitive for the benefit in congestion relief. ▪ No PTL is recommended in this segment.
SB, Alma Avenue to SR 85 (4 miles)	▪ Min left width: 4ft ▪ Min right width: 8 ft ▪ Min total width (right & left combined): 14ft	▪ This segment has lower congestion during PM peak and so there is little benefit from PTL. ▪ Since on each side the min shoulder width is less than 10 ft, restriping is required to create PTL. ▪ With the minimum total shoulder width above 14 ft, there is room to create PTL while leaving 1.5 ft on one side. ▪ if the PTL is used for HOV and buses, then placing PTL on the left side adjacent to the existing HOV lane is recommended. ▪ If the PTL is used for all vehicles, placing it on the right side to avoid interference with existing HOV lane t is recommended.

POTENTIAL PART-TIME LANE PROJECTS ALONG SR 87 CONNECTOR RAMPS

Some ramps along SR 87 already have an HOV bypass lane and do not have enough shoulder width to add a PTL. Table 5-2 lists the system interchange connector ramps that do not have HOV bypass lanes and their feasibility for PTL. Measurements for shoulders are from Google Earth.

Table 5-2. Part-Time Lane Feasibility Along the SR 87 Connector Ramps

Ramp	Shoulder widths	Assessment
SR 85 NB to SR 87 NB connector ramp	▪ Min left width: 4ft ▪ Min right width: 10 ft ▪ Min total width (right & left combined): 12ft	▪ This ramp doesn't show much congestion during AM peak hours. ▪ There is room to add PTL with changes at the gore of the SR 85 and SR 87 merge.
I-280 NB to SR 87 NB connector ramp	▪ Min left width: 2ft ▪ Min right width: 10 ft ▪ Min total width (right & left combined): 12ft	▪ This ramp has room to add PTL, but the lane widths would be less than 12 ft and that may restrict speed and/or types of vehicles in the PTL. ▪ Adding PTL on this ramp would relieve congestion on the ramp and on the I-280 mainline; however, there could be an increase in downstream congestion near Julian St.
I-280 SB to SR 87 NB connector ramp	▪ Min left width: 4ft ▪ Min right width: 8 ft ▪ Min total width (right & left combined): 12ft	▪ This ramp has room to add PTL. ▪ Adding PTL on this ramp would relieve congestion on the ramp as well as on I-280 mainline; however, there could be an increase in downstream congestion near Julian St.
I-280 NB to SR 87 SB connector ramp	▪ Min left width: 4ft ▪ Min right width: 10 ft ▪ Min total width (right & left combined): 12ft	▪ This ramp has room to add PTL, but the lane widths would be less than 12 ft, which may restrict speed and/or types of vehicles in PTL. ▪ Adding PTL on this ramp would relieve congestion on the ramp as well as on I-280 mainline.
I-280 SB to SR 87 SB connector ramp	▪ Min left width: 4ft ▪ Min right width: 10 ft ▪ Min total width (right & left combined): 12ft	▪ This ramp has room to add PTL, but the lane widths would be less than 12 ft, which may restrict speed and/or types of vehicles in PTL.
SR 87 NB to I-280 NB connector ramp	▪ Min left width: 4ft ▪ Min right width: 10 ft ▪ Min total width (right & left combined): 12ft	▪ This ramp has room to add PTL, but the lane widths would be less than 12 ft, which may restrict speed and/or types on vehicles in PTL. ▪ Adding PTL on this ramp would relieve congestion on the ramp as well as on I-280 mainline.
SR 87 NB to I-280 SB connector ramp	▪ Min left width: 4ft ▪ Min right width: 10 ft ▪ Min total width (right & left combined): 12ft	▪ This ramp has room to add PTL, but the lane widths would be less than 12 ft, which may restrict speed and/or types of vehicles in PTL. ▪ Adding PTL on this ramp would relieve congestion on the ramp as well as on I-280 mainline.
Charcot Avenue to SR 87 SB on ramp	▪ Min left width: 4ft ▪ Min right width: 10 ft ▪ Min total width (right & left combined): 12ft	▪ This ramp is congested and can benefit from adding PTL. ▪ There is room to add PTL on this ramp, but the lane width may be less than 12 ft.

All potential projects identified in tables 5-1 and 5-2 need further evaluation, such as quantifying operational benefits, measuring vehicular sight distances, and performing detailed geometrical and structural assessment. Some areas may require lane restriping to consolidate shoulder widths on one side, which may at different places require moving utilities and loop detectors, adding cost to the project. Emergency pullout areas may also be required, based on the length of the PTL, which can, likewise, raise cost and feasibility challenges. Additionally, the older segment of SR 87 between I-280 and SR 85 was constructed before 2000, and the shoulder sub-base was not designed structurally for traffic; enhancements to ensure structural integrity may be required, adding cost to the project.

IMPLEMENTATION OF DYNAMIC PART-TIME LANES

Implementing dynamic PTL instead of static PTL provides flexibility to open and close the shoulder, segment-by-segment, based on demand. Implementing dynamic freeway shoulders to ensure smooth operations requires the use of technology, as follows:

- Electronic signage to provide guidance for travelers when these lanes are available (Figure 5-5)
- Sensory equipment to measure traffic flow and continually monitor when it is best to open and close these lanes (Figure 5-6)
- Peripherals to provide real-time communications to field devices to monitor traffic conditions by transmitting information to a central or remote monitoring location

Figure 5-5. Part-Time Lane Example on I-110 at I-5 in Los Angeles, CA

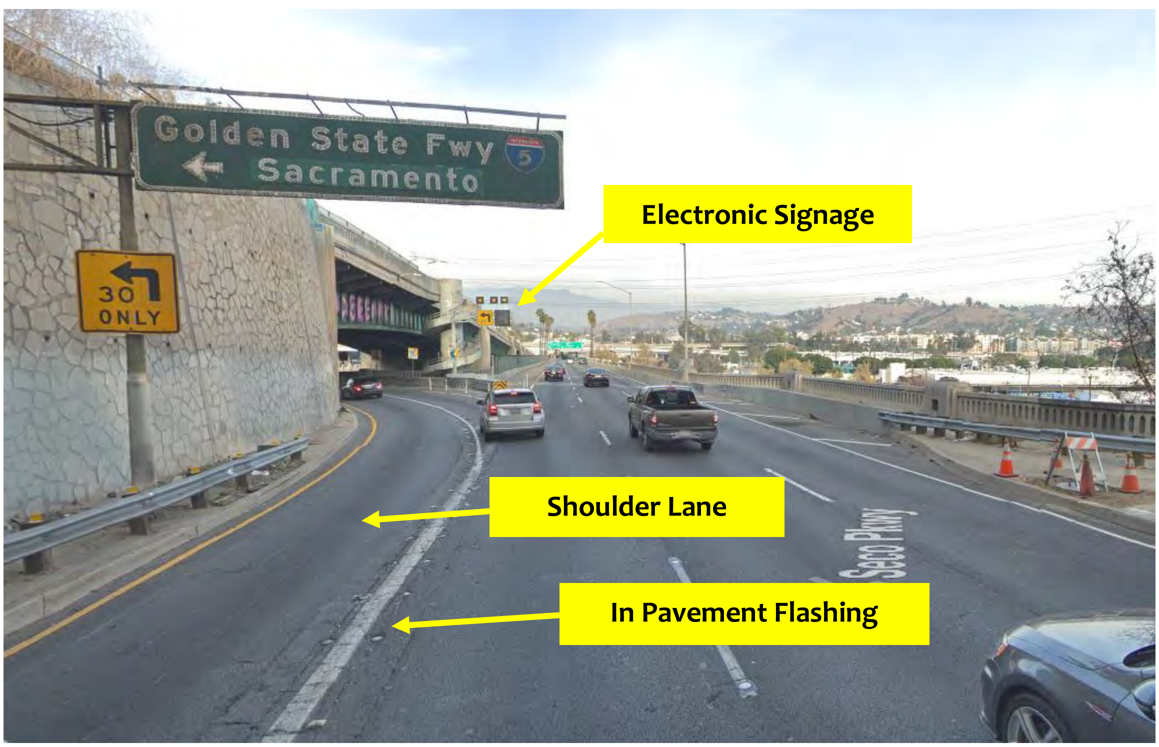
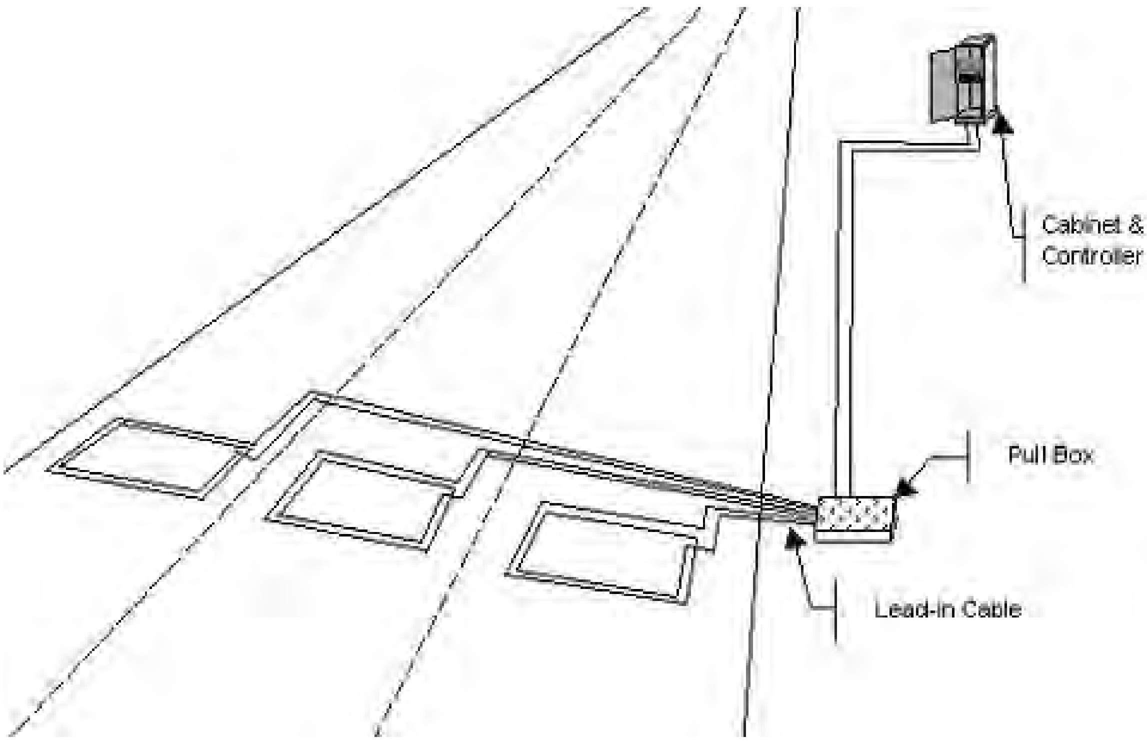


Image Source: Google Maps

The implementation of either type of PTL typically works in conjunction with other congestion management technologies, such as ramp metering, which uses traditional timing plans or "smartly" adapts to traffic flows on the corridor.

In summary, despite physical constraints along the SR 87 corridor, there are segments and ramps where implementing PTL to optimize the existing freeway capacity and improve traffic flows is feasible. These projects are further evaluated in Section 7.

Figure 5-6. Sensory Equipment Example Detector Loops on Freeway



Source: FHWA

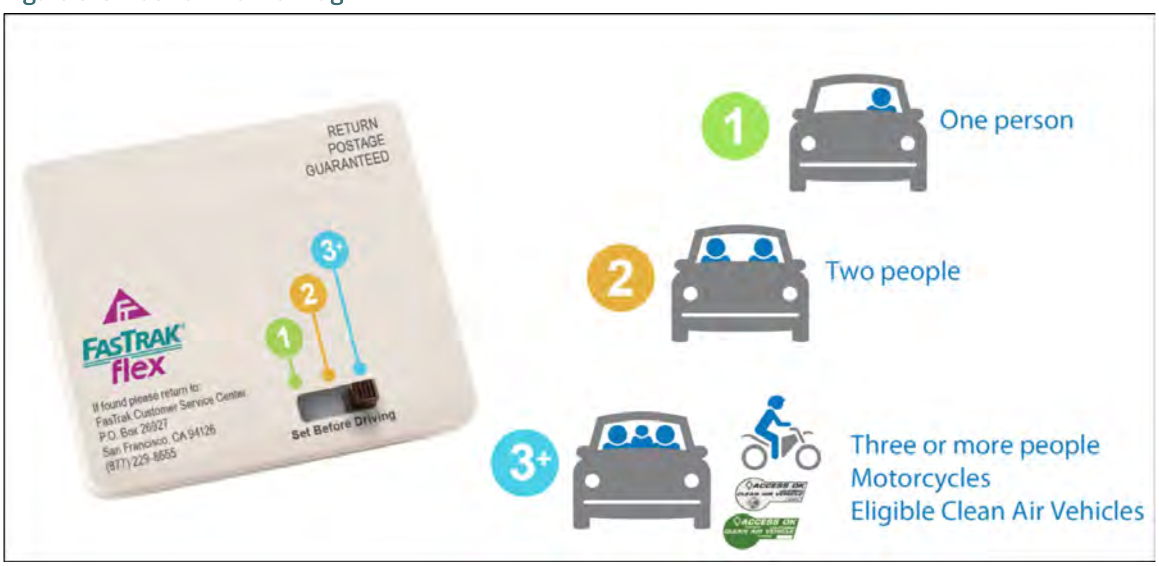
5.1.2 Dynamic Pricing/Express Lanes

Express lanes on freeways can help meet the transportation needs of a growing population. An express lane (EL) is an HOV lane used by carpools, motorcycles, and clean-air vehicles (with applicable decals) for free but that can also be used by single-occupant vehicles provided they pay a toll using a FasTrak transponder. Dynamic pricing changes the price of the toll that single-occupant vehicles must pay based on the congestion level at the time the vehicle enters the express lane. Express lanes that use dynamic pricing are equipped with digital signs that indicate the price of the toll. Figure 5-7 shows an express lane on SR 237. Figure 5-8 shows a FasTrak flex toll tag.

Converting HOV lanes to express lanes could optimize existing capacity and improve operations through downtown San Jose, both in the northbound and southbound directions. Refer to Chapter 3 for a description of existing conditions along this segment.

Figure 5-7. Express Lane on SR 237

Figure 5-8. FasTrak Flex Toll Tag



Currently, to use the HOV lanes along SR 87, vehicles must have two or more people (HOV2+). The SR 87 corridor may benefit from a change from HOV 2+ to an express lane with HOV 3+ occupancy (three or more people). There is an ongoing effort by the Caltrans District 4 managed lane committee to convert the minimum occupancy of all express lanes, as well as all metered ramps with HOV bypass lanes along the express lane corridor, from HOV2+ to HOV3+. This would encourage more people to carpool. The move to HOV 3+ would also ensure congestion relief and trip reliability well into the future for transit riders, carpoolers, and drivers who choose to pay a toll, as the population continues to grow. At the same time, additional riders in carpools and on transit would take single-occupant vehicles off the road, reducing vehicle emissions and congestion.

Results from the community survey conducted as part of this corridor study show that about 37% of survey participants support the conversion of HOV lanes to express lanes. About 46% are opposed, and 17% are neutral. In addition, survey respondents, in the ideas and suggestions section, noted the high violation rate in HOV lanes and that more enforcement is required. Morning congestion in the northbound HOV lane may be a reason for the high percentage of respondents who are opposed to converting the existing HOV lane.

Assembly Bill 544, Vehicles: High-Occupancy Vehicle Lanes, signed into law in October 2017, extended California's clean air decal program to allow eligible single-occupant vehicles into carpool lanes. However, eligible vehicles purchased prior to January 2017 will no longer be allowed to use the HOV/EL lane when driven by a solo driver. Decals issued before January 1, 2017, will be retired by January 1, 2019, lowering the number of single-occupant cars using HOV lanes.[3] Observations made of HOV lanes on SR 87 and the express lane on SR 237 show that over 30% of the vehicles using these lanes are currently eligible vehicles with decals. The new decal sticker program rules could provide relief to the existing overcrowding in these lanes.[4]

Plan Bay Area 2040 and VTA's Envision plan comprise plans to convert the existing HOV lane to an express lane in both directions of SR 87 between I-880 and SR 85. The express lanes will offer a more reliable commute for carpoolers and other eligible users, manage congestion in this corridor, and generate additional revenue that will be used for transit services and other transportation improvements in the corridors.

5.1.3 US 101 SB to SR 87 SB Ramp Improvements

As discussed in Section 3, Existing Conditions, the ramp connecting southbound US-101 to southbound SR 87 is a single lane ramp that has a very long back-up during evening peak hours, causing congestion on the southbound US-101 mainline. As part of the community survey for this study, the VTA received many written requests to improve capacity on this ramp to reduce congestion at the interchange. A project is underway to add a second lane on this ramp. However, the project will add a second lane on the ramp only. This study proposes installing new traffic monitoring stations in addition to the improvements that are underway.

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[3] Jessie Levin, "Are We There Yet?: The Story of Carpool Lanes in Southern California," The Claremont Journal of Law and Public Policy, March 1, 2018. (https://5clpp.com/2018/03/01/are-we-there-yet-the-story-of-carpool-lanes-in-southern-california/)

[4] Brandi Childress, "New Rules Coming to SR 237 Express Lanes Next Summer," Connect with VTA, October 3, 2018 (http://www.vta.org/News-and-Media/Connect-with-VTA/New-Rules-Coming-to-SR-237-Express-Lanes-Next-Summer#.W8EoEXtKhEY)

5.2 Technology-Based Improvements

This section describes potential projects and initiatives that use technology to enhance capacity, manage transportation demand, or manage traffic flow. The following sections give a brief description of each project, including major advantages and disadvantages.

5.2.1 Adaptive Ramp Metering

Adaptive ramp metering employs algorithms to optimize vehicle release rates at freeway on-ramps based on the level of congestion on the overall freeway mainline. This technique effectively responds to recurring and non-recurring congestion because it can react to mainline traffic conditions and on/off mainline flow in real time. Extending ramp metering hours should also be considered more reliable travel time benefits along the freeway mainline.

Adaptive ramp metering is a low-cost approach to providing congestion relief on the corridor, compared with capital improvements, provided the necessary metering equipment and associated communications infrastructure is available. Figure 5-9 shows ramp meters on southbound SR 87.

Figure 5-9. Metering on Southbound SR 87

Most of the on-ramps on the SR 87 corridor have metering equipment, making SR 87 an ideal corridor to implement adaptive ramp metering to address the following operational issues:

- Varying traffic flows at on-ramps on northbound SR 87, such as at Capitol Expressway and Almaden Expressway, in the morning peak period, which have multiple peak times through the morning peak period.
- Off-peak congestion related to three major event centers are located adjacent to the corridor: the SAP Center in downtown San Jose, San Jose McEnery Convention Center in downtown San Jose, and Avaya Stadium just north of downtown San Jose. Special events at these centers cause congestion outside of the typical peak periods and unusual traffic peaking conditions, which are difficult to address with typical ramp metering applications.

Based on system-wide adaptive ramp metering (SWARM) implementation in Los Angeles and Ventura Counties in California, Caltrans found that the combined strategy generated the most benefits in terms of traffic conditions on the mainline freeway.[5] In particular, it increased the mainline speed by 11% during the morning rush, decreased the travel time by 14%, and reduced the freeway delay by 17%.[6]

Adaptive ramp metering requires dedicated communication infrastructure to allow a centralized management server to monitor the traffic conditions throughout the corridor. Communications infrastructure is a potential improvement that is needed in this corridor for many other technology-based improvements.

5.2.2 Mobility as a Service – Mobility Playbook

The landscape of transportation is rapidly changing since the introduction of smart phones, cloud computing, enhanced data mining tools, and other recent technology advancements. These changes have led to the evolution of trip decision making among travelers, for example:

- Car sharing services are filling the void of on-demand transportation services.
- Docked and dockless bicycle/scooter sharing are now viable transportation alternatives for first-last mile trips, an example being the introduction of Bird scooters in downtown San Jose (Figure 5-10).
- Cloud-based trip planning and traffic information tools that provide real-time information, such as Google Maps, Waze, and traffic data providers, such as TomTom and INRIX, are helping travelers plan their trips more precisely.
- Carpool ride matching apps, such as Waze Carpool, Scoop, and RideAmigos, are simplifying the carpool-finding process.

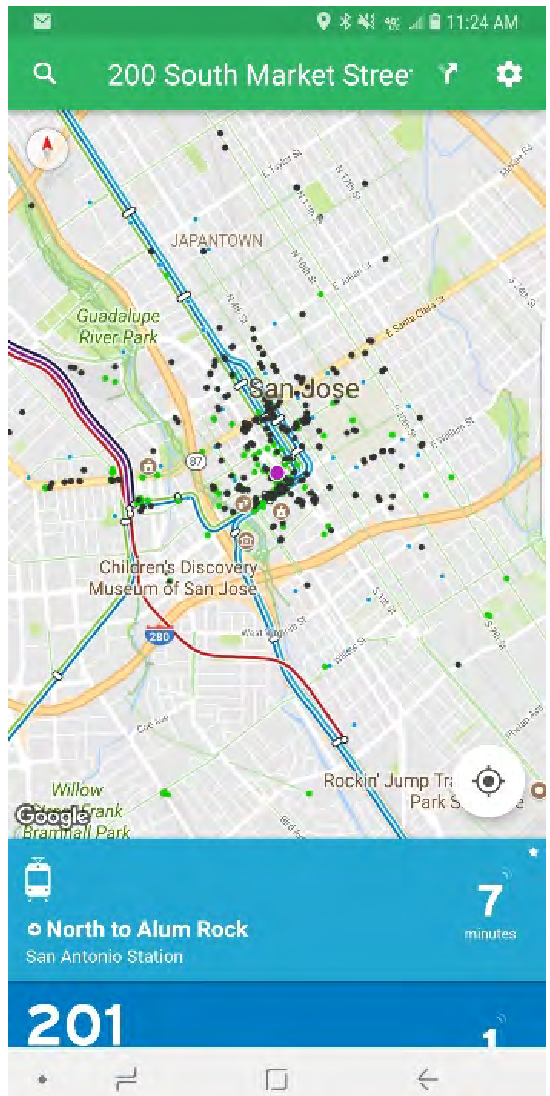


Figure 5-10. Snapshot of Bird Scooter Locations in Downtown San Jose
Source: Transit App

[5] The term "combined strategy" refers to the combination of the existing local individual ramp metering and adaptive ramp metering whereby the ramp meters communicate with each other.

[6] Christopher M. Monsere et al, "Using Archived Its Data to Measure the Operational Benefits of a System-Wide Adaptive Ramp Metering System," Oregon Department of Transportation Research Unit, FHWA and Oregon Transportation Research and Education Consortium, December 2008 (https://www.oregon.gov/ODOT/Programs/ResearchDocuments/SWARM_Final_Report.pdf)

Although these technologies provide travelers with new tools on how to plan and make a trip, there is no convenient, unified interface that would combine all of the existing services. The lack of an integrated traveler information source and a single traveler planning tool appears to be one barrier for using alternative transportation modes, yet an increase in the number of multimodal trips could significantly reduce congestion on the SR 87 corridor.

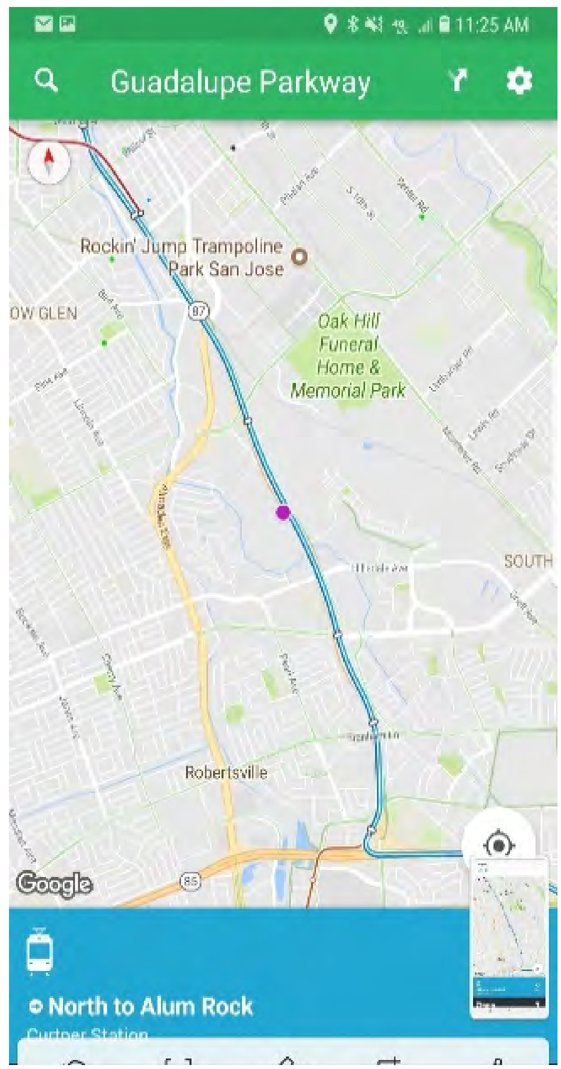
Barriers to Alternative Modes and Multi-Modalism

According to the community survey conducted as part of this study, 76% of survey participants identified themselves as solo driver commuters. Those participants were asked what would motivate them to carpool, take transit, or bike.

The most common responses are underlined below:

- *Transit takes longer than driving:* The available real-time data for both the freeway corridor and transit travel times show nearly similar travel times during peak periods.
- *Transit stops are too far away from home and work (first-last mile issue)*: Docked and dock-less bicycle and scooter share can address this first-last mile issue. As shown in Figure 5-10, numerous scooters are present throughout the downtown area, but not south of I-280 (Figure 5-11). Expanding the availability and use of scooters in these unserved areas could fill the needs of transit riders on this corridor who live in the surrounding neighborhoods.
- *Uncertainty of carpool benefits (actual travel times saving benefits):* Today, information about carpool travel times is available through Waze through users who self-declare as carpoolers. Traveler information, which is consumed by Waze, TomTom, INRIX, and other data providers, will increasingly become more accurate with enhancements to GPS technologies in mobile devices.
- *Need for a vehicle during midday:* Uber, Lyft, and other transportation network companies (TNC), also known as ridesharing companies, are transportation services that could fill this traveler need. For example, offering employers the ability to use VTA's RideAmigos platform for commute tracking and rewards/incentives.

Figure 5-11. Snapshot of Bird Scooter Locations South of I-280
Source: Transit App



What is a Mobility Playbook?

Agencies within large metropolitan areas such as the Seattle Department of Transportation (SDOT) and Los Angeles Department of Transportation have come to realize that traditional roadway improvements are not producing long-lasting effects on congestion reduction. To meet growing transportation needs, agencies are seeking sustainable, lower cost solutions. These agencies have developed transportation strategic plans and are using technology to collect and disseminate information on travel conditions in real-time to transportation system operators and travelers. Using technology to collect and analyze data allows agencies to provide optimal solutions to both operators and travelers alike.

A mobility playbook is a shift in mindset away from a travel approach based on a single-occupant vehicle and, instead, focuses on mobility needs. SDOT's mobility playbook best describes this paradigm shift in its overall guiding principle:

With cars, we forced our city to adapt to the technology instead of shaping the technology to serve the people living and working in our city. The New Mobility Playbook is our chance to forge a different future.

Core Elements of a Mobility Playbook

The essential elements of a mobility playbook use technology to develop a service model called Mobility-as-a-Service (MaaS) and continuing performance monitoring to make quick adjustments to the transportation services.

MaaS is a concept that brings all types of transportation services together into a convenient and intuitive interface that aids travelers in planning and taking their trips. MaaS combines transportation options from different providers (both public and private) and includes trip planning, reservations, and payment.

Performance monitoring of the transportation services is essential to efficiently and timely deploy resources to support constantly changing needs of the users. The latest mobile communication devices, cloud-based technologies, and data mining tools have made it easier to conduct performance monitoring in real-time; also, they have created opportunities to cross-query multiple data sources from these services to predict trends in user service needs.

The final and most essential component to the successful implementation of a mobility playbook is a relationship between public and private sectors, who are both transportation service providers and facilitators of a seamless operation.

Proposed Mobility Playbook for SR 87 Corridor

According to the community survey conducted as part of this study, one of largest origin and destination (OD) pairings is between downtown San Jose and the neighborhoods between the I-280 and SR 85 interchanges (i.e., Willow Glen, Tamien, Communication Hills, Guadalupe Canoas, Canoas Garden, Branham, Thousand Oaks, and Vista Park). The following characteristics of this OD scenario provide the VTA with a unique opportunity to pilot a mobility playbook:

- Light rail travels parallel to the corridor and has the capacity to take additional passengers.
- Real-time travel information on light rail is available through Swiftly in open-source format, and can be easily shared.

- Lime, Bird, and other e-scooters and bike share providers are already operating within downtown San Jose and central San Jose. As a first-last mile option, the deployment of these scooters could be expanded to the Tamien, Capitol, Ohlone-Chynoweth, and Santa Teresa light rail stations to attract commuters from neighborhoods between the I-280 and SR 85 interchanges to use light rail as an alternative mode of travel.
- Transportation network companies such as Uber and Lyft are already operating throughout the corridor. Parking at some light rail stations south of I-280 is underused; parking spaces at these stations could be converted to passenger pick-up and drop-off areas for TNC operators and could include bike/scooter share spaces. Such implementation could also be another first-last mile option to attract commuters to use light rail as an alternative mode of travel.
- VTA already operates an electronic payment system for its transit system. This electronic payment system could be interlinked with the TNCs and scooter and bike share operators to create a single payment system. This single payment system could be used as a financial incentive by providing discounted trips using TNCs or scooters or bikes share services to attract commuters to light rail, or vice-versa.

The focus of any mobility playbook is on the end-traveler's need for transport. The transportation modes should be integrated and easily accessible to plan, make, and pay for a trip. Currently, although SR 87 is a multimodal corridor, users are not able to seamlessly use all of the travel options available on the corridor. The pilot SR 87 Mobility Playbook would integrate all the travel and information options described into a single app or web service to maximize the use of all modes on the corridor.

Available studies[7] show that travel demand management tools have demonstrated shifts away from single-occupant vehicles of between 5% and as high 15%, with similar operational gains on the corridor (e.g., reduction in congestion). The relative cost to implement a mobility playbook is very low in comparison to other technology-based transportation projects. Implementation ranges between less than $1 million to $2 million to implement.

A mobility playbook requires an ongoing dialogue between private-sector partners, such as the TNCs, transportation service providers and public-sector partners. While the interests and processes of the partnering groups are not always compatible, some of the challenges could be overcome through the development of a memorandum of understanding that defines roles or through alternative approaches to the procuring of services (e.g., pilots, public-private partnerships).

[7] Federal Highway Administration, "Integrating Demand Management into the Transportation Planning Process: A Desk Reference," Publication Number FHWA-HOP-12-035, August 2012. (https://ops.fhwa.dot.gov/publications/fhwahop12035/index.htm)

5.3 Technology Infrastructure Enhancements

Many current and future technology solutions will depend on a reliable and fast communication network that connects ramp meters, sensors, the Caltrans PeMs, changeable message signs, transponders, mobile apps, self-driving vehicles, and data storage and processing centers. Building the infrastructure for the future will enable fast deployment of technology-based solutions in the future. Technology infrastructure enhancements may require public-private partnerships, multi-agency collaborations, and standardization across states through the Federal Highway Administration. This section considers a few potential infrastructure projects for SR 87.

5.3.1 Backbone Corridor Communications

A reliable, high speed, and high bandwidth communications backbone is an essential infrastructure element needed to manage and operate a freeway that uses technology, including to provide timely information to travelers on a corridor. SR 87's limited dedicated communications infrastructure is strictly defined to specific purposes, such as emergency services and light rail operations. The locations and dedicated use of communications infrastructure on the corridor are as follows:

- Fiber optic communications infrastructure is in the median of SR 87 within VTA's light rail track right-of-way between the I-280 and SR 85 interchanges. This fiber optic communication is used mainly for VTA's light rail track control, security and surveillance, and fare collection.
- As part of the event management system for the SAP Center just west of SR 87 at Santa Clara Street, the City of San Jose has dedicated communications infrastructure on Santa Clara Street and on the off-ramp to Santa Clara Street for operating electronic changeable message signs, traffic signal coordination, and traffic surveillance.
- The County of Santa Clara Communications Department plans to interconnect the various first responder facilities along N. First Street from downtown San Jose to Tasman Drive, and along SR 87 from SR 85 to downtown. The department is currently negotiating with VTA to use one duct or conduit within VTA's light rail right-of-way to install fiber optic lines to provide this interconnection.

Although some dedicated communications lines exist on the corridor, some infrastructure being used for transportation is limited. Caltrans has installed ramp metering, traffic surveillance cameras, and traffic monitoring stations (traffic volume and speed data collection) in numerous locations along the corridor that do not use dedicated communications lines but rather rely on leased low-speed/bandwidth communication or wireless communication devices.

As an overall benefit to the corridor and to meet existing and future needs for high speed and bandwidth, the VTA should consider building a backbone communications corridor in the near-term. Shared use among stakeholders should be considered to reduce the burden on any single user of the cost to construct, manage, and operate the fiber optics communications lines.

Along with the backbone communications corridor, vehicle-to-infrastructure communications mechanisms will need to be built and traffic management strategies based on real-time inputs will need to be developed.

A backbone communications corridor will

- Provide reliable, high speed, and high bandwidth communications to transportation system operators and real-time transmission of transportation conditions to travelers.
- Allow quicker response to incidents and unusual traffic conditions.
- Support potential future technologies such as connected vehicles. The cost to plan, engineer, and construct this infrastructure is high, estimated at approximately $5 to $10 million. Because of the high cost, other communications media such as wireless (4G, 5G, or microwave) or leased high-speed/bandwidth lines should be considered in the interim.

5.3.2 Changeable Message Signs

Changeable message signs that display travel time information for all modes are a good way to provide real-time information while encouraging drivers to use alternate modes when the freeway is congested (Figure 5-12). Currently, there are three changeable message signs on SR 87, near the SAP Center. Additional new signs that display travel times for various modes (car, bus, LRT), parking availability (e.g., near the LRT station at Capitol Expressway and Diridon Station) should be considered close to key congested areas such as the I-280 interchange, Alma Avenue interchange, and US 101 interchange. Locating these signs ahead of the interchanges would be beneficial. Carpool Lane Travel Time Information Apps

Existing traffic and map-related apps like Google Maps, Waze, and Apple Maps do not adequately provide separate travel time estimates and traffic information for HOV and GP lanes. Using more accurate lane tracking technologies for the HOV and GP lanes would enable drivers to better plan their routes to reduce travel time and avoid clogging side streets when the data shows that the HOV lane would be the more expedient option.

Figure 5-12. Changeable Message Sign Display with Train Schedule and Travel Time
Source: ScienceDaily

5.3.3 Speed Harmonization

Speed harmonization is part of an active transportation management strategy that uses real-time displays of speed limits and warning messages about congestion to reduce the risk of collisions and rear-end crashes caused by weaving. There are several areas on the SR 87 corridor where congestion occurs because of weaving and lane changes. For example, significant weaving and merging on northbound SR 87 between the I-280 interchange and the Hedding Street overcross causes a bottleneck during the morning peak hours. Through speed harmonization, drivers can be guided to reduce their speed and use the appropriate lane as they approach the bottleneck, which increases safety and reduces congestion.

Speed harmonization requires ITS (intelligent transportation system) infrastructure. SR 87 currently has limited ITS infrastructure. To enable various active transportation management strategies, VTA would need to develop multi-use ITS infrastructure. Further study is required on these strategies with active involvement of all stakeholders.

5.4 Transportation Demand Management Strategies

Several ideas for transportation demand management were considered in this study. Ideas also came from the community survey.

5.4.1 Extend Carpool Hours

Existing carpool hours on SR 87 are from 5 AM to 9 AM in the morning rush hours and 3 PM to 7 PM in the evening rush hours in both the northbound and southbound directions. Extending carpool hours beyond 9 AM in the morning could encourage more people to carpool.

5.4.2 Increase Carpool Occupancy Requirement to 3+

The existing carpool lanes require at least two people per vehicle. The northbound SR 87 HOV lane is congested in morning peak hours, which is discouraging commuters from using the HOV lane. Changing the carpool requirement to three or more people per vehicle would ensure that congestion in the HOV lane is reduced and could significantly improve travel time. This may encourage more people to carpool, which would result in an overall reduction of vehicles on SR 87. An improvement in travel time in the HOV lane would also make buses that use the HOV lane a more attractive option to commuters. The downside of this idea is that GP lanes could become more congested, as vehicles with only two people move into the GP lanes. A change to HOV3+ could be combined with converting the HOV lanes to express lanes with demand pricing to optimize lane capacity and travel time, and to generate revenue that can be used for improvements in the corridor.

5.4.3 Promote Carpool Use By Providing Incentives

Partnering with employers in the corridor to encourage carpooling with incentives like reserved parking, cash, etc., could increase carpool use and result in better use of the carpool lane.

5.4.4 Reduce Downtown On-Street Parking

A generous parking supply in downtown San Jose has led to more people driving to the area even though alternate modes of travel and transit are available. Reducing the number of parking spaces or increasing the cost of parking, or both, combined with first-last mile options like bike share could encourage people to use transit. Reducing parking would also free up space for other uses such as public plazas, parks, additional offices, and affordable housing. It would also increase the compactness of development near transit stations.

Table 5-3 shows information about San Jose, the number of parking spaces downtown, and information from the community survey on modes of travel to downtown.

Table 5-3. Available Parking in Downtown San Jose & Modes of Travel to Downtown

Metered On-Street Parking Spaces	Off-Street Public Parking Spaces	Mode of Transportation to Downtown
2,533	7,709*	66% Drive alone; 13% Carpool 16% Public Transportation 2% Bike; 2% Uber/Lyft

* Not all of these spaces are publicly available due to various agreements.
Source: City of San Jose and VTA SR 87 Community Survey

5.5 Multi-Modal Improvements

Transit and bicycle use are alternatives to cars that help reduce number of vehicles on the freeways. The SR 87 corridor has the advantage of having light rail and bus service that connect residential neighborhoods in south to downtown areas in the north. The Guadalupe River Trail and Highway 87 Bikeway provide a nearly continuous parallel route for bicycling. This section identifies first-last mile gaps and discusses ideas for improving use of alternate modes such as transit and bicycles.

5.5.1 First-Last Mile Options

One of the issues with transit use is the first-last mile connectivity. The following sections identify some options to improve the connectivity of various modes through private-sector participation.

On Demand Shuttles

On demand shuttle services, which have been available in some cities, are increasingly becoming more viable, due to advances in mobile apps that make it easier to handle communication, location, coordination, routing, and payment. Private shuttles, including some services in parternship with a public agency, have been deployed in several cities. Services like Chariot in San Francisco run 14-seater vans on fixed routes and through their apps enable passengers to find the closest routes and best timing, reserve rides, and pay via smartphone. Services like RideCo provide software for automated shared vehicle itineraries based on customer pick-up and drop location and expected time of arrival, taking into consideration real-world conditions like traffic. These services can be customized to efficiently provide on-demand shuttle services that commuters can rely on. Partnering with big companies that employ hundreds of people to provide shuttle service between the nearest transit station and their office locations would encourage more people to use public transit. These services can be on-demand in non-peak hours while providing regular service during peak hours.

Public-Private Partnership with Rideshare Companies

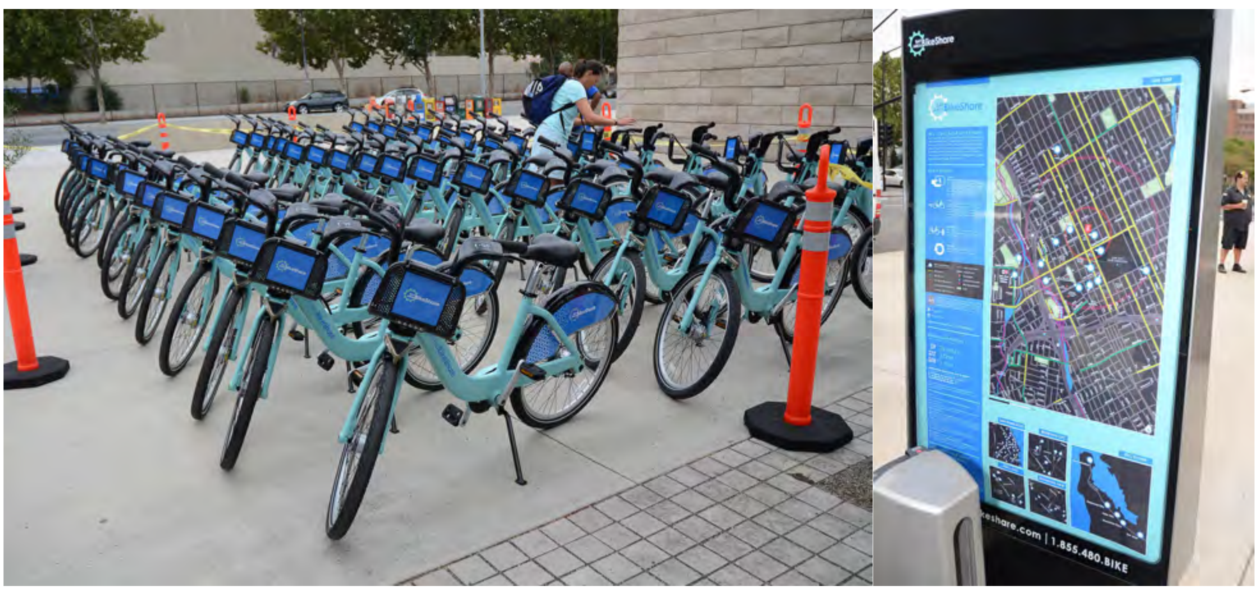
Rideshare companies like Uber and Lyft are partnering with public transit agencies to provide first-last mile options at reduced cost to commuters. The advantage of this type of partnership is that companies like Uber have the technology to make it easier for commuters to call for a ride to and from transit stations without much delay. The public transit agency in partnership with the rideshare company subsidizes the cost of the travel to and from the transit station and charges for the entire ride—from origin to destination including transit — as one cost that is optimized. Based on ridership and common destinations, high-occupancy shuttles can be used through ridesharing apps to reduce number of vehicle trips. Some examples of such partnerships are the Lyft and Trimet partnership in Portland, OR, whose app combines Lyft information with the option to buy transit tickets; Xerox GoLA in Los Angeles, Go Denver trip planning apps, Dallas Area Rapid Transit's GoPass app; Florida's Pinellas Suncoast Transit Authority's partnership with Uber; and Metropolitan Atlanta Rapid Transit Authority's partnership with Uber. Because LRT in the SR 87 corridor connects dense residential areas like Blossom Hill and Communication Hill to employment centers in downtown and the golden triangle, implementing a rideshare program could be a convenient first-last mile option.

Bike Share and Electric Scooters and Bikes

As described in Chapter 3, Existing Conditions, several bike share, e-bike, and e-scooter vendors currently operate in and around downtown San Jose (Figure 5-13). These are options to address first-last mile connectivity that could be combined with transit trips. To get the highest benefit from these services, the VTA will need to develop strategies such as

- Work with City of San Jose and shared mobility vendors to encourage customers to use these devices for everyday trips as well as for first-last mile transit access.
- Plan, fund, design or build bike/pedestrian improvements that provide better access to light rail, the Guadalupe River Trail and the Highway 87 Bikeway, so shared mobility can become a safe, comfortable first-last mile option.
- Encourage or require vendors to provide real-time bike and scooter location data in a standard open data format. This will encourage competition and permit third parties to develop apps that allow customers to choose the nearest bike or scooter.

Figure 5-13. Bike Share in Downtown San Jose



5.5.2 Bicycle & Pedestrian Improvements

Walking and biking to transit stations is another option for first-last mile connectivity to transit stations. High-quality bikeway corridors, such as the Guadalupe River Trail, encourage people to bike to and from their destinations, instead of driving or taking transit.

Planned Bicycle Projects

Several bicycle improvement projects are planned near SR 87. These projects are identified in the Countywide Bicycle Plan and in local plans such as the San Jose Better Bikeways program and San Jose Trails Program. Some of these projects could have a significant effect on operation of SR 87 because they would create a high-quality, connected network of bicycle facilities that provide an alternative mode of transportation along the corridor.

SAN JOSE BIKE PLAN 2020

The San Jose Bike Plan 2020 was adopted by the City Council in 2009. The plan recommends policies, projects, and programs to realize this vision and create a San Jose community where bicycling is convenient, safe, and commonplace. The plan proposes a 500-mile network of bicycle facilities including 400 miles of on-street lanes/routes and 100 miles of trails. The plan also categorizes the recommended projects as priority 1 and 2 projects. Figure 5-14 shows an example of bicycle lanes in downtown San Jose.

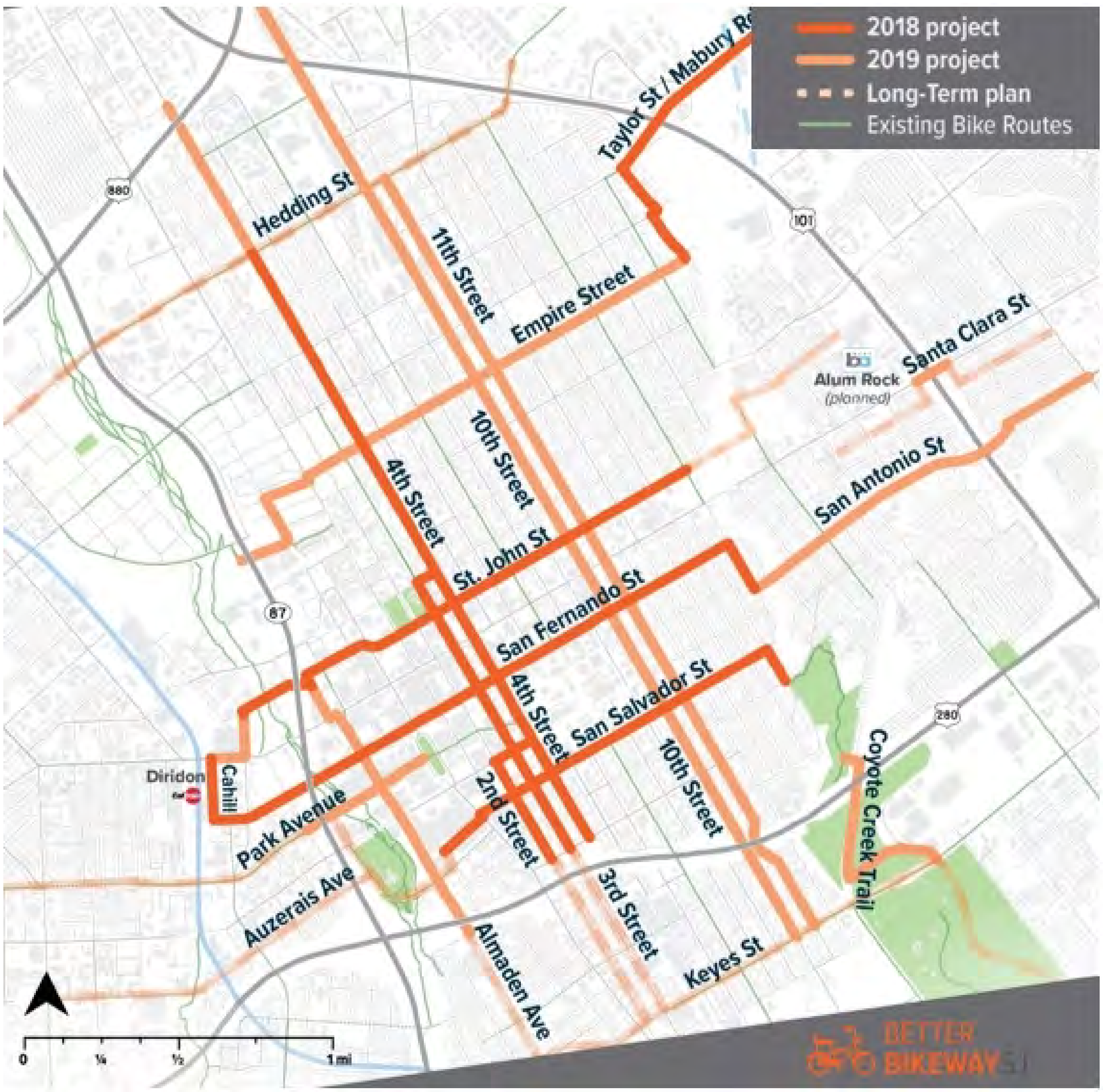
The City of San Jose is in the process of updating the current plan with a new plan for horizon year 2025.

Figure 5-14. Bicycle Lanes in Downtown San Jose

BETTER BIKEWAYS PROGRAM

The City of San Jose is in the process of developing a two-year bikeways enhancement program in central San Jose. The effort, dubbed "Better Bikeways," emphasizes street calming and complete streets treatments. Selected corridors in this program will be improved in conjunction with re-pavement projects. Several streets that cross SR 87 will be improved: Empire St., St. John St., San Fernando St., Park Ave., and Auzerais Ave. Bicycle improvements include cycle tracks, bike boulevards, intersection improvements, and improvements to points of conflict between bus stops and bike lanes. Upon full build-out, downtown San Jose will be connected with a safe and convenient network of bicycle facilities and high-quality access to exiting trails and transit stations including Diridon Station and VTA light rail stations. Figure 5-15 shows the City's estimated roll-out of the projects.

Figure 5-15. Better Bikeways Program



Source: City of San Jose

SKY LANE VISION STUDY

The City of San Jose Trails Program has developed a vision study for a signature bicycle and pedestrian bridge that extends the Three Creeks Trail from the Willow Glen neighborhood, across VTA LRT tracks, Caltrain tracks, and SR 87 to Coyote Creek Trail. The visionary project is conceptual, but presents an example of how bicycle facilities can be used for placemaking and tourist attractions. Refer to Figures 5-16 and 5-17.

Figure 5-16. SKY Lane Vision Study
Source: City of San Jose Parks, Recreation and Neighborhood Services Department

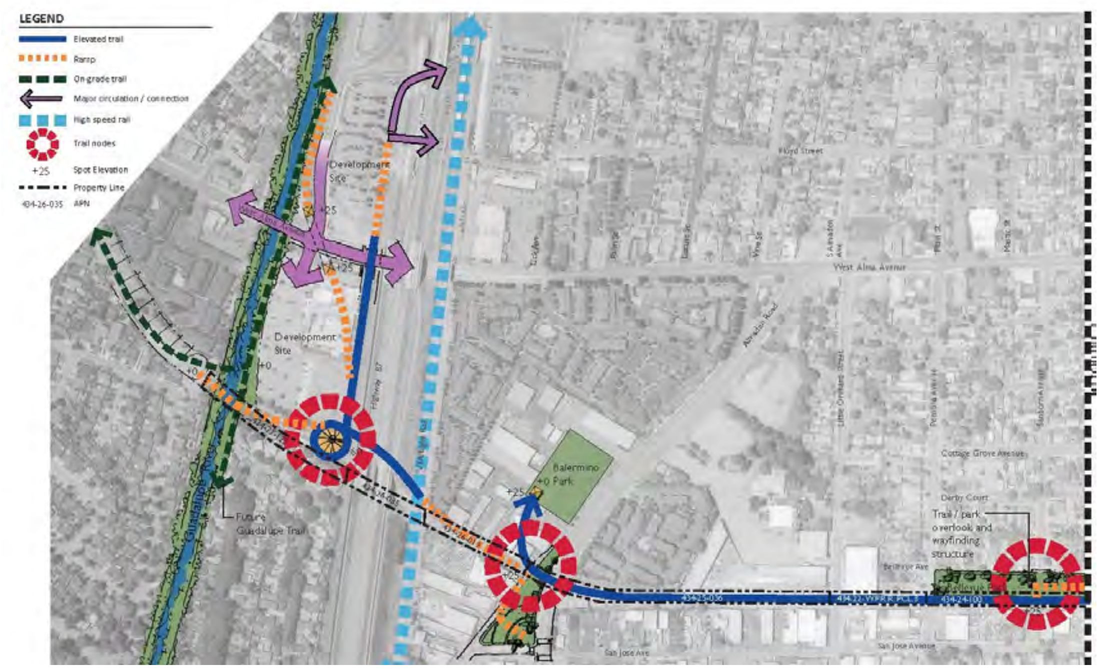


Figure 5-17. SKY Lane Vision Study Conceptual Alignment
Source: City of San Jose Parks, Recreation and Neighborhood Services Department

COMMUNICATIONS HILL TRAIL

Communications Hill is a development located in central San Jose between SR 87 and Monterey Road. The land use designation for this area is a mixed use of residential, commercial, retail industrial park, and other supporting uses. Early phases of development of the Communications Hill Trail have been completed, and more developments will be completed in future years. Planned development will provide about 5 new miles of trails and extend the trail system from the Hill to the Highway 87 Bikeway and Curtner LRT station. A 0.6-mile reach of the trail is open on the Hill; it extends from Grassina Street to Communications Hill Boulevard.

The entire development will provide 2,200 new residential units. Implementation of Communication Hills Trail will benefit current and future residents of this newly developed neighborhood in San Jose and create a well-connected alternative mode for residents to access the Curtner LRT station or the Highway 87 Bikeway (Figure 5-18).

Figure 5-18. Communication Hills Planned Trail Alignment

Source: City of San Jose Park, Recreation and Neighborhood Services Department

COUNTYWIDE BICYCLE PLAN

The 2018 Countywide Bicycle Plan was adopted by the VTA Board of Directors in summer 2018. The Plan identifies Cross County Bikeway Corridors (CCBCs), which represent corridors that potentially have significant impact on bicycle commute at the countywide level. During the planning process, staff developed a prioritization methodology for CCBCs. The result is a subset of CCBCs that are identified as Priority CCBCs.

The plan also identifies Across Barriers Connections (ABCs). These are locations where an improvement is needed to provide adequate bicycle access across a major barrier (freeway, rail line or waterway). The plan identifies three categories of ABCs:

- Category 1: Inadequate Roadway Crossings – Existing roadway crossings of barriers where there is no bicycle lane and the shoulder is less than four feet wide.

- Category 2: Unfriendly Freeway Interchanges – Freeway interchanges with free on/off-ramps or no bicycle lane or shoulder.
- Category 3: Large Distance Between Existing Crossings of Major Barriers –Segments where physical crossings of major barriers are more than one mile apart.

In total, 48 ABCs are identified within one mile of the SR 87 corridor, as shown in Figure 5-19. Proposed CCBCs within one mile around SR 87 are shown in Figure 5-20.

CALTRANS DISTRICT 4 BIKE PLAN

The Caltrans District 4 Bike Plan was released in spring 2018 as the first ever bike plan for the State highway system in the San Francisco Bay Area. The plan identifies infrastructure improvements that can enhance bicycle safety and mobility throughout District 4 and remove some of the barriers to bicycling in the region. The plan was developed in cooperation with local and regional partners to ensure that the improvements on the State highway system complement proposals for local networks.

Nine bicycle projects around SR 87 are planned, including one top-tier new separated crossing project at SR 87 and Guadalupe Parkway. All District 4 Bike Plan projects are listed in Section 7.

Planned Pedestrian Projects

Better walking access to transit stops can potentially encourage more commuters to take transit. For the purpose of this study, VTA has drawn recommended pedestrian improvements from two places: 1) projects identified in VTA's recently adopted Pedestrian Access to Transit Plan and 2) newly identified pedestrian improvements identified within a half-mile walkshed of VTA light rail stations. Both are described below.

VTA'S PEDESTRIAN ACCESS TO TRANSIT PLAN

VTA's Pedestrian Access to Transit Plan was adopted in fall 2017. The plan analyzed pedestrian conditions countywide and identified twelve focus areas that have a greater need for pedestrian access improvements around transit stops. Two of the focus areas intersect with SR 87 study area. Twenty-seven capital projects identified in the plan are located within a half-mile of the SR 87 corridor.

OTHER PEDESTRIAN IMPROVEMENTS WITHIN HALF MILE OF LIGHT RAIL STATIONS

Using Geographic Information Systems tools, VTA drew a half-mile boundary around light rail stations. The walkshed is drawn using the street network, and so includes only areas that are physically accessible within a half-mile (Figure 5-21). Using aerial and street view photos, VTA identified potential infrastructure improvements. These focused on intersection improvements, filling in sidewalk gaps, shortening crossing distance, new crossings, streetscape improvements, and new pedestrian connections.

Figure 5-19. Proposed Across Barrier Connections (Abcs) Within a Mile Buffer Around SR 87

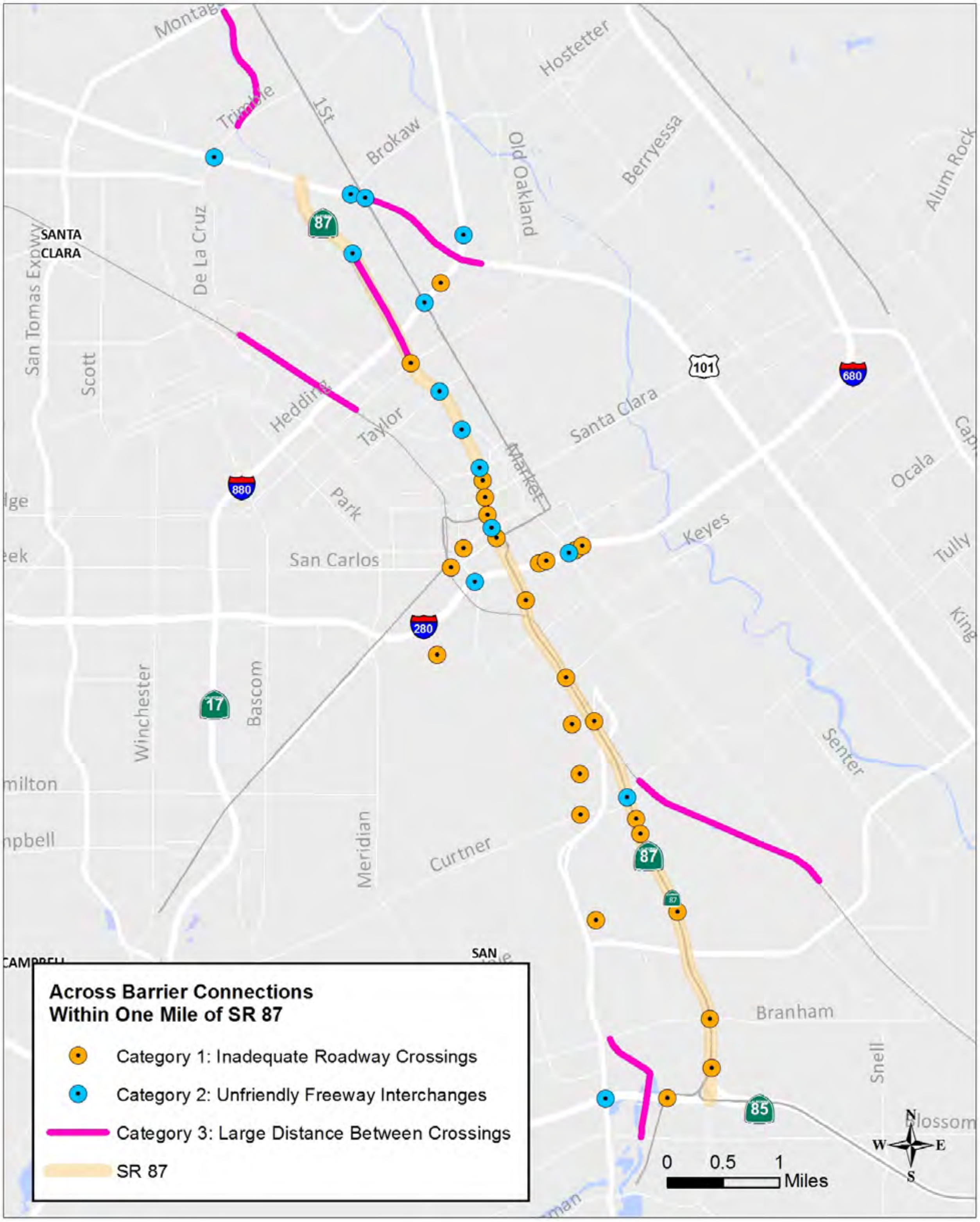


Figure 5-20. Proposed Cross County Bikeway Corridors (Ccbcs) Within One Mile Around SR 87

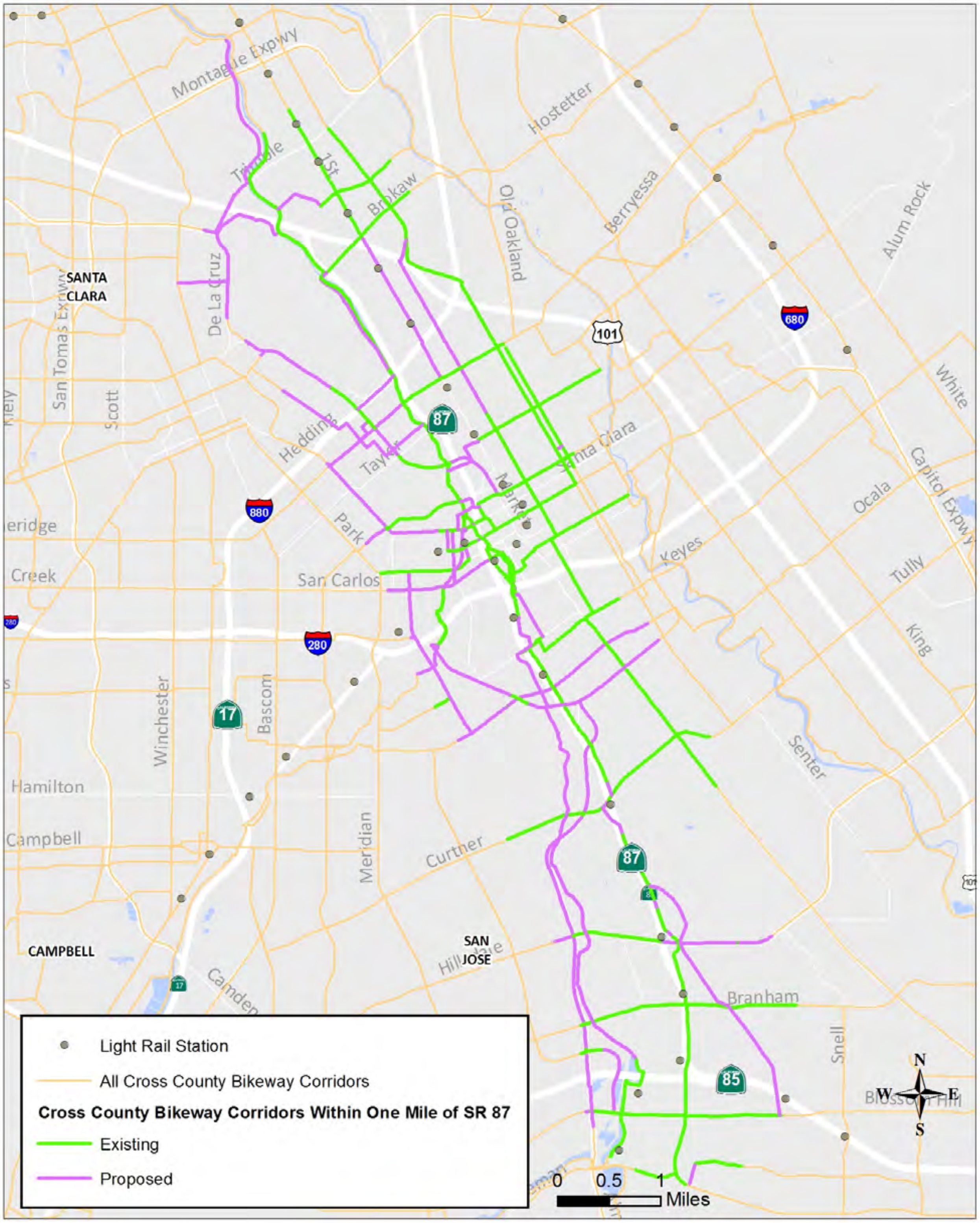
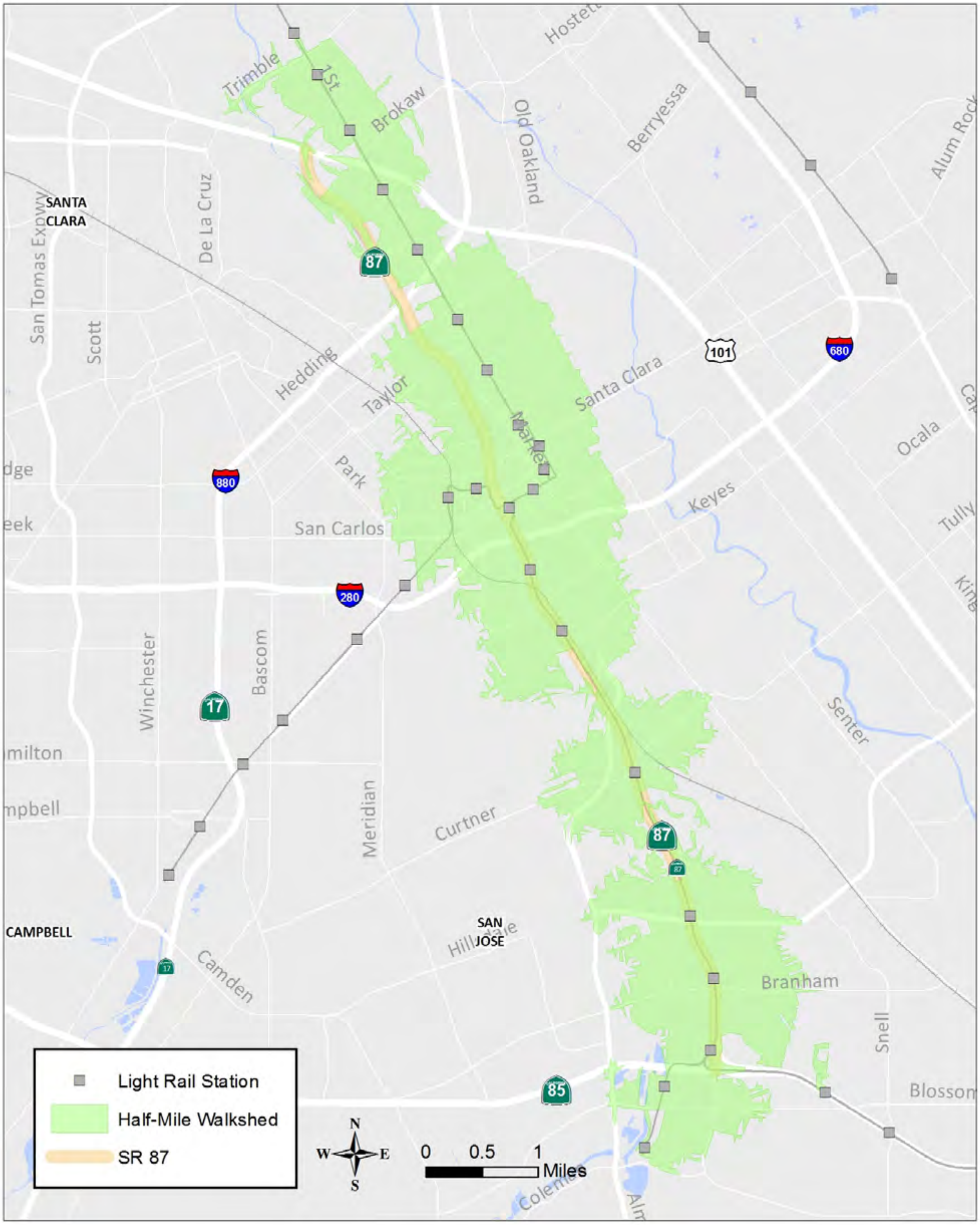


Figure 5-21. Half-Mile Walkshed Around VTA Light Rail Stations – Used For Identifying Potential Pedestrian Improvements.



Education and Encouragement to Support Mode Shift

If every commuter that currently drives took transit, biked, or walked just once a week, vehicle commuter congestion would be reduced by 20%. Small changes and new habits, when applied across a large group, can result in significant changes. Education and encouragement programs can help shift people's ideas of what is possible and help them make new choices.

Mode shift can be supported in a variety of ways:

- Publicizing and supporting events like Bike to Work Day
- Supporting personal travel planning efforts, which provide customized travel options and special events for individuals that live or work in a transit or bike supportive area
- Carpool and bikepool matching services
- Showing bicycle and transit travel times alongside driving travel times for changeable message signs
- Real-time electronic message boards at trail heads for communication with trail users
- Providing feedback and a sense of community to trail and transit users with automated counting systems that display the number of people who "took the trail" or "got off at this stop" that day (Figure 5-22)
- Publicizing the existence of the Guadalupe River Trail and SR 87 Trail, through events, rides, public art2ork visible from SR 87 (figures 5-23 and 5-24)
- Developing an app/website or other method for trail users to identify problem spots and send their concerns to the appropriate public agency to remedy
- Using illuminated pavement as wayfinding at trail heads and trails (Figure 5-25)

Figure 5-22. Bike Counter in San Francisco

Figure 5-23. Conceptual Sketch of Temporary Art Installation that Identifies the Guadalupe River Trail for Motorists on SR 87

Figure 5-24. Conceptual Sketch of Billboard Reminding Drivers They Can Bike Instead of Drive.

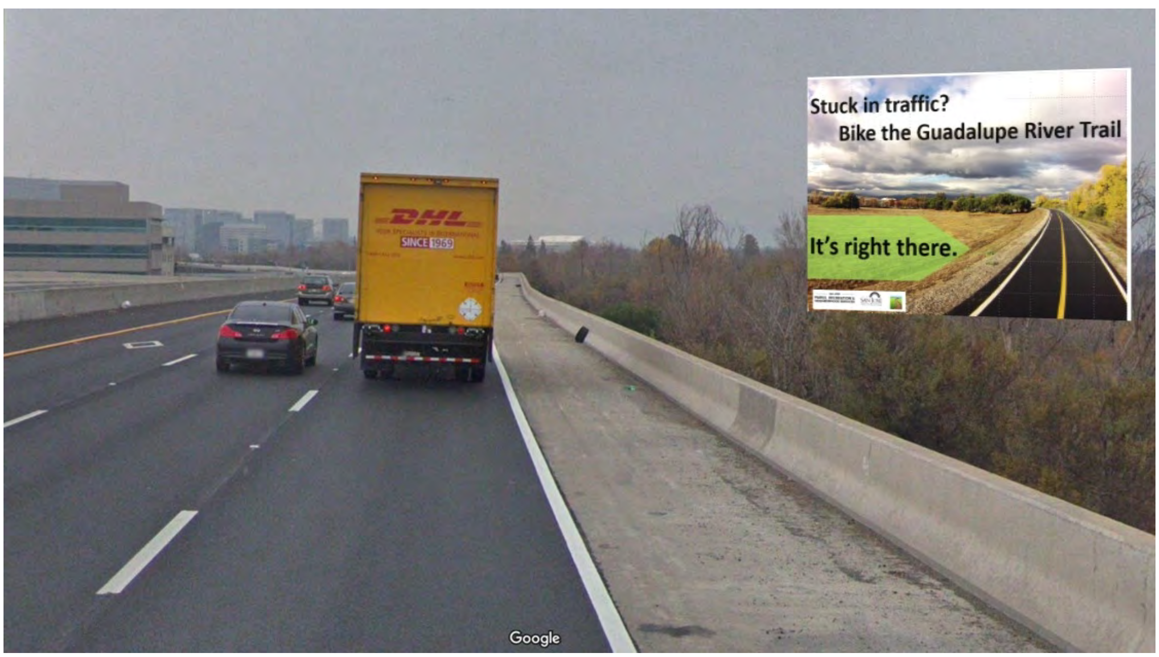


Figure 5-25. Illuminated Pavement, Poland

Source: EcoWatch

5.5.3 Transit Improvements

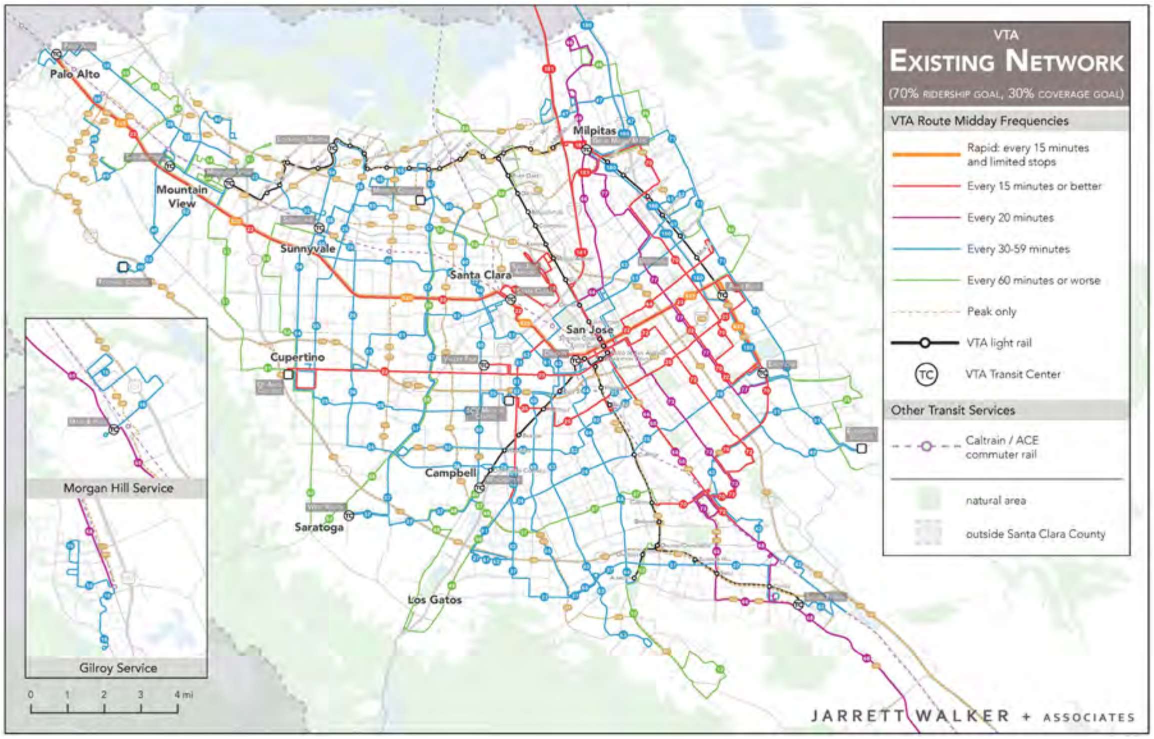
Planned Transit Projects

Santa Clara County—home to almost 2 million residents and a major work destination within the Bay Area—strongly needs a robust and efficient public transit system. For the past three decades, the County has been rapidly changing, leading to adjustments in demand for public transportation. To better facilitate these changes and prepare for the future growth, VTA has developed a series of public transit-focused plans and potential projects with a timeline ranging from immediate implementation to 20+ years of planning. A significant number of these projects are located within the boundary of SR 87 and, therefore, will influence the corridor's operation in the future. This section discusses all known to-date transit projects along SR 87.

NEXT Network

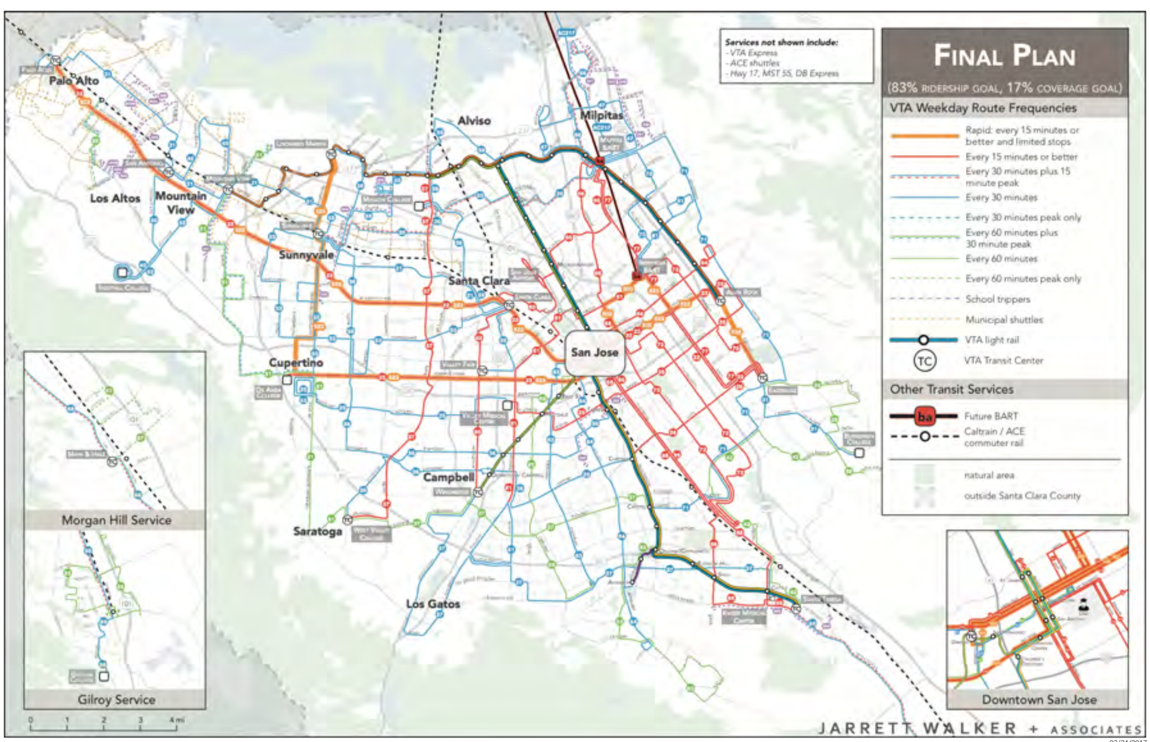
VTA conducts bi-annnual transit service plan revisions; for the fiscal year 18-19 transit service plan, VTA expanded this effort to completely redesign the transit network to increase overall ridership and improve cost-effectivness. Because of the scale of the changes, this effort was developed into a separate plan called "NEXT Network." The general details of the current route network and NEXT Network are shown on the maps in figures 5-26, 5-27 and 5-28.

Figure 5-26. Existing VTA Transit Network



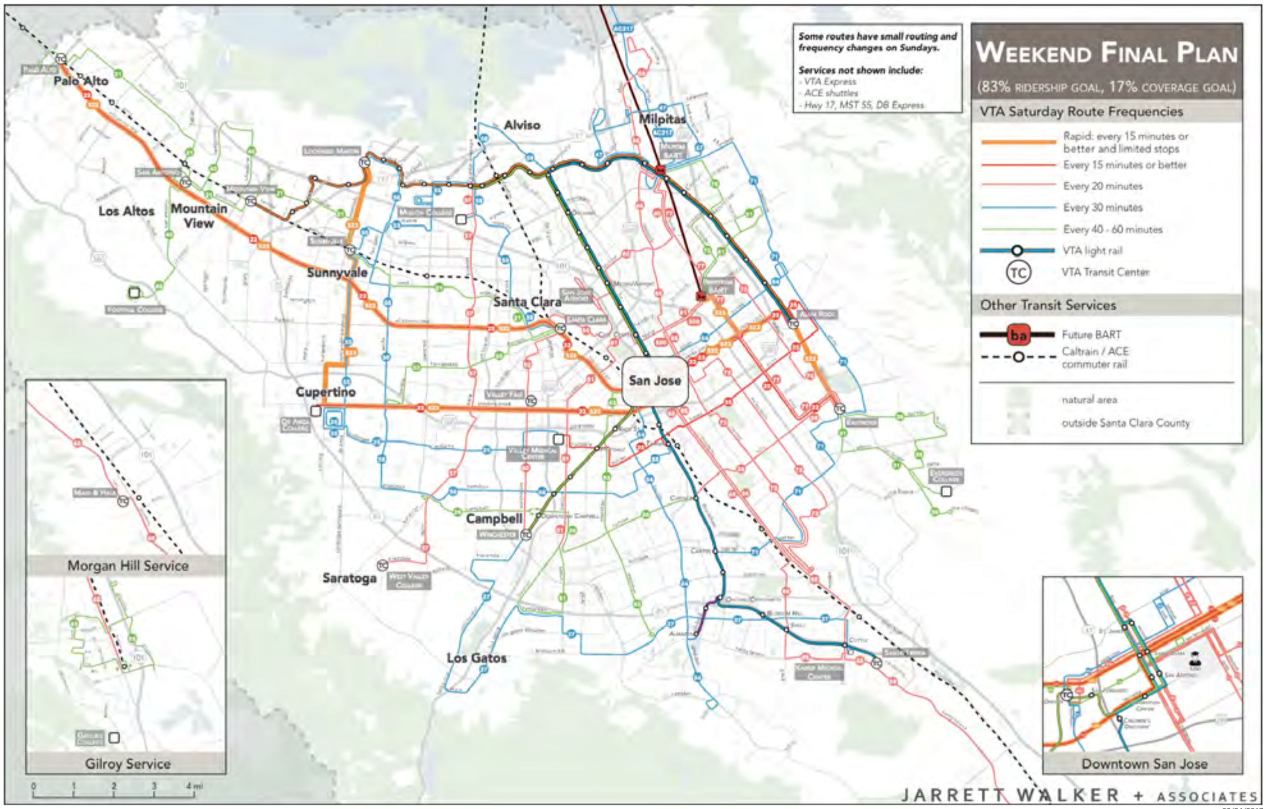
Source: http://nextnetwork.vta.org/transit-service-maps

Figure 5-27. VTA NEXT Network Route Plan – Weekday



Source: http://nextnetwork.vta.org/transit-service-maps

Figure 5-28. VTA NEXT Network Route Plan – Weekend



Source: http://nextnetwork.vta.org/transit-service-maps

As described in Section 3, Existing Conditions, there are several transit routes that run along SR 87, at least partially. Changes in operation to some of the routes are listed in Table 5-4 . All changes are considered for the parts of the routes within the corridor boundaries. No changes are planned for LRT 901 (blue), LRT 900 (purple), Express Bus 168, or Express Bus 182.

Table 5-4. Changes to Operations of Existing Transit Routes in the SR 87 Corridor

Transit Line	Route	Weekday Frequency	Saturday Frequency	Sunday Frequency	Hours of Operation
LRT 902 (Green)	None	30 min to 15 min (midday)	None	None	None
Bus 64	Change downtown routing (Julian to 6th/7th and San Fernando); extend route to Camden in Almaden Valley.	None	None	None	11:30 pm to 12:00 am (Weekday) 11:00 pm to 12:00 am (Saturday) 10:00 pm to 11:00 pm (Sunday)
Bus 66	Weekday frequency changes by segment; move to 10th/11th Streets from 1st Street	20 min (midday) to 15–30 min (all day)	None	None	11:00 pm to 12:00 am (Sunday)
Bus 68	Decrease midday frequency south of Santa Teresa LRT station; increase midday frequency north of Santa Teresa LRT station.	20 min (midday) to 15–30 min (all day)	None	None	1:30 am to 12:00 am (Weekday) 1:30 am to 12:00 am (Saturday) 1:30 am to 12:00 am (Sunday)
Bus 82	Discontinued				

Light Rail Safety and Speed Pilot in Downtown San Jose

VTA plans to launch a six-month pilot by the end of 2018 designed to increase safety near light rail in downtown San Jose. The Light Rail Safety and Speed Pilot Project's goal is to enhance safety near light rail lines in downtown as a first step to eventually increasing operating speeds in the area.[8]

Downtown San Jose is the slowest part of VTA's light rail system. The regulated operating speed for light rail in downtown is 10 mph, although trains average about 7.5 mph between stations. The current design of the transit mall lacks a separation between the sidewalk and trackway. This can cause unpredictable pedestrian, bicycle, and vehicle intrusions into the trackway (Figure 5-29).

[8] Light Rail Safety and Speed Pilot Project: http://www.vta.org/projects-and-programs/transit/light-rail-speed-and-safety

Figure 5-29. Light Rail in Downtown San Jose

The pilot will be installed on Second Street between San Fernando and San Carlos streets. VTA and community stakeholders undertook an iterative process to define appropriate enhancements and ensure that design elements address the needs of the community, businesses, and residents. Designs are scheduled to be finalized in June 2019 and will include railings that will run the length of the pilot block with breaks for driveways and the Paseo de San Antonio crossing. The railing will help delineate the sidewalk from the trackway. Wayfinding signage will also be added to help guide people to designated crossing areas. The results of the pilot will inform VTA's decisions about future improvements along the transit mall.

Transit Access Improvements and Incentives

Many participants of VTA's community survey for this study said that schedules for various transit services like bus, LRT, Caltrain should be coordinated such that there is sufficient transfer time for passengers without either a long wait or missing the next connection. There was also public support for improving lighting and cleanliness at transit stations and bus stops. Improving pedestrian access to stations was also an important consideration. Encouraging transit use through public agency and company partnerships by providing incentives like subsidized transit cards and promotions like "take transit to work" days would be helpful in increasing transit ridership.


NORTH
87
EXIT 6
Santa Clara St
Julian St
San Carlos St
Auzerais Ave
82
ONLY

6

EVALUATION OF POTENTIAL ALTERNATIVES

The potential improvements discussed in Chapter 6 were assessed based on cost- benefit criteria. The evaluation methodology and criteria used are described in this section.

SECTION CONTENTS

- Frewway Projects Evaluation & Cost Estimates
- Bicycle Projects Evaluation & Cost Estimates
- Pedestrian Projects Evaluation & Cost Estimates
- Future Planned Transit Projects

6.1 Freeway Projects Evaluation & Cost Estimates

A weighted score methodology was used to evaluate potential freeway improvements. Six criteria were identified, and a weighted percentage was assigned to each criterion according to its relative importance. Each criterion was then scored from 1 to 10, with 1 being the least favorable and 10 being the most favorable. A rating of 5 was considered neutral, 1–2 not favorable, 3–4 less favorable, 6–8 favorable, and 9–10 highly favorable. The score was then multiplied by the weighted percentage, and the results for all criteria were then totaled to arrive at an overall score for that project. All projects were then ranked from highest to lowest, with the highest being ranked 1.

Table 6-1 shows the criteria considered and the weights assigned each criterion.

Table 6-1. Weighted Criteria for Evaluating Freeway Improvement Projects

Criteria	Description	Weight
Increases vehicle occupancy levels	If more people carpooled, average vehicle occupancy would increase, which is a benefit.	35%
Improves Travel time	Travel time reduction is a benefit.	15%
Increases use of transit and other modes	If the project increases the use of transit, then it is favorable. For example, converting the shoulder for bus use would improve bus travel time.	25%
Reduces emissions	Environmental benefits would accrue through the reduction in the number of vehicles on the freeway.	5%
Public opinion	Taken from the survey results.	10%
Enhances safety	By reducing the probability of incidents.	10%

To generate a priority list, VTA staff evaluated all recommended projects by asking the following questions:

- Is this a technology-based improvement?
- Does this project improve traffic operations?
- Does this project help reduce solo driving?
- Is this an independent project or a dependent infrastructure enhancement like a communication backbone or a new transit line; does it require legislation approval, etc.?

Freeway improvements were categorized into:

1. Freeway capacity utilization
2. Technology improvements
3. Transportation demand management

Potential options in each category were compared to each other. Tables 6-2 through 6-4 show the improvement options according to their ranking from highest to lowest, along with cost, timeline and priority.

Table 6-2. Freeway Capacity Utilization Options

P#	Freeway Capacity Utilization Potential Projects/ Strategies	Cost ($M) 2017	Timeline Near 1-3 yrs Mid 3-7 yrs Long > 7 yrs	Priority
A1	PTL - Connector Ramps - Charcot Avenue to SR 87 SB (HOV only)	$3	Near	High
A2	PTL - Connector Ramps - I-280 SB to SR 87 SB (HOV only)	$3	Near	High
A3	PTL - Connector Ramps - SR 87 SB to I-280 NB (HOV only)	$3	Near	High
A4	PTL - Connector Ramps - SR 87 NB to I-280 NB (HOV only)	$3	Mid	High
A5	PTL - Connector Ramps - I-280 NB to SR 87 NB (HOV only)	$3	Mid	High
A6	PTL SB - Alma to SR 85 (Transit only - left shoulder)	$24	Mid	High
A7	PTL - Connector Ramps - I-280 NB to SR 87 SB (HOV only)	$6	Mid	High
A8	PTL - Connector Ramps - I-280 SB to SR 87 NB (HOV only)	$3	Mid	High
A9	PTL NB - Alma Avenue to I-280 off-ramp (All Vehicles-Right Shoulder)	$5	Mid	Low
A10	PTL NB - Hedding to Airport Parkway (Transit & HOV - left shoulder)	$5	Mid	Low
A11	US 101 SB to SR 87 SB ITS elements	$2	Mid	Low
A12	Convert HOV to EL in Southbound Direction	$20	Mid	Low
A13	PTL NB - Hedding to Airport Parkway (Transit - left shoulder)	$19	Mid	Low
A14	PTL - Connector Ramps - SR 85 NB to SR 87 NB (HOV only)	$24	Mid	Low
A15	PTL SB - Alma to SR 85 (Transit and HOV - left shoulder)	$2	Long	Low
A16	PTL SB - Airport Parkway to Hedding (All Vehicles - right shoulder)	$6	Long	Low

P#	Freeway Capacity Utilization Potential Projects/ Strategies	Cost ($M) 2017	Timeline Near 1-3 yrs Mid 3-7 yrs Long > 7 yrs	Priority
A17	PTL NB - SR 85 to Alma Avenue (All Vehicles - right Shoulder)	$19	Long	Low
A18	PTL NB - Hedding to Airport Parkway (All vehicles - right shoulder)	$5	Long	Low
A19	PTL SB - Alma to SR 85 (All vehicles - right shoulder)	$24	Long	Low
A20	Convert HOV to EL in Northbound Direction	$6	Long	Low
A21	SR 87 Technology-based Corridor Improvements (RTP ID 17-07-0009)	$52	RTP	RTP
A22	Double Lanes Southbound US 101 off-ramp to Southbound SR 87 (RTP ID 17-07-0044)	$3	Near	High

Note: RTP= Regional Transportation Plan

Table 6-3. Technology-Based Improvement Options

P#	Technology Improvements Potential Projects/ Strategies	Cost ($M) 2017	Timeline Near 1-3 yrs Mid 3-7 yrs Long > 7 yrs	Priority
TI 1	MaaS (Mobility as a service) (App)	$2	Near	High
TI 2	Technology infrastructure enhancements (Backbone corridor communications)	$8	Near	High
TI 3	CMS - SR 87/Narvaez Ave-Capitol Expressway (P&R Availability, LRT Travel time)	$1	Near	High
TI 4	CMS - SR 87 NB near Diridon Station (P&R Availability, LRT Travel time)	$1	Near	High
TI 5	CMS - SR 87 SB near Diridon Station (P&R Availability, LRT Travel time)	$1	Near	High
TI 6	Adaptive Ramp metering	$1.5	Mid	High
TI 7	CMS - US 101 SB to SR 87 SB (LRT travel time)	$2	Mid	High
TI 8	Carpool lane travel time information Apps	$1	Mid	High
TI 9	Speed Harmonization (to reduce recurring congestion)	$1	Mid	Low

Table 6-4. Transportation Demand Management Options

P#	Transportation Demand Management Potential Projects/ Strategies	Cost ($M) 2017	Timeline Near 1-3 yrs Mid 3-7 yrs Long > 7 yrs	Priority
TDM1	Promote carpool use by providing incentives (by employer)	$0.50	Near	High
TDM2	Extend carpool hours for provide travel time reliability all day long	$0.50	Near	High
TDM3	First-Last Mile trip completion alternatives to promote transit use	$1.50	Near	High
TDM4	Balanced Transportation Education Program	$5.40	Near	High
TDM5	Staggered work schedules	$0.50	Near	Low
TDM6	Encourage Companies to provide more shuttles with higher occupancy	$0.50	Mid	Low
TDM7	Develop semi-customized transit routes partially subsidized by employers	$0.50	Mid	Low
TDM7	Convert HOV 2+ to HOV 3+	$0.50	Long	Low

6.2 Bicycle Projects Evaluation & Cost Estimates

City of San Jose Bike Plan 2020 prioritized the recommended projects into priority 1 and 2. Unbuilt projects that serve the SR 87 study area are listed in Table 6-5 as recommended projects. The California Department of Transportation (Caltrans) District 4 (D4) Bike Plan identified nine projects in SR 87 study area that are also listed in Table 6-5.

During development of the 2018 Countywide Bicycle Plan, staff developed a prioritization methodology for two types of bicycle improvement projects: Cross County Bikeway Corridors (CCBCs) and Across Barrier Connection (ABC) Improvements. To be consistent, the same criteria are used for SR 87 recommended bicycle projects.

To prioritize CCBCs, VTA evaluated the recommended network to identify corridors that will best advance the Countywide Bicycle Plan's vision of a safe, convenient, and connected network of bikeways that serve major destinations. Potential ridership, as estimated by VTA's travel demand model, played a key role in identifying priority CCBCs.

The criteria used to prioritize CCBCs are:

- Safety: Bicycle collision density; additional weight for fatal and severe injury collisions.
- Safety: High level of traffic stress; bicycle level of traffic stress, calculated based on posted speeds, vehicle volumes, and existing bicycle infrastructure. Higher stress segments received higher scores than lower stress segments. It is not possible to measure levels of traffic stress on unbuilt bicycle paths. Instead, we assumed all unbuilt bicycle paths have a high level of traffic stress.
- Projected bicycle ridership in 2026.
- Projected transit access in 2026.
- Projected bicycle ridership for work and school commutes in 2026.
- Destinations; average density per mile of schools, parks, and shopping areas within a 1/4 mile. Additional weight for destinations serving disadvantaged populations.
- Projected equity in 2026; the Metropolitan Transportation Committee's (MTC) Communities of Concern area is used.
- Community Support; based on comments received through in-person or online outreach.

To generate a priority list for ABCs, VTA evaluated all recommended ABCs by asking the following questions:

- Does it close a gap in a priority CCBC?
- Does it create a connection to a nearby priority CCBC?
- Was it submitted for consideration for potential 2016 Measure B programming or funding?, through VTA's Envision Process?
- Is it included in a local planning document?
- Is it included in a VTA plan, other than the Countywide Bicycle Plan?

The more "yes" answers it received, the higher an ABC scored.

Table 6-5. Recommended Bicycle Improvement Projects

Note: Priority projects are indicated by dark shading.

Project Locations	At	Status	In Any Previous Plan?	Cost
Type of Project: Intersection Improvement; Inadequate Roadway Crossing				
SR 85	Winfield Blvd.	Planned (no funding)	Countywide Bicycle Plan (CBP)	$1,000,000
I-880	Fourth St.	Planned (no funding)	CBP	$1,000,000
SR 87	Airport Parkway	Planned (no funding)	CBP	$1,000,000
SR 87	Almaden Blvd.	Planned (no funding)	CBP	$1,000,000
SR 87	San Carlos St.	Planned (no funding)	CBP and Caltrans D4 Bike Plan	$1,000,000

Project Locations	At	Status	In Any Previous Plan?	Cost
SR 87	Virginia St.	Unplanned	CBP	$1,000,000
SR 87	Alma Ave.	Planned (no funding)	CBP	$1,000,000
SR 87	Almaden Rd.	Planned (no funding)	CBP	$1,000,000
SR 87	Mill Pond Dr.	Unplanned	CBP	$1,000,000
SR 87	Carol Dr.	Unplanned	CBP	$1,000,000
SR 87	Hillsdale Ave.	Planned (no funding)	CBP	$1,000,000
I-280	Vine St.	Planned (no funding)	CBP	$1,000,000
I-280	Almaden Ave.	Unplanned	CBP	$1,000,000
US 101	Interchange De La Cruz/ Trimble	In progress (some funding)	CBP	$500,000
US 101	Interchange Brokaw	Planned (no funding)	CBP	$500,000
I-280	Interchange Bird	Planned (no funding)	CBP	$500,000
I-280	Interchange First/ Monterey	Planned (no funding)	CBP	$500,000
I-880	Interchange Old Bayshore Highway	Planned (no funding)	CBP	$500,000
I-880	Interchange First	Planned (no funding)	CBP	$500,000
SR 85	Interchange Almaden Expy.	Planned (no funding)	CBP	$500,000
SR 87	Interchange Skyport	Unplanned	CBP	$500,000
SR 87	Interchange Coleman	Planned (no funding)	CBP	$500,000
SR 87	Interchange Julian	Planned (no funding)	CBP and Caltrans D4 Bike Plan	$500,000
SR 87	Interchange Park	Unplanned	CBP	$500,000
SR 87	Interchange Curtner	Unplanned	CBP	$500,000
US 101	Interchange N. First St.	Unplanned	CBP	$500,000
Guadalupe River	Willow Glen Way	In progress (some funding)	CBP	$1,000,000

Project Locations	At	Status	In Any Previous Plan?	Cost
Guadalupe River	Malone Rd.	In progress (some funding)	CBP	$1,000,000
Guadalupe River	Foxworthy Ave.	Unplanned	CBP	$1,000,000
Los Gatos Creek	San Carlos	Unplanned	CBP	$1,000,000
Type of Project: Bicycle/Pedestrian Bridge or Undercrossing				
UPRR/ Caltrain	Between Brokaw and Hedding	Planned not funded	CBP	$10,000,000
Hwy 101	Between First and 10th sts.	In progress	CBP	$10,000,000
SR 87	Between Hedding and Skyport	Unplanned	CBP	$10,000,000
Guadalupe River	Between Branham and Blossom Hill	Planned not funded	CBP	$10,000,000
Guadalupe River	Between Trimble and Montague	Planned not funded	CBP	$10,000,000
Light Rail Tracks	Between Curtner and Fehren	Planned not funded	CBP	$10,000,000
Type of Project: Trail-Class I Path				
Guadalupe River Trail, west side trail	Between River Oaks and Trimble	Planned not funded	CBP	$4,590,000
Los Gatos Creek	From Santa Clara St to San Carlos St	Planned not funded	CBP	$2,100,000
Los Gatos Creek Trail	Between Lunas and Avis	Planned not funded	CBP	$1,890,000
Three Creek Trail	Between Lunas and Spencer	Planned not funded	CBP	$2,760,000
Three Creek Trail	Between Falcon and 10th sts	Planned not funded	CBP	$4,440,000
Guadalupe River Trail	Between Virginia and Chynoweth Ave	Planned not funded	CBP	$15,180,000
Highway 87 Bikeway	Between Curtner and Carol Dr	Planned not funded	CBP	$1,140,000
Highway 87 Bikeway	Unified Way to Curtner	Planned not funded	CBP	$360,000
Highway 87 Bikeway	From Helzer Rd. to Blossom Hill	Planned not funded	CBP	$8,100,000
Type of Project: On-Street Bike Facility				
Trimble	Between Central Expressway and Guadalupe River Trail	Planned not funded	CBP	$348,000

Project Locations	At	Status	In Any Previous Plan?	Cost
Orchard Parkway-Component Dr	Between Charcot Ave. and Guadalupe River Trail	In progress	CBP	$300,000
Airport Blvd-Ewet Rd	De La Cruz to Guadalupe River Trail	Planned not funded	CBP	$456,000
De LA Cruz	From Central Expressway and Reed St.	Planned not funded	CBP	$510,000
Coleman Ave	From De La Cruz ramp to Brokaw	Planned not funded	CBP	$126,000
Coleman Ave	From Brokaw to Newhall	Planned not funded	CBP	$1,350,000
Airport Blvd	From Coleman to Airport Parkway	Planned not funded	CBP	$1,020,000
North First Street	From Brokaw to Hedding	Planned not funded	CBP	$912,000
Zanker Rd	From Bering Dr to Matrix Blvd	In progress	CBP	$132,000
4th Street	From Matrix Blvd to Jackson St.	In progress	CBP	$996,000
Ryland Street	From Guadalupe River Trail to Coleman	Planned not funded	CBP	$220,000
San Pedro	From Ryland to Hawthorne Way	Planned not funded	CBP	$82,500
Hawthorne Way	From san Pedro to N. First	Planned not funded	CBP	$82,500
Coleman Ave	From Hedding to Taylor	Planned not funded	CBP	$210,000
Coleman Ave	From Guadalupe River Trail to St. John	Planned not funded	CBP	$354,000
St. John	From Almaden Blvd to Autumn	In progress	CBP	$148,000
Autumn	From St. John to Santa Clara St	In progress	CBP	$74,000
Martin Ave	From De La Cruz to Lafayette	Planned not funded	CBP	$294,000
The Alameda	From Hedding to Stockton Ave	Planned not funded	CBP	$786,000
Cahill	From Santa Clara St to San Fernando	In progress	CBP	$108,000
Montgomery	From Santa Clara St to San Carlos St	In progress	CBP	$294,000
San Carlos St	From Montgomery to Woz Way	Planned not funded	CBP	$462,000

Project Locations	At	Status	In Any Previous Plan?	Cost
Asbury St	From Guadalupe River Trail to Chestnut	Planned not funded	CBP	$276,000
Chestnut	From Asbury to University	Planned not funded	CBP	$108,000
University	From Chestnut to Stockton Ave	Planned not funded	CBP	$54,000
Stockton Ave	From University to I-880	Planned not funded	CBP	$174,000
Lincoln Ave	Park to Minnesota	In progress	CBP	$1,230,000
Alma	Between Three Creek Trail and 10th St	Planned not funded	CBP	$858,000
Minnesota	Between Three Creek Trail and Glenpine Dr	Planned not funded	CBP	$480,000
Palm	Between Grant and Willow	Planned not funded	CBP	$288,000
Cherry Ave	Between east of Almaden Expressway to Blossom Hill	Planned not funded	CBP	$420,000
Taylor St	Coleman Ave to The Alameda	Planned not funded	San Jose Bike Plan 2020	
Taylor St	First St to 21st St	Planned not funded	San Jose Bike Plan 2020	
Pine Ave	Hicks Ave to Almaden Rd	Planned not funded	San Jose Bike Plan 2020	
Hillsdale Ave	Almaden Expy to Capitol Expy	Planned not funded	San Jose Bike Plan 2020	
Phelan Ave	Monterey to Senter	Planned not funded	San Jose Bike Plan 2020	
Almaden Expressway	From Three Creek Trail to Blossom Hill	Planned not funded	CBP	$2,460,000
Type of Project - Bicycle and Pedestrian Bridge				
SR 87	Guadalupe Pkwy	Planned not funded	Caltrans D4 Bike Plan	Over $7,000,000 (per D4 Bike Plan est.)
Three Creek Trail	Over SR 87	Planned not funded	CBP and Sky Lane Vision Study	$48,000,000
Type of Project - Interchange Reconstruction - Full Reconstruction, Class I				
SR 87	Capitol Corridor rail tracks	Planned not funded	Caltrans D4 Bike Plan	Over $ 7,000,000 (per D4 Bike Plan est.)

Project Locations	At	Status	In Any Previous Plan?	Cost
Type of Project - Interchange reconstruction - Full Reconstruction- Class IV				
SR 87	Taylor St	Planned not funded	Caltrans D4 Bike Plan	Over $ 7,000,000 (per D4 Bike Plan est.)
SR 87	Capitol Expy	Planned not funded	Caltrans D4 Bike Plan	Over $ 7,000,000 (per D4 Bike Plan est.)
Type of Project - Minor Interchange Improvements (Signage And Striping)- Class IV				
SR 87	Azuerais Ave	Planned not funded	Caltrans D4 Bike Plan	$250,000 to $1,5000,000 per D4 Bike Plan est.)
Type of Project - Add Continuous Bikeways on Streets Under/Over Freeway- Class IV				
Guadalupe Pkwy	Parallel to SR 87	Planned not funded	Caltrans D4 Bike Plan	$250,000 to $1,5000,000 per D4 Bike Plan est.)
Hwy 101	North 1st Street/ US 101 interchange	In progress	CBP	$10,000,000
Type of Project - Gap Closure				
SR 87/Alma Connection	Alma	Planned not funded	San Jose local plan	
Curtner Connection	Curtner	Planned not funded	San Jose local plan	
SR 87 Bike Path/Communication Hills Connection	Communication Hills	Planned not funded	San Jose Trails Program	$810,000
Communication Hills Trail	Communication Hills	Planned not funded	San Jose Trails Program	$13,200,000
Narvarez Bike Lanes	Helzer Rd. to Branham Ln	Planned not funded	San Jose local plan	$720,000
Type of Project - Maintenance				
Highway 87 Bikeway Trail Restoration	Entire trail	Not funded		

Table 6-6 lists SR 87 corridor study recommended bicycle infrastructure improvements that are not identified as specific projects in San Jose's adopted local plans or the Countywide Bicycle Plan. These projects include:

- **B1** – Electronic bicycle lockers at transit stations: Currently, VTA's transit stations have only keyed bike lockers or both keyed and electronic bike lockers. Upgrading all the existing bike lockers to electronic version will benefit VTA's transit users. Users can get real-time information about how many lockers are available at each transit station, while with the keyed lockers users can't be certain if a locker will be available when they get to the station.
- **B2** – Wayfinding, signage around transit centers: Improving wayfinding and signage around transit centers, especially the major transit centers such as Tamien and Diridon will benefit people who walk or bike to the transit center.
- **B3** - Real-time electronic signage and counters at trail heads: Some agencies around the Bay Area have implemented real-time bike counters at major points along a bike path or bike lane. The real-time electronic signage communicates with trail users; it will benefit trail users if there is any flooding or trail closure at any segment of the facility. This study recommends installing real-time electronic signage at major trail heads around the study area.
- **B4** – Wayfinding, signage along trails: Improving wayfinding and signage along trails will benefit trail users. The City of San Jose Trail Program updated the Trail Signage Guidelines in 2017.
- **B5** – Lighting along the SR 87 Trail: improve lighting along trail to provide a safe 24/7 access to the trail.

Table 6-6. SR 87 Corridor Study Recommended Bicycle Infrastructure Improvements

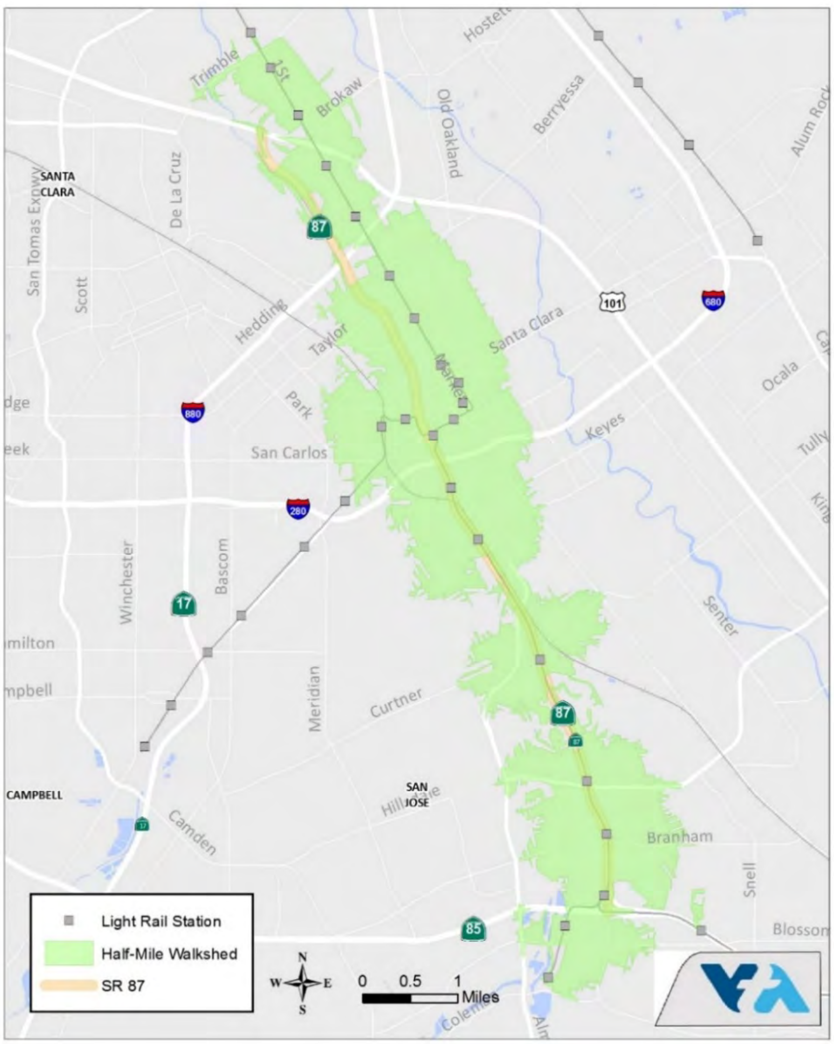
#	Bicycle Infrastructure Improvements	Quantity	Price Per Unit	Total Cost
B1	Electronic bicycle lockers at transit stations	150	$3,000	$450,000
B2	Wayfinding, signage around transit centers	N/A	N/A	$50,000
B3	Real time electronic signage & counter at trail heads	10	$100,000	$1,000,000
B4	Wayfinding, signage along trails	N/A	N/A	$50,000
B5	Lighting along Highway 87 Trail	N/A	N/A	$1,000,000

6.3 Pedestrian Projects Evaluation & Cost Estimates

VTA's Pedestrian Access to Transit Plan was adopted in Fall 2017. The Plan analyzed pedestrian conditions in the countywide level and identified twelve focus areas that have greater need for pedestrian access improvements around transit stops. Two of the focus areas intersect with the SR 87 study area. Twenty-seven capital projects located within a half-mile of SR 87 corridor are identified in this plan; these projects as wells as pedestrian projects that are identified in Guadalupe River Trail Master Plan are listed in Appendix B.

For the purpose of this study, a half-mile walkshed boundary was created around VTA light rail stations by GIS tools (Figure 6-1). The pedestrian needs assessment was done within the walkshed boundary as listed in Table 6-7.

Figure 6-1. Half-Mile Walkshed Around VTA Light Rail Stations



Criteria used for evaluating the pedestrian projects fall in two different categories: community benefits, such as safety, accessibility, and equity, and ease of implementation, such as jurisdictional complexity and existing funding. Table 7-7 shows each criterion along with a description and point value. This methodology is similar to the one used in VTA's Pedestrian Access to Transit Plan.

Table 6-7. Criteria Used for Evaluating Recommended Pedestrian Projects

Criterion	Description	Scoring
Connectivity	Project shortens pedestrian route to transit, completes sidewalks, and/or closes gaps in a transportation facility and/or multimodal network.	Yes=1 point No=0 points
Safety	**High:** Project will address a demonstrated safety issue (e.g., multiple collisions/fatalities/injuries) with a proven/demonstrated countermeasure. **Medium:** Field review and/or public comment indicates a safety problem that would be addressed by the project (e.g., conflicts or evidence of high vehicle traffic volume or speed). **Low:** Project will generally improve safety issues. Project has the potential to reduce exposure/risk of conflicts between motor vehicles and pedestrians.	High=1 point Medium=0.6 points Low=0.3 points Points are not additive.
Accessibility	Project eliminates a barrier to ADA accessibility (e.g., by installing curb ramps where there are none, closing sidewalk gaps, or adding ADA-compliant pedestrian signals where there are none).	Yes=1 point No=0 points
Activity	**Transit Access:** The project falls within a 1/2-mile walk of a rail transit stop or an express bus stop, OR the project falls within a 1/4-mile walk of a bus stop with 40 or more boardings per day. **Destination Access**: The project serves locations that typically generate high levels of pedestrian demand, such as schools, senior centers, community centers, and walkable commercial districts.	Transit Access=0.5 points Destination Access=0.5 points
Equity	Project is located within a Community of Concern or CARE area.[1]	Yes=1 point No=0 points
Community Support	**Local Plans:** The project is identified in a local plan. **Community Champions**: The project is championed by local community members, elected officials or other leaders.	Local Plans= 0.5 points Community Champions= 0.5 points

[1] Community of Concern is identified by Metropolitan Transportation Commission (MTC). Community Air Risk Evaluation (CARE) is identified by Bay Area Air Quality Management District.

Criterion	Description	Scoring
Funding Competitiveness	**Grant Competitiveness:** The project is competitive for One Bay Area Grant (OBAG), Priority Development Area (PDA) Planning Grants, Active Transportation Program (ATP), Highway Safety Improvement Program (HSIP), or other grant programs. **Private Funding:** The project is likely to receive matching funding through private donations (e.g., nonprofit groups, private companies) or be conditioned as part of nearby development.	Grant Competitiveness=0.5 points Private Funding=0.5 points[2]
Maintenance Cost	The project can be implemented without adding signage, striping, public art, lighting, or landscaping that would have to be maintained by the Member Agency.	Yes=1 point No=0 points
Existing Funding	The project is partially funded, with funding deadlines to meet.	Yes=1 point No=0 points
Project Readiness	**Environmental Analysis**: Environmental analysis has been completed, or the project is statutorily or categorically exempt from the California Environmental Quality Act (CEQA). **Right of Way**: The project can be completed without acquisition of right-of-way or easements.	Environmental Analysis=0.5 points Right of Way=0.5 points
Jurisdictional Complexity	**Multiple Member Agencies:** The project can be completed without coordination between multiple Member Agencies/VTA. **Non-Member Agency Involvement**: The project can be completed without coordination with stakeholders such as Caltrans, the Santa Clara Valley Water District, Caltrain, or California Public Utilities Commission.	Multiple Member Agencies=0.5 points Non-Member Agency Involvement=0.5 points

After evaluation, each recommended pedestrian project was identified as one of the following:

- High Priority, Short Term
- High Priority, Long Term
- Medium Term
- Long Term

[2] To evaluate opportunities for private funding through conditions of development, VTA staff conducted a qualitative assessment of the potential for development project(s) to help fund or implement the specified improvements. This assessment was conducted for each Focus Area as a whole, rather than by individual project.

The assessment consisted of two parts: (1) a rating of the amount of recent development that has occurred in the Focus Area (roughly the past five years); and (2) a rating of the general development potential based on availability of underutilized land, and presence of supportive land use plans or policies. For each of these two parts, a score of 0, 0.125 or 0.25 points was given; in that way, the total points for this criterion range from 0 to 0.5 points.

The assumptions and references used in developing order of magnitude cost estimates for the projects are outlined in Table 6-8. Project costs are categorized as "less than $500,000," "$500,000 to $5 million," and "over $5 million." Based on these estimates, there are 83 projects under $500,000, 46 projects between $500,000 and $5 million, and 36 projects over $5 million.

Table 6-8. Assumptions for Order-of-Magnitude Project Cost Estimates[3]

Project type	Less Than $500,000	$500,000–$5M	over $5M
Single-intersection improvements including striping, curb extensions, and pedestrian signals	X		
Adding pedestrian hybrid beacons or rectangular rapid flash beacons	X		
Grouped railway crossing improvements		x	
Single-intersection improvements with adjacent landscaping changes and/or pedestrian refuge		x	
Addition or relocation of a signal mast arm		x	
Multiple signalized intersection improvements		x	
New signalized intersection		x	
Realignment of an intersection		x	
Corridor-level streetscape improvements and sidewalk widening (less than 1/2 mile)		x	
Corridor-level streetscape improvements and sidewalk widening (more than 1/2 mile)			x
Construction of new overcrossings and corridor-level improvements at intersections			x
Completion of sidewalks throughout a neighborhood			x
Intersection ramp realignments, overpass lighting			x
Trail extensions			x

3 Pedestrian Bicycle Information Center, Costs for Pedestrian and Bicyclist Infrastructure Improvements, 2013; Fehr & Peers, 2016. Except Where Noted, Cost Estimates Are for The Largest-Scale Implementation of a Project. Lower Costs May Be Possible with Partial Implementation Of Recommendations Or With The Use Of Short-Term/Tactical Interventions.

Table 6-9 lists the recommended pedestrian improvement projects. More projects are identified in the VTA's Pedestrian Access to Transit Plan (2017). For a supplemental list of pedestrian projects within the walkshed area around VTA light rail stations, review Appendix A.

Table 6-9. SR 87 Corridor Study Recommended Pedestrian Improvement Projects

The "P" numbers in the table correspond to high-priority improvements near light rail stations listed in Table 7-2.

#	Project	Description	Cost
HIGH PRIORITY, SHORT TERM PROJECTS			
Type of Project - Intersection Improvements			
P3	Curtner & Unified Way	Reduce the turning radii, add high-visibility crosswalks, remove the pork-chop island at north side and realign the crosswalk at east led of intersection, add median	less than $500,000
P2	Alma & Lelong	High-visibility crosswalk, reduce the turning radii, redo the curb cuts	less than $500,000
Type of Project - Streetscape Improvements, Gap Closure			
P3	Curtner & Under SR 87	Better lighting, complete the sidewalk	$500,000 to $5 million
Type of Project - Intersection Improvements, Streetscape Improvements			
P3	Curtner & Communication Hills Blvd	Remove the pork-chop islands, add high-visibility crosswalk, add median, widen the sidewalk, close the sidewalk gap at north side of Curtner between Stone and Canoas Garden	$500,000 to $5 million
Type of Project - Gap Closure, Intersection Improvements			
P2	Lelong between Alma and Willow	Close the sidewalk gap at west side, widen the sidewalk at east side, add high-quality mid-block crosswalks for better access to train stations, reduce the turning radii at SR 87 off ramp to Lelong	$500,000 to $5 million
HIGH PRIORITY, LONG TERM PROJECTS			
Type of Project - Intersection Improvements			
P6	Blossom Hill & Santa Teresa Blvd	Possibility of adding median; tighten the curb radii at all four corners	less than $500,000
P6	Blossom Hill & Winfield Blvd	Possibility of adding median	less than $500,000
P6	Santa Teresa & Thornwood Dr	Improve crosswalks, add crosswalk to the north leg of intersection, north-south direction has 7-8 lanes of traffic so pedestrians have to cross a long distance, add median, improve the curb ramps	less than $500,000
P6	Winfield & Thornwood Dr	Add crosswalk to south leg of intersection, improve the curb ramps	less than $500,000

#	Project	Description	Cost
P6	Chynoweth & Pearl	Remove the pork-chop island at north-west corner of intersection, add median, add high-visibility crosswalk, improve curb cuts	less than $500,000
P6	Chynoweth & Sapphire/Winfield	Add median, improve the curb cuts, add high-visibility crosswalk, reduce turning radii at two south side corners of the intersection	less than $500,000
P6	Chynoweth & Fell	Add crosswalk to all four legs of intersection, improve curb cuts	less than $500,000
P6	Chynoweth & New World Dr	Reduce turning radii at south-west corner, add median, improve curb cuts	less than $500,000
P6	Chynoweth & Hyde Park Dr	Add median	less than $500,000
P6	Chynoweth & Under SR 87	Widen the sidewalk, add lighting	less than $500,000
P5	Branham Over SR 87	Remove the fence, add a crosswalk from south side of Branham to the LRT station, widen the sidewalk, add signage and wayfinding elements for LRT station	$500,000 to $5 million
P5	Branham & Pearl	Tighten the turning radii, add median, add high-visibility crosswalk	less than $500,000
P5	Branham & Narvaez	Redesign the intersection and tighten the turning radii, add median, remove the pork-chop island at north-west corner, add high-visibility crosswalk	$500,000 to $5 million
P5	Branham & Heppner/Joseph Special Dr	Add crosswalk/RRFB (rectangular rapid flash beacon) or HAWK (high-intensity activated crosswalk)	$500,000 to $5 million
P5	Branham & Sidlaw Ct	Add high-visibility crosswalk	less than $500,000
P4	Capitol Expy & Vistapark Dr	Add high-visibility crosswalk, widen the sidewalk	less than $500,000
P4	Capitol Expy & Copperfield Dr	Add crosswalk to east leg of intersection, add high-visibility crosswalk, redesign the Bluefield Drive to reduce the turning radii, add median	less than $500,000
P4	Capitol Expy & Narvaez Ave	Remove the pork-chop island at north-west corner, add crosswalk to east leg of intersection, add median, add high-visibility crosswalk, realign the crosswalk at south side of intersection	$500,000 to $5 million
P4	Capitol Expy & SR 87/on and off ramp	Add median to west leg of intersection, add high-visibility crosswalk, redesign the north side of intersection, consider possibility of removing the pork-chop island at north side of intersection, widen the sidewalk, improve the curb cuts	$500,000 to $5 million

#	Project	Description	Cost
P4	Capitol Expy & Pearl	Add median, add high-visibility crosswalk, remove the pork-chop islands and reduce the turning radii, widen the sidewalk	$500,000 to $5 million
P3	Curtner & Canoas Garden	Reduce the turning radii, add median, improve the curb cuts, remove the pork-chop islands	less than $500,000
P3	Curtner & Monterey	Add median, add high-visibility crosswalks, widen the sidewalk	less than $500,000
P3	Curtner & Little orchard Street	Add crosswalk to the east leg of intersection, add median, add high-visibility crosswalks	less than $500,000
P3	Curtner & Almaden Rd	Reduce the turning radii at all four corners, add high-visibility crosswalk, add median at all four legs, improve the curb cuts	less than $500,000
P2	Alma & Minnesota Ave	Add new crosswalk, reduce turning radii at north-west corner	less than $500,000
P2	Minnesota & Bird	Extend the median at Bird, remove the pork-chop islands, add high-visibility crosswalk, re-align the south leg crosswalk	less than $500,000
P2	Alma & Vine/Almaden Ave (Pedestrian Access to Transit Plan)	Redesign crosswalks at Almaden Ave/West Alma Ave/Little Orchard St intersection: 1) restripe all crosswalks to ladder-style 2) add curb extensions to NW and SE corners of South. Almaden Ave-Almaden Rd/West Alma Ave and NE, SW corners of Vine St Almaden Expy/West Alma Ave; Consider full intersection redesign to consolidate vehicle access to SB Almaden Expy to existing west leg of Almaden Expy (S. of Vine Street), Close 5th leg of South Almaden Ave north of Little Orchard St, create public park/plaza with landscaping, Potential to retain narrow lane (20 feet) to allow parking in front of multifamily residential complexes	$500,000 to $5 million
P2	Minnesota & Willow	Add crosswalk	less than $500,000
P1	Virginia & Prevost	Add crosswalk, widen the sidewalk at north side	less than $500,000
P1	Virginia & Bird	Remove the pork-chop island, reduce turning radii at east corners of intersection, re-align the crosswalk at south and east sides of intersection, add high-visibility crosswalk	less than $500,000
P1	Virginia & Palm	Add crosswalk	less than $500,000
Type of Project - Streetscape Improvements			
P4	Capitol Expy & Under SR 87	Improve lighting, improve signage and wayfinding to LRT station	less than $500,000

#	Project	Description	Cost
P2	Alma Under SR 87	Widen sidewalk, add lighting	less than $500,000
Type of Project - Gap Closure, Intersection Improvements			
P3	Curtner & SR 87 Ramps-west of freeway	close the sidewalk gap at north side, add high-visibility crosswalk, add median, improve the curb cuts, add curb cuts to the north side corners	$500,000 to $5 million
P2	Willow Under SR87	Close the sidewalk gap, better lighting	$500,000 to $5 million
Type of Project - Intersection Improvements, Streetscape Improvements			
P3	Curtner & Almaden Expy on/off ramps	Add high visibility crosswalks, widen the sidewalk, remove the pork-chop island the turning radii at southbound off-ramp and reduce the turning radii	$500,000 to $5 million
P2	Willow & Lelong	Add crosswalk from north to south side on intersection after closing the sidewalk gap under SR 87, widen sidewalk around this intersection	less than $500,000
Type of Project - Gap Closure			
P3	Evans Ln, North of Canaos Garden Ave parallel to Almaden Expy	Consider adding sidewalk that meets ADA requirements along Evans Ln to create a pedestrian connection between the two existing apartment communities and the mobile home park to Curtner LRT Station.	$500,000 to $5 million
Type of Project - Gap Closure, Crossing Improvements			
P1	West Virginia & Crossing over UPRR tracks, east of Bird	Close the sidewalk gap and improve crossing over railroad tracks	$500,000 to $5 million

6.4 Future Planned Transit Projects

VTA led long-range transportation planning efforts include Valley Transportation Plan (VTP) 2040, adopted by the VTA Board of Directors in October 2014, Envision Silicon Valley that was adopted by the VTA Board in June 2015. From these projects MTC develops the Regional Transportation Plan (RTP), from which the projects will be selected for funding and implemented. Some of the RTP projects located within SR 87 corridor are listed in Table 6-10.

Table 6-10. Future Transit Projects

	Project Title	Description	RTP ID	Cost ($M) in 2017
	Affordable Fare Program	Increase ridership by reducing the cost of transit services for low-income populations including seniors, persons with disabilities, youth and students.	17-07-0007	44
	BART Silicon Valley Extension – San Jose (Berryessa) to Santa Clara (established capital cost us $5.175 billion)	Extension of BART service from San Jose (Berryessa) to Santa Clara	17-07-0012	5,467
T8	Frequent Core Bus Network – 15 minutes	Provide 15 minute all day service on VTA's highest ridership routes	17-07-0057	658
T7	Mineta San Jose International Airport APM connector – planning and environmental	The proposed project will provide transit link to San Jose International Airport from VTA´s Guadalupe Light Rail Transit (LRT) Line, and from Caltrain and future BART in Santa Clara, using automated People Mover (APM) technology.	17-07-0063	50
T4	Alum Rock/ Santa Clara Street Bus Rapid Transit	Project constructs enhancement in the County's highest ridership corridor, including two miles of dedicated lanes on the eastern half of the corridor and mixed flow operations in the western segments	17-07-0080	115

Table 6-11 lists SR 87 corridor study recommended transit improvements that are not identified as specific projects in the RTP.

Table 6-11. Recommended Transit Improvements Not Identified in the RTP

	Recommended Transit Improvements	Cost ($M) in 2017
T1	Public Private Partnership for micro transit like Uber, Lyft	$2.0
T2	Employer Incentive Programs to Increase Employee Transit Use	$0.5
T6	Transit on Demand (e.g., Chariot)	$0.5

7 RECOMMENDED IMPROVEMENTS

Potential improvements were assessed following the criteria described in Chapter 6. Whether the selected projects will be implemented will depend on the availability of funding, further feasibility analysis, and dependencies, such as the requirement for new legislation.

The recommended improvements for the SR 87 corridor listed in this section are organized by category and probable timeframe for implementation. However, the implementation timeframe will be refined if local and regional priorities change or funding becomes available that would allow expediting project implementation.

SECTION CONTENTS

- Recommended Freeway High-Priority Improvements
- Recommended Bicycle and Pedestrian High Priority Improvements
- Recommended Transit High Priority Improvements
- 2016 Measure B Funding
- Further Study

7.1 Recommended Freeway High-Priority Improvements

Freeway improvements are categorized into three types of improvements:

- Freeway capacity utilization (A #) (refer to Table 6-2)
- Technology-based improvements (TI #) (refer to Table 6-3)
- Transportation demand management strategies (TDM #) (refer to Table 6-4)

The recommended high-priority improvements are listed in Table 7-1 along with a general timeframe for implementation.

Table 7-1. Recommended High-Priority Improvements

P#	Recommended Freeway High-Priority Improvements	Timeframe
A1	PTL - Connector Ramps - Charcot Avenue to SR 87 SB (HOV only)	1 yr
A2	PTL - Connector Ramps - I-280 SB to SR 87 SB (HOV only)	
A3	PTL - Connector Ramps - SR 87 SB to I-280 NB (HOV only)	
TI 1	MaaS (Mobility as a service) (App)	
TI 2	Technology infrastructure enhancements (backbone corridor communications)	
TI 3	CMS – NB SR 87/Narvaez Ave.-Capitol Expressway (P&R availability, LRT travel time)	
TI 4	CMS – NB SR 87 near Diridon Station (P&R availability, LRT travel time)	
TI 5	CMS – SB SR 87 near Diridon Station (P&R availability, LRT travel time)	
TDM 1	Promote Carpool Use by Providing Incentives (by employer)	
TDM 2	Extend Carpool Hours	
TDM 3	First-Last Mile Trip Completion Alternatives	
TDM 4	Balanced Transportation Education Program	3 yrs
A4	PTL - Connector Ramps - SR 87 NB to I-280 NB (HOV only)	
A5	PTL - Connector Ramps - I-280 NB to SR 87 NB (HOV only)	
A6	PTL SB - Alma to SR 85 (transit only - left shoulder)	
A7	PTL - Connector Ramps - I-280 NB to SR 87 SB (HOV only)	
A8	PTL - Connector Ramps - I-280 SB to SR 87 NB (HOV only)	
TI 6	Adaptive Ramp Metering	
TI 7	CMS - US 101 SB to SR 87 SB (LRT travel time)	
TDM 7	Convert HOV 2+ to HOV 3+	7 yrs

7.2 Recommended Bicycle and Pedestrian High-Priority Improvements

The bicycle and pedestrian projects that are identified in local plans or countywide adopted plans are not listed in this chapter. However, implementing the projects that are identified in these plans is very important to creating a safe, connected, and convenient network of bicycle and pedestrian infrastructure around the SR 87 study area. Table 7-2 lists bicycle projects recommended by this study that are in addition to the projects identified in adopted plans (Refer to Table 6-5 and Appendix A) and supplement other planned capital projects.

Better walking access to transit stops could potentially encourage more commuters to take transit. The land use and roadway patterns in Santa Clara County do not favor pedestrians, since the many arterial roads in the county lack high-quality pedestrian infrastructure. Table 6-9 in chapter 6 lists recommended pedestrian improvements within a ½-mile walkshed of the SR 87 corridor.

Table 7-2 shows the projects near light rail stations that are recommended as high-priority improvements. The estimated timeframe to implement these projects is 1–3 years.

Table 7-2. Recommended Bicycle and Pedestrian High-Priority Improvements

P#	Recommended Bicycle (B) & Pedestrian (P) High-Priority Improvements	Timeframe
B1	Electronic bicycle lockers at transit stations	1 yr
B2	Wayfinding, signage around transit centers and along trails	
B3	Real-time electronic signage and counter at trail heads	
B4	Wayfinding, signage along trails	
B5	Lighting along Highway 87 Bikeway	
P1	Virginia LRT Station: three intersection improvements; sidewalk gap closure and crossing improvements	
P2	Tamien LRT Station and Tamien Caltrain Station: six intersection improvements; streetscape improvements and sidewalk gap closures	
P3	Curtner LRT Station: eight intersection improvements; five streetscape improvements and sidewalk gap closures	
P4	Capitol LRT Station: Five intersection improvements; streetscape	
P5	Branham LRT Station: Four intersection improvements; streetscape	
P6	Ohlone/Chynoweth LRT Station: Eight intersection improvements; streetscape improvements	3 yrs

7.3 Recommended Transit High-Priority Improvements

Table 7-3 shows the recommended projects from among the transit projects listed in tables 6-10 and 6-11 along with the general timeframe for implementation. Projects T4, T5, T7, and T8 are part of the approved RTP list.

Table 7-3. Recommended Transit High-Priority Improvements

P#	Recommended Transit High Priority Improvements	Timeline
T1	Public Private Partnership for micro transit like Uber, Lyft	1 yr
T2	Employer Incentive Programs to Increase Employee Transit Use	
T4	Santa Clara/Alum Rock Phase I: BRT (on going)	
T5	North San Jose Transit Improvements	
T6	Transit on Demand (e.g., Chariot)	
T7	Mineta San Jose International Airport Automated People Mover Connector	
T8	Frequent Core Bus Network	7 yrs

7.4 2016 Measure B Funding

Santa Clara County voter approved 2016 Measure B, a 30-year, half-cent countywide sales tax that supports transportation projects and services including but not limited to transit, highways, expressways, and active transportation (bicycles, pedestrians and complete streets).

As projects identified by this study are further defined, eligibility of 2016 Measure B funds will be determined. Once confirmed, funding from the appropriate 2016 Measure B program category will be pursued.

Improvement projects may qualify for the following 2016 Measure B program categories: highway interchange, bicycle & pedestrian, and transit operations.

Some of the near-term, high priority improvements that may be further developed to pursue 2016 Measure B funds are listed in Table 7-4.

Table 7-4. Near-Term Improvements For Potential Measure B Funding

P#	Potential Near-Term Improvements for 2016 Measure B Funding	Cost ($M) 2017
A1	PTTL - Connector Ramps - Charcot Avenue to SR 87 SB (HOV only)	$3.0
A9	PTTL NB - Alma Avenue to I-280 off-ramp (All Vehicles-Right Shoulder)	$5.0
TI 1	MaaS (Mobility as a service) (App)	$2.0
TI 3	CMS - NB SR 87/Narvaez Ave-Capitol Expressway (P&R Availability, LRT Travel time)	$1.0
TI 6	Adaptive Ramp metering	$1.5
T1	Public Private Partnership for micro transit	$2.0
B2	Wayfinding signage around transit stations	$0.05
B4	Wayfinding signage along trails	$0.05
TDM3	First-last mile trip completion alternatives to promote transit	$1.5

7.5 Further Study

Potential projects identified in this study need to be evaluated through detailed study and analysis. Some projects require further narrowing of the scope and identification of specific improvements. For example, the project to install wayfinding signs for bicycle trails needs further study to determine the appropriate location. Projects like development of technology apps and first-last mile connectivity through rideshare options are dependent on public-private partnerships and will require the VTA to identify appropriate partners, establish policy guidelines for strategic collaborations, and undertake further cost-benefit analyses.


Questions? Call
VTA Customer Service,
(408) 321-2300
You must
tag Clipper card
or have Proof of
Payment before
boarding.
VTA

Appendix A

Community Survey Questions

Highway 87 Corridor Study

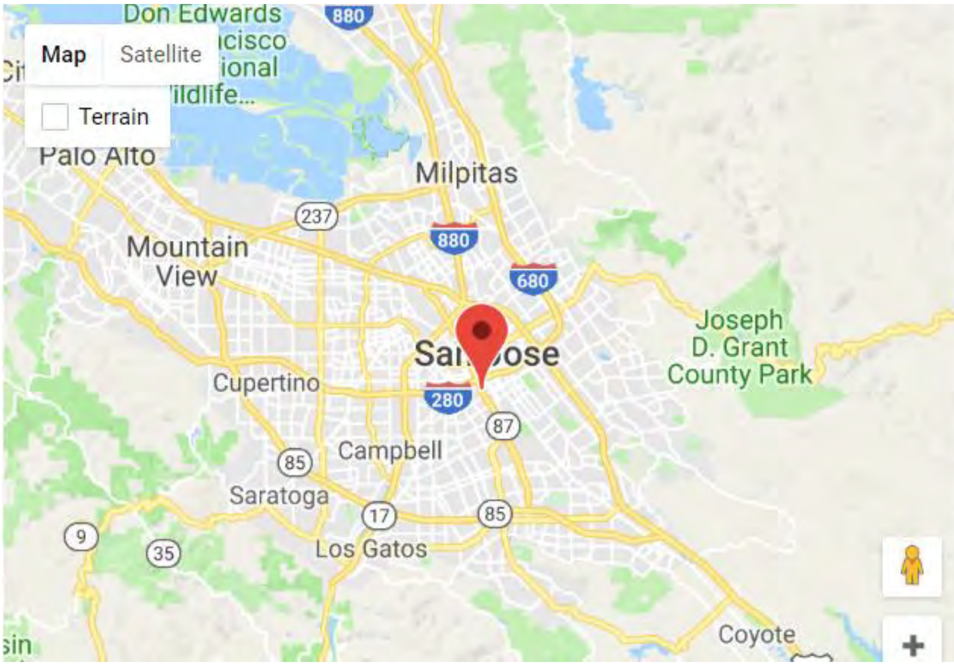
VTA wants to hear from Highway 87 commuters. Please tell us about your trip that takes you onto or adjacent to Highway 87. Your responses will help us determine the existing needs on the highway corridor and to plan for the future.

Survey participants will be entered in a drawing for the chance to win an **Amazon $25 gift card**. The gift cards will be randomly awarded to four lucky survey respondents who provide their email at the end of the survey *and* submit the survey.

Your locations will help us determine where trips along Highway 87 are beginning and where they are ending. Travel patterns and trends will help plan future needs of the corridor. We will not send, publish or share your address.

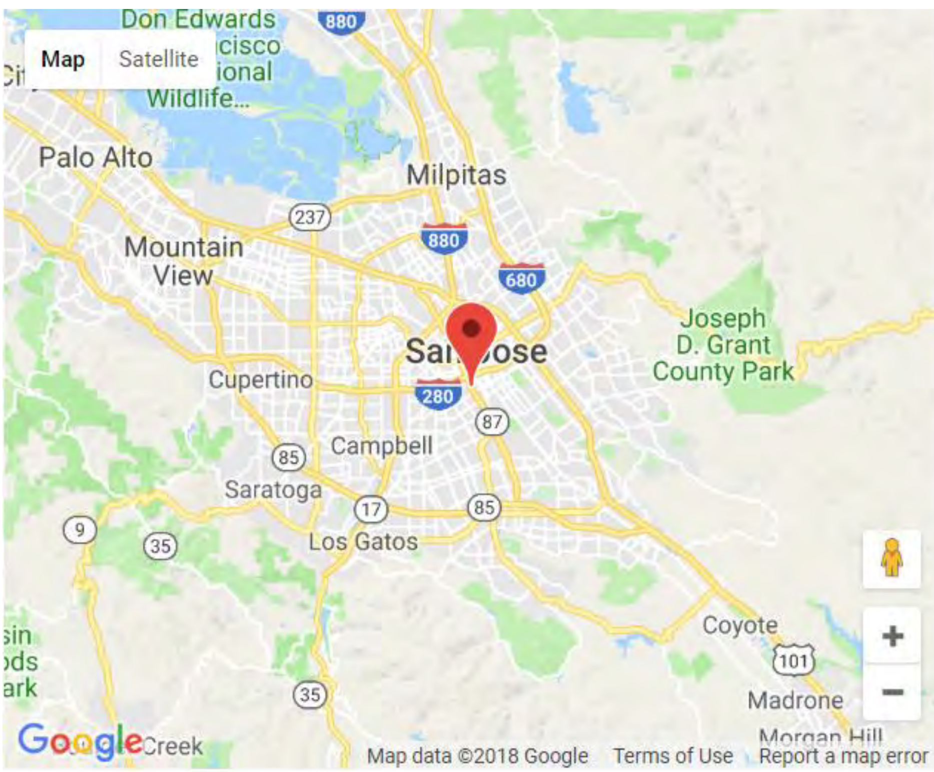
Where do you live? Enter a location

Or, if you prefer, move the red pin to your work or school location. On a smartphone, use two fingers to move the map and hold your finger on the pin before dragging it.



Where do you work or study? Enter a location

Or, if you prefer, move the red pin to your work or school location. On a smartphone, use two fingers to move the map and hold your finger on the pin before dragging it.



How often do you travel along Highway 87?

- ◯ Daily
- ◯ At least once a week
- ◯ At least once a month
- ◯ At least once a year
- ◯ Never

What time(s) of day do you typically travel along Highway 87 (select all that apply)

- ☐ Early morning (5-7 AM)
- ☐ Morning rush (7-9 AM)
- ☐ Midday (9 AM-3 PM)
- ☐ Mid-afternoon (3-5 PM)
- ☐ Afternoon rush (5-7 PM)
- ☐ Evening or dawn (7 PM-5 AM)

What is your most common mode of transportation along Highway 87? (select one) *

- ◯ Drive alone
- ◯ Carpool
- ◯ Light rail
- ◯ Bus
- ◯ Uber/Lyft/taxi
- ◯ Bike
- ◯ Walk
- ◯ Company Shuttle
- ◯ Motorcycle
- ◯ I do not travel along Highway 87

What other mode(s) do you use on Highway 87? (select all that apply)

- ☐ Drive alone
- ☐ Carpool
- ☐ Light rail
- ☐ Bus
- ☐ Uber/Lyft/taxi
- ☐ Bike
- ☐ Walk
- ☐ Company Shuttle
- ☐ Motorcycle
- ☐ Other

What would motivate you to carpool? (select all that apply)

- [ ] Financial incentives for driving less
- [ ] If I can find carpool match on apps like Scoop
- [ ] Not having to drive as often
- [ ] Significant travel time savings in carpool lane
- [ ] Preferential parking for carpool
- [ ] Reliable carpool options like Uber Pool/Lyft Line
- [ ] Other

How many people ride in your carpool/rideshare car (including driver)?

ex: 3

If the company shuttle was not available, how would you get to work?

- ○ Drive alone
- ○ Carpool
- ○ Light rail
- ○ Bus
- ○ Caltrain
- ○ Uber/Lyft/taxi
- ○ Bike
- ○ Walk
- ○ Motorcycle
- ○ Would work elsewhere

How often do you use public transit along Highway 87?

- ○ Daily
- ○ At least once a week
- ○ At least once a month
- ○ At least once a year

How do you get to and from the public transit stops?

- ○ Walk
- ○ Bike
- ○ Dropped off
- ○ Park and ride
- ○ Other

Have you tried taking public transit along Highway 87?

- ○ Yes
- ○ No

What would motivate you to take public transit more regularly? (select all that apply)

- o Better travel options for the first and last miles

- Financial incentives for driving less
- More frequent and reliable service
- Faster travel times
- Other

Why haven't you tried taking public transit? (check all that apply)

- Public transit stops are too far from where I live
- Public transit stops are too far from where I work
- Travel distance is too short so favorable for driving
- Midday vehicle needs
- Concerns about being able to travel by car in an emergency
- Public transit takes longer than driving
- Too many transfers
- Other

What would motivate you to bike more regularly? (select all that apply)

- Continuous bike lane/trail without gaps
- Well maintained bike ways
- Wayfinding signs along bike route
- More accessible bike racks in transit vehicles
- Bike lockers at transit stations
- Other

Why haven't you tried biking? (select all that apply)

- It's too far to bike
- I don't own a bike
- The bike lane/trail network does not cover the places I go to
- I don't feel comfortable biking on the road, even on bike lanes
- I would have trouble taking my bike on transit or leaving it at the stop

Have you tried biking on the Highway 87 trail (the trail that is parallel and located on the east side of Highway 87)?

◯ Yes

◯ No

Next you will see potential ideas for enhancing commuting options along Highway 87. Please rate your level of support for each one.

Part-time Freeway Shoulder Use

(This may eliminate emergency parking) Please indicate your level of support for the following strategies

Part-time shoulder use for buses

- Strongly Oppose
- Oppose
- Neutral
- Support
- Strongly Support

Part-time shoulder use for carpoolers and buses

- Strongly Oppose
- Oppose
- Neutral
- Support
- Strongly Support

Part-time shoulder use for all vehicles as a regular lane

- Strongly Oppose
- Oppose
- Neutral
- Support
- Strongly Support

Express Lanes

Please indicate your level of support for the following strategies

(Express Lanes, also referred to as high occupancy toll lanes, generally provide a higher level of commute reliability for carpoolers and carpool lane eligible commuters for free and for solo commuters for a fee. An example is the SR 237 Express Lanes that are already in operation at the SR 237/I-880 interchange.)

Convert carpool lanes to Express Lanes on Highway 87

- ◯ Strongly Oppose
- ◯ Oppose
- ◯ Neutral
- ◯ Support
- ◯ Strongly Support

Traveler Information

Please indicate your level of support for the following strategies

Add new changeable message signs and other information devices along the freeway

- ◯ Strongly Oppose
- ◯ Oppose
- ◯ Neutral
- ◯ Support
- ◯ Strongly Support

Provide mobile phone apps (that provide better real-time information to me about travel options for my trip)

- Strongly Oppose
- Oppose
- Neutral
- Support
- Strongly Support

Bike Facility Improvements (along Highway 87)

Please indicate your level of support for the following strategies

Provide missing connections in the bicycle facilities

- Strongly Oppose
- Oppose
- Neutral
- Support
- Strongly Support

Improve pavement conditions on bicycle facilities

- Strongly Oppose
- Oppose
- Neutral
- Support
- Strongly Support

Provide barrier-separated bicycle lanes

- ◯ Strongly Oppose
- ◯ Oppose
- ◯ Neutral
- ◯ Support
- ◯ Strongly Support

Improve wayfinding and other signing for bicyclists and pedestrians

- ◯ Strongly Oppose
- ◯ Oppose
- ◯ Neutral
- ◯ Support
- ◯ Strongly Support

Improve trail lighting for pedestrians and bicyclists

- Strongly Oppose
- Oppose
- Neutral
- Support
- Strongly Support

Transit Facility Improvements (along Highway 87)

Please indicate your level of support for the following strategies

Provide improved lighting at public transit stops

- Strongly Oppose
- Oppose
- Neutral
- Support
- Strongly Support

Improve pedestrian access to public transit stops including light rail stations (e.g., improve connections such as sidewalks)

- Strongly Oppose
- Oppose
- Neutral
- Support
- Strongly Support

Alternative Transportation

Please indicate your level of support for the following strategies

Make available more private on-demand shuttle services (e.g., Chariot)

◯ Strongly Oppose
◯ Oppose
◯ Neutral
◯ Support
◯ Strongly Support

Implement innovative incentive programs to promote non-auto options, for driving less, for driving at different times outside normal commute hours, etc.

◯ Strongly Oppose
◯ Oppose
◯ Neutral
◯ Support
◯ Strongly Support

Implement innovate incentive programs to promote more use of public transit, etc.

- ◯ Strongly Oppose
- ◯ Oppose
- ◯ Neutral
- ◯ Support
- ◯ Strongly Support

Implement innovate bike programs that would make biking a more attractive option such as bike sharing, e-bike leasing, etc.

- ◯ Strongly Oppose
- ◯ Oppose
- ◯ Neutral
- ◯ Support
- ◯ Strongly Support

Install better or more bike lockers

- ◯ Strongly Oppose
- ◯ Oppose
- ◯ Neutral
- ◯ Support
- ◯ Strongly Support

If you have other ideas for improving commute options along Highway 87, please specify:

What is the most important change that could be made to improve how you commute or allow you to change to another commute option along Highway 87?

Optional Questions

These optional questions will help us understand the reach of our survey. Your personal information will not be shared outside of the study team.

Age

▼

Employment

▼

Annual Household Income

▼

If you are interested in participating in the gift card raffle, please provide your email:

Please click the Submit button below to complete the survey.

Submit

Appendix B

Pedestrian Projects From Other Plans

Location	Type of Project	Description	In Any Previous Plan?	Cost	Priority
West. Julian St.	Intersection and streetscape improvements along West Julian St.	Intersection and Streetscape improvements: Add high-visibility side-street crosswalks along West Julian St between Guadalupe Pkwy and N 1st St. Consider widening sidewalks, adding landscaped buffers (planters as short-term/tactical option) including shade trees; Recommend minimum 13 ft total sidewalk width per VTA Pedestrian Technical Guidelines Add pedestrian-scale lighting Add curb extensions to reduce pedestrian crossing distance Consider realigning and signalizing intersection of North San Pedro St. and West Julian St. to provide opportunities for pedestrian crossing	Pedestrian Access to Transit Plan	over $5 million	Long term
Diridon	Laurel Grove Lane/ Park Ave. sidewalk completion	Pedestrian network connection: Complete sidewalks around parcel at NW corner of Laurel Grove Lane/ Park Ave. when parcel is redeveloped	Pedestrian Access to Transit Plan	less than $500,000	High priority, short term
Santa Clara Street	Santa Clara St/Cahill St. intersection improvements	Intersection improvement: Stripe ladder crosswalk and add pedestrian signal head to west leg Consider adding pedestrian actuation and reducing signal lengths to reduce pedestrian wait time	Pedestrian Access to Transit Plan	less than $500,000	High priority, short term

Location	Type of Project	Description	In Any Previous Plan?	Cost	Priority
Santa Clara Street	Santa Clara St. /Montgomery St. pedestrian scramble	Intersection improvements: Restripe existing crosswalks to provide pedestrian scramble; opportunity for public art/placemaking similar to mid-block crosswalks at Paseo de San Antonio Consider signalized pedestrian scramble phase	Pedestrian Access to Transit Plan	less than $500,000	Medium term
Santa Clara Street	Santa Clara St./ Delmas Ave. uncontrolled crossing improvements	Crossing improvements: Relocate uncontrolled ladder crosswalk to west side of intersection Add advance yield lines (“shark fts teeth”) for advance stop lines Add curb extensions to reduce pedestrian crossing distance Consider adding Rectangular Rapid Flash Beacon or Pedestrian Hybrid Beacon to improve driver yield rates Consider adding median refuge for pedestrians crossing Santa Clara St.	Pedestrian Access to Transit Plan	$500,000 to $5 million	High priority, short term
Santa Clara Street	SR 87/ Santa Clara St. ramps improvements	Intersection improvements: Add marked pedestrian crossings (ladder) to all legs and re-time signal to permit pedestrian crossing of all legs	Pedestrian Access to Transit Plan	less than $500,000	High priority, short term
Diridon	Pathway and uncontrolled crossing to San Fernando VTA LRT Station	Crossing improvements: Stripe ladder-style crossing of South Montgomery St. at Crandall St. Designate pedestrian corridor to San Fernando Station with new paving, landscaping, and/or paint on existing walkways	Pedestrian Access to Transit Plan	$500,000 to $5 million	High priority, short term

Location	Type of Project	Description	In Any Previous Plan?	Cost	Priority
		Montgomery Street crossing alternatives: 1. Remove 2-3 parking spaces on east side of Montgomery St., stripe two ladder crosswalks, add advance yield lines ("shark fts teeth") and pedestrian crossing signs 2. Remove 5 parking spaces total (2 west side, 3 east side) to create painted pedestrian walk zone, add advance yield lines ("shark fts teeth") and pedestrian crossing signs			
Diridon	Curb cuts and crosswalk improvements at Diridon Station	Crossing improvements: Add curb cuts and replace existing crosswalks with ladder crosswalks for higher visibility at pedestrian crossings of Cahill St. Consider enhanced crossing striping or stamped asphalt treatment	Pedestrian Access to Transit Plan, Diridon Station Master Plan	less than $500,000	High priority, short term
San Fernando VTA Station	Wayfinding improvements through San Fernando Station	Wayfinding: Improve wayfinding through San Fernando Station through pavement markings and signage Coordinate design with forthcoming studies: San Jose Downtown Wayfinding Project and VTA Transit Ridership Improvement Program	Pedestrian Access to Transit Plan	less than $500,000	Medium term
Santa Clara St/ 7th St.	Santa Clara St./7th St. and Santa Clara St./8th St. improvements	Streetscape improvements: Add ladder crosswalks to all four legs of 7th St. intersection • Add ladder crosswalks to south and north legs of 8th St. intersection • Consider signalizing 8th St. intersection to provide opportunities for pedestrian crossing of Santa Clara St.	Pedestrian Access to Transit Plan	$500,000 to $5 million	High priority, short term

Location	Type of Project	Description	In Any Previous Plan?	Cost	Priority
San Carlos St.	Almaden Blvd/San Carlos St. intersection improvements	Intersection improvements: Remove pork chops where feasible, narrow curb radii via curb extensions, stripe ladder crosswalks, add pedestrian refuge to medians	Pedestrian Access to Transit Plan	less than $500,000	High priority, short term
San Carlos St.	Convention Center VTA Station area improvements	Wayfinding and streetscape improvements: Retime mid-block signal and move bus stops closer to mid-block pedestrian crossing. Consider pedestrian wayfinding via pavement markings and passive wayfinding (landscaping, etc.) to clarify routes to/through Civic and National theaters Coordinate design with forthcoming studies: San Jose Downtown Wayfinding Project	Pedestrian Access to Transit Plan	less than $500,000	High priority, short term
Market St./San Carlos St. intersection improvements	Market Street	Intersection and crossing improvements: Cesar Chavez park triangle: 1) stripe SB U-turn more narrowly to slow traffic on turns 2) add second crosswalk closer to Market St NB lanes; OR convert to stop-control and add crosswalk east of existing yield line 3) stripe ladder striped crosswalks between main Cesar Chavez Park and "triangle"; consider adding raised intersection or raised crosswalk treatment for pedestrian crossings 4) extend sidewalks and landscaping of "triangle" portion of park, extending park to area currently striped out alongside Market St NB lanes ¶		$500,000 to $5 million	High priority, short term

Location	Type of Project	Description	In Any Previous Plan?	Cost	Priority
		Market St./San Carlos St. intersection: add curb extension to NW corner, stripe ladder crosswalks at all legs of intersection			
Diridon	Pedestrian Access from Diridon Station to The Alameda and Stockton Ave	Network Connection: Enhance pedestrian access to The Alameda/Stockton Ave. intersection via White St. and Laurel Grove Lane/Bush St.¶	Pedestrian Access to Transit Plan, Diridon Station Master Plan	$500,000 to $5 million	High priority, short term
SR 87 ramps/Saint James St./Notre Dame Ave. improvements	Notre Dame Ave./ E. St. James St./ SR 87 Ramps	Intersection Realign crosswalk on south side; widen south side crosswalk and sidewalk under freeway overpass, add pedestrian-scale lighting at undercrossing. Tighten NW corner via a curb extension	Pedestrian Access to Transit Plan	$500,000 to $5 million	Medium term
Market Street	Market St./Saint John St. intersection improvements	Intersection: Complete crosswalks and sidewalks, stripe ladder crosswalks on all legs	Pedestrian Access to Transit Plan	less than $500,000	High priority, short term
Santa Clara Street	3rd/4th St. curb extensions	Intersection improvements: Consider adding curb extensions to shorten pedestrian crossing distances of Santa Clara St. at 3rd and 4th Streets. Realign bicycle lanes through existing buffers	Pedestrian Access to Transit Plan	less than $500,000	High priority, short term
Santa Clara Street	Bus stop improvements on Santa Clara St	Streetscape improvements: Santa Clara St between Market St and 2nd St:	Pedestrian Access to Transit Plan	less than $500,000	Medium term
Santa Clara VTA Station	Wayfinding improvements at Santa Clara VTA station	Wayfinding: Consider wayfinding signage between stops on Santa Clara Street and on 1st/2nd Streets Coordinate design with forthcoming studies: San Jose Downtown Wayfinding Project	Pedestrian Access to Transit Plan	less than $500,000	Medium term

Location	Type of Project	Description	In Any Previous Plan?	Cost	Priority
Santa Clara VTA LRT Station	Add high-visibility crosswalk treatment at crossings of 1st St and 2nd St	Intersection improvements: Consider ladder crosswalks or other high-visibility crossing treatments at Santa Clara St/1st St and Santa Clara St/2nd St	Pedestrian Access to Transit Plan	less than $500,000	Medium term
Market Street	Market St/Saint James St intersection improvements	Intersection improvements: Add pedestrian crossing on North leg, add curb extension at SW corner into Market St	Pedestrian Access to Transit Plan	less than $500,000	Medium term
San Fernando St	Signalized pedestrian crossing west of SR 87 underpass	Crossing improvements: Add signalized pedestrian crossing immediately east of signal at rail crossing on San Fernando St: stripe ladder crosswalk, add pedestrian signal heads, add curb cuts, remove portion of raised median	Pedestrian Access to Transit Plan	less than $500,000	High priority, short term
San Fernando St	San Fernando St/Delmas Ave VTA improvement alternatives	Intersection and streetscape improvements: Alternatives: 1) Restrict and formalize access at Delmas Ave/San Fernando St: add public art or low vertical landscaping to NE corner, add landscaping/planters) or improved fence treatment to NW corner, stripe ladder crosswalk on west side of pedestrian crossing of tracks on Delmas Ave, replace bollards with swing gates 2) Woonerf treatment to slow all traffic on San Fernando St between Autumn St and SR 87 undercrossing (assumes VTA LRT speeds will remain at 10 mph maximum)	Pedestrian Access to Transit Plan	$500,000 to $5 million	Medium term

Location	Type of Project	Description	In Any Previous Plan?	Cost	Priority
SR 87/Guadalupe Parkway	Guadalupe River Trail/ SR 87 trail gap closure	Pedestrian network connection: Complete Guadalupe River Trail/ SR 87 multi-use trail between West Virginia St and Willow St Consider grade-separated pedestrian and bicycle crossing over Willow Ave	Pedestrian Access to Transit Plan	over $5 million	High priority, long term
W. Alma Ave/ Almaden Rd	SR 87 undercrossing improvements	Streetscape improvements: Add pedestrian lighting and public art at undercrossing	Pedestrian Access to Transit Plan	$500,000 to $5 million	Medium term
Tamien Station	Wayfinding and sidewalks around Tamien Caltrain Station	Wayfinding: Install pedestrian wayfinding signs along Alma Ave; add passive wayfinding/streetscape improvements on Lick Ave Widen and add sidewalks on east and west sides of Lelong St in front of station Reduce radius at NW corner of Lelong St/Alma Ave	Pedestrian Access to Transit Plan	$500,000 to $5 million	Medium term
SR 87/Willow Ave	SR 87 undercrossing at Willow Ave	Pedestrian network connection: Consider closing gap in sidewalk on N side of Willow Ave at SR 87 undercrossing between Minnesota Ave and Mclellan. If grading or other engineering issues make sidewalk completion infeasible, stripe ladder crosswalks and add high-visibility pedestrian crossing signs at Minnesota Ave and Lick Ave	Pedestrian Access to Transit Plan	$500,000 to $5 million	Medium term

Appendix C

Potential Environmental Constraints

The State Route (SR) 87 Corridor, approximately ten miles in length, contains many environmental resources. Any future physical roadway improvement project within the SR 87 project has the potential to adversely affect existing resources; the resources of concern within the corridor include:

- The presence of architectural and known archaeological resources previously determined eligible for the National Register of Historic Places, in addition to a very high sensitivity for unknown archaeological resources;
- Known and potential presence of hazardous materials sites, either by current or historical use;
- Presence or potential presence of special-status plant or animal species;
- Presence of park and recreational areas; and
- Presence of residences and other sensitive uses.

The type of environmental document and supporting technical studies required to determine any affect to environmental resources would depend on the proposed project and the type of funding available (local, state, and/or federal).

Technical studies may include any of the following topical areas:

- Aesthetics
- Air Quality
- Biological Resources
- Cultural Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Noise and Vibration
- Population and Housing
- Public Services
- Recreation
- Transportation
- Utilities and Service Systems

In addition to the above topics, if federal funding is anticipated, additional topical areas may include: Environmental Justice, Section 4(f), and Socioeconomics.

The following regulatory permits, agreements, and/or consultations may also be required depending on the proposed project and whether it affects resource agency jurisdiction:

- U.S. Army Corps of Engineers Section 404 permit for the discharge of dredged or fill material into waters of the United States, including wetlands and other water bodies;
- Regional Water Quality Control Board Section 401 Water Quality Certification and/or Waste Discharge Requirements;
- California Department of Fish and Wildlife Lake and Streambed Alternation Agreement;

- Consultation with the U.S. Fish and Wildlife Service or National Marine Fisheries Service related to special status species; and/or
- Consultation with the Santa Clara Valley Habitat Agency.

Appendix D

Glossary & Abbreviations

ACE forward	A phased improvement plan proposed by the San Joaquin Regional Rail Commission to increase service reliability and frequency, enhance passenger facilities, reduce travel times along the existing ACE service corridor from San Jose to Stockton and extend ACE service to Manteca, Modesto, Ceres, Turlock and Merced.
active transportation management (ATM)	ATM is defined as the ability to dynamically manage recurrent and nonrecurrent congestion based on prevailing and predicted traffic conditions. ATM strategies use technology to enable efficient operation of the existing system by enhancing system monitoring, traveler information and integrated system operations.
Altamont Commuter Express (ACE)	ACE is a commuter rail service that connects Stockton and San Jose.
Assembly Bill 544 High Occupancy Vehicles	AB 544 amends Section 5205.5 of the California Vehicle Code regarding low emissions vehicles. Under the new law, if a vehicle was issued a clean air vehicle decal before January 1, 2017, the sticker will expire on January 1, 2019; however, vehicle owners are allowed to apply for a new sticker that expires January 1, 2022. All decals will expire in 2025.
auxiliary lanes	Additional lanes on freeway from an on-ramp to the consecutive off-ramp or ramps.
average annual daily traffic (AADT)	Total volume of vehicle traffic of a highway or road for a year divided by 365 days.
BART Phase II	BART Phase II continues the Phase I extension for the remaining 6-mile, four-station project, extending south into Santa Clara County (San Jose and Santa Clara). Phase I, the Berryessa Extension Project and Milpitas Stations, is a 10-mile two-station project currently under construction.
Bird (company)	Dockless scooter-share company.
bypass lane	Generally referred to HOV lanes at freeway on-ramps.
California Highway Performance Monitoring System	National level highway information system.

Caltrans Performance Measurement System (PeMs)	Real-time traffic data system that uses sensor detectors along the state highway system. PeMs has over 10 years of data for historical analysis.
Capital Corridor Vision Plan	A long-range plan for the Capital Corridor rail service, which is currently in progress. The final plan will include a detailed ridership analysis, economic analysis, financing plan, and an overall communications plan.
changeable message signs (CMS)	A CMS is primarily used to give motorists real-time traffic safety and guidance information about planned and unplanned events.
collector-distributor road	type of road that parallels and connects the main travel lanes of a highway and frontage roads or entrance ramps.
Community Air Risk Evaluation (CARE)	The CARE Program, managed by the Bay Area Air Quality Management District, aims to reduce health impacts linked to local air quality.
Community of Concern	Metropolitan Transportation Committee's data set that represents all urbanized tracts within the San Francisco Bay Region.
community survey or public survey	Survey to receive feedback from public. For the SR 87 study, public included people who live and travel along the SR 87 corridor.
Congestion Management Agency (CMA)	CMA's are county-level organizations responsible for preparing and implementing congestion management programs. VTA serves as the CMA for Santa Clara County.
connected vehicles	A Connected Vehicle program enables cars, buses, trucks, trains, roads and other infrastructure, and our smartphones and other devices to "talk" to one another.
Countywide Bicycle Plan	Plan that establishes a network of bicycle corridors to create continuous, complete bicycle connections across Santa Clara County.
cross county bikeway corridors (CCBC)	The Countywide Bicycle Plan establishes a network of CCBCs that will provide continuous, complete bike connections across the county.
Diridon Integrated Station Concept Plan	The existing San Jose Diridon Station is a major transit hub located within downtown San Jose. The Diridon Integrated Station Concept Plan is a project to accommodate future intermodal transportation within the station area.
dynamic pricing	With dynamic pricing, tolls are continually adjusted according to traffic conditions to maintain a free-flowing level of traffic.
e-bike	Electric bikes are powered bicycles that are generally battery operated and with intuitive controls.

e-scooter	Electric two-wheel scooter/razor.
express lane (EL)	An express lane is a lane used by carpoolers, motorcyclists, and clean-air vehicles (with applicable decals) for free, and single occupant vehicles that pay a toll with a FasTrak transponder.
Fastrak®	FasTrak is an electronic tolling device that allows drivers to pay tolls automatically from a pre-established account.
first-last mile	If bus or rail service was used for the core part of a trip, the gap from origin to the transit service is called the "first mile," and the gap from the transit service to the destination is called the "last mile."
Focus Area	Area or zone that is the area of focus.
Ford GoBike	Ford GoBike is a regional public bicycle sharing system in the San Francisco Bay Area.
general purpose lanes	Lanes on a roadway that do not have occupancy restrictions.
golden triangle area	Area surrounded in Santa Clara County by US 101, SR 237 and I-880.
Guadalupe River Trail	The Guadalupe River Trail extends from Alviso at the southern edge of San Francisco Bay to downtown San Jose.
high-occupancy vehicle	Vehicle with two more people.
Highway 87 Bikeway	The Highway 87 bikeway follows the highway and is used primarily for commute purposes. The bikeway includes some on-street travel between Unified Drive and Carol Drive, and along Narvarez Avenue.
INRIX	A source of data, analytics and technology used by automakers, governments, consultants and businesses to see new patterns in how vehicles and people move that can inform their decision-making.
intelligent transportation systems (ITS)	ITS is an advanced application that aims to provide innovative services relating to different modes of transportation.
level of service (LOS)	LOS is a term used to qualitatively describe the operating conditions of a roadway based on factors such as speed, travel time.
Level of Traffic Stress (LTS)	LTS is a rating given to a road segment or crossing indicating the traffic stress it imposes on bicyclists.
light rail train (LRT)	VTA operates an LRT system that serves San Jose, California, and its suburbs in Silicon Valley and consists of a 42.2-mile network.

LimeBike	LimeBike is a company that provides smart affordable mobility through equitable distribution of shared scooters, bikes and transit vehicles both electric and regular.
Mobility-as-a-Service (MaaS)	Maas is a public-private partnership to develop an app toward mobility solutions. This service would help shift travelers away from personally owned modes of transportation.
multimodal	Refers to various modes of transportation such as walking, bicycling, automobile, public transit, and connections among various modes.
north San Jose	North San Jose is mainly known as home to majority of San Jose's 6,600+ tech companies including tech giants like Samsung, Cisco and PayPal.
origin/destination (OD)	"Origin" is the beginning of a trip, and "destination" is the end of a trip. An OD survey provides a detailed picture of trip patterns and travel choices.
Park-and-Ride	Parking lots with public transportation connections that allow commuters to park their automobiles and take transit.
part-time shoulder use	Part-time shoulder use is a transportation system management and operations strategy that uses shoulders to provide additional capacity when it is most needed, and preserves shoulders as refuge areas during the majority of the day.
part-time lane	Part-time shoulder use lanes in California are refereed as part-time lanes.
pork chop island	Pork chop islands are triangular raised islands placed between a right-turn slip lane and through-travel lanes. They channelize vehicular traffic and provide a refuge for pedestrians crossing a roadway.
Priority Development Areas	Areas of development that include transit changes with surrounding residential, office and commercial developments.
RideAmigos	Joint venture app that provides transportation/commuter solutions to organizations.
RideCo	Fully automated technology that creates shared vehicle itineraries, offering higher vehicle utilization and shared mobility.
San Jose McEnery Convention Center	Event center located in downtown San Jose that hosts hundreds of varied events.
SAP Center	Indoor arena located in San Jose. Its primary tenant is the San Jose Sharks of the National hockey league.
Smart Carpool Program	Programs such as RideAmigos that helps travelers find a carpool match and encourage employee carpooling.

south San Jose	Large geographic area that includes SR85/SR 87 as well as the US 101/SR 85 interchange areas.
SR 87 corridor	Area around the SR 87 freeway that includes bikeways along the freeway as well as transit that runs in the median of SR 87. For the study, a ¼ mile on either side of the freeway was considered for analysis.
Statewide Integrated Traffic Records System (SWITRS)	Database that serves as a means to collect and process data gathered from a collision scene. This database is managed by the California Highway Patrol.
Swiftly	A real-time transit app for arrival and departure predictions. Historical data is available for analysis.
TomTom	Global leader in navigation, traffic and map products, GPS Sport Watches, and fleet management solutions.
Transit Signal Priority (TSP)	TSP for buses or LRT is a name for various techniques to improve service and reduce delay for mass transit vehicles at intersections. TSP allows transit agencies to preempt or truncate green cycle times at signals for more accurate schedule adherence.
Transportation Network Company (TNC)	TNC are companies such as Uber and Lyft that provide app-based ride-sourcing services.
TriMet	TriMet is an organization that provides bus, light rail and commuter rail transit services in the Portland, Oregon, metro area.
Vital Signs	MTC's Vital Signs is a web-based tool that helps Bay Area residents explore our region's performance using a series of indicators in four key areas of regional vitality – transportation, land and people, the economy, the environment and social equity.
VTA community survey	Survey that VTA conducts to reach out to and seek input from the public.
Waze	Waze is GPS navigation software. It works on smartphones and tablet computers that have GPS support. It provides turn-by-turn navigation information and user-submitted travel times and route details, while downloading location-dependent information over a mobile telephone network.
woonerf	A road in which devices for reducing or slowing the flow of traffic have been installed.
zero emissions vehicles	A vehicle that emits no exhaust gas from the onboard source of power.

Abbreviation	Term
AADT	average annual daily traffic
AB 544	Assembly Bill 544
ACE	Altamont Commuter Express
ATM	active transportation management
CCBC	cross county bikeway corridors
CMA	Congestion Management Agency
CMS	changeable message signs
CV	connected vehicles
EL	express lane
ft	feet
GP lanes	general purpose lanes
HOV	high-occupancy vehicle
IDSN	Integrated Digital Services Network
LOS	level of service
LRT	light rail train
LTS	level of traffic stress
MaaS	mobility-as-a-service
mph	miles per hour
OD	origin/destination
PeMs	Caltrans Performance Measurement System
PTSU	part-time shoulder use
PTL	part-time lane
SWITRS	Statewide Integrated Traffic Records System
TNC	Transportation Network Company
TSP	Transit Signal Priority