

## State Route 108/49

MULTIMODAL CONGESTED CORRIDOR PLAN Jamestown and Sonora, CA District 10, October 2021





TUOLUMNE COUNTY TRANSPORTATION COUNCIL





California Department of Transportation Provide a safe, sustainable, integrated, and efficient transportation system to enhance California's economy and livability.

Approvals:

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## **Executive Summary**

The California Department of Transportation (Caltrans) in collaboration with the Tuolumne County Transportation Council (TCTC) developed this corridor plan for State Route (SR) 108/49 through Jamestown and Sonora. The purpose of the plan was to prioritize for potential funding strategies that improve the multimodal performance of the highway in more congested areas of Tuolumne County as well as identifying active transportation enhancement and vehicle congestion reduction projects. The study examined existing and projected traffic conditions. It evaluated project strategies to see if they might enhance safety, reduce vehicle delay and congestion on the state highway, enhance multimodal connectivity, reduce vehicle miles traveled (VMT), reduce greenhouse gas emissions (GHG), and improve truck facility connectivity. Projects ranged from changes to intersections, changes to mainline highway facilities, operations changes, new bicycle path installation, to proposed paved shoulder widenings and new crosswalks. Strategies also included model evaluations of eastern and western bypasses relative to congestion in downtown Sonora.

## **Examination of Existing Conditions**

The plan gathered existing data on geographical setting, demographics, origin and destination behavior, land use, highway characteristics, truck accessibility, planning documents and policies, transit, highway operations, intersection counts, and proposed projects, among other areas of interest. Having data on existing conditions provided local context for observations on facility deficiencies, as well as providing historical information later used to craft potential strategies to address needs in the corridor. Recreational vehicles (RVs) were not identified as a separate vehicle class in data collection, nor were any scenarios utilized to specifically address RV travel behaviors.

For a rural region, the SR 108/49 under existing conditions showed that the corridor is highly congested during peak hours, showing a level of service (LOS) performance of 'F'. These highly vehicular congested areas included SR 49 in downtown Sonora from Washington Street to Shaw's Flat Road. Another congested area included SR 108/49 in Jamestown from South Main Street to the Stockton Road and SR 108 split. Video counts at intersections indicated instances of mid-day and afternoon peak hour factors (PHF) above 0.95, showing at intersections the highway had volumes operating close to capacity. PHF is the highest hourly volume divided by the highest flow in a fifteen-minute period within a peak hour.

Tachometer runs in the corridor showed the presence of delay, especially when documenting average speeds more than five miles below posted speed limits in downtown Sonora and near the Rawhide Road intersection in Jamestown. Video counts also documented pedestrian activity in downtown, at the entrance to the county fairgrounds, and at the Rawhide Road intersection in Jamestown. Field observations also noted pedestrians and bicyclists using the shoulder along the state highway between Sonora and Jamestown.

There are edge line rumble strips with measured gaps and center line rumble strips west of the Woods Creek Bridge (post mile 13.52) continuing to the west end of the corridor study area. There are also center line rumble strips north of Jack Page Road (post mile 19.49) continuing to the north end of the corridor study area.

Existing conditions also documented an increasing percentage of residents of retirement age and a limited growth county population since 2010. Also noted was the presence of census tracts that met the parameters of an economically disadvantaged community, according to the California Department of Housing and Community Development (HCD) and low-income definitions per Assembly Bill 1550 (AB 1550). Most census tracts in the corridor plan area met criteria to be classified as low-income communities, having census tract and household income at or below 80 percent of the statewide median income.

The Study included a survey of high school students at Sonora High School that gauged student interest in an exclusive bicycle and/or pedestrian pathway that connected the school to other locations in the study area. Most students expressed reserved interest in using such a facility. The two main reasons were far distances from home to school, and concerns related to safety.

## Results

Results for this study are depicted into two ways. Any strategy that showed any improvement, regardless of how minimal, achieved a goal and objective. Table 79 listed all strategies and the goals they did and did not achieve. Based on the percentage of goals achieved, strategies were ranked in tiers, as shown in Table 80. Tier One was for the most successful strategies, and Tier Four was for the least successful.

The second method compared and ranked strategies based on how they performed in relation to the no-build conditions. The better the strategy performed, the higher its ranking. This method went beyond just answering the question on a strategy achieving a goal. Tables 1 and 2 below compared strategies tested in model simulation, and Table 3 compared non-motorized strategies not tested in simulation.

### Assessment and Modeled Strategy Results

The plan examined deficiencies using performance assessments. A performance assessment is a quantifiable measure of one component of the state highway system (SHS) using a characteristic that gauged how well the system was meeting the needs of transportation users.

Characteristics measured with performance assessments included vehicle delay, vehicle queue length, VMT, GHG emissions, and carbon dioxide (CO2) emissions. The comparison was between no-build conditions on the state highway and conditions after a proposed strategy was installed in the system. These comparisons were made under existing 2018 conditions and projected 2040 conditions. The extent conditions changed after installing a proposed strategy in the simulation model determined how much the strategy improved highway conditions. Strategies that performed better than the no-build scenario achieved a corridor study goal and an objective, and how well the strategy performed determined its ranking among other tested strategies. Tables 1 and 2 show the results of simulation analysis. Scenarios were ranked from best performing to those that showed little change. Strategies that received a total score of less than 500 were preferred strategies, achieving a corridor study goal.

The Greenley Extension strategy was tested in two different programs: one macro and one micro traffic modeling program. This means the Greenley Extension appears twice in Table 2, because the strategy was measured using different metrics dependent on which program was used in analysis. The strategy is the same, but there are two sets of results.

#### Table 1: Comparison of Strategy Performance and Rankings, 2018

	Percent of Existing 2018 Conditions						
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Existing No-Build	100	100	100	100	100	500	7
Shaw's Flat Intersection	188.4	185	83	101.3	130	687.7	10
SR 108 Freeway	25.4	79.6	96.6	88.2	90	379.8	4
Active Transportation Pathway	201.4	138.5	97.1	126.6	110	673.6	9
Rawhide Realignment	29.2	56	81.7	61	74	301.9	3
Mackey Ranch Intersection	161	135	95	125	110	626	8
5-lane Widening	1.9	34.3	86.7	58.4	60.9	242.2	1
4-lane Widening	1.6	35.3	97.9	65.3	60.9	261	2
All Strategies	81.8	97.8	93	96	105	473.6	6
Signal Timing Adjustments***	90	73.5	100	100	77.8	441.3	5
2040 No-Build Chicken R to Parrott's	377	156	98.9	141	126	898.9	11
2040 No-Build Mackey R to Parrott's	953	185	98.1	144	130	1,510	12
NA: Not Applicable							

ignal timing adjustments were modeled in Synchro 10 in Jamestown using HCM-bas

#### Table 2: Comparisons of Strategy Performance and Rankings, 2040

	Percent of Future Projected 2040 Conditions							
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	AADT **	Rank
Future No-build	100	100	100	100	100	500	NA	9
Future Shaw's Flat Intersection	127.7	141.7	99.5	117.9	128	614.8	NA	10
SR 108 Freeway	5.6	51.2	104.3	67.7	73	301.8	NA	4
Active Transportation Pathway	52.1	97.3	99.8	103.1	104	456.3	NA	6
Future Rawhide Realignment	123.3	88.6	98.4	87.5	93	490.8	NA	7
Future Mackey Ranch Intersection	166	182	96	183.7	138	766	NA	11
5-lane Widening	0.5	25.3	102.6	49.8	48.3	226.5	NA	1
4-lane Widening	0.8	29.2	111.7	55.6	51.7	249	NA	3
Greenley Intersection	104	94	98.4	98.4	96.2	491	NA	8
All Strategies	0.7	31.3	88	51.6	65.4	237	NA	2
Signal Timing Adjustments***	122	29.6	100	100	66.7	418.3	NA	5
2040 No-build TransCAD	NA	NA	NA	NA	NA	NA	100	4
Greenley Extension	NA	NA	NA	NA	NA	NA	86.5	1
Montezuma Western Bypass*	NA	NA	NA	NA	NA	NA	99.3	2
Bell Mooney Western Bypass*	NA	NA	NA	NA	NA	NA	99.7	3
NA: not applicable								

\*Both strategies incorporated simulations that included installation of the Greenley Extension into a future no-build projected model

\*\*AADT refers to volumes in downtown Sonora based on origin/destination studies using the Tuolumne TransCAD model

\*\*\*Signal timing adjustments were modeled in Synchro 10 using HCM-based LOS measures; scores were based on signal timing adjustments at Rawhide Road

and SR 108/49 with a highway widened to four lanes; the score at Fifth Avenue under the same circumstances would have been 393

- Modeling showed that the mode shifting proposal did better in 2040 conditions than in • 2018 conditions, showing reductions in VMT, delay, and queuing. An active transportation pathway may be a good long-term investment. Table 3 also shows this strategy performed well as a non-motorized gap-fill strategy.
- The Greenley Extension showed consistent mainline highway performance improvement in future conditions. Public comment and feedback indicated support for this strategy.
- Lane widening improvements on SR 108/49 exhibited improvement in both 2018 and 2040 conditions.
- Signal timing adjustments on SR 108/49 near Jamestown under existing conditions showed improved local area LOS and less gueuing.
- The Rawhide Road intersection and bridge realignment proposal performed well in 2018 conditions
- A strategy utilizing several scenarios at once, called the "all-strategies scenario" ٠ performed second best in 2040 conditions.

- TransCAD travel demand modeling software showed that proposed bypasses reduced volume in downtown Sonora under future 2040 growth projections. As was the case with microsimulation, the Greenley Extension had consistent effects, reducing downtown volume by approximately 13 to 14 percent. The Greenley Extension should reduce travel times for ambulances that need to access medical facilities on Greenley Road, saving emergency response vehicles from having to navigate downtown congestion.
- Two proposed unfunded western bypasses provided a less than one percent reduction in traffic volume in downtown Sonora, varying from 0.3 to 0.7 percent reduction. This minimal change showed local trip generation in the study area. Rawhide Road and Jamestown Roads' use as existing western bypasses also limited the effectiveness of the hypothetical bypasses tested in the study.

If built to contemporary standards, the western bypasses would provide Terminal Access (TA) truck access from the Calaveras County line to SR 108/49. However, SR 49 in Calaveras is not a TA facility until post mile 7.21 in Angels Camp. If improving highways to TA standards is a priority, then more work would be needed on SR 49 in Calaveras County. Currently, TA access is not available to the entirety of SR 108/49 in Tuolumne County, which is a National Highway System (NHS) route in the corridor study area.

## Safety and Gap Reduction Strategies

Measuring a safety enhancement used records of highway accident and crash data. If other factors affecting safety incidents are taken into consideration, analyzing data from before and after a highway improvement could determine if conditions became safer due to a specific enhancement. However, to gauge if a strategy leads to fewer fatal and injury incidents, the limitation of accident data collection is that the data cannot be collected until after the improvement is complete. In lieu of this, complete streets and traffic operations strategies also have an analysis that examines their potential benefits to safety based on peer-reviewed research. What this examination showed is that widening paved shoulders, extending sidewalks, installing separated and protected bicycle lanes, and installing crosswalks with certain design features under certain traffic conditions can contribute to safer conditions in the corridor.

Other items subjected to performance assessments included gap measures in active transportation, as well as environmental status, gaps in truck highway facilities, Americans with Disabilities Act (ADA) needs, and existing gaps in Intelligent Transportation Systems (ITS). Most items evaluated with performance assessments were then matched with a strategy designed to enhance multimodal performance on the highway system. The comparison was between the existing highway network and what the network would be like after gap-fill improvements. The placement of crosswalk, shoulder-widening, bike path, and sidewalk strategies met either observed active transportation needs, or they brought the highway to meet Highway Design Manual (HDM) guidelines, or they filled gaps inside city limits or inside built environments.

Strategies addressing gaps in active transportation infrastructure led to increasing the amount of continuous facilities. These efforts included installing sidewalks, crosswalks, ADA compliant curb ramps, integrating bicycle and pedestrian paths, and installing wider paved shoulders with edge lines on both sides of the highway. Installation of rumble strips was not examined; however, such installation must feature design elements sensitive to the needs of bicyclists.

- The study identified locations with a need for sidewalks on both sides of the highway:
  - 1. SR 108/49 in Jamestown from South Main Street (PM 14.33) to Fifth Avenue (PM 15.0)
  - 2. SR 108/49 split (PM 16.47) to the intersection of SR 49 and Washington Street (PM 17.96)
  - 3. SR 49 and Shaw's Flat Road (PM 18.5) to SR 49 and Preston Place (PM 19.4)
- The study identified the following locations in Jamestown and Sonora in need of crosswalks or crosswalk enhancements that cross the state highway:
  - 1. SR 108/49 and Rawhide in Jamestown (realigned intersection at PM 14.82)
  - 2. SR 108/49 and Fifth Avenue in Jamestown (PM 15.0)
  - 3. SR 49 and Woods Creek Drive next to the entrance to the Motherlode Fairgrounds (PM 17.5)
  - 4. SR 49 and West Jackson Street in Sonora (PM 17.61)
  - 5. SR 49 and Green Street in Sonora (PM 17.94)
  - 6. SR 49 and Shaw's Flat in Sonora next to Sonora High School (PM 18.52)
- The study identified the following intersections in need of ADA compliant curb ramps in Jamestown:
  - 1. South Main Street (PM 14.33)
  - 2. Smoke Street (PM 14.6)
  - Rawhide Road/Humbug Street (realigned intersection at PM 14.82)

- 4. Jamestown Road/North Main Street (PM 14.82)
- 5. Fifth Avenue (PM 15.0)
- The study identified intersections along SR 49 in need of ADA compliant curb ramps in Sonora:
  - 1. Ponderosa Lane (PM 17.3)
  - 2. Fairview Lane (PM 17.34)
  - 3. South Forest Road (PM 17.47)
  - 4. Woods Creek Dr./Fairgrounds (PM 17.5)
  - 5. West Jackson Drive (PM 17.61)
  - 6. West Bradford (PM 17.7)
  - 7. Green Street (PM 17.94)
  - 8. Washington Street (PM 17.97)
  - 9. Theall Street (PM 18.01)
  - 10. Linoberg Street (PM 18.06)
  - 11. East Bradford Street (PM 18.11)
  - 12. East Jackson Street (PM 18.16)

- 13. Yaney Avenue (PM 18.18)
- 14. Dodge Street (PM 18.21)
- 15. Snell Street/Elkin Street (PM 18.29)
- 16. School Street (PM 18.49)
- 17. Shaw's Flat Road/Columbia Way (PM 18.52)
- 18. Steffen Lane (PM 18.76)
- 19. O'Hara Drive (PM 19.07)
- 20. Dossi Way/Columbia Way (PM 19.22)
- 21. Dossi Way (PM 19.35)
- 22. Preston Place (PM 19.4)

- The study identified locations in need of separated and protected bicycle lane paths along the state highway:
  - 1. Chicken Ranch Road (PM 12.81) to South Forest Road (PM 17.48)
  - 2. School Street or Shaw's Flat Road (PM 18.5) to Parrott's Ferry Road (PM 20.39)
- The study identified the following locations in need for widened paved shoulders of at least eight feet with edge lines on both sides along the state highway:
  - 1. Near Jamestown from Chicken Ranch Road (PM 12.817) to Mill Villa Road (PM 16.07)
  - 2. South of Sonora from approximately PM 16.7 to PM 17.0
  - 3. North of Sonora approximately PM 18.6 to Parrott's Ferry Road (PM 20.39)

Table 3 below showed how effective non-motorized strategies were at closing gaps when compared to the existing state highway. Queue length, delay, VMT, Emissions, CO<sup>2</sup> emissions, and LOS metrics do not apply to non-motorized strategies, so they are not included in the following table.

Strategy/Project	Percent Change from Existing 2018 Conditions: Gap Fill Need	Rank
8ft. paved shoulders	85	3
Sidewalk gap fill	77 to 81.5	4
Active Transportation Pathway	100	1
ADA updates	97	2
Crosswalks	74	5

Table 3: Comparison of Non-motorized Strategy Performance and Rankings

- The active transportation path appeared to be the most effective when examined from a gap-fill perspective. Part of the reason for this is that there is currently no bicycle facility along the state highway in the study area.
- All the non-motorized strategies reduced gaps, easily achieving goals when compared to the existing system.

Map 1 below showed all the proposed projects in Tuolumne's 2016 RTP that were incorporated in the strategies examined in this corridor study. Nineteen RTP-based strategies were included in whole or in part in this corridor study. Strategies included active transportation enhancements and changes meant to address traffic congestion on the highway. Caltrans and local agency partners may amend the scope of final project recommendations depending on availability of new data, funding possibilities, public feedback, and changing economic conditions. Overall, both plans advocate for strategies that can reduce GHG emissions, reduce VMT, fill gaps in active transportation infrastructure, can act as evacuation routes during a wildfire, and that can mitigate delay and queuing on SR 108/49.

The District 10 California Active Transportation (CAT) Plan is a separate Caltrans planning effort that addresses gaps and needs concerning active transportation facilities on and close to the state highway system. The CAT Plan includes map survey feedback from agency partners and the public in Tuolumne County that can serve as a further resource for identifying where multimodal improvements need to occur along SR 108 and SR 49.

Map 1: RTP Proposed Projects and Corridor Study Strategies



## Concurrence Between TCTC and Caltrans Efforts

This plan attempted to show concurrence with TCTC, the City of Sonora, and Tuolumne County. While TCTC's SR 49 Multimodal Corridor Plan focused more on active transportation, this study focused on traffic operations and active transportation strategies. Though some variation on scope and strategy type does exist between the two documents, both plans endorsed the development of an active transportation pathway/shared use path throughout the corridor, gap-fill of sidewalks in built environments, as well as center turn lane and lane widening strategies on the highway. Through peer agency review and public comment, Caltrans, TCTC, the City of Sonora, and Tuolumne County will hone a list of endorsed multi-modal projects in the corridor study area. These projects will be reflective of a combined partner effort to secure funding for making transportation improvements in the state highway corridor from Mackey Ranch Road to Parrott's Ferry Road.

Strategy timeframes were categorized into the following: short-term, medium-term, and longterm. Descriptions of time lengths were based on the Caltrans Corridor Planning Process Guide. Because of funding constraints and geographic area, several strategies can not be implemented at one time, but would likely see phased construction. The timeframe shown in Table 71 also breaks strategies into separate geographic components. Separating into different sections followed the tiered project development of proposed improvements in the 2016 TCTC RTP.

Pending partner agency review, public input, and changing economic conditions, timeframes might be subject to change. The timeframe represents an idea on which strategies might be implemented first, but it is not a final decision beyond revision.

Adjusting and developing a final set of recommendations is a group effort between Caltrans, the Chicken Ranch Rancheria of Me-Wuk Indians, TCTC, Tuolumne County, the City of Sonora, and the public. Stakeholders collaborate to make possible changes to the list of preferred strategies. Upon consensus and agreement, agency partners, with public consultation, develop a final list of strategies to meet goals and objectives. Stakeholders can decide together how to publish the final recommendations in a manner that is accessible to the public.

Once approved by Caltrans and local agency partners, the selected and prioritized strategies may be considered as recommendations for projects and can be fed into Caltrans district system planning processes and RTP processes. The projects are intended to serve as recommendations for the corridor that carry an estimated timeframe of project phasing and completion. These projects become eligible for pre-project initiation document (PID) candidates when funding programs are open. Calls for projects at the federal, state, regional, or local level draw from these pre-PID project candidates for possible funding and implementation.

The corridor planning process is documented with the publication of the study, but the publication does not represent the end of the planning process. Publication is an important milestone that will be revisited by the corridor team in future cycles. It should be officially adopted by the lead agency and core partners. After its adoption, it can be officially used to identify project candidates for funding or planning efforts that identify future investment opportunities.

Ongoing reporting on corridor performance is conducted to evaluate the effectiveness of recommended projects and strategies over time. The lead agency and corridor team need to ensure mechanisms are in place for ongoing monitoring and evaluation.

### Notes on Corridor Strategies and Data

- Volumes in simulation models came from camera counts in eight locations using noon peak hour data. This decision to use noon peak data may explain why some of the simulation videos appeared to be low on traffic volume. Afternoon was usually when the overall peak hours occurred. Volumes in modeling would have been higher had overall peak hour data been used instead. Regardless of volume timings used in simulation, data and comparative analysis did indicate changes to the performance of the highway depending on the strategy tested.
- Truck volume simulations were based on estimates from the Caltrans 2017 Truck Volumes Book, as truck volumes in count video simulations appeared lower than expected. This led to two percent more truck volumes at most locations. Truck counts in the camera counts included articulated trucks, single-unit trucks, and buses.
- Simulation data was presented in terms of how the results affected corridor-wide performance, and how they affected performance at the location where the proposal was suggested. This discussion at both the corridor and local levels took into consideration the need to better understand how proposed strategies worked at the intersection where they were installed, and how these strategies changed the behavior of the entire corridor.
- Although the Shaw's Flat and Mackey Ranch roundabout proposals increased delay and queue length in modeling, these strategies may have merit if their intention is to slow down traffic and reduce the risk of collisions. In other words, performance in modeling is only one indicator for strategy effectiveness. The roundabout proposals deserve consideration beyond simulated traffic conditions.
- Comments from the Chicken Ranch Rancheria of Me-Wuk Indians of California indicated that the roundabout proposal at Mackey Ranch Road was selected as the preferred alternative by Caltrans, the Tribe, the Tribe's consultant, and TCTC. Comments also indicated that an Intersection Control Evaluation (ICE) Step II study was completed in December 2019. The study concluded that the roundabout was the best performing alternative. The ICE Step II study is included in the Appendix for reference.
- The five-lane widening scenario includes pedestrian, bicycle, and transit improvements. It is not just a vehicle congestion reduction project.
- Freight was discussed to the extent that SR 49 from Sonora to the Calaveras County is not truck Terminal Access (TA) compliant. Traffic Operations concluded that the cost to make the alignment TA standard was substantial, and that such an effort would jeopardize the historic and cultural character of Sonora. The primary alternative to addressing the lack of a TA standard facility was building a western bypass instead, an RTP tier three proposal the location of which has not been decided. A separate freight study may be needed to address truck access issues not only in Tuolumne, but also in other Motherlode jurisdictions.

- One recommendation for data collection is having seven-day-long video collection times using cameras for locations that only had 24-hour to 48-hour-long count sessions studv. locations included Columbia for the These the Wav/Shaw's Flat intersection near Sonora High School, the entrance to the Motherlode Fairgrounds on SR 49, and at the Fifth Avenue intersection with SR 108/49. More qualitative research and public outreach on community demand for active transportation facility improvements were also needed to better gauge support for active transportation projects.
- Regardless of scenario, Jamestown and downtown Sonora still showed concentration of delay. Lane widening, the Rawhide intersection realignment, and the Greenley Extension in 2040 did reduce delay, but no scenario eliminated delay completely in either location.
- The lack of parking in downtown Sonora creates additional local congestion and delay, as motorists spend extra time driving searching for available parking. This study did not address parking challenges in downtown, but Vision Sonora and TCTC's Multimodal Corridor Plan do present strategies for improving parking access and its effects on local congestion.
- The Greenley Extension and lane widening scenarios may act as evacuation routes in the event of a wildfire or a forest fire. Given the increasing risk of fires in California over the last ten years, further study on bypasses and lane widening strategies as evacuation routes is warranted. A funding source for highway projects that focus on emergency evacuation routes in rural areas of California is an issue that policymakers need to address.
- The Greenley Extension is not only a vehicle congestion and delay reduction strategy. • The drop in volume with the bypass presents multimodal benefits for downtown Sonora. reducing volume Sonora. the By in downtown benefits pedestrians. Less vehicular congestion in downtown lowers strategy pedestrian level of stress.
- While Tables 1 and 2 in this Executive Summary and in Section 4.1 may give the impression that this report prioritizes vehicle-centric operations improvements, it is necessary to note that this report is a multimodal report that evaluates gaps and needs along the state highway concerning paved shoulder widths, sidewalks, crosswalks, bicycle lanes, and ADA curb ramps. With exception to the active transportation pathway scenario, the reason these active transportation strategies do not appear in Tables 1 and 2 is because they were not evaluated in traffic model simulation. Instead, field review infrastructure gap filling, taking into consideration documented existing bicycle and pedestrian use, was used as a measure of strategy effectiveness. Table 3 and Chapter 5 present the results of analyzing active transportation infrastructure needs for this report. Although certain vehicle congestion reduction and operations strategies score well in Tables 1 and 2 and in Chapter 4, those rankings only apply to strategies tested in computer simulation. Nonmotorized strategies in Table 3 and Chapter 5 are a separate group of strategies with their own set of performance measures. These strategies are no less significant than motorized strategies in their attempt to address a need or a deficiency in the state highway's ability to provide access and safety for all users, regardless of mode.

# **1. INTRODUCTION**

## 1.1. Methodology

The approach taken in a corridor study to characterize conditions is based upon several premises that may not apply to conditions in Tuolumne County. California Transportation Commission (CTC) guidance for the Congested Corridor Program and the Trade Corridor Enhancement Program performance metrics tend to address conditions on freeway traffic corridors designed for uninterrupted flow consistent with Highway Capacity Manual (HCM) standards. Along with cellphone probe data, key metrics of delay, and travel time reliability rely upon well-instrumented intelligent transportation system corridors within an urban context.

There are few traffic monitoring stations in Tuolumne County that are incorporated into the Performance Monitoring System (PeMS) so that their data can be relied upon to provide a clear sense of system performance beyond a sampling of traffic volumes for a specified period. Although SR 49 is part of the National Highway System, it is not included in the highway PeMS, which is employed partly to provide information on trip reliability for both passenger vehicles and trucks.

Use of corridor modeling using Vissim is intended to partly address these issues and metrics. An idealized corridor with no exits and a speed limit of 65 MPH was developed as a modeling scenario to best compare the existing facility with the concept facility of an expressway as part of the Freeway and Expressway System (California Streets and Highways Code (CSHC) sections 250-257). The assumption is that the influence of geometry of the corridor on performance is better represented by Vissim than simplified one dimensional models and equations, and should allow a better comparison of outcomes between models and reality.

A separate consideration was the accuracy and precision of traffic volumes in the corridor. These are reported annually, derived from continuous collection at PeMS sites (which are essentially instrumented detector loops installed underneath the road surface) and should be considered estimates rather than as a census; and do not include means to report bicycle, pedestrian, or motorcycle traffic. To better characterize the variety of vehicular movements in the corridor, Miovision camera counts were employed at specific locations.

Tier I through Tier III projects identified in the 2016 Regional Transportation Plan were evaluated for the congestion relief they provided on the state highway in Jamestown and Sonora. These included nineteen RTP-specific proposed projects that appear in scenarios and strategies split between short term, medium term, and long-term projects. Each was evaluated within their timeframe to assess their efficacy.

### **Demographics Changes**

A key concern in developing the plan was the demographic change underway in Tuolumne County. This is discussed in greater detail below. California Department of Finance (DoF) population projections indicate a decline in population in the County continuing through to 2045; however, the most recent traffic demand model employed a growth rate of 1.1%. A likely explanation for this discrepancy would be that the DoF numbers only reflect residents that make Tuolumne County their primary residence.

With the declining population numbers, Caltrans views the county undergoing an ongoing conversion of primary residences to secondary or vacation homes. At present, the percentage of dwelling units in the County that are not primary residences is over 25%. This pattern appears to be present in all the Mountain Counties in District 10, which are reported to have declining populations, the exception being Amador County. Within the County, this conversion appears to predominate in the Census Designated Places (CDP) outside the immediate corridor, and their impact to traffic patterns in the study area may not be great, but their effects to regional VMT may be reflected in the higher growth rates in the Travel Demand Model (TDM), and overall air quality.

A second factor are changes in the regional population structure. First, more households are comprised of members sixty and older now than in 2000. Notable in 2010 was a change first attributed to the Great Recession and thought to be temporary, was a transition in the number of working households in the County to retired or under-employed. Notable in statistics, this change was confirmed by a drop in interregional travel between Tuolumne County and both Stanislaus and Calaveras Counties (2,125 workers traveled out of Tuolumne in 2006-2010; 1,465 in 2012-2016). These two shifts may explain in part the reported worsening in traffic congestion in the corridor.

Elderly driving behaviors result in two general patterns—fewer work and school commutes but compensated by more daily local trips for errand running, and fewer trips outside of daylight hours compared to the overall population. Likely outcomes are increased traffic in morning and midday hours. It is unclear how much if at all this endogamous change in travel behavior affected congestion in the corridor, and it would depend on end trips for medical or household needs. In the corridor that may translate to an increase in trips to and from medical offices at Stockton Road near the fairgrounds, but possibly little else.

Comparison of current with past travel patterns in rural areas is often problematic. A rough index of change would be a comparison of work commutes reported on the American Community Survey (ACS), compared to volumes reported from Traffic Monitoring Stations (TMS) along the route, in this case the PeMS stations on the SR 120/108 expressway and the records for the Calaveras and Tuolumne TMS on SR 49. Similarly, traffic volumes acquired at the PeMS stations during nonpeak recreation travel times (Friday through Sunday in late Winter) compared to those same periods in the Summer. The same data comparison could be performed during the critical period of 2009 to 2010, and possibly during another interval.

## VMT Mode Shift Scenario in Model Simulation

Vision Sonora addresses to a degree mode shift in a complete streets context. It targets bicycle and pedestrian facilities that parallel SR 49 with a bicycle route on Stewart Street and a multiuse trail along Stockton Street into historic downtown Sonora. However, without the affiliated bicycle and pedestrian planning for the County, the sense and implementation of a biking and walking network integrated with regional and interregional transit service is skeletal. Currently, TCTC is undertaking a bicycle and pedestrian plan, and until it is complete, Caltrans is unable to evaluate active transportation facilities, beyond what have been reported and recommended in Vision Sonora. A specific consideration is how bicycle travel on the portions of SR 49 in Sonora might be addressed, given the parallel routes—should the facility be Class III, or should bicycle travel be restricted from the right of way. However, in undertaking this study, there is the capability to assess reductions in greenhouse gases and VMT by meeting various parameters of mode shift away from the use of single occupancy automobiles, and specifically modeling the effect of a targeted Active Transportation Program on congestion.

Mimicking a viable pattern of replacement may be difficult. American Community Survey input on local walking and bicycling to work suggests that such travel modes are already in employment in the corridor area within two census tracts (tracts 11 and 12) comprising Sonora acting as origins and destinations for most trips. With a substantially older population than characteristic of other areas of California, there may be a great, though understandable, reluctance to undertake this mode shift towards greater use of walking and bicycling; and it may be necessary for the model to target enclaves with younger populations. Left unaddressed in this study is what role direct access to transit may play.

What is modeled is an active transportation travel network from Chicken Ranch Road to Parrott's Ferry with bicycling and walking use in line with Caltrans' goals and targets, joined to an effort to portray a realistic scenario. Census Transportation Planning Products (CTPP) data already depicted 0.45 percent commuting as cycling and 6.5 percent as walking.

This association to reality means the rate of reduction from single occupancy vehicles (SOVs) to walking and bicycling may be small in the model (0.5 percent reduction from trips generated in the no-build scenario to bicycles, and 0.5 percent reduction from trips into walking). Based on CTPP data showing 6.5 percent of commuting as pedestrian, the percent mode shift toward pedestrians in the model could be larger than 0.5 percent. More data collection in the future may carry the possibility of adjusting the rate to a higher percentage of reduction. For now, the key with modeling a mode shift to active transportation is finding out if there is a decline in GHG emissions, fuel consumption, and a drop in VMT.

## 1.2. The 2018 Corridor Planning Effort

This corridor plan was developed in the same fiscal year as the Draft Caltrans Corridor Planning Guidebook. The Guidebook outlined Caltrans' expectations on the corridor planning process, replaced transportation concept report (TCR) guidelines, and was intended for use by Caltrans' staff developing corridor planning efforts. This plan followed steps identified as fundamental toward the completion of a corridor plan.



#### Figure 1: Corridor Planning Process Step 1

The introduction of this study conformed to what the Draft 2018 Caltrans Corridor Planning Guidebook designated as **Step 1 of 8: The Scope Effort**. This chapter introduced the corridor planning effort, defined the corridor partnership with agency partners, identified deficiencies in the corridor, and listed goals, objectives, and performance measures for the corridor's improvement.

The Road Repair and Accountability Act of 2017, or Senate Bill (SB) 1, created the Solutions for Congested Corridors Program. This program supports state transportation projects designed to reduce congestion and GHG in highly traveled corridors, while favoring multimodal enhancements that focus on safety, environmental protection, and that maintain the economic and cultural character of the jurisdictions that state highways serve. These improvements do not have to be limited to the SHS, and other agencies besides Caltrans can nominate projects for funding.

CSHC sections 2391-2397 specifically addressed the statutory requirements of the Congested Corridors Program. According to the Draft 2018 Comprehensive Multimodal Corridor Plan Guidelines, the statute required the following:

Funding shall be available for projects that make specific performance improvements and are part of a comprehensive corridor plan designed to reduce congestion in highly traveled corridors by providing more transportation choices for residents, commuters, and visitors to the area of the corridor while preserving the character of the local community.

The Draft Corridor Plan Guidelines serve as a companion document to the adopted Solutions for Congested Corridors Program Guidelines. The Plan Guidelines stipulate the following on the Corridor Planning Guidebook:

Comprehensive multimodal corridor plans that address the SHS and that are utilized to apply for funding from the Congested Corridors Program should be consistent with the intent of the Caltrans Corridor Planning Guidebook and any subsequent versions of that document.

The corridor plan is part of Caltrans' focus on instituting a planning to programming cycle for improvements and enhancements to the SHS. Figure 2 illustrates corridor studies' relationship to statewide and regional plans, district system management plans (DSMPs), project candidate lists, and funding program requests. System Planning will continue to focus on identifying long-term multimodal needs based on highway conditions.

This plan is consistent with California Transportation Plan 2050's (CTP 2050) Vision to reduce transportation-based greenhouse gas emissions, enhance highway safety, eliminate transportation barriers and burdens on low-income and environmentally disadvantaged communities, promote multi-modal transportation options, develop strategies that promote a transportation network more resilient to climate change and natural hazards, and expand infrastructure accessibility for all transportation users. A synopsis of CTP 2050 and its eight goals needed to carry out its Vision are available in Appendix VI.P.

As mentioned further in 1.5 Study Purpose, this plan is also in alignment with statewide plans and policies that promote investments in active transportation on and near the SHS.

#### Figure 2: System Planning to Programming



### 1.2.1. What is System Planning

Statute defines System Planning's role in Caltrans' stewardship of state highways. According to California Government Code Section (CGCS) §65086:

The Department of Transportation, in consultation with transportation planning agencies, county transportation commissions, counties, and cities, shall carry out long-term state highway system planning to identify future highway improvements.<sup>1</sup>

System Planning is the long-range transportation planning process for Caltrans. The System Planning process fulfills Caltrans' statutory responsibility as owner/operator of the SHS by evaluating conditions and proposing enhancements to the SHS. Through System Planning, Caltrans focuses on developing an integrated multimodal transportation system that meets Caltrans' goals of safety and health; stewardship and efficiency; sustainability, livability and economy, system performance, and organization excellence. System Planning evaluates current and future need on the SHS utilizing analysis that considers multimodal traffic behavior, as well as the effects of planning on environmental and social justice.

### 1.2.2. What is a Corridor

The Guidebook defines a corridor as a geographic area, often linear, identified by a travelshed of existing and forecasted travel patterns for people and goods, as multimodal and context specific, as limited by travel or modal decision points, and as an area that provides

<sup>&</sup>lt;sup>1</sup> CA Webpage: Legislative Law Code Section

access to jobs, education, services, and housing. A corridor does not have to be limited to only one state highway.

## 1.3. Corridor Partnership

Caltrans District 10 through the Offices of System Planning and Travel Forecasting, in consultation with the TCTC, the City of Sonora, and Tuolumne County, submitted this Sonora/Jamestown SR 108/49 Corridor Study. System Planning worked with TCTC on identifying conditions in the corridor, examining multimodal needs and opportunities, sharing updates on the progress of the study document, and sharing updates on data collection and resources. Partner agencies in Tuolumne County reviewed the draft document and provided comments.

## 1.4. Study Area

The corridor study area contained segments from SR 49 post mile (PM) 12.817 (Chicken Ranch Road) to PM 20.392 (Parrott's Ferry Road), extending 7.575 miles, as featured in Map 2. Parallel facilities east and west of SR 49 were evaluated based on how improvements affected the state right of way. The evaluation of a proposed bypass west of Jamestown/Sonora considered how the bypass might relieve congestion on right of way in Sonora. Vision Sonora described TCTC's approach to addressing congestion and safety deficiencies within the City of Sonora. The 2016 TCTC Regional Transportation Plan (RTP) encompassed the county. This corridor study covered an area inclusive of Sonora, Jamestown, areas near the Chicken Ranch Rancheria of Me-Wuk Indians, and Columbia College.

## 1.5. Study Purpose

The purpose of this plan was to identify transportation needs and consider opportunities to improve the state highway corridor in northwest Tuolumne County by documenting the existing and projected future multimodal conditions and assets of the SR 108/49 corridor. The study conducted performance assessments of facilities and traffic behavior, and presented and analyzed strategies' abilities to enhance safety, reduce congestion, reduce GHG emissions, and enhance multimodal opportunities. The outcome was to identify analyzed strategies eligible for funding that could address corridor deficiencies. Goals and objectives of this study were sensitive of the goals and objectives of existing planning documents and efforts.

In addition to CTP 2050, planning documents and efforts with which this plan's strategies are consistent include Toward an Active California from 2017, the statewide plan for non-motorized transportation. Caltrans' 2015 Strategic Management Plan's goal is to triple bicycle, double pedestrian, and double transit trips by 2020. Toward an Active California provides recommendations and strategies to help Caltrans achieve this goal. To further endorse pedestrian and bicycle activity, Toward an Active California encouraged the development of active transportation plans, such as District 10's CAT Plan, with which this corridor plan is also consistent. Other statewide plans and policies this plan follows include the 2010 Smart Mobility Framework, the Complete Streets Elements Toolbox, and Deputy Directive 64-R2. More information about these policies is available in Appendix VI.

Map 2: SR 108/49 Corridor Study Area



## 1.6. Needs and Opportunities

### 1.6.1. Deficiencies

The Sonora/Jamestown community has consistently congested state highway segments. Truck volumes, commuter flow, recreational traffic from the San Joaquin Valley to the Sierra Nevada Mountains, and local vehicle activity within Tuolumne County resulted in a network that operates near capacity during peak hours. TCTC, the City of Sonora, and Tuolumne County had expressed in their planning documents a need to address congestion and delay on the SHS. It is noted, however, that Rawhide Road and Jamestown Road are well-used north-south bypasses around downtown Sonora. Rawhide is used by traffic not destined for downtown.

In addition to congestion and vehicle delay, there was an incomplete presence of Surface Transportation Assistance Act (STAA) standard truck facilities, and gaps in multimodal connectivity along SR 108/49 from Chicken Ranch Road to SR 49 and Parrott's Ferry Road. Observations of bicyclists and pedestrians using shoulders along the highway in video count data and during field reviews further illustrated the need to address gaps in active transportation.

Traffic in this area operated at LOS ranging from E to F during peak hours,<sup>2</sup> with delay occurring on both weekdays and weekends. Video counts and model simulation also showed traffic operating with congestion and delay. This study was to endorse strategies that enhanced safety, reduced congestion, reduced delay, lowered GHG emissions, and provided for better connection among multimodal facilities.

### 1.6.2. Opportunities

In 2017, Governor Edmund G. Brown signed into law SB 1, The Road Repair and Recovery Act. This legislation, meant to invest 5.4 billion dollars annually over the next decade into the maintenance and repair of the SHS, and to invest in multimodal transportation improvements throughout the state, created the Solutions for Congested Corridors Program. The Congested Corridors Program allocated two hundred and fifty million dollars annually to the California Transportation Commission (CTC) to fund projects designed to mitigate and reduce congestion while enhancing multimodal opportunities within congested travel corridors in California. The program called for projects that might incrementally improve transportation performance in a corridor plan, the purpose of which was to reduce congestion in a highly traveled corridor. It was in this spirit of the SB1 program that this study evaluated solutions in the Jamestown/Sonora Corridor to determine if they reduced congestion, enhanced safety, reduced GHG emissions, reduced delay, and expanded multimodal transportation opportunities.

In 2013, Caltrans published Main Street, California - A Guide for Improving Community and Transportation Vitality, to address planning and design challenges for State highway corridors that also served as community "main streets". The goal of that effort was to

<sup>&</sup>lt;sup>2</sup> 2013 SR 49 TCR, pgs. 24-28

ensure that the state highway main streets adequately "accommodate the circulation of the local community as well as regional and statewide travel demands [in a way that] makes main streets an asset to the local community" through the incorporation of "complete street" and active transportation into planning studies and transportation improvements. This corridor study focused on strategies that can reduce congestion while promoting complete streets.

## 1.7. Goals and Objectives

Goals and objectives for this Corridor Study were as follows:

**Goal 1**: Enhance safety in the corridor Objective 1.1: Reduce accidents on the state highway

**Goal 2**: Improve vehicle transportation mobility in the corridor Objective 2.1: Reduce vehicle delay and congestion Objective 2.2: Reduce vehicle queueing Objective 2.3: Reduce VMT

Goal 3: Improve multimodal access

Objective 3.1: Eliminate gaps in active transportation facilities Objective 3.2: Lessen gaps in separate facilities for pedestrians and bicyclists Objective 3.3: Lessen gaps in protected facilities for pedestrians and bicyclists

- **Goal 4**: Improve Air Quality and Reduce GHG emissions Objective 4.1: Lower GHG emissions
- **Goal 5**: Improve Freight and Goods Movement in the Corridor Objective 5.1: Enhance STAA standard facility connectivity in the corridor Objective 5.2: Reduce truck delay

## 1.8. Performance Metrics and Methods

The SR 49 Corridor Study was developed with CTC guidance for congested corridor studies in mind, as well as Caltrans guidance on the development of performance metrics. The emphasis is upon quantifiable metrics that are measurable and repeatable. The challenge has been in the formulation of metrics amenable to highway contexts, typically urban freeways for a rural context. Although SR 49 is on the NHS, it is not subject to highway PeMS data collection, nor is it fully monitored by a network of Intelligent Transportation System (ITS) devices, or the Performance Measurement System (PeMS).

## Goal 1: Enhance Safety

Objective 1.1: Reduce the number of accidents on the state highway

**Performance Measure 1.1:** Use the Statewide Integrated Traffic Records System (SWITRS) to report the number of incidents on the highway that occurred before and after completion of non-motorized and operations projects.

**Analysis Method**: Designate a value for number of accidents per 1,000 VMT. A decline in accidents after a completed project may show a safety improvement, if factors like vehicle obstacle detection technology, self-driving vehicles, weather, time and day of occurrence, month of the year, and changes to future highway volumes are taken into consideration. This demonstration requires data retrieval after the enhancements are completed in the future, and therefore data analysis of existing and future conditions is not possible in one episode of data collection.

Discussion of the general safety benefits of this study's strategies is not a performance measure or an objective for meeting Goal 1. However, a review of safety characteristics of non-motorized and operations enhancements can illustrate the potential safety benefits these strategies may have for the corridor.

## Goal 2: Improve Vehicle Mobility

**Objective 2.1**: Reduce vehicle delay and congestion

**Performance Measure 2.1.1:** Compared the differences in values between the recorded speed of tachometer runs to the posted speed limits. The lesser the difference was, the lesser the delay.

**Analysis Method**: Conducted tachometer runs in both directions, measuring the time it took to drive on the corridor between a series of fixed locations. Average speeds between timed locations within the corridor showed how fast or how slow traffic operated compared to posted speed limits. Data was collected from 7AM to 6PM on two separate weekdays in summer when school was not in session. Data from tachometer runs was used to calibrate subsequent Vissim simulations. Documented differences between tachometer run data and Vissim scenario output.

**Performance Measure 2.1.2:** Compared the differences in simulation output vehicle delay values between a no-build base scenario in Vissim with values obtained after a simulation that tested a strategy. The lesser the value in the output, the lesser the delay was.

**Analysis Method**: Ran microsimulation scenarios in Vissim using data from video camera intersection counts. Incorporated proposed strategies into Vissim scenarios. Differences in table output for vehicle delay determined any quantitative change or improvement.

**Objective 2.2**: Reduce vehicle queue time and length

**Performance Measure 2.2**: Compared the differences in values of vehicle queue length and time between a base scenario and a strategy scenario. The lesser the queue values were, the lesser the volume and time.

**Analysis Method**: Used Vissim simulation output data to measure vehicle queue length and time in the corridor. Documented differences between several scenarios against the base scenario.

#### **Objective 2.3**: Reduce VMT per capita

**Performance Measure 2.3**: Compared VMT in the output of a no-build base scenario with the VMT of scenarios that featured a proposed change. The lesser the VMT in the proposed improvements was, the lesser the delay and GHG emissions were for the corridor.

**Analysis Method**: Used Vissim microsimulation scenario outputs to compare VMT values between no-build scenarios with a scenario that featured a proposed mode shift from cars to non-motorized transportation. Quantifiable change in VMT and effects on other performance measures determine effectiveness of tested strategy.

### Goal 3: Improve Multimodal Access

**Objective 3.1**: Lessen gaps in active transportation facilities

**Performance Measure 3.1**: Compared ratios of the amount of existing active transportation assets to the complete length of the corridor area, or to the extent of city limits. The closer the ratio was to one, the fewer the gaps were.

**Analysis Method**: Used a ratio to measure the extent of an existing asset to areas of the corridor that did not yet have multimodal facilities. Used field review, measuring wheels, and Google Maps to verify data on the current conditions of sidewalks, crosswalks, bicycle paths, paved shoulder widths, and ADA compliant intersection curbs.

#### **Objective 3.2**: Build separate facilities for pedestrians and bicyclists

**Performance Measure 3.2**: Compare ratios of the amount of existing separated active transportation assets from mainline vehicle traffic to the complete length of the corridor area, or to the extent of city limits. The closer the ratio is to one, the more separated facilities there are. This measure may also be viewed as a safety enhancement for pedestrians<sup>3</sup>, bicyclists, and motorists.<sup>4</sup>

**Analysis Method**: Used a ratio to measure the extent of an existing separated asset to areas of the corridor that did not yet have such features. Used field review and Google Maps to verify data on current conditions. A separated asset is a facility for pedestrian

<sup>&</sup>lt;sup>3</sup> NACTO webpage: Crosswalks and Crossings

<sup>&</sup>lt;sup>4</sup> <u>Bloomberg Citylab webpage: Protected Bike Lanes Are Safer for Drivers, Too</u>

and/or bicyclist use in which car access is prohibited that features its own right of way set apart from vehicle lanes.

**Objective 3.3**: Build protected facilities for pedestrians and bicyclists

**Performance Measure 3.3**: Compare ratios of the amount of existing protected active transportation assets from mainline vehicle traffic to the complete length of the corridor area, or to the extent of city limits. The closer the ratio is to one, the more protected facilities there are. This measure may also be viewed as a safety enhancement for bicyclists and motorists.

**Analysis Method**: Used a ratio to measure the extent of an existing protected asset to areas of the corridor that did not yet have them. Used field review and Google Maps to verify data on current conditions. A protected asset is a facility for bicycle and/or pedestrian use that features a barrier or partition that obstructs and keeps out car traffic from non-motorized right of way.

## Goal 4: Reduce Greenhouse Gas Emissions (GHG)

**Objective 4.1**: Lower GHG emissions

**Performance Measure 4.1**: Compared quantifiable GHG emissions between various model scenarios. If proposed improvements in the model showed fewer GHG emissions output than the no-build base model, then the strategy reduced GHG emissions.

**Analysis Method**: Used Vissim microsimulation output to gauge GHG emissions. Compared the values of emissions between a no-build base model and the measured output from scenarios depicting proposed changes. Documented differences.

Objective 4.2: Reduce VMT per capita

**Performance Measure 4.2**: This was the same as Performance Measure 1.3. The lesser the VMT in the proposed improvements was, the lesser the GHG emissions were.

Analysis Method: The method was the same as the one for Performance Measure 1.3.

Objective 4.3: Reduce vehicle delay

**Performance Measure 4.3.1:** This was the same as Performance Measure 1.1.1. Lessening delay on the state highway, in the sense that fewer vehicles had to travel below the speed limit, could have benefits in lowering GHG emissions.<sup>5</sup>

Analysis Method: The method was the same as the one for Performance Measure 1.1.1.

**Performance Measure 4.3.2:** This was the same as Performance Measure 1.1.2. Lessening delay could have benefits in lowering GHG emissions.

Analysis Method: The method was the same as the one for Performance Measure 1.1.2.

<sup>&</sup>lt;sup>5</sup> UC Davis Webpage: Cutting Greenhouse Gas Emissions is Only the Beginning
**Objective 4.4**: Reduce vehicle queue time and length

**Performance Measure 4.4**: This was the same as Performance Measure 1.2. Lowering vehicle queue length and time could have benefits in lowering GHG emissions.

Analysis Method: The method was the same as the one for Performance Measure 1.2.

**Objective 4.5**: Lessen gaps in active transportation facilities

**Performance Measure 4.5**: This was the same as Performance Measure 2.1. Eliminating gaps and improving access with active transportation facilities could have benefits in lowering GHG emissions.<sup>6</sup> More multimodal connectivity and access could lead to more transportation options that produce fewer GHGs.

Analysis Method: The method was the same as Performance Measure 2.1.

### Goal 5: Improve STAA truck mobility in the corridor

**Objective 5.1**: Enhance STAA standard facility connectivity

**Performance Measure 5.1**: Determine ratio of existing STAA standard highway with the overall length of the corridor. The closer the ratio was to one, the more STAA compliant the facilities in the corridor were.

**Analysis Method**: Used a ratio based on existing STAA designation to determine how much of the highway currently was STAA standard. Compared current facility to the total extent of the corridor area. Examined ratios of proposed changes in TransCAD to overall corridor extent and compared differences to a ratio with a no-build facility.

Objective 5.2: Reduce truck delay

**Performance Measure 5.2**: Measured truck delay from model output with truck delay from outputs incorporating proposed strategies. The lesser the value, the lesser the truck delay was.

**Analysis Method**: Used Vissim microsimulation and TransCAD modeling to measure changes to operations and route destinations in the corridor area. Differences in speed and delay determined which strategies, if any, lessened truck delay the most.

<sup>&</sup>lt;sup>6</sup> MPLS Webpage: Does bike commuting impact your carbon footprint?

## 1.9. Timeframe & Data Sources

The study commenced in August of 2017. Data sources for the study were as follows:

#### 1.9.1. Review of Existing Documents

This Corridor Study proposed strategies consistent with goals, objectives, and proposed projects listed in state and local planning documents. For a list of state and local planning documents relevant to this Corridor Study, refer to the Appendix, Section VI.

#### 1.9.2. Field Review

System Planning needed field review to capture data on existing conditions. Paved shoulder widths, sidewalk and crosswalk connectivity, ADA compliance, local road vehicle inputs, pedestrian counts, and tachometer runs required field observation.

#### 1.9.3. Video Camera Counts

Counts at intersections utilized video equipment. From 24-hour to one week periods, counts captured volumes, modes, the presence of active transportation, and turning movements at eight locations. Video counts yielded data on existing operations and delay conditions. This data was modeled in an existing no-build microsimulation. Counts data also provided information on peak hour times and PHFs.

#### 1.9.4. Microsimulation Modeling

The Corridor Study used Vissim microsimulation to gauge if strategies improved operating conditions on the state highway. Vehicle delay, vehicle queue length, GHG emissions, and VMT were quantifiable data that microsimulation provided with various scenarios. Data from video counts was used as input into the base model scenario. Growth rates from 2015 to 2040 in the Tuolumne TransCAD model provided guidance on vehicle inputs for running simulations in projected 2040 conditions.

Synchro 8 was used to conduct simulation studies on a four-lane widening scenario, and on signal timing adjustments to the Rawhide Road and Fifth Avenue intersections with SR 108/49 near Jamestown. Scenarios used 2018 and projected 2040 conditions to determine if changes to signal timings lessened congestion. These simulations used data from video counts at the two intersections, as well as volumes data from the Tuolumne County Traffic Demand Model (TDM). These studies yielded performance data on vehicle delay, queueing, and Highway Capacity Manual (HCM) based LOS measurements.

#### 1.9.5. Macrosimulation Modeling

The corridor study used the Tuolumne County TransCAD model to gauge the effectiveness of proposed bypasses at reducing congestion and delay. Two bypasses were analyzed using TransCAD: the Greenley Extension and a location-undefined

Western Bypass. Comparisons were made using existing conditions, future no-build projections, and future projections including the bypasses. The Study used the model to evaluate bypass effects on speed and volume in downtown Sonora under existing and 2040 conditions.

#### 1.9.6. Origin/Destination Modeling

System Planning utilized two methods for origin/destination data collection. Planning worked with Travel Forecasting to use the Tuolumne County TransCAD model to study origin and destination travel in the corridor area. Using select-link analysis, TransCAD showed the extent congestion was caused by local traffic within the county as opposed to traffic from outside the county. System Planning also examined data from performance measurement stations (PeMS) to gauge changes in volume entering and leaving Tuolumne County over a multiyear period. Taken together, the data showed volume changes and a rough composition of drivers going through downtown Sonora.

#### 1.9.7. Collaboration with Agency Partners

The corridor study shared data from field reviews, model simulations, and video counts with partner agencies. TCTC, the Tuolumne County Transit Agency (TCTA), the City of Sonora, and Tuolumne County also had data available for sharing with System Planning and Goods Movement. The Chicken Ranch Rancheria of Me-Wuk Indians of California shared an ICE report detailing traffic and safety impacts from a new roundabout installation. Combining efforts with data collection and analysis allowed the Corridor Study to define deficiencies and develop analyzed strategies that better reflected local priorities. Local agency data shared with Caltrans included items such as transit needs reports, transit ridership, GIS transit maps, and traffic accident location maps.

#### 1.9.8. Department of Finance and U.S. Census

Changes to demographics, employment, income, and housing came from the California Department of Finance (DOF) and the American Community Survey (ACS). Data was used to document conditions concerning Tuolumne's population growth, its disadvantaged communities, and housing market.

## 1.10. Regulatory & Planning Framework

This section recognized existing state and local regulatory and planning documents that guided transportation planning decisions in the SR 108/49 Corridor in northwest Tuolumne County. To the extent feasible, the following documents were referenced in this corridor study, especially in discussions on Existing Conditions and in Improvement Strategies. Refer to the Appendix Section VI for a list and brief synopsis of the documents.

# 2. EXISTING CONDITIONS

This chapter corresponded to **Step 2 of the 8 phases of the Corridor Planning Process: Gather Information**. Information includes a brief corridor description, basic system characteristics, and some of the corridor's unique elements compared with a larger regional and state context. Figure 3 shows Step 2.

Figure 3: Corridor Planning Process Step 2



## 2.1. Geographical Setting

The corridor study area is in northwestern Tuolumne County from PM 12.817 to PM 20.392 on SR 49 from Chicken Ranch Road to Parrott's Ferry Road. Tuolumne County is in the western foothills of the Sierra Nevada Mountains in Central California. Foothill and mountainous counties on the west side of the Sierra Nevada Mountains are included in a north/south region called the Mother Lode, famous for its history as a major mining location in the 19<sup>th</sup> and 20<sup>th</sup> Centuries. The Mother Lode is located just east of the agriculture-intensive San Joaquin Valley. The northern portion of Yosemite National Park is in Tuolumne County, with access to the Park via SR 120.



Several east west highways connect the former mining towns of the Mother Lode to the larger urban conurbations in the valley, and eventually to San Francisco and Silicon Valley on the coast. In Tuolumne County, SR 120/108 is the main east-west highway that links the communities of Jamestown and Sonora to Modesto and Stockton in the valley. The SR 120 and SR 108 are the two highways in the county that traverse the Sierra Nevada Mountains, connecting the San Joaquin Valley to U.S. 395 and the Great Basin of Nevada to the east. Both state highways are closed in the winter.

Photo 3: Old Highway Bridge Photo 4: Mark Twain Bret Harte Trail Plaque



Located west of Jamestown near Mackey Ranch Road and Chicken Ranch Road is the reservation of the Chicken Ranch Rancheria of Me-Wuk Indians. The tribe is federally recognized and is led by an elected council. Indigenous to California, the Chicken Ranch Rancheria of Me-Wuk Indians belong to the Central Sierra Miwok division of the Plains and Sierra Miwok. The Miwok are known for their skilled basketry traditions. The language of the Me-Wuk Indians is Central Sierra Miwok, a language classified in the endangered Utian linguistic group.

The corridor study area features two historic communities: Jamestown and Sonora. Sonora, the County seat, is the only incorporated city in the county. Both communities originated from primary sector-based economies, featuring gold mining and timber with railroad access to the San Joaquin Valley. They began as resource extraction-dependent economies, subject to boom and bust cycles from the 19<sup>th</sup> Century into the 1940s. It was in the 1930s and 1940s that Tuolumne County's economy diversified, as evidenced by occupation-related census data from the time. Today's economy is more varied, still including mining and timber sectors, but also local and chain retail, healthcare services, local, county, and federal government offices, K-12 education and post-secondary education centers, and tourism.

The communities of Jamestown and Sonora feature points of interest that act as regional trip attractors. Both locations feature well-preserved historic 19<sup>th</sup> Century downtowns with buildings on the National Historic Register. Jamestown is host to the historic Railtown 1897 State Historic Park, featuring locomotives from the 19<sup>th</sup> Century used in several Western films. Jamestown also has the Jamestown Elementary School District located on Fifth Avenue east of historic Jamestown. The Motherlode Fairgrounds, located along SR 49 and Southgate Drive just west of Downtown Sonora, hosts events and festivals throughout the year. Sonora has a concentration of civic institutions: Sonora High School, Cassina High School, Tuolumne County Superior Court, and the Sonora Opera Hall and Community Center. Located north of Sonora is the historic Columbia State Park, a preserved Gold Rush-era frontier town, and Columbia College, the County's sole center for tertiary study.

Photo 5: Standard Lumber Company



Photo 6: Downtown Sonora in 1962 Photo 7: Harvard Mine in Jamestown



On the south end of the corridor study area is the Chicken Ranch Casino located on the Chicken Ranch Rancheria. Located on Mackey Ranch Road is the Sierra Rock Products facility. West of the corridor study area are Tulloch Reservoir and New Melones Lake, which are watersport recreation areas. Also located to the west runs Table Mountain, a unique flat-topped local landmark, running generally from northeast to southwest, roughly parallel to Woods Creek.

East of the corridor study area along Mono Way are several big box chain retailers, shopping centers, restaurants, car dealerships, hotels that cater to tourists visiting Yosemite National Park, and the Black Oak Casino Resort, located in the community of Tuolumne south of SR 108. Sierra Pacific Industries maintains a timber processing plant in Standard. Recreational opportunities exist on SR 108 in the Sierra Nevada Mountains east of Sonora. The Dodge Ridge Ski Resort, Pinecrest Lake, Donnell Vista, and the Kennedy Meadows Resort are frequent outdoor destinations.

There are three healthcare centers in the corridor study area: the Tuolumne General Medical Facility on South Washington Street, the Sonora Regional Medical Center located off Forest Road and SR 49 across from the Motherlode fairgrounds, and the Sonora Regional Medical Center on Greenley Road north of Mono Way. The location on Greenley has an emergency response unit. There is a new dialysis center on SR 108/49 in Jamestown just south of the Rawhide intersection and across the highway from Smoke Street. There are also medical offices east of Downtown Sonora near the intersection of Morning Star Drive and Greenley Road.

Tuolumne County currently does not have a regular service passenger rail system, although the Railtown 1897 State Historic Park does offer short-distance recreational rail travel at limited times of the year. The closest regular scheduled passenger rail stations from Tuolumne are the Amtrak stations in Stockton and Modesto. The Sierra Railroad is the sole rail operator in the County, hauling timber and wood products from Tuolumne County to Stanislaus, operating on a standard gauge railroad from Oakdale to Standard.

Photo 8: Railtown 1897 State Historic Park

Photo 9: Railtown 1897 State Historic Park



The county has one regional and one community airport. Columbia Airport, classified as a regional facility, is located west of Columbia State Historic Park north of the corridor study area. The airport is home to a CalFire Air Attack Base and is a site for air ambulance services. The airport does not have regular passenger service. The community airport is Pine Mountain Lake, located near Groveland outside of the corridor study area.

## 2.2. Demographics

Congestion relief and transportation mode shift in Tuolumne County rely on understanding three general issues outlined in the following discussion of demography-what role if any did past land use decisions and local urban morphology play in setting up the current congestion patterns in the County; to what degree might tourism, a major economic sector in the Mother Lode, play in contributing to congestion; and how might current and future demographic trends exacerbate or ameliorate congestion—considerations that need to be weighed in considering efforts towards expenditures on improving the regional and interregional transportation networks. Although all three have been suggested at times as primary factors for the congested conditions seen in the SR 49 and SR 108 corridor, and are gualitative in their measurement, there is a great amount of uncertainty as to their power. Presently there is a global and national shift in that people are moving from rural places to urban; California in the last decade has seen some of the greatest property destruction and loss of life due to wildland fires as a significant manifestation of global warming; the recent pandemic has extended the time for economic recovery and to address California's housing crisis. Superficially, these trends suggest a lackluster future for the Mother Lode and Tuolumne County, but proper planning and investment may sustain various communities into the next century and beyond.

In the following discussion on the demography of Tuolumne County there are three considerations:

- 1. Are the congestion issues in Sonora a result of past land use decisions?
- 2. Is local congestion an outcome of tourism?
- 3. Will future changes in population numbers and structure fix the congestion problem?

A second set of considerations revolve around issues related to mode choice. Do opportunities exist under current conditions to decrease the share of single occupancy vehicle (SOV) trips as a component of travel in state highway corridors? Can walking and cycling opportunities in the local travel network be improved with efforts on the SHS?

Tuolumne County is in the Sierra Nevada Foothills known as the Mother Lode. Seven counties comprise the region—Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne, and Mariposa. The estimated population of the region is about 830,000, of which approximately 150,000 live in District 10. Since the Gold Rush, the Mother Lode experienced declining populations until the period before World War II, except for Placer, which has experienced continuous growth since the start of the Twentieth Century. All other Mother Lode counties experienced their greatest growth in the period between 1960 and 1990 and have seen it taper off since then. Presently, only Tuolumne and Mariposa are estimated to have experienced negative growth since the 2010 census. Currently, the population of Tuolumne County is projected to continue to decline by over 9,000 by 2040.



#### Figure 4: Population Change in Tuolumne from 2000 to 2017

There was also a culture divide that needed to be appreciated in distinguishing the southern counties of the Mother Lode from the northern ones. In local parlance it was the difference between a flatlander and those who lived in the foothills, or suburbia from exurbia. Appreciable portions of El Dorado, Placer and to a lesser degree Nevada Counties were indistinguishable from the suburban cities and towns surrounding Sacramento along the US 50 and I-80 corridors. It was also along these corridors that a large proportion of the population lived. Because of this, what economic or demographic trends were occurring in the mountain and foothill communities became obscured by the larger suburban population. For this reason, the rest of the discussion will be limited to the southern Mother Lode (Amador, Calaveras, Tuolumne, and Mariposa).

Topography has been an important constraint on population growth and economic diversity. Within the southern Mother Lode each county is set apart from the other by steep river canyons, with an eastward rising slope towards the Crest of the Sierra Nevada to an elevation between 8,000 to 10,000 feet. Although past engineering practices could maintain toll roads that crossed the Crest outside of winter and ford rivers at periods of low flow, the preeminent practice was to construct permanent year-round roads upon ridges and drainages that formed the interfluves,

that permitted the movement of people and goods in a westward direction to the Central Valley, once the region was occupied by Europeans. With the Gold Rush a large pool of laborers was formed whose employment centered around the extraction of gold and other mineral wealth. Almost exclusively male, the sex ratio in the region remained that way until the period of World War II. The data suggested that many of these men were transient (and may have remained this way until the recent present when the construction boom ended with the Great Recession) in a manner like Hispanic migrants, and in several cities of the developing world.

With the onset of the Gold Rush diversified employment to provide the various goods and services required by the miners arose in San Francisco, Sacramento, and Stockton. The mining population of the Mother Lode remained migratory after its initial arrival, and they moved on to other places once the easily exploited gold and mineral deposits were exhausted. It is not until the early twentieth century that employment in Tuolumne County diversified as the various occupations recorded in the 1930 and 1940 censuses attest, with a local economy where few worked in mines and sawmills, and the growing employment sectors were health and government related.

Like other communities coming to terms with increasing population during the post war period (circa 1930 to 1960), the organization of available space and land use shifted to specialized sectors away from general multiple use. For Tuolumne County (and elsewhere in the Mother Lode), this period was marked by future reductions in a gender imbalance of males over females that persisted from the Gold Rush, and continuing diversification of employment away from logging and mining, although a large number of occupations in the 1930 and 1940 censuses were affiliated with the West Side Logging Company and Railroad.

Photographs from the period lack any indication of travel by means other than automobile, with period cars and pickups parked at the street curbs, suggesting a relatively well-to-do community with enough disposable income. Although early on the integration of housing and businesses near the intersection of Washington and Stockton Streets, as well as Main Street, Jamestown, suggest relatively compact communities, the expansion of businesses along Mono Way into East Sonora and towards Tuolumne City suggests an uncoupling of where one lives and works possibly in order to minimize the negative externalities of noise and pollution affiliated with lumber and stamp mills. The sprawl resulting from this segregation of place likely contributed to early traffic congestion and elevated parking demand in a community built before the invention of the automobile, and the trend was further exacerbated by the development of residential communities away from Sonora like Phoenix Lake and Twain Hart, while the major employer, the government, remained near the older center.

Outside of the population of migratory workers, the relict population has always been on average older than in the rest of California. Much of this is due to outmigration of young adults for better opportunities in education and employment. If there was a sufficient influx of younger families to replace those promoted to empty nester retirees, or those having out migrated for work elsewhere, there was little problem maintaining services and economic opportunity within a tolerable standard of living. However, with the housing shortage in California having driven up home prices, and with the foreclosure crisis and Great Recession, few families could afford a home purchase. Secondly, those whose homes were bought and paid off could afford the purchase of a second vacation or transition home.

### 2.2.1. Population Change

With a 2010 population of 55,365, Tuolumne County has had the largest population of the five District 10 mountain counties since 1930. Total population from the 2017 ACS was 54,248. This amounted to a 0.28 percent decline in population annually. Sonora's 2010 population was 4,904, and its 2017 ACS population was 4,824. This amounted to a 0.23 percent decline annually.

Although much of the County's population decline may be attributed to the Sierra Conservation Camp reducing its inmate population by 1,800 between 2009 and 2019, these reductions are not reflected in changes in smaller geographic units representative of other census tracts; and are not included in other demographic measures that do not include institutional living such as employment, commuting practices, and household characteristics, all of which are discussed below.

According to the ACS, population growth in the county since 2010 had been negative, and it was projected to decline over the next twenty-five years. The DoF projects that Tuolumne's population will decline by approximately 9,320 to 45,950 by 2040. This change amounts to a 15% decline. Several outcomes may follow from this change, mostly a reduction in individuals employed providing government services due to an eroding tax base, a movement toward an even greater share of the population being retired (both aggregate and percentage), and a shift in local employment towards elderly services, and likely away from tourism.



#### Figure 5: Population Growth in Motherlode Counties

Data revealed that a greater percentage of the population was concentrated in age ranges 55 and higher. The 2010 population of Tuolumne County was made up of 20.4 percent aged 65 years and over, 17.5 percent were less than 18 years of age, and 4.2 percent were less than five years of age. A demographic shift toward a more senior population that began in the 1990's, the percentage of the population that was 55 years and above was higher for Tuolumne County than it was for the State. Demographic projections suggest the age group of 65 and older would continue to compose a greater percentage of the county's population in 2020 and 2030.

#### Figure 6: Population Comparison by Age



The shift toward an older population means local and regional agencies will need to develop planning policies that are sensitive to the needs of older residents, such as provision of convenient public transportation, dial-a-ride services, ADA compliant street architecture, and access to healthcare facilities and assisted living institutions. 63 percent of residents over the age of 60 are expected to require long term care.

Also, if the current trend of declining population and a more senior population continues, interregional travel originating from the county will decline, with an affiliated increase in local trips. Studies from the 2000 National Household Survey indicated that elderly drivers made fewer single occupancy vehicle (SOV) trips for work and education, but that they made an equivalent or greater number of local trips during the week.

### 2.2.2. Workforce and Population

Two consecutive ACS reports covering the period between 2006 and 2013 reported a decline in the working population of Tuolumne County by nine percent. The number of workers employed outside the county declined proportionally and numerically. Furthermore, although Economic Development Department (EDD) data indicated a noticeable drop in employment that occurred in 2009 and 2010 in the range of about 3,400 jobs, there was no correspondent drop in population. There was no noticeable increase in outmigration or in unemployment during this time. Accounting for the low numbers of persons in age groups more likely to not actively seek work for various reasons, it was plausible that the decrease in employment was a result of workers shifting into retirement. Table 4 and Figure 7 below indicated the point at which there was a noticeable drop in workforce participation. The orange row (designated with an O) in the table highlighted the time when the decrease in employment numbers was recorded.

Job scarcity has been a driver of both interregional commuting and high unemployment in the southern Mother Lode. Although difficult to measure, underemployment contributes to seasonal variation in unemployment for the region with much of the seasonal employment limited to the summer season, with collecting unemployment insurance after the snow falls. As can be seen

in Table 4, the overall unemployment rate never seems to dip below 5% in the eighteen years of record, while the work force varies between 40 to 47% of the total population.

State FY	Color	Workforce (WF)	Employed	WF/POP	Unemployment	Change in WF	Change in Pop					
1990-2000	NC	23,130	21,790	42.4%	5.8%	N/A	N/A					
2000-2001	NC	24,120	22,840	43.6%	5.3%	990	739					
2001-2002	NC	24,820	23,260	44.4%	6.3%	700	584					
2002-2003	NC	25,460	23,680	45.1%	7.0%	640	532					
2003-2004	NC	25,660	23,900	45.5%	6.9%	200	-73					
2004-2005	NC	26,110	24,530	46.3%	6.1%	450	83					
2005-2006	NC	25,920	24,520	45.8%	5.4%	-190	106					
2006-2007	NC	25,970	24,470	46.3%	5.8%	50	-425					
2007-2008	NC	26,120	24,250	46.6%	7.2%	150	-73					
2008-2009	NC	26,100	23,070	47.2%	11.6%	-20	-802					
2009-2010	0	22,710	19,410	41.3%	14.5%	-3,390	-297					
2010-2011	NC	22,700	19,410	41.1%	14.5%	-10	229					
2011-2012	NC	22,560	19,680	41.0%	12.8%	-140	-157					
2012-2013	NC	22,090	19,760	40.2%	10.5%	-470	-139					
2013-2014	NC	21,820	20,000	39.9%	8.3%	-270	-210					
2014-2015	NC	21,820	20,320	40.0%	6.9%	0	-155					
2015-2016	NC	22,040	20,710	40.6%	6.0%	220	-238					
2016-2017	NC	22,120	20,970	40.9%	5.2%	80	-255					
	WE: workforce_POP: population_EY: fiscal year: NC: no color: O: orange											

Table 4: Annual Changes in the Workforce Population in Tuolumne County, 1990 to 2017

#### Figure 7: Tuolumne Workforce



The reduction of the workforce by 3,400 workers appears to have influenced the long-range forecast for Tuolumne County's growth. By 2060, DOF sees negative growth among populations aged 0 to 24, slight growth in populations aged 25 to 39; declines in populations aged 40-64; and growth in the population aged 65 and above. The pattern would suggest that population growth will be driven not by natural increase, but in-migration, with an increase of those age 65 and older of 6,941 more than the number in this age group in 2010, an increase from 21 percent to 32 percent of the total population.<sup>7</sup>

<sup>7</sup> DOF Table P2 Total Estimated and Projected Population for California Counties July 1<sup>st</sup>, 2010 to July 1<sup>st</sup>, 2060 in 5-year Increments.

What is noteworthy in Table 4 is how the relationship between the workforce and population changed with the onset of the Great Recession (FY 2008-2009). Negative growth in both measures runs between FY 2008-2009 and FY 2014-2015 to where the aggregate change in population is 1,531 (including 1,440 inmates) but the change in the workforce is 4,300. These numbers suggest that around 700 workers left the County, which means around 3,500 remained. There are two possible explanations for the departures: they either joined the legions of discouraged workers that no longer collect unemployment, or they chose to retire. If it is the first reason, then there should be a large pool of workers that resume employment later (there would be an increase in the work force without a related bump in population). The overall decline in population suggests that this may have occurred in FY 2015-2016, the last year reported. This rebound may be a contributing factor to observed growth in local traffic, but it would likely not supplant the likely reduction in overall trips with the declining population (the observation would be subject to recency bias).

The alternative explanation that many participants in the work force chose retirement would have a different set of outcomes. There should be a decline in work trips throughout the system, but that decline might affect the interregional commute more on account of higher wages and more generous retirement packages in the Central Valley and Bay Area, making it easier for workers to retire early. Depending on available medical services in Tuolumne, there may be an increase in overall interregional traffic volume in order to access these services elsewhere. These changes would be swamped by declining population but could be assessed using PeMS data.

Although the purpose of the traffic demand model is to estimate current and future emissions, it can be used to provide some insight into traffic volumes. The current model estimates growth at over one percent a year, but this may reflect a conservative treatment of dwelling units as permanent residences to provide a measure of the maximum of potential air pollution impacts from local land use. If household size is shrinking and dwelling units are not occupied year-round the estimated trips per household should exceed what there are in reality. Whether this underestimate of trips by the model exceeds those generated by the shift to larger segments of the population in retirement should be evaluated. The second consideration is does it reverse traffic growth before 2045. This will be addressed in the following discussion of the TDM.

The 2013 SR 49 TCR reported that in the 2010 census, 87.2 percent of residents were identified as white, as compared to 57.6 percent for the state. Native Americans made up 1.9 percent as compared to one percent statewide. White persons not Hispanic accounted for 81.9 percent, compared to 40.1 percent statewide. For persons of Hispanic or Latino origin, the Census found 10.7 percent was the number in Tuolumne, as compared to 37.6 percent statewide. Based on data, social justice needs of residents in the county were not like the needs of residents in the San Joaquin Valley, which had a more diverse racial composition.

### 2.2.3. Income

Median household income (2006-2010) for Tuolumne County was below the state average (\$47,462 for Tuolumne compared to \$60,883 for California from the 2010 Census). The percentage of persons with incomes at or below the federal poverty level, for the period of 2006-2010, was 11.7 percent as compared to 13.7 percent statewide. However, most locations in the corridor plan area, including Jamestown and Sonora, did qualify as low-income communities as compared to the statewide median income.

Data from the American Community Survey and from Census Transportation Planning Products (CTPP) revealed that most census tracts and households in the corridor plan area had a median income at or below 80% of the statewide median income. Thresholds and definitions for low-income communities and households are defined by California's HCD and AB 1550. The California Climate Investments Priority Populations 3.0 website shows the census tracts meeting the low-income community designation in Tuolumne. This web map can also be accessed at Appendix III.A.1.

### 2.2.4. Housing

#### Vacancy and Seasonal Housing

There was an estimated 31,360 housing units in Tuolumne in 2016. In 2010, units numbered at 31,035. The vacancy rate was 29.6 percent. The rate in 2010 was 28.5 percent. The vacancy rate for the City of Sonora in 2016 was 10.5 percent. For 2010, it was 5.2. The estimated 2016 vacancy rate for California was 7.9 percent. In 2010, it was 8.6 percent. This indicated that the county vacancy rate was much higher than the rate for the state. According to 2006-2010 ACS five-year estimates, of the total 8,845 vacant units in the county, 7,040 were classified as vacant for seasonal, occasional, and recreational use. That was about 79.5 percent of all vacant units in Tuolumne County. The category All Other Vacant totaled at 805. This was about nine percent of total vacant units in the county. The percentages of 79.5 and nine suggest that congestion on highways has seasonal characteristics due to second home ownership. These figures might also suggest changes throughout the year in volume due to access to units vacant during off-peak seasons, or that catered to tourists using housing for short-term rentals.

Tables 5 and 6 below compare vacancy rates in Tuolumne with rates in other California mountain and valley counties. The pattern is that rates are higher in mountain counties due to housing used for seasonal, recreational, or occasional use. The valley counties show low percentages of vacancies and second housing. The presence of high vacancy percentages and recreational use affects traffic volume on state highways in mountain counties, creating seasonal fluctuation. This fluctuation will affect vehicle miles traveled, delay, emissions, and congestion.

County	Total Housing Units		Vacant for Rent		Vacant for Sale Only			Vacant for Seasonal, Rec., or Occasional Use			Occupied			
	Est	MoE	Est	MoE	%	Est	MoE	%	Est	MoE	%	Est	MoE	%
Alpine	1,770	43	50	32	2.8	25	21	1.4	1,285	57	72.6	345	71	19.5
Amador	18,205	167	325	162	1.8	265	129	1.5	2,385	353	13.1	14,250	469	78.3
Calaveras	28,105	82	410	184	1.5	290	147	1.0	8,285	432	29.5	17,715	500	63.0
El Dorado	88 <i>,</i> 880	131	1,205	285	1.4	915	263	1.0	16,210	569	18.2	67,530	666	76.0
Mariposa	10,335	176	395	159	3.8	285	121	2.8	1,380	217	13.4	7,255	313	70.2
Nevada	53,190	129	480	212	0.9	620	209	1.2	9,825	562	18.5	40,585	664	76.3
Placer	157,890	247	2,430	419	1.5	1,420	258	0.9	14,565	433	9.2	136,730	754	86.6
Plumas	15 <i>,</i> 695	58	245	115	1.6	305	121	1.9	5 <i>,</i> 635	275	35.9	8,375	322	53.4
Sierra	2,350	51	0	12	0.0	45	43	1.9	765	141	32.6	1,275	144	54.3
Tuolumne	31,360	137	390	175	1.2	370	165	1.2	7,390	475	23.6	22,085	508	70.4
Est: Estimate; MoE: Margin of Error; %: percent; Rec.: Recreational														

## Table 5: Comparison of Vacant and Seasonal Housing percentages in Mountain Counties, 2012-2016

County	Total Ho Unit	Total Housing Units		Vacant for Rent			Vacant for Sale Only			Vacant for Seasonal, Rec., or Occasional Use			Occupied		
	Est	MoE	Est	MoE	%	Est	MoE	%	Est	MoE	%	Est	MoE	%	
Fresno	323,855	264	6,910	755	2.1	1,955	361	0.6	5,135	407	1.6	299,455	1,245	92.5	
Kern	291,290	366	6,695	589	2.3	2,805	521	1.0	6,870	607	2.4	262,335	1,278	90.1	
Kings	44,955	240	935	281	2.1	350	148	0.8	285	162	0.6	41,845	558	93.1	
Madera	49 <i>,</i> 845	185	1,000	256	2.0	660	218	1.3	3,095	409	6.2	43,575	659	87.4	
Merced	84,140	286	1,680	305	2.0	545	198	0.6	500	181	0.6	78,270	665	93.0	
Sacramento	562,005	584	12,830	729	2.3	3 <i>,</i> 975	510	0.7	2,245	364	0.4	527,335	1,525	93.8	
San Joaquin	237,750	318	4,815	487	2.0	1,415	311	0.6	1,115	258	0.5	221,705	953	93.3	
Stanislaus	180,385	205	3,160	515	1.8	1,290	356	0.7	365	154	0.2	170,330	901	94.4	
Tulare	145,660	184	1,950	318	1.3	1,355	285	0.9	2,460	344	1.7	134,155	755	92.1	
Tuolumne	31,360	137	390	175	1.2	370	165	1.2	7,390	475	23.6	22,085	508	70.4	
Est: Estimate; MoE: Margin of Error; %: percent; Rec.: Recreational															

Table 6: Comparison of Vacant and Seasonal Housing Percentages in Valley Counties, 2012-2016

### Dwelling Type and Number of Vehicles

Single family detached dwellings made up 80 percent of all housing units in the county in 2016. The second largest category was mobile homes at 9.5 percent, and the third largest category were apartments of three to nine units at 5.2 percent. In 2010, the percentages were 79.6 percent, 10.2 percent, and five percent respectively. The state percentage of single-family detached dwellings in 2016 was 58 percent, for three to nine-unit apartments was 11.8 percent, and for mobile homes was 3.7 percent.

Of the number of vehicles available for occupied housing units in the estimated 2016 data, the largest category was two vehicles at 36.8 percent, the second largest was one vehicle at 29.5 percent, and the third largest was three or more vehicles at 27.8 percent. Only 5.9 percent of dwellings reported having no access to a vehicle. This indicated the necessity of having an automobile to accomplish most travel-related tasks in Tuolumne, such as commuting, shopping, going to school, or going to appointments. The California state percentage of two vehicles available in 2016 was 37.4 percent, 31.7 percent for one vehicle available, 23.2 percent for three or more vehicles available, and 7.6 percent for no vehicles available.

### Household Income and Cost of Housing

Data show that the cost of housing takes up a considerable proportion of household income in Tuolumne County, just as it does throughout California. The cost of housing may act as an additional burden in Jamestown, a community that meets the parameters of a disadvantaged community in the corridor study area.

Housing units with a mortgage cost in 2016 that exceeded 35 percent household income was 33.5 percent of all units. The statewide percentage was 31.9 percent. This figure was the highest percentage of units in this category for the county and for the state. A mortgage that amounted to less than 20 percent of income had the second highest percentage at 30 percent. The statewide percentage in this category was similar at 30.9 percent.

For rented units, gross rent that was 35 percent or more of household income made up 48 percent of all rented units in the county. For California the figure was similar at 47 percent. The figures of 48 percent and 47 percent represented the largest category of rented housing units in both the county and the state respectively. The second highest percentage of rented units, 25 to 29.9 percent of income, came in at 12.2 percent of all rented dwellings. For the state, the second highest category was 20 to 24.9 percent at 12.1 percent of all units. The leading range for monthly rental rates was 500 to 599 dollars at 48.9 percent of rental households. Renters who paid 1,000 to 1,499 per month came in 31.1 percent. Those who paid less than 500 a month came in at 10.1 percent.

## 2.2.5. Commuting and Transportation Choice

CTPP data from the ACS was gathered to better understand existing mode choices and transportation infrastructure needs. Examining walking and bicycling as a commute choice showed the status of active transportation use in the corridor study area.

The corridor study area covered four U.S. census tracts in Tuolumne county: Tracts 11, 12, 21, and 51. Census Tracts 11 and 12 covered the City of Sonora and its immediate vicinity. Census Tract 21 included Columbia Community College and the Columbia State Historic Park. Census Tract 51 included Jamestown and the Chicken Ranch Rancheria of Me-Wuk Indians of California. Reference the Appendix XI for complete CTPP transportation mode choice tables.

Excluding working from home, data showed that 80.3 percent of all commuting in the corridor study area utilized single occupancy vehicles (SOVs). However, 7.2 percent of commuting was done with walking. Data also showed bicycle commuting activity between tracts 11 and 12. All pedestrian activity occurred within census tracts and not from one tract to another. Despite this localization of activity, this percentage illustrated a need to enhance and maintain active transportation infrastructure in the corridor.

Tract No.	Total	SOV	2 people	3 or more	Transit	Walking	Cycling	Work at Home		
11	732	474	0	35	8	80	15	120		
12	625	484	4	4	43	20	0	70		
21	760	555	60	10	0	30	0	105		
51	1,235	845	185	4	0	80	0	120		
Total	3,352	2,358	249	53	51	210	15	415		
% of Total	NA	70.3	7.4	1.5	1.5	6.3	0.45	12.4		
SOV: single occupancy vehicle										

Table 7: CTPP Means of Commute Transportation in Tuolumne County, 2012-2016 U.S. Census ACS

#### Map 3: Census Tracts



### 2.2.6. School Enrollment and Commute Behavior

Census data from 2000 to 2010 indicated a decrease in the total population of K-12 school-aged persons. Also evident was a decline in student enrollment in public schools in Jamestown and Sonora. Surveys with schools in the corridor indicated that most students did not use active transportation to access school:

- In the Sonora Union High School District, percentages of active transportation users ranged from five to seven percent of the student body at Sonora Elementary and Sonora High Schools respectively
- Students that rode buses in the same district ranged from 20 to 40 percent
- About 36 percent of Sonora High School students were dropped off at school
- 54 percent of students at Sonora Elementary were dropped off
- Students at the high school who drove themselves numbered at 25 percent

- 11 percent of high school students carpooled
- No student at Sonora Elementary drove to school for the obvious reason that they're too young to drive

Only two percent of students at Motherlode Adventist Junior Academy used active transportation. The rest of the student body depended on cars, either being dropped off or carpooled. No respondents indicated using buses to access the school.

The first survey was conducted in February and March of 2018. The survey asked school administrators about what transportation mode students and staff used to access school. Questions were submitted to the school via email, and they were as follows:

- 1. Total number of students enrolled.
- 2. The transportation mode choice of students.
  - a. How many students use the school bus?
  - b. How many students use active transportation (bike or walk)?
  - c. How many students drive alone?
  - d. How many students carpool?
  - e. How many students are dropped off in the morning and picked up after school?
- 3. Total numbers of staff at school and how they commute to the school.

Possible strategies to increase active transportation use focused on filling paved gaps in pedestrian infrastructure, promoting expansion of bicycle facilities in areas with less car traffic volume, and promoting protected bicycle lanes.

Further discussion on active transportation enhancements was included in Section 4.5.1 in a separate survey with Sonora High School students. Schools that participated in the surveys are shown below in Map 4. To see school survey response data, access Appendix VII.A.

Map 4: Corridor Study Participatory Schools



## 2.3. Origin and Destination Studies

Origin and destination studies were conducted to determine how much the congestion in downtown Sonora came from local traffic as opposed to traffic from outside Tuolumne County. Data sources utilized for the studies included performance monitoring stations located on state right of way (PeMS), census stations, and volumes contained in the Tuolumne County existing and projected TransCAD model.

Data obtained from functioning PeMS and census stations indicated overall decline in volumes from 2012 to 2017 at county lines. Figure 8 showed declines in Annual Average Daily Traffic (AADT) entering and leaving Tuolumne County with Calaveras and Stanislaus counties. Peak hour volumes at the Calaveras county line with SR 49 were consistent, but data indicated a decline in AADT. The Stanislaus county line data with SR 120/108 exhibited a decline in both peak hour and AADT volumes. It should be noted that the 2013 peak volumes were reported outside of the time of the Rim Fire, except for October when the fire was in containment. To view data results, refer to the table in Part IV.A. *Origin Destination PeMS Data* in the Appendix.



Figure 8: PeMS Traffic Volumes, 2012-2017

TransCAD select link analysis revealed that 28.85 percent of downtown Sonora traffic originated outside the county under 2015 AADT conditions. Future 2040 projections with no improvements showed 29.25 percent of traffic in downtown coming from outside Tuolumne. With the Greenley Extension, the percentage dropped to 25.93 percent, and with both a western bypass and the extension the downtown traffic was 25.63 percent coming from outside Tuolumne.

What the select link analysis showed was that most congestion in downtown was due to traffic that originated locally. Maps 5 to 8 displayed the percentage of traffic in downtown Sonora coming from outside the county. Refer to the Appendix IV.B. for the table on TransCAD Downtown Sonora select link analysis, and for maps showing select link origin/destinations of traffic volume using proposed bypasses.

Although SR 120/108 had a higher volume of traffic than SR 49 did, downtown Sonora was less of a destination for traffic coming from Stanislaus than for traffic coming from Calaveras. For

drivers on SR 120/108, there were other destinations they may have been accessing, such as Yosemite National Park, the Dodge Ridge Ski Resort, East Sonora, or the Black Oak Casino. There was a higher percentage of traffic on SR 49 using downtown Sonora as a destination. Downtown Sonora serves as a medical services center, as well as a retail corridor. Drivers from Calaveras also used downtown as a pass thru to shopping destinations in East Sonora.



Map 5: 2015 SR 49 Select Link External Trip Percentages



Map 6: 2040 SR 49 Select Link External Trips with East Bypass Percentages

Map 7: SR 49 Select Link External Trips with East and Western Bypass Percentages





Map 8: 2040 SR 49 Select Link External Trip Percentages without Bypasses

## 2.4. Highway Network

The corridor study focused on the SHS in the Jamestown and Sonora region, specifically SR 49 from Chicken Ranch Road (PM 12.817) to Parrott's Ferry Road (PM 20.392). SR 108 is concurrent with SR 49 in the corridor study area from PM 12.817 to Stockton Road at PM 16.48.

In the corridor study area, SR 49 is classified as a principal arterial, is considered a conventional highway, is on the Interregional Road System (IRRS), is on the NHS, is on the Freeway and Expressway System (FHS) from Chicken Ranch Road to Stockton Road, and does have a freeway agreement from PM 13.41 to PM 16.29. The highway is eligible for scenic highway status. Bicycles are allowed on the highway.

SR 49 is TA for trucks from Chicken Ranch Road to Stockton Road. From Stockton Road and SR 108, the highway is TA until PM 17.305. From PM 17.305 to PM 17.965 it is classified with California legal status with an advisory of trucks no longer than a kingpin-to-rear-axle (KPRA) of over 30 feet. From the intersection of Stockton Road and Washington in downtown Sonora to the north end of the study area at Parrott's Ferry Road (PM 20.4), the highway is designated as California legal with an advisory of trucks no longer than a KPRA of over 30 feet. Trucks need to use caution in areas with KPRA advisories and use alternative routes with no advisory status if available.

#### Map 9: Truck Network



Map 10 showed current speed limits zones in the corridor study area. Speed limits affected the comfort of bicyclists and pedestrians using the corridor. The higher the speed limit was, the more stress active transportation users experienced. Posted speed limits were compared to measured speeds in tachometer runs. The slower the measured speed was compared to the posted speed, the more the delay was.

#### Map 10: Speed Limit Zones



Travel forecast data from the 2013 SR 49 TCR indicated that SR 49 in the study area possessed a current peak hour LOS ranging from 'E' to 'F', and a projected 2030 peak hour LOS ranging from 'E' to 'F', provided that there were no future improvements. This determination did not meet the minimum concept LOS standard for an IRRS highway in District 10, which is LOS 'D' in urban environments and LOS 'C' is rural areas. This illustrated that there was a performance deficiency on the highway in Jamestown and Sonora. This LOS reflected vehicles only.

Throughout the corridor study area, the 2013 SR 49 TCR stipulated a post-2030 UTC for SR 49 as a four-lane expressway. This expressway may be built on currently undetermined new alignment, as segments in the study area act as a main street for Jamestown and Sonora. This corridor study examined potential bypass plans that might fill the role of an expressway on new alignment.

Map 11: Vehicle LOS



## 2.5. Parallel Facilities & Extensions

In addition to SR 108/49, the Corridor Study evaluated local roads that acted as additional carriers of traffic, to the extent that a potential parallel facility might relieve deficient conditions on the state highway. This included Jamestown Road and Rawhide Road, both of which run in a general north/south direction west of Downtown Sonora. Of interest was Greenley Road, a generally north to south local road located east of Downtown Sonora. Greenley Road would connect via the unbuilt Greenley Extension to SR 49 north of Sonora. The Extension would give traffic and freight the option of using a route to access SR 108 without going through downtown.

A possible western bypass was also the subject of a TransCAD study by Caltrans District 10 Forecasting. The bypass, listed as a Tier 3 project in the TCTC 2016 RTP, would give regional traffic and trucks the ability to bypass Sonora and Jamestown, and allow users to access East Sonora from Angels Camp quicker if the bypass is built to STAA expressway standards. No decision has been proposed that identifies the bypass's location or alignment. Map 12 featured the state highways in the study area, as well as parallel facilities and potential bypasses.

#### Map 12: Parallel Facilities



## 2.6. Transit

Three agencies operate transit in the corridor study area: TCTA, YARTS, and Calaveras Transit.

#### Map 13: Bus Transit



## **Tuolumne County Transit Agency (TCTA)**

TCTA runs five fixed-route bus routes and one general public on-demand dial-a-ride service. Weekday hours of operation for the transit network start as early as 6:25AM on Routes 2 and 5, and it ends as late as 8:10PM on Route 1. The transit agency also operates the winters-only Ski Bus, which runs weekends and holidays from 7AM to 4:30PM from season opening through March to the Dodge Ridge Ski Resort from Sonora.

According to the TCTA Performance Report for Fiscal Year 2016/2017, the overall fare box recovery ratio for fixed route services was 8.9 percent. This was a decline from 10.1 percent in FY15, 10.3 percent in FY14, and 12.2 percent in FY13. Passengers per vehicle service hour (VSH) was 6.4. This was comparable to previous figures of 6.7 in FY15, 6.3 in FY14, and 6.6 in FY13. Passengers per vehicle service mile (VSM) had been consistent over the last four fiscal years at 0.4. Operating cost per trip in FY16 was \$14.40. This was higher than \$13.22 in FY15, \$13.72 in FY14, and \$11.58 in FY13. Operating cost per VSH in FY16 was \$85.40, \$87.94 in FY15, \$86.27 in FY14, and \$76.36 in FY13.



#### Figure 9: TCTA Performance 2013-2016

The route with the highest passengers per VSH and VSM, and the lowest operating cost per trip and per VSH was Route 1, which is a loop that connects Sonora and Jamestown. The secondbest performing route in these categories was Route 4, a loop that connects Sonora with Columbia Community College. The route with the lowest passenger per VSH and VSM, and the highest operating cost per trip and per VSH was Route 6, which serves East Sonora, Phoenix Lake and Crystal Falls. Route 6, due to low fixed route demand, was converted into an ondemand dial-a-ride service in 2017.

The FY 2017/2018 Unmet Transit Needs Findings Report deemed that there were no unmet transit needs that were reasonable to meet, though two of the five public requests received focused on providing transportation to a population that is likely to be more transit dependent, as defined by the TDA, than most members of the public.

### Calaveras Transit

Calaveras Transit operates the Red Line on weekdays from Vista del Lago on SR 26 to Columbia College in Tuolumne County, with stops in between at San Andreas and Angels Camp. Hours of operation are from 5:50AM to 7:15PM, running in the range of one hour to two-hour headways. The Red Line is the main trunk line for Calaveras, serving the county's SR 49 corridor. The line has the highest ridership number, total and daily average, of all Calaveras routes.

The most recent transit performance report available online from Calaveras Transit was published before the agency made changes to its routes in 2016. Today's Red Line is an amalgam of Routes 1 and 4, except the current route does not access Arnold.

For fiscal year 2014/2015, the fare box recovery ratio for Route 4, the route with a portion that operated in Tuolumne, was 12.78 percent. This was an increase from 11.4 percent in fiscal year 2013/2014. Passengers per VSH was 8.41, per VSM it was 0.32. In FY 13/14, the per-passenger VSH was 8.5, and the per-passenger VSM was 0.31. The operating cost per passenger in FY 14/15 was \$12.30. In FY 13/14, it was \$12.64. The subsidy per passenger in FY 14/15 was \$10.73, and in FY 13/14 it was \$11.20. Route 4 ranked second only to then Route 1 in ridership numbers, at 13,072, compared to Route 1's 14,888. Route 4 did have a slightly lower subsidy per passenger, the lowest in the Calaveras Transit System. Route 1's subsidy was slightly more at \$12.41. Put together, Routes 1 and 4 had the best performance in terms of ridership, recovery ratio, and subsidy, of all routes in Calaveras.



#### Figure 10: Calaveras Transit Performance

The FY 2017/2018 Unmet Transit Needs Findings Report for CCOG deemed that there were no unmet transit needs identified as "Reasonable to Meet" for FY 2017-2018. However, the Social Services Transportation Advisory Council (SSTAC) encouraged Calaveras Transit to conduct further analysis of service alternatives for out-of-county medical trips. SSTAC acknowledged Calaveras Transit's efforts to serve out-of-county trips to Stockton through the Delta Gold Line, even though the Delta Gold Line did not generate enough levels of ridership to sustain the service. SSTAC recommended the transit agency evaluate services and/or partnerships to address this need.
Unmet Transit Needs Findings also listed developing cost-effective and innovative partnerships with private non-profit or for-profit entities to serve areas not accessible by transit, or areas currently too cost prohibitive. Examples included partnerships with companies such as Uber or Lyft to accommodate last mile/first mile trips.

## YARTS

YARTS operates a route that connects Sonora, Jamestown, and Groveland to Yosemite National Park. Operating seven days a week from May 15<sup>th</sup> to September 30<sup>th</sup>, the bus has hours of operation from 6:40AM to 8:45PM with headways ranging from 30 minutes to an hour. The number of buses running depends on the time of the season.

A total of 3,746 passengers used the Tuolumne YARTS route for the month of August 2017. The figure for July 2017 was 4,813. For June the figure was 5,260. These were higher numbers than in 2016. In 2016, passenger numbers for June were 2,494. In July, they were 3,386, and in August 2016 they were 2,271. In May 2016, the number was 647. In May 2017, the number was 1,378. In September 2016, total passengers were 930. In September 2017, the total number was 1,367, the latest month at the time of writing that featured a full month of YARTS operation in Tuolumne County.

Outside Yosemite National Park, bus stops in 2017 with the most ridership on the Tuolumne Route were Yosemite Pines RV Park and Yosemite Lakes Camp. Together, they comprised 26.9 percent of total ridership for the month of August 2017. In July, it was 27.5 percent. In June it was 23.7 percent. The popularity of these two bus stops was consistent throughout the summer of 2017, although Mary Laveroni Park and Buck Meadows Resort made up about seven to 10 percent of ridership in the summer. The most popular bus stops in 2016 were Old Yosemite Road and Thousand Trails Y, composing about 30 to 35 percent of all passengers on the Tuolumne Route. Stops located in Downtown Sonora and Jamestown were not leading sources of ridership.<sup>8</sup>

<sup>&</sup>lt;sup>8</sup> YARTS monthly VIA Service Reports, 2016-2017





According to the 2016 and 2017 reports, no riders on the Tuolumne YARTS route were Amtrak passengers utilizing YARTS service. Amtrak is accessible from the YARTS Merced Route, which connects the City of Merced to the Park via SR 140 in Merced and Mariposa Counties.

There are commuter tickets available for purchase on YARTS. The ticket is good for 20 days of use per month. Reports from 2017 indicated the percentage of ticket sales that were commuter ticket ranged from 0.87 in May to 14.29 in July. The average percent of commuter tickets sold compared to total tickets overall for 2017 was about nine percent. In 2016, commuter ticket sales made up about six percent of total sales. This ticket sale data showed that YARTS provided not only a service to tourists, but also to commuters.

Fare box recovery ratio for the YARTS 120 Route was consistent for 2016 and 2017 at 22 percent. Operating cost per passenger for 2016 ranged from \$15.17 to \$23.74. For 2017 the range was from \$9.45 to \$14.92. Passengers per VSH in 2016 ranged from 0.16 to 0.25. In 2017, the range was 0.1 to 0.16. Passengers per VSM in 2016 ranged from 4.61 to 7.23. In 2017, the range was from 3.25 to 4.55.

### Figure 12: YARTS Performance



The following table showed percentages of YARTS ridership per bus stop in 2016 and 2017. The green color indicated stops located in the SR 108/49 corridor study area. Gray identified stops not used, and light orange showed stops with the second and third highest percentages on the route. Not surprisingly, the stop with the highest percentage was the Yosemite Visitor Center, the final stop inside the park, averaging at 51.9 percent. The median percentage of ridership for stops inside the corridor study area was about 2.17. Most ridership came from outside the study area. Inns of California Downtown had the highest percentage in the corridor.

Table 8: Percentages of Ridership per YARTS Bus Stop on the SR 120 Sonora Jamestown Route, 2016-2017

Pick Up Location	May-16	Jun-16	Jul-16	Aug-16	Sep-16	May-17	Jun-17	Jul-17	Aug-17	Sep-17
Sonora Best Western	2.94	0.76	1	1.37	1.4	2.54	2.64	1.79	2.59	1.17
Inns of California Downtown	4.48	2.29	0.71	1.19	2.47	0.65	0.82	1.75	0.88	1.02
Jamestown Main	3.25	1.8	0.59	1.06	2.15	0.29	1.27	1.52	1.04	1.02
Sum of stops in corridor	7.73	4.09	1.3	2.25	4.62	.94	2.09	3.27	1.92	2.04
Groveland Mary L park	6.18	3.21	3.4	3.96	4.09	4.64	5.48	5.96	5.02	5.93
Old Yosemite Rd	9.89	16.8	14.74	15.46	12.58	0.58	NA	NA	NA	NA
Buck Meadows	2.01	4.13	3.28	3.61	3.12	2.61	3.06	4.9	2.22	1.9
Thousand Trails Y	15.92	18.89	21.38	14.09	25.7	0.29	NA	NA	NA	NA
Big Oak Flat Park	4.02	0.56	2.1	2.51	0.75	1.02	1.24	1.1	1.68	1.76
Crane Flat Gas Station	0.46	1.04	1.3	2.99	3.44	0.58	0.25	2.29	4.64	1.39
Yosemite Visitor	50.23	50.12	50.8	52.22	43.98	59.43	59.01	51.13	52	50.18
Black Oak Hotel	0.62	0.4	0.71	1.54	0.32	1.02	0.61	0.44	0.43	0.66
Rush Creek Lodge	NA	NA	NA	NA	NA	1.74	1.9	1.6	2.59	2.93
Yosemite Pines RV Park	NA	NA	NA	NA	NA	14.22	16.33	17.45	16.84	12.07
Yosemite Lakes Camp	NA	NA	NA	NA	NA	9.58	7.4	10.08	10.06	19.97
Source: YARTS monthly VIA Service Reports, 2016-2017										

# 2.7. Traffic Operations

## 2.7.1. Current Conditions

There were four traffic signals in the Corridor Study Area: Rawhide Road and SR 108/49, Washington Street and SR 49, Parrott's Ferry and SR 49, and a new signal at SR 108/49 and Fifth Avenue. There was a continuous flashing caution light located at the intersection of SR 49 and School Street and Columbia Way to warn motorists of pedestrians using the yellow crosswalk crossing SR 49 near the high school. Locations that had auxiliary turning lanes were as follows, from north to south. Numbers corresponded to what was listed in Figure 29.

- 1. At the intersection of SR 49 and Parrott's Ferry Road (Tuolumne [TUO] 49 PM 20.39), there was a left turn lane SR 49 eastbound to Parrott's Ferry northbound, and a right turn lane connector from SR 49 westbound to Parrott's Ferry northbound.
- 2. At the intersection of SR 49 and Steffen Lane (TUO 49 PM 18.76), there was a left turn lane from northbound SR 49 to westbound Steffen Lane.
- 3. At the intersection of SR 49 and Columbia Way and North Washington Street (TUO 49 PM 18.52), there was a left turn lane from southbound SR 49 to eastbound Columbia Way, and a left turn lane from northbound SR 49 to westbound Washington Street along Sonora High School.
- 4. At the intersection of SR 49 and School Street (TUO 49 PM 18.49) there was a left turn lane from northbound SR 49 to westbound School Street.
- 5. At the intersection of SR 49 and Snell Street (TUO 49 PM 18.29), there was a left turn lane from northbound SR 49 to northwest bound Snell Street.
- 6. At the intersection of SR 49 and Stockton Road (TUO 49 PM 17.97), there was a left turn lane from eastbound Stockton Road to northbound Washington Street. There was a right turn lane from eastbound Stockton Road to southbound Washington Street and a mixed right turn lane from southbound SR 49 to westbound Stockton Road.
- 7. On SR 49 (TUO 49 PM 17.85), there was a left turn lane from eastbound Stockton Road to the Save Mart parking lot between Bradford and Green Streets.
- 8. At the intersection of SR 49 and Bradford Street (TUO 49 PM 17.7), there was a left turn lane from eastbound SR 49 to northeast bound Bradford Street. This turn lane was part of a two-way left turn lane.
- 9. At the intersection of SR 49 and Southgate Drive (TUO 49 PM 17.5), there was a left turn lane from southbound SR 49 to southeast bound Southgate Drive next to the Motherlode Fairgrounds. This turn lane was part of a two-way center left turn lane.

- 10. At the intersection of SR 49 and South Forest Road (TUO 49 PM 17.48), there was a left turn lane from northbound SR 49 to westbound South Forest Road. This turn lane was part of a two-way left turn lane.
- 11. At the intersection of SR 49 and Fairview Lane (TUO 49 PM 17.34), there was a left turn lane from northbound SR 49 to westbound Fairview Lane. This turn lane was part of a two-way center left turn lane.
- 12. At the intersection of SR 49 and Ponderosa Lane (TUO 49 PM 17.31), there was a left turn lane from northbound SR 49 to westbound Ponderosa Lane. This turn lane was part of a two-way left turn lane.
- 13. At the junction of SR 108/49 and the SR 49 split and Stockton Road (TUO 49 PM 16.48), there was an eastbound and northbound off ramp from SR 108/49 to northbound SR 49. There was also a merge lane on westbound SR 108/49 for traffic coming out of southbound SR 49. There was a right turn lane from westbound SR 108 to northbound SR 49, and from southbound SR 49 to westbound SR 108/49.
- 14. At the intersection of SR 108/49 and Mill Villa Road (TUO 49 PM 16.06), there was a left turn lane from westbound SR 108/49 to southbound Mill Villa Road, and there was a merge lane on westbound SR 108/49 for traffic coming out of northbound Mill Villa Road.
- 15. At the intersection of SR 108/49 and Golf Links Road (TUO 49 PM 15.98), there was a left turn lane from eastbound SR 108/49 to northbound Golf Links Road. This turn lane was part of a two-way left turn lane. There was an eastbound merge lane on SR 108/49 for traffic coming out of southbound Golf Links Road.
- 16. At the intersection of SR 108/49 and Chabroullian Road (TUO 49 PM 15.78), there was a left turn lane from eastbound SR 108/49 to northbound Chabroullian Road. This turn lane was part of a two-way center left turn lane.
- 17. At the intersection of SR 108/49 and Fifth Avenue (TUO 49 PM 15.03), there was a left turn lane from eastbound SR 108/49 to northbound Fifth Avenue. There was also a left turn lane from westbound SR 108/49 to southbound Fifth Avenue.
- 18. At the intersection of SR 108/49 and Jamestown Road (TUO 49 PM 14.81), there was a left turn lane from northeast bound SR 108/49 to northeast bound Jamestown Road. There was also a left turn lane going from southwest bound SR 108/49 to southbound Main Street.
- 19. At the intersection of SR 108/49 and Rawhide Road (TUO 49 PM 14.74), there was a left turn lane from northeast bound SR 108/49 to northwest bound Rawhide. This turn lane was part of a two-way center left turn lane. There is a left turn lane on SR 108/49 going southwest bound to southbound Humbug Street.
- 20. At the intersection of SR 108/49 and South Main Street (TUO 49 PM 14.37), there was a left turn lane from southbound SR 108/49 to eastbound Main Street. This turn lane was part of a two-way center left turn lane. There was also a southbound merging lane on SR 108/49 coming out of westbound Main Street.

- 21. At the intersection of SR 108/49 and Rolling Hills Boulevard (TUO 49 PM 13.89), there was a left turn lane from southwest bound SR 108/49 to southbound Rolling Hills Boulevard.
- 22. At the intersection of SR 108/49 and Victoria Way (TUO 49 PM 13.75), there was a left turn lane from eastbound SR 108/49 to northbound Victoria Way. There was also an eastbound merging lane on SR 108/49 for traffic coming out of southbound Victoria Way.
- 23. At the intersection of SR 108/49 and High School Road (TUO 49 PM 12.97), there was a left turn lane from eastbound SR 108/49 to northbound High School Road.
- 24. At the intersection of SR 108/49 and Chicken Ranch Road (TUO 49 PM 12.81), there was a left turn lane from eastbound SR 108/49 to westbound Chicken Ranch Road.

Map 14: Auxiliary Lanes and Ramps



Locations that had center two-way left turn lanes were as follows:

- There was a center two-way left turn lane on SR 108/49 from Rod's Auto Repair and Tire (TUO 49 PM 15.17) to South Main Street in Jamestown (TUO 49 PM 14.39), excluding intersections and left turn lanes. Figure 30 showed this turn lane as three separate turn lanes, due to intersections and left turn lanes spaced between portions of the center left turn lane.
- 2. There was a center two-way left turn lane on SR 108/49 from Golf Links Road (TUO 49 PM 15.98) to Chabroullian Road (TUO 49 PM 15.78).
- 3. There was a center left turn lane on SR 49 from the entrance to the Community Pharmacy Stockton Street (TUO 49 PM 17.76) near Sonora to the entrance of the Community Thrift Shop (TUO 49 PM 17.1) south of the Fairgrounds, excluding intersections and left turn lanes. Figure 30 showed this turn lane as two separate turn lanes, due to intersections and left turn lanes spaced between the center left turn lane.

### Map 15: Two-Way Center Left Turn Lanes



## 2.7.2. Traffic Operations Studies

Six locations were the focus of current efforts to improve operations. Enhancements to safety were also a factor in changes. Deficient intersection LOS, either current or projected, delay and queuing, and past safety incidents and accidents determined the need for enhancements. Local agencies and Caltrans may endorse projects that reconfigure/redesign intersections, add signals, install auxiliary lanes, and install pedestrian and bicycle facilities.

### Roundabout at Mackey Ranch Road and SR 108/49

The current intersection at SR 108/49 and Chicken Ranch Road has non-standard road geometry and access points. There is a proposed project to install a roundabout at the SR 108/49 and Mackey Ranch Road intersection that would provide the main access to the casino and bingo hall, instead of the current Chicken Ranch Road further north.

An intersection control evaluation (ICE) report from January of 2018 was performed to identify viable alternatives that can enhance safety, operations, and multimodal accessibility to the casino located on the reservation of the Chicken Ranch Rancheria of Me-Wuk Indians of California. The report compared a traffic signal and roundabout alternatives for the intersection. The study found that the roundabout performed better with vehicle LOS, did better with pedestrian and vehicle safety, and that the roundabout had fewer conflict points than the traffic signal. An ICE Step II report completed in December of 2019 came to similar conclusions. That report found that the roundabout performed better than the signal alternative. The ICE report found that the roundabout option reduced vehicle delay, lessened the severity of accidents, and had the support of the Tribe and the County. That ICE report is included in the Appendix for reference purposes.

The proposed roundabout at Mackey Ranch Road and SR 108/49 was one enhancement strategy modeled as a scenario using microsimulation. Modeling results are discussed in Part IV.

### **Downtown Sonora**

SR 49 in downtown Sonora experiences the most deficient LOS in the corridor. Traffic performs at a volume beyond the capacity of the two-lane conventional roadway that runs through downtown from Washington Street to Columbia Way. As right of way is constrained and downtown has historical and community value, options to address performance deficiencies on Washington Street are limited to non-capacity-expanding changes such as pedestrian facilities, signal timings, encouraging the use of parallel facilities, and parking off SR 49.

The highway in this segment is a Complete Streets corridor with main street and CSS characteristics. Currently, downtown features parallel parking, eight crosswalks from the Red Church intersection to Stockton Street, at-grade intersection corners, and a historical downtown core with buildings on the National Historic Register. There is little to no room available for a Class II or Class IV bicycle facility in this location, unless street parking is removed.

The idea is to enhance safety and accessibility in downtown, as well as to maintain heritage and built character. TCTC plans to make pedestrian improvements to SR 49 in downtown Sonora from the intersection of Washington and Stockton to the 5-point intersection close to Sonora High School. The section between Stockton Street and the Red Church has illustrated plans in Vision Sonora, as well as the 5-point intersection near the high school. TCTC promotes parking on nearby local streets, rather than finding spots along SR 49, as this activity contributes to congestion. Bicycle use is encouraged on nearby streets that have less volume, such as Stewart.

Intersection improvements and complete streets improvements at SR 49 and Columbia Way are listed as a Tier 1B capital improvement project in the RTP. ADA improvements on SR 49 in Sonora are listed as another Tier 1B project. The construction of a park-n-ride facility in Sonora is listed as a Tier 1A project in the RTP. Courthouse Park rehabilitation of a bus stop and Complete Streets improvements in Downtown are listed as Tier 1C projects. The Greenley Road Extension, which would operate as a bypass around Downtown, is listed as a Tier 1C project in the RTP. Washington Street Corridor Red Church pedestrian improvements, and the Sonora to Columbia/Sonora to Jamestown Regional Trails are listed as Tier 2 Alternative B non-motorized transportation projects in the RTP.

The five-point roundabout at Columbia Way near the high school was one enhancement strategy modeled as a scenario using microsimulation. Modeling results were discussed in Part IV. Gap fill analysis of ADA curb ramp and crosswalk improvements in Downtown were also examined in Part IV. Also analyzed in Part IV was a TransCAD model of the Greenley Extension.

### Woods Creek Bridge and Rawhide Road

This project in Jamestown calls for realigning Rawhide Road to have the road meet at SR 49 as a four-way signalized intersection with North Main Street. The plan was to also construct a new bridge over Woods Creek. The realignment of Rawhide Road and the construction of a new Rawhide Bridge were listed as Tier 1A capital improvement projects in the 2016 TCTC RTP. TCTC wanted to use the currently existing bridge as part of a future non-motorized trail system. No widening was expected for SR 49 for this project. The existing signal at Rawhide Road and SR 49 would be relocated to the new intersection.

The intersection of Rawhide Road and SR 49 performs under deficient conditions, in part because the Woods Creek Bridge is a one-lane bridge. The bridge no longer meets the volume that uses Rawhide to connect to Jamestown and to SR 49. A two-lane bridge is needed. The purpose of the realignment of the SR 49 and Rawhide Road intersection with North Main Street is to improve traffic operations. The realignment of the Rawhide Road intersection was one enhancement strategy modeled as a scenario using microsimulation. Modeling results were discussed in Part IV.

## Intersection of Jamestown Road and SR 49

Existing conditions illustrate that the intersection of Jamestown Road and SR 49 operates at LOS F. This intersection is located next to the currently existing SR 49 Rawhide Road intersection. As a result, as part of the Rawhide Road realignment and bridge improvement project, the SR 49 and Jamestown Road intersection would be limited to westbound right-in and right-out only with SR 49 and Jamestown Road. The rest of the intersection with SR 49 would be detached from the highway. Removing Jamestown Road intersection from full access to SR 49 will simplify traffic behavior in this segment of the corridor. The realignment of the Jamestown Road intersection with SR 108/49 was included with the realignment of the Rawhide intersection in a strategy modeled using microsimulation. Modeling results were discussed in Part IV.

### Intersection of SR 49 and Parrott's Ferry Road

At the north end of the corridor, SR 49 and Parrott's Ferry Road is an intersection that exhibits traffic performance deficiencies. The layout of the current intersection is not conducive to meet future demand. There is a proposal to redevelop the intersection, which would create a conventional T intersection without the northwest bound SR 49 one-way turnoff onto northbound Parrott's Ferry Road. The turnout would be removed from the future intersection. Intersection improvements at this location are listed as a Tier IA project in the 2016 RTP.

## 2.8. Intelligent Transportation Systems

There are four existing ITS or Transportation Management System (TMS) elements in the corridor, which include three signals and one Vehicle Detection Station (VDS). The VDS is a working Performance Measurement System (PeMS) unit, located on SR 108 west of Lime Kiln Road at PM R0.73, east of the SR 108/49 split between Sonora and Jamestown. PeMS is a program that measures volume and delay on the SHS, gauging congestion and traffic flow. PeMS requires regular maintenance and data handling training to be useful to measure vehicular activity. PeMS does not count truck activity.

There are fourteen elements designated for Wish List improvements. A Wish List improvement is an upgrade Caltrans would like to make if funding for its installation is available. Three Wish List items are to install Internet Protocol (IP) cameras at existing signals. The locations are at PM 14.75 near Rawhide and SR 49, PM 17.94 near Stockton Road and Washington Street, and PM 20.4 near Parrott's Ferry Road and SR 49. The IP cameras will assist in performing remote surveillance on traffic signals and optimization of signal timings to allow for the efficient movement of traffic.

There are three Wish List items to install VDS at PM 14.74 at the intersection of Rawhide and SR 49, PM 17.97 near the intersection of Washington and Stockton in downtown Sonora, and PM 20.36 near Parrot's Ferry Road. The reason for installing more VDS is to improve PeMS data collection capacity and to enhance traffic census data collection efforts. In addition, there is a need for a Highway Advisory Radio (HAR) in the area. HAR is a low power (10-watt) FCC licensed non-commercial radio station operated by Caltrans. Its purpose is to transmit detailed local traffic and road information to motorists on the SHS. There is a Closed-Circuit Television (CCTV) camera proposed at the junction of SR 108 and SR 49. The CCTV camera contains electronic video devices installed along the roadway to visually identify the nature of an accident after it has been detected by the system or reported to the TMC. CCTV cameras reduce the time that the TMC operators require to verify an accident and determine the type of response necessary. CCTV cameras can also be utilized during incident management to assist TMC operators to monitor congestion and queueing.

There is a need for three Changeable Message Signs (CMS) in the area. By informing the motorist of traffic conditions ahead, a CMS gives the driver an opportunity to choose an alternate route, thus reducing travel delay. CMS also provides traveler information, public service messages, and emergency alerts. Caltrans wants to better understand traffic behavior where the SR 108 splits from SR 49, and to inform drivers of delays and possible parallel routes to take in the event of a shutdown, or an event that affects traffic flow on the SHS. Figure 90 shows current locations of ITS elements and locations of Wish List improvements. Needs are concentrated near the Stockton Road SR 108/49 intersection. The proposed locations for all Wish List elements are approximate.

#### Map 16: ITS and Wish List Locations



# 2.9. Land Use

The SR 108/49 Corridor is under the jurisdiction of two land use planning agencies: The City of Sonora and Tuolumne County. The City of Sonora 2020 General Plan affects locations from the SR 108/49 split to SR 49 and Preston Road. The current Tuolumne County General Plan, adopted in 1996, affects locations outside of Sonora's sphere of influence. The county is currently in the process of drafting a new general plan. Jamestown is not an incorporated city, but the town does have a Community Plan in the Tuolumne County General Plan.

Three agencies that manage land also in the corridor area include the federally recognized Chicken Ranch Rancheria of Me-Wuk Indians of California, the federal Bureau of Land Management (BLM), and two state facilities, Columbia State Historic Park and Railtown 1897 State Historic Park. Map 17 shows land use agencies in the corridor study area.

Table 9 identifies land uses according to the Caltrans Smart Mobility Framework. The lower the number for the place type, the greater the suitability for SMART mobility development, or for the existence of land uses that are more compatible with multimodal, environmentally sustainable, compact, active transportation planning. The corridor was divided into six sections to reflect overall changes in land use characteristics. Each section has land use characteristics that differentiate it from neighboring sections.

#### Table 9: Land Use

Segment	Place Type <sup>9</sup>		
Chicken Ranch Road to South Main Street	Rural Settlements and Agricultural Lands (5B)		
South Main Street to Fifth Avenue	Rural Towns (5A)		
5 <sup>th</sup> Avenue to SR 108/49 split	Rural Settlements and Agricultural Lands (5B)		
SR 108/49 split to Forest Road	Rural Settlements and Agricultural Lands (5B)		
Forest Road to Columbia Way	Compact Community (3)		
Columbia Way to Parrott's Ferry Road	Rural Settlements and Agricultural Lands (5B)		

The corridor is host to a variety of land uses. From Chicken Ranch Road to South Main Street, land uses feature low-density single family detached residential development surrounded by agricultural and grazing uses. There is some decentralized commercial development, particularly related to agricultural equipment, roadside auto/traveler services, and commercial storage facilities. The former Harvard Mine, no longer in operation, is located on the north side of SR 108/49, and is currently under county ownership.

From South Main Street to Fifth Avenue, the corridor encompasses the historic community of Jamestown. SR 108/49 bypasses to the west Jamestown's historical Downtown and railyard. Land uses feature single family detached residential, some multifamily, commercial and retail, as well as institutional facilities, such as an elementary school. Jamestown has a 19<sup>th</sup> Century Gold Rush-era preserved downtown street located to the east of the highway, as well as Railtown 1897 State Historic Park, a museum dedicated to 19<sup>th</sup> Century western railroads. Trains and buildings at the museum have often been used as a set for movies. There are plans to open a medical facility along SR 108/49 in the community.

<sup>9</sup> Land use designations taken from the Smart Mobility Framework (2012), the lower the number for the place type, the greater the suitability for SMART mobility development.

Photo 10: Downtown Jamestown, circa 2018

Photo 11: Downtown Jamestown, circa 2018



A unique characteristic of the corridor study area is its population density. Sonora's population density is 1,593 people per square mile. This is the highest population density of all Mother Lode communities in District 10. Topographical constraints such as hills and ravines, as well as the prevalence of federal land management limit the city's space for development. As a result, Sonora land uses are more compact, especially in downtown.

From Fifth Avenue to the SR 108/49 split, land uses are limited to rural single-family residential, undeveloped hilly forested terrain, and some commercial services. There is a concentration of mobile home parks in this area. From the split to Forest Road, land uses feature undeveloped hilly forested terrain, with exception to the county fairgrounds vicinity. Closer to Sonora, areas surrounding and including the fairgrounds feature single family residential, medical facilities, public institutional, green/open space, and roadside commercial and retail activity.

The City of Sonora encompasses several land uses from Forest Avenue to Columbia Way. Uses include single and multifamily residential, public institutional, green space, commercial and retail venues, health care facilities, and exhibition space at the Motherlode Fairgrounds. Adventist Health Sonora on Greenley Street and Delnero Drive features the area's only emergency response center.

Downtown Sonora features an historical Nineteenth Century main street, a block street layout, and buildings listed on the National Historic Register. Most land uses in Downtown feature retail geared toward residents and tourists: restaurants, cafes, bars, historic hotels, and civic institutions, such as the county courthouse. Sonora High School and Cassina High School, as well as the school district administration building, are located within blocks of Washington Street in Downtown.

Scattered single family residential with undeveloped forested rolling terrain are the main land use types north of Columbia Way to Parrott's Ferry. There is some commercial activity along Steffen Lane and near Preston Place.

Land uses of note beyond state right of way include Columbia College next to Columbia State Historic Park, big box retail development in East Sonora near the new SR 108 Sonora Bypass,

the Chicken Ranch Casino, the Black Oak Casino in Tuolumne, Sierra Pacific Industries in Standard, and the Sierra Rock Products quarry located to the south of the corridor limits. The City of Sonora 2020 General Plan Land Use Element does endorse policies that favor more compact, mixed use, environmentally sustainable, multimodal development. The Draft General Plan for Tuolumne County also promotes similar policies. These are policies for this study to consider while developing multimodal strategies to reduce congestion, delay, and GHG emissions.

## Local Development-Intergovernmental Review (LD-IGR)

Caltrans DD 25-R1, dated June 2005, seeks to reduce vehicle trips associated with proposed new local development and recommends appropriate mitigation measures for transportation impacts from local developments. The purpose is to ensure that local land use planning and development decisions include the provision of transportation choices, including transit, intercity rail passenger service, walking, and biking, when appropriate.

Due to recent state legislation, State Bill 743 (SB 743), there is currently a statewide shift of the transportation metric utilized to analyze transportation impacts under the California Environmental Quality Act (CEQA) from Level of Service (LOS) automobile delay analysis to alternative measures of transportation analysis including Vehicle Miles Traveled (VMT) and local safety analysis.

## Park and Ride

The 2020 Tuolumne County Active Transportation Plan indicates that there are currently two formal park and ride facilities in the county, neither of which are located in the corridor study area. The plan states that the Sonora City General Plan 2020 Circulation Element proposes four locations for park and ride facilities in the city. One of those locations is near the intersection of SR 108 and South Washington Street. TCTC's SR 49 Multi-Modal Corridor Plan proposes three park and ride locations along SR 49 within the study corridor: one near SR 108/49 in Jamestown, one in downtown Sonora, and a third close to the SR 49 and Parrott's Ferry intersection. These proposed facilities would be developed with transit stops to facilitate mode shift in the Jamestown and Sonora area.

The 2018 Transportation Element of the Tuolumne County General Plan identifies park and ride facilities as a way to reduce VMT through mode shifting. Park and rides can help lessen vehicular volume and encourage a shift to transit if they are planned with and next to stops and stations. The Air Quality Element chapter of the county's general plan also promotes park and ride facilities as one method to reduce VMT and vehicle emissions.

Caltrans' 2010 Smart Mobility Framework lists park and ride facilities as one strategy that agricultural and rural areas can use to develop a more accessible, sustainable, and multimodal transportation system, especially when there are concentrated work destinations. Caltrans' 2018 Complete Streets Elements Toolbox lists park and ride facilities as an improvement that can support efforts to reduce VMT, vehicle congestion, and GHG emissions, while enhancing multimodal and transit options.

Map 17: Land Use Agencies



# 2.10. Environmental Status

A description of environmental conditions in the Corridor Study Area is outlined in Table 10.

### Table 10: Environmental Status

Impacted Items	Degree of Impact				
Flood Plain	100-year at creeks				
Wetlands	Moderate to High				
Special Status Species	Moderate to High				
Cultural Resources	Moderate to High				
Leaking Underground Tanks	Various				
	Moderate to High: Aerially Deposited Lead, Naturally Occurring Asbestos (NOA),				
Possible Hazardous Waste	hydrocarbons				
	Mining waste: adits and tunnels beneath highway near Episcopal Church, as well as former				
	mines at Harvard Mine, near Woods Creek, and along Table Mountain				

### Table 11: Air Quality

Air Quality Items	Air Quality
Ozone	Unclassified: Non-attainment
Particulate Matter 10m	Unclassified: Attainment
Particulate Matter 2.5m	Unclassified: Attainment
Carbon Monoxide	Unclassified: Attainment
Air Quality Management District	Tuolumne Air District
Air Basin	Mountain Counties Air Basin

Historical preservation is a leading concern for project feasibility in the Corridor Study Area, as Jamestown and Sonora have over 150 years of mining and frontier heritage requiring preservation. Both downtowns feature 19<sup>th</sup> Century architecture that possesses historical and cultural value. Active and multimodal transportation improvements in Downtown Sonora and Jamestown require planning that incorporates community support and sensitivity of community heritage.

The Corridor Study area also features sensitive Native American heritage and assets. The federally recognized Chicken Ranch Rancheria of Me-Wuk Indians is located adjacent to the Corridor Study Area near Chicken Ranch Road and close to Montezuma Junction. Decisions regarding improvements to transportation infrastructure require collaboration with Native Americans.

The effects of global warming/climate change are already evident in California. Global anthropomorphic caused CO2 emissions have contributed to excessive summer temperatures, extreme weather events, drought, and forest fires, all of which are of concern in the Sierra Nevada Motherlode.

Climate change intensifies summer drought conditions, raising the risk of ground water depletion and wildfires. Forested areas suffering from drought risk health degradation to trees and greater vulnerability to disease and infestation. Bark beetle infestation poses a challenge to forest management, particularly to higher elevations with yellow pine populations. The corridor is located in areas of oak woodlands, which also need preservation. Winters in California can bring excessive rain events, increasing the number of hazardous events in valley and foothill communities. District 10 Maintenance in 2018 identified locations on SR 49 between postmile 17.1 and 17.3 as at risk of slides with continuous rain. Maintenance also noted that locations on SR 49 at postmile 22.8 and 25.4 between Parrott's Ferry Road and the Calaveras County Line are at risk of slides and flooding during rain events. Woods Creek, according to data from 2012 and 2013 TCRs, has a 100-year flood risk. Agencies at all levels of government need to be prepared to mitigate the impacts of flooding on infrastructure and local economies.

Rain in mountainous and hilly areas also brings the possibility of mudslides that close highway access. Mudslides that shut down highways have been a re-occurring phenomenon in Motherlode counties over the last several years. Agencies in the Corridor Study area need planning that takes account of mudslide risks.

Forest fires affect air quality, posing a health issue not just for residents suffering from respiratory and heart conditions, but also jeopardizing the health of all Californians. California already has challenges with air quality from emissions from auto-centric development, especially in valley portions of the state. Smoke from fires makes valley air quality even worse. In mountainous areas, smoke diminishes scenic views in national parks. In addition to posing a health risk, smoky air affects the market for tourism near national and state parks in rural counties. Forest fires can also increase the risk of mudslides and flash floods during rain events after the fire has ended, as there is less vegetation to hold soil in place.

Avoidance of naturally occurring asbestos is a consideration if excavating hillsides along the corridor for a potential active transportation pathway.

There are several strategies available for improving deficient air quality and combating the effects of climate change. These approaches include better management and prevention of forest fires, sustainable land use practices, and endorsement of active and multimodal transportation choices. Reducing CO2 emissions is essential.

Executive Order N-79-20 is one such strategy California is using to address climate change. The Governor's order calls for elimination of sales of new internal combustion passenger vehicles by 2035. In addition, Executive Order N-19-19 requires California state government to enact policies and best practices in its functioning business activities that reduce GHG emissions and mitigate the effects of climate change while building a sustainable and inclusive economy. N-19-19 directs the Department of Finance to establish a Climate Investment Framework and the State Transportation Agency to leverage more than five billion dollars to reverse the trend in increased fuel consumption and reduce GHG emissions.

# 2.11. Projects

Table 11 below listed all candidate and planned projects in the corridor from Caltrans records as of March 2018. None of these projects had funding. Projects highlighted in orange (O) were projects that were also identified in the TCTC 2016 RTP, or that were projects similar in location or purpose to ones identified in the RTP. Projects in light blue (B) were similar in characteristics to potential strategies examined and analyzed in this Corridor Study. Some of these projects listed in Table 11 may be eligible for State Highway Operation and Protection Program (SHOPP) funding. Additional information about SHOPP is available in Appendix Section XII.

### Map 18: RTP Proposed Projects and Corridor Study Strategies



### Table 12: Caltrans Projects in Tuolumne County at SR 49 PM 12.817 to PM 20.392

Post Mile	Project Name/Description	APL	Project Location		Project EA
TUO 49 PM	Jamestown 2-way left turn	No	In Tuolumne County on SR 49 from north of Woods Creek		10-0G940
13.8/14.4	Lane		Bridge to Main Street in Jamestown		
TUO 49 PM	Install asphalt concrete	No	Near Jamestown at various locations	NC	10-0A180_
12.4/14.8			In Coneyo from north of Course Street to couth of		
18 6/22 8	Asphalt concrete overlay	No	Fraguero Road	NC	10-0A720_
TUO 49 PM			On SR 49 at various locations near Sims Road, near		
10.2/25.3	Replace and upgrade culverts	No	Rawhide Road, and near Tuttletown	NC	10-0E430_
TUO 49 PM	Rubberized hot mix asphalt	No	At and Near Jamestown from 0.2 miles south of Chicken	NC	10 01420
12.6/16.5	overlay	NU	Ranch Road to East Junction SR 108	NC	10-0101430_
TUO 49 PM	Woods Creek Bridge	No	In Jamestown on SR 49	0	10-0\/540
14.5/15.3	Replacement		at Woods Creek Bridge Rawhide Road	Ŭ	
TUO 49 PM 14.8	Jamestown Road queue detector loops	No	In Jamestown on SR 49 at Jamestown Road/Main Street intersection	NC	10-0Y400_
TUO 49 PM	Intersection improvement	No	In Jamestown from south of Rawhide Road to Fifth	Б	10 14020
14.6/15.3	Intersection improvement	NO	Avenue	в	10-1A020_
TUO 49 PM 18.5	SR 49 Shaw's Flat Road intersection improvements	No	SR 49 and Shaw's Flat intersection next to Sonora	0	10-1E290_
TUO 49 PM 16.5	Slide Repair	No	Near Sonora at Mill Villa Court	NC	10-2A550
TUO 49 PM	Con M	No	Fact of Chinasa Comp	NC	10.27080
11.6/13.5	Сар-М	NO		NC	10-37980_
TUO 49 PM 18.0	Install pedestrian signals and crosswalk	No	In Sonora at Old Route 108	NC	10-3A540_
TUO 49 PM	Intersection improvements	No	In Jamestown from south of Rawhide Road to north of	В	10-3A810
14.5/15.3	near Rawhide Road	-	Fifth Avenue		
TUO 49 PM 17.5	Replace bridge rails and widen bridge	No	In Sonora at Woods Creek Bridge # 32-06	NC	10-41750_
TUO 49 PM	Build roundabout	No	Mackey Banch Boad and SB 108/49	в	10-1K720
12.13					10 110 20_
TUO 49 PM 14.7	Install signals	No	Rawhide Road and SR 49	NC	10-0E510_
100 49 PM	Slope repair	No	Near Sonora at various locations		10-0F040_
TUO 49 PM 20.8	Construct left turn pocket	No	Shaw's Flat Road and SR 49 north of Sonora	0	10-0F710
TUO 49 PM 20.8	Rock and shrub removal	No	Shaw's Flat Road and SR 49	NC	10-0H620
TUO 49 PM	Joint seal replacement and	Na		NC	10 01250
4.5/13.5	bridge deck treatment	NO	In various locations	NC	10-0N350_
TUO 49 PM	Dig out and replace AC	No	In Tuolumpe County on SR 49	NC	10-0P400
13.6/15.5		NO		inc.	10 01 400_
TUO 49 PM	Install intersection lighting	No	SR 49 and LaGrange Road	NC	10-0V640
12.8/8.2					
100 49 PIVI	Rubberized hot mix asphalt	No	In and near Sonora on SR 49 0.2 miles north of Mill Villa Road	NC	10-0V930_
TUO 49 PM					
12.8/16.5	RHMA Overlay	No	Various locations	NC	10-1F590_
TUO PM 17.9	Roadway and intersection	No	On SR 49 in downtown Sonora; transit and accessibility	NC	10-1K590_
TUO PM 17 7	Embankment wall renair	No	PM 17.7 on SR 49 in TUO	NC	10-16860
APL: Approved Project List; EA: Expenditure Authorization: NC: no color: O: orange: B: light blue					

Table 12 below listed all tiered projects in the corridor, according to the 2016 TCTC RTP. Projects highlighted in orange (O) were projects that were also identified in Caltrans projects databases, or that were similar in location or purpose to projects in Caltrans databases. Projects in light blue (B) were similar in characteristics to potential strategies examined and analyzed in this Corridor Study. Nineteen projects in the 2016 RTP were comparable in whole or in part to strategies proposed in this corridor study. This showed similar interests between TCTC and Caltrans on enhancing active transportation and improving highway operations.

- TCTC is also planning a park and ride facility with ZEV (zero emission vehicle) chargers in downtown Jamestown, and ZEV chargers are also planned in Sonora. These are short to midterm improvement projects. For further information on ZEV in Tuolumne, you can consult the Central Sierra Zero Emission Vehicle (ZEV) Readiness Plan, completed in September 2019.
- The Vision Sonora Plan and the SR 49 Complete Streets Plan discuss downtown parking options including technological improvements. These should be supported as mid-term improvements.

Tier	Post Mile	Project Description	Mode	Color	<b>Project EA</b>	
Tier 1A	TUO SR 49 PM 20.392	Parrott's Ferry Road at SR 49 intersection improvements	SHP/AT	NC	N/A	
Tier 1A	Approximately TUO SR 49 PM 17.5/PM 18.5	Stockton Road/Washington Street Corridor Transit and Accessibility Project	TST/AT	NC	N/A	
Tier 1A	TUO SR 49 PM 14.73	New Rawhide Bridge and Rawhide Road realignment with SR 49	AT	0	N/A	
Tier 1B	TUO SR 49 PM 12.817/PM 14.34	Continuous left turn lane from Chicken Ranch Road to South Main Street and Complete Streets improvements	SHP/AT	0	N/A	
Tier 1B	TUO SR 49 PM 18.5	Intersection improvements at SR 49 and Columbia Way and Complete Streets improvements	SHP/AT	В	N/A	
Tier 1B	TUO SR 49 PM 20.871	Left turn channelization at Shaw's Flat Road and SR 49	SHP/AT	0	N/A	
Tier 1B	TUO SR 49 PM 14.34/PM 15.03	Stage 1 on SR 49: widen to 5 lanes from South Main Street to Fifth Avenue and Complete Streets	TST/AT	В	N/A	
Tier 1B	Approximately TUO SR 49 PM 17.96/PM 18.3	Complete Streets and ADA improvements in DT Sonora on SR 49	AT	В	N/A	
Tier 1C	Various	Install bicycle signs along state highway	SHP	NC	N/A	
Tier 1C	TUO SR 49 PM 12.817	Intersection improvements at SR 49 and Chicken Ranch Road	SHP/AT	NC	N/A	
Tier 1C	TBD	Intersection improvements at SR 49 and Stockton Road	SHP/AT	NC	N/A	
Tier 1C	TBD	Complete Streets and ADA improvements in Jamestown	AT	NC	N/A	
Tier 1C	тво	Phase 1: North-South Connector: Greenley Extension to SR 49 and Complete Streets	AT	В	N/A	
Tier 2	TUO SR 49 PM 12.817/PM 14.34	Stage 2 on SR 49: widen to 5 lanes from Chicken Ranch Road to South Main Street	SHP	В	N/A	
Tier 2	TUO SR 49 PM 15.03/PM 16.48	Stage 3 on SR 49: Widen to 5 lanes from Fifth Avenue to Stockton Road	SHP	В	N/A	
Tier 2	TUO SR 49 PM 20.392/TBD	On SR 49 widen to 5 lanes from Parrott's Ferry Rd. to the new Greenley Road intersection	SHP	В	N/A	
Tier 2	TUO SR 49 PM 14.73	Reuse soon-to-be-abandoned Old Rawhide Bridge for Angels Spur Trail	AT	NC	N/A	
Tier 2	TUO SR 49 PM 18.3	Washington Street and Red Church pedestrian improvements	AT	В	N/A	
Tier 2	TBD	Columbia College to Sonora High School Regional Trail	AT	В	N/A	
Tier 2	TBD	Dragoon Gulch Connector Trail	AT	NC	N/A	
Tier 2	TBD	Jamestown to Sonora High School Regional Trail	AT	В	N/A	
Tier 2	TUO SR 49 PM 17.97/PM 17.5	Stockton Road Complete Streets Project from DT Sonora to the Fairgrounds	AT	В	N/A	
Tier 3	TUO SR 49 PM 20.392/PM 18.5	On SR 49 continuous left turn lane from Parrott's Ferry Road to Columbia Way	SHP	В	N/A	
Tier 3	TBD	Plan and design Western Sonora Bypass	NA	В	N/A	
Tier 3	TUO SR 49 PM 13.4	Intersection improvements at SR 49/Bell Mooney Rd./Harvard Mine Rd.	SHP	NC	N/A	
Tier 3	TBD	SR 49 Western Bypass near Jamestown to Rawhide Rd.	NA	NC	N/A	
Tier 3	TBD	Class I and Class II Sonora High School to Columbia College Regional Trail	AT	В	N/A	
Tier 3	TBD	Class I and Class II Jamestown to Sonora High School Regional Trail	AT	В	N/A	
Tier 3	TBD	Woods Creek Regional Trail from Sonora High School to Lake Don Pedro	AT	NC	N/A	
Tier 3	TUO SR 49 PM 16.5/PM 17.5	Construct sidewalk improvements on SR 49 from SR 108 to Fairgrounds	AT	В	N/A	
Tier 3	TUO SR 49 PM 18.3/PM 18.5	Construct sidewalk improvements on SR 49 from Snell Street to Columbia Way	AT	NC	N/A	
Tier 3	TUO SR 49 PM 17.5	SR 49 and Southgate Drive and South Forest Drive intersection and Complete Streets improvements	AT	В	N/A	
DT: Downtown; TBD: To Be Determined; SHP: State Highway Project; AT: Active Transportation; TST: Transit; N/A: Not Applicable; Bd.: road: EA: Expenditure Authorization: NC: no color: O: orange: B: light blue						

#### Table 13: TCTC 2016 RTP Tiered Project List

# 2.12. Video Counts

Using cameras, System Planning counted traffic on the highway to evaluate existing conditions. System Planning also gathered data for subsequent use in microsimulation existing traffic modeling and future scenario modeling. Data was sent to Miovision to be counted and processed. After processing, the counts helped gauge deficient traffic behavior and later evaluate ways to reduce delay and lower VMT.

Counts data was fed into a microsimulation model from Mackey Ranch Road to Parrott's Ferry Road. System Planning ran strategy scenarios showing how each scenario affected the corridor. Performance analysis metrics in the program acted as tools enabling planners to observe how scenarios affected corridor behavior.

System Planning chose eight Locations and ran counts from January to May 2018. In addition to single occupancy vehicles, modes captured included single-unit trucks, articulated trucks, motorcycles, buses, pedestrians, and bicycles. The following information was also collected in the video camera counts:

- 1. Total volume
- 2. Intersection turning movements
- 3. Peak hour behaviors
- 4. Peak hour factors

Truck classifications in the counts did not correspond to FHWA standards for truck classification. However, it was still possible to gauge truck volume by combining the percentages for singleunit trucks, articulated trucks, and buses into one value. RVs were not counted as a separate vehicle class, nor were any scenarios developed with a focus on RV travel behaviors.

TCTC noted that the count volumes, especially truck counts, appeared low. Counts taken not during the peak season of summer recreation might be a reason for the discrepancy. Another reason may be that the counts were based not on overall peak hours, but on midday peaks. Overall peak hours were often PM peak hours.

Regardless, counts indicated vehicle intersection delay and congestion, deficient levels of service, and the presence of pedestrians and bicyclists. Strategies tested in microsimulation did show changes compared to existing no build conditions, even if counts were based on midday activity.

As the number of trucks appeared low in simulations, truck volumes from the Caltrans 2017 Truck Volumes Book were used to supplement the volumes documented in the counts. This meant the Vissim model included truck percentages ranging from two to four points higher than the percentages found in the camera counts.

Locations were chosen to 1) capture traffic entering and exiting the corridor study area, 2) to observe areas that have had patterns of delay and congestion, and 3) to observe areas that have had active transportation and motor vehicle conflicts. Map 19 shows the camera count locations:

Location on SR 108/49	Length of Count	Month Data Collected	Geometry Type
Montezuma Junction	7 days	May	3 legs
Chicken Ranch	7 days	April, May	3 legs
Rawhide	7 days	May	4 legs
SR 108 East of Stockton Road	7 days	May	2-way
Fairgrounds Entrance	2 days	March	4 legs
Stockton and Washington	7 days	May	3 legs
Shaw's Flat/Columbia	1 day	January, February	4 legs
Parrott's Ferry	7 days	April, May	3 legs

### Table 14: 2018 Corridor Study Camera Count Locations

To obtain more robust data, there needed to be longer count periods for the fairgrounds' intersection and the Shaw's Flat/Columbia Way intersection. Though data can be extrapolated beyond 24 and 48 hours, seven-day counts would produce more complete data. There also needed to be a seven-day count at SR 108/49 and Fifth Avenue that measured congestion and pedestrian activity. Active transportation counts were also needed for the long edges of T intersections, as regular intersection counts in these locations didn't count active transportation using the area along the long side of the intersection that didn't feature a leg. What follows is a description of the eight locations chosen for video counts.

### Map 19: Camera Count Locations



## 2.12.1. Montezuma Junction

Located outside the Corridor Study Area, this intersection that joins SR 49 and SR 108 was chosen for its ability to provide data for use in a traffic model of a western bypass. A western bypass was proposed in the 2016 TCTC RTP as an unfunded Tier III project that would relieve truck traffic and regional thru traffic from downtown Sonora. No alignment for a western bypass has been selected, and no decision has been made regarding scope, schedule, or cost of work. Montezuma Junction is one possible location where a bypass might originate as it circumvents Sonora and Jamestown toward SR 49 near the Tuolumne/Calaveras county line. Traffic modeling indicated the extent a bypass diverted traffic from downtown. The Google Maps images below indicate the general location where cameras were placed. Counts used one camera and lasted for one week from May 17<sup>th</sup> to May 24<sup>th</sup>, 2018.

Photo 12: Montezuma Junction and SR 108/49



## 2.12.2. Chicken Ranch Road

A camera was installed on a streetlight at the intersection of SR 108/49 and Chicken Ranch Road. This location was selected as it is the southwestern endpoint of the corridor study area. Data from here will serve to build a more complete model, showing vehicles entering and leaving the corridor from the southwest. Data will show turning movements at the intersection. Chicken Ranch Road approaches SR 108/49 at an acute angle. SR 108/49 itself is in a curve as Chicken Ranch Road meets with it. There was a traffic study from January of 2018 that evaluated improvements to this intersection in coordination with installation of new access in a separate location to the casino located in the Chicken Ranch Rancheria. Counts at Chicken Ranch Road used one camera and lasted one week, going from April 25<sup>th</sup> to May 2<sup>nd</sup>, 2018.

Photo 13: Chicken Ranch Road Intersection



## 2.12.3. Rawhide Road

The Rawhide Road signalized intersection is a site of peak hour congestion. A camera here will be able to capture the timing of deficient traffic behavior. Rawhide Bridge, located about a hundred feet from the intersection, is a one-lane bridge slated for replacement. Data will gauge how queuing to cross the bridge affects traffic flow. Close to this intersection is the Main Street/Jamestown Road intersection. There is a Tier I project planned to restrict access to this intersection, which approaches SR 108/49 at an acute angle, is too close to the Rawhide Road intersection. Data will also document pedestrian and bicycle use in this area. Counts at Rawhide Road used one camera and lasted for one week, going from May 3<sup>rd</sup> to May 10<sup>th</sup>, 2018.

Photo 14: Rawhide Road Intersection



## 2.12.4. SR 108 East of SR 49 Split

A camera was set up east of the SR 108/49 Stockton Road split to measure traffic entering and exiting the corridor study area on SR 108. This data will help build a more complete microsimulation model. Pedestrian and bicycle activity were also counted as part of this location. Counts at the 108/49 Split used one camera and lasted for one week, going from May 3<sup>rd</sup> to May 10<sup>th</sup>, 2018.

### Photo 15: East of SR 108/49 Split



## 2.12.5. SR 49 and the Entrance to the Fairgrounds

Two cameras were set up at this intersection collecting data on pedestrian activity during the Sonora Celtic Fair, held from March 9<sup>th</sup> to the 11<sup>th</sup>. A more complete understanding of how pedestrians cross the highway in this area can serve to inform decision makers on how to best meet the safety needs of users of active transportation during events at the Motherlode Fairgrounds. Vision Sonora has plans to modify this intersection, improving access for active transportation purposes. Counts at Woods Creek Drive used two cameras and lasted for 48 hours, going from March 9<sup>th</sup> to March 10<sup>th</sup>, 2018.

Photo 16: Woods Creek/Fairgrounds Intersection



## 2.12.6. Stockton Road and Washington Street

A camera was installed at the northwest corner of Stockton Road and Washington Street in Downtown Sonora to count all vehicle traffic, as well as active transportation, including bicycles and pedestrians. The count lasted for seven days, beginning on Thursday May 17<sup>th</sup> and ending on Thursday, May 24<sup>th</sup>. Of interest to the count was obtaining traffic numbers entering and exiting the Corridor Study Area on South Washington Street, to provide a realistic number for a more complete Vissim model. Vision Sonora has plans to improve this intersection, as well as other downtown intersections, and to encourage a pedestrian-friendly environment that highlights the culture and historical heritage of Sonora. Counts at Stockton Road and Washington Street used one camera and lasted for one week, going from May 17<sup>th</sup> to May 24<sup>th</sup>, 2018.

Photo 17: Stockton and Washington Intersection



## 2.12.7. Shaw's Flat and Columbia Way

Cameras were placed here to gauge pedestrian activity, especially how pedestrians access neighboring Sonora High School. This location currently has one marked crosswalk crossing the state highway. It has a geometrically non-standard layout, featuring five legs, if School Street is included. Vision Sonora has plans to enhance pedestrian access and safety at this intersection, as well as plans to modify the unique five-legged shape of this location. Vehicular traffic was also counted at this location. Counts at Columbia Way and School Street used two cameras and lasted 24 hours, going from January 31<sup>st</sup> to February 1<sup>st</sup>, 2018.

Photo 18: Columbia Way Intersection



### 2.12.8. SR 49 and Parrott's Ferry Road

One camera was positioned at the northern end of the corridor at the intersection of Parrott's Ferry Road and SR 49. Collected traffic data included vehicles entering and exiting the corridor along SR 49, as well as gauging activity on Parrott's Ferry. There are proposed plans to modify the intersection, removing the northbound slip lane from SR 49 to Parrott's Ferry. There is a traffic study from 2011 for this intersection. Counts lasted for one week, going from April 25<sup>th</sup> to May 2<sup>nd</sup>, 2018.

#### Photo 19: Parrott's Ferry Intersection



# 2.13. Video Counts Data

## **Peak Hours**

Peak hour refers to the time of day when vehicle volumes on the road are the highest. Typically, higher volumes occur at least twice a day, reflecting commute behavior, the afternoon peak usually being the higher of the two. Higher traffic volumes can feature congestion and delay in a corridor. Data collected documented peak hour and peak period behavior.

Based on counts at the eight locations, weekday afternoon peak hours generally ranged from 4PM to 5:15PM, no longer than a half hour at most count locations. Morning weekday peak hours ranged from 7:30AM to 8AM. Weekday midday peak hours ranged from 1PM to 3PM in most locations. Weekend morning peak hours averaged later in the day at all locations, going from generally 10AM to 11AM. Afternoon weekend peak hours averaged from 2PM to 4PM overall with some variation at individual locations.

## **Peak Hour Factor**

Any PHF above 0.95 suggests that the facility is congested for one or more hours a day, and that it has little or no remaining capacity for more traffic. This means that the congestion spreads in time and on to any other links near the congested area, as the highway is a fixed asset that cannot expand immediately to meet changing demand of vehicular traffic volume. Instead, the peak of the volume extends into more time intervals, as well as extending the length of congestion on the roadway itself.

Chicken Ranch and downtown Sonora were the locations that had the most PHFs above 0.95. A PHF of 1.0 indicates that the traffic volume in every 15-minute interval is the same and therefore the traffic flow is consistent throughout the hour. Lower PHF values indicate more variable traffic flows and that traffic volume has a spike during the peak 15-minute interval.

## AADT

Traffic counts provided both daily and hourly (in 15-minute increments) volume data (Appendix I.A. and I.B.) that can be assigned an annual average daily traffic (AADT) estimate for each leg of each intersection included in the study. This can be used to calculate an approximate Link LOS, the most basic measure of performance. This measure of LOS does not take into consideration the delay that may exist at an intersection. Rather, the general LOS measurements refer to LOS that exists on segments or links between intersections. AADTs used a monthly seasonal adjustment rate appropriate for the month in which the data was collected.

Truck AADT used in Miovision is not consistent with FHWA categories for freight classification. Truck volume in Miovision is made up of single-unit trucks, articulated trucks, and buses.

## 2.13.1. Montezuma Junction

### Figure 13: Montezuma Junction Turning Movement, May 17th to 21st, 2018

#### SR 108/49 Montezuma Part 1 - TMC

Thu May 17, 2018 Full Length (1:30 PM-1:30 PM (+4)) All Classes (Motorcycles, Cars, Light Goods Vehicles, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk) All Movements ID: 530955, Location: 37.919029, -120.451875 Provided by: Caltrans District 10 --System Planning 1976 Martin Luther King Jr. Blvd., Stockton, CA, 95205, US



#### Figure 14: Montezuma Junction Mode Composition May 17th to 21st, 2018

Bicycles on Crosswalk - 0.0%
Pedestrians - 0.0%
Bicycles on Road - 0.0%
Buses - 0.2%
Single-Unit Trucks - 2.0%
Articulated Trucks - 2.6%
Motorcycles - 2.8%
Light Goods Vehicles - 24.6%
Cars - 67.7%

The data showed that while most traffic passes east/west on SR 108 through the intersection, there was a preference between the south leg of the intersection (SR 49) and the east leg of the
intersection (SR 108/49). The intersection turning movements in Figure 13 showed turning behaviors from May 17<sup>th</sup> to the 21<sup>st</sup>, 2018. This behavior was expected, as Montezuma Junction was the northeast point of a triangle that connects SR 120 and SR 49 to SR 108. Turning left out of the south leg of SR 49 onto westbound SR 108 is not common, as there is an opportunity further south to use SR 120 going west to connect to SR 108 instead. Making left turns at this intersection onto westbound SR 108 is a movement used for local trips. Also, the angle of approach to the intersection is more conducive to gentle right turns from the south leg onto eastbound SR 108/49 than for sharp left turns going westbound. Figure 14 showed mode composition from May 17<sup>th</sup> to May 21<sup>st</sup>. For complete counts and tables from May 17<sup>th</sup> to May 24<sup>th</sup>, refer to Appendix I.A.1 and I.B.1.

Macrosimulation analysis modeled a bypass originating from this location and ending at a location further north on SR 49 west of Sonora close to the county lines of Tuolumne and Calaveras. Some counts accessing the eastern leg of the intersection were redirected into the bypass.

## Table 15: Montezuma Junction Camera Data

Peak Hour used	Number of Times PHF	Truck Composition at	Level of Service on
in Vissim Model	beyond 0.95	Midday Peak Hour	Highway
Friday May 18 <sup>th</sup> , 2018	4	7.2%	E
12-1PM			

- Volumes from the midday peak hour of Friday May 18<sup>th</sup>, 2018 from 12PM to 1PM were used in the Vissim model.
- Any instance of PHF in any leg of the intersection surpassed 0.95 four times during the seven-day count. This indicated congestion in this area.
- Trucks amounted to 7.2 percent of total counts at this intersection in the midday peak hour.
- Appendix I.A.1. illustrates volumes for all legs. For the SR 108 legs, AADT numbers were consistent with a highway performing at a LOS of 'E'. This level was deficient, suggesting that the highway was not meeting traffic demand. AADT on the south leg of SR 49 fell into a LOS of 'B', meaning that there was no need to address a traffic deficiency on that portion of the highway. AADTs used a monthly seasonal adjustment rate for May.

# **Active Transportation**

 Since this location was rural, few active transportation users were expected. The total number of active users counted was 61. Fifty-five percent of the active transportation count for the week occurred in a 45-minute timeframe between 3:45PM and 4:30PM on Monday, May 21<sup>st</sup>. In other words, 61 may not be a consistent number at this location.

# Table 16: Montezuma Junction Active Transportation May 17th to 24th, 2018

Mode	Count
Pedestrians	46
Bicyclists	15
Total	61

# 2.13.2. Chicken Ranch and SR 108/49

## Figure 15: Chicken Ranch Turning Movement April 25th to 29th, 2018

#### Chicken Ranch rd - TMC

Wed Apr 25, 2018 Full Length (12 PM-12 PM (+4)) All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk) All Movements ID: 520026, Location: 37.935093, -120.443116

[N] S/B 49 Total: 71279 ln: 34898 Out: 36381 31440 3455 ო [W] E/B Chicken Ranch Rd  $\sim$ Total: 11817 In: 5853 Out: 5964 3 3323 2527 2 5 2506 33055 Out: 33972 ln: 35566 Total: 69538 [S] N/B 49

Provided by: Caltrans District 10 – System Planning 1976 Martin Luther King Jr. Blvd., Stockton, CA, 95205, US Figure 16: Chicken Ranch Mode Composition April 25th to 29th, 2018

Bicycles on Crosswalk - 0.0%
Pedestrians - 0.0%
Bicycles on Road - 0.0%
Buses - 0.3%
Motorcycles - 1.1%
Single-Unit Trucks - 2.2%
Articulated Trucks - 2.5%
Lights - 93.9%

Data indicated that most traffic movement stayed on SR 108/49. Figure 15 showed vehicleturning movements from April 25<sup>th</sup> to April 29<sup>th</sup>, 2018. This connectivity was also the case for bicycles and pedestrians, of which 35 were counted over the seven-day period. Figure 16 showed vehicle composition from April 25<sup>th</sup> to 29<sup>th</sup>, 2018. For complete counts and tables from April 25<sup>th</sup> to May 2<sup>nd</sup>, refer to Appendix I.A.2. and I.B.2.

Drivers making left turns off northbound SR 108/49 onto westbound Chicken Ranch Road comprised about 40 percent of all turns onto westbound Chicken Ranch Road. Because of the sharp angle of the intersection, along with a history of collisions at this location, this percentage suggested a need for developing the intersection into a layout that was closer to a 90-degree T intersection. Another irregular angle turning movement that may need an improvement was the left turn from Chicken Ranch Road onto eastbound SR 108/49. Left turn movements made up 58 percent of all turn movements out of Chicken Ranch Road onto the highway.

## Table 17: Chicken Ranch Camera Data

Peak Hour used	Number of Times PHF	Truck Composition at	Level of Service on
in Vissim Model	beyond 0.95	Midday Peak Hour	Highway
Friday April 27 <sup>th</sup> , 2018	10	9.9%	E
12-1PM			

- Volumes from the midday peak hour of Friday April 27<sup>th</sup>, 2018 from 12 to 1PM were used in the Vissim model.
- Any instance of PHF in any leg of the intersection surpassed 0.95 ten times during the seven-day count. Current facility capacity may not be able to meet demand on PM, midday weekend, and PM weekend peak hours.
- Trucks composed about ten percent of counts at this intersection in the midday peak hour. The ten percent figure was used in the Vissim model
- Appendix I.A.2. illustrated volumes at this location for all legs. For the SR 108/49 legs, AADT numbers were consistent with a highway performing at LOS of 'E'. This level was deficient. AADTs used a monthly seasonal adjustment rate for April.

# Active Transportation

Table 18: Chicken Ranch Active Transportation April 25th to May 2nd, 2018

Mode	Count
Pedestrians	13
Bicyclists	22
Total	35

# 2.13.3. Rawhide and SR 108/49

## Figure 17: Rawhide Road Turning Movements May 2nd to 6th, 2018

#### Tuo 49 Rawhide Rd - TMC

Wed May 2, 2018 Full Length (3:30 PM-3:30 PM (+4)) All Classes (Motorcycles, Cars, Light Goods Vehicles, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Pedestrians, Bicycles on Road, Bicycles on Crosswalk) All Movements ID: 522865, Location: 37.956293, -120.422693 Provided by: Caltrans District 10 -- System Planning 1976 Martin Luther King Jr. Blvd., Stockton, CA, 95205, US



Figure 18: Rawhide Road Mode Composition May 2nd to 6th, 2018



Data indicated that while most traffic continued on SR 108/49 through the intersection, there was connectivity between the Rawhide Road leg and the north leg of SR 108/49. This suggested that there were origins and destinations, as far as these two legs were concerned, that were local, either in or not far from Jamestown and Sonora. Figure 17 showed counts from Wednesday, May 2<sup>nd</sup> to Sunday, May 6<sup>th</sup>, and Figure 18 showed mode composition for the same days. For complete counts and tables from May 2<sup>nd</sup> to May 9<sup>th</sup>, refer to Appendix I.A.3. and I.B.3.

Table 19: Rawhide and Humbug Road Intersection Camera Data

Peak Hour used	Number of Times PHF	Truck Composition at	Level of Service on
in Vissim Model	beyond 0.95	Midday Peak Hour	Highway
Friday May 4 <sup>th</sup> , 2018 12-1PM	2	7.3%	E

- Volumes from the midday peak hour of Friday May 4<sup>th</sup>, 2018 from 12PM to 1PM were used in the Vissim model.
- PHF for all intersection legs surpassed 0.95 two times during the seven-day count.
- Trucks composed about 7.3 percent of counts at this intersection in the midday peak hour.
- Appendix I.A.3. illustrated volumes at this location for all legs. For the SR 108/49 legs, AADT numbers were consistent with a highway performing at a LOS of 'D' to 'E'. This level was borderline deficient. AADTs used a monthly seasonal adjustment rate for April.

# **Active Transportation**

 Active transportation continued through the intersection on SR 108/49, but there was also a pattern of bicyclists and pedestrians going through Rawhide to/from the north leg of SR 108/49. To view active transportation intersection movements for Rawhide Road, refer to Appendix I.A.3. Although active transportation made up less than one percent of all total counts, there were 183 counts over the seven-day period. This count showed there was a need for active transportation infrastructure at this location.

# Table 20: Rawhide and Humbug Road Intersection Active Transportation May 2nd to 9th, 2018

Mode	Count
Pedestrians	141
Bicyclists	42
Total	183

# 2.13.4. SR 108 East of SR 108/49 Split

Figure 19: SR 108 East of Split Two-Way Volumes May 2nd to 6th, 2018







The counts at this location were for through lanes only (Figure 39). No intersection data was gathered. Eastbound was the more dominant direction at a ratio of about 21.31/20.66 and 10.29/9.30. Figures 19 and 20 showed counts and mode composition from Wednesday, May 2<sup>nd</sup> to Sunday, May 6<sup>th</sup>. Refer to Appendix I.A.4. and I.B.4. for a complete view of seven-day counts and tables at this location from May 2<sup>nd</sup> to May 8<sup>th</sup>.

## Table 21: SR 108 East of Stockton Road Split Camera Data

Peak Hour used	Number of Times	Truck Composition at	Level of Service on
in Vissim Model	PHF beyond 0.95	Midday Peak Hour	Highway
Friday May 4 <sup>th</sup> , 2018 12-1PM	3	5.1%	E

- Volumes from the midday peak hour of Friday May 4<sup>th</sup>, 2018 from 12PM to 1PM were used in the model.
- PHF surpassed 0.95 three times during the seven-day count. Current facility conditions may not be able to meet vehicular demand on PM, AM weekend, and PM weekend hours.
- Trucks composed 5.1 percent of total counts at this location during the midday peak hour.
- Appendix I.A.4. illustrated volumes at this location. For SR 108 east of the split, the AADT number was consistent with a highway performing at a LOS of 'E'. This level was deficient,

showing that there was a need to address a capacity deficiency. AADTs used a monthly seasonal adjustment rate for May.

• There were 11 bicyclists and 16 pedestrians counted here from May 2<sup>nd</sup> to May 8<sup>th</sup>.

# 2.13.5. Motherlode Fairgrounds

## Figure 21: Motherlode Fairgrounds Turning Movements March 9th to 10th, 2018

### Tuo 49 Tuolumne County FG Ent - TMC

Fri Mar 9, 2018 Full Length (12 PM-4:45 PM (+1)) All Classes (Motorcycles, Cars, Light Goods Vehicles, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk) All Movements ID: 504340, Location: 37.979913, -120.388883 Provided by: Caltrans District 10 --System Planning 1976 Martin Luther King Jr. Blvd., Stockton, CA, 95205, US



Figure 22: Motherlode Fairgrounds Mode Composition March 9th to 10th, 2018

Bicycles on Crosswalk - 0.0%
Bicycles on Road - 0.1%
Articulated Trucks - 0.3%
Motorcycles - 0.4%
Buses - 0.6%
Single-Unit Trucks - 0.8%
Light Goods Vehicles - 14.4%
Pedestrians - 36.2%
Cars - 47.3%

Two cameras were used to collect data over a time span of 48 hours at the entrance to the Tuolumne County Motherlode Fairgrounds. Data collected at this intersection measured active transportation behavior during the Celtic Faire, held in 2018 from March 9<sup>th</sup> to the 11<sup>th</sup>. Vehicular activity was also counted. Figures 21 and 22 showed turning movement and mode composition from noon on Friday, March 9<sup>th</sup> to 5:30PM on Saturday, March 10<sup>th</sup>, 2018. Refer to Appendix I.A.5. and I.B.5. for a complete view of counts and tables at this location.

At this location, most auto traffic stayed on SR 49, though there was a preference for the Forest Road leg. Northbound SR 49 was the more dominant direction, as opposed to southbound SR 49, at a ratio that ranged from 1.38/1.11 to 6.77/5.14. To see a complete display of intersection turning movements, refer to Appendix I.A.5.

Table 22: Stockton Road and Washington Street Motherlode Fairgrounds Camera Data

Peak Hour used	Number of Times	Truck Composition at	Level of Service on
in Vissim Model	PHF beyond 0.95	Midday Peak Hour	Highway
Friday March 9 <sup>th</sup> , 2018 12-1PM	0	2.6%	E

- Friday March 9<sup>th</sup>, 2018 from 12 to 1PM was used as the midday peak hour volume input for the Vissim model
- PHF at this location did not exceed 0.95 at any point in the two-day count.
- Trucks composed about 2.6 percent of volume during the midday peak hour at this intersection. As mentioned in Section 2.11, truck volumes from the 2017 Truck Volumes Book were supplemented with the Vissim model, as Miovision truck volumes appeared low in simulations.
- Appendix I.A.5. illustrated volumes at this location. For SR 49, the AADT number was consistent with a highway performing at LOS of 'C'. This level was satisfactory, showing that there was no current need to address a highway capacity deficiency. AADTs used a monthly seasonal adjustment rate for March.

# Active Transportation

- There were over 10,000 pedestrians counted at this location—the most of any location in the Corridor Study. Most of the foot traffic used the pedestrian crosswalk across Stockton Road, but there were several instances of pedestrians jaywalking in other areas of the intersection, or in locations south of the intersection.
- The Celtic Faire influenced the large number of pedestrian counts. Regardless, pedestrian and bicycle activity did show a need to address active transportation at this location. Vision Sonora, the TCTC Complete Streets Plan, and this Corridor Study all contain strategies that enhance active transportation infrastructure at the entrance to the Fairgrounds and Forest Road.

Table 23: Motherlode Fairgrounds Entrance Active Transportation March 9th to 10th, 2018

Mode	Count
Pedestrians	10,827
Bicyclists	53
Total	10,880

# 2.13.6. Stockton Road and Washington Street

## Figure 23: Stockton and Washington Turning Movements May 17th to 21st, 2018

#### Tuo 49 Stockton at Washington St - TMC

Thu May 17, 2018 Full Length (1 PM-1 PM (+4)) All Classes (Motorcycles, Cars, Light Goods Vehicles, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk) All Movements ID: 529916, Location: 37.982977, -120.382159



Provided by: Caltrans District 10 --System Planning 1976 Martin Luther King Jr. Blvd., Stockton, CA, 95205, US Figure 24: Stockton and Washington Mode Composition May 17th to 21st, 2018

Bicycles on Crosswalk - 0.0%
Bicycles on Road - 0.1%
Buses - 0.4%
Articulated Trucks - 0.5%
Single-Unit Trucks - 1.2%
Motorcycles - 1.7%
Pedestrians - 4.0%
Light Goods Vehicles - 24.6%
Cars - 67.4%

Data indicated that while most traffic passed north/south on Washington Street, there was more connectivity with Stockton Road and the south leg of Washington Street than with the north leg. Based on 96 hours of counting, the ratio of traffic going northbound on Washington Street as opposed to going southbound was about 3.215 to 3.633. Southbound Washington Street was the dominant direction in the intersection. Figures 23 and 24 showed counts for turning movements and mode composition from Thursday, May 17<sup>th</sup> to Monday, May 21<sup>st</sup>. For complete counts from May 17<sup>th</sup> to May 24<sup>th</sup>, refer to Appendix I.A.6 and I.B.6.

Table 24: Stockton and Washington Street Camera Data

Peak Hour used	Number of Times	Truck Composition at	Level of Service on
in Vissim Model	PHF beyond 0.95	Midday Peak Hour	Highway
Friday May 18 <sup>th</sup> , 2018 11:45AM-12:45PM	9	3.3%	E

- Volumes from the midday peak hour of Friday May 18<sup>th</sup>, 2018 from 11:45AM to 12:45PM were used in the model.
- Any instance of PHF in any leg entering the intersection surpassed 0.95 nine times during the seven-day count. Current facility conditions may not be able to meet vehicular demand on midday, PM, AM weekend, midday weekend, and PM weekend peak hours. This location is the most congested of all count locations in the corridor.
- Trucks composed about 3.3 percent of total counts at this intersection during the midday peak hour. Despite Washington Street not being designated as an STAA TA route, there were still STAA articulated trucks using this highway during working hours, especially logging and quarry trucks. Though four percent appeared small, there was enough truck activity contributing to congestion.
- Appendix I.A.6. illustrated volumes at this location. For the north and south legs of Washington Street, the AADT number was consistent with a highway performing at a LOS of 'E'. This level was deficient, showing that there was a need to address a highway capacity deficiency. The Stockton leg had an AADT indicative of a LOS 'D' rating. AADTs used a monthly seasonal adjustment rate for April.

# Active Transportation

 Active transportation used all legs of the intersection. There were 5,491 pedestrians and 156 bicyclists. The complete number of active transportation users here was likely higher, as these numbers did not include the number of pedestrians and bicyclists using the sidewalk on the long edge of the T intersection. The only count location with a higher active transportation count was the entrance to the Fairgrounds, but that count had a twoday duration during the Sonora Celtic Faire. It was not a surprise that the active transportation portion at Washington and Stockton was significant, being that the location was in downtown Sonora. To view complete active transportation counts from May 17<sup>th</sup> to May 24<sup>th</sup>, refer to Appendix I.A.6. and I.B.6.

Table 25: Stockton and Washington Street Active Transportation May 17th to 24th, 2018

Mode	Count
Pedestrians	5,491
Bicyclists	156
Total	5,647

# 2.13.7. SR 49 Near Sonora High School

## Figure 25: Shaw's Flat Intersection Turning Movements January 31st to February 1st, 2018

#### Sonora HS - TMC

Wed Jan 31, 2018 Full Length (11:30 AM-11:15 AM (+1)) All Classes (Motorcycles, Cars, Light Goods Vehicles, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk) All Movements ID: 512146, Location: 37.990584, -120.384352, Site Code: From Columbia Way

[N] S/B 49 Total: 14726 ln: 7336 Out: 7390 6997 222 117 ▶2 3 10 [W] E/B Shaws Flat Rd [E] W/B Columbia Way ω Total: 3954 In: 1977 Out: 1977 80 15 137 In: 304 Total: 441 209 2 171 18 Out: 137 1786 ω 3 1738 7139 N Out: 8993 ln: 8880 Total: 17873 [S] N/B 49

Provided by: Caltrans District 10 --System Planning 1976 Martin Luther King Jr. Blvd., Stockton, CA, 95205, US Figure 26: Shaw's Flat Intersection Mode Composition January 31st to February 1st, 2018

Bicycles on Crosswalk - 0.0%
Bicycles on Road - 0.0%
Pedestrians - 0.2%
Motorcycles - 0.3%
Articulated Trucks - 0.8%
Buses - 0.8%
Single-Unit Trucks - 1.4%
Light Goods Vehicles - 21.9%
Cars - 74.6%

Two cameras were set up at this location for a 24-hour count: one near the SR 49 and Columbia Way/Shaw's Flat intersection, and another one south of the SR 49 and School Street intersection.

Data indicated that while most traffic passed on SR 49 through this location, there was a preference between the south leg of SR 49 and the Shaw's Flat leg, which runs adjacent to Sonora High School. This may suggest that origins and destinations, as far as these two legs are concerned, are local, either within or not far from Sonora. It may also indicate the presence of student and staff traffic related to school operations. The southbound traffic direction of SR 49 was slightly dominant over the northbound direction at a ratio of 8.99 to 7.39 respectively. Figures 25 and 26 showed turning movements and mode composition for the SR 49/Shaw's Flat intersection from Wednesday, January 31<sup>st</sup> to Thursday, February 1<sup>st</sup>, 2018. For complete counts and tables at this location, refer to Appendix I.A.7. and I.B.7.

Table 26: Shaw's Flat and Columbia Way Intersection Camera Data

Peak Hour used	Number of Times PHF	Truck Composition at	Level of Service on
in Vissim Model	beyond 0.95	Midday Peak Hour	Highway
Wednesday January 31 <sup>st</sup> , 2018 12-1PM	2	3.2%	E

- Wednesday January 31<sup>st</sup>, 2018 from 12 to 1PM was the peak hour used in Vissim modeling.
- PHF surpassed 0.95 two times during the 24-hour count. This might indicate congestion at this intersection, but a longer count period was needed to develop a clearer idea of the extent of congestion. Conditions might not be able to meet vehicular demand on midday and PM peak hours.
- Trucks composed about 3.2 percent of total counts at this intersection during the midday peak hour. SR 49 in this area is not listed as an STAA TA route.
- Appendix I.A.7. illustrated volumes at this location. For the north and south legs of SR 49, the AADT numbers were consistent with a highway performing at a LOS of 'E'. This level was deficient. AADTs used a monthly seasonal adjustment rate for January.

# Active Transportation

 Most active transportation at this location utilized crosswalks on the southbound side of the highway, as well as the crosswalk on the highway between School Street and Columbia Way. Students accessing the high school were the likely reason for the number of pedestrians documented in the count. There were 305 total active transportation users. If this were extrapolated into a five-day count, the estimate would be 1,525 users, giving the Shaw's Flat/Columbia Way intersection the third highest count location in the corridor. Peak hour for active transportation appeared to take place around 4 to 5PM. The data showed a need for active transportation enhancements at this location, something that Vision Sonora, the TCTC Complete Streets Report, and this Corridor Study all address at this location.

Table 27: Shaw's Flat and Columbia Way Intersection Active Transportation January 31st to February 1st, 2018

Mode	Count
Pedestrians	283
Bicyclists	22
Total	305

# 2.13.8. Parrott's Ferry and SR 49

## Figure 27: Parrott's Ferry Intersection Turning Movements April 25th to 29th, 2018

#### Parrotts Ferry Rd - TMC

Wed Apr 25, 2018 Full Length (12 PM-2 PM (+4)) All Classes (Motorcycles, Cars, Light Goods Vehicles, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk) All Movements ID: 521298, Location: 38.013979, -120.39606 Provided by: Caltrans District 10 --System Planning 1976 Martin Luther King Jr. Blvd., Stockton, CA, 95205, US



Figure 28: Parrott's Ferry Intersection Mode Composition April 25th to 29th, 2018

Bicycles on Crosswalk - 0.0%
Pedestrians - 0.0%
Bicycles on Road - 0.0%
Buses - 0.4%
Motorcycles - 0.6%
Articulated Trucks - 0.7%
Single-Unit Trucks - 1.2%
Light Goods Vehicles - 19.4%
Cars - 77.6%

Data indicated that most traffic movement was connecting both directions of the Parrott's Ferry intersection leg to both directions of the south leg of SR 49 going to/from Sonora. This connectivity was also the case for bicycles and pedestrians, of which there were 39 counted over the seven-day period. This indicated that most of the traffic that went through this intersection served local destinations and origins in and between Columbia and Sonora. Most active transportation was clustered on either Parrott's Ferry Road or the south leg of SR 49.

The northbound slip lane from SR 49 to Parrott's Ferry was not clearly visible from the camera. This lack of visibility from the camera raised the possibility of a less accurate count of traffic using the ramp. To correct for this possibility, volume balancing was applied to the counts. Balancing meant that volume leaving Parrott's Ferry bound for Sonora was roughly proportional to volume going from Sonora to Parrott's Ferry. Figures 27 and 28 showed turning movements and mode composition from Wednesday, April 25<sup>th</sup> to Sunday, April 29<sup>th</sup>, 2018. For complete counts and tables from April 25<sup>th</sup> to May 2<sup>nd</sup>, refer to Appendix I.A.8. and I.B.8.

Table 28: Parrott's Ferry Intersection Camera Data

Peak Hour used	Number of Times	Truck Composition at	Level of Service on
in Vissim Model	PHF beyond 0.95	Midday Peak Hour	Highway
Friday April 27 <sup>th</sup> , 2018 11:45AM-12:45PM	3	3.8%	E

- Friday April 27<sup>th</sup>, 2018 from 11:45AM to 12:45PM was the midday peak hour volume used in the Vissim model.
- PHF for any intersection leg surpassed 0.95 three times during the seven-day count.
- Trucks composed about 3.8 percent of total counts at this intersection during the midday peak hour. SR 49 in this area is designated under California Legal Advisory with a KPRA of over 30 feet. Most trucks were connecting between Parrott's Ferry and the south leg of SR 49 to/from Sonora.
- Appendix I.A.8. illustrated volumes at this location. For the north and south legs of SR 49, the AADT numbers were consistent with a highway performing at a LOS of 'E'. This level was deficient. AADTs used a monthly seasonal adjustment rate for April. The rate depended on the month of the year in which the count was executed.

# Active Transportation

• There were few counts for active transportation users at this intersection. However, 39 users were likely an undercount, as counts were not collected for users along the long edge of the T intersection.

Table 29: Parrott's Ferry Intersection Active Transportation April 25th to May 2nd, 2018

Mode	Count
Pedestrians	7
Bicyclists	32
Total	39

# 2.14. Google Maps Route Review

Google Maps can provide a basic estimate of comparative travel times among selected routes. This service is used to assist drivers in selecting the fastest route from an origin to a destination. It can provide an idea of where deficient traffic flow is located and what the parallel routes are for circumventing a congested area. Google Maps provides a general estimate of trip time and is not a substitute for a select link analysis or for a traffic model.

Inquiries were conducted in 2018 on July 20<sup>th</sup>, 23<sup>rd</sup>, SeptemberFifth, and on January 18<sup>th</sup>, 22<sup>nd</sup>, 28<sup>th</sup>, 30<sup>th</sup>, and February 28<sup>th</sup>, 2019. Further inquires are advised, as such inquiries at different times of the year and on different days may reveal discrepancies influenced by day and season in the amount of time it takes to access destinations. Friday typically has more congested traffic than other days, but summer traffic may not be as congested as afternoon traffic during a month in which school is in session. Google data is drawn from aggregate cell phone signals from drivers.

# 2.14.1. North/South Parallel Routes

A comparison of parallel routes from Chicken Ranch Road to Parrott's Ferry Road revealed that Jamestown Road is the preferred route on Google Maps. A comparison at 7:05PM on Friday, July 20<sup>th</sup> showed that Jamestown was the faster route, besting SR 49 through Downtown by two minutes. A comparison on Monday, July 23<sup>rd</sup> at 11AM showed Jamestown as the quicker route, besting SR 49 by one minute. A comparison on Wednesday, SeptemberFifth at 5:25PM showed Jamestown Road to be the faster route, out-performing SR 49 in Sonora, 11 minutes to 15 minutes. Friday, January 18<sup>th</sup>, 2019 showed Jamestown was two minutes faster than using SR 49. Table 29 showed results from this route.

A second north/south route was queried, traveling from Springfield Road to Campo Seco Road near Cuesta Serena. The differences in route choice for this query revealed minor differences in timing. On Friday January 18<sup>th</sup>, 2019 at 3PM Jamestown Road was the fastest route, clocking at 15 minutes as opposed to 16 minutes through Downtown. A query from January 30<sup>th</sup> showed Jamestown as the faster route, but snap shots from the 22<sup>nd</sup> and the 28<sup>th</sup> showed Downtown as the faster route. A query from January 28<sup>th</sup> showed the routes took the same amount of time. Table 30 showed results from this route. Maps 20 and 21 showed Google Maps images of the

two routes. Routes highlighted in blue in the maps indicate the fastest route between the two points selected.

Query	Jamestown Road	SR 49 through DT Sonora	Difference in Time	Time	Day
January 22 <sup>nd</sup> , 2019	12	14	2 minutes	1350	Tuesday
January 28 <sup>th</sup> , 2019	12	14	2 minutes	0850	Monday
SeptemberFifth, 2018	11	15	4 minutes	1725	Wednesday
January 18 <sup>th</sup> , 2019	12	14	2 minutes	1400	Friday
February 28 <sup>th</sup> , 2019	12	14	2 minutes	1730	Thursday

## Table 30: Google Routes South of Jamestown to Parrott's Ferry Road Comparison in Minutes

## Table 31: Google Routes Springfield to Campo Seco Road Comparison in Minutes

Query	Jamestown Road	SR 49 through DT Sonora	Difference in Time	Time	Day
January 22 <sup>nd</sup> , 2019	15	13	-2 minutes	1400	Tuesday
January 28 <sup>th</sup> , 2019	15	13	-2 minutes	0855	Monday
January 30 <sup>th</sup> , 2019	14	16	2 minutes	1345	Wednesday
January 18th, 2019	15	16	1 minute	1300	Friday
January 28 <sup>th</sup> , 2019	15	15	same	1730	Thursday

## Map 20: Jamestown to Parrott's Ferry

### Map 21: Springfield to Campo Seco



# 2.14.2. East/West Parallel Routes

Comparing routes running generally east/west suggests the fastest current method from Mark Twain's Cabin to Lime Kiln Road was on Rawhide Road. Figure 53 shows the Rawhide alternative, at 16 minutes, is three minutes faster than using SR 49 through Downtown Sonora. These comparisons were made at 4:10PM on Friday, July 20<sup>th</sup>, 2018. A comparison at 5:10PM on Wednesday, SeptemberFifth shows that Rawhide Road is five minutes faster than going through Downtown, at 14 minutes as opposed to 19 minutes. Comparisons made in January

and February of 2019 showed that the Rawhide route was faster. Table 31 showed comparisons on this route.

A second east/west route was examined. This route started west of Jamestown close to High School Road on SR 108/49 and finished on Cabezut Road east of Downtown Sonora. Results showed that the SR 108/49 route using part of Mono Way was the fastest route, followed by the route through Downtown Sonora, although there were instances when the routes had the same amount of time. Queried on Friday January 18th, 2019 at 4:10PM, the fastest route used SR 108/49, South Washington Street, Mono Way, and Greenley Road. This route took 12 minutes, as opposed to routes through Campo Seco and SR 49 past the Motherlode Fairgrounds, which took 15 and 13 minutes respectively. Table 32 showed guery results for this route.

Google Maps suggests SR 49 through Sonora is the slowest route of travel from one side of the corridor area to the other, but a more detailed analysis from a TransCAD model is necessary. Local parallel routes appear to have better run times than SR 49 in Downtown. Maps 22 and 23 showed Google Maps images of the two routes. Routes highlighted in blue in the maps indicate the fastest route between the two points selected.

Query	Rawhide Road	SR 49 through DT Sonora	Difference in Time	Time	Day
January 22 <sup>nd</sup> , 2019	15	19	4 minutes	1345	Tuesday
January 28 <sup>th</sup> , 2019	14	16	2 minutes	0855	Monday
February 28 <sup>th</sup> , 2019	15	18	3 minutes	1735	Thursday
July 20 <sup>th</sup> , 2018	16	19	3 minutes	1410	Friday
SeptemberFifth, 2018	14	19	5 minutes	1710	Wednesday

## Table 32: Google Routes Mark Twain's Cabin to Lime Kiln Road Comparison in Minutes

Ŭ						
Query	SR 108/49	Campo Seco	SR 49	Difference	Time	Day
	and Mono Way		thru DT Sonora	in Time		
January 22 <sup>nd</sup> , 2019	12	15	13	3 min., 1 min.	1340	Tuesday
January 28 <sup>th</sup> , 2019	12	15	12	3 min., even	0900	Monday
January 30 <sup>th</sup> , 2019	13	15	13	2 min., even	1350	Wedn.
January 18 <sup>th</sup> , 2019	12	15	13	3 min., 1 min.	1610	Friday

13

15

3 min., 1 min.

1735

Thursday

## Table 33: Google Routes SR 108/49 to Cabezut Road Comparison in Minutes

12

February 28<sup>th</sup>, 2019



Map 23: SR 108/49 to Cabezut



# 2.15. Tachometer Runs

System Planning and Goods Movement conducted midweek tachometer (TAC) runs to gauge delay along the corridor. Runs were held in the afternoon on Thursday, June 14<sup>th</sup> (12PM to 5:40PM) and in the morning of Wednesday, June 27<sup>th</sup> (6:50AM to 12:30PM). Drivers followed the state highway through a series of points and measured the time it took to get from one point to the other. To better determine behavioral characteristics on the roadway, TAC runs were made during different times of the day to measure when peak hours occurred.

The longer the time it took to travel from one point to another, and the greater the difference between the posted speed limit and the slower actual measured speed, the greater the delay was. Longer delays affected emergency response vehicles' abilities to access destinations in a timely manner, especially when ambulances and fire trucks used SR 49 through downtown Sonora during lunch and afternoon hours.

Comparing the same segments with runs made at differing times showed when delay was most prevalent. TAC runs led to a clearer understanding of which areas in the corridor might benefit from improvements that mitigate deficient traffic flow. Map 24 showed the points in the corridor that were used as time markers.

## Map 24: Tachometer Run Time Points



These differences indicated delay was recorded on Washington Street, between the intersections of Stockton Street and Shaw's Flat next to the high school. Delay was also observed near Jamestown. The range with the most delay was from noon to 1PM. This suggests the presence of a midday lunch peak. This increase in volume during lunch is also visible in video counts at the corner of Washington and Stockton, and in counts near the high school.

To better gauge how traffic behaves during the school year, a TAC run in September or October is recommended. An autumn TAC run may indicate greater delay in areas located close to schools. However, even though TAC runs featured in this study were performed during summer, there was still delay. Figure 29 showed delay for north and southbound directions on SR 49 from Woods Creek Bridge near Harvard Mine in the south to Parrott's Ferry Road in the north. For more information and listings on time recordings for each run, refer to Appendix II.A. and II.B.

The northbound direction had a faster speed of 35.25 MPH, as opposed to the south bound's 31.27. The slowest average runs in the northbound direction, both 28.9 MPH, occurred between the times of 11:36 and 11:50AM and 12:50 and 1:12PM. The slowest runs in the southbound direction occurred between the times of 9:55 to 10:08AM at 28.7 MPH, and between 11:54AM to 12:08PM at 28.9 MPH. Data suggested lunch times having the most delay. Figure 29 showed segments with posted speed limits for comparison.

Factoring measurements taken from start time to end time of TAC runs in both directions, the four slowest sections were located on SR 49 in Sonora between Bradford and School Streets. The average speed totaled 17.13 MPH, which was about eight miles below the posted speed limit. Outside of Downtown Sonora, the only other section that delivered speeds more than five miles below the posted speed limit was Jamestown from South Main Street to Fifth Avenue. The average speed here was 32.7 MPH, which is about eight miles below the speed limit.



## Figure 29: TAC Run Speed Comparisons

# 3. PERFORMANCE ASSESSMENTS

This chapter corresponds to **Step 3 of the 8 phases of the Corridor Planning Process: Conduct Performance Assessments**. Assessments of existing assets in the corridor establish a baseline against which analysis of strategies determines which improvements have the most effect, both throughout the corridor and at the location close to the proposed change. Comparison between existing performance assessments and future strategies analysis illuminate which changes, if any, will have the best impact in meeting the five goals listed in 1.7. Figure 30 shows step three of the eight-step process.

The assets discussed in this section are directly affected by the goals and objectives listed in 1.7. This section shows the current conditions of the assets and states they will be subjected to analyses that determine if any strategies can improve their existing conditions. The results of the analyses are discussed later in **Steps 4 and 5**, but **Step 3** introduces the assets that are the focus of efforts to enhance corridor performance.

The assets include the highway itself, specifically documenting as-is highway performance metrics such as queue length and vehicle delay, as well as GHG emissions, and an estimate of vehicle volumes. Other assets the goals address include the current highway condition for STAA truck access and current paved shoulder widths, as well as active transportation infrastructure such as sidewalks, crosswalks, bicycle lanes, and ADA curb ramps. Since Goal 1 focuses on safety, **Step 3** also discusses existing safety conditions in terms of recorded collisions and incidents on the highway.

**Step 3** will evaluate all these assets' existing conditions, and the next section will gauge which strategies improve performance, lessen gaps, enhance safety, and accomplish the goals listed in 1.7.



## Figure 30: Corridor Planning Process Step 3

# **Existing Conditions Traffic Model**

# 3.1.1. PTV Vissim Modeling

PTV Vissim software was selected to model the corridor for two reasons:

1) Planners wanted to analyze data that otherwise would have been difficult to collect in the field, i.e. queue length, LOS, vehicle delay, emissions, and fuel consumption.

2) Visualization of proposed projects using Vissim is cost effective and adds value to outreach efforts when presenting build or no-build alternatives to stakeholders.

Figure 31: View of Stockton and Washington in Vissim



Under Vissim's scenario management, ten build alternatives were modeled using road geometry and a combination of video counts and historical data. Scenarios included existing and 2040 conditions, unless stated otherwise. The scenarios were as follows:

- 1) No-build conditions
- 2) Restricted access freeway scenario with 65 MPH speed limits from Mackey Ranch to the SR 108/49 Split
- 3) Proposed intersection improvement to replace the unsignalized intersection at North Washington Street, Shaw's Flat Road, and Columbia Way
- 4) Bridge and intersection realignment at Rawhide Road and SR 108/49
- 5) Proposed intersection improvement at Mackey Ranch Road and SR 108/49
- 6) Five-lane expansion of SR 108/49 from Chicken Ranch Road to the SR 108/49 split, and from O'Hara Road to Parrott's Ferry Road

- 7) Four-lane expansion of SR 108/49 from Chicken Ranch Road to the SR 108/49 split, and from O'Hara Road to Parrott's Ferry Road
- 8) 2040 no-build scenario including hypothetical access to the Greenley Road Extension
- 9) Mode shift scenario from single occupancy vehicles to bicycles and pedestrians from Chicken Ranch Road to Parrott's Ferry Road
- 10) 2040 all-strategies scenario that includes the scenarios identified above: 2, 3, 4, 5, and 7

Alternatives modeled with projected 2040 conditions used percent volume changes to vehicle inputs according to the Tuolumne County TDM.

# 3.1.2. Methodology

Base data was derived from field camera counts at eight locations in the corridor to reflect vehicle composition, turning movements, pedestrian activity, bicycle activity, and volumes. To effectively generate beneficial measurable data from any modeling system, the composition of background inputs and assumptions, i.e. base data, must be tailored to match existing conditions as closely as possible. After matching existing corridor geometry, field data was collected using strategically placed Miovision cameras along the route.

There was a lack of camera data between camera count locations in the corridor. As a result, planning staff field observation was used to collect vehicle volumes and composition data in Jamestown for entries and local streets to/from gas stations and restaurants between South Main Street and Rawhide Road. Field observation data collection was also utilized in downtown Sonora between The Red Church and Stockton Road. This data helped fill the gap between camera count locations in built environments and was also added to the base model.

Volume balancing tools were used outside of built environments to approximate activity from local inputs into the corridor not covered by cameras. Both Vissim and Synchro used volume balancing tools. Intersection volumes were used to estimate inputs and turning movements at all access points, while maintaining volume levels at known intersections. Finally, tachometer run field data was cross-checked with data collection within the model to ensure vehicles were traversing the system at rates that accurately reflected corridor travel times.

Base model data was taken from midday peak hour volumes. Data at the Fifth Avenue and SR 108/49 intersection used PM peak hours instead. Using this data, simulation results were aggregated to convergence across several iterations. Data is the average of five to eight runs for each scenario and is not depicting any specific route direction. Results analyzed and taken into consideration when determining performance measurements were as follows: queue length, number of vehicles, LOS, vehicle delay, emissions (carbon monoxide [CO], nitrogen oxides [NOx], volatile organic compounds [VOCs]), and total fuel consumption. Carbon dioxide emissions were derived from fuel consumption. Vissim included these measures of effectiveness as part of its simulation data evaluation.

Figure 32: View of Rawhide and SR 108/49 Realignment Scenario in Vissim



Figure 33: View of SR 108/49 Split During Simulation Run



# 3.1.3. Nodes

Simulation evaluation results were collected at specific areas along the corridor referred to as "nodes" in Vissim. Nodes of varying lengths were established on the base model at select areas upstream and downstream from each of the build alternatives and at critical entry/exit points of the system. Placement of the nodes as data collectors in the base scenario at these locations was key in determining changes between build alternatives, as these node locations remained constant between each of the scenarios. Existing no-build microsimulation conditions tables were placed in the Appendix in section V.A.

Existing no-build conditions for the Mackey Ranch intersection, the freeway scenario, an allstrategies scenario, and an active transportation scenario were grouped separately from the nobuild conditions for other alternatives. These scenarios used the same base model, but with added centerline highway mileage and two more nodes added on the north and south sides of the Sierra Rock Road/SR 108/49 intersection for additional data. Figures 34 and 35 show node locations along the SR 49 (wire mode). Nodes are the polygons located on the state highway.

### Figure 34: Node Locations



# Figure 35: Node Locations



# Figure 36: Snapshot of Node Data Results After Simulation Runs

200 ft						EPRIN C										
Select layout	ىلى -			😫 Σ ź	9											
Count: 22 SimRun	TimeInt	Movement	QLen	QLenMax	Vehs(All)	Pers(All)	LOS(AII)	LOSVal(All)	VehDelay(All)	PersDelay(All)	StopDelay(All)	Stops(All)	EmissionsCO	EmissionsNOx	EmissionsVOC	FuelConsumption
1 1	3600-72	1: North of	0.00	0.00	163	163	LOS_A	1	1.67	1.67	0.00	0.00	48.296	9.397	11.193	0.691
2 1	3600-72	1: North of	0.00	0.00	135	135	LOS_A	1	0.62	0.62	0.00	0.00	37.085	7.215	8.595	0.531
3 1	3600-72	1: North of	0.00	0.00	298	298	LOS_A	1	1.19	1.19	0.00	0.00	85.366	16.609	19.784	1.221
4 1	3600-72	2: South of	0.00	0.00	165	165	LOS_A	1	4.67	4.67	0.33	0.34	82.256	16.004	19.064	1.177
5 1	3600-72	2: South of	0.00	0.00	138	138	LOS_A	1	2.84	2.84	0.00	0.00	51.274	9.976	11.883	0.734
6 1	3600-72	2: South of	0.00	0.00	303	303	LOS_A	1	3.83	3.83	0.18	0.18	133.079	25.892	30.842	1.904
7 1	3600-72	3: South of	0.01	19.41	200	200	LOS_C	3	23.42	23.42	18.54	0.50	126.953	24.700	29.423	1.816

### Table 34: Node Data Table Results After Simulation Runs

	Simulation			Queue	QLen	Vehicles	Persons	LOS	LOS	Vehicle	Persons	Stop	Stops	Emissions	Emissions	Emissions	Fuel
Count: 22	Run	Time Int	Movement	Length	Maximum	(All)	(All)	(All)	Value (All)	Delay (All)	Delay (All)	Delay (All)	(All)	CO	NOx	VOC	Consumption
1	1	3600-72	1: North of	0.00	0.00	163	163	LOS A	1	1.67	1.67	0.00	0.00	48.296	9.397	11.193	0.691
2	1	3600-72	1: North of	0.00	0.00	135	135	LOS A	1	0.62	0.62	0.00	0.00	37.085	7.215	8.595	0.531
3	1	3600-72	1: North of	0.00	0.00	298	298	LOS A	1	1.19	1.19	0.00	0.00	85.366	16.609	19.784	1.221
4	1	3600-72	2: South of	0.00	0.00	165	165	LOS A	1	4.67	4.67	0.33	0.34	82.256	16.004	19.064	1.177
5	1	3600-72	2: South of	0.00	0.00	138	138	LOS A	1	2.84	2.84	0.00	0.00	51.274	9.976	11.883	0.734
6	1	3600-72	2: South of	0.00	0.00	303	303	LOS A	1	3.83	3.83	0.18	0.18	133.079	25.892	30.842	1.904
7	1	3600-72	3: South of	0.01	19.41	200	200	LOS C	3	23.42	23.42	18.54	0.50	126.953	24.700	29.423	1.816

Map 25 shows approximate locations of data collection points in the base model. The nodes captured quantifiable data as the model was running. Sums and averages were tallied after model scenarios and no-build scenarios were finished. The results are in Appendix V and in sections 4.14 and 4.15. Existing base model conditions used for the Mackey Ranch intersection, the freeway scenario, an all-strategies scenario, a future Greenley Extension scenario, and an active transportation scenario were displayed separately in Figures 38, 40, 42, 44, and 46, as the model for these had to include more centerline mileage and two more data collection nodes.
#### Map 25: Node Data Collection Locations



### 3.1.4. Heat Maps

A weighted color scheme was used along corridor links to generate heat maps that represented vehicle speeds. Heat maps are useful tools in quickly evaluating network conditions and identifying congested areas in build alternatives. Purple and red colors indicated greater delay and congestion through slower speeds. Green colors depicted less congestion through faster speeds. Corridor heat maps indicated congestion at critical points along the route: at the Rawhide Road intersection, at the junction of SR 49 and Washington Street, and at the five-point intersection east of Sonora High School.

Map 26: Overview of Corridor Heat Map Under Existing No-build Conditions



### 3.1.5. Next Steps for Microsimulation of the Corridor

Although scenarios were examined under existing and projected conditions, opportunities for further analysis have been limited. Caltrans District 10 Traffic Operations advises that an Intersection Control Evaluation (ICE) process is needed to determine if a roundabout or a signal is better at improving intersection performance. In addition to two roundabout scenarios, alternative scenarios featuring signalized intersections, one for each intersection, should also be examined at the Shaw's Flat and Mackey Ranch Road locations. The more effective of the two strategies is the one to endorse for intersection improvements.

Due to resource constraints, this study did not have the opportunity to also run signal scenarios, in addition to roundabout scenarios. Both roundabout and traffic signals should be included in future modeling tests, instead of using only a roundabout strategy. The ICE process will determine which traffic control device is more effective in terms of corridor system performance.

Another item to consider is modeling the Lime Kiln and South Washington and SR 108 signalized intersection. This intersection is located about one mile east of the corridor study area. As this location is subject to congestion, queueing, and delay, a study of its signal timing and vehicle behavior is advised. Volumes data, turning movements data, and multimodal-sensitive observations of the intersection would be needed to conduct a study of this location.



Map 27: Overview of Heat Map in Jamestown Area Under Existing No-build Conditions

Map 28: Heat Map in Downtown Sonora Under Existing No-build Conditions



The following graphs depict Vissim existing conditions based on one-hour-long midday peak data from Miovision camera counts. The node collection locations are not equidistant and are averages of behaviors in both directions.

### 3.1.6. VMT

Figures 37 and 38 depicted total number of vehicles running in the existing conditions model. Numbers are greater on the east west SR108/49 portion than on the SR 49 section. Since the Gold Rush, most traffic volumes have followed east-west connectivity between population centers in the Central Valley with Motherlode communities.

#### Table 35: VMT Performance Assessment (Figures 64 and 65)

	Chicken Ranch to Parrott's Ferry	Mackey Ranch to Parrott's Ferry
Total Vehicles in Model (per hour)	16,499	19.940
Corridor Length (miles)	7.575	8.275
Average VMT	124,979	165,004
Goal 2 sets out to improve vehicle transportation efficiency. Goal 4 targets reductions in GHG emissions. VMT reduction		
can assist in achieving these goals. Later analysis will determine if strategies reduce VMT in the corridor.		

#### Figure 37: Number of Vehicles, Existing



#### Figure 38: Number of Vehicles, Existing



### 3.1.7. Vehicle Queue Lengths

Figures 39 and 40 showed total queue length after a no-build existing conditions simulation. Though not included in the study area, the PeMS station on SR 108 near the Lime Kiln Road and South Washington intersection has detected delay on SR 108, running east-west from East Sonora to Jamestown.

#### Table 36: Queue Length Performance Assessment (Figures 66 and 67)

	Chicken Ranch to Parrott's Ferry	Mackey Ranch to Parrott's Ferry
Total Queue Length (feet)	681.6	247.9
Corridor Length (miles)	7.575	8.275
Goal 2 sets out to improve vehicle mobility in the corridor and Goal 4 focuses on GHG emissions. Lessening vehicle delay and congestion through lessening queue length is a way to improve efficiency and reduce emissions. Later analysis will		
determine if any strategy can reduce queue length from the existing average.		

#### Figure 39: Queue Length, Existing No-build Condition



#### Figure 40: Queue Length, Existing No-build



### 3.1.8. Vehicle Delay

Figures 41 and 42 depicted existing conditions vehicle delay in the microsimulation model. Measured in seconds spent beyond the amount of time used to travel at a rate of speed based on posted speed limits, the graph shows delay peaking in downtown Sonora, as well as delay

near Rawhide Road in Jamestown. This data is comparable to results from tachometer runs conducted in June of 2018 in that distribution of delay in the corridor appears in similar locations.

#### Table 37: Vehicle Delay Performance Assessment (Figures 68 and 69)

	Chicken Ranch to Parrott's Ferry	Mackey Ranch to Parrott's Ferry	
Total Vehicle Delay (seconds)	123.9	84.13	
Corridor Length (miles)	7.575	8.275	
Goal 2 and Goal 4 focus on vehicle flow efficiency and GHG emissions reduction. Reduction in vehicle delay can assist in			
accomplishing these goals. Analysis can determine if any strategies deliver a reduction in delay.			

#### Figure 41: Vehicle Delay, Existing No-build



#### Figure 42: Vehicle Delay, Existing No-build



### 3.1.9. Model GHG Emissions

Figures 43 and 44 illustrated total GHG emissions in grams. It can be difficult to pinpoint exact locations of mobile sources of GHG emissions, but an overall pattern of emissions levels from transportation in a region is possible to detect. The emissions amount for the existing corridor is the number that will be used to make comparisons with GHG emissions of scenarios that have a proposed strategy, rather than focusing on emissions points of individual nodes. Carbon monoxide, nitrogen oxides, and volatile organic compounds are weak GHG gasses, but they can contribute indirectly to the presence of carbon and rising temperatures in the atmosphere.

#### Table 38: GHG Performance Assessment (Figures 70 and 71)

	Chicken Ranch to Parrott's Ferry Mackey Ranch to Parrot		
Carbon Monoxide (grams)	14,380 12,182.6		
Nitrogen Oxides (grams)	2,797.8	2,370.3	
Volatile Organic Compounds (grams)	ms) 3,332.7 2,823.4		
Corridor Length (miles)	7.575 8.275		
Goal 4 stipulates lowering GHG emissions. Analysis will determine if strategies can lower GHG emissions.			

#### Figure 43: GHG Emissions, Existing No-build



#### Figure 44: GHG Emissions, Existing No-build



### 3.1.10. Model Carbon Dioxide (CO2) Emissions

Figures 45 and 46 showed CO2 emissions. Like GHG emissions, the overall average emissions number for the corridor, rather than numbers for individual points, was the figure to use to compare to model emissions results from proposed strategies. CO2 emissions were derived from multiplying 8.887 kilograms of CO2 tailpipe emissions per U.S. gallon of gasoline<sup>10</sup> with the total amount of fuel consumption for the corridor.

#### Table 39: CO2 Emissions Performance Assessment (Figures 70 and 71)

	Chicken Ranch to Parrott's Ferry Mackey Ranch to Parrott's F	
Carbon Dioxide (kilograms)	1,828.3	1,548.9
Corridor Length (miles)	7.575 8.275	
Goal 4 addresses reduction of GHG emissions. Analysis will determine what proposals may reduce CO2 emissions.		

#### Figure 45: CO2 Emissions, Existing No-build



<sup>10</sup> US EPA Webpage: Greenhouse Gas Emissions from a Typical Passenger Vehicle

#### Figure 46: CO2 Emissions, Existing No-build



## **3.2.Goods Movement**

Trucks and rail handle freight in Tuolumne, focusing on primary sector activities, particularly forestry and mining.

### 3.2.1. Rail

The Sierra Railroad hauls goods from Tuolumne County to Stanislaus, operating on a standard gauge railroad from Oakdale to Standard. The Sierra Railroad freight component carries timber products.

Photo 20: Railtown 1897 State Historic Park

Photo 21: Railtown 1897 State Historic Park



#### Photo 22: Sierra Railroad



Railroad conditions are not optimal. Because of current physical conditions of the Sierra Railroad's tracks, about half of the tracks are restricted to a maximum speed of 15 miles per hour (MPH), one third are restricted to 20 MPH, and one-sixth to 10 MPH.<sup>11</sup> For safety reasons, modern high capacity freight cars are not able to access lumber mills. Railroad tracks need to be replaced in some locations for the railroad to expand its opportunities.

Policy 2 on page 27 of the 2016 TCTC RTP endorsed locating future industries adjacent to the Sierra Northern Railroad to maximize use of the railroad and mitigate truck traffic on state highways and regional parallel facilities. Policy 3 advocated for actions that minimize impacts of truck traffic on the local roadway system.

### 3.2.2. Trucks

Trucks haul timber products or minerals. There are also trucks that service retail operations, running from distribution centers located in the San Joaquin Valley to stores and restaurants in Sonora and Jamestown.

Downtown Sonora is a location where there is need for policies that relieve freight congestion on Washington Street, as SR 49 in Downtown Sonora is usually congested during business hours, having a LOS of 'F' during peak hours. Despite SR 49 in downtown Sonora possessing a designation of California Legal Advisory, STAA articulated trucks still use the corridor. Trucks were observed operating in downtown Sonora during video camera count collections and tachometer runs in spring and summer of 2018. This activity presented more congestion in downtown and posed a possible safety risk. A strategy that addresses truck congestion in downtown may assist in improving current deficient conditions.

SR 108/49 is on the NHS. Highways on the NHS must be expressway standard. Locations not designated as TA are not compliant to NHS standards, and currently 41 percent of the highway in the corridor is not NHS compliant.

<sup>&</sup>lt;sup>11</sup> 2016 TCTC RTP, Chapter Nine, p. 200

To make all of SR 49 STAA standard without bypasses, District 10 Traffic Operations identified five locations between Ponderosa Lane and the Calaveras/Tuolumne county line that would need infrastructural improvements. These changes would convert TUO-49 from a California Legal to an STAA truck route. In addition to the five locations identified below there is also a project in the PS&E stage located at PM 25.3 on SR 49 (10-1G651) near Tuttletown. The purpose of this is to widen the sharp curve at that location and bring it to STAA standard. Below are five locations that would need to be improved along with a cost estimate for each:

Location	Post Mile	Description	Estimated Cost
1	TUO 49 17.96	Downtown Sonora	\$2,835,000
2	TUO 49 23.71	Rawhide Road	\$621,000
3	TUO 49 25.57	North of Tuttletown	\$425,250
4	TUO 49 25.62	North of Tuttletown	\$425,250
5	TUO 49 25.73	North of Tuttletown	\$445,500
			\$4,752,000

Table 40: Estimated Costs to Improve SR 49 to STAA Standards in Corridor Study Area

System Planning and Goods Movement, and TCTC, do not endorse the proposed changes at Location #1. These changes are not included in the 2016 RTP. The proposal at Location #1 is not compatible with Complete Streets nor with Context Sensitive Solutions in Sonora; implementing at least one of these changes would conflict with Vision Sonora. What these hypothetical changes indicate is that corridor enhancements for trucks would likely entail the construction of an STAA standard bypass, instead of changes to the highway in historic downtown Sonora. A bypass would give trucks an alternative route around downtown if downtown is not the last destination.

#### PERFORMANCE ASSESSMENT

Of the 7.575 miles in the corridor study area, about 59 percent of the highway is deemed TA. The lack of TA access for the other 41 percent, from PM 17.3 to PM R27.48, is a freight infrastructure deficiency. Performance of freight activities is not optimal. Goal 5 calls for strategies that improve freight mobility in the corridor, and analysis will determine if a proposed strategy can enhance TA compliance.

Details of each location are shown as follows:

#### Location #1 PM 17.96 in downtown Sonora:

800 SF Pavement Widening/Signal Modification/Curb Ramp & Sidewalks/Eliminate Parking ESTIMATE = \$2,100,000 x 1.35 (35% contingency) = \$2,835,000 (Historical Building at NW will be affected)





#### Location #2 PM 23.71 at Rawhide Road:

4,600 SF pavement widening **ESTIMATE** \$460,000 x 1.35 (35% contingency) **= \$621,000** Photo 24: Rawhide Road and SR 49 STAA Changes



Locations #3 PM 25.57 & # 4 PM 25.62 north of Tuttletown: 4050 SF + 2250 SF= 6300 SF pavement widening ESTIMATE \$630,000 x 1.35 (35% contingency) = \$850,500 Photo 25: North of Tuttletown STAA Changes



Location #5 PM 25.73 north of Tuttletown 3300 SF pavement widening ESTIMATE \$330,000 x 1.35 (35% contingency) = \$445,500 Photo 26: North of Tuttletown STAA Changes



## 3.3.Bicycles

Bicycles are allowed on SR 108/49, as shown in Map 29. The current facility can be described as unsigned unclassified bicycle accessible. The only state highways in District 10 on which bicycle use is prohibited are SR 99 and I-5 south of the junction with SR 33.

The HDM stipulates that bicycle LOS needs to be at least comparable to vehicle LOS on the state highway. In traffic modeling software, traffic volume, number of auto lanes, and speed limits affect bicycle LOS scores in the output. Improvements to shoulders themselves won't change the bicycle LOS, unless there is an improvement to a separated, non-shared bicycle facility.

#### PERFORMANCE ASSESSMENT

There is currently no continuous Class I, II, or IV bicycle pathway in the corridor, either on state right of way, or on an accessible connected parallel facility. The current bicycle LOS in the corridor is deficient. Goal 1 promotes safety. Goal 3 focuses on improving multimodal access in the corridor study area. Strategy analysis will determine if any improvements can meet these goals.

### 3.3.1. Bicycle Level of Stress

In addition to not adhering to the HDM standard for bicycle LOS, field observation and video data suggested a need to provide established bicycle facilities in the corridor. Bicyclists have been detected from Montezuma Junction to Parrott's Ferry Road on field reviews. Video count data also identified the presence of bicyclists.

Level of Traffic Stress (LTS) is another method to measure bicycle facility performance. The rubric used in this study was developed at the Mineta Transportation Institute at San Jose State University. There are four levels of stress, the descriptions of which are based on standards developed at San Jose State. The least stressful level, the level most bicyclists prefer, is LTS 1. The least desirable level for most bicyclists is LTS 4. Overall, the corridor is a stressful environment for bicyclists, due to a lack of separated and protected bicycle facilities on or parallel to the state highway, as well as exposure on the state highway to congested traffic volumes, intersection PHF over 0.95, and speeds above 30 MPH. Map 30 shows stress levels in the corridor.

LTS 1 refers to a bicycle facility that is physically separated from traffic, or a facility that operates in a low-volume, mixed-flow traffic area at 25 MPH or less. Bike lanes are typically six feet wide or more, intersections are easy to cross. Another key component for LTS 1 facilities is that they are comfortable and safe for children.

LTS 2 features bike lanes that are 5.5ft. in width or less and operate next to 30 MPH auto traffic. Crossings are unsignalized of up to 5 lanes at 30 MPH. LTS 2 environments are comfortable for adults. The Mineta Institute states that LTS 2 bicycle facilities are typical in The Netherlands.

LTS 3 includes bicycle lanes next to posted 35 MPH traffic, or mixed-flow traffic at 30 MPH or less. This includes the section in downtown Sonora from West Jackson Street on Stockton Road to Steffen Lane on SR 49.

LTS 4 refers to an environment where there is no separated facility, where traffic speeds are 40 MPH or faster. Figure 22 shows bicycle LTS in the corridor. Not one section in the corridor currently has an LTS of 1 or 2.

#### PERFORMANCE ASSESSMENT

Of 7.575 miles, there is no location where the LTS is either LTS 1 or LTS 2. The existing corridor is a stressful environment for bicyclists. Goal 1 targets safety improvements. Goal 3 aims to improve multimodal access in the corridor. Analysis of proposed strategies will determine if any strategy lessens bicycle stress and meets either of these goals.

#### Map 29: Bicycle Accessibility



#### Map 30: Bicycle Stress



### 3.3.2. Paved Shoulder Width

Bicyclists can legally use the through lanes on a state highway when there is no separated facility available, and state law requires motorists to allow at least three feet of separation when passing a bicyclist.

Chapter 300 of the HDM states that new construction conventional two-lane highways with less than 400 two-way AADT require four feet paved shoulders, while highways of the same type with more than 400 AADT require eight feet.<sup>12</sup> Slow-moving vehicle lanes on a two-lane facility require four feet.

However, several existing sections within the corridor feature three lanes. Also, the 2016 RTP lists five-lane facilities on SR 49 as future planned projects, and the 2013 SR 49 TCR 2030 concept facility calls for a four-lane conventional highway in most locations along the corridor. The HDM stipulates that multilane divided and undivided conventional highways maintain a standard paved shoulder width of eight feet. Parallel parking spaces in downtown Sonora are counted as part of the paved shoulder width. In locations where on-street parking is allowed, such as in downtown Sonora, ten feet width is preferred.<sup>13</sup>

The presence of an eight feet paved shoulder does not automatically mean that there is a designated bicycle facility class on the state highway; however, the shoulder can serve as a de facto bicycle lane. Having consistent eight feet wide paved shoulders in the corridor can enhance bicycle safety. Map 31 shows current paved shoulder widths in the corridor.

Though bicycle use is allowed on SR 49 and bicyclists do use the corridor, most locations currently don't feature at least eight feet wide paved shoulders with white edge striping on both sides of the road. Several locations on the state right of way feature less than a one-foot wide paved shoulder.

#### PERFORMANCE ASSESSMENT

Of the 7.575 miles in the state highway corridor from Chicken Ranch Road to Parrott's Ferry Road, only approximately 1.15 miles, or 15 percent, of the state right of way has paved shoulder width of at least eight feet with white edge striping on both sides of the highway. Approximately 0.68 miles, or 8.9 percent of the total length of the corridor, is located at the junction where eastbound SR 49 splits from eastbound SR 108 between Sonora and Jamestown. Bicyclists need more paved shoulders for refuge. Goal 1 promotes enhancing safety in the corridor for all users. Goal 3 sets out to improve multimodal access. Later analysis is used to determine if strategies meet either of these goals.

<sup>12</sup> Caltrans Webpage: Highway Design Manual, 300-21

<sup>&</sup>lt;sup>13</sup> Caltrans Webpage: Highway Design Manual, 300-4

#### Map 31: Shoulder Refuge



## 3.4.Pedestrian Facilities

### 3.4.1. Sidewalks

The 2016 RTP advocated for improvements in the corridor, but there is no continuous and connected paved sidewalk in built environments. As with bicycle LOS, the HDM stipulates that pedestrian LOS must be at least as good as vehicle LOS on a state highway. Any enhancement to vehicle LOS on SR 49 also requires a comparable improvement to pedestrian LOS. Highways that act as main streets in built environments see more demand for maintained pedestrian facilities. Field review and video counts did see pedestrians using the shoulders between Sonora and Jamestown, in addition to locations in downtown that already had sidewalks. Map 32 features sidewalks along the corridor. Sidewalks in Sonora have been relinquished to the city.

The corridor features paved sidewalks on both sides of SR 108/49 in the following locations:

- 1. Downtown Sonora from Shaw's Flat Road to Stockton Street (PM 18.52 to PM 17.97)
- 2. Stockton Road from Washington Street to Green Street (PM 17.97 to PM 17.94)
- 3. Bradford Street to West Jackson Street (PM 17.7 to PM 17.61)

Sections of SR 108/49 that feature a paved sidewalk on one side of the street are as follows:

- 1. Stockton Street from Green Street to Bradford Street (PM 17.94 to PM 17.7)
- 2. West Jackson Street to Forest Road (PM 17.61 to PM 17.48)
- 3. Steffen Lane (PM 18.76) to PM 18.65

Locations on the highway with hard surfaces but no sidewalks include the following:

- 1. SR 108/49 in Jamestown from South Main Street (PM 14.37) to PM 14.46
- 2. Stockton Road next to the Fairgrounds from Forest Road (PM 17.48) to PM 17.15
- 3. Woods Creek to the Baptist Church across from the Fairgrounds (PM 17.5 to PM 17.51)
- 4. From the five-point intersection with North Washington Street (PM 18.52) to PM 18.56
- 5. SR 49 north of Sonora from Jack Page Road (PM 19.5) to PM 19.43.

#### PERFORMANCE ASSESSMENT

In Jamestown from the intersection of South Main Street and SR 108/49 (PM 14.33) to the intersection of Fifth Avenue (PM 15.00), there are currently no paved sidewalks. Though some locations along the highway have paved hard surfaces where pedestrians can walk, there should be further investigation and consideration for constructing sidewalks in the community along state right of way. Goal 1 promotes safety and Goal 3 advocates for improved multimodal facilities. Analysis will determine which strategies meet these goals.

#### PERFORMANCE ASSESSMENT

From PM 17.15 south of Ponderosa Lane near the Fairgrounds to PM 19.40 at Preston Place north of Downtown Sonora, paved sidewalks on both sides of SR 49 comprise about 29.5 percent of all adjacent space along the highway shoulder. Further consideration of the deficiency in provision of paved sidewalk facilities is advised for both sides of SR 49 in the City of Sonora. Goal 1 promotes safety and Goal 3 advocates for improved multimodal facilities. Analysis will determine which strategies lessen gaps in sidewalks along state right of way in Sonora.

### 3.4.2. Crosswalks

There are fourteen painted crosswalks at nine intersections in the corridor. It is implied that all crosswalks cross or are adjacent to the state highway, unless otherwise noted. Crosswalks are located at the following locations:

- 1. SR 49 and Southgate Drive at the main entrance to the Tuolumne County Fairgrounds (PM 17.5)
- 2. Three painted crosswalks, one for each leg, at the T-intersection of SR 49 and Washington Street in Downtown Sonora (PM 17.9)
- 3. SR 49 and Theall Street in Downtown Sonora (PM 18.0)
- 4. SR 49 and Linoberg Street (PM 18.06)
- 5. SR 49 and Bradford Street (PM 18.11)
- 6. SR 49 and Jackson Street (PM 18.16)
- 7. SR 49 and Dodge Street (PM 18.22)
- 8. SR 49 midway between Dodge and Snell Streets (PM 18.26)
- 9. Three crosswalks, each for the north, west, and east legs of SR 49 and Elkin Street in front of the Red Church (PM 18.29)
- 10. Yellow crosswalk on SR 49 and School Street near Sonora High School (PM 18.495)

None of these crosswalks feature fully ADA-compliant curb ramps and yellow bubble mats.

#### PERFORMANCE ASSESSMENT

There are no crosswalks on or adjacent to the state highway in Jamestown. Based on video counts and field observations, there is a need for painted crosswalks at least at the Rawhide Road and North Main Street intersections. Goal 1 promotes safety and Goal 3 advocates for improved multimodal facilities, and analysis will determine which strategies can increase the number of crosswalks along state right of way in Jamestown.

### **Pedestrian Crossing Signals**

There is one pedestrian crossing light in the corridor. It is located at SR 49 and Washington Street in Downtown Sonora. The light timing at this location was recently adjusted to enhance pedestrian safety while crossing the street. There are also non-lighted yield-to-pedestrians signs and an overhead flashing caution light located at the yellow crosswalk near Sonora High School.

#### Map 32: Pedestrian Facility Conditions



#### Map 33: Crosswalks and Signals



## 3.5. Americans with Disabilities Act

The only pedestrian intersection ramps in the corridor with fully compliant Americans with Disability Act (ADA) architecture were the north and south sides of East Cowan Street and SR 49 in Sonora (PM 18.4), and the southeast side of Columbia Way and SR 49 at the end of a yellow crosswalk at the five-point intersection next to Sonora High School (PM 18.495).

Map 34 identified current intersection pedestrian conditions in the corridor. The intersections were classified according to how they met ADA needs. The categories were as follows:

- 1. Corners with ramps level with the street surface with yellow raised-dome detectable warning surfaces
- 2. Intersection corners that have ramps or that are at a level plane with the street surface, but that have no yellow raised-dome detectable warning surface
- 3. Sidewalk intersection corners that are not ramped, not level, nor have a detectable warning surface
- 4. Street intersections with no pedestrian facilities

This map does not include access points that are not streets or alleys, such as driveways or turn-offs into businesses. Also, their inclusion would not have changed the overall count of compliant or partially compliant pedestrian ramps in the corridor. For an explanation of what a compliant ADA curb ramp entails, access the following Caltrans website: http://www.dot.ca.gov/design/stp/accessibility.html. Photos 27 and 28 feature examples of compliant ADA facilities. A curb ramp is not necessary when there is no sidewalk.

#### PERFORMANCE ASSESSMENT

Of the 50 intersection corners connected to sidewalks located along the 7.575-mile SR 108/49 corridor, three currently have ramps level with the street surface with yellow raised-dome detectable warning surfaces. That's about six percent. More ADA compliant corners are needed, at least in Sonora and Jamestown. Goal 3 advocates for improved multimodal facilities access, and analysis will determine which strategies increase the number of ADA facilities along state right of way and reduce gaps.



#### Map 34: ADA Intersection Status



## 3.6. Safety

Projects nominated for the SB 1 Congested Corridors Program must be in a multimodal corridor plan, and those plans should consider improvements to safety within the corridor. Addressing transportation safety is one of the factors SB 1 considers in determining which projects receive funding.

### 3.6.1. Statewide Integrated Traffic Records System

The following section describes safety incidents leading to injury that have occurred in the corridor (PM 12.817 to PM 20.392) based on California Highway Patrol (CHP) Statewide Integrated Traffic Records System (SWITRS) data from January 2009 through January of 2017. Most injuries occurred along Jamestown, and most active transportation injuries concentrated in Downtown Sonora, based on data collected from SWITRS and from District 10 Safety.

General data is as follows. From 2009 to January 2017, SWITRS recorded 233 incidents that resulted in injuries, and there were 339 injured victims. Most incidents did not result in serious injury, but there were three fatalities over the seven-year data collection period. There were 33 severe injuries and 105 visible injuries. Figure 47 shows count of crash injury severity. Injury type is categorized by the seriousness of the injury. Complaint of pain was the most common injury type.



#### Figure 47: Injury Severity

The mean for the number of incidents was approximately 29 and the mode of injurious incidents from 2009 through 2016 was 31. The median number of incidents was 30.5. The highest number of injurious incidents was 49 in 2009 and the lowest was 13 in 2016. Figure 48 shows changes in the number of collisions leading to injuries on state right of way in the corridor study area over time. Overall, the total number of incidents declined from 2009 through 2016.



#### Figure 48: Year and Injurious Collision Incidents

Most traffic incidents on SR 108/49 occurred on Fridays, followed by Tuesdays, as shown in Figure 49. This data is not unusual, as AADT is typically greater on Friday afternoons and evenings than on other days of the week.



#### Figure 49: Day of the Week and Injurious Incidents

Hours from 3PM to 6PM had the highest number of incidents, followed by time periods of noon to 3PM and 9AM to noon. Not surprisingly, Figure 50 shows that the hours of midnight to 6AM had the fewest number of incidents. Afternoon hours with high numbers of incidents are also hours that exhibit peak hour traffic volumes.





Unsafe speeds had the most violations, followed by automobile right of way incidents. Improper turning and driving under the influence (DUI) also had several violations. Figure 51 represents categories of incident violation types.

#### Figure 51: Incident Violation Category



Figure 52 illustrates the distribution of incidents according to intersections or closest intersection along the corridor. Intersections like Forest Road/Woods Creek Drive/Southgate Drive were treated as one postmile, as well as Bell Mooney Road/West Harvard Mine Road, North Main Road/Jamestown Road, SR 108/Stockton Road, and Stockton Road/Washington Street. For purposes of this study, the post mile listed in the data was given greater weight in determining the location of the incident, rather than the listed intersection.

The distribution of incidents concentrated in one location: intersections near north Jamestown. The intersections with the three highest numbers of incidents are as follows starting from the highest number: 1) SR 108/49 and Fifth Avenue, 2) SR 108/49 and Jamestown Road, and 3) SR 108/49 and Rawhide Road.



Figure 52: Distribution of Injuries on SR 108/49

Of 233 incidents that occurred from 2009 through 2016 resulting in injuries, 30 were active transportation-related—about 13 percent. Figure 53 shows the proportion of incidents that involved users of active transportation.

#### Figure 53: Incidents by Mode Type



### 3.6.2. Incidents Involving Active Transportation

Incidents overall concentrated along right of way near Jamestown, but most injuries that involved active transportation occurred along SR 49 in downtown Sonora. Of 339 injuries, 32 were related to active transportation. That's about 9.5 percent of all injuries. Figure 54 shows the distribution of injuries from active transportation in the corridor study area.

According to data from SWITRS, three fatalities occurred in the study area, one related to an accident involving a motorcycle crash, and two related to accidents involving pedestrians. Figure 55 shows fatalities from 2009-2016.



#### Figure 54: Active Transportation Injuries on SR 108/49

#### Figure 55: Fatalities



Data from the Transportation Injury Mapping System (TIMS) accessed on July 12<sup>th</sup>, 2019 indicates similar reporting for accidents involving pedestrians and bicyclists in the corridor. From January 1<sup>st</sup>, 2010 to December 31<sup>st</sup>, 2018, TIMS reported 23 collisions in the study area involving non-motorized transportation users on or near the state highway. Filters for collisions with pedestrians and bicyclists were applied in the query tool. Map 35 is a cluster map showing the locations of incidents in the corridor area. Data in TIMS is also based on SWITRS. Refer to Appendix VIII for tables and charts on TIMS data concerning collisions involving active transportation.



#### Map 35: TIMS Active Transportation Collision Locations (2010-2018), created July 15th, 2019

#### PERFORMANCE ASSESSMENT

The number of collisions leading to injuries and deaths in the corridor has varied from 13 to 49 annually (2010-2017). These are 13 to 49 collisions too many. Goal 1 is to enhance safety. The main objective is to reduce the number of accidents on state right of way. Ideally, there should not only be zero collisions on SR 108/49, but also zero collisions leading to casualties. There should also be zero collisions involving active transportation. The difference between existing conditions and accomplishing Goal 1 ranges from 13 to 49 and zero.

### 3.6.3. Traffic Safety Investigation Reports (TIR)

As of August of 2018, there were 65 Traffic Safety Investigation Reports on the state highway between the postmiles of TUO 49 PM 12.0 to TUO 49 PM 21.0. There were six investigations on the highway near Jamestown, all of which were at the intersection of SR 49 and Jamestown Road (PM 14.812). Figure 52 indicated the SR 49/Jamestown Road intersection as the location with the second highest number of accidents in the corridor.

There were 36 investigations within the city limits of Sonora. There was also one investigation where a requestor was requesting a guardrail from PM 18.63 to PM 18.76 near Steffen Lane.

Investigations from District 10 Safety of note were as follows with the corresponding recommendations. These locations were in the city limits of Sonora.

TIR #161-0024A: TUO 49 PM 18.293: Area of the existing crosswalk across Elkin Street at SR 49/Elkin Street intersection should be marked with a ladder marking per California 2014 Manual on Uniform Traffic Control Devices (MUTCD) figure 3B-19 (CA). Refresh Pedestrian crossing ahead markings on the southbound approach to the intersection. At the time of writing in April of 2020, the crosswalk on Elkin Street had been changed to a ladder crosswalk marking.

TIR #163-0092: TUO 49 PM 17.965-18.64: Pedestrian Crossing Ahead markings on SR 49 from the intersection with Stockton Street (PM 17.965) to the intersection with Elkin Street/Snell Road (PM 18.293) are not needed. Pedestrian Crossing Ahead marking on SR 49 southbound approach to Elkin Street/Snell Road intersection is needed.

TIR #151-0124O: TUO 49 PM 17.2-17.50: Due to auto-pedestrian collisions, the following is recommended: install flashing beacons on the Pedestrian Crossing (W11-2) signs for both directions of the highway, install high visibility crosswalk markings, install Yield Here to Pedestrians (R1-5) sign/yield lines/pavement marking (pedestrian crossing) in the southbound direction, increase the size of Pedestrian Crossing (W11-2) signs and install diagonal Downward Pointing Arrow (W13-7P) signs. Relocate No Parking sign, remove existing old pedestrian crossing signs.

# 4. SIMULATION STRATEGIES
This chapter corresponds to **Steps 4 and 5 of the 8 phases of the Corridor Planning Process: Identifying Potential Strategies and Analyzing Solutions**. Scenarios are analyzed using quantitative measures that compare model performance. For microsimulation modeling, the lesser the output for the scenarios measured, the better the performance. Measured characteristics included VMT, vehicle LOS, emissions, delay, and vehicle queue length. For macrosimulation strategies, the more these strategies reduced AADT in downtown Sonora the more effective they were at reducing congestion and routing traffic around downtown.

Chapter Four covered strategies tested in computer model simulation. Chapter Five covered active transportation strategies using a gap analysis.



#### Figure 56: Corridor Planning Process Steps 4 and 5

# 4.1. Overall Simulation Results

Simulations with Vissim used existing 2018 conditions based on traffic count data from cameras, field review data of local inputs in built environments in 2019, and 2040 projected conditions based on the growth rate in the Tuolumne County TDM. Baseline conditions were obtained with a model of existing conditions with current and projected traffic volumes (existing and future no build scenarios). Many of the proposed projects target 'spot' improvements, and the purpose of the simulation is to assess the degree of improved performance at that location, and the degree of adverse impact to the system beyond that improvement by comparison with the 'no build.' Depending on whether a 'spot' project is an operational or a safety improvement, the simulation may lead to recommendations of secondary improvements intended to preserve downstream performance away from the safety project. System improvements such as proposed widenings, extensions, and bypasses were evaluated with comparison to the no-builds without consideration of secondary improvements. A mix and match effort was then undertaken with the best performer with a near term construction date (tier 1a), the best performer with an intermediate construction date (tier 1b), and the best performer with a construction date close to 2040 (tier 1c) to assess how the three might work together.

Appendix Section V contains data tables showing results of no-build and scenario model simulation runs. The tables depict a comparison of overall effects of existing and projected scenarios. Table 41 below lists the twenty-three scenarios used in Vissim to model highway performance in microsimulation.

Enhancements to signal timings at Rawhide and Fifth Avenue intersections on SR 108/49 were modeled using Trafficware Synchro Ten. 2018 and 2040 conditions were modeled using data collected from camera counts at both intersections and percentage changes in growth in the Tuolumne TransCAD model between 2018 and 2040. In addition to Vissim, Synchro was also used to model performance before and after a five-lane widening project in Jamestown. LOS values in Synchro 10 were based on HCM standards.

	Conditions	Scenario	Extent
1	2018 Existing	No-build	Chicken Ranch to Parrott's Ferry
2	2018 Existing	Shaw's Flat Intersection Improvement	Chicken Ranch to Parrott's Ferry
3	2018 Existing	Rawhide Realignment	Chicken Ranch to Parrott's Ferry
4	2018 Existing	Four-lane expansion of SR 108/49	Chicken Ranch to Parrott's Ferry
5	2018 Existing	Five-lane expansion of SR 108/49	Chicken Ranch to Parrott's Ferry
6	2018 Existing	Signal Timing Enhancements (Synchro)	Chicken Ranch to Parrott's Ferry
7	2018 Existing	No-build	Mackey Ranch to Parrott's Ferry
8	2018 Existing	Mackey Ranch Intersection Improvement	Mackey Ranch to Parrott's Ferry
9	2018 Existing	All Strategies	Mackey Ranch to Parrott's Ferry
10	2018 Existing	108 Freeway	Mackey Ranch to Parrott's Ferry
11	2018 Existing	Active Transportation Path	Mackey Ranch to Parrott's Ferry
12	2040 Projection	No-build	Chicken Ranch to Parrott's Ferry
13	2040 Projection	Shaw's Flat Intersection Improvement	Chicken Ranch to Parrott's Ferry
14	2040 Projection	Rawhide Realignment	Chicken Ranch to Parrott's Ferry
15	2040 Projection	Four-lane expansion of SR 108/49	Chicken Ranch to Parrott's Ferry
16	2040 Projection	Five-lane expansion of SR 108/49	Chicken Ranch to Parrott's Ferry
17	2040 Projection	Signal Timing Enhancements (Synchro)	Chicken Ranch to Parrott's Ferry
18	2040 Projection	No-build	Mackey Ranch to Parrott's Ferry
19	2040 Projection	Mackey Ranch Intersection Improvement	Mackey Ranch to Parrott's Ferry
20	2040 Projection	Greenley Extension Intersection	Mackey Ranch to Parrott's Ferry
21	2040 Projection	All Strategies	Mackey Ranch to Parrott's Ferry
22	2040 Projection	108 Freeway	Mackey Ranch to Parrott's Ferry
23	2040 Projection	Active Transportation Path	Mackey Ranch to Parrott's Ferry

#### Table 41: List of Microsimulation Scenarios

### Corridor-wide Goals and Objectives Met

Table 42 below showed how strategies performed compared to the goals listed in Chapter 1. The table showed if strategies achieved goals, and organized strategies by type: bypasses, operations, and non-motorized changes.

The table also listed the percentage of goals and objectives achieved for each strategy. This was a rough estimate of success, as some goals and objectives only applied to some strategies. For example, the objective of reducing gaps in bicycle lanes only applied to active transportation improvements that specifically included bicycle lanes, or that might accommodate bicycles. Such an objective did not apply to a proposal to install more ADA curb ramps or sidewalks. The goal and objective of reducing gaps in active transportation did not apply to bypass proposals, as the intent of proposed bypasses was not to address shortages in active transportation facilities.

	Propose	d Study Strategies	E	Bypas	s					Op	erat	ions						Non-	moto	rized	
Goals and Objectives			Bell Mooney	Montezuma	Greenley	Shaws Flat	Mackey Ranch	Bridge Realign	Greenley	Signals**	5 lanes	4 lanes	2040 No-build	AT Pathway	108 Freeway	All strategies	Sidewalks	ADA ramps	AT Pathway	Crosswalks*	Shoulders
1		Enhance safety	NA	NA	NA	U	U	N A	N A	N A	N A	N A	N A	Y	NA	NA	Y	Υ	Y	Y	Υ
2	Reduce (2018)	Delay and congestion	NA	NA	NA	N	N	Y	N A	Y	Y	Y	N A	N	Y	Y	NA	NA	N	NA	N A
2	Reduce (2018)	VMT	NA	NA	NA	Y	Y	Y	N A	N A	Y	Y	N A	Y	Y	Y	NA	NA	Y	NA	N A
2	Reduce (2018)	Queueing	NA	NA	NA	N	N	Y	N A	Y	Y	Y	N A	N	Y	Y	NA	NA	N	NA	N A
2	Reduce (2040)	Delay and congestion	N	N	Y	N	N	Y	Y	Y	Y	Y	Ν	Y	Y	Y	NA	NA	Y	NA	N A
2	Reduce (2040)	VMT	NA	NA	NA	Y	Y	Y	Y	N A	N	Ν	Y	Y	N	Y	NA	NA	Y	NA	N A
2	Reduce (2040)	Queuing	NA	NA	NA	N	N	Ν	Ν	Ν	Y	Y	Ν	Y	Y	Y	NA	NA	Y	NA	N A
3	Reduce gaps in	Active Transport	NA	NA	NA	NA	NA	N A	N A	N A	N A	N A	N A	Y	NA	NA	Y	Y	Y	Y	Y
3	Reduce gaps in	Separate Bikeways	NA	NA	NA	NA	NA	N A	N A	N A	N A	N A	N A	Y	NA	NA	NA	NA	Y	NA	N
3	Reduce gaps in	Protected Bikeways	NA	NA	NA	NA	NA	N A	N A	N A	N A	N A	N A	Y	NA	NA	NA	NA	Y	NA	N
4	Lower	GHG emissions (2018)	NA	NA	NA	Ν	Ν	Υ	N A	N A	Y	Υ	N A	Ν	Y	Y	NA	NA	Ν	NA	N
4	Lower	GHG emissions (2040)	NA	NA	NA	Ν	Ν	Y	Y	N A	Y	Υ	Ν	Ν	Y	Y	NA	NA	Ν	NA	N A
5	Reduce	Gaps in STAA HWYs	Υ	Y	Y	NA	NA	N A	N A	N A	N A	N A	N A	N A	NA	NA	NA	NA	NA	NA	N A
5	Reduce	Truck Delay/Congestion	Ν	Ν	Y	Ν	Ν	Y	Y	Y	Υ	Υ	Ν	N A	Y	Υ	NA	NA	NA	NA	N A
Percentage of goals met 🛛 💥 💥 👌						22	22	89	80	80	89	89	20	67	89	100	100	100	100	100	50
Y: U:	goal met; N: Unclear: rou	goal not met undabouts can reduce the se	everit	ty of	vehic	le cra	ashes	, but	safe	ty be	enefi	ts to	ped	estria	ans an	d cyc	lists ar	re not	t clea	r with	out

data on local traffic behavior characteristics and Complete Streets-centric design enhancements taken into consideration

\*Crosswalks can assist in attaining Goal 1 if they include additional street and curb design elements, as identified in Section 4.11 \*\*Signal timing adjustments modeled using Synchro 10; results based on data at the Rawhide intersection with a four-lane widening **RP**: Results Pending; **NA**: not applicable

The active transportation pathway scenario, shown in the table as AT Pathway, was classified as both an operations and non-motorized strategy. The AT Pathway was tested in Vissim using a mode shift scenario in 2018 and 2040 conditions—the purpose of which to determine if such a pathway could reduce VMT on the adjacent highway, at least in simulation. In the non-motorized category, the AT Pathway was evaluated on the metric of its ability to fill a gap in the existing network of non-motorized transportation infrastructure in the corridor.

## **Goal Results**

The all-strategies and Greenley bypass scenarios were the most successful. Non-motorized strategies such as sidewalk gap-fill, crosswalks, ADA curb ramps, and bicycle paths also performed well. The least successful strategies included the potential western bypasses, the roundabout scenarios, and the 2040 no-build alternative.

Although the two roundabout proposals increased delay and queuing after installation, they did lower total VMT presence in the corridor. To deem these two scenarios as failures might not be warranted if the purpose of the roundabouts was to slow down traffic. The proposed intersection improvement at Shaw's Flat might have merit if it were coordinated with the opening of the Greenley Extension. This eastern bypass was shown in macro and micro simulation to redirect volume out of downtown, meaning that fewer vehicles would need to pass through the proposed roundabout area. Reduced volume coupled with a roundabout encouraging slower speeds could lead to lower traffic stress for active transportation users in the corridor near downtown.

### **Corridor-wide Simulation Rankings**

Stratogy/Droject		Perce	ent of Existing	g 2018 Conditions	5		
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Existing No-Build	100	100	100	100	100	500	7
Shaw's Flat Intersection	188.4	185	83	101.3	130	687.7	10
SR 108 Freeway	25.4	79.6	96.6	88.2	90	379.8	4
Active Transportation Pathway	201.4	138.5	97.1	126.6	110	673.6	9
Rawhide Realignment	29.2	56	81.7	61	74	301.9	3
Mackey Ranch Intersection	161	135	95	125	110	626	8
5-lane Widening	1.9	34.3	86.7	58.4	60.9	242.2	1
4-lane Widening	1.6	35.3	97.9	65.3	60.9	261	2
All Strategies	81.8	97.8	93	96	105	473.6	6
Signal Timing Adjustments***	90	73.5	100	100	77.8	441.3	5
2040 No-Build Chicken R to Parrott's	377	156	98.9	141	126	898.9	11
2040 No-Build Mackey R to Parrott's	953	185	98.1	144	130	1,510	12
NA: Not Applicable							

#### Table 43: Comparison of Strategy Performance and Rankings, 2018

\*\*\*Signal timing adjustments were modeled in Synchro 10 in Jamestown using HCM-based LOS measures

#### Table 44: Comparison of Strategy Performance and Rankings, 2040

		Percen	t of Future	Projected 204	0 Conditio	ns		
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	AADT**	Rank
Future No-build	100	100	100	100	100	500	NA	9
Future Shaw's Flat Intersection	127.7	141.7	99.5	117.9	128	614.8	NA	10
SR 108 Freeway	5.6	51.2	104.3	67.7	73	301.8	NA	4
Active Transportation Pathway	52.1	97.3	99.8	103.1	104	456.3	NA	6
Future Rawhide Realignment	123.3	88.6	98.4	87.5	93	490.8	NA	7
Future Mackey Ranch Intersection	166	182	96	183.7	138	766	NA	11
5-lane Widening	0.5	25.3	102.6	49.8	48.3	226.5	NA	1
4-lane Widening	0.8	29.2	111.7	55.6	51.7	249	NA	3
Greenley Intersection	104	94	98.4	98.4	96.2	491	NA	8
All Strategies	0.7	31.3	88	51.6	65.4	237	NA	2
Signal Timing Adjustments***	122	29.6	100	100	66.7	418.3	NA	5
2040 No-build TransCAD	NA	NA	NA	NA	NA	NA	100	4
Greenley Extension	NA	NA	NA	NA	NA	NA	86.5	1
Montezuma Western Bypass*	NA	NA	NA	NA	NA	NA	99.3	2
Bell Mooney Western Bypass*	NA	NA	NA	NA	NA	NA	99.7	3

NA: not applicable

\*Both strategies incorporated simulations that included installation of the Greenley Extension into a future no-build projected model

\*\*AADT refers to volumes in downtown Sonora based on origin/destination studies using the Tuolumne TransCAD model

\*\*\*Signal timing adjustments were modeled in Synchro 10 using HCM-based LOS measures; scores were based on signal timing adjustments at Rawhide Road and SR 108/49 with a highway widened to four lanes; the score at Fifth Avenue under the same circumstances would have been 393

The above tables compared strategy results with no-build outcomes tested in simulation. Strategies such as sidewalks, shoulders, and ADA curb ramps, which were not tested in

simulation, were not addressed in these tables. Performance indicators used to measure strategy effectiveness included queue length, delay, VMT, GHG emissions, and LOS.

Rankings reflected proposed strategies' performance in model simulations. The purpose of the rankings was to assist stakeholders in identifying which strategies to prioritize for funding opportunities.

The purpose of tables 43 and 44 was to gauge how effective a strategy was by measuring how much an improvement occurred compared to a no-build scenario. The base condition was set at a score of 100 for no-build scenarios. Any strategy that scored less than 100 in any of the five categories registered an improvement compared to the no-build. Any score over 100 meant the strategy performed worse than the no-build and did not show an improvement.

Individual scores per measure were summed to give an overall impression of the effectiveness of a strategy. A score of 500 was the baseline, as it was reflective of existing no-build conditions. A score less than 500 was preferred. The more a score exceeded 500, the less effective the strategy was reducing delay and emissions, at least from a corridor-wide perspective.

## **Ranking Results**

Compared to no-build conditions, the best performing strategies in simulation included the lanewidening and all-strategies scenarios. The Rawhide realignment scenario performed well in 2018 existing conditions. The signal timing adjustments in Jamestown also performed well in both 2018 and 2040 conditions. The Greenley Extension did show improvement in downtown Sonora in both 2040 Vissim and TranCAD simulations. Scenarios that didn't perform well in simulation included the two proposed roundabouts and the no-build alternatives. Again, although the roundabouts did not perform well in simulation, they may still have merit if their purpose is to slow down traffic, especially near Sonora High School. The proposed roundabouts should not be deemed insufficient strategies based on performance in simulation alone.

# 4.2. Parameters and Data Patterns

## **Simulation Parameters**

The following parameters were applied to the design and maintenance of microsimulation modeling. They were applicable to all scenarios tested in 2018 and 2040 conditions.

- Data were analyzed after letting Vissim do five simulation runs for each scenario.
- Scenarios were evaluated not just at the corridor level, but also at the site of the proposed project. Node data collection occurred with all scenarios at all data collection points from one end of the corridor study area to the other. This method of data collection meant that it was possible to observe how a proposed project affected the entire corridor's average behavior, as well as how a project affected the highway in the local location of the proposed improvement. This feature made regional and local analysis possible.
- LOS in Vissim is not based on HCM standards, but it still indicates performance in the model simulations. LOS measures were taken at each node point. A value is assigned

based on LOS performance. A score of "1" indicates LOS "A" performance, generally the least congested. A score of "6" is the lowest score, indicating LOS "F" performance, or a facility with congested or slow traffic. Scores are assigned to each node and added into an overall score. The lesser the score is, the better the LOS performance is.

- Measures for CO, NOx, and VOC emissions, as well as for fuel consumption and CO2 emissions all showed similar behaviors. While results differed between scenarios, emissions showed consistent results within each scenario. For example, if there is a 15 percent increase in CO emissions over the no-build network, then there is also a 15 percent increase in emissions of NOx and VOC, as well as a 15 percent increase in fuel consumption and CO2. Within each scenario, the 15 percent change was consistent across measures.
- In Sonora in the 2040 projected simulations, vehicular traffic input to Linoberg Street between SR 49 and Stewart Street was set to zero, as Linoberg is set to be turned into a pedestrian zone. Linoberg in existing conditions is currently one-way and is modeled as such in existing conditions scenarios.
- The new signal at Fifth Avenue and SR 108/49 is included in the model base network.
- The DoF projected population growth in Tuolumne into 2060 as negative. The 2010 population was listed at 55,240, but the projected population in 2060 is 40,724. This amounted to a per annum decline of about 0.5 percent. However, the TDM featured less than one percent annual growth in land uses. 2040 projections from the county model were based on changes to land uses and not changes to population.
- Traffic input growth rate changes for all 2040 projected simulations came from a model variation without a future completed Greenley Bypass in the TDM, except for the all-strategies and Greenley scenarios—scenarios that did include the Greenley Extension connection to SR 49 north of Sonora near O'Hara Drive.
- In each time step, the current queue length is measured upstream by the queue counter and the arithmetic mean is thus calculated per time interval.
- Although land use development's influence on the system has yet to be realized, its impact is unlikely to be understood until after construction is complete in the future; the full buildout volumes are included in the 2040 no-build, while no volume increase above existing conditions is applied in the current no-build scenario.

## Patterns in Simulation Results

There were consistent geospatial data patterns throughout simulation regardless of scenario tested.

Vehicle counts were higher on the SR 108/49 portion of the corridor than on the SR 49 portion. The area with the lowest volume was on Stockton Road between downtown and the SR 108/49 split. Regardless of scenario, these patterns in volumes were generally consistent in simulation. Figure 57 illustrates this basic pattern.





Regardless of scenario, emissions data peaked in areas south of Parrott's Ferry Road and north of the Shaw's Flat intersection. This location overall featured the highest emissions levels throughout simulation. Locations east of the Rawhide Road intersection near Jamestown exhibited a secondary peak of emissions. Figure 58 is representative of the trend of emissions concentrations north of Sonora and just east of the Rawhide intersection.



Figure 58: GHG Emissions for Existing No-build in Grams, 2018

Regardless of scenario, simulations showed consistent concentrations of delay in downtown Sonora. Outside of downtown, delay was also visibly concentrated east of the Rawhide Road intersection near Jamestown. Though the downtown area was more pronounced, these two locations had the most concentrations of delay throughout most scenarios. Figure 59 shows a representative distribution of delay in the corridor.



Figure 59: Vehicle Delay in the SR 108/49 Corridor

LOS was consistently most deficient in downtown Sonora throughout all strategy simulations. In addition to downtown, a less deficient cluster of LOS scores did appear in both roundabout scenarios, both no-build conditions, and in the Rawhide bridge realignment scenario. Figure 60 is representative of the distribution of LOS scores in most simulations.



Figure 60: Level of Service Scores in the SR 108/49 Corridor

Queue length data concentrated in downtown Sonora and east of the Rawhide Road intersection near Jamestown. When comparing results over most simulations, queue lengths either peaked in downtown, or they peaked near Jamestown. In no-build scenarios, the 2040 Greenley Extension scenario, the Rawhide Road bridge realignment scenario, and in the Mackey Ranch

roundabout scenario, queue lengths peaked near Jamestown. In the hypothetical SR 108 freeway scenario, the all-strategies scenario, and in the Shaw's Flat roundabout scenario queue lengths were highest in downtown Sonora. Two figures below illustrate the general trends for queue lengths seen over most simulations.

No proposed project specifically targeted reductions in queue length to show improvement. Queue length was a measure indirectly affected by the congestion reduction strategies examined in this study.

#### Figure 61: Queue Lengths in the SR 108/49 Corridor





#### Figure 62: Queue Lengths in the SR 108/49 Corridor

What follows is a description of each proposed or hypothetical project modeled in microsimulation. With exception to no-builds and the hypothetical SR 108 freeway, scenario results are discussed in terms of how they affected the overall corridor from Mackey Ranch Road to Parrott's Ferry Road, and in terms of how they affected the local area where the project was proposed. A comparative list of performance indicator data for each scenario is contained in Sections V and IX of the Appendix.

# 4.3. No-Build Scenarios

#### Figure 63: Shaw's Flat Intersection



#### Figure 64: Shaw's Flat Intersection in Vissim



A no-build alternative left the existing and future system untouched. Under existing conditions, data was the same as data presented in Section 3.1. This simulation alternative did not address the need for congestion mitigation and may carry negative consequences as land use and population change. Figures 63 and 64 show the SR 49/Columbia Way and SR 108/49/Rawhide Road intersections under existing conditions. The no-build scenario served as a basis to compare the effectiveness of model strategies under existing 2018 conditions.

A separate scenario was made for the Mackey Ranch roundabout strategy, as the length of the corridor with Mackey Ranch was 8.275 miles, rather than the 7.575 miles from Chicken Ranch Road to Parrott's Ferry. This change in distance affected VMT. Also, the no-build and build scenarios with the Mackey Ranch roundabout included two extra data collection points: one north and one south of the Mackey Ranch/Sierra Rock intersection.

	Volu	ime	Emis	sions L		DS	Delay		Queue Length	
Segment	2018	2040	2018	2040	2018	2040	2018	2040	2018	2040
Chicken Ranch to Parrott's Ferry	16,499	16,319	14,380	20,266	23	29	124	195	682	2567
Mackey Ranch to Parrott's Ferry	19,940	19,568	12,182	17,544	20	26	84	156	248	2363
LOS: level of service;	emissions	value is the	e carbon n	nonoxide d	output					

#### Table 45: Comparison of 2018 and 2040 No-build Condition Models

Two future no-build scenarios, one with and one without the extra mileage to Mackey Ranch Road, based on 2040 projections, were also tested. Increases in delay and queue length and declines in relative LOS relate to the slight decline in vehicle volume measured under 2040 conditions. Because of greater congestion, fewer vehicles were able to enter the network than under 2018 conditions, leading to a slightly lower rough VMT in 2040. Greater congestion also aligned with more greenhouse gas emissions. Data output in Sections V, IX, and X in the Appendix compare existing and future no-build data with results from proposed strategies.

# 4.4. SR 108 Freeway

The SR 108 Freeway was a hypothetical scenario used to illustrate optimal queuing and delay conditions as the result of an improvement in a model. System Planning and Goods Movement does not endorse this scenario as a solution to congestion challenges and safety needs in the corridor. The purpose of the scenario was to act as a point of comparison on the effects of an access-controlled facility with minimal vehicle conflict points.

The scenario applied to the SR 108 portion of the corridor from the SR 108/49 Split in the east end of the corridor to the west end of the corridor past Mackey Ranch Road. The only access point was with Stockton Road's connection to SR 108 at the SR 108/49 split. All other inputs from the Split past Mackey Ranch Road were removed from the scenario. Signals, crosswalks, and turning lanes were also removed or inactivated in Vissim. With free flow speeds set as high as 70 MPH, speed limits were set at 60 to 65 MPH for the entire highway from Stockton Road past Mackey Ranch Road. Map 36 shows the extent of this hypothetical-only scenario.

This scenario applied to sections of highway between PM 12.13 and PM 16.48. Therefore, comparisons were only made between this section of roadway and comparable sections from other strategies. For a complete set of comparisons, both within the SR 108 section of the corridor and for the complete corridor, refer to Appendix V.

- As expected, this hypothetical strategy (along with the lane-widening scenarios) had the lowest queue length value. This result also applied for conditions in 2040.
- Measurements of vehicle delay placed the freeway scenario in the top half of performers in 2018 and in 2040, but it did not have the lowest measure of delay.
- For LOS results in 2018 and 2040, the freeway scenario performed with results comparable to the most free-flow and best performance characteristics of LOS evaluation. Refer to Appendix V for detailed results.
- Under 2018 conditions, the freeway had the second highest vehicle volume after the nobuild alternative. Under 2040 conditions, it had the highest vehicle volume of all scenarios.
- Despite accruing the lowest queue length values and well-performing LOS scores, the freeway scenario had the fifth lowest GHG emissions in 2018 and the third lowest

emissions in 2040. This result may be an indication of the limited degree of GHG reductions due to vehicle speeds above 60 MPH and to a comparatively high number of volumes in existing and 2040 conditions.

• Refer to Appendix V.A and V.B, as well as Appendix X for data on this scenario.

#### Map 36: SR 108 Hypothetical Freeway



# 4.5. Active Transportation Path

The Active Transportation Path is a proposed strategy meant to address the needs of documented active transportation users in the corridor. A separated and protected path would also address the corridor's bicycle user stress, mitigate the highway's deficient LOS score for bicyclists and pedestrians, and provide further refuge from mainline vehicle volumes and speeds. A survey at Sonora High School was conducted to gauge community interest. This study also considered existing right of way constraints.

### Need

Camera counts documented pedestrians and bicyclists using the state highway in all count locations, even if four of the locations may have been undercounted for active transportation users. Table 46 listed the numbers of active transportation users at each location. When working at home was excluded, CTPP data from Census tracts in the corridor indicated seven percent of all work commutes in the corridor as pedestrian activity. Two percent of commuters in Census Tract 11 in Sonora were bicyclists commuting to Census Tract 12 next door. Table 46 shows the percentage of mode choice for commuting, and it shows the percentage of commuters in Census Tract 11 walking and cycling to work. Taking into consideration current gaps in sidewalks and bicycle lanes, observational data and commute mode data indicated existing need for bicycle and pedestrian infrastructure enhancements along the corridor. The Active Transportation Path is a proposed response to that need.

Location	Pedestrians	Bicyclists
Montezuma Junction	46	15
Chicken Ranch Road	13	22
Rawhide/Humbug	141	42
East of SR 108/49 Split	16	11
Fairgrounds Entrance	10,827*	53
Stockton/Washington	5,491	156
Shaw's Flat/Columbia Way	283	22
Parrott's Ferry	7	32
Total	16,824	353
*Counts taken during the 2018 Celtic Fa	ire	

Table 46: Active Transportation Camera Counts in the SR 108/49 Corridor, 2018

Table 47: CTPP Means of Commute Transportation in Tuolumne County, 2012-2016 U.S. Census ACS

Tract No.	Total	SOV	2 people	3 or more	Transit	Walking	Cycling	Work at Home
11	732	474	0	35	8	80	15	120
12	625	484	4	4	43	20	0	70
21	760	555	60	10	0	30	0	105
51	1,235	845	185	4	0	80	0	120
Total	3,352	2,358	249	53	51	210	15	415
% of Total	NA	70.3	7.4	1.5	1.5	6.3	0.45	12.4
SOV: single oc	cupancy veh	icle; No.: numb	er; NA: not app	olicable				

Table 48: CTPP Means of Commute Transportation in Tuolumne County Census Tract 11, 2012-2016 U.S. Census ACS

Tract No.	Total	SOV	2 People	3 or more	Transit	Walking	Cycling	Work at Home		
11	732	474	0	35	8	80	15	120		
% of Total NA 64.7 0 4.8 1.1 10.9 2.0 16.4										
SOV: single oc	cupancy veh	icle; No.: numb	er; NA: not ap	olicable						

Bicycle stress in the corridor was pegged at levels of three and four—conditions acceptable to experienced riders who expect high amounts of volume and speeds in excess of 30 and 35 MPH. The HDM designated that bicycle and pedestrian facilities must have a performance LOS at least comparable to that of LOS for vehicles. Active transportation LOS along the corridor was either less than the vehicular LOS or was at an existing LOS of 'E' or 'F'. Paved shoulder widths were fewer than eight feet in most areas. The lack of paved shoulders impeded bicyclists' abilities to access refuge when the mainline featured cars traveling at speeds greater than 30 and 35 MPH, or when the highway had congested traffic.

## Strategy

The strategy is the installation of a separated paved pathway for bicyclists and pedestrians (Map 37). By providing active transportation users an exclusive facility apart from the highway right of way, the path can benefit the corridor by potentially accomplishing the following: 1) lessening points of conflict on the state highway between cars and active transportation users, 2) providing space for a connected method of transportation that emits fewer greenhouse gases, and 3) lessening some local origin and destination auto VMT.

The alignment for this facility is like routes highlighted in the TCTC Jamestown to Columbia Complete Streets Corridor Plan in the 2016 RTP, shown in Map 38. The RTP also features proposed Tier 2 non-motorized projects that anticipate new revenue sources: CMAQ, ATP, and Cap and Trade. Under such funding, TCTC has identified several trails for non-motorized uses. Map 39 shows Alternative B Non-Motorized Projects from the RTP.

The separate facility would exist on portions of parallel facilities off the state highway, along with areas located adjacent to the state highway or on state right of way. The facility might start at Chicken Ranch Road and SR 108/49 and extend to a location near Parrott's Ferry Road and SR 49, connecting the Chicken Ranch Rancheria to Columbia College, as well as locations in between in Jamestown and Sonora. In locations adjacent to the state highway, a separated Class IV or Class I barrier between the pathway and the state highway would be advised.

A separated and protected facility has safety benefits. According to research at the University of Colorado Denver and the University of New Mexico, protected and separated facilities reduce the chances of accidents for bicyclists and cars.<sup>14</sup> A path for Jamestown and Sonora should be separated and protected from mainline traffic.

Gauging demand for an active transportation path is a step in studying possible multimodal routing. Further transportation data collection along routes may be necessary to gauge volumes. An analysis using detectors, Vissim, or Miovision is possible. The District 10 CAT Plan is a separate effort to study gaps and needs for bicyclists and pedestrians on and close to state highways. Among other locations in the district, the CAT Plan is collecting feedback from agency partners and the public in the Sonora and Jamestown area. In addition to safety benefits, an active transportation path would help meet the following goals:

Goal 2: Improve Vehicle Transportation Mobility in the Corridor

A. Objectives 2.1 through 2.3: Reduce vehicle delay, queueing, and VMT Goal 3: Improve Multimodal Access

A. Objectives 3.1 to 3.3: Lessen gaps in active transportation facilities, and lessen

gaps in protected and separated bicycle facilities

Goal 4: Reduce GHG emissions

A. Objectives 4.1 to 4.5: Lessening emissions and active transportation gaps

The viability of this strategy depends in part on existing right of way (RoW) availability along the highway. Refer to section 4.5.2 for a discussion on right of way considerations.

## Corridor-based Perspective

Table 49: AT Pathway Strategy Performance Ranking

2018 Conditions	9 out of 12
2040 Conditions	6 out of 11

The active transportation pathway performed better in 2040 than in 2018, showing greater reductions in queue length and delay than under existing conditions. In both conditions the strategy did reduce VMT, though GHG emissions increased. Mode shifting was set at 0.5 percent from SOVs to pedestrians and bicyclists each, amounting to one percent in total mode shift from cars to active transportation. This strategy warrants further research as it did show ability to reduce congestion on the state highway.

Table 50: AT Pathway Comparison of Strategy Performance and Rankings, 2018

Strategy/Project	Percent of Existing 2018 Conditions								
Strategy/Floject	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank		
Existing No-Build	100	100	100	100	100	500	7		
Active Transportation Pathway	201.4	138.5	97.1	126.6	110	673.6	9		

<sup>&</sup>lt;sup>14</sup> <u>Bloomberg CityLab Webpage: Protected Bike lanes Are Safer for Drivers, Too</u>

#### Table 51: Comparison of Strategy Performance and Rankings, 2040

Strategy/Project	Percent of Future Projected 2040 Conditions								
Strategy/Froject	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank		
Future No-build	100	100	100	100	100	500	9		
Active Transportation Pathway	52.1	97.3	99.8	103.1	104	456.3	6		

## Local Site Perspective

Under existing conditions, delay and queue length appeared to concentrate between the SR 108/49 split and the Rawhide Road intersection. Performance in this area accounted for the pathway's meager overall performance. Compared to the existing no-build condition, delay and queue length values performed well in the rest of the corridor.

VMT in the pathway scenario was less than the no-build condition in downtown Sonora, and VMT in Jamestown measured lower than the freeway and no-build scenarios. The all-strategies and Mackey Ranch improvement still produced lower VMT in Jamestown. GHG emissions in the pathway scenario performed better than the no-build condition in downtown and north of downtown, but the section between the SR 108/49 split and Rawhide Road produced emissions values that exceeded the no-build condition by up to four times. Values from this section accounted for the pathway's overall deficient emissions performance under 2018 conditions.

Patterns were similar in future conditions. GHG emissions were lower than the no-build condition in downtown, but emissions were higher in Jamestown. VMT was slightly lower south of downtown Sonora and in Jamestown than in the future no-build, but slightly higher in downtown Sonora. Queue length was lower in downtown Sonora, and it was half the amount of the no-build condition in Jamestown. LOS was the same throughout the corridor, except for a one-point increase in east of Chicken Ranch Road west of Jamestown. Delay was lower in downtown than under the no-build condition. The pathway scenario had the lowest delay figure of all scenarios for the location between the fairgrounds and the SR 108/49 split.

For a more detailed comparison on model results between the active transportation pathway and the no-build condition, refer to section V in the Appendix.

#### Map 37: Potential Active Transportation Path





#### Map 38: TCTC Jamestown to Columbia Complete Streets Corridor Plan



#### Map 39: TCTC Financial Alternative B Non-Motorized Projects

## 4.5.1. Active Transportation Survey at Sonora High

To determine if there was demand for an active transportation path, System Planning and Goods Movement conducted a survey of students at Sonora High School. The survey gauged if students would change modes of transportation if a paved Class IV or Class I bicycle path and pedestrian walkway were available.

If the Sonora School District applied for Safe Routes to School funds was a question asked to administrators only. The answer to the question was that the district had not applied for such funding.

Sonora High School was selected as a location for the survey because the school campus is adjacent to SR 49 and Downtown Sonora, placing it within the corridor. Most students and staff used cars to get to school Monday to Friday. This activity placed additional volume on the state highway contributing to congestion and delay. System Planning wanted to see if an active transportation path was an opportunity to reduce congestion in downtown by providing an alternative route for students. Sonora High School was selected because of its large participant sampling size compared to other schools in the area. The school was also selected because it has an administration that assisted in implementing the survey.

Out of 973 students who took the survey, response rates ranged from 81 to 98, or about eight to ten percent. Further surveying or research with partnership with the high school is suggested to achieve a higher response rate and better data verification.

The results of the survey indicated that 36.5 percent of students were dropped off at school, 25 percent drove themselves, 21 percent took the school bus, 10.5 percent carpooled, and seven percent biked or walked.

The survey found that 56 percent of students said they would not utilize an active transportation path if one were available, and that 73.5 percent of students said that there were challenges associated with active transportation that prohibited them from bicycling or walking to school. Of students that said there were challenges, 76.5 percent said distance from home to school was a reason, 62 percent said safety was a problem, 42 percent identified weather as a reason, and 8.5 percent said that the cost of a bicycle or a scooter was a factor. This follow-up question allowed students to select more than one reason. This allowance for more than one answer is why the percentages appeared to add to a value greater than 100.

Overall, results indicated that most students utilized cars to get to school and that students were reluctant to switch to active transportation mainly because of distance and safety. Any future transportation path near SHS would need to be one that connects residential areas to the school in ways that consider distance and safety for its users. Refer to Appendix VII.B. to review survey results from Sonora High School.

## 4.5.2. Right of Way Considerations on SR 108/49

The 2016 TCTC RTP listed Tier 1 and Tier 2 projects that would widen SR 108/49 to five lanes from Chicken Ranch Road to Stockton Road, and from Parrott's Ferry Road to the new intersection for the Greenley Extension north of downtown. A continuous left turn lane would continue from the Greenley Extension intersection on SR 49 to Columbia Way. In addition, the RTP contained proposed projects to install regional trails and bicycle lanes from Jamestown to Sonora High School, and from the high school to Columbia College.

According to the HDM, a five-lane conventional highway requires at least eight feet of paved shoulder on both sides. A preliminary summing of widths of five lanes for vehicular traffic, paved shoulders, and a twelve-foot wide separated pathway for bicycles and pedestrians resulted in a total of about 90 feet of needed RoW. The following map, Map 40, showed estimated RoW widths in the corridor study area based on Caltrans District 10 RoW maps. The map provided an overview of which areas along the state highway might accommodate a five-lane widening with paved shoulders and a separated active transportation path. The map also provided a basic view of easement locations. The map could be used as a basic gauge of RoW feasibility for future multimodal improvements; however, verification of RoW measurements with the Division of Right of Way would be needed for an up-to-date and detailed understanding of existing constraints.

Locations with easements and less than generally 90 feet of RoW presented possible constraints for the development of an active transportation path along the highway in combination with a five-lane facility. However, most sections in the corridor study area appear to have RoW available for an adjacent active transportation facility. At least 50 percent of locations might have had at least 90 feet for the inclusion of a separated active transportation path that would run adjacent to the highway. RoW locations in downtown Sonora were not examined due to spatial constraints with downtown's historical built environment and traffic volumes, as well as proposed bicycle lanes and regional trails, based on maps in the RTP, not utilizing Washington Street in downtown. Local topographical considerations such as slopes and hill embankments adjacent to the highway, or the excavation thereof, were not examined as part of depicting extant RoW width.

#### Map 40: Right of Way Widths



# 4.6. Shaw's Flat Improvement

Figure 65: Intersection Improvement at Shaw's Flat



Figure 66: Intersection Improvement at Shaw's Flat



Vision Sonora includes the SR 49 North Gateway Corridor Project, which includes a proposal to develop a roundabout at the Columbia Way/Shaw's Flat/SR 49 intersection next to the high school. The purpose of the roundabout is to improve vehicle operations and to facilitate better connected pedestrian crossings. There is a listed RTP Tier 1B intersection and Complete Streets improvement on SR 49 at the same intersection. Map 41 features the location of the proposed roundabout and Figure 65 shows a Vision Sonora roundabout design used in the Vissim simulation. What is advised for future study is conducting an ICE that will compare a signal installation at the intersection with a roundabout. This evaluation will provide further data regarding which is more effective in improving the condition of the highway north of downtown: a roundabout or a signal.

With fewer points of vehicle conflict than conventional intersections, the roundabout can act as a safety enhancement. According to the American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA), roundabouts have an 82 percent reduction in severe crashes when compared to a two-way stop intersection.<sup>15</sup> Compared to a signalized intersection, the reduction in severe vehicle crashes is 78 percent. However, roundabouts will not improve pedestrian LOS, and their safety benefits for active transportation users depends on context-sensitive local traffic behavior and Complete Streets design elements beyond the presence of a roundabout itself. That said, roundabouts also reduce pedestrian exposure by reducing the number of conflict points from 24 to eight when compared to a four-legged signalized intersection.

### Corridor-based Perspective

#### Table 52: Shaw's Flat Strategy Performance Ranking

2018 Conditions	10 out of 12
2040 Conditions	10 out of 11

The Shaw's Flat roundabout strategy did not perform well in simulated conditions. After simulation runs under 2018 conditions, this scenario showed increases in queue length, vehicle delay, and small increases to emissions. It also showed a worse-performing LOS score than the no-build condition. This scenario ranked tenth best out of twelve scenarios in 2018 conditions. Performance indicator values also fared worse in 2040 conditions, with exception to VMT (VMT also was lower in 2018 conditions). This model simulation under future conditions led to the Shaw's Flat roundabout scenario performing tenth out of eleven scenarios. This scenario appeared non-effective at meeting most goals and objectives identified earlier in this study.

#### Table 53: Shaw's Flat Comparison of Strategy Performance and Rankings, 2018

Stratogy/Broject	Percent of Existing 2018 Conditions						
Strategy/Floject	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Existing No-Build	100	100	100	100	100	500	7
Shaw's Flat Intersection	188.4	185	83	101.3	130	687.7	10

#### Table 54: Comparison of Strategy Performance and Rankings, 2040

Stratogy/Project	Percent of Future Projected 2040 Conditions						
Strategy/Project	Queue Length	Delay	VMT	LOS	Score	Rank	
Future No-build	100	100	100	100	100	500	9
Future Shaw's Flat Intersection	127.7	141.7	99.5	117.9	128	614.8	10

## Local Site Perspective

Measures on vehicle delay, queue length, and LOS show greater congestion near the intersection where the roundabout would be installed. In fact, indicators for delay, queue length, and deficient LOS are highest with the Shaw's Flat roundabout at the Columbia Way/Shaw's Flat intersection than they were with indicators at this location with all other scenarios. The node collection zone south of the intersection exhibited high values. These performance indicators

<sup>&</sup>lt;sup>15</sup> FHWA Website: Proven Countermeasures Roundabouts

showed congestion at this location in both 2018 and 2040 conditions. The roundabout registered lower numbers for vehicle volumes in 2018 and 2040 conditions than the no-build conditions. This was likely because of increased queue length and delay preventing more vehicles from entering and passing through the simulated model network. For a more detailed comparison on model results between the roundabout strategy and the no-build condition, refer to sections V, IX, and X in the Appendix.

Even though the roundabout did not rank well compared to other scenarios, it may have merit as a strategy if its purpose is to slow down vehicles near the high school and before entering downtown. Slowing down vehicles on a conventional highway in built environments can be a safety enhancement. Roundabouts also reduce pedestrian exposure by reducing the number of conflict points from 24 to eight.



#### Map 41: Proposed Columbia Way Intersection Improvement Location

# 4.7. Rawhide Bridge Realignment

Figure 67: Plan View of Rawhide Bridge and Intersection Realignment



The Rawhide Bridge and intersection realignment in Jamestown near the Rawhide and SR 108/49 intersection is listed in the 2016 RTP as a Tier 1A improvement. The purpose of this project is to improve traffic operations at the intersection. Map 42 shows the location of the project.

In addition to the realignment and construction of a new two-lane bridge that replaces the existing one-lane bridge, the project will move the Rawhide/SR108/49 intersection to a location further east that is suitable for the new bridge alignment. The new intersection will link Rawhide Road with North Main Street in Jamestown. The project will also turn Jamestown Road into right in/right out access to the state highway, accessible only to the westbound direction of the state highway.

The model simulated the proposed improvement using a configuration of Jamestown Road that allowed right-in and right-out access from and to westbound SR 108/49. Figure 67 shows a plan view of the current proposal.

An examination of the new Fifth Avenue signal and its coordination with Rawhide Road is featured in a separate scenario. As these two signals are close to each other, coordination is necessary to mitigate congestion and queues. Studying the delay and queuing characteristics of traffic would give a clearer understanding of how the two signals affect behavior along this section of the state highway.

A simulation in 2040 using the bridge and intersection realignment scenario was also tested using Synchro 10 between the Rawhide Road and Fifth Avenue intersections. The data showed reduction in delay with coordinated and optimized signal timing. Refer to section 4.13 to see the results of that simulation.

### Corridor-based Perspective

#### Table 55: Rawhide Realignment Strategy Performance Ranking

2018 Conditions	3 out of 12
2040 Conditions	7 out of 11

The Rawhide intersection and bridge realignment scenario was one of the better performing scenarios in simulation, especially in 2018 conditions. After simulation runs under existing conditions, this scenario showed a reduction in queue length, vehicle delay, VMT, and emissions. It also showed a better-performing LOS score. This scenario ranked third best out of twelve scenarios in 2018 conditions. Improvements in performance indicator values were also noted in 2040 conditions, with exception to queue length. This model simulation under future conditions led to the realignment scenario performing seventh best out of eleven scenarios. This scenario appeared effective at meeting most goals and objectives identified earlier in this study.

#### Table 56: Rawhide Realignment Comparison of Strategy Performance and Ranking, 2018

Stratogy/Project	Percent of Existing 2018 Conditions						
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Existing No-Build	100	100	100	100	100	500	7
Rawhide Realignment	29.2	56	81.7	61	74	301.9	3

#### Table 57: Comparison of Strategy Performance and Rankings, 2040

Stratogy/Project	Percent of Future Projected 2040 Conditions							
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank	
Future No-build	100	100	100	100	100	500	9	
Future Rawhide Realignment	123.3	88.6	98.4	87.5	93	490.8	7	

### Local Site Perspective

From the consideration of the Jamestown location where the realignment would be located, the simulation gave queue lengths, delay figures, and emissions output that were lower than other scenarios, except for the lane-widenings, the all-strategies scenario, and the SR 108 hypothetical freeway. The simulation also generated favorable LOS scores compared to other scenarios, with exception to the lane widenings, the all-strategies, and the freeway.

This strategy produced better results under existing conditions than in 2040 conditions. In 2040 conditions, the realignment produced queue lengths higher than other scenarios but generated LOS scores comparable to other proposed scenarios. Of course, the lane widenings, the all-strategies scenario, and the freeway produced better LOS values. The Mackey Ranch roundabout strategy had a more deficient LOS score at the location of the proposed realignment. The realignment in 2040 produced a delay value that was lower than other scenarios, except for

the lane widenings, the all-strategies, and the hypothetical freeway. The realignment produced emissions values higher than all scenarios except the roundabout strategies.

For a more detailed comparison on model results between the intersection and bridge realignment and the no-build condition, refer to sections V, IX, and X in the Appendix.

Map 42: Location of Rawhide Realignment



# 4.8. Mackey Ranch Road Improvement

Figure 68: Mackey Ranch Intersection Improvement



There is a proposed project to install a roundabout at Mackey Ranch Road and SR 108/49. This improvement would become the new main entrance into the reservation of the Chicken Ranch Rancheria of Me-Wuk Indians, replacing Chicken Ranch Road as the primary entrance to the reservation and the casino. Simulations were performed for existing no-build and roundabout scenarios, as well as for 2040 projections. The roundabout scenario with adjusted traffic routing and volumes took into consideration the new entrance diverting most traffic away from Chicken Ranch Road. Ninety percent of east-bound existing traffic using Chicken Ranch Road to access the highway was model diverted to the proposed roundabout further south. Results below were from the scenario that featured the roundabout with adjusted traffic routing.

An ICE Step II study was completed in December 2019. That study found the roundabout option to be the preferred option for reducing vehicle delay and for reducing the severity of accidents. Caltrans departments, TCTC, the Chicken Ranch Rancheria of Me-Wuk Indians of California, and the Tribe's consultant have expressed support for the roundabout option over the signalized alternative.

With fewer points of vehicle conflict than conventional intersections, the roundabout can act as a safety enhancement. According to AASHTO and the FHWA, roundabouts have an 82 percent reduction in severe crashes for vehicles when compared to a two-way stop. Compared to a signalized intersection, the reduction in severe crashes is 78 percent. However,

roundabouts will not improve pedestrian LOS, and their safety benefits for active transportation users depends on context-sensitive local traffic behavior, and Complete Streets design elements beyond the presence of a roundabout itself. That said, pedestrian conflict points in roundabouts drop from 24 to eight when compared to a signalized four-legged intersection.

## Corridor-based Perspective

#### Table 58: Mackey Ranch Intersection Strategy Performance Ranking

2018 Conditions	8 out of 12
2040 Conditions	11 out of 11

The Mackey Ranch roundabout strategy did not perform well in simulated conditions. After simulation runs under 2018 conditions, this scenario showed increases in queue length, vehicle delay, and emissions. It also showed a worse-performing LOS score than the no-build condition. This scenario ranked eighth best out of twelve scenarios in 2018 conditions. Performance indicator values also fared worse in 2040 conditions, with exception to VMT (VMT also was lower in 2018 conditions). This model simulation under future conditions led to the Mackey Ranch roundabout scenario performing last out of eleven scenarios. This scenario appeared non-effective at meeting most goals and objectives identified earlier in this study.

#### Table 59: Mackey Ranch Intersection Comparison of Strategy Performance and Rankings, 2018

Stratogy/Project	Percent of Existing 2018 Conditions						
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Existing No-Build	100	100	100	100	100	500	7
Mackey Ranch Intersection	161	135	95	125	110	626	8

#### Table 60: Comparison of Strategy Performance and Rankings, 2040

Stratogy/Project	Percent of Future Projected 2040 Conditions							
Strategy/Project	Queue Length	Queue Length Delay VMT GHG Emissions LOS				Score	Rank	
Future No-build	100	100	100	100	100	500	9	
Future Mackey Ranch Intersection	166	182	96	183.7	138	766	11	

### Local Site Perspective

Under examination at the location of the proposed change, this scenario showed the most queue length and delay when compared to other scenarios at the Mackey Ranch/Sierra Rock Road intersection. The LOS score measured at this location was also the most deficient compared to the ones for other scenarios at this location. These results were comparable for both 2018 and 2040 conditions. This scenario also had the highest emissions at its proposed location under both 2018 and 2040 conditions.

Like the roundabout scenario at Shaw's Flat close to the high school, this scenario may have merit if its intention is to slow vehicle traffic speed at the location of installation. As mentioned earlier, this strategy may also have safety benefits. For a more detailed comparison on model results between the roundabout and the no-build condition, refer to sections V, IX, and X in the Appendix.
## 4.9. Four Lane Widening on SR 108/49

#### Figure 69: Four Lane Widening Strategy



System Planning used Vissim to model a scenario that included a four-lane widening of SR 108/49 from Chicken Ranch Road to the SR 108/49 split, and north of downtown on SR 49 from O'Hara Drive to the Parrott's Ferry intersection. The TCTC 2016 RTP lists lane expansion on SR 108/49 as Tier I improvements. There is another scenario in this corridor study that models a five-lane improvement. Such a scenario is the same as the four-lane improvement, except that the five-lane enhancement includes more center two-way left turn lanes, unlike the four-lane scenario. Figure 69 shows a four-lane scenario between the Rawhide Road and Fifth Avenue intersections.

The purpose of this scenario is to determine if lane expansion reduces delay, queueing, and emissions. However, lane expansion is not eligible for SB 1 funding. SB 1 is meant for maintenance projects, as well as multimodal and active transportation investments that reduce congestion and delay, and that enhance safety in a corridor area. However, public comment and feedback has indicated that lane widening scenarios may enable SR 108/49 to serve as an emergency evacuation route in the event of a forest fire. Further analysis and modeling on highways acting as evacuation routes is advised.

A simulation in 2040 using the four-lane scenario was also tested using Synchro 10 between the Rawhide Road and Fifth Avenue intersections. The data showed reduction in delay with coordinated and optimized signal timing. Refer to section 4.13 to see the results of that simulation.

## **Corridor-based Perspective**

#### Table 61: Four Lane Strategy Performance Ranking

2018 Conditions	2 out of 12
2040 Conditions	3 out of 11

Expansion to four lanes performed well in simulation, finishing second out of twelve scenarios in 2018 conditions and third out of eleven in 2040 conditions. The lane-widening scenario showed the most decrease in queue length, as well as clear decreases in vehicle delay and emissions. Along with the five-lane scenario, it also showed the best-performing LOS score over the no-build condition. Performance indicator values also fared better in 2040 conditions, with exception to a higher VMT count. This scenario was effective at meeting goals and objectives identified earlier in this study.

#### Table 62: Four Lane Comparison of Strategy Performance and Rankings, 2018

Stratogy/Project	Percent of Existing 2018 Conditions						
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Existing No-Build	100	100	100	100	100	500	7
4-lane Widening	1.6	35.3	97.9	65.3	60.9	261	2

#### Table 63: Comparison of Strategy Performance and Rankings, 2040

Stratogy/Project	Percent of Future Projected 2040 Conditions						
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Future No-build	100	100	100	100	100	500	9
4-lane Widening	0.8	29.2	111.7	55.6	51.7	249	3

## Local Site Perspective

The four lane-widening simulation produced the lowest queue lengths and lowest delay figures at the locations where the change would be built, which were on the SR 108 portion of the corridor and on the SR 49 portion north of Sonora. The only locations in the corridor that registered any queue length under the lane widening simulation were north and south of the Shaw's Flat intersection. This location would be physically unaffected by the lane widening strategy. The node data collection points north and south of the Shaw's Flat intersection also had the highest delay figures under lane expansion. This scenario also generated the most favorable LOS scores compared to other scenarios. Emissions levels were high in the SR 108 portion of the corridor compared to levels within the same scenario in other locations in the corridor. This is the case for 2018 and 2040 conditions.

In 2040 conditions, the scenario performed well with queue length reduction in the Jamestown area, although the five-lane scenario, the hypothetical SR 108 freeway, and the all-strategies scenario still returned lower queue length rates. A similar pattern of results occurred with delay: the strategy performing well, but not as well as the five-lane scenario, the SR 108 freeway, or the all-strategies scenario. The same pattern emerged for emissions: the four-lane scenario emissions were lower than the no-build's, but they were higher when compared to those of the

same three other scenarios. LOS values for the SR 108 section were better than the future nobuild condition, but they were second best compared to the five-lane scenario.

For a more detailed comparison on model results between the four-lane widening and the nobuild condition, refer to sections V, IX, and X in the Appendix.

## 4.10. Five Lane Widening on SR 108/49

The five-lane scenario covered the same locations as the four-lane scenario. They were the same, except that the five-lane variation included extended center-lane auxiliary turning lanes at all intersections. The four-lane strategy included no more center turn lanes than what already existed. Like the four-lane scenario, the purpose was to determine if expansion reduced delay, queueing, and emissions. Lane expansion is not eligible for SB 1 funding.

### **Corridor-based Perspective**

#### Table 64: Five Lane Strategy Performance Ranking

2018 Conditions	1 out of 12
2040 Conditions	1 out of 11

The five-lane scenario performed best, finishing first in both 2018 and 2040. It showed improvements in all indicators, except for an increase in VMT in 2040. It had the second-best queue length value in 2018 after the four-lane scenario. The scenario had the biggest decreases in delay and emissions in 2018, as well as a tie with the four-lane scenario for the best performing LOS. In 2040, the scenario had the best queue length and LOS. The five-lane scenario had the second-best delay and emissions score after the all-strategies scenario.

#### Table 65: Five Lane Comparison of Strategy Performance and Rankings, 2018

Stratogy/Project	Percent of Existing 2018 Conditions						
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Existing No-Build	100	100	100	100	100	500	7
5-lane Widening	1.9	34.3	86.7	58.4	60.9	242.2	1

#### Table 66: Comparison of Strategy Performance and Rankings, 2040

Strategy/Project	Percent of Future Projected 2040 Conditions						
Strategy/Froject	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Future No-build	100	100	100	100	100	500	9
5-lane Widening	0.5	25.3	102.6	49.8	48.3	226.5	1

### Local Site Perspective

As with the four-lane scenario, the five-lane scenario exhibited no queue length along the SR 108 portion. The only queue length measure in the simulation was located near the Shaw's Flat intersection. 2040 conditions also showed little to no queue length in the sites of proposed changes. As with the four-lane scenario, volumes were highest in the SR 108 section of the corridor area. Volumes were high along the SR 108 portion in 2040.

LOS measures performed well at sites of proposed changes, and delay in 2018 conditions at sites of change was lower among the widening scenarios than for any other scenario. The freeway and all-strategies scenarios in 2040 conditions featured delay comparable to lane widening strategies. In both 2018 and 2040 conditions, emissions levels were high in the SR 108 portion compared to values within the same scenario but at other locations. However, emissions were highest south of Parrott's Ferry Road. This may be due to faster speeds in that section. Compared to other scenarios, emissions in the SR 108 section was low in both 2018 and 2040 conditions. For more comparison between the five-lanes and the no-build, refer to sections V, IX, and X in the Appendix.

## 4.11. Greenley Extension to SR 49

The Greenley Extension is not just a volume and congestion reduction strategy for downtown Sonora. It is also a multimodal strategy with potential benefits for pedestrian activity in downtown. Through reduction of vehicle volumes (a change more readily seen in macrosimulation), the bypass had the indirect active transportation benefit of lessening levels of stress for pedestrians. The strategy may also have an environmental benefit, as GHG emissions declined in downtown compared to conditions without the bypass.



#### Figure 70: Greenley Extension in Vissim





This scenario modeled traffic behavior after the installation of the Greenley Extension. 2040 conditions were used to show how the Greenley may affect congestion and delay in the corridor, particularly in downtown Sonora. Unlike the 2040 growth rate used for other scenarios not including the Greenley Extension, the growth rate used in scenarios with the Greenley Extension factored in the inclusion of the bypass.

2040 turning movement estimates based on traffic demand model inputs were also needed to model the percentage of traffic the Greenley removed from southbound SR 49 into Sonora. This turning movement ratio was applied to 2040 model scenarios in Vissim, regardless of differences in volumes between the scenarios. The turning movements can provide a general understanding of the ratio of volumes and turning movement decisions.

For traffic input going westbound on the Greenley Extension into the proposed intersection, an approximate 5.5 percent volume growth rate was applied from existing 2018 to 2040 projected conditions. Figure 71 shows estimated turning movements at the Greenley intersection with SR 49 using 2040 volumes.

Like what was shown in TransCAD simulation earlier, the Greenley Extension did lead to a reduction in vehicle volume through downtown Sonora. The Extension acted as a local bypass for vehicles wanting to circumvent downtown in route to destinations in East Sonora. Public comment and feedback indicated support for this bypass strategy, as well as the possibility of this strategy acting as an emergency evacuation route during a forest fire.

### **Corridor-wide Perspective**

The Greenley Extension was modeled only under 2040 conditions. Results indicated that the proposed bypass did lead to performance indicators that were better than the future no-build condition. The strategy ranked eight out of eleven in 2040 and ranked one spot higher than the no-build condition. With exception to queue length, the Extension showed indicators all performing better than the no-build condition.

#### Table 67: Greenley Extension Strategy Performance Ranking

2040 Conditions	8 out of 11

Table 68: Greenley Extension Comparison of Strategy Performance and Rankings, 2040

Strategy/Project	Percent of Future Projected 2040 Conditions						
Strategy/Froject	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Future No-build	100	100	100	100	100	500	9
Greenley Intersection	104	94	98.4	98.4	96.2	491	8

### Local Site Perspective

The local site perspective for this scenario was downtown Sonora, as the purpose of this scenario was to improve congestion in downtown by routing some traffic on a bypass. Simulations showed that queue length dropped in downtown with figures representing 18 percent of the no-build condition value. Volume came to 94.3 percent of the future no-build condition value, ranking the Extension third best among all scenarios for VMT reduction in downtown in 2040 conditions. LOS performance in simulation was better than the no-build condition. Delay in downtown dropped with the Extension in 2040 conditions, amounting to 67.4 percent of the no-build value. Emissions in downtown dropped with the Extension was effective in reducing congestion and delay in downtown. For more comparison of results between the Extension and the no-build condition, refer to sections V, IX, and X in the Appendix.

## 4.12. All Strategies Scenario

System Planning devised existing and 2040 projected volumes conditions that featured several strategies into one scenario. The purpose was to evaluate how multiple strategies affected highway performance at once. This scenario incorporated a corridor length of 8.275 miles from Mackey Ranch Road to Parrott's Ferry Road. Strategies included in this scenario were as follows in no order of importance:

- 1. Mackey Ranch Road intersection strategy
- 2. Rawhide Road bridge and intersection strategy
- 3. Shaw's Flat intersection improvement at SR 49
- 4. Five-lane widening south and north of Sonora
- 5. Greenley Extension intersection with SR 49 north of Sonora

The modeled strategies not included in an all-strategies scenario were no-build strategies, the freeway scenario, and the signal timing coordination and optimization strategy.

## Corridor-wide Perspective

The all-strategies scenario finished sixth out of twelve scenarios in 2018 conditions, and it finished second out of eleven under 2040 conditions. The scenario did better than the no-build conditions in both 2018 and 2040. With exception to LOS, this scenario showed improvement in all performance indicators in 2018 conditions. The all-strategies scenario under 2040 conditions showed improvement in all performance indicators.

#### Table 69: All Strategies Strategy Performance Ranking

2018 Conditions	6 out of 12
2040 Conditions	2 out of 11

#### Table 70: All Strategies Comparison of Strategy Performance and Rankings, 2018

Stratogy/Project	Percent of Existing 2018 Conditions						
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Existing No-Build	100	100	100	100	100	500	7
All Strategies	81.8	97.8	93	96	105	473.6	6

#### Table 71: Comparison of Strategy Performance and Rankings, 2040

Stratogy/Project	Percent of Future Projected 2040 Conditions						
Strategy/Project	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Future No-build	100	100	100	100	100	500	9
All Strategies	0.7	31.3	88	51.6	65.4	237	2

## Local Site Perspective

Though this strategy performed well overall, the all-strategies scenario produced the second highest queue length measures of all scenarios in downtown in 2018 conditions, although queue lengths were much lower in the Jamestown area. Volumes in downtown were lower in 2018 conditions than they were for the no-build. LOS scores in downtown were two points more deficient than in no-build conditions. Delay in downtown in 2018 conditions was the second highest of all scenarios, including higher than the no-build condition in that location, and was second only to the delay figure for the Shaw's Flat roundabout strategy. Emissions in downtown were the Shaw's Flat roundabout strategy.

The all-strategies scenario performed well with queue lengths in downtown in 2040, registering the second lowest queue length value for all scenarios. The strategy had the lowest volumes in downtown in 2040 of all scenarios. The strategy had one of the better-performing LOS scores in downtown in 2040, achieving an improvement of one point less than the future no-build. It registered the second lowest delay figure in downtown, second only to the five-lane widening strategy. The all-strategies scenario in simulation achieved the second lowest emissions score in downtown, second only to the five-lane widening strategy. Like observations about this

strategy from a corridor-wide perspective, the all-strategies did well in downtown Sonora in 2040 conditions. It also did well, compared to most strategies, when examined in the Jamestown area in 2040. This strategy showed at least some degree of effectiveness reducing congestion in the future.

For more comparison of results between the Extension and the no-build condition, refer to sections V, IX, and X in the Appendix.

## 4.13. Signal Timing Adjustments

The Office of Travel Forecasting used another microsimulation to test changes to signal timings at the SR 108/49 and Rawhide Road intersection, and at the SR 108/49 and Fifth Avenue intersection. The purpose of this test was to see if changes to timings could reduce delay and improve mainline performance in areas close to the intersections. Synchro was used as the modeling software. Both existing 2018 and projected Tuolumne Model 2040 conditions were modeled. Figure 72 shows the location for the signal timing simulations. While Vissim used a non-standard metric for LOS values, Synchro used HCM-based LOS evaluation for operations performance.

Figure 72: Signal Timing Adjustments Location



The operations of the two intersections were evaluated using the existing uncoordinated signal timings as well as using coordinated and optimized signal timings. Through coordination and retiming of the two signals, LOS for the Fifth Avenue and SR 108/49 intersection was expected

to improve from LOS 'E' (unacceptable<sup>16</sup>) to LOS 'C' (acceptable), while the LOS for Rawhide Road and SR 108/49 was expected to be unchanged at LOS 'D'. Because SR 108/49 in this location was on the IRRS, a LOS of 'D' was not acceptable. Minimum concept LOS in rural areas of state highways on the IRRS was 'C'.

### Comparison to Other Scenarios

Unlike scenarios modeled in Vissim, the signal timing and optimization scenario was constructed using a section of SR 108/49 from Rawhide Road to Fifth Avenue near Jamestown. This limited span in geographical coverage meant that a corridor-wide perspective of this scenario's effects was not possible. Regardless, the comparison that did occur was purely based on how well the signal timing adjustments changed highway performance from the no-build condition.

Ranking this scenario with other ones was then done by gauging its percentage improvement over the no-build compared to improvements of other strategies over their no-build conditions. The results were shown in Tables 43 and 44 on page 161. The drawback of these tables was that they compared a strategy of about one mile in length with strategies that were generally eight miles. Such a comparison may be unfair to strategies with longer center-line mileage.

To account for this discrepancy, a comparison was made using highway data points near the Rawhide and Fifth Avenue intersections. This enabled a more proportional and equal geographical comparison between the Synchro signalization scenario and the Vissim scenarios. Results are contained in Table 61. Using this local form of comparison, the signal optimization and timing strategy performed seventh best among twelve scenarios in 2018 and fifth best among eleven scenarios in 2040. Synchro simulation revealed that signal timing adjustments made general improvements to queue length, delay, and LOS under 2018 conditions.

#### Table 72: Signal Timings Strategy Performance Ranking

2018 Conditions	7 out of 12
2040 Conditions	5 out of 11

#### Table 73: Signal Timings Comparison of Strategy Performance and Rankings, 2018

Stratogy/Broject	Percent of Existing 2018 Conditions						
Strategy/Froject	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Existing No-Build	100	100	100	100	100	500	8
Signal Timing Adjustments	90	73.5	100	100	77.8	441.3	7

#### Table 74: Comparison of Strategy Performance and Rankings, 2040

Stratogy/Droject	Percent of Future Projected 2040 Conditions						
Strategy/Froject	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank
Future No-build	100	100	100	100	100	500	7
Signal Timing with Other Adjustments	122	29.6	100	100	66.7	418.3	5

## Local Site Perspective

<sup>&</sup>lt;sup>16</sup> 2018 Tuolumne County General Plan, Volume I: General Plan Policy Document, Chapter 4 – Transportation Element

Improvement was observed with queuing. The queue lengths are expected to be shorter for all the protected left-turn movements (except one) after the signals are retimed and coordinated; and all the 95<sup>th</sup> percentile queue lengths<sup>17</sup> are expected to be contained within the left-turn pockets. Volumes from a weekday PM peak hour are used for this analysis, since weekend and holiday data are not available currently. But as illustrated using just the PM peak hour data, by retiming and coordinating the signals, driver experience going through these intersections is expected to improve. Operations from the two timing-schemes are summarized in Table 75.

Scenario	Location	Average Delay (sec.)	LOS	95% Q (ft.)	Storage Length (ft.)		
2019 with Existing Timing	Rawhide Rd	43.2	D	112 (EBL) / 42 (WBL)	200 (EBL) / 120 (WBL)		
2019 with Existing Timing	Fifth Avenue	63.4	E	74 (EBL) / 72 (WBL)	130 (EBL) / 120 (WBL)		
2019 with Coordination and Optimized Timing	Rawhide Rd	49	D	94 (EBL) / 30 (WBL)	200 (EBL) / 120 (WBL)		
2019 with Coordination and Optimized Timing	Fifth Avenue	29.3	С	57 (EBL) / 89 (WBL)	130 (EBL) / 120 (WBL)		
Results are estimated using methodology described in the Highway Capacity Manual 6th Edition and using p.m. peak hour data. Q: queue length; ft.: feet; EBL: east bound lane; WBL: west bound lane; Rd: road							

Tabla <sup>1</sup>	75.	Intersection	Operations	Signal	Timing	Stratogio	e Evicting	Conditions
lanc	10.	Intersection	Operations	Signal	TITITI	Slialeyle	s, Laisung	Conditions

The Synchro simulations showed that signal coordination and optimized timings in existing conditions at Fifth Avenue did accomplish Goal 2 Objective 2.1., reduction of vehicle delay, and Objective 2.2., reduction of queuing.

Using forecasted 2040 PM peak hour turn volumes derived from the Tuolumne County Model and without any changes to the intersections' geometries, both Rawhide Road and Fifth Avenue intersections were projected to fail operationally despite coordination and optimization of signal timings. Both intersections qualified as LOS 'F'. Additionally, the left-turning queues were expected to exceed the pocket lengths in all but one of the instances.

With the Rawhide Road bridge and intersection realignment strategy (see Figure 98), improvement in 2040 delay occurred on both Rawhide and SR 108/SR 49 and Fifth Avenue and SR 108/SR 49 intersections. However, both failed operationally, only achieving a LOS of 'E'. Coordination with the realignment strategy did accomplish Goal 2 Objective 2.1., reduction of vehicle delay, at least in the studied location.

If there was a four-lane widening on SR 108/49 from Rawhide Road to Fifth Avenue, these two signalized intersections would see their operations improve to LOS 'D' for both. See Table 76 below for these two intersections estimated 2040 operational statistics without and with SR 108/49 intersection realignment and the lane widenings. Signal coordination with four lanes did achieve Goal 2 Objective 2.1, reduction of vehicle delay, at least in the studied location. Turn storages are not listed in the table because their lengths will be determined according to analysis.

<sup>&</sup>lt;sup>17</sup> The estimated length of queue where the queues formed can be expected to be this length or less 95% of the time.

#### Table 76: Intersection Operations Signal Timing Geometric Strategies, 2040 Conditions

Scenario	Location	Average Delay (sec.)	LOS	95% Q (ft.)
2040 Coordination and Optimized Timing	Rawhide Rd	130.1	F	298 (EBL) / 27 (WBL)
2040 Coordination and Optimized Timing	Fifth Avenue	136.2	F	146 (EBL) / 510 (WBL)
2040 Coordination and Optimized Timing with the Rawhide Bridge and Intersection Realignment	Rawhide Rd	59.8	E	268 (EBL) / 369 (WBL)
2040 Coordination and Optimized Timing with the Rawhide Bridge and Intersection Realignment	Fifth Avenue	67.5	E	338 (EBL) / 486 (WBL)
2040 Coordination and Optimized Timing with four-lane widening on SR 108/49 between Rawhide and Fifth Avenue	Rawhide Rd	38.5	D	174 (EBL) / 221 (WBL)
2040 Coordination and Optimized Timing with four-lane widening on SR 108/49 between Rawhide and Fifth Avenue	Fifth Avenue	48.2	D	274 (EBL) / 323 (EBL)

Results are estimated using methodology described in the Highway Capacity Manual 6th Edition and using PM peak hour data. **Q**: queue length; **ft**.: feet; **EBL**: east bound lane; **WBL**: west bound lane; **Rd**: road

## 4.14. Node-based Results, 2018

The following charts compared Vissim simulation results based on node location. This method made it possible to visually see how strategies compared with each other and how they compared throughout the length of the corridor. Charts depicted strategy performance under 2018 and projected 2040 conditions.





#### Figure 74: Vissim Scenarios Volumes, 2018











Figure 77: Vissim Scenarios CO Emissions, 2018



## 4.15. Node-based Results, 2040









Figure 80: Vissim Scenarios LOS Scores, 2040





#### Figure 81: Vissim Scenarios Delay Measures, 2040





## 4.16. Macrosimulation and Bypasses

The following three scenarios focused on volume reduction through downtown Sonora through the modeling of a proposed bypass. Macrosimulation using TransCAD was used to test strategies to determine if bypasses reduced volume. The three strategies tested in macrosimulation were as follows:

- 1. The Greenley Extension located east of downtown Sonora
- 2. A western bypass option from Tuttletown to Montezuma Junction and SR 108/49
- 3. A western bypass from Tuttletown to Bell Mooney/Harvard Mine Roads and SR 108/49

Table 77 below indicates the results from modeling based on no-build conditions and proposed bypass changes. Modeling was done based on projected 2040 volume conditions.

Table 77: Downtown Sonora Volume Comparison of Strategy Performance and Rankings with and Without Bypasses

Strategy/Project	Volume**	Percent of No-build Volume	Rank of Effectiveness***	
2040 No-build TransCAD	18,998	100	4	
Greenley Extension	16,432	86.5	1	
Montezuma Junction Western Bypass*	16,305	85.8	2	
Bell Mooney Western Bypass*	16,380	86.2	3	
DNA: data not available				

DNA: data not available

\*Both strategies incorporated simulations that already included installation of the Greenley Extension into 2040 projected model \*\*Volumes in Downtown Sonora based on origin/destination studies using the Tuolumne TransCAD model \*\*\* 1 = most effective at reducing volume; 4 = least effective at reducing volume

## 4.16.1. Greenley Extension

The Greenley Extension is a proposed connection of Greenley Road between Lyons Bald Mountain Road and SR 49 between Jack Page Road and Pesce Way north of downtown Sonora. Map 43, retrieved from page 129 of the TCTC 2016 RTP, shows the Extension's general location. Section 4.11 covered this same strategy as tested in microsimulation using Vissim. This section covers Greenley Extension results as tested in macrosimulation using TransCAD.

#### Map 43: Greenley Extension Location



The purpose of the extension is to reduce congestion on SR 49 in downtown by giving motorists whose destination is not downtown the option of bypassing it to the east. The extension would also benefit active transportation in downtown by lowering pedestrian level of stress, and it would assist emergency response vehicles in accessing destinations by giving them the opportunity to use an alternative route rather than going through downtown. The improvement was listed as a Tier 1C long range project in the 2016 RTP. As mentioned earlier in section 4.11, public feedback also indicated that the Greenley Extension could act as an emergency evacuation route during a forest fire.

System Planning and the Office of Travel Forecasting examined the Greenley Extension's effects on the state highway in a 2015 TransCAD model featuring a 1.1 percent annual household number growth rate from 2015 to 2040. The Extension is included in TCTC's 2040 TransCAD model. After running the model, System Planning measured the change in behavior that occurred with the Extension. The model showed reduction in congestion in downtown after the Extension was completed. The future no-build projected model had a volume of 18,998 in downtown. The projected volume with the Extension featured a reduced volume of 16,432. The reduction was approximately 13 to 14 percent less through downtown than it was in the projected model without the Extension. Map 44 and Map 45 showed differences in volumes between the future no-build scenario and the future model with the Extension. Table 77 shows differences in volumes between 2040 no-build and bypass scenarios.

Based on projected modeling the Greenley Extension would reduce congestion in downtown, and it would provide an alternative route around downtown for emergency vehicles.

Travel Forecasting adjusted some components of the Tuolumne model. The model speed in downtown Sonora was set at 35MPH free-flow speed. The original volume capacity in downtown in the model was 800 vehicles per lane. This was raised to 950. Forecasting ensured data verification by using 500 iterations for model simulation runs, and they used a relative gap of one ten-thousandths (0.0001).

In addition to its benefits to emergency response vehicles and as a possible evacuation route in the event of a forest fire, the Greenley Extension strategy also has benefits to multimodal transportation in downtown Sonora. Specifically, the reduction in volume and vehicular congestion in downtown can lower pedestrian level of stress. Downtown Sonora is a popular location for pedestrian activity. Reduced volumes due to the extension can act as an enhancement for active transportation activities in the area. Map 44: 2040 Model AADT Without Any Bypass



#### Map 45: 2040 Model AADT with Greenley Extension



### 4.16.2. Western Bypasses

The western bypass is an unconstrained project listed in the 2016 RTP. The location has not been determined. The purpose of the bypass would be to reduce congestion in Sonora and Jamestown, as well as providing a truck terminal access (TA) expressway facility. The existing SR 49, which is on the NHS, is not TA standard north of Ponderosa Lane to Angels Camp. The model featured a bypass that would link SR 49 near Tuttletown to SR 108/49 near Montezuma Junction, or from a location west of Tuttletown to the intersection of Harvard Mine and Bell Mooney Road.

Modeling indicated minimal reduction through Sonora and Jamestown if a bypass were constructed. Instead of an AADT of 16,432, volume through downtown with a western bypass ending at Montezuma Junction would be measured in downtown at 16,305. This is a reduction of only 0.77 percent. If the bypass terminus is Bell Mooney Road, the volume in downtown would be 16,380. This is only a reduction of about 0.3 percent from the scenario with only the Greenley Extension. Maps 46 and 47 compared traffic volumes with both bypass scenarios. The bypass to Montezuma Junction would carry more volume. Considering that Rawhide Road and Jamestown Road act as existing western bypasses for downtown Sonora, these results showing minimal change are not surprising.

Based on model projections, a western bypass would reduce only minimal congestion in downtown Sonora. It is unclear if such a strategy would meet Goal 2 Objective 2.1, 2.2, and 2.4 for downtown. However, the bypasses could still meet Goal 5 and Objectives 5.1 and 5.2, the enhancement of STAA standard facility connectivity in the corridor and the reduction of truck delay through downtown.

Though doing little to reduce volume in downtown Sonora, the western bypass strategies may close the gap of state highway facilities not at TA standard for trucks. With a bypass to Calaveras County, all of SR 49 in the corridor study area would become TA standard.

Map 46: 2040 Model AADT with Greenley Extension and Montezuma Junction Bypass



Map 47: 2040 Model AADT with Greenley Extension and Bell Mooney/Harvard Mine Bypass



# 5. Non-Motorized Strategies

Chapter Five corresponds to **Steps 4 and 5 of the 8 phases of the Corridor Planning Process: Identifying Potential Strategies and Analyzing Solutions**. Scenarios were analyzed using quantitative measures that compared performance. Strategies tested in model simulation were discussed in Section Four. This section covered active transportation strategies.

For active transportation strategies, the study used a gap analysis comparing proposed changes based on how many gaps in the existing network the changes would close. The higher the percentage of completion the strategy proposed, the more the strategy achieved gap reduction. The outcome was data that identified the extent strategies were effective in meeting goals and objectives. Figure 83 shows steps four and five of the eight-step corridor planning process.



Non-motorized strategies covered assets including paved shoulders, sidewalks, bicycle paths, ADA-compliant curb ramps, and crosswalks. Results indicated that the installation of a separated and protected bicycle lane showed the most improvement compared to existing no-build conditions. Installing more ADA curb ramps, and paved shoulders also showed noticeable improvement over existing conditions. However, all active transportation strategies made a difference in terms of closing a gap between the Chicken Ranch Rancheria and Parrott's Ferry Road. Table 78 shows the percent change these strategies had over no-build conditions. The table also ranks them.

Active transportation strategies are no less significant in terms of addressing a need than vehicle operations strategies. With exception to the Active Transportation Path, active transportation strategies were not discussed in Chapter 4 because they were not evaluated using model simulation. However, non-motorized strategies followed a separate measure of evaluation and ranked as well as vehicle operations strategies, as shown in Table 80.

	Percent Change from Existing 2018 Conditions							
Strategy/Project	Queue Length	Delay	VMT	Emissions	CO2 Emissions	LOS	Gap Fill Need	Rank
8ft. paved shoulders	NA	NA	NA	NA	NA	NA	85	3
Sidewalk gap fill	NA	NA	NA	NA	NA	NA	77 to 81.5	4
Active Transportation Path	NA	NA	NA	NA	NA	NA	100	1
ADA updates	NA	NA	NA	NA	NA	NA	97	2
Crosswalks	NA	NA	NA	NA	NA	NA	74	5
NA: Not Applicable								

#### Table 78: Comparison of Non-motorized Strategy Performance and Rankings

## 5.1. Sidewalk Gap Mitigation

In the City of Sonora from PM 17.15 south of Ponderosa Lane to PM 19.40 at Preston Place, only 29.5 percent of all space adjacent to the state highway shoulder has paved sidewalks on both sides of the highway. This amounts to 8.7 percent of the length of the corridor. There is currently no state right of way in Jamestown from South Main Street to Fifth Avenue with sidewalks.

Eliminating gaps in sidewalks in built environments in Jamestown and Sonora would lead to an increase in sidewalk availability for the corridor. After gap-fill improvements, approximately 38 percent of the corridor length from Chicken Ranch Road to Parrott's Ferry Road would have paved sidewalks. This is about 30 percent better than existing conditions and about 2.24 centerline miles of more coverage. This strategy would accomplish Goal 3 Objective 3.1: lessening gaps in active transportation infrastructure. It would also improve more state right of way in accordance with HDM guidelines for pedestrian facility LOS to be at least comparable to automobile LOS.<sup>18</sup> Expanded sidewalks would also meet observed need of pedestrians using shoulders on the highway between Sonora and Jamestown, as well as documented pedestrian counts at the Rawhide, Fifth Avenue, and SR 108/49 intersections.

Installation of more sidewalks can act as a safety enhancement. Although a Complete Streets strategy, sidewalk installation can help accomplish Goal 1 concerning safety. According to the Federal Highway Administration (FHWA), sidewalks can help prevent up to 88 percent of "walking along roadway crashes," among having other pedestrian safety benefits.<sup>19</sup>

If sidewalks are extended to PM 16.48 at the SR 108/49 split, then 47 percent of the corridor would have paved sidewalks. This change would be a 39 percent point improvement over existing conditions and would be comparable to about 2.92 centerline miles of more coverage.

Map 48 shows locations in the corridor with gap mitigation. This strategy only considers sidewalk connectivity in built environments, as opposed to all right of way along the state highway. The reason areas limited to Jamestown and Sonora are considered is that the need for paved sidewalks decreases beyond town environments. However, proposed projects in the 2016 RTP also influenced locations for sidewalk strategies. This includes adding sidewalk from Ponderosa Lane to the SR 108/49 split. Still within Sonora city limits, homelessness along Woods Creek in this area presents a need for paved sidewalks.

Locations outside of built environments feature a strategy to install a ten-to-twelve-foot barrierseparated active transportation path that connects locations along the corridor from Chicken Ranch Road to Columbia College. This path could be used by both bicyclists and pedestrians. Such a strategy is discussed in section 4.5. The viability of this strategy depends in part on existing right of way availability along the highway.

With consultation from the public, local agencies can provide direction as to which sidewalk proposals to endorse. The District 10 CAT Plan is a separate planning effort that can gauge community feedback that further identifies gaps in pedestrian and bicycle facilities.

<sup>&</sup>lt;sup>18</sup> <u>Caltrans Webpage: Design Guidance</u>

<sup>&</sup>lt;sup>19</sup> FHWA Webpage: Safety Program

#### Map 48: Potential Sidewalk Strategy



## 5.2. Upgrade to ADA Compliance

In the City of Sonora and Jamestown along SR 108/49, ADA compliant architecture makes up about 3.4 percent of all intersection corners or crosswalk ends. Of 88 corners and crosswalk ends counted, only three are fully compliant. Map 49 below shows ADA mitigation in both communities. The strategy is to upgrade all noncompliant street corners in Sonora and Jamestown. A strategy with ADA improvements leads to 100 percent compliance in city limits and built environments. Improving corners to ADA compliance helps meet Goal 3, which sets out to improve multimodal access. Local agencies with consultation from the public can provide input as to the extent of ADA enhancements outside of Downtown Sonora. If there are new sidewalks and crosswalks installed along state right of way, then the strategy calls for ADA compliance for all crosswalk ends.

#### Map 49: Proposed ADA Enhancements



## 5.3. Crosswalk Installation

Existing marked crosswalks in the corridor number at 14, all located in Sonora. With all proposed crosswalks the total becomes 58. However, before a crosswalk can be installed, a Caltrans Traffic Safety engineering study is needed, per the California MUTCD. Such an investigation would examine if the intersection met a pedestrian demand threshold. It is not automatic that pedestrian presence requires installation of a marked crosswalk.

If crosswalks get approval from engineering studies, then these additions will improve accessibility for pedestrians in built environments and will improve pedestrian LOS. The additional crosswalks bring the Corridor Study closer to accomplishing Goal 3: improving multimodal transportation access through the lessening of gaps in the active transportation network.

Crosswalks, though a Complete Streets strategy, can also act as a safety enhancement, provided that additional design features are included with the crosswalks. A crosswalk in and of itself may not enhance corridor safety.<sup>20</sup> According to NACTO, some elements that can enhance the safety of a crosswalk include the following:

- 1. Rapid flash beacons
- 2. Street lighting
- 3. Countdown signals
- 4. Minimum six feet-wide pedestrian-accessible median islands
- 5. Curb extensions
- 6. Advanced yield stop bars (perpendicular to vehicle travel lane, not to crosswalk)
- 7. Continental crosswalk pavement paint schemes rather than basic parallel two-line crosswalks

Crosswalks that incorporate these design strategies can assist in meeting this study's Goal 1 of enhancing safety.

## 5.3.1. Sonora

System Planning's strategy follows Vision Sonora's proposals for marked crosswalks across the state highway, plus two additional crosswalks more than in Vision Sonora. This strategy features six new crosswalks crossing the state highway in Sonora:

- 1. Two crosswalks at the Jackson Street intersection, one for each state highway leg of the T-intersection (PM 17.62). Vision Sonora called for one crosswalk crossing the state highway at this location.
- 2. Two crosswalks connecting Green Street in Downtown, one for each leg of the state highway (PM 17.93). Vision Sonora called for one crosswalk crossing the state highway at this location.
- 3. Crosswalk on the south leg of the Snell Street and SR 49 intersection (PM 18.295).
- 4. North leg crosswalk at the North Washington and Columbia Way intersection next to Sonora High School (PM 18.521).

<sup>&</sup>lt;sup>20</sup> NACTO Webpage: Crosswalks and Crossings

All six new crosswalks are consistent with Vision Sonora proposals, as well as installing crosswalks along the side streets in Downtown Sonora and at the remodeled Fairgrounds entrance. Figures 84 to 88 show Vision Sonora proposed improvements for crosswalks.

Beyond improvements as detailed in Vision Sonora, the strategy includes new crosswalks along Fairview Lane (PM 17.35) and Ponderosa Lane (PM 17.31). These crosswalks would not cross the state highway, but they would run parallel to it. The strategy also calls for new crosswalks north of the Shaw's Flat and Columbia Way five-point intersection near the high school to Preston Place at the north end of the Sonora City limits (from PM 18.52 to PM 19.4). None of these crosswalks would traverse SR 49. Taken with Vision Sonora improvements, this strategy would cover all crossings in the Sonora City limits along state right of way. Local agencies, with input from the public, can provide guidance as to which marked crosswalk proposals to endorse.

## 5.3.2. Jamestown

Based on 2018/2019 Miovision data collected by System Planning and the Office of Traffic Safety, there is a deficiency of marked crosswalks on the highway in the Jamestown area.

The Rawhide Road Bridge and intersection realignment project did show the edition of two new crosswalks at the new Rawhide and North Main Street intersection (PM 14.8). The plan view showed the crosswalks on the west and north legs of the intersection in Figure 89. However, more crosswalks are needed, particularly third and fourth crosswalks that cross at the east and south legs of the intersection. The redesigned intersection of Humbug Street (PM 14.74) also needs a crosswalk that runs parallel to the state highway.

Figure 90 showed seven day-long video counts at the existing Rawhide intersection counting 75 pedestrians crossing the intersection along the south leg (Humbug Street). The west leg of the intersection featured 43 pedestrians crossing in a location that currently has no crosswalk or sidewalk. 24 to 48-hour-long Traffic Safety counts from June 2019 showed pedestrians using the Fifth Avenue intersection without crosswalks.

The strategy suggested new marked crosswalks at the intersection of SR 108/49 and Fifth Avenue (PM 15.0), as well as crosswalks for the new Jamestown Road realignment (PM 14.84) and South Main Street into Jamestown (PM 14.34). The only crosswalks that would traverse the highway in Jamestown are two at the realigned Rawhide and two at the Fifth Avenue intersections. Map 50 shows existing and proposed crosswalks in the corridor. Local agencies, with consultation from the public, can provide input on which proposed crosswalks to endorse.

#### Figure 84: Vision Sonora Improvements at Fairgrounds



Figure 3-13. Fairgrounds Entrance Facing East

#### Figure 85: Vision Sonora Improvements on Stockton Road



Figure 3-17. Stockton Street- West Gateway Corridor

Figure 86: Vision Sonora Improvements on Stockton and Washington Intersection







#### Figure 88: Vision Sonora Improvements in Downtown Sonora



Figure 3-24. Snell/Washington Intersection
Figure 89: Vision Sonora Improvements in Downtown Sonora



Figure 3-26. Washington Street in the Historic Downtown Core

## Figure 90: Proposed Rawhide Bridge and Intersection Realignment



## Figure 91: Turning Movements at SR 108/49 and Rawhide

#### Tuo 49 Rawhide Rd - TMC

Wed May 2, 2018 Full Length (3:30PM-3:30PM (14)) All Classes (Motorcycles, Cars, Light Goods Vehicles, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Pedestrians, Bicycles on Road, Bicycles on Crosswalk) All Movements ID: 522865, Location: 37.956293, -120.422693 Provided by: Caltrans District 10 -- System Planning 1976 Martin Luther King Jr. Blvd., Stockton, CA, 95205, US



## Figure 92: Turning Movements at SR 180/49 and Rawhide

#### Tuo 49 Rawhide Rd - TMC

Sun May 6, 2018 Full Length (3:30PM-7:30AM (+1)) All Classes (Motorcycles, Cars, Light Goods Vehicles, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk) All Movements ID: 523689, Location: 37.956293, -120.422693 Provided by: Caltrans District 10 --System Planning 1976 Martin Luther King Jr. Blvd., Stockton, CA, 95205, US



#### Map 50: Crosswalk Strategies



# 5.4. Paved Shoulder Gap Mitigation

Existing conditions indicate only 1.15 miles, or 15 percent, of state right of way in the corridor study area has at least four feet of paved shoulder with edge striping on both sides. Only approximately 1.13 miles have paved shoulder width of at least eight feet on both sides of the highway, with or without edge line striping on both sides. This is also about 15 percent of the corridor. Furthermore, about 2.73 miles have paved shoulder width of at least eight feet on at least one side of the highway. This amounts to about 36 percent of the corridor.

Widening paved shoulders, though a Complete Streets strategy, can act as a safety enhancement for non-motorized transportation. The FHWA notes that widening paved shoulders can reduce various types of crashes from 15 to 75 percent.<sup>21</sup> Widening shoulders on the highway can assist in meeting Goal 1 of enhancing safety in the corridor.

State law requires that cars give bicyclists at least three feet of space when passing them. Completing the other 85 percent ensures bicyclists will have an available refuge in the corridor when cars are passing, and the refuge helps realize Caltrans efforts to meet Goal 3: enhancing multimodal transportation access by closing gaps in the active transportation network. Wider paved shoulders can also reduce bicycle level of stress.<sup>22</sup> <sup>23</sup> Map 51 below shows locations where at least an eight feet paved shoulder with edge striping on both sides is needed. The map also shows locations that have parallel parking.

<sup>&</sup>lt;sup>21</sup> FHWA Webpage: Safety Benefits of Walkways

<sup>&</sup>lt;sup>22</sup> ODOT PDF file: Multimodal Analysis

<sup>&</sup>lt;sup>23</sup> The Journal of Transport and Land Use PDF file: Measuring low-stress connectivity in terms of bike-accessible jobs

## Map 51: Paved Shoulder Strategy



# 6. SELECTION AND PRIORITIZATION

This chapter corresponds to **Step 6 of the 8 phases of the Corridor Planning Process: Select and Prioritize Solutions**, as shown in Figure 91. The Corridor Planning Process Guide states that in this section, "The corridor team meets to make decisions on which corridor projects and strategies to recommend, and prioritizes those strategies recommended by assigning an expected implementation timeframe." The outcome is a set of possible solutions for the corridor that address identified issues and that meet the corridor plan's goals and objectives.

## Figure 93: Corridor Planning Process Step 6



The Caltrans corridor plan guidance notes that the corridor selection and prioritization process is generally conducted in the following steps, as shown in Figure 92. The corridor team may use a scoring and weighting system, a set of performance thresholds, or a three-tier performance category measurement system to gauge preferred strategies.

## Figure 94: Selection and Prioritization Process



Chapters Four and Five covered the first step identified in Figure 92: **Review Evaluation Results**. In addition to review in earlier chapters, the evaluation results were expressed in Tables 39, 40, 41, 63, 64, and with the visual charts featured in sections 4.14 and 4.15. These figures and charts compared strategy effectiveness with no-build alternatives and with other strategies from one end of the corridor to the other end, giving an idea of which strategies were the most

effective in meeting goals and objectives. This chapter focuses on the second step in the Selection and Prioritization Process: **Select and Group Projects**.

# 6.1. Strategy Effectiveness

## 6.1.1. Goals Met

Strategy effectiveness was depicted with two approaches. The first approach, represented with Table 79, organized strategy performance on the simple achievement of goals and objectives identified in this study. Table 79 listed goals, objectives, and strategies. The table then indicated if the strategy accomplished any of them. If the proposed strategy had simulation data results lesser in value than the no-build scenario results, then the strategy was given a "Y" for "yes," meaning that the strategy featured simulation data output that was greater than performance indicators in a no-build scenario, then the strategy was given a "N" for "no," meaning that the strategy did not meet a goal and an objective. In addition to being shown below, this table can also be accessed on page 160 in Chapter Four.

As stated in the Executive Summary, this is a multimodal report that focuses analysis on vehicle-centric operations, potential bypasses, and active transportation enhancement strategies. Results in Tables 81 and 82 only show strategies tested in simulation and do not include all non-motorized strategies examined in this report. Tables 79 and 80 do include all strategies tested, showing the diversity of motorized and non-motorized strategies discussed and tested. Three out of the five strategies in Table 80 that meet 100 percent of their goals are active transportation strategies. The purpose of this report was to prioritize for potential funding strategies that enhance the performance of the state highway system through not only vehicle operations changes, but also multimodal and active transportation strategies that fill gaps and meet non-motorized needs.

As identified elsewhere, the Greenley Extension scenario has potential benefits for emergency vehicle response time, as an escape route from a natural disaster or forest fire, and as a benefit for lowering pedestrian levels of stress in downtown Sonora. Volume reduction documented in modeling gives the Greenley Extension a multimodal benefit for the corridor, improving conditions for pedestrian activity in the downtown area.

The Greenley Extension strategy was tested in macro and microsimulation. This is why it appears twice in several results tables.

## Table 79: List of Strategies and Goals Met

Proposed Corridor Study Strategies			E	Вураз	ss					Ор	erat	ions						Non-	moto	rized	
Goals and Objectives		Bell Mooney	Montezuma	Greenley	Shaws Flat	Mackey Ranch	Bridge Realign	Greenley	Signals**	5 lanes	4 lanes	2040 No-build	AT Pathway	108 Freeway	All strategies	Sidewalks	ADA ramps	AT Pathway	Crosswalks*	Shoulders	
1		Enhance safety	NA	NA	NA	U	U	N A	N A	N A	N A	N A	N A	Y	NA	NA	Y	Y	Υ	Y	Υ
2	Reduce (2018)	Delay and congestion	NA	NA	NA	N	N	Y	N A	Y	Y	Y	N A	N	Y	Y	NA	NA	N	NA	N A
2	Reduce (2018)	VMT	NA	NA	NA	Y	Y	Y	N A	N A	Y	Y	N A	Y	Y	Y	NA	NA	Y	NA	N A
2	Reduce (2018)	Queueing	NA	NA	NA	N	Ν	Y	N A	Y	Y	Y	N A	N	Y	Y	NA	NA	N	NA	N A
2	Reduce (2040)	Delay and congestion	N	N	Y	Ν	Ν	Y	Y	Y	Y	Y	N	Y	Y	Y	NA	NA	Y	NA	N A
2	Reduce (2040)	VMT	NA	NA	NA	Y	Y	Y	Y	N A	N	N	Y	Y	Ν	Y	NA	NA	Y	NA	N A
2	Reduce (2040)	Queuing	NA	NA	NA	Ν	Ν	N	N	N	Y	Y	N	Y	Y	Y	NA	NA	Y	NA	N A
3	Reduce gaps in	Active Transport	NA	NA	NA	NA	NA	N A	N A	N A	N A	N A	N A	Y	NA	NA	Y	Y	Y	Y	Y
3	Reduce gaps in	Separate Bikeways	NA	NA	NA	NA	NA	N A	N A	N A	N A	N A	N A	Y	NA	NA	NA	NA	Y	NA	N
3	Reduce gaps in	Protected Bikeways	NA	NA	NA	NA	NA	N A	N A	N A	N A	N A	N A	Y	NA	NA	NA	NA	Y	NA	N
4	Lower	GHG emissions (2018)	NA	NA	NA	Ν	Ν	Y	N A	N A	Y	Υ	N A	Ν	Y	Υ	NA	NA	Ν	NA	N A
4	Lower	GHG emissions (2040)	NA	NA	NA	Ν	Ν	Y	Y	N A	Y	Y	Ν	Ν	Υ	Y	NA	NA	Ν	NA	N A
5	Reduce	Gaps in STAA HWYs	Υ	Υ	Y	NA	NA	N A	N A	N A	N A	N A	N A	N A	NA	NA	NA	NA	NA	NA	N A
5	Reduce	Truck Delay/Congestion	Ν	Ν	Y	Ν	Ν	Y	Y	Y	Y	Y	Ν	N A	Y	Y	NA	NA	NA	NA	N A
Percentage of goals met 🛛 🛱					100	22	22	89	80	80	89	89	20	67	89	100	100	100	100	100	50
Y: (	Y: goal met; N: goal not met																				

U: Unclear: roundabouts can reduce the severity of vehicle crashes, but safety benefits to pedestrians and cyclists are not clear without data on local traffic behavior characteristics and Complete Streets-centric design enhancements taken into consideration

\*Crosswalks can assist in attaining Goal 1 if they include additional street and curb design elements, as identified in Section 4.11

\*\*Signal timing adjustments modeled using Synchro 10; results based on data at the Rawhide intersection with a four-lane widening RP: Results Pending; NA: not applicable

Table 79 only gauged effectiveness based on a yes/no question, but the table also displayed the percentage of goals and objectives strategies met. The higher the percentage was, the more goals they met. Derived on these percentages, Table 80 categorized the strategies into four tiers based on the achievement percentage of goals and objectives.

## 6.1.2. Tiered Rankings of Strategies by Goals Met

Tier One is for strategies that achieved one hundred percent of relevant goals and objectives. Tier Two is for strategies that achieved between 70 to 99 percent of goals and objectives. Tier Three is for strategies that achieved between 50 to 69 percent, and Tier Four is for strategies that only achieved fewer than 50 percent.

Tier Ranking	Strategy	Beginning TUO 49 PM	Ending TUO 49 PM	Percent of Goals Met					
1	All Strategies	12.12/18.51	16.48/20.4	100					
1	Greenley Extension (TransCAD)	~19.1	~19.1	100					
1	Sidewalks	14.04/16.48/18.51	15.0/17.94/19.4	100					
1	ADA curb ramps	14.04/16.48/18.51	15.0/17.94/19.4	100					
1	Crosswalks	14.04/16.48/18.51	15.0/17.94/19.4	100					
2	Rawhide Intersection and Bridge Realignment	14.5	14.9	89					
2	5 Lane Widening	12.81/~19.1	16.48/20.4	89					
2	4 Lanes Widening	12.81/~19.1	16.48/20.4	89					
2	SR 108 Freeway	12.12	16.48	89					
2	Greenley Extension (Vissim)	~19.1	~19.1	80					
2	Signal Coordination at Rawhide and Fifth Avenue	14.74	15.0	80					
3	Active Transportation Pathway	12.81/18.51	17.94/20.4	67					
3	Paved Shoulder Widths*	12.12	20.4	50					
4	Bell Mooney Western Bypass**	13.4	25.75	33					
4	Montezuma Junction Western Bypass**	11.6	25.75	33					
4	Shaw's Flat Intersection Improvement	18.51	18.51	22					
4	Mackey Ranch Intersection Improvement	12.12	12.12	22					
4	2040 No-build Scenario	12.12	20.4	20					
*: Not all locations within designated postmiles will need widened shoulders; **: Bypasses would be on new alignment, designated postmiles are two									
noints only									

## Table 80: Strategy Performance Rankings by Tier

- The best-performing strategies were as follows: the all-strategies scenario, the Greenley Extension, installing more sidewalks, ADA curb ramp additions, and adding crosswalks. All these strategies are Tier One, having met 100 percent of relevant goals and objectives.
- Tier Two strategies included the Rawhide intersection and bridge realignment, the fivelane and four-lane widening, a hypothetical freeway scenario, the Greenley Extension modeled in microsimulation, and signal coordination on Rawhide Road and Fifth Avenue in Jamestown. These strategies accomplished 80 to 89 percent of goals and objectives.
- The active transportation path and widening paved shoulder widths accomplished half to most of relevant goals and objectives, putting them in Tier Three.
- While strategies in the top three tiers may have approval to be on a list of final recommendations, the two intersection improvements at Shaw's Flat and Mackey Ranch in Tier Four deserve consideration beyond the performance indicators used in this study. As discussed in Chapter Four, both intersection strategies led to increases in queue length and vehicle delay. These increases were scored negatively in analysis compared to no-build conditions. However, if the intent of these intersection improvements is to slow down traffic and enhance safety, then these two strategies should not be disregarded.

Not all goals and objectives were applied to all strategies, because some strategies cannot be tested in simulation. Some strategies, through virtue of their design, are not meant to address all goals and objectives. It also may not be fair to judge the effectiveness of strategies by comparing a proposal subjected to having to meet three goals with a strategy deemed to having to meet ten goals.

## 6.1.3. Comparison of Performance and Rankings

The second approach to measuring effectiveness is to compare strategies to their no-build conditions. The following tables ranked strategies not on simply meeting a goal or an objective, but on how much they changed conditions compared to no-build scenarios. These tables applied to strategies tested in micro and macro simulation, and two tables were necessary to separate simulations using 2018 and 2040 conditions. The more the strategy reduced a quantitative

condition compared to its no-build alternative, the better the strategy performed. 500 was a base score based on no-build conditions. Any total score below 500 was an improvement. Any score above 500 meant the strategy performed worse than the no-build. Tables 81 and 82 below make these comparisons and can also be found in Chapter Four on page 161.

	Porcent of Existing 2018 Conditions										
Strategy/Project		Perce	nt of Existing	g 2018 Conditions	>						
Strategy/Hojeet	Queue Length	Delay	VMT	GHG Emissions	LOS	Score	Rank				
Existing No-Build	100	100	100	100	100	500	7				
Shaw's Flat Intersection	188.4	185	83	101.3	130	687.7	10				
SR 108 Freeway	25.4	79.6	96.6	88.2	90	379.8	4				
Active Transportation Pathway	201.4	138.5	97.1	126.6	110	673.6	9				
Rawhide Realignment	29.2	56	81.7	61	74	301.9	3				
Mackey Ranch Intersection	161	135	95	125	110	626	8				
5-lane Widening	1.9	34.3	86.7	58.4	60.9	242.2	1				
4-lane Widening	1.6	35.3	97.9	65.3	60.9	261	2				
All Strategies	81.8	97.8	93	96	105	473.6	6				
Signal Timing Adjustments***	90	73.5	100	100	77.8	441.3	5				
2040 No-Build Chicken R to Parrott's	377	156	98.9	141	126	898.9	11				
2040 No-Build Mackey R to Parrott's	953	185	98.1	144	130	1,510	12				
NA: Not Applicable											
***Signal timing adjustments were mo	deled in Synchro 10 ir	n Jamestown us	sing HCM-based	LOS measures							

#### Table 81: Comparison of Strategy Performance and Rankings, 2018

## Table 82: Comparison of Strategy Performance and Rankings, 2040

Stratogy/Droject	Percent of Future Projected 2040 Conditions										
Strategy/Project	Queue	Delay	VMT	GHG Emissions	LOS	Score	AADT**	Rank			
Future No-build	100	100	100	100	100	500	NA	9			
Future Shaw's Flat Intersection	127.7	141.7	99.5	117.9	128	614.8	NA	10			
SR 108 Freeway	5.6	51.2	104.3	67.7	73	301.8	NA	4			
Active Transportation Pathway	52.1	97.3	99.8	103.1	104	456.3	NA	6			
Future Rawhide Realignment	123.3	88.6	98.4	87.5	93	490.8	NA	7			
Future Mackey Ranch Intersection	166	182	96	183.7	138	766	NA	11			
5-lane Widening	0.5	25.3	102.6	49.8	48.3	226.5	NA	1			
4-lane Widening	0.8	29.2	111.7	55.6	51.7	249	NA	3			
Greenley Intersection	104	94	98.4	98.4	96.2	491	NA	8			
All Strategies	0.7	31.3	88	51.6	65.4	237	NA	2			
Signal Timing Adjustments***	122	29.6	100	100	66.7	418.3	NA	5			
2040 No-build TransCAD	NA	NA	NA	NA	NA	NA	100	4			
Greenley Extension	NA	NA	NA	NA	NA	NA	86.5	1			
Montezuma Western Bypass*	NA	NA	NA	NA	NA	NA	99.3	2			
Bell Mooney Western Bypass*	NA	NA	NA	NA	NA	NA	99.7	3			
ALA											

NA: not applicable

\*Both strategies incorporated simulations that included installation of the Greenley Extension into a future no-build projected model

\*\*AADT refers to volumes in downtown Sonora based on origin/destination studies using the Tuolumne TransCAD model

\*\*\*Signal timing adjustments were modeled in Synchro 10 using HCM-based LOS measures; scores were based on signal timing adjustments at Rawhide Road and SR 108/49 with a highway widened to four lanes; the score at Fifth Avenue under the same circumstances would have been 393

What Tables 81 and 82 do is provide a clear comparison of which strategies were the best performers, rather than just answering the question if a strategy meets a goal or an objective.

Some results on strategy performance in model simulation are as follows:

- The best overall performer was the five-lane widening scenario (which is a multimodal scenario in its Jamestown PID application), finishing first in 2018 and 2040 conditions.
- The active transportation path scenario performed with mixed results in 2018 conditions, placing ninth out of twelve scenarios. However, it performed better than the no-build

condition in 2040, ranking sixth out of eleven strategies. This strategy may have long-term benefits.

- The four-lane widening scenario also did well.
- The all-strategies scenario was the second-best performer in 2040 conditions, though it managed only to do slightly better than the existing no-build condition.
- The Rawhide intersection and bridge realignment was the third most effective scenario compared to the no-build condition in 2018, and it still performed better than the no-build condition in 2040 conditions.
- Signal timing optimization and synchronization in Jamestown was effective in Synchro simulation in 2018 and 2040 conditions.
- The Greenley Extension in microsimulation finished seventh overall in 2040 conditions, performing slightly better than the no-build condition.
- The Greenley Extension in macrosimulation led to a thirteen to fourteen percent reduction in downtown volume.
- Both western bypass options showed minimal downtown volume reduction in 2040, though they would close gaps in terminal access truck routes.
- The no-build scenario was not the least performing option in either 2018 or 2040 Vissim simulations.

Caltrans and local agency partners decide which strategies offer the most potential based on the consideration of how well proposals meet goals and objectives.

Stakeholders may have differing metrics for evaluating strategies, but the ranking system and tiered system developed in this study is one possible way of gauging success. Additional factors to consider when selecting strategies may include benefit/cost results, project deliverability or feasibility, project sequencing, matching funds and leverage, regional or statewide significance, as well as other factors such as system continuity and politics. Caltrans and agency partners can determine additional factors to consider when choosing strategies to support.

# 6.2. Timeframe for Strategies

This section lists the expected implementation timeframe for strategies based on the TCTC 2016 RTP tiered project list, the Caltrans Ongoing Projects List (OPI), and the Caltrans Status of Projects (SoP) list. Timeframe for strategies was as follows: short/near-term, medium-term, and long-term. Descriptions of time lengths were based on the Corridor Planning Process Guide.

- "Short-term" describes strategies in development or that will begin development in one to four years
- "Medium-term" references strategies that could be implemented within five to ten years
- "Long-term" describes strategies that could be built in eleven years and beyond

Because of funding constraints and geographic area, several strategies can not be implemented at one time, but would likely see staged construction. Table 83 takes into account staged construction for strategies by breaking them down into separate geographic components. Separating the strategies into different sections followed the tiered project development of proposed improvements in the 2016 TCTC RTP.

For a list of potential project funding programs and strategies, refer to Appendix XII.

Pending partner agency review, public input, and changing economic conditions, this timeframe might be subject to change. The timeframe represents an idea on which strategies might be implemented first, but it is not a final decision beyond revision.

					Time Frame					
Strategy	Location	Beginning TUO 49 PM	Ending TUO 49 PM	Short- term	Medium -term	Long- term	Hypothetical			
Signal Timing and Coordination	Rawhide and Fifth Avenue	14.74	15.0	Х	NA	NA	NA			
Mackey Ranch Improvement	SR 108/49 and Mackey Ranch	12.12	12.12	Х	NA	NA	NA			
4-lane widening	Various locations in the corridor	12.81/~19.1	16.48/20.4	NA	NA	NA	Х			
5-lane widening	Chicken Ranch to S. Main	12.81	14.04	NA	NA	Х	NA			
5-lane widening	S. Main to Fifth Ave.	14.04	15.31	NA	Х	NA	NA			
5-lane widening	Fifth Ave. to Stockton Rd.	15.31	16.48	NA	NA	Х	NA			
5-lane widening	Greenley to Parrott's	~19.1	20.4	NA	NA	Х	NA			
Rawhide and Bridge Realign	Rawhide Rd. to Jamestown Rd.	14.5	14.9	Х	NA	NA	NA			
Shaw's Flat Improvement	Shaw's Flat/Columbia Way/SR 49	18.51	18.51	NA	Х	NA	NA			
Greenley Extension	Greenley and SR 49	~19.1	~19.1	NA	Х	NA	NA			
Western Bypass	Montezuma Junction	11.6	25.75	NA	NA	NA	Х			
Western Bypass	Bell Mooney	13.4	25.75	NA	NA	NA	Х			
Active Transportation Path	Chicken Ranch to S. Main	12.81	14.04	NA	Х	NA	NA			
Active Transportation Path	S. Main to Fifth Ave.	14.04	15.0	NA	Х	NA	NA			
Active Transportation Path	Fifth Ave. to SHS	15.0	18.51	NA	NA	Х	NA			
Active Transportation Path	Fairgrounds to DT Sonora	17.5	17.94	NA	NA	Х	NA			
Active Transportation Path	SHS to Columbia College	18.51	20.4	NA	NA	Х	NA			
ADA Improvements	S. Main to Fifth Ave.	14.04	15.0	NA	х	NA	NA			
ADA Improvements	SR 108 to Fairgrounds	16.48	17.5	NA	NA	Х	NA			
ADA Improvements	Fairgrounds to DT Sonora	17.5	17.94	NA	NA	Х	NA			
ADA Improvements	Downtown Sonora	17.94	18.3	NA	Х	NA	NA			
ADA Improvements	Shaw's Flat to Preston Place	18.51	19.4	NA	NA	Х	NA			
Sidewalk Improvements	S. Main to Fifth Ave.	14.04	15.0	NA	Х	NA	NA			
Sidewalk Improvements	SR 108 to Fairgrounds Ent.	16.48	17.5	NA	NA	Х	NA			
Sidewalk Improvements	Fairgrounds to DT Sonora	17.5	17.94	NA	NA	Х	NA			
Sidewalk Improvements	Downtown Sonora	17.94	18.3	NA	Х	NA	NA			
Sidewalk Improvements	Shaw's Flat to Preston Place	18.51	19.4	NA	NA	Х	NA			
Crosswalk Improvements	S. Main to Fifth Ave.	14.04	15.0	NA	Х	NA	NA			
Crosswalk Improvements	SR 108 to Fairgrounds Ent.	16.48	17.5	NA	NA	Х	NA			
Crosswalk Improvements	Fairgrounds to DT Sonora	17.5	17.94	NA	NA	Х	NA			
Crosswalk Improvements	Downtown Sonora	17.94	18.3	NA	Х	NA	NA			
Crosswalk Improvements	Shaw's Flat to Preston Place	18.51	19.4	NA	NA	Х	NA			
Paved shoulder widening	Mackey Ranch to S. Main	12.12	14.04	NA	Х	NA	NA			
Paved shoulder widening	S. Main to Fifth Ave.	14.04	15.0	NA	Х	NA	NA			
Paved shoulder widening	Fifth Ave. to Stockton Rd.	15.0	16.48	NA	NA	Х	NA			
Paved shoulder widening	SR 108 to Fairgrounds	16.48	17.5	NA	NA	Х	NA			
Paved shoulder widening	Fairgrounds to DT Sonora	17.5	17.94	NA	NA	Х	NA			
Paved shoulder widening	DT Sonora to Parrott's	18.3	20.4	NA	NA	Х	NA			
SR 108 Freeway	Mackey Ranch to Stockton	12.12	16.48	NA	NA	NA	X			
2040 No-build Alternative	various	12.12	20.4	NA	NA	NA	X			
PM: nostmile: Ave : avenue: Rd : road: S : south: ** approximate location: DT: downtown: SHS: Sonora High School: Ent : ontrance										
NA: not applicable										

#### Table 83: Strategy Timeframes in the SR 108/49 Corridor Study

Observations on the above timeframe in Table 83 are as follows:

- The intersection improvement at Mackey Ranch and SR 108/49 is scheduled to go to construction in 2020.
- The Rawhide Road intersection and bridge realignment strategy is already in preliminary planning review at the time of writing and will go to construction within four to five years.

- Widening SR 108/49 in Jamestown to five lanes with Complete Streets improvements from South Main Street to Fifth Avenue is already in the planning initiation document (PID) stage.
- Complete Streets enhancements, including ADA curb ramp strategies, in downtown Sonora are expected to go to construction in the next five to ten years.
- Compared to most strategies, adjustments to Caltrans signal timings do not require much time between the decision to change signal timings and the implementation of new timings.
- Strategy timeframes are subject to change pending partner agency review and funding availability, among other factors.

## 6.3. Next Steps

## 6.3.1. Adjust and Develop Final Recommendations

Adjusting and developing a final set of recommendations is a group effort between Caltrans, the Chicken Ranch Rancheria of Me-Wuk Indians, TCTC, Tuolumne County, the City of Sonora, and the public. Stakeholders collaborate to make possible changes to the list of preferred strategies. Upon consensus and agreement, agency partners, with public consultation, develop a final list of strategies to meet goals and objectives. Stakeholders can decide together how to publish the final recommendations in a manner that is accessible to the public.

Once approved by Caltrans and local agency partners, the selected and prioritized strategies may be considered as recommendations for projects and can be fed into Caltrans district system planning processes and RTP processes. The projects are supposed to act as recommendations for the corridor that carry an estimated timeframe of project phasing and completion. These projects become eligible for pre-project initiation document (PID) candidates when funding programs are open. Calls for projects at the federal, state, regional, or local level draw from these pre-PID project candidates for possible funding and implementation.

## 6.3.2. Publishing and Implementing the Corridor Study

Page 53 of the Corridor Planning Process Guide states the following concerning the publishing and implementation of a corridor plan or corridor study:

Outcome: An adopted and published Corridor Plan that defines how a corridor is performing, why it is performing that way, and recommends projects and strategies that achieve corridor goals and objectives. Documented consensus around recommendations, priorities, performance measures, and responsibilities. Recommendations made ready to be implemented by the corridor partnership.

The corridor planning process is documented with the publication of the corridor plan, which can be in any appropriate format. Web accessibility should be essential when publishing the document. The adopted corridor study documents how a corridor performs today, why it is performing that way, and recommends projects and strategies that achieve the goals and objectives agreed upon by its partners.

Publication of the corridor plan does not represent the end of the corridor planning process but is an important milestone that will be revisited by the corridor team in future review cycles. It should be officially adopted by the lead agency and core partners. After its adoption, it can be officially used to identify project candidates for funding programs or planning efforts that identify future investment opportunities.

## 6.3.3. Monitoring and Evaluating Progress

Ongoing reporting on corridor performance is conducted to evaluate the effectiveness of recommended projects and strategies on corridor performance over time. Corridor objectives may also be re-assessed and refined by the corridor team. The corridor study may also identify triggers and events that may necessitate the update of the study and a reassessment of strategies. Examples of conditions that may warrant revisiting the study include the following: technological disruptions or advancements, major new economic, population or environmental changes in the corridor, or significant new regional or statewide planning initiatives.

To determine strategy success, monitoring and evaluation will be necessary in the future. This is the case for strategies meant to address a safety-related issue. Only an assessment in the future can determine if a safety enhancement will lead to fewer collisions, since it is not possible before construction to know or model at present if a safety proposal leads to a change in accidents. Likewise, only future observations can tell how much pedestrian and bicycle use the proposed active transportation pathway will have. While transportation planning research can inform about which strategies are effective at meeting a need, future data collection is necessary.

The results of the corridor planning process are revisited over time by monitoring corridor performance indicators and evaluating the effect of implemented projects and strategies on those indicators. The lead agency and corridor team need to ensure mechanisms are in place for ongoing monitoring and evaluation. The mechanisms should include a plan for monitoring of corridor performance indicators, regular updates of the corridor performance assessment, and publication of results. When the corridor team meets to review updated performance assessment results, it is also a good time to reassess the corridor objectives and other approaches to the corridor study to ensure the right issues are still being addressed. Page 55 from the Corridor Planning Process Guide suggests the following activities to monitor and evaluate the progress of recommended corridor study strategies:

• Develop Corridor Performance Monitoring Plan

Developing a Corridor Performance Monitoring Plan ensures a process is in place to regularly conduct corridor performance assessments and report on corridor performance indicators.

Evaluate Corridor Performance Effectiveness

Determine the ongoing effectiveness of implemented strategies by regularly updating the corridor performance assessment initially done earlier in the corridor planning process.

• Assess Impacts on Other Plans

Assess the impacts that implementation the Corridor Plan has on other plans such as the CTP, Caltrans SMP and modal plans, RTPs and other planning efforts.

• Assess and Refine Corridor Objectives

Following the latest results of the corridor performance assessment, the corridor team should meet to discuss the results and determine if any refinements or adjustments should be made to the corridor objectives, performance assessment or evaluation approach.

#### Publish Corridor Performance Assessment Results

The results of regular corridor performance assessments should be published to monitor

progress over time and help keep corridor partners engaged in the outcome of the corridor planning process