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. According to the San Jose Mercury News, traffic on major Bay Area freeways has grown 80% since 2010. 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.
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

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

<table>
<thead>
<tr>
<th>What would motivate you to take transit more regularly?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faster travel times</td>
</tr>
<tr>
<td>More frequent and reliable service</td>
</tr>
<tr>
<td>Better travel options for first/last mile</td>
</tr>
<tr>
<td>Financial incentives</td>
</tr>
<tr>
<td>Expand transit route network</td>
</tr>
<tr>
<td>Improve safety and comfort</td>
</tr>
<tr>
<td>Nothing</td>
</tr>
</tbody>
</table>

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

Have you ever tried biking on the Highway 87 trail?
- Yes: 15%
- No: 85%

What would motivate you to bike more regularly?
- Continuous bike lane/trail without gaps: 35%
- Well maintained bike ways: 29%
- Distance is too long for commute: 7%
- Bike lockers at transit stations: 6%
- Wayfinding signs along bike route: 9%
- Improved safety: 11%
- More accessible bike racks in transit vehicles: 11%

State Route 87 Community Survey - Spring 2018
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)*

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

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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

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Ideas to Encourage Mode Shift</th>
<th>Technology Based Improvement</th>
<th>Cost ($M) 2017</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTL - Connector Ramps - Charcot Avenue to SR 87 SB (HOV only) (A1)</td>
<td>√</td>
<td>√</td>
<td>3.0</td>
<td>Near</td>
</tr>
<tr>
<td>PTL - Connector Ramps - I-280 SB to SR 87 SB (HOV only) (A2)</td>
<td>√</td>
<td>√</td>
<td>3.0</td>
<td>Near</td>
</tr>
<tr>
<td>PTL - Connector Ramps - SR 87 SB to I-280 NB (HOV only) (A3)</td>
<td>√</td>
<td>√</td>
<td>3.0</td>
<td>Near</td>
</tr>
<tr>
<td>MaaS (Mobility as a Service) (App) (TI1)</td>
<td>√</td>
<td>√</td>
<td>2.0</td>
<td>Near</td>
</tr>
<tr>
<td>Technology infrastructure enhancements (backbone corridor communications) (TI2)</td>
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<tr>
<td>CMS - SR 87/Narvaez Ave-Capitol Expressway (P&amp;R availability, LRT travel time) (TI3)</td>
<td>√</td>
<td>√</td>
<td>1.0</td>
<td>Near</td>
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<tr>
<td>CMS - SR 87 SB near Diridon Station (P&amp;R availability, LRT travel time) (TI4)</td>
<td>√</td>
<td>√</td>
<td>1.0</td>
<td>Near</td>
</tr>
<tr>
<td>CMS - SR 87 SB near Diridon Station (P&amp;R availability, LRT travel time) (TI5)</td>
<td>√</td>
<td>√</td>
<td>1.0</td>
<td>Near</td>
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<tr>
<td>Promote carpool use by providing employer incentives (TDM1)</td>
<td>√</td>
<td></td>
<td>0.5</td>
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<tr>
<td>Extend carpool hours to provide travel time reliability all day long (TDM2)</td>
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<tr>
<td>First-Last Mile trip completion alternatives to promote transit use (TDM3)</td>
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<tr>
<td>Public-private partnership for micro transit like Uber, Lyft (T1)</td>
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<td>2.0</td>
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<tr>
<td>Employer Incentive Programs to Increase Employee Transit Use (T2)</td>
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<tr>
<td>Transit on Demand (e.g., Chariot) (T6)</td>
<td></td>
<td></td>
<td>0.5</td>
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<tr>
<td>Electronic bicycle lockers at transit stations (B1)</td>
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<td>√</td>
<td>0.1</td>
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</tr>
<tr>
<td>Recommendations</td>
<td>Ideas to Encourage Mode Shift</td>
<td>Technology Based Improvement</td>
<td>Cost ($M) 2017</td>
<td>Timeline</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
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<td>-----------------</td>
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<tr>
<td>Wayfinding, signage around transit centers (B2)</td>
<td>√</td>
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<td>0.05</td>
<td>Near</td>
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<tr>
<td>Real-time electronic signage and counter at trail heads (B3)</td>
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<td>1.0</td>
<td>Near</td>
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<tr>
<td>Wayfinding signage along trails (B4)</td>
<td>√</td>
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<td>0.05</td>
<td>Near</td>
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<tr>
<td>Lighting along SR 87 Trail (B5)</td>
<td>√</td>
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<td>0.50</td>
<td>Near</td>
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<td>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)</td>
<td>√</td>
<td></td>
<td>0.05 to 5.0</td>
<td>Near</td>
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<tr>
<td>PTL - Connector Ramps - SR 87 NB to I-280 NB (HOV only) (A4)</td>
<td>√</td>
<td>√</td>
<td>3.0</td>
<td>Mid</td>
</tr>
<tr>
<td>PTL - Connector Ramps - I-280 NB to SR 87 NB (HOV only) (A5)</td>
<td>√</td>
<td>√</td>
<td>3.0</td>
<td>Mid</td>
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<tr>
<td>PTL NB - Alma Avenue to I-280 off-ramp (all vehicles-right shoulder) (A6)</td>
<td>√</td>
<td></td>
<td>5.0</td>
<td>Mid</td>
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<tr>
<td>PTL - Connector Ramps - I-280 NB to SR 87 SB (HOV only) (A7)</td>
<td>√</td>
<td>√</td>
<td>3.0</td>
<td>Mid</td>
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<tr>
<td>PTL - Connector Ramps - I-280 SB to SR 87 NB (HOV only) (A8)</td>
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<td>√</td>
<td>3.0</td>
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<tr>
<td>Adaptive Ramp metering (T16)</td>
<td>√</td>
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<tr>
<td>CMS - US 101 SB to SR 87 SB (LRT travel time) (T17)</td>
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<td>1.0</td>
<td>Mid</td>
</tr>
<tr>
<td>Convert HOV 2+ to HOV 3+ (TDM 7)</td>
<td>√</td>
<td></td>
<td>0.5</td>
<td>Long</td>
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</tbody>
</table>
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.