

# State Route 49: I-80 to McKnight Way Draft Safety Assessment Report



Prepared for:



July 2020



# Safety Assessment Report

State Route 49: I-80 to McKnight Way

03-PLA-49 PM 3.2/11.4

03-NEV-49 PM 0.0/13.7

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**July 2020**

# Table of Contents

---

<b>1. Introduction</b> .....	<b>1</b>
1.1 Purpose .....	1
1.2 Participants .....	1
1.3 Process .....	1
<b>2. Corridor Description</b> .....	<b>2</b>
2.1 Segment 1.....	3
2.2 Segment 2.....	4
2.3 Segment 3.....	4
2.4 Segment 4.....	5
<b>3. Collision History</b> .....	<b>6</b>
3.1 Collisions .....	6
3.2 Collision Rate .....	6
3.3 Collision Trends.....	7
3.4 Collisions by Time and Day.....	8
3.5 Collision Type .....	10
3.6 Other Contextual Factors.....	11
3.7 Collision Density.....	12
3.8 Fatal Collisions.....	13
<b>4. Key Issues</b> .....	<b>22</b>
<b>5. Improvement History</b> .....	<b>24</b>
5.1 Previous Improvements.....	24
5.2 Existing Safety Features .....	24
5.3 Recent Actions .....	25
5.4 Approved and Funded Projects.....	26
5.5 Planned Projects.....	26
<b>6. Potential Safety Enhancements</b> .....	<b>28</b>
6.1 Near Term Treatments .....	28
6.2 Long Term Treatments .....	34
6.3 Proven Safety Countermeasures .....	42
6.4 Vision for Ultimate Facility.....	43
<b>7. References</b> .....	<b>44</b>

## Appendices

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- A. Workshop Attendance List
- B. Workshop Agenda
- C. Workshop Presentation Slides
- D. TASAS Table B Summary
- E. FHWA Proven Safety Countermeasures
- F. Highway 49 PLA/NEV Corridor Improvement

## List of Figures

---

Figure 1 – Segment 1 North of Elm Avenue (PM PLA 3.47) and Segment 2 at Joeger Road (PM PLA R7.96) .....	3
Figure 2 – Segment 3 North of Alta Sierra Drive (PM 9.22) and Segment 4 at Golden Chain Motel (PM 11.62). 4	
Figure 3 – Collisions by Year .....	8
Figure 4 – Collisions by Month .....	9
Figure 5 – Collisions by Time of Day.....	9
Figure 6 – Collision Type Percentage by Segment .....	11
Figure 7A: Collision Density (All Collisions) – Segment 1.....	14
Figure 7B: Collision Density (All Collisions) – Segment 2.....	15
Figure 7C: Collision Density (All Collisions) – Segment 3.....	16
Figure 7D: Collision Density (All Collisions) – Segment 4 .....	17
Figure 8A: Collision Density (Fatal Plus Injury Collisions) – Segment 1 .....	18
Figure 8B: Collision Density (Fatal Plus Injury Collisions) – Segment 2 .....	19
Figure 8C: Collision Density (Fatal Plus Injury Collisions) – Segment 3 .....	20
Figure 8D: Collision Density (Fatal Plus Injury Collisions) – Segment 4.....	21
Figure 9 – Edge Line Rumble Strip and Overhead Flashing Beacon.....	25

## List of Tables

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Table 1: Corridor Description .....	2
Table 2: Collisions and Persons Killed and Injured .....	6
Table 3: Collision Rate Comparison.....	7
Table 4: Collision Type by Percentage.....	10
Table 5: Fatal Collisions .....	13
Table 6: Near Term Treatments – Physical Countermeasures .....	31
Table 7: Long Term Treatments – Physical Countermeasures.....	38
Table 8: FHWA Proven Safety Countermeasures.....	42
Table 9: Vision for Ultimate Facility .....	43

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# 1. Introduction

The State Route (SR) 49 Safety Audit Workshop was held on February 18, 19, and 20, 2020 at the Caltrans maintenance office in Rocklin and the Placer County Transportation Planning Agency in Auburn. The project area covers SR 49 from Interstate 80 (I-80) in Auburn to McKnight Way in Grass Valley.

## 1.1 Purpose

At the beginning of the workshop, Caltrans identified the primary objectives of the study as follows:

1. Identify safety-related improvements that could be installed within the very near term
2. Identify enhancements that could be added to planned projects in the corridor
3. Identify long term projects to improve corridor safety

## 1.2 Participants

This effort was a collaboration of several agencies: Caltrans (District 3), Federal Highway Administration (FHWA), California Highway Patrol (CHP), the Nevada County Transportation Commission (NCTC), the Placer County Transportation Planning Agency (PCTPA), Placer County Department of Public Works, the City of Auburn, and the Auburn City Fire Department.

The safety audit was the combined effort of 22 individuals representing the entities listed above. A complete list of the individuals is provided in Appendix A. Caltrans retained Fehr & Peers to evaluate crash data and facilitate the efforts of the participants.

## 1.3 Process

The final agenda for the safety audit workshop is provided in Appendix B. The morning of the first day was used to understand the nature of the issues, with a deep dive into the historical collision data. In the afternoon, the team conducted an in-person field review of the corridor with stops at six locations and discussed their observations. In the evening, a smaller group drove the corridor to observe conditions during darkness. On the second day, the team considered improvement ideas from their own experience, resource documents, and innovative efforts from elsewhere in the country. These ideas were discussed freely, with a bias towards including ideas that may potentially enhance safety, even if they may be difficult or expensive to implement. The final day was a review and refinement of the improvement strategies.

## 2. Corridor Description

The 22-mile SR 49 study corridor transitions from six-lane suburban street in Auburn to a four-lane rural highway in Placer County, to a rural two-lane highway in Nevada County, and to a four-lane freeway in Grass Valley. Given the variation along the route, the corridor was divided into the following four segments that have similar characteristics.

1. I-80 to Dry Creek Road – a four to six lane suburban arterial in Auburn and North Auburn
2. Dry Creek Road to Wolf Road/Combie Road – a four-lane rural highway with a continuous two-way left turn lane (striped median)
3. Wolf Road/Combie Road to Allison Ranch Road/La Barr Meadows Road – a two-lane highway with truck climbing lanes
4. Allison Ranch Road/La Barr Meadows Road to McKnight Way – a two-lane highway that transitions to a four-lane freeway at McKnight Way

The roadway characteristics are summarized in Table 1. A description of each segment is provided below.

**Table 1: Corridor Description**

Characteristic	Segment 1	Segment 2	Segment 3	Segment 4
Limits	I-80 to Dry Creek Road	Dry Creek Road to Wolf Road/Combie Road	Wolf Road/Combie Road to Allison Ranch Road/La Barr Meadows Road	Allison Ranch Road/La Barr Meadows Road to McKnight Way
Post miles	PLA 3.21 to 7.43	PLA 7.43 to NEV 2.19	NEV 2.19 to R10.71	NEV R10.71 to R13.66
Length	4.2 miles	6.2 miles	8.5 miles	3.0 miles
AADT <sup>1</sup>	40,500	32,000	24,200	26,800
Adjacent land uses	Urbanized	Rural	Rural	Rural
Lanes	4 / 6	4	2	2
Posted speed	45 / 55 mph	65 mph	55 mph	55 mph
Traffic signals <sup>2</sup>	15	2	4	1
Median	TWLTL <sup>3</sup> / Raised	TWLTL	TWLTL / None	None
Shoulder width	4-8 feet	8 feet	2-8 feet	2-8 feet

- Notes:
1. Highest average annual daily traffic (AADT) volume listed for the segment in the 2017 traffic volumes (<https://dot.ca.gov/programs/traffic-operations/census/traffic-volumes/2017>)
  2. The number of signals includes boundary intersections.
  3. TWLTL indicates a continuous two-way left-turn lane (striped median).

Source: Fehr & Peers (2020)



## 2.1 Segment 1

Segment 1 is from I-80 to Dry Creek Road in Placer County, post mile (PM) PLA 3.21 to 7.43. This segment is in an urbanized portion of Placer County. The portion south of Nevada Street/Marguerite Mine Road (PM PLA 4.55) is with the City of Auburn, and the portion to the north is in the unincorporated part of the County. Commercial and industrial parcels line the corridor including grocery stores, fast food restaurants, car dealerships, and big box retail outlets. Residential areas are mostly set back from the roadway except for the north end of the segment, where mobile home parks are located to the west. An elementary school and a hospital are located near Bell Road (PM 6.38) and Education Street (PM 6.54), and a middle school is located at Palm Avenue (PM 3.78).

Segment 1 has a posted speed of 45 miles per hour (mph) from I-80 to Locksley Lane (PM 6.96). North of Locksley Lane to Dry Creek Road, the posted speed is 55 mph based on an engineering and traffic survey conducted in 2017 that lowered the speed limit from the default speed limit of 65 mph as provided in CVC 22349. Including the I-80 ramp terminal intersections, Segment 1 has 15 traffic signals. Four travel lanes are provided from I-80 to Luther Road (PM 5.21). Luther Road to Bell Road has six lanes, and then the roadway narrows back to four lanes from Bell Road to Dry Creek Road. The most common median treatment is a two-way left-turn lane (striped median), which facilitates access to adjacent parcels. At some locations, a striped or raised median is used to prohibit left turns to and from driveways. A paved shoulder of varying width exists along the segment, but it is not formally designated as a Class II bicycle lane. Sidewalks primarily exist along recently improved parcels (for example, the shopping center on the southeast corner at Bell Road).



**Figure 1 – Segment 1 North of Elm Avenue (PM PLA 3.47) and Segment 2 at Joeger Road (PM PLA R7.96)**

## 2.2 Segment 2

Segment 2 is from Dry Creek Road in Placer County (PM PLA 7.43) to Wolf Road/Combie Road in Nevada County (PM NEV 2.19). The urbanized North Auburn area ends about a quarter mile north of Dry Creek Road. The rural land uses are primarily residential ranch homes and agricultural properties. Near the north end of the segment there are industrial and commercial parcels at Streeter Road (PM NEV 1.71) and Wolf Road/Combie Road.

Segment 2 has a posted speed of 55 mph from Dry Creek Road to Michael Lane (PM PLA R7.74, about 0.3 miles to the north) based on an engineering and traffic survey that lowered the speed limit from the default speed limit of 65 mph as provided in CVC 22349.. The rest of the segment is posted at 65 mph. Traffic signals exist only at the end points: Dry Creek Road and Wolf Road/Combie Road. The roadway generally has two lanes with a two-way left-turn lane (striped median) and an eight-foot shoulder in each direction. In the Nevada County portion, frontage roads are used to consolidate driveways.

## 2.3 Segment 3

Segment 3 is from Wolf Road/Combie Road to Allison Ranch Road/La Barr Meadows Road (PM NEV 2.20 to 10.56) in the rural portion of Nevada County. The adjacent land uses are primarily rural residential and agricultural parcels. A commercial area exists at Alta Sierra Drive (PM 9.22), and a few residential neighborhoods are located at the north end of the segment near Allison Ranch Road/La Barr Meadows Road.



**Figure 2 – Segment 3 North of Alta Sierra Drive (PM 9.22) and Segment 4 at Golden Chain Motel (PM 11.62)**

Segment 3 has a posted speed of 55 mph. Traffic signals are provided at Wolf Road/Combie Road, Lime Kiln Road (PM 7.17), Alta Sierra Drive, and Allison Ranch Road/La Barr Meadows Road. The four lanes at the southern end of the segment narrow to two lanes about one-half mile to the north. The highway widens to four lanes at the signals at Lime Kiln Road and Allison Ranch Road/La Barr Meadows Road. A northbound

truck climbing lane is provided from Auburn Road (PM 8.09) to Allison Ranch Road/La Barr Meadows Road. A turnout exists north of Running M Drive/Clivus Drive at PM 4.02. Left and right turn pockets are provided at various intersections to facilitate access. No left turn signs are posted at a few intersections in the southbound direction where there is one travel lane and no left turn pocket. Paved shoulder widths vary along this segment from 2 to 8 feet.

## 2.4 Segment 4

Segment 4 is from Allison Ranch Road/La Barr Meadows Road to McKnight Way (PM NEV 10.56 to R13.66). The segment starts in the south in a rural portion of Nevada County and enters the City of Grass Valley at the north end. The adjacent land uses are primarily rural residential with isolated commercial parcels near Wellswood Way (PM 11.69) and Crestview Drive (PM 12.89). A church is located in the middle of the segment, and mobile parks are located near and have access at Allison Ranch Road/La Barr Meadows Road. At the north end, commercial and industrial parcels adjoin the McKnight Way interchange.

Segment 4 has a posted speed of 55 mph that transitions to 60 mph north of McKnight Way. A traffic signal exists at Allison Ranch Road/La Barr Meadows Road, where the roadway has four lanes. The roadway transitions from four to two lanes about one-quarter mile north of Allison Ranch Road/La Barr Meadows Road. Left turn pockets are provided near Wellswood Way, Bethel Church Way (PM 11.90), Smith Road (PM 12.58), and Crestview Drive. The roadway then transitions to a four-lane freeway at about 0.4 miles south of the McKnight Way overcrossing. Paved shoulder widths vary along this segment from 2 to 8 feet.

## 3. Collision History

The findings from the evaluation of the collision history are summarized below. The presentation slides showing the collision and daily traffic volume history are provided in Appendix C.

### 3.1 Collisions

Collision history from the 10-year period from January 2010 through December 2019 was obtained from Caltrans' Traffic Accident Surveillance and Analysis System (TASAS). Table 2 lists the number of collisions and the number of persons killed and injured for each segment.

**Table 2: Collisions and Persons Killed and Injured**

Segment	Collisions			Persons		
	Total	Fatality	Injury	Fatality & Injury	Killed	Injured
1. I-80 to Dry Creek Rd (PM PLA 3.208 to 7.427)	1,266	11	433	444	12	648
2. Dry Creek Rd to Wolf Road/Combie Road (PM PLA 7.427 to NEV 2.194)	414	16	164	180	18	283
3. Wolf Road/Combie Road to Allison Ranch Road/ La Barr Meadows Road (PM NEV 2.194 to R10.710)	534	6	180	186	7	296
4. Allison Ranch Road/ La Barr Meadows Road to McKnight Way (PM NEV R10.710 to R13.663)	182	0	39	39	0	46
Total	2,396	33	816	849	37	1,273

Source: Caltrans TASAS for January 2010 to December 2019

Segment 1 had the highest number of collisions, more than half of all collisions in the study corridor. However, more fatality-related collisions occurred in Segment 2 (16) than in Segment 1 (11). In the 33 fatality-related collisions, 37 people were killed. In the 816 injury-related collisions, 1,273 people were injured.

### 3.2 Collision Rate

The collision rate is calculated by dividing the number of collisions by the traffic volume and the roadway length. Table 3 compares the actual collision rates to the average crash rates for similar facilities on a statewide basis in (see Appendix D for additional details). The first segment in the urbanized area of Auburn

and North Auburn has actual collision rates higher than the statewide averages for fatality, fatality and injury, and total collisions. All three actual rates are more than twice the average rate for similar facilities. The second segment has a fatality rate two-and-a-half times the statewide average, but the fatality and injury and total collision rates are lower than average. Collision rates for the northern segments are lower than the statewide averages.

**Table 3: Collision Rate Comparison**

Segment	Actual Collision Rate			Average Collision Rate		
	Fatality	Fatality & Injury	Total	Fatality	Fatality & Injury	Total
1. I-80 to Dry Creek Rd (PM PLA 3.208 to 7.427)	<b><u>0.020</u></b>	<b><u>0.81</u></b>	<b><u>2.32</u></b>	0.008	0.40	0.97
2. Dry Creek Rd to Wolf Road/Combie Road (PM PLA 7.427 to NEV 2.194)	<b><u>0.025</u></b>	0.27	0.62	0.010	0.30	0.78
3. Wolf Road/Combie Road to Allison Ranch Road/ La Barr Meadows Road (PM NEV 2.194 to R10.710)	0.008	0.25	0.73	0.017	0.37	0.91
4. Allison Ranch Road/ La Barr Meadows Road to McKnight Way <sup>1</sup> (PM NEV R10.710 to R13.663)	0.000	0.37	1.00	0.014	0.42	1.02

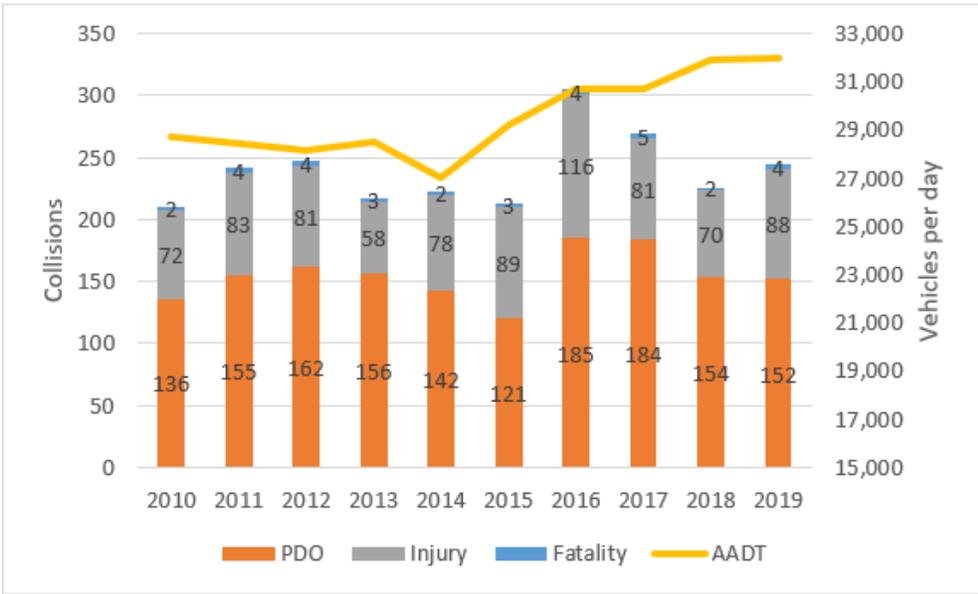
Notes: Collision rates are reported as collisions per million vehicle miles. Bold and underline font indicates an actual rate that is greater than the average rate.

1. Due to reporting limitations because the post mile changed at the boundary, the collision rates for this segment were only provided for a three-year period from January 2016 to December 2018.

Source: Caltrans TASAS for January 2010 to December 2019

### 3.3 Collision Trends

Figure 3 shows collisions by year for the study corridor. Reported collisions rose from 210 in 2010 to 244 in 2019, with a high of 305 collisions in 2016. The most property damage only (PDO) and injury collisions (116) occurred in 2016, and the most fatality collisions (5) occurred in 2017. The higher collisions in 2016 and 2017 correspond with an increase in average annual daily traffic (AADT) volume between 2014 and 2016, as reported by the census station at Lorenson Road (PM PLA R8.97).

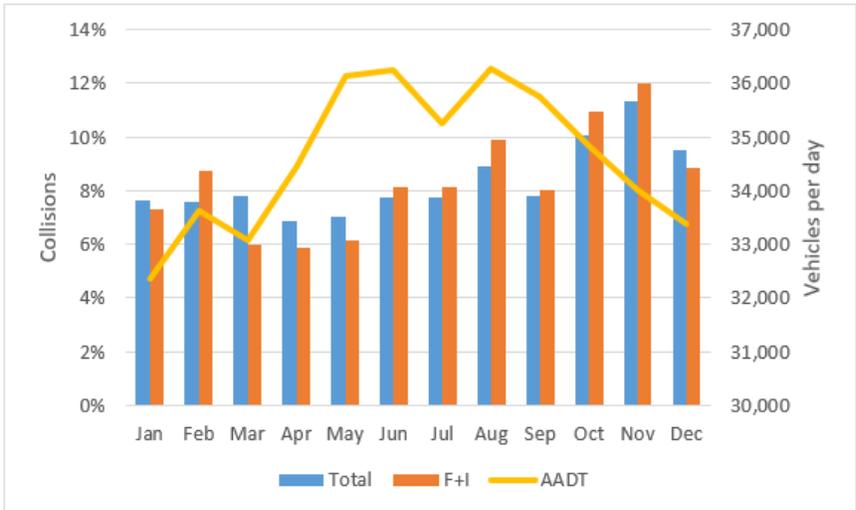


**Figure 3 – Collisions by Year**

The trend over time of other factors was reviewed. The percentage of severe (fatality and injury) collisions was found to vary around 30 to 40 percent. Collisions by side of the highway (that is, the direction of travel) were found to be evenly split. Intersection-related collisions were found to vary from 15 to 20 percent. These factors did not show a trend over time. These factors and the total collisions were reviewed by segment, and the results are provided in Appendix C.

### 3.4 Collisions by Time and Day

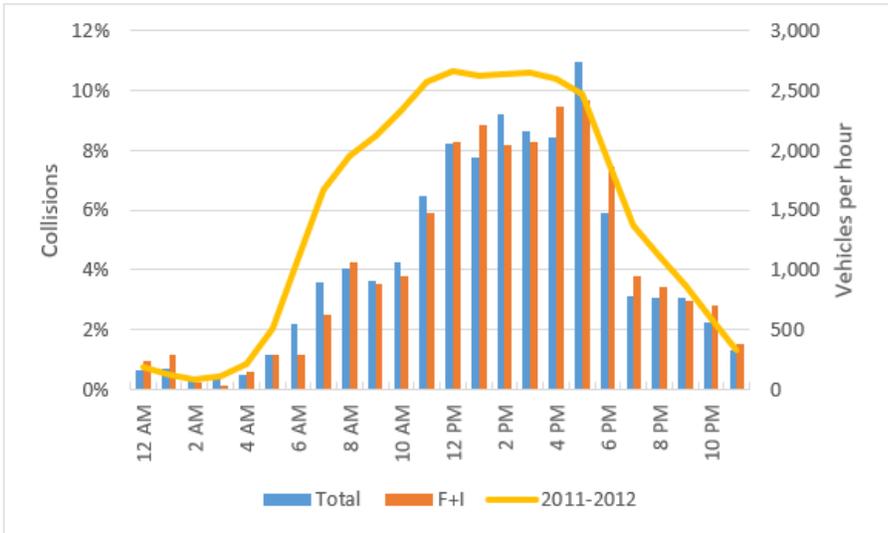
Figure 4 shows the percentage of collisions and daily volume (at Bell Road in 2011-2012) by month. The peak months for travel are late spring through summer (May to September). However, the peak months for collisions are October and November. These months correspond to peaks in recreational traffic for seasonal events and the onset of poor weather conditions. The urbanized Segment 1 has a relatively uniform distribution of collisions across the months, so the increased crashes in the fall months occurs in the rural segments.



**Figure 4 – Collisions by Month**

Collisions are highest on weekdays (12 to 18 percent of all collisions) compared to weekend days (8 to 11 percent). This corresponds with daily traffic volumes that are higher on weekdays than weekends. This trend generally holds for the segments except for Segment 4 (Allison Ranch Road/La Barr Meadows Road to McKnight Way), which has a notable spike on Sundays (25 percent of fatality and injury collisions occurred on this day).

Figure 5 shows collisions and hourly volume by time of day from the count station at Bell Road (although older, the 2011-2012 time period provided the most complete year from the traffic census data).



**Figure 5 – Collisions by Time of Day**

The highest hours for collisions are 11 AM to 6 PM. Although traffic volumes are relatively high during the morning hours, collisions are low. Segment 3 (Dry Creek Road to Wolf Road/Combie Road) is the only segment that has a higher percentage of collisions in the morning, from 7 to 9 AM. Segment 4 has a particularly concentrated number of collisions from 5 to 7 PM.

## 3.5 Collision Type

The most common collision type in the study corridor is a rear-end collision, which is about half (51 percent) of all collisions and of fatality and injury collisions. The next most common collision types are broadside, sideswipe, and hit object collisions. Table 4 lists the number, percentage, and rank of collisions types for total and fatality and injury collisions.

**Table 4: Collision Type by Percentage**

Collision Type	Total Collisions			Fatality & Injury Collisions		
	Total	Percentage	Rank	Total	Percentage	Rank
Head-On	84	4%	6	48	6%	5
Sideswipe	267	11%	3	49	6%	4
Rear End	1,220	51%	1	431	51%	1
Broadside	364	15%	2	177	21%	2
Hit Object	259	11%	4	68	8%	3
Overturn	40	2%	7	27	3%	7
Auto-Ped	32	1%	8	30	4%	6
Other	123	5%	5	16	2%	8
Not Stated	7	0%	9	3	0%	9

Source: Caltrans TASAS for January 2010 to December 2019

Figure 6 shows the share of collision types for each segment. For Segment 1, rear-end collisions are even more frequent (63 percent) than for the overall corridor (51 percent), and broadside collisions are the second most frequent type (16 percent) rather than sideswipe or hit object collisions. These collision types are associated with congestion (in the case of rear-end collisions) and cross traffic (in the case of broadside collisions), which are typically higher in urbanized areas. In the rural segments, hit object collisions are the second or third most frequent type. The "other" collision type is high in Segments 3 and 4 (12 to 13 percent).

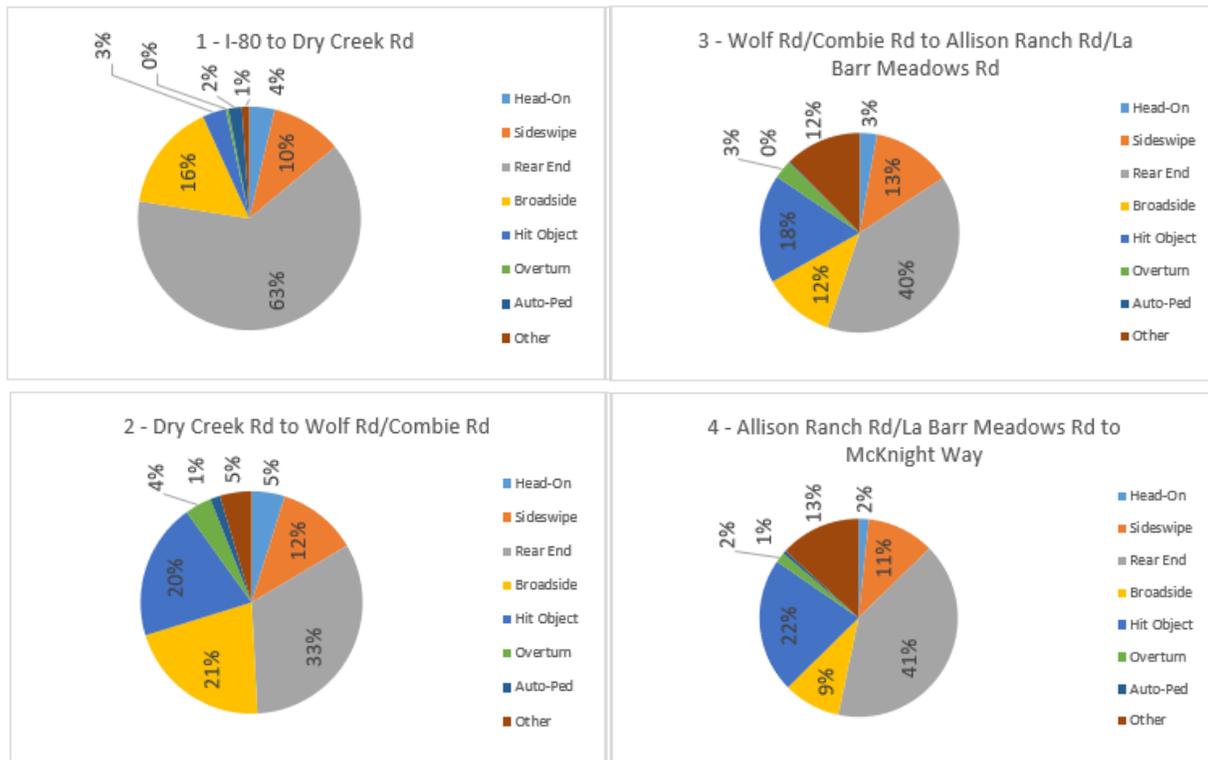


Figure 6 – Collision Type Percentage by Segment

### 3.6 Other Contextual Factors

The other contextual factors that were evaluated are the primary collision factor, weather, lighting, pavement condition, number of vehicles, and vehicle type. Here is a summary of the findings (see Appendix C for additional details).

- Speeding was the most frequent primary collision factor (43 percent), with failure to yield (15 percent) and other violation (15 percent) as the next most frequent factors.
- In the northern two segments, "other than driver" (17 to 18 percent) was the second most frequent factor. This category includes outside influences such as an animal in the roadway, a mechanical defect, roadway debris, and a medical event.
- Most collisions occurred during clear weather (75 percent). Rainy weather was 6 to 8 percent of collisions for all segments.
- Most collisions occurred during daylight (73 percent). Collisions in the dark were approximately split between those with streetlights (12 percent) and without streetlights (11 percent).

- Most collisions occurred on dry pavement (86 percent). Collisions on wet pavement varied from 11 to 18 percent with the highest percentage in Segment 3 (Wolf Road/Combie Road to Allison Ranch Road/La Barr Meadows Road).
- Overall, most collisions involved two vehicles (67 percent). Single vehicle collisions are more common in the three rural segments (30 to 33 percent) compared with the urban segment (6 percent).
- Most collisions involved passenger cars (72 percent). Trucks, motorcycles, and pedestrians are each 2 percent or lower. In Segments 2 and 3, animals are involved in collisions more frequently (4 and 7 percent, respectively) than for the corridor as a whole (2 percent).

Although it is listed as the most common primary collision factor, speeding in this context is not limited to traveling faster than the posted speed limit. CVC 22350 states that "no person shall drive a vehicle upon a highway at a speed greater than is reasonable or prudent having due regard for weather, visibility, the traffic on, and the surface and width of, the highway, and in no event at a speed which endangers the safety of persons or property." As a result, a California Highway Patrol (CHP) officer can cite a driver for speeding when traveling 45 mph in a 55-mph zone if the speed was not reasonable for the conditions at that time. Rear end collisions often have speeding as the primary collision factor since the following driver was traveling too fast to stop before the collision.

## 3.7 Collision Density

The spatial distribution of the 2010 to 2019 collisions from the TASAS database is shown in Figures 7 and 8 for total and fatal plus injury collisions, respectively. Fatal plus injury collisions are those collisions that involve at least one person injured or killed. Separate figures are provided for each segment.

For Segment 1, both total and fatal plus injury collisions are clustered around signalized intersections. The north legs at Bell Road (PM PLA 6.38) and Luther Road (PM 5.21) have the highest concentrations of collisions. Many of these are rear-end collisions may be related to drivers traveling at higher speeds encountering a queue at a signalized intersection. Palm Avenue (PM 3.78) has a high concentration of total collisions, but relatively fewer fatal plus injury collisions.

The only two signalized intersections in Segment 2, Dry Creek Road (PM PLA 7.43) and Wolf Road/Combie Road (PM NEV 2.19), have the highest concentration of collisions. Like Bell Road and Luther Road in Segment 1, the collisions are highest on the north leg of the Dry Creek Road intersection. Collisions at Wolf Road/Combie Road are centered on the intersection rather than on the north or south leg. Lone Star Road (PM PLA R10.28) is the only other high concentration of total collisions, but both Lone Star Road and Lorenson Road/Florence Lane (PM PLA R8.97) have a high concentration of fatal plus injury collisions.

For Segment 3, the four signalized intersections – Wolf Road/Combie Road, Lime Kiln Road (PM NEV 7.17), Alta Sierra Drive (PM 9.22), and Allison Ranch Road/La Barr Meadows Road (PM R10.71) – have the highest

concentrations of total collisions. For fatal plus injury collisions, hot spots occur at several locations including Round Valley Road (PM 8.43) and Pekolee Drive (PM 8.00).

Segment 4 has its highest concentration of total collisions at the signalized Allison Ranch Road/La Barr Meadows Road and the unsignalized Smith Road (PM NEV 12.58) intersections. One of the three hot spots in the fatal plus injury figure is the same as for total collisions (Allison Ranch Road/La Barr Meadows Road), but the other two are the Wellswood Way intersection (PM 11.69) and the McKnight Way (PM R13.66) ramps.

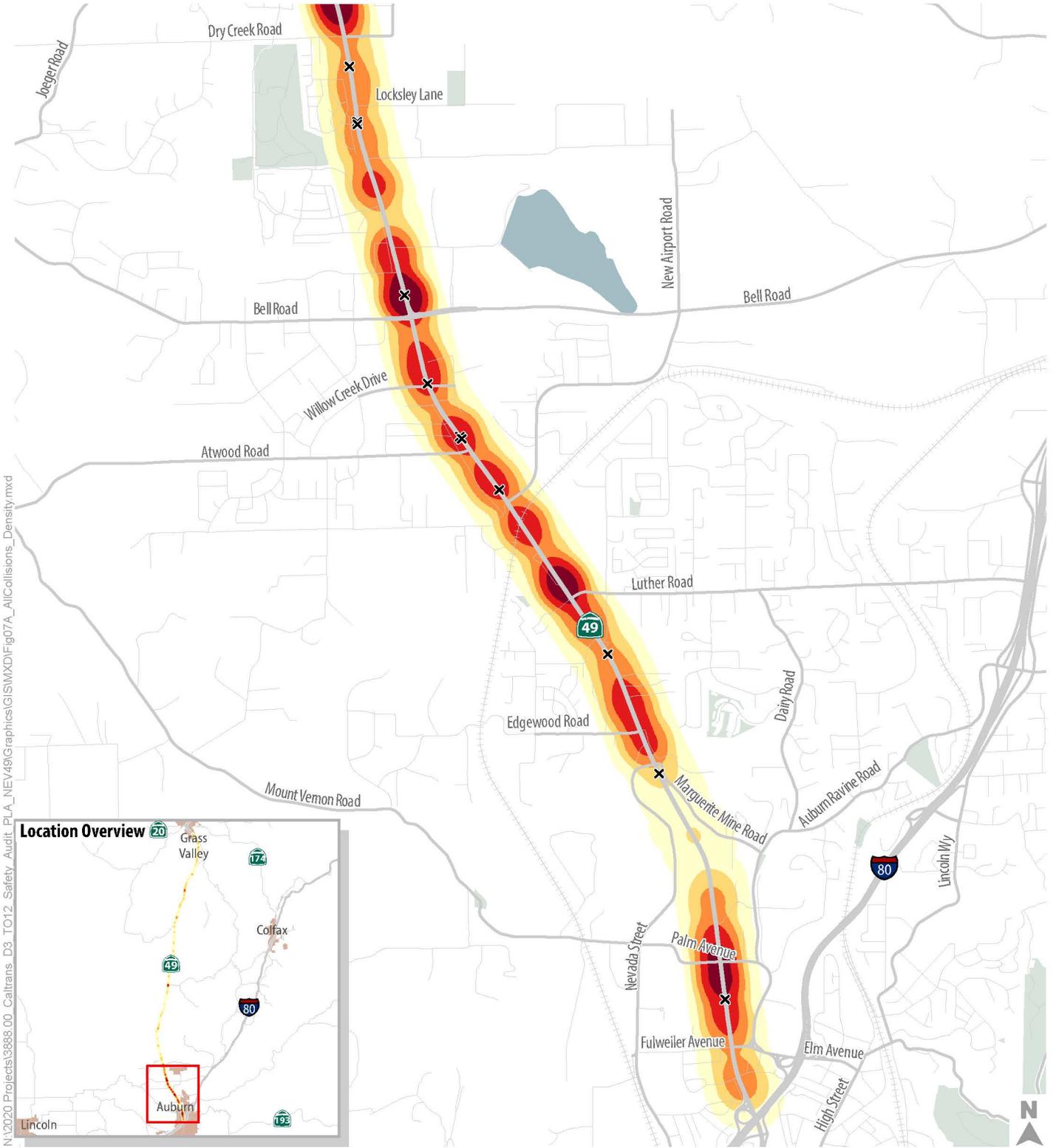
## 3.8 Fatal Collisions

The 10-year collision data (2010-2019) has 33 fatality-related collisions on the SR 49 study corridor (which resulted in 37 fatalities as shown in Table 2). Table 5 lists the fatal collisions by segment. The locations of the fatal collisions are shown on Figures 7 and 8.

**Table 5: Fatal Collisions**

Segment	Collisions	Comments
1. I-80 to Dry Creek Rd (PM PLA 3.25 to 7.42)	11	<ul style="list-style-type: none"> <li>8 auto-pedestrian collisions</li> <li>2 at Atwood Road and 2 at Rock Creek Mobile Home Park driveway</li> <li>7 occurred in the last five years (2015-2019)</li> <li>9 occurred at night</li> <li>7 located in the southbound direction</li> </ul>
2. Dry Creek Rd to Wolf Road/Combie Road (PM PLA 7.42 to NEV 2.20)	16	<ul style="list-style-type: none"> <li>6 broadside collisions</li> <li>6 located within 0.5 miles of Dry Creek Road</li> </ul>
3. Wolf Road/Combie Road to Allison Ranch Road/ La Barr Meadows Road (PM NEV 2.20 to 10.56)	6	<ul style="list-style-type: none"> <li>2 each of head-on, broadside, and hit object</li> <li>3 located near Mother Lode Road/Oak Drive (near the southbound lane drop)</li> <li>All located in the southbound direction</li> </ul>
4. Allison Ranch Road/ La Barr Meadows Road to McKnight Way (PM NEV 10.56 to 13.66)	0	
Total	33	

Source: Caltrans TASAS for January 2010 to December 2019



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Collision Density  
 Low High

x Fatal Collision

Figure 7A

Collision Density (All Collisions) - Segment 1



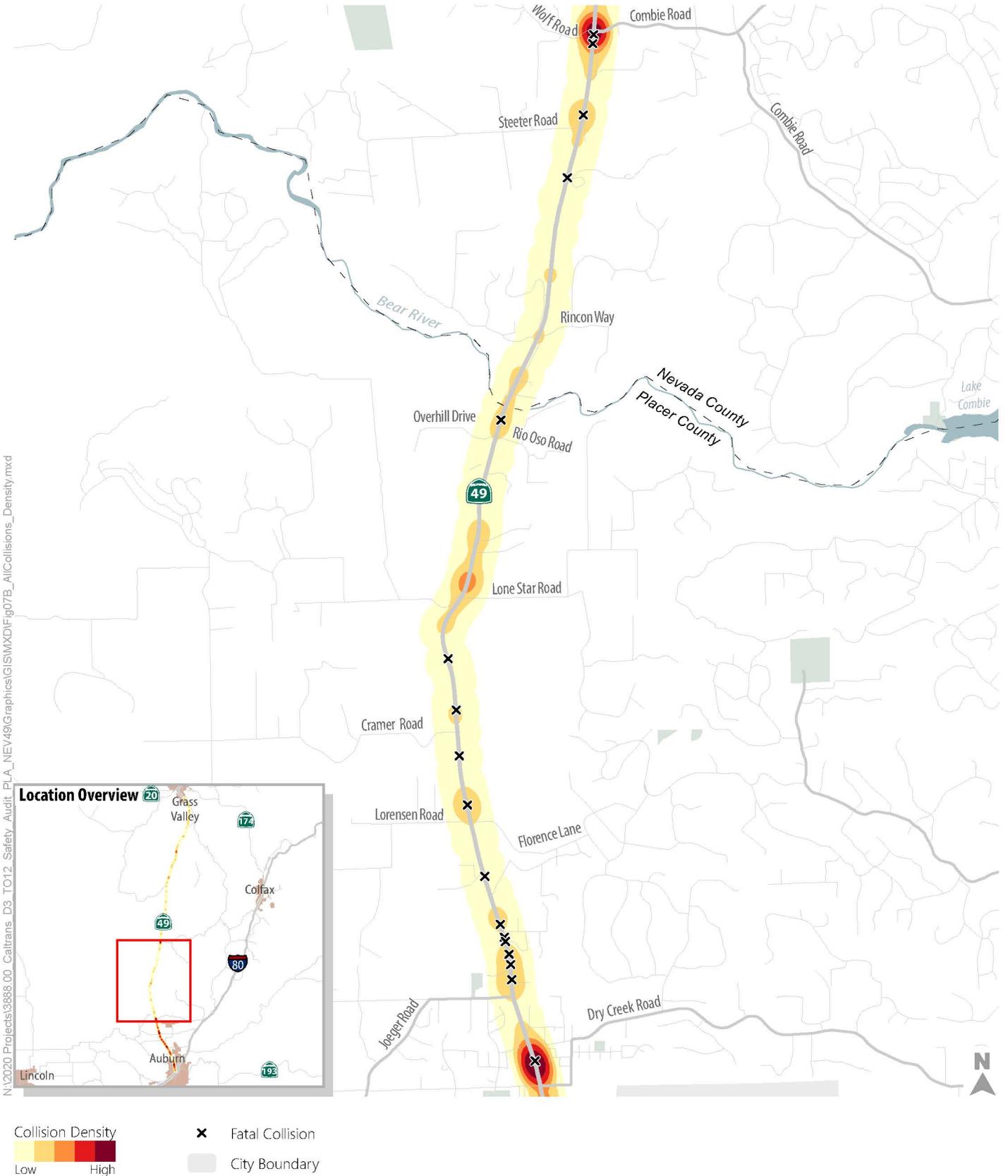
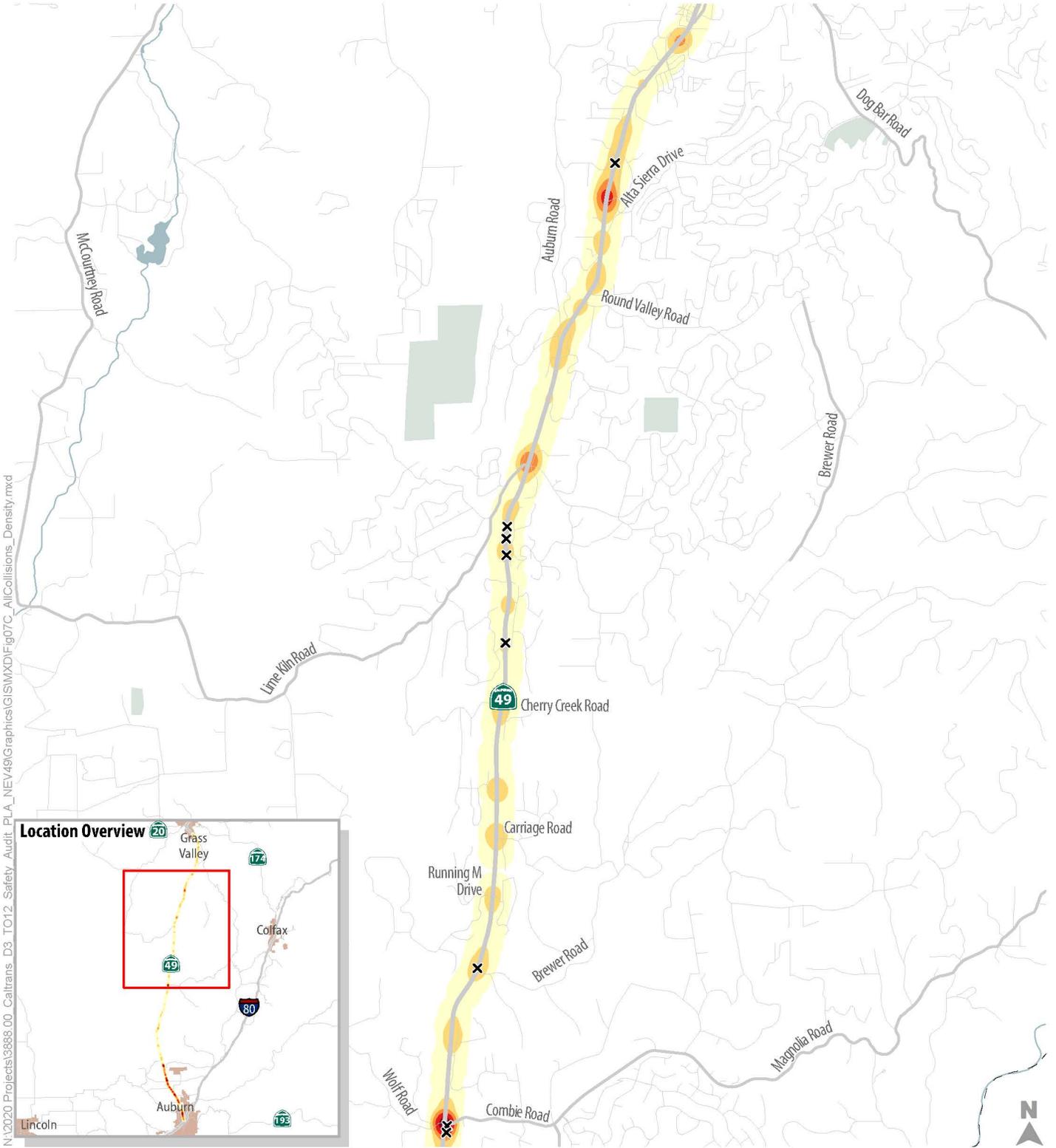


Figure 7B

Collision Density (All Collisions) - Segment 2





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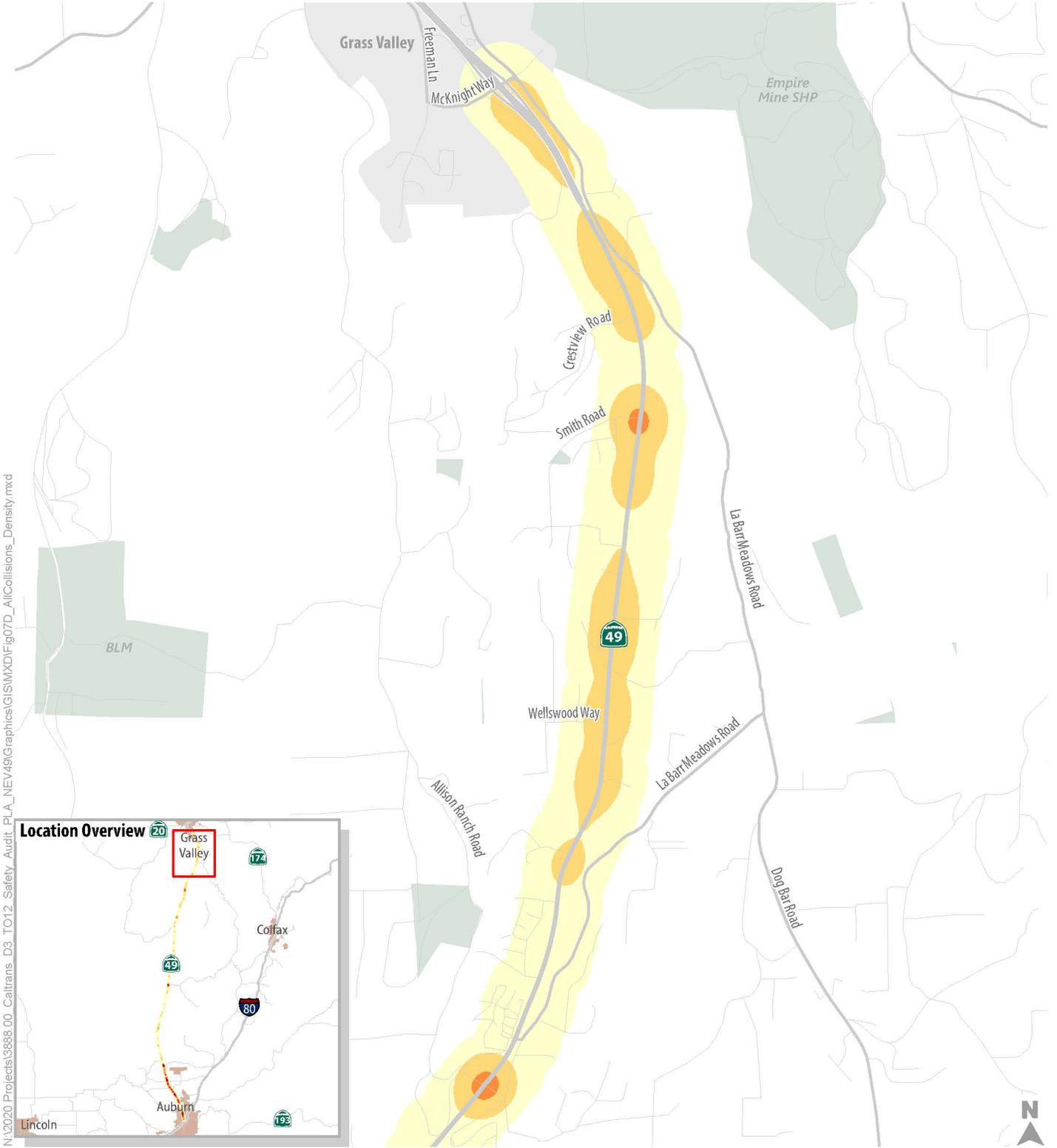


Collision Density	✕ Fatal Collision
Low High	City Boundary

Figure 7C

Collision Density (All Collisions) - Segment 3





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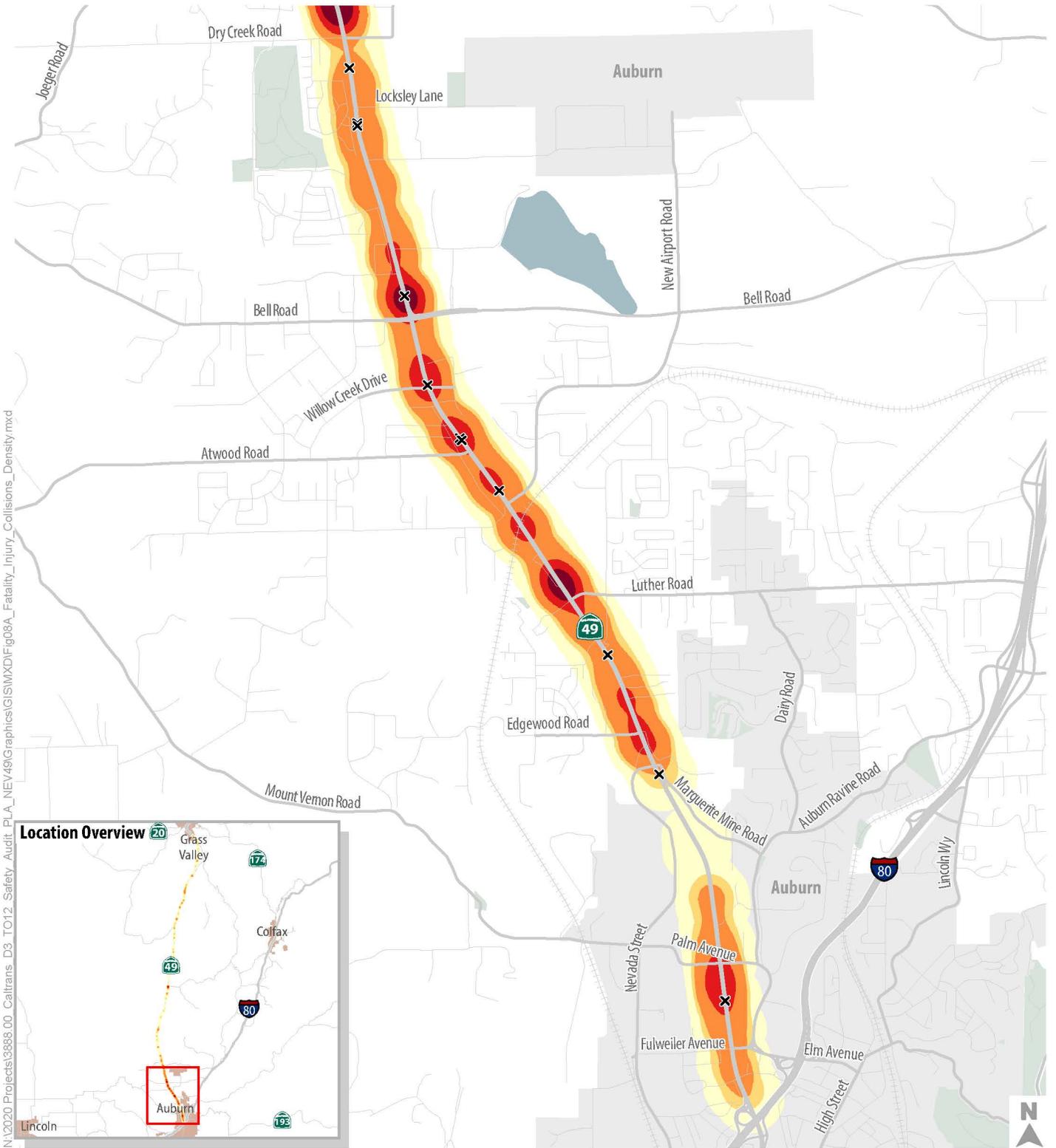
Collision Density  
 Low High

✘ Fatal Collision  
 City Boundary

Figure 7D

Collision Density (All Collisions) - Segment 4





- ✕ Fatal Collision
- City Boundary

Figure 8A

Collision Density (Fatal and Injury Collisions) - Segment 1



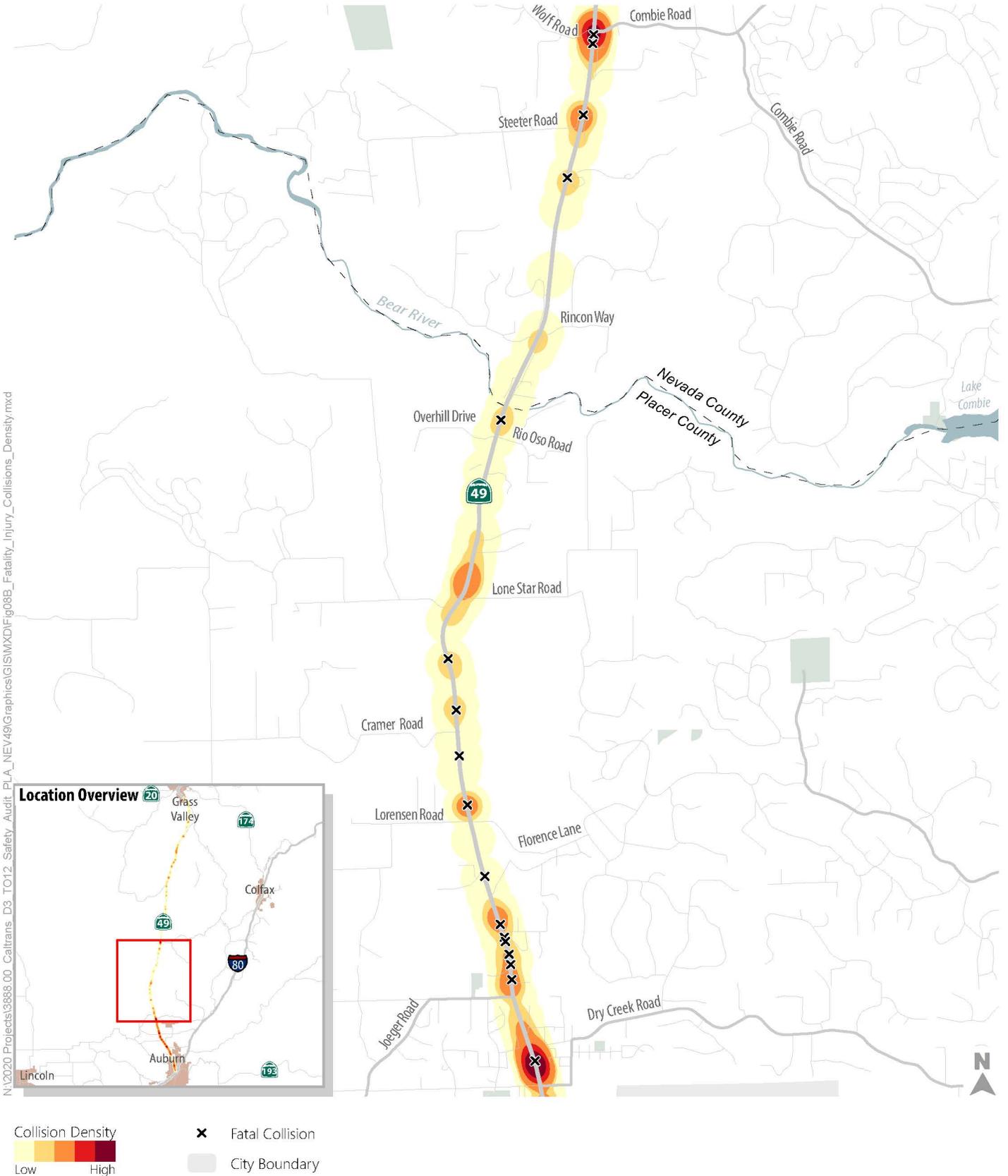
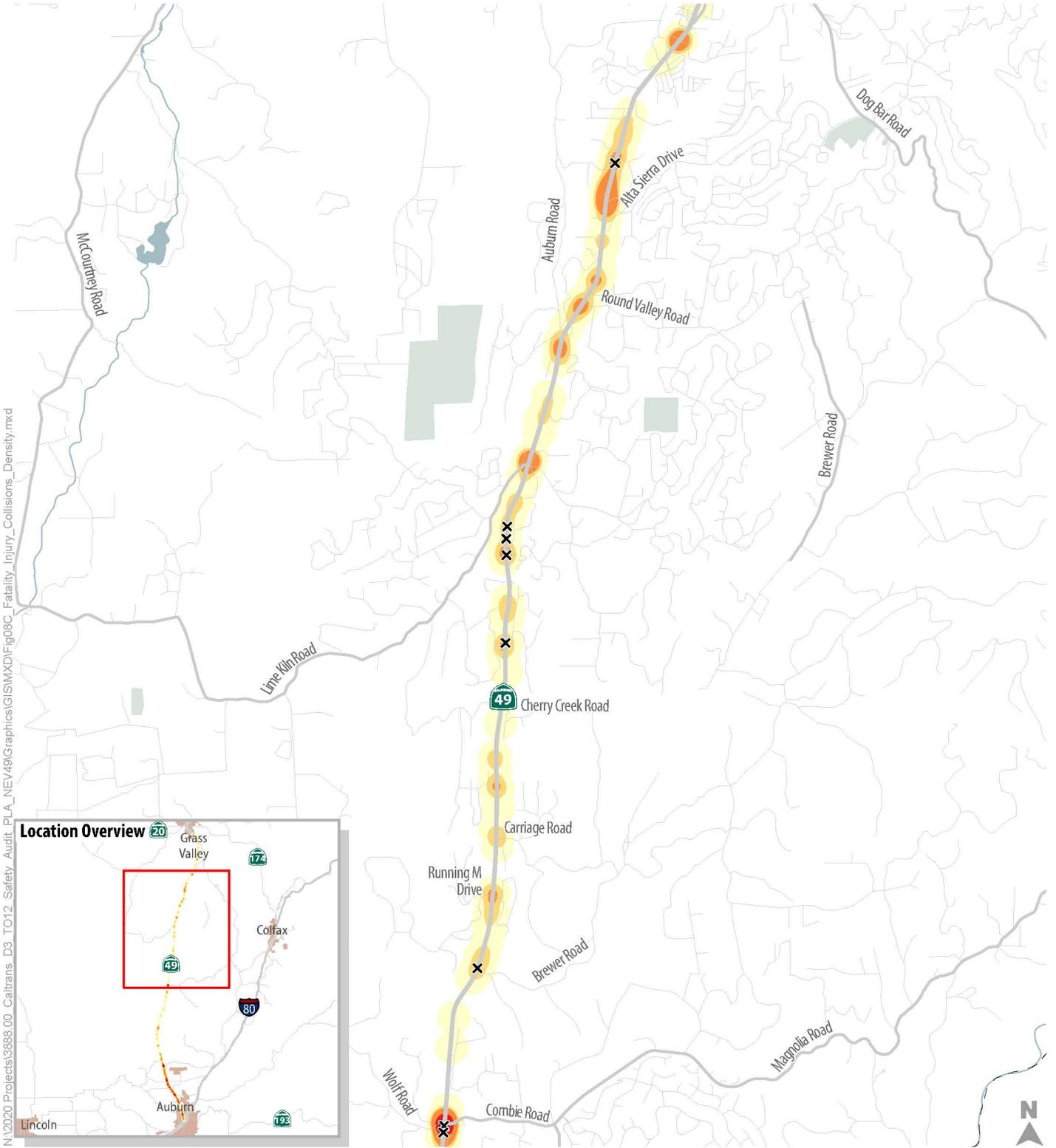


Figure 8B

Collision Density (Fatal and Injury Collisions) - Segment 2





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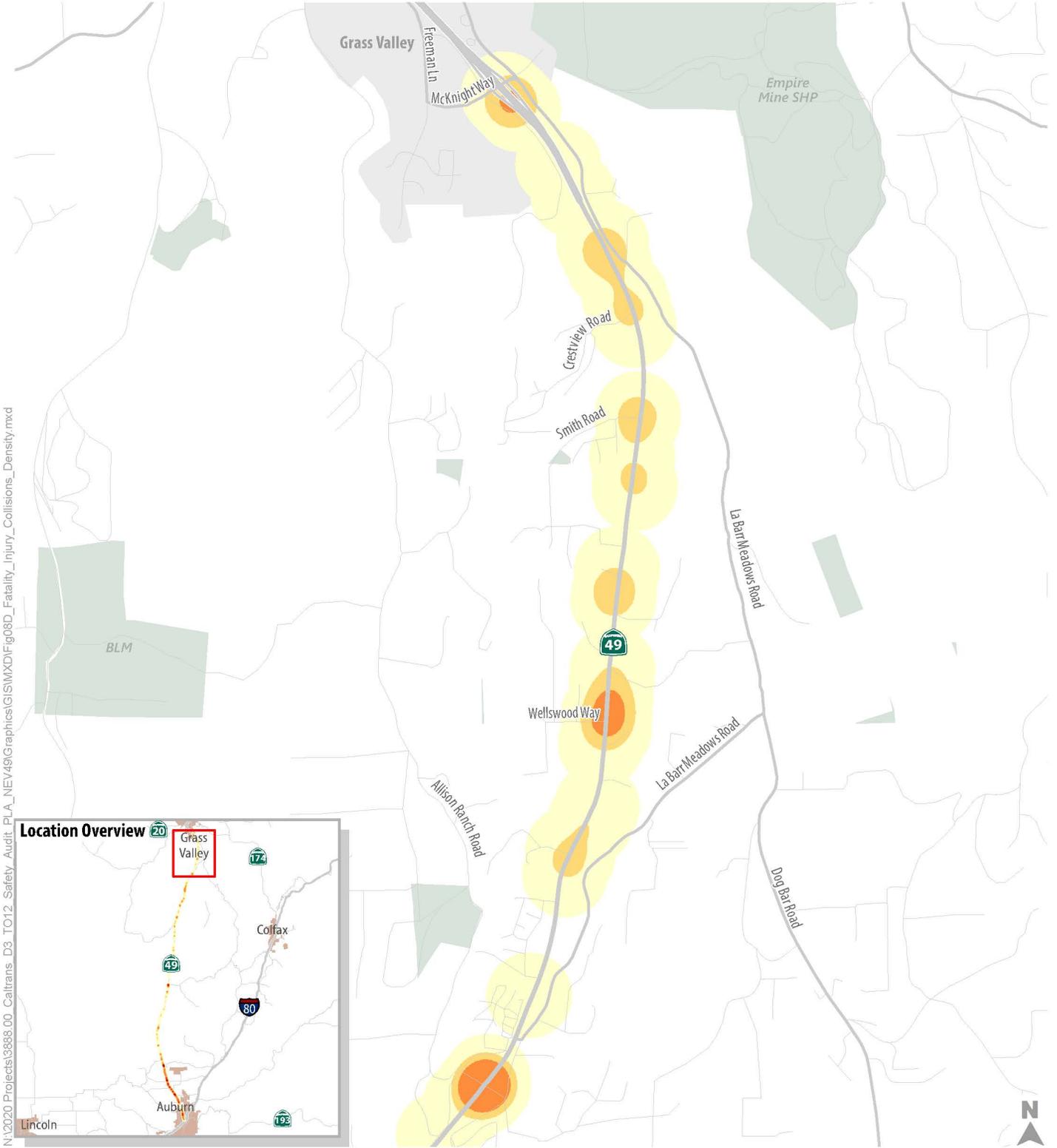


Collision Density  
 Low High  
 × Fatality Collision  
 City Boundary

Figure 8C

Collision Density (Fatal and Injury Collisions) - Segment 3





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- ✘ Fatal Collision
- City Boundary



Figure 8D

Collision Density (Fatal and Injury Collisions) - Segment 4

## 4. Key Issues

The following issues were flagged by the team from their observations and/or the collision history.

### Corridor

- More collisions occur during the fall, possibly related to the slippery pavement during the first rain event after the dry summer months, increased traffic volumes at the start of the school year, the change from daylight savings to standard time, and seasonal animal migration.
- More collisions occur on weekdays than on weekends.
- More collisions occur during the PM hours (noon to midnight) than the AM hours (midnight to noon).

### Segment 1

- Auto-ped collisions are high (24 total, 8 out of 11 fatality collisions).
- Congestion-related collisions are high: 63 percent are rear-end collisions, which are usually congestion-related, and an additional 26 percent are broadsides and sideswipes, which may be congestion-related.
- Collision rates are higher than statewide average for total and severe collisions.
- Making left turns from unsignalized side streets requires driver patience, especially during peak periods.
- Drivers have difficulty entering the roadway at unsignalized intersections due to few and inconsistent gaps in traffic, especially during peak periods.
- There is a lack of lighting between intersections.

### Segment 2

- Fatality rate is higher than statewide average, but other collision rates are lower.
- Drivers have difficulty entering the roadway at unsignalized intersections due to limited sight distance at some intersections and driver inability to accurately judge available gaps in traffic to make a safe turning movement.
- Lone Star Road intersection has limited sight distance in the northbound direction due to existing terrain.
- Southbound congestion at Dry Creek Road contributes to collisions.

### Segment 3

- Southbound congestion at Wolf Road/Combie Road and Alta Sierra Drive contributes to collisions.
- Some portions of the roadway have a restricted clear recovery zone and narrow shoulders.
- Drivers have difficulty entering the roadway at unsignalized intersections due to limited sight distance at some intersections and driver inability to accurately judge available gaps in traffic to make a safe turning movement.
- SR 49 has variability in roadway width and design features due to frontage improvements associated with land development and spot improvements with agency-funded projects.
- There is a lack of passing opportunities 3.7 miles northbound and 4 miles southbound between about Cameo Drive and Mother Lode Road/Oak Drive.
- Collision history shows higher concentrations at lane drop merge areas.

### Segment 4

- Collision history shows higher concentrations at lane drop merge areas.
- Drivers have difficulty entering the roadway at unsignalized intersections due to limited sight distance at some intersections and driver inability to accurately judge available gaps in traffic to make a safe turning movement.

## 5. Improvement History

This chapter lists previous projects on the corridor, the existing safety enhancements, and planned improvements.

### 5.1 Previous Improvements

Over the last ten years (2010 to 2019), Caltrans has constructed the following projects on the study corridor (see Appendix F for details). The cost and completion year of each project is provided.

- Installed shoulder and centerline rumble strips and six-inch striping from south of Michael Lane to the Bear River Bridge (\$1.4 million, 2019)
- Extended northbound passing lane from Combie Road to Brewer Road (\$1.4 million, 2010)
- Constructed right turn pocket at Brewer Road (\$0.5 million, 2015)
- Constructed right turn pockets and shoulders at Carriage Road and Ladybird Drive (\$2.2 million, 2014)
- Constructed northbound right turn lane and shoulder at Holcomb Drive/Cherry Creek Road (\$0.8 million, 2014)
- Improved roadway curve superelevation near Mother Lode Road (\$0.6 million, 2018)
- Installed emergency vehicle signal preemption at Wolf Road/Combie Road, Lime Kiln Road, and Alta Sierra Drive (\$0.1 million, 2018)
- Widened SR 49 to five lanes from north of Alta Sierra Drive to south of Wellswood Way, constructed frontage roads, and installed a traffic signal at La Barr Meadows Road/Allison Ranch Road (\$28.9 million, 2014)
- Constructed southbound right turn pocket at Smith Road (\$0.5 million, 2016)
- Installed guardrail and rumble strips in Nevada County at various locations (\$4.9 million, 2015)

### 5.2 Existing Safety Features

The following is a list of safety treatments that have been implemented on the corridor, some of which were installed under the previous projects listed above.

- Centerline and edge line rumble strips have been installed in the rural areas (Segments 2, 3, & 4). This is the FHWA Proven Safety Countermeasure for Longitudinal Rumble Strips and Stripes.

- Oversize speed limit signs have been posted in Segment 2.
- Overhead flashing beacons for signal ahead warning exist on southbound at Dry Creek Road, northbound and southbound at Wolf Road/Combie Road, and southbound at Allison Ranch Road/La Barr Meadows Road.
- Roadside flashing beacons for signal ahead warning exist on southbound SR 49 at Palm Avenue, northbound and southbound at Lime Kiln Road and Alta Sierra Drive, and northbound at Allison Ranch Road/La Barr Meadows Road.
- Mandatory headlight use signs are in place for Segments 2, 3, and 4. Associated safety corridor signs are in place, but the safety corridor designation has expired.



**Figure 9 – Edge Line Rumble Strip and Overhead Flashing Beacon**

## 5.3 Recent Actions

Caltrans has taken the following actions in this corridor approximately within the last year:

- In Nevada County, SR 49 has been restriped to have six-inch pavement markings (Segments 2, 3, and 4).
- In Placer County, center line rumble strips and six-inch edge line pavement markings were installed in Segment 2 (EA 4H030).

The pavement is currently (as of March 2020) being rehabilitated from I-80 to Dry Creek Road (EA 2F340). As part of this project, six-inch enhanced wet night visibility striping will be installed, and new signs will be installed with Type XI sheeting (both are standard). New signals will be installed at Locksley Lane and Shale Ridge Road. A sidewalk will be constructed in on at least one side of the roadway from Nevada Street to Palm Avenue. The paved shoulder will be widened to eight feet within the project limits, and the shoulder will be striped as a Class II bicycle lane.

## 5.4 Approved and Funded Projects

Caltrans is already planning to take the following actions:

- Install four radar speed feedback signs (Segments 2 and 3, EA 3H340):
  - Northbound near Florence Lane (PM PLA 9.2)
  - Southbound south of Streeter Road (PM NEV 1.6)
  - Northbound north of Wolf Road/Combie Road (PM NEV 2.8)
  - Southbound south of Pekolee Drive (PM NEV 7.9)
- Install safety lighting at Brewer Road and a second flashing beacon for signal ahead warning for northbound and southbound at Alta Sierra Drive (Segment 3, EA 3H340)
- Install a northbound acceleration lane at Wolf Road/Combie Road (Segment 3, EA 3H640)
- Construct a two-way left turn lane and 8-foot shoulders between Round Valley Road and Quail Creek Drive (Segment 3, EA 3H650)

A PCTPA-led and state-funded project along SR 49 from I-80 to Dry Creek Road (Segment 1) will add nearly three miles of sidewalk to at least one side of the roadway for the project limits. Placer County Health and Human Services is leading an associated Safe Routes to Schools project for six nearby schools.

Two development-driven projects are planned for the corridor. In Nevada County, the existing intersection at Woodridge Court (PM 1.9) will be updated. In Placer County, a northbound lane will be constructed from Education Street to Quartz Drive along the frontage of the Auburn Creekside Center.

The above projects are planned to start in 2020, 2021, or 2022.

## 5.5 Planned Projects

In Segment 2, Caltrans has identified and is currently developing a project (EA 4H600) to install concrete median barrier between Lorenson Road/Florence Lane and Lone Star Road. The median barrier would address a cross median collision pattern that qualifies for funding under the Highway Safety Improvement Program. All intersections and driveways between the two end intersections would be restricted to right-in and right-out movements. To accommodate the U-turns and to slow traffic, multi-lane roundabouts would be installed at the end points. The project incorporates two FHWA Proven Safety Countermeasures, Median Barrier and Roundabouts.

A project in Segment 4 proposes to widen SR 49 between Allison Ranch Road/La Barr Meadows Road and McKnight Way (EA 4E170). Three alternatives are under consideration. The first would provide two northbound lanes, one southbound lane, and median two-way left-turn lane. The second would add a

second southbound lane. The last alternative would install a median barrier, construct frontage roads to consolidate driveways, and install roundabouts or signals at Wellswood Way and Smith Road to accommodate U-turns and local street access. Funding for construction of this project has not yet been identified.

## 6. Potential Safety Enhancements

Caltrans asked the team to identify potential safety enhancements that could be installed in both the near term and long term. In the first section below, the team identified the near term (within two years) potential actions for consideration by Caltrans. The next section lists potential longer-term actions (two to ten years), and the final section describes the ultimate vision for the facility that would help to address safety concerns. These lists are the result of team brainstorming, and each suggestion will require further engineering review for potential efficacy and cost considerations. The lists below are numbered for convenience but do not imply priority.

### 6.1 Near Term Treatments

This section describes potential safety enhancements that could be implemented within the next two years on the SR 49 corridor.

#### **Education, Encouragement, Enforcement, and Evaluation**

The following countermeasures apply to the entire corridor and focus on non-engineering solutions.

1. Create an organized media campaign that could include a dedicated web page, videos, targeted Facebook campaigns, and “pop-up” activities at public gatherings (such as the county fair).
2. Institute a regular (quarterly or semi-annual) gathering of safety-related staff from multiple entities to share information and coordinate programs and messaging. Potential participants would include Caltrans, City and County public works, City and County fire departments and other first responders, cities, bicycle advocates, schools, CHP, hospitals, County public health, tourism industry, and agricultural industry.
3. At public workshops for upcoming construction projects, provide corridor safety messaging.
4. Investigate renewing the “safety corridor” designation.
5. Conduct outreach activities regarding safety plans with citizens groups (Citizens for 49 Safety and Fix49), business groups, and the general public, such as senior centers, schools, and churches.
6. Partner with CHP and fire departments on outreach events (for example, Coffee with a Cop).
7. Support a grant application for added CHP enforcement in the fall (to address the first rain of the season, time change, and other seasonal effects on collisions).
8. Develop a structured evaluation program to annually review performance data to determine trends and the need for additional countermeasures. The performance data should include speeds, collisions, and feedback from key user groups.

9. For outreach events, prepare driver education materials with input from CHP, Office of Traffic Safety, and DMV on determining a safe gap when turning on and off the highway.

## Engineering

The following potential safety enhancements are physical improvements to the roadway. These elements are summarized in Table 6.

1. Enhance signs by enlarging and/or upgrading the Type XI retroreflective sheeting to enhance visibility. In particular, review deer crossing signs in Segments 2, 3, and 4 and no left turn signs in Segment 3.
2. Install signal ahead warning sign, potentially with a flashing beacon, for the northbound approach to New Airport Road in Segment 1. The jog in the roadway at the railroad overcrossing may obscure the adjacent downstream traffic signal.
3. Reduce excessive foliage growth that may be restricting sight distance at curves and intersections in Segments 2, 3, and 4.
4. Upgrade existing crosswalk striping at all locations to the ladder pattern with longitudinal markings and raised pavement markers on the leading edge to increase the conspicuity of crossings.
5. Add crosswalk markings at Lime Kiln Road (Segment 3), and refresh crosswalk markings at I-80 Westbound Ramps/Sawyer Street (Segment 1).
6. Provide advanced stop bars for downhill approaches at traffic signals in Segments 1, 2, and 3 to encourage drivers to not encroach into crosswalks.
7. Optimize and coordinate traffic signals in Segment 1 to better manage vehicle flow, speed, and travel time.
8. Install a speed zone ahead sign for the southbound direction near Joeger Road to warn of the speed limit reduction north of Dry Creek Road.
9. Upgrade all longitudinal striping to current Caltrans standard of six-inch Enhanced Wet Night Visibility Thermoplastic throughout the corridor to increase visibility of lane lines.
10. Add retroreflective strips to signs posts in Segments 2, 3, and 4 to improve visibility of signs and the edge of pavement.
11. Install retroreflective back plates at traffic signals to improve visibility of traffic signals especially during a power outage. This is a FHWA Proven Safety Countermeasure.
12. Install or refresh reflectors on cut and fill slopes, guard rail, and concrete barrier in Segments 3 and 4.

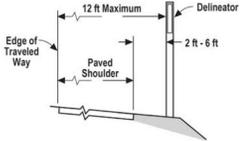
13. Install enhanced wet night visibility pavement markings in Segments 2, 3, and 4. This is an element of the FHWA Proven Safety Countermeasure for Enhanced Delineation and Friction for Horizontal Curves.
14. Install or refresh centerline pavement markers in Segments 2, 3, and 4. Add markers to the nose of right turn lane gore points. Install white/red pavement markers for lane striping on multi-lane roadways.
15. Install guide signs on southbound SR 49 to direct travelers to use Bell Road and Elm Avenue as alternate routes to I-80. Similarly, install guide signs on I-80 to direct travelers to use Bell Road as an alternate route to SR 49.



**Table 6: Near Term Treatments – Physical Countermeasures**

Countermeasure	Image	Segment 1	Segment 2	Segment 3	Segment 4
1. Install enhanced signs		N/A	X	X	X
2. Install signal ahead warning		Northbound at New Airport Rd	N/A	N/A	N/A
3. Reduce foliage growth in clear recovery zone		N/A	N/A	X	X
4. Upgrade existing crosswalk striping (ladder)		X	X	X	X
5. Add/refresh crosswalk markings		I-80 Westbound Ramps/Sawyer St	N/A	Lime Kiln Rd	N/A
6. Add advanced stop bar for downhill approaches at signals		X	X	X	N/A



Countermeasure	Image	Segment 1	Segment 2	Segment 3	Segment 4
7. Optimize/coordinate signals		X	N/A	N/A	N/A
8. Install speed zone ahead sign		N/A	Southbound at Joeger Rd	N/A	N/A
9. Upgrade to 6-inch striping		X	X	X	X
10. Add retroreflective strips to signposts		N/A	X	X	X
11. Install retro reflective back plates		X	X	X	X
12. Install/refresh reflectors on slopes and barriers		N/A	N/A	X	X



Countermeasure	Image	Segment 1	Segment 2	Segment 3	Segment 4
13. Install enhanced wet night visibility pavement markings		N/A <sup>1</sup>	X	X	X
14. Install or refresh pavement markers		N/A <sup>1</sup>	X	X	X
15. Install guide signing		Southbound SR 49 at Bell Rd and Elm Ave, Eastbound I-80 at SR 49	N/A	N/A	N/A

Notes: "X" indicates that the treatment applies to the entire segment, and "N/A" indicates that the treatment does not apply to the segment.  
1. New pavement markings and markers will be installed as part of the current roadway rehabilitation project in Segment 1.

Source: Fehr & Peers (2020)

## 6.2 Long Term Treatments

The following potential safety enhancements are expected to take longer to implement, more than 2 years up to as many as 10 years.

### **Education, Encouragement, Enforcement, and Evaluation**

1. Develop corridor wide messaging regarding safety and plans for countermeasures for use with the changeable message signs. For example, a safety campaign can be conducted to warn drivers of slippery pavement conditions in the fall when the first rainfall is likely to occur.
2. Coordinate on the development of a driver education program with CHP, Office of Traffic Safety, and DMV that includes a virtual reality element on gap acceptance for turning on and off the highway.
3. Support the development of sub-area evacuation plans for communities along the corridor (Lake of the Pines, Alta Sierra, etc.) so that evacuations are coordinated to keep the highway flowing.
4. Support the development of a corridor operations plan for an evacuation event for coordination among Caltrans, CHP, fire departments, county sheriff, emergency services, etc.
5. Develop safety messages to be displayed on changeable message signs (CMS) to be used on the corridor.

### **Engineering**

The following potential safety enhancements are physical improvements to the roadway. These elements are summarized in Table 7.

1. Conduct a speed zone study for Segment 1. Investigate reducing the posted speed between Dry Creek Road and Bell Road after the installation of the new traffic signals at Shale Ridge Road and Locksley Lane. Reducing the posted speed in Segment 1 may be justified due to the high occurrence of auto-pedestrian collisions.
2. Construct eight-foot shoulders to provide a paved recovery zone and to facilitate right turns on and off the highway. While the planned Round Valley Road to Quail Creek Drive widening project will provide this for a portion of Segment 3, other locations in Segments 3 and 4 would benefit from shoulder widening.
3. Investigate installing raised medians at selected locations in Segment 1 to reduce conflict points at unsignalized intersections and for driveways near signalized intersections (for example, Rock Creek Mobile Home Park driveway).

4. Widen side street approaches to eliminate split-phase signal operations at five intersections in Segment 1. This will allow more time for the SR 49 approaches so that congestion-related collisions may be reduced.
5. Investigate adding crosswalks to the fourth leg at signalized intersections in Segments 1, 2, and 3, where feasible, to reduce pedestrian delay and pedestrians crossing outside of crosswalks.
6. Investigate adding right turn pockets at unsignalized intersections throughout the corridor to reduce the potential for right turn queues affecting through vehicles. This is an element of the FHWA Proven Safety Countermeasure for Left and Right Turn Lanes at Two-Way Stop-Controller Intersections.
7. Construct intersection improvements at selected locations to reduce congestion-related collisions.
  - a. In Segment 1, widen the southbound approach at I-80 Westbound Ramps to provide more southbound right turn capacity so that the queues for vehicles heading to westbound I-80 is reduced.
  - b. In Segment 2, consider improvements at Wolf Road/Combie Road including a displaced left turn intersection (also known as a continuous flow intersection).
  - c. In Segment 3, widen the southbound approach at Alta Sierra Drive or modify the traffic signal so that the southbound through movement does not stop (similar to the operation of Hazel Avenue/US 50 Eastbound Ramps in Rancho Cordova).
8. Upgrade the eight-inch signal heads at Lime Kiln Road (Segment 3) to twelve inches. Review traffic signals and flashing beacons throughout the corridor to upgrade to twelve-inch heads if appropriate.
9. Install extinguishable message signs to warn drivers of long queues at signalized intersections. Recommended locations for the signs are the southbound approaches to Palm Avenue (Segment 1), Dry Creek Road (Segment 2), and Wolf Road/Combie Road and Alta Sierra Drive (Segment 3).
10. Install Intelligent Transportation System elements in the corridor to inform traffic managers and to provide better traveler information.
  - a. Install changeable message signs to notify travelers of road conditions and anticipated travel times. Potential locations on SR 49 are southbound at Bell Road (Segment 1), northbound at Dry Creek Road (Segment 1), and southbound near McKnight Way (Segment 4). Another potential location is on eastbound I-80 west of SR 49 to provide travel time information to Grass Valley via SR 49 and Bell Road.
  - b. Install closed-circuit television cameras at major intersections (traffic signals, roundabouts, etc.) to provide monitoring for traffic operations and incident response.

- c. Install weather monitoring stations (RWIS) so that drivers can be warned of weather conditions via the changeable message signs.
11. Investigate if longitudinal pedestrian-scale street lighting in Segment 1 meets warrants, safety guidance, or HSIP program requirements. If so, work to program projects to install lighting to improve the visibility of pedestrians at night.
12. Investigate vehicle/animal collision patterns to determine feasible locations to construct wildlife fencing and undercrossings in Segments 2, 3, and 4 to reduce vehicle conflicts with wildlife.
13. Consolidate and/or remove driveways to reduce conflict points with highway traffic. In Segment 1, driveways could be consolidated in the portion from Nevada Street to Luther Road. In Segment 4, driveways near Crestview Drive could be closed since parcel access is available via the parallel La Barr Meadows Road. This is the FHWA Proven Safety Countermeasure for Corridor Access Management.
14. Install high friction pavement on the approaches to signalized intersections to reduce rear-end collisions. Potential treatment locations are the downhill southbound approaches at Palm Avenue (Segment 1), Atwood Drive (Segment 1), Wolf Road/Combie Road (Segment 3), and Alta Sierra Drive (Segment 4).
15. Evaluate the existing alignment for opportunities to straighten horizontal and flatten vertical curves and to widen clear recovery zones. For example, the railroad overpass south of New Airport Road in Segment 1 causes a jog in the roadway alignment that may contribute to vehicle collisions. Wider clear recovery zones and flattened slopes adjacent to the roadway may improve sight distance on curves in Segments 3 and 4. Widening the clear recovery zone is an element of the FHWA Proven Safety Countermeasure for Roadside Design Improvements at Curves.
16. Identify and implement vehicle pullout areas for CHP to stage their vehicles for enforcement in Segments 3 and 4 where shoulders are less than eight feet wide and driveways are infrequent.
17. Investigate if safety lighting at unsignalized intersections and lane drop merge areas in Segments 3 and 4 meets required warrants or HSIP program requirements. Potential locations are Pingree Road, Bethel Church Way, and south of McKnight Way.
18. Extend the merge areas away from the traffic signal at Lime Kiln Road in the northbound direction (Segment 3) and away from the McKnight Way on-ramp in the southbound direction (Segment 4).
19. Install curve warning signs and chevrons in accordance with the current requirements in the California Manual on Uniform Traffic Control Devices. This is an element of the FHWA Proven Safety Countermeasure for Enhanced Delineation and Friction for Horizontal Curves.
20. Widen two-lane highway segments to provide a center two-way left-turn lane to facilitate left turns to and from the highway and to provide a median recovery zone for errant drivers. This is an



element of the FHWA Proven Safety Countermeasure for Left and Right Turn Lanes at Two-Way Stop-Controller Intersections.

21. Construct passing lanes in both directions in Segment 3 to improve driver comfort and increase available gaps for side street approaches. The location should be approximately midway between Cameo Drive and Mother Lode Road/Oak Drive.



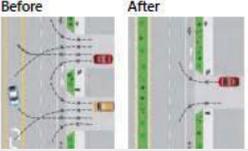
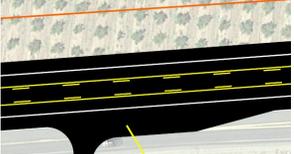
**Table 7: Long Term Treatments – Physical Countermeasures**

Countermeasure	Image	Segment 1	Segment 2	Segment 3	Segment 4
1. Conduct speed zone study		X	N/A	N/A	N/A
2. Construct 8-foot shoulders		N/A <sup>1</sup>	N/A <sup>2</sup>	X	X
3. Install raised median		X [Example: Elm Ave to Palm Ave]	N/A	N/A	N/A
4. Widen side street approach to eliminate split phasing		X [Example: Palm Ave]	N/A	N/A	N/A
5. Add crosswalk to 4th leg		X [Example: Palm Ave]	X	X	
6. Add right turn lane		X [Example: Middle School Drwy]	X	X	X



Countermeasure	Image	Segment 1	Segment 2	Segment 3	Segment 4
7. Improve intersection		Widen southbound approach at I-80 Westbound Ramps	Expand Wolf Rd/Combie Rd	Widen southbound or modify signal at Alta Sierra Dr	N/A
8. Upgrade signals to 12-inch heads		N/A	N/A	Lime Kiln Rd	N/A
9. Install queue/slow traffic warning signs		Southbound at Palm Ave	Southbound at Dry Creek Rd	Southbound at Wolf Rd/Combie Rd	Southbound at Alta Sierra Dr
10. Install Intelligent Transportation System elements		X	X	X	X
11. Investigate longitudinal lighting for pedestrians		X	N/A	N/A	N/A
12. Determine potential for wildlife fencing and undercrossings		N/A	X	X	X



Countermeasure	Image	Segment 1	Segment 2	Segment 3	Segment 4
13. Consolidate or remove driveways		Nevada St to Luther Rd	N/A	N/A	Near Crestview Dr
14. Place high friction pavement		Southbound at Palm Ave and Atwood Dr	N/A	Southbound at Wolf Rd/Combie Rd	Southbound at Alta Sierra Dr
15. Realign roadway and widen clear recovery zone		X	X	X	X
16. Identify and construct enforcement pullouts		N/A	N/A	X	X
17. Install safety lighting at intersections and merges		N/A	N/A	X [Example: Pingree Rd]	X [Example: Southbound after McKnight Way]
18. Extend merge area		N/A	N/A	Northbound north of Lime Kiln Rd	Southbound south of McKnight Way



Countermeasure	Image	Segment 1	Segment 2	Segment 3	Segment 4
19. Install chevrons/curve warning signs		N/A	N/A	X	X
20. Construct two-way left-turn lane		N/A	N/A	X	X
21. Construct passing lanes		N/A	N/A	X	N/A

Notes: "X" indicates that the treatment applies to the entire segment, and "N/A" indicates that the treatment does not apply to the segment.

1. 8-foot shoulders will be constructed in Segment 1 as part of the current roadway rehabilitation project.

2. 8-foot shoulders exist in Segment 2.

Source: Fehr & Peers (2020)

## 6.3 Proven Safety Countermeasures

The FHWA promotes twenty proven safety countermeasures that address roadway departure, intersection, bicycle, and pedestrian crashes. The safety audit team reviewed this list when developing suggestions for safety treatments for the SR 49 corridor. Table 8 lists the FHWA countermeasures and notes which of the near term and long term potential safety treatments relate to the countermeasure.

**Table 8: FHWA Proven Safety Countermeasures**

Countermeasure	Potential Treatment <sup>1</sup>	
	Near Term	Long Term
Backplates with Retroreflective Borders	11	N/A
Corridor Access Management	N/A	14
Dedicated Left- and Right-Turn Lanes at Intersections	N/A	6, 21
Enhanced Delineation and Friction for Horizontal Curves	13	N/A
Leading Pedestrian Interval	N/A	N/A
Local Road Safety Plan	N/A	N/A
Longitudinal Rumble Strips and Stripes on Two-Lane Roads	– <sup>2</sup>	N/A
Median Barrier	– <sup>3</sup>	N/A
Medians and Pedestrian Crossing Islands in Urban and Suburban Areas	N/A	N/A
Pedestrian Hybrid Beacon	N/A	N/A
Reduced Left-Turn Conflict Intersections	N/A	N/A
Road Diet	N/A	N/A
Road Safety Audit	– <sup>4</sup>	N/A
Roadside Design Improvement at Curves	N/A	16, 20
Roundabouts	– <sup>3</sup>	N/A
Safety Edges <sub>SM</sub>	N/A	N/A
Systemic Application of Multiple Low Cost Countermeasures at Stop-Controlled Intersections	N/A	N/A
USLIMITS2	N/A	N/A
Walkways	– <sup>5</sup>	N/A
Yellow Change Intervals	N/A	N/A

- Notes:
1. The listed number refers to the potential treatments described in Sections 6.1 and 6.2.
  2. Longitudinal rumble strips exist on SR 49 in Segments 2, 3, and 4 (see Section 5.2).
  3. Median barrier and roundabouts would be installed as part of a planned project in Segment 2 (see Section 5.5).
  4. This report is a product of a road safety audit.
  5. Sidewalks will be installed as part of an approved and funded project in Segment 1 (see Section 5.4).
- "N/A" indicates that the countermeasure does not have an associated near term or long term potential treatment.

Source: FHWA, Fehr & Peers (2020)

## 6.4 Vision for Ultimate Facility

Table 9 lists the ultimate concept facility for each segment in the SR 49 study area as recommended by the safety audit team. The urban segment from I-80 to Dry Creek Road would have six lanes and function as a suburban arterial street. A raised median would be used to limit conflicts from side streets, and pedestrian and bicycle facilities would be included. The rural segment from Dry Creek Road to Wolf Road/Combie Road would remain four lanes, but a median barrier would be installed to limit cross-median collisions. At intersections, control would be provided by a traffic signal or roundabout. For Segments 3 and 4 in Nevada County, the goal would be to provide more consistency by providing at least a three-lane cross-section with passing lanes. A center two-way left turn lane would accommodate turning traffic from side streets. The ultimate configuration would be a five-lane cross-section to provide continuous passing opportunities. Median barrier would be installed where needed to limit cross-median collisions.

**Table 9: Vision for Ultimate Facility**

Segment	Configuration
1. I-80 to Dry Creek Rd	6 lanes with raised median
2. Dry Creek Rd to Wolf Road/Combie Road	4 lanes with median barrier and signals/roundabouts at intersections
3. Wolf Road/Combie Road to Allison Ranch Road/ La Barr Meadows Road	Interim – 3 lanes (TWLTL) with passing lanes Ultimate – 5 lanes (TWLTL) with signals/roundabouts at intersections and median barrier, as needed
4. Allison Ranch Road/ La Barr Meadows Road to McKnight Way	

Source: Fehr & Peers (2020)

## 7. References

- FHWA Proven Safety Countermeasures, (<https://safety.fhwa.dot.gov/provencountermeasures/>)
- Human Factors Guidelines for Road Systems, NCHRP Report 600  
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