Eastern Sierra Corridor Freight Study

Final Report

prepared for

Caltrans

prepared by

Cambridge Systematics, Inc.

with

American Transportation Research Institute

February 28, 2019

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Acronyms and Abbreviations

AADT	Average Annual Daily Traffic
AADTT	Average Annual Daily Truck Traffic
AID	Accelerated Innovation Deployment
BUILD	Better Utilizing Investments to Leverage Development
AFB	Air Force Base
APCS	Automated Pavement Condition Survey
BLM	Bureau of Land Management
CCTV	Closed Circuit Television
CHP	California Highway Patrol
CMS	Changeable Message Sign
CMV	Commercial Motor Vehicle
COG	Council of Governments
CS	Count Station
DEIR	Draft Environmental Impact Report
DERA	Diesel Emissions Reductions Act
DOT	Department of Transportation
DWP	Los Angeles Department of Water and Power
ELD	electronic logging device
ESWG	Eastern Sierra Working Group
FAST Act	Fixing America's Surface Transportation Act
FAF4	Freight Analysis Framework version 4
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FY	Fiscal Year
GIS	Geographic Information System
HSIP	Highway Safety Improvement Program

INFRA	Infrastructure for Rebuilding America
IRI	International Roughness Index
ITD	Innovative Technology Deployment Program
ITS	Intelligent Transportation System
LOS	Level of Service
LTC	Local Transportation Commission
LTL	Less than truckload
MAP-21	Moving Ahead for Progress in the 21st Century
mph	Miles Per Hour
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
Mt	Mountain Pass Closure Message Signs
NHFP	National Highway Freight Program
NHPP	National Highway Performance Program
NHS	National Highway System
NTC	National Training Center
O-D	Origin-Destination
P3	public-private partnership
PM_{10}	Particulate Matter 10
$PM_{2.5}$	Particulate Matter 2.5
RWIS	Road Weather Information System
SBCTA	San Bernardino County Transportation Authority
SCAG	Southern California Association of Governments
STAA	Surface Transportation Assistance Act
STBG	Surface Transportation Block Grant Program
TIGER	Transportation Investment Generating Economic Recovery
TCR	Transportation Concept Report
TEU	Twenty-Foot Equivalent Unit

TPAS	truck parking availability system
TPIMS	truck parking information management system
TTAC	Transportation Technical Advisory Committee
US EPA	U.S. Environmental Protection Agency
USDA	U.S. Department of Agriculture
V/C	Volume-to-Capacity

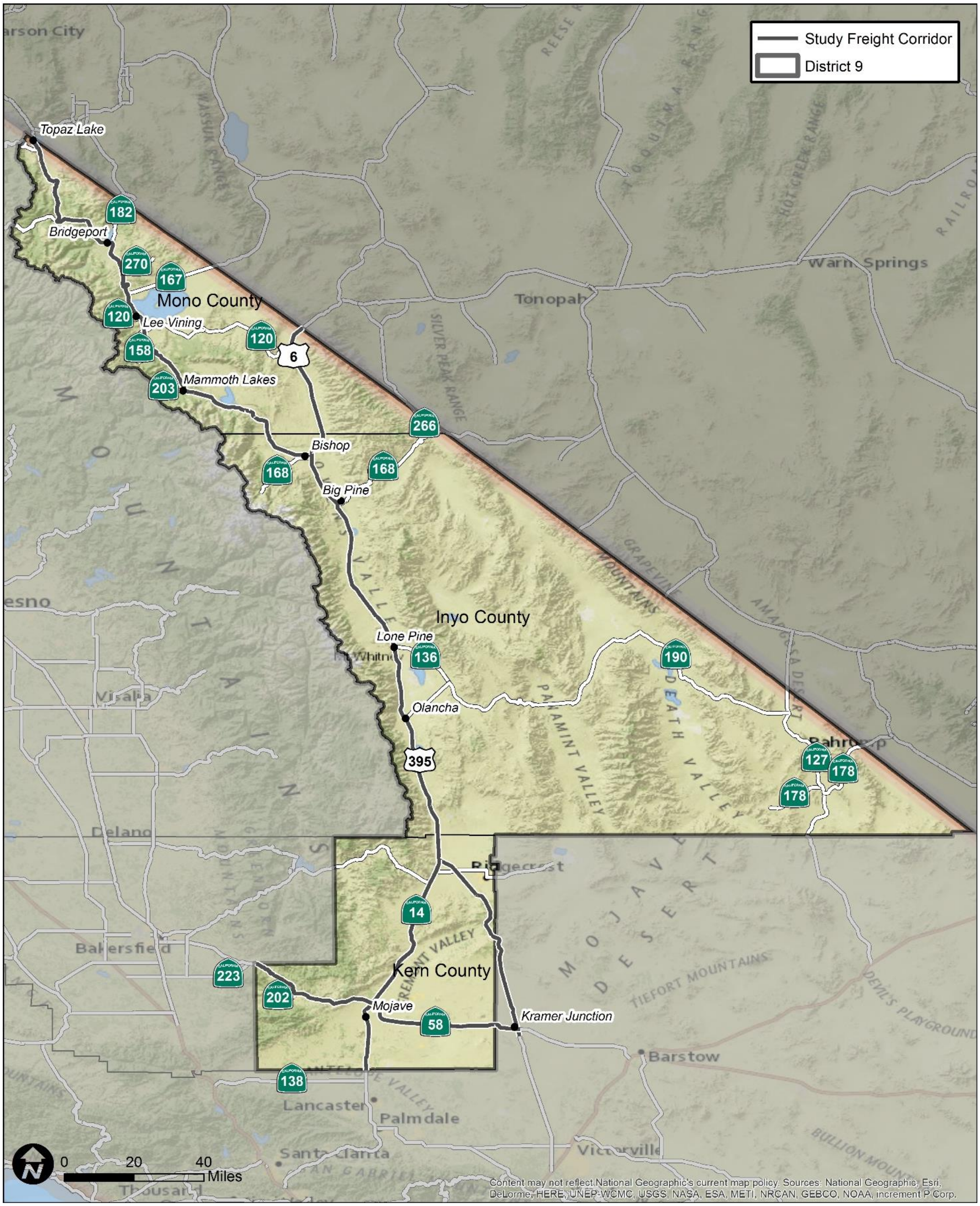
Executive Summary

The eastern side of California's Sierra Nevada Mountain range is lined with scenic tourist destinations and peaceful ranching communities. Residents and visitors are drawn to this region to enjoy nature's playground. Connecting these rural towns and iconic sites to each other and to the outside world is US 395, which also serves as the most direct route between Southern California's Inland Empire and the Reno metropolitan area in Northwestern Nevada. Truck drivers have enjoyed traveling this route for decades. However, with the recent and projected growth of the Inland Empire and Northwestern Nevada, there is growing concern with potential conflicts between trucks and the small communities they pass through.

U.S. 395 along West Walker River, South of Walker

As shown in Figure ES.1, the Eastern Sierra Corridor (the region within the California Department of Transportation (Caltrans) District 9 boundary) is a rural region served by a long north-south highway corridor consisting mainly of US 395 that provides lifeline accessibility for people and goods in Inyo and Mono Counties, tourist accessibility to recreational destinations (such as Bodie State Historic Park, Mono Lake, Mammoth Lakes, Mount Whitney, Death Valley National Park, and numerous quaint towns, shops and museums, etc.) and major interregional goods movement connectivity between Northern Nevada and Southern/Central Valley California.

Figure ES.1 Eastern Sierra Corridor Study Area



Source: Caltrans State Highway Geographic Information System (GIS) data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017).

Bishop Main Street

The primary highways of interest to this study, US 395, US 6, SR 14, and SR 58 also are the main streets of many of the communities in this study area, lined with hotels, restaurants, shops, and pedestrians. Sometimes trucks can be seen as a nuisance when parked in undesignated locations or driving through busy tourist destinations. Conversely, passing through these many towns increases the travel time for truck drivers with delivery deadlines and required rest stops. In addition, high mountain passes, strong winds, two-lane highways, and other natural and manmade conditions can pose challenges to the efficient movement of freight through the corridor.

This study uses a data-driven approach to identify current and future areas of concern impeding the efficient and safe movement of freight, or adversely impacting the quality of life for the residents and visitors of the corridor, assess strategies and recommendations to overcome these obstacles, and highlight options to fund projects.

Commercial and Industrial Activity Centers

From an origin-destination study that Caltrans conducted in 2011, we learn that 90 percent of all trucks traveling within the corridor originate or terminate in Southern California, Northern Nevada, or somewhere within the corridor. Therefore, understanding the major economic activity centers within these three areas is the greatest indicator of future truck volumes.

Eastern Sierra Corridor Activity Centers

Tourism is the major economic driver within the Eastern Sierra Corridor. Visitors are drawn to iconic destinations and natural playgrounds of Yosemite, Mount Whitney, Mammoth Lakes, and myriad other beauties of the Eastern Sierra. The 2011 US 395 Origin and Destination Study found that over 60 percent of surveyed travelers entering the area described recreation as the main purpose of their trip. Recreational visitors drive a demand for food and supplies at hotels, restaurants, shops, and visitor centers.

Restaurant Supplies Delivery in Bishop

Northern Nevada Activity Centers

The five counties in Northern Nevada at the north end of the study corridor—Carson City, Douglas, Lyon, Storey, and Washoe—are experiencing tremendous growth, especially in logistics and manufacturing. According to a study commissioned by the Economic Development Authority of Western Nevada, this growth is "driven by a regional economy that is becoming increasingly diversified due to a proactive regional business recruitment and retention strategy, locational/transportation advantages (e.g., access to I-80 and the Union Pacific Railroad), a pro-business climate in Nevada and a progressively well-funded economic development program."[1]

Photo Source: http://tahoereno.com/.

Tesla recognized the advantages of locating their Gigafactory in Northern Nevada, and became an anchor for subsequent new and relocated facilities. Tesla and many others are located in the Tahoe-Reno Industrial Center in Storey County with 30,000 developable acres able to accommodate over 300 million square feet industrial space.

Southern California Activity Centers

Southern California is one of the largest economic activity centers in the U.S. According to a recent New York Times article, "California accounted for 17 percent of job growth in the United States from 2012 to 2016, and a quarter of the growth in gross domestic product…. The Ports of Los Angeles and Long Beach have been at the center of a rebound in container traffic and international trade."[2]

Graphic Source: http://theworldlogisticscenter.com/portfolio/bringing-jobs-to-moreno-valley-2/*.*

Changing consumer demands including the growing impact of e-commerce will likely generate additional truck trips to serve residential populations in the Corridor—many of which will originate in Southern California and be serviced through large logistics centers such as the World Logistics Center in Moreno Valley. This proposed $3 billion, high-tech distribution hub, with 40 million square feet of facilities, would bring thousands

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1 RCG Economics. 2015. Northern Nevada Regional Growth Study 2015 to 2019. Accessed from: http://edawn.org/epic-report/.

2 McPhate, Mike. 2017. "California Today: How California Helps the U.S. Economy." New York Times, June 5, 2017. Accessed from: https://www.nytimes.com/2017/06/05/us/california-today-how-california-helps-the-us-economy.html.

of jobs to Moreno Valley. With those jobs would come an estimated 11,621 total daily trips in the region from medium- and heavy-duty trucks, based on the Environmental Impact Report.

Central Valley California Activity Centers

SR 58 functions as an extension of I-40 to California's agriculturally-rich Central Valley. The area is home to more than 250 different crops with an estimated value of $17 billion per year supplying 8 percent of the U.S. agricultural output (by value), and one-quarter of the Nation's food.[3] Based on stakeholder outreach, the City of Shafter is pursuing the development of a major inland port that would likely increase truck volumes on SR 58.

Truck Traffic Patterns

Due to the rapid growth of the logistics and manufacturing industries just north and south of the Study Area, there is a concern that future truck traffic through Eastern Sierra will overwhelm the capacity of the system and negatively impact the local tourism industry and quality of life, as well as important supply chains. This perception is illustrated in Figure ES.2.

However, analysis from this Study concludes that this scenario will not occur. There are two main reasons underlying this conclusion:

1. Northern Nevada is aligned with the San Francisco major trade area.
2. The Inland Empire is aligned with Greater Southern California and its ports.

Companies locate in the Inland Empire because of its close proximity to the Greater Southern California market and the Ports of Los Angeles and Long Beach; and companies are moving to Northern Nevada because of its close proximity to Northern California markets and ports. Truck traffic patterns will primarily be east and west between these destinations. Therefore, the actual freight impacts to Eastern Sierra from outside the corridor, illustrated in Figure ES.3, are projected to be moderate, as the primary freight flows from Northern Nevada and the Inland Empire are, and will continue to be east-west, and not north-south along US 395.

3 https://ca.water.usgs.gov/projects/central-valley/about-central-valley.html (last accessed on November 16, 2017).

Figure ES.2 Perceived Freight impacts from Outside the Corridor

Source: Cambridge Systematics.

Figure ES.3 Actual Freight Impacts from Outside the Corridor

Source: Cambridge Systematics.

A methodology was developed and applied in order to quantify the above assumptions, and estimate future truck volumes in the Study Area. High and low truck volume estimates for large, 5+ axle trucks—of primary interest in this study—are shown in Table ES.1. Because the projected growth rate in freight-related employment varies between the three sources utilized for this analysis, high and low truck volume estimates are provided. The projected growth in large, 5+ axle trucks is well within the capacity of the system and should not worsen congestion, disrupt trade flows, or diminish local tourism or quality of life. It is approximately commensurate with the anticipated growth of all vehicular traffic in the Study Area. The one exception is truck traffic on SR 58, which is projected to increase dramatically by 2040.

Table ES.1 2015 and Estimated 2040 Daily 5+ Axle Truck Traffic

Highway Segment	2015	2040 Low	2040 High
US 395 North Segment (Bridgeport)	284	404	466
US 395 Middle Segment (Big Pine)	684	943	1,090
US 395 South Segment (Inyokern)	357	496	501
SR 14 North Segment (Indian Wells)	775	1,054	1,062
SR 14 South Segment (Mojave)	954	1,281	1,285
SR 58 (Tehachapi)	3,906	6,050	6,187[1]
SR 58 (Kramer Junction)	3,415	5,595	5,769
US 6 (Benton)	369	507	584

Source: Table 5.2 of this study; Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040); and Cambridge Systematics' auto volume growth calculations.

[1] The Caltrans Statewide Travel Demand Model forecasts 12,395 total volume of all sizes and types of trucks on SR 58 in the year 2040

Truck Parking

Truck parking capacity has become a more pressing topic after the passage of Jason's Law as part of Moving Ahead for Progress in the 21st Century (MAP-21) legislation. Jason's Law requires States to evaluate their ability to provide adequate parking and rest facilities for commercial motor vehicles (CMV), address the volume of CMV traffic in each State, and develop a method to measure the adequacy of CMV parking in each State.[4]

Trucks typically need to park for one of the three reasons listed below. In the Eastern Sierra Corridor, reasons 1 and 3 are the most common reasons trucks require parking.

1. They are on a long-distance stretch of their trip and need to find a suitable (and available) parking location to satisfy hours of service (HOS) requirements while maximizing their driving distance for the day.

2. They are at an origin and destination and have to wait for access to the freight facility where they are loading or unloading, and the facility does not provide long-term parking for trucks.

3. They are in the middle of their driving period, but an incident in front of them has either closed or severely congested the highway, and their best option is to park and reset their HOS status.

[4] "Jason's Law Truck Parking Survey Results and Comparative Analysis." U.S. Department of Transportation, Federal Highway Administration. Accessed October 6, 2016. Available from: http://www.ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch1.htm. An updated version of the survey should be completed in spring 2019.

Insufficient and/or inadequate truck parking creates both safety and economic competitiveness concerns. For this reason, it is imperative that States and regions examine truck parking as an asset to be managed, even if many of the investment and use decisions are made by the private sector.

Capacity in the Eastern Sierra Corridor consists of approximately 629 total authorized truck parking spaces, 68 public (10.8 percent) and 561 private (89.2 percent), spread between 18 locations. This count includes two facilities which are expected to come online in the near future—99 spaces in development at a new Boron Loves Travel Plaza which will be located just north of Exit 199 and a planned expansion of the Fort Independence Travel Plaza to a total of 50 spaces.[5]

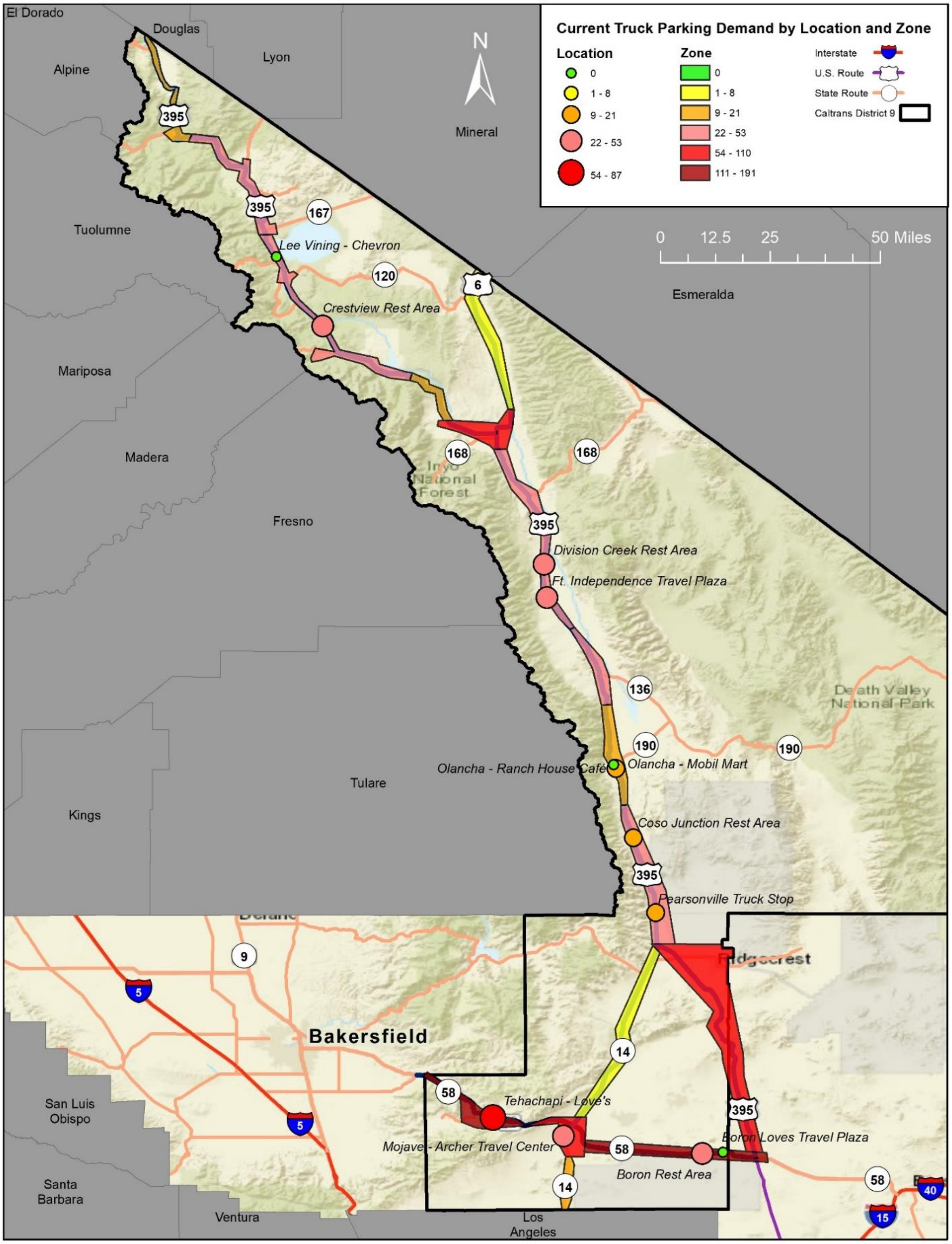
By splitting the Corridor into 14 zones and comparing demand to existing authorized capacity, current and future truck parking gaps were identified. Based on this analysis and additional stakeholder outreach and meetings, the largest gap and area of concern is the Bishop zone centered on the City of Bishop. This zone is located at the intersection of US 395 and US 6 and has no authorized truck parking spaces. The next largest gap is in the Ridgecrest zone south of the intersection with SR 14 with approximately 99 additional authorized spaces needed, followed by the Bridgeport zone with a gap of 53 spaces. This is shown in Figure ES.4.

This gap between demand and supply leads to trucks parking at undesignated locations for example, along shoulders of US 6 near Bishop, and South Landing Road exit on US 395 near Lake Crowley. Demand may be driven by the need for short-term parking near amenities, restaurants, delivery sites, or other locations. As most of these locations are in more populated areas and may not have appropriate parking facilities for trucks on-site (or in the case of businesses, may not allow trucks to park on-site until a specific delivery window), roadside parking is common. Longer-term parking at undesignated areas can occur when designated parking locations are full, when a driver misjudges their hours of service or travel time and are forced to stop before reaching a designated area, or when weather or other event causes a route closure or severe delay.

Truck Parking in Undesignated Areas—US 6 in Bishop

5 The Boron Loves Travel Plaza was approved by Kern County in October 2018. Anticipated completion dates for the two projects are unavailable.

Figure ES.4 ATRI Truck GPS Analysis—Current Truck Parking Demand

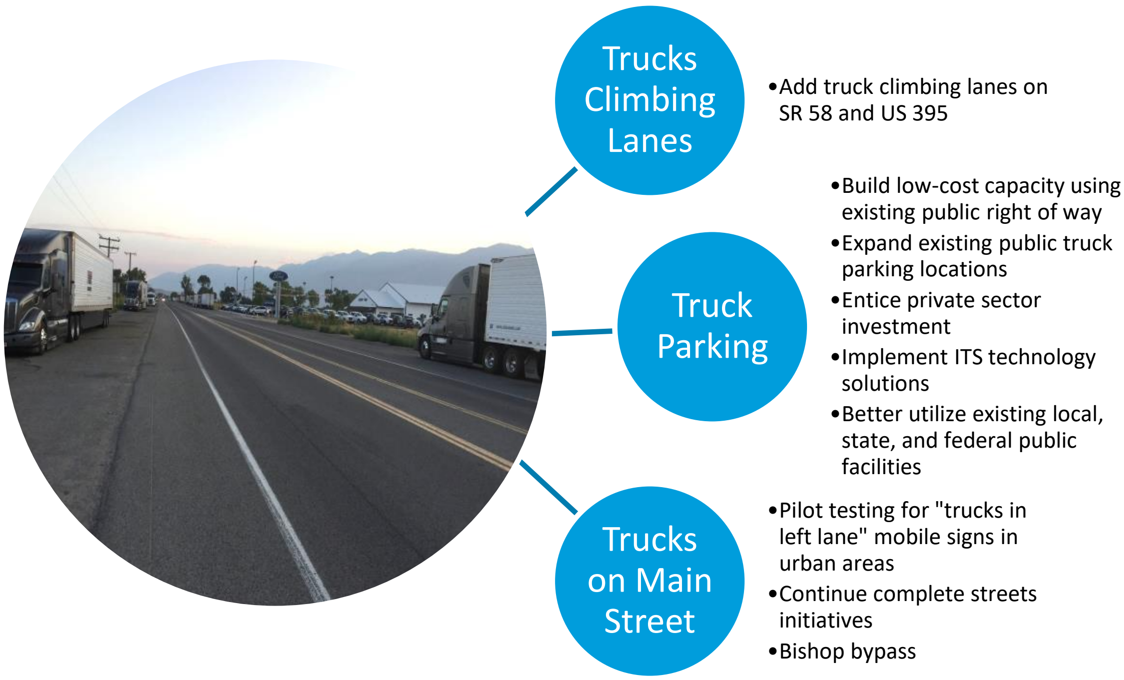


Source: ATRI, Caltrans, Consultant Analysis, 2018.

Recommendations and Implementation

Recommendations in this study were developed to address three main areas of concern. Those recommendation areas developed in this study span three topic areas and five solutions within the truck parking topic as shown in Figure ES.5 below.

Figure ES.5 Eastern Sierra Corridor Recommendation Areas and Solutions



Specific actions were then identified and divided into four categories based on their relative cost and priority. This set of implementation actions, shown in Table ES.2 should form the basis of future truck-related projects in the Corridor.

Table ES.2 Eastern Sierra Corridor Implementation Recommendations

Implementation Actions Cost and Priority	Solution Category	Location	Project
Lower-Cost, Higher Priority	Truck Parking	Bishop	• Share findings with private truck stops to entice investment • Develop a low-cost lot on public ROW
		Bridgeport	• Develop a low-cost lot on public ROW, possibly at southern end of town, and increase enforcement of unauthorized parking in other locations in town
		Ridgecrest	• Share study findings with private truck stops to entice private investment • Develop a low-cost lot on public ROW
		Tehachapi	• Develop a low-cost lot on public ROW, possibly within the SR 58/Capital Hills Parkway interchange, with 50 spaces to start and expandable to 100 spaces if demand increase

Implementation Actions Cost and Priority	Solution Category	Location	Project
		Boron	• Encourage development of the planned Loves Travel Plaza
		Independence	• Encourage the development of the planned parking expansion at the Ft. Independence Travel Plaza. Current data indicates that most trucks parking in the Independence zone are parking in and around the Travel Plaza
	Trucks on Main Street	Corridor-wide	• Pilot test requiring trucks to drive in the left lanes through towns by placing mobile dynamic message signs at either end of a town for one to two months. • Continue complete streets studies and initiatives in corridor
		Bishop	• Study the feasibility of a truck route that connects to an expanded Bishop Airport, and bypasses much of US 6 and US 395 through Bishop. Consider including a low-cost truck parking lot along the route, possibly near the airport.
Higher-Cost, Higher Priority	Truck Parking	Mammoth	• Upgrade the Crestview Rest Area so that it can remain open year-round, with an additional 45-65 truck parking spaces.
	Steep Grades	Tehachapi Summit	• Add an additional lane (truck climbing lane) in both directions on SR 58 over Tehachapi Summit.
		Conway Summit	• Add a truck climbing lane (or passing lane) on southbound US 395, north of Conway Summit.
	Advanced Traveler Information	Corridor-wide	• Implement a truck parking availability system at all rest areas, and advance notification of adverse highway conditions.
Lower-Cost, Lower Priority	Truck Parking	Corridor-wide	• Allow trucks to park at weigh stations and vehicle chain-up areas when not in use. • Expand the parking time limit at rest areas beyond 8 hours.
Higher-Cost, Lower Priority	Truck Parking	Big Pine	• Add 30-50 new truck parking spaces to the Division Creek Rest Area
		Boron	• Add a combined 100 new truck parking spaces to the eastbound and westbound Boron Rest Areas.
		Coso Junction	• Add 22 new truck parking spaces to the Coso Junction Rest Area.

Introduction

1.1 Purpose

The eastern side of California's Sierra Nevada Mountain range is lined with scenic tourist destinations and peaceful ranching communities. Residents and visitors are drawn to this region to enjoy nature's playground. Connecting these towns and iconic sites to each other and to the outside world is US 395 (see Figure 1.1), which also serves as the most direct route between Southern California and the Reno metropolitan area in Northwestern Nevada. Truck drivers have enjoyed traveling this route for decades; however, with the recent and projected growth of Southern California and Northwestern Nevada, there is growing concern with potential conflicts between trucks and the small communities they pass through.

Figure 1.1 US 395 along West Walker River, South of Walker

The primary highways of interest to this study, US 395, US 6, SR 14, and SR 58, also are the main streets of many of the communities in this study area, lined with hotels, restaurants, shops, and pedestrians (Figure 1.2). Sometimes trucks can be seen as a nuisance when parked in undesignated locations or driving through busy tourist destinations. Conversely, passing through these many towns increases the travel time for truck drivers with delivery deadlines and required rest stops. In addition, high mountain passes, strong winds, two-lane highways, and other natural and manmade conditions can pose challenges to the efficient movement of freight through the corridor.

Figure 1.2 Bishop Main Street

This study uses a data-driven approach to identify current and future areas of concern impeding the efficient and safe movement of freight, or adversely impacting the quality of life for the residents and visitors of the corridor. Strategies for overcoming these obstacles, and opportunities for enhancing the corridor were evaluated and prioritized, and potential funding source identified for implementing them.

1.2 Organization

The remainder of this document is organized as follows.

- **Section 2.0 Corrective Overview** describes the study limits and general characteristics.
- **Section 3.0 Socioeconomic Characteristics** describes population and employment trends.
- **Section 4.0 Land Use Characteristics** evaluates the factors that generate truck trips through the corridor, in particular, the commercial and industrial activity centers within the corridor and at either end. This information is the foundation for projecting future truck volumes.

- **Section 5.0 Truck Traffic Patterns** addresses highway network capacity, current and projected traffic for trucks and all vehicles, and the level of service or congestion within the corridor. In addition, it describes safety concerns and the connectivity and redundancy of the corridor and how it fits within the broader regional transportation and freight network.
- **Section 6.0 Key Assets and Highway Grades** summarizes pavement conditions, grade issues, and the Intelligent Transportation System (ITS) assets within the corridor and the function they serve.
- **Section 7.0 Trucks on Main Street** identifies the economic benefits of truck trips as well as best practices for managing truck traffic in urban areas.
- **Section 8.0 Truck Parking** is an analysis of the supply and demand for truck parking in order to quantify the gap between supply and demand.
- **Section 9.0 Recommended Solutions** summarizes the key recommendations from this plan and identifies potential funding options.
- S**ection 10.0 Implementation Plan** categorizes the recommendations by relative cost and priority.
- **Section 11 Stakeholder Outreach** notes the stakeholder and industry outreach efforts conducted for this Study.

In addition, there are three appendixes provided. The first highlights ITS elements in the Eastern Sierra Corridor. The second provides details on truck parking supply and the methodology used to calculated demand. The third provides maps showing actual locations trucks are parked in the Eastern Sierra Corridor based on GPS data over an eight-week period from the American Transportation Research Institute (ATRI).

2

Corridor Overview

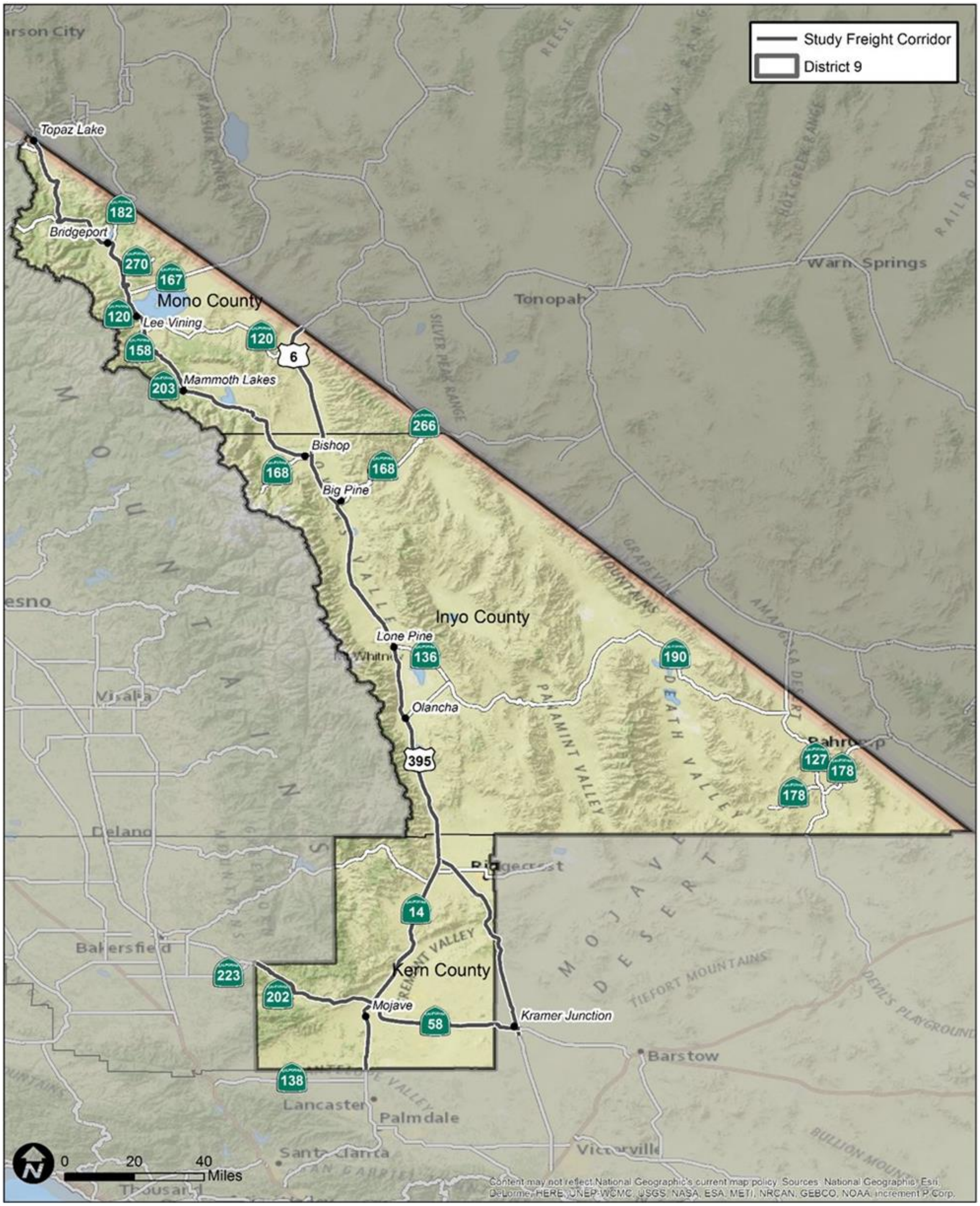
As shown in Figure 2.1, the Eastern Sierra Corridor (the region within Caltrans District 9 boundary) is a rural region served by a long north-south highway corridor consisting mainly of US 395 that provides lifeline accessibility for people and goods in Inyo and Mono Counties, tourist accessibility to recreational destinations (such as Bodie State Historic Park, Mono Lake, Mammoth Lakes, Mount Whitney, Death Valley National Park, and numerous quaint towns, shops and museums, etc.) and major interregional goods movement connectivity between Northern Nevada and Southern/Central Valley California.

Topographical extremes, geological features, biological diversity, and cultural resources characterize the rural region.[6] The highest elevation on the highway system for this region is at Tioga Pass (on SR 120 at 9,945 feet elevation) and the lowest elevation is at Death Valley National Park (on SR 190 at 242 feet below sea level). Flash flooding (resulting from isolated thunderstorms), seasonal snow (over high altitude passes in northern and southwestern part of the region) and strong winds (resulting from barren/desert land cover in southern part of the region, and deep valleys throughout US 395) are considerations that need to be regularly factored into truck travel in this region. Monitor Pass (on SR 89) near Alpine, Sonora Pass (on SR 108) between Walker and Bridgeport, Tioga Pass (on SR 120) near Mono Lake have snow closures during winter.[7] Occasionally, short-term closures due to snowfall and landslide/mudslide events also occur in mountainous sections of US 395 (in the northern part) and SR 58 (over Tehachapi Pass).

6 http://www.dot.ca.gov/hq/tpp//offices/ogm/district_freight_factsheets/D9/D9_Factsheet_080916_Final.pdf (last accessed on November 2, 2017).

7 http://www.dot.ca.gov/hq/roadinfo/clsdlst.htm (last accessed on November 2, 2017).

Figure 2.1 Eastern Sierra Corridor Study Area



Source: Caltrans State Highway GIS data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017).

For the purposes of this Study, the Eastern Sierra Corridor (or the study corridor) is identified as a set of all State highway segments within Caltrans District 9 boundary that have major goods movement functions for the Eastern Sierra region. These include highway segments of US 395, State Route 14 (SR 14), US 6, and SR 58 within Caltrans District 9 boundary. Approximately 28 miles on US 395 south of the Caltrans District 9 boundary and approximately 6 miles on SR 58 east of the Caltrans District 9 boundary also were added to include an important connecting node of US 395/SR 58 junction near Kramer for the study corridor. The study corridor consists of seven major goods movement segments with an approximate total of 518 centerline miles and 1,677 lane miles. All of these segments are designated as Surface Transportation Assistance Act (STAA) National Network routes that can handle STAA trucks.[8]

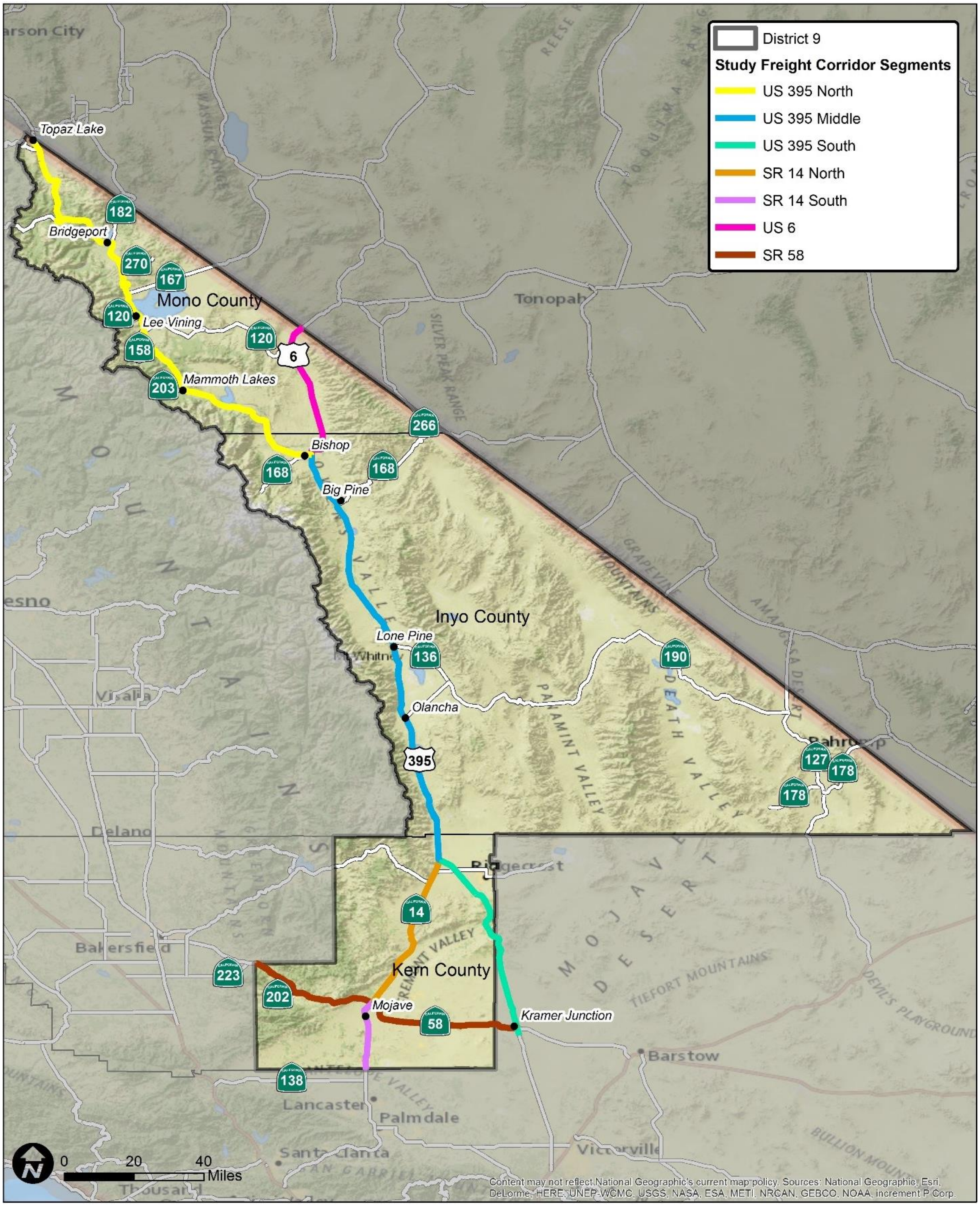
There are other State highway segments within Caltrans District 9 boundary intersecting the study corridor; some of which are STAA Terminal Access routes (including SR 108, SR 120, SR 182), or allow California legal trucks (including SR 89, SR 270, SR 167, SR 158, SR 203, SR 136, SR 190, SR 168, SR 178) with or without special advisory or restrictions.[9] These are mainly used for people movement, and some of them connect to recreational destinations. Goods movement on these highway segments is limited to local pickup/delivery and rarely used as through routes for large (five or more axle) trucks.

Eight roadway segments, shown in Figure 2.2, were defined for the study corridor using major freight nodes as logical breakpoints, namely, US 395, US 6, SR 14, and SR 58 at the borders for Caltrans District 9, US 395/US 6 intersection near Bishop, US 395/SR 14 intersection near Ridgecrest, US 395/SR 58 intersection at Kramer Junction, and SR 14/SR 58 intersection near Mojave. Table 2.1 shows information on the goods movement function (in the context of the study corridor), existing roadway characteristics, and environmental considerations of these highway segments. Discussions of the information shown in this table are found in later sections of this study.

8 The STAA of 1982 allows large trucks, referred to as STAA trucks, to operate on interstates and certain primary routes—U.S. Highways, some State and local routes—called collectively the National Network and Terminal Access routes. STAA trucks are longer, and thus have larger turning radius, than California legal trucks.

9 http://www.dot.ca.gov/trafficops/trucks/docs/truckmap-d09.pdf (last accessed on November 2, 2017).

Figure 2.2 Study Segments



Source: Caltrans State Highway GIS data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017).

Table 2.1 Eastern Sierra Corridor, Goods Movement Functions, Existing Roadway Characteristics, and Environmental Considerations by Highway Segment

Seg #	Route	From	To	Centerline Mile (Lane Mile)	Goods Movement Function	Existing Roadway Characteristics	Environmental Considerations
1	US 395	**California/ Nevada border near Topaz Lake**	**US 395/ SR 58 junction near Kramer**	**339 (1,087)**			
1A	US 395 North Segment	Caltrans District 9 Boundary (California/ Nevada border near Topaz Lake)	US 395/ US 6 junction near Bishop	144 (449)	**Access** to populated places, tourist attractions, farms and ranches, and mines/plants in Mono County; **Connectivity** to San Francisco Bay Area, Sacramento area, and Northern California, and origins/destinations in Northern Nevada, Northwest region of U.S. and rest of eastern U.S. via US 50 and I-80	Rural highway – 14 miles 4-lane divided, 66 miles 4-lane undivided and 64 miles 2-lane undivided; 18 miles expressway, 68 miles conventional/expressway and 58 miles conventional; 83 miles rolling terrain, 48 miles mountainous terrain and 13 miles flat terrain; designated as STAA route; ITS elements include mainline detection, Changeable Message Signs (CMS), Road Weather Information System (RWIS), Closed Circuit Television (CCTV) Camera, Classification Count Station and Mountain Pass Closure Message Sign Based on 2015 Counts on US 395 at PM 120.95 A in Inyo County – AADT: 7,400; average annual daily truck traffic (AADTT): 1,036; 5+ Axle AADTT: 284	Passes through Bishop Paiute Tribe and Bridgeport Indian Colony areas; designated as nonattainment for Particulate Matter 10 (PM_{10}); perennial waterways cross the highway; flooding areas present; volcanic areas from Long Valley caldera to Mono Lake Volcanic Field; threatened species – Greater Sage Grouse, Sierra Nevada red fox, etc.
1B	US 395 Middle Segment	US 395/ US 6 junction near Bishop	US 395/ SR 14 junction near Ridgecrest	135 (518)	**Access** to populated places, tourist attractions, farms and ranches, and mines/plants in Inyo County, Crystal Geyser Roxane Water Bottling Facility; **north-south connectivity** between US 395 North Segment or US 6 and US 395 South Segment	Rural highway – 62 miles 4-lane divided, 62 miles 4-lane undivided and 11 miles 2-lane undivided; 42 miles expressway, 75 miles conventional/expressway and 18 miles conventional; 68 miles rolling terrain and 67 miles flat terrain; designated as STAA route; ITS elements include mainline detection, CMS, RWIS, intersection traffic signals and Weigh-in-Motion Station and Mountain Pass Closure Message Sign Based on 2015 Counts on US 395 at PM 10 0.833 B in Inyo County – AADT: 6,200; AADTT: 1,468; 5+ Axle AADTT: 684	Passes through Lone Pine Paiute-Shoshone Tribe area, Fort Independence Indian Community area, and Big Pine Paiute Tribe area; Designated as nonattainment for PM_{10}; perennial waterways cross the highway; flooding areas present; Owens Valley Fault extends from Olancha to Bishop; threatened species – Desert Tortoise, Mohave ground squirrel, etc.

Seg #	Route	From	To	Centerline Mile (Lane Mile)	Goods Movement Function	Existing Roadway Characteristics	Environmental Considerations
1C	US 395 South Segment	US 395/ SR 14 junction near Ridgecrest	US 395/ SR 58 junction near Kramer	60 (120)	**Access** to populated places and tourist attractions in eastern Kern County, mines/ `plants, farms, solar array, Off-Highway Vehicle Areas, and military installations (China Lake NWC); **North-south connectivity** between US 395 South Segment and SR 58 or US 395 connection to eastern parts of Southern California through High Desert and over Cajon Pass on I-15	Rural 2-lane undivided conventional highway – 47 miles conventional, 13 miles expressway; designated as STAA route; rolling terrain; ITS elements include mainline detection Based on 2015 Counts on US 395 at PM R29.64 B in Kern County – AADT: 2,750; AADTT: 622; 5+ Axle AADTT: 357	In Caltrans District 8: designated as nonattainment for ozone, Particulate Matter 2.5 ($PM_{2.5}$), and PM_{10}; in Caltrans District 9: designated as nonattainment for ozone; threatened species – Desert Tortoise, Mohave ground squirrel, etc.
2	**SR 14**	**US 395/ SR 14 junction near Ridgecrest**	**SR 14/ SR 58 junction near Mojave**	**66 (231)**			
2A	SR 14 North Segment	US 395/ SR 14 junction near Ridgecrest	SR 14/ SR 58 junction near Mojave	48 (158)	**Access** to populated places and tourist attractions in eastern Kern County, solar projects and Off-Highway Vehicle Areas; **North-south connectivity** between US 395 South Segment and SR 58 or SR 14 South Segment	Mostly rural highway – 20 miles 4-lane divided expressway, 12 miles 4-lane divided conventional/expressway and 16 miles 2-lane undivided conventional/expressway; rolling and flat terrain mix; designated as STAA route; ITS elements include Mountain Pass Closure Message Sign Based on 2015 Counts on SR 14 at PM 57.767 B in Kern County – AADT: 5,100; AADTT: 968; 5+ Axle AADTT: 775	Designated as nonattainment for ozone and PM_{10}; threatened species – Desert Tortoise, Mohave Ground Squirrel, etc.
2B	SR 14 South Segment	SR 14/ SR 58 junction near Mojave	Caltrans District 9 Boundary	18 (73)	**Access** to populated places in eastern Kern County, including Mojave and Rosamond, wind farms, Mojave Air and Space Port, and military installations (Edwards Air Force Base (AFB)); **Connectivity** to western parts of Southern California through High Desert and Antelope Valley	Mostly rural highway – 13 miles 4-lane divided freeway and 5 miles 4-lane divided/undivided conventional; Rolling and flat terrain mix; Designated as STAA route Based on 2015 Counts on SR 14 at PM R0 A in Kern County – AADT: 31,500; AADTT: 1,826; 5+ Axle AADTT: 954	Designated as nonattainment for ozone and PM_{10}; threatened species – Desert Tortoise

Seg #	Route	From	To	Centerline Mile (Lane Mile)	Goods Movement Function	Existing Roadway Characteristics	Environmental Considerations
3	**US 6**	**US 395/ US 6 junction near Bishop**	**Caltrans District 9 Boundary (California/ Nevada border near Truman Meadows Rd)**	**41 (81)**	**Alternate connectivity** to origins/destinations in Northern Nevada and rest of eastern U.S. via US 95	Mostly rural highway – 2-lane undivided conventional; 32 miles flat terrain and 9 miles rolling terrain; designated as STAA route; ITS elements include mainline detection, RWIS, CCTV, Camera and Classification Count Station Based on 2015 Counts on US 6 at PM R3.952 A in Inyo County – AADT: 2,255; AADTT: 693; 5+ Axle AADTT: 369	Passes through Bishop Paiute Tribe area and Utu Gwaitu Tribe area; Designated as nonattainment for PM_{10}
4	**SR 58**	**Caltrans D9 Boundary (near SR 223/ SR 58 Junction)**	**US 395/ SR 58 junction near Kramer**	**72 (278)**	**Access** to populated places in eastern Kern County, including City of Tehachapi, mines/plants, wind farms, and military installations (Edwards AFB); **Connectivity** to Central Valley California, and origins/destinations in Southern Nevada and rest of eastern U.S. via I-15 and I-40	Mostly rural highway – 67 miles 4-lane divided and 5 miles 2-lane undivided; 53 miles freeway, 14 miles expressway and 5 miles conventional; 14 miles mountainous terrain, 14 miles rolling terrain and 44 miles flat terrain; designated as STAA route; ITS elements include Traffic Count Station, CMS and RWIS Based on 2015 Counts on SR 58 at PM R94.19 A in Kern County – AADT: 21,450; AADTT: 6,434; 5+ Axle AADTT: 3,906; and at PM 5.4 A in San Bernardino County – AADT: 11,400; AADTT: 4,127; 5+ Axle AADTT: 3,415	Eastern Kern County designated as nonattainment for ozone; threatened species – Desert Tortoise, Mohave ground squirrel, San Joaquin kit fox, Swainson's hawk, etc.
Total				**518 (1,677)**			

Source: Caltrans District 9 Transportation Concept Report (TCR) for US 395, November 2014; Caltrans District 6 Corridor System Management Plan for SR 58, September 2011; Caltrans District 8 TCR for SR 58, September 2012; Caltrans District 9 TCR for SR 14, October 2012; Caltrans District 9 TCR for US 6, June 2016; and Caltrans District 8 TCR for US 395, June 2017; Caltrans Traffic Counts, 2015.

3 Socioeconomic Characteristics

3.1 Population

The study corridor contained within the Caltrans District 9 boundary has a total population of about 145,000 persons.[10] US 395 north segment provides access to populated places, including Topaz Lake, Walker, Bridgeport, Mono City, Lee Vining, June Lake, Mammoth Lakes, and Tom's Place in Mono County; while US 395 middle segment provides access to populated places, including Bishop, Big Pine, Independence, Lone Pine, and Olancha in Inyo County. US 395 south segment provides access to populated places, including Inyokern, Ridgecrest and Randsburg in eastern Kern County. SR 14 north segment provides access to California City in eastern Kern County, while SR 14 south segment provides access to populated places, including Mojave and Rosamond also in eastern Kern County. SR 58 segment provides access to populated places, including City of Tehachapi, Mojave, and Boron.

South of the study corridor, there are major population centers, including Bakersfield in Kern County with population of over 350,000 persons,[11] Greater Antelope Valley area[12] with population of over 500,000 persons,[13] and Victor Valley area[14] with population of over 300,000 persons.[15] More widely, Southern California's metropolitan planning organization (MPO), Southern California Association of Governments

10 http://www.dot.ca.gov/hq/tpp//offices/ogm/district_freight_factsheets/D9/D9_Factsheet_080916_Final.pdf (last accessed on November 2, 2017).

11 U.S. Census Bureau, 2010 Census.

12 Includes cities of Lancaster, Palmdale, and southern portion of Caltrans District 9 (cities of Tehachapi, California City and Ridgecrest).

13 http://socalleadingedge.org/our-region/ (last accessed on November 2, 2017).

14 Includes cities of Adelanto, Hesperia, Victorville and the Town of Apple Valley.

15 http://www.victorvalleyca.com/regional_profile.php (last accessed on November 2, 2017).

(Footnote continued on next page...)

(SCAG) region, consisting of the Counties of Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura, has a population of over 18 million persons.[16]

North of the study corridor, the population of Northern Nevada, consisting of Counties of Carson City, Douglas, Lyon, Storey, and Washoe, has a population of over 600,000 persons.[17]

Figure 3.1 shows the population density in the study corridor in 2015 based on U.S. Census estimates.

Flow of goods to study corridor, as well as to the population centers located north and south of the region, contributes to freight demand in the study corridor. The size of population and its density are indicators of a geography's relative attraction of consumer goods of retail trade and parcel delivery types.

Based on population alone, the study corridor has a low consumer goods attraction potential compared to its surrounding areas; however, the large volume of visitors to the region helps drive up demand. Eastern Sierra region's consumer goods demand is fully captive to the study corridor. The surrounding areas' consumer goods demand can be met by a large number of markets that use freight corridors other than the study corridor, such as international trade gateway ports (at Los Angeles, Long Beach, and Oakland) and border crossings for global production; national trade corridors of I-5, I-80, I-15, and I-40; and Class I freight rail lines for domestic production; and local distribution road network for local production. Discretionary consumer goods flowing on the study corridor include flows between Southern California or Central Valley California and Northern Nevada.

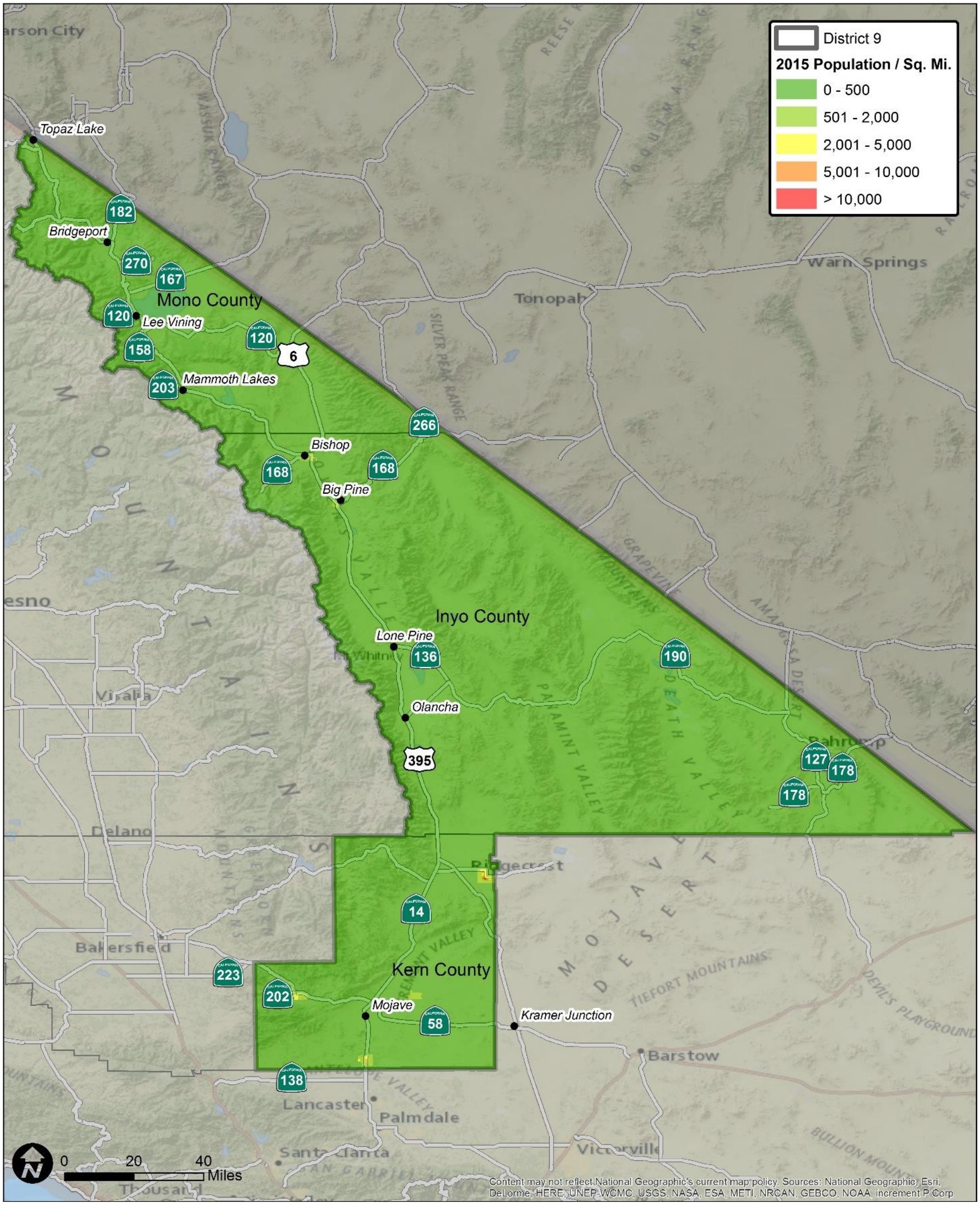
Figure 3.2 shows the anticipated growth in total population in the study corridor and surrounding areas between a base year and 2040, the long-term forecast year. The population growth information was compiled from several data sources, including California Statewide Model socioeconomic projections for Inyo, Kern, and Mono Counties (base year = 2015, forecast year = 2040); SCAG socioeconomic projections for Southern California (base year = 2012, forecast year = 2040); Nevada DOT socioeconomic projections for Northern Nevada (base year = 2015, forecast year = 2040). Nevada DOT made baseline scenario and high scenario population projections; the former is shown in this section. The information was aggregated to populated areas, including: 1) Inyo County; 2) Mono County; 3) Bakersfield City area and rest of Kern County in Kern County; 4) Antelope Valley area, San Gabriel Valley area, and 10 other named areas in Los Angeles County; 5) San Bernardino City area, Ontario Airport area, and four other named areas in San Bernardino County; 6) Riverside City area, Coachella Valley area, and two other named areas in Riverside County; 7) North Orange County area, John Wayne Airport Area, and three other named areas in Orange County; 8) Ventura city area and rest of Ventura County in Ventura County; 9) Imperial County; 10) Washoe MPO, Campo MPO, Tahoe MPO, and rest of Northern Nevada in Northern Nevada; and 11) Clark County in Southern Nevada.

Based on the map, Central Los Angeles County area, South Riverside County area, Bakersfield City area, and Clark County, Nevada (shown in dark blue) would experience the highest population growth. Followed by this, San Fernando Valley area, Western Los Angeles County area, San Gabriel Valley area, Riverside City area, Coachella Valley area, San Bernardino City area, and Victor Valley area (shown in shades of green) would experience a high population growth.

16 SCAG Regional Travel Demand Model, base year 2012 socioeconomic data.

17 Nevada Department of Transportation (DOT), Statewide Travel Demand Model, base year 2015 socioeconomic data.

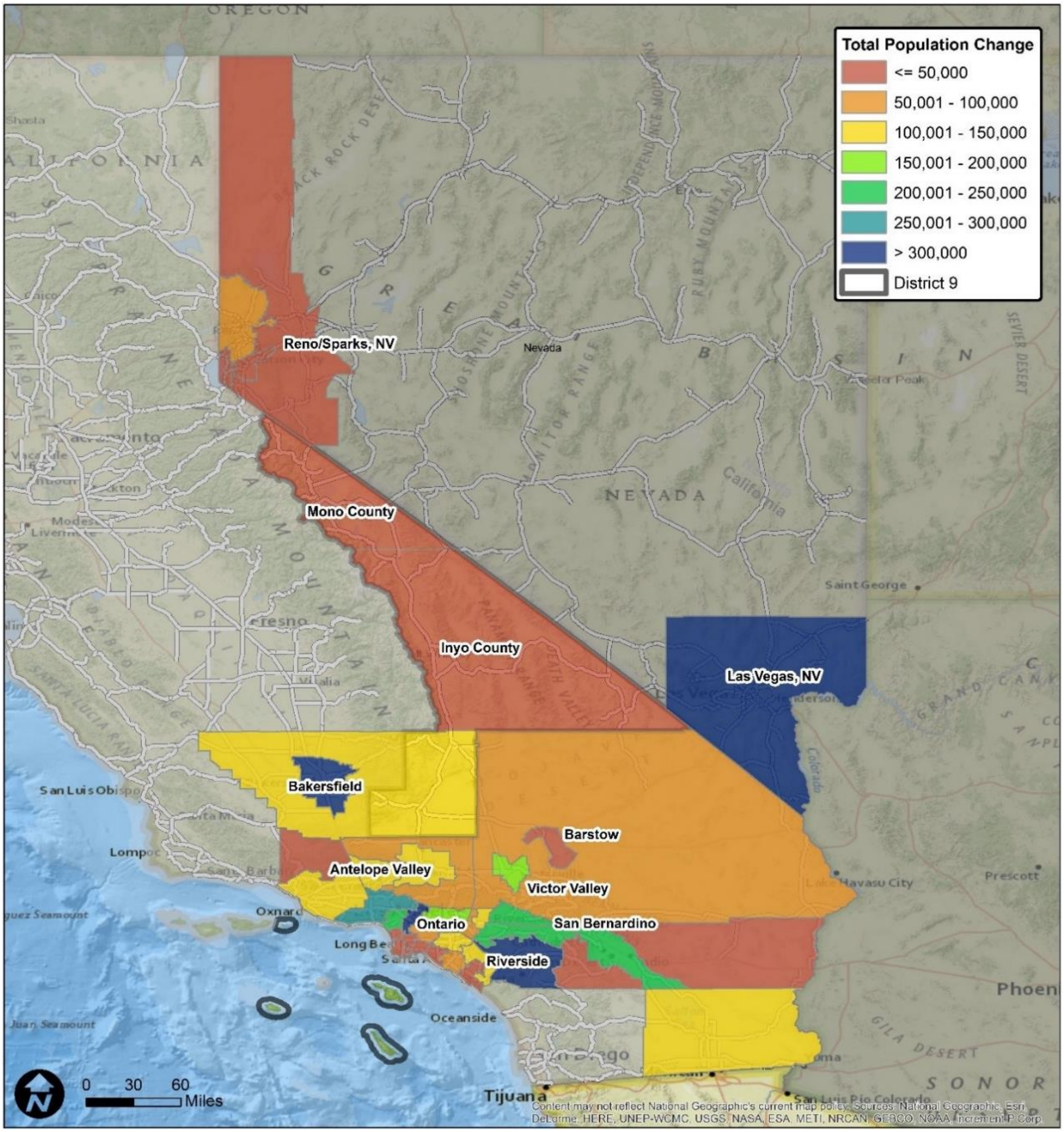
Figure 3.1 Population Density for Eastern Sierra Corridor
2015



Source: Caltrans State Highway Geographic Information System (GIS) data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017); and U.S. Census Bureau.

Figure 3.2 Projected Population Change for Eastern Sierra Corridor and Surrounding Areas

Base Year to Forecast Year



Source: Caltrans State Highway GIS data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017); Caltrans Statewide Travel Demand Model; SCAG Regional Travel Demand Model; and Nevada DOT Statewide Travel Demand Model—Baseline Forecast Scenario.

Note: The map is showing population change projections for Inyo and Mono Counties in the study corridor, named populated areas within the Counties of Kern, Imperial, Orange, Los Angeles, Riverside, San Bernardino, and Ventura, and metropolitan areas in Northern Nevada and Southern Nevada.

Only few of the populated areas shown in Figure 3.2 are considered to be key areas that are likely to contribute to freight demand on the study corridor. Table 3.1 shows the population growth information for these key areas.

Table 3.1 Projected Population Change for Key Areas in the Eastern Sierra Corridor and Surrounding Areas

Base Year to Forecast Year

Populated Area	Base Year Population	Forecast Year Population	Change in Population	Percent Change in Population	Annualized Percent Growth in Population
Inyo County	19,078	22,715	3,637	19%	0.7%
Mono County	15,712	27,775	12,063	77%	2.3%
Subtotal for Inyo/Mono Counties	34,790	50,490	15,700	45%	1.5%
Bakersfield City area	639,806	1,007,850	368,044	58%	1.8%
Rest of Kern County	285,433	416,538	131,105	46%	1.5%
Subtotal for Kern County	925,239	1,424,388	499,149	54%	1.7%
Antelope Valley area	363,142	481,278	118,136	33%	1.0%
Riverside City area	938,748	1,185,209	246,461	26%	0.8%
South Riverside County area	835,189	1,246,808	411,619	49%	1.4%
San Bernardino City area	876,027	1,082,065	206,038	24%	0.8%
Ontario Airport area	334,980	462,766	127,786	38%	1.2%
Victor Valley area	315,672	468,898	153,226	49%	1.4%
Barstow City area	30,957	44,705	13,748	44%	1.3%
Subtotal for Southern California Key Areas	3,694,715	4,971,729	1,277,014	35%	1.1%
Washoe MPO	435,775	519,688	83,913	19%	0.7%
Campo MPO	83,752	99,243	15,491	18%	0.7%
Tahoe MPO	14,798	17,128	2,330	16%	0.6%
Rest of Northern Nevada	74,959	103,325	28,366	38%	1.3%
Subtotal for Northern Nevada Key Areas	609,284	739,384	130,100	21%	0.8%
Clark County, NV	2,120,230	2,858,053	737,823	35%	1.2%
Subtotal for Southern Nevada Key Area	2,120,230	2,858,053	737,823	35%	1.2%

Source: Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040); SCAG Regional Travel Demand Model (base year = 2012, forecast year = 2040); and Nevada DOT Statewide Travel Demand Model (base year = 2015, forecast year = 2040).

3.2 Employment

"Freight employment," which includes employment in goods producing sectors, such as agriculture, mining, logging, construction, manufacturing, trade, transportation and utilities, and its density, are indicators of a geography's relative production and attraction of industry-to-industry, industry-to-market, and market-to-consumer goods flow.

Estimates for total employment and freight employment in the year 2015 were gathered from U.S. Census. Figure 3.3 and Figure 3.4 show densities in total employment per square mile and freight employment per square mile in the study corridor. At a very high level, total employment density patterns generally follow the population density patterns, with higher employment in more populated areas. Freight employment is concentrated in fewer locations within the populated areas due to local land use ordinances and industry clustering.

Based on the employment data, the study corridor has a low goods production and attraction potential compared to its surrounding areas. Based on its proximity to high concentration freight employment regions in Southern California, the study corridor has the potential to serve as a secondary freight activity (goods storage/handling) center for Southern California. However, it might be a low potential due to a low supply of private lands (see Section 4.2 of this study) and presence of competitive (in terms of distance to market/ consumers, multimodal corridors, etc.) and rapidly expanding freight activity centers in Inland Empire (industrial areas in eastern Los Angeles County, San Bernardino County, and Riverside County); Bakersfield City area; Victor Valley area; Barstow City area; and Northern Nevada. At present, the study corridor serves mainly as a conduit for truck-based goods flow between freight activity centers in Northern Nevada and Southern California with truck stops for food, fueling, and parking.

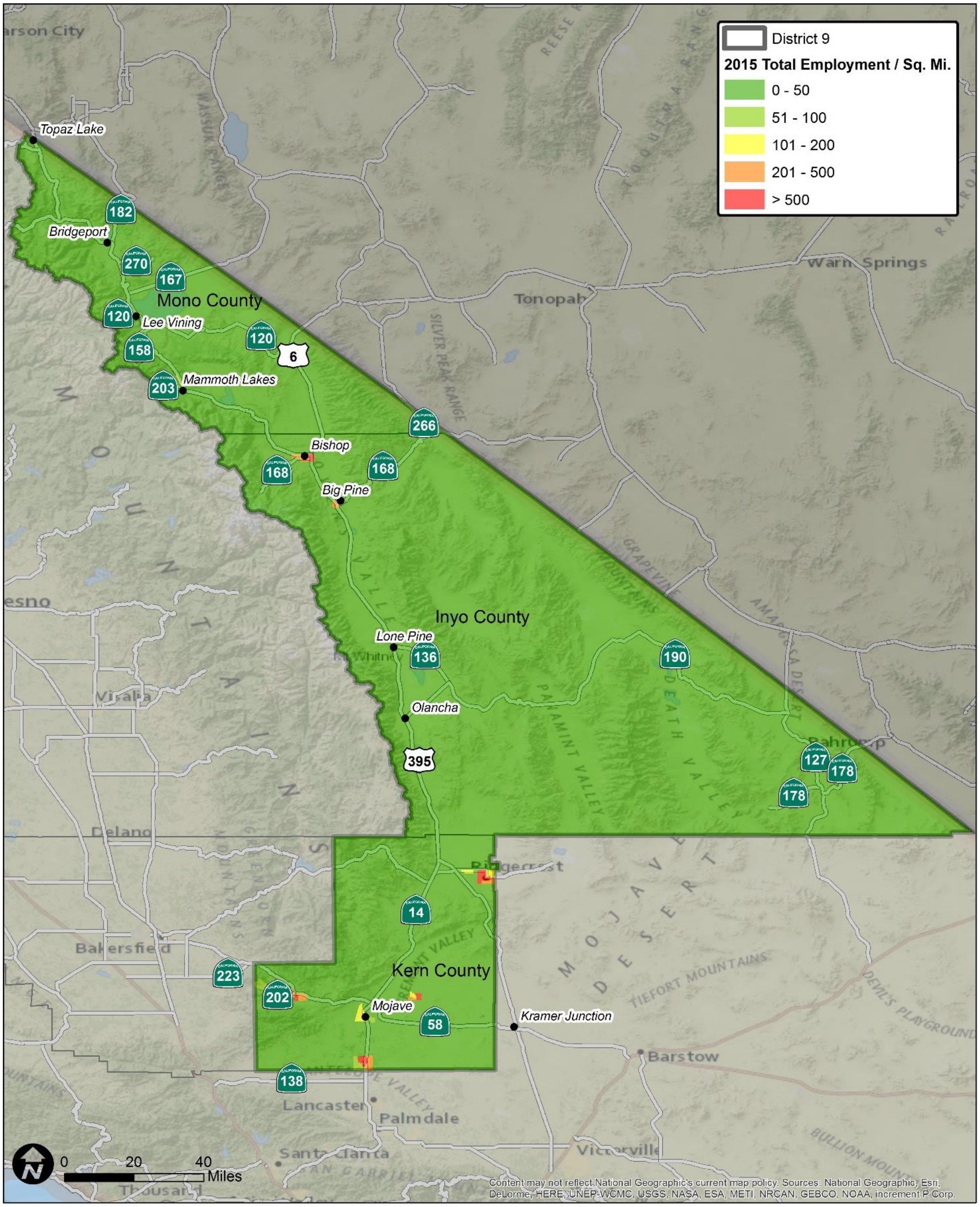
Using the same data sources and populated areas as that for population, freight employment growth information was compiled and aggregated. Figure 3.5 shows the anticipated growth in freight employment in the study corridor and surrounding areas between a base year and a long-term forecast year (that is roughly 25 years after the base year).

As shown on Figure 3.5, Central Los Angeles County area, North Orange County area, Riverside City area, South Riverside County area, Rest of Kern County area, Reno/Sparks City area, and Clark County, Nevada (shown in dark blue) would experience the highest freight employment growth. Followed by this, San Fernando Valley area, Western Los Angeles County area, John Wayne Airport area, Coachella Valley area, Ontario Airport area, San Bernardino City area, and Bakersfield City area (shown in shades of green) would experience a high freight employment growth.

Only few of the areas shown in Figure 3.5 are considered to be key areas that are likely to contribute to freight demand on the study corridor. Table 3.2 shows the freight employment growth information for these key areas.

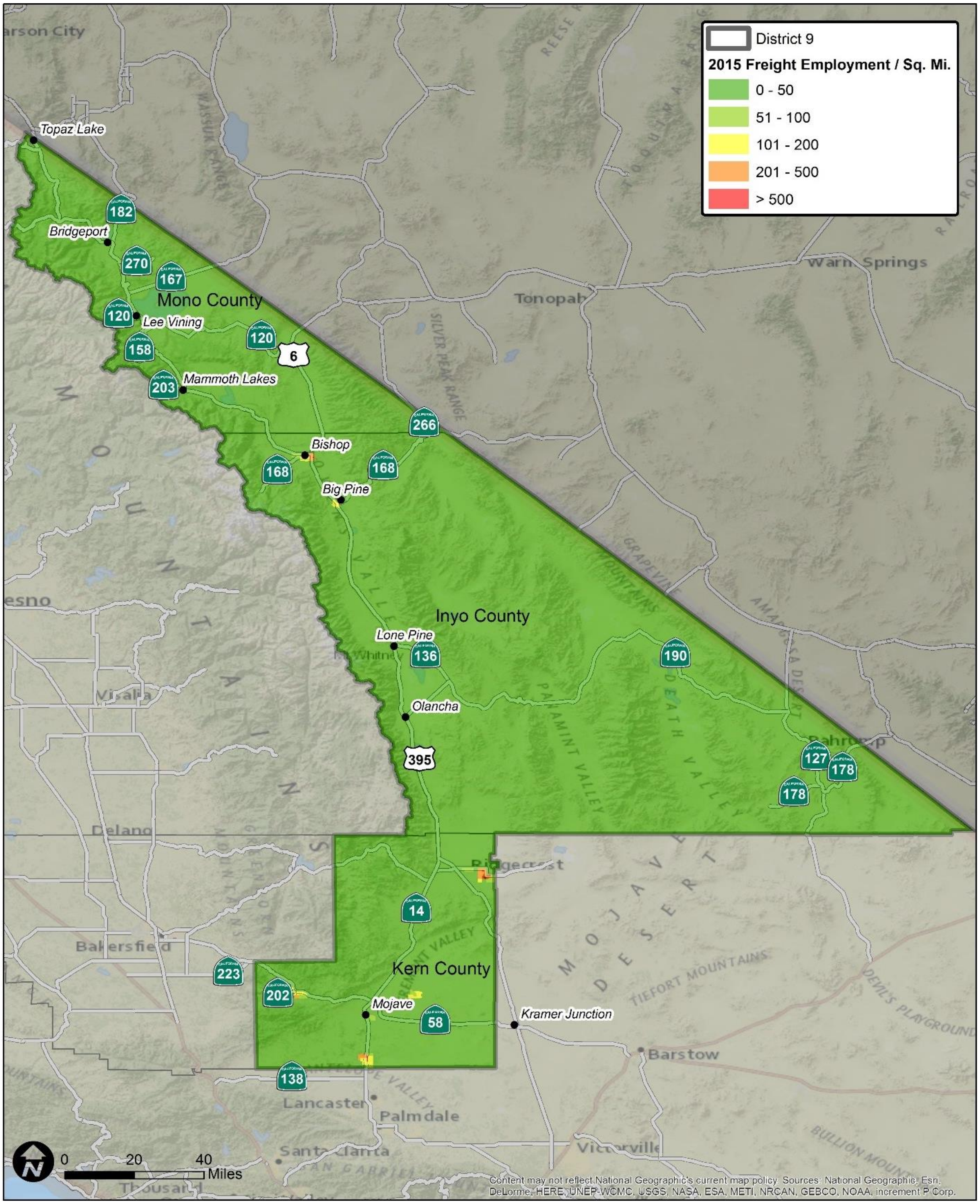
Figure 3.3 Estimated Total Employment Density for Eastern Sierra Corridor

2015



Source: Caltrans State Highway GIS data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017); and U.S. Census Bureau.

Figure 3.4 Estimated Freight Employment Density for Eastern Sierra Corridor *2015*

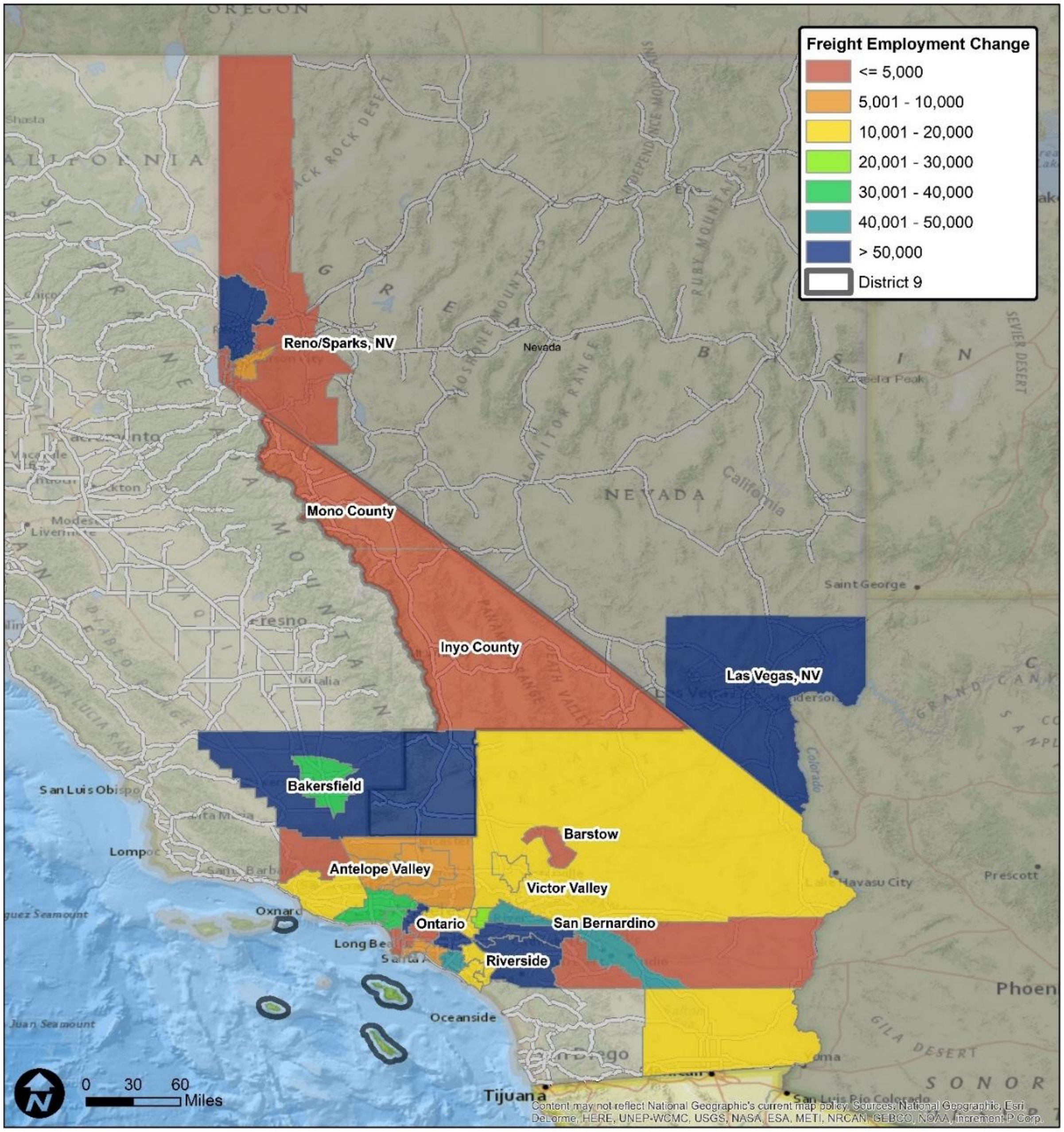


Source: Caltrans State Highway GIS data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017); and U.S. Census Bureau.

Note: Freight employment refers to employment in agriculture, mining and logging, construction, utilities, manufacturing, trade (wholesale and retail), and logistics (transportation and warehousing) sectors.

Figure 3.5 Projected Freight Employment Change for Eastern Sierra Corridor and Surrounding Areas

Base Year to Forecast Year



Source: Caltrans State Highway GIS data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017); Caltrans Statewide Travel Demand Model; SCAG Regional Travel Demand Model; and Nevada DOT Statewide Travel Demand Model—Baseline Forecast Scenario.

Note: The map is showing freight employment change projections for Inyo and Mono Counties in the Eastern Sierra region, named populated areas within the Counties of Kern, Imperial, Orange, Los Angeles, Riverside, San Bernardino, and Ventura, and metropolitan areas in Northern Nevada and Southern Nevada. Freight employment refers to employment in agriculture, mining and logging, construction, utilities, manufacturing, trade (wholesale and retail), and logistics (transportation and warehousing) sectors. Specific freight sectors, however, varied between the data sources.

Table 3.2 Projected Freight Employment Change for Key Areas in the Eastern Sierra Corridor and Surrounding Areas

Base Year to Forecast Year

	Freight Employment						
Populated Area	**Base Year**	**Base Year Percentage of Total Employment**	**Forecast Year**	**Forecast Year Percentage of Total Employment**	**Change**	**Percent Change**	**Annualized Percent Growth**
Inyo County	3,744	39%	3,622	38%	-122	-3%	-0.1%
Mono County	2,023	21%	3,624	23%	1,601	79%	2.4%
Subtotal for Inyo/Mono Counties	5,767	30%	7,246	28%	1,479	26%	0.9%
Bakersfield City area	105,828	41%	144,197	38%	38,369	36%	1.2%
Rest of Kern County	67,577	51%	127,354	46%	59,777	88%	2.6%
Subtotal for Kern County	173,405	44%	271,551	41%	98,146	57%	1.8%
Antelope Valley area	22,857	28%	30,552	28%	7,695	34%	1.0%
San Fernando Valley Area	253,919	33%	292,260	30%	38,341	15%	0.5%
Central LA County	192,036	28%	246,231	27%	54,195	28%	0.9%
San Gabriel Valley Area	199,968	36%	219,674	33%	19,706	10%	0.3%
Subtotal for South Coast Key Areas	668,780	32%	788,717	30%	119,937	18%	0.6%
Riverside City area	114,370	40%	174,847	36%	60,477	53%	1.5%
South Riverside County area	72,254	41%	141,922	37%	69,668	96%	2.4%
San Bernardino City area	86,940	33%	132,714	33%	45,774	53%	1.5%
Ontario Airport area	86,741	50%	113,665	41%	26,924	31%	1.0%
Victor Valley area	20,647	32%	38,568	35%	17,921	87%	2.3%
Barstow City area	2,538	28%	5,427	29%	2,889	114%	2.8%
Subtotal for Eastern Southern California Key Areas	383,490	40%	607,143	36%	223,653	58%	1.7%
Washoe MPO	91,533	34%	144,240	38%	52,707	58%	1.8%
Campo MPO	18,191	53%	25,629	58%	7,438	41%	1.4%
Tahoe MPO	1,459	12%	1,690	12%	231	16%	0.6%
Rest of Northern Nevada	15,444	49%	18,948	49%	3,504	23%	0.8%
Subtotal for Northern Nevada Key Areas	126,627	37%	190,507	40%	63,880	50%	1.6%
Clark County, NV	223,540	24%	332,807	26%	109,267	49%	1.6%
Subtotal for Southern Nevada Key Area	223,540	24%	332,807	26%	109,267	49%	1.6%

Source: Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040); SCAG Regional Travel Demand Model (base year = 2012, forecast year = 2040); and Nevada DOT Statewide Travel Demand Model (base year = 2015, forecast year = 2040) – Baseline Forecast Scenario.

Note: Freight employment generally refers to employment in agriculture, mining and logging, construction, utilities, manufacturing, trade (wholesale and retail), and logistics (transportation and warehousing) sectors. Specific freight sectors, however, varied between the data sources.

Land Use Characteristics

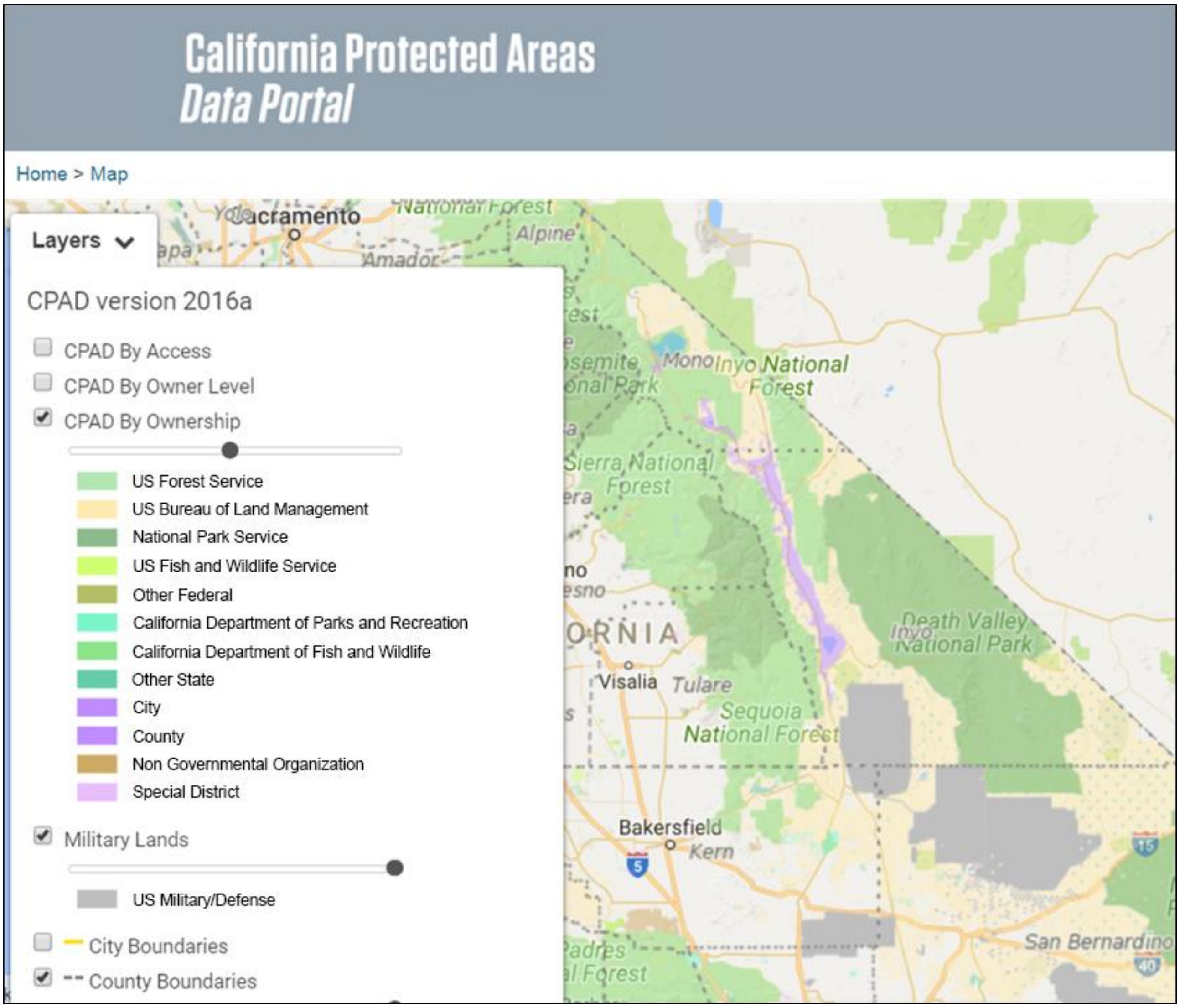
4.1 Overview

Over 90 percent of land area in the Eastern Sierra Corridor belong to public agencies or the U.S. Department of Defense (the military), shown in Figure 4.1. Only a small portion of the lands is privately owned or leased from the public agencies. Within the private lands in the region, there are residential; farming/ranching; mining; energy production; commercial (e.g., hotels, shops, gas stations); and industrial (e.g., water bottling facility, ores and mineral processing plants) land uses. Tourism is the major economic driver within the Eastern Sierra Corridor. To a smaller extent, agriculture, mining, and energy production are contributors to the local economy. There also are major commercial and industrial activity centers outside the Eastern Sierra region that are potential current and future users of the study corridor.

4.2 Public Lands

Public land owners include the U.S. Forest Service, National Park Service, U.S. Bureau of Land Management (BLM), and county/city. The land owned and conserved by the U.S. Forest Service and National Park Service is put to recreational use, including access to parks for day use, overnight use, undeveloped areas and wilderness, and off-highway vehicle areas.

Figure 4.1 California Public and Military Lands by Ownership Agency



Source: California Protected Areas Data Portal Website: http://www.calands.org/map (last accessed on November 2, 2017).

On the lands owned by the BLM along the study corridor, several Federally recognized tribes are located, including Bishop Paiute Tribe, Bridgeport Indian Colony, Lone Pine Paiute-Shoshone Tribe, Fort Independence Indian Community, Big Pine Paiute Tribe, and Utu Gwaitu Tribe. Based on the U.S. Bureau of Indian Affairs website,[18] the tribes possess inherent rights of self-government (i.e., tribal sovereignty) and are entitled to receive certain Federal benefits, services, and protections under a government-to-government relationship with the United States. Aside from this, the BLM authorizes renewable energy production, mining, grazing, and timber harvesting; and makes conservation efforts to ensure natural, recreational, historical, and cultural resources will be available for future generations.[19]

18 https://www.bia.gov (last accessed on November 2, 2017).

19 https://www.blm.gov/about/what-we-manage/california (last accessed on November 2, 2017).

On county/city-owned lands, there also are recreational, historical, and cultural resources, such as museums, shops, and hotels that attract visitors.

Los Angeles Department of Water and Power also owns a substantial portion of land in the Owens Valley near Bishop (less than 3 percent of total land in Inyo County).[20] These lands offer a broad array of recreational opportunities, as well as grazing by local ranchers.

4.3 Military Installations

According to the R-2508 Complex Joint Land Use Study[21], the military owns lands and R-2508 complex in the study corridor. The R-2508 complex is a strategically important national military asset that provides the largest single area of Special Use Airspace over land in the United States, covering a land area of 20,000 square miles. The R-2508 Complex includes three military Installations:

1. **Naval Air Weapons Station China Lake.** The installation currently serves as the host for the Naval Air Warfare Center Weapons Division under the Naval Air Systems Command. It serves as a station for the research, development, test, and evaluation of weapons. In 2007, China Lake NWC employed over 6,555 persons, including 767 military personnel, 3,388 civilians, and over 2,400 contractors.

2. **Edwards Air Force Base.** Edwards AFB supports the mission of the Air Force to guard the United States in its global interests through the use of superior defense systems in air, space, and cyberspace. In Fiscal Year (FY) 2006, the base employed 11,111 persons, including 3,209 military personnel and 7,902 civilians and contractors. Almost 12,000 indirect jobs to local residents were created by the base.

3. **Fort Irwin/National Training Center (NTC).** The NTC provides arms training in interagency, intergovernmental, and multinational venues to prepare brigade combat teams for combat. In November 2007, the center employed 5,170 military personnel and 3,469 civilians. Rotational units training at the NTC added another 4,000 to 5,000 people. Fort Irwin employed 12,000 contractors too.

4.4 Agriculture

According to the 2012 U.S. Census of Agriculture, Inyo County has 125 farms with a total of 330,840 acres. Market value of total agricultural products sold equal $19.6 million, ranking 52 among 58 counties in California. Crop sales make up 35 percent, and livestock sales make up 65 percent of total agricultural products sold. The top crop items are forage-land used for all hay and haylage, grass silage, and greenchop, dates, vegetables (onions are popular), cantaloupes and muskmelons, and nursery stock crops. The top livestock inventory items are cattle and calves, horses and ponies, colonies of bees, poultry, sheep, and lambs.[22]

According to the 2012 U.S. Census of Agriculture, Mono County has 72 farms with a total of 56,386 acres (see Figure 4.2). Market value of total agricultural products sold equal $18.0 million, ranking 53 among

[20] http://www.inyocounty.us/ab628/documents/e5_10_LandUse_071414.pdf (last accessed on November 2, 2017).

[21] https://www.kerncounty.com/planning/pdfs/final_r2508_1executive_summary.pdf (last accessed on November 2, 2017).

[22] https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/California/cp06027.pdf (last accessed on November 2, 2017).

(Footnote continued on next page...)

58 counties in California. Crop sales make up 49 percent, and livestock sales make up 51 percent of total agricultural products sold. The top crop items are forage-land used for all hay and haylage, grass silage, and greenchop, vegetables, garlic, olives and cuttings, seedlings, liners and plugs. The top livestock inventory items are cattle and calves, sheep and lambs, horses and ponies, colonies of bees, and poultry.[23]

Some pistachio farming was found to take place near Ridgecrest in eastern Kern County, although a majority is cultivated in southern Central Valley California.[24] "Long-day" variety of onions was identified to be grown in High Desert and Antelope Valley.[25]

Trucks hauling hay and produce during the growing season are seen throughout the study corridor (see Figure 4.3).

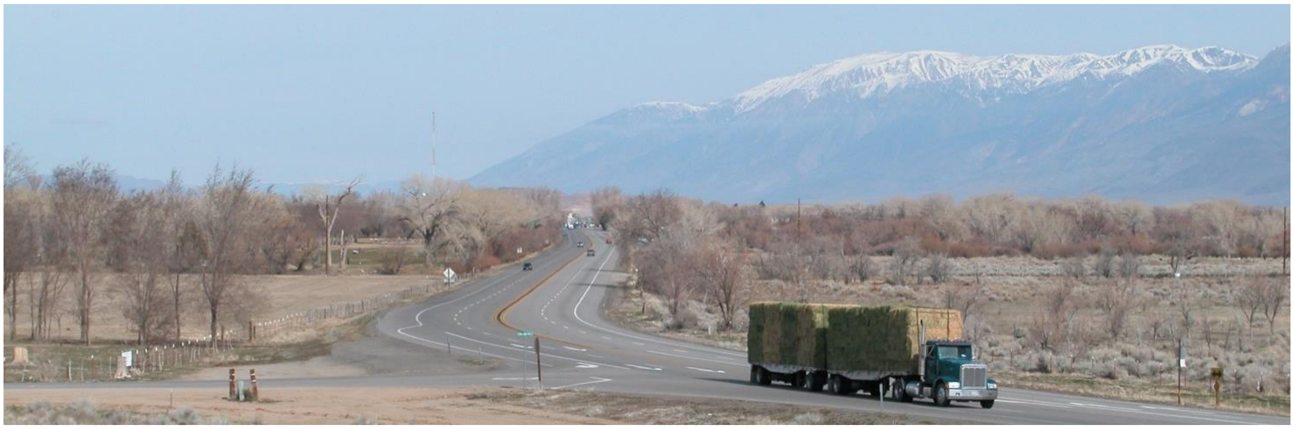
Figure 4.2 Antelope Valley Ranch Lands

[23] https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/California/cp06051.pdf (last accessed on November 2, 2017).

[24] https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Pistachio_Production_CA.pdf (last accessed on November 2, 2017).

[25] https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Onion_Production_CA.pdf (last accessed on November 2, 2017).

Figure 4.3 Hay Truck on US 395 South of Bishop



The Adult Use of Marijuana Act was passed and became law on November 9, 2016 in California. The Act legalizes hemp (Cannabis plant) cultivation and marijuana (Cannabis) use in California, along with imposing a tax on the sale, cultivation, and manufacturing of marijuana. Prior to this, the Medical Cannabis Regulation and Safety Act was passed in 2015 and amended in 2016. Most recently (in July 2017), these acts have been melded together to form the Medical and Adult-Use Cannabis Regulation and Safety Act. A draft environmental impact report (DEIR) of "CalCannabis"[26] estimated that cannabis production in California in 2016 was approximately 13.5 million pounds, consisting of 650,000 pounds of medical cannabis, 1.85 million pounds of cultivation for in-State nonmedical use, and 11 million pounds of cultivation for export outside of the State. Out of this, 300,000 pounds (that is, 2.2 percent of total production) were estimated to be produced from Southeast Interior California that includes Inyo, Mono, Tuolumne, Mariposa, San Bernardino, Riverside, and Imperial Counties. The DEIR also estimated that, under the Medical Cannabis Regulation and Safety Act and the Adult Use of Marijuana Act, overall production would remain generally unchanged. Licensed medical in-State consumption would decrease from 650,000 pounds to 250,000 pounds. Licensed adult-use consumption, a new, previously nonexistent market, would be 1 million pounds. Unlicensed in-State consumption would decrease from 1.85 million pounds to 1.25 million pounds. The DEIR expects these changes to take place by 2018. This Study anticipates growth in new adult use hemp cultivation and distribution to take place in Eastern Sierra region.

4.5 Mining and Mineral Processing Plants

The Eastern Sierra Corridor and its surrounding areas have several active and abandoned/closed mine and mineral processing plants.

Rio Tinto Borates operate Rio Tinto Boron Mine (formerly U.S. Borax Boron Mine) located near Boron, which is the largest open pit mine in California, and is probably the largest borate mine in the world. Rio Tinto Borates mines approximately 3 million tons of borate ore every year and employs around 800 people. The

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[26] California Department of Food and Agriculture, CalCannabis Cultivation Licensing Branch, *CalCannabis Cultivation Licensing – Draft Program Environmental Impact Report*, June 2017.

(Footnote continued on next page...)

borates from this mine are used in numerous products, including detergents, glass, insulation, and ceramics.[27,28] Class I freight railroad serves this facility; hence, the use of the study corridor is avoided.

Searles Valley Minerals processes brine solutions from Searles Lake to produce sodium carbonate (or "soda ash"), boric acid, sodium sulfate, several specialty forms of borax, and salt. The extraction method is solution mining, not open pit mining. The products have a wide-range of uses, including glass-making, industrial laundries, dyes, detergents, flat screen monitors, electronic parts and special coatings, fire retardants, fiberglass insulation, and wood treatments.[29] Mined and processed products are moved by Trona Railroad, a short line railroad, and interchanged with Class I freight railroads; hence, the use of the study corridor is avoided.

Golden Queen Mining Company operate Soledad Mountain mine located near Mojave, which is an open pit mine to extract gold and silver. Based on a 2015 feasibility study conducted by the company, average gold and silver production was projected as approximately 74,000 ounces and 781,000 ounces, respectively, per year over an 11-year mine life. The company also proposed an aggregate and construction materials business using waste rock and sand produced as a by-product of mining operation.[30]

U.S. Pumice Company mine and process natural pumice near Lee Vining for a variety of uses, including abrasive cleaning products.

CalPortland, a building materials company, operates Mojave Cement Plant near Mojave, where it extracts limestone with which it then produces cement, at this 9,000 acre site.[31]

Goldcorp formerly operated Rand mine complex (consisting of Yellow Aster, Lamont, and Baltic mines) near Randsburg and Red Mountain, which is a former open pit gold mine located spread over approximately 1,050 acres. It was closed in January 2003 after depleting the economic ore. During operations, approximately 160 million tons of material were mined and processed to produce more than 900,000 ounces of gold.

Pine Creek tungsten mine was operational for nearly 54 years before being shut down in 2001 due to the availability of low-cost imports of tungsten from China.[32]

Other mineral deposits available in the study corridor include kaolin, bentonite, marble, dimension stone, gypsum, and gemstones. Other smaller mineral processing activities include talc, sulfur, perlite, and fullers earth production.

The Division of Measurement Standards of the California Department of Food and Agriculture[33] identified privately owned licensed "weightmaster" locations—weightmasters are individuals or firms who weigh or

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27 http://clui.org/ludb/site/rio-tinto-boron-mine-formerly-us-borax-boron-mine (last accessed on November 2, 2017).

28 http://www.riotinto.com/energyandminerals/boron-4638.aspx (last accessed on November 2, 2017).

29 http://www.svminerals.com/default.aspx (last accessed on November 2, 2017).

30 https://www.goldenqueen.com/project/soldedad-mountain (last accessed on November 2, 2017).

31 http://clui.org/ludb/site/california-portland-cement-companys-mojave-plant (last accessed on November 2, 2017).

32 http://www.rockcreeklake.com/board/index.php?topic=55.0 (last accessed on November 2, 2017).

33 https://www.cdfa.ca.gov/dms/programs/wm/licensedlocations/activelocationslisting.html (last accessed on November 2, 2017).

measure bulk commodities and issue certificates of accuracy. Based on this, other mining and extraction based firms include Granite Construction Company in Lee Vining, Bishop, Inyokern and Mojave; Marzano & Sons General Engineering Contractors in June Lake and Lee Vining; 7/11 Materials Inc. in Mammoth Lakes, Bishop, and Keeler; Global Pumice, LLC in Olancha, and Black Point Cinders Inc. in Lee Vining.

Freight generated from mining and mineral processing plants is likely to be small and mostly concentrated along SR 58 corridor; however, it could drastically increase if freight rail service to Rio Tinto Boron Mine or Searles Valley Minerals is eliminated.

4.6 Commercial and Industrial Activity Centers

From the origin-destination study that Caltrans conducted in 2011, we learn that 90 percent of all trucks traveling within the corridor originate or terminate in Southern California, Northern Nevada, or somewhere within the corridor. Therefore, understanding the major economic activity centers within these three areas is the greatest indicator of future truck volumes.

4.6.1 Eastern Sierra Corridor Activity Centers

Tourism is the major economic driver within the Eastern Sierra Corridor. Visitors are drawn to iconic destinations and natural playgrounds of Yosemite, Mount Whitney, Mammoth Lakes, and myriad other beauties of the Eastern Sierra. The 2011 US 395 Origin and Destination Study found that over 60 percent of surveyed travelers entering the area described recreation as the main purpose of their trip. Along with the arrival of recreational visitors, there forms a demand for food and supplies at hotels, restaurants, shops, and visitor centers (see Figure 4.4).

Figure 4.4 Restaurant Supplies Delivery in Bishop

According to U.S. Department of Agriculture (USDA) Forest Service National Visitor Use Monitoring Program, annual number of site visits[34] estimates for Inyo National Forest and Sierra National Forest are 5,495,000 in FY 2011 and 1,312,000 in FY 2012, respectively[35]. According to the Integrated Resource Management Applications Portal of the National Park Service,[36] annual number of recreational visits, in 2016, to Death Valley National Park, Manzanar National Historic Site and Devils Postpile National Monument, are 1,296,283, 105,307, and 135,404, respectively. As published in by the Mountain Town News,[37] SMARI (a marketing research firm) on behalf of Mammoth Lakes Tourism Board estimated 2.32 million visitors to Mammoth in 2015. SMARI also estimated 859,000 winter visitors (about 40 percent) to Mammoth in 2015; most of whom are headed to Mammoth Mountain Ski Area. Many visitors are attracted to Bishop to enjoy stunning, world-renown scenery, unparalleled outdoor recreation opportunities, and a lively rural culture.

According to the 2011 Origin-Destination Study for US 395,[38] international traffic to the Eastern Sierra region has increased from 1.0 percent in 2000 to 5.1 percent in 2011. International travelers were mainly from France and Germany.

Over the past 20 years, the number of recreational visits to national parks has fluctuated; however, growth in population and tourism-related marketing will be key to its long-term growth. A few of the tourist-related improvements and future plans in Mono and Inyo Counties include the following:

- Bishop Paiute Hotel and Casino Project.[39]
- Eastern California Museum Expansion, Independence.[40]
- Fort Independence Hotel and Casino Project.[41]
- Tioga Inn Development, Lee Vining.[42]
- Rock Creek Ranch, Paradise.[43]

[34] A Site Visit is the entry of one person onto a national forest site or area to participate in recreation activities for an unspecified period of time.

[35] https://apps.fs.usda.gov/nvum/results/ReportCache/2015_R05_Master_Report.pdf (last accessed on November 2, 2017).

[36] https://irma.nps.gov/Stats/ (last accessed on November 2, 2017).

[37] http://thesheetnews.com/2016/09/09/the-records-keep-falling/ (last accessed on November 2, 2017).

[38] http://www.dot.ca.gov/d9/planning/docs/o_d_study_2011_2.pdf (last accessed on November 2, 2017).

[39] http://www.inyoplanning.org/projects.htm (last accessed on November 16, 2017).

[40] http://www.inyoplanning.org/projects.htm (last accessed on November 16, 2017).

[41] http://www.inyoplanning.org/projects/FortIndependenceCasino.htm (last accessed on November 16, 2017).

[42] Mono County. 2015. Mono County Land Use General Plan. Accessed from: http://www.monocounty.ca.gov/sites/default/files/fileattachments/planning_division/page/812/2015_land_use_final.08.15_0.pdf (last accessed on November 16, 2017).

[43] http://www.monocounty.ca.gov/planning/page/rock-creek-ranch-specific-plan-draft-eir-and-final-eir-2008 (last accessed on November 16, 2017).

(Footnote continued on next page...)

- Develop a Walker Main Street plan on US 395 to improve the visitor experience and tourism.[44]
- US 395 improvements through Bridgeport to better reflect the small town character and contribute to economic development in town.[45]

Among industries, Crystal Geyser Roxane Alpine Spring Water bottling plant is a key freight generator in the Eastern Sierra Corridor located at Olancha, delivering a significant amount of bottled water primarily to Southern California.

Renewable energy production is another major industry in the study corridor. The Tehachapi Wind Farm, with around 4,731 wind turbines, is the second largest collection of wind generators in California. It is located near Mojave. Solar Star I & II, spanning over 3,200 acres is located in Rosamond, California, started operating in 2013; they have a combined total energy production capacity of 412 Megawatts, it is the world's largest solar farm. There are several other wind farms and solar farms in this region. These facilities are not intensive users of the study corridor. Occasionally, these facilities require truck-based transport of replacement parts and supplies. New installations have over-dimensional and special cargo transportation needs.

Proposed energy projects in the corridor include:

- Munro Valley Solar Project—a proposed 4.0 megawatt solar photovoltaic generating facility located south of Olancha.[46]
- Mammoth Pacific 1 Replacement Project of a geothermal facility located near Casa Diablo Hot Springs in Mono County.[47]

Due to limited availability of privately owned lands in the Eastern Sierra region, future commercial and industrial real-estate developments in the study corridor are likely to be few and scattered. Correspondingly, growth in truck traffic from within the corridor is expected to be very modest.

[44] Mono County. 2015. Mono County Land Use General Plan. Accessed from: http://www.monocounty.ca.gov/sites/default/files/fileattachments/planning_division/page/812/2015_land_use_final.08.15_0.pdf (last accessed on November 16, 2017).

[45] Mono County. 2015. Mono County Land Use General Plan. Accessed from: http://www.monocounty.ca.gov/sites/default/files/fileattachments/planning_division/page/812/2015_land_use_final.08.15_0.pdf (last accessed on November 16, 2017).

[46] http://www.inyoplanning.org/projects/MunroValley/Index.htm (last accessed on November 16, 2017).

[47] http://www.monocounty.ca.gov/planning/page/mammoth-pacific-1-mp-1-replacement-plant-project (last accessed on November 16, 2017).

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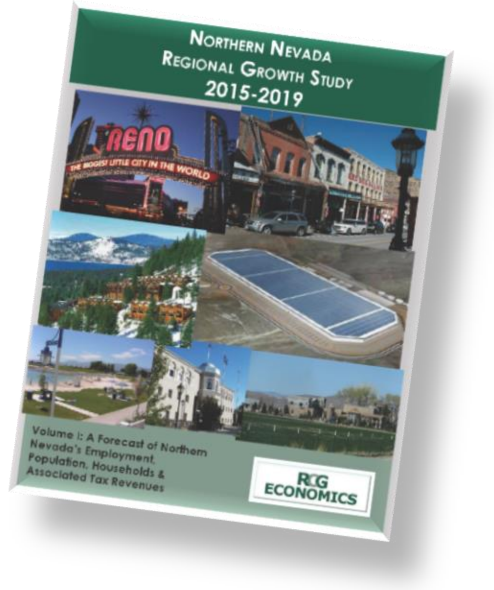
4.6.2 Northern Nevada Activity Centers

The five counties in Northern Nevada at the north end of the study corridor—Carson City, Douglas, Lyon, Storey, and Washoe—are experiencing tremendous growth, especially in logistics and manufacturing. According to a study commissioned by the Economic Development Authority of Western Nevada, this growth is "driven by a regional economy that is becoming increasingly diversified due to a proactive regional business recruitment and retention strategy, locational/transportation advantages (e.g., access to I-80 and the Union Pacific Railroad), a pro-business climate in Nevada and a progressively well-funded economic development program."[48]



Tesla recognized the advantages of locating their Gigafactory in Northern Nevada, and became an anchor for subsequent new and relocated facilities. Tesla and many others are located in the Tahoe-Reno Industrial Center in Storey County with 30,000 developable acres able to accommodate over 300 million square feet industrial space.

According to the EDAWN study, by 2019 the area is forecasted to have an additional 42,395 residents over 2015, for a total of 638,302 or 7.1-percent increase, and an additional 52,371 workers, for a total of 400,870.[49] Economic indicators suggest that these early projections are being exceeded.

Photo Source: http://tahoereno.com/.

According to the Nevada State Freight Plan, Northern Nevada is part of the San Francisco Major Trade Area, as shown in Figure 4.5. A major trade area is an economic region, not a political jurisdiction, formed around economic trade areas. Northern Nevada "is becoming a more diverse and integral subcomponent of the Northern California market…. Increasingly, Northern California companies are seeing Reno as an extended submarket…."[50]

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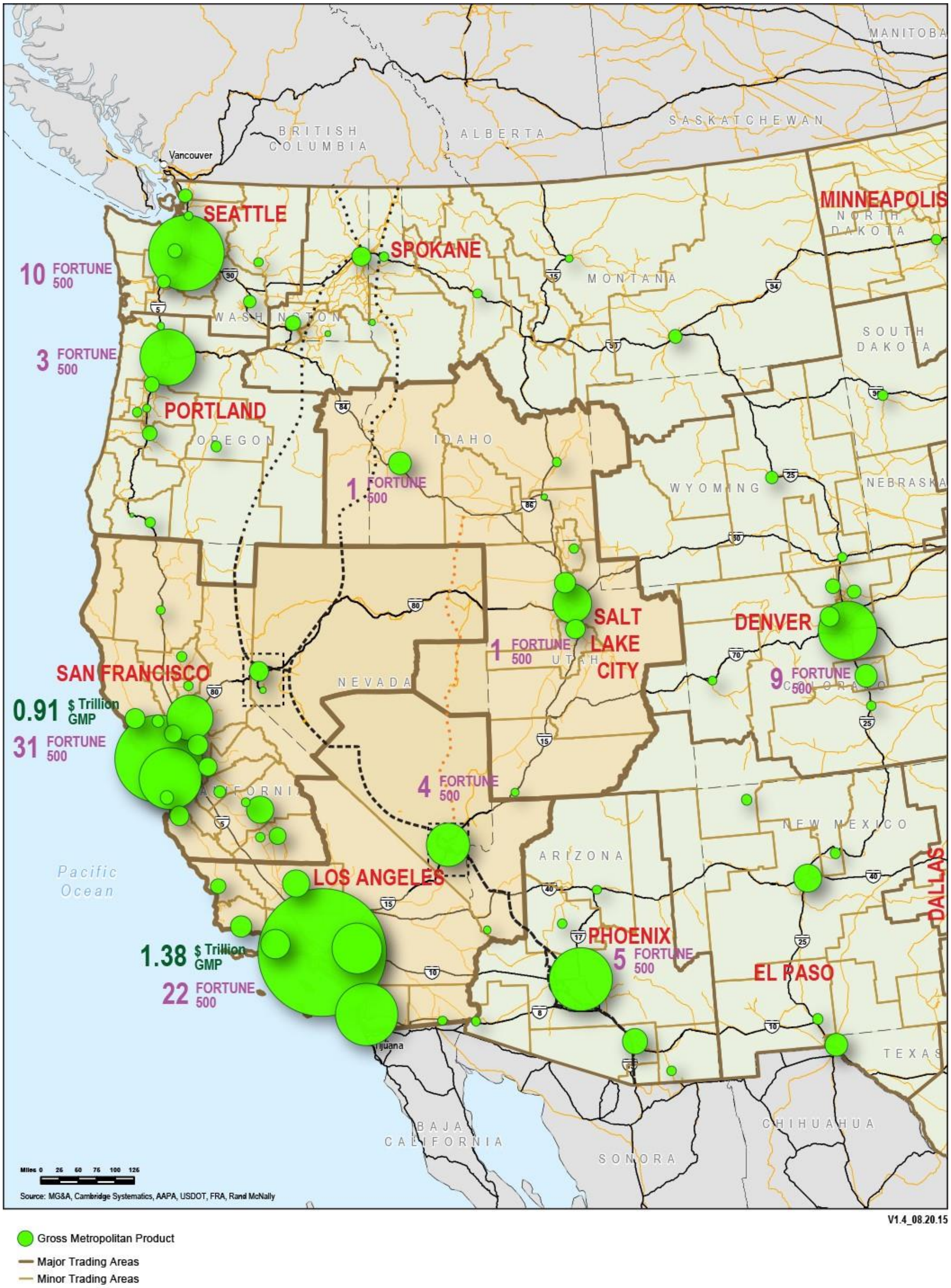
48 RCG Economics. 2015. Northern Nevada Regional Growth Study 2015-2019. Accessed from: http://edawn.org/epic-report/.

49 RCG Economics. 2015. Northern Nevada Regional Growth Study 2015-2019. Accessed from: http://edawn.org/epic-report/.

50 Nevada DOT. 2016. Nevada State Freight Plan. Accessed from: https://www.nevadadot.com/mobility/freight-planning/nevada-freight-plan.

Figure 4.5 Major and Minor Trade Areas in California and Surrounding States



Source: Nevada State Freight Plan: https://www.nevadadot.com/mobility/freight-planning/nevada-freight-plan.

4.6.3 Southern California Activity Centers

Southern California is one of the largest economic activity centers in the U.S. According to a recent New York Times article, "California accounted for 17 percent of job growth in the United States from 2012 to 2016, and a quarter of the growth in gross domestic product…. The Ports of Los Angeles and Long Beach have been at the center of a rebound in container traffic and international trade."[51]

The World Logistics Center in Moreno Valley (see Figure 4.6) is a proposed $3 billion, high-tech distribution hub, with 40 million square feet of facilities, projected to bring thousands of jobs to Moreno Valley. A comprehensive Traffic Impact Analysis was prepared, as part of the Environmental Impact Report for the project, to evaluate the World Logistics Center's impacts throughout the region. The analysis estimates 11,621 total daily trips from medium- and heavy-duty trucks, as shown in Table 4.1.

Figure 4.6 The World Logistics Center

Source: http://theworldlogisticscenter.com/portfolio/bringing-jobs-to-moreno-valley-2/.

[51] McPhate, M. 2017. "California Today: How California Helps the U.S. Economy." New York Times, June 5, 2017. Accessed from: https://www.nytimes.com/2017/06/05/us/california-today-how-california-helps-the-us-economy.html.

Table 4.1 Daily Vehicle Trips to and from the World Logistics Center

Type of Vehicle	Number of Daily Trips
Passenger Cars	54,714
Light-duty Trucks (2-axle)	2,385
Medium-duty Trucks (3-axle)	3,181
Heavy-duty Trucks (4-axle)	8,440
Total Daily Trips	**68,720**

Source: LSA Associates. 2015. The World Logistics Center Project: Final Programmatic Environmental Impact Report. Accessed from: http://www.moreno-valley.ca.us/cdd/pdfs/projects/wlc/FEIR.pdf.

Of significant interest to this study are the projected truck trip distribution patterns indicating the direction of travel to and from the facility. According to the traffic impact analysis, the vast majority (82 percent) of the truck trips will move to and from the West, and only 6 percent of trucks (approximately 700) will move to and from the north. The study area for the analysis did not extend into the Eastern Sierra Corridor, so there is no way to know definitively how many of the 700 trucks per day will pass through the Eastern Sierra. However, as shown on Figure 4.7, I-15 only loses about 11 percent of truck traffic between the junctions of US 395 and SR 58. Therefore, if all 700 truck trips moving to and from the north traveled on I-15, we would assume that approximately 77 trucks would divert onto US 395 and SR 18, and it is very likely that not all of those would continue their journey all the way north through Eastern Sierra. Based on this and other data and models described later, it is assumed that very few of these trips to and from the north will travel on US 395 through the Study Corridor.

Figure 4.7 I-15 Truck Traffic Diverted onto US 395

Source: Caltrans State Highway GIS data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017); and Caltrans Traffic Counts, 2015

Another major development directly south of the study corridor is the Southern California Logistics Airport located in Victorville. It is an "8,500-acre multimodal freight transportation hub…supported by extensive air, ground, and rail connections. It includes…a 2,500-acre cargo and aviation facility; the Southern California Logistics Centre, a 2,500-acre commercial and industrial complex entitled for 60 million square feet of development; and the planned Southern California Rail Complex, which will be a 3,500-acre intermodal complex featuring rail-served facilities."[52]

Graphic Source:
http://victorvillecity.com/industrial/.

4.6.4 Central Valley California Activity Centers

SR 58 functions as an extension of I-40 to California's Central Valley, rich in agriculture. The U.S. Geological Survey reports the following statistics:[53]

- More than 250 different crops are grown in the Central Valley with an estimated value of $17 billion per year.
- Approximately 75 percent of the irrigated land in California and 17 percent of the Nation's irrigated land are in the Central Valley.
- Using fewer than 1 percent of U.S. farmland, the Central Valley supplies 8 percent of U.S. agricultural output (by value) and produces one-quarter of the Nation's food, including 40 percent of the Nation's fruits, nuts, and other table foods.
- The predominate crop types are cereal grains, hay, cotton, tomatoes, vegetables, citrus, tree fruits, nuts, table grapes, and wine grapes.

Based on the outreach (see Section 11.0), the City of Shafter is pursuing the development of a major inland port that would likely increase truck volumes on SR 58.

52 Metzler, K. 2015. "Southern California Logistics Airport Puts Victorville on the Map." NAIOP Development magazine, summer 2015. Accessed from: http://www.naiop.org/en/Magazine/2015/Summer-2015/Development-Ownership/Southern-California-Logistics-Airport.aspx.

53 https://ca.water.usgs.gov/projects/central-valley/about-central-valley.html (last accessed on November 16, 2017).

Truck Traffic Patterns

Due to the rapid growth of the logistics and manufacturing industries just north and south of the Study Area, there is a concern that future truck traffic through Eastern Sierra will overwhelm the capacity of the system and negatively impact the local tourism industry and quality of life, as well as important supply chains. This perception is illustrated in Figure 5.1. However, analysis from this Study concludes this will not occur. Two major themes help to frame the quantitative analyses that will follow in this section:

1. Northern Nevada is aligned with the San Francisco major trade area.
2. The Inland Empire is aligned with Greater Southern California and its ports.

5.1 Framework for Understanding Future Freight Patterns

5.1.1 Northern Nevada Aligned with San Francisco Major Trade Area

The Nevada State Freight Plan included an analysis of the economics, freight flows, and supply chains affecting Northern Nevada, and found that:

- Northern Nevada "is becoming a more diverse and integral subcomponent of the Northern California market."[54] (See also Section 4.6.2 of this Report.)
- Northern Nevada's largest trading partners (50 percent) are California's coastal and northern regions.[55]
- "…Reno-Carson City area's short distance to the Port of Oakland enables global supply lines at a competitive pricing, and also provides access to the global market."[56]

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[54] NSFP, Market Analysis, Appendix 3

[55] NSFP, FAF, Appendix 2C.

[56] NSFP, Supply Chain Analysis, Appendix 2D.

Figure 5.1 Perceived Freight Impacts from Outside the Corridor

Source: Cambridge Systematics.

The Nevada State Freight Plan concluded that the Northern Nevada market is strongly aligned with Northern California, and that freight flows will primarily travel between those destinations—not south along US 395 to the Inland Empire of Southern California. Economic development marketing materials for Northern Nevada strengthen this argument by touting its access to east-west running I-80 and Union Pacific Railroad. One of the reasons that Tesla chose to construct its Gigafactory in Northern Nevada is due to the close proximity to its vehicle manufacturing plant in Fremont, California.

5.1.2 Inland Empire Aligned with Greater Southern California and Ports

As stated in Section 4.6.3 of this Report, an estimated 82 percent of World Logistic Center truck trips will travel to and from the west.[57] The City of Moreno Valley, home of the World Logistic Center, touts on its website[58] that the City:

- Is centrally located at the junction of two major transportation corridors (I-215 and SR 60) in Southern California.
- Provides swift access to Los Angeles, Orange, and San Diego Counties, and key markets in Las Vegas and Arizona.
- Offers freeway access to intermodal facility and two major ports (the Port of Los Angeles and Port of Long Beach).
- Has a designated Foreign Trade Zone, making it a prime location for international companies.

5.1.3 Projected Truck Volumes

The above factors support the conclusion that companies locate in the Inland Empire because of its close proximity to the Greater Southern California market and the Ports of Los Angeles and Long Beach; and companies are moving to Northern Nevada because of its close proximity to Northern California markets and ports. Truck traffic patterns will primarily be east and west between these destinations. Therefore, the actual freight impacts to Eastern Sierra from outside the corridor, illustrated in Figure 5.2, are projected to be moderate, as the primary freight flows from Northern Nevada and the Inland Empire are, and will continue to be east-west, and not north-south along US 395.

A methodology was developed and applied in order to quantify the above assumptions, and estimate future truck volumes in the Study Area. Current truck volumes were distributed among origin-destination (O-D) pairs gleaned from two Caltrans O-D Studies. A growth factor for those O-D pairs was calculated from accepted and peer-reviewed sources, including the SCAG Travel Demand Model, the Nevada Statewide Model, and the Northern Nevada Regional Growth Study. Model outputs were not used, rather, freight-related future employment growth was extracted from these sources and applied to the current O-D volumes in order to calculate future O-D volumes.

High and low truck volume estimates for large, 5+ axle trucks—of primary interest in this study—are shown in Table 5.1. Because the projected growth rate in freight-related employment varies between the three sources—high and low truck volume estimates are provided. The projected growth in large, 5+ axle trucks is well within the capacity of the system and should not worsen congestion, disrupt trade flows, or diminish local tourism or quality of life. It is approximately commensurate with the anticipated growth of all vehicular traffic in the Study Area. The one exception is truck traffic on SR 58, which is projected to increase dramatically by 2040. In fact, the California Statewide Travel Demand Model projects even higher truck volumes on SR 58.

[57] World Logistic Center EIR Traffic Analysis.

[58] http://moval.maps.ArcGIS.com/apps/MapSeries/index.html?appid=41004835d28c4546800c4288b7dbf6b6.

Figure 5.2 Actual Freight Impacts from Outside the Corridor

Source: Cambridge Systematics.

Table 5.1 Daily 5+ Axle Truck Traffic
2015 and Estimated 2040

Highway Segment	2015	2040 Low	2040 High
US 395 North Segment (Bridgeport)	294	404	466
US 395 Middle Segment (Big Pine)	684	943	1,090
US 395 South Segment (Inyokern)	357	496	501
SR 14 North Segment (Indian Wells)	775	1,054	1,062
SR 14 South Segment (Mojave)	954	1,281	1,285
SR 58 (Tehachapi)	3,906	6,050	6,187
SR 58 (Kramer Junction)	3,415	5,595	5,769
US 6 (Benton)	369	507	584

Source: Table 5.2 of this study; Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040); and Cambridge Systematics' auto volume growth calculations.

The following sections provide a more detailed description of the quantitative analyses and findings regarding current and projected truck volumes, and the associated highway capacity, regional network, and relative safety of the system.

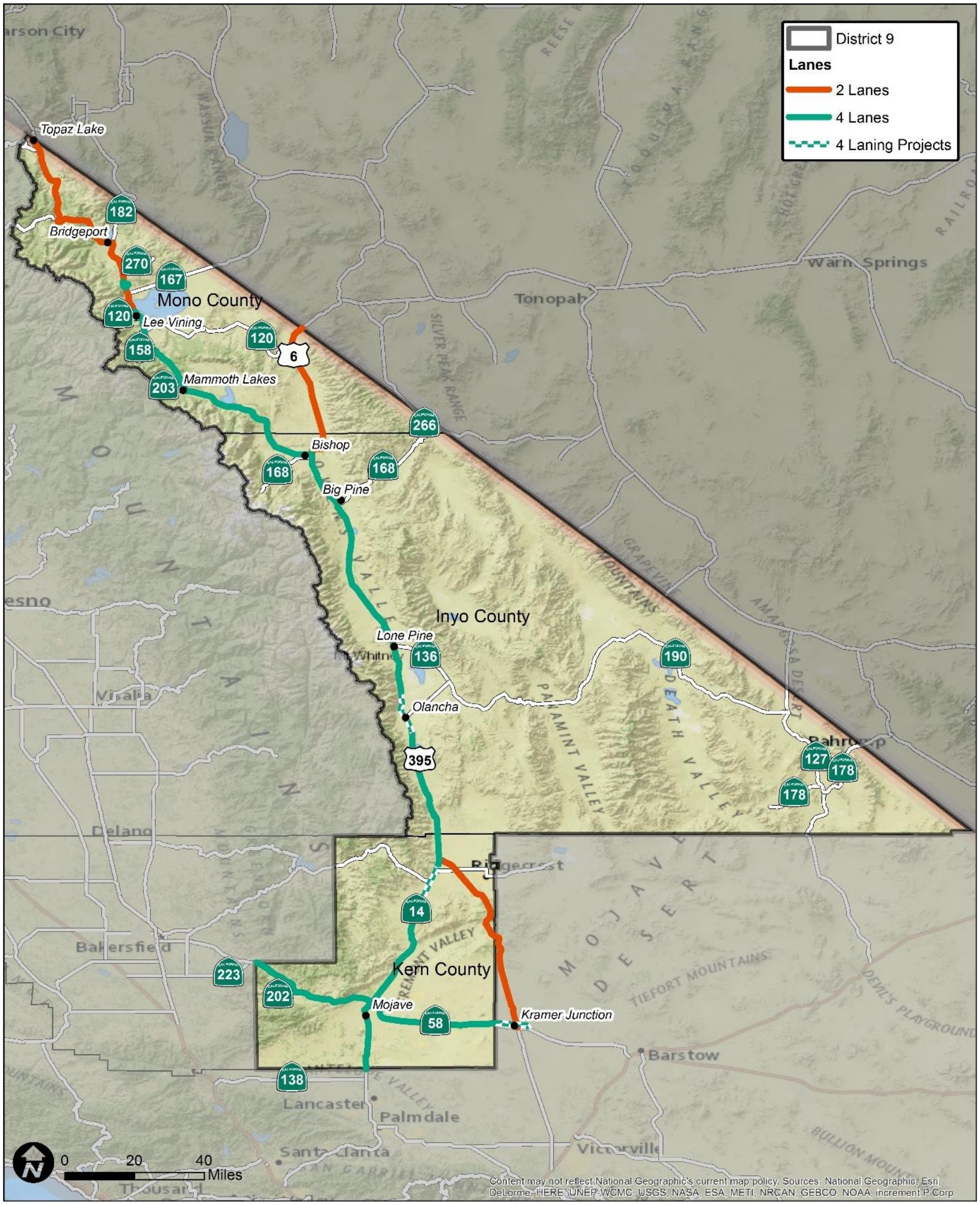
5.2 Highway Capacity

Figure 5.3 shows the existing and planned number of lanes in the study corridor. While a majority (about 93 percent of 72 centerline miles) of SR 58 is four-lane freeway or expressway, US 395 consists of long sections of conventional two-lane highway (about 40 percent of 339 centerline miles). The two-lane portions of US 395 are present mostly within US 395 north and south segments. A majority length of US 395 middle segment is four-lane with a mix of a conventional highway and an expressway. SR 14 also is mostly (about 76 percent of 66 centerline miles) four-lane with a mix of a conventional highway and an expressway. The two-lane portion of SR 14 is present within SR 14 north segment. US 6 is fully (100 percent of 41 miles) a two-lane conventional highway.

For a given terrain, two-lane highways have a lower passenger cars per hour per lane capacity than four-lane highways;[59] as the latter allows easier and safer passing of slow-moving vehicles than the former. On two-lane highways, slow-moving vehicles act as moving bottlenecks for faster-moving vehicles, the issue becomes worse with increase in grade. Passing or climbing lanes are used on two-lane highways to enhance highway capacity. The study corridor uses passing or climbing lanes throughout the two-lane portions of highway segments. Adequacy of passing lanes was not studied; however, it was understood that the primary physical constraints to installation of passing or climbing lanes are in the winding and narrow right-of-way sections of US 395 north segment north of Bridgeport.

[59] On level terrain, typically a two-lane highway has a capacity of about 1,400 passenger cars per hour per lane; while typically a four-lane highway has a capacity of about 1,900 passenger cars per hour per lane.

Figure 5.3 Number of Lanes on Eastern Sierra Corridor
Existing and Planned



Source: Caltrans State Highway GIS data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017); Caltrans District 9 TCR for US 395, November 2014; Caltrans District 6 Corridor System Management Plan for SR 58, September 2011; Caltrans District 8 TCR for SR 58, September 2012; Caltrans District 9 TCR for SR 14, October 2012; and Caltrans District 9 TCR for US 6, June 2016; and Caltrans District 8 TCR for US 395, June 2017.

5.3 Traffic Volumes

5.3.1 Existing Truck Traffic and Total Traffic Volumes

Figure 5.4 shows the annual average daily truck traffic volumes on the study corridor and nearby major goods movement highways. Within the study corridor, SR 58 carried the highest truck traffic of over 6,000 trucks per day on average in 2015. All other highway segments in the study corridor carried less than 2,000 trucks per day on average in 2015.

Among the corridors crossing the California/Nevada border, the truck traffic in 2015 was split on an average day as follows: I-80 – 5,883 (27.8 percent); US 395 – 1,036 (4.9 percent); US 6 – 693 (3.3 percent); I-15 – 7,751 (36.7 percent); and I-40 – 5,571 (27.3 percent), with a total of 21,134 (100 percent).[60] This indicates the highways in the study corridor play a small yet significant role in interstate traffic.

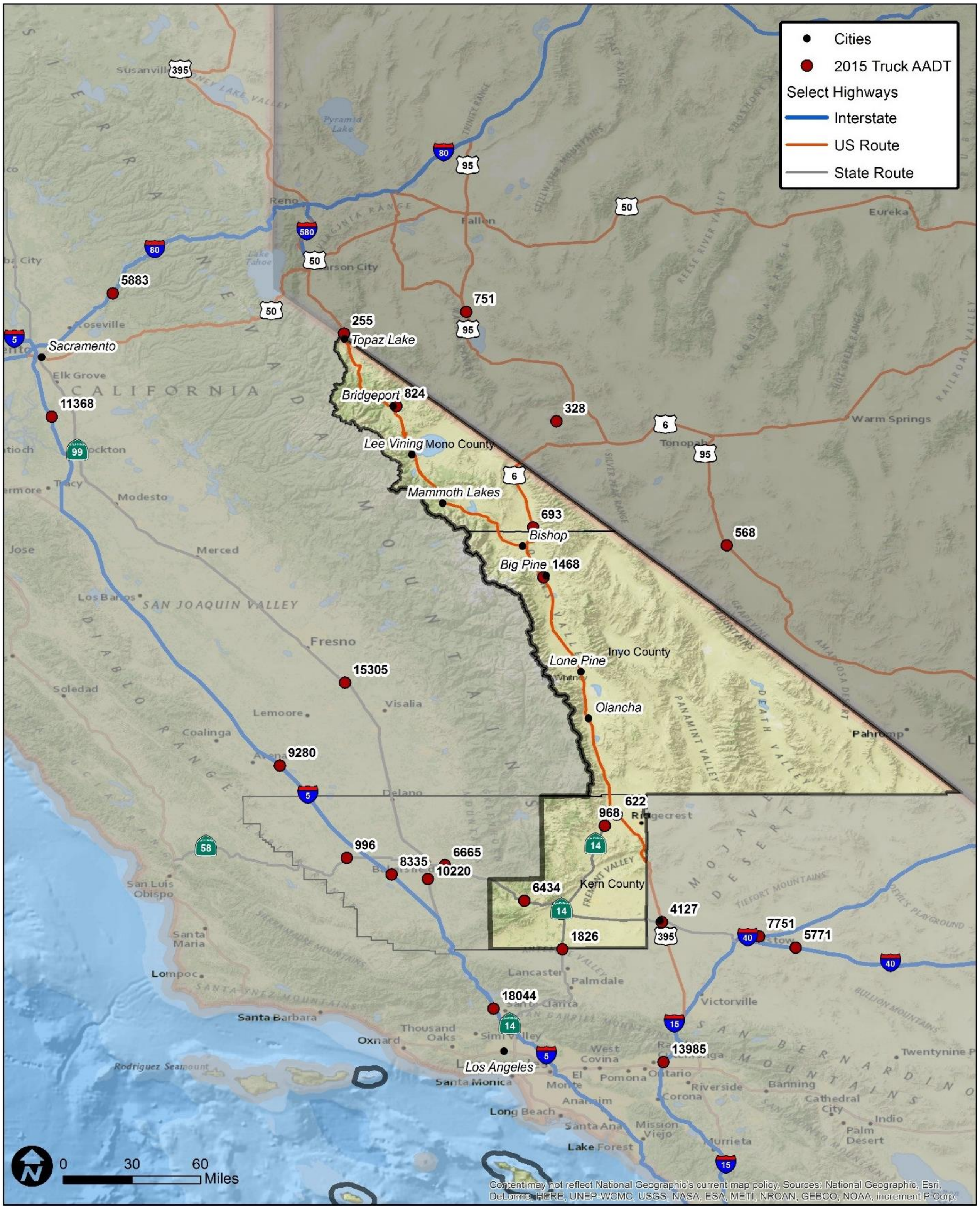
The truck traffic volume map also indicates that I-5 and SR 99 are preferred routes over US 395 for north-south intrastate movements between the populated areas of San Francisco Bay Area, Los Angeles metropolitan area, Sacramento area, and Central Valley of California. SR 58 provides the shortest connection between I-5/SR 99 and I-15/I-40, which makes it important for goods movement.

Table 5.2 shows the total AADT, percent of auto AADT, truck AADT, and 5 or more axles truck AADT in 2015 at the same locations within the study corridor, as shown in Figure 5.4.

SR 58 segment, being a critical link between I-5 and I-15/I-40 corridors, is the most traveled in terms of truck traffic with truck percent ranging 30 to 36 percent. On the other hand, SR 14 south segment, being the closest to major population centers in Antelope Valley and major employment center of Edwards Air Force Base and cities, is the most traveled segment in terms of auto traffic with auto percent of about 94 percent. The highest 5 or more axles truck percent ranging 80 to 83 percent are seen on SR 58 segment and SR 14 north segment.

[60] Some highways such as US 50 and SR 127 also cross California/Nevada border, but truck traffic data was not collected for them; hence not included. Including them would change the percentage shares slightly.

Figure 5.4 Average Annual Daily Truck Traffic Within the Eastern Sierra Corridor and Without on the Regional Highway Network



Source: Caltrans State Highway GIS data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017); and Caltrans Traffic Counts, 2015

Table 5.2 Existing Average Annual Daily Traffic on Eastern Sierra Corridor

2015

Highway Segment	Total AADT	Auto AADT	Truck AADT	5 or More Axles Truck AADT	Auto AADT %	Truck AADT %	5 or More Axles Truck AADT %	5 or More Axles Truck AADT % of Truck AADT
US 395 North Segment	4,000	3,176	824	294	79%	21%	7%	36%
US 395 Middle Segment	6,200	4,732	1,468	684	76%	24%	11%	47%
US 395 South Segment	2,750	2,128	622	357	77%	23%	13%	57%
SR 14 North Segment	5,100	4,132	968	775	81%	19%	15%	80%
SR 14 South Segment	31,500	29,674	1,826	954	94%	6%	3%	52%
SR 58 Segment	21,450	15,016	6,434	3,906	70%	30%	18%	61%
SR 58 (East of US 395/SR 58 Jct.) Segment	11,400	7,273	4,127	3,415	64%	36%	30%	83%
US 6 Segment	2,255	1,562	693	369	69%	31%	16%	53%

Source: Caltrans Traffic Counts, 2015.

5.3.2 Existing Truck Origin-Destination Patterns

Two O-D surveys were available for the study corridor—one was conducted in 2011 on US 395 for autos and trucks[61] and other was conducted in 2009 on SR 58 for trucks only.[62] There were some differences in O-D survey zones used by the surveys, as shown in Figure 5.5 and Figure 5.6.

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[61] Caltrans District 9, US 395 Origination and Destination Study, 2011.

[62] San Bernardino County Transportation Authority, Kern Council of Governments, and Caltrans Districts 6, 8, 9, and Headquarters, *SR 58 Origin and Destination Truck Study*, Final Report, February 2009. Available at: http://gosbcta.com/plans-projects/studies/past-studies/SR-58_Study_Report.pdf (last accessed on November 2, 2017).

Figure 5.5 US 395 Origin/Destination Survey Zones

Source: 2011 US 395 O-D Survey.

Note: Southern CA as defined by the survey includes the Counties of Imperial, eastern Kern (Kern County within Caltrans District 9 boundary), Orange, Riverside, San Bernardino, and San Diego. South Coast CA as defined by the survey includes the Counties of Los Angeles, Santa Barbara, and Ventura. Eastern Sierra as defined by the survey includes the Counties of Inyo and Mono. Central CA as defined by the survey includes the Counties of Alameda, Alpine, Amador, Calaveras, Contra Costa, Fresno, western Kern (Kern County outside Caltrans District 9 boundary), Kings, Madera, Marin, Mariposa, Merced, Monterey, Napa, San Benito, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma, Stanislaus, Tulare, and Tuolumne. And Northern CA as defined by the survey includes rest of the counties in California.

Figure 5.6 SR 58 Origin/Destination Survey Zones

Source: 2009 SR 58 O-D Survey.

Note: Southern Border as defined by the survey includes the Counties of Imperial and San Diego. Southern California as defined by the survey includes the Counties of Los Angeles, Orange, Riverside, San Bernardino, and Ventura. Central Coast as defined by the survey includes the Counties of Monterey, San Benito, San Luis Obispo, and Santa Barbara. San Joaquin Valley as defined by the survey includes the Counties of Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare. Central Sierra as defined by the survey includes the Counties of Alpine, Amador, Calvares, Inyo, Mariposa, Mono, and Tuolumne. Bay Area as defined by the survey includes the Counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, and Sonoma. Greater Sacramento as defined by the survey includes the Counties of El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba. Northern Sacramento Valley as defined by the survey includes the Counties of Butte, Colusa, Glenn, Shasta, and Tehama. And Northern CA as defined by the survey includes rest of the counties in California.

In the 2011 US 395 O-D survey, multiple survey locations on US 395, all north of SR 58, were used. Recreation was the trip purpose for 61.2 percent of all surveyed vehicles. Trucks formed 9 percent of all surveyed vehicles with work/business as the sole trip purpose. Table 5.3 shows the truck flow pattern or the distribution of "weighted"[63] truck survey counts (equivalent to truck traffic counts) across aggregated O-D pairs. Based on this table, trucks that originated/terminated in Inyo/Mono Counties formed approximately 33 percent of the total trucks on US 395, the remaining approximately 67 percent are passing through the Eastern Sierra Corridor. Trucks that originated/terminated in Nevada formed approximately 48 percent of the total trucks on US 395. Trucks that originated/terminated in Southern California formed approximately 44 percent of the total trucks on US 395. Trucks that originated/terminated in South Coast California formed approximately 31 percent of the total trucks on US 395. Due to the alignment of US 395, a vast majority of truck flows to/from Nevada were assumed to be truck flows from/to Northern Nevada. For locations within California, except Eastern Sierra, I-5/SR 58/I-15 corridor was considered to be a preferred route for truck flows to/from Southern Nevada.

Table 5.3 US 395 O-D Survey "Weighted" Truck Survey Counts Distribution by O-D Pair
2011

O-D Pair	Percentage of All "Weighted" Truck Survey Counts
Southern California – Nevada[1]	22.1%
South Coast CA – Nevada[1]	17.7%
Inyo/Mono Counties – Southern California	13.5%
Southern California – Rest of U.S.	8.3%
Inyo/Mono Counties – South Coast CA	7.4%
South Coast CA – Rest of U.S.	5.9%
Inyo/Mono Counties – Nevada[1]	5.8%
Inyo/Mono Counties (Intra)	3.7%
Inyo/Mono Counties – Central Valley California	3.1%
Central Valley California – Nevada[1]	2.8%
Central Valley California – Rest of U.S.	2.2%
All other O-D Pairs	7.5%
Total	**100.0%**

Source: Caltrans District 9, US 395 Origination and Destination Study, 2011.

[1] Based on the orientation of the US 395 corridor, the origin or destination of Nevada is assumed to be mostly in Northern Nevada.

Based on the truck survey counts in the 2011 US 395 O-D survey, trucks with empty loads were found to make 24.4 percent of the total trucks. About 51.7 percent of total trucks were found to carry retail trade commodity type (mostly food, beverage, building materials, and general merchandise), distantly followed by 6.7 percent of wholesale trade commodity type, 4.5 percent of transportation and warehousing commodity type, 3.4 percent of mining commodity type, 3.2 percent of agricultural commodity type, 2.3 percent of public administration commodity type, 1.6 percent of manufacturing commodity type, and rest of 2.2 percent of

[63] Weights were determined by Caltrans District 9 for O-D counts based on relative occurrences of surveyed trips, that is traffic count divided by survey count for a given trip type.

other commodity types. This commodity information may not represent actual commodities carried, as truck drivers will sometimes provide misinformation to these types of surveys due to confidentiality concerns—in these situations, the most common response is to declare the truck is empty.

In the 2009 SR 58 O-D survey, four truck intercept survey locations, two in each direction of SR 58, were used. Table 5.4 shows the truck flow pattern or distribution of truck survey counts across aggregated destinations for SR 58 eastbound flows (that is, destinations east of survey locations only), and the distribution of truck survey counts across aggregated origins for SR 58 westbound flows (that is, origins east of survey locations only). This is different in format from the survey result for the US 395 O-D survey, where both origin and destination were identified. Based on this table, trucks that originated/terminated in Eastern Sierra and eastern Kern County formed approximately 9.2 percent of the total trucks on SR 58. Trucks that originated/terminated in Southern California and Southern Border zones formed approximately 23.2 percent of the total trucks on SR 58. Trucks that originated/terminated in Nevada formed approximately 7.8 percent of the total trucks on SR 58, which was assumed to be split between Northern Nevada and Southern Nevada in proportion to 2015 freight employment roughly as 36 percent and 64 percent, respectively. In other words, the shares for trucks that originated/terminated in Northern Nevada and Southern Nevada were estimated as 2.8 percent and 5.0 percent. Trucks that originated/terminated in Eastern Sierra and Northern Nevada, and to a small extent those that originated/terminated in eastern Kern County and rest of U.S. (via US 395), are expected to travel also on SR 14, US 395, and US 6 north of SR 58. Trucks that originated/terminated in Southern California are expected to travel also on SR 14 and US 395 south of SR 58. Trucks that originated/terminated in rest of U.S. (via I-15/I-40 corridors) are expected to use only SR 58 within Caltrans District 9 boundary.

Table 5.4 SR 58 O-D Survey Truck Survey Counts Distribution by Origin or Destination

2009

Destination (Eastbound)/Origin (Westbound)	% of All Truck Survey Counts Eastbound	% of All Truck Survey Counts Westbound	% of All Truck Survey Counts – Bidirectional Average
Southern California + Southern Border	23.0%	23.3%	23.2%
San Joaquin Valley California[1]	7.4%	10.1%	8.8%
Central Sierra[2]	0.4%	0.4%	0.4%
Nevada	8.4%	7.2%	7.8%
Northern Nevada	3.0%	2.6%	2.8%
Southern Nevada	5.4%	4.6%	5.0%
Rest of U.S.	60.8%	59.0%	59.9%
Total	**100.0%**	**100.0%**	**100.0%**

Source: San Bernardino County Transportation Authority, Kern Council of Governments, and Caltrans Districts 6, 8, 9, and Headquarters, SR 58 Origin and Destination Truck Study, Final Report, February 2009. Available at: http://gosbcta.com/plans-projects/studies/past-studies/SR 58_Study_Report.pdf (last accessed on November 2, 2017); Nevada DOT Statewide Travel Demand Model (base year = 2015, forecast year = 2040); and Cambridge Systematics' Analysis.

[1] Based on the survey locations, the destination for eastbound direction and the origin for westbound direction SR 58 truck traffic flows for this zone is assumed to be in eastern Kern County.

[2] Based on the survey locations, the destination for eastbound direction and the origin for westbound direction SR 58 truck traffic flows for this zone is assumed to be in Eastern Sierra (Inyo/Mono Counties).

There are data redundancy or overlaps in the truck O-D surveys for US 395 and SR 58; particularly, the truck flows between San Joaquin Valley and any one of the following zones: Eastern Sierra, Northern Nevada, and rest of U.S. (via US 395) were captured in both truck O-D surveys. For these O-D pairs, the 2011 US 395 O-D survey data was used in truck traffic forecasting (see Section 5.3.4), as the truck traffic flow pattern is more recent than the 2009 SR 58 O-D survey data, and less likely to be affected by the 2008 to 2009 global economic recession. Relative shares of the O-D pairs that are captured solely by one of the truck O-D surveys (that is, O-D pairs that travel on US 395 but not on SR 58, or O-D pairs that travel on SR 58 but not on US 395) were used without any changes. These procedures helped overcome the differences in O-D survey zones and the differences in survey result formats.

5.3.3 Existing Truck Traffic and Auto Traffic Patterns

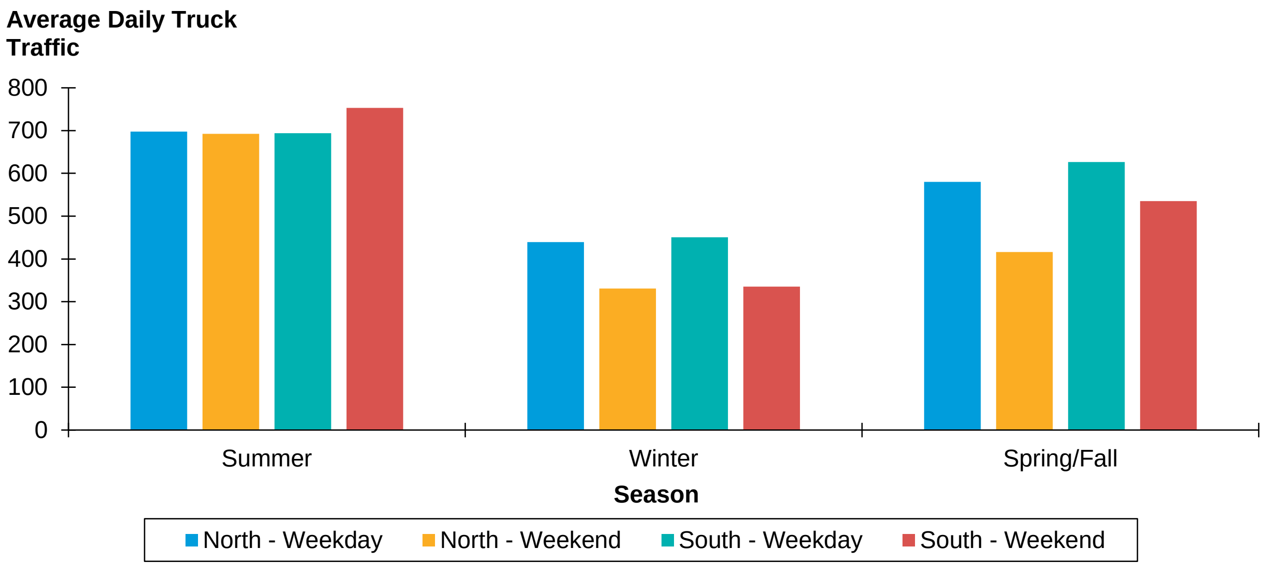
There were several ITS facilities on the study corridor, as discussed in Section 6.1 of this study. Among these are six classification count stations. Data were collected at three out of the six classification count station locations in the study corridor, as follows: 1) Count Station 906 on US 395 at PM 120.95 A (just north of Bishop) in Inyo County; 2) Count Station 945 on US 6 at PM R3.952 A (just north of Bishop) in Inyo County; and 3) Count Station 971 SR 14 at PM 64.559 B (south of US 395/SR 14 junction) in Kern County. The data were used to understand seasonal, directional, and day of the week (weekday/weekend) patterns for truck traffic and auto traffic in the year 2016. Figure 5.7, Figure 5.8, and Figure 5.9 show these traffic patterns at the three count stations.

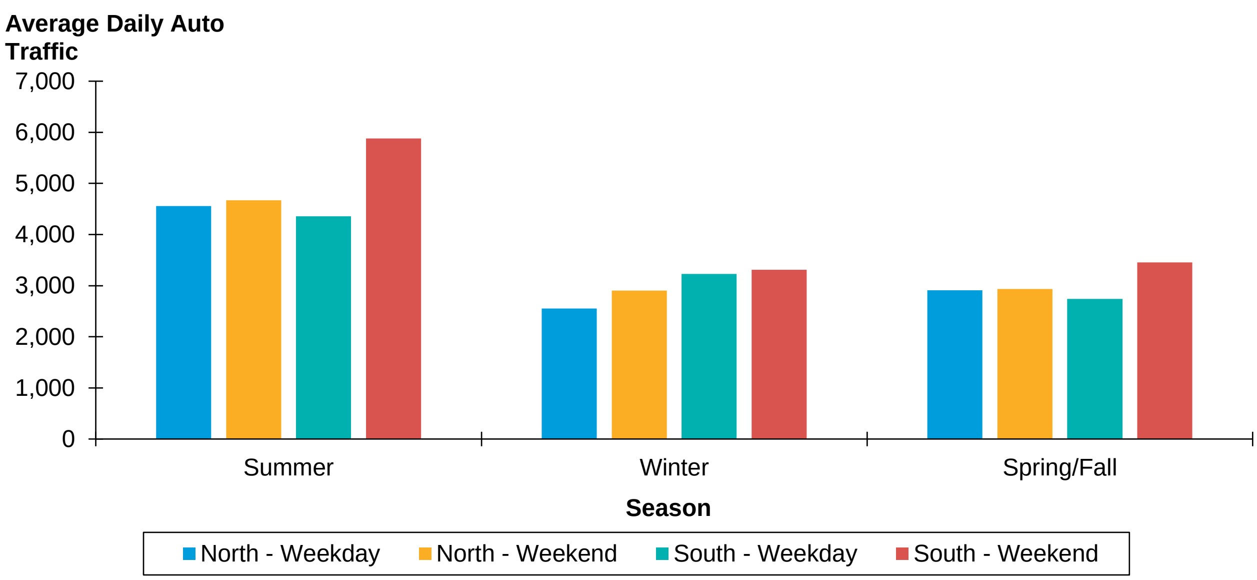
At Count Station 906, summer season unidirectional average daily traffic count ranges from 693 to 753 for trucks and from 4,354 to 5,881 for autos. In winter season, average daily truck traffic is about 44 percent to 65 percent of the summer season average daily truck traffic, and average daily auto traffic is about 56 percent to 74 percent of the summer season average daily auto traffic. In spring/fall season, average daily truck traffic is about 60 percent to 90 percent of the summer season average daily truck traffic, and average daily auto traffic is about 59 percent to 64 percent of the summer season average daily auto traffic. The directional splits are overall favored towards higher southbound traffic, with shares reaching up to 56 percent of bidirectional total for both trucks and autos. Weekend traffic is at the same level as weekday traffic for trucks in summer season, and auto in all seasons; while weekend traffic is consistently lower than weekday traffic for trucks in other seasons.

At Count Station 945, summer season unidirectional average daily traffic count ranges from 374 to 598 for trucks and from 1,015 to 1,331 for autos. In winter season, average daily truck traffic is about 65 percent to 99 percent of the summer season average daily truck traffic, and average daily auto traffic is about 53 percent to 71 percent of the summer season average daily auto traffic. In spring/fall season, average daily truck traffic is about 68 percent to 91 percent of the summer season average daily truck traffic, and average daily auto traffic is about 55 percent to 74 percent of the summer season average daily auto traffic. The directional splits are overall favored towards higher southbound traffic, with shares reaching up to 59 percent of bidirectional total for trucks and 60 percent of bidirectional total for autos. Weekend traffic is consistently lower than weekday traffic for trucks in all seasons, while weekend traffic is only marginally lower than weekday traffic for auto in all seasons.

Figure 5.7 Traffic Patterns at Count Station 906 on US 395 at PM 120.95 A in Inyo County

2016



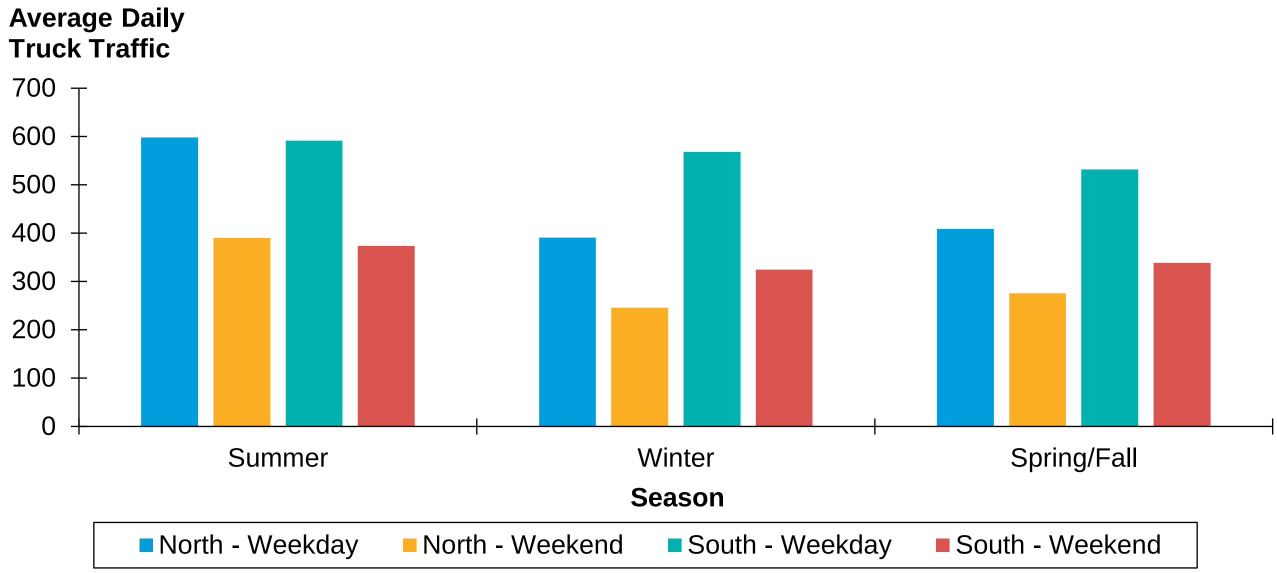


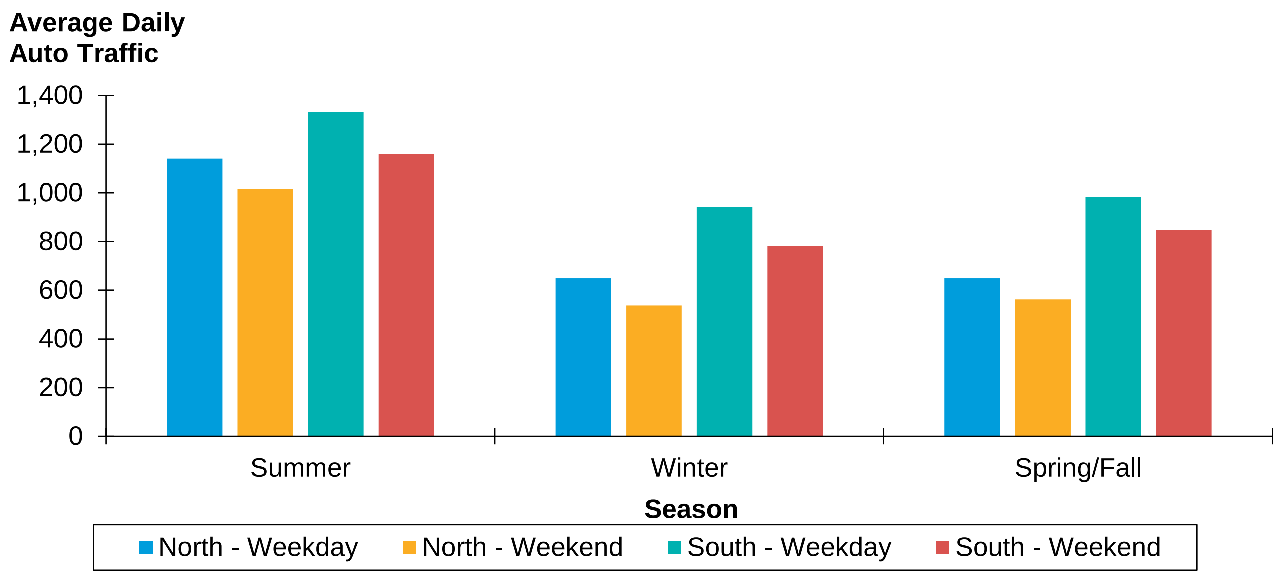
Source: Caltrans District 9.

Note: Summer season was assumed for the months of June, July, and August. Winter season was assumed for the months of December, January, February, March, and April. Spring/fall season was assumed for the months of May, September, October, and November. Weekday included Monday to Friday, while weekend included Saturday and Sunday. Data for some months in each season were missing. The graphs are showing a daily average of traffic for the available months of data.

Figure 5.8 Traffic Patterns at Count Station 945 on US 6 at PM R3.952 A in Inyo County

2016





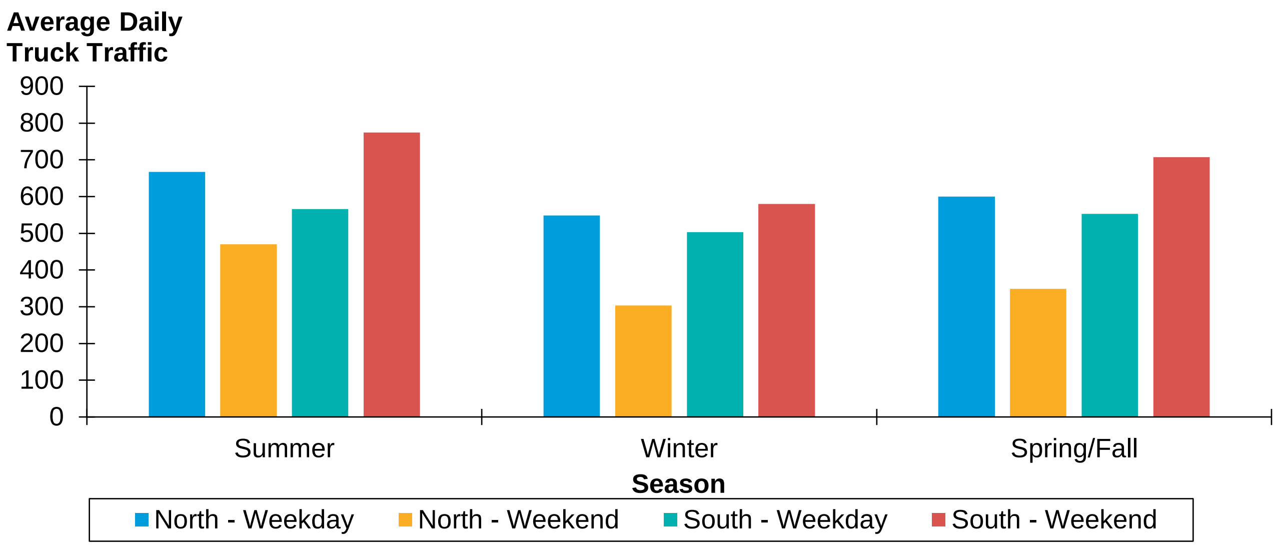
Source: Caltrans District 9.

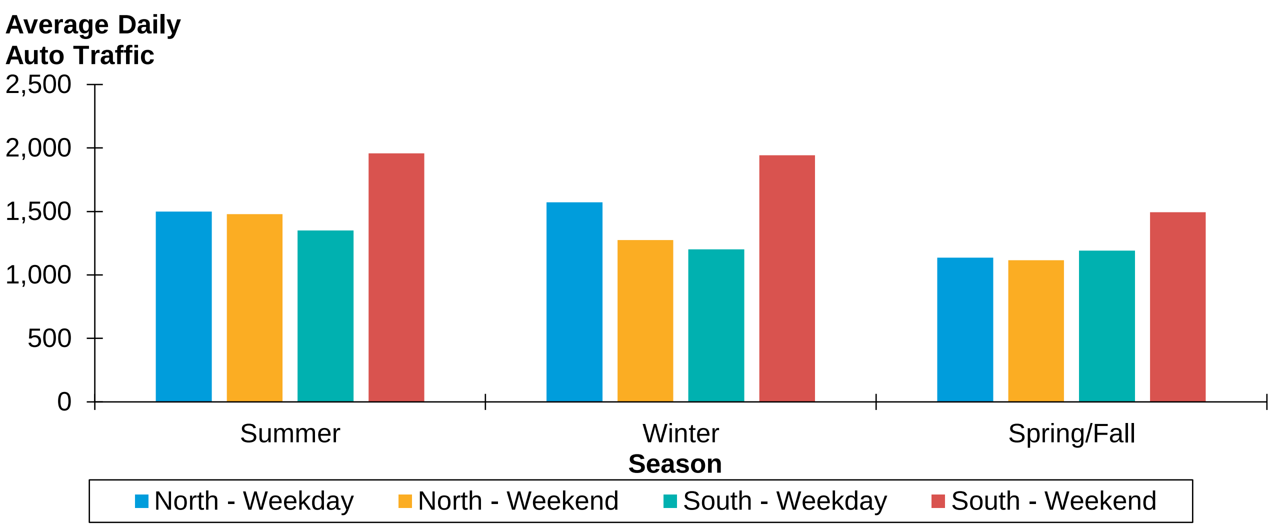
Note: Summer season was assumed for the months of June, July, and August. Winter season was assumed for the months of December, January, February, March, and April. Spring/fall season was assumed for the months of May, September, October, and November. Weekday included Monday to Friday, while weekend included Saturday and Sunday. Data for some months in each season was missing. The graphs are showing a daily average of traffic for the available months of data.

At Count Station 971, summer season unidirectional average daily traffic count ranges from 470 to 774 for trucks and from 1,349 to 1,959 for autos. In winter season average daily truck traffic is about 64 percent to 89 percent of the summer season average daily truck traffic, and average daily auto traffic is about 89 percent to 105 percent of the summer season average daily auto traffic. In other words, auto traffic in the winter season is about the same as in the summer season. In spring/fall season average daily truck traffic is about 74 percent to 98 percent of the summer season average daily truck traffic, and average daily auto traffic is about 75 percent to 88 percent of the summer season average daily auto traffic. The directional splits are favored towards higher southbound traffic but only in the weekends, with shares reaching up to 67 percent of bidirectional total for trucks and 60 percent of bidirectional total for autos. In all seasons, there is not much difference in weekday and weekend traffic for autos in the northbound direction. Weekend traffic is consistently lower than weekday traffic for trucks in the northbound direction in all seasons, while weekend traffic is consistently higher than weekday traffic for trucks and autos in the southbound direction.

Figure 5.9 Traffic Patterns at Count Station 971 SR 14 at PM 64.559 B in Kern County

2016





Source: Caltrans District 9.

Note: Summer season was assumed for the months of June, July, and August. Winter season was assumed for the months of December, January, February, March, and April. Spring/fall season was assumed for the months of May, September, October, and November. Weekday included Monday to Friday, while weekend included Saturday and Sunday. Data for some months in each season was missing. The graphs are showing a daily average of traffic for the available months of data.

Based on the analyzed traffic patterns, seasonality effect, namely, that is reduction in traffic during winter and spring/fall seasons compared to summer season, is stronger in the northern count station locations on US 395 and US 6 than the southern count station location on SR 14. The seasonality effect is seen with both trucks and autos. For the analyzed count station locations, southbound direction holds a greater amount of traffic flow compared to northbound direction; this is consistently true for weekend auto traffic. There is no common pattern in weekday/weekend traffic-level differences; this varies by location, direction, and vehicle type.

5.3.4 Future Truck Traffic and Total Traffic Volumes

A forecasting method was developed for estimating growth factors for truck travel, while existing growth factors for auto travel in Caltrans statewide travel demand model (base year = 2015, forecast year = 2040) were used. The growth factors were applied to base year truck and auto traffic volumes to estimate future year truck and auto traffic volumes. The resulting future traffic and auto traffic volumes were added together to estimate future total traffic volumes. The forecasts were made at segment level for the study corridor.

Truck Traffic Forecasting

Truck traffic forecasting was done in a two-step process: in the first step, base year truck O-D traffic volumes on the study corridor were estimated using truck O-D surveys; and in the second-step, growth factors by O-D pair were identified using socioeconomic forecasts and applied to the base year truck O-D traffic volumes to estimate future year truck traffic volumes on the study corridor. In order to apply the growth factors, Furness/Fratar trip distribution calculations were performed.

Base Year Truck Origin-Destination Traffic Volume Estimation

Origin and destination zones were defined consistent with the 2011 US 395 O-D Survey for all truck flows using US 395. For clarity, "Southern California" zone in the 2011 US 395 O-D Survey is referred to as eastern Southern California. Eastern part of Kern County falling within the Caltrans District 9 boundary also was separated from eastern Southern California. Three zones were added for truck flows traveling on SR 58, but not traveling on US 395, namely, eastern Kern County, Southern Nevada, and rest of U.S. via I-15/I-40. Base year truck O-D traffic volumes on US 395 middle segment and SR 58 (Tehachapi Summit) segment were estimated using relative shares in the truck O-D surveys. Principles of conservation of flow and allocation assumptions were used to estimate truck O-D traffic volumes for other segments of the study corridor as follows:

- US 395 middle segment truck O-D flows were split between US 6 segment and US 395 north segment in the proportion of their total truck traffic volumes.
- Truck flows with trip ends in Central Valley were split between SR 14 north segment and US 395 south segment in the proportion of 80:20.
- Truck flows with trip ends in South Coast and Southern California zones were split between SR 14 north segment and US 395 south segment, and between SR 14 south segment and US 395 south of SR 58 (not a study corridor segment) in the proportion of 50:50.
- Truck traffic for "all other O-D pairs" was estimated as a difference between total truck traffic and truck traffic estimates for known O-D pairs.

Base year percent shares by combining O-D surveys and resulting average daily truck traffic estimates at O-D level for study corridor segments are shown in Table 5.5.

Table 5.5 Base Year O-D-Level Percent Shares and Average Daily Truck Traffic Estimates by Study Corridor Segment

2015

Origin/Destination	Percent Share of Total Flow	US 395 Middle	US 395 North	US 395 South	SR 14 North	US 6	Percent Share of Total Flow	SR 58	SR 58 (East of US 395/ SR 58 Jct.)	SR 14 South
Eastern Southern California – Northern Nevada	22.1%	324	176	162	162	148				162
South Coast – Northern Nevada	17.7%	259	141	130	130	119				130
Inyo/Mono Counties – Eastern Southern California	13.5%	198	116	99	99	98				99
Eastern Southern California – Rest of U.S.	8.3%	122	66	61	61	56				61
Inyo/Mono Counties – South Coast	7.4%	109	64	54	54	54				54
South Coast – Rest of U.S.	5.9%	87	47	43	43	40				43
Inyo/Mono Counties – Northern Nevada	5.8%	85	50			42				
Inyo/Mono Counties (Intra)	3.7%	55	32			27				
Inyo/Mono Counties – Central Valley California	3.1%	45	27	9	36	22	0.7%	45		
Central Valley California – Northern Nevada	2.8%	41	22	8	33	19	0.6%	41		
Central Valley California – Rest of U.S. via US 395	2.2%	32	18	6	26	15	0.5%	32		
Trip ends in Eastern Southern California							12.2%	783		391
Trip ends in South Coast							12.2%	783		391
Trip ends in Southern Nevada							5.2%	337	317	
Trip ends in Rest of U.S. via I-15/I-40							59.4%	3,822	3,603	
All other O-D Pairs	7.5%	110	65	49	323	55	9.2%	592	206	494
Total	**100.0%**	**1,468**	**824**	**622**	**968**	**693**	**100.0%**	**6,434**	**4,127**	**1,826**

Source: Caltrans District 9, US 395 Origination and Destination Study, 2011; San Bernardino County Transportation Authority, Kern Council of Governments, and Caltrans Districts 6, 8, 9, and Headquarters, SR 58 Origin and Destination Truck Study, Final Report, February 2009; and Caltrans Traffic Counts, 2015.

Truck Trips Growth Factor Determination and Application

Truck traffic on the study corridor segments was assumed to grow as a result of growth in truck trips at origin or destination zones. Truck trip productions and attractions for a zone were assumed to grow proportionate to the freight employment growth of key industrial areas within the zone, as provided by regional/statewide travel demand models (see Table 3.2 of this study). Some exceptions to this rule, however, are as follows:

- **South Coast California zone.** Here, truck trip productions and attractions were assumed to grow due to a weighted average of freight employment growth of key industrial areas and Ports of Long Beach/ Los Angeles cargo growth. As shown in Table 3.2 of this study, freight employment of key industrial areas has a compound annualized growth rate of 0.6 percent. An update to the cargo forecast is being made for the Ports,[64] based on which ports cargo is expected to increase from 15.4 million twenty-foot equivalent units (TEU) in 2015 to 41.1 million TEUs by 2040 under a baseline forecast scenario, at a compound annualized growth rate of 4.0 percent. Considering truck trips in Los Angeles County in the SCAG 2016 to 2040 Regional Transportation Plan,[65] the share of port truck trips out of total truck trips was determined as 7.7 percent. Using 7.7 percent as weight for the port cargo growth rate and 92.3 percent as weight for the freight employment growth rate, an average growth rate was determined as 0.9 percent.

- **Northern and Southern Nevada zones.** Nevada DOT statewide travel demand model provides 2040 freight employment under a baseline forecast scenario and a high forecast scenario. Table 3.2 of this study showed freight employment in 2040 under the baseline forecast scenario. For the purpose of truck traffic forecasting, these were treated as "low" and "moderate" forecast scenarios for Nevada zones, respectively. Under the "low" forecast scenario, compound annualized growth rates of Northern Nevada and Southern Nevada zones are expected to be 1.6 percent each. Under the "moderate" forecast scenario, compound annualized growth rates of Northern Nevada and Southern Nevada zones are expected to be 2.0 percent and 3.1 percent, respectively. A "high" forecast scenario was defined for Northern Nevada zone based on the EDAWN study discussed in Section 4.6.2 of this study. The EDAWN study projected total employment for Northern Nevada to grow at a compound annualized growth rate of 3.6 percent between 2015 and 2019. This growth rate was extrapolated to the year 2040 under the "high" forecast scenario. Under this "high" forecast scenario, Southern Nevada zone was assumed to reach the same growth as under the "moderate" forecast scenario.

- **Unspecified zones.** There were no usable freight employment projections for "all other O-D pairs" and "trip ends in the rest of U.S. via I-15/I-40." Hence, the Federal Highway Administration (FHWA) Freight Analysis Framework Version 4 (FAF4) database was used to fill the data gap. A growth factor was derived using 2015 and 2040 truck tonnage projections in FAF4 by using a sum of domestic interregional O-D flows in California-and-Northern Nevada mega-region and O-D flows from/to Inyo/Mono Counties to rest of U.S. (excluding California and Northern Nevada). The resulting average annualized growth factor of 0.9 percent was used for "all other O-D pairs." Another growth factor was derived using 2015 and 2040 truck tonnage projections in FAF4 by using O-D flows from/to Central Valley California to rest of

[64] CMANC's Presentation to POLA, titled "Port of Los Angeles Update" on January 20, 2017. Available at: http://www.cmanc.com/web/presentations/Winter2017Presentations/Arend_Kurt.pdf (last accessed on January 15, 2018).

[65] SCAG 2016-2040 RTP Draft Appendix on Goods Movement, December 2015. Available at: http://scagrtpscs.net/Documents/2016/draft/d2016RTPSCS_GoodsMovement.pdf (last accessed on January 15, 2018).

U.S. (excluding California and Northern Nevada). The resulting average annualized growth factor of 2.1 percent was used for "trip ends in the rest of U.S. via I-15/I-40."

Overall, the growth rates and growth factors used for origin/destination zones are shown in Table 5.6. The growth in truck traffic associated with all access routes to/from a given zone including the study corridor are assumed to have the same truck traffic growth factor. For instance, this assumes that I-80 and US 395 providing truck access to Northern Nevada are assumed to have the same truck traffic growth factor of 2.40 under the "high" forecast scenario. Since I-80 would have carried higher share of traffic from/to Northern Nevada than US 395 in the base year, the estimated growth obtained by multiplying the base year truck traffic volumes with a single growth factor will be higher on I-80 than US 395.

Table 5.6 Truck Trip Growth Rates and Growth Factors for O-D Zones
Base Year to Forecast Year

	"Low" Forecast Scenario		"Moderate" Forecast Scenario		"High" Forecast Scenario	
Origin/Destination	**Compound Annualized Growth Rate**	**Growth Factor**	**Compound Annualized Growth Rate**	**Growth Factor**	**Compound Annualized Growth Rate**	**Growth Factor**
Inyo/Mono Counties	0.9%	1.26	0.9%	1.26	0.9%	1.26
Eastern Southern California	1.7%	1.51	1.7%	1.51	1.7%	1.51
South Coast	0.9%	1.24	0.9%	1.24	0.9%	1.24
Central Valley (excluding eastern Kern County)	1.8%	1.57	1.8%	1.57	1.8%	1.57
Northern Nevada	1.6%	1.50	2.0%	1.65	3.6%	2.40
Southern Nevada	1.6%	1.49	3.1%	2.15	3.1%	2.15
Rest of U.S. via I-15/I-40	2.1%	1.67	2.1%	1.67	2.1%	1.67
Eastern Kern County or Other	0.9%	1.24	0.9%	1.24	0.9%	1.24

Source: Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040); SCAG Regional Travel Demand Model (base year = 2012, forecast year = 2040); Nevada DOT Statewide Travel Demand Model (base year = 2015, forecast year = 2040) – Baseline Forecast Scenario; and FAF4 = FHWA's Freight Analysis Framework Version 4 Database.

Note: Freight employment generally refers to employment in agriculture, mining and logging, construction, utilities, manufacturing, trade (wholesale and retail), and logistics (transportation and warehousing) sectors. Specific freight sectors, however, varied between the data sources.

In order to estimate forecast year truck traffic volumes using the growth factors, Furness/Fratar trip distribution calculations, which is a popular iterative constrained growth factor method for trip distribution, were performed. Base year truck O-D traffic volumes table as seed or initial values. Due to the nature of available O-D data, doubly constrained growth factor method was used for all O-D pairs using US 395 middle segment, while singly constrained growth factor method was used for O-D pairs other than US 395. The O-D-level estimates relevant to each study corridor segment were aggregated to develop future average daily truck traffic volume projections. The growth factors and forecast year average daily truck traffic estimates at O-D level for study corridor segments are shown in Table 5.7.

Table 5.7 Forecast Year O-D Level 2015 to 2040 Growth Factors and Average Daily Truck Traffic Estimates by Study Corridor Segment

2040 Low-High

Origin/Destination	2015-2040 Growth Factor	Growth Factor Source	US 395 Middle	US 395 North	US 395 South	SR 14 North	US 6	SR 58	SR 58 (East of US 395/ SR 58 Jct.)	SR 14 South
Eastern Southern California – Northern Nevada	1.66-2.24	SED	537-724	292-393	268-362	268-362	245-331			268-362
South Coast – Northern Nevada	1.34-1.70	SED	348-442	189-240	174-221	174-221	159-202			174-221
Inyo/Mono Counties – Eastern Southern California	1.38-0.49	SED	272-97	160-57	136-49	136-49	135-48			136-49
Eastern Southern California – Rest of U.S.	1.32-1.30	SED	161-159	88-87	81-80	81-80	74-73			81-80
Inyo/Mono Counties – South Coast	1.11-0.37	SED	121-41	71-24	61-20	61-20	60-20			61-20
South Coast – Rest of U.S.	1.07-0.99	SED	92-86	50-47	46-43	46-43	42-39			46-43
Inyo/Mono Counties – Northern Nevada	1.29-4.82	SED	109-408	64-240			54-201			
Inyo/Mono Counties (Intra)	1.07-1.06	SED	59-58	35-34			29-29			
Inyo/Mono Counties – Central Valley California	1.48-0.59	SED	67-27	39-16	13-5	54-21	33-13	67-27		
Central Valley California – Northern Nevada	1.78-2.69	SED	74-111	40-60	15-22	59-89	34-51	74-111		
Central Valley California – Rest of U.S. via US 395	1.41-1.56	SED	46-51	25-28	9-10	37-41	21-23	46-51		
Trip ends in Eastern Southern California	1.51-1.51	SED						1,179-1,179		590-590
Trip ends in South Coast	1.24-1.24	SED						967-967		484-484
Trip ends in Southern Nevada	1.49-2.15	SED						501-725	683	
Trip ends in Rest of U.S. via I-15/I-40	1.67-1.67	FAF4						6,398-6,398	6,033-6,033	
All other O-D Pairs	1.24-1.24	FAF4	137-137	80-80	60-60	401-401	68-68	733-733	256-256	612-612
Total			**2,023-2,340**	**1,133-1,305**	**864-873**	**1,316-1,326**	**953-1,098**	**9,966-10,192**	**6,761-6,972**	**2,452-2,460**

Source: Table 5.5 of this study; Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040); SCAG Regional Travel Demand Model (base year = 2012, forecast year = 2040); Nevada DOT, Statewide Travel Demand Model (base year = 2015, forecast year = 2040); and FHWA's FAF4 Database. (Note: SED = Model's Socioeconomic Data and Projections).

Although the O-D-level solution for Furness/Fratar distribution method numerically satisfies the growth factors at all origins and destinations, growth factors of less than 1 were estimated by the method for O-D pairs of "Inyo/Mono Counties—Northern Nevada" and "Inyo/Mono Counties (Intra)," although these were anticipated to be over 1. Since the growth factor for all truck traffic with trip ends in Inyo/Mono Counties was estimated as greater than 1, the anomalies were overlooked.

Between the "low" forecast scenario and "high" forecast scenario, the key change in the context of Eastern Sierra region is a shift in truck O-D flows from South Coast and eastern Southern California zones to Northern Nevada zone, and also there is an increase in through flows.

The growth in truck traffic associated with the access routes to zones other than the study corridor were not evaluated in this study as base year truck traffic at O-D level was not collected on routes other than the study corridor.

Comparison to California Statewide Model Truck Traffic Volume Forecasts

Table 5.8 shows a comparison of truck traffic volume forecasts between the study methodology and California Statewide Model. It is noticed that several segments in the California Statewide Model are not calibrated to the base year average daily truck counts along the study corridor. Overlooking the base year volume differences, the projected volumes based on the study methodology are marginally higher on all US 395 segments and the SR 14 north segment than the California statewide travel demand model. The study methodology is predicting far less growth on SR 14 south segment than the California Statewide Model. SR 58 segment and SR 14 north segment too have a much higher growth percentage than the study methodology. Inclusion of the High Desert Corridor project between SR 14 in Los Angeles County and SR 18 in San Bernardino County within the California Statewide Model is identified as one of key reasons for the high growth percentages. The project results in diversions of truck traffic from US 395 corridor. Such diversion was not accounted in the study methodology. Lastly, the study methodology projects much higher traffic volume on US 6 than that projected by the California Statewide model.

In summary, the traffic projections based on the study methodology on highway segments serving Inyo/Mono Counties are comparable with the California Statewide Model. However, for SR 58 and SR 14 highways that serve the southern part of Caltrans District 9 region, there is a higher potential for growth in truck traffic than that projected by the study methodology.

Table 5.8 Comparison of Study Methodology Forecasts to California Statewide Model Truck Traffic Volume Forecasts

	Study Methodology			California Statewide Model		
Highway Segment	2015 Truck AADT	2040 Truck AADT	Percent Growth	2015 Daily Truck Volume	2040 Daily Truck Volume	Percent Growth
US 395 North Segment	824	1,133-1,305	37%-58%	766	1,019	33%
US 395 Middle Segment	1,468	2,023-2,340	38%-59%	885	1,043	18%
US 395 South Segment	622	864-873	39%-40%	593	744	25%
SR 14 North Segment	968	1,316-1,326	36%-37%	482	1,307	171%
SR 14 South Segment	1,826	2,452-2,460	34%-35%	2,790	10,216	266%
SR 58 Segment	6,434	9,966-10,192	55%-58%	4,835	12,395	156%
SR 58 (East of US 395/SR 58 Jct.) Segment	4,127	6,761-6,972	64%-69%	2,523	4,267	69%
US 6 Segment	693	953-1,098	37%-58%	108	144	33%

Source: Table 5.2 and Table 5.7 of this study; Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040). (Note: Link closest to the count location was selected for the volume summary shown above.)

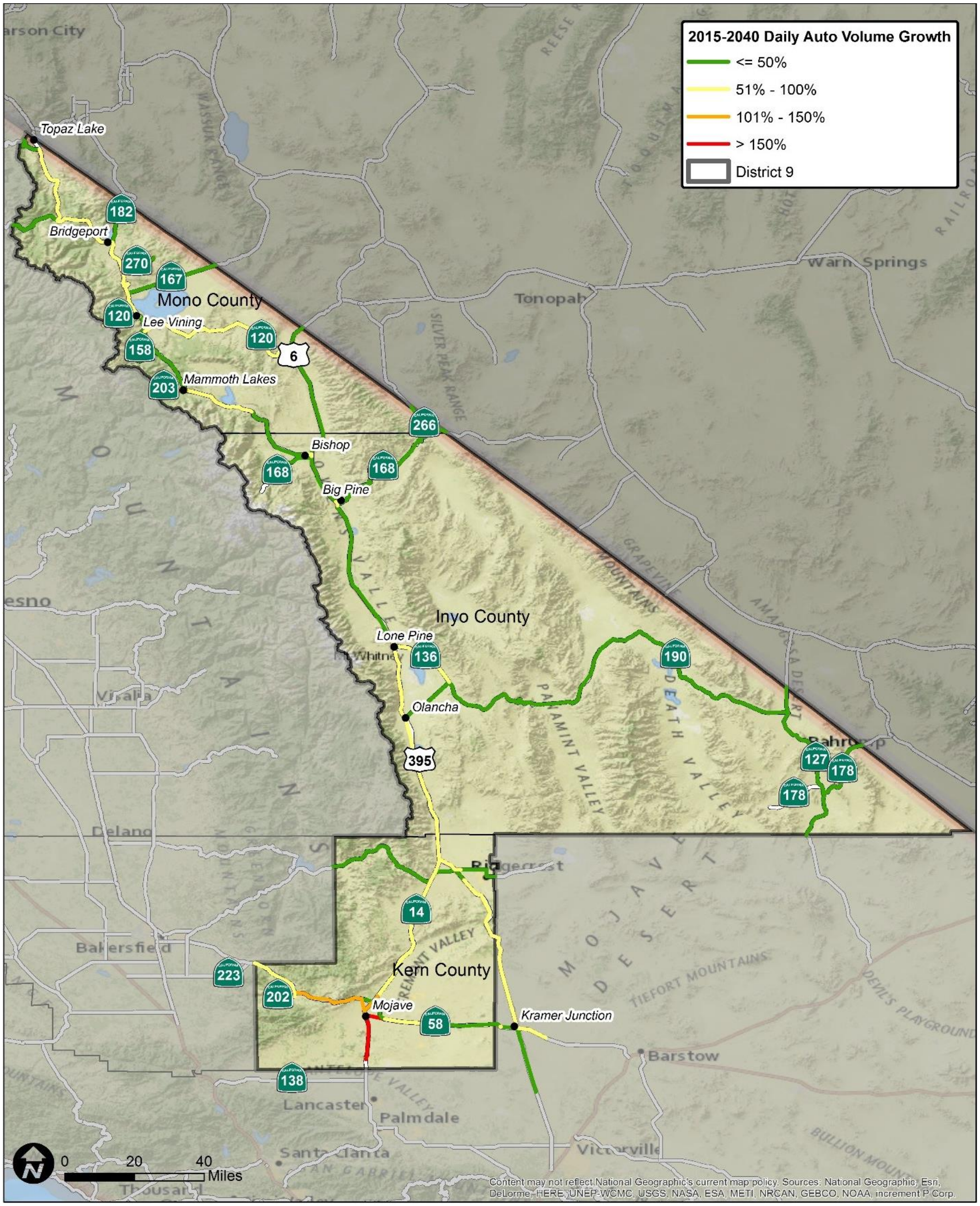
Auto Traffic Forecasting

For future auto traffic volumes, auto vehicle miles traveled were computed in 2015 and 2040 for study corridor segments in the California statewide model, and growth percent in auto vehicle miles were applied to existing average daily auto traffic volumes to project future average daily auto traffic volumes. Figure 5.10 shows the auto volume growth percent at link level in the California statewide model for reference. Since there are variations in auto volume growth percent for model defined links within each study corridor segment, vehicle miles was used as the basis for the auto traffic projections at segment level.

Table 5.9 shows auto vehicle miles traveled in 2015 and 2040 and percent growth based on California Statewide travel demand model on various segments of the study corridor.

Figure 5.10 California Statewide Travel Demand Model-Based Link-Level Auto Volume Growth

2015 to 2040



Source: Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040); and Cambridge Systematics' model outputs processing to convert unidirectional link volumes to bidirectional link volumes.

Table 5.9 California Statewide Travel Demand Model-Based Auto Vehicle Miles Traveled Growth

2015 to 2040

Highway Segment	2015 Auto Vehicle Miles Traveled	2040 Auto Vehicle Miles Traveled	Percentage Change in Auto Vehicle Miles Traveled
US 395 North Segment	324,593	496,128	53%
US 395 Middle Segment	286,387	452,333	58%
US 395 South Segment	86,503	143,875	66%
SR 14 North Segment	60,300	113,173	88%
SR 14 South Segment	121,921	337,088	176%
SR 58 Segment	242,380	425,066	75%
SR 58 (East of US 395/SR 58 Jct.) Segment	11,858	19,317	63%
US 6 Segment	13,699	19,733	44%
Total	**1,147,640**	**2,006,713**	**75%**

Source: Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040); and Cambridge Systematics' model outputs processing to convert unidirectional link volumes to bidirectional link volumes.

Total Traffic Estimation

Combining the truck traffic forecasts and auto volume growth information, Table 5.10 shows projections for the total AADT, auto AADT, and truck AADT in 2040. Percent growth in truck AADT also was applied to 5 or more axles truck AADT.

SR 58 segment will continue to dominate in terms of truck traffic with average daily truck volumes expected to reach over 10,000 trucks per day at Tehachapi Summit. On the other hand, SR 14 south segment is expected to see very high growth in auto traffic, development of High Desert Corridor,[66] which improves connectivity to San Bernardino County would be a key reason for this high growth on SR 14. All study corridor segments north of SR 58 are expected to have moderate growth in truck traffic relative to SR 58 segments, with average daily truck volumes barely crossing 2,000 trucks per day on US 395 middle segment. SR 14 north segment and SR 58 segment also are expected to see a high growth, while all other study corridor segments north of SR 58 are expected to have moderate growth in truck traffic relative to SR 14 segments.

[66] https://www.metro.net/projects/high-desert-corridor/ (last accessed on November 2, 2017).

Table 5.10 Estimated 2040 Average Annual Daily Traffic on Eastern Sierra Corridor
Low-High Scenarios

Highway Segment	Total AADT	Auto AADT	Truck AADT	5 or More Axles Truck AADT	Percent Growth in Total AADT	Percent Growth in Auto AADT	Percent Growth in Truck AADT	Percent Growth in 5 or More Axles Truck AADT
US 395 North Segment	5,987-6,160	4,854	1,133-1,305	404-466	50%-54%	53%	37%-58%	37%-58%
US 395 Middle Segment	9,497-9,814	7,474	2,023-2,340	943-1,090	53%-58%	58%	38%-59%	38%-59%
US 395 South Segment	4,403-4,412	3,539	864-873	496-501	60%-60%	66%	39%-40%	39%-40%
SR 14 North Segment	9,071-9,081	7,755	1,316-1,326	1,054-1,062	78%-78%	88%	36%-37%	36%-37%
SR 14 South Segment	84,495-84,503	82,043	2,452-2,460	1,281-1,285	168%-168%	176%	34%-35%	34%-35%
SR 58 Segment	36,300-36,526	26,334	9,966-10,192	6,050-6,187	69%-70%	75%	55%-58%	55%-58%
SR 58 (East of US 395/SR 58 Jct.) Segment	18,609-18,820	11,848	6,761-6,972	5,595-5,769	63%-65%	63%	64%-69%	64%-69%
US 6 Segment	3,203-3,348	2,250	953-1,098	507-584	42%-48%	44%	37%-58%	37%-58%

Source: Table 5.2 of this study; Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040); and Cambridge Systematics' auto volume growth calculations.

5.4 Network Connectivity and Redundancy

Connectivity through US 395 north segment and SR 58 west of SR 14 (over Tehachapi) are impacted by mountainous terrain. Slow truck speeds on mountain grades lead to reduced highway capacity. Frequently, closures due to snowfall and landslide/mudslide events also occur.

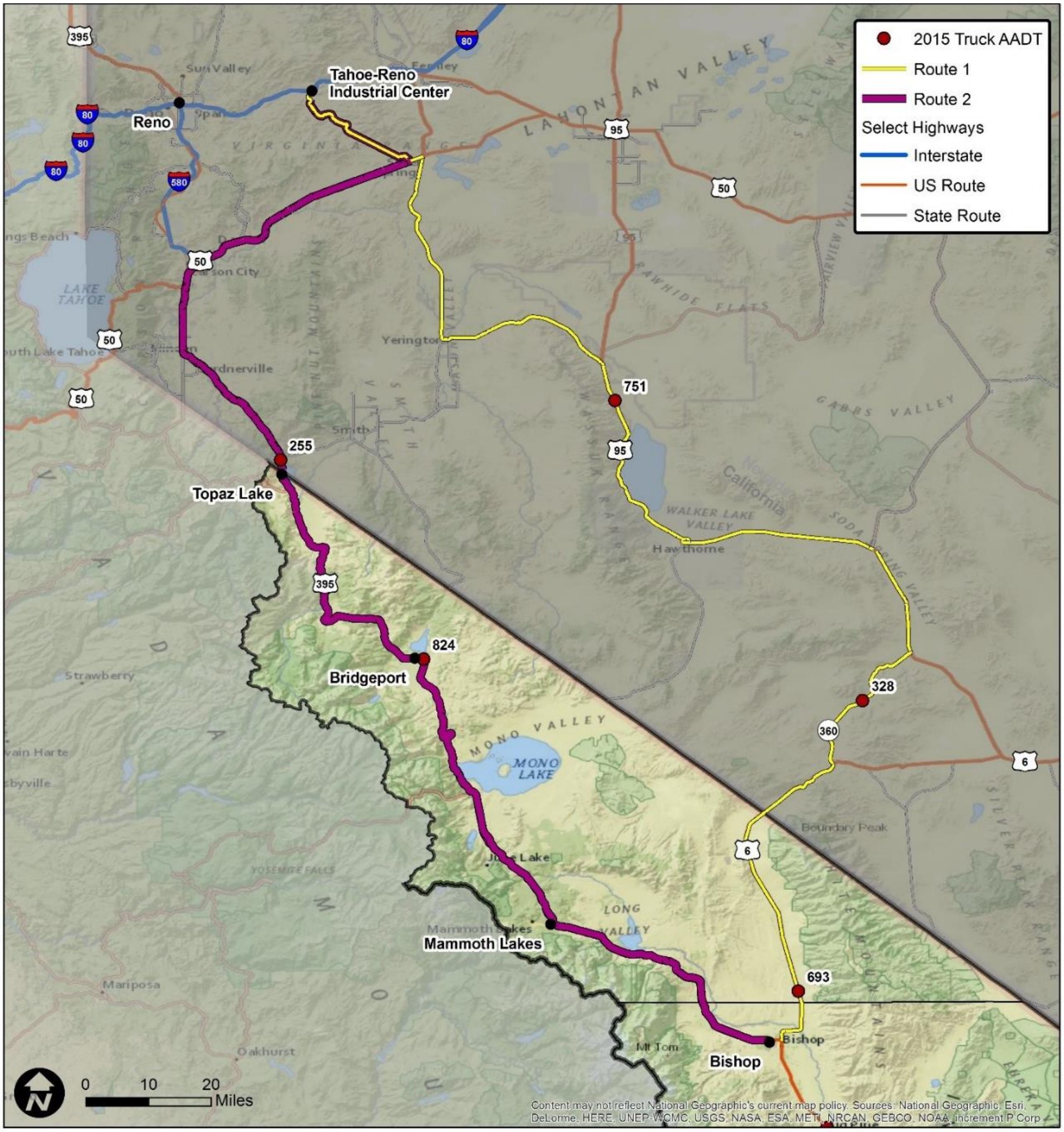
Within the study corridor, network redundancy for north-south connectivity is present south of US 395/SR 14 junction, as well as north of US 395/SR 6 junction, where US 395 branches off into almost parallel highways. There is limited network redundancy for east-west connectivity—SR 58 is the sole corridor.

Outside the study corridor, broader network redundancy exists for connectivity between freight activity centers in Southern California and Northern Nevada, and between those in southern Central Valley California and Northern Nevada. I-5 and SR 99 serve as major north-south corridors west of the study corridor.

Interviews revealed that a preferred route for many truckers between Northern Nevada and Bishop, California, is via US 95 (or US 95a), to NV 360, to US 6, to US 395 at Bishop. For trucks coming from the Tahoe Reno Industrial Center, or points east of there, this is the more direct route. For trucks coming from the Reno/Sparks area, this adds 40 to 50 miles to the trip, but interviews indicated a preference for this route because it avoids three mountain passes on US 395 between the California/Nevada border and Bishop.

Truck count data support this. As shown on Figure 5.11, there are more trucks entering California from Nevada via NV 360 just east of California (328 AADTT), than on US 395 just north of the California border (255 AADTT).

Figure 5.11 Parallel Route to US 395 North Segment



Source: Caltrans State Highway GIS data: http://www.dot.ca.gov/hq/tsip/gis/datalibrary/Metadata/StateHighway.html (last accessed on November 2, 2017); and Caltrans Traffic Counts, 2015.

5.5 Level of Service of Operations

Peak-hour levels of service (LOS) are typically measured for highway segments in terms of peak-hour volume-to-capacity (V/C) ratios. LOS A (V/C <= 0.33) is the highest level of service, while LOS F (V/C >= 1) is the lowest level of service.[67]

Using Highway Capacity Manual methods, a level of service analysis was conducted by Caltrans.[68] The analysis showed that: 1) in the base year of 2013, LOS for US 395 North Segment was A, except in 64 miles of two-lane portion, where it varied between B and C; 2) in the base year of 2013, LOS for US 395 Middle Segment was A, except in 11 miles of two-lane portion, where it was D; 3) in the base year of 2012/2013, LOS for US 395 South Segment varied between B and D; 4) in the base year of 2010, LOS for SR 14 North Segment was A, except in 16 miles of two-lane portion, where it was D; 5) in the base year of 2010, LOS for SR 14 South Segment was A; 6) in the base year of 2014, LOS for US 6 was A, except in one-mile portion north of Bishop, where it is B; and 7) in the base year of 2009, LOS for SR 58 was B, except five-mile portion east of Boron, where it is E.

Therefore, congestion currently is not an issue for the four-lane portions of highway segments or the two-lane portions with passing/climbing lanes. Moving bottlenecks, however, form due to slow-moving trucks on other two-lane portions.

Assuming the counts and volumes identified for study corridor segments to be uniform over the length of the segments, study corridor vehicle miles traveled are approximately estimated as 4.5 million vehicle miles in 2015 and increasing to 7.9 million vehicle miles in 2040; that is an increase of 75 percent. This increase is likely to worsen travel conditions on two-lane portions of the highway segments by increasing the frequency and size of moving bottlenecks. Large increase in truck volumes on SR 58 and the presence of Tehachapi Summit could further constrain the capacity and lower the level of service. Future traffic volumes on SR 14 south segment are projected to be 2.5 to 3 times greater than current traffic volumes, which could have an impact on the level of service on the highway segment and at the interchange between SR 58 and SR 14 due to additional merges/diverges.

5.6 Trucks Bypassing Weigh Stations

Based on the outreach and stakeholder meetings, insufficient number of weigh stations, combined with enforcement staffing limitations in the study corridor, provides opportunities for oversize/overweight vehicles to bypass weigh stations. For example, Oak Creek Road is used to bypass the weigh station east of Tehachapi.

[67] Based on Highway Capacity Manual definition for highway segments, LOS A: V/C <= 0.33; LOS B: 0.33 < V/C <= 0.55; LOS C: 0.55 < V/C <=0.75; LOS D: 0.75 < V/C <=0.89; LOS E: 0.89 < V/C <=1; and LOS F: V/C > 1.

[68] Caltrans District 9 TCR for US 395, November 2014; Caltrans District 6 Corridor System Management Plan for SR 58, September 2011; Caltrans District 8 TCR for SR 58, September 2012; Caltrans District 9 TCR for SR 14, October 2012; Caltrans District 9 TCR for US 6, June 2016; and Caltrans District 8 TCR for US 395, June 2017.

5.7 Truck-Involved Crashes

An analysis of crash data from January 2011 to August 2015 does not reveal any unexpected outcomes or higher than average statistics. A few key statistics for the entire study area from 2011 to 2015 are noted below.

- 2,242 reported crashes, all vehicle types.
- 777 crashes, or 34.66 percent, involved trucks.
- 203 crashes, or 26.1 percent, of truck-involved crashes were the fault of the truck driver.

These statistics reveal that only 9 percent of all crashes in the Study Area were reported as the fault of the truck driver.

6 Key Assets and Highway Grades

6.1 Public ITS Facilities

To assist with fast and safe people and goods movement, there are several ITS elements on the study corridor, including mainline detection, Changeable Message Signs (CMS), Road Weather Information System (RWIS), Closed Circuit Television (CCTV) Camera, Weigh-in-Motion Station, Classification Count Station, Mountain Pass Closure Message Signs (Mt), and intersection traffic signals. CMS, RWIS, and Mt are particularly important for the study corridor as it faces extreme weather events, including extreme heat, snowfall, strong and gusty winds, flash flooding, and smoke-related to fire events in Sierra mountain range. **Appendix A** of this study shows the number and locations of existing and proposed ITS elements at various sections of the study corridor.

Classification Count Station data were collected at three out of the six locations in the study corridor, as follows: 1) Count Station (CS) 906 on US 395 at PM 120.95 A in Inyo County; 2) CS 945 on US 6 at PM R3.952 A in Inyo County; and 3) CS 971 SR 14 at PM 64.559 B in Kern County. The data were used to understand seasonal and day of the week patterns for the year 2016; data summaries are shown in Section 5.3 of this study.

6.2 Pavement Condition

For planning purposes, Caltrans classifies the State highway system as Class 1, 2, and 3 based on the following definitions:[69]

- **Class 1.** Contains route segments classified as Interstate and other principal arterials, which are further subdivided as Goods, Truck, and the Strategic Highway Network.

[69] http://dot.ca.gov/hq/maint/Pavement/Offices/Pavement_Management/PDF/SOP-2015.pdf (last accessed on November 2, 2017).

- **Class 2.** Contains route segments classified NHS and the Interregional Road System.
- **Class 3.** All other routes not included in Class 1 and 2.

All four of the study corridor highways (US 395, SR 14, SR 58, and US 6) are Class 1 roadways. Based on Caltrans District 9 provided pavement condition data, about 92 percent of 1,525 lane miles of these roadways (excluding 28-mile portion on US 395 south segment and 6-mile portion of SR 58 outside the Caltrans District 9 boundary) are made of flexible pavement. Jointed plain concrete is present over 50 lane miles on SR 14 and 69 lane miles on SR 58.

To maintain the health of the system, the PaveM software was developed. PaveM is the "State-of-the-Art" technology that stores high-definition photo imagery from Automated Pavement Condition Survey (APCS) to analyze every mile of pavement. APCS data is collected annually in compliance with the MAP-21.[70]

To make the APCS data easy to understand, Caltrans converts the pavement condition data to three pavement condition states as follows:

- **State 1/Green.** Pavement in good/excellent condition with no or few potholes or cracks. This pavement requires a preventive maintenance treatment.
- **State 2/Yellow.** Pavement is in fair condition with minor surface distress, such as minor cracking, slab cracking, raveling, and potholes. This pavement requires a corrective maintenance treatment.
- **State 3/Red.** Pavement includes major distress (pavement in poor condition with extensive cracks), minor distress (pavement in poor condition with significant cracks), and poor ride only. The repair treatment is a major rehabilitation, reconstruction, lane replacement, or a Capital Preventive Maintenance project.

Caltrans District 9 provided lane miles of the study corridor by pavement condition state for a base year of 2015 and a forecast year of 2029, as shown in Table 6.1. Figure 6.1 shows the same information in percent shares format. According to this data, pavement condition in 2015 was mostly fair, and will remain mostly fair until 2029. Although 22 percent of lane miles of SR 58 were in good state in 2015, it will become fair or poor by 2029. This is likely due to a growth in vehicle miles traveled, especially growth in large truck vehicle miles traveled, which reduces pavement life.

FHWA monitors the NHS health using the International Roughness Index (IRI) and vehicle miles traveled. FHWA simplified the IRI or ride quality into "Good" or "Acceptable" in the 2008 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance—Report to Congress (FHWA, 2008). To be rated "Good," the IRI is below 95 inches per mile; and to be rated "Acceptable," the IRI is equal to or greater than 95 inches per mile, but below or equal to 170 inches per mile. "Poor" rating (IRI > 170 inches per mile).

70 http://dot.ca.gov/hq/maint/Pavement/Offices/Pavement_Management/index.html (last accessed on November 2, 2017).

Table 6.1 Lane Miles of the Study Corridor Highway by Pavement Condition State

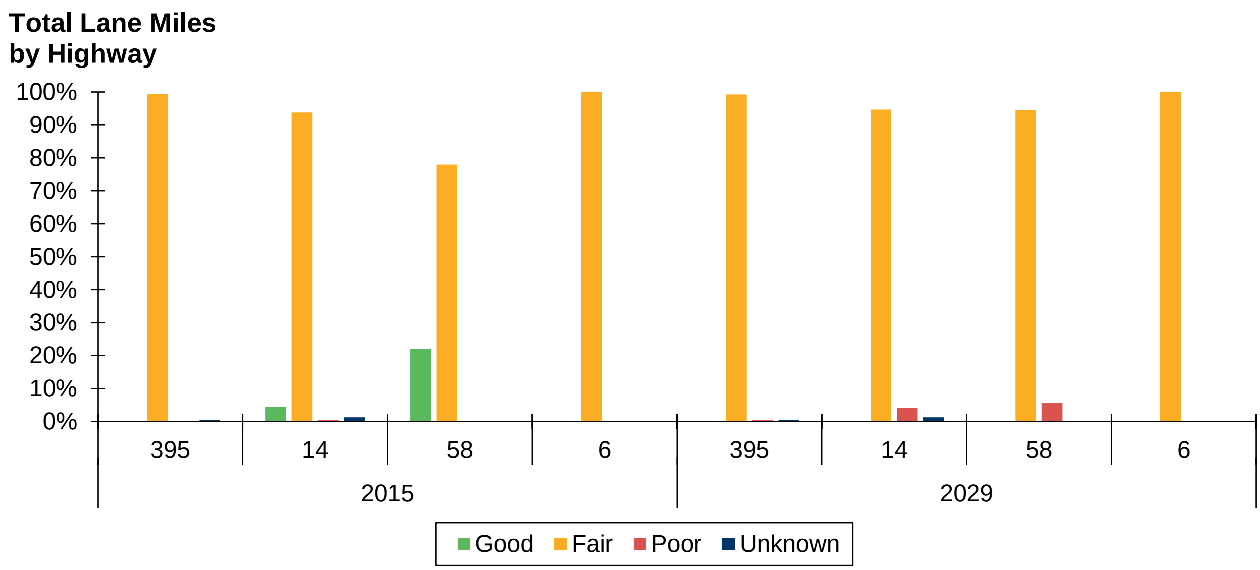
2015 and 2029

Year	Highway	"Good" Pavement Condition Lane Miles	"Fair" Pavement Condition Lane Miles	"Poor" Pavement Condition Lane Miles	"Unknown" Pavement Condition Lane Miles	Total Lane Miles
2015	US 395		952	1	5	957
	SR 14	10	213	1	3	226
	SR 58	57	203			261
	US 6		81			81
Total		**67**	**1,448**	**2**	**8**	**1,525**
2029	US 395		950	4	4	957
	SR 14		214	9	3	226
	SR 58		246	14		261
	US 6		81			81
Total			**1,491**	**27**	**6**	**1,525**

Source: Caltrans District 9 Pavement Condition Data.

Figure 6.1 Shares of Total Lane Miles of the Study Corridor Highway by Pavement Condition State

2015 and 2029



Source: Caltrans District 9 Pavement Condition Data.

Caltrans District 9 provided IRI averages in inches per mile by roadway link for a base year of 2015 and a forecast year of 2029. This information was converted to ride quality states. Lane miles of the study corridor by ride quality state are shown in Table 6.2. Figure 6.2 shows the same information in percent shares format. According to this data, ride quality condition in 2015 was mostly (about 96 percent) good, but will change to mostly (about 91 percent) acceptable by 2029. Although less than 1 percent of lane miles was in poor state in 2015, it will increase to about 3 percent by 2029.

Table 6.2 Lane Miles of the Study Corridor Highway by Ride Quality State

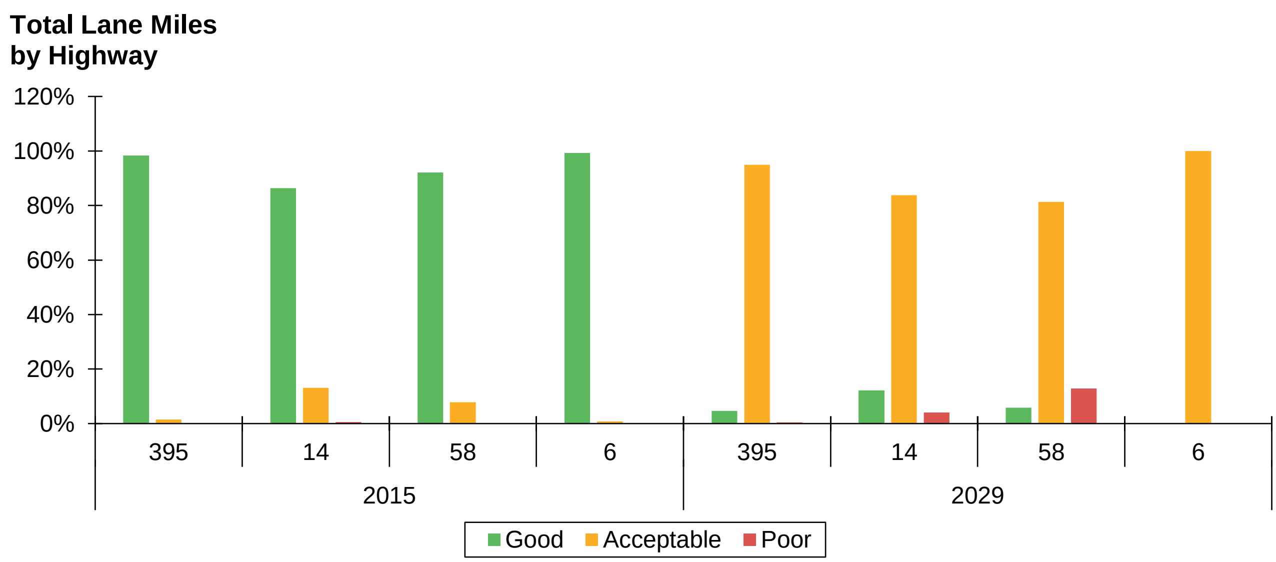
2015 and 2029

Year	Highway	"Good" Ride Quality Lane Miles	"Acceptable" Ride Quality Lane Miles	"Poor" Ride Quality Lane Miles	Total Lane Miles
2015	US 395	942	15	1	957
	SR 14	195	30	1	226
	SR 58	240	20		261
	US 6	80	1		81
Total		**1,457**	**65**	**2**	**1,525**
2029	US 395	45	908	4	957
	SR 14	28	190	9	226
	SR 58	15	212	34	261
	US 6		81		81
Total		**88**	**1,391**	**47**	**1,525**

Source: Caltrans District 9 Pavement Condition Data.

Figure 6.2 Shares of Total Lane Miles of the Study Corridor Highway by Ride Quality State

2015 and 2029



Source: Caltrans District 9 Pavement Condition Data.

6.3 Steep Grades on SR 58 and US 395

SR 58 provides a critical link from California's Central Valley to major interstate freeways (I-5 to the west, and I-40 and I-15 to the east) with access to the rest of the country. It is mostly a four-lane, access controlled, divided highway, and those sections that are not are programmed to be in the future. As a comparison, more trucks travel on SR 58 than on I-80 between Sacramento, California, and Reno, Nevada; and as noted in Section 5.3, that volume is expected to increase in the future. Two important developments could drive truck volumes even higher: Shafter proposes to develop a major inland port, and the Kern COG is advancing plans to extend SR 58 west to I-5.

SR 58 climbs a steep grade over Tehachapi Summit that slows trucks and other heavy vehicles dramatically. While there are two lanes in each direction, quite often slow-moving vehicles will cross into the left lane to pass even slower moving vehicles, creating a significant slow-down on the highway and potentially unsafe conditions due to the dramatic speed differential of approaching cars. The projected increase in truck volumes on SR 58 may exacerbate this condition.

Most of the summits on US 395 have passing lanes with the exception of US 395 southbound, north of Conway Summit.

Truck on Main Streets

Many of the communities within the Study Area desire to better reflect their small town character and improve the visitor and tourism experience, thus contributing to economic development. Trucks traveling on Main streets can be perceived as creating an undesirable or unsafe environment for pedestrians and cyclists. The associated problem statement is as follows:

> *"The major highways in the Study Area serve as main streets to many communities they pass through. The truck traffic on these highways that serve as main streets is perceived to detract from the small town character of the communities they pass through."*

An extensive literature review was conducted to identify methods for quantifying the economic benefits of truck traffic on rural communities, and best practices for managing the negative impacts. The research included outreach to the National Association of Truck Stop Operators (NATSO). The key findings based on these are presented below.

7.1 Economic Benefits of Truck Traffic on Rural Communities

Truck traffic passing through a local community can have direct and indirect economic impacts for those communities that provide services drivers need, such as fuel, parking, food, supplies, showers, lodging, oil change, tire replacement, vehicle repair, etc. Truck services add to the town's tax revenue, which in turn can help the community develop other infrastructure that reflect the priorities of its people, history and culture. Typical (average) economic impacts from truck service facilities located adjacent to Interstate highways were collected from a national level survey conducted by NATSO and subsequently updated by researchers at Virginia Tech[71] (See Table 7.1). The economic impacts of a truck stop located on rural highways with lower

[71] NATSO surveyed 245 truck stops and 35 truck repair centers in 2003, operated by NATSO and Society of Independent Gasoline Marketing Association (SIGMA) members across the country, within a quarter mile of the interstate highway system. The survey results were updated in 2010 using a smaller survey of 60 NATSO and SIGMA members, as well as limited data collected from the large truck stop chains, TA/Petro and Flying J/Pilot, both conducted by researchers at Virginia Tech.

truck volumes would be expected to be lower. A truck stop is a larger facility that provides a wider range of services than a truck fuel stop. Truck repair services provide additional revenue to a truck stop operator. Depending on the available resources in the local community, truck service facilities may also make purchases from local suppliers.

Table 7.1 Typical economic impacts from Truck Service Facilities located within a Quarter Mile from the Interstate Highway System

Economic Impact Measure	Truckstop with Truck Repair	Truckstop without Truck Repair	Truck Fuel Stop
Total Annual Sales (a)	$45,863,888	$43,615,658	$17,420,971
Full Time Employment (FTE)	71	60	15
Annual Local Tax Revenue (a)	$72,955	$72,955	$22,257
Employee Compensation per FTE Employee (b)	$23,726	$23,723	$25,311

Source: Virginia Tech, Impact of Commercial Rest Areas on Business Activity at Interstate Highway Interchanges, Performed for NATSO, 2011; NATSO, Fueling American Prosperity, 2003; Historical Consumer Price Index for All Urban Consumers (CPI-U): U.S. city average.

Note: The estimates are national averages. Actual tax revenue and employee compensation would depend on local conditions. All amounts are in 2017 dollars for marked items as follows: (a) converted from 2010 dollars, and (b) converted from 2003 dollars.

In addition to the typical economic impacts, both NATSO[72] and Virginia Tech researchers[73] have also developed statistical relationships (ordinary least squares linear models) linking county level truck service sales to truck traffic (commercial vehicle miles traveled per day) and population in the county.

US 395 is not part of the interstate highway system, therefore, sales generated by truck service facilities could differ from the estimate made using NATSO's or Virginia Tech's model. Higher volume truck traffic on the interstate highway system would be expected to generate greater sales revenue than lower volume roads. However, this could be somewhat mitigated by lower access control, higher visibility, and lower vehicle speeds on rural highways. Local traffic, socioeconomic and geographical conditions may also impact the type of services, location, size and spacing of truck service facilities, which were not discussed in the research conducted by NATSO or Virginia Tech.

7.2 Best Practices for Managing Truck Traffic on Main Streets

An exhaustive literature review was conducted to find best practices or solutions for managing trucks on main streets in rural communities. Unfortunately there are only a limited number of publications, studies, or projects that specifically address this issue for rural areas, therefore the research was broadened to include urban areas. One of the more helpful resources is a database of case studies that FHWA maintains that demonstrate how transportation agencies have applied context sensitive solutions to main streets and the

[72] NATSO, Fueling American Prosperity, 2003.

[73] Virginia Tech, Impact of Commercial Rest Areas on Business Activity at Interstate Highway Interchanges, Performed for NATSO, 2011.

consideration they gave to trucks. Design guidelines and other sources were also reviewed to collect information on how to accommodate trucks on main streets and measures for reducing truck impacts on operations and safety of other vehicles, bicyclists and pedestrians, and on the environment (emissions, noise and vibration impacts on people and buildings).

The best practices or solutions that help preserve “the small town character” can be broadly classified into two categories: truck-centric design and impact mitigation measures for main streets, and truck bypasses around main streets. The Texas Transportation Institute (TTI)[74] encourages special truck treatments when annual average daily truck traffic (AADTT) reaches a threshold value of 5,000 trucks per day. Between 1,000 to 5,000 trucks per day, some truck treatments may be considered. Truck only roadways were recommended only when the volume reaches reasonably full utilization of a minimum two-lane roadway, that is, 25,000 trucks per day. (Designing for trucks was discussed in the context of sight distance, horizontal alignment, cross-section elements, ITS and roadside parking.)

The AADTT for large, 5+ axle trucks on US 395 (at Big Pine where the volumes are the highest) falls far below these thresholds—only 700 trucks per day in 2015, and a projected 1,100 trucks per day in 2040—and therefore don’t warrant special truck treatments or truck-only facilities. Moderate street design, operational changes, and traffic calming measures are more practical and applicable in the Eastern Sierra Corridor. Several such options are summarized below.

7.2.1 Through Trucks Restricted to Inside Lanes

Unlike access-controlled interstate highways that restrict trucks from using the leftmost lanes, most main streets in the U.S. do not restrict commercial vehicles to particular lanes. They may however have restricted transit/bike lanes. It is a common practice to design the outside lane (the rightmost lane) wider than the inside lane for several reasons: slow-moving trucks and buses that have a wider dimension can use the outside lane, bikes, on-street parking and emergency stopping vehicles can share the space with moving vehicular traffic on the outside lane, and narrower inside lanes would have a traffic calming effect on drivers using them. Pavement markings and left-turn or right-turn only lanes are used at intersections on main street to temporarily restrict or channelize through and turning traffic.

A special case of managing truck traffic on main streets was noticed in the cities of Minden and Gardnerville in Douglas County, Nevada. Here, the through trucks are restricted to the inside lane (the left-most lane, see Figure 7.1).

[74] Texas Transportation Institute (TTI), Truck Accommodation Design Guidance: Policy Maker Workshop, FHWA Report No. FHWA/TX-04/4364-3, October 2003.

Figure 7.1 Through Trucks Restricted to Inside Lanes in Gardnerville, Nevada

Source: Cambridge Systematics.

The Bishop Area Access & Circulation Feasibility Study[75] identified that the restriction of trucks to inside lanes would have several pros and cons. Some of the pros include: (1) It improves access and reduces vehicle-vehicle conflicts for cars and delivery/pickup trucks to local businesses. (2) Increasing distance between large and heavy vehicles and bikes/pedestrians improves perceived safety, and (3) Increasing distance between trucks and buildings reduces noise impacts due to attenuation. Some of the cons include: (1) It goes against driver expectation, who typically use the left lane for overtaking maneuver. If a slow-moving truck occupies the left lane, a car would be forced to overtake using the right lane, which brings a fast moving vehicle closer to bikes/pedestrians. The California Vehicle Code which would apply to the US 395 corridor requires trucks to use the outside lane except to pass. (2) Making left turns would become more difficult and unsafe due to a "barrier effect" created by truck on the left lane. Although, a truck occupying the right lane would also have a similar barrier effect for right turn, left turns are more difficult maneuvers than right turns (in terms of physical and mental demands on drivers) and have more dangerous consequences than right turns (in terms of crash type and severity), and (3) In case of narrow right-of-way situations, cross-sections that satisfy all conditions, that is, a minimum lane width for trucks on the inside lane, a minimum

75 http://www.dot.ca.gov/d9/planning/baacs/baacs_final.pdf (last accessed on November 28, 2018).

lane width for all other uses (moving vehicles, stopped or parked vehicles and bikes) on the outside lane, and minimum lane widths for turning lanes at intersections would become challenging.

The roadway characteristics and truck volumes in Minden and Gardnerville are very similar to several of the communities in this study, and much can be learned from how this restriction is applied and what it achieves in these two Nevada communities.

Signs are posted at either end of the urban area indicating: “Trucks Use Left Lane Next 4 Miles”. As shown in Figure 7.2, trucks entering the restricted area are often in the right lane and must change lanes.

Figure 7.2 Northbound US 395 Sign Posted South of Gardnerville, Nevada

Source: Photo: Cambridge Systematics.

The northbound sign posted south of Gardnerville (Figure 7.2) is placed far enough south of the congested urban areas, giving trucks ample distance to make the lane change. The southbound sign north of Minden, shown in Figure 7.3, is placed closer to the urban core, just south of SR 88, due to the high volume of trucks turning right onto SR 88. Over a 4-hour period on October 24, 2018, trucks were observed safely making the lane change. When traffic was heavy it took longer to change lanes, but all did so. The majority of trucks were already driving in the left lane as they approached the signs—likely because the drivers were familiar with the route and made the lane change in advance of the congested urban area.

Figure 7.3 Southbound US 395 Sign Posted North of Minden, Nevada

Source: Cambridge Systematics.

Anecdotal input gathered from several local residents, law enforcement, and transportation agency staff indicate that the local residents appreciate limiting through trucks to the inside lane and believe it improves safety. Those interviewed stated that most truck drivers comply with the restriction, however it is not uncommon to see Nevada Highway Patrol ticketing those who do not. During the October 24th field observations only one truck was recorded driving in the right-hand lane.

Truck drivers who routinely travel US 395 are accustomed to these restrictions in Minden and Gardnerville, and would likely accept and comply with them in other communities along US 395 in the Eastern Sierra Corridor. A simple and low-cost pilot test could be conducted to determine driver compliance, effectiveness, and local acceptance of restricting through trucks to the left lane. Mobile dynamic message signs could be placed approximately ½ mile at either end of a town for a 2-month period. No other changes would be needed. Following the pilot test, local residents, businesses, and law enforcement should be interviewed to discuss the pros and cons to assist in the decision whether or not to implement the restrictions permanently and through all affected communities.

7.2.2 Other Design and Complete Street Treatments

The City of Portland[76] has suggested several design practices for accommodating truck turning maneuvers on main streets with mixed uses. These include pedestrian median refuge islands, curb extensions, mountable curbs and intersection stop bar location. A median refuge island is used for wide street crossings for addressing conflicts between pedestrians and turning trucks. Curb extension involves extending the curb outward toward the centerline of the street, which reduces pedestrian crossing distances. It may also define on-street parking zone. In order to support truck turns, corners with curb extensions require a larger corner radius than a traditional corner design. Mountable curbs can provide a means for a large truck to more easily perform a turn maneuver but it should be considered on a limited basis and carefully, especially for right turns as the truck has limited visibility to the right. Moving back the stop bar can provide additional area for a left-turning truck to complete turns without conflicts with other vehicles; it can also assist pedestrian movements and allow for a relatively small curb radii.

FHWA research[77] identified that the roadway purposes of high-speed travel over long distances, and local access for vehicles and people, converge at main streets in rural communities. This research tested and recommended use of low-cost traffic calming or speed management measures[78] to reduce safety impacts of through movement on local access at rural sites where there is a large difference between the posted speed and the prevailing speed, and which would also reduce the cost burden on enforcement. The traffic calming measures in a rural context should be designed to handle large/heavy trucks and farm vehicles. These include: a) transverse or converging chevron pavement markings, b) reduce speed limit or “SLOW” pavement markings, c) speed feedback sign, d) physical lane narrowing,[79] e) speed limit markings with colored pavement background, and f) speed table.

The City of Bishop General Plan[80] indicates increased use of US 395, US 6 and SR 168 through Bishop will continue to add to the noise level, thus gradually expanding the 65 CNEL (community noise equivalent level) noise contours. The plan has three basic strategies for noise reduction and control, these are reduction at the source, transmission reduction (from source to receiver), and receiver reduction. For truck traffic, the reduction at the source can be achieved through manufacturing and operational standards imposed by State and Federal agencies—use of baffles, mufflers, speed limits, insulation and other similar techniques. To reduce or block transmission of noise, techniques include noise-based setbacks to buildings on main street and strategic buffering (including landscaping, barriers, building orientation). Noise insulation, building design, and noise sensitive site planning are used reduce noise exposure at receptor. The methods are also applicable to main streets of other towns that fall along the US 395 corridor.

The City of Bishop General Plan[81] has declared no significant environmental impacts on air quality on people and buildings due to the planned economic development (both in terms of the planned city projects and in a

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[76] City of Portland, Designing for Truck Movements and Other Large Vehicles in Portland, October 2008.

[77] FHWA, A Technical Brief: Traffic Calming on Main Roads Through Rural Communities, FHWA Publication No.: FHWA-HRT-08-067, February 2009.

[78] Identified from European and other literature.

[79] Using (i) painted center island and edge line markings, (ii) shoulder widening, or (iii) center island with tubular markers.

[80] http://www.cityofbishop.com/PublicWorks/Planning/GeneralPlan/Noise.pdf (last accessed on November 28, 2018).

[81] Ibid.

(Footnote continued on next page...)

cumulative sense). This means the emissions associated with truck traffic are not excessive, however, to maintain a small town character and community well-being, truck emission standards should continue to be imposed by State and Federal agencies.

7.2.3 Truck Bypasses around Main Streets

Truck Bypasses around Main Streets eliminate the movement of trucks and/or through traffic on a main street by providing an alternate path circumventing a populated area on which vehicles can maintain a higher average speed (or lower travel time) than on the main street. This eliminates congestion on the main street and adverse impacts on the quality of life surrounding the main street[82]. In the context of a rural community that relies on tourism revenue from non-commercial travelers, a bypass limited to trucks only is desired, but nearly impossible to achieve. Unless they intend to stop in town, most travelers prefer taking the quickest and most reliable route. Thus, a bypass removes the frequency of impulse stops.

The economic trade-off between truck bypass facility costs (right-of-way acquisition, relocation, environmental mitigation, design and construction), utilization and revenue (if tolled), environmental and sprawl impacts versus marginal congestion, safety and environmental costs of trucks remaining on main streets should be a key consideration.

A truck bypass facility may not be suited to a rural community that is not affected by congestion or not evidently experiencing adverse impacts of trucks on the quality of life (e.g., higher than average[83] rate of truck involved vehicle, pedestrian or bicycle crashes, innumerous complaints of truck driver behavior, noise, fumes and vibration).

Even if a truck bypass facility is built, commercial vehicles would continue to operate on main streets to make local deliveries and pickups to stores, restaurants, hotels, homes and other businesses. So, street design guidelines to accommodate trucks would still need to be followed.

Case study examples for truck bypass projects can be found in North Dakota where truck reliever route and bypasses[84] have been built or being built to divert large volumes of truck traffic belonging to Bakken area oil field businesses that have boomed since 2010. The projects include bypasses around the townships of Williston, Alexander, Watford City and New Town. Watford City, for example, had a three-fold increase in population in the past decade and local businesses have received a boost due to the oil boom. The main street has become very busy, as a result. The bypass around the city has relieved the main street.[85]

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[82] University of South Florida's Center for Urban Transportation Research, Bypass Basics: Considering a bypass in your small or medium-sized community, Final Report prepared for FDOT Systems Planning Office, 2014. https://www.cutr.usf.edu/wp-content/uploads/2018/04/Bypass-Basics-Brochure-2014.pdf (last accessed on November 28, 2018).

[83] Average for a main street type facility in the state or nation.

[84] https://www.dot.nd.gov/conferences/construction/presentations/2017/Bakken%20Update.pdf (last accessed on November 28, 2018).

[85] WBUR News Article by Jeff Brady, After Struggles, North Dakota Grows Into Its Ongoing Oil Boom, dated November 23, 2018. http://www.wbur.org/npr/669198912/after-struggles-north-dakota-grows-into-its-ongoing-oil-boom (last accessed on November 28, 2018).

Truck Parking

Truck parking capacity has become a more pressing topic after the passage of Jason's Law as part of Moving Ahead for Progress in the 21st Century (MAP-21) legislation. Named for a truck driver who was murdered while parked at an abandoned gas station after arriving at a delivery site earlier than the site allowed, the legislation addresses the shortage of long-term parking for commercial vehicles on the National Highway System (NHS), and seeks to improve safety for truck drivers nationwide. Jason's Law requires States to evaluate their ability to provide adequate parking and rest facilities for commercial motor vehicles (CMV), address the volume of CMV traffic in each State, and develop a method to measure the adequacy of CMV parking in each State.[86]

Insufficient and/or inadequate truck parking creates both safety and economic competitiveness concerns that are likely to increase as the Federal mandate for electronic logging devices is enforced. This technology replaces paper log books, and will likely force drivers to be more conservative when making decisions about when to park, as the electronic logs measure even small encroachments over the Hours of Service limits.

For this reason, it is imperative that States and regions examine truck parking as an asset to be managed, even if many of the investment and use decisions are made by the private sector.

This analysis identifies gaps between demand for truck parking and existing authorized truck parking spaces (supply). Based on outreach and stakeholder meetings, there is a gap in the corridor (either in total number of spaces or in where those spaces are located) making truck parking at undesignated locations a concern; for example, along shoulders of US 6 near Bishop (see Figure 8.1), and South Landing Road exit on US 395 near Lake Crowley.

[86] "Jason's Law Truck Parking Survey Results and Comparative Analysis." U.S. Department of Transportation, Federal Highway Administration. Accessed October 6, 2016. Available from: http://www.ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch1.htm. An updated version of the survey should be completed in spring 2019.

Figure 8.1 Truck Parking in Undesignated Areas—US 6 in Bishop

Source: Cambridge Systematics, Inc.

Trucks typically need to park for one of the three reasons listed below. In the Eastern Sierra Corridor, reasons 1 and 3 are the most common reasons trucks require parking.

1. They are on a long-distance stretch of their trip and need to find a suitable (and available) parking location to satisfy hours of service (HOS) requirements while maximizing their driving distance for the day.

2. They are at an origin and destination and have to wait for access to the freight facility where they are loading or unloading, and the facility does not provide long-term parking for trucks.

3. They are in the middle of their driving period, but an incident in front of them has either closed or severely congested the highway, and their best option is to park and reset their HOS status.

HOS regulations are developed by the Federal Motor Carrier Safety Administration (FMCSA). These regulations, summarized in Table 8.1, are an important part in calculating long-term truck parking demand.

Table 8.1 Summary of Federal HOS Regulations

HOS Provision	Description
11-Hour Driving Limit	Drivers may drive a maximum of 11 hours after 10 consecutive hours off duty. All time spent at the driving controls of a CMV in operation is considered driving time.
14-Hour Driving Limit	Property-carrying drivers may not drive beyond the 14^{th} consecutive hour after coming on duty, following 10 consecutive hours off duty.
Rest breaks	Drivers may drive only if eight hours or less have passed since the end of the driver's last off-duty or sleeper berth period of at least 30 minutes.
60/70-Hour Limit	Drivers may not drive after 60/70 hours on duty in 7/8 consecutive dates. A driver may restart a 7/8 consecutive day period after taking 34 or more consecutive hours off duty.
Sleep Berth Provision	Drivers using the sleeper berth provision must take at least eight consecutive hours in the sleeper berth, plus a separate two consecutive hours either in the sleeper berth or off duty.
34-Hour Restart	A driver of a property-carrying vehicle may "restart" a 7/8-consecutive-day period after taking 34 or more consecutive hours off duty.

Source: Federal Motor Carrier Safety Administration.

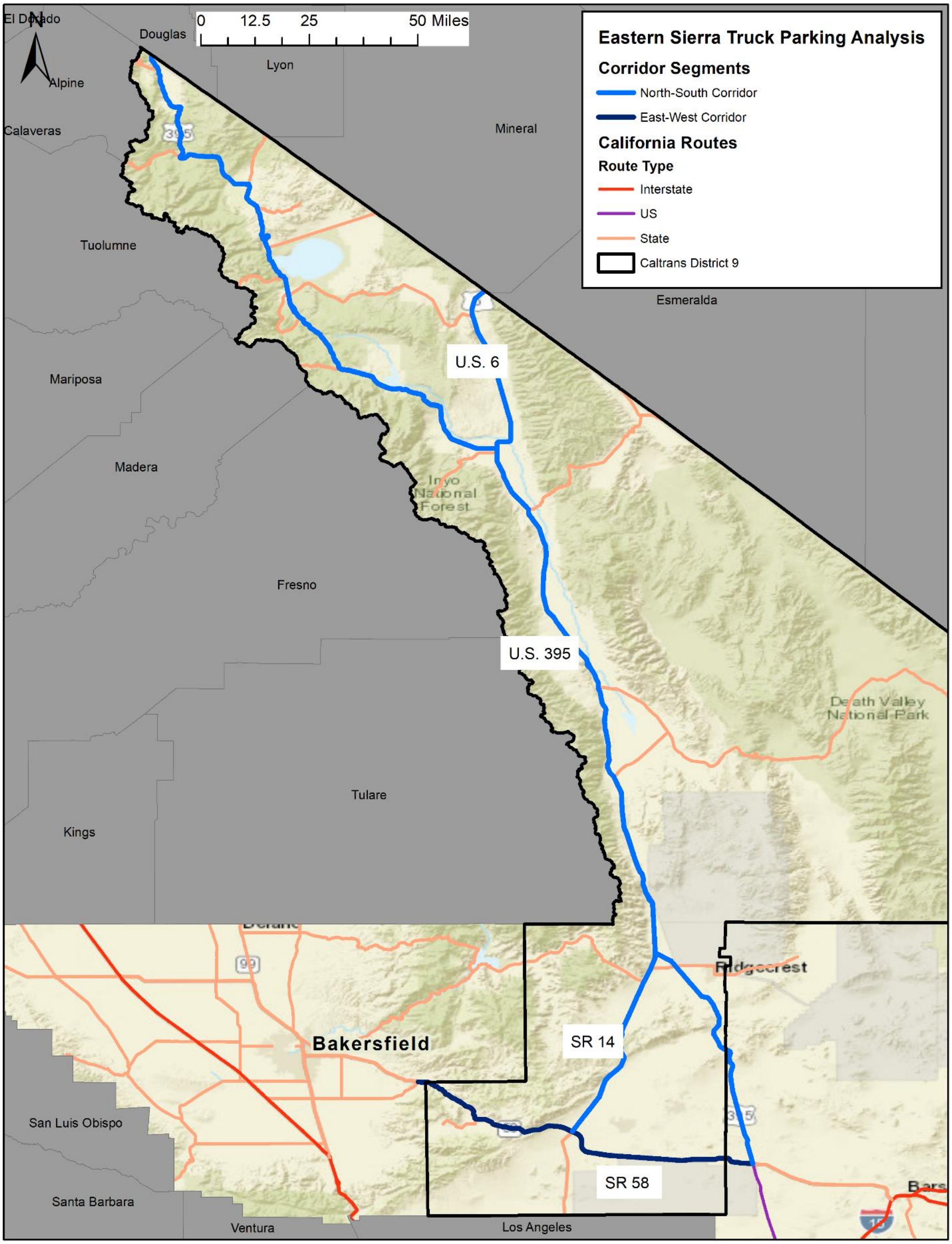
This section provides an analysis of truck parking in the Eastern Sierra Corridor. Two corridors were considered in this analysis. The first is the Eastern Sierra North-South Corridor, which consists of US 395 from SR 58 to the Nevada border, US 6 from US 395 in Bishop to the Nevada border, and SR 14 from SR 58 to US 395 are shown as part of the North-South Corridor since trucks on these routes use segments of US 395. The second is the Eastern Sierra East-West Corridor which is SR 58 from SR 223 to US 395. These corridor limits were chosen to be roughly contiguous with Caltrans District 9 and are shown in Figure 8.2.

The remaining sections include:

- **Section 8.1**—Truck Parking Supply; and
- **Section 8.2**—Truck Parking Demand and Gap Analysis using two different methodologies.

Finally, Appendix B contains profiles of the truck parking locations and detailed calculations of truck parking demand to support the FHWA methodology described in Section 1058.2.1. Appendix C contains additional truck parking utilization maps generated by the American Transportation Research Institute (ATRI).

Figure 8.2 Eastern Sierra Truck Parking Analysis Corridor Segments



Source: Caltrans.

8.1 Truck Parking Supply

Capacity in the two corridors under analysis consists of approximately 629 total spaces, 68 public (10.8 percent) and 561 private (89.2 percent), spread between 18 locations. This count includes two facilities which are expected to come online in the near future—99 spaces in development at a new Boron Loves Travel Plaza which will be located just north of Exit 199 and a planned expansion of the Fort Independence Travel Plaza to a total of 50 spaces.[87]

Because the Mojave-Archer Travel Center, Mojave-Speedway Travel Center, Boron Loves Travel Plaza (in development), Boron-Pilot Travel Center and Boron Highway Rest Areas (EB and WB) can easily serve trucks in both the North-South and East-West corridors, they are included in each corridor when discussed separately but only counted once in the aggregate. If viewed separately, there are 430 spaces in the North-South Corridor and 488 in the East-West Corridor compared to an actual total supply of 629 spaces in both corridors. This potential to "double-count" some supply, particularly where the two corridors intersect, means that the supply estimate for each corridor is likely higher than what is actually available at any given time.

The supply of designated truck parking locations in the corridors is drawn from two sources. The first is an inventory of public and private truck parking developed in response to Jason's Law. The second is a scan of truck parking applications and online parking databases, including Allstays.com, Truckstopandservices.com, and TruckerPath (iPhone app). These apps and websites include more detailed information on amenities available. This scan collected all locations noted as having truck parking available, even if they appeared on only one of the information databases. Finally, Google Earth and Google Maps were used to spot-check locations and visually determine the approximate number of spaces at sites when the sources disagreed. Note that there may be some additional parking capacity in various locations throughout the corridor associated with individual businesses but since these spaces are not open to the general public they are not identified.

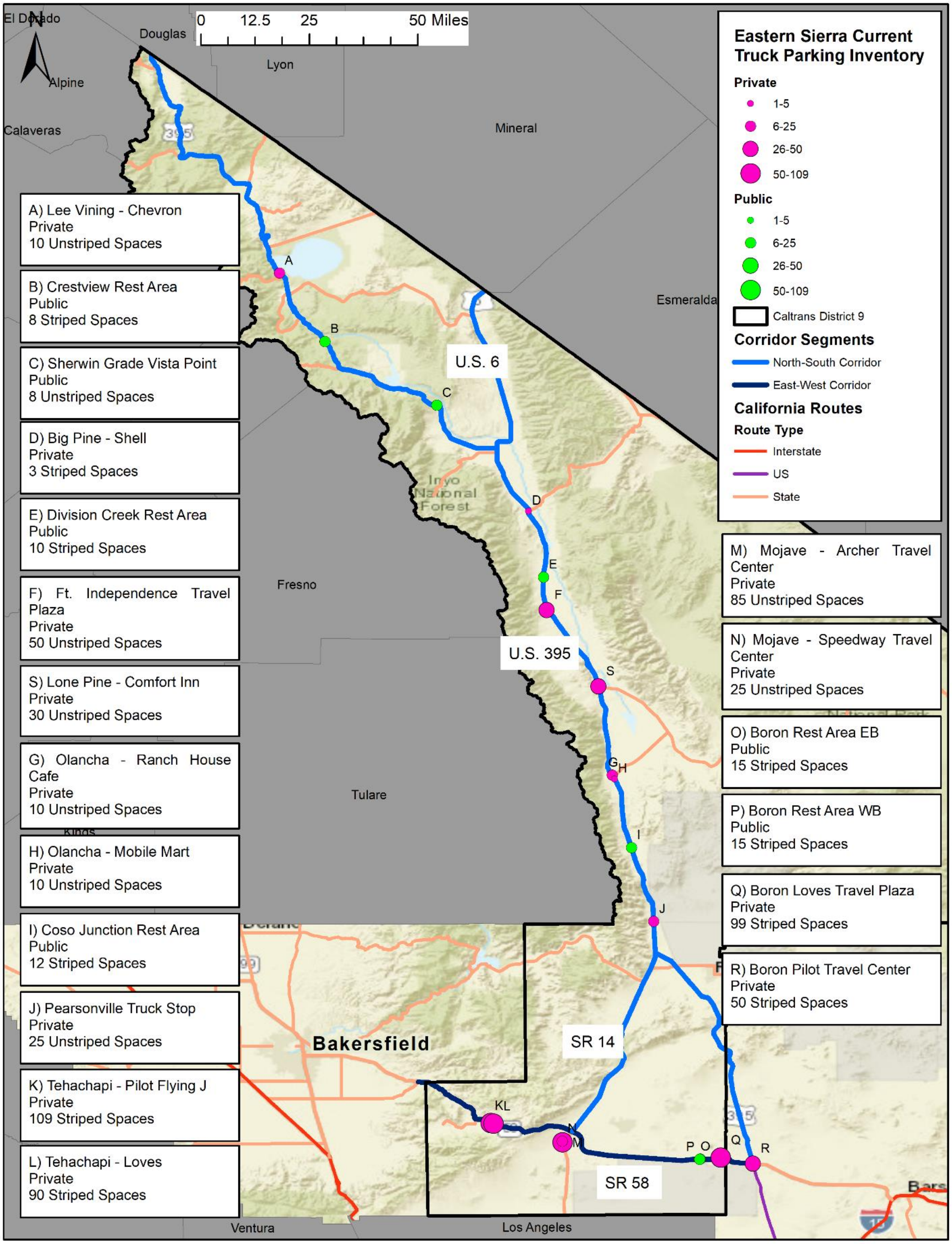
The number of spots, the type of parking (striped spaces, packed dirt), and the amenities available varies widely. Appendix A provides a profile of the truck parking locations in the study region.

8.1.1 Designated Truck Parking Supply

Figure 8.3 shows designated truck parking inventory in the study corridor.

87 The Boron Loves Travel Plaza was approved by Kern County in October 2018. Anticipated completion dates for the two projects are unavailable.

Figure 8.3 Designated Truck Parking Inventory in Eastern Sierra Corridor



Source: Caltrans, TruckerPath, Allstays.com, Truckstopandservices.com, Google Earth and Google Maps.

The North-South Corridor, consisting of US 395 from SR 58 to the Nevada border, SR 14 from SR 58 to US 395, and US 6 from US 395 to Nevada contains 17 parking locations. As described above, truck parking supply on SR 58 between SR 14 and US 395 is included as these locations are easily accessible to trucks on the North-South Corridor. Table 8.2 provides a breakdown of parking supply.

Table 8.2 North-South Corridor Designated Truck Parking Supply

Locations (Spaces)	Striped	Unstriped	Total
Public	5 (60)	1 (8)	6 (68)
Private	2 (53)	9 (339)	11 (392)
Total	**7 (113)**	**10 (347)**	**17 (460)**

The East-West Corridor of SR 58 between SR 223 and US 395 contains 8 parking locations with a total of 488 spaces. Table 8.3 provides a breakout of the parking type by ownership and striped/unstriped spaces.

Table 8.3 East-West Corridor Designated Truck Parking Supply

Locations (Spaces)	Striped	Unstriped	Total
Public	2 (30)	0 (0)	2 (30)
Private	4 (348)	2 (110)	6 (458)
Total	**6 (378)**	**2 (110)**	**8 (488)**

8.1.2 Undesignated Truck Parking

Truck parking at undesignated locations occurs for many reasons. Short-term parking near amenities, restaurants, delivery sites, or other locations for a short stop occurs throughout the two corridors. As most of these locations are in more populated areas and may not have appropriate parking facilities for trucks on-site (or in the case of businesses, may not allow trucks to park on-site until a specific delivery window), roadside parking is common.

Longer-term parking at undesignated areas can occur when designated parking locations are full, when a driver misjudges their hours of service or travel time and are forced to stop before reaching a designated area, or when weather or other event causes a route closure or severe delay. Figure 8.4 provides an example of this type of parking in Bishop.

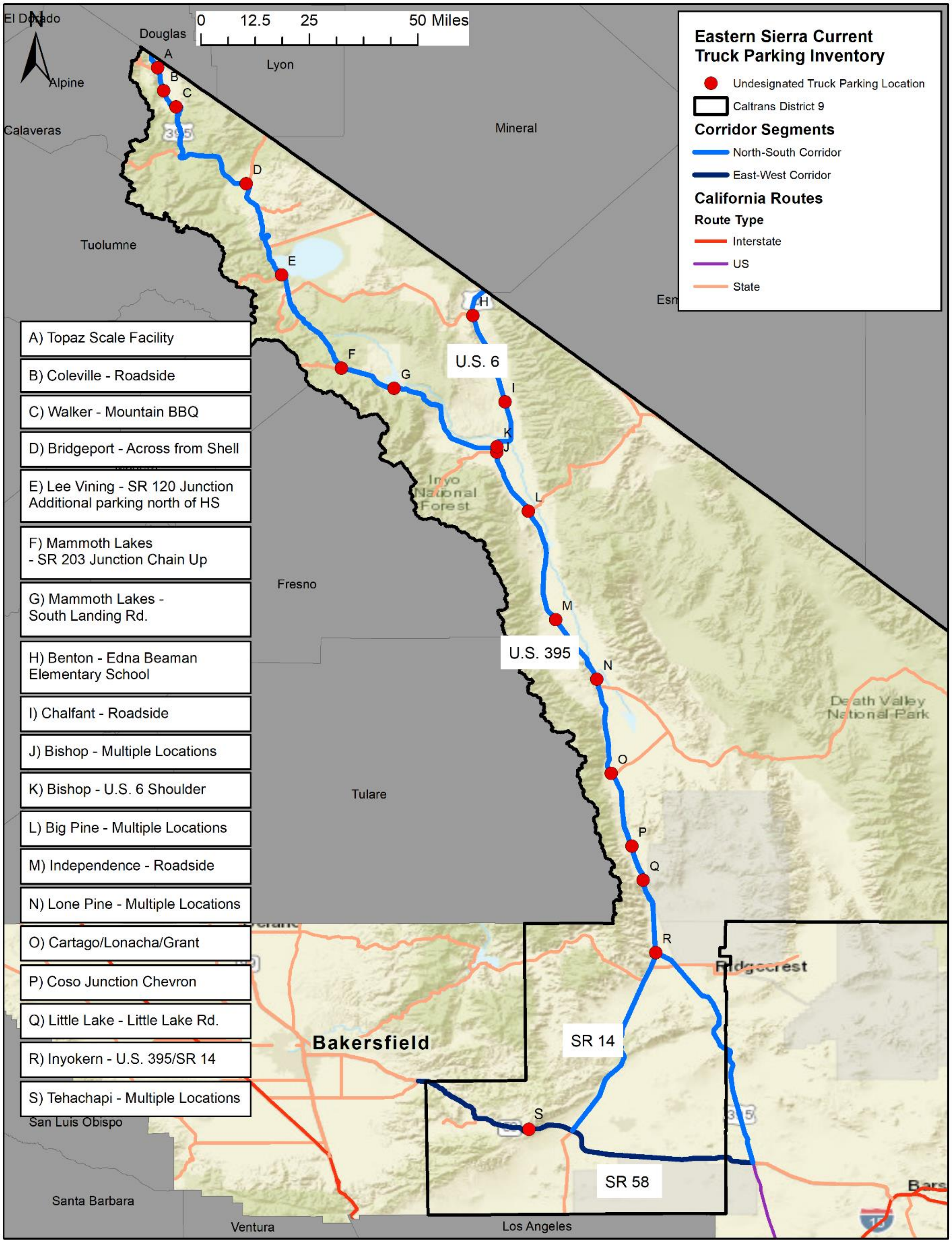
Figure 8.5 and Table 8.4 show locations of undesignated truck parking in the North-South Corridor, including US 395 and US 6.[88] This list is not exhaustive—there may be additional location where trucks occasionally stop.

[88] Information provided by California Highway Patrol Commercial Vehicle Enforcement Unit.

Figure 8.4 Truck Parking in Undesignated Area: Old K-Mart in Bishop (Blocked Off in 2018 to Prohibit Parking)

Source: Cambridge Systematics.

Figure 8.5 Undesignated Truck Parking on Eastern Sierra North-South Corridor



Source: California Highway Patrol, Consultant Analysis.

Table 8.4 Eastern Sierra North-South Corridor—Undesignated Truck Parking Locations

ID	Municipality	Name/ Description	County	Frequency	Comments
A	Topaz	Weigh Scale Facility	Mono	Sporadic, but common	
B	Coleville	Roadside	Mono	Not common	
C	Walker	Mountain BBQ	Mono	Sporadic, but common	
D	Bridgeport	Across from Shell	Mono	Common	
E	Lee Vining	SR 120 Junction	Mono	Sporadic	Also a sporadic location north of High School
F	Mammoth Lakes	SR 203 Junction Chain Up	Mono	Sporadic, but common	
G	Mammoth Lakes	South Landing Rd.	Mono	Common	
H	Benton	Edna Beaman Elementary School	Mono	Common	Complaints at school about parking/idling. Other roadside locations in Benton (sporadic, but common)
I	Chalfant	Roadside	Mono	Sporadic, becoming more common	
J	Bishop	Multiple Locations (see comments)	Inyo	Varies	Several locations around motels/eateries (very common). US 6/Wye Rd. near Ford dealer and north to Dixon Ln. (very common); Spruce St. behind Vons (common); Vons/old K-Mart (common); Taco Bell (common); Jack in the Box parking lot (common); JSO Jay St. (becoming less common); Bishop Pit Scale (sporadic); random locations in the middle of two-way turn lanes (becoming less common due to enforcement)
K	Bishop	US 6 Shoulder	Inyo	Common	
L	Big Pine	Multiple Locations (see comments)	Inyo	Varies	Country Kitchen Restaurant (very common); Shell (very common); street parking (sporadic)
M	Independence	Roadside	Inyo	Sporadic, but common	Private food truck location between Center St. and W. Payne on private property (sporadic but common)
N	Lone Pine	Multiple Locations (see comments)	Inyo	Common	Surface streets (common); paved private parking lot across from McDonald's (very common); Gravel/dirt lot across from Chevron (very common)
O	Cartago/ Olancha/Grant	Roadside	Inyo	Very common	Multiple locations where services are present
P	Coso Junction	Chevron	Inyo	Very common	
Q	Little Lake	Little Lake Rd.	Inyo	Sporadic	
R	Inyokern	US 395/SR 14 Junction	Kern	Common	
S	Tehachapi	Multiple Locations (see comments)	Kern	Common	In vacant lots south and west of Pilot/Flying J, east of Loves, and near the hospital

Source: Stakeholder Outreach.

8.2 Truck Parking Demand and Gap

This analysis used two different approaches to determining truck parking demand and the current and future gap between truck parking demand and supply. The first is a modeling approach developed by FHWA. The second utilizes truck GPS data collected by the American Transportation Research Institute (ATRI). Each methodology is discussed separately in the following sections.

8.2.1 FHWA Truck Parking Demand Analysis

The FHWA approach used to calculate truck parking demand is based on three related studies:

- FHWA—Study of Adequacy of Commercial Truck Parking Facilities—Technical Report (2002). Referenced as "FHWA".
- Pennsylvania State Transportation Advisory Committee—Truck Parking in Pennsylvania (2007). Referenced as "Pennsylvania STAC".
- Virginia DOT—Virginia Truck Parking Study (2015). Referenced as "Virginia DOT".

The Pennsylvania STAC and Virginia DOT models are based on the original FHWA approach but update some of the variables based on changes in FMCSA HOS regulations since 2002.

FHWA Truck Parking Demand

The model used to calculate truck parking demand requires five key user inputs. These inputs were all included in the original FHWA study:

- Truck AADT (AADTT).[89]
- Corridor Length (L).
- Corridor Speed Limit or Average Speed (S).
- Percent of Trucks making short-haul trips (SH).
- Percent of Trucks making long-haul trips (LH).

The core equation for estimating truck parking demand (D) is shown below.

$$D = THT\ X\ Pavg \qquad (1)$$

Truck Hours Traveled (THT) is calculated based on:

$$THT = CAADT\ X\ (L/S) \qquad (2)$$

89 The FHWA study also included a 15% "buffer" to account for variances in AADTT. The Pennsylvania STAC and Virginia DOT studies did not include this calculation. This analysis includes that buffer to help account for daily and seasonal variances in the data.

At its most basic level, the more time trucks require to transit a corridor (L/S) and the more trucks in the corridor (AADTT), the higher the probability that they will need to stop at some point during that trip. Short-term parking demand and long-term parking demand are calculated separately within the corridor and then combined to produce an overall truck parking demand figure. The key factor in this is determining the percent of traffic on the corridor engaged in long-haul versus short-haul trips. Based on observations and estimates of the percent of trucks that are parked for less than three hours (SH) versus those parked for more than three hours (LH), the original FHWA study used a 36 percent SH to 64 percent LH split for urban segments (defined as within 200 miles of a city with a population of 200,000 or more) and a 7 percent SH to 93 percent LH split for rural segments. The Pennsylvania STAC model used a 79 percent SH to 21 percent LH split while Virginia DOT used a 65 percent SH to 35 percent LH split. This study uses the FHWA methodology with a 36 percent SH to 64 percent LH split.

Existing Truck Parking Gap

The North-South and East-West corridors were analyzed separately. A summary of results is presented in Table 8.5. Appendix A contains a full description of the methodology, input values and calculations.

Table 8.5 Eastern Sierra Truck Parking Demand Results

Corridor	North-South Corridor (2015)	East-West Corridor (2015)
Miles	312	45
Speed (mph)	50	50
AADTT	823	3,906
Buffer AADTT	946	4,492
Short-Haul AADTT	341	1,617
Long-Haul AADTT	605	2,875
Short-Haul Peak Parking Demand	28	19
Long-Haul Peak Parking Demand	408	279
Total Parking Demand	**436**	**298**
Total Parking Demand per Mile	**1.4**	**6.6**

Note: AADTT rounded to nearest whole number. Errors due to rounding.

Future Demand

Table 8.6 below shows 2015 and projected 2040 truck volumes for each of the individual segments in the two corridors. Section 5.3.4 describes the process used to generate the future truck volumes shown in the Table 8.6. Note that the 2040 projections include a range of truck volumes and truck parking demand.

Table 8.6 Eastern Sierra Truck Volumes by Segment, 2015 and 2040

Corridor Segment	Truck AADT (2015)	Truck AADT (2040)	5-Axle Truck AADT (2015)	5-Axle Truck AADT (2040)
US 395 North Segment	824	1,133 – 1,305	284	404 – 466
US 395 Middle Segment	1,468	2,023 – 2,340	684	943 – 1,090
US 395 South Segment	622	864 – 873	357	496 – 501
US 6	693	953 – 1,098	369	507 – 584
SR 14 North Segment	968	1,316 – 1,326	775	1,054 – 1,062
SR 58 (Tehachapi Summit)	6,434	9,966 – 10,192	3,906	6,050 – 6,187
North-South Corridor (North) Total	1,517	2,085 – 2,403	663	911 – 1,050
North-South Corridor (Middle) Total	1,468	2,023 – 2,340	684	943 – 1,090
North-South Corridor (South) Total	1,590	2,180 – 2,199	1,132	1,549 – 1,562
North-South Corridor Average	1,525	2,096 – 2,314	823	1,134 – 1,234
East-West Corridor Total	6,434	9,966 – 10,192	3,906	6,050 – 6,187

Note: AADTT rounded to nearest whole number. Errors due to rounding.

Table 8.7 shows the impact of this increase in truck traffic on parking demand and capacity. In the North-South Corridor, between 165 and 218 additional spaces will be needed by 2040. In the East-West Corridor, between 164 and 175 new spaces will be needed by 2040.

Table 8.7 Eastern Sierra Truck Parking Demand, 2015 and 2040

Corridor	North-South Corridor (2015)	North-South Corridor (2040)	East-West Corridor (2015)	East-West Corridor (2040)
Miles	312	312	45	45
Speed (mph)	50	50	50	50
AADTT	823	1,134 – 1,234	3,906	6,050 – 7,115
Buffer AADTT	946	1,304 – 1,419	4,491	6,958 – 7,115
Short-Haul AADTT	341	470 – 511	1,617	2,505 – 2,561
Long-Haul AADTT	606	835 – 908	2,874	4,453 – 4,554
Short-Haul Peak Parking Demand	28	39 – 42	19.29	30 – 31
Long-Haul Peak Parking Demand	408	562 – 911	279	432 – 442
Total Parking Demand	**436**	**601 – 654**	**298**	**462 – 473**
Total Parking Demand per Mile	**1.4**	**1.9 – 2.1**	**6.6**	**10.3 – 10.5**

Note: AADTT rounded to nearest whole number. Errors due to rounding.

Future Truck Parking Gap

Table 8.8 provides a summary of the current and projected future truck parking demand based on 5+ axle trucks and the current and projected designated truck parking supply for the Eastern Sierra North-South Corridor (US 395, US 6, and SR 14) and the East-West Corridor (SR 58).

Table 8.8 Eastern Sierra Corridor Truck Parking Supply and Demand Summary

	North-South Corridor		East-West Corridor	
Scenario	**2015**	**2040, Low – High**	**2015**	**2040, Low-High**
Miles	312	312	45	45
Speed (mph)	50	50	50	50
AADTT	823	1,134 – 1,234	3,906	6,050 – 7,115
Buffer AADTT	946	1,304 – 1,419	4,492	6,958 – 7,115
Short-Haul AADTT	341	470 – 511	1,617	2,505 – 2,561
Long-Haul AADTT	606	835 – 908	2,875	4,453 – 4,554
Short-Haul Peak Parking Demand	28	39 – 42	19	30 – 31
Long-Haul Peak Parking Demand	408	562 – 911	279	432 – 442
Total Parking Demand	**436**	**601 – 654**	**298**	**462 – 473**
Total Designated Parking Capacity	**460**	**460**	**488**	**488**
Truck Parking Gap	**-24**	**141 – 194**	**-190**	**-26 – -15**

Source: Consultant Analysis. Rounded up to nearest whole number of spaces.

Note: Total Designated Parking Capacity includes 99 spaces under development (Boron—Loves Travel Plaza) and uses a total of 50 spaces at Fort Independence Travel Plaza (35 spaces in planning).

The analysis shows that current supply in the corridor is slightly above current demand at the corridor level but a gap of between 141 and 194 spaces is expected by 2040 on the North-South Corridor. In the East-West Corridor, there is a surplus of 190 spaces currently and a projected surplus of between 26 and 15 spaces in 2040.

The parking demand estimates provided in this study should be considered as an indicator of potential shortages, as the model does not account for a number of factors, including the following:

- Driver choice or technology (stopping early in a favored location, electric vehicle charging, etc.).
- Local parking required for pickups/deliveries.
- Corridor interdependence—parking needs in one segment can be met with parking in a nearby segment. This is especially true of the shorter east-west SR 58 corridor, where additional parking is available just outside the study area. The FHWA study reported difficulty in validating the model on short segments versus corridors that spanned longer distances, and the Pennsylvania STAC and Virginia DOT models were focused on statewide results.
- Parking needed for abnormal conditions, such as closure of portions of the route (or adjacent routes) due to storms, crashes, or other nonrecurring events. Snow and high winds are the most common situations leading to a temporary road closure, and one or both can and do occur almost anywhere along the corridor and at any time during the year. When a section of highway becomes impassable, California Highway Patrol and Caltrans staff consult to determine the most logical place to close the highway, where it is possible to turn around and close to a town where services are available for travelers waiting out the weather event. Closures occur most commonly near the towns of Lee Vining, Bishop, Lone Pine, Inyokern (and Ridgecrest, just off SR 178), and Mojave. The two lane portions of US 395 and SR 182

near Bridgeport also commonly close due to weather, slide, and traffic collision events which often leave limited or no detour options available and create additional demand for parking in Bridgeport.

8.2.2 ATRI Truck GPS Parking Demand

One limitation with the FHWA model approach is the inability to determine specific locations where trucks are parking since demand is estimated at the corridor level (or sub-corridor level). To help address this concern, a second truck parking analysis was completed utilizing truck GPS data provided by the American Transportation Research Institute (ATRI).

Methodology

To identify parked trucks, ATRI developed an algorithm to identify when a truck is stopped and to then calculate how long the vehicle is stopped. Specifically, the algorithm is used to analyze a stream of GPS records for each truck in the data sample, and calculates a truck's moving speed based on the distance traveled and amount of time between consecutive GPS records.

However, satellite triangulation can lead to very small variations in ping location for a truck stopped at the same location, which means that the calculated moving speed for a parked truck can be greater than 0. As such, a threshold of five miles per hour or less is used to characterize a stopped truck. Once a truck is classified as "stopped", the algorithm calculates the amount of time that elapses between the truck coming to a stop and when it begins moving again. For purposes of this analysis, the length of stop were categorized as: 30 minutes to 2 hours; and 2 hours or more (up to 14 hours). Stops of less than 30 minutes were not included in the dataset.

The study region was divided into 18 broad zones and 15 more discreet polygons (locations) which cover specific locations with known truck parking activity, shown in Figure 8.6. By analyzing zones (or specific locations), this analysis approach also clarifies the supply of truck parking and avoid potential double-counting locations in Mojave or Kramer Junction that serve traffic on multiple corridors.

The ATRI database includes between 15% and 50% of all Class 6-8 trucks, depending on the roadway type. Nationwide, ATRI's raw data sample is between 800,000 and 1,000,000 vehicles, of which approximately 89% are "18 wheelers." To calculate demand, ATRI queried their database to determine the number of trucks parked in these zones and locations during the following two-week periods:

- March 17 – 30, 2018.
- May 6 – 19, 2018.
- July 15 – 28, 2018.
- September 9 – 22, 2018.

However, ATRI does not have access to truck GPS data for all vehicles in the corridor.[90] An expansion factor is needed to extrapolate the parked vehicle counts derived from ATRI's data sample to an estimate of the full population of parked trucks in the study area. To calculate these expansion factors, commercial average annual daily traffic (AADTT) figures for 5+ axle vehicles were collected from multiple count stations in

[90] ATRI's national sample is typically between 15% and 50% of all Class 6-8 trucks depending on roadway type. The total national raw data size is between 800,000 and 1,000,000 trucks of which 89% are "18 wheelers."

proximity to the parking zones studied in this analysis. These stations provided detailed counts that aligned with the dates queried by ATRI (above) allowing for a precise expansion factor to be calculated. In areas where count stations were too far from a parking zone, the count station data were supplemented with 5+ axle AADTT figures from locations monitored by Caltrans.[91]

ATRI's GPS data were then joined with a shapefile of the count stations and Caltrans locations to calculate comparable AADTT figures within the ATRI data sample. To avoid double-counting trucks at each location, a truck could only be included in the volume calculations once per hour. The number of trucks at these count locations were then summed up for each day in the data sample, and the daily totals were then averaged to derive ATRI's AADTT at each location. Finally, expansion factors were calculated for each count station by dividing the AADTT figures by the corresponding ATRI AADTT figure.

Although separate AADTT figures were provided for all trucks and 5-axle trucks, the expansion factors used in this analysis are based on the 5-axle AADTT counts with one exception.[92] The number of trucks in the ATRI sample at the Summit Overhead count station on SR 58 exceeded the 5-axle AADTT count available from the 2018 detailed Caltrans data, so the AADTT figure for all trucks was used to calculate the expansion factor at this location.[93]

The resulting expansion factors were then joined to the raw parked truck count data at the corresponding parking zone to calculate the expanded parked truck counts. The raw counts from ATRI and the 2018 detailed or 2016 Caltrans average counts used for each zone or location are shown in Table 8.9.

To further refine this analysis, the total number of trucks parked during the four time periods above were summed and the percent of trucks stopped for more than 2 hours was calculated. This study is focused on long-term truck parking and trucks stopped for less than 2 hours likely represent vehicles stopping for gas, food, loading/unloading or to fulfil a short-term HOS break (and thus do not stay in a parking space for long). For all zones and polygons, the Mojave-Archer Travel Center had the highest percent of vehicles stopped for more than two hours (46.2 percent), followed by the Pearsonville Truck Stop (40.9 percent).

The ATRI Raw Counts shown in Table 8.9 are the low and high number of "pings" from a set of 28 two-day averages. Each set includes the average of two days within the two week periods during which ATRI pulled data. For example, for March 2018, the "Sunday" raw count is an average of truck "pings" in a given zone/location on March 18 and March 25, 2018. Since these values already help account for daily variability by being an average, this study used the maximum expanded truck count for each zone or polygon to show a "peak" demand. By multiplying the expanded peak demand by the percent of trucks at each location parked for more than two hours, a peak long-term parking demand is calculated.

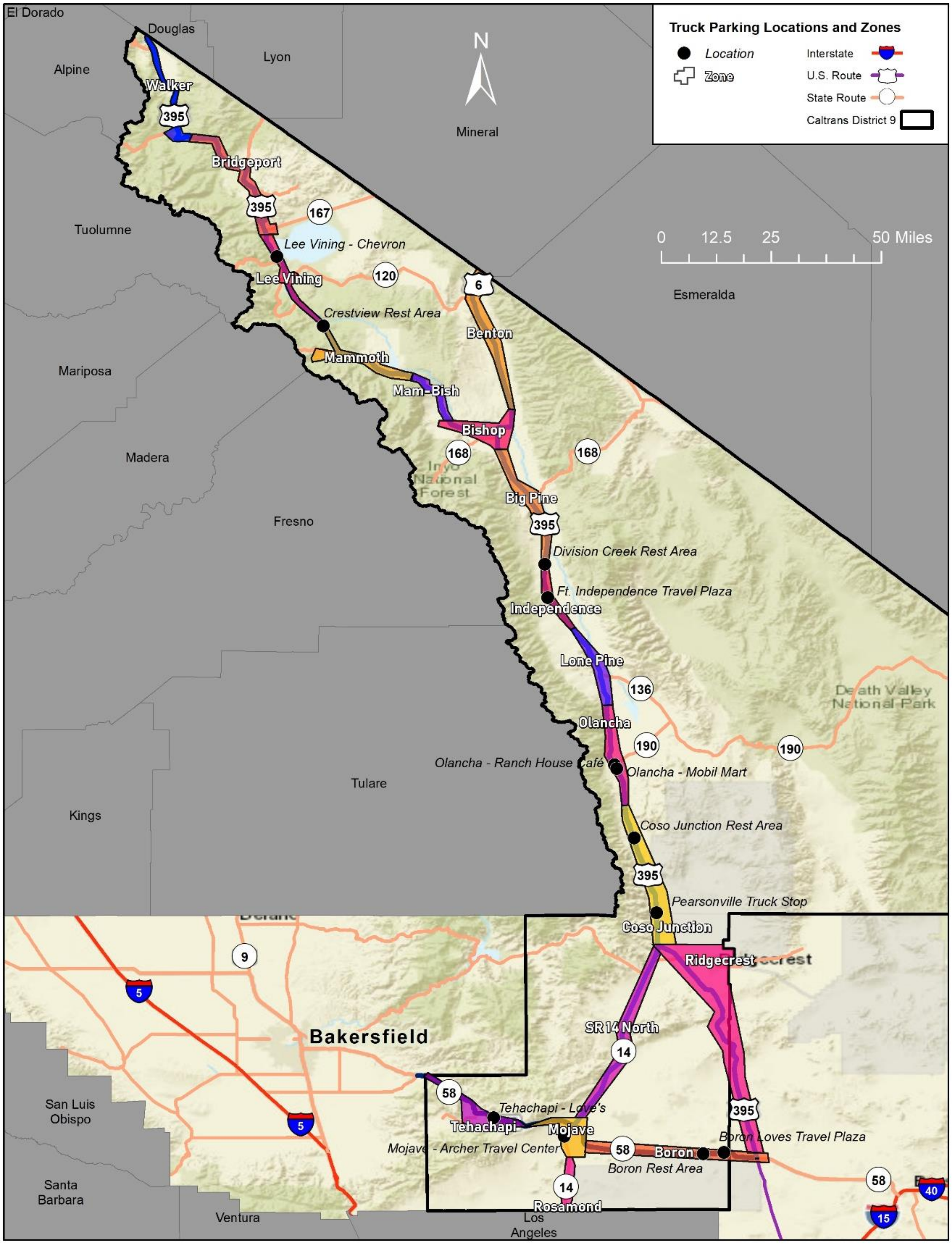
For future demand, a growth factor from Table 5.10 was applied to the expanded truck count derived from ATRI. Since the maximum value at each site was used to calculate current demand, the future demand applied the **low scenario growth factor** to each zone or polygon based on its location in the relevant study segments. This information is shown in Table 8.10.

[91] These sites used a 2016 Caltrans average as the detailed count sites were considered too far away from the zone or location to provide relevant information.

[92] The majority of ATRI GPS devices are in tractor units, meaning that most of the ATRI GPS "pings" are from multi-unit tractor-trailer combinations.

[93] This location was used to calculate the expansion factor for the following: Tehachapi—Loves; Mojave—Archer Travel Center; Boron EB/WB; Boron—Pilot Travel Center; Tehachapi (zone); Mojave (zone); Boron (zone).

Figure 8.6 Zones and Locations for Truck GPS Parking Demand Analysis



Source: ATRI data with consultant analysis, 2018.

Table 8.9 ATRI Truck GPS and Caltrans Truck Counts

Name	Zone or Location	ATRI Raw Counts (Range)	Caltrans AADTT (5+ Axle)	ATRI Expanded Counts (Range)
Lee Vining - Chevron	Location	0 – 1	321[1]	0 – 5
Crestview Rest Area	Location	0 – 23	370[1]	0 – 146
Division Creek Rest Area	Location	14 – 50	687	41 – 148
Ft. Independence Travel Plaza	Location	9 – 44	687	26 – 133
Olancha - Ranch House Café	Location	0 – 1	687	0 – 3
Olancha - Mobil Mart	Location	2 – 20	687	5 – 60
Coso Junction Rest Area	Location	2 – 15	461	4 – 34
Pearsonville Truck Stop	Location	4 – 22	461	9 – 50
Tehachapi - Love's	Location	106 – 213	1,418	169 – 337
Mojave - Archer Travel Center	Location	5 – 40	1,418	7 – 64
Boron Rest Area (EB & WB)	Location	53 – 117	1,418	84 – 117
Boron - Pilot Travel Center	Location	57 – 122	1,418	91 – 194
US 6 Shoulder, Bishop	Location	9 – 34	402	23 – 64
Walker	Zone	2 – 17	307[1]	8 – 68
Bridgeport	Zone	4 – 34	236[1]	24 – 139
Lee Vining	Zone	1 – 23	332[1]	5 – 136
Mammoth	Zone	3 – 41	424[1]	22 – 280
Mam-Bish	Zone	1 – 15	333	3 – 46
Bishop	Zone	33 – 131	836	102 – 407
Benton	Zone	1 – 10	402	2 – 20
Big Pine	Zone	4 – 27	936	16 – 104
Independence	Zone	18 – 67	687	57 – 217
Lone Pine	Zone	10 – 61	687	29 – 194
Olancha	Zone	6 – 30	687	19 – 91
Coso Junction	Zone	20 – 67	461	41 – 141
Ridgecrest	Zone	20 – 140	524[1]	57 – 378
SR 14 North	Zone	1 – 18	321	4 – 85
Tehachapi	Zone	184 – 487	1,418	292 – 774
Mojave	Zone	28 – 128	1,418	44 – 202
Rosamond	Zone	4 – 44	1,021[1]	12 – 141
Boron	Zone	154 – 511	1,418	249 – 808

[1] 2016 Caltrans Average used instead of detailed monthly counts from 2018.

Source: Caltrans Detail Vehicle Classification Daily Count. Select Months, 2018. Caltrans 2016 average truck counts from: http://www.dot.ca.gov/trafficops/census/.

Table 8.10 Estimated 2040 Average Annual Daily Traffic on Eastern Sierra Corridor

Low-High Scenarios

Highway Segment	Total AADT	Auto AADT	Truck AADT	5 or More Axles Truck AADT	Percent Growth in Total AADT	Percent Growth in Auto AADT	Percent Growth in Truck AADT	Percent Growth in 5 or More Axles Truck AADT (Low Scenario)
US 395 North Segment	5,987-6,160	4,854	1,133-1,305	404-466	50%-54%	53%	37%-58%	**37%**
US 395 Middle Segment	9,497-9,814	7,474	2,023-2,340	943-1,090	53%-58%	58%	38%-59%	**38%**
US 395 South Segment	4,403-4,412	3,539	864-873	496-501	60%-60%	66%	39%-40%	**39%**
SR 14 North Segment	9,071-9,081	7,755	1,316-1,326	1,054-1,062	78%-78%	88%	36%-37%	**36%**
SR 14 South Segment	84,495-84,503	82,043	2,452-2,460	1,281-1,285	168%-168%	176%	34%-35%	**34%**
SR 58 Segment	36,300-36,526	26,334	9,966-10,192	6,050-6,187	69%-70%	75%	55%-58%	**55%**
SR 58 (East of US 395/SR 58 Jct.) Segment	18,609-18,820	11,848	6,761-6,972	5,595-5,769	63%-65%	63%	64%-69%	**64%**
US 6 Segment	3,203-3,348	2,250	953-1,098	507-584	42%-48%	44%	37%-58%	**37%**

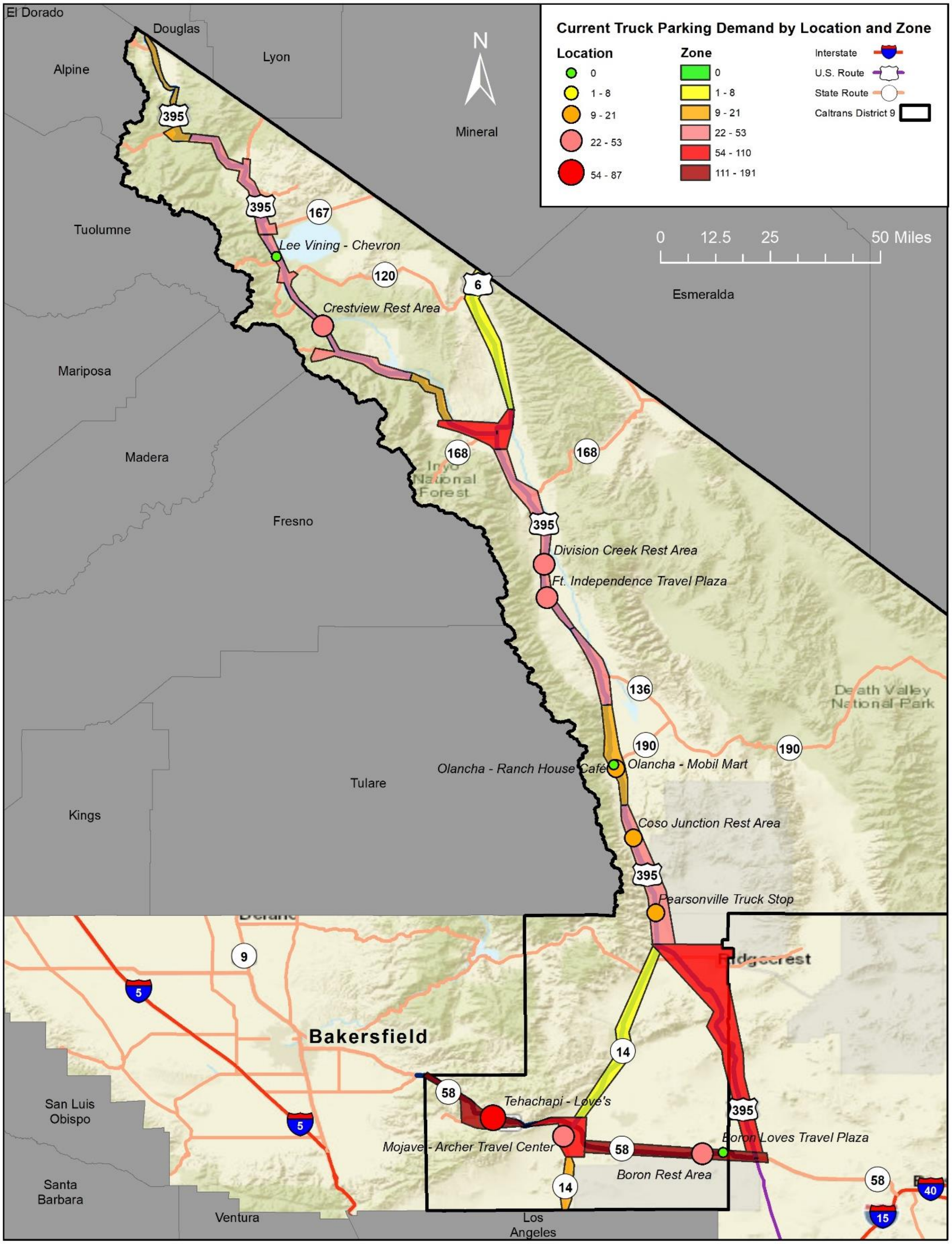
Source: Caltrans Statewide Travel Demand Model (base year = 2015, forecast year = 2040); and Cambridge Systematics' auto volume growth calculations.

Current and Future Truck Parking Demand and Gap

Figure 8.7 through Figure 8.9 are a set of maps that show existing truck parking demand and the current and future gap in truck parking by zone and location. These maps are summarized in Table 8.11. Green highlighted cells indicate a surplus in truck parking, red cells indicate a truck parking gap of 30 spaces or greater.

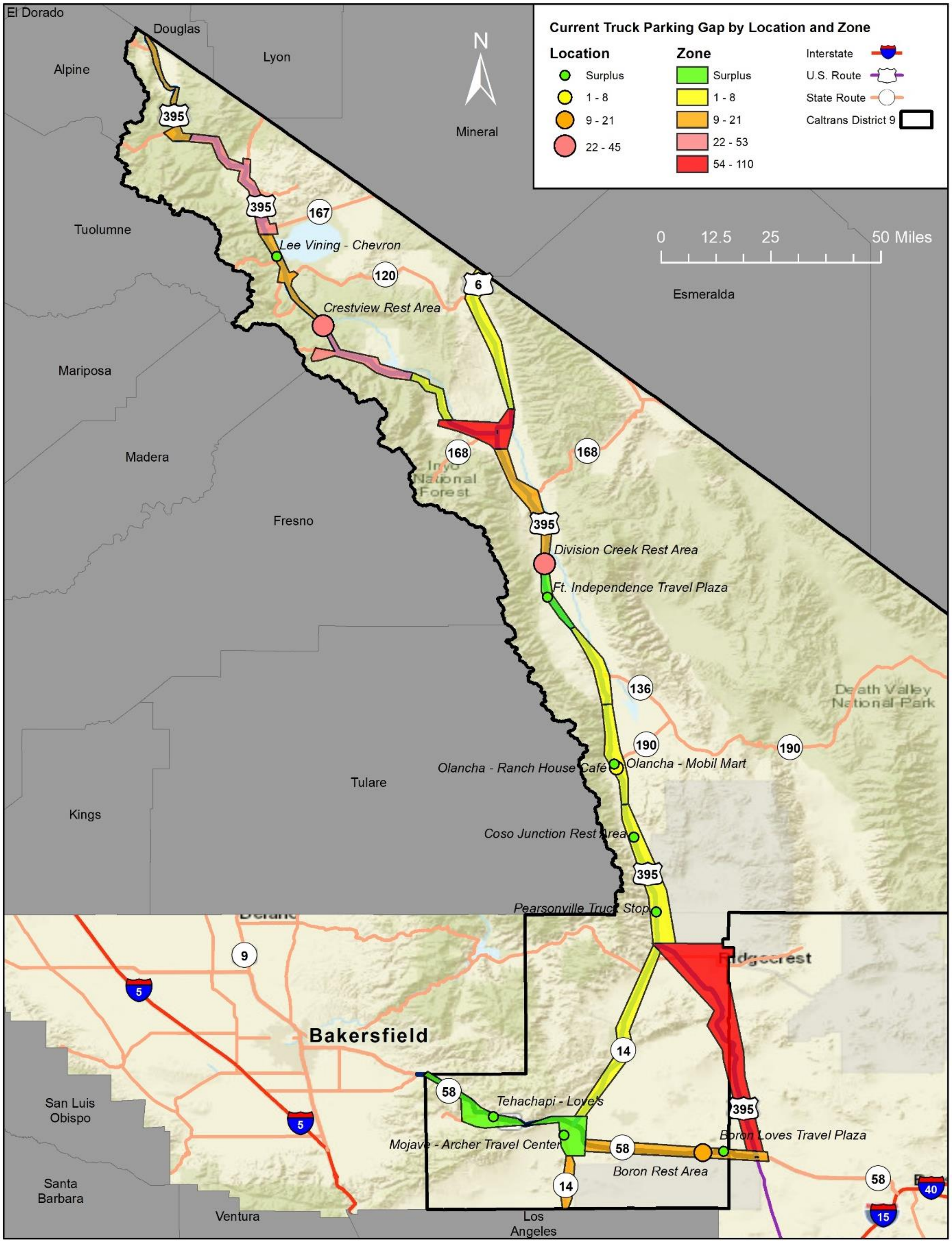
Figure 8.7 shows current truck demand based on the expanded ATRI counts of trucks parking for two or more hours in each zone and location in the study region. As noted in the methodology section, these demand estimates are the maximum values from a set of 28 two-day averages at each location so these values should be closer to the higher end of demand than the demand on any given day. Demand is highest in the Tehachapi and Boron zones on SR 58—both zones have a truck parking demand of approximately 190 trucks per day. The Bishop zone has a demand of approximately 110 trucks per day and the Ridgecrest zone has a truck parking demand of approximately 99 trucks per day.

Figure 8.7 ATRI Truck GPS Analysis—Current Truck Parking Demand



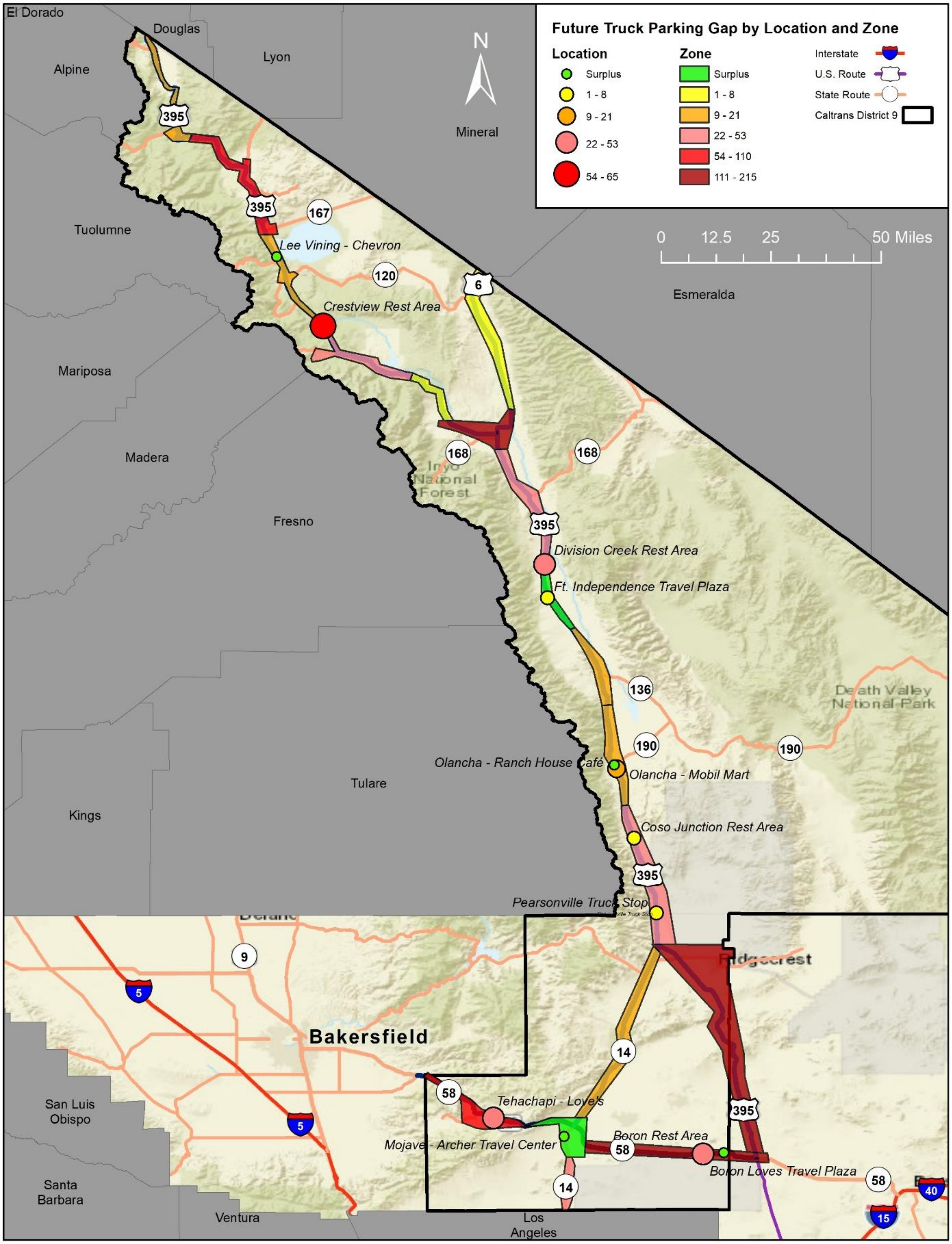
Source: ATRI, Caltrans, Consultant Analysis, 2018.

Figure 8.8 ATRI Truck GPS Analysis—Current Truck Parking Gap



Source: ATRI, Caltrans, Consultant Analysis, 2018.

Figure 8.9 ATRI Truck GPS Analysis—Future Truck Parking Gap



Source: ATRI, Caltrans, Consultant Analysis, 2018.

Table 8.11 ATRI Truck GPS Parking Analysis Summary

Name	Zone or Location	ATRI Raw Counts (Range)	Caltrans AADTT (5+ Axle)	ATRI Expanded Counts (Range)	% 2+ Hour Parking	2+ Hour Maximum Count (Demand)	Authorized Parking (Supply)	Current Gap (Demand-Supply)	Future Gap
Lee Vining - Chevron	Location	0-1	321*	0-5	0.00%	0	10	-10	-10
Crestview Rest Area	Location	0-23	370*	0-146	36.46%	53	8	45	65
Division Creek Rest Area	Location	14-50	687	41-148	29.13%	43	10	33	49
Ft. Independence Travel Plaza	Location	9-44	687	26-133	30.21%	40	50	-10	5
Olancha - Ranch House Café	Location	0-1	687	0-3	0.00%	0	10	-10	-10
Olancha - Mobil Mart	Location	2-20	687	5-60	18.15%	11	5	6	10
Coso Junction Rest Area	Location	2-15	461	4-34	35.54%	12	12	0	5
Pearsonville Truck Stop	Location	4-22	461	9-50	40.90%	21	25	-4	4
Tehachapi - Love's	Location	106-213	1,418	169-337	25.67%	87	90	-3	45
Mojave - Archer Travel Center	Location	5-40	1,418	7-64	46.23%	30	85	-55	-39
Boron Rest Area (EB & WB)	Location	53-117	1,418	84-117	24.00%	45	30	15	40
Boron - Pilot Travel Center	Location	57-122	1,418	91-194	33.25%	65	50	15	51
US 6 Shoulder, Bishop	Location	9-34	402	23-64	38.27%	25	0	25	34
Walker	Zone	2-17	307*	8-68	16.81%	11	0	11	15
Bridgeport	Zone	4-34	236*	24-139	29.85%	53	0	53	73
Lee Vining	Zone	1-23	332*	5-136	16.33%	22	10	12	20
Mammoth	Zone	3-41	424*	22-280	15.71%	44	8	36	52
Mam-Bish	Zone	1-15	333	3-46	19.63%	9	8	1	4
Bishop	Zone	33-131	836	102-407	26.98%	110	0	110	152
Benton	Zone	1-10	402	2-20	22.55%	5	0	5	7
Big Pine	Zone	4-27	936	16-104	23.24%	24	3	21	30
Independence	Zone	18-67	687	57-217	18.82%	41	60	-19	-3
Lone Pine	Zone	10-61	687	29-194	18.52%	36	30	6	20
Olancha	Zone	6-30	687	19-91	19.60%	18	15	3	10

Name	Zone or Location	ATRI Raw Counts (Range)	Caltrans AADTT (5+ Axle)	ATRI Expanded Counts (Range)	% 2+ Hour Parking	2+ Hour Maximum Count (Demand)	Authorized Parking (Supply)	Current Gap (Demand-Supply)	Future Gap
Coso Junction	Zone	20-67	461	41-141	28.56%	43	37	6	22
Ridgecrest	Zone	20-140	524*	57-378	26.20%	99	0	99	138
SR 14 North	Zone	1-18	321	4-85	9.62%	8	0	8	11
Tehachapi	Zone	184-487	1,418	292-774	24.64%	191	199	-8	97
Mojave	Zone	28-128	1,418	44-202	30.35%	61	110	-49	-15
Rosamond	Zone	4-44	1,021*	12-141	12.39%	18	0	18	24
Boron	Zone	154-511	1,418	249-808	23.46%	190	179	11	116

Note: Boron and Independence zones include parking in development (Boron—Loves 99 spaces) or in planning (Fort Independence Travel Plaza—35 additional spaces, 50 total). Negative numbers indicates supply is higher than demand.

Figure 8.8 shows the gap between existing truck parking supply and demand.[94] At the zone level, there is an approximate gap of 164 spaces throughout the study region. The largest gap and area of concern is the Bishop zone centered on the City of Bishop. This zone is located at the intersection of US 395 and US 6 and has no authorized truck parking spaces. The next largest gap is in the Ridgecrest zone with approximately 99 additional authorized spaces needed, followed by Bridgeport with a gap of 53.

Figure 8.9 shows the future gap in truck parking based on the low growth scenario in the US 395 study region. The Bishop, Ridgecrest, and Bridgeport zones will continue to be areas of concern if no action is taken. The biggest change however is anticipated in the Tehachapi and Boron zones due to the large increase in truck volume anticipated on SR 58.

One caveat to the ATRI demand analysis is that ATRI data show where trucks are parking, but not necessarily where they want to park if spaces were available. It is likely that many of the unauthorized parking locations in the corridors indicate this unmet demand and are where trucks want to park, but this may not be true in all cases. For example, a new privately owned truck parking facility in Bishop with a number of amenities could be enough of a draw that trucks stop parking in unauthorized locations in adjacent zones.

8.2.3 Comparison of FHWA and ATRI Truck GPS Analysis

Table 8.12 sums the demand by zone from ATRI using all but Tehachapi, Mojave, and Boron as the North-South Corridor and those three as the East-West Corridor and compares that demand to numbers derived from the FHWA demand model.

In both corridors, the ATRI analysis shows a higher demand for parking both currently and in the future. Both approaches show the North-South Corridor with a higher level of demand than the East-West Corridor. The FHWA approach shows a surplus of approximately 25 spaces currently while ATRI shows that demand exceeds supply by approximately 150 spaces.

Table 8.12 Eastern Sierra Corridor Truck Parking Supply and Demand Summary

	North-South Corridor				East-West Corridor			
	FHWA		ATRI		FHWA		ATRI	
Scenario	2015	2040, Low – High	2015	2040	2015	2040, Low-High	2015	2040
Miles	312	312			45	45		
Speed (mph)	50	50			50	50		
AADTT	823	1,134 – 1,234			3,906	6,050 – 7,115		
Buffer AADTT	946	1,304 – 1,419			4,492	6,958 – 7,115		
Short-Haul AADTT	341	470 – 511			1,617	2,505 – 2,561		
Long-Haul AADTT	606	835 – 908			2,875	4,453 – 4,554		
Short-Haul Peak Parking Demand	28	39 – 42			19	30 – 31		

[94] Supply includes the 99 spaces under development at Boron Loves Travel Plaza and 50 spaces total in planning at Fort Independence Travel Plaza.

	North-South Corridor				East-West Corridor			
	FHWA		ATRI		FHWA		ATRI	
Scenario	**2015**	**2040, Low – High**	**2015**	**2040**	**2015**	**2040, Low-High**	**2015**	**2040**
Long-Haul Peak Parking Demand	408	562 – 911			279	432 – 442		
Total Parking Demand	**436**	**601 – 654**	**541**	**745**	**298**	**462 – 473**	**442**	**685**
Total Designated Parking Capacity	**460**	**460**	**460**	**460**	**488**	**488**	**488**	**488**
Truck Parking Gap	**-24**	**141-194**	**81**	**350**	**-190**	**(-26) – (-15)**	**-46**	**197**

Source: Consultant Analysis. Rounded up to nearest whole number of spaces.

Note: Total Designated Parking Capacity includes 99 spaces under development (Boron—Loves Travel Plaza) and uses a total of 50 spaces at Fort Independence Travel Plaza (35 spaces in planning).

8.2.4 Incident Demand Due to Temporary Road Closures

Although not included in either demand methodology above, temporary road closures or detours on other routes can cause dramatic increases in parking demand. Snow and high winds are the most common situations leading to a temporary road closure, and one or both can and do occur almost anywhere along the corridor and at any time during the year. When a section of highway becomes impassable, California Highway Patrol and Caltrans staff consult to determine the most logical place to close the highway, where it is possible to turn-around and close to a town where services are available for travelers waiting out the weather event. Closures occur most commonly near the towns of Lee Vining, Bishop, Lone Pine, Inyokern (and Ridgecrest, just off SR 178), and Mojave. The two lane portions of US 395 and SR 182 near Bridgeport also commonly close due to weather, slide, and traffic collision events which often leave limited or no detour options available and create additional demand for parking in Bridgeport. Additional truck parking capacity throughout the corridor to meet ongoing demand will also provide additional capacity for incident induced demand.

9 Recommended Solutions

9.1 Truck Climbing Lanes

Truck climbing lanes help improve safety and efficiency in areas with steep grades and high truck volumes. SR 58 climbs a steep grade over Tehachapi Summit that slows trucks and other heavy vehicles dramatically. While there are two lanes in each direction, quite often slow-moving vehicles will cross into the left lane to pass even slower moving vehicles, creating a significant slow-down on the highway and potentially unsafe conditions due to the dramatic speed differential of approaching cars. The projected increase in truck volumes on SR 58 may exacerbate this condition. Most of the summits on US 395 have passing lanes with the exception of US 395 southbound, north of Conway Summit.

Adding passing lanes at these two locations would improve travel time and safety in the region.

9.2 Trucks on Main Street

Caltrans has implemented very effective and well received complete streets improvements in Bridgeport and continues to work with other communities along the corridor. As this seems to have the greatest impact for minimizing the negative perceptions of trucks on main streets, it is recommended that Caltrans continue these effort.

In addition, a low-cost pilot test for requiring trucks to drive in the left lane through towns is also recommended. The pilot test would involve positioning portable dynamic message signs at either end of a town displaying the message, “TRUCKS USE LEFT LANE NEXT XX MILES”. Leave the signs up for one or two months to observe truck driver behavior and gauge acceptance from the local community. Because many truck drivers on US 395 are familiar with the restriction in Minden and Gardnerville, it may be readily accepted.

9.3 Truck Parking Recommendations

Truck parking recommendations for the Eastern Sierra Corridor fall into five broad categories:

- Solution 1: Build low-cost capacity utilizing existing public right of way (ROW).
- Solution 2: Expand existing public truck parking (focus on rest areas).
- Solution 3: Entice private sector investment in truck parking (either alone or as part of a public-private partnership).
- Solution 4: Implement intelligent transportation systems (ITS) technology.
- Solution 5: Better Utilization of Existing Public Facilities.

Examples of each of these are shown in the following section. Recommendations for each zone in the Eastern Sierra Corridor are then presented at the end.

9.3.1 Solution 1: Build Low-Cost Capacity Utilizing Existing Public Right of Way

The first approach is for local or State agencies or municipalities to expand capacity in the corridor using existing public ROW to build new, lower-cost facilities. By keeping initial costs low and using existing ROW, this solution can be implemented more quickly than other options and also have the potential to be expanded if they prove useful. Gravel lots will need routine maintenance to keep them graded and level, especially those used for emergency truck parking in the event of winter road closures to facilitate snow removal, and trash receptacles will require regular servicing. Underutilized lots can be closed with minimal financial impact. Lots with heavy use may need to be paved, striped, and vault toilets added in order to reduce ongoing maintenance costs. Those decisions will need to be weighed against the capital costs of the upgrades. It is likely that this solution will require limited environmental review as the facilities will be on disturbed land within public right-of-way.

Several examples of this approach exist throughout the United States:

- Truck turnout areas are a common approach to provide truck parking. This solution works best in rural areas with lower volumes and good visibility to accommodate acceleration/deceleration needs. An example of this approach from I-15 (Mormon Mesa) in Nevada is shown in Figure 9.1. Sites can be paved or not and often include just a trash receptacle for amenities. The Sherwin Grade Vista Point parking location is a similar location although it is not truck specific.

Figure 9.1 Truck Turnout—Mormon Mesa, NV (I-15)

Source: Cambridge Systematics.

- Truck parking inside a highway clover leaf interchange. This approach utilizes existing DOT land on the inside of a half clover leaf interchange. This land has limited commercial value for other purposes due to its location. An example of this solution from the Nebraska DOT is shown in Figure 9.2. This site is located adjacent to I-80 near Big Springs, NE. The site provides parking for approximately100-200 trucks each night and uses asphalt millings from a prior repaving project to provide ground cover. Light is provided by existing high mast light poles and the site contains a trash dumpster. This solution is easily scalable to the acreage available, and the asphalt millings can be re-used if trucks do not utilize the lot.

Figure 9.2 Truck Parking in a Half Clover Leaf—Big Springs, NE (I-80)

Source: Google Maps.

9.3.2 Solution 2: Expand Existing Public Truck Parking Facilities

The second solution focuses on expanding parking availability at already existing locations. This strategy is mainly directed at the rest areas at Crestview, Division Creek, Coso Junction, and Boron. Rather than constructing new facilities, existing sites—especially those with amenities like toilets—should increase the number of truck parking spaces available.

In addition, truck parking at public rest areas is currently limited to 8 hours. Beginning in the summer of 2019, this policy will change to allow trucks to park for up to 10 hours. This change will allow trucks to use public rest areas to fulfil their full HOS rest mandate and improve truck parking conditions throughout California.

Figure 9.3 through Figure 9.6 show parking utilization at these four rest areas.

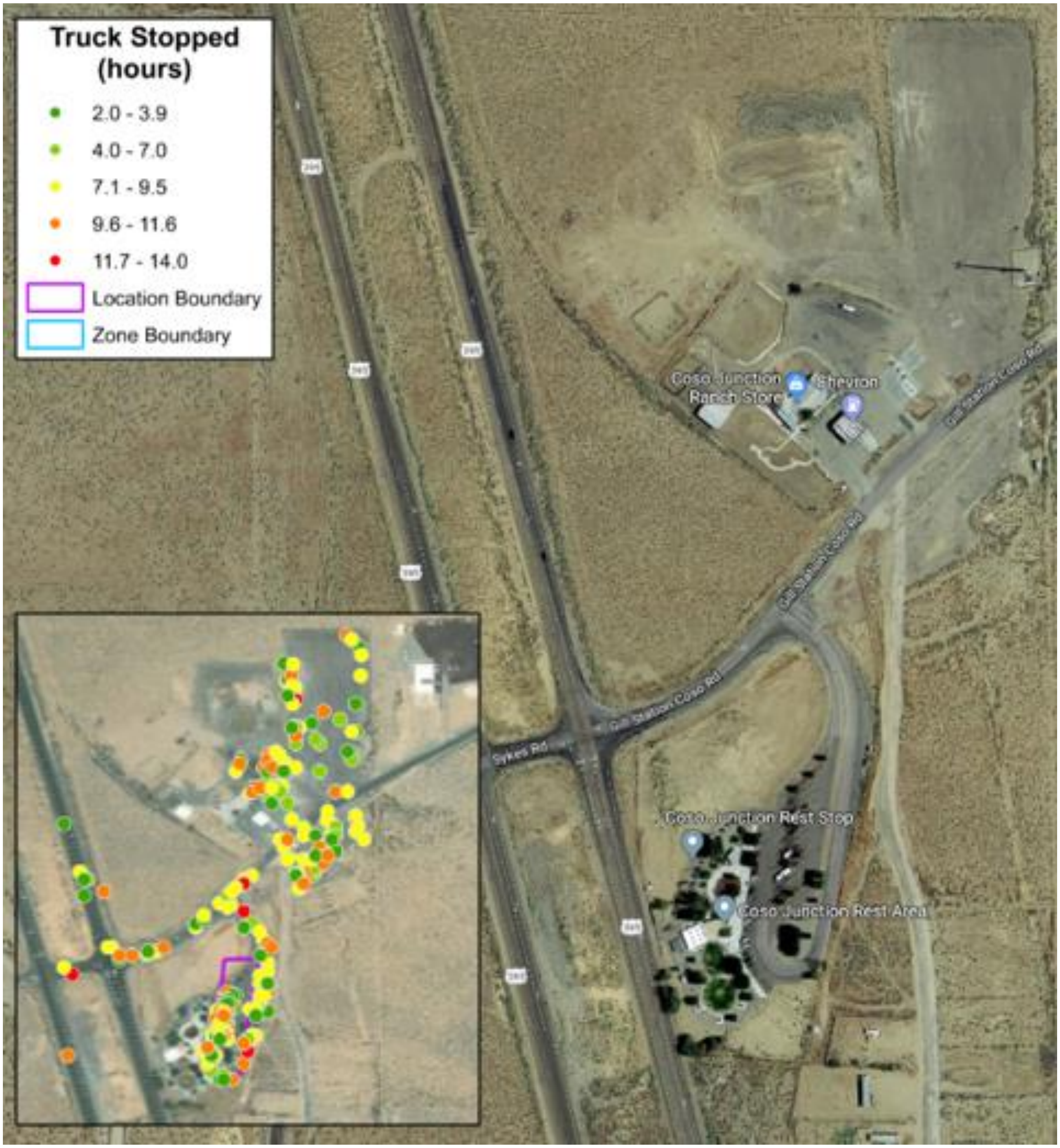
Figure 9.3 Truck Parking Demand at Crestview Rest Area

Source: ATRI, Google Maps. See Appendix B for additional parking utilization maps.

Figure 9.4 Truck Parking Demand at Division Creek Rest Area

Source: ATRI, Google Maps. See Appendix B for additional parking utilization maps.

Figure 9.5 Truck Parking Demand at Coso Junction Rest Area



Source: ATRI, Google Maps. See Appendix B for additional parking utilization maps.

Figure 9.6 Truck Parking Demand at Boron Rest Area

Source: ATRI, Google Maps. See Appendix B for additional parking utilization maps.

9.3.3 Solution 3: Entice Private Sector Investment

The third solution focuses on enticing private sector investment in truck parking to help solve the worst capacity issues. According to multiple surveys by ATRI, most drivers prefer to stop at large, privately operated, truck parking facilities which offer a number of amenities including bathrooms, fuel, and food. Since these facilities are businesses, they must be able to make a return on investment which limits their potential deployment in the Eastern Sierra Corridor. One location where demand appears to be high enough to justify private investment is Bishop. Exploring a public-private partnership (P3) where a municipality or Caltrans aids development by providing funding, infrastructure, or other incentives may be desirable. Additional information on P3s is provided in Section 9.4.3.

This solution could also include working with existing businesses in the Corridor to ensure that trucks arriving at their facility have a place to park on-site. This would help alleviate the need for trucks to park for short periods of time while waiting for a delivery window (staging parking), potential freeing other capacity or removing those trucks from unauthorized locations. Locations with a driver shortage or other constraints that make a particular route or area unpopular can be targeted, as providing parking to drivers can make a business more popular with drivers and ensure they are able to hire the capacity needed to carry their loads.

For example, Unilever partnered with Kriska Transportation Group to create the Safe Haven Program which allows drivers to park onsite or immediately adjacent to their distribution centers both for staging purposes and overnight. An example site is shown in Figure 9.7. Kriska's dispatch assigns drivers to parking spots at the distribution centers. Drivers must follow specific safety measures, such as wearing safety vests at all times and carrying a flashlight at night. This solution turned this facility from a less-desirable route (due to time/distances involved) to one of the most popular for drivers. Under-utilized private parking lots could also be examined as an alternative to official public or private truck parking lots. However, using excess space at commercial properties to allow truck parking is typically up to the individual parcel owner or store manager and subject to municipal regulations.

Figure 9.7 Unilver Distribution Center and Trailer Parking Area (Newville, PA)

Source: National Coalition on Truck Parking Working Group Products. December, 2018. Note that the red square indicates the truck parking area.

9.3.4 Solution 4: Implement ITS Technology Solutions

Intelligent transportation systems (ITS) can take many forms, from providing transit signal priority to make a bus trip faster to ramp metering to control the flow of vehicles onto a congested highway. Within truck parking, ITS is focused on determining the number of available truck parking spaces at a location and disseminating that information to drivers and dispatchers. These deployments are often called Truck Parking Availability Systems (TPAS) or Truck Parking Information Management Systems (TPIMS).

To understand how many spaces are available at a truck parking site, two common approaches used in the United States are: 1) a site volume approach to measure truck volume entering and leaving a site, and 2) a vehicle occupancy approach which uses in-ground sensors in each parking space to determine availability. The site volume approach determines availability by measuring site volume, or the number of vehicles entering and leaving the site. By comparing this to the overall number of spaces, an occupancy rate can be calculated. This approach works best at sites with a single truck ingress point and a single truck egress point separated from other traffic types to avoid counting other vehicles. Common detection systems include pneumatic tubes (similar to those used to count traffic—see Figure 9.8), inductive loop detectors, and piezoelectric sensors, laser detection, radio-frequency identification, and Commercial Mobile Radio Services (CMRS) wireless communication technology.

Figure 9.8 Installing In-Pavement Traffic Counter

Source: Washington State DOT.

The second approach to determining truck parking availability determines occupancy by detecting if a space is occupied. Video detection, light and laser detection, and in-pavement sensors are common approaches. Caltrans is already heavily involved in testing these various approaches through the Smart Truck Parking project with deployments in Sacramento and Stockton.[95]

Changeable message signs (CMS)[96] on the roadside, web-based information systems such as a State 511 or Americantruckparking.com and/or mobile applications are all possible avenues to disseminate parking availability information to drivers and dispatchers.

9.3.5 Solution 5: Better Utilization of Existing Local, State, and Federal Public Facilities

Truck inspection sites, vehicle chain-up areas, vista points, fairgrounds, and visitor centers (such as the Mono Basin Scenic Area Visitor Center operated by the U.S. Forest Service) are already paved, with safe ingress and egress. Expanding their function to include truck parking *when not in use* is a low cost and effective option. Inspection sites and fairgrounds are used sporadically, chain-up areas are only used during snow events, and public areas like vista points and visitors centers are not used or are closed during the night when drivers are in most need of parking and rest.

Sherwin Grade Vista Point northwest of Bishop is one example of this type of facility already existing on US 395 which could be signed to specifically allow for truck parking during overnight hours.

95 http://www.itscalifornia.org/Content/AnnualMeetings/2014/Presentations/TechSession7/4_-_ITSCA2014_TS7_Completes_the_Street_Martin.pdf.

96 Also called variable message signs (VMS), dynamic message signs (DMS), dynamic parking message signs (DPMS) or dynamic parking capacity signs (DPCS) depending on the specific design and information displayed.

9.3.6 Applicable Corridor Recommendations

To help identify specific areas within each zone where trucks currently stop, ATRI developed maps of each zone with dots indicating a stopped truck, color coded for the amount of time stopped. Maps of each zone are included in Appendix B, and show dots of all stopped trucks pulled from all four time periods the data were collected. In a few cases this mapping exercise revealed trucks parking on authorized private property, not designated as an official truck parking lot, but nevertheless allowed by the property owner, such as adjacent to a hotel or at the rear of a commercial retail center near the loading bays. In these cases the documented supply of authorized truck parking spaces was increased in that zone. More importantly, the plotted dots reveal clusters of parked trucks used to make better informed recommendations for the size and location of additional facilities.

Table 9.1 below recommends specific solutions by zone and offers notes and justifications for those solutions as appropriate. Solutions 4 and 5, providing advance parking availability to drivers and better utilization of existing public facilities, and recommended throughout the corridor. Providing advanced notification of parking availability in one zone will benefit all other zones as it will help drivers know when and where they can find parking, and thus reduce the frequency of parking at unauthorized locations. Because Solutions 4 and 5 are not zone specific, they are not included in Table 9.1.

Table 9.1 Zonal Recommendations

Zone Name	Current Gap	Future Gap	New Low-cost Lot on Public ROW	Expand Existing Rest Area	Entice Private Truck Stop	Notes
Walker	11	15				Dispersed and limited truck parking along US 395 mostly for shorter durations.
Bridgeport	53	73	X			No authorized parking available. Majority of trucks are parking at closed Busters dirt lot. Local residents don't like trucks parking in town, nor are there options for a parking lot in town. Recommend pilot testing a low-cost lot south of town, outside the populated areas, on Caltrans ROW (if available) to accommodate a minimum of 20 trucks, with the ability to expand to 75. May need to fence off the Buster's lot with a sign indicating truck parking available south of town.
Lee Vining	12	20				Dispersed and limited truck parking along US 395 mostly for shorter durations. A few longer-term park in Lee Vining or near the June Lake Junction Store. No trucks were reported parking at the Lee Vining Chevron during the data collection time periods. If the local community feels unauthorized parking is a concern, enforcement could encourage trucks to park at the Chevron. Expansion of the Crestview Rest Area may reduce demand in the Lee Vining zone.
Mammoth	36	52		X		Dispersed truck parking occurs throughout the zone with a heavy concentration at the Crestview Rest Area which has a current gap of 45, and future gap of 65. Recommend upgrading the Crestview Rest Area so that it can remain open year-round, with an additional 45-65 truck parking spaces.
Mam-Bish	1	4				Dispersed and limited truck parking along US 395 mostly at viewpoints, brake check areas, etc. Parking expansion in neighboring zones may reduce unauthorized parking in this zone.
Bishop	110	152	X		X	Approximately 10% of the trucks appear to be parked on authorized private property, such as the loading dock area behind the new K-Mart/Vons shopping center. The majority are parking in unauthorized locations. The largest cluster is along the shoulders of US 6 just north of US 395, where a peak of approximately 25 trucks is estimated to park. Given its location at the junction of US 6 and US 395, approximately the midpoint of the corridor, and the large supply of amenities drivers need, a full service truck stop would likely succeed in Bishop. If one cannot be enticed, a new low-cost lot on public ROW should be considered, with lighting, trash receptacles, and vault toilets. A minimum of 100 spaces, with the ability to expand to 150, should be considered between public and private facilities.
Benton	5	7				Trucks are parking across the street from Benton Station. Adding capacity in Bishop may satisfy the demand in Benton. Alternatively, a full service truck stop in Benton may attract some of the truck parking need in Bishop to Benton, but it may be difficult to entice private investment.
Big Pine	21	30		X		Trucks are parking in the Shell designated lot (3 spaces), vacant lot north of Hi Country Market, and a few other random locations. Most of the overnight parking occurs at the Division Creek Rest Area with an estimated peak of approximately 43 trucks (and only 10 spaces), estimated to increase to 59 by the year 2040. Recommend adding 30-50 new truck parking spaces to the Division Creek Rest Area.
Independence	-19	-3			X	Most of the trucks in this zone park at or near the Ft. Independence Travel Plaza—an estimated peak of approximately 40 trucks. When the Travel Plaza adds 50 truck parking spaces as planned, the need will be filled.

Zone Name	Current Gap	Future Gap	New Low-cost Lot on Public ROW	Expand Existing Rest Area	Entice Private Truck Stop	Notes
Lone Pine	6	20				Dispersed and limited truck parking along US 395 mostly for shorter durations.
Olancha	3	10				Dispersed and limited truck parking along US 395 mostly for shorter durations.
Coso Junction	6	22		X		Most trucks in this zone park at the Coso Junction Rest Area which has an estimated peak demand equal to the supply—12 spaces. However, the map indicates overflow truck parking near the Rest Area. Recommend adding 22 additional spaces to the Coso Junction Rest Area.
Ridgecrest	99	138	X		X	The majority of the parking in this zone occurs within the urban area of Ridgecrest, some in hotel parking lots (where drivers might be spending the night) or the backside of retail centers where it is presumably allowed. But it appears that most parking occurs in unauthorized locations. The total gap is comparable to the Bishop zone, however a much larger share of trucks are parked for only 2 – 6 hours and in retail/commercial areas, indicating they may be stopped briefly before or after making a delivery. Additional parking is needed, but given the lower demand and proximity to large truck stops on SR 58, it may be difficult to attract private investment. The better option may be to develop a new low-cost lot on public ROW with 50 spaces to start, expandable to 100 if needed.
SR 14 North	8	11				Dispersed and limited truck parking along US 395 mostly for shorter durations.
Tehachapi	-8	97	X			While the total estimated count indicates the current supply is close to the current demand, the map showing where trucks are parking matches reports from local transportation officials that the two truck stops fill up and trucks park around them, south of the hospital, and are scattered throughout the town. Additionally, the plot map indicates trucks park all along SR 58 wherever there is a wide shoulder or pull out area, and many are parking 5 – 11 hours, not just for quick, emergency needs. Parking on the side of higher volume and higher speed highways, like SR 58, is not as safe as parking off the highway via properly designed acceleration and deceleration lanes. Recommend developing low-cost lot(s) on public ROW with 50 spaces to start, expandable to 100 as demand increases. Consideration could be given to developing a lot within one of the large interchanges, similar to the Nebraska example.
Mojave	-49	-15				The Mojave zone has adequate capacity, yet drivers are still electing to park along the side of SR 58, possibly because it's more convenient that pulling off the highway to the town. Truck parking availability information throughout the corridor might help.
Rosamond	18	24				Random and diverse parking occurs in this zone—no significant clusters or patterns are noted.
Boron	11	116		X		The majority of parking in this zone occurs in the 12 mile stretch from the Boron Travel Plaza to Kramer Junction. The gap indicated in this table assumes the addition of the proposed Loves Travel Plaza with 99 spaces. The eastbound and westbound Boron Rest Areas should also be expanded as current demand already exceeds supply by 15 spaces, and over 100 additional spaces are projected to be needed in the future for the entire zone.

Note: Negative number indicates a surplus of supply.

9.4 Truck Parking Funding and Financing Options

This section identifies potential funding options at the Federal and State level for truck parking-related projects. It also highlights a number of alternative funding options including user fees and public-private partnerships (P3s).

9.4.1 Federal Funding Options for Truck Parking

Section 1401 of Public Law 112-141 (MAP-21), commonly referred to as "Jason's Law," established eligibility for a range of facilities to provide for commercial motor vehicle parking. These facilities, located on the National Highway System (NHS), provide safe parking for truck drivers enhances public safety by ensuring drivers are well rested. Prior research by the Federal Motor Carrier Administration indicates that fatigue is a factor in approximately 13 percent of large truck involved crashes.[97] Eligible activities under Jason's Law include:

1. Constructing safety rest areas with truck parking.
2. Constructing public truck parking facilities adjacent to truck stops and travel plazas.
3. Opening existing facilities such as inspection and weigh stations and park-and-ride facilities to accommodate truck parking.
4. Promoting the availability of publicly or privately provided truck parking on the National Highway System (NHS) using intelligent transportation systems (ITS) or other means.
5. Constructing turnouts along the NHS for truck parking.
6. Making capital improvements to seasonal public truck parking facilities to allow the facilities to remain open year-round.
7. Improving the geometric design of interchanges on the NHS to improve access to truck parking facilities.

There are a number of Federal formula fund programs which may be used to support the above truck parking projects:

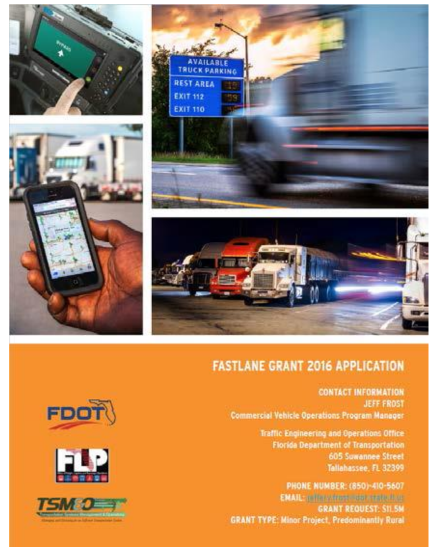
- **Surface Transportation Block Grant Program** (STBG) provides funding for truck parking facilities eligible under Section 1401 (Jason's Law) in MAP-21. The program was changed from the Surface Transportation Program to its current format in the FAST Act.
- **National Highway Freight Program** (NHFP) provides formula funds to States to improve the condition and performance of the National Highway Freight Network under 23 U.S.C. 167(i). Eligible activities include truck parking facilities and real-time traffic, roadway condition, and multimodal transportation information systems. The NHFP funds are eligible for use on the Primary Highway Freight System or National Highway Freight Network, or for projects that improve safety, mobility, or efficiency on those systems.

97 https://www.fmcsa.dot.gov/safety/research-and-analysis/large-truck-crash-causation-study-analysis-brief.

- **Highway Safety Improvement Program** (HSIP) provides funding for truck parking, provided the need for truck parking is consistent with the State Strategic Highway Safety Plan (SHSP) developed under 23 U.S.C. 148 and the project corrects or improves a roadway feature that constitutes a hazard to road users or addresses a highway safety problem.

- **National Highway Performance Program** (NHPP) funds may be obligated for a project on an eligible facility that supports progress toward the achievement of national performance goals for improving infrastructure condition, safety, congestion reduction, system reliability, or freight movement on the NHS. Eligible projects include highway safety improvements on the NHS, which may include truck parking per 23 U.S.C. 148.

- **Congestion Mitigation and Air Quality Improvement Program** (CMAQ) may be eligible for the construction of truck stop electrification systems that reduce the need for trucks to idle under 23 U.S.C. 149, but is not eligible for construction of truck parking. Eligibility must be determined in consultation with the U.S. Environmental Protection Agency (U.S. EPA) based upon the likelihood that the associated emissions reduction would benefit a nonattainment or maintenance area.



Source: FHWA.

In addition to formula funding programs, there are also several grant opportunities for truck parking projects, including the following:

- **Infrastructure for Rebuilding America** (INFRA) Grant program is a multiyear discretionary grant program in the Fixing America's Surface Transportation (FAST) Act to fund critical freight and highway projects. Eligible projects include highway freight projects on the National Highway Freight Network, highway projects on the NHS and other specified intermodal freight projects. The INFRA Grant can cover up to 60 percent of the total project cost. Formerly known as the Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE) Grant. Florida DOT received funding for its truck parking availability system (TPAS), which detects available truck parking and collects data at over 70 public facilities in Florida, via a $10.8 million FASTLANE grant in 2016. Florida DOT's TPAS project is the only truck parking project that has received FASTLANE/INFRA grant funding.

- **Better Utilizing Investments to Leverage Development** (BUILD) Transportation Discretionary grants program (formerly known as the TIGER grant program) provides capital funding directly to any public entity, including municipalities, counties, port authorities, tribal governments, and metropolitan planning organizations, including multi-modal and multi-jurisdictional projects that are difficult to fund through traditional Federal programs. These grants are intended to support innovative projects that generate economic development and improve access to reliable, safe, and affordable transportation and are not specifically focused to freight needs. FY2018 awards include funding for the "I-80 Winter Freight Improvement Project" submitted by Wyoming DOT which will construct approximately 5.5 miles of passing lanes and two truck parking areas in addition to installing dedicated short-range communication

(DSRC) roadside radios in Albany and Carbon counties.[98] TIGER funds have been used in the past to support truck parking projects, most notably the 2015 award of $25 million to the DOTs of Kansas, Indiana, Iowa, Kentucky, Michigan, Minnesota, Ohio, and Wisconsin for a Regional TPIMS. The system had a soft launch in the fall of 2018 and is scheduled to cover more than 150 parking sites on nine high-volume corridors starting in the summer of 2019.[99] Funding can be used for 100 percent of project costs in rural areas and for up to 80 percent of costs in urban areas.[100]

- **Innovative Technology Deployment** (ITD) Program (formerly known as CVISN) provides an additional funding source for truck parking projects through the Federal Motor Carrier Safety Administration (FMCSA) High Priority—ITD Grant. Historically, the ITD Program has focused on commercial vehicle enforcement with funds supporting three deployment areas: electronic credentialing, safety information exchange, and electronic screening. The FY2018 grant cycle highlighted truck parking as a priority project area for States that have achieved Core Compliance in the program.[101] Projects should demonstrate real-time truck parking availability information dissemination to drivers using dynamic message signs, interactive voice recognition, smartphone applications, or other proven technology. Projects are funded at an 85 percent Federal/15 percent State match level. California is Core Compliant and so could access this funding if a truck parking technology project is included in the State's Program Plan and Top-level Design (PP/TLD).

- **Accelerated Innovation Deployment** (AID) Demonstration program provides funding as an incentive for eligible entities to accelerate the implementation and adoption of innovation in highway transportation. The AID Demonstration program is one initiative under the Federal Highway Administration (FHWA) Technology and Innovation Deployment Program providing funding and other resources to offset the risk of trying an innovation. Approximately $10 million in funding is available from FY2016 through FY2020. Projects must involve any phase of a highway transportation project between project planning and project delivery including planning, financing, operation, structures, materials, pavements, environment, and construction. In addition to the FASTLANE grant award, Florida DOT was awarded an AID grant for $1 million in 2015 to deploy its real-time Truck Parking Availability System (TPAS).

- **Diesel Emissions Reductions Act** (DERA) Clean Diesel Funding Assistance Program provides approximately $40 million in competitive grant funding through the U.S. EPA. The Program solicits proposals nationwide for projects that

Source: Boston MPO.

98 https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/327856/build-fact-sheets-121118-355pm-update.pdf.

99 https://www.fleetowner.com/driver-management/real-time-truck-parking-data-aims-strengthen-midwest-freight-corridors.

100 Rural areas are those outside of a US Census defined "Urbanized Area" which consists of a densely settled territory with a population of 50,000 people or more.

101 As of April 2018, all states in the I-95 Corridor Coalition are Core Compliant with the exception of the District of Columbia, New Hampshire, Pennsylvania, Rhode Island, and Vermont,. https://www.fmcsa.dot.gov/information-systems/itd/itd-current-status.

achieve significant reductions in diesel emissions in terms of tons of pollution produced and exposure, particularly from fleets operating in areas designated by the Administrator as poor air quality areas. Grant funds may be used for clean diesel projects, including EPA-verified technologies, California Air Resources Board verified technologies, idle-reduction technologies, aerodynamic technologies and low rolling resistance tires, and early engine, vehicle, or equipment replacements. Historically, this grant funding has been used for truck parking activities, including truck stop electrification, truck fleet replacement, and other truck parking activities.

- **Advanced Transportation and Congestion Management Technologies Deployment** (ATCMTD) program provides up to $60 million in Federal Funding (50/50 match) to eligible entities to develop model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment. Though truck parking is not explicitly stated as an eligible activity, the funds may be used towards transportation management technologies, data collection systems, pricing/payment systems, or other technologies that support truck parking activities. Funds for FY2018 have not been awarded as of October 2018. An example of a proposed Concept of Operations for a truck parking availability system on the I-10 Corridor in California, Arizona, New Mexico, and Texas is shown in Figure 9.9.

Figure 9.9 I-10 Corridor Coalition Truck Parking Availability System Concept of Operations

Source: ATCMTD Grant Application, FY 2018. https://www.ttnews.com/articles/i-10-coalition-applies-federal-grant-ease-truck-parking.

- **Volkswagen (VW) settlement payments**[102] totaling $4.7 billion will be split into two distinct funds: 1) $2.7 billion will go towards an Environmental Mitigation Trust to fund projects that reduce nitrogen oxide (NOx) emissions where VW diesel 2.0 liter vehicles were, are, or will be operated, and 2) the remaining $2 billion will go toward zero emissions vehicle investments to improve infrastructure, access, and education to advance zero emission vehicles. States will determine how the Environmental Mitigation Trust funds will be spent. VW will determine how the zero-emission vehicle (ZEV)[103] funds will be spent, subject to approval of the U.S. EPA and the California Air Resources Board. Eligible activities for ZEV infrastructure investments include designing, planning, constructing, installing, operating and maintaining infrastructure. Infrastructure designations include shared Level 2 charging stations, public DC fast charging stations that use non-proprietary connections, ZEV fueling stations, and next-generation public ZEV charging infrastructure. VW has stated an interest in installing chargers in approximately 15 metro areas and developing a cross-country network of 200+ fast-charging stations during the first investment cycle.[104] Truck parking projects that are eligible under DERA (including truck stop electrification) are eligible.[105]

9.4.2 State Funding Options for Truck Parking

Alternative Rest Area Stopping Opportunity (ARASO)

An Alternative Rest Area Stopping Opportunity (ARASO) is a public-private commercial Safety Roadside Rest Area (SRRA) located along non-interstate highways. These facilities supplement the overall SRRA system and are eligible for partial public funding such as the State Highway Operations and Protection Program (SHOPP) described below. An ARASO may also be referred to as a State Traveler Services Parking Area or Facility since the FHWA may prohibit the use of terms such as “rest area” for traditional SRRAs that are State-owned, operated, and without commercial services.[106] The minimum requirements for an ARASO are very similar to those for an Interstate Oasis, but the California Project Development Procedures Manual (PDPM) does provide some guidelines for ARASOs that differ from an Interstate Oasis requirements such as the minimum distance between stopping facilities, the minimum time limit for free parking, and the maximum distance between the facility and the highway.[107]

Within Caltrans District 9, the 2011 SRRA Master Plan lists three existing ARASO partnerships: the Shell Station on U.S. 395 at 102 Pearson Road, Inyokern, CA, the Love’s Travel Center at Exit 151 at the Tehachapi Blvd and SR-58 interchange, and multiple commercial operators at SR-58 Exit 149 at the Mill Street/SR-58 interchange. The SRRA Master Plan also lists some SRRAs in strategic locations that could be converted into ARASOs with minimum cost and benefit the overall SRRA system. Along U.S. 395, the Master Plan noted that Coso Junction SRRA provides a high degree of value and parking should be expanded within the existing ROW if possible, or through an ARASO if not. The Master Plan also noted that Division Creek SRRA provides a relatively low value to the travelling public but its location on a remote

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[102] More information about the settlements between the U.S. EPA and Volkswagen and its entities is available here: https://www.epa.gov/enforcement/volkswagen-clean-air-act-civil-settlement.

[103] ZEVs include light duty trucks, medium duty vehicles, or heavy duty vehicles that produces zero exhaust emissions, as well as plug-in hybrid electric trucks.

[104] www.electrifyamerica.com.

[105] https://www.epa.gov/sites/production/files/2017-10/documents/faq-ben.pdf.

[106] 2011 SRRA Master Plan.

[107] 2011 SRRA Master Plan.

stretch of US 395 meant that it should remain open unless a suitable ARASO can be developed. Note that these recommendations are not specific to truck parking needs and that ARASO funding is not limited to truck parking projects.

State Highway Operations and Protection Program (SHOPP)

The State Highway Operations and Protection Program (SHOPP) is a four-year document of projects issued on a rolling basis every two years with a biennial ten-year plan. SHOPP projects are limited to capital improvements related to maintenance, safety, operation, and rehabilitation of the State highway system, but do not add new capacity to the system. The projects chosen for the SHOPP are consistent with the Transportation Asset Management Plan (TAMP) and are funded through a mixture of Federal and State monies. One source of the funds for the SHOPP are the Road Maintenance and Rehabilitation Account created by Senate Bill 1 (SB 1), though not all projects listed in the SHOPP are eligible for SB 1 funding. SRRA rehabilitation and new SRRA projects are included in the SHOPP program in the Roadside preservation category and are ranked 25th and 26th in priority for the SHOPP, respectively. SRRA rehabilitation included the expansion of parking capacity to meet 20-year capacity needs. New SRRA projects supplement existing rest areas and are identified in the SRRA System Master Plan. The 2018 SHOPP issued in October 2018 does not have any projects related to SRRAs in District 9.[108]

9.4.3 Alternative Funding Options for Truck Parking

Direct User Fees

Pay-for-use truck parking is relatively rare in the United States. Some truck parking facilities do offer reservation systems where a space can be reserved for a fee, but few charge a "use" fee for all vehicles entering the lot. However, a limited number of public and private examples exist. A public parking lot off I-86 in Elmira, NY and a short-term parking facility operated by Truck Specialized Parking Services (TSPS) in Detroit, MI are two possible examples.

User fees can help projects fund operations and maintenance costs and potentially generate a profit to help cover initial capital costs. The fee structure would need to be organized to establish usage type: short-term, overnight, or long-term local parking due to the different parking patterns with each. For example, a lot aimed at short-term staging parking would expect a higher truck turnover rate than a lot designed to accommodate overnight parking. Within an urban staging area, the direct user fees could be collected from the individual driver, or through a space licensing agreement with their delivery location.

Isolating or Increasing Current Tax Revenue

For the maintenance of existing public truck parking areas, as well as some structured P3 agreements, funding could be directed from existing taxes and fees including: Truck & Trailer Sales Tax, Heavy Vehicle Use Tax, Truck Tire Tax. These taxes are currently deposited in the Highway Trust Fund (HTF)[109] and could be earmarked or partially isolated for truck parking specific projects. This would, in essence, be creating a

[108] State Highway Operation and Protection Program 10-Year Project Book Fiscal Years 2017/18 – 2026/27, October 2018.

[109] FHWA. "Funding Federal-aid Highways, Section 07—The Highway Trust Fund." Office of Policy and Government Affairs. January 2017. https://www.fhwa.dot.gov/policy/olsp/fundingfederalaid/07.cfm.

truck parking user fee through this tax revenue, while also directly giving needed services back to the truckers who pay the tax.

Some States also allow municipalities or counties to add additional taxes onto the existing State sales tax for specific purposes. Transportation specific local taxes could be added with a portion or all of the revenue being used to provide truck parking in that local area. One alternative could include the earmarking of existing State revenue sources toward bond or debt repayment for a potential truck parking facility.

Tax Incentives

To encourage more truck parking development at private facilities or in a collective joint-use area, a tax incentive program may be developed.[110] This program could be focused on the preservation of industrial activity in the area in conjunction with truck parking requirements. The State or municipality taxing authority could enact an incentive program, establish an industrial tax district, or pooled funding mechanism for the development of greater off-street truck parking on individual facilities or at a joint-use staging area. The State of New York had previously explored a tax incentive program for new truck parking under MAP-21 and Jason's Law, but the bill made it no further than State's Senate Transportation Committee.[111]

Tax incentives or low-interest State or municipal loans could also be created to support expansion of truck parking at private sector areas, such as truck stops or shopping centers. These incentives and loans may also encourage individual freight facilities to establish more on-site parking. Using public finance, right-of-way authority, or taxing structure to support private sector development, could also be translated into an overall public-private-partnership (P3) agreement.

Public-Private Partnership (P3)

P3s are an alternative financing and risk transfer tool used by governments for large projects, as opposed to a standard public procurement. A P3 is an agreement between a Government agency and a private-sector company, or consortia, for the designing, building, financing, operating, and/or maintenance (or any combination) of a project and assets for a designated period of time, usually 25 to 30 years or longer.

There are risks and benefits to organizing a potential truck parking solution under a P3 arrangement. Since the agreement may encompass many decades and various parties, the long-term usage patterns have to be well understood and all parties clear on their responsibilities and expectations. Even with the inherent risk, P3s can be seen as attractive alternative to traditional procurements as Government agencies can allow for new methods of innovative financing for parking projects and financial risk on the project can be shared with or fully transferred to the private sector. A well-developed P3 can also have the benefit of incentivizing the use of the parking area by freight facilities directly involved in the building, operations, and/or maintenance of the new truck parking area.

P3s can be used to develop both new facilities or expanding existing ones. New facilities allow for the greatest flexibility in the project development and P3 structuring. In cases where the P3 is expanding or

[110] FHWA, National Coalition on Truck Parking. "Activity Report 2015-2016." https://ops.fhwa.dot.gov/publications/fhwahop17026/fhwahop17026.pdf.

[111] New York Senate Bill S.3773 https://trackbill.com/bill/new-york-senate-bill-3773-creates-various-programs-to-protect-safety-of-truck-drivers/393441/.

revitalizing existing assets, the private sector may seek higher compensation for taking on the additional risk of assets which they did not have control of during its initial planning, construction, or prior maintenance.

Design-Build-Finance-Operate-Maintain (DBFOM)

P3s under a design-build-finance-operate-maintain (DBFOM) arrangement or concession transfer to a private sector partner full responsibility for the design, construction, finance, and long term operations and maintenance of a facility or asset over a set period of time. In almost all cases, the public entity retains overall ownership of the facility throughout, and has responsibility transferred back at the end of the contractual period. During the time the private sector is responsible for the facility or asset, they will be compensated through availability payments (contractually set annual payments from the public sector with level-of-service requirements), through a collection of tolls or direct user-fees, or an agreed combination of both.

Public-Private Partnership Structures

Should a P3 model of project delivery be chosen, there are several different ways in which a P3 can structured:

1. **Condominium**—Useful to maintain separate ownership of any multi-facility parking area, or serving a variety of users. Within the condominium approach, both public and private partners would own and maintain defined sections of the overall parking area. The agreement would need to outline overall facility maintenance/security costs, but individual parking spaces would be designated to specific users. This structure could be organized after a facility has been built, either fully by the public sector, the private sector, or through a mixed funding source. Users would be able to then use their designated and managed spaces for individual operations, or lease/rent them to other users as needed.

2. **Lease or Leaseback**—Usually the public entity, as the owner of the property, will enter into a long-term lease agreement with a developer or consortium who then designs, finances, and builds the facility on behalf of the public entity. The lease is focused on the land on which the facility sits, and the public entity can lease-back the completed facility for their own use, or allow the facility to be leased to others (i.e., local freight centers). The private developer will structure the facility use cost/lease to cover operating expenses, service debt costs, and brings some set return on investment. At the end of the set lease period, the public entity receives the land and built facility back from the original developer or current owner for a previously agreed fee in the lease contract (often in the industry only $1).

3. **Concessionaire Agreement**—Similar to aforementioned Lease or Leaseback, except in this case, the developer is actually both the builder and operator of the facility. Within a concession agreement, the private sector developer or consortium will operate and maintain the facility throughout the set life of the project, and at the end transfer all operations back to the public entity (again, usually for $1). During the time of operations, the developer will organize usage of the facility, and charge appropriate costs to cover operating expenses, service debt costs, and bring in a return on investment.

4. **Long-Term Lease Structure**—Very similar to the other agreements, but in this case, the land is being transferred for around 99 years. The private developer will also take on tax considerations of the land and the facility.

In all of these structures, the public entity does not always have to be initial land owner. Through tax incentives, zoning procedures, or transportation planning, the public entity could help to facilitate an agreement between a developer and a private landowner.

Sponsorships

A final P3 approach involves obtaining private-sector sponsorships for signage. For example, Florida DOT is currently looking for a sponsor to support its statewide TPAS signage after receiving FHWA approval in February 2018. There are 72 signs in advance of 67 Weigh Station, Rest Area, and Welcome Center facilities available for sponsorship although the initial sponsorship locations will be fewer due to site work in some locations. FDOT would ideally like a single sponsor but is open to regional sponsors. FDOT anticipates gross annual sales between $226,000 and $407,000 for a statewide sponsor, between $158,000 and $271,000 for a regional sponsorship based on selling 50% of the available inventory, and more than $500,000 for a regional approach with 100% of inventory sold. Prospective sponsors include recruiting and training companies, trucking companies, service providers (tires, navigation, etc.), manufacturers, insurance companies, and trucking associations.[112][113] Revenue will be used for O&M costs associated with the truck parking program and emphasizing the link between sponsor, O&M, and the safety benefits provided by the TPAS was a key strategy in getting the program approved.[114]

Beyond truck parking, FDOT also partnered with GEICO to sponsor its "safe phone zone" signs, which are aimed at curbing distracted driving. Signage encourages drivers to pull over into these "safe phone zones" to use their cellphones for calling, texting, and accessing mobile apps while on a break from driving. Although GEICO no longer sponsors these zones in Florida, it continues to support similar efforts in New Jersey (see Figure 9.10), New York, Virginia, Arizona, Illinois, North Carolina, and Texas.[115] These efforts helps bring in additional revenue to each State's highway system for reinvestment in rest areas and other highway operational needs, while also reducing instances of distracted driving.

[112] FDOT letter to James Christian, Division Administrator – FHWA. "Florida – Truck Parking Availability System Sponsorship Program." January 24, 2018.

[113] FHWA blocked a request from Texas Department of Transportation in 2017 to display commercial logos on electronic message signs. Note that the FDOT sponsorship panels will be separate from the TPAS sign. For further information, see: https://www.natso.com/articles/articles/view/fhwa-blocks-commercialization-of-signs-on-the-public-right-of-way.

[114] Email from Marsha Johnson, Strategic Initiatives Office, FDOT. November 28, 2018.

[115] http://www.safephonezone.com/index.html.

Figure 9.10 GEICO Sponsorship in New Jersey

Source: NJDOT.

Implementation Plan

Specific implementation actions are presented below to advance the proposed recommendations, divided into four categories: lower-cost, higher priority; lower-cost, lower priority; higher-cost, higher priority; and higher-cost, lower-priority.

10.1 Lower-Cost, Higher Priority Actions

10.1.1 Truck Parking

- Bishop:
  - Share study findings with private truck stops to entice investment.
  - Develop a low-cost lot on public ROW.
- Bridgeport: Develop a low-cost lot on public ROW, possibly at southern end of town, and increase enforcement of unauthorized parking in other locations in town.
- Ridgecrest:
  - Share study findings with private truck stops to entice private investment.
  - Develop a low-cost lot on public ROW.
- Tehachapi: Develop a low-cost lot on public ROW, possibly within the SR 58/Capital Hills Parkway interchange, with 50 spaces to start and expandable to 100 if demand increases.
- Boron: Encourage development of the planned Loves Travel Plaza.

- Independence: Encourage development of the planned parking expansion at the Ft. Independence Travel Plaza. Current data indicates that most trucks parking in the Independence zone are parking in and around Ft. Independence Travel Plaza.

10.1.2 Trucks on Main Street

- Pilot test requiring trucks to drive in the left lanes through towns by placing mobile dynamic message signs at either end of a town for one to two months.

- Continue complete streets studies and initiatives in corridor.

- Study the feasibility of a truck route that connects to an expanded Bishop Airport, and bypasses much of US 6 and US 395 through Bishop. Consider including a low-cost truck parking lot along the route, possibly near the airport.

10.2 Higher-Cost, Higher Priority Actions

10.2.1 Truck Parking

- Mammoth: Upgrade the Crestview Rest Area so that it can remain open year-round, with an additional 45-65 truck parking spaces.

10.2.2 Steep Grades

- Add an additional lane (truck climbing lane) in both directions on SR 58 over Tehachapi Summit.

- Add a truck climbing lane (or passing lane) on southbound US 395, north of Conway Summit.

10.2.3 Advance Traveler Information

- Corridor-wide: Implement a truck parking availability system at all rest areas, and advance notification of adverse highway conditions.

10.3 Lower-Cost, Lower Priority Actions

10.3.1 Truck Parking

- Corridor-wide: Allow trucks to park at weigh stations and vehicle chain-up areas when not in use.

- Corridor-wide: Expand the parking time limit at rest areas beyond 8 hours.

10.4 Higher-Cost, Lower-Priority Actions

10.4.1 Truck Parking

- Big Pine: Add 30-50 new truck parking spaces to the Division Creek Rest Area.
- Boron: Add a combined 100 new truck parking spaces to the eastbound and westbound Boron Rest Areas.
- Coso Junction: Add 22 new truck parking spaces to the Coso Junction Rest Area.

11 Stakeholder Outreach

A series of meetings and interviews were held with a broad base of stakeholders in order to learn first-hand about conditions in the corridor, identify areas of concern, understand the story behind the data, and validate model forecast. Below is summary of the key takeaways from these meetings.

11.1 Mono County LTC, August 14, 2017; and Inyo County LTC, August 16, 2017

- Use of airbrakes through Antelope Valley is a nuisance.
- Overnight truck parking in undesignated areas in Bridgeport is a concern.
- Benton Paiute Reservation considering a truck stop on US 6.
- All rest areas along US 395 are full overnight.

11.2 Kern COG Transportation Technical Advisory Committee (TTAC), October 4, 2017

- SR 58 effectively serves as a western extension of I-40, and carries more trucks than does I-80 over Donner Pass.
- Kern COG's highest priority project is to extend the freeway status of SR 58 from Bakersfield west to I-5. The second and third highest priority projects are climbing lanes west of Tehachapi and an interchange at California City Boulevard. When these projects are complete, the volume of trucks on SR 58 within the study area of the Eastern Sierra Corridor will likely increase.
- Oversize/overweight vehicles use Oak Creek Road to bypass the weigh station east of Tehachapi.

- The City of Shafter is pursuing the development of a major inland port that would likely increase truck volumes on SR 58.

11.3 Eastern Sierra Working Group (ESWG), October 3, 2017

- Representatives attended the ESWG from California Highway Patrol, Caltrans Districts 8 and 9, City of Bishop, Inyo County, Kern COG, Mono County, Nevada DOT, and San Bernardino County Transportation Authority.
- Robust discussion was held noting specific locations where trucks park in undesignated areas, safety concerns, communication needs, future developments and traffic generators, the effects of weather, and other topics.

11.4 Eastern Sierra Working Group (ESWG), January 31, 2018

- This study needs to identify more accurately where and how much additional truck parking is needed.
- One slow truck can have a big impact on a 2-lane section of highway.
- Passing/climbing lane needed on US 395 southbound, north of Conway Summit.
- Consider limit trucks to the left lane through towns.

11.5 Eastern Sierra Working Group (ESWG), December 5, 2018

- Important finding that truck traffic growth will be natural—consistent with overall traffic increases—and not elevated due to external growth factors.
- There is a new Flying J in Tehachapi, a new truck stop is approved in Boron, Ft Independence plans to expand truck parking lot.
- The Crestview Rest Area is closed during the winter. Adding additional truck parking spaces should be part of an overhaul of the facility to enable it to remain operational during the winter months.
- Pilot testing restricting truck traffic to the left lane is a reasonable and feasible recommendation.

11.6 Mono County LTC, December 10, 2018

- In Bridgeport trucks park at the vacant Busters lot, which is not preferred by the community. Possibly locate a lot just south of town.
- Proposed recommendations well received.

11.7 Kern COG Transportation Technical Advisory Committee (TTAC), January 2, 2019

- The two truck stops in Tehachapi typically fill up and overflow most nights.
- Kern County is becoming a logistics hub. A new Amazon fulfillment center is planned in Bakersfield. Growth will increase need for truck parking along SR 58.
- Proposed recommendations well received.

11.8 Inyo County LTC, January 22, 2019

- Los Angeles Water and Power owns most vacant land around Bishop and cannot sell property to private entities. Caltrans can request transfer of right-of-way.
- The Comfort Inn in Lone Pine is considering developing the vacant lot adjacent to the hotel where trucks are currently parking.
- Proposed recommendations well received.

11.9 Confidential Interviews

Confidential interviews were held with economic development agencies, trucking companies, and manufacturing/distribution companies in an effort to validate model projections, better understand why trucks use the corridor, and gather any recommendations for improvements. Below are a few of the takeaways.

US 395 is generally the preferred route for most trucker drivers traveling between Northern Nevada and the Inland Empire of Southern California. Only one company interviewed stated that they do not regularly route trucks down US 395 due to steep grades and inclement weather conditions, and instead route trucks via I-5 or US 95. When asked if development of I-11 between Northern and Southern Nevada would draw them away from US 395, all responded no—passing through Las Vegas adds 150 miles to a trip between Reno, Nevada, and Moreno Valley, California. Taking I-5 adds 110 miles. US 395 is the most direct route and many trucker drivers enjoy the beauty of the drive.

The interviews revealed that some drivers prefer to bypass the northern portion of US 395 from Mindon, Nevada to Bishop, California, and will take US 95 south from Reno to SR 360, then US 6 to Bishop, and then south on US 395. This is especially the case during inclement weather, or when trucks have heavy loads, or with drivers who are more familiar with the region and recognize the safety benefits of this route. It is 40 to 50 miles longer, depending on the starting point, but is flatter and safer (see Figure 11.1), and avoids higher mountain passes. Chain-up areas able to accommodate 6 to 8 trucks are needed on either side of Montgomery Pass (on US 6), preferably on SR 360 just north of US 6 and another at the State line. SR 360 just north of US 6 is flatter and safer for chain-up than on US 6. US 395 south of Bishop has a flat terrain and trucks can use it in all seasons.

A minority of those interviewed said that a large percent of overall truck trips out of Northern Nevada were headed to Southern California, and thus would use US 395. Most said that travel or trade between these two metropolitan areas made up between zero and 10 percent of total trips to/from Northern Nevada. Most believe that truck volumes on US 395 will increase in the future because of the logistics and manufacturing growth in Northern Nevada.

All of the trucking companies interviewed would like to see more truck parking in the corridor—especially with amenities where drivers can shower and get a hot meal, fuel, service, and other necessities.

Figure 11.1 US 6, Five Miles South of Benton, California

ITS Elements in Eastern Sierra Corridor

This Appendix presents an inventory of existing and proposed intelligent transportation systems (ITS) elements on the study corridor, the data were collected from the office of California Department of Transportation (Caltrans) District 9. Table A.1 shows a summary of this inventory. Six of the 111 existing count stations are axle-based classification count stations; other count stations provide other types of information. Changeable message signs (CMS) are used to communicate road conditions, especial during weather events. Road weather information system (RWIS) is used by dispatch to make decisions relating to weather events. Mountain Closure Message Signs (Mt) inform status of Tioga, Sonora, and Monitor Passes, whether open or closed due to heavy snowfall or landslide/mudslide events.

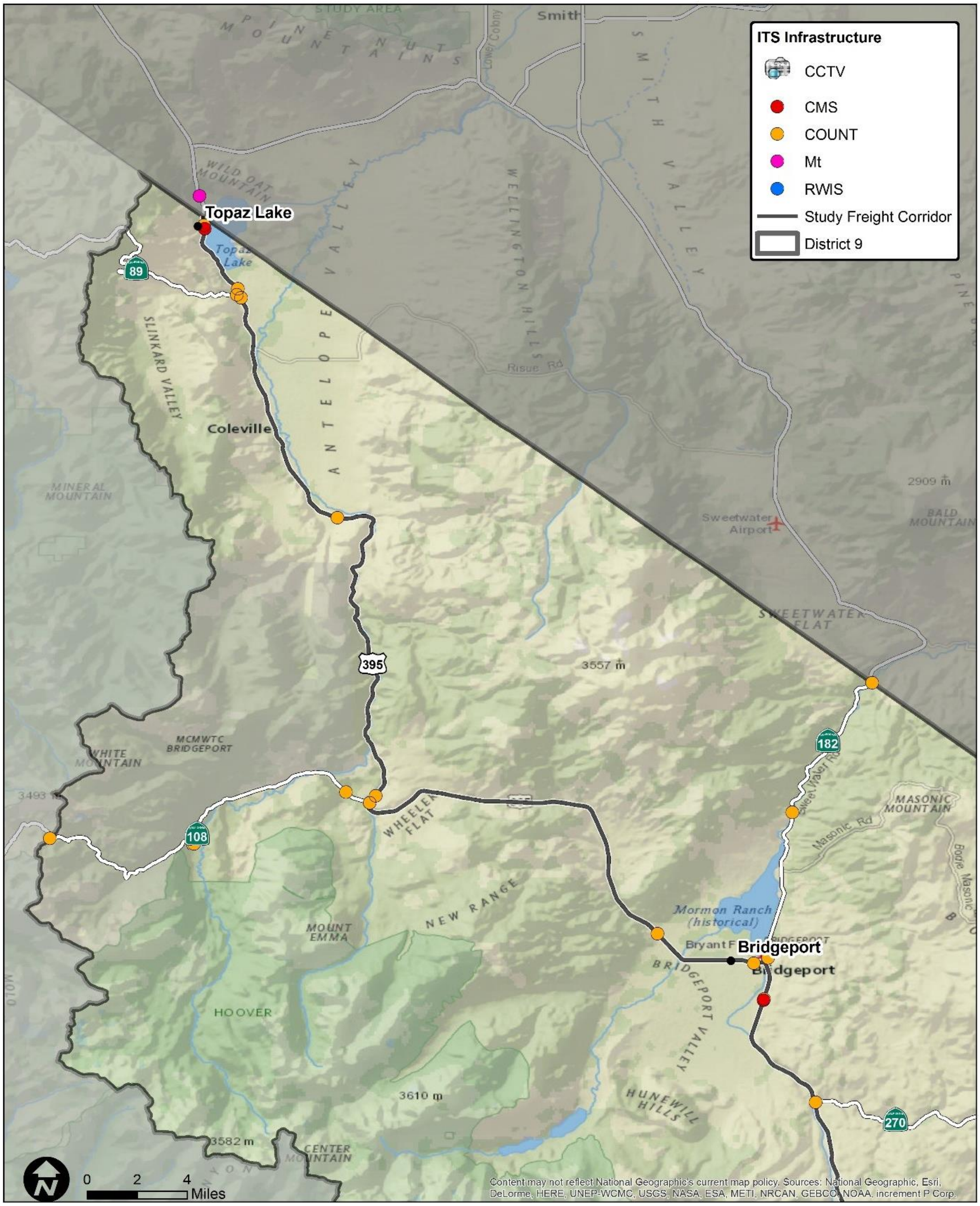
Table A.1 Inventory of Existing and Proposed ITS Elements in Eastern Sierra Corridor

	Number of ITS Elements		
ITS Facility Type	Existing	Proposed	Total
CCTV	4		4
CMS	10	6	16
COUNT	111		111
Mt	4		4
RWIS	18	6	24
Total	**147**	**12**	**159**

Source: Caltrans District 9.
Note: CCTV = Closed Circuit Television Cameras, CMS = Changeable Message Signs, COUNT = Count Stations, Mt = Mountain Closure Message Signs, and RWIS = Road Weather Information System.

Figure A.1 to Figure A.6 show locations of existing ITS elements in the study corridor; while Figure A.7 shows proposed locations.

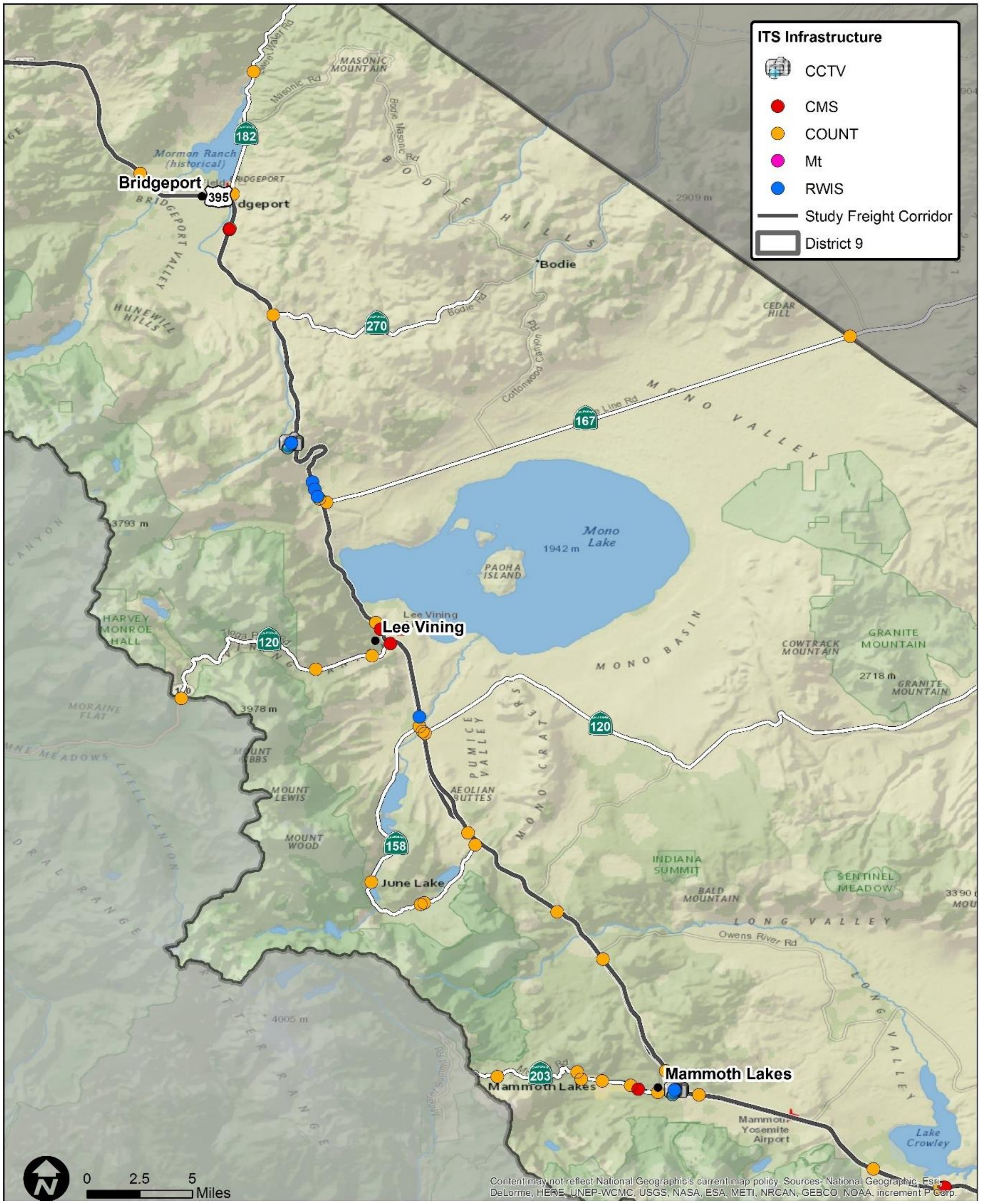
Figure A.1 Existing ITS Elements in Eastern Sierra Corridor Section 1—Topaz Lake to Bridgeport



Source: California Department of Transportation (Caltrans) District 9.

Note: CCTV = Closed Circuit Television Cameras, CMS = Changeable Message Signs, COUNT = Count Stations, Mt = Mountain Closure Message Signs, and RWIS = Road Weather Information System.

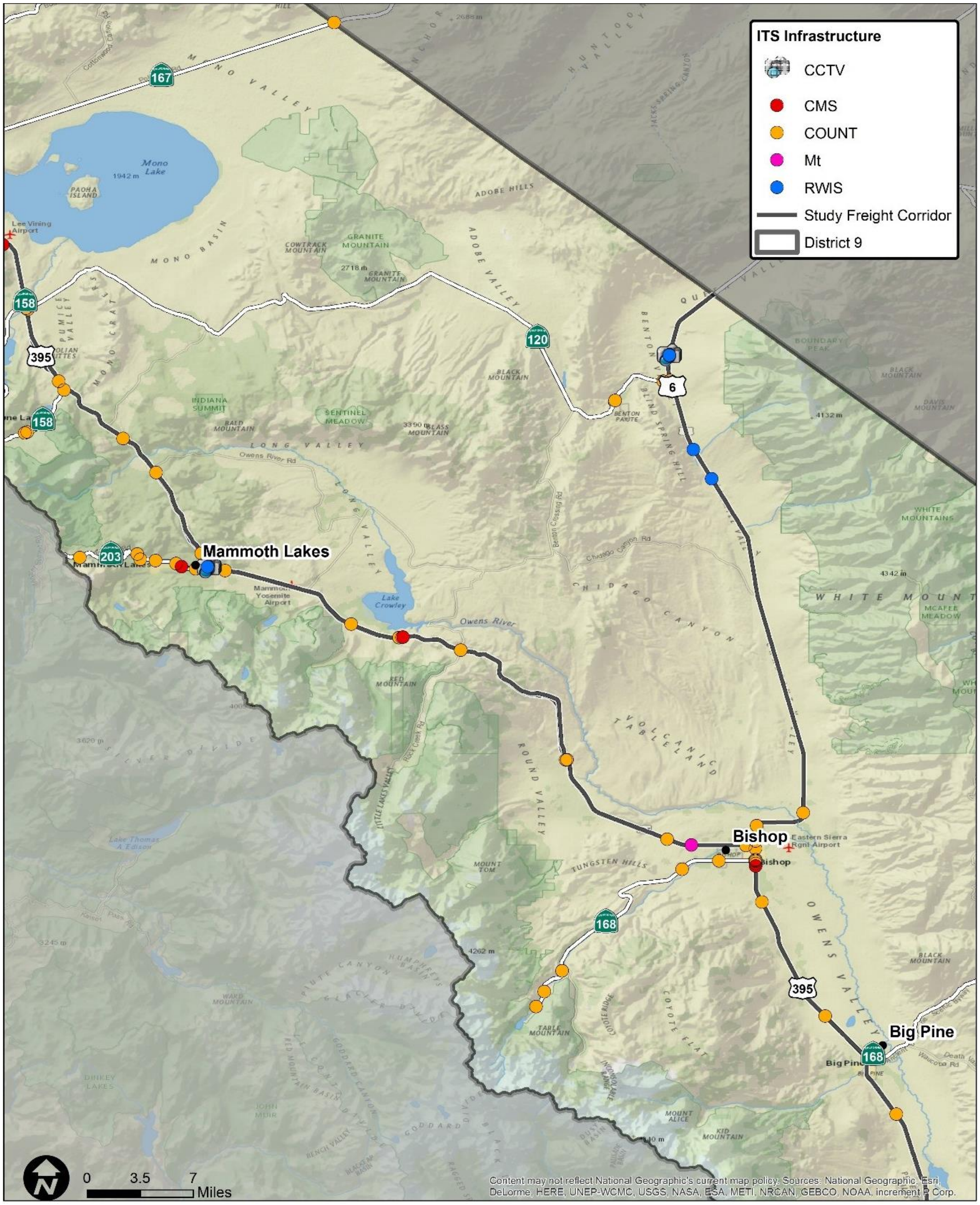
Figure A.2 Existing ITS Elements in Eastern Sierra Corridor Section 2—Bridgeport to Mammoth Lakes



Source: California Department of Transportation (Caltrans) District 9.

Note: CCTV = Closed Circuit Television Cameras, CMS = Changeable Message Signs, COUNT = Count Stations, Mt = Mountain Closure Message Signs, and RWIS = Road Weather Information System.

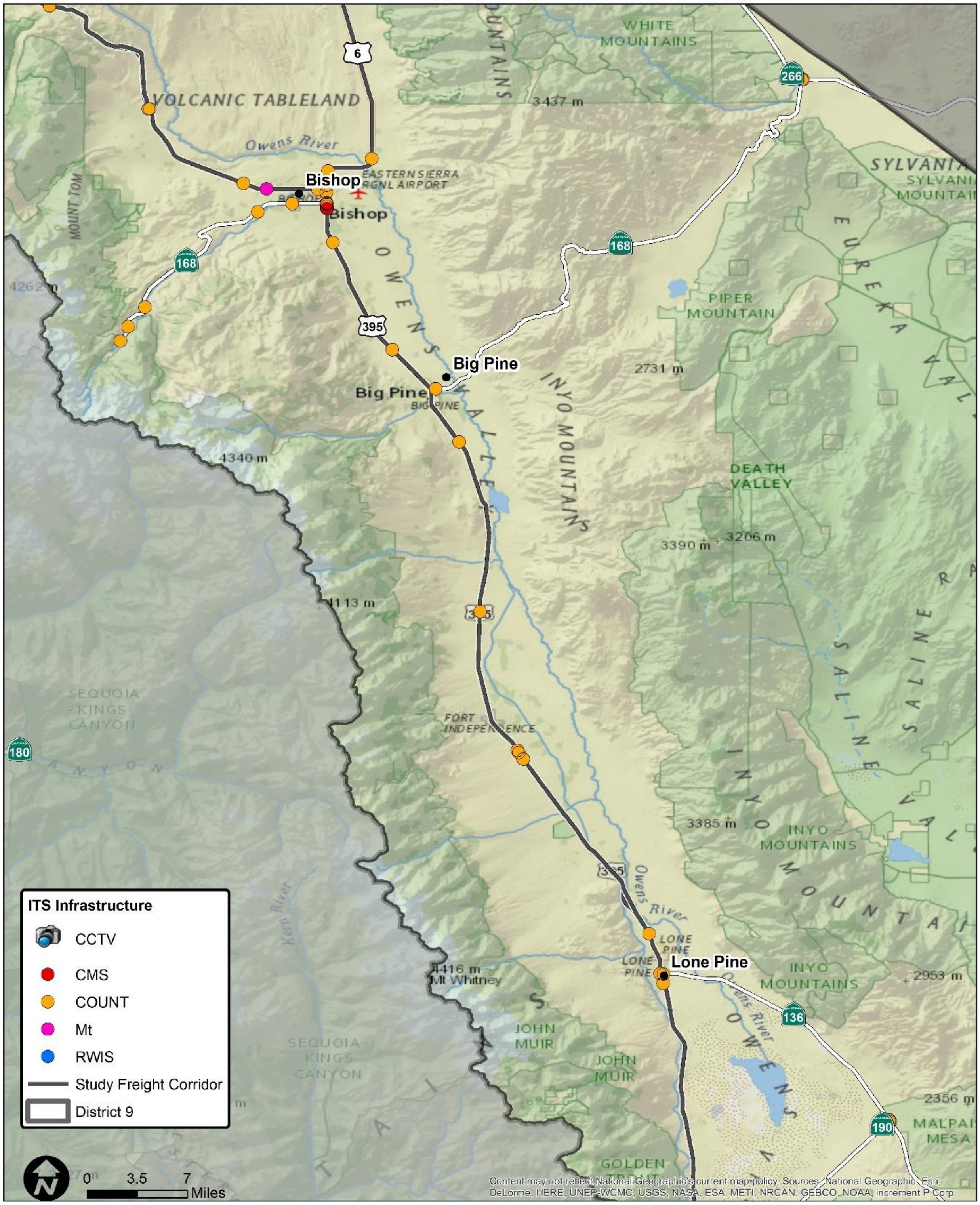
Figure A.3 Existing ITS Elements in Eastern Sierra Corridor Section 3—Mammoth Lakes to Bishop



Source: California Department of Transportation (Caltrans) District 9.

Note: CCTV = Closed Circuit Television Cameras, CMS = Changeable Message Signs, COUNT = Count Stations, Mt = Mountain Closure Message Signs, and RWIS = Road Weather Information System.

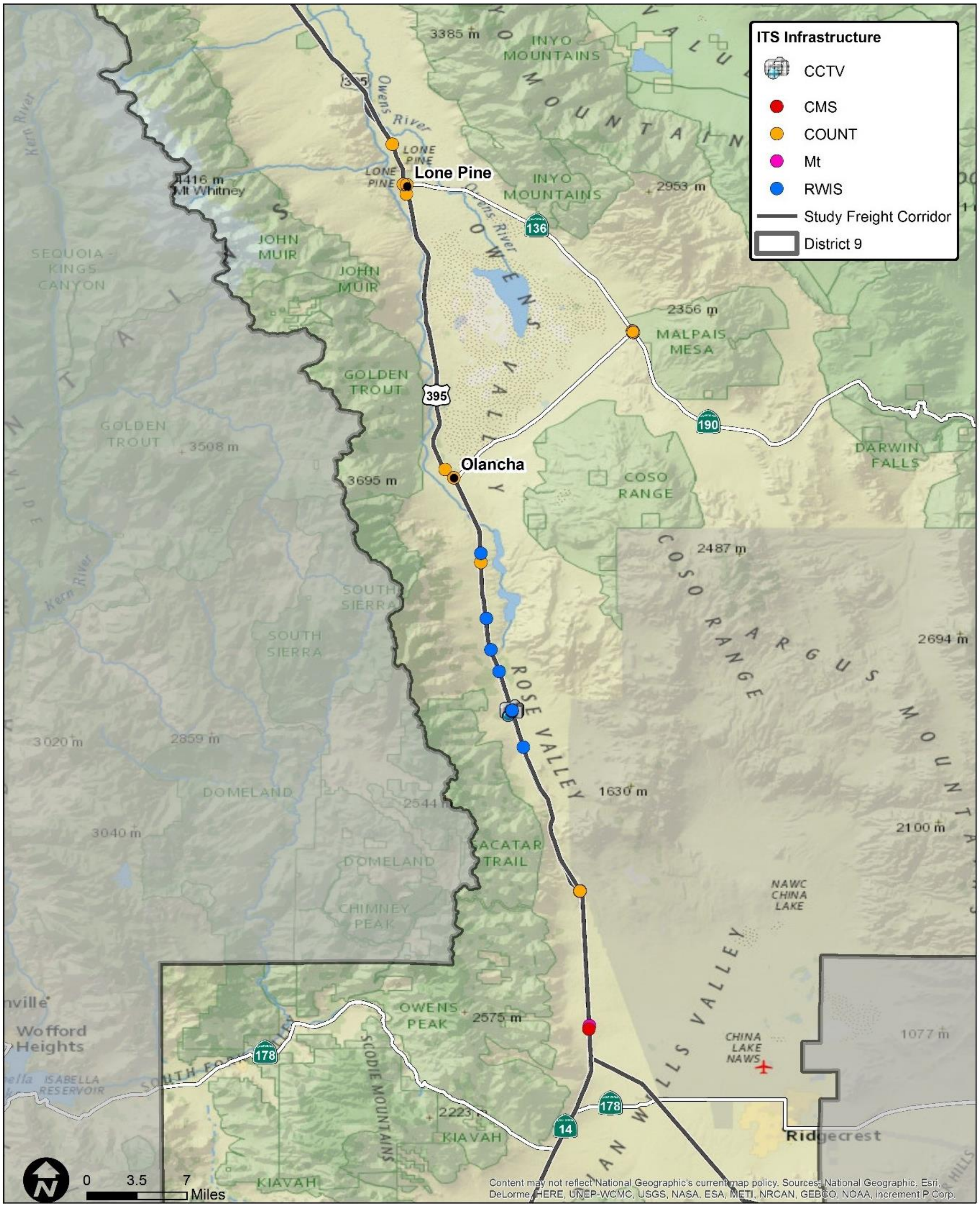
Figure A.4 Existing ITS Elements in Eastern Sierra Corridor Section 4—Bishop to Lone Pine



Source: California Department of Transportation (Caltrans) District 9.

Note: CCTV = Closed Circuit Television Cameras, CMS = Changeable Message Signs, COUNT = Count Stations, Mt = Mountain Closure Message Signs, and RWIS = Road Weather Information System.

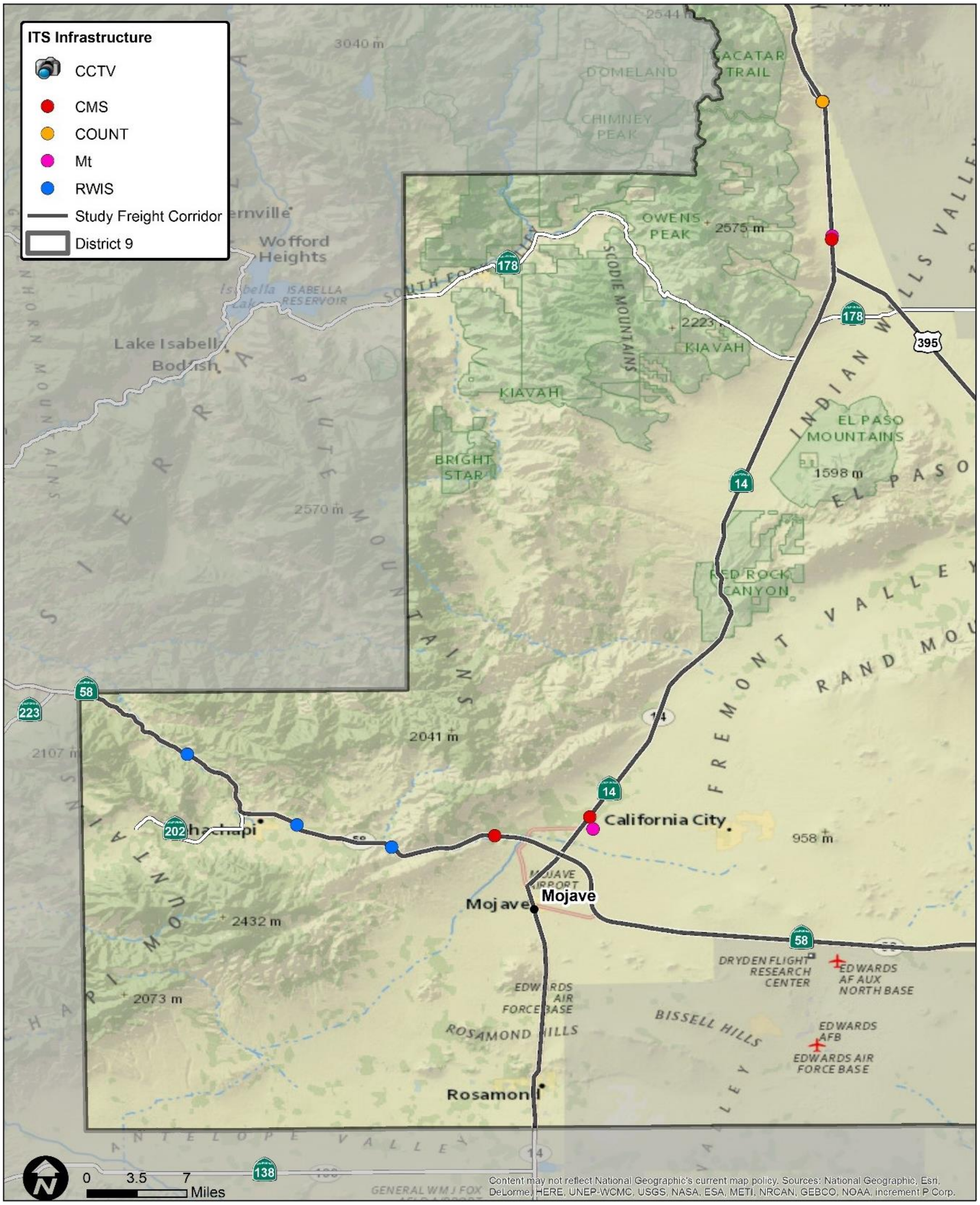
Figure A.5 Existing ITS Elements in Eastern Sierra Corridor Section 5—Lone Pine to US 395/SR 14 Junction



Source: California Department of Transportation (Caltrans) District 9.

Note: CCTV = Closed Circuit Television Cameras, CMS = Changeable Message Signs, COUNT = Count Stations, Mt = Mountain Closure Message Signs, and RWIS = Road Weather Information System.

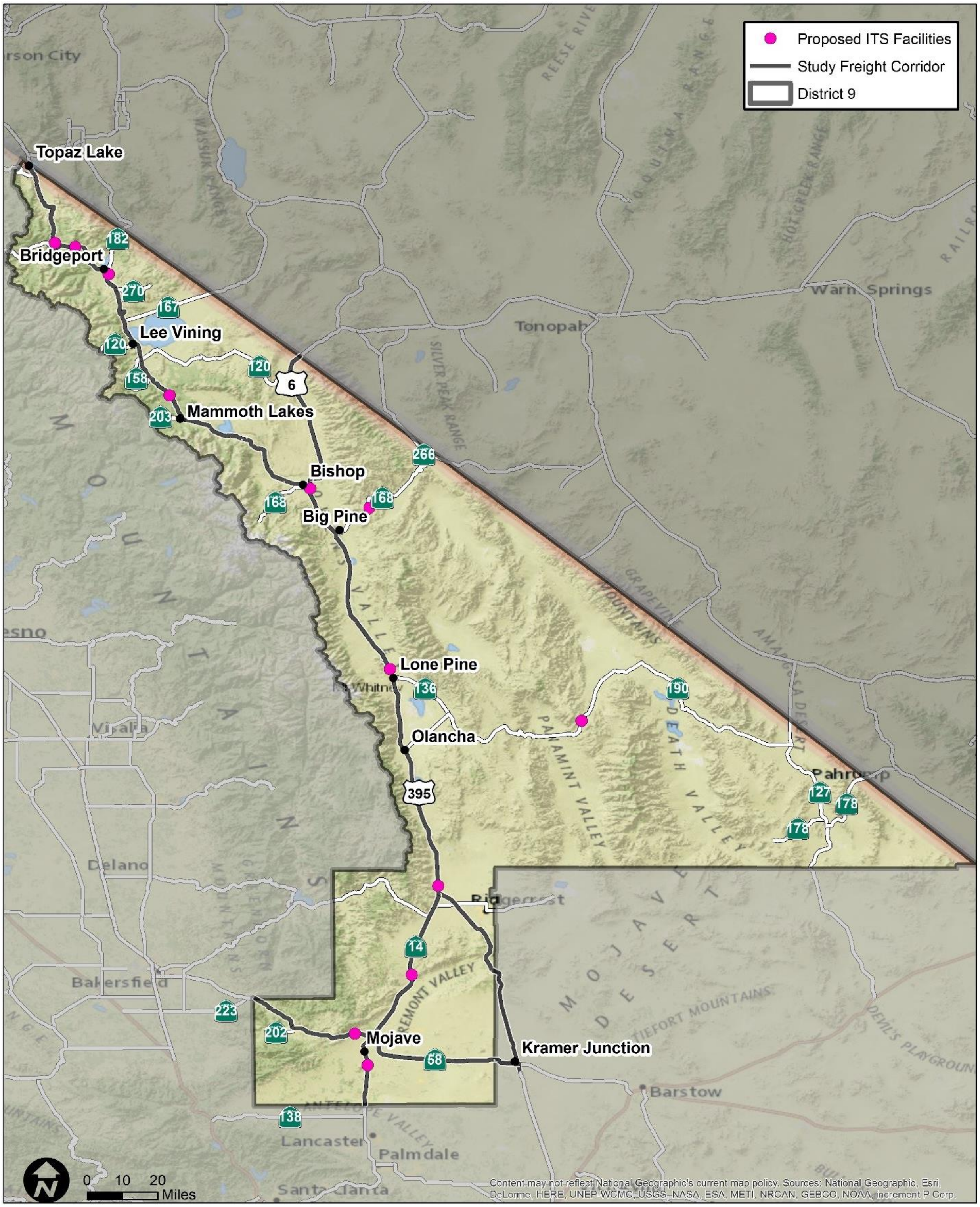
Figure A.6 Existing ITS Elements in Eastern Sierra Corridor Section 6—US 395/SR 14 Junction to Caltrans District 9 South Boundary



Source: Caltrans District 9.

Note: CCTV = Closed Circuit Television Cameras, CMS = Changeable Message Signs, COUNT = Count Stations, Mt = Mountain Closure Message Signs, and RWIS = Road Weather Information System.

Figure A.7 Proposed ITS Elements in Eastern Sierra Corridor



Source: Caltrans District 9.

Note: Proposed facilities include six CMS locations and six RWIS locations.

APPENDIX B

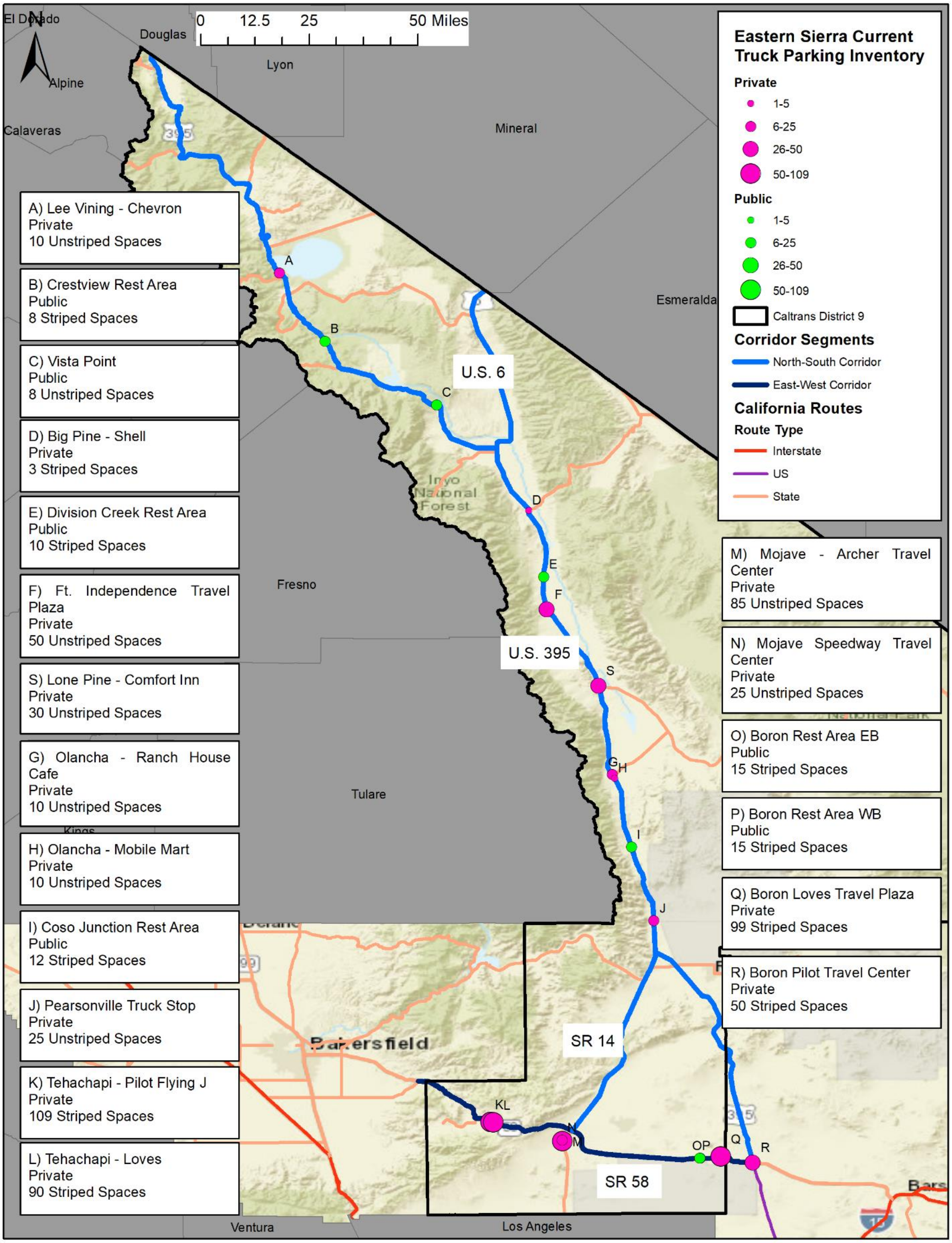
Truck Parking Inventory Data

The following pages contain profiles for designated parking locations in the North-South Corridor (traveling from north to south) and the East-West Corridor (traveling west to east).

Note that all aerial map images are taken from Google Maps, all photographs are property of Cambridge Systematics, Inc. The Bishop—Shell location is included below but not in Figure B.1. This was identified in the Jason’s Law survey but Google Maps shows possible unstriped truck parking spaces. For purposes of the inventory and analysis, this site is counted as having 0 spaces available.

The final section provides the inputs and calculations used to determine truck parking demand using the FHWA methodology.

Figure B.1 Eastern Sierra Truck Parking Inventory



Source: Caltrans, FHWA, TruckerPath, Allstays.com, Truckstopandservices.com.

B.1 North-South Corridor

The North-South Corridor, consisting of US 395 from SR 58 to the Nevada border, SR 14 from SR 58 to US 395, and US 6 from US 395 to Nevada contains 16 parking locations. As described above, truck parking supply on SR 58 between SR 14 and US 395 is included as these locations are easily accessible to trucks on the North-South Corridor. Table B.1 provides a breakdown of parking supply.

Table B.1 North-South Corridor Designated Truck Parking Supply

Locations (Spaces)	Striped	Unstriped	Total
Public	5 (60)	1 (8)	6 (68)
Private	2 (53)	8 (309)	10 (362)
Total	7 (113)	9 (317)	**16 (430)**

B) Crestview Rest Area

- Key Information
  - Latitude: 37.731175
  - Longitude: -118.969272
  - County: Mono
  - Public/Private: Public
  - Striped Truck Spaces: 8
  - Unstriped Space: None
  - Amenities: Restroom, vending machines.
- Notes: Open 24/7, 8 hours/day parking limit

C) Sherwin Grade Vista Point

- Key Information
  - Latitude: 37.518843
  - Longitude: -118.596239
  - County: Mono
  - Public/Private: Public
  - Striped Truck Spaces: None
  - Unstriped Spaces: 8
  - Amenities:
- Notes: NB and SB separate locations

D) Big Pine - Shell

- Key Information
  - Latitude: 37.166431
  - Longitude: -118.289803
  - County: Inyo
  - Public/Private: Private
  - Striped Truck Spaces: 3
  - Unstriped Spaces: 0
  - Amenities: Diesel, Scales, Fuelman, ATM

E) Division Creek Rest Area

- Key Information
  - Latitude: 36.945371
  - Longitude: -118.238913
  - County: Inyo
  - Public/Private: Public
  - Striped Truck Spaces: 10
  - Unstriped Spaces: Limited on west side of parking area
  - Amenities: Restroom, vending machines.
- Notes: Open 24/7, 8 hours/day parking limit

F) Ft. Independence Travel Plaza

- Key Information
  - Latitude: 36.835971
  - Longitude: -118.229565
  - County: Inyo
  - Public/Private: Private
  - Striped Truck Spaces: 0
  - Unstriped Spaces: 15
  - Amenities: Gas (possibly diesel), WiFi, ATM, Tire care

S) Lone Pine – Comfort Inn

Key Information

- Latitude: 36.582454
- Longitude: -118.057039
- County: Inyo
- Public/Private: Private
- Striped Truck Spaces: 0
- Unstriped Spaces: 30
- Amenities:

G) Olancha – Ranch House Cafe

Key Information

- Latitude: 36.286477
- Longitude: -118.010784
- County: Inyo
- Public/Private: Private
- Striped Truck Spaces: 0
- Unstriped Spaces: 10
- Amenities:

H) Olancha – Mobil Mart

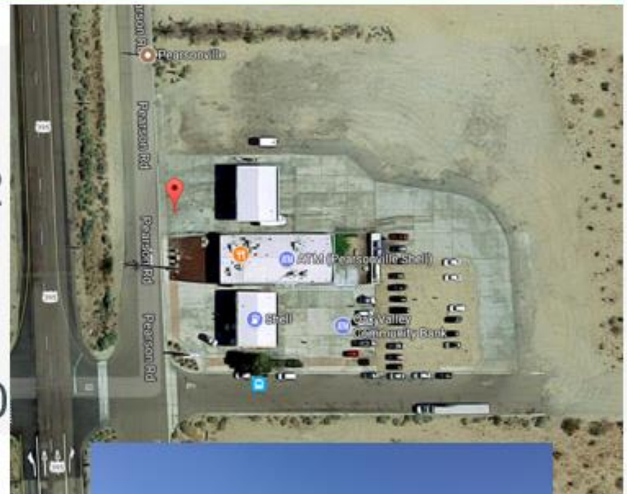
- Key Information
  - Latitude: 36.274075
  - Longitude: -118.002547
  - County: Inyo
  - Public/Private: Private
  - Striped Truck Spaces: 0
  - Unstriped Spaces: 5
  - Amenities: Gas, ATM
- Notes: Possible additional informal parking spaces in dirt area

I) Coso Junction Rest Area

- Key Information
  - Latitude: 36.044800
  - Longitude: -117.946306
  - County: Inyo
  - Public/Private: Public
  - Striped Truck Spaces: 12
  - Unstriped Spaces: 0
  - Amenities: Restroom, vending machines. Store, fuel, and informal parking at Coso Junction Ranch Store/Chevron nearby
- Notes: Open 24/7, 8 hours/day parking limit

J) Pearsonville Truck Stop

- Key Information
  - Latitude: 35.798813
  - Longitude: -117.872192
  - County: Inyo
  - Public/Private: Private
  - Striped Truck Spaces: 0
  - Unstriped Spaces: 25
  - Amenities: Diesel, WiFi, Scales, Shower (5), Tire care, ATM, TRANSFLO Express

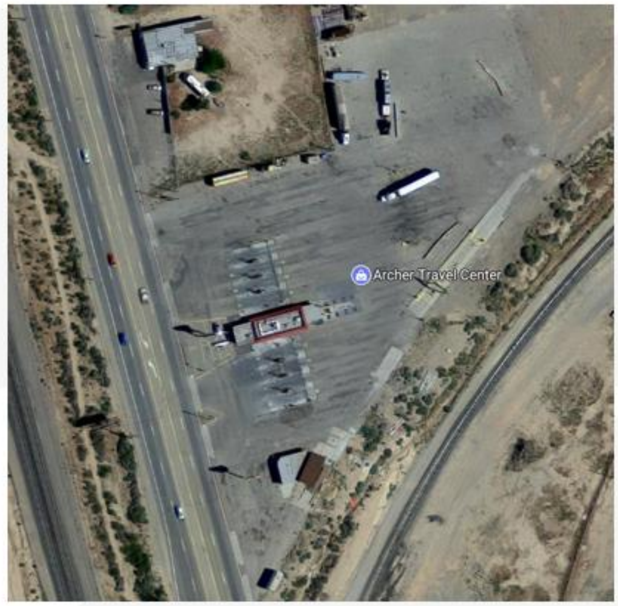


Bishop – Shell Car Wash

- Key Information
  - Latitude: 37.357563
  - Longitude: -118.395103
  - County: Inyo
  - Public/Private: Private
  - Striped Truck Spaces: 0
  - Unstriped Spaces: 0
  - Amenities: Diesel
- Notes: Jason's Law lists 0 parking spaces, but scan on Google Maps shows possible unstripped spaces in rear of facility

M) Mojave – Archer Travel Center

- Key Information
  - Latitude: 35.063362
  - Longitude: -118.177109
  - County: Kern
  - Public/Private: Private
  - Striped Truck Spaces: 0
  - Unstriped Space: 85
  - Amenities: Diesel, WiFi, Restroom, Scales, Showers (4), Bulk DEF(lines), TRANSFLO Express, Tire care, ATM



N) Mojave – Speedway Travel Center

- Key Information
  - Latitude: 35.06699
  - Longitude: -118.177696
  - County: Kern
  - Public/Private: Private
  - Striped Truck Spaces: 0
  - Unstriped Space: 25
  - Amenities: Diesel, WiFi, Restroom, Scales, Showers (3), Bulk DEF(lines), TRANSFLO Express, Tire care, ATM

O) Boron Rest Area EB

- Key Information
  - Latitude: 35.00697
  - Longitude: -117.71746
  - County: Kern
  - Public/Private: Public
  - Striped Truck Spaces: 15
  - Unstriped Spaces: Along shoulder of rest area
  - Amenities: Restroom, vending machines.
- Notes: Open 24/7, 8 hours/day parking limit

P) Boron Rest Area WB

- Key Information
  - Latitude: 35.006653
  - Longitude: -117.718642
  - County: Kern
  - Public/Private: Public
  - Striped Truck Spaces: 15
  - Unstriped Spaces: Along shoulder of rest area
  - Amenities: Restroom, vending machines.
- Notes: Open 24/7, 8 hours/day parking limit

Q) Boron - Pilot Travel Center

- Key Information
  - Latitude: 34.991896
  - Longitude: -117.541907
  - County: Inyo
  - Public/Private: Private
  - Striped Truck Spaces: 50
  - Unstriped Spaces: 0
  - Amenities: Diesel, WiFi, Restroom, Scales, Showers (7), Bulk DEF(lines), TRANSFLO Express, ATM

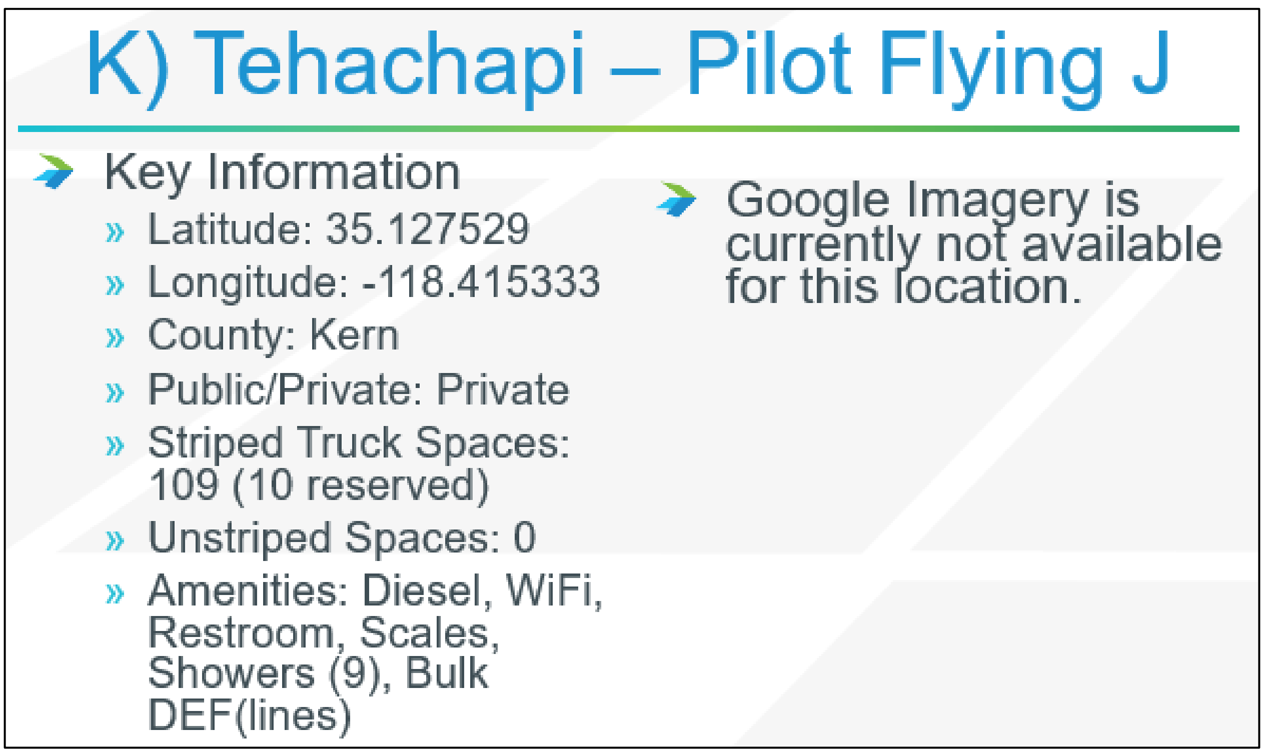
B.2 East-West Corridor

The East-West Corridor of SR 58 between SR 223 and US 395 contains 8 parking locations with a total of 488 spaces. Table B.2 provides a breakout of the parking type by ownership and striped/unstriped spaces.

Table B.2 East-West Corridor Designated Truck Parking Supply

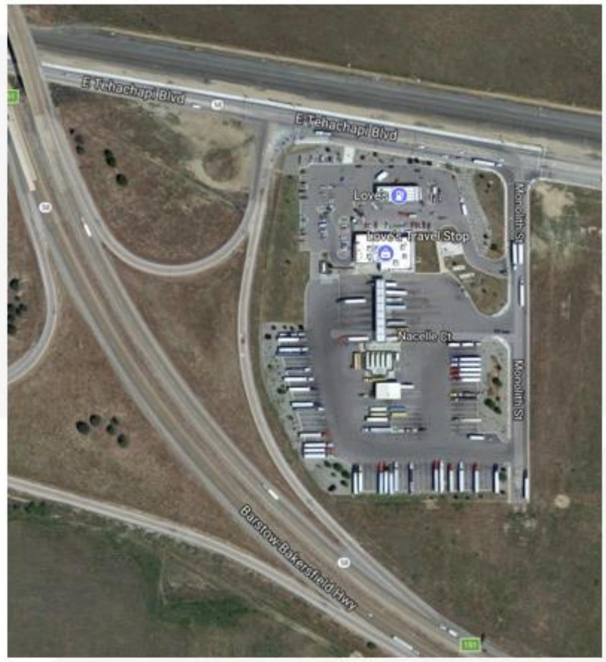
Locations (Spaces)	Striped	Unstriped	Total
Public	2 (30)	0 (0)	2 (30)
Private	4 (348)	2 (110)	6 (458)
Total	6 (378)	2 (110)	**8 (488)**

The following pages contain profiles for designated parking locations in the corridor, traveling from west to east. Note that all aerial map images are taken from Google Maps. The Boron Pilot Travel Center which is under development is not included in this inventory.



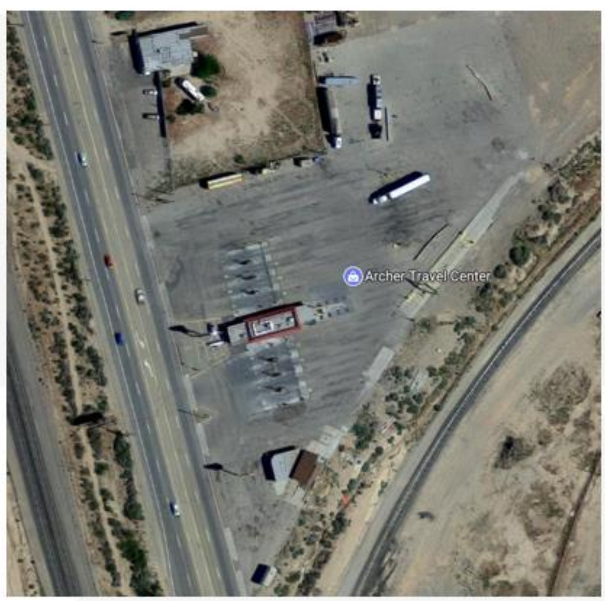
L) Tehachapi - Loves

- Key Information
  - Latitude: 35.125439
  - Longitude: -118.407333
  - County: Kern
  - Public/Private: Private
  - Striped Truck Spaces: 90
  - Unstriped Spaces: 0
  - Amenities: WiFi, Restroom, Scales, Showers (5), Bulk DEF(lines), TRANSFLO Express, Tire care, ATM



M) Mojave – Archer Travel Center

- Key Information
  - Latitude: 35.063362
  - Longitude: -118.177109
  - County: Kern
  - Public/Private: Private
  - Striped Truck Spaces: 0
  - Unstriped Space: 85
  - Amenities: Diesel, WiFi, Restroom, Scales, Showers (4), Bulk DEF(lines), TRANSFLO Express, Tire care, ATM



N) Mojave – Speedway Travel Center

- Key Information
  - Latitude: 35.06699
  - Longitude: -118.177696
  - County: Kern
  - Public/Private: Private
  - Striped Truck Spaces: 0
  - Unstriped Space: 25
  - Amenities: Diesel, WiFi, Restroom, Scales, Showers (3), Bulk DEF(lines), TRANSFLO Express, Tire care, ATM

O) Boron Rest Area EB

- Key Information
  - Latitude: 35.00697
  - Longitude: -117.71746
  - County: Kern
  - Public/Private: Public
  - Striped Truck Spaces: 15
  - Unstriped Spaces: Along shoulder of rest area
  - Amenities: Restroom, vending machines.
- Notes: Open 24/7, 8 hours/day parking limit

P) Boron Rest Area WB

- Key Information
  - Latitude: 35.006653
  - Longitude: -117.718642
  - County: Kern
  - Public/Private: Public
  - Striped Truck Spaces: 15
  - Unstriped Spaces: Along shoulder of rest area
  - Amenities: Restroom, vending machines.
- Notes: Open 24/7, 8 hours/day parking limit

B.3 FHWA Methodology Truck Parking Demand Inputs and Calculations

The model used to calculate truck parking demand requires 5 key user inputs. These inputs were all included in the original FHWA study:

- Truck AADT (AADTT).[116]
- Corridor Length (L).
- Corridor Speed Limit or Average Speed (S).
- Percent of Trucks making short-haul trips (SH).
- Percent of Trucks making long-haul trips (LH).

The core equation for estimating truck parking demand (D) is shown below.

$$D = THT\ X\ Pavg \qquad (1)$$

Truck Hours Traveled (THT) is calculated based on:

$$THT = CAADT\ X\ (L/S) \qquad (2)$$

[116] The FHWA study also included a 15% “buffer” to account for variances in AADTT. The Pennsylvania STAC and Virginia DOT studies did not include this calculation. This analysis includes that buffer to help account for daily and seasonal variances in the data.

At its most basic level, the more time trucks require to transit a corridor (L/S) and the more trucks in the corridor (AADTT), the higher the probability that they will need to stop at some point during that trip.

The average parking duration (P_{avg}) was expanded in the original FHWA study to include a number of additional parameters including:

- Hours of Service limitations (updated by the Pennsylvania STAC and Virginia DOT studies).
- Variation in truck parking characteristics for long-haul (LH) and short-haul (SH) trips. SH trips can be made within a single day under hours-of-service regulations in place in 2002.
- Ratio of SH trips to LH trips. Parking duration is used as a surrogate. Based on observations and estimates of the percent of trucks that are parked for less than three hours (SH) versus those parked for more than three hours (LH), the original FHWA study used a 36% SH to 64% LH split for urban segments (defined as within 200 miles of a city with a population of 200,000 or more) and a 7% SH to 93% LH split for rural segments. The Pennsylvania STAC model used a 79% SH to 21% LH split while Virginia DOT used a 65% SH to 35% LH split. This study uses the FHWA methodology with a 36% SH to 64% LH split.
- Time required for loading/unloading, staging, and other activities that occur while the driver is "on-duty" but off the roadway network.
- Demand for parking at public versus private rest areas.
- Peak parking factors for long-haul and short-haul trucks. This determines the percent of daily parking demand that occurs during peak hours. Pennsylvania STAC and Virginia DOT both used 3 A.M to 4 A.M. as the peak parking hour.

These parameters are further discussed in the sections below.

B.3.1 Short-Term Parking Demand

To calculate short-term parking demand, the following steps were used for each corridor:

1. **Calculate average 5-axle AADTT**. Caltrans produced 2015 truck counts for each of the segments in the study area with separate totals available by number of axles. Many of the count locations registered a large number of 2-axle trucks. These vehicles are most likely service vehicles or local delivery vehicles which are unlikely to generate significant demand for truck parking. In addition, large 5-axle (or more) vehicles require more space and are a larger safety concern in the region according to stakeholders. For this reason, this study uses the average 5+ axle truck count as the AADTT.

   To calculate the average for the entire corridor, total 5+ axle truck volumes in three segments were generated: 1) North: US 395 north of Bishop and US 6 (sum of truck counts), 2) Middle: US 395 from Inyokern to Bishop, and 3) South: US 395 from SR 58 to Inyokern and SR 14 (sum of truck counts).

2. **Calculate buffer AADTT**. The average AADTT value was multiplied by a 15% "buffer" to account for variances in the average daily truck traffic. This approach was used in the original FHWA study but not in the Pennsylvania STAC and Virginia DOT studies. This analysis includes the buffer to help account for daily and seasonal variances in the corridor.

For the short-haul calculation, the total daily truck volume is used instead of the short-haul percent because both short-haul and long-haul trucks can stop for short periods of time (bathroom, fuel, etc.).

3. **Calculate segment length (L)**. This was taken from Google Maps.

4. **Calculate segment speed (S)**. A speed of 50 mph was used for each segment. This is slightly slower than the average speed for cars through the corridor (calculated using Google Maps).

   Using equation 2, multiplying the buffer AADTT by the corridor length divided by corridor speed produces a truck-hours-traveled for the corridor.

5. **Calculate truck hours parked**. Using a truck parking/operating ratio of 5 minutes parked to 55 minutes of travel per hour, taken from the original FHWA study, the truck-hours-traveled is multiplied by 0.083.

6. **Calculate daily short-term truck stops**. All three studies used a value of 0.367 hours (22 minutes per hour) for the median short-term parking duration. This means that a driver would theoretically make a short-term parking stop once every 4 hours for 22 minutes. The total truck hours parked is multiplied by 0.367.

7. **Calculate peak parking demand (short-haul)**. The utilization rate for trucks parked for less than 3 hours during the peak period of parking demand (between 3 A.M. and 4 A.M.) was estimated as 2.11% in the Pennsylvania STAC model. This value was used in the Virginia DOT model as well. Multiplying the daily truck stops by this value produces a peak parking demand for short-haul trips.

B.3.2 Long-Term Parking Demand

To calculate long-term parking demand, the following steps were used for each segment:

1. **Calculate long-haul trip 5-axle AADTT**. To calculate the average for the entire corridor, total 5+ axle truck volumes in three segments were generated: 1) North: US 395 north of Bishop and US 6 (sum of truck counts), 2) Middle: US 395 from Inyokern to Bishop, and 3) South: US 395 from SR 58 to Inyokern and SR 14 (sum of truck counts). However, only some trips in the corridor will require trucks to stop for long periods of rest. The average 5-axle AADTT was multiplied by the percent of trucks making long-haul trips (LH). For this model, a value of 64% was used consistent with the FHWA model.

2. **Calculate buffer AADTT**. The AADTT provided in step 1 was then multiplied by a 15% “buffer” to account for variances in the average daily truck traffic. This approach was used in the original FHWA study but not in the Pennsylvania STAC and Virginia DOT studies. This analysis includes the buffer to help account for daily and seasonal variances in the corridor.

3. **Calculate segment length (L)**. This was taken from Google Maps.

4. **Calculate segment speed (S)**. A speed of 50 mph was used for each segment. This is slightly slower than the average speed for cars through the corridor (calculated using Google Maps).

Using equation 2, multiplying the buffer AADTT by the corridor length divided by corridor speed produces a truck-hours-traveled for each segment.

To derive long-term parking activity, a number of additional factors were considered. All three studies use a similar approach, though the Pennsylvania STAC and Virginia DOT approaches are updated to account for changes in FMCSA HOS restrictions since the 2002 FHWA study. Table B.3 is taken from the Pennsylvania STAC model.

Table B.3 Long-Haul Truck Parking Demand—HOS Related Variables

Variable	Description	Derivation/Source
F_D	Driving hours permitted in a daily on-duty window	11 out of 14, or 0.786 (FMCSA Regulations)
OD_8	Maximum *on-duty* hours permitted 8 over consecutive days	70 (FMCSA)
DR_8	Maximum *driving hours* permitted over 8 consecutive days	55 (OD_8 X F_D)
H_T	Total hours in 8-day period	192 (24 X 8)
H_H	Avg. hours at home (off-duty and away from truck) for long-haul truckers in 8-day period	42 (2002 FHWA Study)
H_R	Average hours with truck (on-duty or off-duty) for long-haul truckers in 8-day period	150 (H_T – H_H)
D%	Fraction of time on the road (on-duty and driving) for long-haul truckers in 8-day period	0.367 (DR_8 / $H_{R(}$
P%	Fraction of time long-haul truckers must be off-duty and/or parked under FMCSA regulations	0.633 (1 – D%)
P	**Parking Ratio (hours parked for FMCSA regulations for every hour driving)**	**1.725 (P% / D%)**

Source: Pennsylvania STAC *Truck Parking in Pennsylvania*.

1. **Calculate truck hours parked**. This is found by multiplying the truck hours traveled by the parking ratio.

2. **Calculate daily long-term parking stops**. All three studies adopted a median long-term parking value of 435 minutes or 7.25 hours. This represents the estimated typical parking duration for trucks that park for extended periods of time to meet FCMSA requirements. The value is calculated by multiplying the truck hours parked by 7.25 hours.

3. **Calculate the peak parking demand (long-haul)**. Similar to the peak parking demand (short-haul), the daily parking stops is multiplied by a utilization rate for trucks parked for more than 3 hours during the peak period of parking demand (between 3 A.M. and 4 A.M.). A value of 45.33% was used in Pennsylvania STAC and Virginia DOT models. Multiplying the Daily Truck Stops by this value produces a peak parking demand for long-haul trips.

Finally, to calculate total truck parking demand, the peak parking demand for short-haul and long-haul trips are summed.

One final note is that the FHWA methodology included a differentiation between public and private parking facilities and the desirability of each option. Neither the Pennsylvania STAC nor the Virginia DOT models used this variable. Due to the limited parking options in these corridors and the narrow focus of the analysis, this variable was not used in the model.

B.3.3 FHWA Demand Analysis Methodology Inputs

US 395 from SR 58 to NV Border

Model Inputs

Input	Average	Source/Notes
Average Truck AADT	823	
Buffer AADTT	946.45	Used in FHWA study, not in PA or VA. 15% to account for seasonal/daily distribution
Length (L)	312	Miles, from Google Maps, SR 58 to NV border
Speed (S)	50	MPH (Estimate)
Percent Short-Haul	36%	FHWA Methodology
Percent Long-Haul	64%	FHWA Methodology
Daily Short-Haul Trips	340.722	
Daily Long-Haul Trips	605.728	

Short-Term Parking Assumptions

P(avg)	0.083	5 min parked to 55 min of travel per hour (VA Study) average parking duration per hour of travel
Ave Parking Duration	0.367	hr/stop (VA Study). EG. Typical truck operator stops for 22 minutes when taking a short-term break
Peak Overall Parking Activity	3-4 AM	Peak Parking Period (VA Study)
% Trucks Parked during Peak Period	2.11%	% Trucks parked less than 3 hours are in the facility during the peak parking period (VA study)

Short-Term Parking Formulas

Truck Hours Traveled	5,905.848	AADTT (with buffer)*L/S
Truck Hours Parked	490.185	AADTT (with buffer)*L/S*P(avg)
Daily Truck Stops	1,335.655	Hours parked/Ave parking duration
Peak Parking Demand	28.182	Daily Truck Stops*% Trucks parked during peak period

Long-Term Parking Assumptions

F(d)	0.786	11/14 hours - maximum hours permitted in daily on-duty window (FMCSA)
OD(8)	70	hours - Max on-duty hours permitted over 8 consecutive days (FMCSA)
DR(8)	55	hours - Max driving hours permitted over 8 consecutive days (F(d)*OD(8))
H(**t**otal)	192	hours - Total hours in 8 consecutive days

H(**h**ome)	42	Ave hours at home (off-duty) for long-haul truckers over 8 consecutive days (from 2002 FHWA study)
H(**r**oad)	150	Ave hours with truck (on or off duty) for long haul truckers over 8 consecutive days
D%	0.367	Fraction of time on the road (on-duty and driving) for long-haul trucks over 8 consecutive days
P%	0.633	Fraction of time long-haul truckers must be off-duty and/or parked over 8 consecutive days under FMCSA regulations
P(avg)	1.725	Hours parked for FMCSA regulations for every hour of driving
Average Parking Duration	7.25	hours (435 minutes) (VA study)
Peak Overall Parking Activity	3-4 AM	Peak Parking Period (VA Study)
% Trucks Parked during Peak Period	45.35%	% Trucks parked more than 3 hours are in the facility during the peak parking period (VA study)
Long-Term Parking Formulas		
Truck Hours Traveled in Corridor	3,779.743	
Truck Hours Park	6,519.284	AADTT(with buffer)*L/S*P(avg)
Daily truck stops	899.212	Hours Parked/Ave parking duration
Peak Parking Demand	407.792	
Total Truck Parking Demand	435.975	
Parking Demand per Mile	1.397	

SR 58 from SR 223 to US 395 (2015)

Model Inputs

Input	**Average**	**Source/Notes**
Average Truck AADT	3,906	
Buffer AADTT	4,491.90	Used in FHWA study, not in PA or VA. 15% to account for seasonal/daily distribution
Length (L)	45	Miles, from Google Maps, SR 58 to NV border
Speed (S)	50	MPH (Estimate)
Percent Short-Haul	36%	FHWA Methodology and CA O/D Study
Percent Long-Haul	64%	FHWA Methodology and CA O/D Study
Daily Short-Haul Trips	1,617.084	
Daily Long-Haul Trips	2,874.816	
Short-Term Parking Assumptions		
P(avg)	0.083	5 min parked to 55 min of travel per hour (VA Study) average parking duration per hour of travel
Ave Parking Duration	0.367	hr/stop (VA Study). EG. Typical truck operator stops for 22 minutes when taking a short-term break
Peak Overall Parking Activity	3-4 AM	Peak Parking Period (VA Study)
% Trucks Parked during Peak Period	2.11%	% Trucks parked less than 3 hours are in the facility during the peak parking period (VA study)
Short-Term Parking Formulas		
Truck Hours Traveled in Corridor	4,042.71	AADTT (with buffer)*L/S
Truck Hours Parked	335.545	AADTT (with buffer)*L/S*P(avg)

Daily Truck Stops	914.291	Hours parked/Ave parking duration
Peak Parking Demand	19.2916	Daily Truck Stops*% Trucks parked during peak period
Long-Term Parking Assumptions		
F(d)	0.786	11/14 hours - maximum hours permitted in daily on-duty window (FMCSA)
OD(8)	70	hours - Max on-duty hours permitted over 8 consecutive days (FMCSA)
DR(8)	55	hours - Max driving hours permitted over 8 consecutive days (F(d)*OD(8))
H(**t**otal)	192	hours - Total hours in 8 consecutive days
H(**h**ome)	42	Ave hours at home (off-duty) for long-haul truckers over 8 consecutive days (from 2002 FHWA study)
H(**r**oad)	150	Ave hours with truck (on or off duty) for long haul truckers over 8 consecutive days
D%	0.367	Fraction of time on the road (on-duty and driving) for long-haul trucks over 8 consecutive days
P%	0.633	Fraction of time long-haul truckers must be off-duty and/or parked over 8 consecutive days under FMCSA regulations
P(avg)	1.725	Hours parked for FMCSA regulations for every hour of driving
Average Parking Duration	7.25	hours (435 minutes) (VA study)
Peak Overall Parking Activity	3-4 AM	Peak Parking Period (VA Study)
% Trucks Parked during Peak Period	45.35%	% Trucks parked more than 3 hours are in the facility during the peak parking period (VA study)
Long-Term Parking Formulas		
Truck Hours Traveled in Corridor	2,587.334	
Truck Hours Park	4,462.623	AADTT(with buffer)*L/S*P(avg)
Daily truck stops	615.534	Hours Parked/Ave parking duration
Peak Parking Demand	279.145	
Total Truck Parking Demand	**298.436**	
Parking Demand per Mile	**6.632**	

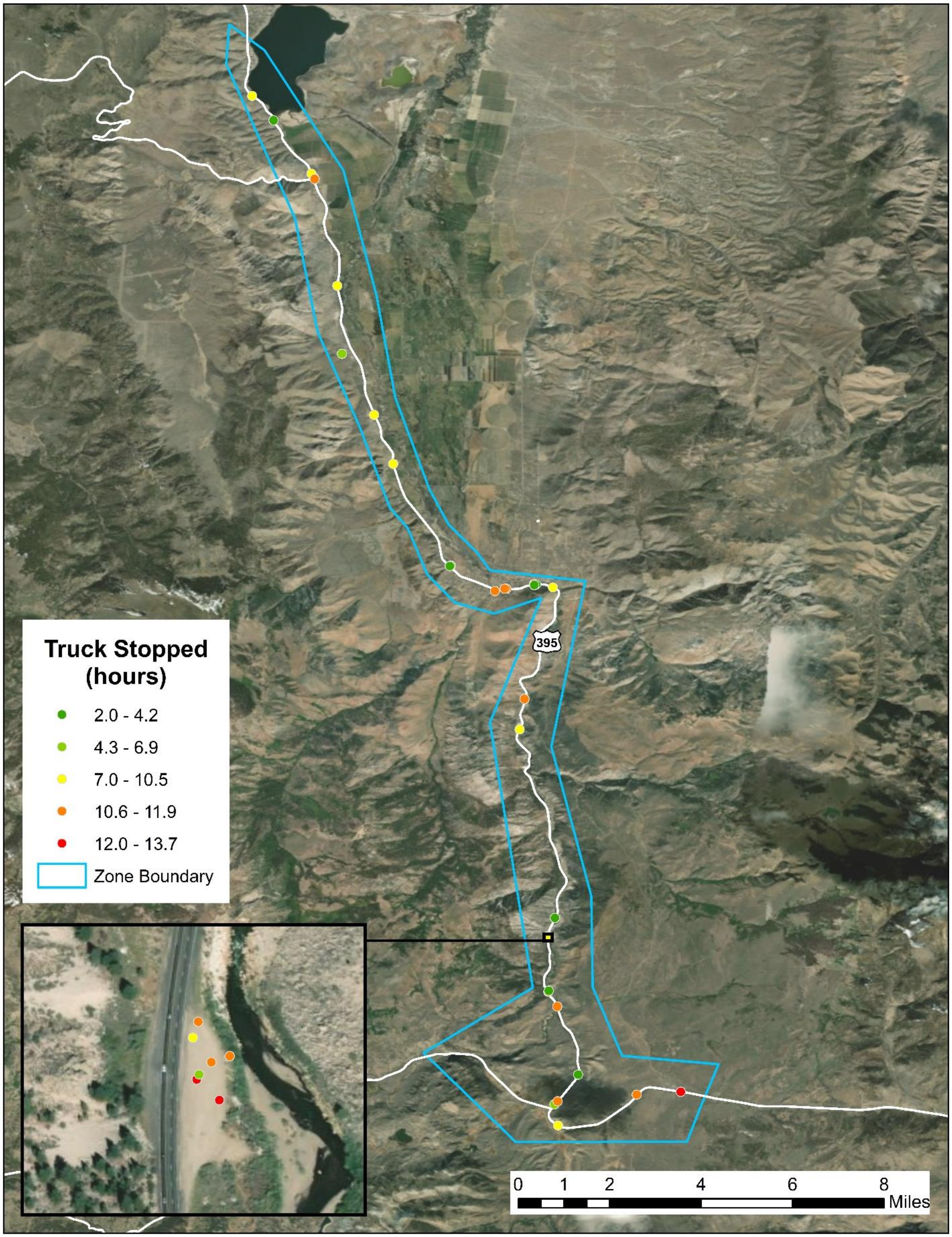
ATRI Truck Parking Zone Analysis

Eastern Sierra Corridor. For each map, trucks parked during the following four two-week periods are shown. The dates are:

- March 17 – 30, 2018.
- May 6 – 19, 2018.
- July 15 – 28, 2018.
- September 9 – 22, 2018.

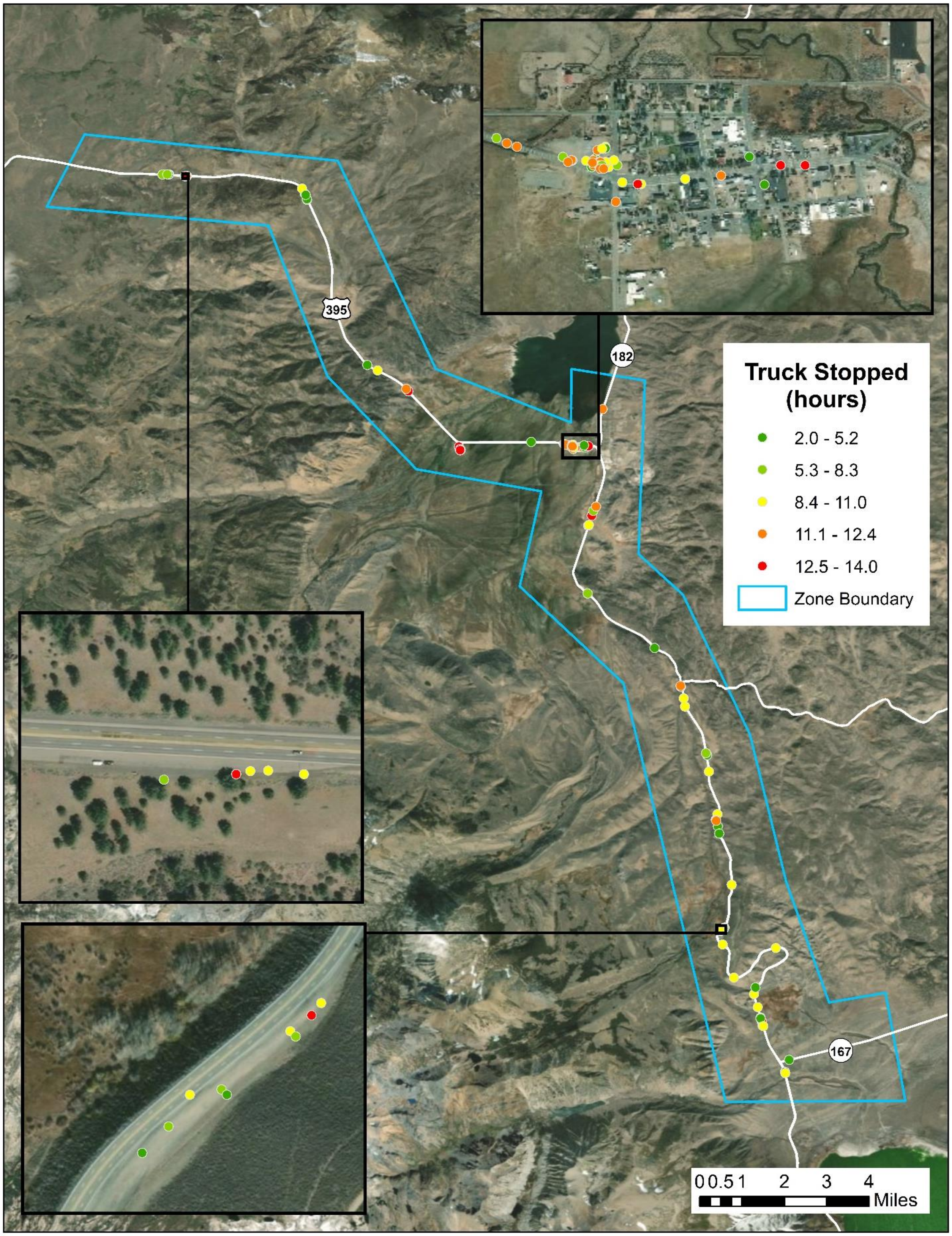
Trucks are differentiated by the length of time parked. Zones are displayed from north to south in the US 395 Corridor, followed by west to east in the SR 58 Corridor.

Figure C.1 ATRI Truck GPS Analysis—Walker Zone



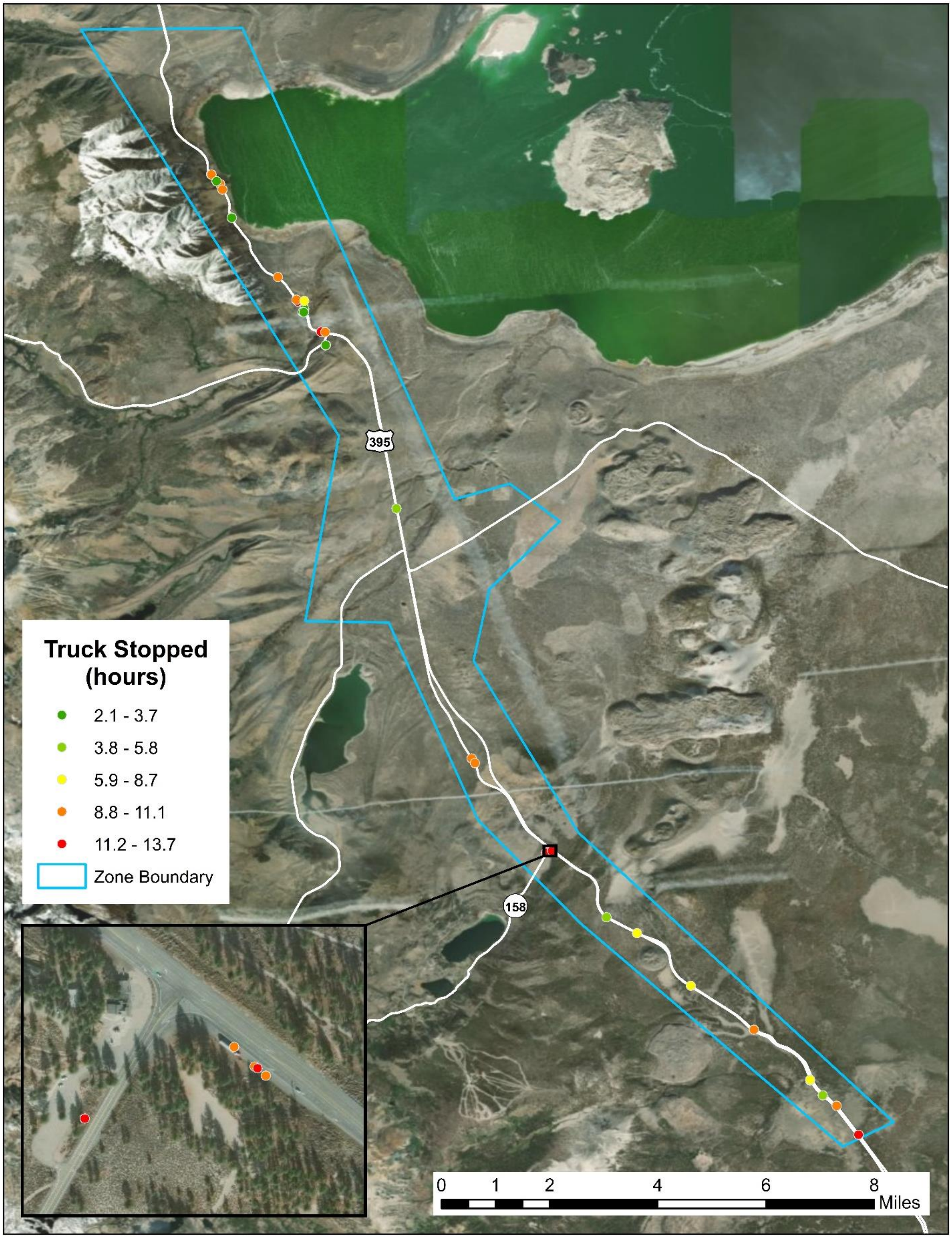
Source: Google Maps, ATRI.

Figure C.2 ATRI Truck GPS Analysis—Bridgeport Zone



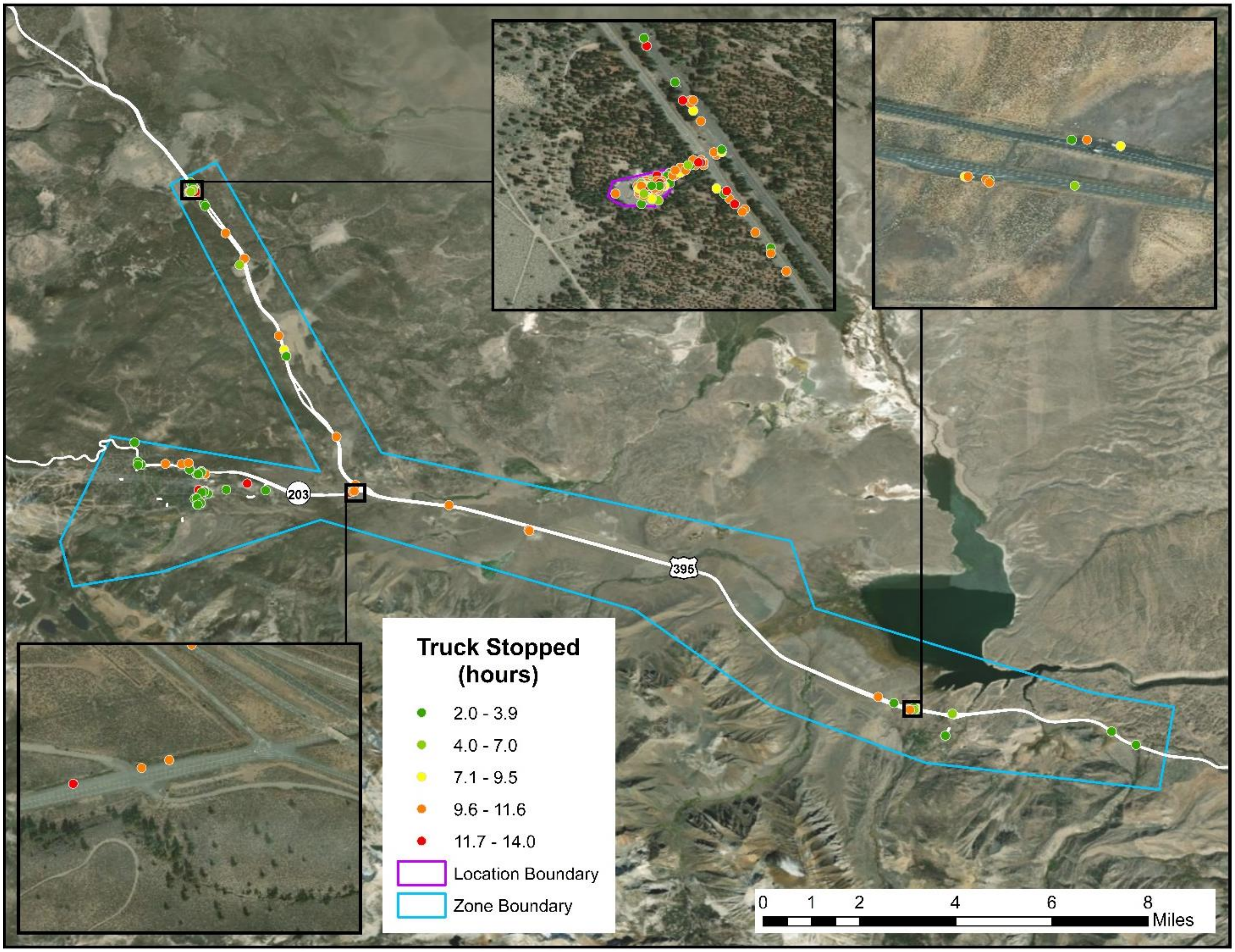
Source: Google Maps, ATRI.

Figure C.3 ATRI Truck GPS Analysis—Lee Vining Zone



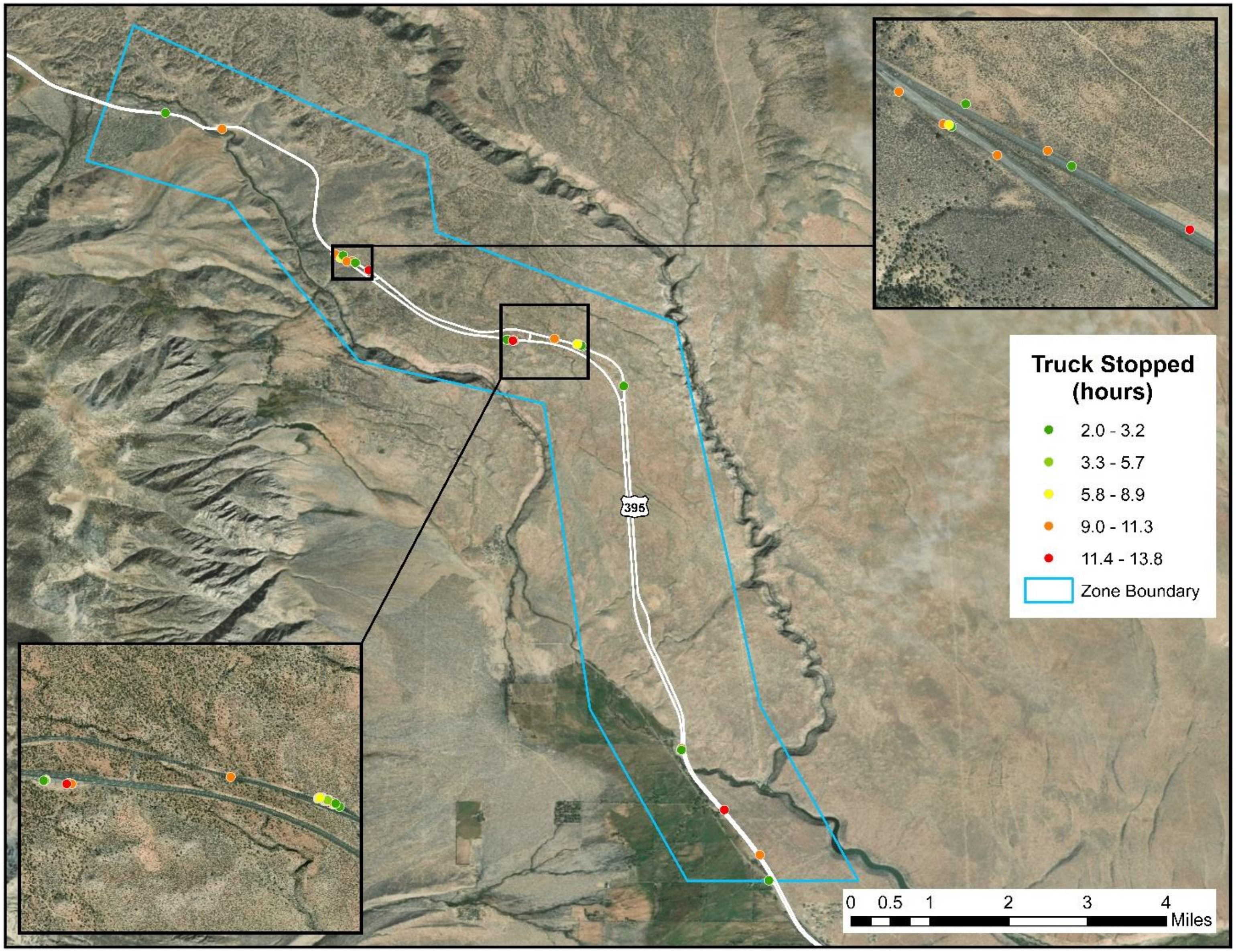
Source: Google Maps, ATRI.

Figure C.4 ATRI Truck GPS Analysis—Mammoth Zone



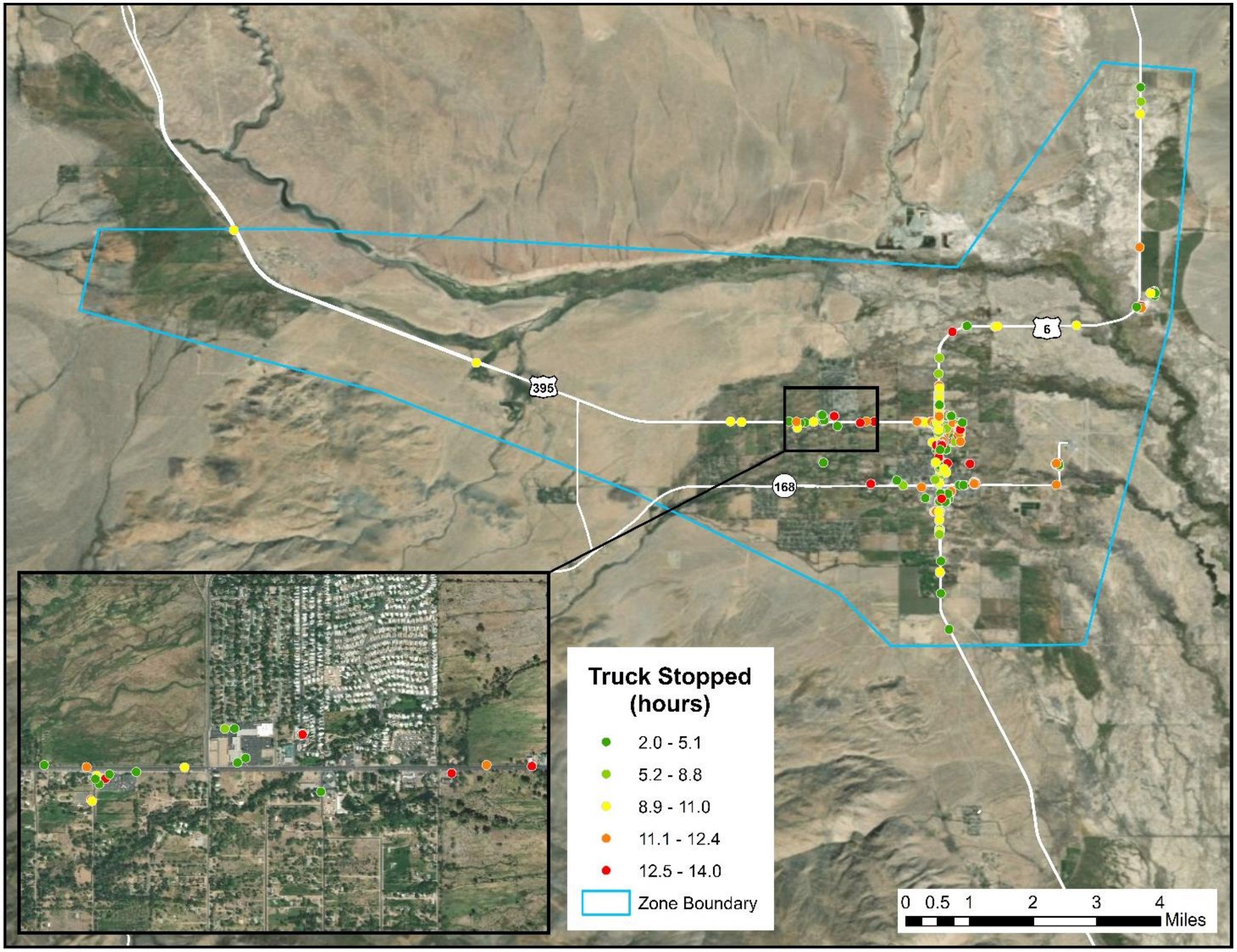
Source: Google Maps, ATRI.

Figure C.5 ATRI Truck GPS Analysis—Mam-Bish Zone



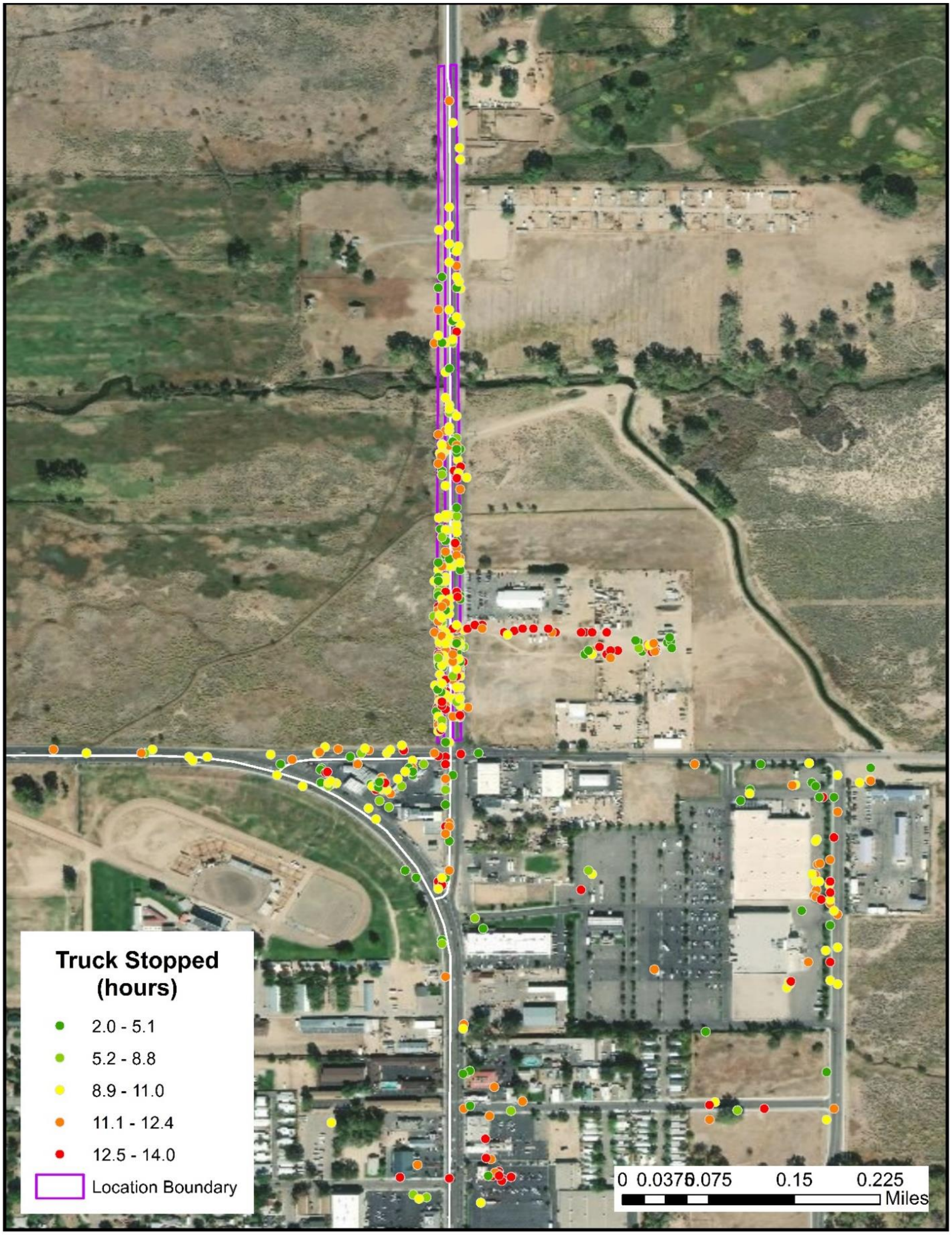
Source: Google Maps, ATRI.

Figure C.6 ATRI Truck GPS Analysis—Bishop Zone



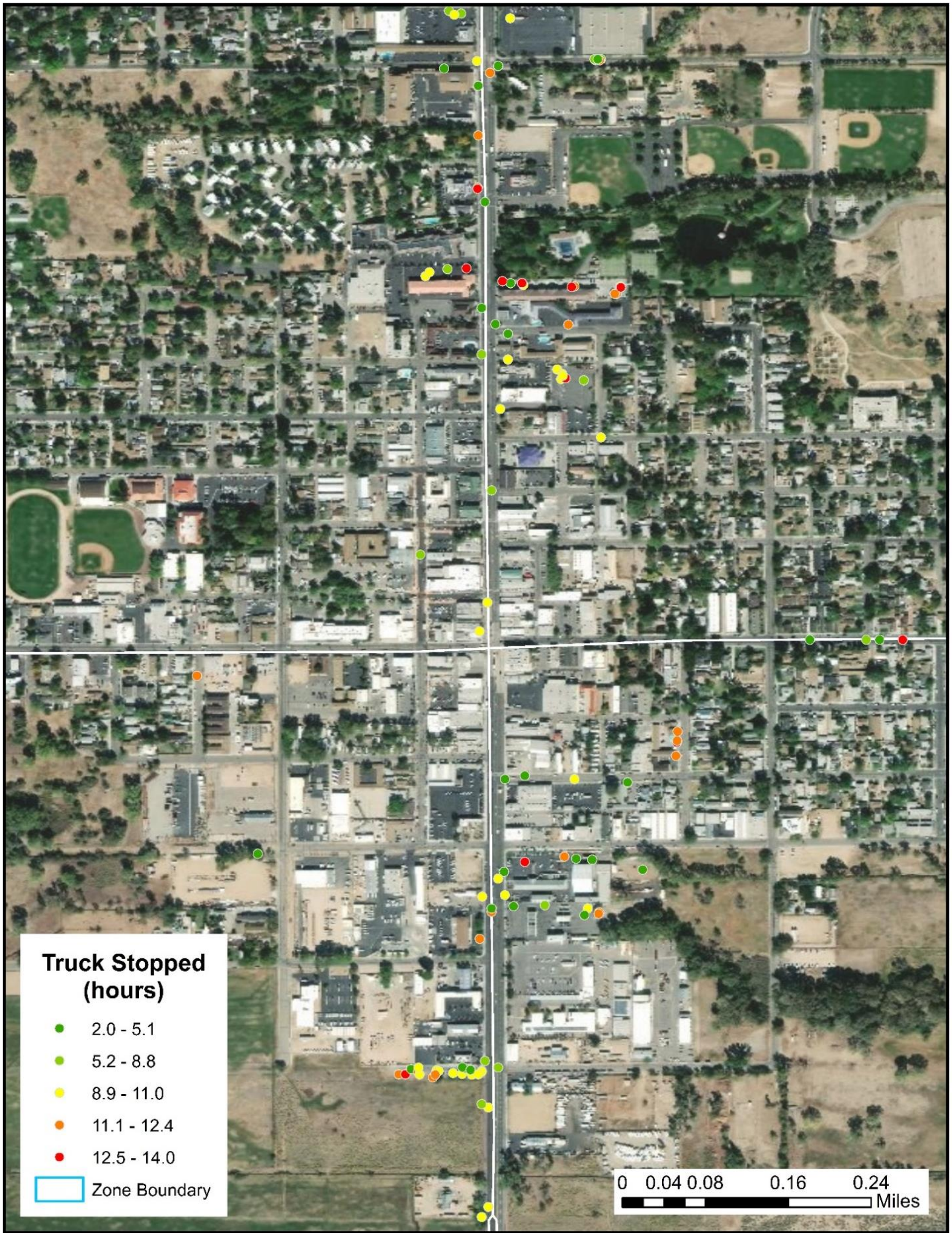
Source: Google Maps, ATRI.

Figure C.7 ATRI Truck GPS Analysis—Bishop Detail (North)



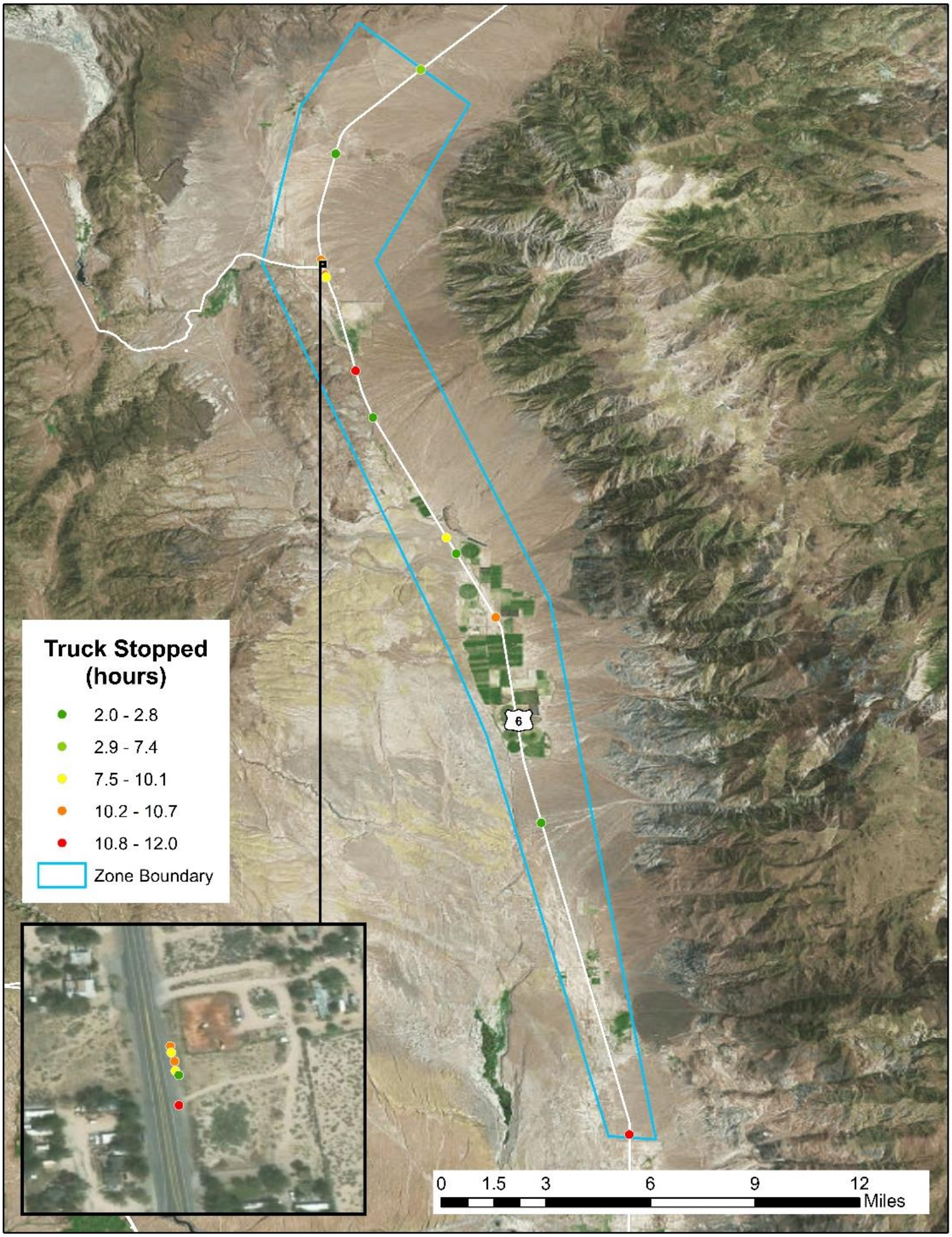
Source: Google Maps, ATRI.

Figure C.8 ATRI Truck GPS—Bishop Detail (South)



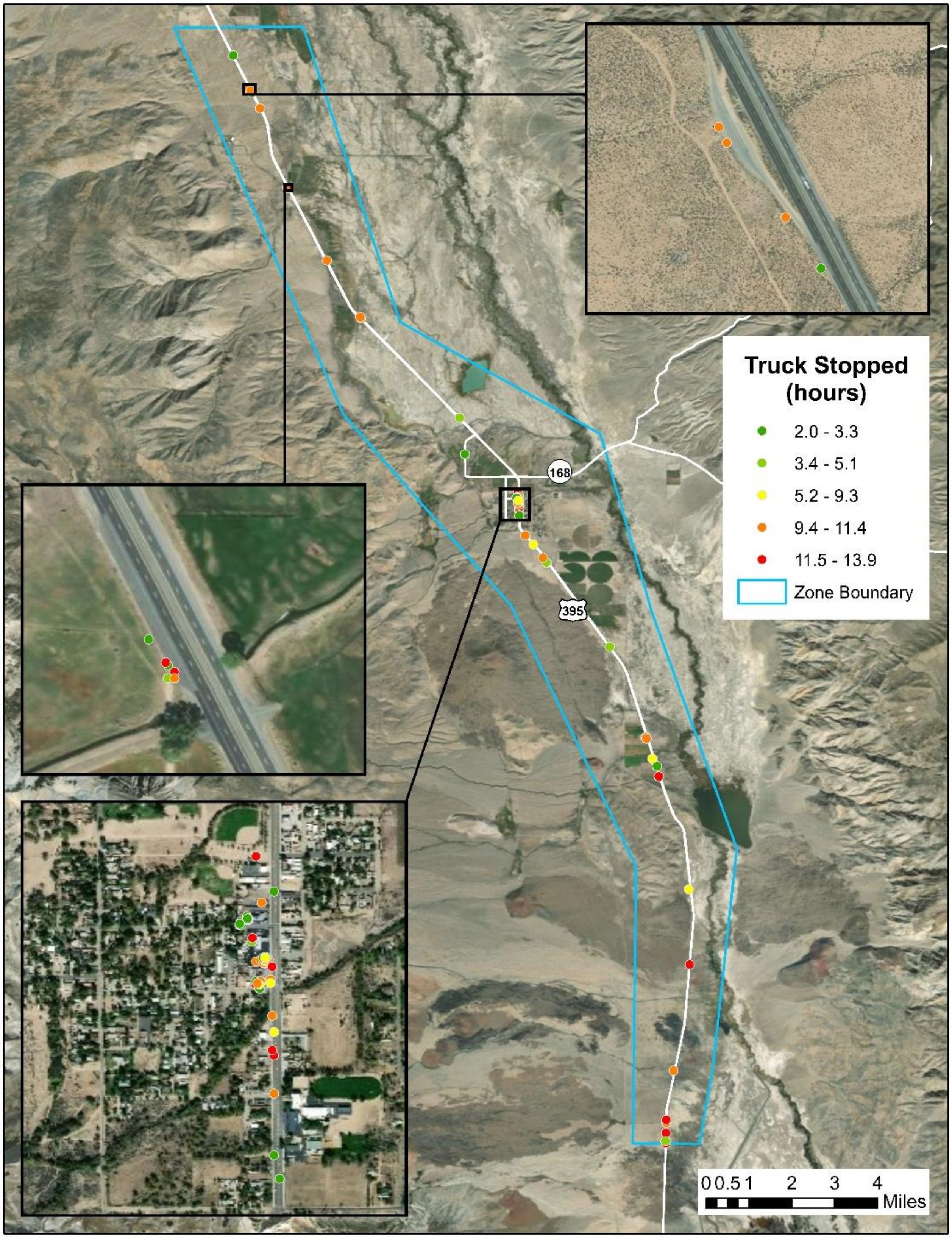
Source: Google Maps, ATRI.

Figure C.9 ATRI Truck GPS Analysis—Benton Zone



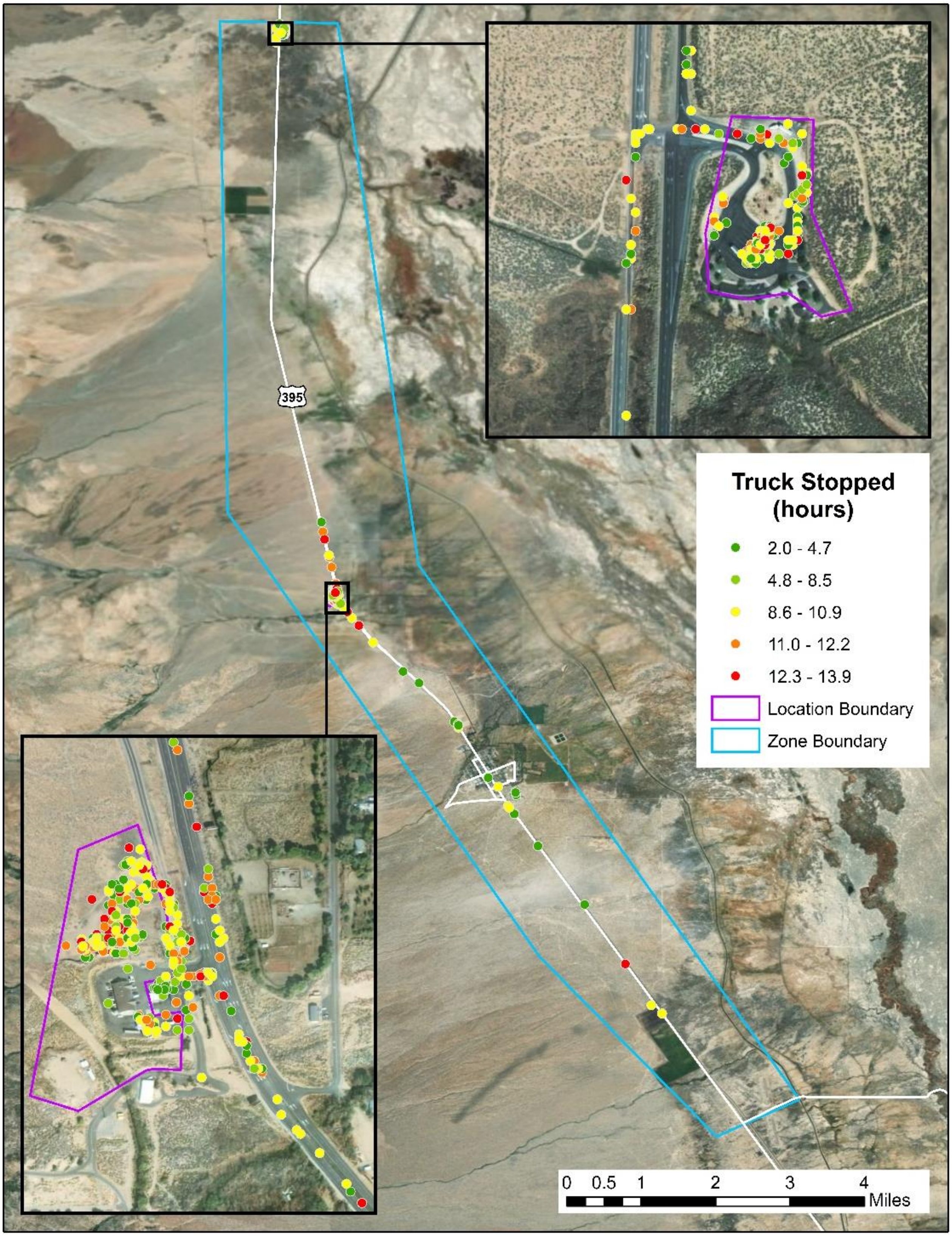
Source: Google Maps, ATRI.

Figure C.10 ATRI Truck GPS Analysis—Big Pine Zone



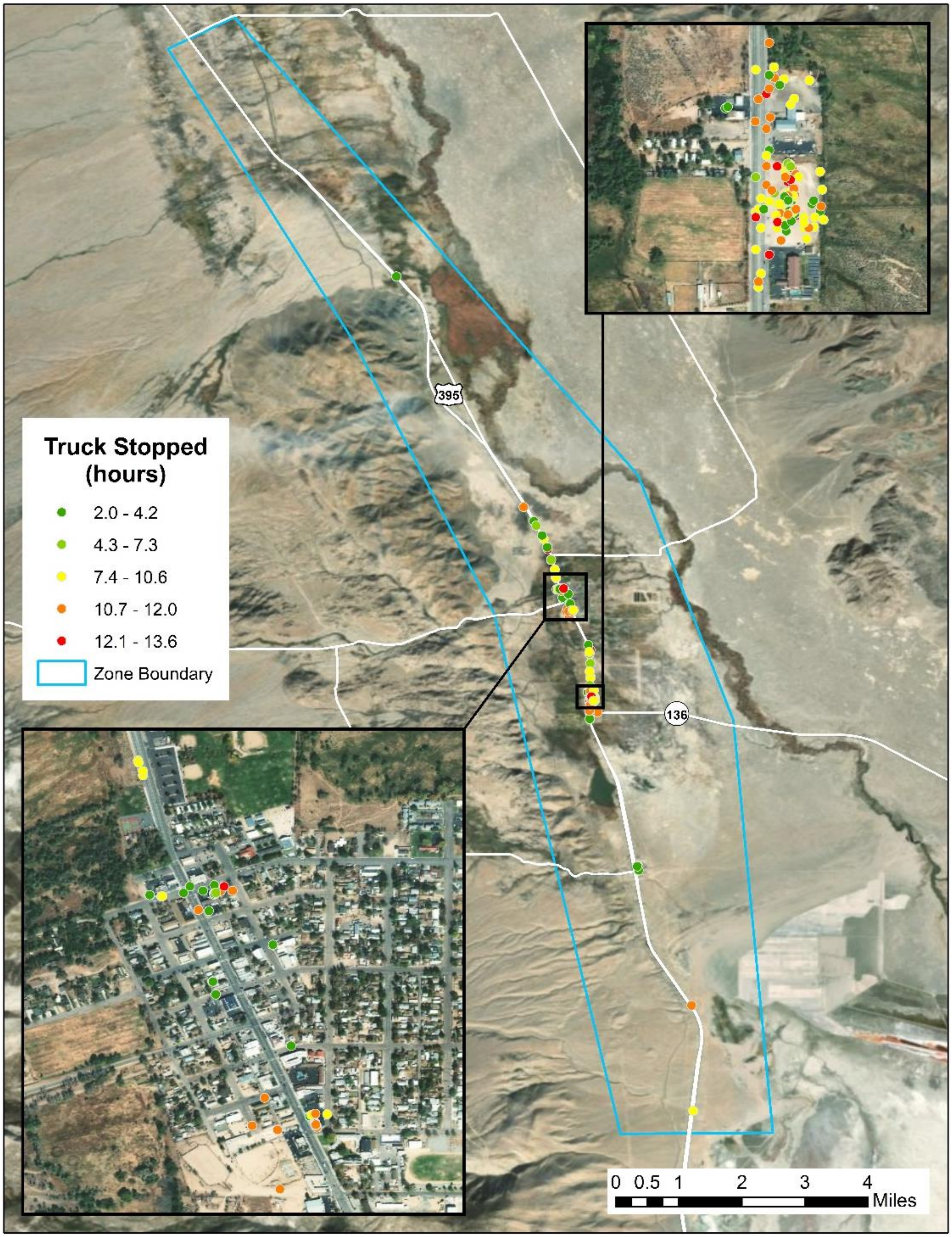
Source: Google Maps, ATRI.

Figure C.11 ATRI Truck GPS Analysis—Independence Zone



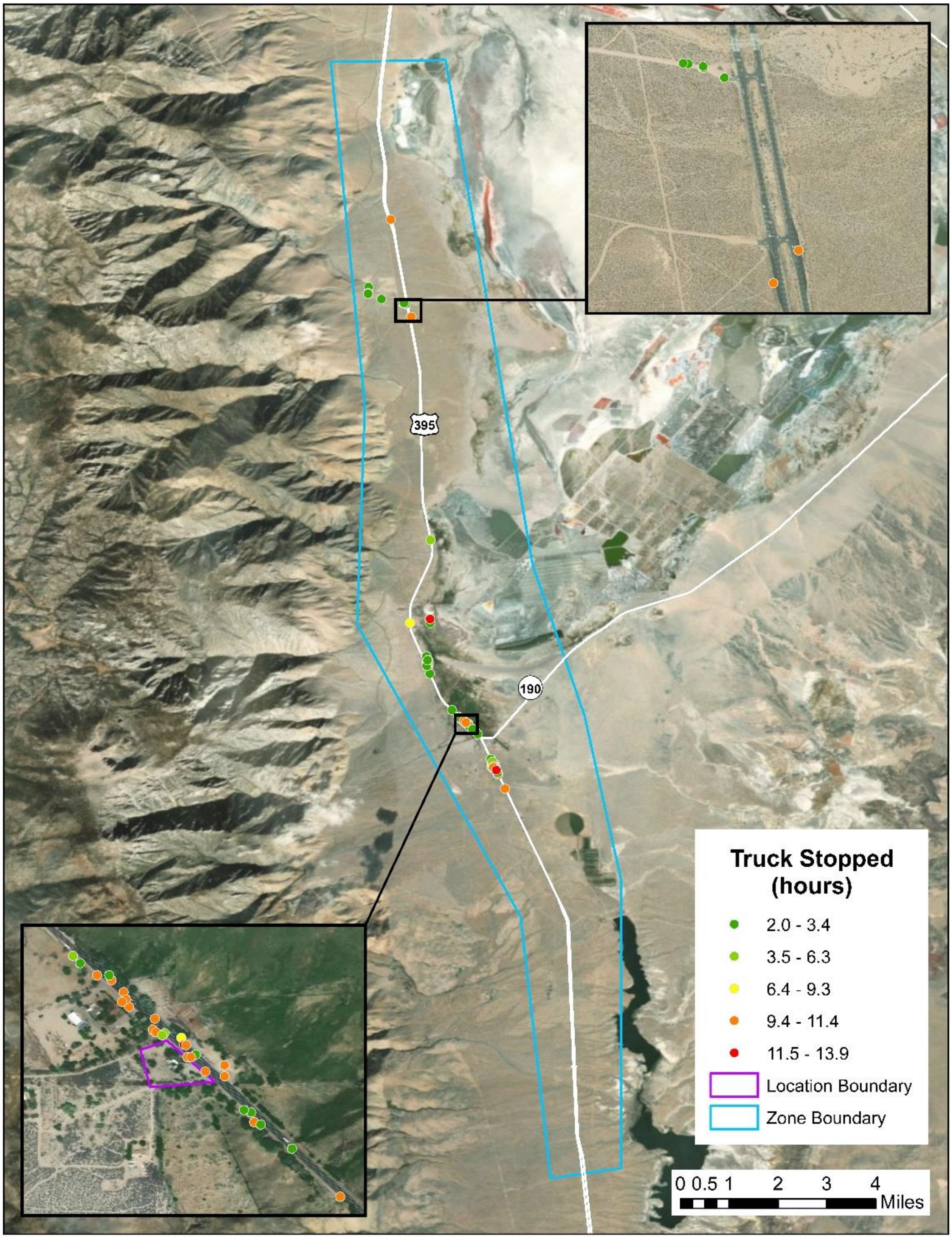
Source: Google Maps, ATRI.

Figure C.12 ATRI Truck GPS Analysis—Lone Pine Zone



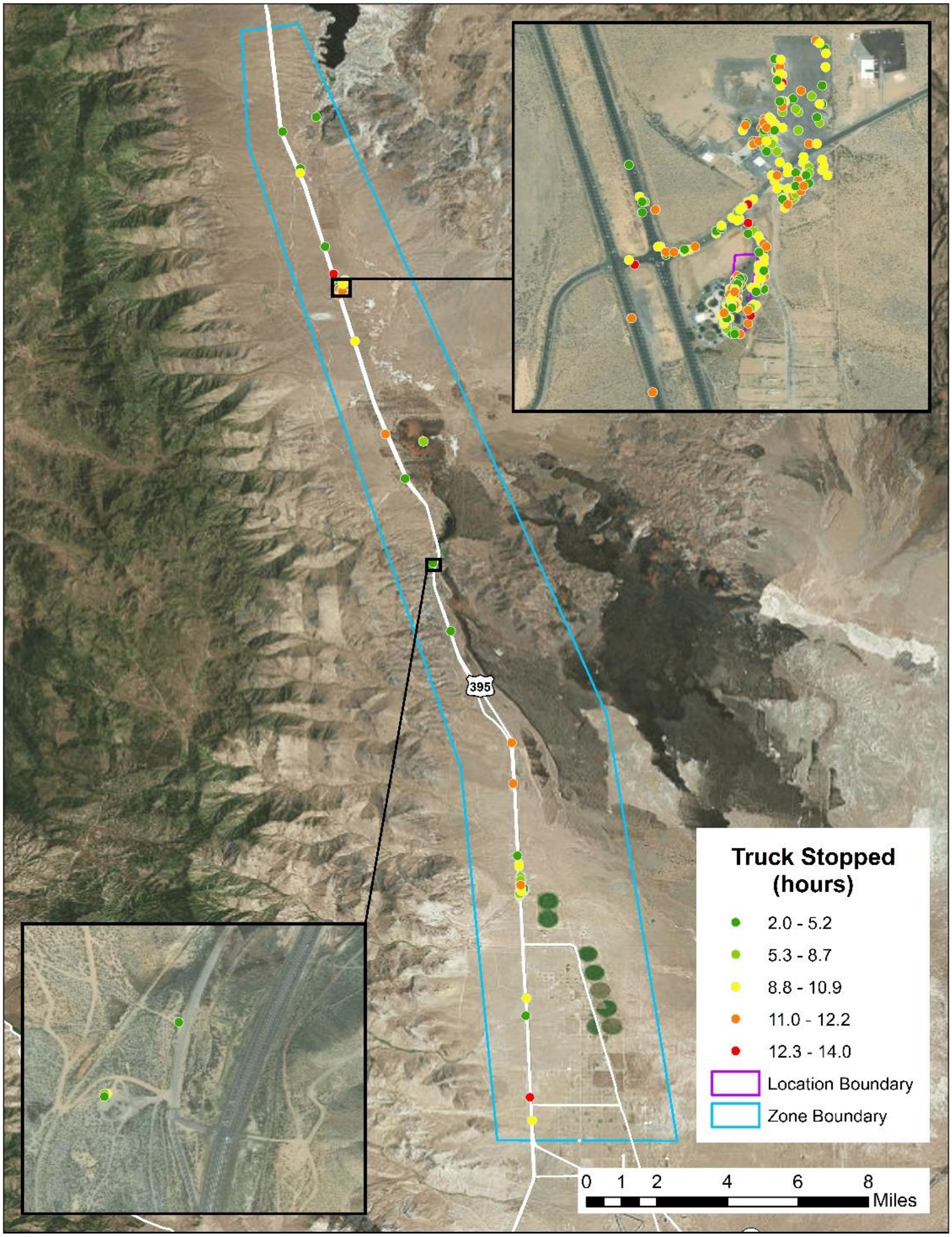
Source: Google Maps, ATRI.

Figure C.13 ATRI Truck GPS Analysis—Olancha Zone



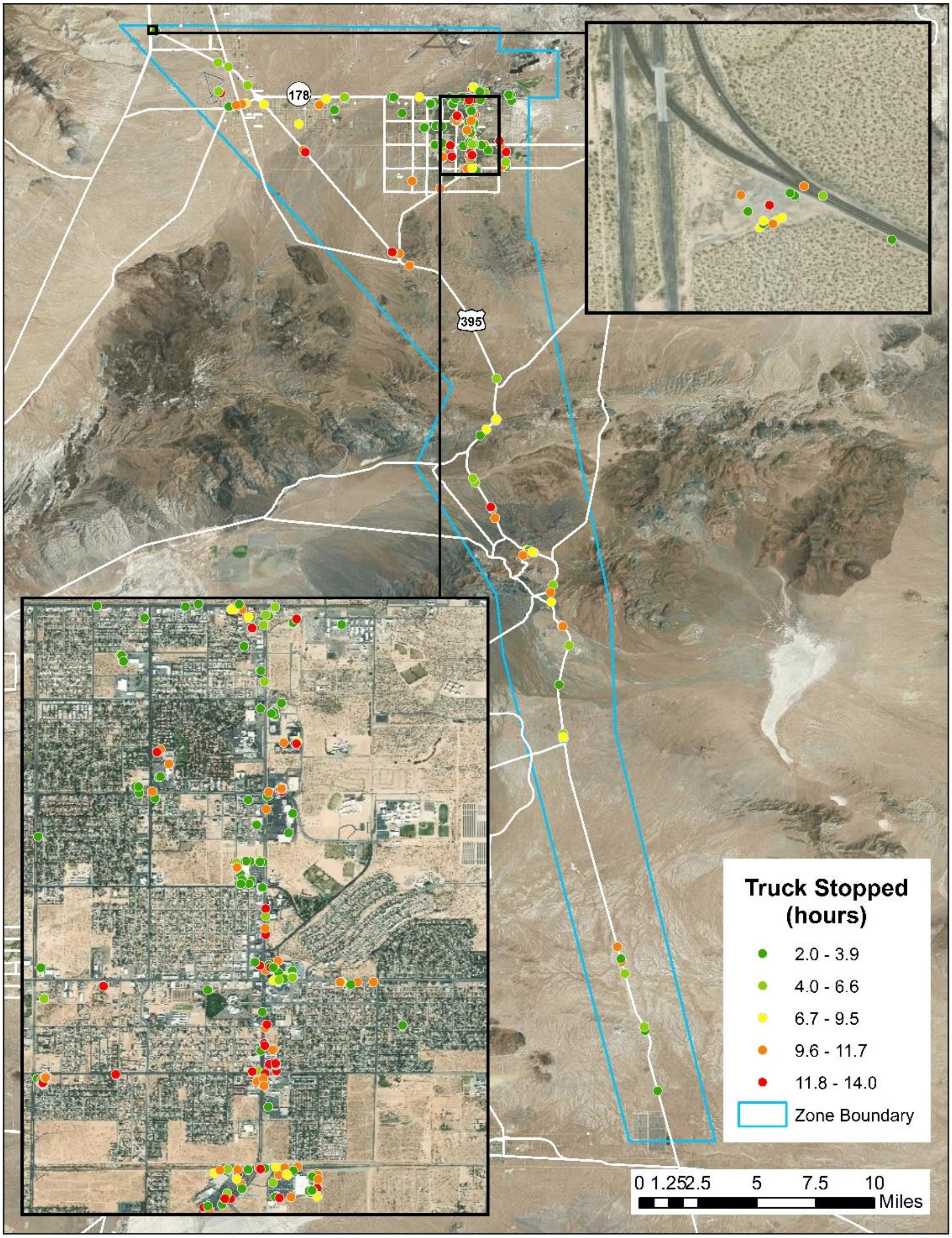
Source: Google Maps, ATRI.

Figure C.14 ATRI Truck GPS Analysis—Coso Junction Zone



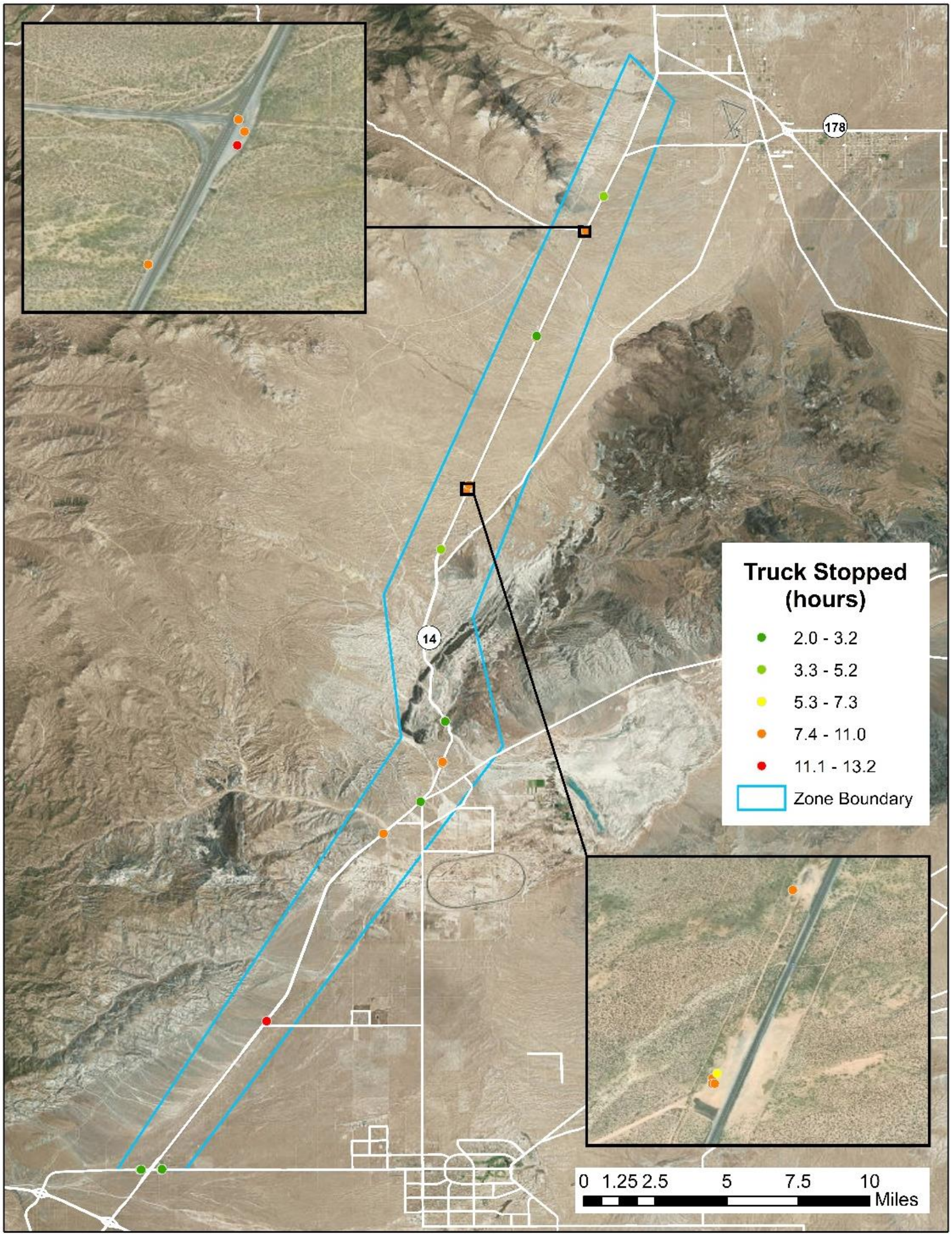
Source: Google Maps, ATRI.

Figure C.15 ATRI Truck GPS Analysis—Ridgecrest Zone



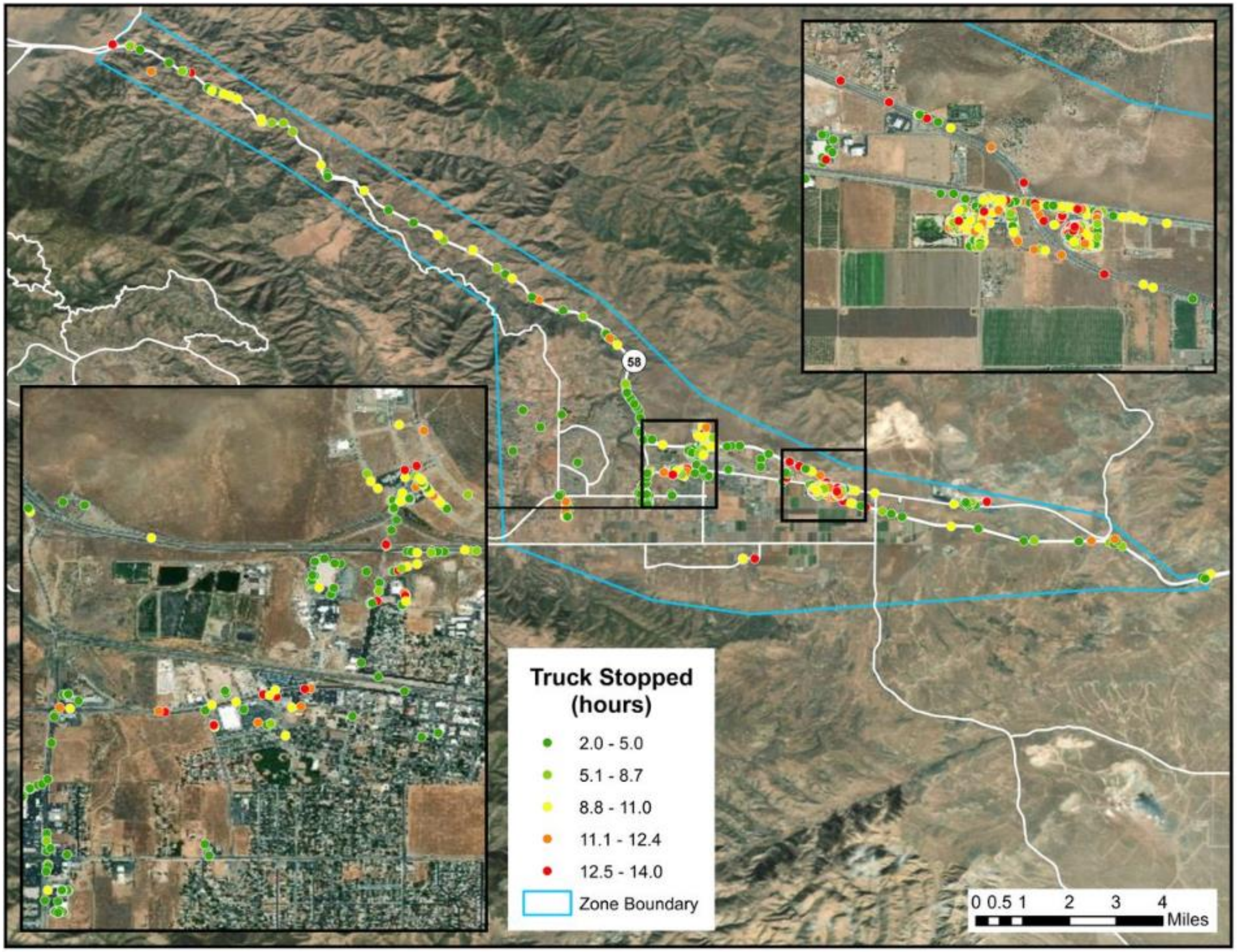
Source: Google Maps, ATRI.

Figure C.16 ATRI Truck GPS Analysis—SR 14 North Zone



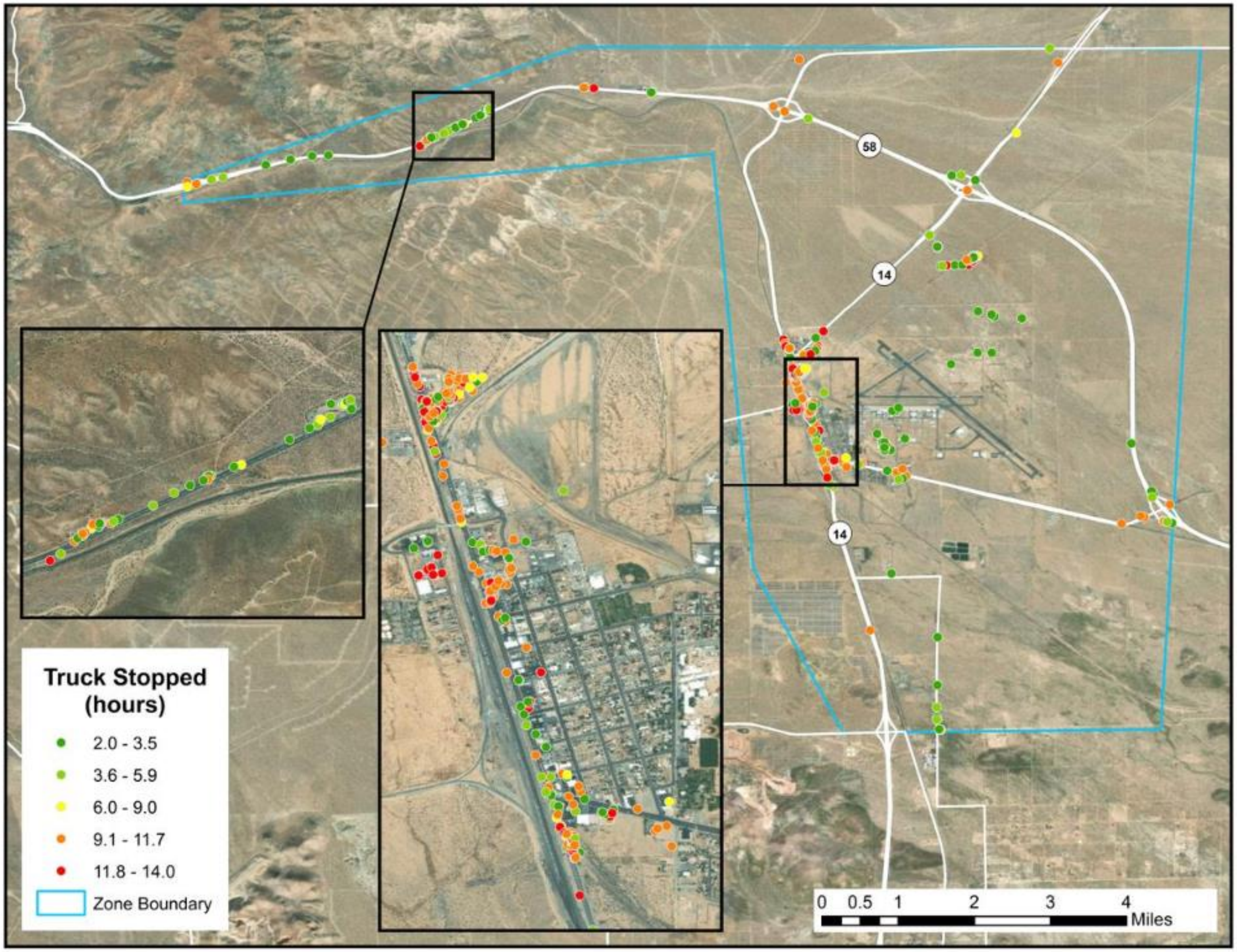
Source: Google Maps, ATRI.

Figure C.17 ATRI Truck GPS Analysis—Tehachapi Zone



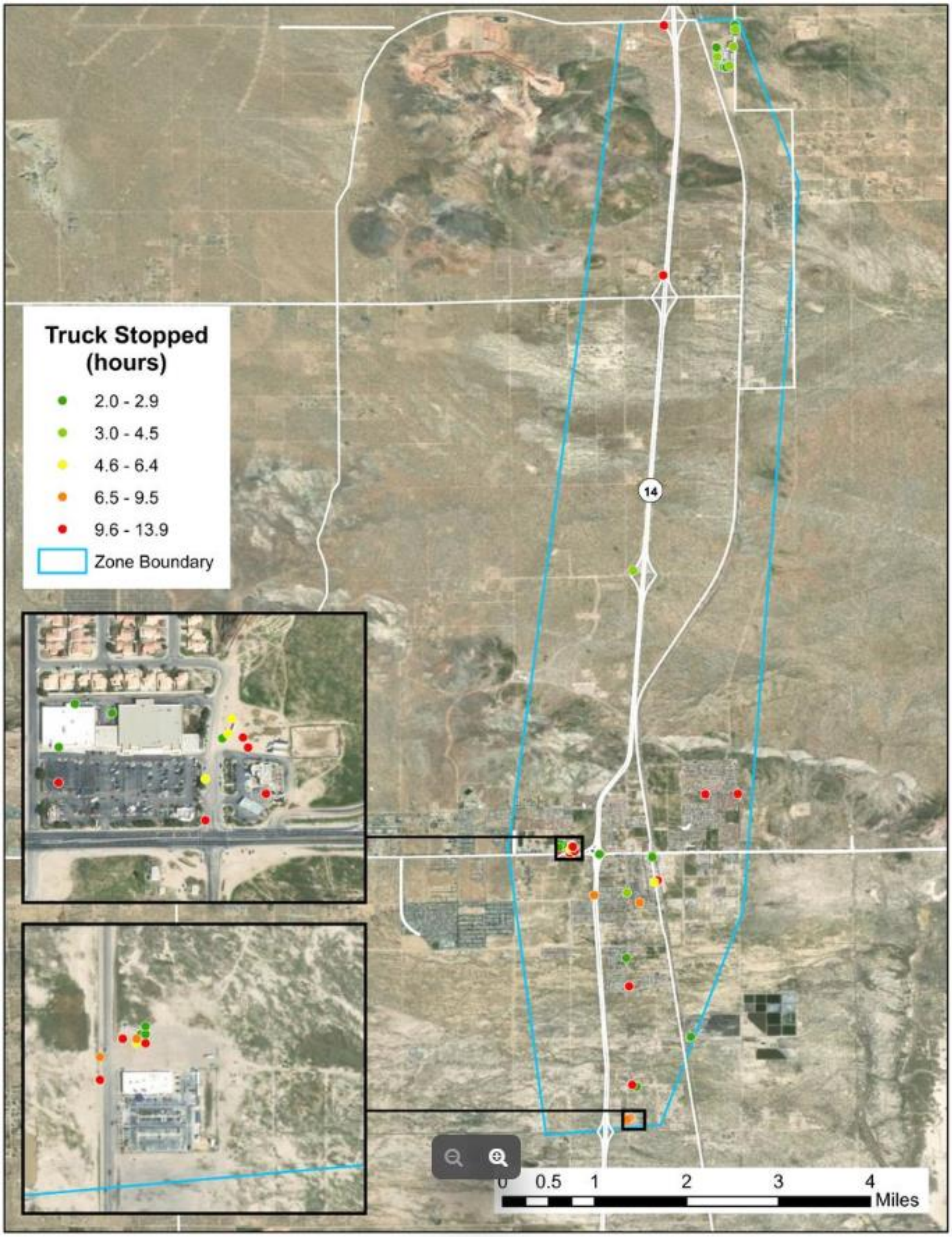
Source: Google Maps, ATRI.

Figure C.18 ATRI Truck GPS Analysis—Mojave Zone



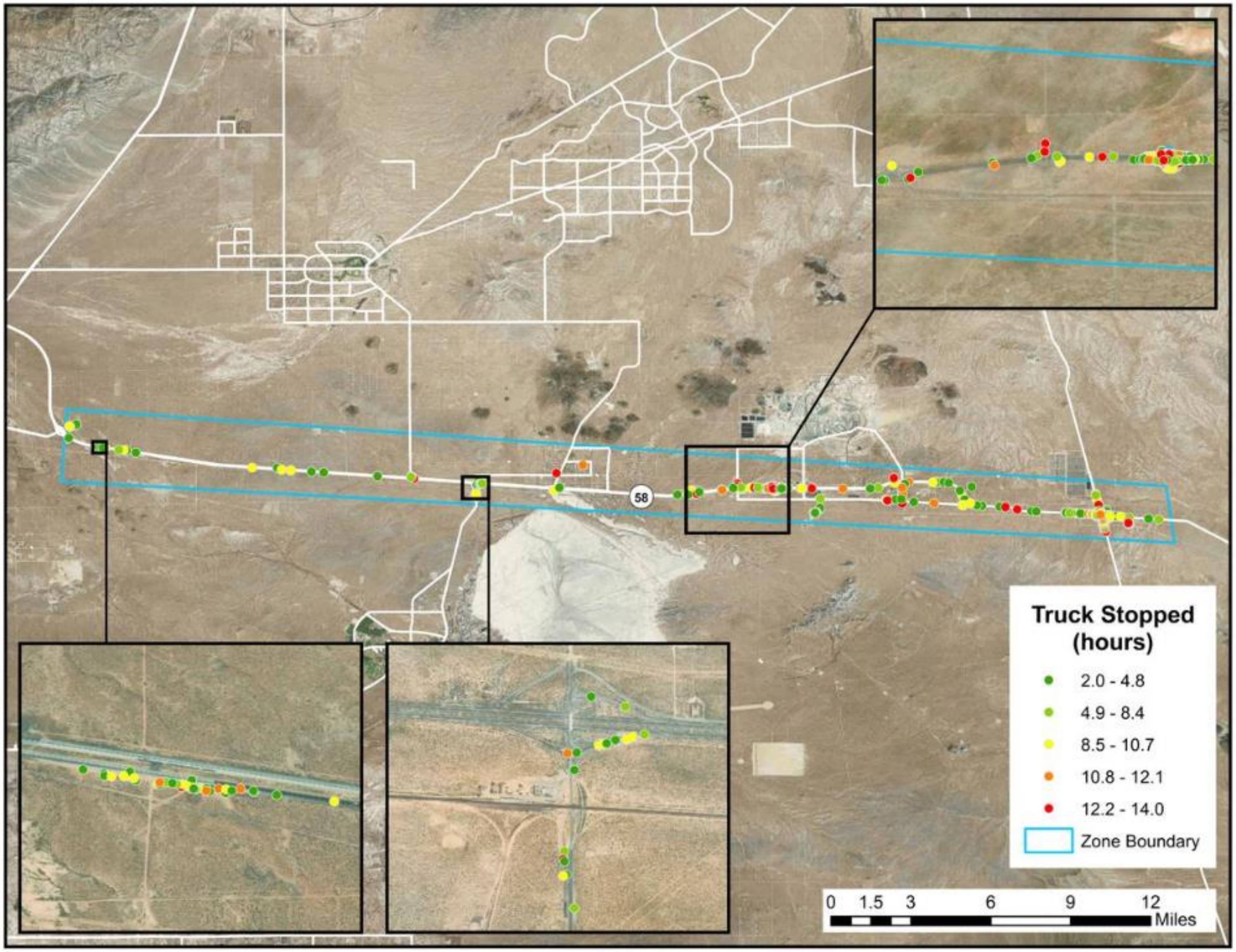
Source: Google Maps, ATRI.

Figure C.19 ATRI Truck GPS Analysis—Rosamond Zone



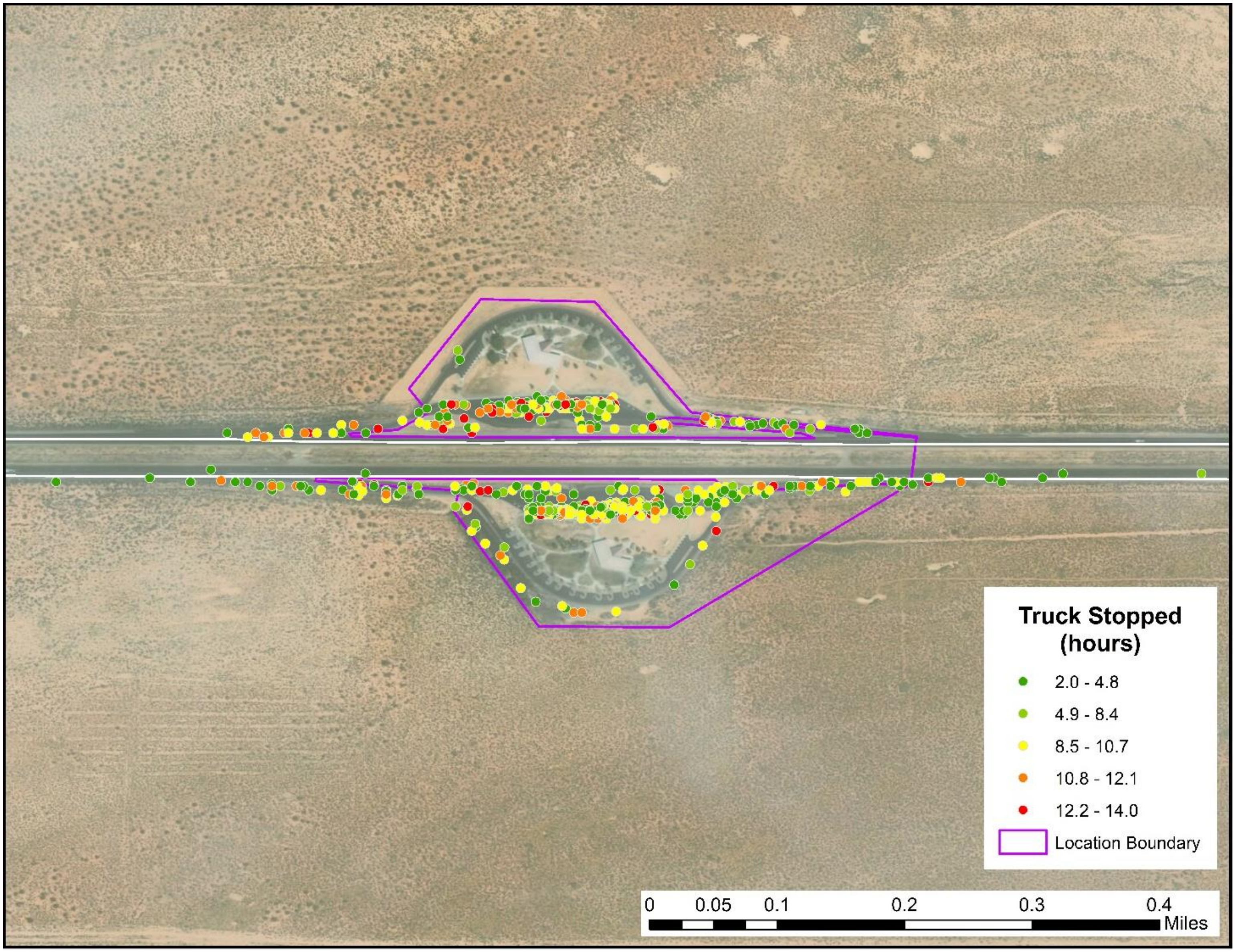
Source: Google Maps, ATRI.

Figure C.20 ATRI Truck GPS Analysis—Boron Zone



Source: Google Maps, ATRI.

Figure C.21 ATRI Truck GPS Analysis—Boron Rest Area Detail



Source: Google Maps, ATRI.