San Joaquin Valley I-5/SR 99 Goods Movement Corridor Study

Final Report

Technical Memorandums 1, 2 & 3, 4 and 7

submitted to

Fresno Council of Governments

submitted by

Cambridge Systematics, Inc.

in association with

Fehr & Peers

The Tioga Group

CAMBRIDGE SYSTEMATICS

San Joaquin Valley I-5/SR 99 Goods Movement Study

Final Report:

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Tasks 2 & 3: Projects and Programs Identification
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Appendices:

A. References
B. Freight Generators in San Joaquin Valley
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Executive Summary

Project Background

The San Joaquin Valley (the Valley) is a major generator of economic activity within California. Its dominant industries include agriculture, food production, energy, and construction, among many others. Over 407 million tons of goods were moved to, from, and within the Valley in 2007, and this is expected to exceed 500 million tons by 2040.[1] Moreover, the Valley's major transportation-dependent industries have catalyzed the emergence of an independent logistics sector in the region. In short, safe, efficient, and reliable goods movement corridors are vital to the economic health of the Valley, and, in turn, the state.

Given that 92 percent of freight in the Valley is carried by truck, Interstate 5 (I-5) and State Route 99 (SR 99) are the core goods movement corridors in the Valley, and are expected to remain so for the near future. They are the busiest truck routes in the Valley and among the busiest in the entire state. These two north-south routes connect the region's cities, and provide important links to east-west routes within California and to other states. Although I-5 and SR 99 are each crucial goods movement corridors, they play different roles, with I-5 primarily carrying long-haul traffic (including through traffic) and SR 99 favoring shorter trips within the region.

Fresno Council of Governments has identified several strategic goals that animate this study and the recommendations made herein. These goals include: improving economic competitiveness; preserving infrastructure; improving mobility and travel time reliability; improving security and safety; deploying innovative technologies and practices; and planning and funding investments in a collaborative manner.

Regional Freight Clusters

A major effort and focus of this study involved identifying major truck generators in the Valley. This study identified seventeen major freight clusters responsible for a large percentage of truck trips within the Valley and to and from other regions in California. Each of these clusters consists of some combination of intermodal facilities, distribution centers, and/or large manufacturing firms. The clusters are distributed throughout the Valley, with four located in San Joaquin County, two in Stanislaus County, one each in Merced and Madera counties, one in Fresno County, one in Kings County, three in Tulare County, and four in Kern County. GPS data were used to identify trip distribution patterns between these freight clusters as well as destinations in the Valley and throughout California.

- **San Joaquin County:** Clusters in San Joaquin County include sites in Tracy, Lathrop, Lodi, and Stockton. The Tracy and Lodi clusters consist primarily of distribution centers focusing on wholesale and retail trade, whereas the Lodi cluster's primary businesses are manufacturers.

[1] Due to changes in Commodity Flow Survey (CFS) zones, including the separation of Fresno County as its own zone, estimates before 2012 are not directly comparable to those after.

The Stockton cluster includes five distribution centers and two intermodal facilities, one of which is the Port of Stockton.

- **Stanislaus County:** The County's clusters are located in Patterson and Modesto. The Patterson cluster includes a distribution center and a manufacturer employing 500-999 employees, with significant accessibility via both I-5 and SR 33. The Modesto cluster includes several large agricultural industry employers, two distribution centers, and an intermodal facility.

- **Madera County:** The cluster located in Madera includes three agriculture-related businesses, four manufacturers, two major wholesalers/retailers, and a distribution center. It is accessible via SR 99 and SR 145.

- **Merced County:** The Merced cluster features six large businesses and distribution centers, focusing on agriculture, manufacturing, and wholesale/retail trade. It has access to the region via SR 99, SR 140, and SR 59.

- **Fresno County:** The cluster located in Fresno features cluster features five distribution centers, two large agricultural businesses, an airport, and an intermodal distribution facility. The intermodal distribution facility makes connections between rail and trucks. The Fresno cluster enjoys a prime location at the intersection of several major highways, including SR 99, SR 41, SR 168, and SR 180

- **Kings County:** The County's freight cluster is located in Hanford, and consists of two distribution centers, six major businesses, and one intermodal facility. The intermodal facility provides connections between truck and rail.

- **Tulare County:** One of Tulare County's freight clusters is located in Visalia, and includes a number of distribution centers and businesses, focusing on wholesale/retail trade, agriculture, and manufacturing. Tulare County's second cluster, in Porterville, contains a distribution center (employing between 1,000 and 4,999 people) and a large business, both of which focus on wholesale and retail trade.

- **Kern County:** Kern County has four major clusters, the largest of which is located in Bakersfield. It has two distribution centers and five large businesses connected with goods movement, which together employ thousands of people. This cluster benefits from access to a large number of highways, as well as significant recent investments in the regional highway network. Next, the Shafter cluster is close to the Bakersfield cluster and includes a distribution center logistics park and access to SR 43, SR 99, and I-5. Thirdly, the Delano cluster features a distribution center and large agricultural business. Finally, the Tejon Ranch cluster includes a number of distribution centers and space for growth at the junction of I-5 and SR 99, with easy access to the Central Valley and Southern California.

Approach

This San Joaquin Valley I-5 / SR 99 Goods Movement Corridor Study is divided into seven tasks, of which this report incorporates Tasks 1, 2, 3, 4, and 7. The other two tasks (5 and 6) covered coordination in support of the other tasks. Task 5 covered meetings and coordination, and Task 6 covered coordination with other efforts, including the Sustainable Implementation Plan.

- ***Establish the need for streamlining goods movement.*** **Task 1** evaluated existing conditions along the corridor, including with respect to traffic conditions; goods movement patterns; safety and collision profiles; and multimodal facilities. It also discussed current trend and implications for the future of goods movement along the corridor. In particular, this task identified the seventeen primary freight clusters within the Valley, and used GPS data to analyze the trips generated by them.

- ***Name specific "pain points" and priorities for mitigation.*** **Task 2** identified specific concerns affecting goods movement along the corridor. Within each county along the corridor, the report identifies major traffic generators, congested segments, and critical safety segments. In addition, the report discusses truck service facilities that play a critical role in goods movement infrastructure, including weigh stations, parking facilities, and liquid natural gas (LNG) fueling stations.

- ***Identify mitigating projects and programs.*** **Task 3** named specific projects and programs with the potential to mitigate certain of the concerns identified in Task 2. Crucially, the report distinguishes between *projects*, which target specific pieces of roadway, and *programs*, which aim to implement policies and technologies directly affecting the entire corridor.

- ***Evaluate the feasibility of implementing projects and programs.*** **Task 4** evaluates the strategies identified in Task 3 with respect to several metrics, including implementation time, cost, and benefit gained in order to provide an overall perspective on their feasibility and advisability in the context of budgetary constraints and designated funding sources.

- ***Analyze potential for technical demonstration of specified technology.*** **Task 7** analyzes a specific Pilot Project Demonstration as established by a Demonstration Working Group established in January 2016. The specified task is a demonstration of Truck Platooning, also known as a "connected truck." This analysis describes the economic, environmental, and operational benefits of this technology, as well as the challenges that may arise in implementing it.

Findings & Next Steps

Current & Anticipated Future Conditions

Although evidence suggests that traffic often moves below the posted speed limit on I-5 and SR 99, this is not necessarily indicative of the existence of significant bottlenecks or lack of capacity along the entire corridor. On the other hand, analysis of current land use in the counties in the I-5 / SR 99 corridor suggests that it is likely that freight traffic will grow in the coming years, potentially putting significant pressure on the corridor.

Recommendations

- **Shovel-ready projects.** This report identifies projects and programs in a large variety of areas that may be eligible for various funding sources, including those that are ready construction within 0-5 years.
- **Connector projects.** Decreased congestion, increased corridor capacity, and greater safety may be obtained through a series of I-5 / SR 99 connector enhancement projects identified by this report. Before moving forward with any of these projects, further study will be required, including: (1) full traffic analysis that takes into account all potential traffic shift; (2) analysis of future demand and associated benefits; and (3) a review of connectivity and access enhancements in line with regional land use and development plans. This report recommends proceeding with further analysis of corridor-to-corridor connectors.
- **ITS - Technological improvements.** Potential technology benefits identified in this report, including ramp metering at specific locations, truck parking information systems, and truck platooning all have the potential to improve efficiency, safety, and reliability within the corridor. Their unique technological focus makes them candidates for funding sources unavailable for other types of projects, as well as strong candidates for private investment.
- **Operational improvements.** Operational demonstration projects were considered but deemed not feasible within the timeframe and/or budget of the study. These demonstrations include: real-time truck parking applications, truck tolling on I-5, and eliminating the lower speed limit for heavy-duty trucks on I-5.
- **Truck platooning demonstration.** This report recommends a demonstration of truck platooning in the corridor, as studied during Task 7. (Truck platooning consists of a series of trucks following each other on the road, with automatic acceleration and braking controlled by vehicle-to-vehicle communication, but manual steering.) The technology provides significant fuel economy, safety, and environmental improvements, with a reduction in road congestion. Of note, the California Air Resources Board has announced a Grant Solicitation for On-Road Advanced Technology Demonstration Projects. Up to $17 million is available for an advanced technology freight demonstration, for which this project appears to be a strong candidate.

Sources of Funding

There are a number of state and federal programs that could potentially fund one or more of the projects identified as priorities in this report. Among these are federal FASTLANE and Advanced Transportation and Congestion Management Technologies Deployment Program funds, future gas tax revenues (SB 1), California Air Resources Board (CARB), and the California Energy Program.

It is important to keep in mind that Valley projects will need to compete with other worthy projects from around the state and country, but can more effectively compete for these funds by bundling together to increase their benefit-cost ratio. Accordingly, we have named several "bundles" of projects that can be advanced together to meet specific goals, including with respect to: highway infrastructure improvement / congestion relief; technological enhancement; environmental impact; and safety improvement.

Given the difficulty of predicting the availability of funds from year to year and the pool of proposals against which Valley projects will compete, it is necessary to be both flexible and opportunistic in prioritizing Valleywide projects and jointly pursuing funding opportunities.

1.0 OVERVIEW

1.1 Background

The San Joaquin Valley (the Valley) has long been acknowledged as one of the critical goods movement centers in California, and Interstate 5 (I-5), as the principal interstate highway route, performs a critical role in goods movement. The Valley economy relies on an efficient and well-functioning goods movement system. The SJV Interregional Goods Movement Plan (SJVIGMP) reported that goods movement dependent industries (including agriculture, food processing, construction, energy production, and transportation and logistics) accounted for over 564,000 jobs and $56 billion in economic output in 2010. Over 463 million tons of goods were moved into, out of, and within the Valley in 2007, and this was expected to grow to over 800 million tons by 2040. While agriculture and food products will continue to play an important role in this growth, the Valley is also becoming a major distribution and logistics center with expanding numbers of mega-distribution centers and even new manufacturing facilities. All of this growth will contribute to needs for improved goods movement systems in the Valley, and innovative approaches will be necessary to meet this demand.

I-5 and State Route 99 (SR 99) play critical and unique roles as the major goods movement facilities in the Valley. At present, 92 percent of goods in the Valley are carried by truck, and this is not expected to change in the near future. I-5 and SR 99 carry the highest volumes of trucks in the Valley and in some locations, among the highest volumes in the state. This is a reflection of the traditional north-south orientation of freight flows in the Valley, associated with the through routing of trucks to connect the major coastal urban areas to the north and south of the Valley, the north-south orientation of the Valley's major urban centers, and the need to access major east-west interstate connections north and south of the Valley itself.

I-5 is the route that is favored for long-haul movements. It carries higher levels of through traffic and there has traditionally been less development along this route. However, new developments in warehousing and distribution centers and manufacturing are taking advantage of access to I-5. Increasing traffic that is being generated within the Valley uses I-5 for national connections. SR 99 runs through each of the urban areas in the Valley and includes truck traffic distributing goods to/from these areas. It also provides connections to east-west routes that support the farm-to-market traffic and connections between farms and food processing that characterize the agricultural supply chain. It is the backbone of intra-Valley goods movement and a major route for commuters who share the road with trucks in the urban centers.

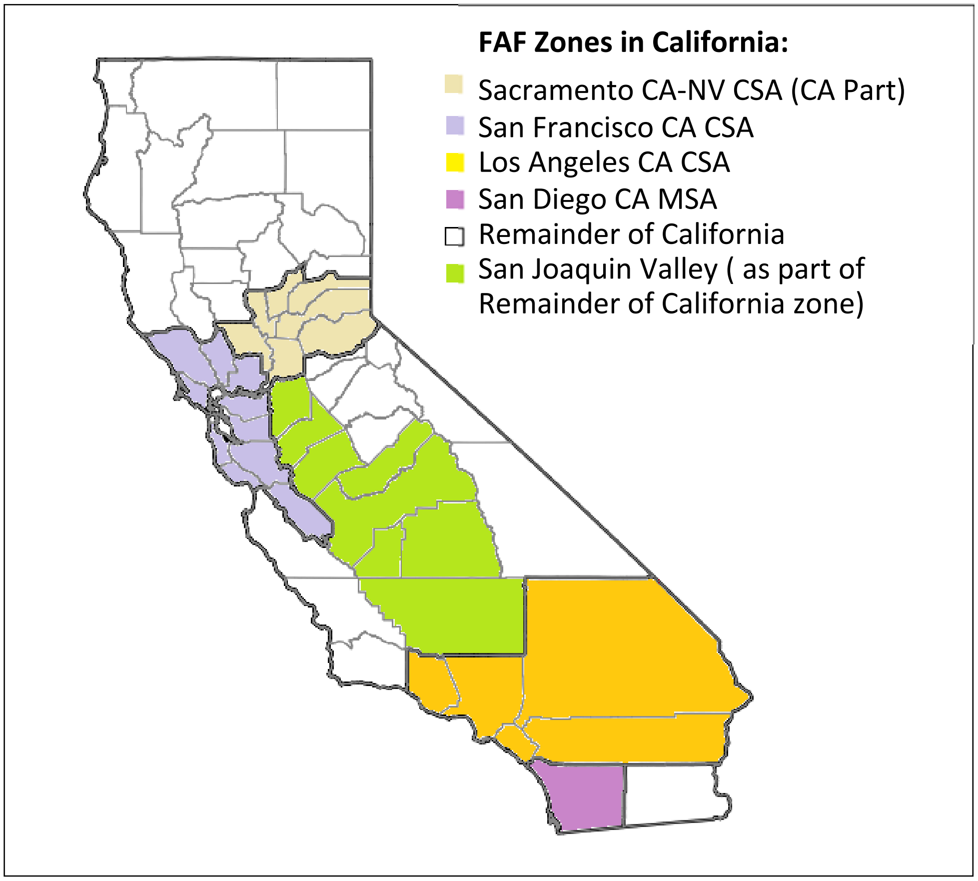
Both I-5 and SR 99 carry large volumes of truck traffic with comparable volumes on each. The types of truck traffic are slightly different, with I-5 carrying a higher percentage of 5+ axle trucks and SR 99 carrying more of a mix that includes local delivery and service vehicles serving population centers. Because of the limitations of the east-west network for truck movement and the distance between the two routes through much of the Valley, trucks do not tend to move from one route to the other for bypassing areas of congestion. The highest volumes of truck traffic are found on I-5 in the north, mostly in San Joaquin County. Analysis of future freight flows and associated truck traffic patterns conducted in the SJVIGMP indicated higher levels of projected growth in truck traffic on I-5 as compared to SR 99. On I-5, the highest volume-to-capacity (v/c) ratios and poorest levels of service will be found in Stanislaus and San Joaquin County, with v/c ratios only slightly better from the Kings/Fresno County line north. SR 99 already experiences high levels of congestion during peak periods in most of the urban areas, and this will worsen in the future. The pattern that shows higher truck volumes and poorer level of service in the north on I-5 in the future reflects, to some degree, the growth in distribution center traffic feeding the Bay Area that has already occurred in the north. However, there are trends that need to be examined during this study that could affect these future forecasts and create even greater volumes of truck traffic in the southern parts of the Valley. There is growing interest in locating large distribution centers and manufacturing facilities in Kern County to take advantage of proximity to the large Southern California markets and the Ports of Los Angeles /Long Beach (POLA/POLB). These connections are expected to grow and create new sources of truck traffic in Kern County. Recent studies of warehousing space supply and demand in the Southern California Association of Governments (SCAG) region conducted by Cambridge Systematics (CS) show that Southern California will not be able to meet all of the demand for warehouse space, and southern Kern County is a likely location for spillover development.

The SJVIGMP identified a number of high priority road widening projects on both I-5 and SR 99 to address future capacity deficiencies. For I-5, these projects were mostly north of the Kings/Fresno County line to the Sacramento/San Joaquin County line. The improvements on SR 99 are captured in the SR 99 Business Plan that has been a priority of focused attention in the Valley for some time. The objective of this study is to look at strategic approaches to addressing future freight demand and to identify the most feasible options that emphasize innovative approaches. This study will examine innovative approaches that create opportunities for public-private funding partnerships (such as tolled truck-only lanes), that create incentives to the trucking industry to manage demand (through use of larger combination vehicles or novel technology solutions), efficiency improvements that rely on Intelligent Transportation Systems (ITS) or other technology options, and greater use of alternative modes such as rail. While many of these approaches have been examined in past studies, there has never been a comprehensive examination to determine which options are the most feasible, which will draw the most positive response from industry, and which will work most effectively with other plans for these two highway corridors while minimizing negative impacts on connecting roadways and adjacent communities.

1.2 Goods Movement Trends in the Valley

The Freight Analysis Framework (FAF) integrates data from a variety of sources to create a comprehensive picture of freight movement among states and major metropolitan areas by all modes of transportation. With data from the Commodity Flow Survey (CFS) and additional sources, FAF provides estimates for tonnage, value, and domestic ton-miles by region of origin and destination, commodity type, and mode. This is an aggregate national database that captures trends of commodity flows between metropolitan areas for broad range of commodities. The Census Bureau conducts CFS every five years. The most recent survey is from 2012 and has not been released fully yet. The FAF database is based on FAF zones. There are 5 zones in FAF 3. The eight counties in San Joaquin Valley and counties in northern California form the FAF zone "Remainder of California." Given the low rate of economic activities in northern California, it is reasonable to assume that the San Joaquin Valley is the main freight generator in this FAF zone. Fresno County was added as a new zone in FAF 4.

Figure 1.1 FAF3 zones in California



Source: FAF3, 2007.

We compared the "Remainder of California" zone in the 2007 (FAF3), 2012 (FAF4), and 2015 (from FAF3 estimates). To ensure consistency between analysis years, we combined Fresno and the "Remainder of California" zones. The analysis in this study is based on the first version of FAF4 data published in September 2015. There might be future revisions later. Besides zoning changes, there are also some differences in FAF3 and FAF4 methodologies and assumptions. Commodity Flow Survey (CFS) is the major data source for FAF. However, about one third of information presented in FAF is out of CFS scope. Estimation process for some of CFS out of Scope commodity groups, including crude petroleum has systematically changed in FAF4. Agriculture products are also out of CFS scope. We identified inconsistencies between FAF4 detail agriculture commodity flow report and 2012 Agriculture Census report, published by Department of Agriculture 2012.

Global recession had significant impacts on goods movement in the Valley. 2015 estimates are based on CFS 2002 when the economy was at the highest point. The estimates for 2012 are significantly below 2015 estimates. Over all there is a 20 percent reduction in tonnage and a 10 percent increase in value of goods generated in the "Remainder of California" zone between 2012 and 2007; therefore, the average price per tonnage increased by about 38 percent.

The 2008-2009 global recession accompanied by a severe drought contributed to this situation. The goods movement between the Valley and the Bay Area (San Francisco FAF zone) decreased by over 50 percent. There was also a noticeable change in the average price of goods generated in the Valley. Although reductions in both the volume and tonnage of freight generated in the "Remainder of California" zone occurred, the average price per tonnage increased by about 16 percent. Goods moving between the Valley and San Diego County experienced the highest increase in the average $/tonnage of shipments, with a more than 60 percent increase in value coupled with a 37 percent decrease in tonnage.

Table 1.1 Destination Distribution of Trips Generated in the "Remainder of California" FAF Zone

	Total Tonnage (KTon)			Total Value (M$)			2012 Growth		
Destination Region	2007 (FAF3)	2012 (FAF4)	2015 (FAF3 Est.)	2007	2012	2015	Weight	Value	Avg. Price
Outside California	29,513	21,296	37,107	49,851	26,739	60,757	-28%	-46%	-26%
In California	243,504	205,472	277,843	179,918	127,620	223,123	-16%	-29%	-16%
Los Angeles CA CSA	29,348	18,728	35,215	27,423	21,544	33,215	-36%	-21%	23%
Sacramento CA-NV CSA	12,540	7,661	14,883	12,540	7,774	15,006	-39%	-38%	1%
San Diego CA MSA	2,275	1,424	2,853	3,117	3,125	4,308	-37%	0.2%	60%
San Francisco CA CSA	38,876	17,581	40,618	29,674	18,379	37,925	-55%	-38%	37%
Remainder of California	174,315	160,077	184,273	107,164	76,799	132,670	-8%	-28%	-22%

Source: [FAF3, 2007; FAF4, 2012].

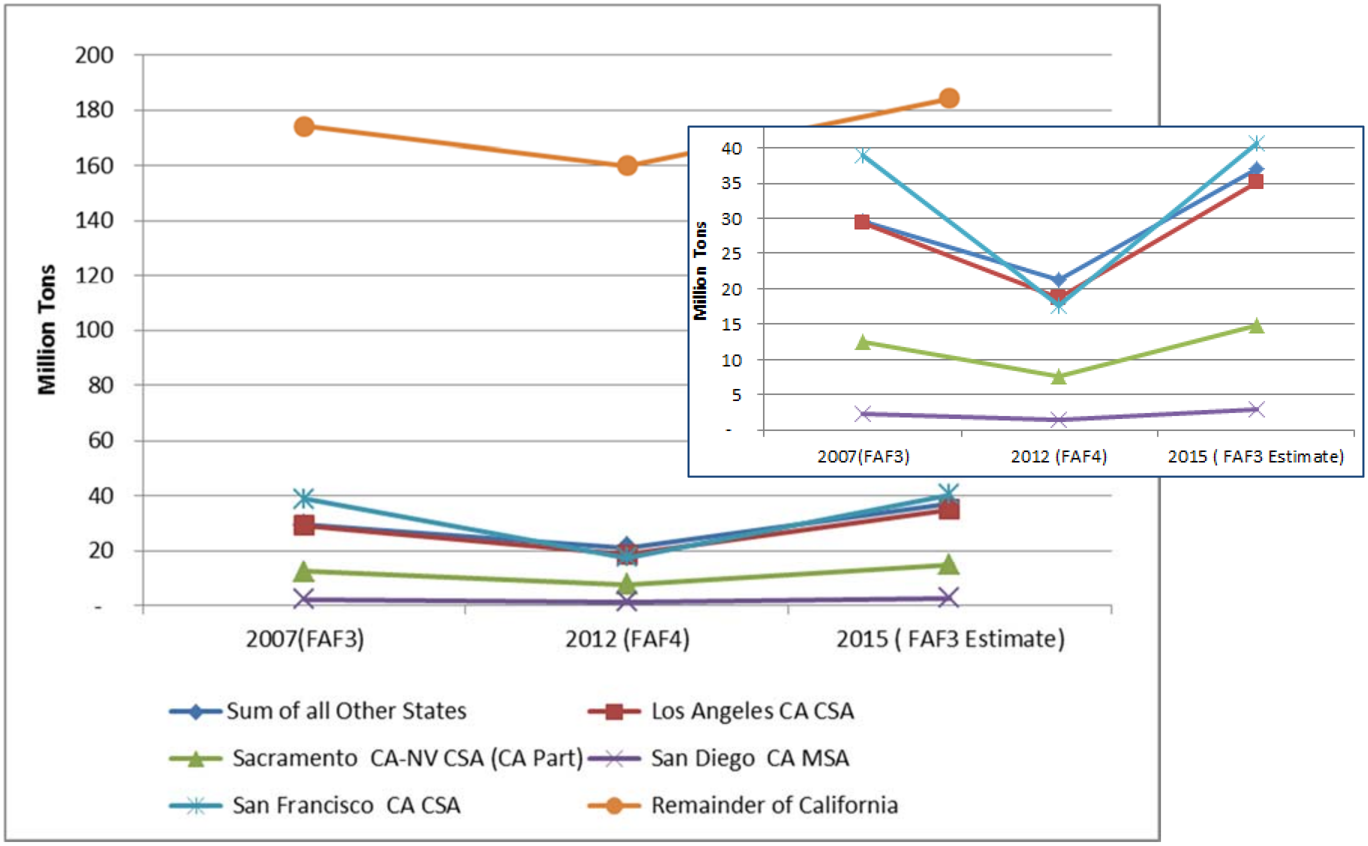
Note: Crude petroleum is excluded from this analysis.

FAF3 web site: *http://faf.ornl.gov/fafweb/Extraction1.aspx*

FAF4 web site: *http://faf.ornl.gov/faf4/Extraction1.aspx*

The major mode of transportation for crude petroleum is pipeline. In 2007, about 14.8 million tons of crude petroleum shipped from Remainder of California to other FAF zone. In 2012 this shipment increased to 20 million tons. The change in the FAF methodology contributed to some of this difference.

Figure 1.2 Trends of destination distribution for freight generated at "Remainder of California" FAF zone



Source: FAF3, 2007; FAF4, 2012.

Note: Crude petroleum is excluded from this analysis.

The San Joaquin Valley is the home of significant agriculture, including farms and related industries. Table 1.2 summarizes the tonnage and value of shipments by trucks for commodities in agriculture, food, and beverages industries. Trucking is the primary mode of transportation for these industries carrying over 97 percent of agricultural, food, and beverage commodities. Overall, there has been 3 percent reduction in tonnage of shipments but a 13 percent increase in value of shipments.

Table 1.2 Agriculture, food and beverage trip production trends in the "Remainder of California" FAF zone

	Total Tonnage (KTon)			Total Value ($M)			2012 Growth		
Destination Region	2007 (FAF3)	2012 (FAF4)	2015 (FAF3 Est.)	2007	2012	2015	Weight	Value	Avg. Price
Agriculture Products	91,966	88,993	113,386	67,787	76,315	83,827	-3%	13%	16%

Source: FAF3, 2007; FAF4, 2012.

1.3 Key Findings

In order to better depict and describe the key findings of the existing conditions analysis, the team developed a web map with a fact sheet for more than 150 highway segments in the Valley. Each fact sheet provides the following information about the specific segment:

- Through traffic vs. traffic related to that county;
- Truck weight and classification data;
- Annual, monthly, and daily truck and auto volumes and traffic patterns/distribution;
- Operational performance, including Level of Service (LOS), Vehicle Hours of Delay and/or Travel (VHD/VHT), and/or congested speed;
- Design characteristics, including number of lanes, posted speed limits, and number of interchanges; and,
- Collision data, including type and frequency of truck-involved collisions, as well as number of collisions that resulted in injury or fatality, and GIS map of public and private truck stops and rest stops.

We developed a set of freight activity clusters in the Valley that generate and absorb the majority of truck traffic. The freight clusters include major businesses, intermodal facilities and large distribution centers and warehouses. Using GPS data, we identified the distribution of truck trips based on truck origins and destinations related to each freight cluster.

We reviewed more than 25 documents to identify future development and improvement plans related to goods movement within the study area, and summarized the findings. According to these planning documents, the recent growth in logistics facilities and manufacturing in the Valley is highly likely to continue. Understanding the potential growth and identifying priority improvements will be critical.

Although congested speed on some segments of I-5 and SR 99 are up to 15 percent slower than the posted speed limit, this does not necessarily mean there is traffic bottleneck. Outside dense urban areas the Volume/Capacity (V/C) ratio during peak periods for these corridors is less than 0.65, and the average V/C along I-5 and SR 99 during peak periods is 0.25 and 0.51 respectively. Having high truck percentage may cause slower traffic flow along SR 99. The truck percentage for each segment is shown on the fact sheet for each segment on the web map.

The 2008-2009 global recession had significant impacts on the Valley's goods movement patterns. The 2012 tonnage of goods transported s in the Valley are still 30 to 50 percent lower than 2015 forecasts based on in 2007 commodity flow survey trends.

1.4 Existing Conditions Analysis Approach Summary

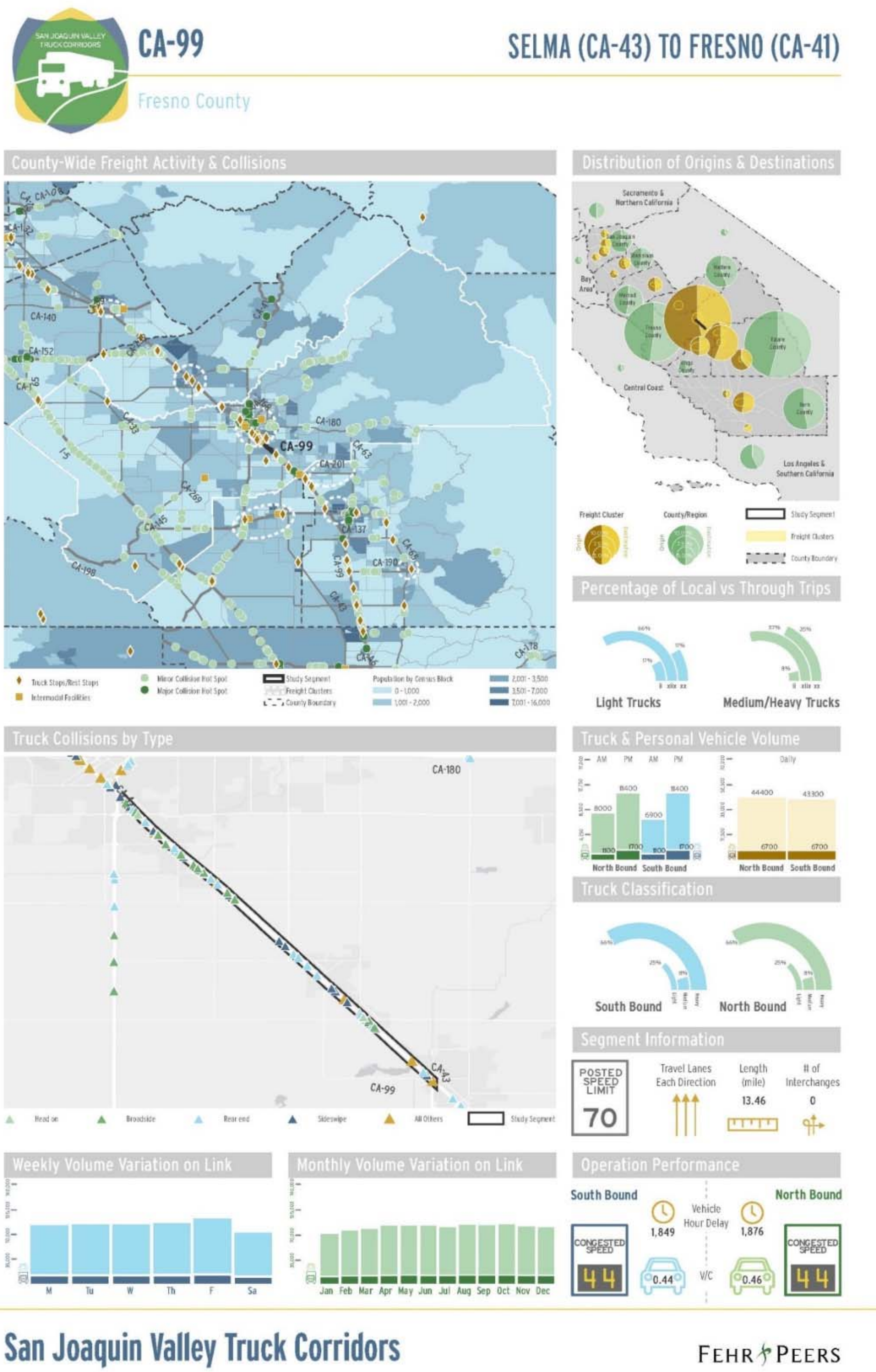
This report assesses the existing goods movement demand and operations within the Valley and provides information about the role of major freight corridors, including I-5 and SR 99 in the region. This work builds on the existing conditions analysis that was completed for the SJVIGMP. It also incorporates other data sources from more recent localized studies in the Valley and provides a comprehensive analysis of safety, traffic congestion, and truck trip patterns in the Valley. A major focus of this report is to document changes caused by the 2008-2009 global recession, as well as to investigate emerging trends that could result in alterations to truck and rail system usage in the Valley.

This report relies on a significant amount of goods movement research and analysis previously conducted in the Valley. This report documents those studies and also provides a tool for visualizing data abstracted from various sources. The visualization tool depicts trucking attributes throughout the Valley as previously described. Figure 1.3 shows an example infographic for a segment along SR 99 in the study area.

The analysis process involved a systematic approach to breaking the two freeway corridors into manageable segments. This resulted in 152 analysis segments covering approximately 298 miles along I-5 and 285 miles along SR 99. This classification allows us to summarize the data and provide meaningful statistics for each segment. For this project, the team purchased global positioning system (GPS) data for a large sample of trucks to gain a complete current understanding of truck distribution patterns along the I-5/SR 99 corridor. The GPS truck fleet data provides the O/D of trips that travel on I-5 and/or SR 99, including detailed route choice, average travel time, and truck size category (Light, Medium, and Heavy-heavy duty trucks[2]) for each data point. Our selected GPS data vendor, StreetLight, partners with GPS data providers to process the data and provide a large, reliable sample set. While this data source does not include the load, commodity, value, or vehicle type, this study combined the large GPS truck sample size data with other data sources, such as the latest Freight Analysis Framework (FAF) commodity flow dataset from the Federal Highway Administration (FHWA) to identify goods movement patterns in the study area.

[2] In this analysis, Light heavy duty trucks have Gross Vehicle Weight (GVM) less than 14000 pounds, Medium heavy duty trucks' GVM is between 14000 and 26000 lbs and Heavy heavy duty trucks's GVM is greater than 26000 lbs.

Figure 1.3 Sample of the Infographic Page on the Web Map



The Geo-Database developed for this project, integrates all of the data sources into a consistent format. When significant discrepancies were identified between data sets, other data sources were utilized to resolve the discrepancies, including:

- Caltrans Performance Measurement System (PeMS) year 2014
- Weigh-in-Motion (WIM) year 2014
- Travel Advance Monitoring System (TAMS) year 2014 and 2015
- Highway Performance Monitoring System (HPMS) 2013
- Other individual counts year 2010 and later
- Caltrans annual count book 2013
- Highway Performance Monitoring System (HPMS) 2015
- Collision data base for year 2009-2013

The data sources listed above were used to review existing truck traffic patterns and the share of truck traffic compared to overall traffic volumes on the I-5/SR 99, as well as on primary Central Valley east-west connectors. Truck volumes on I-5 are among the highest in the area, especially at the junctions with SR 99 and I-205, where Caltrans recorded more than 35,000 daily truck trips. While I-5 tends to carry more through truck traffic, SR 99's proximity to urban centers generates truck trips serving the Valley. At the junction of I-5 and SR 99, truck volumes exceeded 13,000 per day in 2012, according to Caltrans.

Various data sources were used, including the Valleywide Truck Model and California Statewide Freight Forecasting Model (CSFFM) to clarify truck distribution on I-5 and SR 99. Based on these data, a defined network consisting of I-5, SR 99 and crossing arterials, was developed to estimate the truck volumes on representative links of each segment, and to provide existing and future (2040) daily truck volume forecasts for major segments on this network.

This effort included a detailed review of the freight and truck forecasts from the Valleywide truck model that were used in the SJVIGMP to determine if any modifications to the Valleywide truck model were necessary. The Valleywide truck model was last updated with commodity flow data from FAF version 2 and there have been several subsequent updates of the FAF data to account for post-recession and recovery effects. Therefore, for this project, CSFFM was determined to be a better option. The CSFFM will be the primary tool for conducting the impact assessments later in the project so it will need to reflect the latest trend information and freight forecasts.

In addition to the GIS map discussed before, Fehr & Peers will host the web map during the course of the project for all study partners to view. The web-based map will provide information listed in Table 1.3, including daily and monthly seasonal pattern, truck classification count, and/or congested speeds. However, the information presented for all segments along I-5 and SR 99 is not complete and may be out of date. This data will be supplemented with data contained in the CSFFM during the next phase of the study.

Table 1.3 Segment Fact Sheets

Data category	Detail variables
Design characteristics	Approximate length of each segment
	Number of main lanes at each segment
	Functional classification
	Posted speed limit
	Number of grade separated interchanges along each segment
	Capacity
Volumes	Daily AM and PM peak period (total traffic and truck only traffic)
	Day of week traffic pattern (total traffic and truck only traffic)
	Monthly traffic pattern (total traffic and truck only traffic)
	Percentage of small, medium and heavy trucks
Origin-Destination data	Percentage of through trips vs trips generated in the Valley
	Distribution of origin and destination of trucks
Operation Performance measures	Average peak periods V/C
	Average congested speed during peak periods
	Peak period vehicle hours of delay
Land use information	Population density at block group level
	Caltrans and private truck stops and rest stops
	Intermodal facilities near each segment
	Freight clusters near each segment including large businesses (greater than 100 employees), distribution centers and warehouses
Safety status	Number of truck-related collisions per vehicle mile traveled
	Number of severe collisions per vehicle mile traveled
	Frequency, severity and type of collisions along each segment
	Truck signage inventory along each segment

2.0 ECONOMY, LAND USE AND DEMOGRAPHIC SUMMARY

The San Joaquin Valley is comprised of 8 counties, 62 cities, and is home to nearly 4 million people. The largest cities, Fresno, Bakersfield, Modesto, and Stockton have populations in excess of 200,000. It is a primarily agricultural region and one of the most productive in the country, with a major role in the distribution of agricultural products, processed food, and energy products throughout California. The Valley is home to a vast and diverse agricultural industry, producing crops such as cotton, grapes, nuts, as well as raising livestock. Much of the industry throughout the Valley works in support of the farming community. Several large oil fields located across the San Joaquin Valley contribute to a strong presence of the oil industry.

According to data published by the State of California Employment Development Department, the estimated labor force in the Valley is 1,822,600 with an unemployment rate of more than 10 percent in 2015. The statewide average in October 2015 was 5.7 percent. The average for the eight counties in 2014 was 11.6 percent and the trend since then has been a gradual improvement.

Table 2.1 presents the establishments by size in the eight counties of San Joaquin Valley (Kern, Kings, Tulare, Fresno, Madera, Merced, Stanislaus, and San Joaquin).

Table 2.1 Establishments by size in the Valley

		Number of Employees				
Industry	**Number of Establishments**	**1-99**	**'100-249'**	**'250-499'**	**'500-999'**	**'1000 or more'**
Agriculture, Forestry, Fishing and Hunting	529	508	12	7	0	2
Mining, Quarrying, and Oil and Gas Extraction	270	243	17	6	3	1
Utilities	273	264	5	2	0	2
Construction	5,320	5,270	38	7	3	2
Manufacturing	2,379	2,163	147	43	18	8
Wholesale Trade	3,477	3,398	60	17	2	0
Retail Trade	9,334	9,104	195	35	0	0
Transportation and Warehousing	2,487	2,401	61	16	7	2
Total	24,069	23,351	535	133	33	17

Source: CBP, 2013.

3.0 TRANSPORTATION NETWORK AND ACCESSSIBILITY

3.1 Roadway Network

I-5 and SR 99 Freeways

Interstate 5 and California State Route 99 make up the two primary north-south freeway routes through the San Joaquin Valley, connecting cities within the Valley as well as interregional travel between southern and northern California. Within the next few years, SR 99 will become exclusively a controlled-access freeway, like I-5, with the upgrading of the remaining non-freeway segments. The last traffic signal on SR 99 was bypassed in 1996, bringing the highway one step closer towards an uninterrupted corridor. SR 99 directly connects the major cities in the Valley, from Bakersfield north through Fresno, Modesto, and Stockton, while I-5 is primarily a through-corridor with few cities along the way.

Both highways are at least two lanes in each direction. SR 99 has been widened to three lanes along most of its length excluding some portions such as the cities of Atwater, Merced, and portions south to Madera. I-5 is almost exclusively two lanes from southern Kern County until it reaches I-205 near Tracy. The speed limit for most of I-5 through the region is 70 mph. Many long sections of SR 99 allow speeds up to 70 mph, but are reduced in urban areas to 65 mph or lower.

Other State Highways in the San Joaquin Valley

Many state highways cross the Valley and connect farms and industry to both I-5 and SR 99. Some of these include (from south to north):

- Primarily East-West
  - CA-4
  - CA-12
  - CA-120/205
  - CA-132
  - CA-140
  - CA-152
  - CA-155
  - CA-180
  - CA-198
  - CA-223
  - CA-46
  - CA-58
  - CA-65
- Primarily North-South
  - CA-33
  - CA-41
  - CA-43
  - CA-59
  - CA-145
  - CA-165

These highways encompass a wide variety of characteristics from freeways to rural roads, and many become more controlled (grade separation and ramps or signals) as they approach urban areas. For example, Routes 41, 43, 46, 152, and 198 are primarily classified as expressways or freeways for much of their length through the Valley, with limited driveway or local road access and typically higher speeds. Other routes have a less regional function and are characterized by more signals and intersections, undivided roadway, and lower speeds. In general, however, the speed limit on most state highways between I-5 and SR 99 is a minimum of 55 mph. Most of these routes are primarily one lane in each direction, but segments of Routes 41, 43, 198, and most of 152 are two lanes. Some routes, such as SR 132 and SR 58 are being planned for major improvement projects to increase capacity and mobility.

Truck Stops and Rest Stops in the Valley

There are 47 Caltrans truck stop facilities located in the San Joaquin Valley, as shown in Figure 3.1, including 22 along I-5 and 25 along SR 99. There are many more privately-owned truck stops[3] available along SR 99, with a fairly even distribution along the length, while I-5 has very sparse coverage with lengthy gaps between stops. According to our estimates, there are 74 total (public and private) truck stops within one mile of SR 99, which is 285 miles long in the study area. There are only 37 total truck stops within one mile of I-5, which is 298 miles long through the study area. In both cases, truck stops tend to cluster, but the clustering of stops along I-5 is greater, leaving gaps ranging from only a few miles to as long as 65 miles between available facilities. On SR 99 the gaps are generally much smaller, with no gap greater than 16 miles observed. Please refer to the GIS web maps for location of truck stops along each segment.

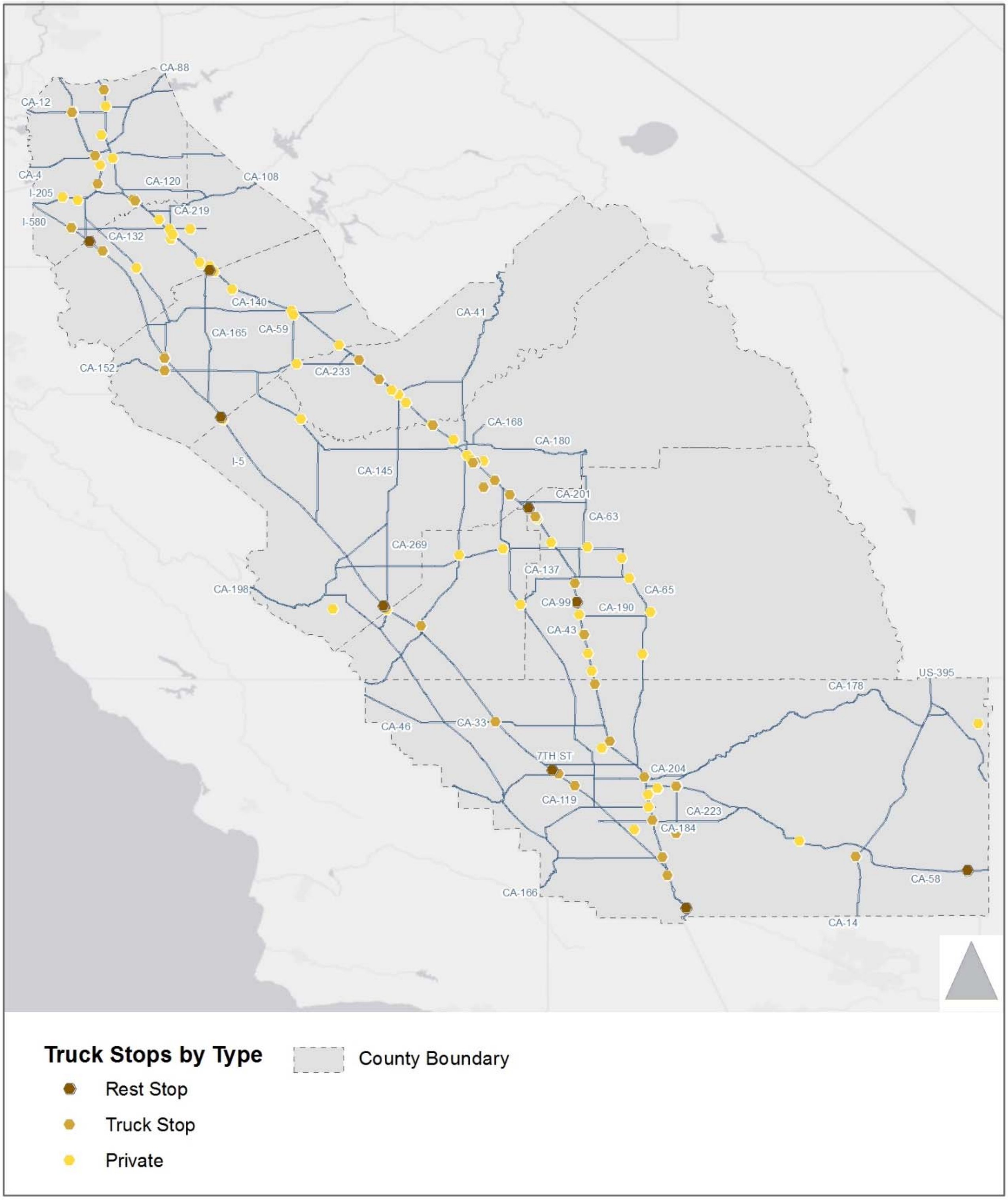
There is at least one truck stop facility per county on I-5. Kern County has the most evenly distributed and highest quantity of truck stops. On SR 99, truck stop coverage is generally evenly distributed among each county. Truck stops are often located near interchanges with state routes, especially on I-5 between Kern, Kings, Merced, and San Joaquin counties. This is less true along SR 99, where the urbanized areas are more frequent and geographic coverage is greater.

3.2 Rail Transportation: Short Lines and National Connections

The rail freight network in the San Joaquin Valley includes two Class I railroads, the BNSF Railway and Union Pacific Railroad (UPRR), and a number of Class III "short line" railroads which primarily provide local freight service and organization of freight (switching) for larger railroads. Railroads are grouped into three classes based on annual operating revenue limits established by the Surface Transportation Board (STB). Class I railroads generate more than $399 million in annual operating revenues, while Class III short lines generate less than $31.9 million in annual operating revenues. There are no Class II railroads operating in California.

[3] Private truck stops are identified based on online search. There was no consolidated list available.

Figure 3.1 Location of Truck Stops in the Valley



Source: Online data sources (8).

According to the 2013 California State Rail Plan, there are 26 active short line and switching railroads across the state. At least eight of these (operating more than 10 miles of track) are active in the San Joaquin Valley. The report identifies several projects in the Valley that improve connections between railroads and the Port of Stockton, and other short line projects to upgrade track and improve the ability of short lines to carry the heavier loads that larger railroads move.

Future Roadway and Rail Plans and Projects

Fehr & Peers conducted an extensive literature review covering many studies and plans from the past decade on freight and mobility topics that have a statewide or San Joaquin Valley focus. The documents are generally grouped by subject matter: congestion and demand management; safety; air quality, sustainability, and the environment; rail and intermodal freight; and finally, funding. A summary of each document is provided in the subsequent sections. Some documents touch on several or all of these topics. There are studies that collected and analyzed freight travel data in support of future planning efforts, and other documents that comprehensively identify improvement projects for selected corridors. A few documents identify high-level policies or recommended practices that may relate to goods movement.

Congestion & Demand Management Projects

Most of the documents included in the literature review are primarily concerned with road congestion and demand management, by inventorying planned projects to address specific issues, or through policy recommendations such as congestion pricing. There are several documents with a broad geographic focus, primarily those developed by Caltrans. Some are more regionally focused, typically studies conducted by Councils of Governments.

- Transportation Concept Report (Caltrans, various years)
  - These four documents provide direction for policies and plans within a specific Caltrans district for reducing congestion and improving safety.
    - SR 99 District 6 (2003)
    - SR 99 District 10 (2002, 2008, 2011)
    - I-5 District 6 (2013)
    - I-5 District 10 (2012)
- Updated Business Plan for SR 99, Vol I-III (Caltrans 2013)
  - Identifies funding sources for a set of projects based on long-range goals to improve operations and meet demand for capacity. Projects include interchange improvements, select highway widening, and addition of new interchanges.
- State of California Freight Mobility Plan (CFMP) (Caltrans 2014)

  - "Address[es] the needs of California's full, multimodal, integrated freight system… An aggregate of the freight projects included in each of the State's regional transportation plans yields a list of 700 projects, addressing all freight modes"

- Tulare County Association of Governments Regional Transportation Plan, Goods Movement Chapter (2014)

  - Primarily a policy document that focuses on agricultural commodities movement and related improvements on State Route 99. Also notes major projects such as widenings of Road 80, Avenue 416, State Route 65 south of Porterville, and the conversion of Spruce Road (future SR-65 alignment) into a 2-lane expressway.

- Fresno Council of Governments (COG) Regional Transportation Plan (2014)

  - High-level policy document with limited emphasis on freight. Does not identify specific projects, except with regards to the near-term expansion of SR-99 to six lanes along all portions in the county.

- Alameda County's Goods Movement Plan: Inventory of Plans and Studies (2014)

  - Policy document that reviews all other related plans in the county, region, and state noting goals, trends/issues, land use trends/issues, projects, and mitigation measures. Identifies projects with high level analysis of each plan, including the Alameda Countywide Transportation Plan with $239 million for road/freight/goods movement.

- Kern COG Regional Transportation Plan/Sustainable Communities Strategies (2014)

  - High-level policy document with a "Freight Movement Action Element." Lists short- and long-term proposed actions including the widening and construction of new roadways, expansion of rail, intermodal options, truck climbing lanes on SR 58, and the creation of Paramount Logistics Park for freight activities.

- Kings County Regional Transportation Plan and Sustainable Communities Strategies (2014)

  - High-level policy document with a "Goods Movement" chapter, focused on railroad and freight truck movements and emphasizes the agricultural industry product movements. Does not list specific freight projects.

- San Joaquin Valley Interregional Goods Movement, Executive Summary (2013)

  - Long range plan through 2040, includes a prioritized project list and top 50 freight projects for the San Joaquin Valley.

- I-5, SR-99 Origin and Destination Truck Study (2009)

  - Study uses survey and truck travel data to understand goods movement in the San Joaquin Valley. Does not list specific freight projects.

- SR-99, SR-198 Gateways Truck Origin and Destination Study (2015)
  - Uses survey and truck travel data to understand goods movement in the San Joaquin Valley, and does not list specific freight projects.

Safety Improvement Projects

Improving safety is often an impetus for infrastructure projects, and is thus included in various forms in documents such as the Caltrans *Updated Business Plan for SR-99*, the Caltrans *Transportation Concept Report* series, or many of the above plans conducted on behalf of various regional governments. These documents primarily identify specific projects along major freeway facilities, such as improving interchange designs or deploying intelligent transportation systems (ITS), many of which have safety benefits as a primary or secondary goal. The Federal Motor Carrier Safety Administration (FMCSA) *Large Truck and Bus Collision Facts 2013* does not identify any projects or policies but provides national statistics on commercial vehicle collision data. The list below includes only documents specifically concerned with safety data and analysis:

- Large Truck and Bus Collision Facts (FMCSA, 2015)
- Traffic Safety Facts 2013 (National Highway Traffic Safety Administration, 2013)

Air Quality, Sustainability, and Environmental Projects

The effects of highway travel on the environment are becoming a greater concern over time, leading to several policy-focused documents that will have an influence on goods movement.

- CARB Sustainable Freight (2015)
  - Lists enforcement policies and regulations to reduce emissions, and generalized land use and highway planning goals.
- San Joaquin Valley Goods Movement Sustainable Implementation Plan (RFP, 2015)
  - Plan which prioritizes freight first/last mile issues, truck routing and parking needs, rural priority corridors, goods movement performance measurement and system modeling frameworks, a sustainable communities and freight strategy integration, and public outreach.
- Land of Risk/Land of Opportunity: Cumulative Environmental Vulnerability in California's San Joaquin Valley. UC Davis Center for Regional Change (2011)
  - Provides a health assessment of the San Joaquin Valley, including the risks of living near freeways. Does not identify specific actions or mitigations related to highway management.

Rail and Intermodal Freight Movement Improvement Projects

In many cases, the subject of rail and intermodal freight movement is closely related to the congestion and demand management topic. The documents listed below are those primarily concerned with rail planning, but several documents in the above congestion topic include projects or policies related to rail transport.

- California State Rail Plan (Caltrans 2013)
  - "Establishes a statewide vision and objectives, sets priorities, and develops implementation strategies to enhance passenger and freight rail service in the public interest." Specifically identifies a number of grade crossing projects and short line railroad projects, noting that short lines are often vital to improving freight mobility but may lack the resources of national railroad companies.
- San Joaquin Corridor Strategic Plan, Caltrans, (2008)
  - Focuses on strategic rail improvements within the corridor. The plan highlights Alternative 1 as the best development strategy for the corridor, which improves frequency and tracks and prioritizes improvements into immediate, near-term, medium-term, and long-term projects.
- Service Development Plan for San Joaquin Corridor (2013)
  - Plan for improved intercity passenger rail service in the San Joaquin Corridor. Describes service expansion and operational improvements.

Funding Sources for Projects

The funding of projects is an ever-present concern, but as several documents note, such as the *San Joaquin Valley Interregional Goods Movement Plan*, funding specifically for goods movement is especially scarce and must be assembled from many sources. Many of the documents listed already identify potential funding sources, such as the *Updated Business Plan for SR-99,* the *California State Rail Plan*, Regional Transportation Plans and other strategic plans. San Joaquin Valley Interregional Goods Movement Plan (2013) provided a complete review of funding resources for prioritized projects in the Valley.

4.0 EXISTING TRAFFIC CONDITION

To systematically study truck traffic in the San Joaquin Valley via I-5 and SR 99 and other major state routes, the roadway network was divided into 152 segments.

Figure 4.1 shows the study network. These segments cover 298 miles of I-5, 285 miles of SR 99, and 1,780 miles of other state routes. We prepared a Geo-Database to integrate all the data sources in consistent format. There are significant discrepancies in the data from different data sources due to data collection methods, and assumptions in reporting the data. Where these discrepancies were significant, we selected the information from the source that was most appropriate based on our knowledge of the area. The data sources are used for traffic volumes are:

- Performance Measuring System (PeMS) year 2014
- Weigh-in-motion (WIM) year 2014
- Travel Advance Monitoring System (TAMS) year 2014 and 2015
- Other individual counts year 2010 and later
- Caltrans annual count book 2013 and 2014
- Highway Performance Monitoring System (HPMRS) (two month summary in 2015)

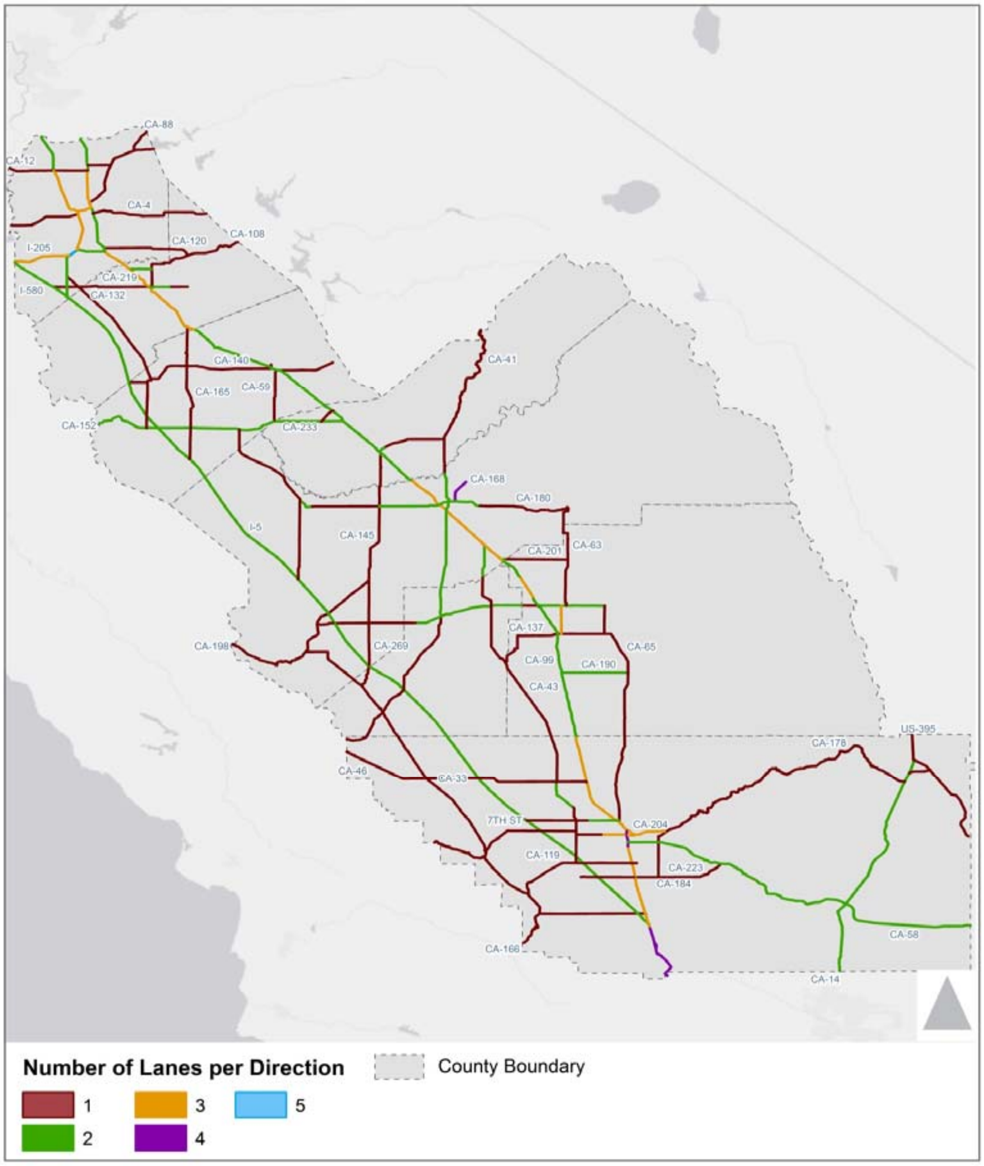
Fehr & Peers developed a web map with visual summary fact sheets for each segment to facilitate reviewing process. Fehr & Peers will host the web map during the course of the project and deliver the geo-database to client at the end of the project. The goal is to provide the traffic and other information presented in Table 4.1 for each segment.

Table 4.1 Segment Fact Sheets

Data category	Detail variables
Design characteristics	Approximate length of each segment
	Number of main lanes at each segment
	Functional class
	Posted speed
	Number of grade separated interchanges along each segment
	Capacity
Volumes	Average daily AM and PM peak period (total traffic and truck only traffic)
	Day of week traffic pattern (total traffic and truck only traffic)
	Monthly traffic pattern (total traffic and truck only traffic)

Data category	Detail variables
	Percent of small, medium and heavy trucks
Operation Performance measures	Average peak period V/C
	Average congested speed during peak periods
	Peak periods vehicle hours of delay

Figure 4.1 Study Segments



Source: California Statewide Model Network, Aerial images.

The Caltrans statewide truck network and the San Joaquin passenger model network were used to identify design characteristics of each segment in the study area. Furthermore, a close examination of overall traffic along I-5 and SR 99 provided an understanding of the relationship between commodity flows and truck traffic patterns along I-5 and SR 99 in the region.

4.1 Overall Traffic Patterns

The data from 912 PeMS stations located on state highways and freeway main lines for 2014 were combined and processed. There are 382 stations on SR 99, 151 stations on I-5, 71 stations on North/South highways, and 237 on East/West truck routes in the Valley. Since the focus of this study is interregional movements, stations in high-density urban areas were excluded.

PeMS is the only data source that provides continuous information about speeds and volumes throughout the year at each location. It is the best data source to examine seasonality, day of week patterns and peak and off-peak hour volumes. It also provides average speed during each hour. This information was used to calculate vehicle hours of delay during peak periods. PeMS detectors do not differentiate vehicle type but combining this database with local counts, GPS data and weigh-in-motion (WIM) counts provides a good indication of overall traffic and truck traffic flows in the study area.

Monthly Traffic Pattern

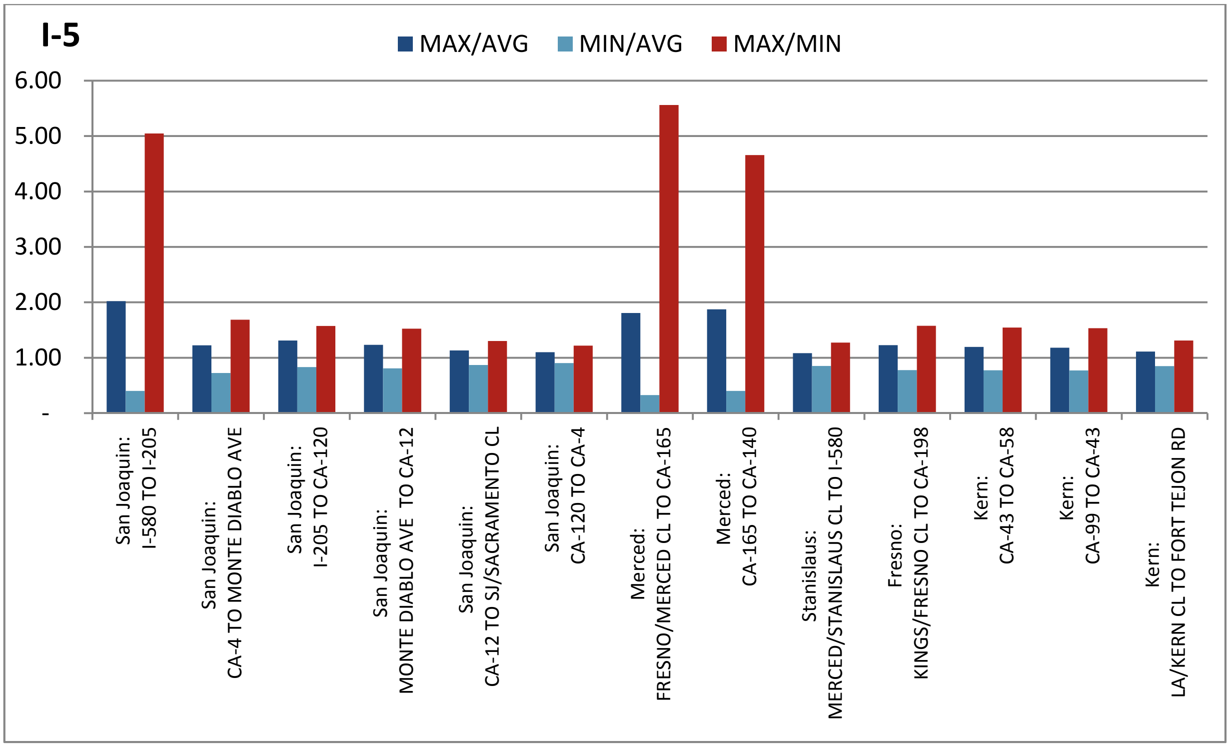
Monthly and daily traffic patterns for each segment are provided on the web map. Fifty of 152 segments in the study area have a PeMS station. Some segments have more than one PeMS station. At the time of this study there was no PeMS station at Kings County. Therefor there is no representative of study segments from Kings County in figures and tables of seasonality and temporal analysis.

The seasonality effect is not the same for all segments. To measure the extent of seasonal variation in traffic, three ratio of $\frac{Maximum\ month}{minimum\ month}, \frac{Maximum\ month}{monthly\ average}, \frac{Minimum\ month}{monthly\ average}$ for each segment is calculated, where these ratios are close to 1 the average, maximum and minimum traffic volume along the segment are close and the seasonality effect is not significant.

Figure 4.2 and Figure 4.3 show seasonality of several segments along I-5 and SR 99. In general, I-5 traffic patterns show more variability by month. The highest seasonality effects for both corridors are in San Joaquin and Merced counties.

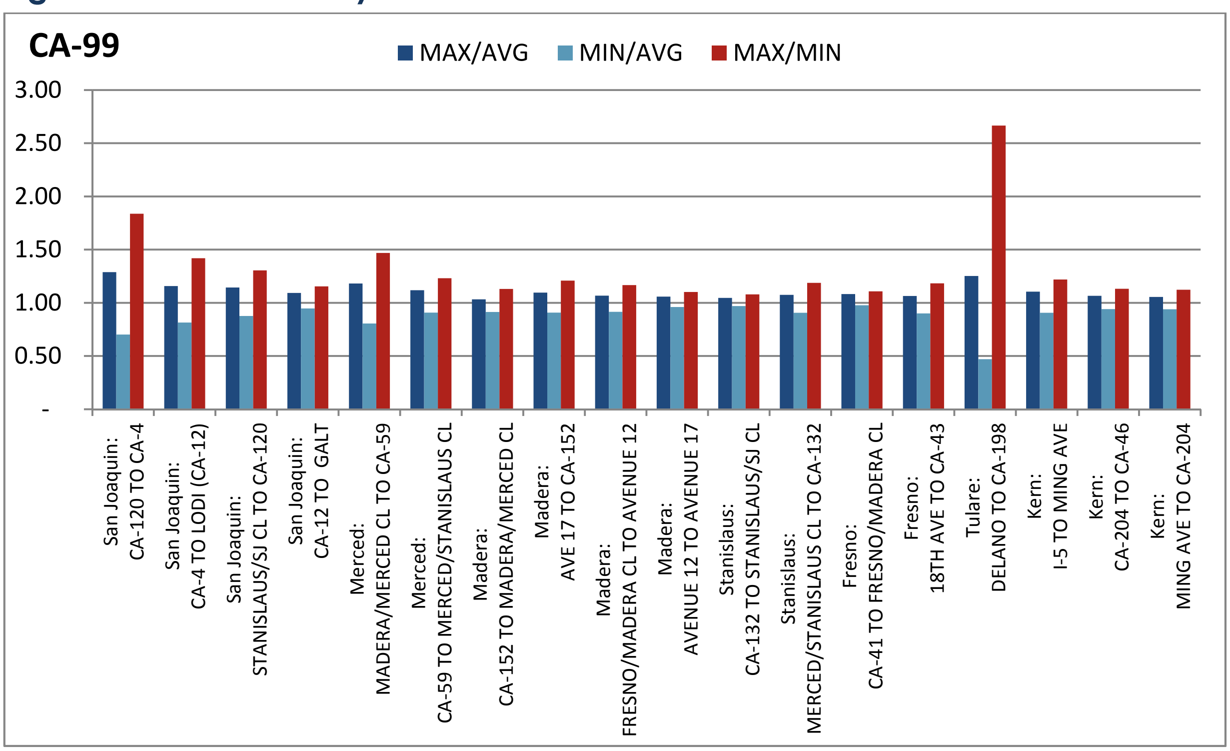
The highest and lowest months are not consistent among different segments of the I-5 and SR 99 corridors. Overall the highest months are April to July and the lowest months are December to February.

Figure 4.2 Seasonality Effect for Stations on I-5



Source: PeMS, 2014.

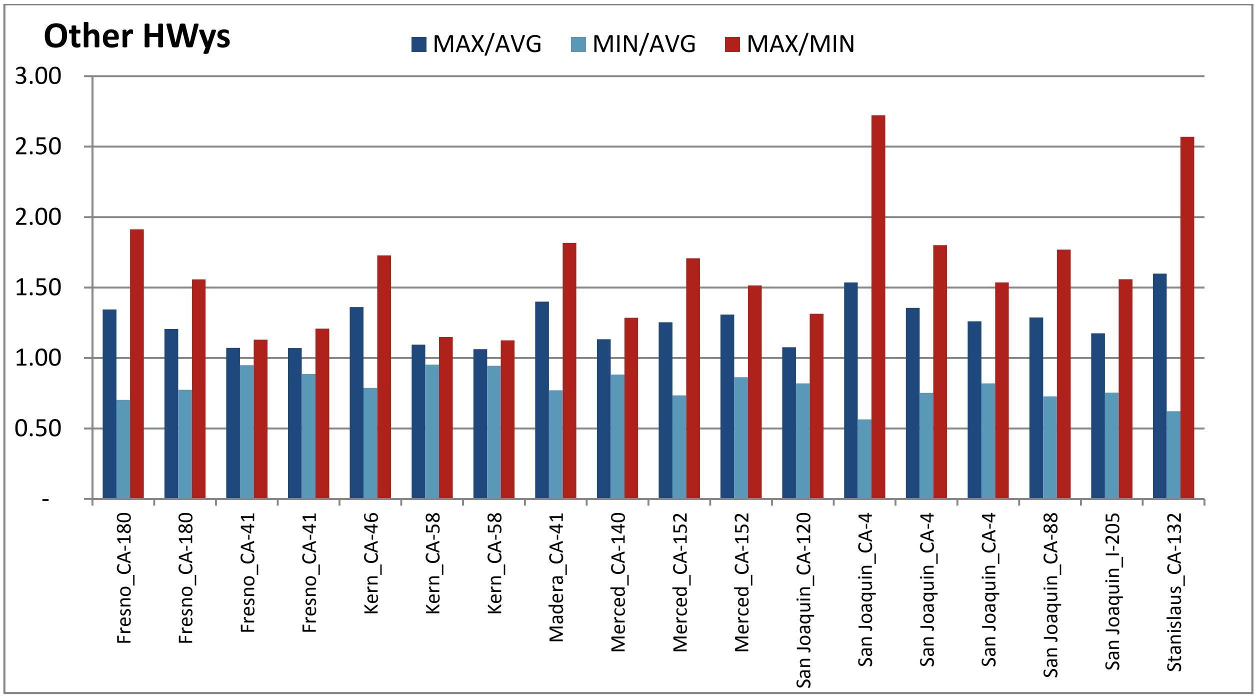
Figure 4.3 Seasonality Effect for Stations on SR 99



Source: PeMS, 2014.

The seasonality effects on the other state highways are shown in Figure 4.4. The seasonality effect in San Joaquin and Merced County is greater than other counties. The highest and lowest month varies and there is no consistent pattern. Please refer to the fact sheets on the web map for each segment for the detailed seasonality pattern. A count of available PeMS detectors per highway segment is available in the appendix of this report.

Figure 4.4 Seasonality Effect for Stations on Other Highways in the Valley

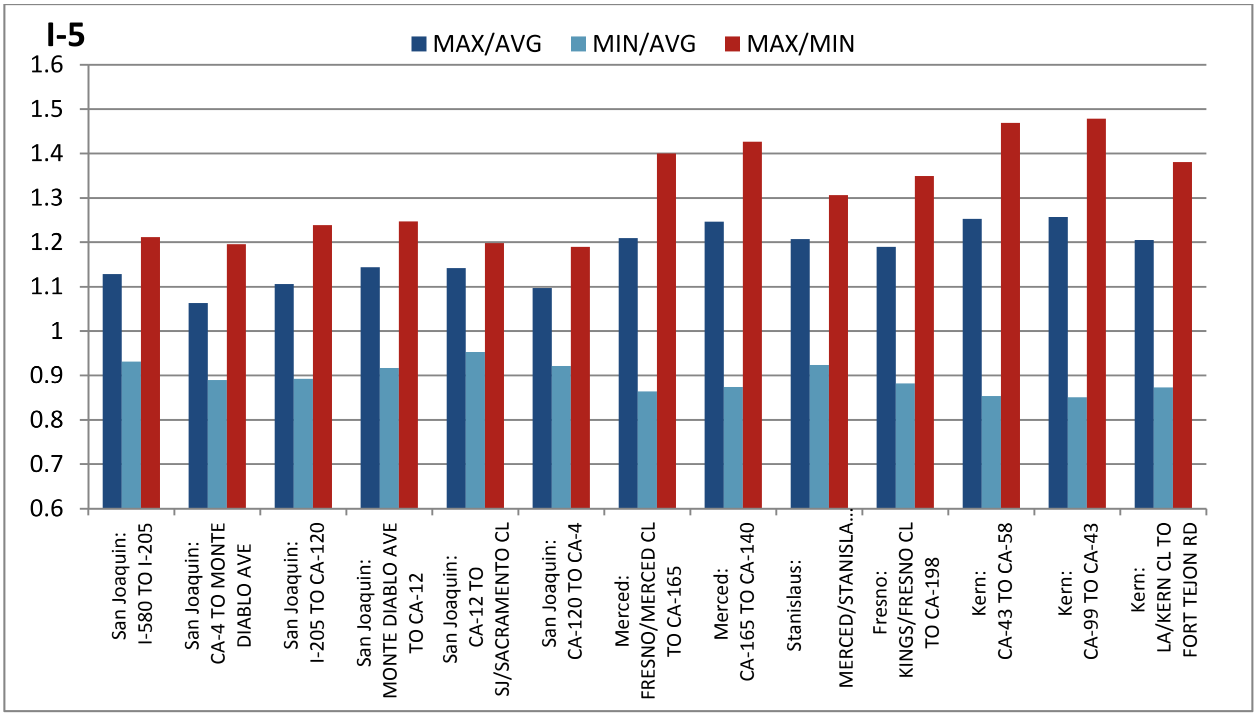


Source: PeMS, 2014.

Day of Week Traffic Pattern

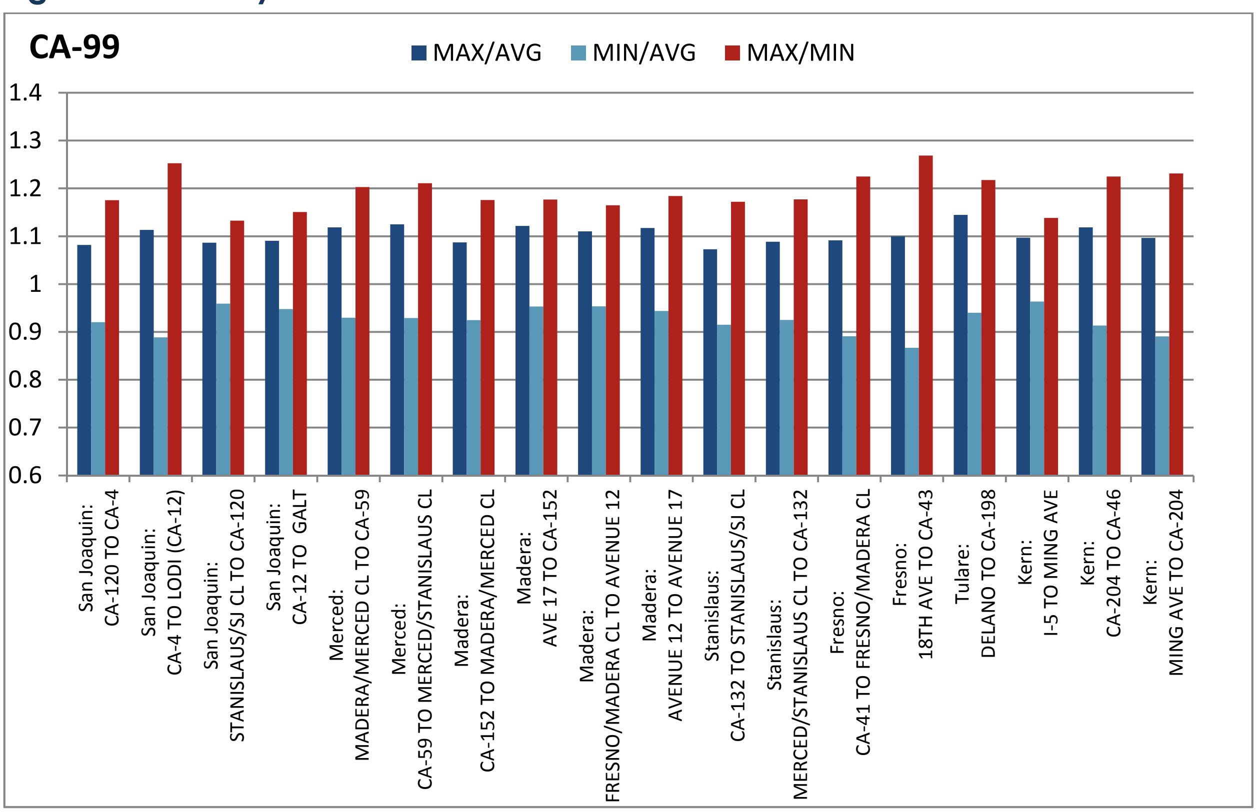
The fluctuations of traffic by days of the week are more significant and consistent along the corridor than seasonal patterns. Similar to monthly traffic patterns, Merced County and San Joaquin County present the highest daily fluctuation. Figure 4.5, Figure 4.6 and Figure 4.7 show the daily effect on segments along I-5, SR 99 and other state highways. Thursdays and Fridays are consistently the busiest days of the week across most segments of I-5, SR 99 and other state highways in the Valley. The lowest daily traffic on most segments of SR 99 and other state highways happen on Saturday and Monday, while the I-5 corridor has the least daily traffic on Saturday or Tuesday.

Figure 4.5 Daily Effect for Stations on I-5



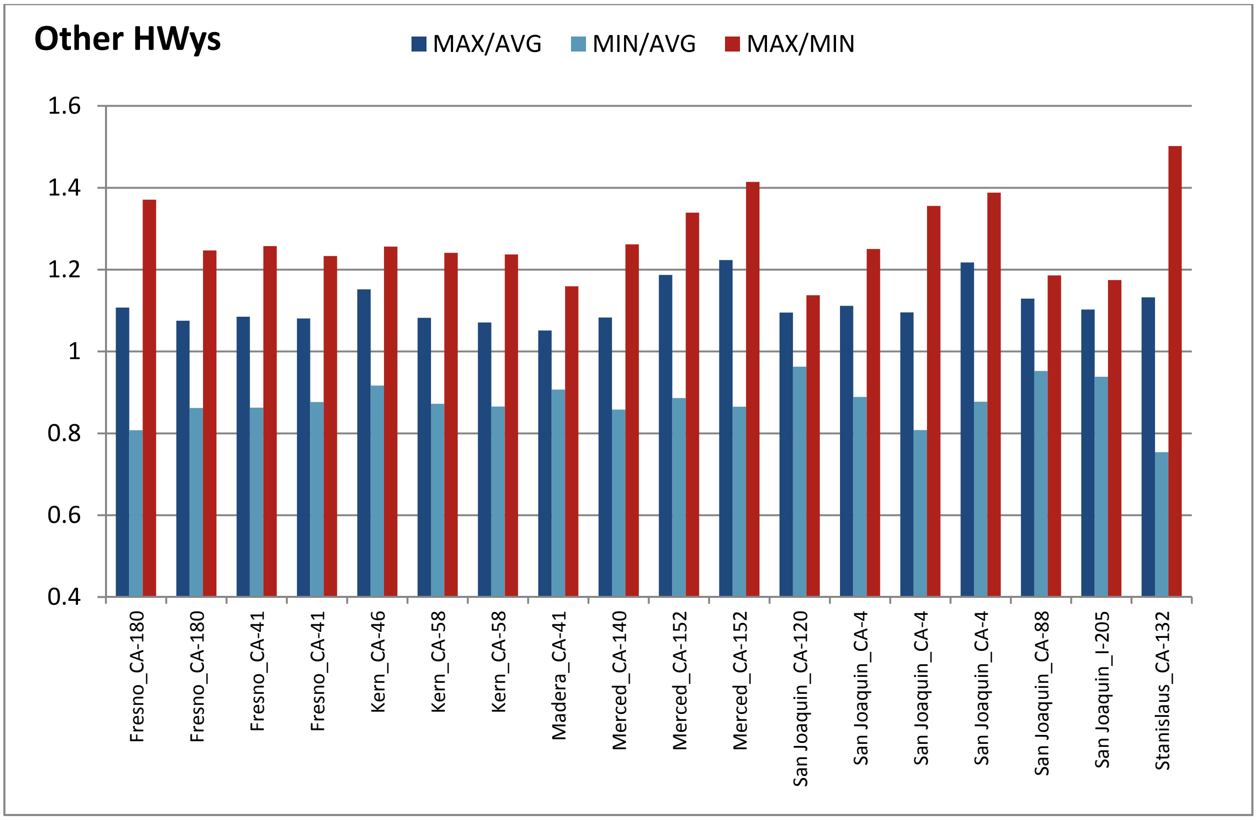
Source: PeMS, 2014.

Figure 4.6 Daily Effect for Different Stations on SR 99



Source: PeMS, 2014.

Figure 4.7 Daily Effect for Stations on Other Highways in the Valley



Source: PeMS, 2014.

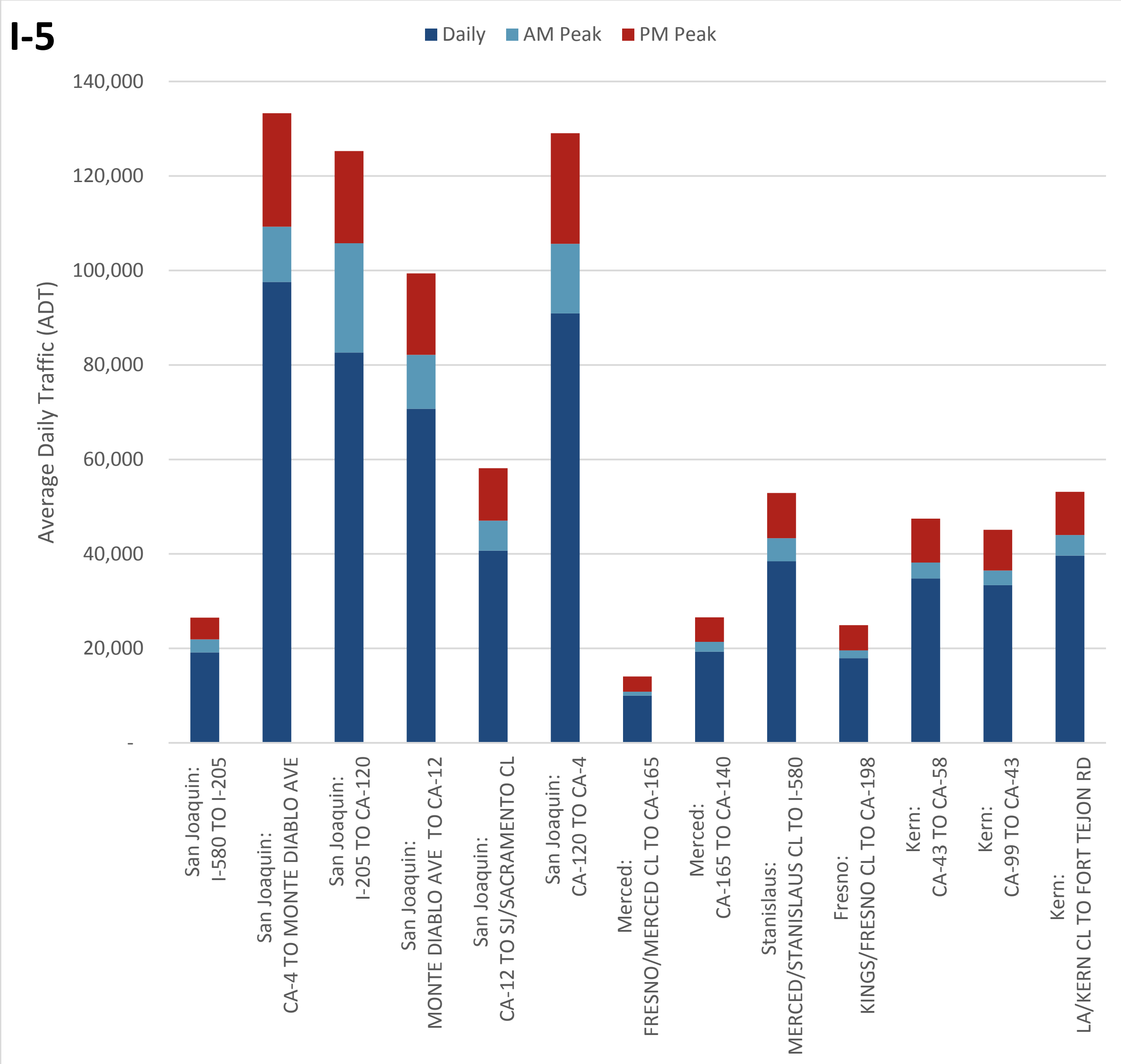
Time of Day Traffic Pattern

For this study AM and PM peak periods are defined as 6:00 to 9:00 AM and 3:00 to 7:00 PM respectively. Figure 4.8 and Figure 4.9 show average daily traffic (ADT) on different segments of I-5 and SR 99 and their share of AM and PM peak period traffic.

On the I-5 corridor, on average, 10 to15 percent of daily traffic occurs during 3-hour AM peak period and 24 to 32 percent of the traffic happens during the 4-hour PM peak period. There are two exceptional segments: 1) I-5 between I-205 and SR 120 with a morning peak of 28 percent of daily traffic, and 2) I-5 between the Merced/Fresno County line and SR 165, with a PM peak period at 37 percent of daily traffic.

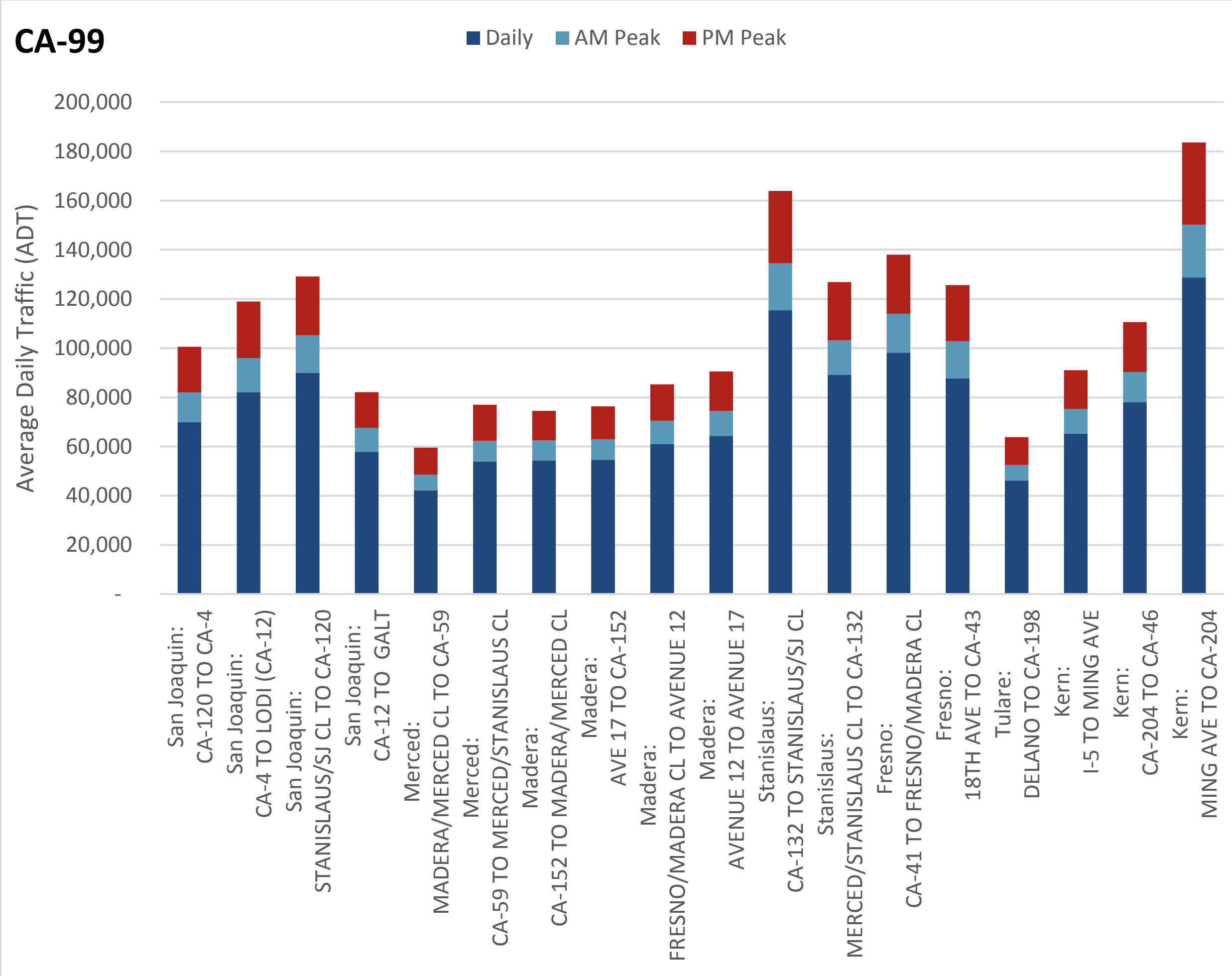
On SR 99, the average share of morning peak period to daily traffic is 14 to 17 percent and the average share of PM peak period is 25 to 30 percent. Therefore, the traffic on SR 99 has more time of day peaking than I-5.

Figure 4.8 Daily and Peak Period Volumes for Stations on I-5



Source: PeMS, 2014.

Figure 4.9 Daily and Peak Period Volumes for Stations on SR 99

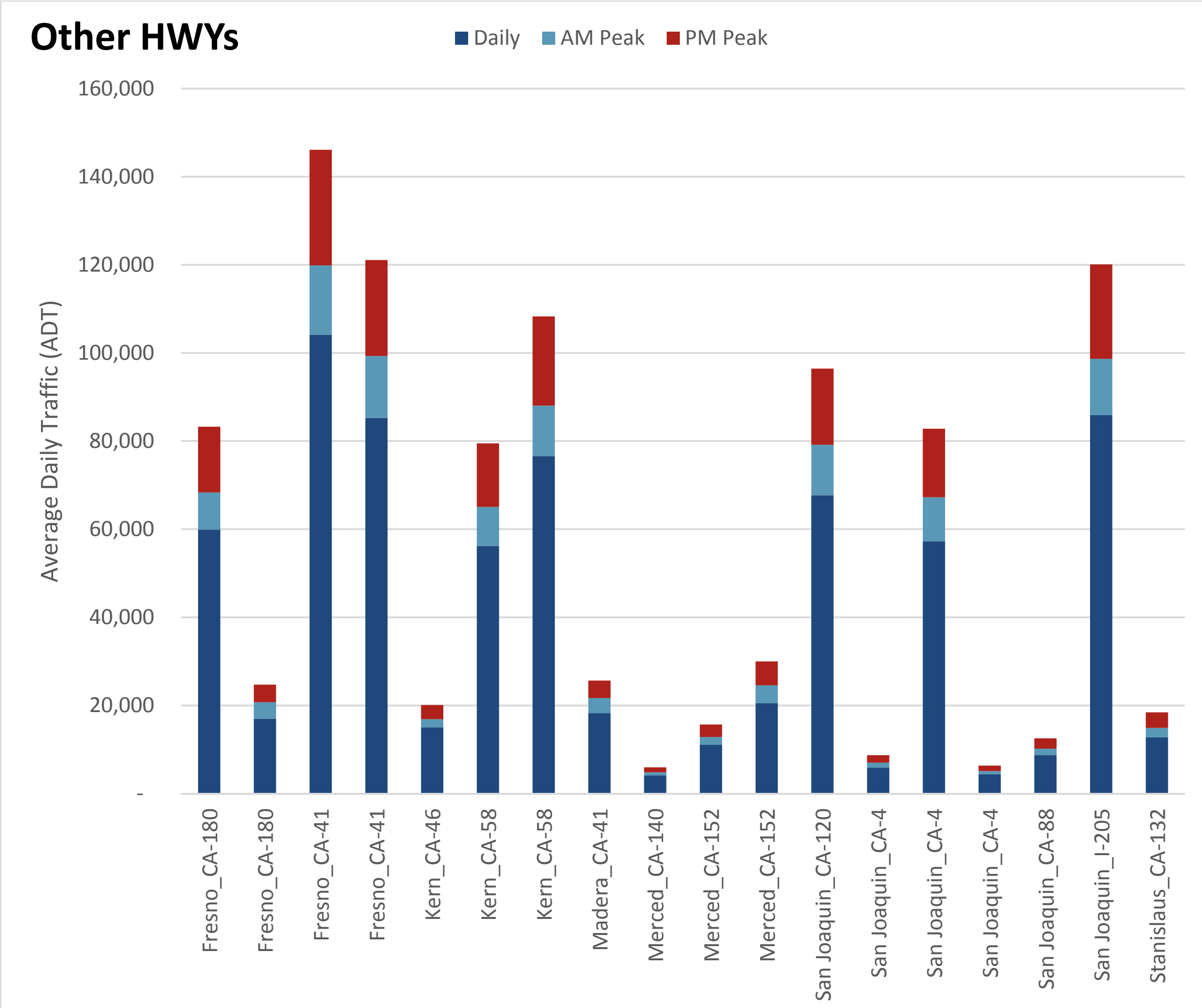


Source: PeMS, 2014.

On the other state highways, the traffic during the AM peak period is about 15 to 20 percent of the average daily traffic. The exceptions are: SR 180 between Clovis (Temperance Avenue) to SR 63 and SR 46 between I-5 and the San Luis Obispo/Kern County line. The AM peak period traffic on these two segments are 22 and 12 percent, respectively.

Traffic during the PM peak period is between 22 to 28 percent of the average daily traffic on the other state highways in the Valley. Figure 4.10 shows the AM and PM peak period shares of traffic and average daily traffic on the other state highways in the Valley.

Figure 4.10 Daily and Peak Period for Stations on Other Highways in the Valley



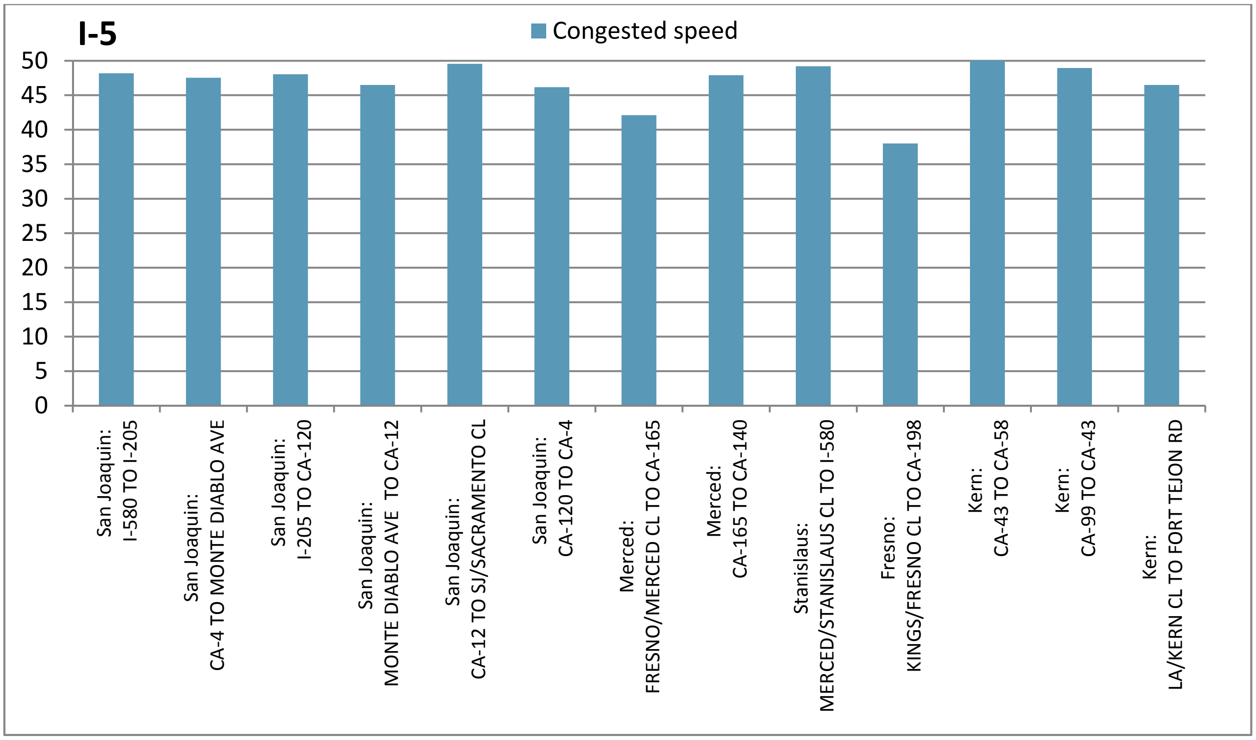
Source: PeMS, 2014.

Traffic Operation Performance Measures

The average congested speed during the AM and PM peak periods for the year of 2014 along segments of I-5 and SR 99 are calculated and shown in Figure 4.11and Figure 4.12. The posted speed limit on all of these segments is 65 mph.

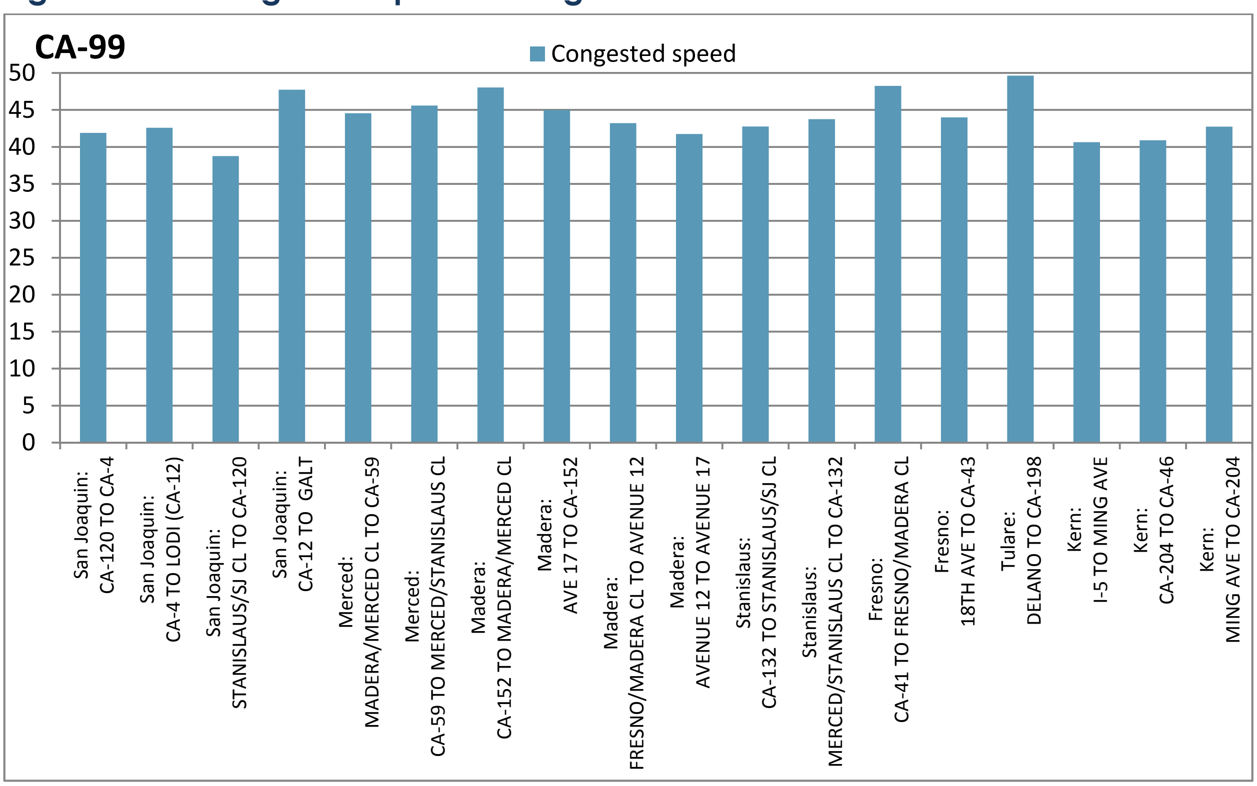
Although congested speeds on some segments of I-5 and SR 99 are 10 to 15 percent slower than posted speed, this does not necessarily mean there is traffic bottleneck. Outside dense urban areas the V/C ratio during peak periods for these corridors is less than 0.65, and the average V/C along I-5 and SR 99 during peak periods is 0.25 and 0.51, respectively.

Figure 4.11 Congested Speed during Peak Periods on Different Stations on I-5



Source: PeMS, 2014.

Figure 4.12 Congested Speed during Peak Periods on Stations on SR 99



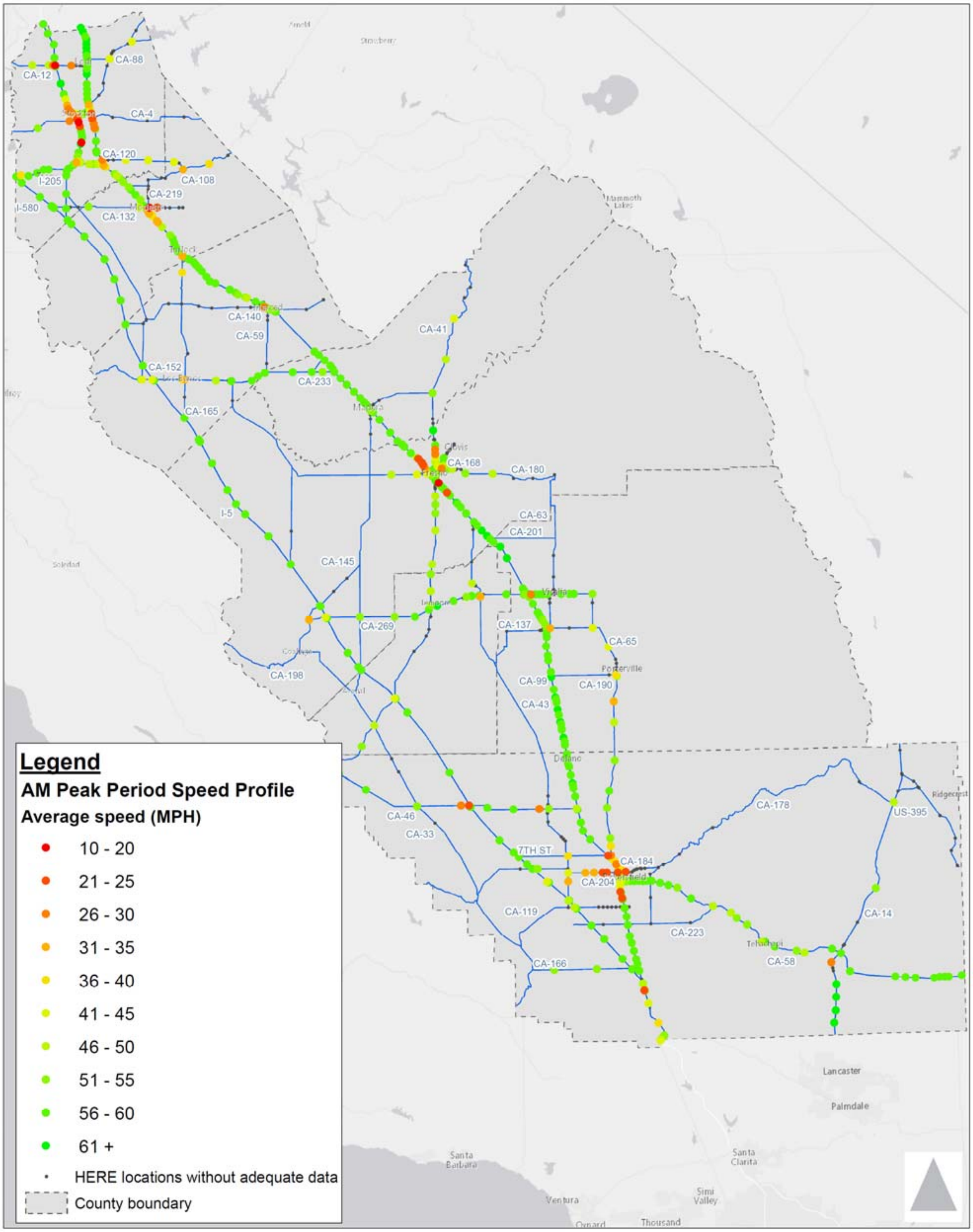
Source: PeMS, 2014.

We also analyzed HERE speed data for the month of October 2015 to identify congested locations along the state highways in the Valley. "HERE" also known as the National Performance Management Research Data Set (NPMRDS) and have larger coverage relative to PeMS. These data are collected at locations across the state highway network of the United States. Each location is made up of a certain length of roadway and is available in either direction. Data are averaged by five-minute increments and gathered into one-month batches by state. The data coverage is generally comprehensive, but not all locations have robust data sets for all times of all days of a given month.

The speed profile for all locations on Tuesday through Thursdays of the month during AM and PM peak periods (6-9am/4-7pm) were extracted. Locations with at least 10 days of available data were considered for this analysis. To evaluate the performance of each segment during peak periods, the lowest 15 minute average speed (slowest average weekday travel speeds for any 15 minutes of the peak period) was considered as congested speed. The results for AM and PM peak periods are shown in Figure 4.13 and Figure 4.14.

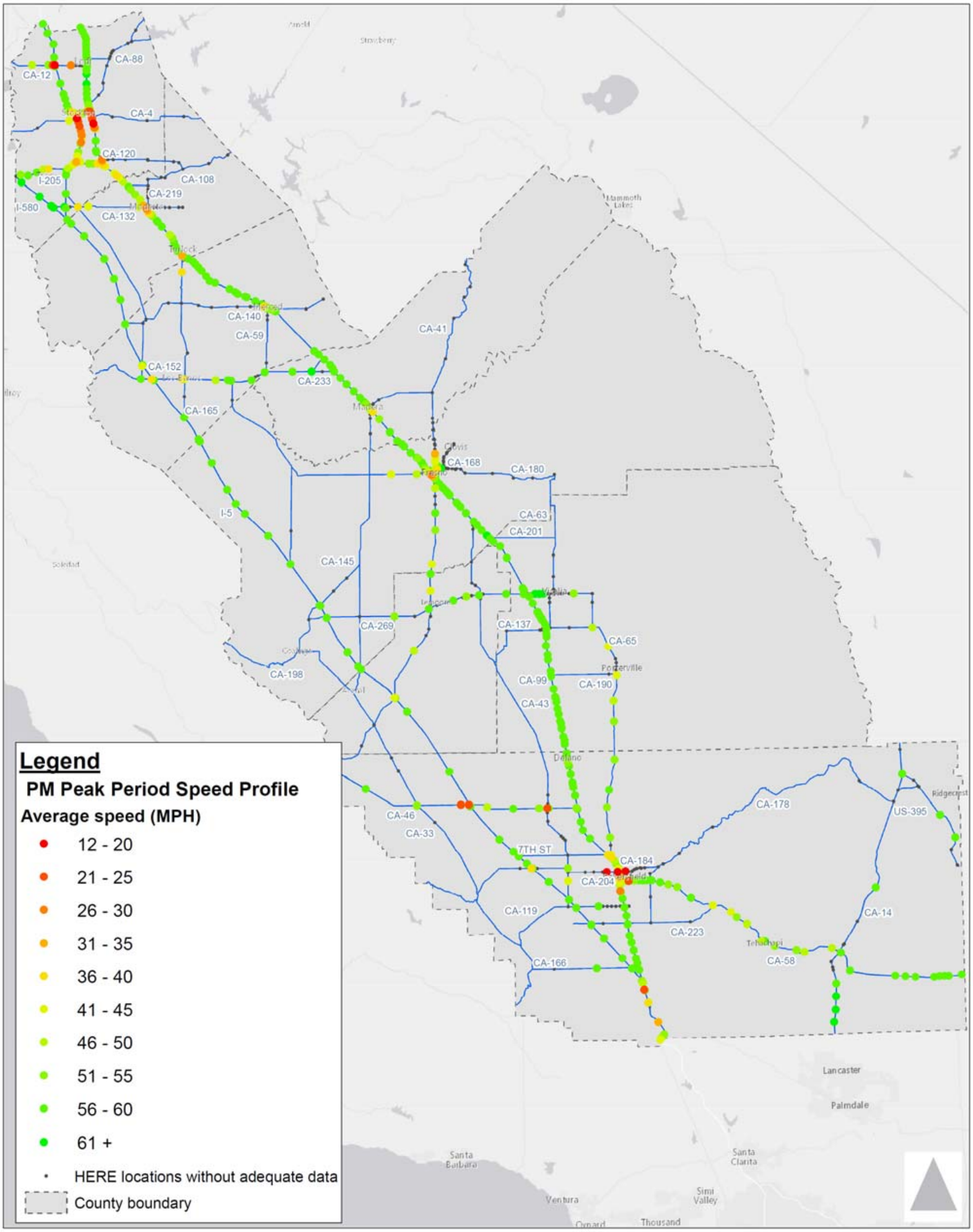
Similar to PeMS speed profile, the HERE speed data does not show any major congestion bottlenecks outside urban areas. It should be noted that HERE and PeMS data base do not have detail coverage at ramps and interchanges where most road users experience delay.

Figure 4.13 Congested Speed during AM Peak Periods



Source: HERE, October 2015.

Figure 4.14 Congested Speed during PM Peak Periods



Source: HERE, October 2015.

4.2 Truck Traffic Patterns

There are 13 Caltrans WIM Stations in the San Joaquin Valley. This is the only continuously available database that provides truck classification data by axle configuration. There are four stations along I-5, three stations along SR 99, and six other stations on other state highways, as shown in Table 4.2.

Table 4.2 Segments Fact Sheets

WIM Station ID	Location
I-5 Stations:	
1	I-5 San Joaquin County at post mile 43.7 near Lodi
27	I-5 San Joaquin County at post mile 7.4 near Tracy
7	I-5 San Merced County at post mile 20.2 near Santa Nella
73	I-5 Kern County at post mile 48.7 near Stockdale
SR 99 Stations:	
74	SR 99 Kern County at post mile 20.2 near Bakersfield[a]
10	SR 99 Fresno County at post mile 25 near Fresno
75	SR 99 Stanislaus County at post mile R8.4 near Keyes
Other Highways:	
113	CA-580 San Joaquin County at post mile 8.2 near Carbona
44	CA-205 San Joaquin County at post mile R9.5 near Banta
99	CA-102 Tuolumne County at post mile 6.4 near Tulloch
115	CA-65 Tulare County at post mile R23.4 near Porterville
114	CA-58 Kern County at post mile R64.9 near Arvin
36	CA-33 Merced County at post mile 20.2 near Los Banos

a The 2014 database did not include data for WIM Station 74 on SR-99

Source: WIM, 2014.

Data collected by the WIM stations in 2014 was processed and summarized to study seasonal and daily traffic patterns. Some stations were under maintenance during some months, and due to technical issues, the April data was deemed unusable.

The truck data available from the WIM stations is classified using the FHWA's axle-based truck classifications. For the purpose of this study, the nine FHWA truck classifications were aggregated into three groups as follows:

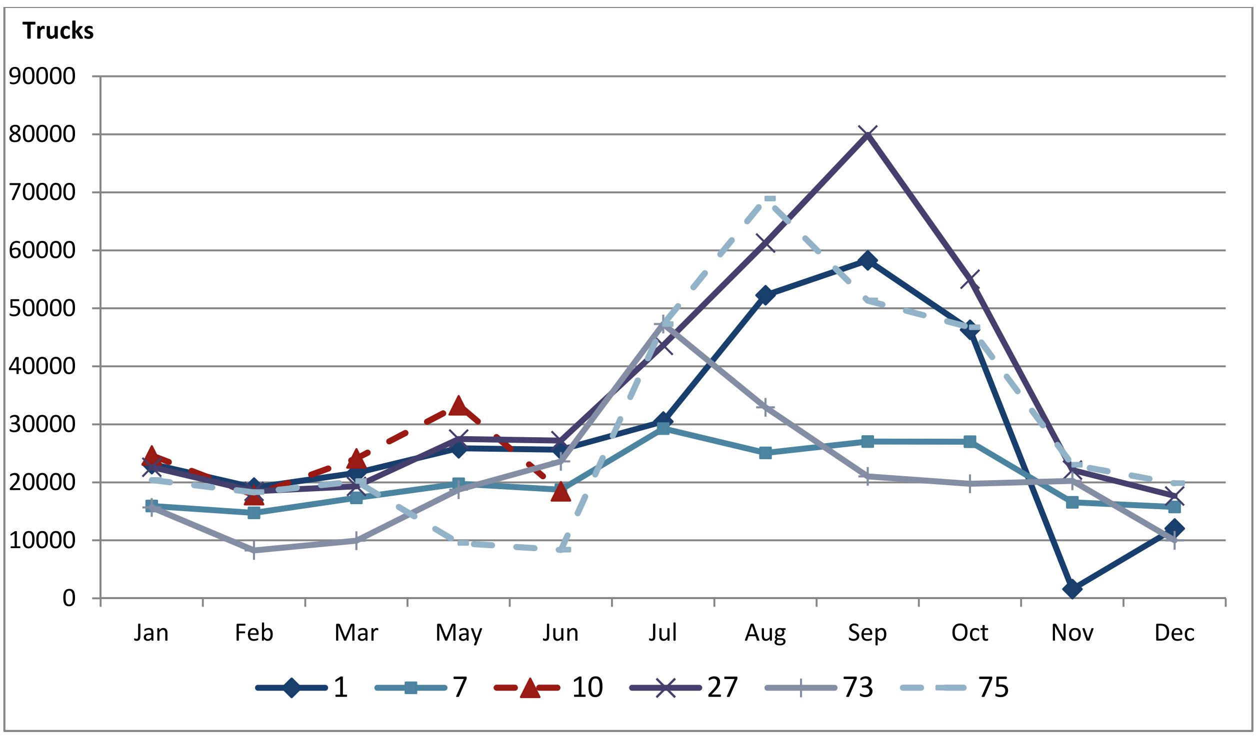
- Heavy-heavy duty trucks: multi-trailer trucks with 5 or more axles representing FHWA classes 11-13

- Medium-heavy duty trucks: Single-trailer trucks with 3 or more axles representing FHWA classes 8-10
- Light-heavy duty trucks: Single unit trucks representing FHWA classes 5-7

Although WIM counts do not reveal body classification or origin/destination information, previous surveys indicate that the origin and/or destination of the majority of trucks on SR 99 is within the San Joaquin Valley; whereas, the majority of trucks on I-5 have origins or destinations in Southern California, the Bay Area, or Sacramento. This topic is discussed further in Section 6.

Figure 4.15, Figure 4.16, and Figure 4.17show monthly traffic patterns for Heavy-, Medium- and Light-heavy duty trucks for stations along I-5 and SR 99 with available truck classification data. Dashed lines display the stations along SR 99 and solid lines display stations along I-5.

Figure 4.15 Monthly Traffic Pattern for Heavy-Heavy Duty Trucks on I-5 and SR 99



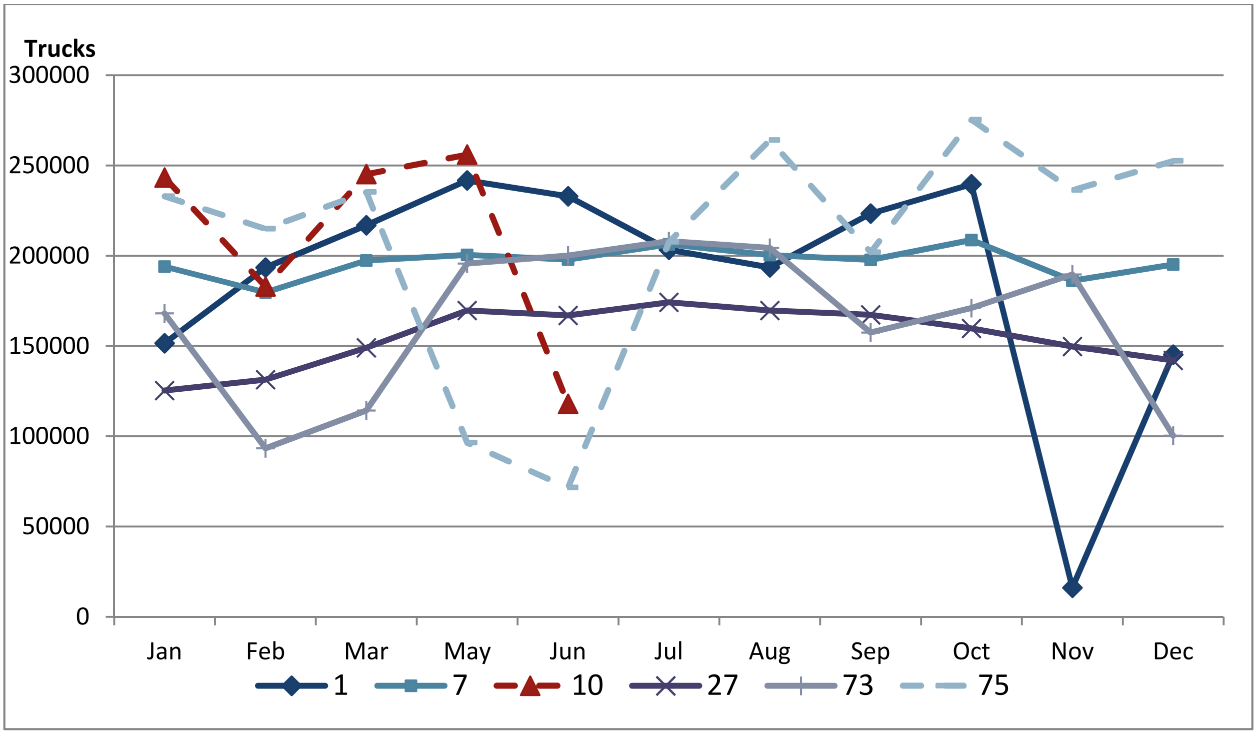
Source: WIM, 2014.

There is a clear difference in the seasonality effect for different truck classes. The peak season for Heavy-heavy duty trucks is between July and October for both I-5 and SR 99. The data for Station 1 on I-5 for November is not reasonable. This might be due to a calibration issue at the station. The data for Station 10 on SR 99 in Fresno County was not available between July and December. Heavy-heavy duty trucks contribute between 7 to 14 percent of total truck traffic on I-5 of SR 99. The share of Heavy-heavy duty trucks on I-5 is slightly higher (11 percent on I-5 versus 9 percent on SR 99)

Overall, Medium-heavy duty trucks have more monthly variation. Station 75 on SR 99 at Stanislaus County shows the largest monthly variation. Station 10 on SR 99 at Fresno County also shows similar fluctuation for available months.

Medium-heavy duty trucks contribute between 60 to 85 percent of the total truck traffic on I-5 and SR 99. The average share of Medium-heavy duty truck on I-5 is 75 percent, whereas it is 70 percent on SR 99.

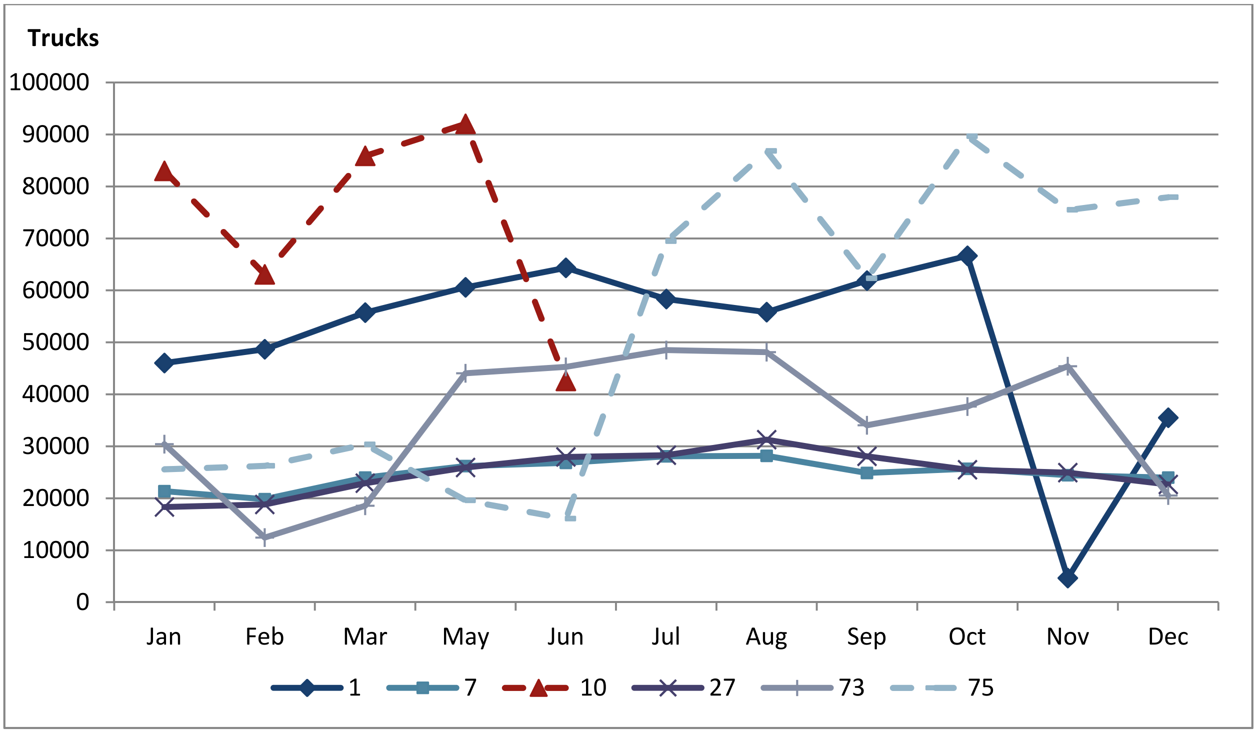
Figure 4.16 Monthly Traffic Pattern for Medium-Heavy Duty Trucks on I-5 and SR 99



Source: WIM, 2014.

The Light-heavy duty trucks are 11 to 24 percent of total truck traffic on SR 99 and 1 to 21 percent of total traffic on I-5. The monthly variation of Light-heavy duty trucks varies significantly at different stations with no specific pattern. Please refer to the fact sheets for each segment for detailed seasonal effects of truck traffic at each segment.

Figure 4.17 Monthly Traffic Pattern for Light-Heavy Duty Trucks on I-5 and SR 99



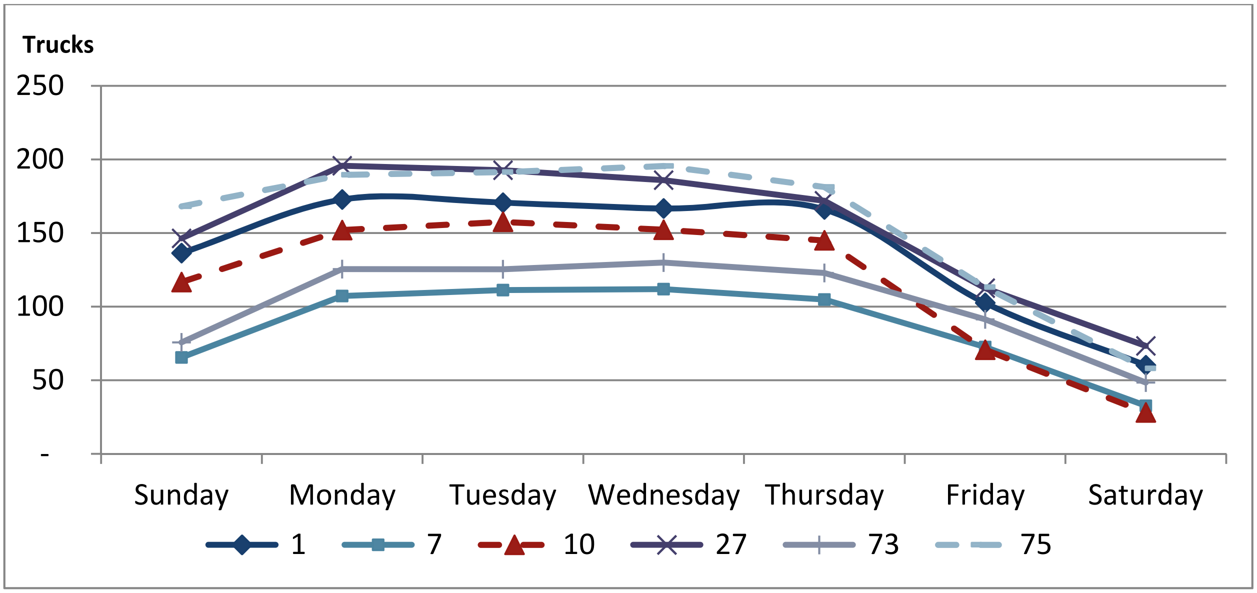
Source: WIM, 2014.

Truck Traffic Patterns by Day of Week

Figure 4.18 and Figure 4.19 and Figure 4.20 represent the day of week traffic patterns for Heavy-, Medium-, and Light-heavy duty truck traffic on I-5 and SR 99. The pattern for all truck categories is similar. Mondays through Thursdays have steady and higher traffic than Fridays and Sundays. As expected, Saturdays have the lowest truck traffic.

Survey data shows that the duration of trips for trucks on SR 99 are usually less than a day round trip and many trucks are traveling between similar facilities for a week.

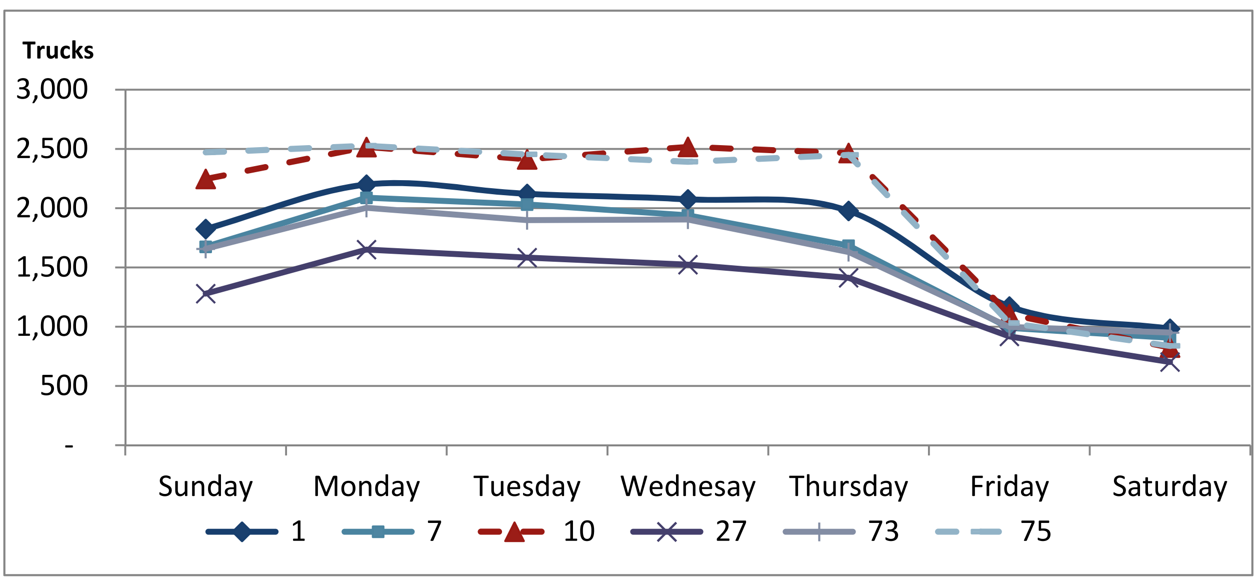
Figure 4.18 Day of Week Traffic Pattern for Heavy-Heavy Duty Trucks on I-5 and SR 99



Source: WIM, 2014.

Heavy-duty trucks on I-5 on Fridays and Sundays are about 60 to 75 percent of average daily traffic, whereas for SR 99 this ratio is 50 to 60 percent.

Figure 4.19 Day of Week Traffic Pattern for Medium-Heavy Duty Trucks on I-5 and SR 99

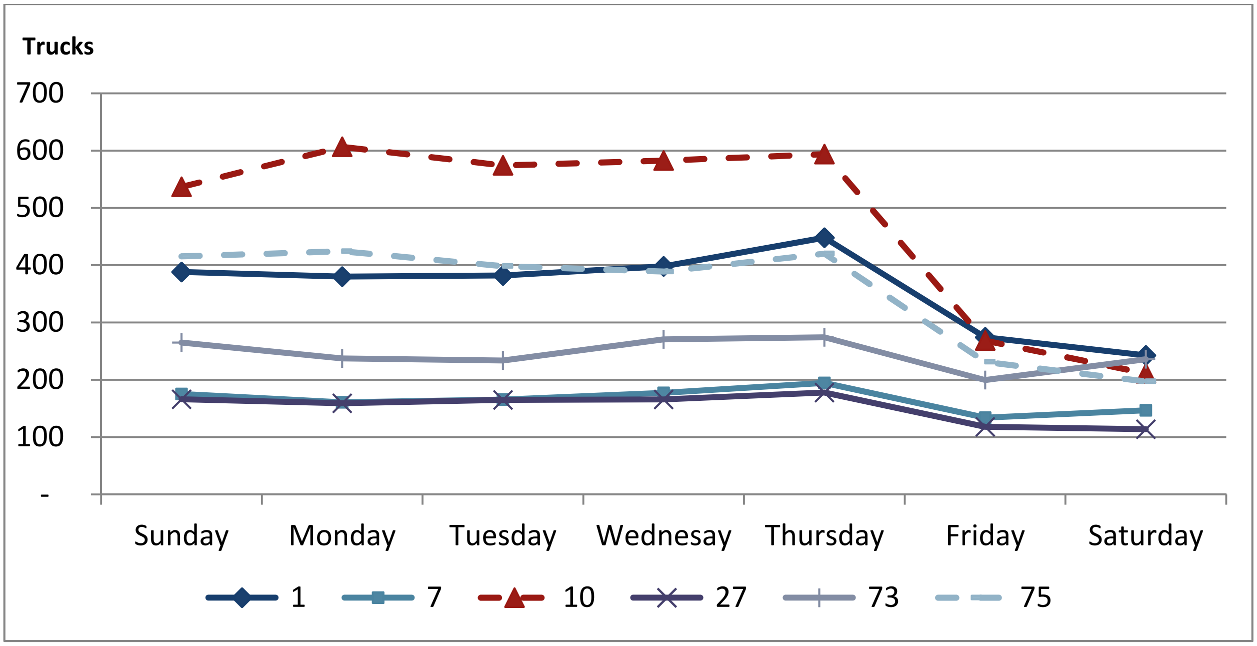


Source: WIM, 2014.

Medium-heavy duty trucks on I-5 on Fridays are about 50 to 60 percent of average daily traffic, and on Sundays are about 88 percent of average daily traffic. Medium-heavy duty trucks on SR 99 on

Fridays are about 40 to 45 percent of average daily traffic, and on Sundays are about 90 percent of average daily traffic.

Figure 4.20 Day of Week Traffic Pattern for Light-Heavy Duty Trucks on I-5 and SR 99



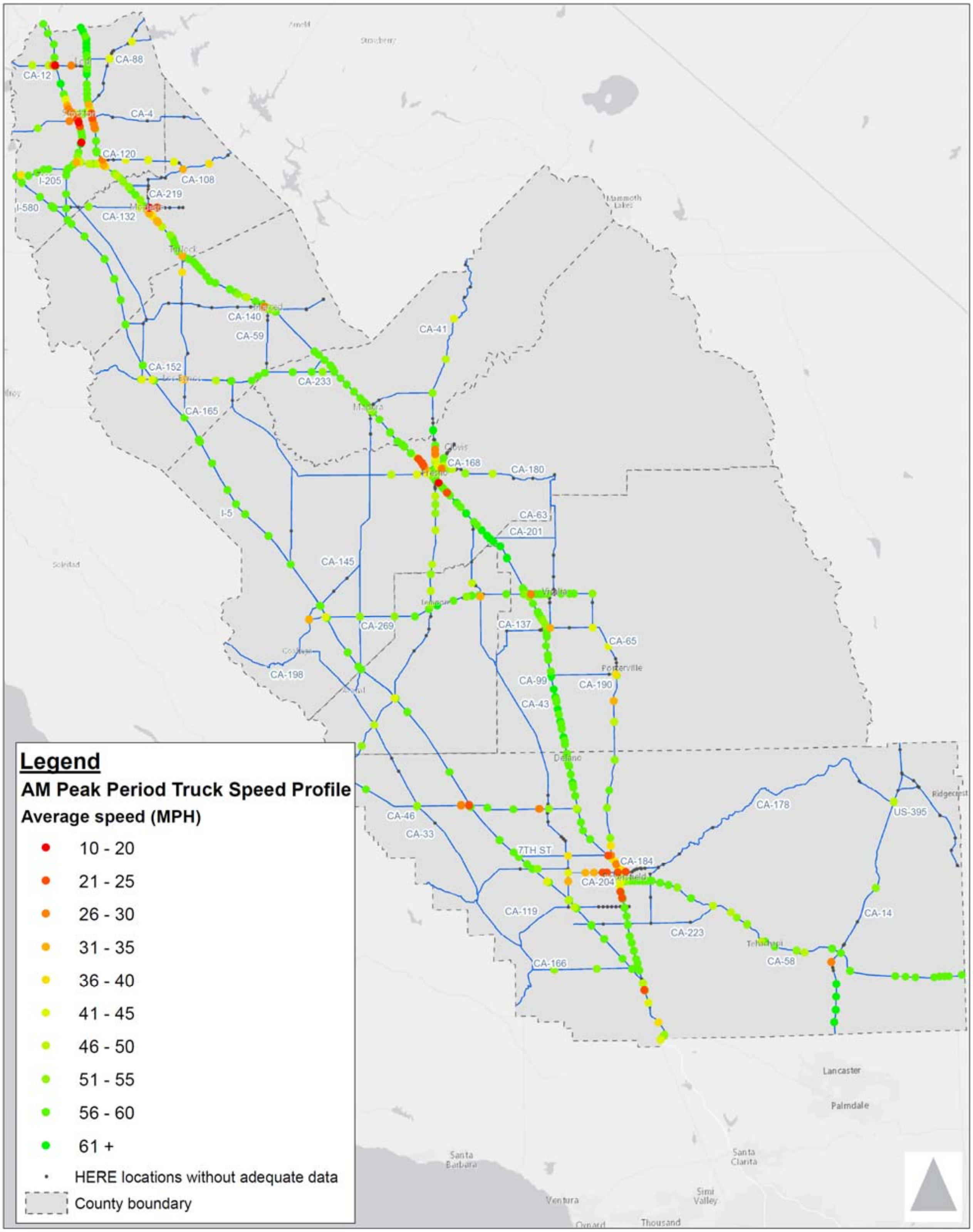
Source: WIM, 2014.

Light-heavy duty trucks on I-5 on Fridays are about 68 to 78 percent of average daily traffic, and on Sundays are about the same as average daily traffic. Light-heavy duty trucks on SR 99 on Fridays are about 51 percent of average daily traffic, and on Sundays are about 5 percent of average daily traffic.

Truck Traffic Operation Performance Measures

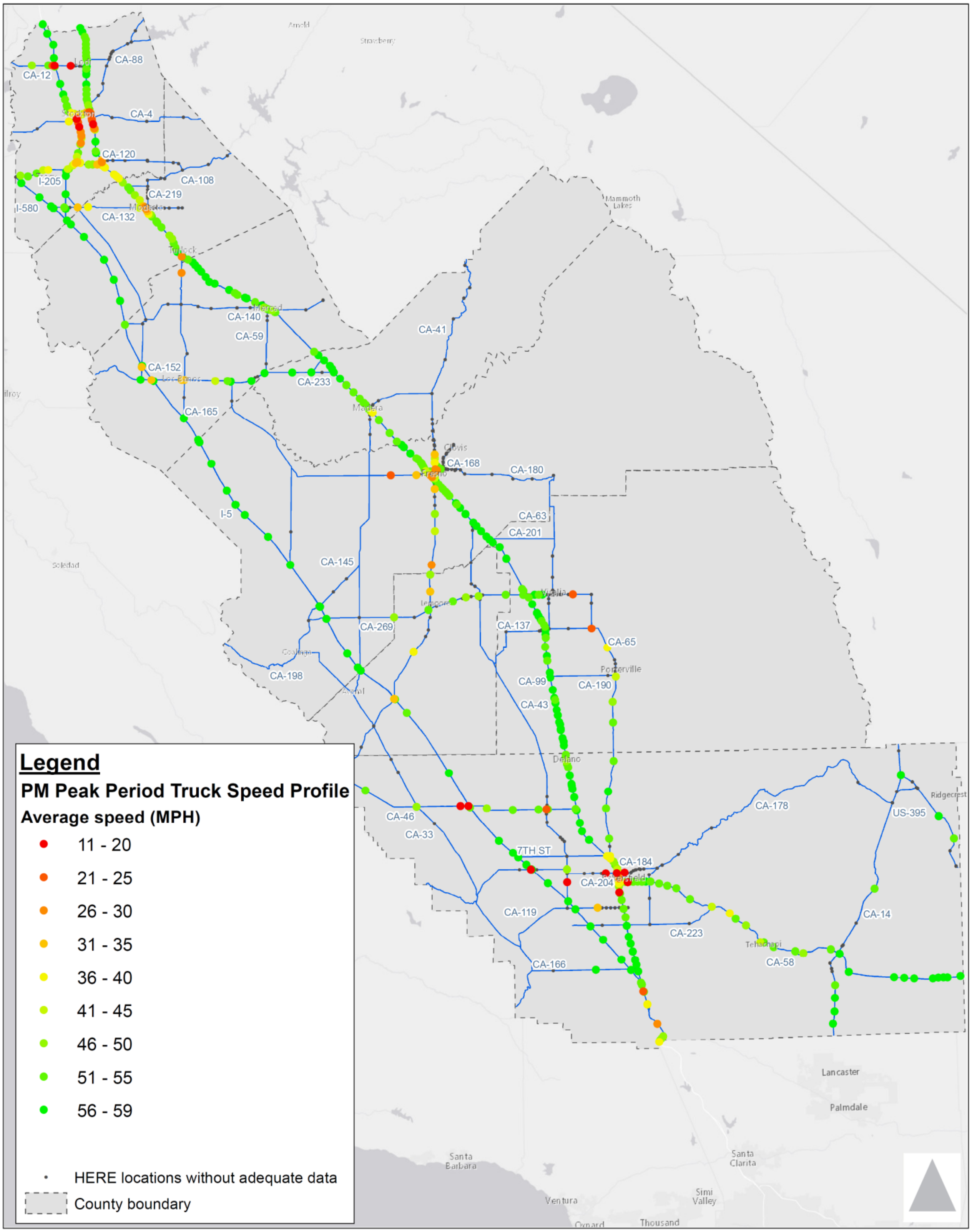
As explained in section 4.1 HERE data is used to analyze the speed profile. The average congested truck speed during the AM and PM peak periods for different segments of state highway in the Valley are calculated and shown in Figures 4.21 and 4.22. Although congested speeds on some segments of I-5 and SR 99 are 10 to 15 percent slower than posted speed, this does not necessarily mean there is traffic bottleneck. Most congested locations are near ramps in urban areas where we do not have good coverage of HERE or PeMS data. Outside dense urban areas the V/C ratio during peak periods for these corridors is less than 0.65, and the average V/C along I-5 and SR 99 during peak periods is 0.25 and 0.51, respectively. Having high truck percentage may cause slower traffic flow along SR 99. The truck percentage for each segment is shown on the fact sheet for each segment on the web map.

Figure 4.21 Truck Congested Speed during AM Peak Periods



Source: HERE, October 2015.

Figure 4.22 Congested Speed during PM Peak Periods



Source: HERE, October 2015.

5.0 SAFETY AND COLLISION PROFILES

Fehr & Peers analyzed collision data along highway facilities throughout the San Joaquin Valley using data from the Statewide Integrated Transportation Injury Mapping System (TIMS). TIMS provides a user-friendly geocoded database of all collisions reported by California Highway Patrol (CHP) and completely recorded collisions from Local Police Departments (LPD). Incomplete LPD reports, especially where location of the incident is not clear, are not included in TIMS. Although Traffic Records System (SWITRS) is a complete data set of all collision records, the format is not usable for regional safety analysis. The difference between SWITRS and TIMS records is different in different regions and depends on the state of the practice of LPDs. For some jurisdictions in San Joaquin Valley, such as Kings County, this difference is significant. The number of TIMS records was slightly more than 20 percent of the number of SWITRS records. Therefore the severity of safety issues might be underestimated for these regions.

TIMS Data were obtained for all collisions coded as occurring on a state highway in the eight counties between January 1, 2009 and December 31, 2013, the most recent year available. Collisions include all types, causes, and levels of severity, with special attention to comparing patterns for all collisions to only those involving trucks, regardless of fault.

Table 5.1 summarizes collisions by involvement of trucks and by year. During the 5-year period, collisions average 4,551 per year, with truck-involved collisions accounting for over 10 percent of all collisions each year.

Table 5.1 Collisions by Truck Involvement and Year

Collision Involvement	2009	2010	2011	2012	2013	Total
No Truck Involved	4,253	4,147	4,059	3,992	3,886	20,337
Truck Involved	483	479	490	479	489	2,420
% Truck Collisions	10.2%	10.4%	10.8%	10.7%	11.2%	10.6%
Total	4,736	4,626	4,549	4,471	4,375	22,757

Source: TIMS, 2009-2013.

For context, statewide reporting, which includes local roads and highways, typically focuses solely on fatal collisions. In 2013, there were 3,000 fatal collisions statewide and 227 of those collisions involved trucks. Of those truck-involved fatal collisions, 38 occurred on state highways in the study area. Collisions in this analysis are limited to only those documented along a highway facility (including Interstate and U.S. routes). Table 5.2 below shows the breakdown of collision severity in the study area during the 5-year period. Although truck-involved collisions are about 10 percent of all collisions, fatal and severe injury truck involved collisions are 20.6 and 14.5 percent of all fatal and severe injury collisions, respectively.

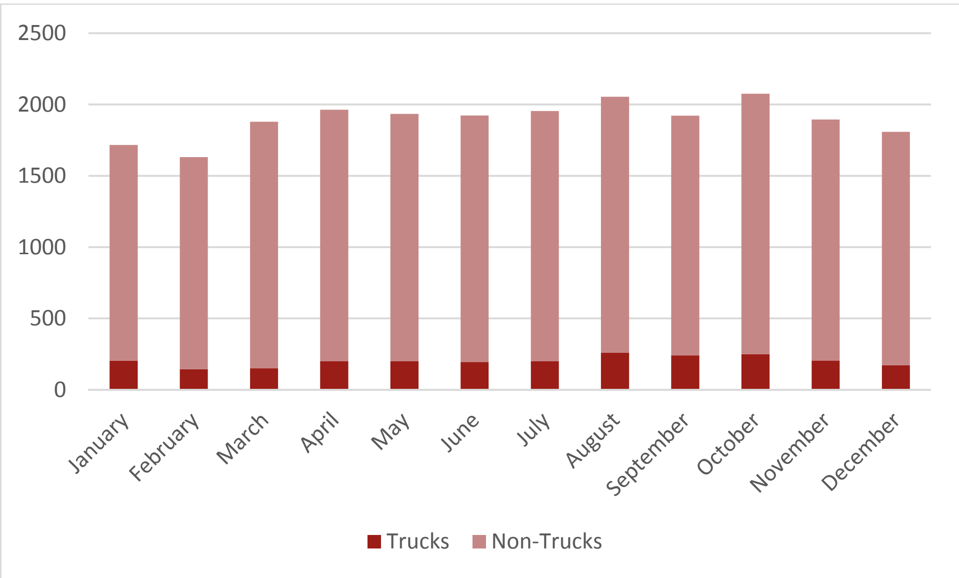
Table 5.2 Collisions by Severity

Collision Involvement	Fatal	Severe Injury	Minor Injury	Complaint of Pain
No Truck Involved	629	1,270	5,573	12,865
Truck Involved	163	215	703	1,339
% Truck Collisions	20.6%	14.5%	11.2%	9.4%
Total	792	1,485	6,276	14,204

Source: TIMS, 2009-2013.

Figure 5.1 shows the average count of collisions by month over the 5-year period as a stacked-bar chart, with truck-involved collisions appearing at the bottom. There is a clear variation in the monthly average, with February being the lowest, and October being the highest.

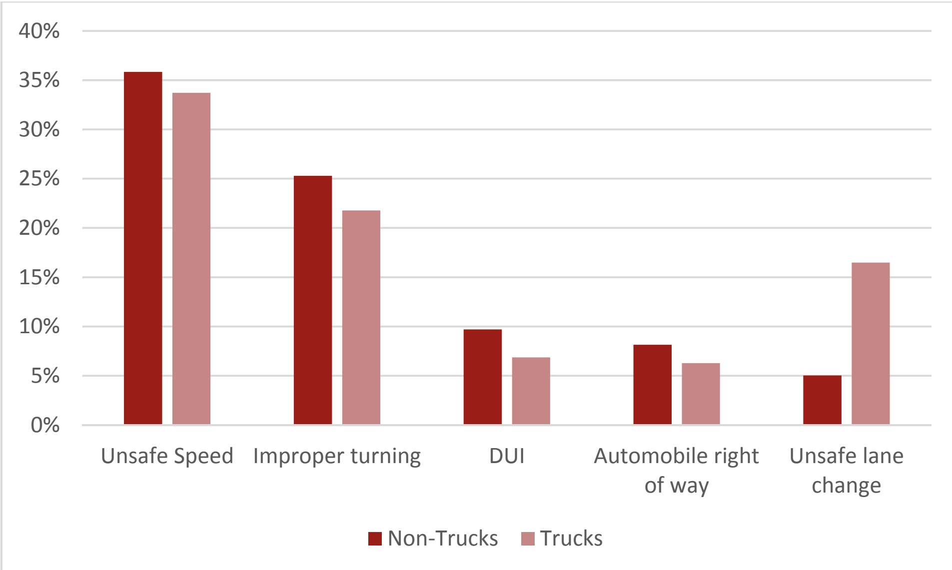
Figure 5.1 Average Collisions by Month and Truck Involvement



Source: TIMS, 2009-2013.

Each collision is documented by the moving vehicle violation type (the behavior that primarily led to a collision) and the collision action type (what or how the vehicle hit something or someone). Across all vehicles, unsafe speed is the leading violation category and rear-end collisions are the most common collision type. Figure 5.2 compares the five most common violation categories for collisions involving any vehicle to those only involving trucks. Note that for truck-involved collisions, the third most common violation is an unsafe lane change, but this does not indicate whether it is trucks or other vehicles that are more often at fault.

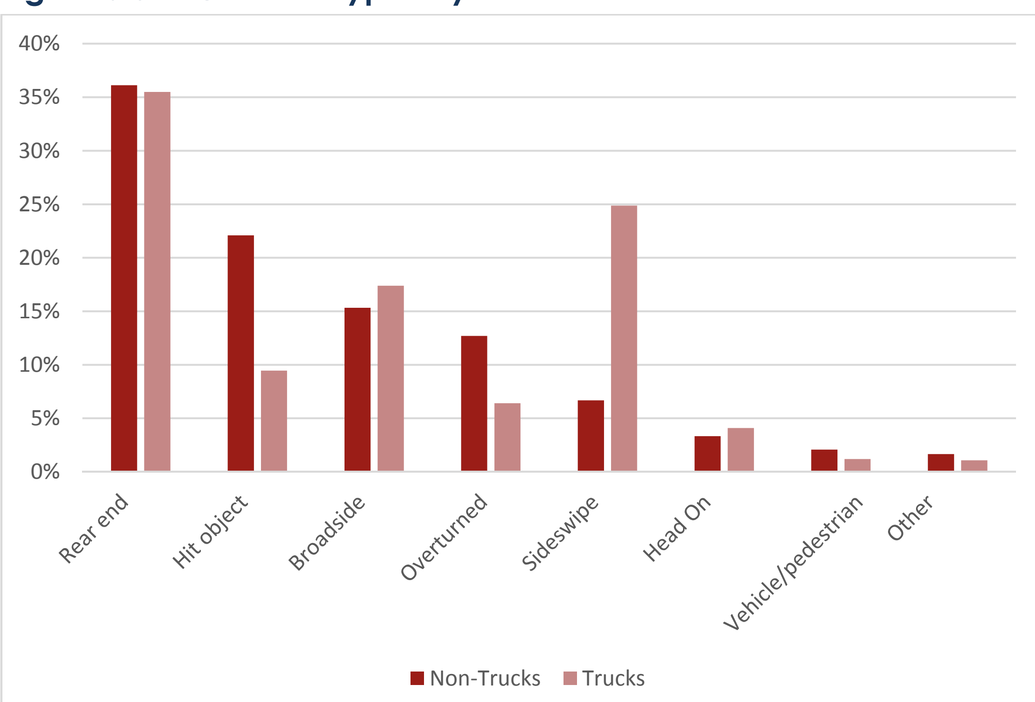
Figure 5.2 Top Five Violation Categories by Truck Involvement



Source: TIMS, 2009-2013.

Figure 5.3 compares the collision type of collisions involving trucks with those that do not involve trucks. A notable difference is the significant jump in the proportion of sideswipe collisions among truck-involved incidents. Although sideswipe collisions account for 25 percent of truck-involved collisions, sideswipes are responsible for only 9 percent of all collisions.

Figure 5.3 Collision Types by Truck Involvement



Source: TIMS, 2009-2013.

Weather could be a factor in collisions. Table 5.3 shows the percentage of documented weather factors in collisions by severity. Only 4 percent of all collisions occur in rainy or foggy conditions. Fatal collisions are somewhat more common in foggy conditions, but are less common in rainy conditions.

Table 5.3 Weather Factors by Severity

Weather Condition	Fatal	Severe Injury	Minor Injury	Complaint of Pain	All
Clear	85%	84%	82%	80%	81%
Cloudy	10%	11%	14%	14%	14%
Raining	1%	3%	2%	3%	3%
Snowing	0%	0%	0%	0%	0%
Fog	3%	1%	1%	1%	1%
Other	0%	0%	0%	0%	0%
Wind	0%	0%	0%	0%	0%
Not Stated	0%	0%	1%	1%	1%

Source: TIMS, 2009-2013.

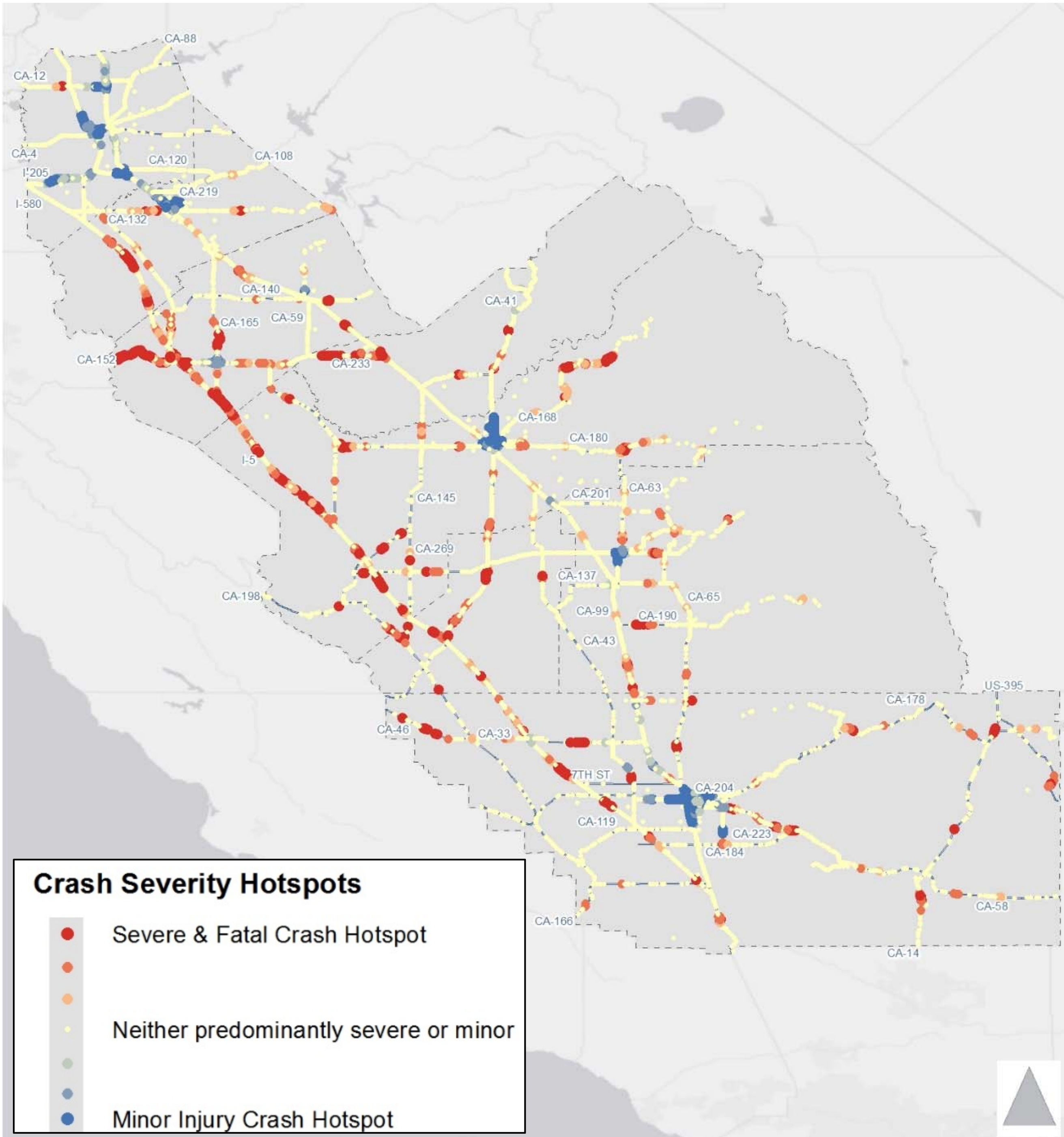
5.1 Spatial Analysis of Collisions

A geographic information systems (GIS) analysis of the data was conducted using ESRI ArcMap to look for spatial patterns. Hot spots of collisions could indicate troublesome locations along a roadway. The Getis-Ord GI Optimized Hot Spot Analysis tool identifies statistically significant "hot" and "cold" spots based on high and low values in the data; in this instance, the severity of each collision in relation to the severity of others nearby. Collisions are coded on a scale of 1-4, with 1 meaning fatal and 4 being only complaint of pain. In Figure 5.4, every dot represents a unique incident. Red dots indicate statistically significant hot spots of severe collisions (groups of points near where most other collisions are severe or fatal). Blue dots indicate statistically significant groups of minor collisions (nearby collisions are mostly not severe or fatal). The yellow dots represent incidents where there is not a statistically significant prevalence of either severe or fatal collisions.

The blue hot spots are found almost exclusively in urban areas, especially Bakersfield, Fresno, and Stockton. These areas are expected to have higher volumes of collisions in general, and hot spots of minor collisions are a reasonable result because speeds are lower in urban areas.

Red hot spots are much more widespread across the study area, but are still heaviest along I-5 where speeds are higher and potential points of conflict (ramps, for example) are fewer. Red hot spots along rural highways are more likely to face a diverse set of challenges. For example, there could be poor sight lines at crossroads or driveways, leading to high incidence of broadside (t-bone) collisions.

Figure 5.4 All Collisions Severity Hotspots Analysis

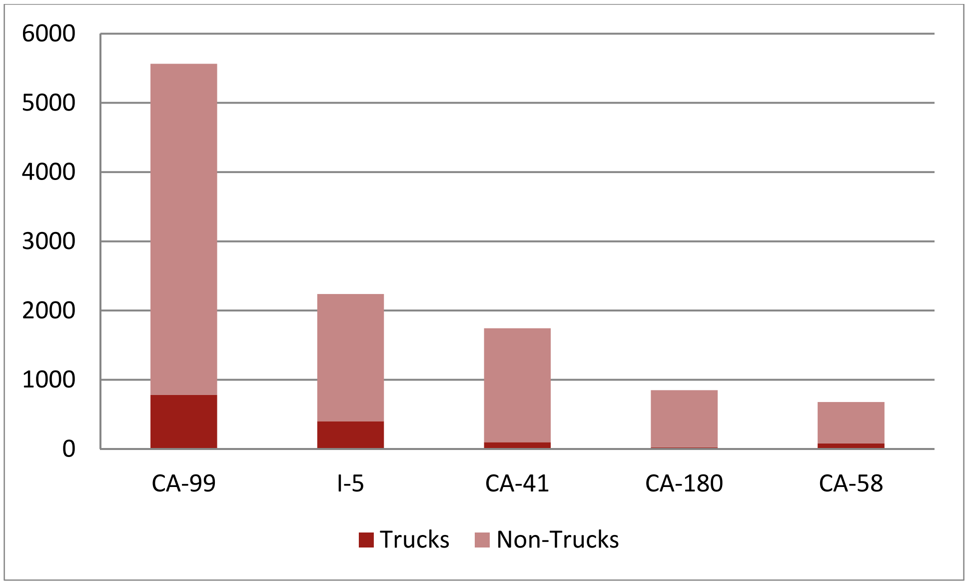


Source: TIMS, 2009-2013.

SR 99 has comparably few and smaller hot spots than I-5 along its length. SR 99 has by far the highest absolute number of collisions during the study period at 5,564, while there were only 2,240 incidents on I-5.

Figure 5.5 shows the absolute number of collisions by truck involvement for the top five state routes in the study area.

Figure 5.5 Absolute Number of Collisions by Truck Involvement



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Source: TIMS, 2009-2013.

For the majority of their length Table 5.4 illustrates the differences in proportion of severity for the same five routes. Note that I-5 has 11 percent severe or fatal collisions compared to 7 percent along SR 99, while CA-58 has 15 percent for the same level of severity.

Table 5.4 Severe Collisions at Different Segments

	Collision Severity				
Highway	**Fatal**	**Severe Injury**	**Minor Injury**	**Complaint of Pain**	**Number of incidents**
SR 99	3%	4%	27%	65%	5564
I-5	5%	6%	34%	55%	2240
CA-41	3%	5%	27%	65%	1744
CA-180	3%	7%	28%	62%	849
CA-58	5%	10%	3%	82%	680

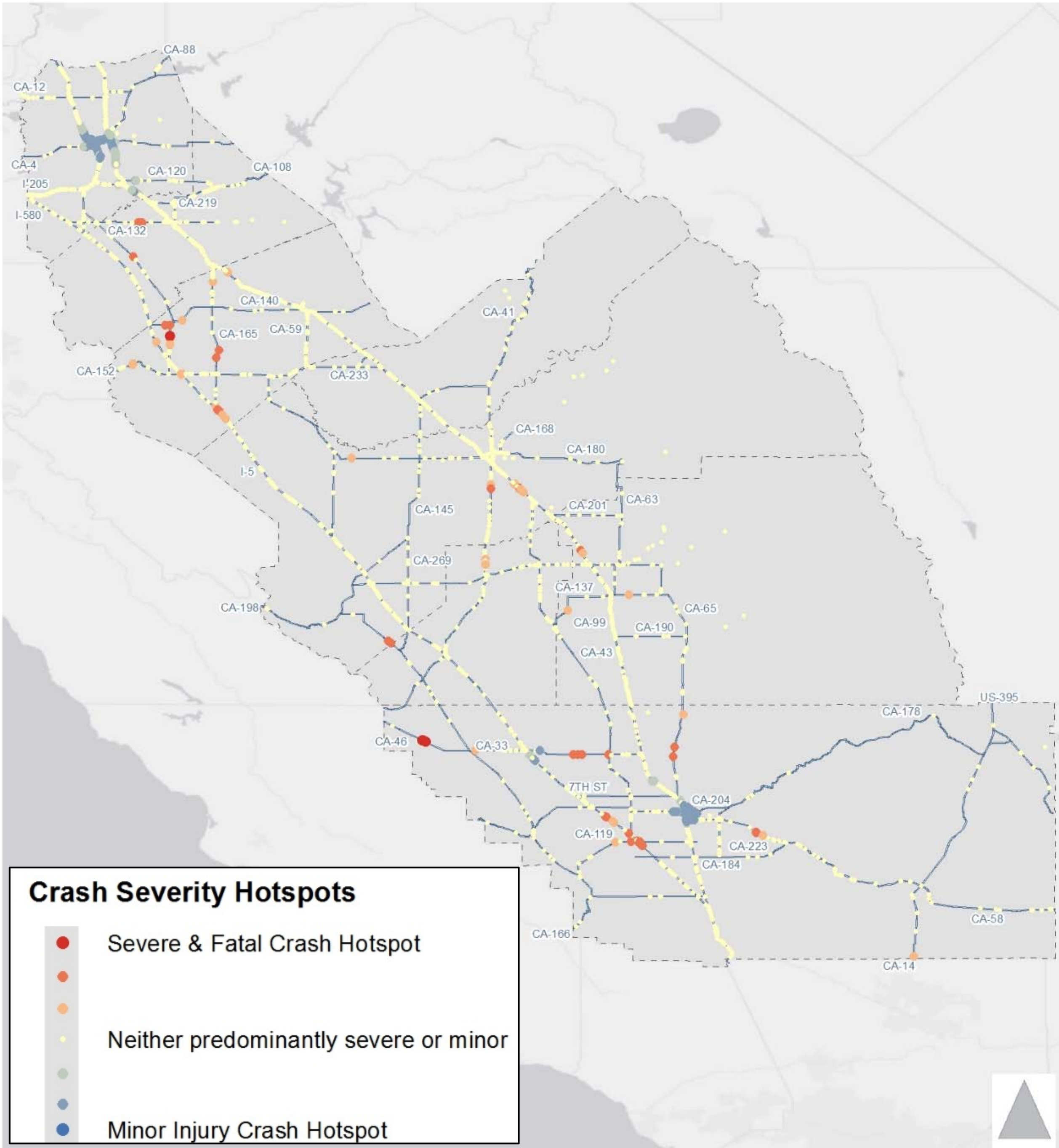
Source: TIMS, 2009-2013.

Hot spots for collisions involving only trucks are comparatively fewer, as shown in Figure 5.6. Minor collision hot spots appear in Bakersfield and Stockton, while some small hot spots of severe collisions appear primarily along or near I-5. While severe and fatal collisions make up 10 percent of all incidents, among truck-involved collisions they account for 15.6 percent. However, the hot spot-identified severe incidents account for less than 2 percent of truck-involved collisions, suggesting that severe truck collisions are spatially dispersed and not significantly clustered within the study area.

Figure 5.7 illustrates the difference in spatial context between I-5 and more rural highways and the prevalence of crash types. For example, along I-5 towards the center of the map, there is a clear prevalence of rear end collisions, as well as sideswipes, both of which are more common along freeways and in situations with greater numbers of trucks. The portion of I-5 northbound approaching CA-165 is one of the few hotspots for severe collisions among not only all vehicles but also those specifically those involving trucks.

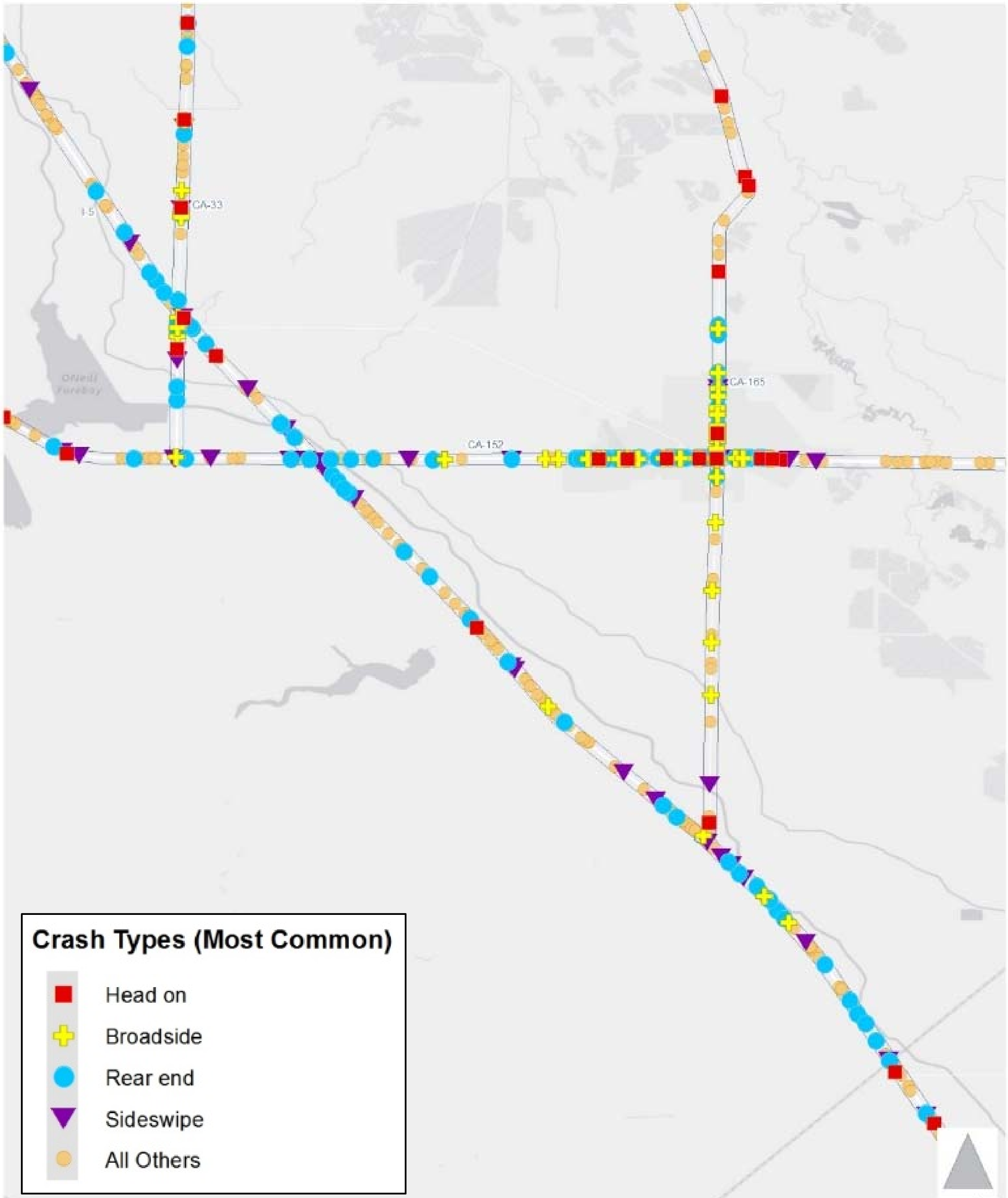
By contrast, along CA-152 (an east-west route between I-5 and SR 99) and CA-165 (north-south), the proportion of broadside and head-on collisions is greater. Head-on collisions are especially notable along CA-152 through the Los Banos area where higher density local streets intersect with the state highway. CA-165 is mostly undivided with one lane in each direction and several at grade intersections. CA-152 is mostly divided with 2 lanes in each direction. The daily truck traffic on CA-152 near Los Banos is 1,300. Total daily traffic is 9,500. Truck traffic is about 15 percent of overall traffic. The characteristics of this facility and high traffic volume may contribute to higher head-on collisions.

Figure 5.6 Hot Spots for Truck-Involved Collisions



Source: TIMS, 2009-2013.

Figure 5.7 Difference between I-5 and Rural Highways and the Prevalence of Collision Types



Source: TIMS, 2009-2013

6.0 MULTIMODAL FACILITIES AND WAREHOUSE/DISTRIBUTION CENTERS

An important element in identifying effective strategic programs is the clustering of multimodal facilities, such as: intermodal rail terminals, warehouses, and distribution facilities. This clustering may point to how modal diversion strategies can work in a corridor, but also will help identify where within a corridor demand is likely to be greatest. This section also describes non-highway freight infrastructure in each corridor and how the freeways connect or interact with other infrastructure, including:

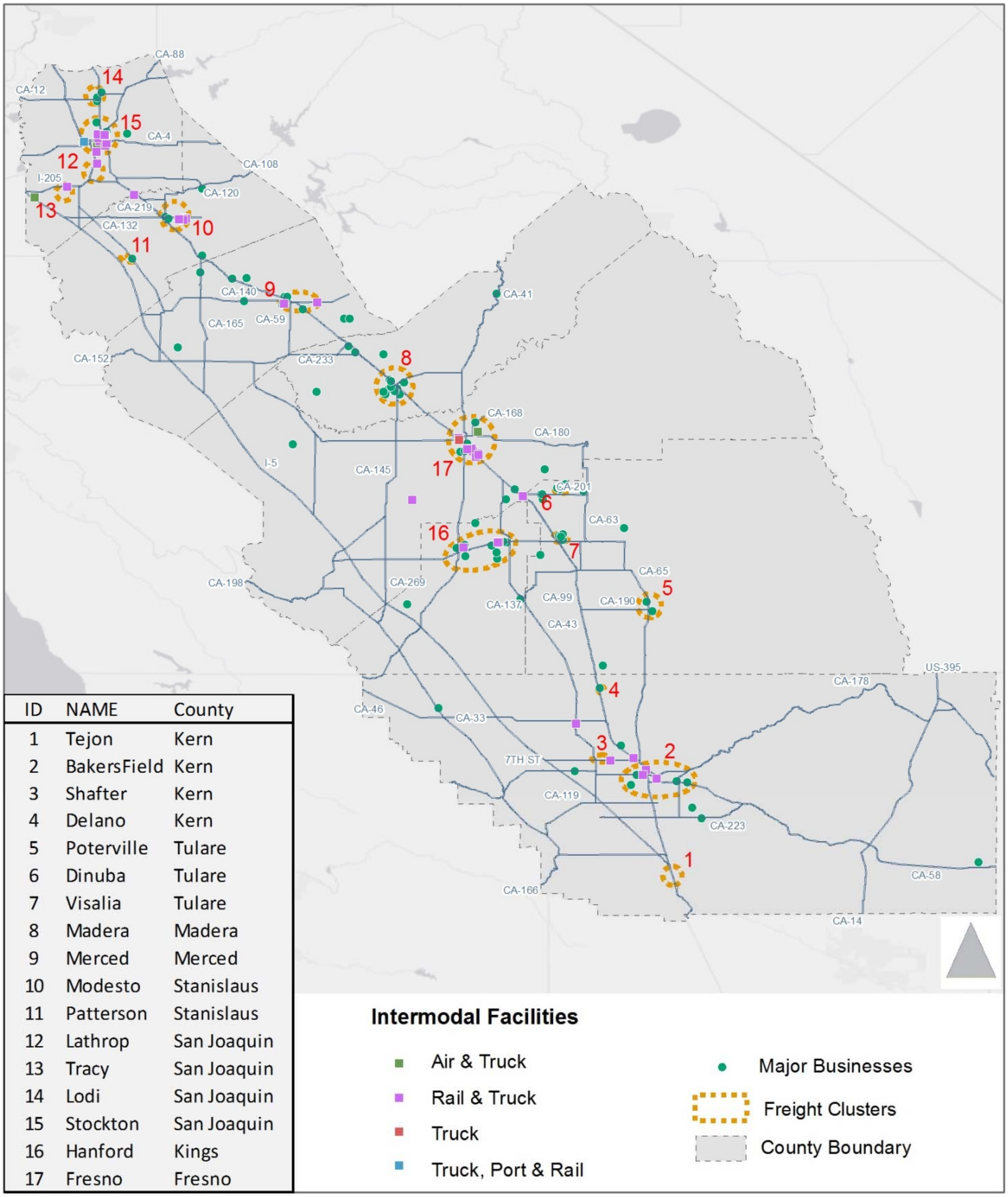
- **Seaports.** The San Joaquin Valley region is effectively served by all major California seaports, although only the Port of Stockton is actually within the region itself. The Ports of Oakland, West Sacramento, Los Angeles, Long Beach, and others are linked to the Valley origins and destinations by truck. We used GPS data to estimate the contribution of truck traffic generated at these ports on I-5/SR 99.

- **Airports.** Airports in the Valley collectively account for less than 1 percent of all air cargo handled by California's civilian airports. However, on a tonnage basis, the leading exports from Los Angeles International (LAX) and San Francisco International (SFO) are agricultural commodities, substantial shares of which were grown in the Valley. Products moved by air continue to use airports outside of the Valley. Due to the lack of direct flights linking the Valley airports with overseas markets, virtually all of these airborne exports must first be trucked to LAX or SFO to reach overseas markets. Therefore, I-5/SR 99 is the major access to connect agricultural industries in the Valley to these airports.

- **Railyards.** The Union Pacific Railroad (UP) and the BNSF Railway (BNSF) both have lines that run north/south through the Valley and both have major intermodal terminals and rail classification yards. Capacity constraints on these lines and at these terminals is important to understand the potential for modal diversion strategies, especially short haul intermodal shuttle services.

Besides intermodal facilities, the Valley is home to many major distribution centers and industries. To facilitate goods movement analysis and truck trips distribution in the study area, we identify several freight clusters in San Joaquin Valley. Each cluster is a combination of intermodal facilities and/or a major distribution center and/or large manufacturing firms. A sample of GPS data was used to identify trip distribution patterns between these freight clusters, counties in the Valley or other regions in California. Figure 6.1 shows the location of freight clusters in the Valley.

Figure 6.1 Location of Freight Clusters with Intermodal Facilities/Large Businesses



ID	NAME	County
1	Tejon	Kern
2	BakersField	Kern
3	Shafter	Kern
4	Delano	Kern
5	Poterville	Tulare
6	Dinuba	Tulare
7	Visalia	Tulare
8	Madera	Madera
9	Merced	Merced
10	Modesto	Stanislaus
11	Patterson	Stanislaus
12	Lathrop	San Joaquin
13	Tracy	San Joaquin
14	Lodi	San Joaquin
15	Stockton	San Joaquin
16	Hanford	Kings
17	Fresno	Fresno

Source: California EDD.

6.1 Freight Activity Clusters

Sixteen major freight activity clusters are identified in the Valley, as shown in Figure 6.1.

In this section, we study freight activity in each cluster with an overview of their existing characteristics and future development plans. Actual trip distribution (origin and destination patterns) and access routes to each cluster were identified using truck GPS data with a sample of 20 million trips.

- **Fresno/Fresno County**

  The Fresno cluster features five distribution centers, two large agricultural businesses, an airport, and an intermodal distribution facility. The distribution centers focus on transportation and warehousing as well as wholesale and retail trade. One of the centers specializes in groceries/retail and employs 500 to 999 employees and another center employs 1,000 to 4,999 employees. The agricultural businesses each employ 1,000 to 4,999 people. The intermodal facility makes connections between rail and trucks. The Fresno cluster boasts the intersection of a number of highway connections such as CA-99, CA-41, CA-168, and CA-180.

- **Hanford/Kings County**

  The Hanford cluster has two distribution centers, six large businesses, and one intermodal facility within its boundaries. The distribution centers focus on wholesale and retail trade, each with 250 to 499 employees. The six businesses have a range of specialties in the agriculture and manufacturing industries. Of the cluster businesses, three employ 100 to 249 employees, two employ 250 to 499, and one employs 1,000 to 4,999. The intermodal facility provides connection between rail and trucks. The Hanford cluster enjoys access to a number of highways including CA-43 and CA-198 and is within 10 miles of CA-99 and CA-41 and 25 miles of I-5.

- **Tracy/San Joaquin County**

  The Tracy cluster contains two distribution centers that focus on wholesale and retail trade including Amazon fulfillment center. This cluster enjoys connections with three interstate highways that include I-5, I-205, and I-580. These highways provide a significant connection to Bay Area and its ports as well.

- **Lathrop/San Joaquin County**

  The Lathrop cluster features three distribution centers that focus on wholesale and retail trade. The cluster connects directly to I-5 and highways CA-99 and CA-120, which give access to area clusters such as Stockton and Tracy. Also, Lathrop enjoys a connection to the Bay Area ports.

- **Lodi/San Joaquin County**

  The Lodi cluster includes three significant businesses. Two of these businesses specialize in manufacturing; one employs 500 to 999 employees and the other 1,000 to 4,999 employees.

This cluster location includes direct access to CA-99 and CA-12 and is five miles from I-5. Lodi's location also provides access to the Bay Area ports.

- **Stockton/San Joaquin County**

  The Stockton cluster has five distribution centers and two intermodal facilities including the Port of Stockton. Two of the distribution centers specialize in wholesale and retail trade and each employ 500 to 999 employees. One distribution center focuses on transportation and warehousing and employs 1,000 to 4,999 employees. The Port of Stockton provides intermodal service for trucks, rail, and serves as an inland deep water port. One other intermodal business provides connection between rail and trucks. The port is a very important operation in San Joaquin County. In 2015, the port welcomed a record 247 ships carrying more than 3.8 million metric tons of cargo, an increase from 2014's record of 230 incoming vessels. This cluster also includes Stockton Metropolitan Airport. Historically this airport did not have significant cargo operations, but the authorities are planning to increase the cargo operation at the airport. The Stockton cluster enjoys access to a number of highways such as I-5, CA-99, CA-4, and CA-88.

- **Patterson/Stanislaus County**

  The Patterson cluster contains one distribution center and one large business. The distribution center specializes in wholesale and retail trade. The business focuses on manufacturing and employs 500 to 999 employees. This cluster has significant accessibility via I-5 and CA-33.

- **Modesto/Stanislaus County**

  The Modesto cluster features a number of large agricultural industry employers, two distribution centers, and an intermodal facility. Eight of the businesses focus on the wine industry and employ 1,000 to 4,999 employees. Two businesses specialize in manufacturing; one employs 1,000 to 4,999 people and the other 500 to 999 employees. One distribution center employs 500 to 999 employees and focuses on wholesale and retail trade. The other center resides in an industrial district with a number of large tenants and provides these businesses with connections to highways, rail, and the airport. The intermodal center provides services for rail and truck. The Modesto cluster enjoys significant highway connections such as CA-99, CA-132, and CA-108.

- **Madera/Madera County**

  The Madera cluster includes a number of large businesses and distribution centers. Three of the businesses focus on agriculture and employ 100 to 499 people. Four of the businesses specialize in manufacturing; one employs 100 to 249 people, two employ 250 to 499 people, and the fourth business employs 500 to 999 people. Two of the focus on wholesale and retail trade and employ 100 to 499 employees. The distribution entity specializes in transportation and warehousing and employs 100 to 249 people. The Madera cluster enjoys connections via highways such as CA-99 and CA-145.

- **Merced/Merced County**

  The Merced cluster features six large businesses and distribution centers. Three of these entities focus on wholesale and retail trade and employ between 100 to 499 people. One of the businesses specializes in agriculture and employs 250 to 499 people. Another business serves as a distribution center and focuses on transportation and warehousing and has 250 to 499 employees. The last business concentrates on manufacturing and employs 500 to 999 people. The Merced cluster connects to the region via highways such as CA-99, CA-140, and CA-59.

- **Bakersfield/Kern County**

  The Bakersfield cluster has two distribution centers and five large businesses connected with goods movement. One distribution center specializes in agricultural production and shipping and employs 1,000 to 4,999 people. Another distribution center provides logistic park access for other businesses. Cluster businesses include two with 500 to 999 employees and three businesses with 1,000 to 4,999 employees. These businesses focus on industries such as agriculture, mining, manufacturing, and wholesale and retail trade. Several ongoing projects in recent years have improved the accessibility and connectivity of this cluster including widening 7th Standard Road and SR 58. These projects are also part of the National Highway Freight Network. Bakersfield enjoys a plethora of connections via highways such as CA-99, CA-65, CA-178, CA-58, and CA-43 and 7th Standard Road. I-5 also travels in proximity to the city and provides access to the western San Joaquin Valley to the north.

- **Shafter/Kern County**

  The Shafter cluster location is in direct proximity to the Bakersfield cluster and includes a distribution center logistics park. A number of highways such as CA-43, CA-99 and I-5 provide access to the cluster.

- **Delano/Kern County**

  The Delano cluster features a distribution center and large agricultural business. The distribution center specializes in wholesale and retail trade and employs 500 to 999 people. The agricultural business employs 1,000 to 4,999 people. The Delano cluster connects to the region via CA-99 and CA-43.

- **Tejon/Kern County**

  The Tejon Ranch cluster includes a number of distribution centers and space for growth. This cluster location at the junction of I-5 and Highway 99 provides accessibility to the Central Valley and Southern California.

- **Visalia/Tulare County**

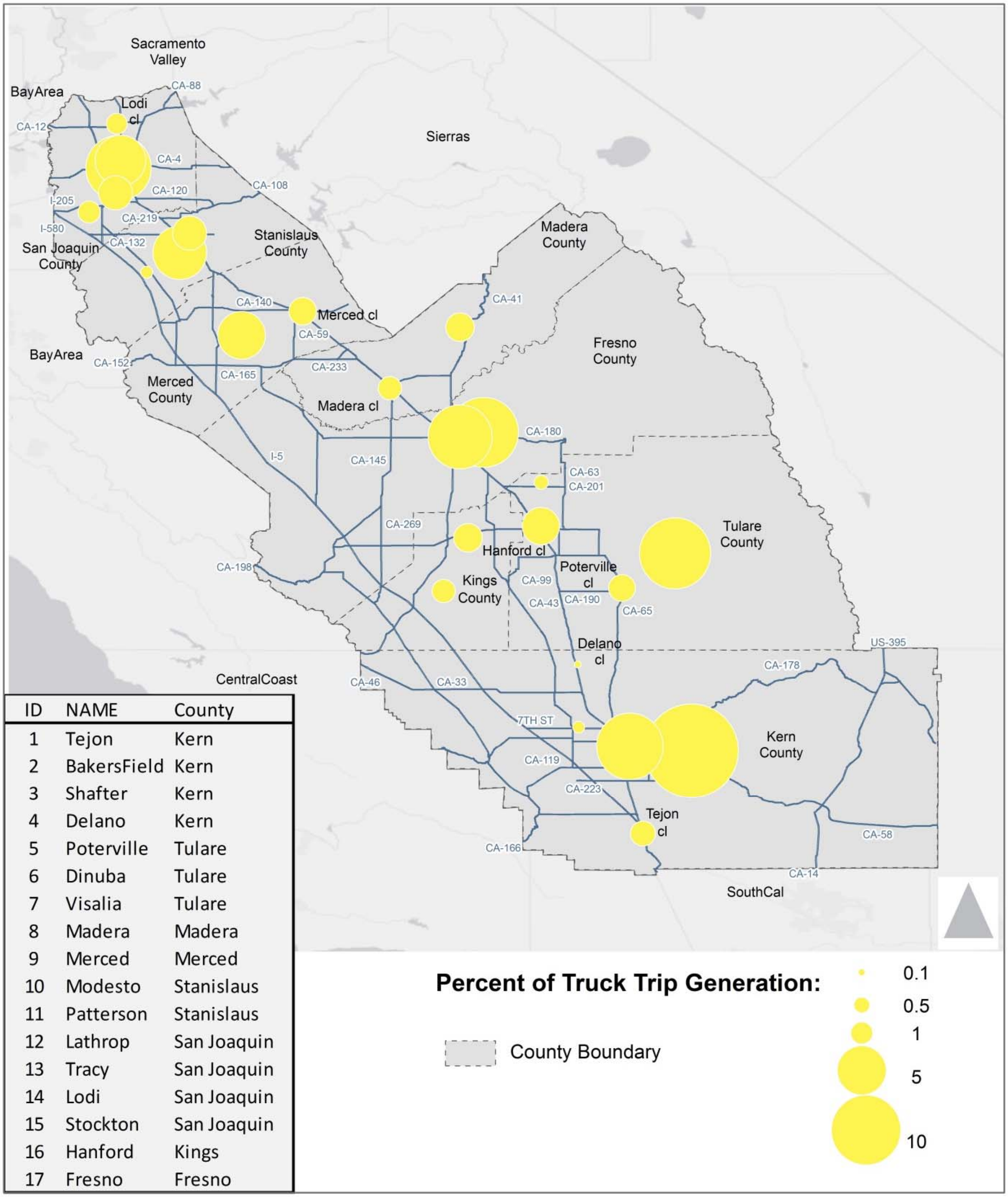
  The Visalia cluster includes a number of distribution centers and businesses. One distribution center focuses on wholesale and retail trade. Businesses focus on agriculture, manufacturing, wholesale and retail trade. A number of highways provide access to this cluster and include CA-198, CA-99, and CA-63.

- **Porterville/Tulare County**

  The Porterville cluster contains a distribution center and one large business. The distribution center employs 1,000 to 4,999 employees with a focus on wholesale and retail trade. The business employs 250 to 499 employees and also focuses on wholesale and retail trade. The cluster connects to the region via highways CA-65 and CA-190.

Figure 6.2 shows the relative magnitude of each freight cluster in generating truck trips and their spatial distribution in the Valley. It should be noted that the freight clusters in this study are not homogenous in characteristics and size (industrial area, number of employment, number and type of establishments, size of intermodal facilities). The objective of this map is to show the geographic distribution of truck trip generation in the Valley.

Figure 6.2 Share of Each Freight Cluster in Generating Truck Trips in the Valley



ID	NAME	County
1	Tejon	Kern
2	BakersField	Kern
3	Shafter	Kern
4	Delano	Kern
5	Poterville	Tulare
6	Dinuba	Tulare
7	Visalia	Tulare
8	Madera	Madera
9	Merced	Merced
10	Modesto	Stanislaus
11	Patterson	Stanislaus
12	Lathrop	San Joaquin
13	Tracy	San Joaquin
14	Lodi	San Joaquin
15	Stockton	San Joaquin
16	Hanford	Kings
17	Fresno	Fresno

Source: StreetLight, 2014.

Table 6.1 shows the truck trip distribution between counties in the Valley and other regions in California. The top table shows the percent trip distribution by each origin region. San Joaquin, Merced and Kern County have the highest intra-valley (trips between Valley and other regions in the state) trip share. Kern County hosts several large distribution centers and intermodal facilities that provide service to southern California (8.2 percent of trips generated in Kern county ends in Southern California). San Joaquin County hosts Port of Stockton. 6.2 percent of trips generated at San Joaquin county ends at Sacramento valley and 7.2 percent ends at Bay area. About 98% of trips originated in Fresno, Kings and Tulare County ends within each county respectively.

Table 6.1 on the bottom shows the percent trip distribution by each destination region. The patterns are similar to the top table, where San Joaquin, Merced and Kern County have the highest intra-valley (trips between Valley and other regions in the state) trip share.

Table 6.2 shows the distribution for the destination of trips originated at each cluster. Except Lodi and Tracy, the destination of at least 50 percent of trips originated at each cluster is within the Valley. Fifty-eight percent of trips that originate at Lodi end at the Sacramento Valley. The Bay Area has the largest share for trips generated at Patterson and Tracy (35 percent) and Southern California is the major destination for the Porterville Cluster (34 percent).Table 6.3Table 6.3 shows the distribution for origin of trips at each cluster. This distribution has fewer peaks, which shows that the freight clusters have a strong regional role and absorb trips from different counties in the Valley and different regions outside of the Valley. About 40 percent of trips destined to the Patterson and Tracy Cluster are from the Bay Area. The Sacramento Valley is the origin of 60 percent of trips that end at Lodi. Thirty-seven percent of trips to the Porterville Cluster are from Southern California.

Table 6.1 Truck Trip distribution

Top: percent trips by origin, Bottom: percent trips by Destination

% Trips by Origin	Fresno	Kern	Kings	Madera	Merced	San Joaquin	Stanislaus	Tulare	Total SJV	Bay Area	Central Coast	Northern California	Sacramento Valley	Sierras	Southern California	Grand Total
Fresno County	81.0	2.2	2.1	3.4	2.4	0.8	0.7	5.9	98.5	0.3	0.3	0.0	0.3	0.0	0.6	100
Kern County	1.3	85.1	0.4	0.2	0.6	0.4	0.3	2.4	90.6	0.2	0.7	0.0	0.2	0.1	8.2	100
Kings County	13.0	3.0	65.0	0.5	0.9	0.4	0.3	14.7	97.9	0.3	0.7	0.0	0.3	0.0	0.8	100
Madera County	24.3	1.6	0.6	49.6	9.6	3.3	3.2	4.5	96.7	0.7	0.5	0.2	1.1	0.2	0.4	100
Merced County	7.0	2.8	0.6	3.9	57.5	6.6	9.0	1.6	89.0	4.1	2.4	0.6	2.7	0.2	1.0	100
San Joaquin County	1.1	0.5	0.1	0.7	2.3	72.9	6.4	0.5	84.5	7.4	0.5	0.9	6.2	0.3	0.2	100
Stanislaus County	1.6	0.7	0.1	1.2	7.0	12.7	69.1	0.6	92.9	3.1	0.4	0.4	2.6	0.5	0.2	100
Tulare County	7.4	5.9	3.0	0.8	0.7	0.3	0.4	79.5	98.0	0.1	0.1	0.0	0.1	0.0	1.7	100
Bay Area	0.1	0.0	0.0	0.0	0.2	1.2	0.3	0.0	1.8	96.1	0.8	0.2	1.1	0.0	0.0	100
CentralCoast County	0.2	1.3	0.1	0.1	0.6	0.2	0.1	0.0	2.5	3.2	92.2	0.0	0.1	0.0	2.0	100
NorthCal	0.1	0.1	0.0	0.1	0.3	1.7	0.3	0.0	2.5	2.0	0.1	90.1	5.3	0.0	0.0	100
Sacramento Valley	0.1	0.1	0.0	0.1	0.4	3.4	0.6	0.0	4.8	3.5	0.1	1.8	89.6	0.2	0.0	100
Sierras	0.1	1.3	0.0	0.3	0.4	2.3	1.7	0.1	6.2	0.4	0.0	0.0	2.5	87.3	3.6	100
SouthCal	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.0	0.1	0.0	0.0	0.0	99.1	100

% Trips by Destination	Fresno	Kern	Kings	Madera	Merced	San Joaquin	Stanislaus	Tulare	Bay Area	Central Coast	Northern California	Sacramento Valley	Sierras	Southern California
Fresno County	81.4	1.4	13.4	23.6	7.2	0.8	1.6	8.1	0.1	0.2	0.1	0.1	0.1	0.0
Kern County	2.0	85.7	3.6	1.8	2.9	0.7	0.9	5.1	0.1	0.8	0.1	0.1	0.8	0.6
Kings County	2.0	0.3	64.0	0.6	0.4	0.1	0.1	3.1	0.0	0.1	0.0	0.0	0.0	0.0
Madera County	3.5	0.2	0.5	49.0	4.2	0.5	1.0	0.9	0.0	0.1	0.0	0.1	0.3	0.0
Merced County	2.4	0.6	1.2	8.9	58.0	2.3	6.5	0.7	0.2	0.7	0.3	0.5	0.5	0.0
San Joaquin County	1.0	0.3	0.7	4.9	6.9	73.6	13.6	0.6	1.3	0.4	1.4	3.1	2.5	0.0
Stanislaus County	0.7	0.2	0.4	3.8	9.6	6.0	68.6	0.4	0.2	0.2	0.3	0.6	1.8	0.0
Tulare County	5.4	2.8	13.9	4.1	1.6	0.2	0.6	79.2	0.0	0.1	0.0	0.0	0.1	0.1
Total SJV	98.5	91.5	97.6	96.7	90.8	84.1	92.9	98.1	1.9	2.5	2.2	4.6	6.1	0.8
Bay Area	0.3	0.1	0.3	0.8	3.4	7.1	3.3	0.1	95.9	3.6	1.7	3.2	0.2	0.0
Central Coast	0.2	1.0	0.6	0.4	2.1	0.2	0.3	0.1	0.7	91.4	0.0	0.1	0.0	0.1
Northern California	0.1	0.0	0.0	0.2	0.5	1.2	0.4	0.0	0.2	0.0	90.7	1.8	0.0	0.0
Sacramento Valley	0.3	0.1	0.3	1.0	2.1	6.9	2.5	0.1	1.2	0.2	5.4	90.1	2.5	0.0
Sierras	0.0	0.1	0.0	0.2	0.2	0.3	0.5	0.0	0.0	0.0	0.0	0.2	87.9	0.0
Southern California	0.6	7.1	1.2	0.6	0.9	0.2	0.2	1.6	0.0	2.3	0.0	0.0	3.3	99.1
Grand Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: StreetLight, 2014.

Table 6.2 Percent Truck Origin Distribution for Trips Generated in Each Cluster

	Origin/ Destination	Freight Activity Clusters																	Counties in the Valley								Total %
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Freight Activity Clusters	1 BakersField	70.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24.6	-	-	-	-	-	1.0	95.7
	2 Delano	4.7	9.8	-	1.4	-	-	-	-	-	-	-	0.7	-	-	2.3	-	-	2.9	49.6	-	-	0.5	-	-	17.7	89.7
	3 Dinuba	-	-	26.1	3.8	0.6	-	-	-	-	-	-	0.7	-	-	-	-	3.9	12.7	0.7	-	0.6	-	-	-	49.3	98.3
	4 Fresno	-	-	-	59.4	0.7	-	-	1.7	-	-	-	-	-	-	-	-	-	22.9	1.1	0.6	2.7	2.4	-	0.5	4.2	96.5
	5 Hanford	-	-	-	3.5	62.6	-	-	-	-	-	-	-	-	-	-	-	2.4	9.7	1.1	7.8	-	-	-	-	10.0	97.0
	6 Lathrop	-	-	-	0.6	-	25.0	0.8	0.5	-	2.3	-	-	-	12.5	-	4.1	-	1.1	0.8	-	0.8	3.6	24.0	3.8	0.5	80.4
	7 Lodi	-	-	-	-	-	2.1	43.8	-	-	1.1	-	-	-	14.1	-	-	-	-	-	-	-	-	21.1	1.6	-	83.6
	8 Madera	-	-	-	11.7	-	-	-	56.0	2.0	-	-	-	-	-	-	-	-	10.1	-	-	9.6	3.1	1.0	1.0	1.9	96.4
	9 Merced	-	-	-	2.6	-	0.6	-	1.1	57.6	1.3	-	-	-	0.5	-	-	-	2.3	-	-	3.5	19.7	1.8	4.1	1.0	96.2
	10 Modesto	-	-	-	0.5	-	1.5	-	-	0.7	47.6	-	-	-	3.1	-	-	-	-	-	-	0.8	2.9	7.8	28.0	-	92.9
	11 Patterson	-	-	-	0.5	-	3.1	-	-	0.5	2.7	37.1	-	-	2.7	-	1.5	-	0.6	-	-	-	3.6	7.9	31.2	-	91.4
	12 Poterville	2.1	-	-	1.8	0.8	-	-	-	-	-	-	56.4	-	-	0.7	-	0.8	1.7	6.9	-	-	0.7	-	-	21.9	93.7
	13 Shafter	13.6	-	-	0.7	-	-	-	-	-	-	-	-	18.6	-	4.2	-	-	1.4	44.8	-	-	0.5	-	0.8	3.0	87.7
	14 Stockton	-	-	-	-	-	4.4	2.0	-	-	1.4	-	-	-	49.6	-	0.9	-	-	-	-	-	1.0	24.9	3.2	-	87.5
	15 Tejon	3.7	-	-	0.7	-	-	-	-	-	-	-	0.7	0.6	-	16.7	-	-	2.2	32.8	0.7	-	2.1	0.7	0.6	3.5	64.9
	16 Tracy	-	-	-	-	-	10.6	-	-	-	1.5	0.5	-	-	5.2	-	25.6	-	-	-	-	-	1.8	33.4	3.4	-	82.2
	17 Visalia	0.5	-	1.4	2.8	3.2	-	-	-	-	-	-	1.1	-	-	-	-	31.9	5.7	2.3	5.5	0.7	-	-	-	42.1	97.2
Counties in the Valley	18 Fresno	-	-	0.5	18.7	1.6	-	-	1.1	-	-	-	-	-	-	-	-	0.6	61.0	2.0	1.1	1.5	1.7	0.5	0.6	5.3	96.3
	19 Kern	12.2	-	-	-	-	-	-	-	-	-	-	-	-	-	2.1	-	-	1.0	67.4	-	-	0.7	-	-	2.2	85.6
	20 Kings	0.6	-	-	4.3	12.7	-	-	-	-	-	-	-	-	-	-	-	5.7	8.6	4.2	44.0	-	1.6	-	0.6	11.1	93.4
	21 Madera	-	-	-	15.7	-	0.8	-	5.3	3.3	0.9	-	-	-	0.9	-	-	0.7	10.1	1.6	-	34.6	9.1	2.5	3.4	4.8	93.7
	22 Merced	-	-	-	4.4	-	1.3	-	0.6	6.3	1.3	-	-	-	1.4	-	-	-	3.4	2.9	0.6	3.1	44.5	4.7	8.7	1.5	84.4
	23 San Joaquin	-	-	-	0.6	-	5.6	2.0	-	-	2.3	-	-	-	14.0	-	3.3	-	0.7	0.5	-	0.7	2.5	43.4	5.3	-	80.9
	24 Stanislaus	-	-	-	0.8	-	1.2	-	-	1.2	11.1	1.3	-	-	2.8	-	-	-	1.0	0.7	-	1.1	7.2	7.6	53.8	0.6	90.6
	25 Tulare	1.1	-	2.0	2.7	1.4	-	-	-	-	-	-	2.9	-	-	-	-	4.0	4.8	4.2	1.3	0.6	0.6	-	-	71.0	96.5

Source: StreetLight, 2014.

Note: Values less than 0.05% are not shown in the table.

Table 6.3 Percent Truck Destination Distribution for Trips Generated in Each Cluster

	Origin/ Destination	Freight Activity Clusters																	Counties in the Valley							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Freight Activity Clusters	1 BakersField	69.7	3.8	-	-	-	-	-	-	-	-	-	1.6	13.3	-	3.4	-	-	-	12.4	0.5	-	-	-	-	0.9
	2 Delano	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3 Dinuba	-	-	26.4	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	0.5	-	-	-	-	-	-	2.0
	4 Fresno	-	2.3	4.2	60.1	3.5	-	-	13.7	2.6	0.5	-	1.6	0.6	-	0.8	-	3.0	19.3	0.5	4.6	14.1	4.5	-	0.7	3.4
	5 Hanford	-	-	0.7	0.7	62.9	-	-	-	-	-	-	0.6	-	-	-	-	3.8	1.6	-	11.3	-	-	-	-	1.6
	6 Lathrop	-	-	-	-	-	28.8	2.2	1.2	0.6	2.3	3.2	-	-	5.6	-	10.8	-	-	-	-	1.2	1.9	6.5	1.5	-
	7 Lodi	-	-	-	-	-	0.9	44.6	-	-	-	-	-	-	2.3	-	-	-	-	-	-	-	-	2.1	-	-
	8 Madera	-	-	-	1.4	-	-	-	52.6	1.3	-	-	-	-	-	-	-	-	1.0	-	-	5.9	0.7	-	-	-
	9 Merced	-	-	-	-	-	-	-	1.7	58.8	0.9	-	-	-	-	-	-	-	-	-	-	3.4	6.7	-	1.1	-
	10 Modesto	-	-	-	-	-	1.7	1.2	-	1.1	46.6	2.0	-	-	1.4	-	1.0	-	-	-	-	1.1	1.5	2.1	11.1	-
	11 Patterson	-	-	-	-	-	-	-	-	-	-	38.2	-	-	-	-	-	-	-	-	-	-	-	-	1.3	-
	12 Poterville	-	1.1	-	-	0.7	-	-	-	-	-	-	61.7	1.0	-	1.0	-	1.1	-	0.6	0.6	-	-	-	-	3.0
	13 Shafter	-	-	-	-	-	-	-	-	-	-	-	-	24.4	-	1.1	-	-	-	0.7	-	-	-	-	-	-
	14 Stockton	-	-	-	-	-	10.9	12.3	-	0.5	3.1	2.4	-	-	48.9	-	5.2	-	-	-	-	1.3	1.1	14.7	2.9	-
	15 Tejon	0.5	2.9	-	-	-	-	-	-	-	-	-	0.7	3.8	-	21.0	-	-	-	2.4	0.8	-	0.6	-	-	-
	16 Tracy	-	-	-	-	-	4.8	-	-	-	0.6	2.0	-	-	0.9	-	26.8	-	-	-	-	-	-	3.5	0.5	-
	17 Visalia	-	-	3.6	-	2.1	-	-	-	-	-	-	0.9	-	-	-	-	32.8	0.6	-	5.2	-	-	-	-	4.4
Counties in the Valley	18 Fresno	-	2.8	12.5	22.6	9.6	0.8	-	10.1	2.0	-	0.8	1.2	1.2	-	2.6	0.5	5.6	61.1	1.1	9.2	9.3	3.6	0.6	1.1	5.0
	19 Kern	24.0	41.6	0.8	1.0	1.1	1.0	-	0.9	-	-	1.2	4.6	40.8	-	35.2	0.8	2.1	1.8	67.0	5.2	1.6	2.9	0.6	0.9	3.7
	20 Kings	-	-	-	0.6	8.4	-	-	-	-	-	-	-	-	-	-	-	6.0	1.0	-	42.1	-	-	-	-	1.2
	21 Madera	-	0.8	0.5	3.1	-	0.6	-	8.4	3.5	0.6	-	-	-	-	-	-	1.0	1.7	-	-	35.4	3.3	-	1.0	0.7
	22 Merced	-	0.5	-	2.4	-	2.9	0.5	2.5	18.8	2.5	3.7	-	0.8	1.2	2.2	2.1	-	1.5	0.7	2.2	8.7	44.6	2.4	6.8	0.6
	23 San Joaquin	-	-	-	0.6	-	23.5	20.1	1.2	1.8	8.3	6.5	-	-	23.2	0.6	32.4	-	0.6	-	-	3.6	4.8	42.8	7.9	-
	24 Stanislaus	-	-	-	0.5	-	3.4	1.6	1.1	4.6	27.4	32.1	-	-	3.2	0.6	3.2	-	0.6	-	0.5	4.1	9.3	5.1	53.7	-
	25 Tulare	1.2	19.1	48.8	3.4	8.9	-	-	2.6	0.9	-	-	22.4	2.5	-	3.1	-	39.3	5.0	2.4	11.1	3.5	1.4	-	0.6	69.5
Total		95.5	87.1	97.5	96.4	97.2	79.2	82.5	95.8	96.4	92.7	92.0	95.3	88.5	86.7	71.5	82.8	96.3	96.3	87.9	93.2	93.1	86.9	80.4	91.2	96.0

Source: StreetLight, 2014.

Note: Values less than 0.05% are not shown in the table.

Table 6.4 shows the distribution of trucks on selected segments in study area based on origin and destination of the trip. Internal/External (IX-XI) trips are those either started or ended outside each county. Internal trips (I-I) trips are those started and ended in the same county. External trips (X-X) trips are through trips that neither origin nor destination of the trip is in the respective county where the segment is located. I-5 and SR-99 segments are highlighted in bold. The share of IX-XI, I-I and X-X trips varies throughout the corridor as expected. Knowing the distribution of the trips helps to understand the role of each facility in regional goods movement.

Table 6.4 Percent Origin Distribution for Trips Generated in Each Cluster

County	Name	% IX-XI	% I-I	% X-X
Fresno County	I-5: KINGS/FRESNO CL TO CA-198	24	2	75
	I-5: CA-198 TO CA-33	23	2	75
	CA-99: SELMA (CA-43) TO FRESNO (CA-41)	58	7	35
	CA-33: I-5 TO MENDOTA (CA-180)	38	52	10
	CA-41: KINGS/FRESNO CL TO CA-99	51	40	9
	CA-145: I-5 TO FRESNO/MADERA CL	24	74	2
	CA-180: CLOVIS (TEMPERANCE AVE) TO CA-63	25	71	4
	CA-180: MENDOTA (CA-33) TO FRESNO SLOUGH	30	69	1
	CA-198: MONTEREY/FRESNO CL TO I-5	62	1	38
Kern County	I-5: CA-99 TO CA-43	59	20	21
	I-5: CA-43 TO CA-58	57	22	21
	CA-99: I-5 TO BAKERSFIELD (MING AVE)	54	25	21
	CA-99: BAKERSFIELD (CA-204) TO CA-46	45	37	18
	CA-58: BAKERSFIELD (WASHINGTON ST) TO BORON	48	34	18
	CA-33: CA-58 TO KERN/KINGS CL	13	87	0
	CA-46: I-5 TO SAN LUIS OBISPO/KERN CL	81	6	12
	CA-58: SAN LUIS OBISPO/KERN CL TO I-5	56	42	2
	CA-178: BAKERSIELD (CA-184) TO U.S. 395	4	96	0
Kings County	I-5: KERN/KINGS CL TO KINGS/FRESNO CL (CA-269)	10	0	90
	CA-41: KERN/KINGS CL TO I-5	32	0	67
	CA-43: CORCORAN (SANTA FE AVE) TO HANFORD (CA-198)	64	26	10
	CA-198: HANFORD (CA-43) TO KINGS/TULARE CL	80	1	19
Madera County	CA-99: FRESNO/MADERA CL TO AVENUE 12	37	1	62
	CA-41: FRESNO/MADERA CL TO MADERA/MARIPOSA CL	87	8	6

County	Name	% IX-XI	% I-I	% X-X
Merced County	I-5: FRESNO/MERCED CL TO CA-165	39	1	60
	CA-99: MERCED (CA-59) TO MERCED/STANISLAUS CL	46	1	53
	CA-99: MADERA/MERCED CL TO MERCED (CA-59)	40	1	59
	CA-152: SANTA CLARA/MERCED CL TO CA-33	52	0	48
San Joaquin County	I-580: I-5 (SAN JOAQUIN CL) TO CA-205	31	2	67
	I-5: CA-12 TO SAN JOAQUIN/SACRAMENTO CL	64	2	34
	I-5: MERCED/STANISLAUS CL TO I-580 (SAN JOAQUIN CL)	19	0	81
	CA-99: LODI TO GALT (SAN JOAQUIN/SACRAMENTO CL)	62	1	37
	CA-99: STANISLAUS/SAN JOAQUIN CL TO MANTECA (CA-120)	61	13	27
	CA-4: CONTRA COSTA/SAN JOAQUIN CL TO STOCKTON (I-5)	86	3	12
	CA-88: STOCKTON (CA-99) TO CA-12	53	32	15
	CA-132: SAN JOAQUIN/STANISLAUS CL TO MODESTO (CA-99)	62	3	35
	I-205: STOCKTON (I-5) TO CA-580	70	14	16
Tulare County	CA-99: DELANO (KERN/TULARE CL) TO VISALIA (CA-198)	0	0	100
	CA-43: KERN/TULARE CL TO CORCORAN (SANTA FE AVE)	0	0	100
	CA-65: KERN/TULARE CL TO CA-198	0	0	100

Source: StreetLight, 2014.

6.2 Future Developments in Major Freight Activity Clusters

An analysis of freight activity clusters was conducted to better understand the clusters' growth and potential impacts on future conditions of freight activity in the region and state. A number of the clusters will see further development of freight infrastructure such as intermodal freight facilities, expansion and maintenance of current roadways and railways, and the development of inland ports. The San Joaquin Valley seeks to bring freight facilities closer to production locations, thereby increasing shipping efficiency and lowering vehicle miles traveled and greenhouse gas emissions.

- **Stockton/San Joaquin County**

Stockton Metro Airport Authority is planning to increase their air cargo operations. Air Transport International Inc., an air cargo charter airline, is expect to begin daily operations at Stockton Metropolitan Airport in Spring 2016, employing about 30 cargo handlers and supervisors, the company and airport officials announced Friday. The cargo operation will take advantage of the airport's cargo apron, a 10-acre facility on the northeast side of the main runway and able to accommodate up to four large air freighters at a time, the cargo apron has gone unused for nearly a decade.

The Port of Stockton is also looking forward to a future of increased traffic and usage several projects underway at and around Rough and Ready Island will make one of the area's largest employers more attractive to private industry shipping companies from around the world such as SCB International, a materials supplier serving the cement manufacturing.

- **Lathrop/San Joaquin County**

The Lathrop cluster will grow as it accommodates expansion from the Bay Area ports. This growth will provide opportunities for increased efficiency of shipping. Lathrop will see improved access between Union Pacific Lathrop Yard and SR 99 through the widening of Roth Road from two to four lanes.

- **Modesto/Stanislaus County**

SR 132 West serves as a major access route for an increasing number of Central Valley commuters traveling to work in and around Modesto as well as a major truck route to industries in this cluster. The project to improve operations on this facility by creating a 4-lane freeway/expressway on a new alignment connecting SR 132 with the City of Modesto is currently in the environmental phase and expected to be open to traffic by 2028. It is expected that this Improvement will impact the routing and truck traffic patterns to this cluster. This project is also part of the National Highway Freight Network.

- **Patterson/Stanislaus County**

The 1 million-square-foot Amazon Fulfilment Center started to operate in Patterson 2015. Another similar size retail warehouse and distribution center known as “Project XX” in west Patterson is also expected to start soon. These large distribution centers increase truck traffic to and from this cluster significantly. The SJV Interregional Goods Movement Plan calls for the development of a new route between SR-99 and I-5 from Turlock to Patterson.

- **Delano/Kern County**

The Delano cluster expects future growth in freight activity. The Kern County Sustainable Communities Strategy calls for increased activity at Delano RailEx intermodal rail freight facilities and the movement of distribution centers closer to the center of the state’s population distribution, which is in Kern County. The SJV Interregional Goods Movement Plan calls for the expansion of the RailEx intermodal facility. Also, these plans call for the short line rail rehabilitation and gap closure.

- **Shafter/Kern County**

The Shafter Inland Port Phase II and III is noted in the SJV Interregional Goods Movement Plan. The Kern County Sustainable Communities Strategy calls for increased activity at Shafter PLP intermodal rail freight facilities and the movement of distribution centers closer to the center of the state’s population distribution, which is in Kern County. Shafter County will also see the private $2 million development of four warehouses/distribution centers.

- **Tejon/Kern County**

The Tejon Ranch cluster is fully entitled to build up to 20 million square feet of new warehouse and industrial space. Also, the area will see the I-5 widened to 10 lanes between Fort Tejon and SR-99.

7.0 FUTURE TRUCK TRAFFIC IN THE VALLEY

7.1 Goods Movement Trends

Based on the latest Freight Analysis Framework (FAF3.4), there will be an approximately 72 percent increase in goods movement in the Valley (Table 7.1) over the next 25 years. According to FAF3.4, over all goods movement and truck traffic in San Joaquin Valley will increase by 77 percent in 2040 (Table 7.2).However the Ton-Miles by trucks increased by 98% in 2040 showing that longer trips are be expected in future.

Table 7.1 Goods Movement Growth in California
All Modes

Origin Zone	Total Ktons	Total Ton-Mile	Total M$
2015 (All Modes)			
Los Angeles CA CSA	644,815	242,689	1,372,952
Sacramento CA-NV CSA (CA Part)	122,665	27,904	75,692
San Diego CA MSA	63,773	13,769	144,576
San Francisco CA CSA	358,324	71,826	500,243
Remainder of California	314,950	101,588	283,880
2040 (All Modes)			
Los Angeles CA CSA	954,369	505,417	2,870,627
Sacramento CA-NV CSA (CA Part)	212,330	47,988	166,833
San Diego CA MSA	92,876	28,673	294,802
San Francisco CA CSA	564,398	125,470	1,170,924
Remainder of California	542,732	181,252	558,693
Growth (All Modes)			
Los Angeles CA CSA	48%	108%	109%
Sacramento CA-NV CSA (CA Part)	73%	72%	120%
San Diego CA MSA	46%	108%	104%
San Francisco CA CSA	58%	75%	134%
Remainder of California	72%	78%	97%

Source: FAF 3.4.

Table 7.2 Goods Movement growth in California
By Truck

Origin zone	Total KTons	Total Ton-Mile	Total M$
2015 (Truck Only)			
Los Angeles CA CSA	485,653	150,398	959,298
Sacramento CA-NV CSA (CA Part)	104,638	17,831	62,867
San Diego CA MSA	61,598	11,342	110,549
San Francisco CA CSA	246,743	39,514	337,971
Remainder of California	277,111	70,754	248,621
2040 (Truck Only)			
Los Angeles CA CSA	733,541	302,141	1,927,478
Sacramento CA-NV CSA (CA Part)	185,104	30,425	135,507
San Diego CA MSA	88,216	21,931	212,414
San Francisco CA CSA	401,500	72,166	808,496
Remainder of California	490,270	129,119	491,932
Growth (Truck Only)			
Los Angeles CA CSA	51%	101%	101%
Sacramento CA-NV CSA (CA Part)	77%	71%	116%
San Diego CA MSA	43%	93%	92%
San Francisco CA CSA	63%	83%	139%
Remainder of California	77%	82%	98%

Source: FAF 3.4.

7.2 Year 2040 Truck Traffic Forecasts

The purpose of this task is to understand the overall truck traffic growth pattern in the Valley along on I-5, SR-99 and major Highways in the Valley. Therefore a total sample of 40 segments from state highway network in the Valley is selected. These segments are part of STAA truck network that provide major access to freight clusters and have existing count data. Where possible, segments are selected close to county lines to have an understanding of intraregional flow between counties and internal versus through trips for each MPO.

The California Statewide Freight Model was used to estimate 2040 truck traffic as the best available tool. The land use forecast in the current model for year 2040 was prepared in 2008 and is not consistent with recent MPOs' land use forecast. Caltrans is in the process of updating future land use data for the statewide models. Knowing that, there might be some discrepancies in the truck traffic forecasts using recent land use data for the year 2040 compared to older land use growth estimates, and it is recommended that these forecasts are revisited once better data are available.

For some selected segments in the report the model forecasts are adjusted based on the GPS truck routing data. Future (2040) truck traffic on selected segments of I-5, SR 99 and other highways in the Valley is estimated and presented in Table 7.3, Figure 7.1, and Figure 7.2 shows these segments on the map and the relative change from 2014 to 2040.

Overall along I-5 corridor the percent growth increases from north to south. This is expected given the major developments in Kern County and hosting several intermodal facility and Shafter and Delano and distribution center at Tejon.

The traffic growth on SR-99 has wider range depends on the location of local developments. Largest growth on SR-99 expected to be in Kern and Merced County area.

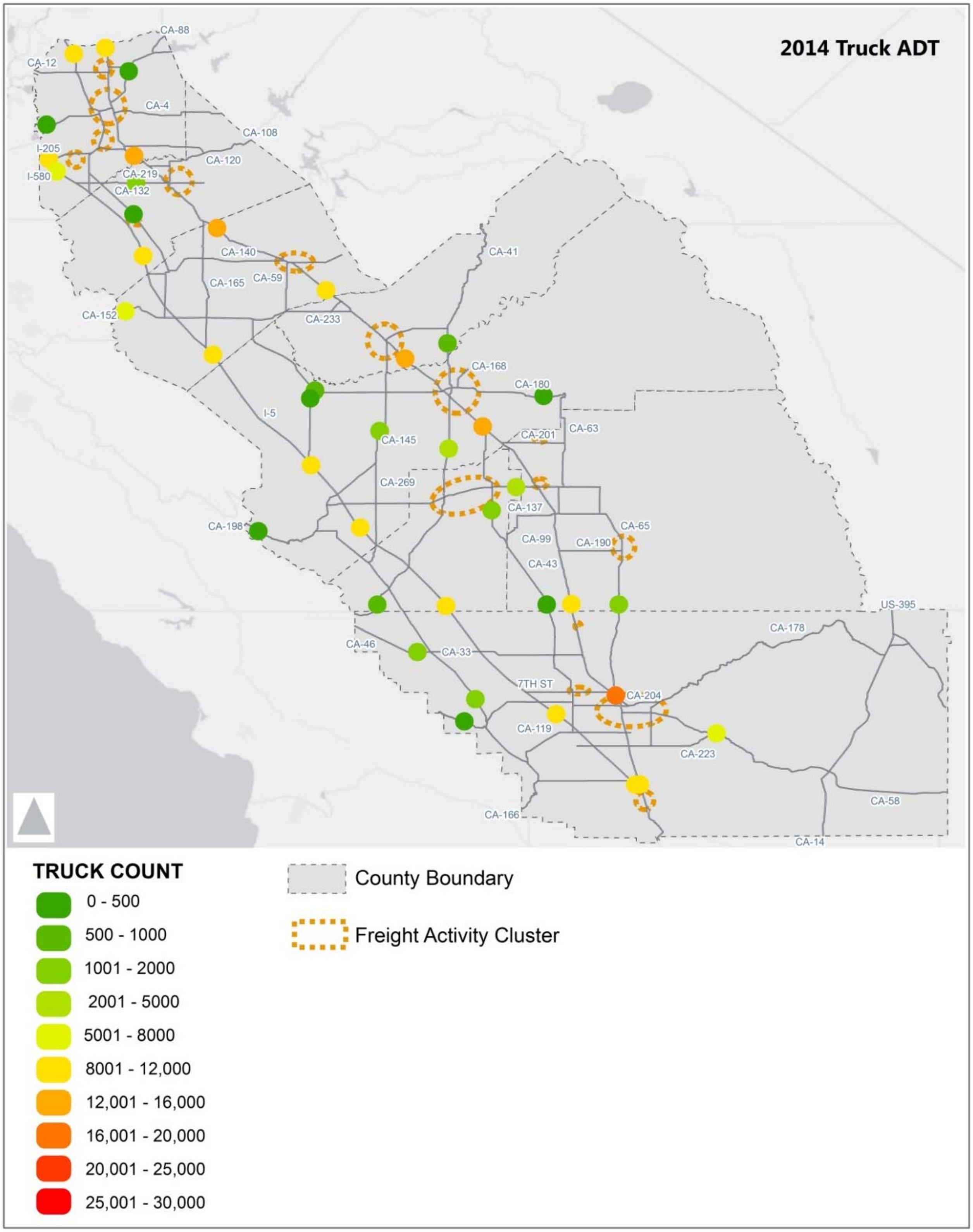
Table 7.3 2040 Truck TrafficForecast (ADT)

County	Segment Address	2014 ADT	2014 TRUCK	2040 TRUCK	Truck GROWTH
Fresno	CA-145: I-5 TO FRESNO/MADERA CL	4700	1,034	1,700	64%
	CA-180: CLOVIS (TEMPERANCE AVE) TO CA-63	5800	348	400	15%
	CA-180: MENDOTA (CA-33) TO FRESNO SLOUGH	6500	650	900	38%
	CA-198: MONTEREY/FRESNO CL TO I-5	800	60	100	67%
	CA-33: I-5 TO MENDOTA (CA-180)	1850	389	800	106%
	CA-41: KINGS/FRESNO CL TO CA-99	14800	2,368	3,500	48%
	CA-99: SELMA (CA-43) TO FRESNO (CA-41)	80000	12,800	17,600	38%
	I-5: KINGS/FRESNO CL TO CA-198	33500	9,380	16,000	71%
	I-5: CA-198 TO CA-33	35500	9,940	18,100	82%
Kern	CA-33: CA-58 TO KERN/KINGS CL	4650	1,488	2,900	95%
	CA-46: I-5 TO SAN LUIS OBISPO/KERN CL	6800	1,700	2,500	47%
	CA-58: BAKERSFIELD (WASHINGTON ST) TO BORON	19700	6,304	8,100	28%
	CA-58: SAN LUIS OBISPO/KERN CL TO I-5	620	167	600	258%
	CA-99: BAKERSFIELD (CA-204) TO CA-46	82000	18,860	30,000	59%
	CA-99: I-5 TO BAKERSFIELD (MING AVE)	40500	10,125	16,400	62%
	I-5: CA-99 TO CA-43	33000	8,910	16,400	84%
	I-5: CA-43 TO CA-58	35000	8,400	15,300	82%
Kings	CA-198: HANFORD (CA-43) TO KINGS/TULARE CL	25000	2,500	3,800	52%
	CA-41: KERN/KINGS CL TO I-5	6500	975	1,200	23%
	CA-43: CORCORAN (SANTA FE AVE) TO HANFORD (CA-198)	5900	1,121	2,500	123%
	I-5: KERN/KINGS CL TO KINGS/FRESNO CL (CA-269)	32000	8,640	15,600	81%
Madera	CA-41: FRESNO/MADERA CL TO MADERA/MARIPOSA CL	18500	925	1,400	51%
	CA-99: FRESNO/MADERA CL TO AVENUE 12	66000	13,200	21,300	61%

	CA-152: SANTA CLARA/MERCED CL TO CA-33	33000	5,280	9,700	84%
	CA-99: MADERA/MERCED CL TO MERCED (CA-59)	38000	8,360	13,700	64%
	CA-99: MERCED (CA-59) TO MERCED/STANISLAUS CL	61000	15,250	22,400	47%
Merced	I-5: FRESNO/MERCED CL TO CA-165	29000	8,120	14,900	83%
San Joaquin	CA-4: CONTRA COSTA/SAN JOAQUIN CL TO STOCKTON (I-5)	992	109	400	267%
	CA-88: STOCKTON (CA-99) TO CA-12	8100	405	500	23%
	CA-99: STANISLAUS/SAN JOAQUIN CL TO MANTECA (CA-120)	114000	15,960	27,300	71%
	CA-99: LODI (CA-12) TO GALT (SAN JOAQUIN/SACRAMENTO CL)	62000	8,060	11,600	44%
	I-205: STOCKTON (I-5) TO CA-580	89000	10,680	18,700	75%
	I-5: CA-12 TO SAN JOAQUIN/SACRAMENTO CL	51000	10,710	17,500	63%
	I-580: I-5 (SAN JOAQUIN CL) TO CA-205	30500	5,490	9,000	64%
Stanislaus	CA-132: SAN JOAQUIN/STANISLAUS CL TO MODESTO (CA-99)	10400	1,872	4,900	162%
	CA-33: MERCED/STANISLAUS CL TO STANISLAUS/SAN JOAQUIN CL	4400	440	1,200	173%
	I-5: MERCED/STANISLAUS CL TO I-580 (SAN JOAQUIN CL)	39000	9,750	19,000	95%
Tulare	CA-43: KERN/TULARE CL TO CORCORAN (SANTA FE AVE)	2650	451	1,100	144%
	CA-65: KERN/TULARE CL TO CA-198	6800	1,088	1,200	10%
	CA-99: DELANO (KERN/TULARE CL) TO VISALIA (CA-198)	47500	9,500	16,700	76%

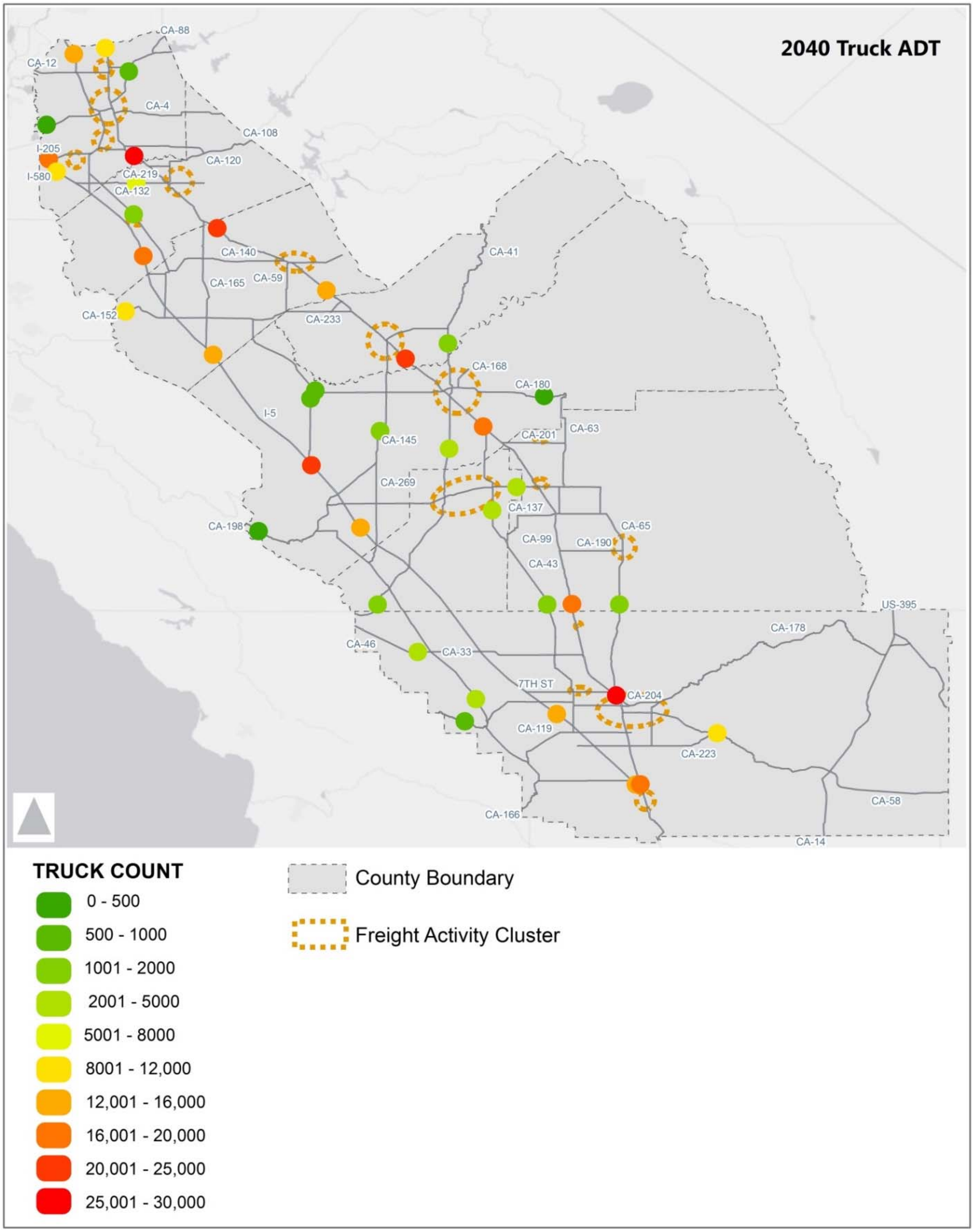
Source: Counts (7), model result.

Figure 7.1 2014 Truck Traffic Counts for Selected Segments



Source: Counts (7), model results.

Figure 7.2 2040 Truck Traffic Forecast for Selected Segments



Source: Model Results.

8.0 TRUCKING AND GOODS MOVEMENT ISSUES

Using the data and information compiled in the database, the most critical trucking and goods movement issues in the I-5/SR 99 corridors were identified in order to determine which of the strategic programs will be most beneficial in addressing these needs. Our approach was to organize, summarize and visualize available information about each segment to understand the big picture of truck movements in the Valley. We focused on the I-5/SR 99 segments that are most heavily impacted by truck traffic in order to guide the development of successful strategies to improve goods movement. We shared the online web map and fact sheets for each segment with Valley MPOs, Caltrans, and TAC members for their review and feedback to ensure that all issues are fully captured and accurately covered.

8.1 Traffic Congestion and Travel Time Reliability Issues

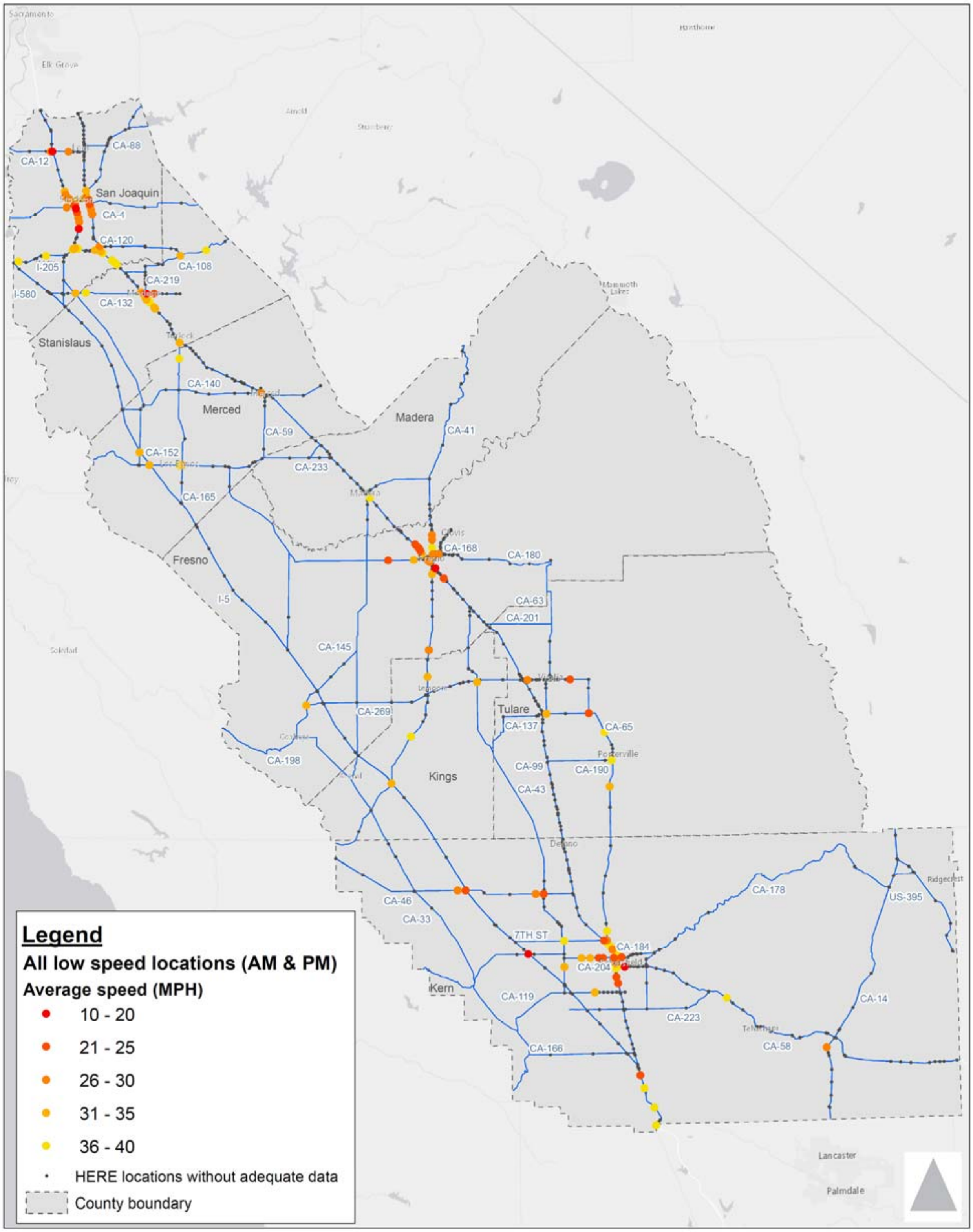
To identify segments with mobility and reliability issues HERE data are used. For this analysis, speed data is processes for Tuesdays through Thursdays for the month of October, 2015 in order to establish average weekday values. The time period was further refined to the peak hours for analysis of 6:00 to 9:00 AM and 4:00 to 7:00 PM. In order to ensure the quality of data, the selection was refined once more to only locations that had at least 10 days of data on average for each five-minute data point. The HERE dataset is not cleaned of outliers or other possible data errors ahead of time, so this refining process reduces the likelihood that a location would show irrational or skewed averages because, for example, there was only one day of data.

To understand the peak hour issues across the entire region, the average speed data was aggregated to 15-minute periods and the lowest average speed for any 15-minute period for both AM and PM peak was selected. This method allows for the variation among regions or even among different road segments which may experience the worst of the peak period at very different times, rather than arbitrarily applying a single 15-minute time period across the entire Valley.

The worst 15-minute average speed was selected as congested peak period speed of that facility, then the congested speed was compared to posted speed limit (free flow speed). In some cases congested speed is 25% of the posted speed limit. In other words, on a highway with a posted speed of 65mph, the average speed would be about 16mph. The congested speed is calculated for both “all vehicles” and “trucks only,” where the data were available. It is important to note that on some segments of major freeways and multilane highways, trucks are subject to speed restrictions (often, a limit of 10mph less than general traffic) that would not be captured by the posted speed limit data source used.

Figure 8.1 provides example areas for further analysis. From the lowest speed locations, ten locations were selected where truck volumes account for at least 10% of all traffic (the lowest ultimately was 12%) and the slow areas were at least one mile in length. Each location selected was supported by HERE data and validated against Google Maps historical traffic data to ensure some other condition, such as construction in the HERE data collection period, was not skewing the results. The locations selected cover a variety of areas across the region, although some counties do not feature an example that met all of the criteria. While the list is dominated by urban areas where AADT tends to be higher and exit and entry ramps or interchanges are more frequent, there are several examples of multilane or single-lane state highways with low AADT and high truck volumes.

Figure 8.1 Congested Locations during AM or PM Peak Period



Source: HERE, October 2015.

8.2 Safety Issues

A regional hot-spot analysis is useful to identify areas to examine more closely, but does not effectively assess the frequency of collisions relative to the use of the road. Where data were available, the rate of collisions per 1,000 average daily trips was calculated. Highways across the study area carry a wide range of traffic volumes, so collision rates are a better indicator of a problem.

The length of segments in the study varies and the ADT values are estimates. Some segments have more ADT data available than others, so the collision rate (collisions per 1,000 ADT) should be understood as an order of magnitude difference, rather than an absolute value.

The average collision rate among the 44 segments with available ADT data was 12.38 collisions per 1,000 ADT. The range is wide, from 1.6 to 184 collisions per 1,000 ADT. Table 8.1 displays the 10 segments with the highest collision rates. At least four of these segments can be considered part of the greater Stockton area.

Table 8.1 List of Top 10 Segments with High Collision Rates in the Valley

Highway	Segment	Collisions 2009-2013	ADT	Collisions Per 1,000 ADT
CA-108	Modesto (CA-132) To Tuolumne/Stanislaus Cl	888	4,800	184.0
CA-120	Manteca (CA-99) To San Joaquin/Stanislaus Cl	145	2,900	50.1
CA-41	Fresno/Madera Cl To Madera/Mariposa Cl	482	18,300	26.4
I-580	I-5 (San Joaquin Cl) To CA-205	116	4,800	24.3
CA-88	Stockton (CA-99) To CA-12	212	8,800	24.2
CA-4	Contra Costa/San Joaquin Cl To Stockton (I-5)	137	5,900	23.2
CA-12	Sacramento/San Joaquin Cl To Lodi West City Limit	84	5,700	14.8
CA-152	Santa Clara/Merced Cl To CA-33	299	20,500	14.6
CA-140	CA-165 To Merced (CA-99)	58	4,100	14.1
CA-4	Stockton (CA-99) To San Joaquin/Stanislaus Cl	52	4,400	11.9

Source: TIMS, Counts (7).

Only the data for SR 99 and I-5 are displayed below in Table 8.2, where data collection for traffic volumes is generally more consistent. Compared to the available segments for other highways, SR 99 and I-5 are relatively much safer despite significantly higher volumes. The average collision rate for other highways where ADT was available is 23.92, compared to 4.54 for SR 99 and 3.88 for I-5.

Table 8.2 List of Segments with High Collisions on I-5 and SR 99

Highway	Segment	Collisions 2009-2013	ADT	Collisions Per 1,000 ADT
SR 99	Delano (Kern/Tulare Cl) To Visalia (CA-198)	530	46,200	11.5
SR 99	Merced (CA-59) To Merced/Stanislaus Cl	422	54,000	7.8
SR 99	Merced/Stanislaus Cl To Modesto (CA-132)	689	89,100	7.7
SR 99	Manteca (CA-120) To Stockton (CA-4)	436	69,900	6.2
SR 99	Fresno (CA-41) To Fresno/Madera Cl	588	98,200	6.0
SR 99	I-5 To Bakersfield (Ming Ave)	322	65,300	4.9
SR 99	Modesto (CA-132) To Stanislaus/San Joaquin Cl	520	115,400	4.5
SR 99	Stockton (CA-4) To Lodi (CA-12)	321	82,100	3.9
SR 99	Bakersfield (CA-204) To CA-46	290	78,100	3.7
SR 99	Selma (CA-43) To Fresno (CA-41)	314	87,800	3.6
SR 99	Lodi (CA-12) To Galt (San Joaquin/Sacramento Cl)	193	57,900	3.3
SR 99	Ming Ave To CA-204 (Bakersfield)	407	128,700	3.2
SR 99	Avenue 12 To Avenue 17 (Madera)	192	64,400	3.0
SR 99	Stanislaus/San Joaquin Cl To Manteca (CA-120)	225	89,900	2.5
SR 99	Fresno/Madera Cl To Avenue 12	118	61,000	1.9
SR 99	CA-152 To Madera/Merced Cl	99	54,400	1.8
SR 99	CA-46 To Delano (Kern/Tulare Cl)	97	61,600	1.6
I-5	I-5 (San Joaquin Cl) To CA-205	671	70,700	9.5
I-5	Monte Diablo Ave (Stockton) To CA-12	148	19,300	7.7
I-5	CA-165 To Merced/Stanislaus Cl (CA-140)	355	90,900	3.9
I-5	Lathrop (CA-120) To Stockton (CA-4)	108	40,700	2.7

Highway	Segment	Collisions 2009-2013	ADT	Collisions Per 1,000 ADT
I-5	CA-12 To San Joaquin/Sacramento Cl	80	33,400	2.4
I-5	CA-99 To CA-43	35	19,200	1.8
I-5	I-580 To I-205	55	34,800	1.6
I-5	CA-43 To CA-58	128	82,600	1.6

Source: TIMS, Counts (7).

9.0 Goods Movement Issues and Opportunities

9.1 Truck Traffic Generators

In the Task 1 memorandum, seventeen freight clusters were identified. These existing freight clusters contribute to major truck trip generation in the Valley. The intent of focusing on existing clusters correlates to a purchase of truck GPS data for the purpose of adding truck origins and destinations information to the travel demand model. While this data is only partial and is not able to tell us about the future, it is very useful for validating the model outputs. As part of Task 1 memorandum, the I-5/SR 99 Technical Advisory committee provided significant feedback about existing and planned freight activity centers. The planned facilities will be important, especially in Task 4 when we investigate the opportunities for identifying east/west connectors with the highest potential for shifting truck traffic from SR 99 to I-5. As part of this next effort, additional truck generators, such as truck parking/storage facilities and service stations, were added to the maps. This additional layer of information provides more details about likely truck routing.

The databases for additional truck generators were developed to guide the location and definition of freight industry clusters, and are not intended to be exhaustive or definitive, and are described as follows:

- **Freight Facilities Database**. This database is an Excel workbook listing names and addresses of 478 identifiable freight-related facilities in the eight-county study area. Those facilities include:
  - Distribution centers (DCs) operated by retail chains or other private sector freight owners (e.g. the Walmart distribution center at Porterville)
  - Warehouses or distribution centers operated by third-party logistics (3PL) firms, either for specific customers or for multiple clients (e.g. multiple Americold Logistics facilities in the study area).
  - Agricultural producers, packers, or processors (e.g. multiple ConAgra facilities in the study area).
  - Manufacturers likely to depend heavily on freight transportation (e.g. Dart Container Corp. in Lodi).
  - Transloaders that shift freight between rail and truck modes (e.g. MET's Valley Transload in Empire).
  - Trucking firms with substantial terminals (e.g. the YRC terminal at Tracy).
  - Rail carload and intermodal freight facilities (e.g. the BNSF Mariposa intermodal terminal at Stockton).

- This list should not be considered exhaustive, and it is possible that some facilities may have opened, closed, or changed names. There was no fixed size or volume cutoff; inclusion was based on scale information found in directories, on websites, or apparent in Google earth aerial photos.

- Sources used to compile the list include databases created for previous San Joaquin Valley projects and industry directories. Extensive use of Google Earth, Google Maps, and company websites was made to locate and identify major facilities in the study area.

- **Truckstops Database.** Within the freight industry, a "truckstop" is normally a large facility providing fuel, food, supplies, services, and overnight parking for heavy-duty trucks. **Figure 9.1** shows a cluster of truckstops near Lost Hills. A database of 182 commercial truckstops was developed from industry listings. This database extended beyond the study area. The listings were reviewed to focus on substantial facilities catering to heavy-duty trucks, and to exclude truckstops that were actually just filling stations or convenience stores.

Figure 9.1 Truckstops, I5/CA46 at Lost Hills

Source: Google Earth, 2016.

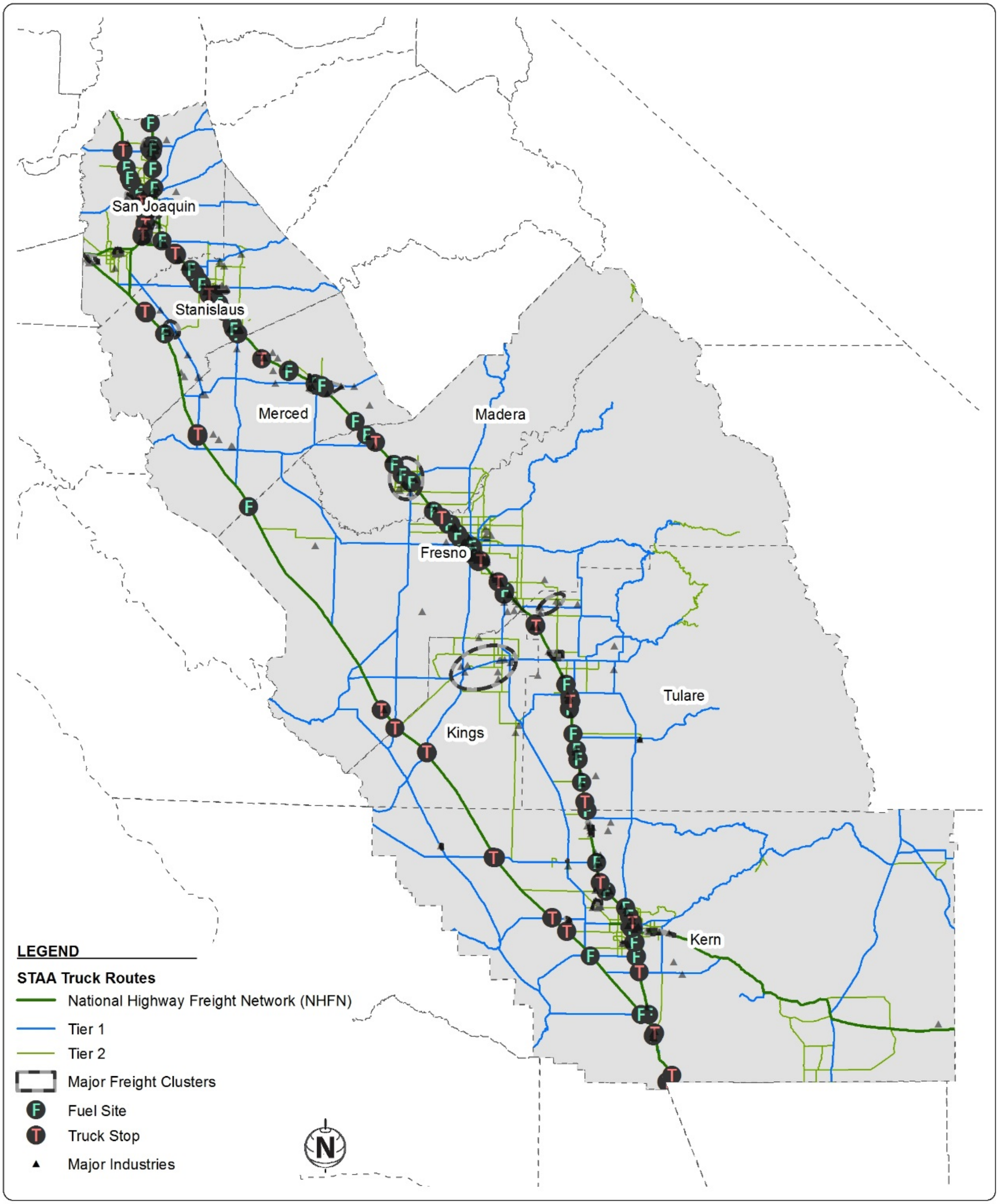
- **Fueling sites.** Heavy duty trucks do not normally patronize normal consumer gas stations. Their drivers obtain fuel at company yards, at truckstops, or at commercial fueling sites. Many commercial fueling sites are unmanned "card lock" locations (**Figure 9.2**), while others are fuel dealers or large gas stations. A database of 242 such sites was developed in the study area, drawing on listings from the two major western fueling networks: Pacific Pride and CFN. A brief review of the data was conducted to eliminate ordinary gas stations that happened to accept Pacific Pride of CFN credit cards.

Figure 9.2 Unmanned Pacific Pride "Card Lock" Fueling Site

Source: Google Earth, 2016.

Figure 9.3 shows the additional truck generators identified in the San Joaquin Valley region using the above databases. A majority of the freight facilities, truckstops and fueling stations are located along SR 99.

Figure 9.3 Freight Clusters and Truck Service Facilities



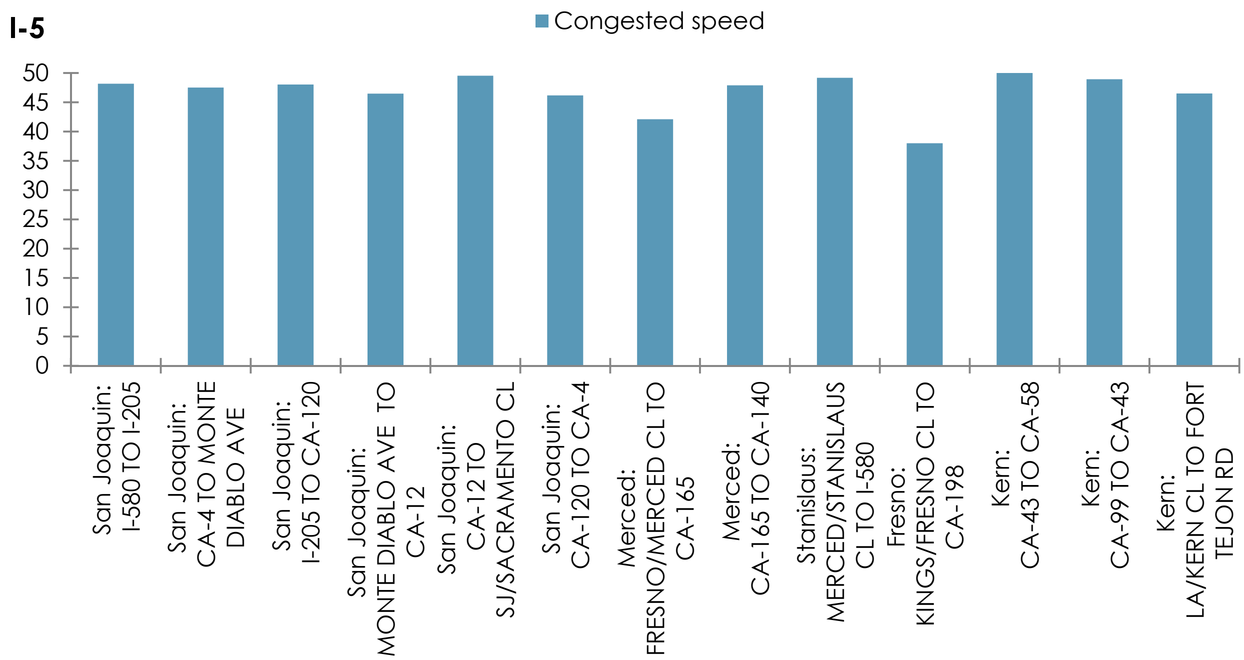
Source: Consultants' Databases Development and Analysis, 2016.

The Regional Transportation Plans (RTP) for each county provided the basis for future industrial land use and growth assumptions, including industrial warehouses, distribution centers, and truck support facilities. The RTP travel demand model land use data were used to determine the existing and future industrial employment growth for each transportation analysis zone (TAZ). The base and future years were defined based on available model data. The base year ranges from 2005 to 2014 and the future year is 2040, except for Madera County which is 2035. These are shown and discussed in Sections 3.4 to 3.11 of this memorandum.

9.2 Mobility

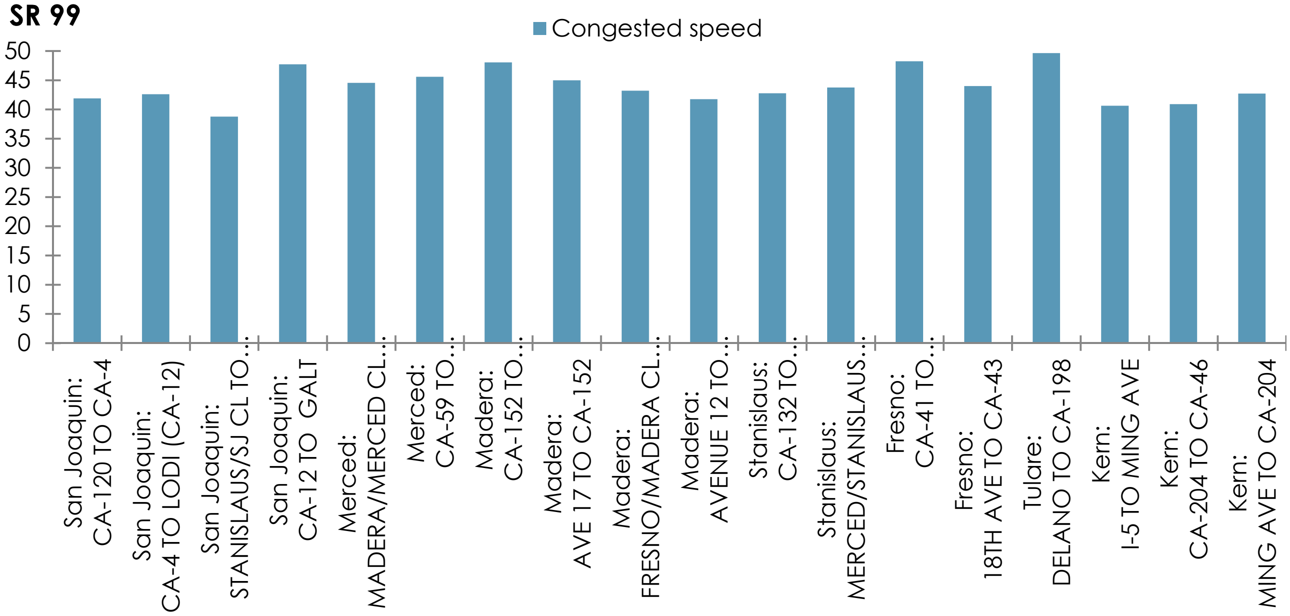
Two charts displaying congested speeds at locations along I-5 and SR 99 and a map of locations with congestion and travel time reliability issues provided in Task 1 memorandum are included again here as a starting point for a more detailed discussion about the critical locations. As stated in Task 1 memorandum, this data posed two problems, including lack of reliable historical data and speed limits shown do not always apply to truck traffic. Commonly, a posted speed limit of 65 mph applies to automobiles while a 55 mph speed limit applies to heavy trucks. For these reasons, actual speeds shown in **Figure 9.4** and **Figure 9.5** below that indicate traffic is moving 10 to 15 percent slower than the posted speed may be due to missing or incorrect data or significant truck traffic that is restricted to a 55 mph speed limit. This information provides a good starting point for identifying critical locations, but this memorandum includes additional information to determine truck bottlenecks. Near dense urban areas, the average V/C along I-5 and SR 99 during peak periods is 0.25 and 0.51, respectively.

Figure 9.4 I-5 Congested Speed (2014)



Source: PeMS, 2014.

Figure 9.5 SR 99 Congested Speed (2014)



Source: PeMS, 2014.

Data for the travel time of vehicles (and in many cases, trucks as well) was collected from "HERE", otherwise known as the National Performance Management Research Data Set (NPMRDS). These data are collected at locations across the US highway network. Each location is composed of a certain length of roadway and is available in either direction. Data are averaged by five-minute increments and gathered into one-month batches by state. The data coverage is generally comprehensive, but not all locations have robust data sets for all times of all days of a given month. The HERE data for each month includes a correspondence table that identifies the length of the segment and the observed average travel time by vehicle type. Vehicle classification is not available for all locations. Using this information, the average speed can be calculated for each segment by type (all vehicle vs Truck only).

For this analysis, data collection locations were selected for all state highways in the San Joaquin Valley, limited to Tuesdays through Thursdays, for the entire month of October 2015. The selection was further refined to the peak hours of 6:00 to 9:00 AM and 4:00 to 7:00 PM. In order to ensure reliable average values, the selection was refined once more to include only locations that had at least 10 days of data on average for each five-minute data point. The HERE dataset is cleaned of outliers or other possible data errors, so this process reduces the likelihood that a location would show irrational or skewed averages.

A comparison of the average speed data aggregated to 15-minute periods and the lowest average speed for any 15-minute period for both AM and PM peak provided an indication of locations experiencing congested speeds. This method allows for the variation among regions, or even among different road segments, which may experience the worst of the peak period at different times.

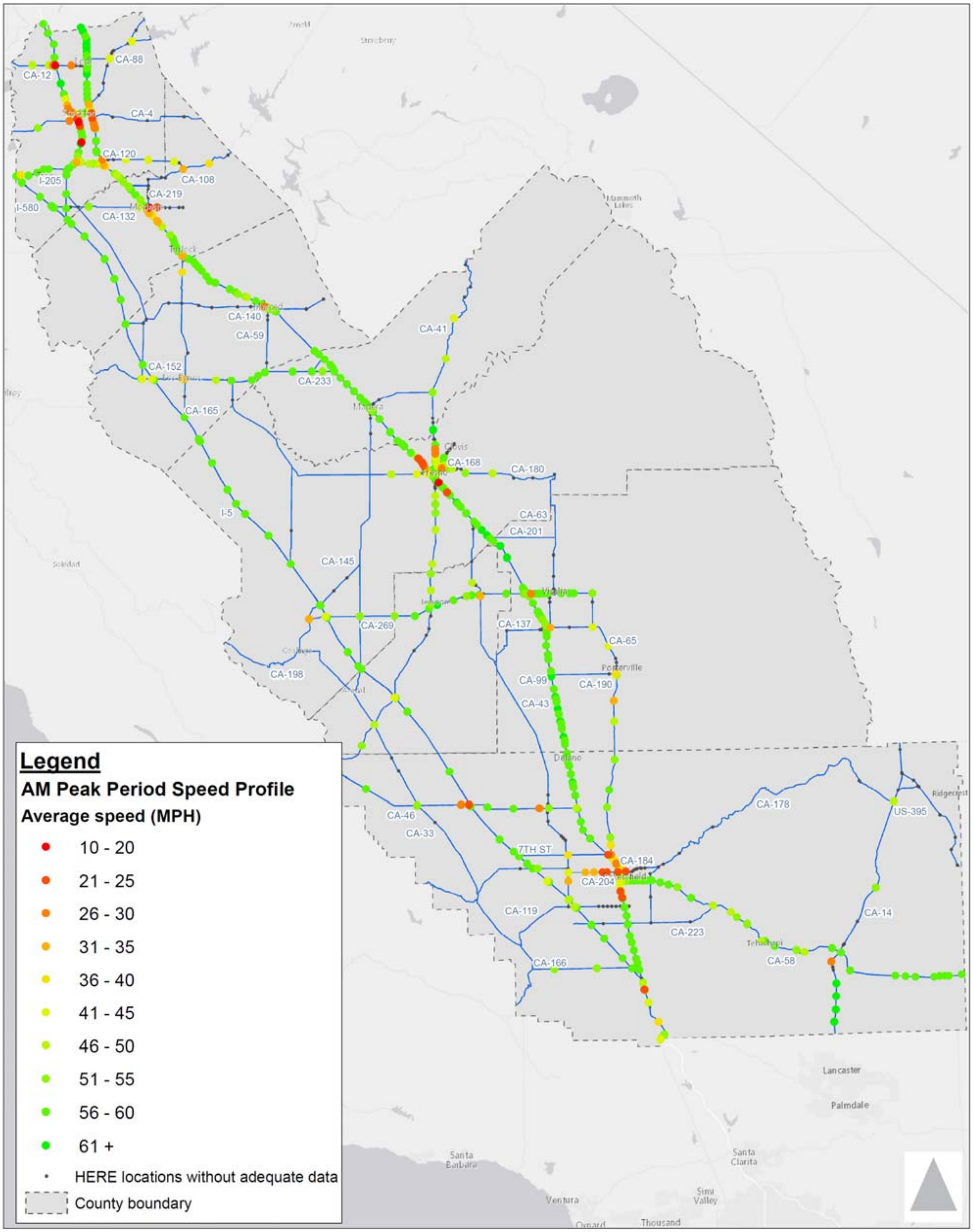
Figure 9.6 and **Figure 9.7** show the speeds for all vehicles and trucks only for the AM and PM peak periods.

To identify congestion issues, the worst 15-minute average speed was compared to the posted speed limit of that facility. In some cases, during the worst 15 minutes vehicles were moving at an average speed 25 percent of the posted speed limit. This method of comparison was calculated for all vehicles, as well as trucks only, where the data were available. On some segments of major freeways and multilane highways, trucks are subject to speed restrictions (often, a limit of 10 mph less than general traffic) that would not be captured by the posted speed limit data source used. Because of this, the ratio of average truck speed to posted speed limit on multilane highways may be somewhat exaggerated, and actual speed values may be more relevant.

Further examination of locations with the lowest average peak period speeds across the entire region yielded ten example areas for further analysis and project prioritization. The basis for selecting an additional ten locations for prioritization included those with a combination of the lowest speeds, at least ten percent truck mix, and a one-mile minimum length. Each location selected was supported by HERE data and validated against Google Maps historical traffic data to ensure some other condition, such as construction, was not skewing the results. The locations selected cover a variety of areas across the region; however, not all counties have segments that reach the level of severity employed by this analysis. This is not to say that some counties do not have any congestion or safety issues, but rather, that the severity of issues does not meet the thresholds established for analyzing the entire region. Setting the thresholds lower would result in an unmanageable number of issue locations in the counties that already meet the minimum thresholds, and furthermore, could overstate and over-correct perceived issues. Critical locations occur most frequently in urban areas where AADT tends to be higher, exit and entry ramps or interchanges are more frequent, and the risk of crashes more prominent.

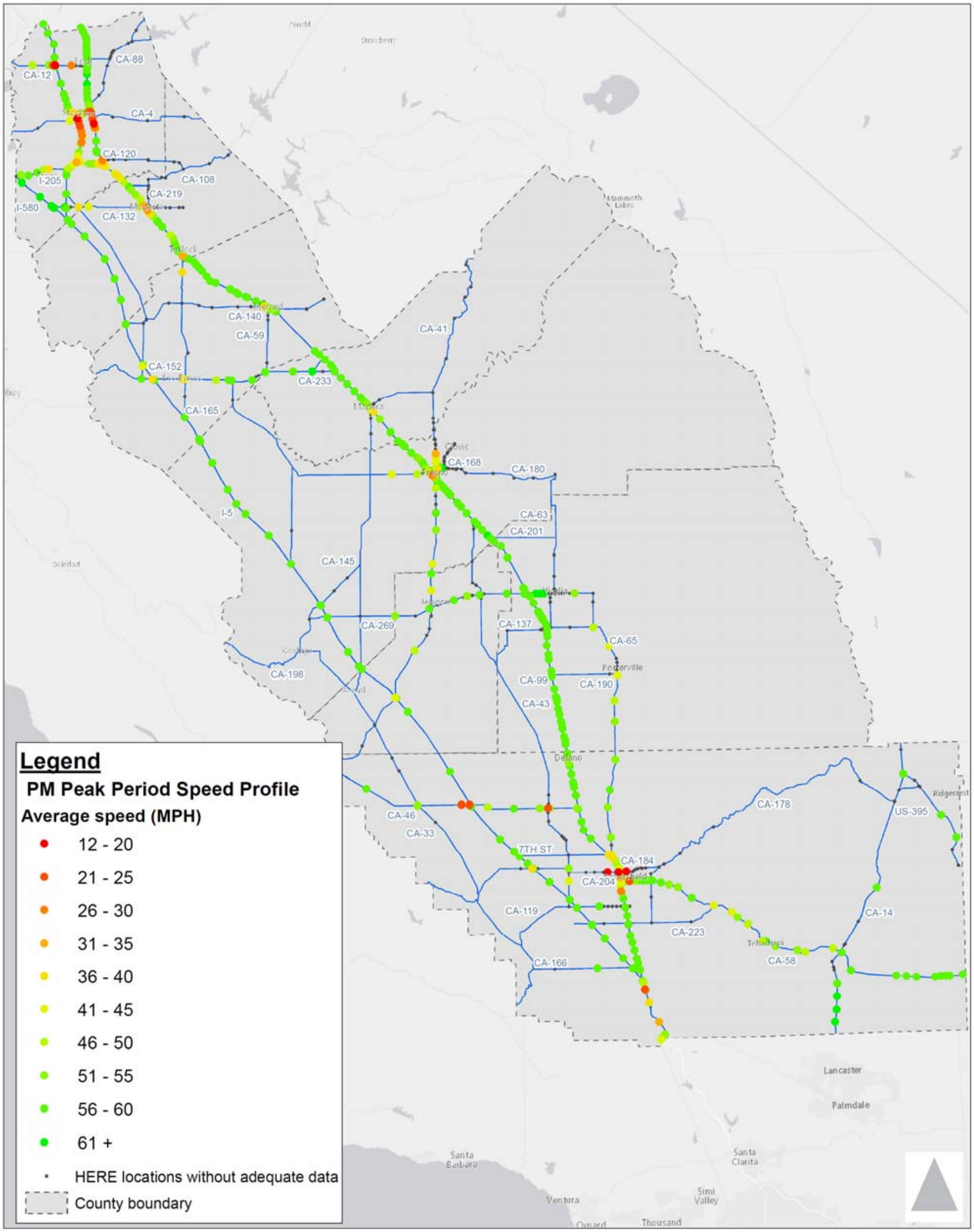
As shown in the following three figures, congestion occurs primarily on SR 99 near urban centers. In order to measure the severity, this analysis employed thresholds for critical locations. The thresholds included locations with congested speeds of more than 15 percent below posted speed limits. Based on this criteria, **Figure 9.8** depicts the critical locations based on existing congested conditions.

Figure 9.6 AM Peak Hour Traffic Congestion, 2015



Source: HERE data, October 2015.

Figure 9.7 PM Peak Period Traffic Congestion (2015)



Source: HERE data, October 2015.

Figure 9.8 Critical Mobility Issues, SR 99 & I-5 Only

Source: HERE DataSafety and Reliability.

The Task 1 memorandum investigated crashes by type along the I-5 and SR 99 corridors, including frequency, severity, and collision type (rear-end, side-swipe, etc.). The most recent available TIMS Data were obtained for all collisions coded as occurring on a state highway in the eight counties between January 1, 2009 and December 31, 2013.

Table 9.1 summarizes collisions by involvement of trucks and by year. During the 5-year period, collisions average 4,551 per year, with truck-involved collisions accounting for over 10 percent of all collisions each year.

Table 9.1 Collisions by truck involvement and year

Collision Involvement	2009	2010	2011	2012	2013	Total
No Truck Involved	4,253	4,147	4,059	3,992	3,886	20,337
Truck Involved	483	479	490	479	489	2,420
% Truck Collisions	10.2%	10.4%	10.8%	10.7%	11.2%	10.6%
Total	**4,736**	**4,626**	**4,549**	**4,471**	**4,375**	**22,757**

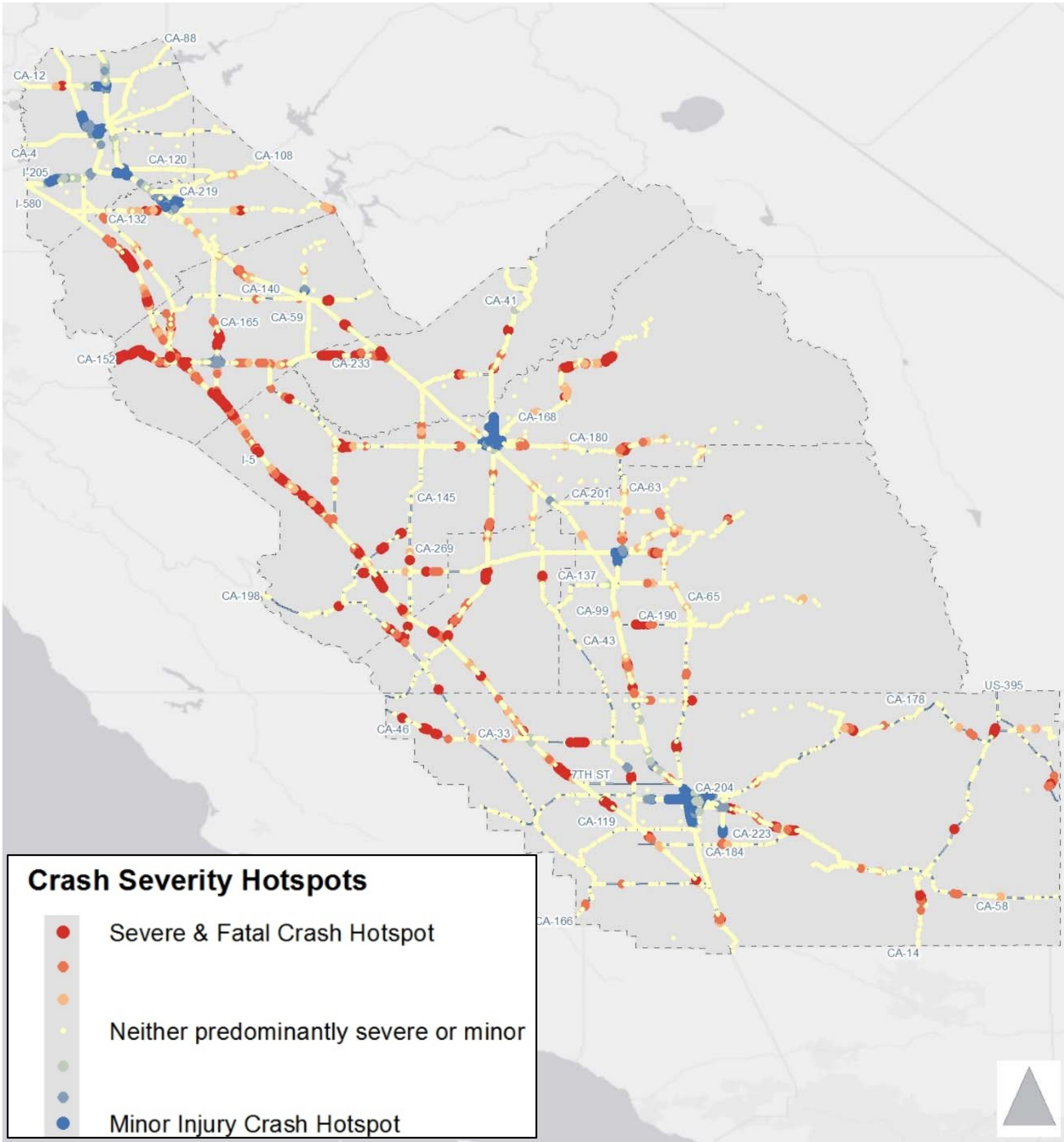
Source: TIMS, 2009-2013.

In order to determine significant safety hot spots, Task 1 memorandum describes the use of the Getis-Ord GI Optimized Hot Spot Analysis tool to identify statistically significant "hot" and "cold" spots based on high and low values in the data (**Figure 9.9**). The tool analyzes the severity of each collision in relation to the severity of others nearby. Collisions are coded on a scale of 1-4, with 1 meaning fatal and 4 being only complaint of pain. In the figure below, every dot represents a unique incident. Red dots indicate statistically significant hot spots of severe collisions (groups of points near where most other collisions are severe or fatal). Blue dots indicate statistically significant groups of minor collisions (nearby collisions are mostly not severe or fatal). The yellow dots represent incidents where there is not a statistically significant prevalence of either severe or fatal collisions.

The blue hot spots are found almost exclusively in urban areas, especially Bakersfield, Fresno, and Stockton. These areas are expected to have higher volumes of collisions in general, and hot spots of minor collisions are a reasonable result because speeds are lower in urban areas.

Red hot spots are much more widespread across the study area, but are still heaviest along I-5 where speeds are higher and potential points of conflict (ramps, for example) are fewer. Red hot spots along rural highways are more likely to face a diverse set of challenges. For example, there could be poor sight lines at crossroads or driveways, leading to high incidence of broadside (t-bone) collisions.

Figure 9.9 All Collisions: Severity Hotspots Analysis



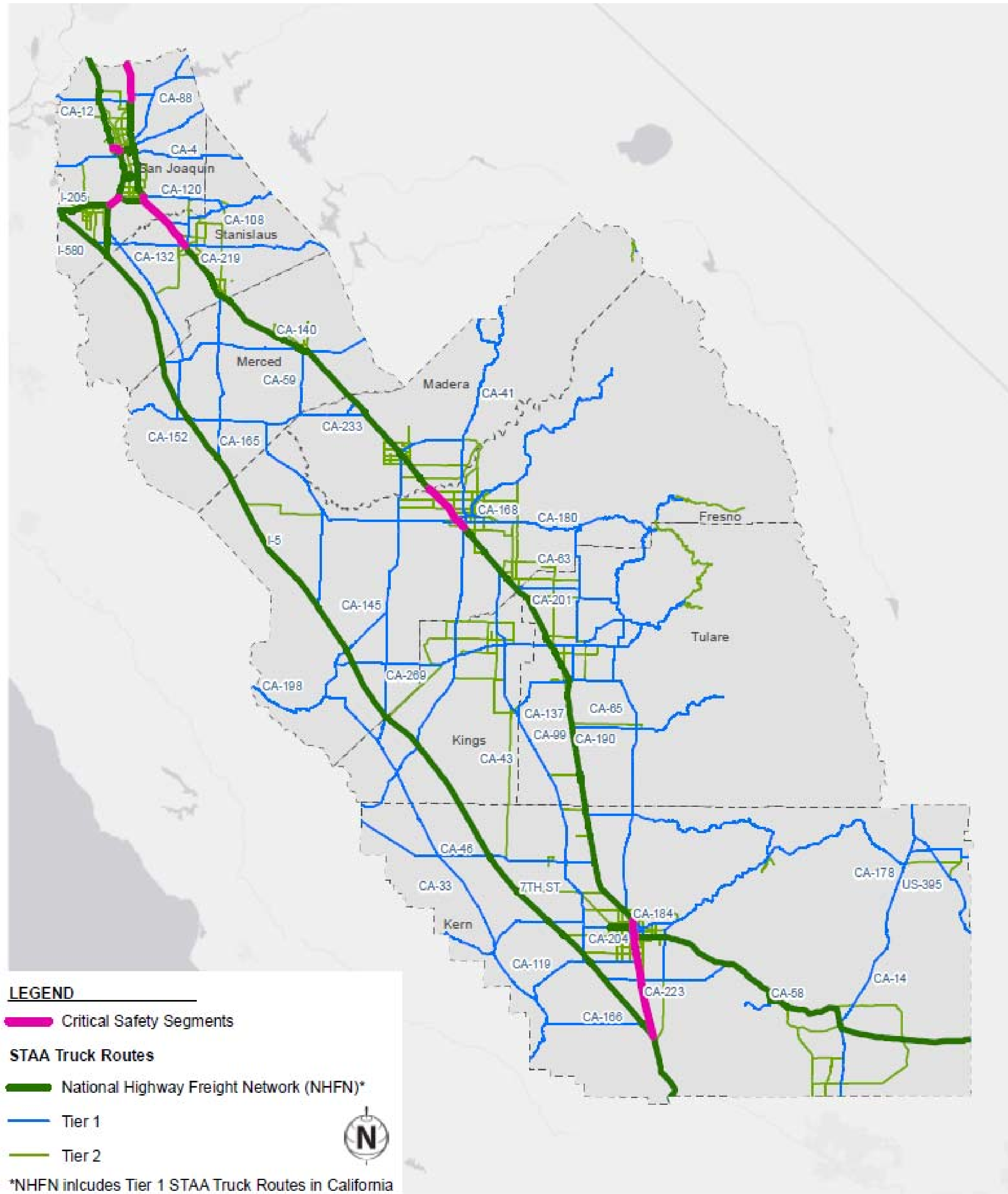
Source: TIMS, 2009-2013.

Similar to how congested speed data assisted with identifying a starting point for investigating mobility issues, the regional hot-spot analysis provided a starting point for narrowing down a list of locations to investigate. Where data were available, the rate of collisions per 1,000 average daily trips was calculated. Locations where two or more similar crashes occurred were investigated more closely to determine if an improvement could alleviate risk of future collisions (**Table 9.2**). **Figure 9.10** shows critical safety locations identified through closer examination of crash cause and frequency.

Table 9.2 List of Segments with High Number of Collisions

Highway	Segment	Collisions 2009-2013	ADT	Collisions per 1,000 ADT
SR 99	Delano (Kern/Tulare Cl) to Visalia (SR 198)	530	46,200	11.5
SR 99	Merced (SR 59) To Merced/Stanislaus Cl	422	54,000	7.8
SR 99	Merced/Stanislaus Cl to Modesto (SR 132)	689	89,100	7.7
SR 99	Manteca (SR 120) to Stockton (SR 4)	436	69,900	6.2
SR 99	Fresno (SR 41) To Fresno/Madera Cl	588	98,200	6.0
SR 99	I-5 To Bakersfield (Ming Ave)	322	65,300	4.9
SR 99	Modesto (SR 132) to Stanislaus/San Joaquin Cl	520	115,400	4.5
SR 99	Stockton (SR 4) To Lodi (SR 12)	321	82,100	3.9
SR 99	Bakersfield (SR 204) To SR 46	290	78,100	3.7
SR 99	Selma (SR 43) To Fresno (SR 41)	314	87,800	3.6
SR 99	Lodi (SR 12) To Galt (San Joaquin/Sacramento Cl)	193	57,900	3.3
SR 99	Ming Ave To SR 204 (Bakersfield)	407	128,700	3.2
SR 99	Avenue 12 To Avenue 17 (Madera)	192	64,400	3.0
SR 99	Stanislaus/San Joaquin Cl to Manteca (SR 120)	225	89,900	2.5
SR 99	Fresno/Madera Cl To Avenue 12	118	61,000	1.9
SR 99	SR 152 To Madera/Merced Cl	99	54,400	1.8
SR 99	SR 46 To Delano (Kern/Tulare Cl)	97	61,600	1.6
I-5	I-5 (San Joaquin Cl) To SR 205	671	70,700	9.5
I-5	Monte Diablo Ave (Stockton) To SR 12	148	19,300	7.7
I-5	SR 165 to Merced/Stanislaus Cl (SR 140)	355	90,900	3.9
I-5	Lathrop (SR 120) to Stockton (SR 4)	108	40,700	2.7
I-5	SR 12 to San Joaquin/Sacramento Cl	80	33,400	2.4
I-5	SR 99 To SR 43	35	19,200	1.8
I-5	I-580 To I-205	55	34,800	1.6
I-5	SR 43 To SR 58	128	82,600	1.6

Figure 9.10 Critical Safety Issues on SR 99 and I-5



Source: TIMS Data.

9.3 Fresno County

9.3.1 Traffic Generators

In Task 1 memorandum, a freight cluster[1] consisting of five distribution centers, two large agricultural businesses, an airport, and an import/export distribution facility was identified in Fresno. The distribution centers identified for this cluster focus on transportation and warehousing as well as wholesale and retail trade, and one of the centers specializes in groceries/retail and employs 500 to 999 employees and another center employs 1,000 to 4,999 employees. The agricultural businesses each employ 1,000 to 4,999 people.

The Fresno Council of Governments (Fresno COG) provided base year and future year land use data for 2014 and 2040 respectively. As per **Figure 9.11,** TAZs with highest expected industrial growth are located in Fresno, Selma, and Reedley. The western portion of Fresno County is also expected to have moderate to high industrial growth as seen in the figure below.

9.3.2 Congested Segments

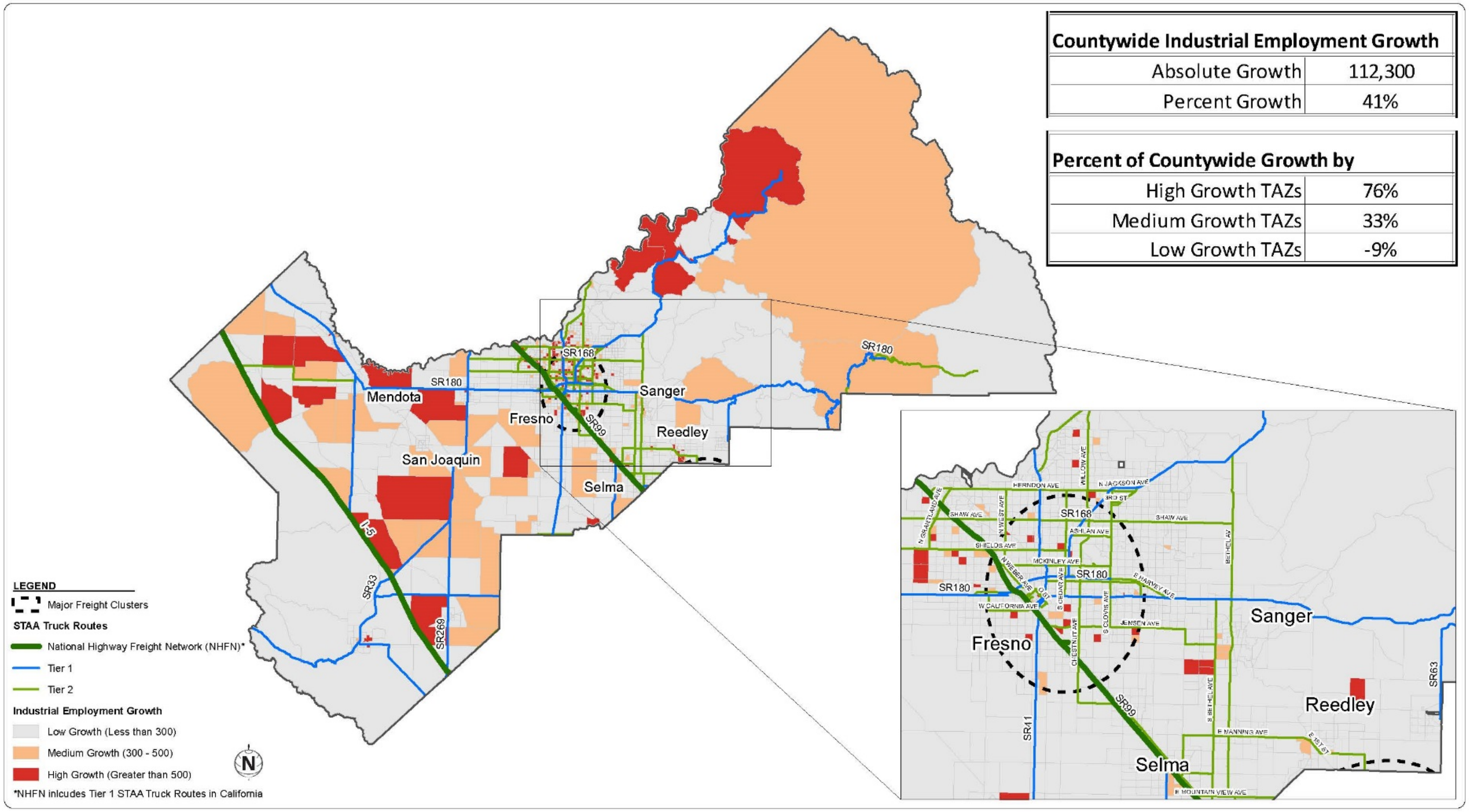
The section identified in **Table 9.3** is considered to be located in a mixed urban land use setting. The critical issue with this congested segment is that the SR 99 passes through Fresno to the west of the core area, with several exit ramps accessing industrial areas and downtown. The truck volume in this segment is relatively high due to the industrial areas along it.

9.3.3 Critical Safety Segments

Table 9.4 shows the details of a critical safety segment in Fresno. The Shaw Avenue and Herndon Avenue intersections on SR 99 have the highest number of truck collisions. There are 10 import/export businesses within 10 miles of this segment with 3 significant freight businesses in close proximity, as well. This segment has a significant number of fatalities, alcohol-related crashes, freight facilities and goods movement, and a high percentage of sideswipe truck collisions, especially near Herndon and Shaw Avenues.

[1] Employment data provided a starting point for determining the locations of freight cluster. Initial investigations identified the following industrial employers. The clusters were expanded and revised based on input from the I-5/SR 99 TAC.

Figure 9.11 Industrial Employment Growth (2010 to 2040)



Countywide Industrial Employment Growth	
Absolute Growth	112,300
Percent Growth	41%

Percent of Countywide Growth by	
High Growth TAZs	76%
Medium Growth TAZs	33%
Low Growth TAZs	-9%

Source: Fresno Council of Governments (COG) 2014 Regional Transportation Plan (RTP).

Table 9.3 List of Congested Segments, Fresno County

Segment	Urban Area	County	Length (Miles)	Lanes	Direction	Posted Speed	Congested Peak-Period Speed AM	Congested Peak-Period Speed PM	AADT	Truck AADT	Trucks of AADT (Percent)
SR 99 from SR 41 to Belmont Ave	Fresno	Fresno County	3.2	4	South bound	65	23	51	80,000	16,800	21%

Table 9.4 List of Critical Safety Segments, Fresno County

Segment	County	Length	Number of Lanes	Number of Collisions	Collisions per Lane Mile	Total Fatalities	Fatalities per Mile	Truck Involved Collision	Percent Truck Involved	Speed Limit
SR 99 from SR 41 to Fresno/Madera County Line	Fresno County	12.7	6	532	6.98	19	1.50	76	14%	65

9.4 Kern County

9.4.1 Traffic Generators

The Task 1 memorandum identified four significant, existing freight clusters[2] in Kern County, Including: Bakersfield, Shafter, Delano, and Tejon. Truck GPS data pulled for these locations allowed for calibration and validation of the existing truck patterns in Kern County. The following describes the four existing clusters where truck data was derived.

- **Shafter:** The Shafter cluster consists of two goods movement sub-clusters. The Lerdo Hwy/SR 99 sub-cluster includes 5 major manufacturing and agricultural processing facilities. The 7th Standard Rd/Santa Fe Way sub-cluster includes 6 major distribution centers including Target, Ross and FedEx Ground, and 3 oil production/refining companies, covering less than half of a 5-square mile industrial zoned area. This cluster is located at the geographic center of population for the State of California, and is also the hub for 10 distribution clusters located throughout southern Central Valley. It is also the site of a new freight container yard to be operated by Shipper's Transport Express, a partner with Stevedoring Services of America (SSA) Marine that operates marine terminals throughout the world, including both container and non-container terminals at the Ports of Los Angeles/Long Beach and Port of Oakland. The planned inland cargo container yard will provide intermodal rail access, storage for full and empty containers and chassis, and provide an equipment reservation system that allows exporters to plan ahead and avoid delays in moving their products to market. Rail service via Union Pacific and BNSF Railway is also available. **Bakersfield:** The Bakersfield cluster consists of three distribution centers and five large goods movement-related businesses, including a distribution center that specializes in agricultural production and shipping and employs 1,000 to 4,999 people and one that provides logistic park access for other businesses. Cluster businesses include two with 500 to 999 employees and three businesses with 1,000 to 4,999 employees. These businesses focus on industries such as oil production/refining, agriculture, mining, manufacturing, and wholesale and retail trade. Several ongoing projects in recent years have improved the accessibility and connectivity of this cluster including widening 7th Standard Road and SR 58. Additional phases of these projects are being recommended by Kern COG for inclusion in the National Highway Freight Network (NHFN).

- **Delano:** The Delano cluster features a distribution center and large agricultural business. The distribution center specializes in wholesale and retail trade and employs 500 to 999 people. The agricultural business employs 1,000 to 4,999 people. Delano is also home to RailEx, the Southwest U.S. node to a national intermodal refrigerated boxcar service that ships agriculture and high value products (liquor/wine) between the San Joaquin Valley and the East Coast of U.S.

- **Tejon Ranch:** The Tejon Ranch cluster includes 5 distribution centers anchored by IKEA that rely heavily on imports that come through the Ports of Los Angeles/Long Beach, 2 truck stops, and a

[2] Employment data provided a starting point for determining the locations of freight cluster. Initial investigations identified the following industrial employers. The clusters were expanded and revised based on input from the I-5/SR 99 TAC.

new retail outlet mall. Like other locations in the Valley, it has a significant amount of entitled area to accommodate future development of similar facilities.**:** Other goods movement clusters include 3 centers in and near Wasco (SR 46 corridor), 3 centers near Buttonwillow (SR 58 corridor), S.E. Bakersfield/Edison/Lamont (agricultural processing facilities), Tehachapi/Mojave (mining, renewable energy production and aerospace), and the large oilfields scattered throughout the south part of the Valley. These other locations account for the majority of resource-related goods movement tonnage in Kern.

The Kern County Council of Governments (Kern COG) provided base year and future year land use data for 2008 and 2040 respectively. TAZs with the highest anticipated industrial growth (over 500 employees per square mile) are located within Bakersfield. Tejon, Mojave, and Ridgecrest are also expected to have moderate to high industrial growth (**Figure 9.12**). The growth in the TAZ at southeast of Shafter between SR 43 and SR 99 is related to planned distribution centers similar to what has been developing in this area over the past few years. Truck network accessibility is a concern in Kern County, as the county is over 8000 square miles. Depends on the location of the establishments in the TAZ, It could be three to ten miles from a truck route.

9.4.2 Congested Segments

The segments in **Table 9.5** present critical congestion issues. The SR 99 segment is an area that is considered light industrial and mixed urban land use. It has many exit ramps that have access to truck-serving industries as well as several east-west state highways crossing or overlapping. This segment also has relatively high truck volume.

The SR 58 segment has high truck volumes as well, more so than the SR 99 segment. The segment is only considered mixed urban in terms of land use. It has a high frequency of driveway cuts on main thoroughfare. It also is near many truck-serving or truck-served industries. It is a diverse corridor with low density warehousing, light industrial and big-box retail near to SR 99, transitioning to single-family residential towards Rosedale. The SR 46 segment is mixed urban land use. It has expected high volumes of turning trucks accessing truck stops.

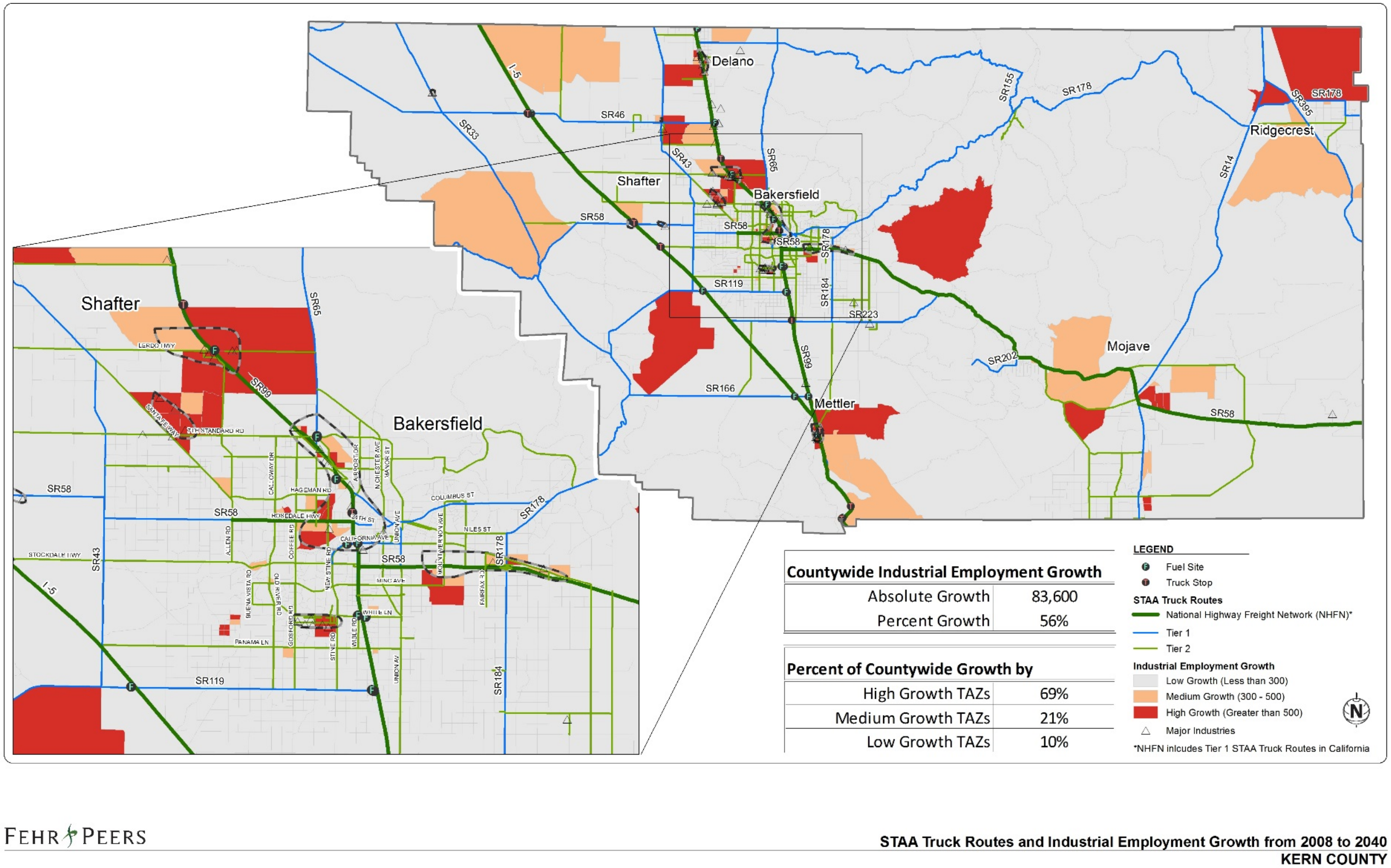
9.4.3 Critical Safety Segments

The segment of SR 99 from Ming Avenue to SR 204 has three import/export businesses in close proximity. The segment intersects with three other significant highways within this stretch. SR 58 east to SR 99 south is a short radius cloverleaf with a 20 MPH speed limit and 1,000 feet in length. California Avenue interchanges are both short radius cloverleaf design ramps with a length of under 1,000 feet. The intersection with SR 58 and south of the intersection have the highest number of truck collisions.

The segment of SR 99 from I-5 to Ming Avenue has the highest number of truck collisions north of the SR 99 and Panama Lane intersection. Collisions are concentrated between Ming Avenue and SR 119, in the south end of Bakersfield. Trucks were involved in 16 percent of collisions, which is the highest rate of truck collisions in the San Joaquin Valley. Caltrans is currently widening SR 99 by adding more lanes.

Figure 9.12 Kern County Industrial Employment Growth

2010 to 2040



Source: Kern Council of Governments (COG) 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS).

Table 9.5 List of Congested Segments, Kern County

Segment	Urban Area	County	Length (Miles)	Lanes	Direction	Posted Speed	Congested Peak-Period Speed AM	Congested Peak-Period Speed PM	AADT (by Direction)	Truck AADT (by Direction)	% Trucks of AADT (Percent)
SR 99 from SR 204 to SR 58	Bakersfield	Kern County	3.8	4	South bound	65	55	30	71,200	9,300	13%
SR 58 from Allen Rd to Oak St	Bakersfield	Kern County	6	2-3	West bound	35	23	17	49,500	10,891	22%
SR 46 From Lost Hills to I-5	East of Lost Hills	Kern County	1.9	1	East bound	45	29	19	10,200	2,551	25%

Table 9.6 List of Critical Safety Segments, Kern County

Segment	County	Length	Number of Lanes	Number of Collisions	Collisions per Lane Mile	Total Fatalities	Fatalities per Mile	Truck Involved Collision	Percent Truck Involved	Speed limit
SR 99 from Ming Ave to SR 204	Kern County	4.66	8	401	10.76	6	1.29	52	13%	65
SR 99 from I-5 to Ming Ave	Kern County	23.57	6	297	2.10	15	0.64	44	15%	65

9.5 Kings County

9.5.1 Traffic Generators

The Hanford freight cluster[3] in Kings County consists of two distribution centers, six large businesses, and one import/export business. The distribution centers focus on wholesale and retail trade, each with 250 to 499 employees. The six businesses have a range of specialties in the agriculture and manufacturing industries. Of the cluster businesses, three employ 100 to 249 employees, two employ 250 to 499, and one employs 1,000 to 4,999.

The Kings County Association of Governments (KCAG) provided base year and future year land use data for 2005 and 2040 respectively. Greater Lemoore, Hanford, and Corcoran areas are anticipated to have the highest industrial growth in Kings County (Figure 9.13). Only a few TAZs in Kings County are expected to have industrial growth exceeding 500 jobs.

9.5.2 Congested Segments

There are no identified congested segments for Kings County due to a lack of PEMS data.

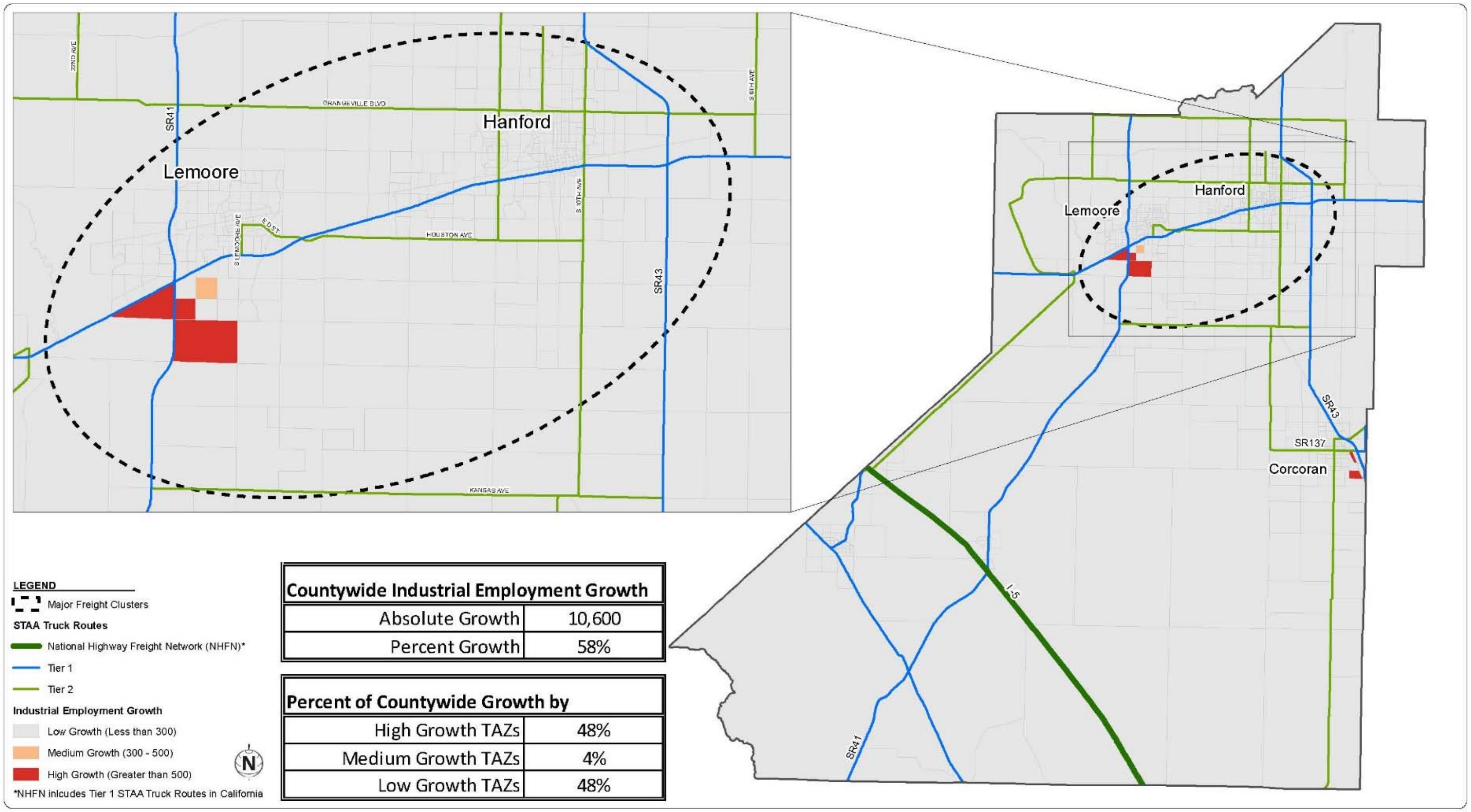
9.5.3 Critical Safety Segments

Crashes identified in King County are not clustered in a way that points to a critical safety segmentThere are no identified segments with critical crash and collision levels in Kings County that meet the criteria established for this study.

[3] Employment data provided a starting point for determining the locations of freight cluster. Initial investigations identified the following industrial employers. The clusters were expanded and revised based on input from the I-5/SR 99 TAC.

Figure 9.13 Kings County Industrial Employment Growth

2010 to 2040



Countywide Industrial Employment Growth	
Absolute Growth	10,600
Percent Growth	58%

Percent of Countywide Growth by	
High Growth TAZs	48%
Medium Growth TAZs	4%
Low Growth TAZs	48%

Source: Kings County Association of Governments (CAG) 2014 Regional Transportation Improvement Program (RTIP).

9.6 Merced County

9.6.1 Traffic Generators

The Merced freight cluster[4] identified in Task 1 memorandum consists of six large businesses and distribution centers. Three of these entities focus on wholesale and retail trade and employ between 100 to 499 people. One of the businesses specializes in agriculture and employs 250 to 499 people. Another business serves as a distribution center and focuses on transportation and warehousing and has 250 to 499 employees. The last business concentrates on manufacturing and employs 500 to 999 people.

Merced County provided base year and future year land use data for 2010 and 2040 respectively. Merced and Atwater areas are anticipated to have the highest industrial growth. Los Banos and Gustine also expected to have moderate to high industrial growth (**Figure 9.14**). High industrial growth areas (TAZs with employment growth over 500) are generally located in agricultural TAZs.

9.6.2 Congested Segments

There are no identified congested segments for Merced County.

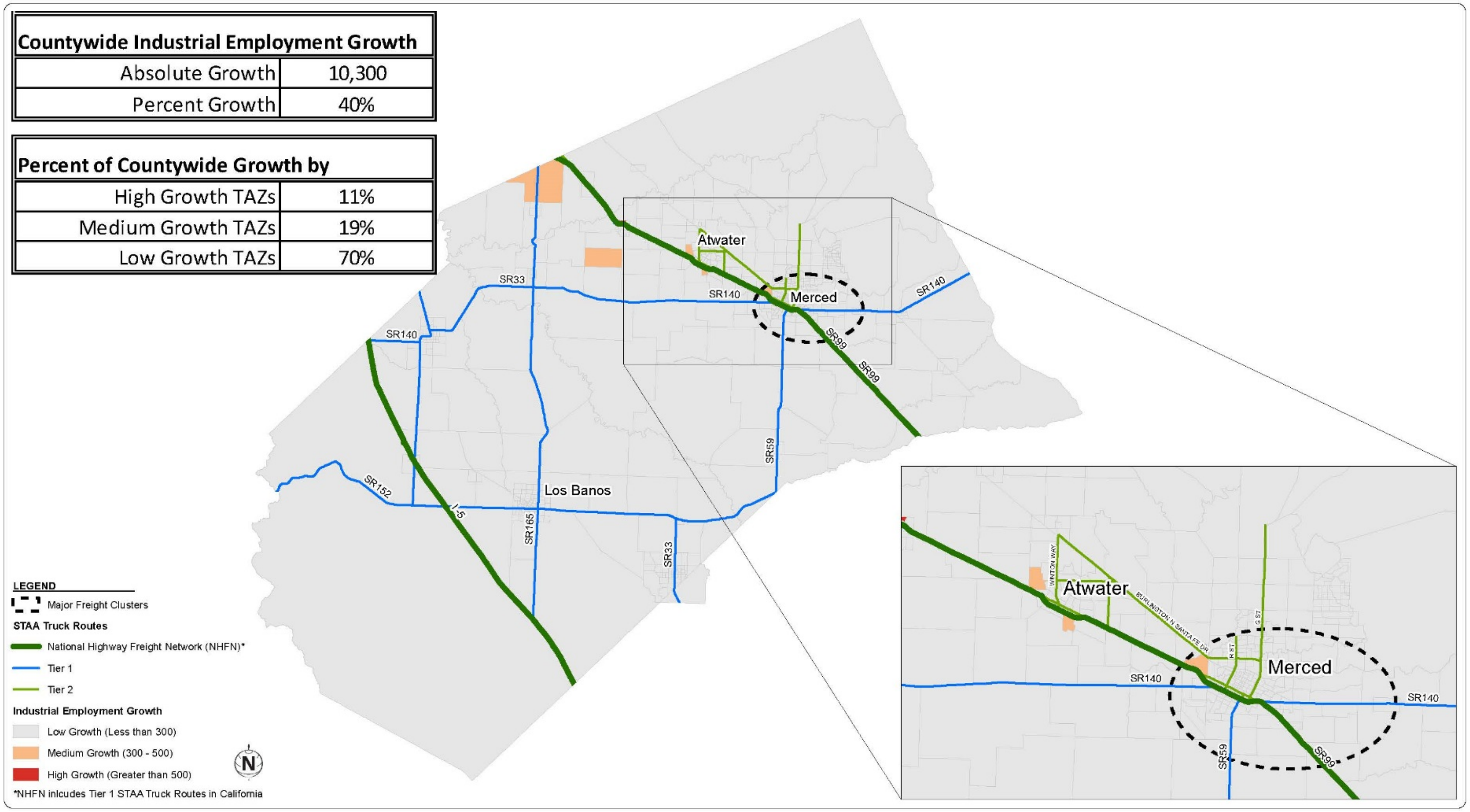
9.6.3 Critical Safety Segments

There is only one identified critical safety segment in Merced County as outlined in **Table 9.7.** The intersection of SR 152 and Badger Flat road, near the large box retail area, has the highest number of truck collisions. The segment is near freight-related activity that includes commercial areas in Los Banos, the surrounding agricultural area, and the corridors connections to I-5 and the Central Valley. There are a significant number of fatalities, especially relative to the volumes on the roadway segment. The collisions are concentrated in Los Banos, especially near the intersection with SR 165. The intersection is wide, between 78 and 87 feet, and is part of the commercial area of Los Banos. There is also a high pedestrian collision history within the Los Banos city limits. Five pedestrian collisions have occurred with two being truck collisions. Constructing a bypass around Los Banos would likely attract more truck and passenger traffic.

[4] Employment data provided a starting point for determining the locations of freight cluster. Initial investigations identified the following industrial employers. The clusters were expanded and revised based on input from the I-5/SR 99 TAC.

Figure 9.14 Merced County Industrial Employment Growth

2010 to 2040



Countywide Industrial Employment Growth	
Absolute Growth	10,300
Percent Growth	40%

Percent of Countywide Growth by	
High Growth TAZs	11%
Medium Growth TAZs	19%
Low Growth TAZs	70%

Source: Madera County Transportation Commission 2014 RTP/SCS.

Table 9.7 List of Critical Safety Segments, Merced County

Segment	County	Length	Number of Lanes	Number of Collisions	Collisions per Lane Mile	Total Fatalities	Fatalities per Mile	Truck Involved Collision	Truck Involved (Percent)	Speed Limit
SR 152 from SR 33 (east) to Santa Clara County Line	Merced County	34.03	4	261	1.92	18	0.53	28	11%	65

9.7 Madera County

9.7.1 Traffic Generators

The Madera freight cluster[5] identified in Task 1 memorandum for the purpose of understanding existing truck patterns consists of a number of large businesses and distribution centers. Three of the businesses focus on agriculture and employ 100 to 499 people. Four of the businesses specialize in manufacturing with one employing 100 to 249 people, two employing 250 to 499 people, and the fourth business employing 500 to 999 people. Two of the businesses focus on wholesale and retail trade and employ 100 to 499 employees. The distribution entity specializes in transportation and warehousing and employs 100 to 249 people.

Madera County Transportation Commission (MCTC) provided base year and future year land use data for 2010 and 2035 respectively. The future industrial growth anticipated to concentrate along the 99 corridor. Rolling Hills, Sumner Hill, and Oakhurst are anticipated to have high industrial growth (**Figure 9.15**). The TAZs with high industrial growth are a mix of industry and agricultural. There are only a few TAZs in Madera County with industrial employment growth over 500.

9.7.2 Congested Segments

The detail of the congested SR 99 segment are outlined in **Table 9.8**. The land use surrounding this segment is considered mixed urban and has a high density of exits in a short stretch through small urban areas.

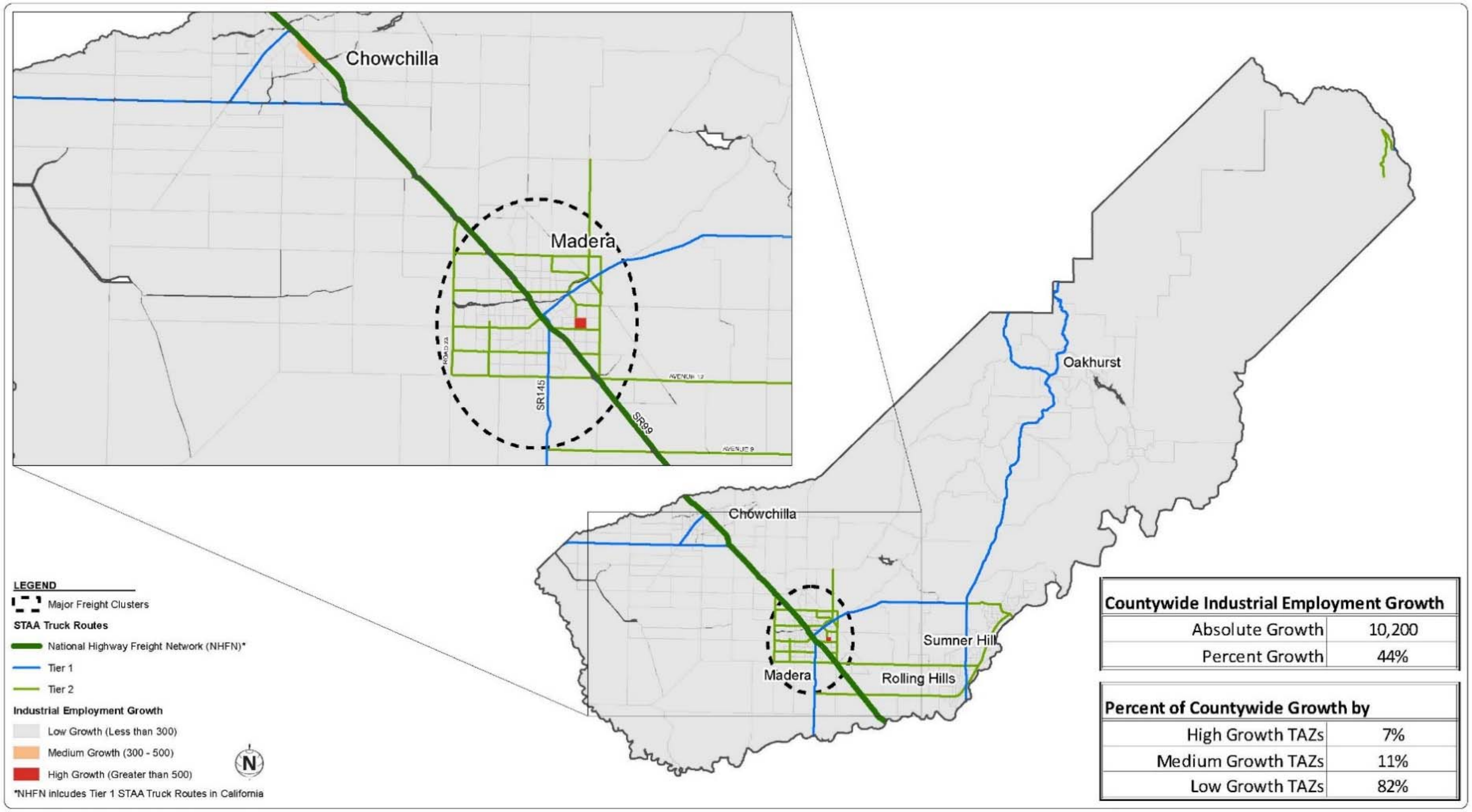
9.7.3 Critical Safety Segments

There are no identified segments with critical crash and collision levels in Madera County.

[5] Employment data provided a starting point for determining the locations of freight cluster. Initial investigations identified the following industrial employers. The clusters were expanded and revised based on input from the I-5/SR 99 TAC.

Figure 9.15 Madera County Industrial Employment Growth

2010 to 2040



Countywide Industrial Employment Growth	
Absolute Growth	10,200
Percent Growth	44%

Percent of Countywide Growth by	
High Growth TAZs	7%
Medium Growth TAZs	11%
Low Growth TAZs	82%

Source: Merced County Association of Governments 2014 RTP/SCS.

Table 9.8 List of Congested Segments, Madera County

Segment	Urban Area	County	Length (Miles)	Lanes	Direction	Posted Speed	Congested Peak-Period Speed		AADT	Truck AADT	Trucks of AADT (Percent)
							AM	PM			
SR 99 from Roberts Ave to Almond Ave	Madera	Madera County	1.9	2	South bound	65	57	39	64,000	12,606	20%

9.8 San Joaquin County

9.8.1 Traffic Generators

Task 1 memorandum identified three significant freight clusters[6] in San Joaquin County, including Tracy, Lathrop, and Lodi. These clusters provided a basis for truck origins and destinations within the County under current conditions. The clusters are described as follows:

- **Tracy/San Joaquin County**

The Tracy cluster contains two distribution centers that focus on wholesale and retail trade including Amazon fulfillment center. This cluster enjoys connections with three interstate highways that include I-5, I-205, and I-580. These highways provide a significant connection to Bay Area and its ports as well.

- **Lathrop:** The Lathrop cluster consists of three distribution centers that focus on wholesale and retail trade and a major intermodal rail yard.

- **Lodi:** The Lodi cluster includes three significant businesses, including two businesses that specialize in manufacturing. One of these employs 500 to 999 employees and the other employs 1,000 to 4,999 employees.

The San Joaquin Council of Governments (SJCOG) provided base year and future year land use data for 2010 and 2040 respectively. Highest Future industrial growth is expected at central areas of Stockton, Lathrop, Tracy, and Lodi. The TAZs with high industrial growth are a mix of industry and agricultural. TAZs located west of Tracy, in southeast Lathrop, and southeast Stockton are anticipated to have over 500 employment growth in future (**Figure 9.16**).

9.8.2 Congested Segments

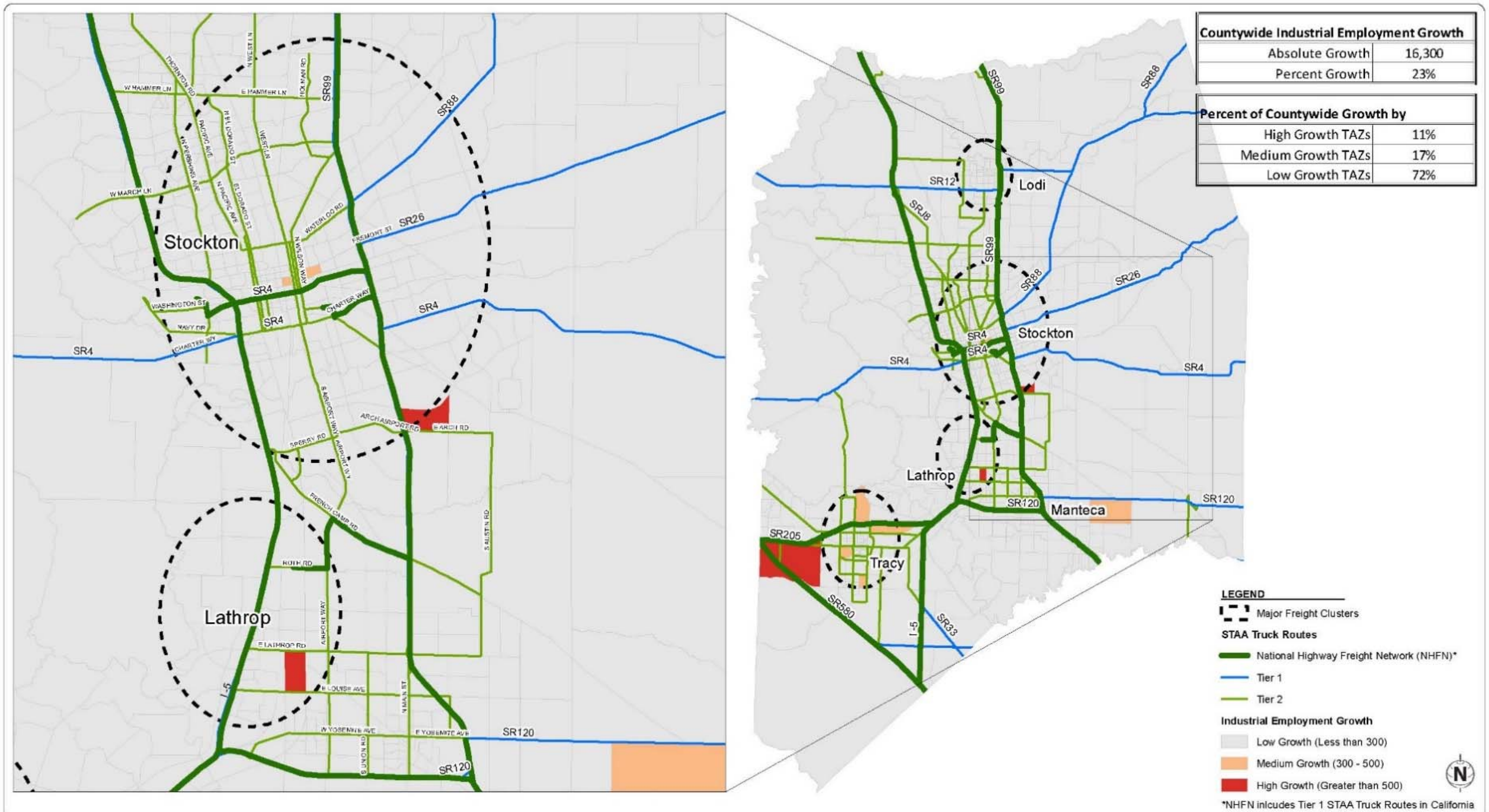
The congested segments are detailed in **Table 9.9** with further analysis and description for each in **Table 9.10.**

9.8.3 Critical Safety Segments

The critical safety segments are outlined in **Table 9.11** with their freight-related land use, highest truck collision intersection and overall analysis found in **Table 9.12.**

[6] Employment data provided a starting point for determining the locations of freight cluster. Initial investigations identified the following industrial employers. The clusters were expanded and revised based on input from the I-5/SR 99 TAC.

Figure 9.16 San Joaquin County Industrial Employment Growth (2010 - 2040)



Source: San Joaquin Council of Governments (COG) 2014 RTP/SCS.

Table 9.9 List of Congested Segments, San Joaquin County

Segment	Urban Area	County	Length (Miles)	Lanes	Direction	Posted Speed	Congested Peak-Period Speed		AADT	Truck AADT	Trucks of AADT (Percent)
							AM	PM			
I-5 from Fremont St. to El Dorado St	Stockton	San Joaquin County	6.29	3	North bound	55-65	29	31	139,000	34,054	24%
SR 99 from SR 4 to Arch Rd	Stockton	San Joaquin County	4.2	2	North bound	65	23	21	96,000	12,673	13%
SR 12 from I-5 ramps to Flag City Blvd	West of Lodi	San Joaquin County	1	2	East bound	55	25	19	16,400	2,280	14%
SR 99 from Woodward Ave to Hammett Ave	Ripon	San Joaquin/ Stanislaus County	5.3	3	South bound	65	48	36	129,000	17,415	14%

Table 9.10 Congested Segments Critical Issue Description, San Joaquin County

Segment	County	Land Use	Description of Critical Issue(s)
I-5 from Fremont St. to El Dorado St	San Joaquin County	Mixed urban	• Numerous ramps plus freeway interchange with SR 4 and Port of Stockton access • High relative volume of trucks to general traffic
SR 99 from SR 4 to Arch Rd	San Joaquin County	Primarily industrial, some low-density residential	• Some large areas of truck-serving industry • SR 4 merges with SR 99 for a brief stretch, joining east-west traffic with north-south • Truck volumes moderate
SR 12 from I-5 ramps to Flag City Blvd	San Joaquin County	industrial	• Expected high volumes of turning trucks entering and exiting SR 12 from low speed or stopped • Several truck stops near interchange, as well as a hotel and RV resort. Further from the interchange is a large trucking firm and many nearby farms.
SR 99 from Woodward Ave to Hammett Ave	San Joaquin/Stanislaus County	Primarily residential and farms	• Moderate truck activity • two truck stops at the north end of Ripon

Table 9.11 List of Critical Safety Segments, San Joaquin County

Segment	County	Length	Number of Lanes	Number of Collisions	Collisions per Lane Mile	Total Fatalities	Fatalities per Mile	Truck Involved Collision	Truck Involved (Percent)	Speed limit
SR 99 from SR 12 to Galt/County Line	San Joaquin County	9.6	4	209	5.44	1	0.10	27	13%	65
I-5 from SR 4 to Stockton/Monte Diablo Ave	San Joaquin County	2.97	8	188	7.91	0	0.00	25	13%	65
I-5 from I-205 to SR 120	San Joaquin County	3.18	8	146	5.74	0	0.00	24	16%	70
99 from SR 120 to Stanislaus County Line	San Joaquin County	5.92	8	227	4.79	1	0.17	37	16%	65
I-205 from I-5 to SR 580	San Joaquin County	12.92	8	437	4.23	2	0.15	48	11%	70

Table 9.12 Critical Safety Segments Description, San Joaquin County

Segment	County	Intersections/Locations with Highest Number of Truck Collisions	Related Freight Land Use	Analysis
SR 99 from SR 12 to Galt/County Line	San Joaquin County	Woodbridge Rd (south of)	Mostly agricultural/rural areas; connects Stockton, Lodi, and Galt with Sacramento	• Many rear-end collisions • Woodbridge Rd entrances/exits are each ~600 feet long with limited line of sight distances (around 100-200 feet) due to sight obstructions such as trees and grade changes. • SR 99 is two lanes in each direction on this segment. • Caltrans made improvement to the pavement surface in this area in 2015; however, they did not improve the Woodbridge offramps
I-5 from SR 4 to Stockton/Monte Diablo Ave	San Joaquin County		3 import/export businesses within 1/2 mile of this segment; industrial area southwest of the segment; residential to the northeast	• Significant volumes travel this short segment; significant truck volumes as well • Primary violation is illegal merge • Analysis of 2009-2014 road conditions shows two SR 4 lanes merging into the four I-5 lanes at the I-5 and SR 4 interchange • Caltrans is making significant changes to the roadway configuration as of Aug 2015.
I-5 from I-205 to SR 120	San Joaquin County	Stewart Rd San Joaquin River Rd	Agricultural/watershed in direct proximity to segment; connects Manteca and Tracy, locally, and Sacramento and the Bay Area, regionally	• Significant volumes travel this short segment; significant truck volumes as well • Significant number of truck-related collisions • Sideswipes account for 42% of truck collisions on this segment.

Segment	County	Intersections/Locations with Highest Number of Truck Collisions	Related Freight Land Use	Analysis
SR 99 from SR 120 to Stanislaus County Line	San Joaquin County	Austin Rd (20 truck collisions) Jack Tone Rd (11)	11 import/export businesses within the local area; 3 other freight generating businesses	• Significant number of truck collisions, especially at Austin Rd • Many collisions occur near the SR 99 and SR 120 interchanges • Significant freight activity and truck volumes on this segment.
I-205 from I-5 to SR 580	San Joaquin County	11th St Macarthur Dr Mountain House Pkwy Tracy Blvd Paradise Rd	1 import/export business directly next to freeway;	• Most collisions occur between Tracy Blvd and MacArthur Dr; some hills in the area; merging lanes/ramps seems well configured, though, lanes do merge to cross the bridges in the area. • 1/3 of all truck collisions occurred in 2009 (19); only 6 collisions in 2013 • half of all collisions occurred between 3 am and 9 am. • Caltrans improved truck signage in 2015

9.9 Stanislaus County

9.9.1 Traffic Generators

Task 1 memorandum identified two existing freight clusters[7] in Stanislaus County, including one in Modesto and another in Patterson. The clusters provide a good understanding of truck origins and destinations within Stanislaus County. The following describes the two clusters.

- **Patterson:** The Patterson cluster contains one distribution center and one large business. The distribution center specializes in wholesale and retail trade. The business focuses on manufacturing and employs 500 to 999 employees.

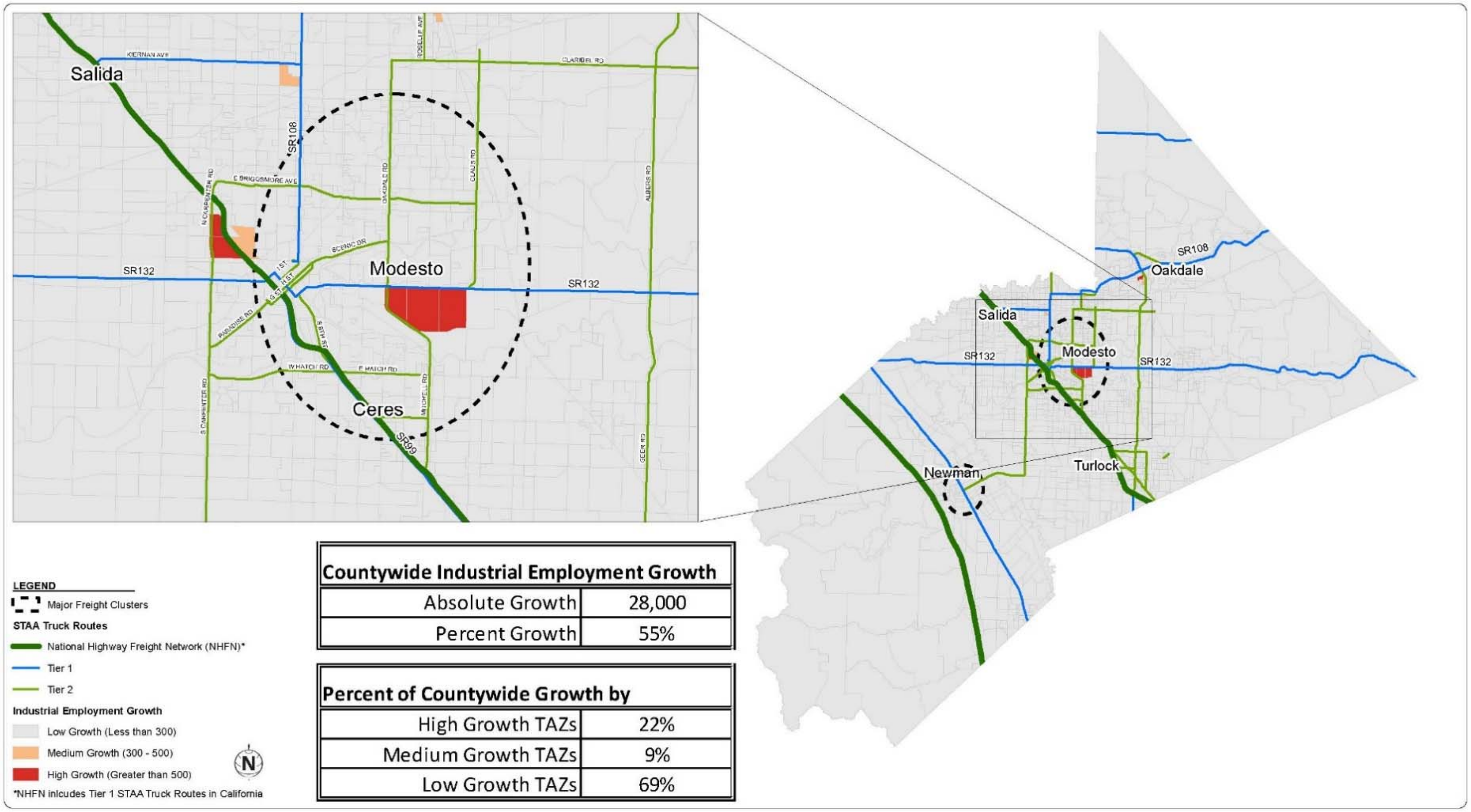
- **Modesto:** The Modesto cluster consists of a number of large agricultural industry employers, two distribution centers, and an import/export business. Eight of the businesses focus on the wine industry and employ 1,000 to 4,999 employees. Two businesses specialize in manufacturing; one employs 1,000 to 4,999 people and the other 500 to 999 employees. One distribution center employs 500 to 999 employees and focuses on wholesale and retail trade. The other center resides in an industrial district with a number of large tenants and provides these businesses with connections to highways, rail, and the airport.

The Stanislaus Council of Governments (StanCOG) provided base year and future year land use data for 2010 and 2040 respectively. The highest industrial growth is expected along the SR 99 corridor and in central Modesto, Turlock, and Oakdale (**Figure 9.17**). The majority of this growth is located in TAZs already dominated by industrial land use.

[7] Employment data provided a starting point for determining the locations of freight cluster. Initial investigations identified the following industrial employers. The clusters were expanded and revised based on input from the I-5/SR 99 TAC.

Figure 9.17 Stanislaus County Industrial Employment Growth

2010 to 2040



Countywide Industrial Employment Growth	
Absolute Growth	28,000
Percent Growth	55%

Percent of Countywide Growth by	
High Growth TAZs	22%
Medium Growth TAZs	9%
Low Growth TAZs	69%

Source: Stanislaus Council of Governments (COG) 2014 RTP/SCS.

9.9.2 Congested Segments

As detailed in **Table 9.13**, the surrounding area of the segment of SR 99, from Beckwith Avenue to Crows Landing Road, is considered to be mixed urban land use while the other section, from Woodward Avenue to Hammett Avenue, is primarily residential and farmland land use.

The former segment is near a core urban area with near-to-freeway industrial uses. Near the downtown Modesto area, the exit density is high but the languidness extends upstream were exists are less frequent. Numerous curves in route through Modesto may be a cause of congestion.

The portion from Woodward Avenue to Hammett Avenue has moderate truck activity, with two truck stops on the northern end of Ripon.

9.9.3 Critical Safety Segments

The segment detailed in **Table 9.14** has the highest number of truck collision on the SR 99 intersections with Carpenter Road or Beckwith Road. In the surrounding area of the segment, there are 4 import/ export businesses and 5 freight-related business, since much of this corridor is industrial. The segment has significant vehicle volumes, truck volumes, and truck collisions, with 37 percent of truck involved collisions are sideswipes near freeway on and off ramps. Some issues are due to exit 227 being short and blocked by grade changes, and the northbound off ramp having a 200-foot line of sight for a 900-foot ramp.

Table 9.13 List of Congested Segments, Stanislaus County

Segment	Urban Area	County	Length (Miles)	Lanes	Direction	Posted Speed	Congested Peak-Period Speed AM	Congested Peak-Period Speed PM	AADT	Truck AADT	% Trucks of AADT (Percent)
SR 99 from Beckwith Ave to Crows Landing Rd	Modesto	Stanislaus County	5.8	3	North bound	65	33	30	103,000	12,414	12%
SR 99 from Woodward Ave to Hammett Ave	Ripon	San Joaquin/ Stanislaus County	5.3	3	South bound	65	48	36	129,000	17,415	14%

Table 9.14 List of Critical Safety Segments, Stanislaus County

Segment	County	Length	Number of Lanes	Number of Collisions	Collisions per Lane Mile	Total Fatalities	Fatalities Per Mile	Truck Involved Collision	Truck Involved (Percent)	Speed Limit
SR 99 from SR 132 to San Joaquin County Line	Stanislaus County	8.95	6	474	8.83	12	1.34	60	13%	65

9.10 Tulare County

9.10.1 Traffic Generators

Task 1 memorandum identified the two freight clusters[8] in Tulare County, including Visalia and Porterville. Truck trips to and from these clusters provided information about truck movements in the County. The two clusters are described below.

- **Porterville:** The Porterville freight cluster contains a distribution center and one large business. The distribution center employs 1,000 to 4,999 employees with a focus on wholesale and retail trade. The business employs 250 to 499 employees and also focuses on wholesale and retail trade.
- **Visalia:** The Visalia freight cluster includes a number of distribution centers and businesses. One distribution center focuses on wholesale and retail trade. The businesses are associated with agriculture, manufacturing, wholesale and retail trade.

The Tulare County Association of Governments (TCAG) provided base year and future year land use data for 2010 and 2040 respectively. The highest industrial growth is anticipated in Dinuba, Visalia, Woodlake, Tulare, Lindsay, and Porterville, as well as along the SR 99 and SR 245 corridors (**Figure 9.18**).

9.10.2 Congested Segments

There are no identified congested segments for Tulare County.

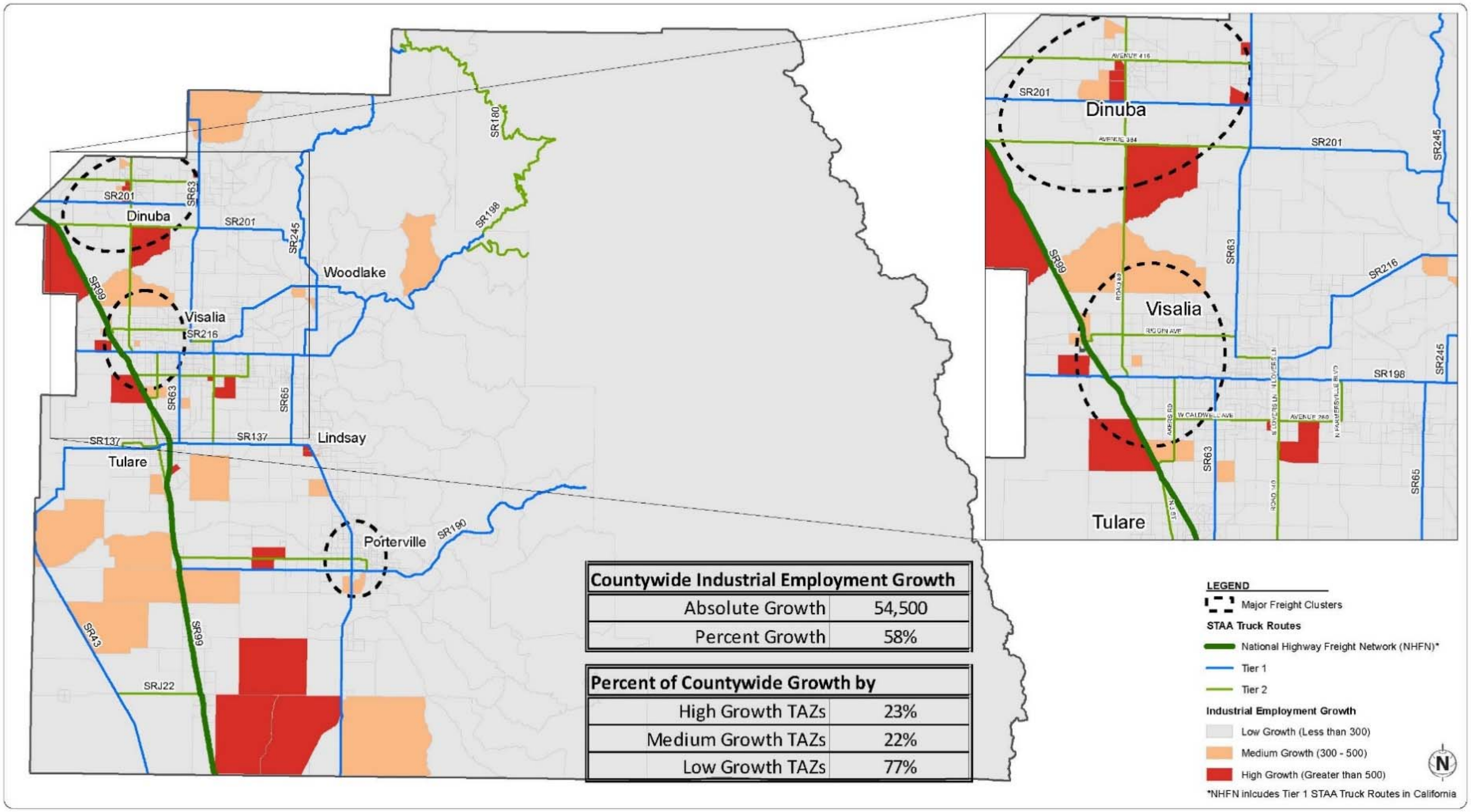
9.10.3 Critical Safety Segments

The segment detailed in **Table 9.15** has the highest number of truck collision on the SR 99 intersections with Carpenter Road or Beckwith Road. In the surrounding area of the segment, there are 4 import/ export businesses and 5 freight-related business, since much of this corridor is industrial. The segment has significant vehicle volumes, truck volumes, and truck collisions, with 37 percent of truck involved collisions are sideswipes near freeway on and off ramps. Some issues are due to exit 227 being short and blocked by grade changes, and the northbound off ramp having a 200-foot line of sight for a 900-foot ramp.

[8] Employment data provided a starting point for determining the locations of freight cluster. Initial investigations identified the following industrial employers. The clusters were expanded and revised based on input from the I-5/SR 99 TAC.

Figure 9.18 Tulare County Industrial Employment Growth

2010 to 2040



Countywide Industrial Employment Growth	
Absolute Growth	54,500
Percent Growth	58%

Percent of Countywide Growth by	
High Growth TAZs	23%
Medium Growth TAZs	22%
Low Growth TAZs	77%

Source: Tulare County Association of Governments 2014 RTP/SCS.

Table 9.15 List of Critical Safety Segments, Tulare County

Segment	County	Length	Number of Lanes	Number of Collisions	Collisions per Lane Mile	Total Fatalities	Fatalities per Mile	Truck Involved Collision	Truck Involved (Percent)	Speed Limit
SR 99 from Kern County border to Visalia	Tulare County	8.95	6	474	8.83	12	1.34	60	13%	65

9.11 Truck Service Facilities

9.11.1 Weigh Stations

Weigh Stations and WIM locations serve dual purposes, including compliance with truck size and weight requirements and safety inspections.

No unit on the California road system can weight more than a total of 80,000 lbs limit. Also, the weight on any one axle cannot exceed 20,000 lbs and any wheel cannot exceed 10,500 lbs.[9] Weigh stations and WIM (weight-in-Motion) sites are used to regulate the truck weight and catch those that exceed the designated weight limits. Weigh stations require the trucks to come to a complete stop and have their weights recorded, while WIM sites can calculate the weight of the truck while they are in motion.

Weight limits are enforced in order to preserve the pavement infrastructure of the highways. Those that have a higher weight to axle ratio produce more pavement damage.[10]

There are a total of three weigh station locations along SR 99 and I-5 in the San Joaquin Valley. SR 99 has only one location – a Class B northbound location at Chowchilla River. Interstate has two locations, Santa Nella and Grapevine. The Santa Nella location is a Class C location with weigh stations in both the north and south directions. The Grapevine location is a Class B weigh station that only serves the northbound direction. Theses weigh stations are visible in **Figure 9.19**.

Both the Class B and C weigh stations are located on major highway routes, but the Class B weigh stations are open 24 hours a day and seven days a week. The Class C weigh stations hours and days of operation are dependent on variable truck traffic. Class B weigh stations are more likely to also have WIM sites as compared to Class C weigh stations. Both the Class B and C weigh stations are designed and staffed to support the general purpose of inspecting vehicle size, weight, equipment, and loads.

According to the trucking industry, the Grapevine Class B location is not equipped with WIM so trucks are required to stop. This poses problems due to the grade. Upon exiting the weigh station, trucks face a steep grade and experience difficulty regaining speed.

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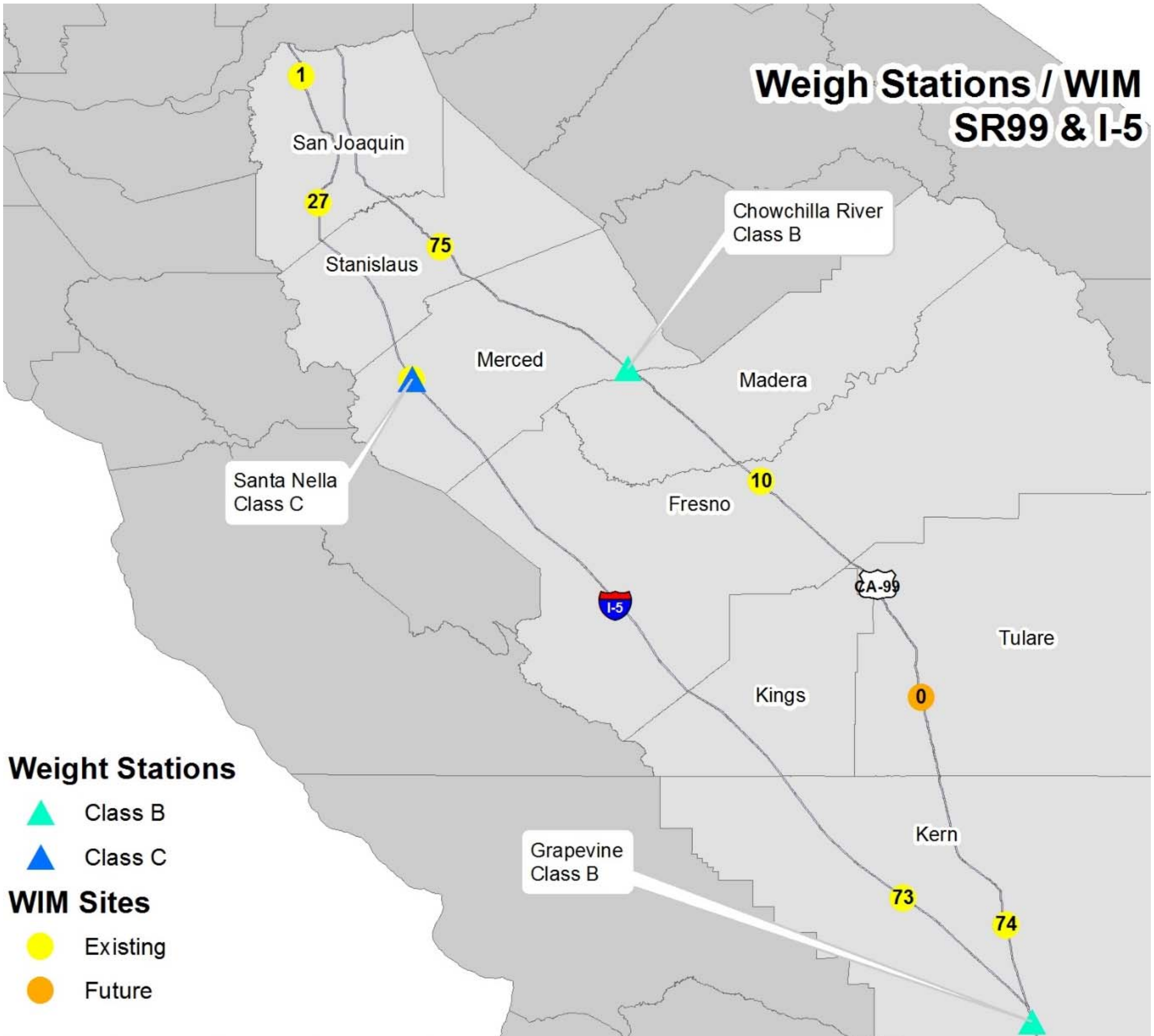
9 Caltrans, Weight Limitations, http://www.dot.ca.gov/trafficops/trucks/weight.html.

10 http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.726.8521&rep=rep1&type=pdf.

Figure 9.19 Weigh Stations and WIM Locations



WIM Sites						
Site #	**District**	**County**	**Route**	**PM**	**Location**	**Status**
10	6	FRE	99	25	Fresno	Existing
73	6	KER	5	48.7	Stockdale	Existing
74	6	KER	99	20.2	Bakersfield	Existing
0	6	TUL	99	19.6	Tipton	Future
7	10	MER	5	20.2	Santa Nella	Existing
1	10	SJ	5	43.7	Lodi	Existing
27	10	SJ	5	7.4	Tracy	Existing
75	10	STA	99	R8.4	Keyes	Existing

Source: Caltrans, Last Update: September 22, 2015.

WIM devices are designed to capture and record axle weights and gross vehicle weights as vehicles drive over a measurement site. Unlike static scales typically used at Weigh Stations, WIM systems are capable of measuring vehicles traveling at a reduced or normal traffic speed and do not require the vehicle to come to a stop. This makes the weighing process more efficient, and, in the case of commercial vehicles, allows for trucks under the weight limit to bypass static scales or inspection.

There are 13 Caltrans WIM Stations in the San Joaquin Valley. This is the only continuously available database that provides truck classification data by axle configuration. There are four stations along I-5, three stations along SR 99, and six other stations on other state highways, as shown in **Table 9.16**.

Table 9.16 WIM Locations

WIM Station ID	Location
I-5 Stations	
1	I-5 San Joaquin County at post mile 43.7 near Lodi
27	I-5 San Joaquin County at post mile 7.4 near Tracy
7	I-5 San Merced County at post mile 20.2 near Santa Nella
73	I-5 Kern County at post mile 48.7 near Stockdale
SR 99 Stations	
74	SR 99 Kern County at post mile 20.2 near Bakersfield
10	SR 99 Fresno County at post mile 25 near Fresno
75	SR 99 Stanislaus County at post mile 8.4 near Keyes
Other Highways	
113	SR 580 San Joaquin County at post mile 8.2 near Carbona
44	SR 205 San Joaquin County at post mile 9.5 near Banta
99	SR 102 Tuolumne County at post mile 6.4 near Tulloch
115	SR 65 Tulare County at post mile 23.4 near Porterville
114	SR 58 Kern County at post mile 64.9 near Arvin
36	SR 33 Merced County at post mile 20.2 near Los Banos

WIM ByPass

Trucks have the opportunity to bypass open weigh stations if they register for the PrePass program with Caltrans. They receive a transponder that creates communication between the weigh station and the truck. If the truck receives a green light at the weigh station, they can bypass it. If it receives a red light, it is required to then go through the weigh station. This system is in practice at the Grapevine weigh station. While this does allow vehicles to bypass the weigh station and therefore requiring less time for their trips, they are still required to slow down at the weigh station to receive either a green or red light. Since the Grapevine weigh station is located on a very steep hill, the trucks have trouble accelerating after they slow down. There currently are no plans to replace this station with a WIM, which would alleviate the complications from trucks slowing down on a steep hill. [11]

Issues

The stakeholders identified two main issues that arise with the weigh stations, including queuing and avoidance. Stakeholders raised concerns about queuing and mainline impediments caused by the I-5 weigh station on the Grapevine. This station requires trucks to stop at the scales and then attempt to merge onto the northbound mainline on a steep grade with an insufficient truck acceleration lane. Stakeholders indicated that truck drivers avoid the weigh station located at Chowchilla River and suggested the addition of a weigh station.

Recommended Considerations

- WIM at Grapevine or add truck climbing lane or longer auxiliary/acceleration lanes for trucks; and
- Add new WIM on E/W Connector near Chowchilla River.

9.11.2 Truck Parking Facilities

There are 47 Caltrans truck stop facilities located in the San Joaquin Valley, as shown in **Figure 9.20**, including 22 along I-5 and 25 along SR 99. There are many more privately-owned truck stops[12] available along SR 99, with a fairly even distribution along the length, while I-5 has very sparse coverage with lengthy gaps between stops. According to our estimates, there are 74 total (public and private) truck stops within one mile of SR 99, which is 285 miles long in the study area. There are only 37 total truck stops within one mile of I-5, which is 298 miles long through the study area. In both cases, truck stops tend to cluster, but the clustering of stops along I-5 is greater, leaving gaps ranging from only a few miles to as long as 65 miles between available facilities. On SR 99 the gaps are generally much smaller, with no gap greater than 16 miles observed. Please refer to the GIS web maps for location of truck stops along each segment.

There is at least one truck stop facility per county on I-5. Kern County has the most evenly distributed and highest quantity of truck stops. On SR 99, truck stop coverage is generally evenly distributed among each county. Truck stops are often located near interchanges with state routes, especially on I-5 between Kern, Kings, Merced, and San Joaquin counties. This is less true along SR 99, where the urbanized areas are more frequent and geographic coverage is greater.

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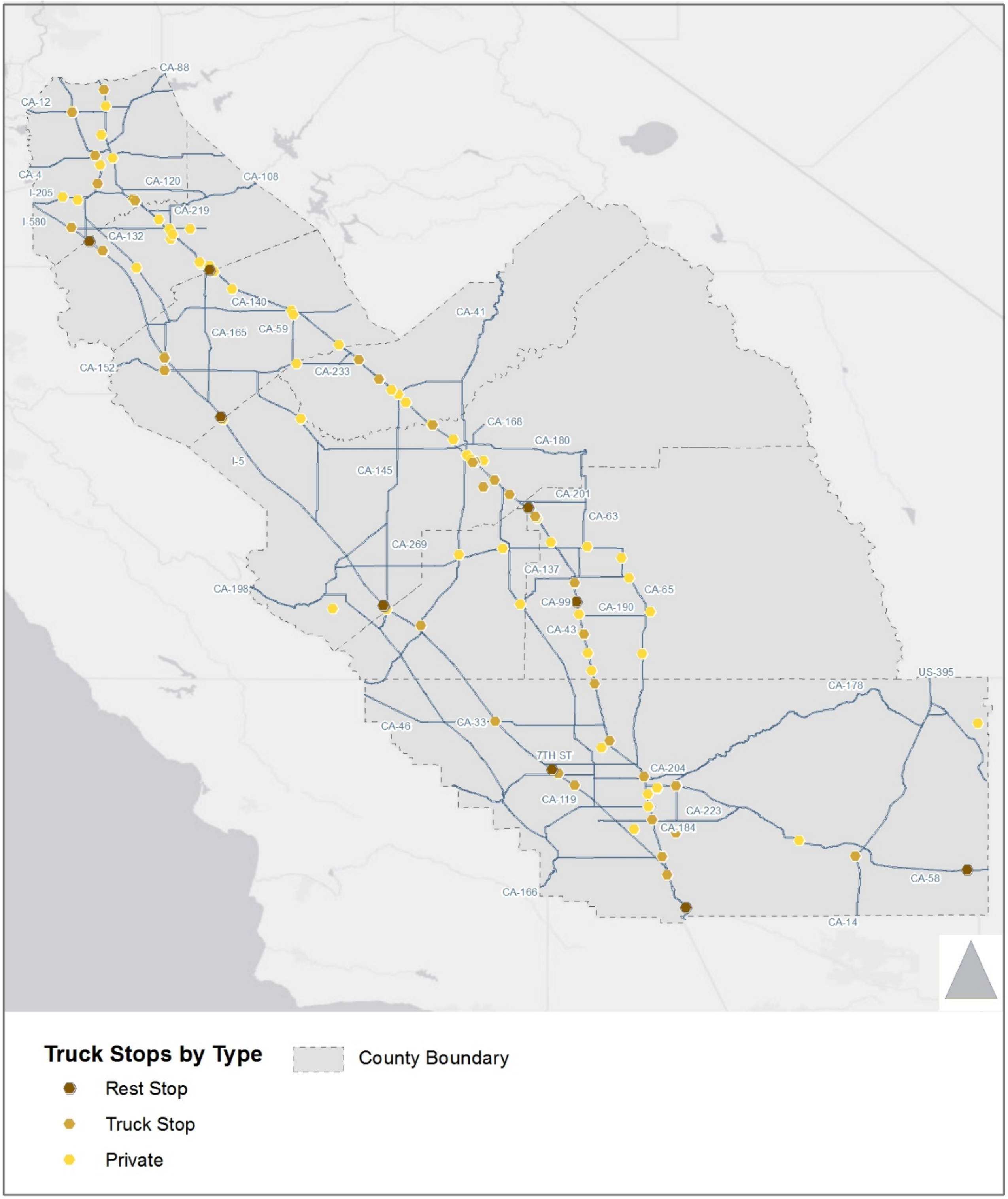
[11] http://www.dot.ca.gov/trafficops/wim/bypass.html.

[12] Private truck stops are identified based on online search. There was no consolidated list available.

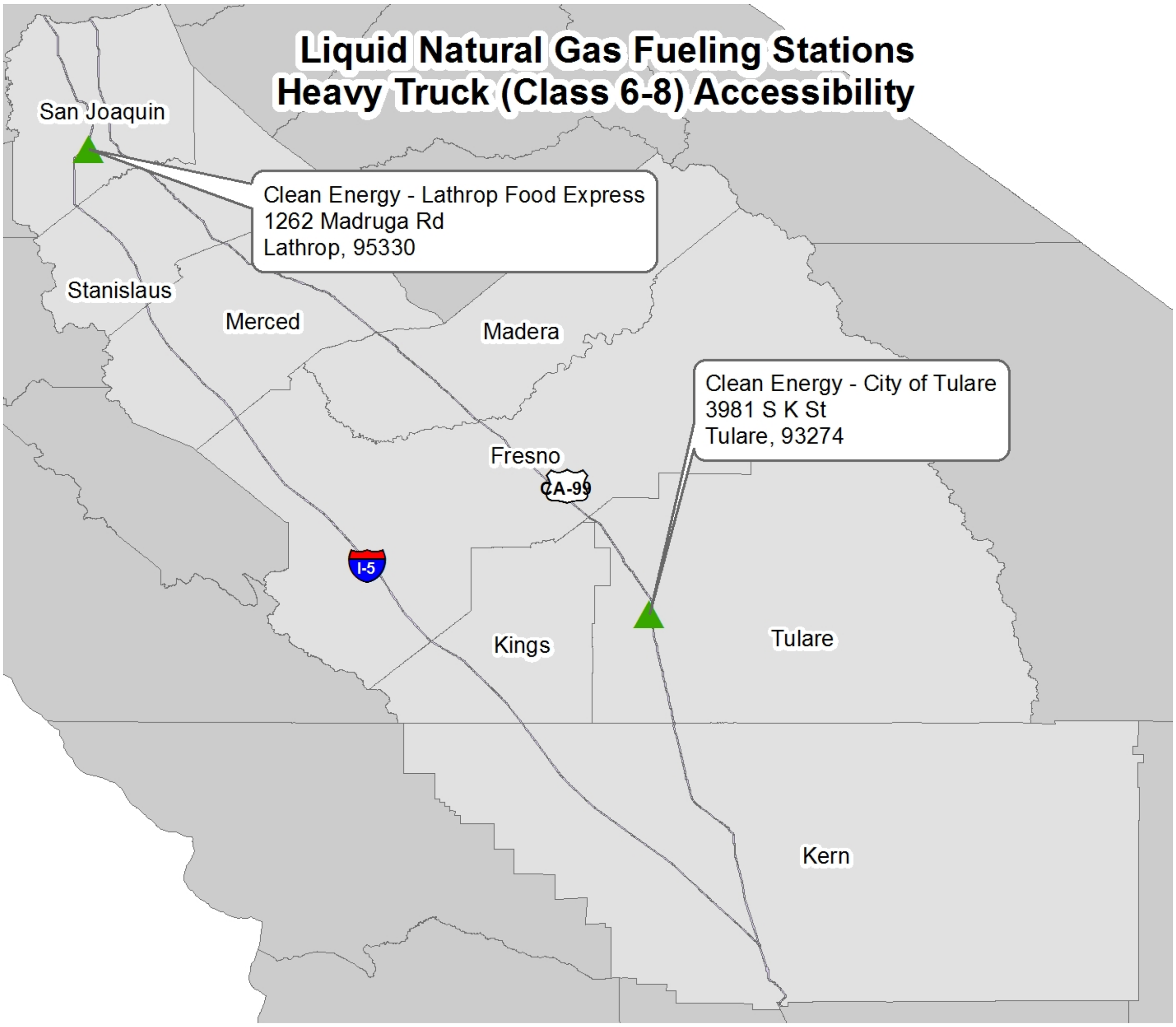
Figure 9.20 Truck Parking Facilities



9.11.3 Liquid Natural Gas Fueling Stations

While there are several natural gas fueling locations along the I-5 and SR 99 corridors, only two locations are capable of accommodating fueling of Class 6 to 8 trucks. The stations are shown in **Figure 9.21.** There is one on I-5 and one on SR 99.

Figure 9.21 Liquid Natural Gas Fueling Stations



Source: US Department of Energy, Alternative Fuels Data Center, Last Update: 7/01/2016.

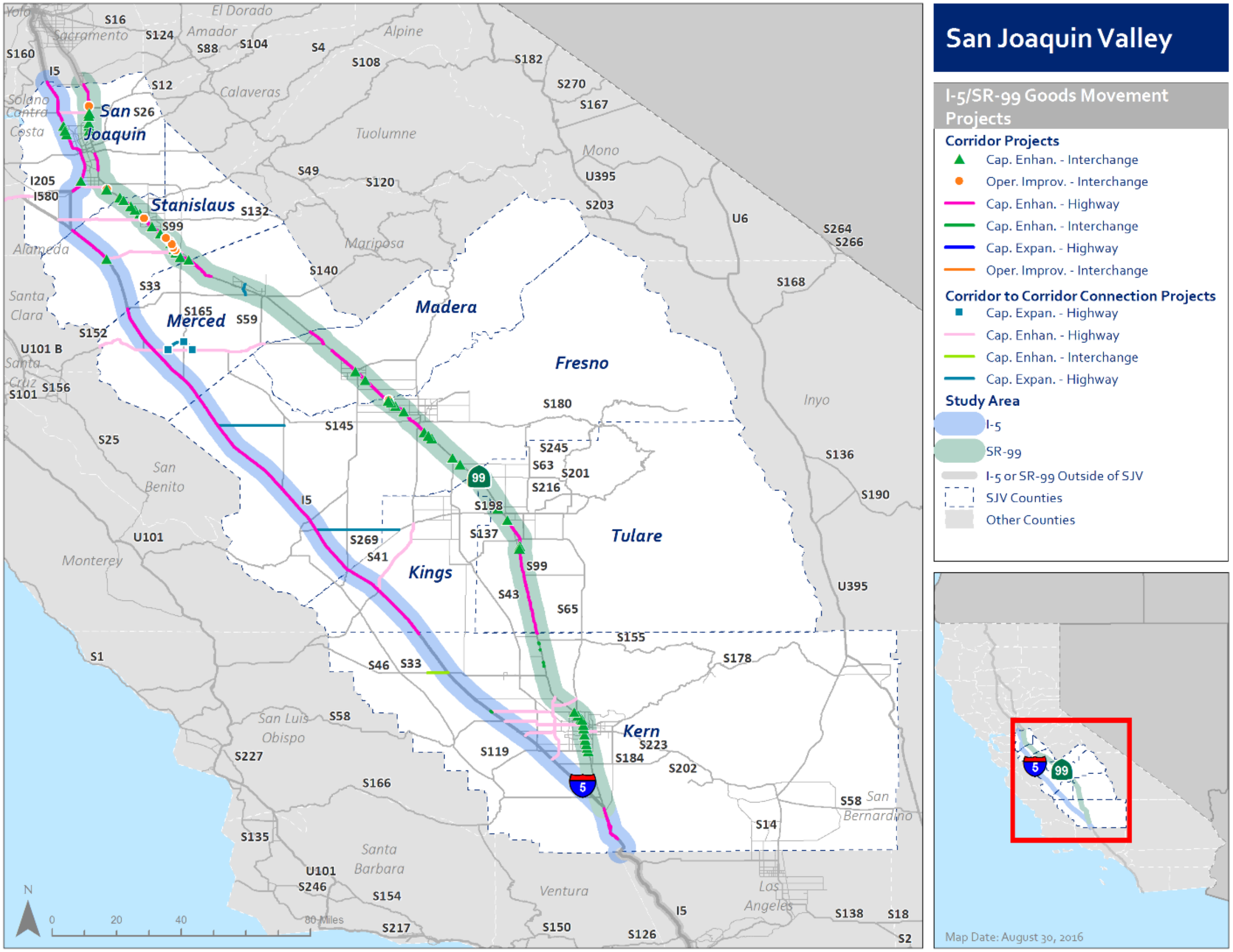
10.0 Identification of Goods Movement-Related Projects

Several statewide, regional, and local transportation plans were searched in order to develop a master list of goods movement-related projects and programs on the I-5 and SR 99 corridors in the San Joaquin Valley region. The plans included: 1) California Department of Transportation (Caltrans) 2014 California Freight Mobility Plan; 2) California 2014 State Transportation Improvement Program (STIP); 3) Fresno Council of Governments (COG) 2014 Regional Transportation Plan (RTP); 4) Kern Council of Governments (COG) 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS); 5) Kings County Association of Governments (CAG) 2014 Regional Transportation Improvement Program (RTIP); 6) Madera County Transportation Commission 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS); 7) Merced County Association of Governments 2014 Regional Transportation Plan/ Sustainable Communities Strategy (RTP/SCS); 8) San Joaquin Council of Governments (COG) 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS); 9) Stanislaus Council of Governments (COG) 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS); and 10) Tulare County Association of Governments 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS).

The three key basis for selection of the projects are as follows: 1) they are located on I-5 or SR 99 corridors and would improve economic efficiency and productivity, alleviate mobility and safety-related goods movement issues, as well as support the growth of agricultural and industrial land uses; 2) they are located on connectors between I-5 and SR 99 corridors and would meaningfully increase network redundancy and alleviate congestion on the SR 99 corridor, along which a majority of freight clusters are located; and/or 3) they are located on key ingress/egress routes of the San Joaquin Valley region and would likely enhance its economic opportunities of handling trade and logistics for the ports and large populations in the Bay Area and Southern California.

Information collected for the projects includes: 1) location and route, 2) project ID, 3) project title and description, 4) project type, 5) project cost, 6) timeline for implementation, and 7) source of project information. The following provides information about projects planned along I-5 and SR 99, as well as along some major east/west or north/south connectors between I-5 and SR 99 that may alleviate SR 99 congestion.

Figure 10.1 Goods Movement Project Map, All Counties



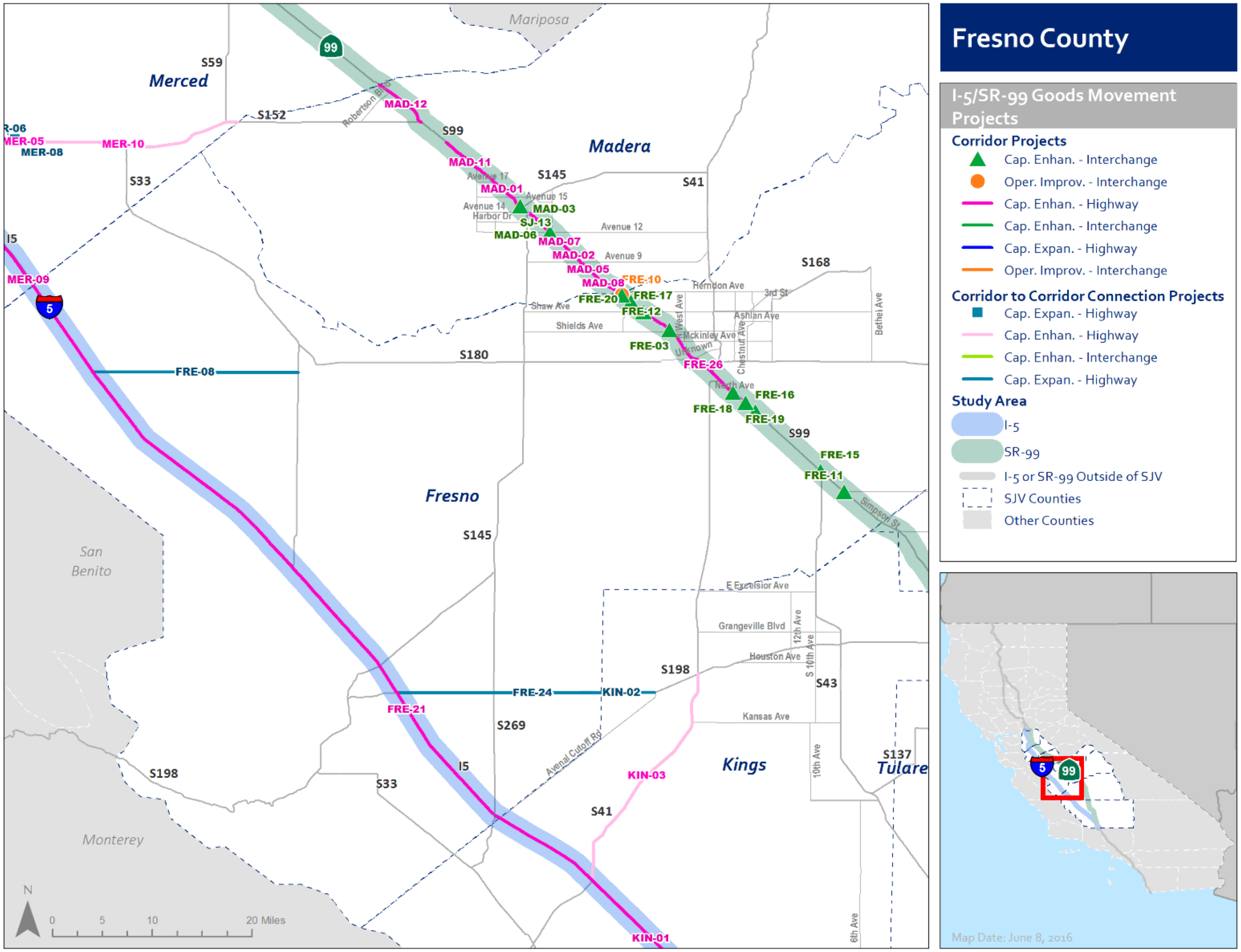
10.1.1 Fresno

Table 10.1 Goods Movement Project List, Fresno County

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
Corridor							
FRE-03	0-5	FRE500766	SR 99	California High-Speed Rail Project-SR 99 Re-Alignment	Cap. Enhan. – Interchange	2014 Fresno COG RTP	$189,500
FRE-10	6-15	FRE111353	SR 99	Herndon @ SR 99- Widen Undercrossing	Oper. Improv. - Interchange	2014 Fresno COG RTP	$26,365
FRE-11	0-5	FRE500404	SR 99	Mountain View and SR 99 Overcrossing: Widen Overcrossing and Improve Ramps	Cap. Enhan. - Interchange	2014 Fresno COG RTP	$45,000
FRE-12	0-5	FRE500143	SR 99	NB SR 99 Herndon Off Ramp: Signalize & Widen Ramp	Cap. Enhan. - Interchange	Fresno COG RTP 2014	$1,000
FRE-15	16-24	FRE500520	SR 99	SR 99 & SR 43/Floral Rd Interchange: Widen and Replace Bridge	Cap. Enhan. - Interchange	2014 Fresno COG RTP	$13,000
FRE-16	6-15	FRE111352	SR 99	SR 99 @ American Avenue Interchange	Cap. Enhan. - Interchange	2014 Fresno COG RTP	$10,385
FRE-17	16-24	FRE500521	SR 99	SR 99 Interchange at Shaw: Improvements	Cap. Enhan. - Interchange	2014 Fresno COG RTP	$86,000
FRE-18	6-15	FRE111355	SR 99	SR 99 InterchangeNorth & Cedar	Cap. Enhan. - Interchange	2014 Fresno COG RTP	$81,605
FRE-19	6-15	FRE500518	SR 99	SR 99-Central and Chestnut: Upgrade Interchange	Cap. Enhan. - Interchange	2014 Fresno COG RTP	$72,500
FRE-20	6-15	FRE111328	SR 99	Veterans Blvd Barstow to BullardBryan-New 6 LD	Cap. Enhan. - Interchange	2014 Fresno COG RTP	$105,619

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
				Super Arterial, Freeway Interchange & Grade Separation @ SR 99			
FRE-21	0-5	15d	I-5	Widen I-5 between Kings County and Merced County lines	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$198,000
FRE-26	0-5	99e	SR 99	Widen SR 99 from 6 to 8 lanes from Central Ave to Bullard Ave.	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$283,000
Connector							
FRE-08	6-15	FRE500514/21	SR 180	Extend SR 180 from Mendota to I-5	Cap. Expan. - Highway	California Freight Mobility Plan December 2014	$223,000
FRE-24	6-15	NEW	SR 198	Widen SR 198 from 2 to 4 lanes from Lemoore Naval Air Station to I-5 (Fresno County Portion).	Cap. Expan. - Highway	California Freight Mobility Plan December 2014	$193,000

Figure 10.2 Goods Movement Project Map, Fresno County



10.1.2 Kern County

Table 10.2 Goods Movement Project List, Kern County

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
Connector							
KER-02	0-5	KER08RTP020	SR 58	Centennial Corridor	Cap. Enhan. - Highway	Kern 2017 STIP Kern 2014	$698,000
KER-03	0-5	51/ KER08RTP114	Centennial Connector	Centennial Connector - SR 58/Cottonwood Rd to Westside Parkway	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	698,000
KER-52	25 or more years	KER08RTP020	Centennial Corridor	I-5 to Westside Parkway at Heath Rd	Cap. Enhan. - Highway	2014 CFMP	$500,000
KER-32	25 or more years	15e/ KER08RTP027	I-5	Widen I-5 between Fort Tejon and SR 99.	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$86,000
KER-51	0-5	KER14RTP001	SR 46	Brown Material Rd to I-5 - interchange upgrade at 1-5 - Phase 4A	Cap. Enhan. - Interchange	2014 CFMP	$27,000
	6-15	KER08RTP018	SR 46	Brown Material Rd to I-5 - interchange upgrade at 1-5 - Phase 4B	Cap. Enhan. - Interchange	2014	$70,000
KER-31	6-15	45/ KER08RTP072 KER08RTP113	7th Standard Rd	Widen 7th Standard Road from I-5 to Sante Fe Way.	Cap. Enhan. - Highway	Kern 2014 RTP	$90,000

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
Corridor							
KER-43	25 or more years	KER08RTP028	I-5	7th Standard Rd Interchange - reconstruct	Cap. Enhan. - Interchange	Kern 2014 RTP	$54,000
KER-45	-24	KER08RTP105	SR 99	At various locations - ramp improvements (HOV - ramp metering)	Oper. Improv. - Interchange	Kern 2014 RTP 2014 CFMP	$148,000
KER-45a	16-24	KER08RTP105	SR 99	SR 99 & Hwy 119	Cap. Enhan. - Interchange	Kern County	
KER-45b	16-24	KER08RTP105	SR 99	SR 99 & Hosking Avenue (completed 2016)	Cap. Enhan. - Interchange	Kern County	
KER-45c	16-24	KER08RTP105	SR 99	SR 99 & Panama Lane	Cap. Enhan. - Interchange	Kern County	
KER-45d	16-24	KER08RTP105	SR 99	SR 99 & White Lane	Cap. Enhan. - Interchange	Kern County	
KER-45e	16-24	KER08RTP105	SR 99	SR 99 & Ming Avenue	Cap. Enhan. - Interchange	Kern County	
KER-45f	16-24	KER08RTP105	SR 99	SR 99 & California Avenue	Cap. Enhan. - Interchange	Kern County	
KER-45g	16-24	KER08RTP105	SR 99	SR 99 & Rosedale Highway	Cap. Enhan. - Interchange	Kern County	
KER-45h	16-24	KER08RTP105	SR 99	Hageman Flyover	Cap. Enhan. - Interchange	Kern County	
KER-45i	16-24	KER08RTP105	SR 99	SR 99 & Olive Drive	Cap. Enhan. - Interchange	Kern County	
KER-45j	16-24	KER08RTP105	SR 99	SR 99 & Snow Road (New Interchange)	Cap. Enhan. - Interchange	Kern County	
KER-45k	16-24	KER08RTP105	SR 99	SR 99 & 7th Standard Road	Cap. Enhan. - Interchange	Kern County	

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
KER-46	16-24	KER08RTP115	SR 99	At Snow Rd - construct new interchange	Cap. Enhan. - Interchange	Kern 2014 RTP 2014 CFMP	$138,200
KER-49	25 or more years		SR 99	Reconstruct interchange at Whisler	Cap. Enhan. - Interchange	Kern 2014 RTP 2014 CFMP	$54,000
KER-48	25 or more years		SR 99	Reconstruct interchange at Pond Rd	Cap. Enhan. - Interchange	Kern 2014 RTP 2014 CFMP	$54,000
KER-47	25 or more years	KER18RTP001	SR 99	Construct new interchange at Hanawalt	Cap. Enhan. - Interchange	Kern 2014 RTP 2014 CFMP	$88,811
KER-44	25 or more years	KER08RTP056	SR 99	Rt 99 - w iden bridge to four lanes; reconstruct ramps	Cap. Enhan. - Interchange	Kern 2014 RTP 2014 CFMP	$134,000
KER-60	25 or more years	KER18RTP002	North Beltway	I-5 to SR 65 - Burbank Street Alignment - construct new highway	Cap. Enhan. - Highway	Kern 2014 RTP	$500,000
KER-59	16-24	KER08RTP139	West Beltway	Pacheco Rd. Westside Parkway - construct new facility	Cap. Enhan. - Highway	Kern 2014 RTP	$115,793
KER-58	6-15	KER08RTP102,	West Beltway	Rosedale Hwy to 7th Standard Rd - construct new facility	Cap. Enhan. - Highway	Kern 2014 RTP	$115,793
KER-57	16-24	KER08RTP097	West Beltway	Taft Hwy to Pacheco Rd - construct new facillity	Cap. Enhan. - Highway	Kern 2014 RTP	$90,000
KER-55	25 or more years	KER08RTP076	West Beltway-North	7th Standard Rd to Rt 99 -extend freeway	Cap. Enhan. - Highway	Kern 2014 RTP	$100,000
KER-54	25 or more years	KER08RTP075	West Beltway-South	Taft Hwy to I-5 - extend freeway	Cap. Enhan. - Highway	Kern 2014 RTP	$100,000

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
KER-50	6-15	KER08RTP016	West Beltway	Rosedale Hwy to Westside Parkway - construct new facility	Cap. Enhan. - Highway	Kern 2014 RTP	$93,500
KER-56	6-15	KER08RTP092	SR 58 (existing)	Rosedale Hwy - Rt 43 to Allen Rd - widen existing highway	Cap. Enhan. - Highway	Kern 2014 RTP 2014 CFMP	$59,000
KER-53		KER08RTP038, KER08RTP092	SR 58 (existing)	Widen SR 58 (Rosedale Hwy) - I-5 to Rt 43	Cap. Enhan. - Highway	Kern 2014 RTP 2014 CFMP	$500,000

Figure 10.3 Goods Movement Project Map, Kern County (North)

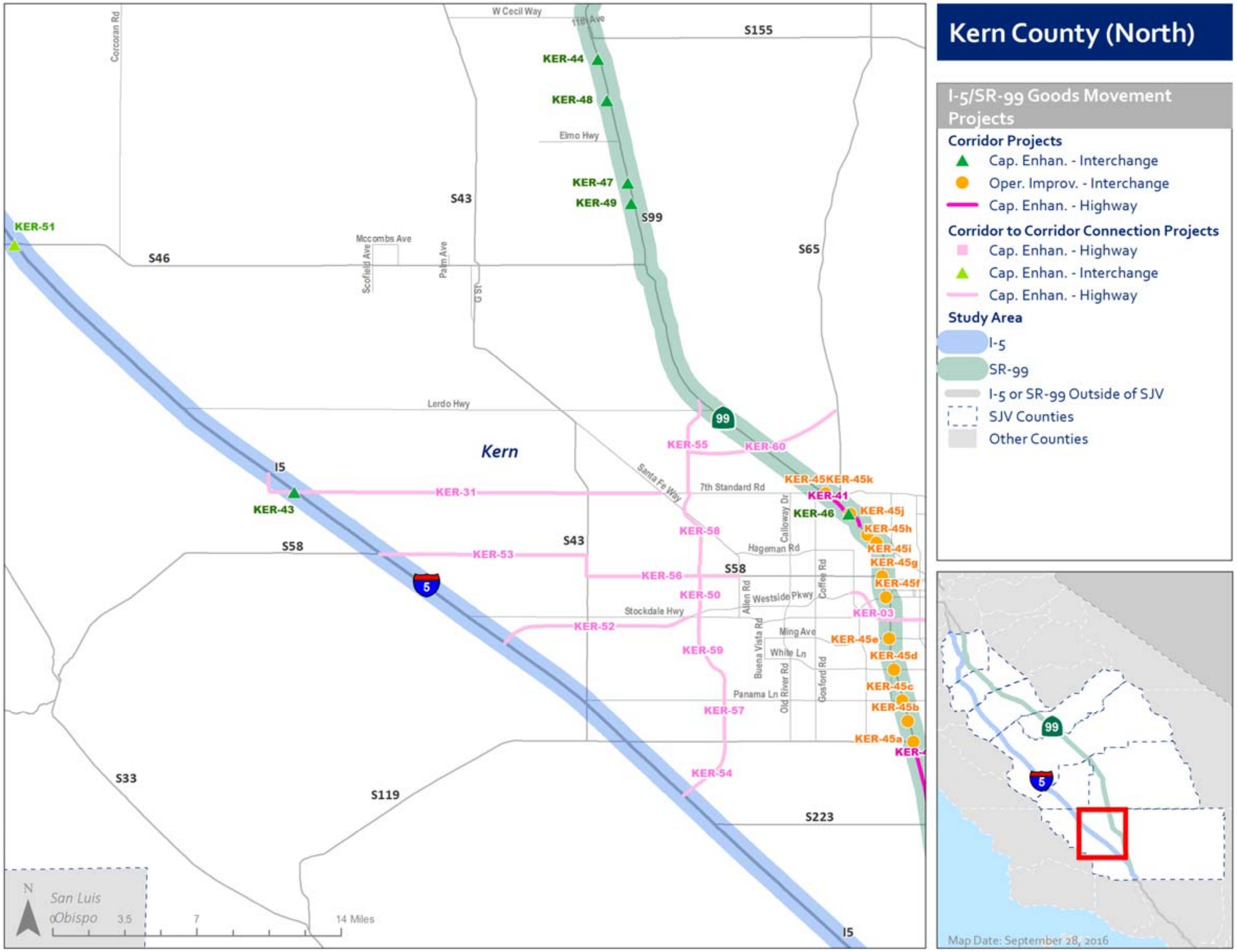
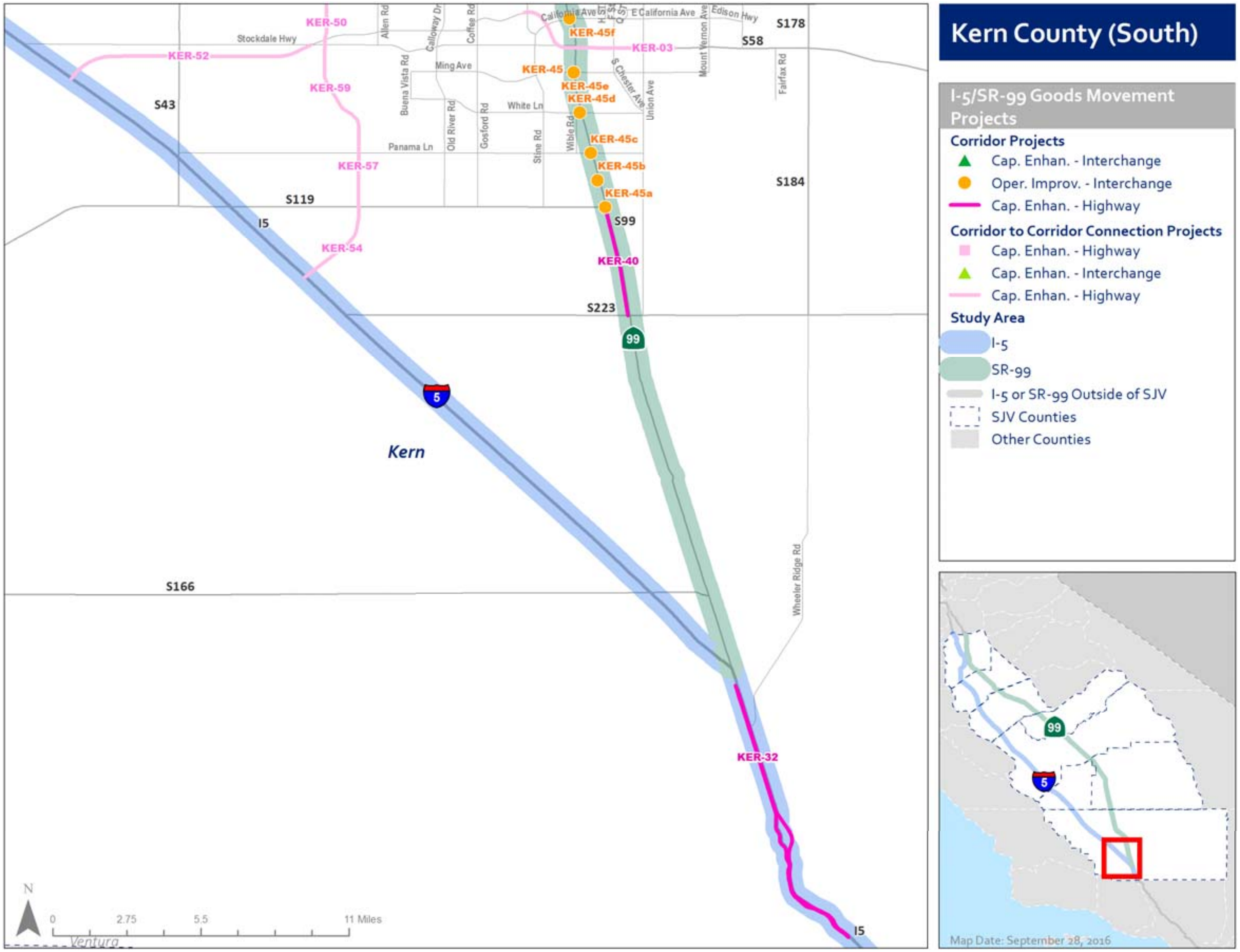


Figure 10.4 Goods Movement Project, Kern County (South)

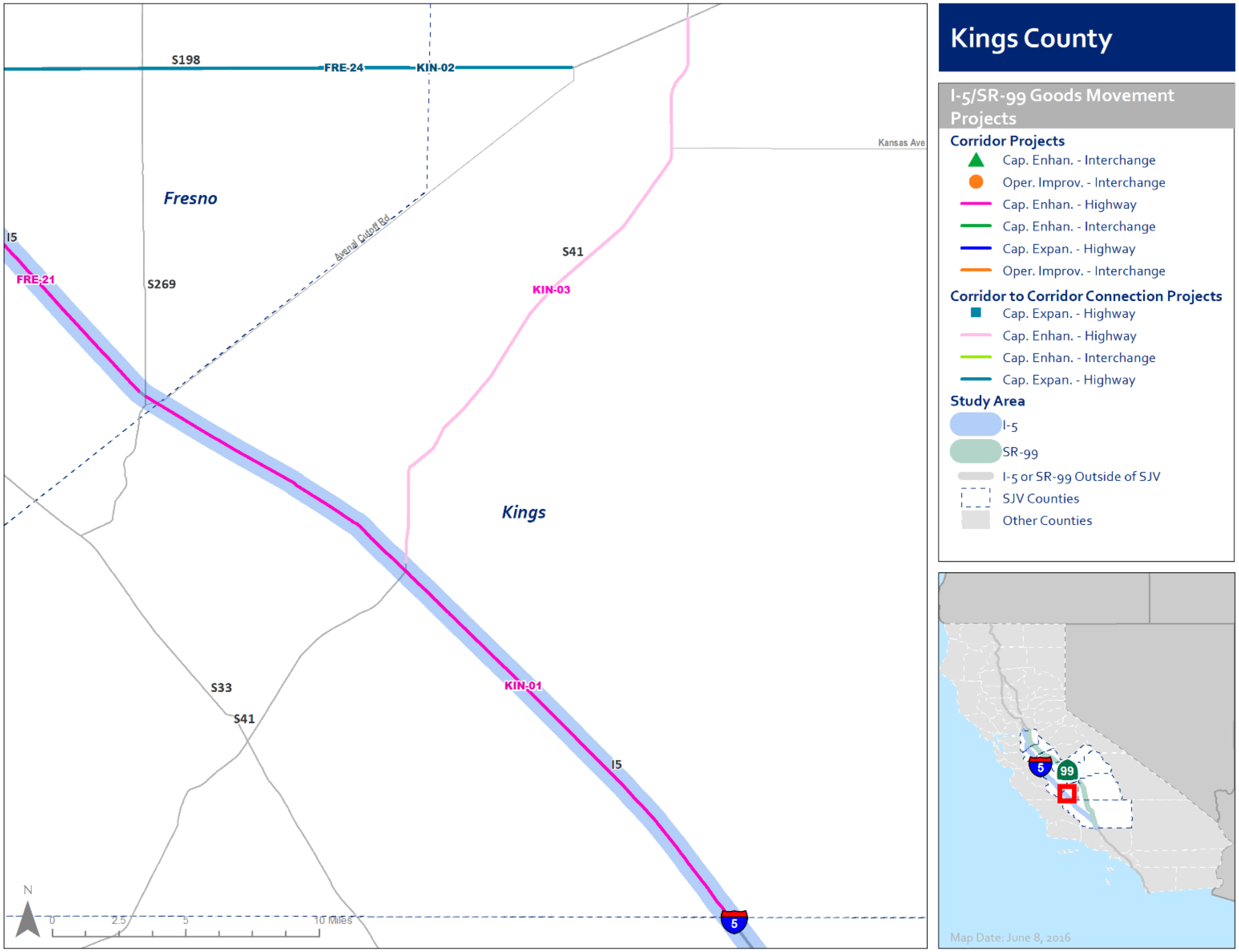


10.1.3 Kings County

Table 10.3 Goods Movement Project List, Kings County

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
Corridor							
KIN-01	6-15	New	I-5	Widen I-5 from 2 to 4 lanes between Kern and Fresno Counties.	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$ 80,000
Connector							
KIN-02	6-15	63	SR 198	Widen SR 198 from 2 to 4 lanes from Lemoore Naval Air Station to I-5 (Kings County Portion).	Cap. Expan. - Highway	California Freight Mobility Plan December 2014	$31,000
KIN-03	6-15	65	SR 41	Widen SR 41 from 2 to 4 lanes from SR 198 to I-5.	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$68,000

Figure 10.5 Goods Movement Project Map, Kings County

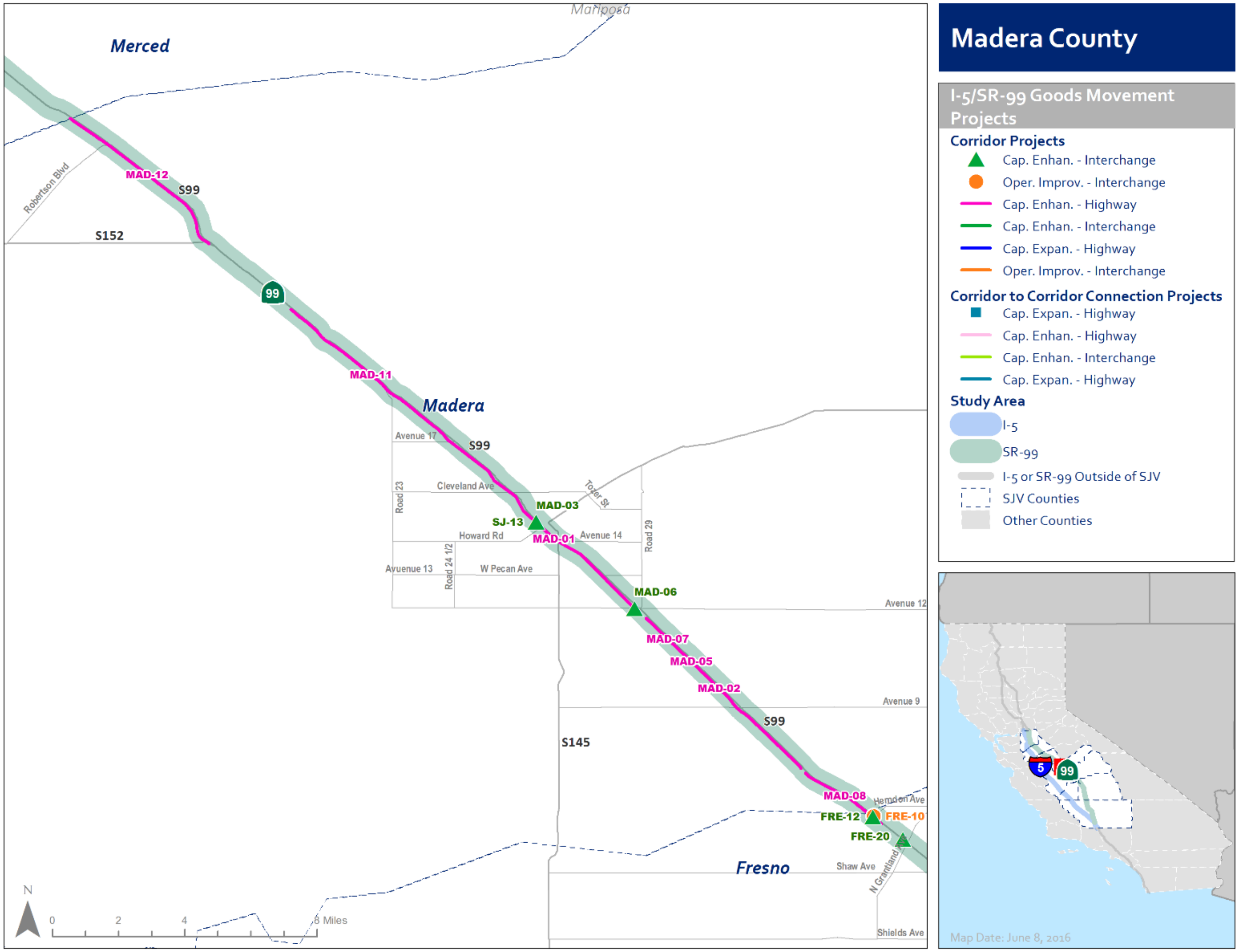


10.1.4 Madera County

Table 10.4 Goods Movement Project List, Madera County

Study D	Timeline (in Years)	ProjectID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
Corridor							
MAD-01	0-5	MAD417004	SR 99	SR99: 4-Lane Freeway to 6-Lane Freeway Ave 12 to Ave 17	Cap. Enhan. - Highway	2013 MCTC FTIP	$91,010
MAD-02	16-24	MAD417003	SR 99	SR99: 4-Lane Freeway to 6-Lane Freeway, Ave 7 to Ave 12	Cap. Enhan. - Highway	2013 MCTC FTIP	$160,571
MAD-03		MAD217030	SR 99	4th Street/SR 99 Interchange Improvements	Cap. Enhan. - Interchange	MCTC 2013 FTIP	$5,918
MAD-05	0-5	5335	SR 99	Madera 6 Lane	Cap. Enhan. - Highway	2014 STIP	
MAD-06	0-5	MAD417001	SR 99	Reconstruct Interchange	Cap. Enhan. - Interchange	MCTC 2013 FTIP	$68,000
MAD-07	0-5	6297	SR 99	South Madera 6 Lane	Cap. Enhan. - Highway	2014 STIP	
MAD-08	0-5	MAD418002	SR 99	Widen SR99: In Fresno & Madera Counties, from south of Grantland Ave UC to north of Avenue 7	Cap. Enhan. - Highway	2013 MCTC FTIP	$54,000
MAD-11	Unknown	0	SR 99	Widen SR 99 from 4 to 6 lanes from Avenue 17 to Avenue 21	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	N/A
MAD-12	Unknown	0	SR 99	Widen SR 99 from 4 to 6 lanes from Avenue 23 to Madera County Line	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	N/A

Figure 10.6 Goods Movement Project Map, Madera County



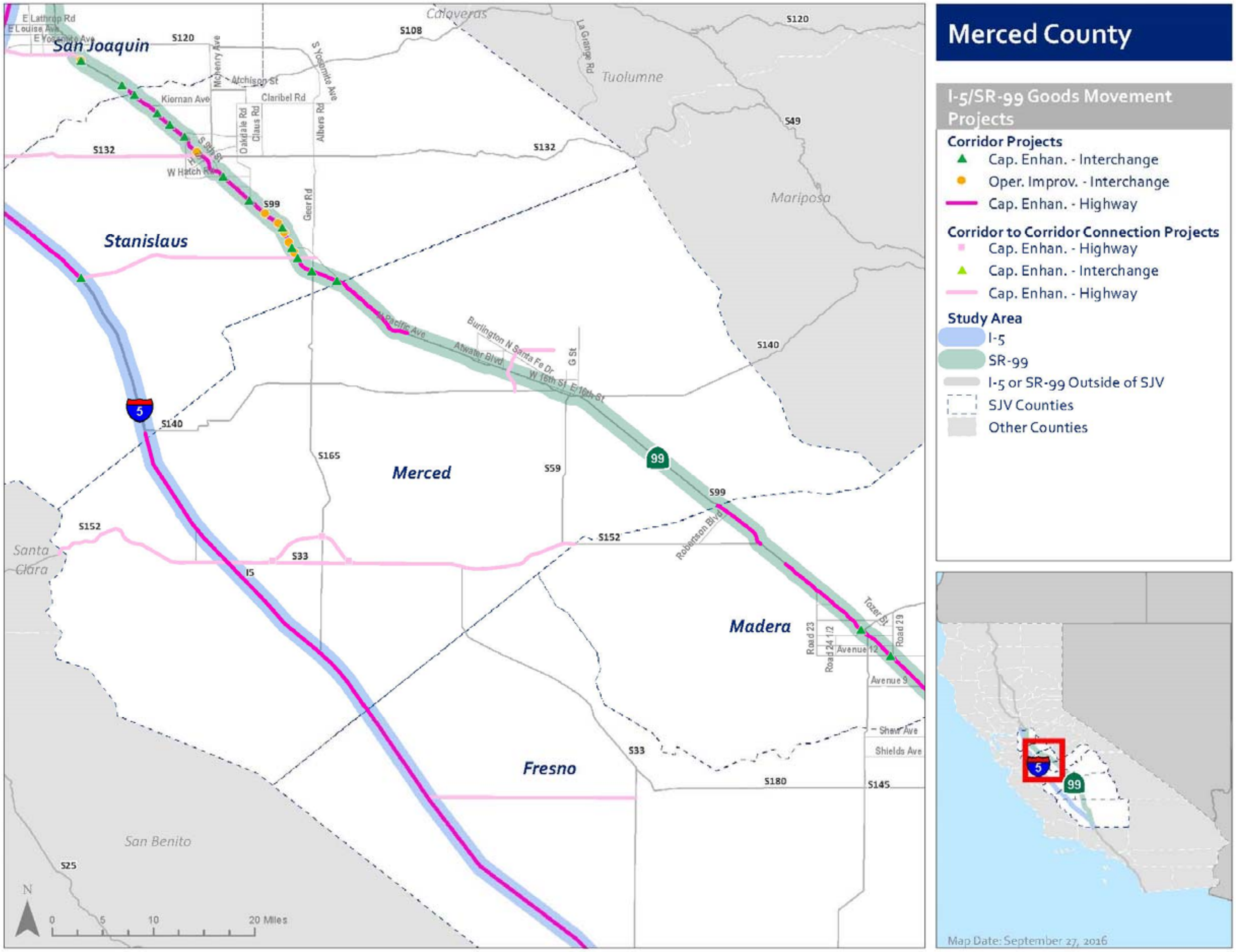
10.1.5 Merced County

Table 10.5 Goods Movement Project List, Merced County

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
Corridor							
MER-03	0-5	0161A	SR 99	Highway 99: Livingston Widening Northbound	Cap. Enhan. - Highway	MCAG	$42,870
MER-04	0-5	0161B	SR 99	Highway 99: Livingston Widening Southbound	Cap. Enhan. - Highway	2014 California STIP	$38,950
MER-09	25 or more		I-5	Widen I 5 from 4 to 6 lanes in Merced County	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	N/A
Connector							
MER-01a	6-15		Atwater-Merced Expressway	Atwater-Merced Expressway, Phase 1B: Green Sands Ave to Santa Fe Drive (Access to Castle Development & Airport)	Cap. Expan. - Highway	MCAG	$66,200
MER-01b	6-15		Atwater-Merced Expressway	Atwater-Merced Expressway, Phase 3: New Hwy 99 Interchange to Hwy 140	Cap. Expan. - Highway	MCAG	$71,800
MER-01b	6-15		Atwater-Merced Expressway	Atwater-Merced Expressway, Phase 2: Reconnect Santa Fe Drive to SR 59 North (Provides direct connect from	6-15	$85,000	Mobility/Reliability. Improve Economic

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
				Northern Merced to U.C. Merced)			Competitiveness
MER-06	6-15	5707A	SR 152	Los Banos Bypass, Segment 1: Btwn. Hwy 165 and E. Hwy 152 with signalized intersections	Cap. Expan. - Highway	MCAG	$54,000
MER-07	25 or more	5707B	SR 152	Los Banos Bypass, Segment 2: Btwn. Hwy 165 and W. Hwy 152 with signalized intersections	Cap. Expan. - Highway	MCAG	$206,000
MER-08	25 or more		SR 152	Los Banos Bypass, Segment 3: Construct 3 interchanges at W. Hwy 152, Hwy 165 and E. Hwy 152	Cap. Expan. - Highway	MCAG	$192,000
MER-10	0-5	19	SR 152	Widen SR 152 between SR 99 and US 101 (in Merced County)	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	N/A

Figure 10.7 Goods Movement Project Map, Merced County



10.1.6 San Joaquin County

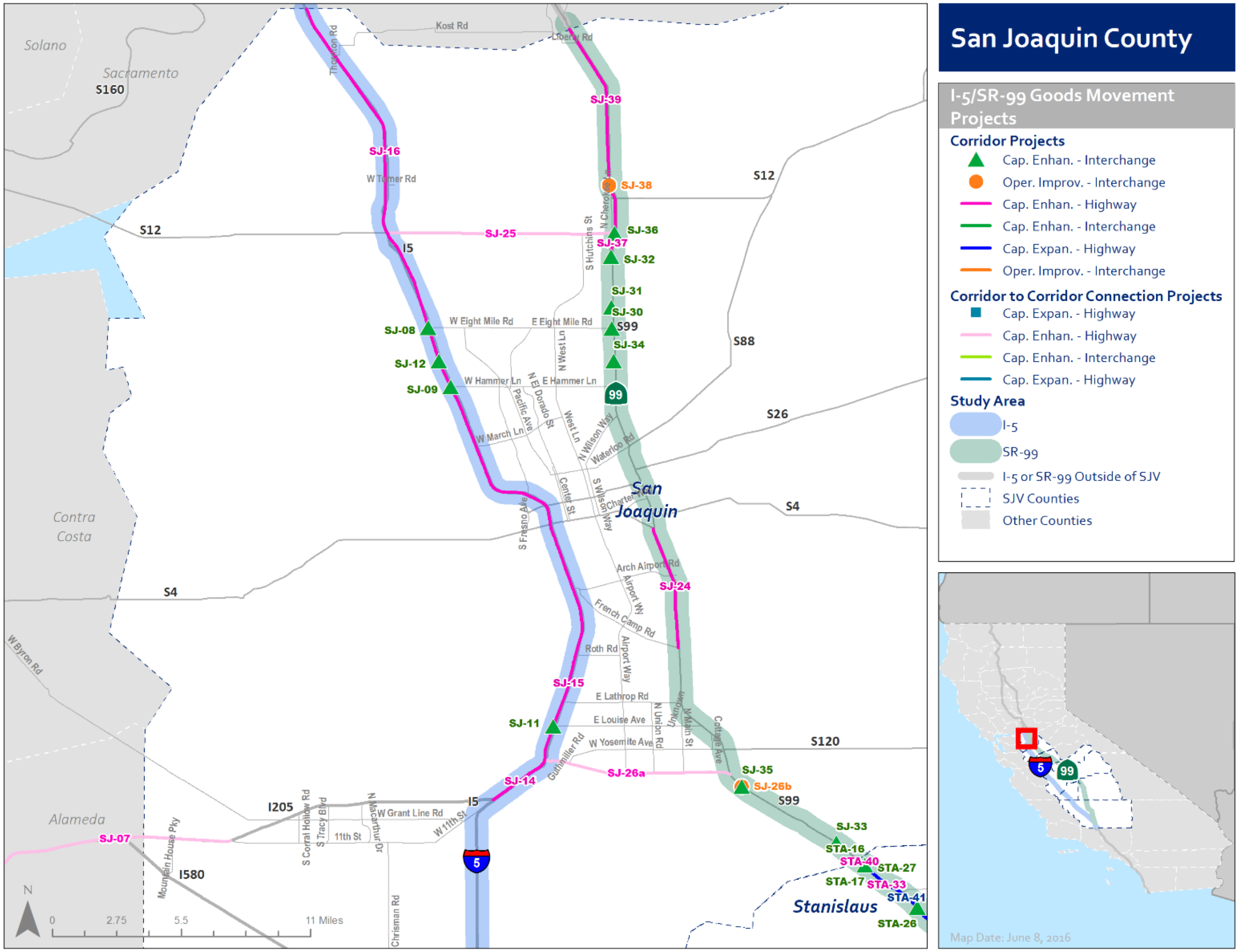
Table 10.6 Goods Movement Project List, San Joaquin County

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
Corridor							
SJ-08	6-15	SJ07-2020	I-5	I-5 at Eight Mile Road Interchange	Cap. Enhan. - Interchange	2014 SJCOG RTP	$51,400
SJ-09	6-15	SJ11-2004	I-5	I-5 at Hammer Lane Intercahnge	Cap. Enhan. - Interchange	2014 SJCOG RTP	$37,200
SJ-11	0-5	SJ07-2005	I-5	I-5 at Louise Avenue Intechnage	Cap. Enhan. - Interchange	2014 SJCOG RTP	$33,000
SJ-12	6-15	SJ11-2006	I-5	I-5 at Otto Drive Interchange	Cap. Enhan. - Interchange	2014 SJCOG RTP	$92,800
SJ-13	0-5	SJ11-3066	I-5	I-5 at Roth Road Interchange	Cap. Enhan. - Interchange	SJCOG RTP 2014	$16,800
SJ-14	0-5	15b	I-5	Widen I-5 between SR 120 and I-205	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$207,970
SJ-15	0-5	15a	I-5	Widen I-5 from 1 mile north of SR 12 to SR 120	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$91,000
SJ-16	6-15	15c	I-5	Widen I-5 from 4 to 6 lanes from 1 mile north of SR 12 to Sacramento County line	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$94,000
SJ-24	0-5	99a	SR 99	Widen SR 99 from French Camp Rd to Mariposa Rd 6 to 8 lanes, with new interchange	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$100,000

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
SJ-26b	0-5	SJ11-2023	SR 99	SR 99 at Austin Road Interchange	Oper. Improv. - Interchange	2014 SJCOG RTP	$3,000
SJ-30	0-5	SJ11-2002	SR 99	SR 99 at Eight Mile Road Interchange	Cap. Enhan. - Interchange	2014 SJCOG RTP	$65,900
SJ-31	0-5	SJ11-2008	SR 99	SR 99 at Gateway Boulevard Interchange	Cap. Enhan. - Interchange	2014 SJCOG RTP	$9,930
SJ-32	16-24	SJ07-2006	SR 99	SR 99 at Harney Lane Interchange	Cap. Enhan. - Interchange	2014 SJCOG RTP	$39,183
SJ-33	0-5	SJ07-2015	SR 99	SR 99 at Main Street/UPRR Interchange (Ripon)	Cap. Enhan. - Interchange	2014 SJCOG RTP	$10,000
SJ-34	0-5	SJ11-2001	SR 99	SR 99 at Morada Interchange	Cap. Enhan. - Interchange	2014 SJCOG RTP	$69,800
SJ-35	0-5	SJ 14-2001	SR 99	SR 99 at Raymus Expressway Interchange	Cap. Enhan. - Interchange	2014 SJCOG RTP	$3,000
SJ-36	6-15	SJ11-2015	SR 99	SR 99 at SR 12 West (Kettleman Lane) Interchange	Cap. Enhan. - Interchange	2014 SJCOG RTP	$16,164
SJ-37	Unknown	SJ14-1003	SR 99	SR 99 Widening	Cap. Enhan. - Highway	2014 SJCOG RTP	$3,000
SJ-38	0-5	3045	SR 99	Turner Road Interchange Operational Improvements	Oper. Improv. - Interchange	2014 California STIP	$3,061
SJ-39	6-15	0	SR 99	Widen SR 99 From Lodi to Sacramento County Line	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$40,000

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
Connector							
SJ-07	6-15	6	I-205/I-580	I-580 Westbound Truck Climbing Lanes	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$114,200
SJ-25	0-5	26	SR 12	Widen SR 12 between I-5 and SR 99	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$60,000
SJ-26a	0-5	16	SR 120	Widen SR 120 between I-5 and SR 99, with new interchange at SR 99	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$115,191

Figure 10.8 Goods Movement Project Map, San Joaquin County



10.1.7 Stanislaus County

Table 10.7 Goods Movement Project List, Stanislaus County

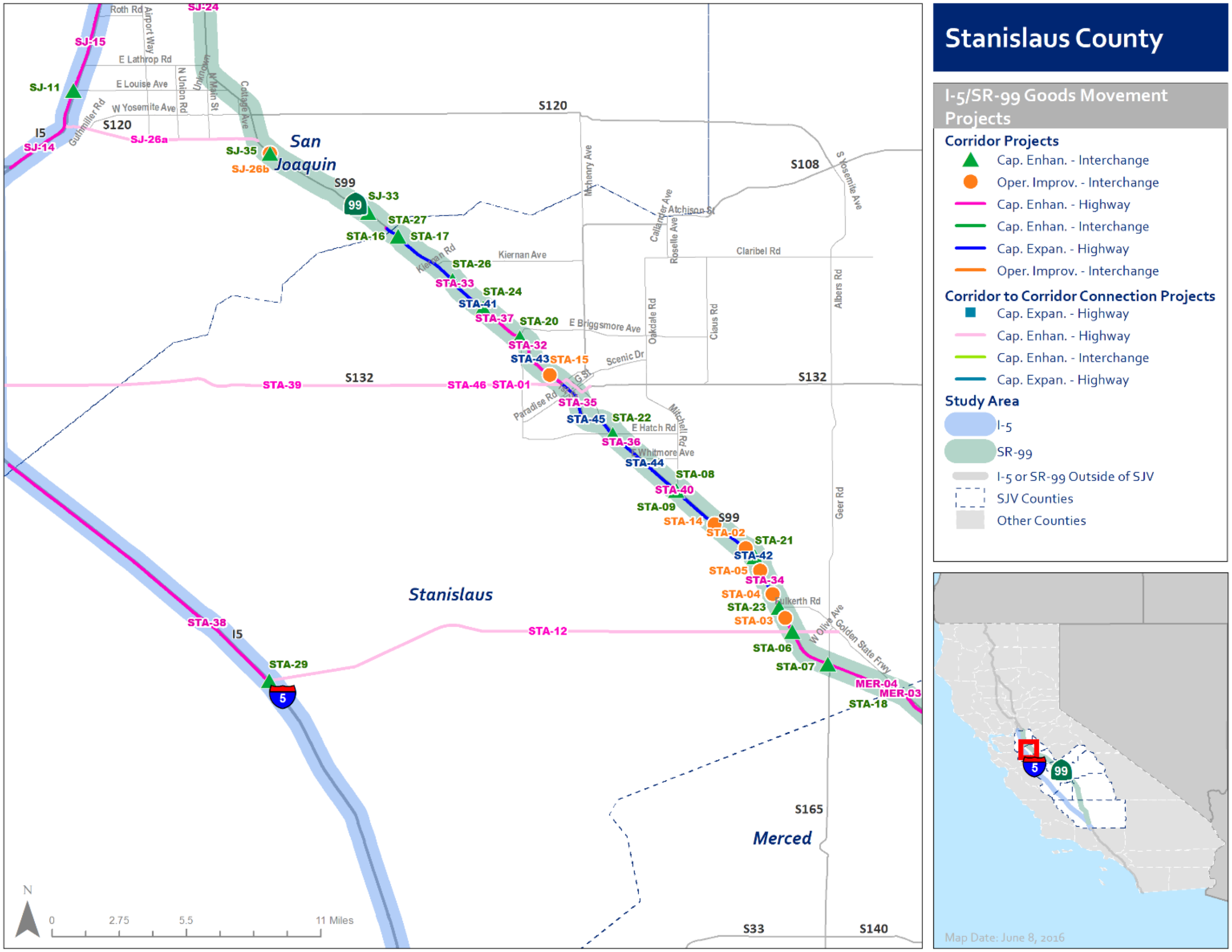
Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
Corridor							
STA-02	6-15	RE02	SR 99	Keyes Rd to Taylor Rd	Oper. Improv. - Interchange	2014 Stanislaus RTP	$6,227
STA-03	6-15	RE05	SR 99	Fulkerth Rd to West Main Street	Oper. Improv. - Interchange	2014 Stanislaus RTP	$6,403
STA-04	6-15	RE04	SR 99	Monte Vista Ave to Fulkerth Rd	Oper. Improv. - Interchange	2014 Stanislaus RTP	$6,462
STA-05	6-15	RE03	SR 99	Taylor Rd to Monte Vista Ave	Oper. Improv. - Interchange	2014 Stanislaus RTP	$6,520
STA-06	6-15	T26	SR 99	W. Main St Interchange	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$19,091
STA-07	6-15	T25	SR 99	SR 99, Lander Ave (SR 165) to S. City Limits	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$35,785
STA-08	6-15	TIER II	SR 99	Mitchell Rd/Service Rd Interchange Phase 2	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$49,586
STA-09	6-15	C08	SR 99	Mitchell Rd/Service Rd Interchange Phase 1	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$122,987
STA-14	16-24	RE07	SR 99	Mitchell Rd to Merced County Line	Oper. Improv. - Interchange	2014 Stanislaus RTP	$3,097
STA-15	6-15	RE06	SR 99	San Joaquin County Line to Mitchell Rd	Oper. Improv. - Interchange	2014 Stanislaus RTP	$15,758

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
STA-16	0-5	TIER II	SR 99	Interchange Ramp and Auxiliary Lane Improvements	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$27,685
STA-17	0-5	SC02	SR 99	SR 99 & Hammett Rd	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$95,524
STA-18	6-15	TIER II	SR 99	Golden State to Youngstown Road	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$20
STA-20	0-5	M15	SR 99	SR 99 & Briggsmore Interchange	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$12,668
STA-21	6-15	T27	SR 99	Taylor Rd & SR 99: Reconstruct Interchange	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$7,694
STA-22	16-24	TIER II	SR 99	Hatch Rd & SR 99: Reconstruct Interchange	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$222,129
STA-23	0-5	T01	SR 99	Reconstruct Interchange at Fulkerth Road	Cap. Enhan. - Interchange	2014 California Freight Mobility Plan	$12,667
STA-24	16-24	TIER II	SR 99	SR 99 & Standiford Ave: Reconstruct Interchange	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$78,944
STA-26	0-5	M17	SR 99	Reconstruct to 8-lane Interchange - Phase II	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$5,835
STA-29	0-5	P02	I-5	I-5 to Rogers Road: Interchange Improvements and Widen Sperry Ave	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$17,505
STA-32	6-15	TIER II	SR 99	SR 99: Kansas Ave to Carpenter Rd	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$60,046

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
STA-33	6-15	TIER II	SR 99	Carpenter Rd to San Joaquin County Line	Cap. Enhan. - Highway	2014 Stanislaus RTP	$82,278
STA-34	6-15	TIER II	SR 99	Widen SR99 from Hatch Rd to Tuolumne Rd	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$102,701
STA-35	6-15	TIER II	SR 99	Widen SR99 from Tuolumne Rd to Kansas Ave	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$128,243
STA-36	6-15	TIER II	SR 99	Widen SR99 from Mitchen Rd to Hatch Rd	Cap. Enhan. - Highway	2014 Stanislaus RTP	$221,877
STA-37	0-5	M02	SR 99	Widen from 6 to 8 lanes	Cap. Enhan. - Highway	2014 Stanislaus RTP	$50,671
STA-38	16-24	(TIER II)	I-5	Widen I-5 from 4 to 6 lanes SJ County line to Sperry Ave	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$300,063
STA-40	0-5	99b	SR 99	Widen SR 99 from 6 to 8 lanes in Stanislaus County	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$473,000
STA-41	25 or more	ST06	SR 99	Widen STA-99 between Carpenter Road and the SJ County line to eight lanes	Cap. Expan. - Highway	California Freight Mobility Plan December 2014	$82,278
STA-42	25 or more	ST03	SR 99	Widen STA-99 between Hatch and Tuolumne Road to eight lanes	Cap. Expan. - Highway	California Freight Mobility Plan December 2014	$102,701

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
STA-43	25 or more	ST05	SR 99	Widen STA-99 between Kansas Ave. and Carpenter Road to eight lanes	Cap. Expan. - Highway	California Freight Mobility Plan December 2014	$60,046
STA-44		ST02	SR 99	Widen STA-99 between Mitchell and Hatch Road to eight lanes	Cap. Expan. - Highway	California Freight Mobility Plan December 2014	$221,877
STA-45	25 or more	ST04	SR 99	Widen STA-99 between Tuolumne Road and Kansas Ave. to eight lanes	Cap. Expan. - Highway	California Freight Mobility Plan December 2014	$128,243
STA-01	2020 Open to traffic Year	M01	SR 132	State Route 132 West Freeway/Expressway	Cap. Enhan. - Highway	2014 Stanislaus RTP	$59,085
Connector							
STA-12	6-15	103	South County Corridor	Expressway connector between SR 99 and I-5 from Turlock to Patterson	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	N/A
STA-39	0-5	17	SR 132	Widen SR 132 connecting SR 99 and I-580	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$100,000
STA-46	2028 Open to traffic year	RE01	SR 132	SR 132 West Freeway/Exressway	Cap. Enhan. - Highway	2014 Stanislaus RTP	$335,009

Figure 10.9 Goods Movement Project Map, Stanislaus County

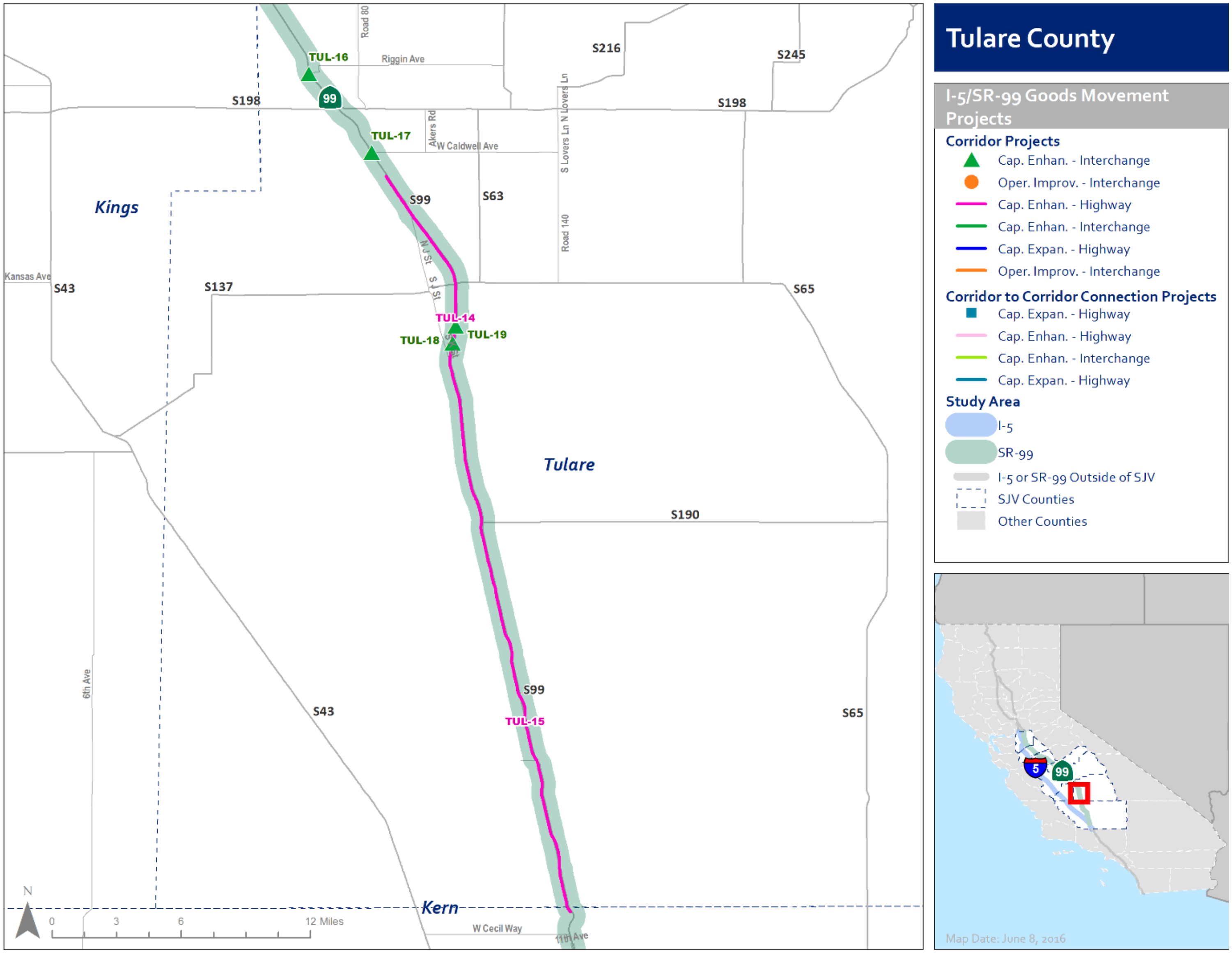


10.1.8 Tulare County

Table 10-8 Goods Movement Project List, Tulare County

Study ID	Timeline (in Years)	Project ID	Route or Facility ID	Project Title and Description	Project Type	Source	Total Project Cost (Thousands)
Corridor							
TUL-14	6-15	99f	SR 99	Widen SR 99 from Avenue 200 to 1.2m south of Avenue 280	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$186,800
TUL-15	25 or more	99g	SR 99	Widen SR 99 from Kern County line to Avenue 200	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$332,500
TUL-16	0-5		SR 99	State Route 99/Betty Drive Interchange	Cap. Enhan. - Interchange	2014 Tulare County RTP	$66,720
TUL-17	6-15		SR 99	State Route 99/Caldwell Avenue Interchange	Cap. Enhan. - Interchange	2014 Tulare County RTP	$76,303
TUL-18	6-15		SR 99	State Route 99/Commercial Interchange	Cap. Enhan. - Interchange	2014 Tulare County RTP	$60,980
TUL-19	6-15		SR 99	State Route 99/Paige Avenue interchange	Cap. Enhan. - Interchange	2014 Tulare County RTP	$73,969

Figure 10.10 Goods Movement Project Map, Tulare County



10.2 Identification of Goods Movement-Related Programmatic Projects

To support the truck technology component of the study, four freight-oriented technologies and strategies are introduced and described herein. Specific examples are included where relevant and insightful, but information related to costs or operator-oriented benefits are excluded from the present discussion.

The following is a summary of the topics included in this overview.

- Truck VMT patterns in the San Joaquin Valley;
- Truck parking technologies/ITS;
- Truck platooning testing programs; and
- Zero- and Near-Zero Emissions Truck Technology.

10.2.1 Truck Vehicle Miles Traveled (VMT) Patterns and Data Collection

Using Caltrans PeMS data, estimates for average weekly truck vehicle miles traveled (VMT) have been calculated for SR 99 and I-5, separately by direction. These VMT estimates are for the full lengths of the respective routes within the study region (i.e., within the boundaries of the eight counties comprising the San Joaquin Valley Regional Planning Agencies). The estimates have been aggregated into four bins according to time-of-day:

- AM Peak (6-9 AM);
- Midday (9 AM to 3 PM);
- PM Peak (3-7 PM); and
- Night (7 PM to 6 AM).

Data were taken for the five-week period between March 27 and May 1, 2016, excluding Sundays. PeMS data were only used from detectors that had at least an 85 percent observation rate in the field during the five-week period (i.e., any stations that had more percent imputed data were excluded from the analysis). Detectors that met this quality threshold were used to estimate VMT across the full corridor based on their specific locations and corresponding ranges of influence.

Results

The estimated weekly average truck VMT results are shown in **Figure 10.11** and **Table 10.9**. To facilitate comparisons between periods of different durations (e.g., between the 11-hour "night" period and the 3-hour "AM Peak" period), all results have been normalized by hour and are therefore reported on a per-hour basis.

Figure 10.11 Average Weekly Truck VMT by Route

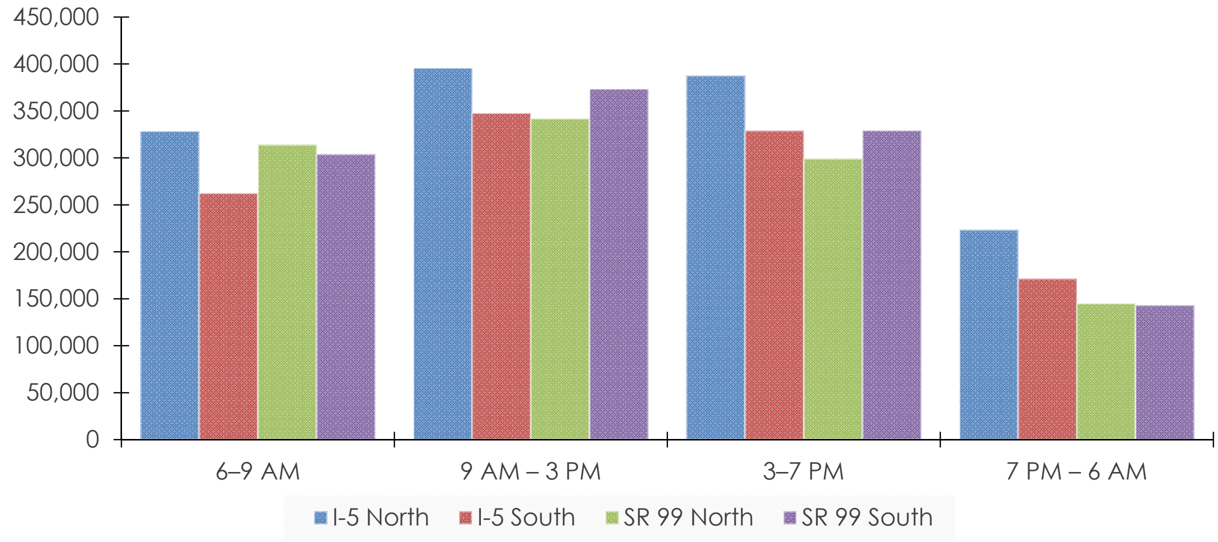


Table 10.9 Average Weekly Truck VMT by Route

Route	6–9 AM	9 AM – 3 PM	3–7 PM	7 PM – 6 AM
I-5 North	328,444	395,957	387,611	223,322
I-5 South	262,382	347,649	329,057	171,468
SR 99 North	313,818	341,786	299,056	145,085
SR 99 South	303,697	373,625	329,330	143,042

10.2.2 Intelligent Transportation Systems (ITS) for Truck Parking Availability

Information and Communications Technology (ICT) Infrastructure can be used to measure the number of available spaces in a certain truck parking areas, for integration into real-time or near-real-time truck parking availability reporting systems. Candidate ICT technologies for this purpose are introduced and described in **Table 10.10** and **Table 10.11**, with additional details for each technology provided at the end of this section.

Table 10.10 Detailed Qualitative Comparison Chart of Parking Detection Technologies

Sensor Technology	Cabling Required (Typically)	Bandwidth Needs	Installation Requires Parking Closure?	Maintenance Needs	Detection Accuracy	Reconfigurable	Cost per Detector	Calibration Effort Required
Inductive Loops	Yes	Low to moderate	Yes	Moderate to high	Excellent	No	Low	Low
Magnetometer (two-axis fluxgate)	No	Low	Yes	Low	Very good	No	Moderate	Low
Microwave Radar	Yes	Moderate	No	Low	Very good	Yes	Low to moderate	Moderate to High
Passive Infrared	Yes	Low to moderate	No	Low	Good	Yes	Low to moderate	Low
Ultrasonic	Yes	Low	No	Low	Good	Yes	Low to Moderate	Moderate
Video Image Processing	Yes	High	No	Moderate to high	Good	Yes	Moderate to High	Moderate

Table 10.11 Quantitative Comparison Chart of Parking Detection Technologies

Sensor Technology	Wireless Data Transmission Available	Battery Power Option	Ease of Installation	Maintenance Needs	Detection Accuracy	Cost per Detector	Typical Coverage per Detector
Inductive Loops	No	No	2 hrs, invasive	Generally maintenance free for first two years. Annualized cost of $746	Best accuracy.	$500 to $800	One space
Magnetometer (two-axis fluxgate)	Yes	Yes	10 min to 1 hour, invasive	Battery replacement after 5-9 years	Approx. 95% in real-world conditions	$900 to $6,300	One space
Microwave Radar	No	No	1 hour, noninvasive, 17 feet high	Minimal. 1.6% needed repair. Annualized cost of $314	Approx. 90% in real world conditions, coupled with Magnetometer	$700 to $3,300	Up to 6-10 spaces
Passive Infrared	Only for on-pavement detectors	Only for in-pavement detectors	30-minute installation, noninvasive, 15-20 feet overhead	Low. Mean time between failures is four years.	Above 99% under ideal conditions.	$700 to $1,200	1-2 spaces
Ultrasonic	No	No	Non-invasive overhead.	Low—no moving parts.	No data.	$600 to $1,900	1-2 spaces
Video Image Processing	Yes	No	1 hour, noninvasive, 30-50 feet high	Lens requires cleaning every 6-12 months. Annualized cost of $580	81% accurate in field tests.	$5,000 to $26,000	Up to 6-8 spaces

Inductive Loops

As the most commonly-used traffic sensing method in the US, inductive loops are a proven, mature, and well-understood technology. Installation is invasive, however, and requires closure of the facility for the cutting and wiring of the loops themselves (as well as any future maintenance). This generally decreases pavement life and increases pavement maintenance costs as well. This technology is generally resilient to most types of inclement weather, but is susceptible to electrical surges or lightning.

Magnetometer (two-axis fluxgate)

As with inductive loops, magnetometers are installed in the pavement and therefore require closure of the facility for installation and maintenance. Some models include wireless communication capability, eliminating the need for lead wire cuts to the sensor. The magnetometer is sensitive to installation depth and lateral position, and can yield inaccurate readings if either is incorrect. As with inductive loops, this technology is relatively resilient to most types of inclement weather.

Microwave Radar

This technology is more susceptible to weather-related interference than in-pavement technologies, but has the advantage of being able to read data from multiple parking stalls simultaneously. Different types of microwave radar exist, but the only type suitable for parking occupancy measurement is frequency modulated continuous wave (FMCW) radar for presence detection.

Passive Infrared

Passive infrared technology is helpful for large scale detection, though it is adversely affected by fog, snow, or any other weather that reduces visibility to less than 20 ft (which can be an issue with Tule Fog in the Central Valley). The most commonly required maintenance needed is periodic lens cleaning, which may require closure of the facility to accomplish.

Ultrasonic

These sensors are heavily used in Japan, but US experience with this technology is limited. These sensors have no moving parts and are therefore relatively durable with reduced maintenance needs. They can be affected by turbulent winds or certain temperature conditions, however.

Video Image Processing

Video-based sensing technology can monitor multiple spaces simultaneously, and allows for relatively easy repositioning if needed. Because it is an optical method, it is sensitive to poor visibility conditions that could arise from inclement weather (e.g., rain, snow, fog). The most commonly required maintenance needed is periodic lens cleaning.

10.2.3 Private Truck Parking and Public-Private Partnership Opportunities

This section explores the potential of using private parking facilities to supplement the limited supply of publicly maintained truck parking along the I-5 and SR 99 corridors.

Past Experience with Public-Private Partnerships

Following a 1997 Caltrans study of its rest areas, the agency established an In-Route Truck Issues Task Force. This task force proposed a PPP approach that involved building lighted and fenced parking areas adjacent to existing private facilities in parts of the state where truck parking capacity was not adequate for prevailing demands. Restroom facilities, sanitation, and security would be provided by private entities through competitive contracts with the state, and signage would be available to direct motorists to these free facilities from the highway.[13]

In 1997, New York State DOT developed a rest area plan that encouraged the formation of PPPs through working groups, low-interest loans, and lease agreements.[14] Other states with existing PPPs for truck parking include Vermont and Iowa.[15]

In 2001, the Connecticut DOT explored the feasibility of using electronic display signs to convey real-time truck parking information to drivers, but found that such a system could not offer a net benefit at the time due to an inability to obtain continuously updated truck parking information to supply the signboards.[16]

In Florida in 2011, the state partnered with a private truck parking facility to construct new parking spaces on land adjacent to the private property, to alleviate a severe shortage of truck parking capacity at that location. This was considered to be a prime example of the type of public-private partnership that FHWA envisioned in its 2002 Adequacy Study, and was included as an eligible type of investment for funding under Congress' Truck Parking Pilot Program.[17]

A 2015 Virginia Truck Parking Study recommended partnering with private industry and local governments to expand existing truck parking capacity, with highest priority given to the areas with the greatest deficit of parking.[18]

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[13] http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_317.pdf.

[14] http://www.dot.state.mn.us/ofrw/PDF/MN_TrkParkFnlRpt.pdf.

[15] http://www.ntsb.gov/news/events/Documents/truck_bus-SIR0001.pdf.

[16] http://www.dot.state.mn.us/ofrw/PDF/MN_TrkParkFnlRpt.pdf.

[17] http://ops.fhwa.dot.gov/freight/documents/cmvrptcgr/index.htm.

[18] Virginia Truck Parking Study, July 2015.

Current State of Truck Parking in the San Joaquin Valley

Out of the 2,763 parking spaces along the I-5 Corridor, only about 10 percent are publicly maintained. Similarly, out of the 2,139 parking spaces along the SR 99 Corridor, only about 6 percent are publicly maintained. Details regarding parking inventory along both corridors is provided in **Table 10-12**.

A survey in 2010 revealed that 78 percent of respondents on Interstate 5 have encountered truck stops that were full.[19] Although the private sector invests in truck parking facilities where profitable, there is often a mismatch between where parking is needed and where it is provided by private entities.[20]

An NTSB Special Report on Truck Parking Areas[21] explored the current shortage of truck parking and found that California ranks in the top four states across the country with respect to truck parking demand. The report further found that an estimated 80 percent of public rest area and 53 percent of private truck stops across the country are full during overnight hours.

Table 10-12 Summary of Parking Supply on I-5 and SR 99

Ownership Type	I-5	SR 99	Total	Percent
Public	288	128	416	8.5%
Private	2,475	2,011	4,486	91.5%
Total	**2,763**	**2,139**	**4,902**	**100%**

ITS Truck Parking Safety and Hours-of-Service (HOS) Benefits

In 2011, the Commercial Vehicle Safety Alliance (CVSA) explored the issue of truck drivers being unable to find legal parking spaces upon reaching their hours-of-service (HOS) limits. **Table 10-13** highlights some of the HOS results from this study. An additional safety-related consideration with respect to truck parking and HOS limits is that the two are often on conflict with each other. As the study pointed out, "enforcement officers are presented with a difficult enforcement choice: force the driver to move the vehicle to a safer location when a driver has reached the HOS limit, or leave the vehicle illegally parked."[22]

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19 http://ops.fhwa.dot.gov/freight/documents/cmvrptcgr/index.htm

20 http://www.ntsb.gov/news/events/Documents/truck_bus-SIR0001.pdf

21 http://www.ntsb.gov/news/events/Documents/truck_bus-SIR0001.pdf

22 http://ops.fhwa.dot.gov/freight/documents/cmvrptcgr/index.htm

Table 10-13 Percent of Illegally Parked Drivers Due to Hours of Service Limits and Lack of Available Truck Parking

State	Illegally Parked Drivers Who Cannot Find a Parking Space and Are Out of HOS
Idaho	25%
Maine	2%
Minnesota	<5%
Montana	3%
Nebraska	73%
Wisconsin	5%

Source: NATSO, 1999.

Measures to address driver fatigue can produce safety benefits, as driving while fatigued accounts for 16 percent of total truck-involved crashes and 5 percent of total fatal truck-involved crashes. Furthermore, providing trucks with guidance to available parking can reduce fuel consumption and emissions.[23] However, in 1999, NATSO investigated the relationship between a lack of truck parking and crash rates, and found no relationship between accident occurrence and truck parking shortfalls, with respect to number of crashes or number of fatal incidents involving large trucks.[24]

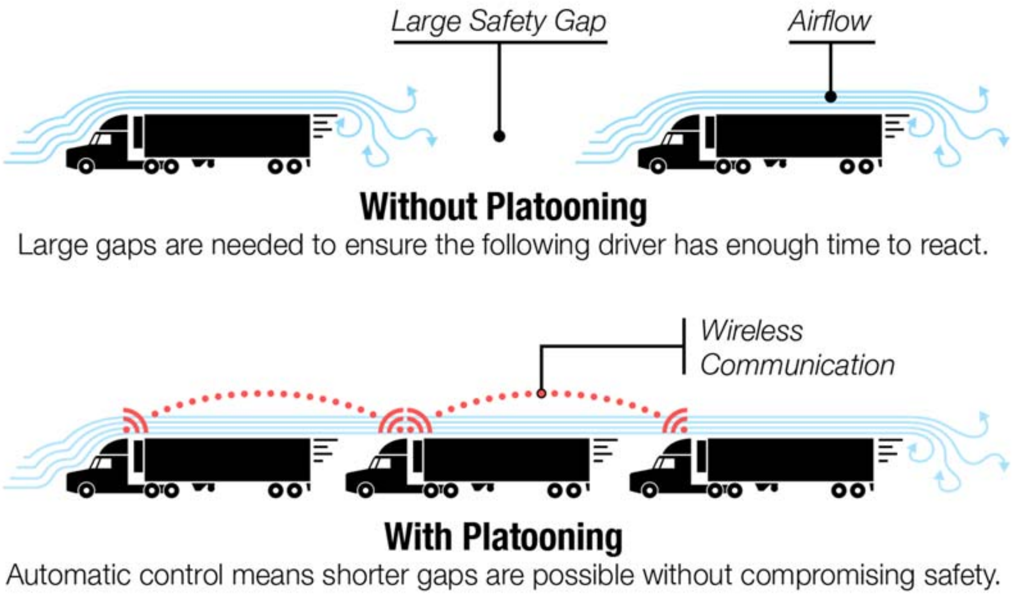
10.2.4 Truck Platooning and Connected Truck Technologies

A truck platoon is a series of trucks following each other on the road, with acceleration and braking controlled automatically (steering is typically still manual). When any truck's speed changes, the others behind it are instantly notified wirelessly, and those trucks respond immediately by braking or accelerating. This allows for much closer following distances, which reduces wind resistance and increases the number of trucks that can fit on the road at high speeds, thereby increasing roadway capacity (see **Figure 10.12**). This also protects against rear-end crashes by automating brake reaction time.

[23] I-5 Smart Truck Parking in California: Public-Private-Academic Collaboration to Aid Truckers in Finding Safe, Legal, and Available Parking Through ITS Technology, Presentation, April 4, 2012.

[24] Examination of the Relationship between Truck Crash Rates and Truck Parking Shortfall Estimates, cited in http://www.ntsb.gov/news/events/Documents/truck_bus-SIR0001.pdf.

Figure 10.12 Truck Platooning Concept



The remainder of this section provides a short summary of pilot studies of this technology in different parts of the nation, including (when available):

- Identification of involved parties;
- Description of the on-board technology;
- Description of corridor and traffic conditions of test; and
- Summary of key findings and recommendations.

Texas Truck Platooning Test Program

In concept development phase.

- **Participants:** Testing performed by the Texas Transportation Institute (TTI).
- **Configuration:** TBD.
- **Corridor:** TBD in Texas.
- **Vehicles and Equipment:** TBD – program includes multiple industry partners, including truck OEMs.

- **Objectives:** Test Level 2 truck platooning – an extension of cooperative adaptive cruise control that uses automated lateral and longitudinal vehicle control, while maintaining a tight formation of vehicles with short following distances.
- **Design:** TBD – Concept of Operations currently under development.
- **Results:** TBD.

FHWA Partial Automation for Truck Platooning (California)

Test program in progress.

- **Participants:** Testing performed by UC Berkeley PATH and Volvo.
- **Configuration:** Two and three-truck platoons, multiple configurations.
- **Corridor:** I-580 in California, between Dublin and Tracey.
- **Vehicles and Equipment:** Volvo trucks.
- **Objectives:** Perform high speed testing, longitudinal maneuvers (platoon splitting, platoon joining), fuel economy analysis, fault detection consideration..
- **Design:** Engine control included both torque control and brake system control.
- **Results:** Testing planned for fall 2016.

FHWA Partial Automation for Truck Platooning (Alabama)

Test program in progress.

- **Participants:** Testing performed by University of Auburn and Peloton.
- **Configuration:** Two-truck platoons.
- **Corridor:** TBD.
- **Vehicles and Equipment:** Peterbilt trucks with Meritor Wabco advanced brake system integration and Peloton prototype commercial-off-the-shelf two-truck platooning system.
- **Objectives:** Test how the system reacts to passenger car cut-ins or other highway anomalies; test how to find similarly equipped vehicles on the road for the platoon; test improved fuel economy, test the role of the lead driver; estimate return on this investment.
- **Design:** Peloton prototype commercial-off-the-shelf two-truck platooning system technology, integrating vehicle-to-vehicle communications with adaptive cruise control.
- **Results:** Testing planned for 2016.

Nevada Truck Platooning Tests

- **Participants:** Testing performed by UC Berkeley PATH.
- **Configuration:** Three-truck platoons, 6 meter spacing at 53 mph.
- **Corridor:** SR 722 in Nevada.
- **Vehicles and Equipment:** Freightliner trucks equipped with a Cummins C-Celect Engine ECU, a V2V communications system (Savari DSRC), a WABCO "Euro" E85, an accelerometer, a gyroscope, a PC104 control computer, Lidar sensors, and Radar sensors.
- **Objectives:** Perform high speed testing, longitudinal maneuvers (platoon splitting, platoon joining), fuel economy analysis, fault detection consideration.
- **Design:** Engine control included both torque control and brake system control.
- **Results:** Performance is sensitive to changes in roadway grade. Line-of-sight was necessary for reliable V2V communications, resulting in the middle truck's being offset laterally by 0.5 meters. First, second, and third truck achieved fuel savings of 4.54 percent, 11.91 percent, and 18.4 percent respectively.

Safe Road Train for the Environment (SARTRE), Aerodynamic Tests

- **Participants:** Volvo Trucks, Volvo Cars and SP (Sweden), Ricardo (UK), IKA (Germany), IDIADA, and Technalia (Spain).
- **Configuration:** Platoons of two trucks, followed by three passenger cars. Spacing of as little as 5 meters.
- **Corridor:** Fuel consumption was evaluated at the IDIADA high-speed test track in Spain.
- **Vehicles and Equipment:** Platoon operation based on radar data and Wi-Fi communication between trucks. Side radar units monitor traffic, forward-facing radar maintains vehicle spacing, and a camera measures position in the lane. A Wi-Fi antenna is mounted above the cabin for wireless communication to other platoon vehicles. New technologies were intentionally not developed for this project, as it was intended to be a demonstration of truck platooning using currently available technology. Acceleration and braking was controlled using radar, adaptive cruise control, and automated emergency braking. Steering control was provided using Volvo's Dynamic Steering system. The Radar and camera equipment is standard production technology, and the Wi-Fi communications use the 802.11p standard.
- **Objectives:** Test aerodynamic effects of platooning and resultant fuel savings.
- **Design:** Control system included steering, acceleration, and braking. Aerodynamic testing was performed at night to minimize fluctuations in temperature and wind.

- **Results:** At a spacing of 5 meters, fuel savings were 8 percent for the lead truck and 13 percent for the following truck. At a spacing of 25 meters, fuel savings were 1.5 percent for the lead truck and 7.5 percent for the following truck.

Safe Road Train for the Environment (SARTRE), CACC and ACC Tests

- **Participants:** Isuzu, HINO, FUSO, UD Trucks.
- **Configuration:** Four-truck platoons. In one test headways are 1 second and speed is deliberately reduced from 80 kph (start) to 50 kph (finish).
- **Corridor:** Unspecified.
- **Vehicles and Equipment:** Four different trucks by four different manufacturers (Isuzu CYL, HINO FW1EXBL, FUSO FS55VVZ, UD Trucks QGK-CD), each approximately 12 meters and 10 tons. Vehicles included V2V communications antennas on the roof of the cabin, a GPS antenna on the top of the cabin, an acceleration sensor, yaw rate sensor, wheel sensor, Laser Radar (IBEO), 76G Millie wave radar, a GPS unit, Rapid Pro unit, Micro Auto Box unit, and HMI screen/indicator lamps.
- **Objectives:** Demonstrate feasibility of truck CACC technology and operation.
- **Design:** In ACC mode, truck control is handled using V2V distance sensors only. In CACC mode, truck control is handled using V2V distance sensors and wireless communication.
- **Results:** At 20 meter spacing, fuel savings were 8 percent on average. At 10 meters, fuel savings were 14 percent on average. At 5 meters, fuel savings were 16 percent on average.

Safe Road Train for the Environment (SARTRE), V2V Communications Tests

- **Participants:** SARTRE participants.
- **Configuration:** Platoons of two trucks followed by three passenger cars, at a spacing of 13 meters. Testing was performed at 50, 70, and 85 kph (6 minutes at each speed).
- **Corridor:** IDIADA test track in Spain.
- **Vehicles and Equipment:** Trucks had two separate radios and antennas for V2V communication. Passenger cars only had one.
- **Objectives:** Investigate potential V2V issues in a platooning environment.
- **Design:** Data is broadcast to all vehicles, not relayed from one to another. Data was encrypted and communicated using 802.11p. Data was sent and received from the SARTRE CAN bus. The experiment did not focus on minimizing data volume or transmission needs. For time synchronization, a GPS/NTP method was used.

- **Results:** Side mirrors were tested as alternate mounting locations for antennas, but were ultimately not selected. Line-of-sight issues may have contributed to lost messages between vehicles in some configurations. Interruptions in V2V communications between vehicles were typically shorter than 100 ms.

Japanese Energy ITS Project

- **Participants:** Ministry of Economy, Trade, and Industry; New Energy and Industrial Technology Development Organization.
- **Configuration:** Four-truck platoons at 80 kph. In CACC mode, the spacing was 30 meters; in fully automated mode, the spacing was 4 meters. Additional demonstrations were performed with three- and four-truck platoons at 30, 10, and 4.7 meter spacings.
- **Corridor:** Tomei Expressway around Tokyo. 100 km segment. Traffic composed of 69 percent light vehicles and 31 percent heavy vehicles. Additional demonstrations performed at AIST test track.
- **Vehicles and Equipment:** Image processing, radar (front bumper mounted), laser scanner (front bumper mounted), V2V communications (antennas installed at rear corners of trailer), and Lidar cameras on the sides of the vehicle. Human-Machine interface includes in-vehicle display and additional indicators on the back of the leading vehicle trailer.
- **Objectives:** Demonstration of automated truck platoons and energy savings. Testing of obstacle avoidance and cut-in scenarios.
- **Design:** Steering and speed control automated. Image processing is used for lane-keeping. Radar, laser, and V2V data are used for gap/longitudinal control.
- **Results:** 13.7 percent fuel reduction for CACC mode, and 15.9 percent fuel reduction in fully automated mode. CO2 emissions were reduced by 2.1 percent at 10-meter gaps, and 4.8 percent at 4-meter gaps.

CHAUFFEUR Project

- **Participants:** European Union, Daimler Chrysler, Renault Recherche, IVECO, Centro Ricerche Fiat, WABCO, Bosch, ZF Lenksysteme, Central Research Laboratories, TUV Rheinland, PTV, Clifford Chance & Punder, and CSST.
- **Configuration:** Two-truck and three-truck platoons with 6-12 meter spacing.
- **Corridor:** Not specified.
- **Vehicles and Equipment:** DaimlerChrysler and IVECO trucks. Dedicated infrared image processing with two cameras, for measurement of tow bar angle and distance. 5.8 GHz V2V communication for platoon formation and coordination.

- **Objectives:** Proof of concept for "electronic tow bar" operation of trucks.
- **Design:** System controls lateral movement (lane keeping) and vehicle spacing, using a lane keeping system and cruise control. The infrared image processing uses a pattern of markers on the backside of the leading truck's trailer, arranged in an octagon.
- **Results:** Up to 20 percent reduction in fuel consumption.

10.2.5 Zero- and Near-Zero Emissions Truck Technology

Leading zero-emissions (ZE) and near-zero-emissions (NZE) truck technologies include: Dual-Mode Hybrid Electric Vehicles (HEVs), Plug-In Hybrid Electric Vehicles (PHEVs), Range-Extended Electric Vehicles (REEVs) with integrated engine, REEVs with integrated fuel cell, Battery Electric Vehicles (BEVs), and range extenders utilizing roadway power. The market readiness of each of these technologies has been evaluated according to NASA's technology readiness level (TRL), described in **Table 10.14**.[25]

In addition to these technologies that are specifically designed to support ZE and NZE truck operations, other congestion mitigation and mobility strategies can help reduce overall emissions levels across all vehicles. Examples of such broadly-applicable strategies include AERIS (EcoDriving) and Freight Advanced Traveler Information System (FRATIS).

Table 10.14 NASA Technology Readiness Levels

Level	Definition
TRL 1	Basic principles observed and reported
TRL 2	Technology concept and/or application formulated
TRL 3	Analytical and experimental critical function and/or characteristic proof-of concept
TRL 4	Component and/or breadboard validation in laboratory environment
TRL 5	Component and/or breadboard validation in relevant environment
TRL 6	System/subsystem model or prototype demonstration in a relevant environment (ground or space)
TRL 7	System prototype demonstration in a space environment
TRL 8	Actual system completed and "flight qualified" through test and demonstration (ground or space)
TRL 9	Actual system "flight proven" through successful mission operations

[25] Technology Readiness Levels: A White Paper", John C. Mankins, Office of Space Access and Technology, NASA 1995.

Dual-Mode Hybrid Electric Vehicles

This is an advanced parallel hybrid with the internal combustion engine being the main source of power. It is a moderately mature technology, with little to no changes in operations as compared to a diesel-operated truck. However, the actual ZE range is limited, as it only functions in ZE mode at low speeds and/or is subject to certain load limits. These trucks achieve approximately 15 percent emissions savings compared to conventional diesel trucks. It is ranked with a 5 on the TRL scale.

Plug-In Hybrid Electric Vehicles

Unlike the HEVs, the PHEVs have batteries that are recharged through the electrical grid. This results in a larger battery, which also provides greater range in ZE mode. Despite this advantage over HEVs, PHEVs are based on a technology that is still in its relative infancy, is more costly, and generally more complex.

Range-Extended Electric Vehicles with Integrated Engine

These vehicles can use either electric power or diesel fuel, but the primary source of energy is the electric motor. The engine can run either on diesel or compressed natural gas (CNG) when the batteries are depleted. The determining factor for ZE range is battery size. Therefore, this truck type can be designed for specific ZE ranges as needed, subject to corresponding changes in cost. The technology has a TRL score of 7. These trucks achieve approximately 25 percent emissions savings compared to conventional diesel trucks.

Range-Extended Electric Vehicles with Integrated Fuel Cells

This technology is analogous to the REEV with integrated engine, except that it relies on a fuel cell in place of an integrated engine when the vehicle battery is depleted. The fuel cells require hydrogen refueling stations for recharging, such that these trucks are a practical solution only in areas where such refueling stations exist. The technology can be designed to fit within tight spaces and can be accommodated by a standard diesel truck, though this comes at a higher price point compared to other technologies. These vehicles also offer relatively long useful lifespans and small maintenance costs. This technology is already available on the market, and scores a 7 on the TRL scale. Because these vehicles are capable of operating in true zero-emissions mode, it is relatively easy to obtain regulatory certification for them.

Battery Electric Vehicles

The BEV an electric-only vehicle powered by its battery alone, meaning that longer ranges require larger, heavier, more costly batteries. The vehicle batteries can be recharged using dedicated recharging stations or overhead/in-pavement catenary power systems (if the vehicle is properly equipped to draw power from such a source). Recharging of the internal battery requires more time than refueling a REEV fuel cell or internal combustion engine. The actual truck technology has a TRL score of 7, while the fuel cell technology has a score of 6. Because these vehicles are capable of operating in true zero-emissions mode, it is relatively easy to obtain regulatory certification for them.

Range Extenders Utilizing Roadway Power

The technology requires roadway infrastructure to charge the electric trucks while on route using technologies that are already widely used for transit vehicles. This technology allows for smaller, cheaper on-board batteries and therefore lower vehicle costs as well. This cost savings per vehicle is offset by significantly greater costs for infrastructure supporting systems relative to other ZE/NZE technologies, however. This system scores a 5 on the TRL scale. Because these vehicles are capable of operating in true zero-emissions mode, it is relatively easy to obtain regulatory certification for them.

10.2.6 Mode Shift: Rail Intermodal

Shifting highway freight movements to rail where possible is a key element of many regional goods movement strategies. The existence of active rail corridors parallel to I-5 and SR 99 suggests that some existing or forecast truck flows could be modal shift candidates; however, in-state rail shipments currently consist primarily of heavy-weight commodities, including borax from the RioTinto mine in eastern Kern County that travels by rail o the Ports of Los Angeles/Long Beach. Besides reducing heavy truck movements on I-5, SR 99, or connecting routes, shifting truck movements to rail might reduce criteria pollutants, fuel use, and GHG emissions.

Rail intermodal service involves rail movement of highway trailers or freight containers between rail terminals, with origin pickup and destination delivery movements made by truck. The ability of intermodal options to compete with highway service depends heavily on distance. Multi-step intermodal service entails substantial cost and time at terminals, but offers unit cost savings on the line-haul move between the terminals. To be cost-competitive and service-competitive with door-to-door truckload service, the rail line-haul move must cover a long enough spread for the line-haul cost savings to offset the pickup, terminal, and delivery costs. For these reasons, most active U.S. rail intermodal corridors are in excess of 500 miles.

There are two active rail intermodal terminals in the SR 99 corridor. These facilities concentrate on domestic movements: UP Lathrop and BNSF Mariposa (Stockton). BNSF formerly offered Chicago service from its Fresno terminal, but discontinued that service in December 2014.

The practical potential for truck-to-rail modal shift depends on technical, economic, and market factors:

- **Technical.** The rail option must be operationally feasible in terms of customer access, rail network connectivity, rail equipment supply, and commodity compatibility with rail movement.
- **Economic.** The door-to-door option must be cost-competitive with trucking while yielding an acceptable profit margin to the railroad and other involved parties. Customers expect to pay substantially less for a rail option.
- **Market.** The rail option must meet the needs of both shipper and receiver in terms of reliability, transit time, shipment size, frequency, access, and cost.

If these criteria are met, customers can choose between roughly equivalent rail and truck options.

There have been multiple studies and initiatives related to additional rail intermodal terminals in the Valley. The primary aim of these proposals has been to take international container movements from the Ports of Oakland, Los Angeles, and Long Beach off the highways. One main proposal has been for a terminal in the Stockton-Lathrop area linked by rail shuttles to the Port of Oakland (the California Inter-Regional Intermodal Service, or "CIRIS" concept). The other major proposal has been for a terminal near Shafter, linked by rail shuttles to Oakland, Los Angeles-Long Beach, or both (the Shafter Logistics Center, or "SLC" concept, superseded by the Paramount Logistics Park and now the Wonderful Logistics Park). There was also a proposal to establish a rail intermodal terminal as part of a business park development at Crows Landing, but rail intermodal service is no longer contemplated as part of that project. Furthermore, this is one intermodal truck to rail terminal in Delano called RailEx, which provides non-stop, unit train, refrigerated box car service between Delano and Albany, New York.

Potential Customer Interest, Volumes, and Costs. Port rail shuttle interest, volume, and cost issues were addressed in a 2003 survey conducted by Cambridge Systematics (CS) for SJCOG; a 2003 feasibility study conducted for SJCOG by Tioga and Railroad Industries: a 2006 study conducted by Tioga, CS, and Railroad Industries on behalf of SJCOG; and a 2009 study conducted by Moffat and Nichol from the City of Shafter. These studies found that rail shuttle services might be attractive to customers, but face serious cost challenges. Most recently, due to the downturn in coal and oil cargo movements, the rail industry has been revisiting short-haul rail opportunities. According to a study being conducted by the Port of Long Beach, trucking costs have increased and rail costs have decreased so the cost difference is shrinking. However, the Port of Long Beach short-haul rail concept includes an assumption that short-haul rail would serve inland port destinations in the Inland Empire and not in the Valley.

The 2003 CS survey found considerable interest in rail intermodal options among SJV shippers and receivers. CS found very clear price sensitivity:

> "The overwhelming response of the interviews is that the usage of CIRIS was found to be extremely sensitive to the price of the CIRIS option relative to the current truck dray operations. CIRIS was considered not to be a viable alternative when the transportation costs were slightly higher than the current trucking operations. Shippers were also reluctant to switch if the price of CIRIS and the current truck dray were the same."

If the rail option were less expensive, however, CS found that a significant portion of the shippers interviewed stated that they would use a rail intermodal service:

> "The highest positive response rating was for next-day service from the Northern San Joaquin Valley region at 81 percent compared to 60 percent, which was the lowest response rating for Kern County."

The 2003 Tioga study estimated potential daily Oakland rail shuttle startup volumes at about 52 annual containers in the Stockton and Fresno markets, growing to about 265 containers at maturity. The study found that rail costs would exceed trucking costs, and estimated the public subsidy need at about $220 per trip.

The 2006 Tioga/CS study updated the 2003 estimates and examined phase implementation option, and confirmed the need for a subsidy:

> "CIRIS service will not be a profitable venture, especially on the shorter Oakland-Stockton leg. Although the upward pressure on trucking costs is raising the CIRIS rate and revenue ceiling, the length of haul is basically too short for profitable rail line haul economics."

The 2009 Moffat & Nichol study examined the potential for rail intermodal service between the ports and Shafter, and concluded that:

> "The challenge with Shafter, as with other potential "inland ports" throughout the United States, is that intermodal rail services become economic for both rail carriers and their customers only under a minimum level of distance and (mostly) volume. It is unclear whether current container volumes to/from the SJV can generate this demand… From Moffatt & Nichol's interviews with shippers, it is unclear that even if intermodal service from and to the Ports of Oakland, Los Angeles or Long Beach was available, it would be used. This is because current round-trip truck service that includes obtaining or returning an empty container from the port along with the loaded move is approximately $650~$700 or about the same as the total costs of a one-way intermodal rail move, including drayage and lift costs."

Importantly, since completion of the 2009 Moffatt & Nichol study, industrial warehousing in Shafter has more than tripled in size with the addition of four major distribution centers. As of 2016, these facilities generate 300 trucks per day.

Potential VMT Reductions. The potential for truck VMT reductions on I-5 and SR 99 through rail intermodal service depends on geography and truck routing patterns, as well as volume. To gauge the potential effectiveness of different rail intermodal strategies in truck VMT reduction, the study team analyzed the truck routing patterns for different combinations of port intermodal terminal locations, and inland importer/exporter locations. The analysis included:

- Routes from the Ports of Oakland and Los Angeles/Long Beach.
- Potential rail intermodal terminal sites at UP Lathrop (representative of the Stockton-Lathrop area), the Shafter Logistics Center, and the dormant BNSF rail intermodal terminal at Fresno (chosen as representative of a mid-SJV site). (**Figure 10.13**).
- Eleven representative distribution centers and production facilities known to be or potentially engaged in containerized import or export movements. (**Figure 10.14**).

Figure 10.13 Potential SJV Rail Intermodal Terminal Sites

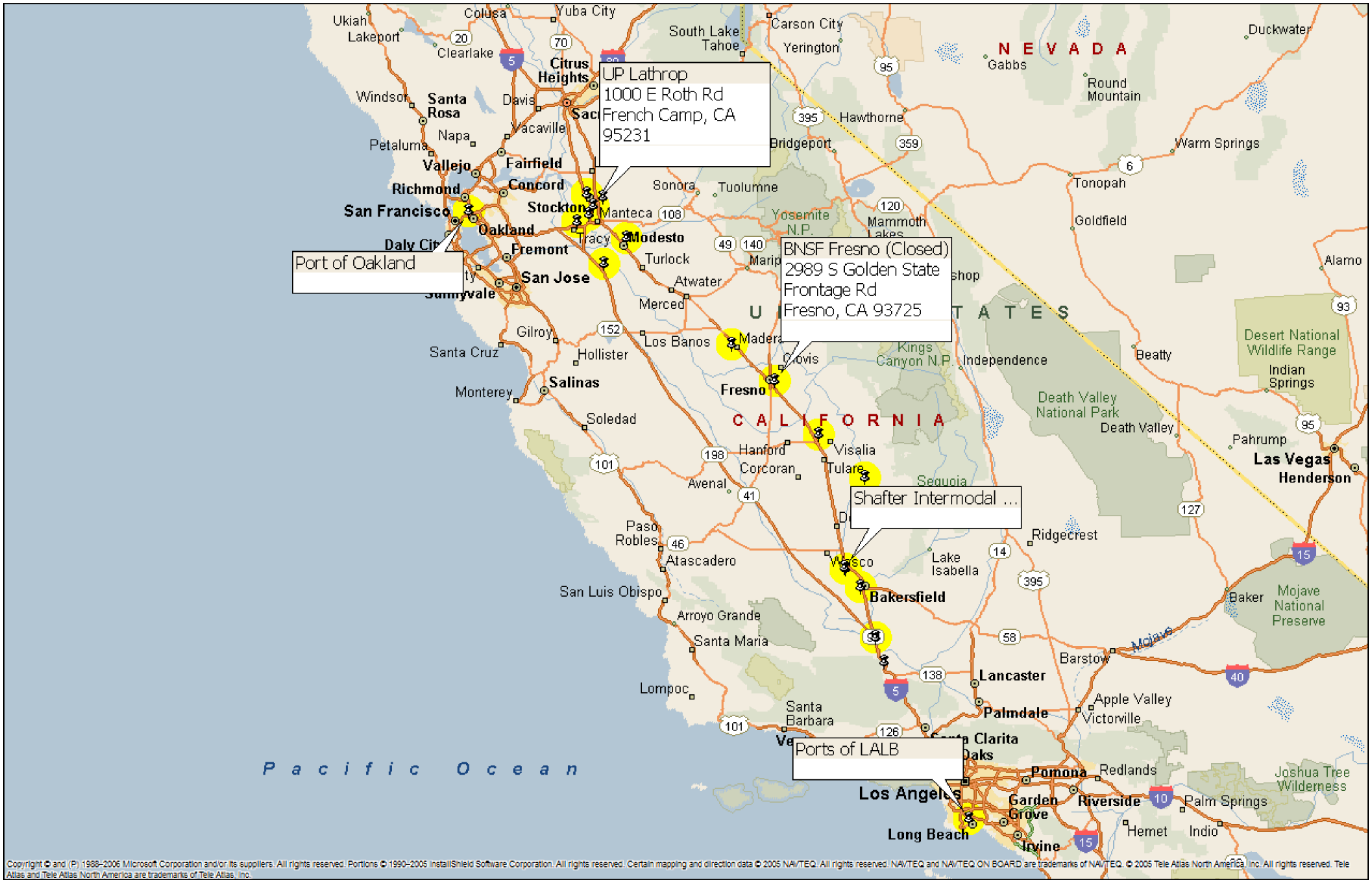
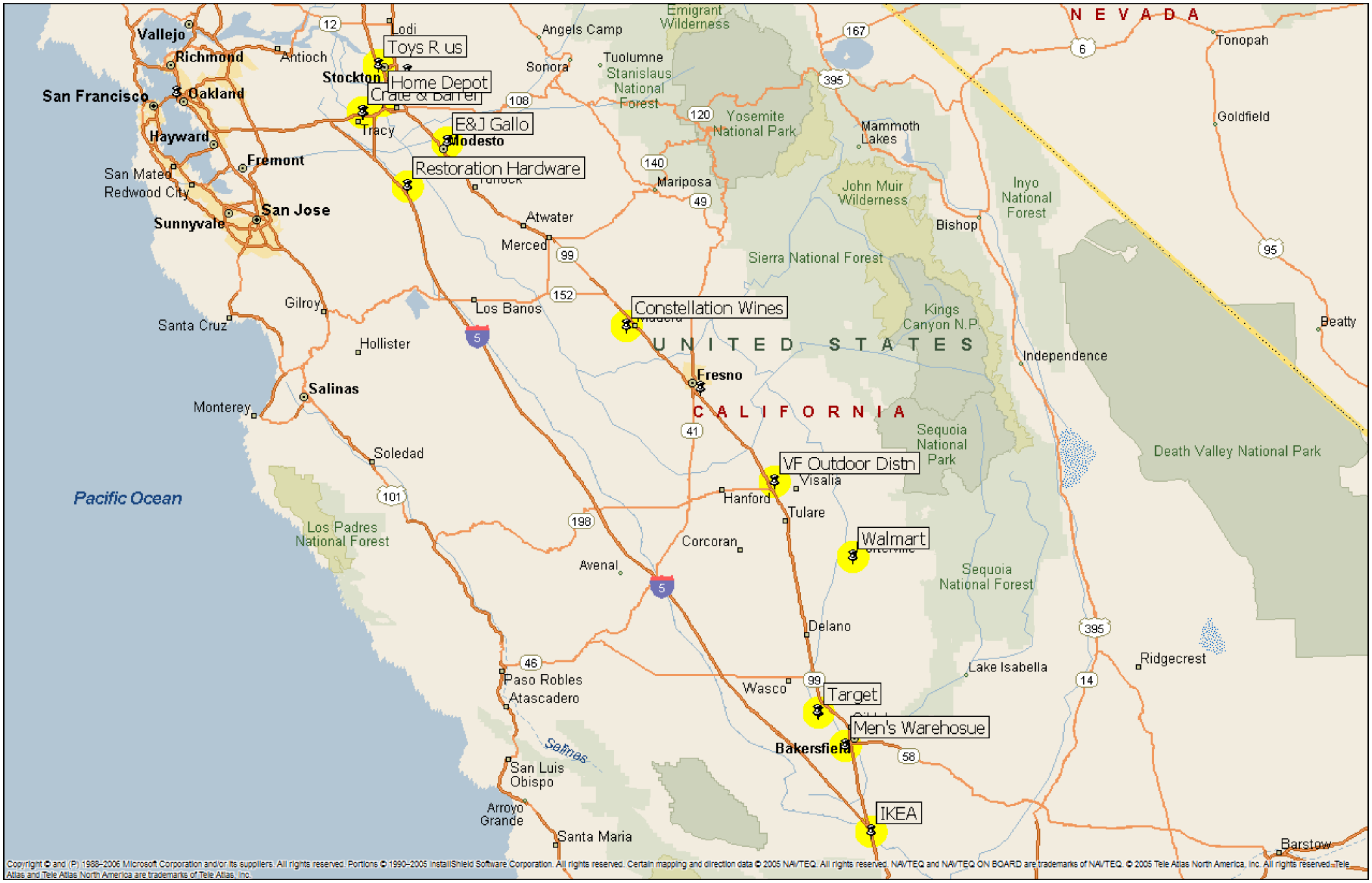


Figure 10.14 SJV Representative Importers and Exporters



For each SJV site and port pair (e.g. Oakland to E&J Gallo at Modesto), the team used Microsoft MapPoint 2006 to determine the likely truck route and segment mileages from the port itself, and from each of the three possible rail intermodal terminals. There were thus five possible routes (two ports and three inland terminals) for each of 11 inland facilities, a total of 55 route combinations. The team then determined the change in VMT on I-5 and SR 99 in the study area and the net VMT difference for the combined I-5/SR 99 corridor.

Port of Oakland Options. The truck VMT for Port of Oakland trips would be concentrated on:

- Short stretches of I-5 and SR 99 north of SR 120;
- SR 99 between SR 120 and SR 152;
- I-5 between I-580 and SR 152; and
- SR 99 south of SR 152.

The study team's findings suggest that:

- A rail shuttle between the Port of Oakland and a Lathrop-area terminal might be effective in reducing port truck VMT on the I-880/I-238/I-580/I-205 east-west corridor, but the effects on north-south I-5/SR 99 corridor would depend heavily on the final destinations of goods.
- A rail shuttle service between Oakland and Fresno would have a different set of VMT impacts. Rail intermodal service via Fresno would increase corridor truck VMT for points between Modesto and Stockton because Fresno is farther from those points than the SR 120 interchange where trucks from Oakland would access SR 99. Corridor VMT would decrease for points from Madera south.
- A shuttle between Oakland and Shafter would, as expected, significantly increase corridor VMT for origins and destinations in the upper SJV (e.g. Modesto and north); however, it is unlikely that goods coming through the Port of Oakland and destined for locations north of Shafter would travel by rail to Shafter. It is much more likely that rail trips to Shafter would originate from the Ports of Long Beach/Los Angeles rather than Oakland.

These findings reinforce the critical role of SJV geography in freight transportation. The route from Oakland meets the I-5/SR 99 corridor at the I-580/I-5/I-205 "triangle" to serve the Stockton/Lathrop area and points south. Replacing this trip with a rail shuttle would reduce east-west VMT but have minimal impact on north-south I-5/SR 99 corridor VMT. A rail shuttle to Fresno and/or Shafter would reduce truck VMT for the lower SJV but there would be no point in trucking containers north from Fresno or Shafter and back toward Oakland.

Ports of Los Angeles/Long Beach Options. The study team used a point on Terminal Island as a representative origin for container movements from the Ports of Los Angeles and Long Beach. From this point the likely route to SJV facilities would cover I-710/I-5 to the point where I-5 and SR 99 diverge north of the Kern County border. For points north of the I-5/SR 99 split, a truck from LA/LB would use either SR 99 or I-5 as appropriate. The analysis suggest that:

- A Shafter rail shuttle would move containers farther north on the same route as the highway trip resulting in some additional backhaul; however, this would still result in a net corridor VMT reduction for almost all SJV points examined due to the VMT reduced between the Ports of Los Angeles/Long Beach and the Kern County logistics facilities. The exception would be for the IKEA facility at Lebec, which is south of the Shafter site. There would also be a 46 VMT reduction on I-5 south of Kern County and a 45 VMT reduction on I-710/I-5 in LA County. Note, however, that large VMT reductions in serving Walmart in Porterville via Shafter would come from diverting trucks off of SR 99/SR 190 to SR 65. Intermodal service at Shafter remains in the planning stages with initial service to the Midwest via BNSF Railway possible due to the favorable travel distance.

- An LA/LB-Fresno rail shuttle would increase corridor VMT south of Fresno and reduce corridor VMT to the north. There would be little point in moving containers by rail to Fresno and then back tracking to points such as Bakersfield or Lebec.

- An LA/LB-Lathrop rail shuttle might yield large corridor VMT savings to points in the upper SJV such as Tracy and Lathrop, but realistically, those locations are more efficiently served via Oakland. There would be substantial VMT increases in the unlikely event that containers were trucked from Lathrop back south below Madera.

Summary of Potential Per-Trip VMT Impacts. Table 10.15 summarizes the estimated per-trip VMT changes within the study area on I-5 and SR 99. The data are "grayed out" for logistically challenged combinations (such as serving IKEA in Lebec via Oakland or backtracking from Fresno to Bakersfield on a movement from LA/LB). **Table 10.15** suggests that the best potential corridor VMT reductions would come from mid-SJV points such as Madera, Visalia, or Porterville.

Table 10.15 Summary of Per-Trip VMT Changes

Net SJV I5/SR99 Corridor Truck VMT Change per Trip, Highway vs. Rail Intermodal

Importer or Exporter	Crate & Barrel	Home Depot	Toys R Us	Restoration Hardware	E& J Gallo	Constellation Wines	VF Outdoor Distribution	Walmart	Target	Men's Warehouse	IKEA
City	Tracy	Lathrop	Stockton	Patterson	Modesto	Madera	Visalia	Porterville	Shafter	Bakersfield	Lebec
Intermodal Port & Terminal											
Oakland-Lathrop	**8**	**-1**	**-7**	20	1	36	36	35	20	21	20
Oakland-Fresno	116	108	108	73	78	**-27**	**-80**	**-81**	-96	-92	-97
Oakland-Shafter	179	180	180	143	171	65	**-53**	**-133**	-188	-190	-194
LALB-Lathrop	-244	-255	-261	-197	-202	**-83**	35	75	161	184	233
LALB-Fresno	-136	-146	-146	-144	-125	**-146**	**-81**	**-41**	45	71	116
LALB-Shafter	-73	-74	-74	-74	-32	**-54**	**-54**	**-93**	**-47**	**-27**	19

A more complete picture of potential VMT impacts will be analyzed as Part of Task 4. This will include an analysis of the overall anticipated VMT reduction between the port of entry and the logistics facilities in the Valley.

10.2.7 Truck Only Toll Lane

Definition

For the purposes of this analysis, the Truck Only Toll Lanes (TOT) definition includes a separated facility restricted to heavy duty trucks only that allows heavy weight and/or longer vehicles than currently allowed under the California Vehicle Code and federal regulations. Furthermore, the TOT concept includes reduced toll rates for zero and near-zero emission trucks. Zero emission trucks would not be required to pay a toll while near-zero emission trucks would pay a reduced toll. Since this pilot encourages near-zero and zero emission trucks, proper fueling infrastructure is needed along the routes. The weight of the trucks would be able to exceed the 80,000 pounds (current maximum) and exceed the maximum length of 75 feet.

Purpose

The purpose is to minimize conflicts between truck and automobile traffic, improve freight efficiencies by moving more goods with less equipment and labor, encourage emissions reductions, and raise revenue for maintaining the new facility.

Current Locations

There are not many truck only lanes in the United States and there are no truck only toll lanes (TOT) in operation. There are two truck only lanes (non-tolled) near and in the study area, including one in the north and south bound direction of I-5 in Los Angeles County at the SR 14 split and another on southbound I-5 in Kern County at the SR 99 junction near the Grapevine, respectively.[26]

Literature Review

In 2001, Southern California Association of Governments (SCAG) completed a study on truck only toll lanes for SR 60 and found that tolls would only be able to pay for 30 percent of the project costs. CALTRANS investigated truck only toll lanes on I-15 in 2005, and came to a similar conclusion. Caltrans continues to study the implementation of dedicated truck-only toll lanes on I-710 between the Ports of LA/LB and SR 60. A revised EIR/EIS for the project is expected to be recirculated in 2017. One of the alternatives under consideration for the I-710 Corridor includes a four-lane separated, limited access, zero-emission, truck-only toll lane. SCAG included this concept in its 2035 Regional Transportation Plan, along with an east-west connection that would move trucks on a dedicated system throughout the heavily populated Los Angeles region.

University of Virginia looked into truck only toll lanes for I-81, and they concluded that it would produce a positive net present value. This means that the money earned from tolls would be able to

[26] Caltrans web page, Truck Only Lanes, http://www.dot.ca.gov/trafficops/trucks/truck-only-lanes.html.

not only cover the cost of the project, but also generate profit. Their concept assumed a private-public partnership. However, the trucking industry disagreed with the assumptions that the time savings would be worth the cost so the project has not moved forward.

Georgia DOT explored the potential of implementing truck only toll lanes on I-75, but they concluded that the benefits associated with an HOV lane would outweigh the benefits of a TOT lane.[27] However, the Georgia Institute of Technology studied the potential implementation of TOT lanes in the Atlanta region in Georgia and concluded significant benefits of TOT lanes over other transportation strategies.[28]

Oregon looked at truck only toll lanes in 2009 and concluded that the major disadvantage would be that trucks would not be willing to pay said toll during off peak period since they would not be gaining any benefit of time savings.[29]

A multi state study was conducted among Montana, Illinois, Indiana, and Ohio of implementing truck only tolls along I-70 in 2011. However the study and plausibility came to a halt in 2013 due to funding and other priorities the states had.

Nashville MPO did a Preliminary Managed Lanes Feasibility Assessment where they took a glimpse at potential truck only toll lanes, but made no further investigation into a detailed study or implementation.[30]

Tampa Bay took a look at truck only toll lanes in their *Planning for Special Treatment of Trucks in Traffic* Study (2015).

Criteria

In the 2001, Southern California Association of Governments (SCAG) published a feasibility report for the potential implementation of truck only lanes. The report outlines criteria of highways that they found, through literature review, would provide a plausible environment in the application of a truck only lane. It should be noted that these conditions are considered for non-tolled truck only lanes.

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[27] Florida DOT, District 7, *Planning for Special Treatment of Trucks in Traffic*, January 2015. http://tampabayfreight.com/wp-content/uploads/FreightWhitePaper_PlanningforSpecialTreatmentofTrucks.pdf.

[28] Meyer, Michael D., P.E., *Feasibility of Truck Only Toll Lane Network: The Case of Atlanta, Georgia.* (Date unknown, but approximately 2005). http://ibtta.org/sites/default/files/GT%20report%20on%20TOTLs%20in%20Atlanta%20Metro.pdf.

[29] Florida DOT, District 7, *Planning for Special Treatment of Trucks in Traffic*, January 2015. http://tampabayfreight.com/wp-content/uploads/FreightWhitePaper_PlanningforSpecialTreatmentofTrucks.pdf.

[30] Parsons Brinckerhoff, Nashville Area MPO, *Managed Lanes Preliminary Feasibility Assessment, February 2015*. http://www.nashvillempo.org/docs/Managed_Lanes-2015.pdf.

- More than 30 percent of vehicle need to be trucks;
- Volume greater than 1,800 vehicles per lane-hour during peak hours; and
- Volume greater than 1,800 vehicles per lane-hour during off-peak hours.[31]

It is already noted that the SR 99 has some of the highest truck volumes in the state, ranging from 10 percent to 30 percent, with the state average at 9 percent. [32] In addition to these thresholds, the numbers instead of percentages of trucks should also be considered in urban areas.

Anticipated Benefits

The benefits as stated in the I-710 analysis include safety, reliability and congestion improvements, as well as reductions in emissions and the impacts of emissions. In addition, separate truck only lanes would improve driver comfort, reduce conflicts between trucks and cars, and could moderate travel speeds. The industry benefits would depend upon access to/from the TOT lanes and the time savings – would the savings result in an additional "turn"?

Separation of Trucks and Passenger Vehicles

The separation of heavy vehicles and passenger vehicles decreases risks of crashes for a few reasons, including different travel speeds, vertical sight distance, and braking distance. About 12 percent of passenger vehicle fatalities involve trucks, and the cause of most truck/auto collisions is due to an error made by the automobile driver. Drivers of automobiles often fail to understand the visibility and braking constraints that truck drivers face. The speeds would also increase since large trucks take up more space – removing them would increase the flow .

The trucking company benefits as well from the reduced accident rates of a truck only lane. In order to deliver on time, trucking companies consider reliability of corridors based on crash rates to ensure that they build enough travel time into their trip planning. Reducing the severity of incidents, as well as overall incident rates would benefit shippers by improving fleet efficiency, which in turn, could reduce the costs of goods. Furthermore, TOT lanes offer opportunities for smoother speeds and truck platooning – both of which improve fuel efficiency and save time. By eliminating automobile disturbances, such as vehicles merging/diverging at interchanges, trucks would brake less and change lanes less frequently. Just an addition of an extra lane alone will increase capacity, thus relieving congestion and lowering travel times. [33]

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[31] http://www.dot.ca.gov/traffops/trucks/truck-only-lanes.htm.

[32] Caltrans, *Updated Business Plan for SR-99, Vol I-III*, 2013.

[33] Forkenbrock, David J. and Jim March, Public Roads Issue No. Vol. 69 No. 2, Publication No. FHWA-HRT-05-007, *Issues in The Financing of Truck-Only Lanes,* September/October 2005. https://www.fhwa.dot.gov/publications/publicroads/05sep/02.cfm.

When there is a truck only lane, platooning can be implemented. Platooning reduces the distance between trucks, with the aid of wireless communication technology, in order to reduce wind resistance and increase capacity of a lane.[34]

The reduction in accidents, extra capacity, and overall increase in homogenous vehicle types will improve the flow while relieving congestion, this decreases travel times for both passenger and commercial vehicles. Since the SJV is a major agriculture hub and has many distribution centers, it relies heavily on punctual deliveries. Especially for the agriculture industry, the faster the perishable goods reach their destination, the better.[35] The reduction in congestion will also reduce the adverse environmental effects.[36]

Truck Tolling Information and Communication Technology

The current national framework for the connected vehicle (CV) environment envisions the use of dedicated short range communication (DSRC), cellular (e.g., 3G, 4G, LTE), or potentially other types of radio communication between vehicles themselves and the surrounding infrastructure. While some of the anticipated applications for CV-instrumented corridors could conceivably utilize non-DSRC communication to realize functionality, DSRC is the only option that would have specific impacts to the infrastructure.

Roadside DSRC has been established by the USDOT as a specifically allocated set of channels and frequencies for use in the anticipated CV world. It is also central to a continuing series of field evaluations and pilots being done by the USDOT. Recent estimates indicate that 20 percent of vehicles will be equipped with some form of CV technology by the year 2025. While other technologies could be implemented to achieve interconnectivity between vehicles, those that are included in the current USDOT-sponsored CV program for accomplishing nationally coordinated standards through non-proprietary (open) solutions.

For freeway and highway driving, on-board communications equipment would be integrated with application equipment and processors that would implement several envisioned application packages. Much of the enabling technology for the autonomous functions will reside in the vehicles themselves and will include, ultimately, a wide variety of Original Equipment Manufacturer on-board vehicle systems. This on-board equipment and technology will communicate with operation centers and remote application servers. The enabling architecture is expected to utilize cellular and DSRC communication.

Some or all of the proposed CV applications will require continuous DSRC coverage over the lengths of the most heavily used freeways and highways in the region (e.g., I-5 and SR 99). To enable this coverage, DSRC roadside installation sites would need to be implemented at regular intervals.

[34] Kahaner, Larry, Fleetowner, *Platooning si closer than you think – just like the trucks,* May 29, 2015. http://fleetowner.com/driver-management-resource-center/platooning-closer-you-think-just-trucks.

[35] Kings County Regional Transportation Plan and Sustainable Communities Strategies (2014).

[36] ttps://opendot.ideascale.com/a/dtd/Raise-interstate-highway-gross-vehicle-weight-limits/31750-7039.

Installation may also need to occur on connecting arterials to provide the degree of coverage necessary for some CV applications.

DSRC is capable of communicating with minimal latency over relatively short distances to ensure timely communication with vehicles. A dedicated DSRC installation would include (at minimum) a DSRC radio, pole, and cabinet. Alternative mounting options include existing light poles, catenary support structures, or signal pole standards. Existing ITS control cabinets can be used to house the DSRC equipment as well. The following list summarizes the typical DSRC field components (supporting systems, such as remote monitoring servers, are not included below):

- DSRC radio;
- DSRC poles and mounting structures;
- DSRC cabinet and equipment;
- Communications, power conduit, and cabling; and
- Splice vaults and pull boxes.

Roadway Pricing Applications for Freight

There are two types of tolls: fixed and variable tolls. The fixed tolls are predetermined based on the distance covered, axle amount, and/or weight per axle of the vehicle, and do not change during the day. The variable tolls are dependent on features, but also change throughout the day either in response to current conditions or according to a predetermined schedule (i.e., by time of day).[37]

California currently has toll lanes that charge fees based on the number of axles, but none of these corridors charge tolls that are dependent on the weight per axle of the vehicle. Charging by weight would be an ideal method for mitigating the damage caused by heavy trucks traveling on I-5 and SR 99. **Table 10.16** lists the states and facilities with toll rates based on per-axle weights.[38]

While tolling can be used to fund road maintenance and generate revenue, it also acts as a travel demand management strategy and therefore may reduce emissions. Discounted toll rates for low-emissions vehicles would encourage greater investment in low-emissions vehicles and technologies by operators and fleet managers.[39]

[37] http://mobility.tamu.edu/mip/strategies-pdfs/travel-options/technical-summary/variable-pricing-4-pg.pdf.

[38] FHWA, https://www.fhwa.dot.gov/policyinformation/tollpage/.

[39] Interviews for the MTC Freight Emissions Study.

Table 10.16 Interstate System Toll Roads in the United States
Weight per Axle Tolling

State	Facility Name
Delaware	John F. Kennedy Memorial Highway (Delaware Turnpike)
Florida	Alligator Alley (Everglades Parkway)
Indiana	Indiana East-West Toll Road
Kansas	Kansas Turnpike
Maine	Maine Turnpike
New Hampshire	F.E. Everett Turnpike
New Hampshire	Spaulding Turnpike
New Hampshire	Blue Star Turnpikes
New York	Gov. Thomas E. Dewey Thruway (Main Line)
New York	Berkshire Section
New York	New England Section
Ohio	Ohio Turnpike
Oklahoma	Turner Turnpike
Oklahoma	Will Rogers Turnpike
Oklahoma	H.E. Bailey Turnpike
South Carolina	Southern Connector

The elasticities of toll-paying behavior are different for freight vehicles than passenger cars. According to a project study jointly sponsored by the National Cooperative Freight Research Program and National Cooperative Highway Research Program, only a small proportion of freight drivers are open to the idea of roadway tolling. As explained in the report:

> *"In completing the surveys, truck drivers stated an extremely low willingness to pay even a token toll for different time savings scenarios. The research found that because respondents had such overwhelmingly negative attitudes about toll roads, they were not able to ascribe a true value to the benefits that toll roads provide."*[40]

In general, drivers that were willing to accept tolls were also ones that had experience with tolled facilities in the past and were more familiar with the benefits of such roadway pricing (e.g., travel time savings).

For I-5 in the Central Valley, the most significant challenges to TOT lanes include little if any time savings of such a facility and an alternative parallel route provided by SR 99. Use of TOT lanes would

[40] http://onlinepubs.trb.org/onlinepubs/ncfrp/ncfrp_w003.pdf

require an incentive to the trucking industry, such as exceedance of the State's truck size and weight limits.

Truck Size and Weight (Increase Size and/or Weight Limitation)

Having a higher weight or length limitation in the truck only toll lane would most directly benefit shippers, but the operating cost savings could also benefit consumers. However, increasing the size and weight limitations could impact safety – either positively or negatively. Arguments in favor of increasing the limits site the fact that fewer trucks would need to travel on the road, thus reducing safety risks. They further argue that the limitations passed in 1982 do not reflect safer equipment and technology on trucks today, such as anti-lock brakes and stringent driver training requirements. Opponents argue that heavier trucks require a longer braking distance, and that crashes involving heavier trucks tend to result in more severe injuries or death. Supporting the proponents, a study recently completed in the UK shows the results of truck safety since the increase in size and weight limits in 2001.

There is currently a shortage of trained truck drivers in the industry. However, this can be alleviated if there is a decrease in the amount of trucks that need driving, which will come about by increasing the weight limit in order to consolidate the same amount of goods needing transport into fewer trucks.[41]

In speaking with trucking industry representatives as part of this study, exceedance of the size (length of trucks) would provide significant benefits as many of the goods that they carry cube out before they weight out. The trucking companies support allowance of longer double trailers, such as two 48-foot trailers. This increase in goods moved by one truck instead of two trucks would improve efficiency of the trips by reducing shipping costs (labor, fuel and equipment cost savings).[42] Reducing the number of trucks hauling the goods would also result in emissions reductions.

The study found that truck-related crashes fell, and fatalities related to truck-involved crashes decreased by 35 percent.[1] Debates continue on this topic at the Federal level.

In addition to longer truck lengths, higher truck weight limits would benefit the agricultural exports moving out of the Valley, including dairy, wine, and nuts. For example, Tulare County is known for its copious amounts of milk exported daily. Those trucks that export the milk also tend to be some of the heaviest, easily hitting the 80,000-pound current limit. Therefore the economies that rely on milk production will be directly influenced, and benefit, from an increased maximum capacity on truck only toll lanes. Tulare also suffers some of the worst air quality due to its basin topography, thus the County as a whole would benefit from the encouragement of greener technologies and the decrease in congestion and trucks passing through due to increase weight limits (increased efficiency).[43]

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[41] http://www.joc.com/special-topics/driver-shortage.

[42] Kings County Regional Transportation Plan and Sustainable Communities Strategies (2014).

[43] Tulare County Association of Governments Regional Transportation Plan, Goods Movement Chapter (2014).

Greener Technology Incentive

Benefits arise when tolls are implemented, reduced for near-zero emission trucks and non-existent for zero emission trucks. This will mitigate the current environment impacts of current truck technology. This boost of receiving the benefits of the truck only toll lane with increased weight limits will hopefully outweigh the cost of implementing zero emission technology that will exclude the trucks from paying the toll.

Tulare county suffers some of the worst air quality due tot it's basin topography, therefore the county as a whole will benefit from the encouragement of greener technologies and the decrease in congestion and trucks passing through due to increased weight limits (increased efficiency).[44]

[44] Tulare County Association of Governments Regional Transportation Plan, Goods Movement Chapter (2014).

11.0 Identification of I-5/SR 99 Connectors

Section 4 compiled the lists of planned projects and applied them to the list of critical locations. All locations will be addressed by the planned improvements. In addition to investigating how these planned improvements will impact future traffic congestion and safety concerns, this section discusses improvements to connectors between I-5 and SR 99. Task 4 memorandum will investigate the benefits that significant improvements to these connectors could provide for SR 99.

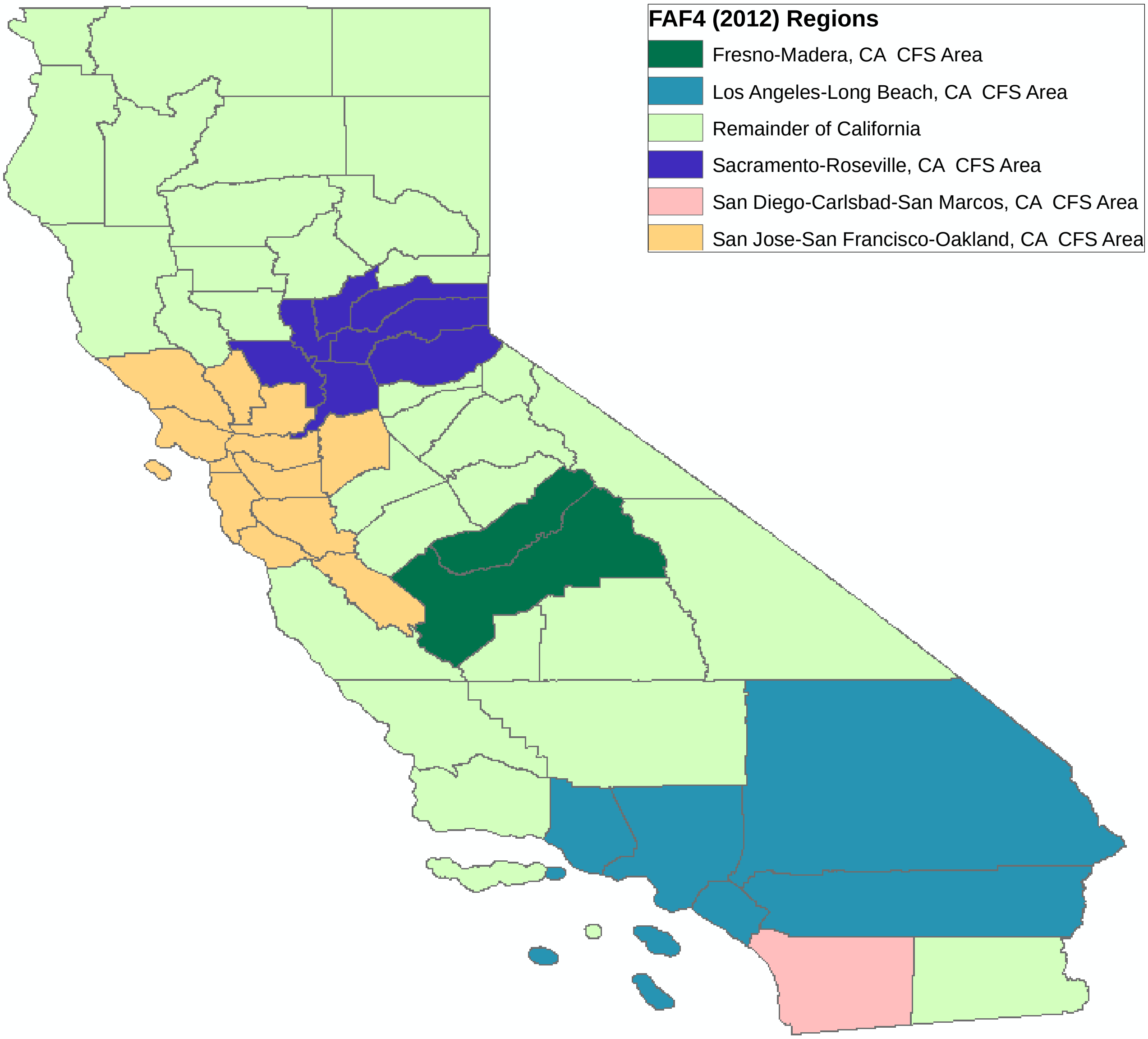
11.1 Methodology for Analyzing Potential I-5/SR 99 Connector Improvements

In order to identify the corridors with the most potential for shifting truck traffic from I-5 to SR 99, a commodities analysis was conducted for the region using FAF data. The table below provides the sum of all commodities shipped between the six Freight Analysis Framework (FAF) regions in California by truck and rail. Trucking contributes to 98.4 percent of total commodity flow. Understanding the commodity flows between FAF regions, along with the locations of major freight generators in each region and GPS data of existing truck origin-destination distribution provides the framework for investigation.

Figure 11.1 Volume of Commodities Transported between FAF Regions by Truck and Rail
Thousand Tons per Year

Region: From/To	Fresno	Los Angeles	Sacramento	San Diego	San Francisco	Rest of California	Grand Total
Fresno	20,527	1,426	383	136	3,222	10,657	36,350
Los Angeles	2,656	318,945	2,321	12,674	8,581	10,387	355,563
Sacramento	1,140	1,000	34,480	180	8,825	7,176	52,802
San Diego	167	3,693	170	33,787	1,353	584	39,754
San Francisco	2,638	7,525	8,351	1,335	134,618	16,497	170,964
Rest of California	13,590	16,214	6,936	1,216	13,236	112,250	163,443
Grand Total	**40,718**	**348,804**	**52,640**	**49,328**	**169,835**	**157,551**	**818,876**

Figure 11.2 FAF 4 Regions (2012)



Trucks that carry commodities make up the majority of trucks on state highways. However, empty trucks and non-freight trucks (moving trucks, utility trucks, landscaping, public agency trucks, tow trucks, construction trucks) are also significant, especially near urban areas. According to National surveys, freight truck traffic consists of 30 percent empty truck moves.

Due to the urban centers located along SR 99 and the rural nature of much of I-5 in the Valley, I-5 has more capacity to provide safe and efficient freight moves as compared to SR 99. In order to reduce congestion and encourage regional truck traffic to travel on I-5 in lieu of SR 99, some of the East/West corridors between I-5 and SR 99 should be considered for improvements.

Based on truck GPS origin/destination data, as well as existing truck traffic and the RTP future growth and network development projects, the following connectors have been identified as candidates for further analysis in the next task.

- SR 58 (future freeway alignment);
- SR 198;
- SR 132;
- SR 140;
- SR 165;
- SR 41; and
- SR 43/Lerdo West Beltway.

In the next task, the following analysis will be applied to these connectors. The outcomes and recommendations will be based on the feasibility of improvements and the ability of the improved corridors to attain minimum benefits. The proposed criteria for this analysis includes:

- Travel time between different regions via different routes;
- Other amenities such as trucks stops and fuel stations; and
- Volume of commodity flow between each origin-destination pair.

12.0 Feasibility Development of I-5/SR 99 Strategic Freight Programs

Table 12.1 shows goods movement-related strategic goals and objectives for the SJV region based on various state and regional transportation planning documents. Appendix A contains the excerpts of vision statements, goals, objectives, policies, and action plans related to goods movement that are part of these planning documents. Based on these, strategic programs are also identified in this table.

Table 12.1 Strategic Goals, Objectives, I-5/SR 99 Strategic Programs

Strategic Goal	Strategic Goal Definition	Strategic Objectives	Strategic Programs for I-5 and SR 99 commercial vehicle corridors
Improve Economic Competitiveness	Improve the contribution of freight transportation system to economic efficiency, productivity, and competitiveness.	• Vitalize/Revitalize commercial vehicle corridors. • Increase transportation choices for freight uses. • Improve access to key economic centers. • Reduce the cost of exporting products from the region, thereby increasing demand for those products and related processing/manufacturing jobs.	• All Strategic Programs under Other Strategic Goals • Overweight/oversize policy to allow heavier/longer trucks on I-5 in both directions between San Joaquin County boundary to Kern County boundary (exact boundaries of this project can be identified during future project development
Preserve Infrastructure	Improve state of good repair of freight transportation system.	• Conduct preventive maintenance and rehabilitation on freight transportation system. • Maximize utilization of available supply for freight uses. • Manage freight demand within existing supply. • Preserve land for future freight uses.	• I-5/SR 99 Roadways Pavement and Bridge Maintenance
Improve Mobility and Travel Time Reliability	Reduce freight transportation system user costs and maintain acceptable levels of service.	• Integrate multiple modes for freight uses. • Minimize congestion and increase operational efficiency for freight uses. • Increase network redundancy for freight uses.	• Truck only Toll Lanes on I-5 between I-5 and I-205 junction in San Joaquin County and I-5 and SR 99 junction in Kern County • I-5/SR 99 Capital Projects for Bottlenecks Congestion Relief • I-5/SR 99 Operational Projects for Bottlenecks Congestion Relief • I-5 to SR 99 Connector Capital and Operational Projects for Improved Accessibility • I-5/SR 99 Interchanges Reconfiguration Program for Key Freight Access Interchanges with Inadequate Design

Strategic Goal	Strategic Goal Definition	Strategic Objectives	Strategic Programs for I-5 and SR 99 commercial vehicle corridors
Improve Safety and Security	Reduce freight transportation system user losses and maintain the lowest level of threat to security.	• Minimize crashes and damages for freight uses. • Improve operations on freight transportation system. • Improve incident management and network resiliency on freight transportation system. • Stay informed about the current level of threat to security on freight transportation system.	• I-5/SR 99 Capital Projects for Safety Hotspots Alleviation • I-5/SR 99 Operational Projects for Safety Hotspots Alleviation
Improve Environment	Improve quality of life for humans and the natural environment impacted by freight uses.	• Stay informed about the current commercial vehicle environmental laws and regulations and improve their enforcement. • Conserve energy and natural resources for freight uses. • Minimize commercial vehicle emissions. • Improve development and implementation of mitigation measures for freight investments. • Improving environmental justice for freight investments.	• Container depot service near Stockton for Port of Oakland and Shafter for Ports of Long Beach/Los Angeles • Short-haul rail service between SJV region and Port of Oakland • Short-haul rail service between SJV region and Ports of Long Beach/Los Angeles
Use Innovative Technology and Practices	Research, test and implement innovative technologies and practices to operate, maintain, and optimize the efficiency of the freight transportation system.	• Develop commercial vehicle alternate fuel technology and fueling infrastructure. • Develop new commercial vehicle to commercial vehicle communications technology applications. • Develop new commercial vehicle operator information systems. • Develop institutional arrangements and business relationships to optimize freight transportation system usage and costs.	• Caltrans' Truck Parking Information System Demonstration on I-5 • This Study for Truck Platooning Demonstration on I-5 • Future Studies and Demonstrations by Public Agencies

Strategic Goal	Strategic Goal Definition	Strategic Objectives	Strategic Programs for I-5 and SR 99 commercial vehicle corridors
Plan and Collaborate to Fund Investments	Prioritize key freight transportation system investments and reduce public funding gaps through planning and collaboration with private sector.	• Develop freight projects list, timeline for implementation and public funding gap information. • Conduct studies to evaluate benefits of key freight transportation system investments. • Coordinate with other public agencies and private sector for freight project or service development and associated land use planning.	• This Study for Freight Projects List • This Study for Identified Funding Opportunities (will be included in Task 4) • This Study for Quantitative Evaluation of key Strategic Programs (will be included in Task 4) • Future Plans, Studies and Coordination Activities by Public Agencies

Source:

1) CalSTA and Caltrans, 2014 California Freight Mobility Plan (http://www.dot.ca.gov/hq/tpp/offices/ogm/CFMP/Web/Display_VisionGoalsObj_ARCH_E_36x48.pdf#zoom=85 (last accessed on May 11, 2016);
2) Fresno Council of Governments (COG) 2014 Regional Transportation Plan (RTP) (http://www.fresnocog.org/sites/default/files/publications/RTP/Final_RTP/2014_RTP_Chapter_Six_Final.pdf (last accessed on May 11, 2016));
3) Kern Council of Governments (COG) 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) (http://www.kerncog.org/images/docs/rtp/2014_RTP.pdf (last accessed on May 11, 2016);
4) Kings County Association of Governments (CAG) 2014 Regional Transportation Improvement Program (RTIP) (http://www.kingscog.org/vertical/sites/%7BC427AE30-9936-4733-B9D4-140709AD3BBF%7D/uploads/Chap_3_-_Policy_Element_-_2014_Final_RTP.pdf (last accessed on May 11, 2016);
5) Madera County Transportation Commission 2014 RTP/SCS (http://www.maderactc.org/wp-content/uploads/2014/07/MCTC-2014-Final-RTP-SCS.pdf (last accessed on May 11, 2016);
6) Merced County Association of Governments 2014 RTP/SCS (http://www.mcagov.org/DocumentCenter/View/314 (last accessed on May 11, 2016);
7) San Joaquin Council of Governments (COG) 2014 RTP/SCS (http://www.sjcog.org/DocumentCenter/View/484 (last accessed on May 11, 2016));
8) Stanislaus Council of Governments (COG) 2014 RTP/SCS (http://www.stancog.org/pdf/rtp/chapter-6-transportation-plan-and-policies.pdf (last accessed on May 11, 2016); and
9) Tulare County Association of Governments 2014 RTP/SCS (http://www.tularecog.org/wp-content/uploads/2015/06/Final-2014-Regional-Transportation-Plan-Sustainable-Communities-Strategy-FULL-DOCUMENT.pdf (last accessed on May 11, 2016).

12.1 Factors for Feasibility Assessment

A qualitative assessment of the feasibility of strategic programs was conducted in this memorandum using the following measures:

- Capital cost per project element – High (greater than $250 million), Medium ($50 million to $250 million), Low (less than $50 million);
- Potential Percent of Truck VMT Reduced – High (greater than 5 percent, say), Low (less than 5 percent, say); and
- Funding situation – Fully funded, Partially funded, Unfunded.

Other qualitative considerations such as operational, technological and institutional barriers associated with the identified strategic programs are discussed earlier in Sections 4.1 and 4.2 of this memorandum.

More detailed evaluation will be conducted for a few of the strategic programs in the Task 4 memorandum of this Study, including: 1) truck only toll corridor on I-5 with and without increased weight limit; 2) I-5 with and without truck platooning; 3) I-5 with varying levels of market penetration of zero emission and near-zero emission commercial vehicles; and 4) east/west connectors between I-5 and SR 99 improvements program.

Potential performance measures for these detailed evaluations are categorized and listed as follows:

1. Facility Owner/Commercial Vehicle Operator related: a) capital costs per year; b) routine maintenance costs per year; c) cost of installation and maintenance of roadside technology; d) user fee-based revenue per year; e) cost of installation and maintenance of new vehicle and on-board technology; f) VMT avoided and related vehicle operating cost savings per year; and g) other shipper cost savings per year.
2. Community impacts related: a) VHT reduction potential; b) crash reduction potential; c) air emissions impacts avoided.
3. Funding related: a) anticipated or Adjusted timeline for implementation of projects and programs; b) suitability to new types of federal, state and local funding; and c) suitability to public-private partnership.

12.2 Feasibility Results

Table 12.2 presents results of a qualitative assessment of feasibility of strategic programs for I-5 and SR 99 commercial vehicle corridors.

Table 12.2 Qualitative Assessment of Feasibility for I-5/SR 99 Strategic Programs

Strategic Program for I-5 and SR 99 commercial vehicle corridors	Capital Cost per Project Element	Percent Truck VMT Reduced	Public Funding Situation	Comments on Feasibility
I-5/SR 99 Roadways Pavement and Bridge Maintenance	Mostly Low, Sometimes Medium	Not Applicable	Mostly Funded	This program already exists. Maintenance of long and old bridges would be resource intensive.
Overweight/oversize policy to allow heavier/longer trucks on I-5 in both directions between San Joaquin County boundary to Kern County boundary (exact boundaries of this project can be identified during future project development)	Unknown (could require reinforcement of bridges and pavement and would likely result in additional maintenance costs)	High	Not Applicable	The economic advantages to freight transportation system users, and possible extension to Oregon along I-5 in the north and possible extension to Nevada along SR 58/I-15 in the east needs to be further evaluated. The institutional barriers to implementing this program would be difficult to cross. There are also operational challenges to freight transitioning from the policy implemented portion of I-5 to other parts of the freight transportation system.
Truck only Toll Lanes on I-5	High	Not Applicable	Unfunded	This program would have substantial mobility, safety and air emission reduction benefits to freight transportation system users, especially if planned in conjunction with OS/OW, truck platooning and clean truck technology
Truck climbing lanes at steep locations such as Altamont Pass, Pacheco Pass and Tehachapi Passes (Grapevine area and SR 58 Eastbound)	Medium	Not Applicable	Unfunded	This program would have substantial mobility and safety benefits to freight transportation system users. They would also strengthen interregional connectivity.
I-5/SR 99 Capital Projects for Bottlenecks Congestion Relief	Mostly Medium	Not Applicable	Partially Funded	This program would have substantial mobility and travel time reliability benefits to freight system users, and

Strategic Program for I-5 and SR 99 commercial vehicle corridors	Capital Cost per Project Element	Percent Truck VMT Reduced	Public Funding Situation	Comments on Feasibility
				projects under this program are already planned. Site constraints could reduce the anticipated benefits.
I-5/SR 99 Operational Projects for Bottlenecks Congestion Relief	Mostly Low	Not Applicable	Partially Funded	This program would have local mobility benefits to freight system users, and projects under this program are already planned.
I-5 to SR 99 Connector Capital and Operational Projects for Improved Accessibility	Mostly Medium	Unknown	Partially Funded	This program would have substantial mobility and travel time reliability benefits to freight system users, and projects under this program are already planned. Site constraints could reduce the anticipated benefits. Improvements to a few east/west connectors between I-5 and SR 99 needs to be further evaluated.
I-5/SR 99 Interchanges Reconfiguration Program for Key Freight Access Interchanges with Inadequate Design	Mostly High, Sometimes Medium	Not Applicable	Partially Funded	This program would have local but substantial mobility and safety benefits to freight system users, and projects under this program are already planned. Site constraints could reduce the anticipated benefits.
I-5/SR 99 Capital Projects for Safety Hotspots Alleviation	Mostly Medium	Not Applicable	Partially Funded	This program would have substantial safety and travel time reliability benefits to freight system users, and projects under this program are already planned. Site constraints could reduce the anticipated benefits.
I-5/SR 99 Operational Projects for Safety Hotspots Alleviation	Mostly Low	Not Applicable	Partially Funded	This program would have local safety benefits to freight system users, and projects under this program are already planned.

Strategic Program for I-5 and SR 99 commercial vehicle corridors	Capital Cost per Project Element	Percent Truck VMT Reduced	Public Funding Situation	Comments on Feasibility
Container depot service near Stockton for Port of Oakland and in Shafter for Ports of Long Beach/ Los Angeles	Unknown	Low	Privately funded	This program would improve access to freight equipment mainly for port users. Port truck trips represent a small percentage of overall truck moves in the Valley. The economic advantages to freight transportation system users needs to be further evaluated.
Short-haul rail service between SJV region and Port of Oakland	High (if new rail intermodal facility is built), otherwise Low (mostly relating to Rolling Stock for Rail Shuttle)	High for mid-SJV locations, Low otherwise	Unfunded	This program would increase mode choice mainly for port users and create new economic development opportunities. This would also require an agreement with the railroad operator to provide a short-haul rail service, and a competitive pricing.
Short-haul rail service between SJV region and Ports of Long Beach/ Los Angeles	Medium	Low-Medium	Not Applicable	This program would increase mode choice mainly for port users and create new economic development opportunities. This would require the cargo owners, a stevedoring company, vessel operator or other entity contracting with a railroad operator in order to implement short-haul rail service. If implemented by a public agency, such an operation would likely require subsidies in order to attract users.
Caltrans' Truck Parking Information System on I-5	Medium	Not Applicable	Partially Funded	This program would increase utilization of existing parking supply. The economic advantages of truck parking information system needs to be further evaluated.

Strategic Program for I-5 and SR 99 commercial vehicle corridors	Capital Cost per Project Element	Percent Truck VMT Reduced	Public Funding Situation	Comments on Feasibility
This Study for Truck Platooning Demonstration on I-5	Medium	Not Applicable	Not Applicable	This program would increase tion of highway capacity. The economic advantages of truck platooning needs to be further evaluated.

13.0 Overview of Task 4: Projects & Programs Assessment

Building on the Tasks 2 and 3 Report, which identified issues, summarized proposed improvements, and developed additional solutions for improving the movement of freight along I-5 and SR 99, this report (Task 4) evaluates those identified projects and programs. The evaluation process includes the selection of performance measures, anticipated benefits of projects identified by the counties, and the analysis of I-5/SR 99 connector routes given certain levels of improvement. This last analysis focuses on the potential for shifting long haul or through truck trips from SR 99 to I-5.

This document is structured as follows:

Section 2: A summary of projects and strategic programs identified in Tasks 2 and 3, a list of performance measures and their relationship to the Study's strategic goals, and an assessment of key projects and programs based on the identified performance measures;

Section 3: An overview of funding sources at the Federal, State, regional, and local levels, an examination of project readiness including implementation timelines, and identification of potential barriers to implementation; and

Section 4: Prioritization of projects based on performance, approval status, and funding availability and a description of next steps.

14.0 Assessment of Strategic Projects and Programs

14.1 Summary of Tasks 2 and 3 Memorandum

Tasks 2 and 3 of this project accomplished a number of goals. First, they identified strategic goals and objectives in the region related to freight movement and identified projects and programs that can help achieve those goals. Second, the Tasks summarized recent project concepts reports including truck only toll lanes and inland port facilities. Third, they explored ongoing research in the realms of truck parking, intelligent transportation systems (ITS), and truck platooning. Finally, the Tasks discussed best practices for goods movement performance measures and potential criteria for the feasibility analysis.

The strategic goals of the I-5/SR 99 Programs include:

- Improve Economic Competitiveness;
- Preserve Infrastructure;
- Improve Mobility and Travel Time Reliability;
- Improve Safety and Security;

- Improve the Environment;
- Use Innovative Technology and Practices; and
- Plan and Collaborate to Fund Investments

Table 14.1 presents a comprehensive list of all projects identified in previous tasks with cost, a timeline for completion, and the strategic goal addressed. In addition to these specific projects, a number of programmatic projects were identified and are shown in: SJVCOG member counties input and the following source documents: (a) CalSTA and Caltrans, 2014 California Freight Mobility Plan; (b) Fresno Council of Governments (COG) 2014 Regional Transportation Plan (RTP); (c) Kern Council of Governments (COG) 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS); (d) Kings County Association of Governments (CAG) 2014 Regional Transportation Improvement Program (RTIP), I Madera County Transportation Commission 2014 RTP/SCS, (f) Merced County Association of Governments 2014 RTP/SCS, (g) San Joaquin Council of Governments (COG) 2014 RTP/SCS; (h) Stanislaus Council of Governments (COG) 2014 RTP/SCS; and (i) Tulare County Association of Governments 2014 RTP/SCS.

Table 14.2 shows the strategic programs would help address the strategic goals listed above but are not definable as specific projects.

Table 14.1 I-5/SR 99 Goods Movement Corridor Study Project List

County	Study ID	Project ID	Route or Facility ID	Title and Description	Timeline (Years)	Total Project Cost (Thousands)	Strategic Goal Addressed
Fresno	FRE-03	FRE500766	SR 99	California High-Speed Rail Project-SR 99 Re-Alignment	0-5	$ 189,500	Economic Competitiveness
Fresno	FRE-10	FRE111353	SR 99	Herndon @ SR 99- Widen Undercrossing	6-15	$ 26,365	Safety/Security
Fresno	FRE-11	FRE500404	SR 99	Mountain View and SR 99 Overcrossing: Widen Overcrossing and Improve Ramps	0-5	$ 45,000	Safety/Security
Fresno	FRE-12	FRE500143	SR 99	NB SR 99 Herndon Off Ramp: Signalize & Widen Ramp	0-5	$ 1,000	Safety/Security
Fresno	FRE-15	FRE500520	SR 99	SR 99 & SR 43/Floral Rd Interchange: Widen and Replace Bridge	16-24	$ 13,000	Infrastructure Preservation, Mobility/Reliability
Fresno	FRE-16	FRE111352	SR 99	SR 99 @ American Avenue Interchange	6-15	$ 10,385	Safety/Security
Fresno	FRE-17	FRE500521	SR 99	SR 99 Interchange at Shaw: Improvements	16-24	$ 86,000	Safety/Security
Fresno	FRE-18	FRE111355	SR 99	SR 99 Interchange North & Cedar	6-15	$ 81,605	Safety/Security
Fresno	FRE-19	FRE500518	SR 99	SR 99-Central and Chestnut: Upgrade Interchange	6-15	$ 72,500	Safety/Security
Fresno	FRE-20	FRE111328	SR 99	Veterans Blvd Barstow to Bullard Bryan-New 6 LD Super Arterial, Freeway Interchange & Grade Separation @ SR 99	6-15	$ 105,619	Mobility/Reliability
Fresno	FRE-21	15d	I-5	Widen I-5 between Kings County and Merced County lines	0-5	$ 198,000	Mobility/Reliability
Fresno	FRE-26	99e	SR 99	Widen SR 99 from 6 to 8 lanes from Central Ave to Bullard Ave.	0-5	$ 283,000	Mobility/Reliability

County	Study ID	Project ID	Route or Facility ID	Title and Description	Timeline (Years)	Total Project Cost (Thousands)	Strategic Goal Addressed
Fresno	FRE-08	FRE500514/21	SR 180	Extend SR 180 from Mendota to I-5	6-15	$ 223,000	Mobility/Reliability. Improve Economic Competitiveness
Fresno	FRE-24	NEW	SR 198	Widen SR 198 from 2 to 4 lanes from Lemoore Naval Air Station to I-5 (Fresno County Portion).	6-15	$ 193,000	Mobility/Reliability
Kern	KER-02	KER08RTP020	SR 58	Centennial Corridor	0-5	$ 698,000	Mobility/Reliability. Improve Economic Competitiveness
Kern	KER-03	51 / KER08RTP114	Centennial Connector	Centennial Connector – SR 58/Cottonwood Rd to Westside Parkway	0-5	$ 698,000	Mobility/Reliability. Improve Economic Competitiveness
Kern	KER-52	KER08RTP020	Centennial Corridor	I-5 to Westside Parkway at Heath Rd	25 or more years	$ 500,000	Mobility/Reliability. Improve Economic Competitiveness
Kern	KER-32	15e / KER08RTP027	I-5	Widen I-5 between Fort Tejon and SR 99.	25 or more years	$ 86,000	Mobility/Reliability
Kern	KER-51	KER14RTP001	SR 46	Brown Material Rd to I-5 – interchange upgrade at 1-5 – Phase 4A	0-5	$ 27,000	Safety/Security
Kern		KER08RTP018	SR 46	Brown Material Rd to I-5 – interchange upgrade at 1-5 – Phase 4B	6-15	$ 70,000	Safety/Security
Kern	KER-31	45 / KER08RTP072 KER08RTP113	7th Standard Rd	Widen 7th Standard Road from I-5 to Sante Fe Way.	6-15	$ 90,000	Mobility/Reliability
Kern	KER-43	KER08RTP028	I-5	7th Standard Rd Interchange – reconstruct	25 or more years	$ 54,000	Safety/Security, Infrastructure Preservation
Kern	KER-45	KER08RTP105	SR 99	At various locations – ramp improvements (HOV – ramp metering)	16-24	$ 148,000	Innovative Technology and Practices
Kern	KER-45a	KER08RTP105	SR 99	SR 99 & Hwy 119	16-24		

County	Study ID	Project ID	Route or Facility ID	Title and Description	Timeline (Years)	Total Project Cost (Thousands)	Strategic Goal Addressed
Kern	KER-45b	KER08RTP105	SR 99	SR 99 & Hosking Avenue (completed 2016)	16-24		
Kern	KER-45c	KER08RTP105	SR 99	SR 99 & Panama Lane	16-24		
Kern	KER-45d	KER08RTP105	SR 99	SR 99 & White Lane	16-24		
Kern	KER-45e	KER08RTP105	SR 99	SR 99 & Ming Avenue	16-24		
Kern	KER-45f	KER08RTP105	SR 99	SR 99 & California Avenue	16-24		
Kern	KER-45g	KER08RTP105	SR 99	SR 99 & Rosedale Highway	16-24		
Kern	KER-45h	KER08RTP105	SR 99	Hageman Flyover	16-24		
Kern	KER-45i	KER08RTP105	SR 99	SR 99 & Olive Drive	16-24		
Kern	KER-45j	KER08RTP105	SR 99	SR 99 & Snow Road (New Interchange)	16-24		Safety/Security, Economic Competitiveness
Kern	KER-45k	KER08RTP105	SR 99	SR 99 & 7th Standard Road	16-24		
Kern	KER-46	KER08RTP115	SR 99	At Snow Rd – construct new interchange	16-24	$ 138,200	Safety/Security, Economic Competitiveness
Kern	KER-49		SR 99	Reconstruct interchange at Whisler	25 or more years	$ 54,000	Safety/Security
Kern	KER-48		SR 99	Reconstruct interchange at Pond Rd	25 or more years	$ 54,000	Safety/Security
Kern	KER-47	KER18RTP001	SR 99	Construct new interchange at Hanawalt	25 or more years	$ 88,811	Safety/Security, Economic Competitiveness
Kern	KER-44	KER08RTP056	SR 99	Rt 99 – widen bridge to four lanes; reconstruct ramps	25 or more years	$ 134,000	Mobility/Reliability
Kern	KER-60	KER18RTP002	North Beltway	I-5 to SR 65 – Burbank Street Alignment – construct new highway	25 or more years	$ 500,000	Mobility/Reliability. Improve Economic Competitiveness
Kern	KER-59	KER08RTP139	West Beltway	Pacheco Rd. Westside Parkway – construct new facility	16-24	$ 115,793	Mobility/Reliability. Improve Economic Competitiveness

County	Study ID	Project ID	Route or Facility ID	Title and Description	Timeline (Years)	Total Project Cost (Thousands)	Strategic Goal Addressed
Kern	KER-58	KER08RTP102,	West Beltway	Rosedale Hwy to 7th Standard Rd – construct new facility	6-15	$ 115,793	Mobility/Reliability. Improve Economic Competitiveness
Kern	KER-57	KER08RTP097	West Beltway	Taft Hwy to Pacheco Rd – construct new facility	16-24	$ 90,000	Mobility/Reliability. Improve Economic Competitiveness
Kern	KER-55	KER08RTP076	West Beltway-North	7th Standard Rd to SR 99 –extend freeway	25 or more years	$ 100,000	Mobility/Reliability. Improve Economic Competitiveness
Kern	KER-54	KER08RTP075	West Beltway-South	Taft Hwy to I-5 – extend freeway	25 or more years	$ 100,000	Mobility/Reliability. Improve Economic Competitiveness
Kern	KER-50	KER08RTP016	West Beltway	Rosedale Hwy to Westside Parkway – construct new facility	6-15	$ 93,500	Mobility/Reliability. Improve Economic Competitiveness
Kern	KER-56	KER08RTP092	SR 58 (existing)	Rosedale Hwy – SR 43 to Allen Rd – widen existing highway	6-15	$ 59,000	Mobility/Reliability
Kern	KER-53	KER08RTP038, KER08RTP092	SR 58 (existing)	Widen SR 58 (Rosedale Hwy) – I-5 to SR 43		$ 500,000	Mobility/Reliability
Kings	KIN-01	NEW	I-5	Widen I-5 from 2 to 4 lanes between Kern and Fresno Counties.	6-15	$ 80,000	Mobility/Reliability
Kings	KIN-02	63	SR 198	Widen SR 198 from 2 to 4 lanes from Lemoore Naval Air Station to I-5 (Kings County Portion).	6-15	$ 31,000	Mobility/Reliability
Kings	KIN-03	65	SR 41	Widen SR 41 from 2 to 4 lanes from SR 198 to I-5.	6-15	$ 68,000	Mobility/Reliability
Madera	MAD-01	MAD417004	SR 99	SR99: 4-Lane Freeway to 6-Lane Freeway Ave 12 to Ave 17	0-5	$ 91,010	Mobility/Reliability
Madera	MAD-02	MAD417003	SR 99	SR99: 4-Lane Freeway to 6-Lane Freeway, Ave 7 to Ave 12	16-24	$ 160,571	Mobility/Reliability

County	Study ID	Project ID	Route or Facility ID	Title and Description	Timeline (Years)	Total Project Cost (Thousands)	Strategic Goal Addressed
Madera	MAD-03	MAD217030	SR 99	4th Street/SR 99 Interchange Improvements		$ 5,918	Safety/Security
Madera	MAD-05	5335	SR 99	Madera 6 Lane	0-5		Mobility/Reliability
Madera	MAD-06	MAD417001	SR 99	Reconstruct Interchange	0-5	$ 68,000	Safety/Security
Madera	MAD-07	6297	SR 99	South Madera 6 Lane	0-5		Mobility/Reliability
Madera	MAD-08	MAD418002	SR 99	Widen SR99: In Fresno & Madera Counties, from south of Grantland Ave UC to north of Avenue 7	0-5	$ 54,000	Mobility/Reliability
Madera	MAD-11	0	SR 99	Widen SR 99 from 4 to 6 lanes from Avenue 17 to Avenue 21	Unknown	N/A	Mobility/Reliability
Madera	MAD-12	0	SR 99	Widen SR 99 from 4 to 6 lanes from Avenue 23 to Madera County Line	Unknown	N/A	Mobility/Reliability
Merced	MER-03	0161A	SR 99	Highway 99: Livingston Widening Northbound	0-5	$ 42,870	Mobility/Reliability
Merced	MER-04	0161B	SR 99	Highway 99: Livingston Widening Southbound	0-5	$ 38,950	Mobility/Reliability
Merced	MER-09		I-5	Widen I 5 from 4 to 6 lanes in Merced County	25 or more	N/A	Mobility/Reliabiilty
Merced	MER-01a		Atwater-Merced Expressway	Atwater-Merced Expressway, Phase 1B: Green Sands Ave to Santa Fe Drive (Access to Castle Development & Airport)	6-15	$ 66,200	Mobility/Reliability. Improve Economic Competitiveness
Merced	MER-01b		Atwater-Merced Expressway	Atwater-Merced Expressway, Phase 2: Reconnect Santa Fe Drive to SR 59 North (Provides direct connect from Northern Merced to U.C. Merced)	6-15	$85,000	Mobility/Reliability. Improve Economic Competitiveness
Merced	MER-01c		Atwater-Merced Expressway	Atwater-Merced Expressway, Phase 3: New Hwy 99 Interchange to Hwy 140	6-15	$ 71,800	Mobility/Reliability. Improve Economic Competitiveness

County	Study ID	Project ID	Route or Facility ID	Title and Description	Timeline (Years)	Total Project Cost (Thousands)	Strategic Goal Addressed
Merced	MER-06	5707A	SR 152	Los Banos Bypass, Segment 1: Btwn. Hwy 165 and E. Hwy 152 with signalized intersections	6-15	$ 68,800	Mobility/Reliability, Safety/Security
Merced	MER-07	5707B	SR 152	Los Banos Bypass, Segment 2: Btwn. Hwy 165 and W. Hwy 152 with signalized intersections	25 or more	$ 206,000	Mobility/Reliability, Safety/Security
Merced	MER-08		SR 152	Los Banos Bypass, Segment 3: Construct 3 interchanges at W. Hwy 152, Hwy 165 and E. Hwy 152	25 or more	$ 192,000	Mobility/Reliability, Safety/Security
Merced	MER-10	19	SR 152	Widen SR 152 between SR 99 and US 101 (in Merced County)	0-5	N/A	Mobility/Reliability
San Joaquin	SJ-08	SJ07-2020	I-5	I-5 at Eight Mile Road Interchange	6-15	$ 51,400	Safety/Security
San Joaquin	SJ-09	SJ11-2004	I-5	I-5 at Hammer Lane Interchange	6-15	$ 37,200	Safety/Security
San Joaquin	SJ-11	SJ07-2005	I-5	I-5 at Louise Avenue Interchange	0-5	$ 33,000	Safety/Security
San Joaquin	SJ-12	SJ11-2006	I-5	I-5 at Otto Drive Interchange	6-15	$ 92,800	Safety/Security
San Joaquin	SJ-13	SJ11-3066	I-5	I-5 at Roth Road Interchange	0-5	$ 16,800	Safety/Security
San Joaquin	SJ-14	15b	I-5	Widen I-5 between SR 120 and I-205	0-5	$ 207,970	Mobility/Reliability
San Joaquin	SJ-15	15a	I-5	Widen I-5 from 1 mile north of SR-12 to SR-120	0-5	$ 91,000	Mobility/Reliability
San Joaquin	SJ-16	15c	I-5	Widen I-5 from 4 to 6 lanes from 1 mile north of SR-12 to Sacramento County line	6-15	$ 94,000	Mobility/Reliability
San Joaquin	SJ-24	99a	SR 99	Widen SR 99 from French Camp Rd to Mariposa Rd 6 to 8 lanes, with new interchange	0-5	$ 100,000	Mobility/Reliability
San Joaquin	SJ-26b	SJ11-2023	SR 99	SR 99 at Austin Road Interchange	0-5	$ 3,000	Safety/Security

County	Study ID	Project ID	Route or Facility ID	Title and Description	Timeline (Years)	Total Project Cost (Thousands)	Strategic Goal Addressed
San Joaquin	SJ-30	SJ11-2002	SR 99	SR 99 at Eight Mile Road Interchange	0-5	$ 65,900	Safety/Security
San Joaquin	SJ-31	SJ11-2008	SR 99	SR 99 at Gateway Boulevard Interchange	0-5	$ 9,930	Safety/Security
San Joaquin	SJ-32	SJ07-2006	SR 99	SR 99 at Harney Lane Interchange	16-24	$ 39,183	Safety/Security
San Joaquin	SJ-33	SJ07-2015	SJ07-2015	SR 99 at Main Street/UPRR Interchange (Ripon)	0-5	$ 10,000	Safety/Security
San Joaquin	SJ-34	SJ11-2001	SJ11-2001	SR 99 at Morada Interchange	0-5	$ 69,800	Safety/Security
San Joaquin	SJ-35	SJ 14-2001	SJ 14-2001	SR 99 at Raymus Expressway Interchange	0-5	$ 3,000	Safety/Security
San Joaquin	SJ-36	SJ11-2015	SJ11-2015	SR 99 at SR-12 West (Kettleman Lane) Interchange	6-15	$ 16,164	Safety/Security
San Joaquin	SJ-37	SJ14-1003	SJ14-1003	SR 99 Widening	Unknown	$ 3,000	Mobility/Reliability
San Joaquin	SJ-38	3045	3045	Turner Road Interchange Operational Improvements	0-5	$ 3,061	Safety/Security, Mobility/Reliability
San Joaquin	SJ-39	0	0	Widen SR 99 From Lodi to Sacramento County Line	6-15	$ 40,000	Mobility/Reliability
San Joaquin	SJ-07	6	6	I-580 Westbound Truck Climbing Lanes	6-15	$ 114,200	Mobility/Reliability, Environment, Safety/Security
San Joaquin	SJ-25	26	26	Widen SR 12 between I-5 and SR 99	0-5	$ 60,000	Mobility/Reliability
San Joaquin	SJ-26a	16	16	Widen SR 120 between I-5 and SR 99, with new interchange at SR 99	0-5	$ 115,191	Mobility/Reliability
Stanislaus	STA-02	RE02	SR 99	Keyes Rd to Taylor Rd	6-15	$ 6,227	
Stanislaus	STA-03	RE05	SR 99	Fulkerth Rd to West Main Street	6-15	$ 6,403	
Stanislaus	STA-04	RE04	SR 99	Monte Vista Ave to Fulkerth Rd	6-15	$ 6,462	
Stanislaus	STA-05	RE03	SR 99	Taylor Rd to Monte Vista Ave	6-15	$ 6,520	
Stanislaus	STA-06	T26	SR 99	W. Main St Interchange	6-15	$ 19,091	Safety/Security

County	Study ID	Project ID	Route or Facility ID	Title and Description	Timeline (Years)	Total Project Cost (Thousands)	Strategic Goal Addressed
Stanislaus	STA-07	T25	SR 99	SR 99, Lander Ave (SR 165) to S. City Limits	6-15	$ 35,785	
Stanislaus	STA-08	TIER II	SR 99	Mitchell Rd/Service Rd Interchange Phase 2	6-15	$ 49,586	Safety/Security
Stanislaus	STA-09	C08	SR 99	Mitchell Rd/Service Rd Interchange Phase 1	6-15	$ 122,987	Safety/Security
Stanislaus	STA-14	RE07	SR 99	Mitchell Rd to Merced County Line	16-24	$ 3,097	
Stanislaus	STA-15	RE06	SR 99	San Joaquin County Line to Mitchell Rd	6-15	$ 15,758	
Stanislaus	STA-16	TIER II	SR 99	Interchange Ramp and Auxiliary Lane Improvements	0-5	$ 27,685	Safety/Security
Stanislaus	STA-17	SC02	SR 99	SR 99 & Hammett Rd	0-5	$ 95,524	
Stanislaus	STA-18	TIER II	SR 99	Golden State to Youngstown Road	6-15	$ 20	
Stanislaus	STA-20	M15	SR 99	SR 99 & Briggsmore Interchange	0-5	$ 12,668	Safety/Security
Stanislaus	STA-21	T27	SR 99	Taylor Rd & SR 99: Reconstruct Interchange	6-15	$ 7,694	Safety/Security
Stanislaus	STA-22	TIER II	SR 99	Hatch Rd & SR 99: Reconstruct Interchange	16-24	$ 222,129	Safety/Security
Stanislaus	STA-23	T01	SR 99	Reconstruct Interchange at Fulkerth Road	0-5	$ 12,667	Safety/Security
Stanislaus	STA-24	TIER II	SR 99	SR 99 & Standiford Ave: Reconstruct Interchange	16-24	$ 78,944	Safety/Security
Stanislaus	STA-26	M17	SR 99	Reconstruct to 8-lane Interchange – Phase II	0-5	$ 5,835	Safety/Security, Mobility/Reliability
Stanislaus	STA-29	P02	I-5	I-5 to Rogers Road: Interchange Improvements and Widen Sperry Ave	0-5	$ 17,505	
Stanislaus	STA-32	TIER II	SR 99	SR 99: Kansas Ave to Carpenter Rd	6-15	$ 60,046	

County	Study ID	Project ID	Route or Facility ID	Title and Description	Timeline (Years)	Total Project Cost (Thousands)	Strategic Goal Addressed
Stanislaus	STA-33	TIER II	SR 99	Carpenter Rd to San Joaquin County Line	6-15	$ 82,278	
Stanislaus	STA-34	TIER II	SR 99	Widen SR99 from Hatch Rd to Tuolumne Rd	6-15	$ 102,701	Mobility/Reliability
Stanislaus	STA-35	TIER II	SR 99	Widen SR99 from Tuolumne Rd to Kansas Ave	6-15	$ 128,243	Mobility/Reliability
Stanislaus	STA-36	TIER II	SR 99	Widen SR99 from Mitchen Rd to Hatch Rd	6-15	$ 221,877	Mobility/Reliability
Stanislaus	STA-37	M02	SR 99	Widen from 6 to 8 lanes	0-5	$ 50,671	Mobility/Reliability
Stanislaus	STA-38	(TIER II)	I-5	Widen I-5 from 4 to 6 lanes SJ County line to Sperry Ave	16-24	$ 300,063	Mobility/Reliability
Stanislaus	STA-40	99b	SR 99	Widen SR 99 from 6 to 8 lanes in Stanislaus County	0-5	$ 473,000	Mobility/Reliability
Stanislaus	STA-41	ST06	SR 99	Widen STA-99 between Carpenter Road and the SJ County line to eight lanes	25 or more	$ 82,278	Mobility/Reliability
Stanislaus	STA-42	ST03	SR 99	Widen STA-99 between Hatch and Tuolumne Road to eight lanes	25 or more	$ 102,701	Mobility/Reliability
Stanislaus	STA-43	ST05	SR 99	Widen STA-99 between Kansas Ave. and Carpenter Road to eight lanes	25 or more	$ 60,046	Mobility/Reliability
Stanislaus	STA-44	ST02	SR 99	Widen STA-99 between Mitchell and Hatch Road to eight lanes	25 or more	$ 221,877	Mobility/Reliability
Stanislaus	STA-45	ST04	SR 99	Widen STA-99 between Tuolumne Road and Kansas Ave. to eight lanes	25 or more	$ 128,243	Mobility/Reliability
Stanislaus	STA-01	M01	SR 132	State Route 132 West Freeway/Expressway	2020 Open to traffic Year	$ 59,085	Mobility/Reliability. Improve Economic Competitiveness

County	Study ID	Project ID	Route or Facility ID	Title and Description	Timeline (Years)	Total Project Cost (Thousands)	Strategic Goal Addressed
Stanislaus	STA-12	103	South County Corridor	Expressway connector between SR 99 and I-5 from Turlock to Patterson	6-15	N/A	Mobility/Reliability. Improve Economic Competitiveness
Stanislaus	STA-39	17	SR 132	Widen SR 132 connecting SR 99 and I-580	0-5	$ 100,000	Mobility/Reliability
Stanislaus	STA-46	RE01	SR 132	SR 132 West Freeway/Exressway	2028 Open to traffic year	$ 335,009	Mobility/Reliability. Improve Economic Competitiveness
Tulare	TUL-14	99f	SR 99	Widen SR 99 from Avenue 200 to 1.2m south of Avenue 280.	6-15	$ 186,800	Mobility/Reliability
Tulare	TUL-15	99g	SR 99	Widen SR 99 from Kern County line to Avenue 200.	25 or more	$ 332,500	Mobility/Reliability
Tulare	TUL-16		SR 99	State Route 99/Betty Drive Interchange	0-5	$ 66,720	Mobility/Reliability
Tulare	TUL-17		SR 99	State Route 99/Caldwell Avenue Interchange	6-15	$ 76,303	Mobility/Reliability
Tulare	TUL-18		SR 99	State Route 99/Commercial Interchange	6-15	$ 60,980	Mobility/Reliability
Tulare	TUL-19		SR 99	State Route 99/Paige Avenue interchange	6-15	$ 73,969	Mobility/Reliability

Source: SJVCOG member counties input and the following source documents: Source: (a) CalSTA and Caltrans, 2014 California Freight Mobility Plan1; (b) Fresno Council of Governments (COG) 2014 Regional Transportation Plan (RTP)2; (c) Kern Council of Governments (COG) 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS)3; (d) Kings County Association of Governments (CAG) 2014 Regional Transportation Improvement Program (RTIP)[4], I Madera County

[1] http://www.dot.ca.gov/hq/tpp/offices/ogm/ CFMP/Web/Display_VisionGoalsObj_ARCH_E_36x48.pdf#zoom=85 (last accessed on May 11, 2016)

[2] http://www.fresnocog.org/sites/default/files/publications/RTP/Final_RTP/2014_RTP_Chapter_Six_Final.pdf (last accessed on May 11, 2016)

[3] http://www.kerncog.org/images/docs/rtp/2014_RTP.pdf (last accessed on May 11, 2016)

[4] http://www.kingscog.org/vertical/sites/ percent7BC427AE30-9936-4733-B9D4-140709AD3BBF percent7D/uploads/Chap_3_-_Policy_Element_-_2014_Final_RTP.pdf (last accessed on May 11, 2016)

Transportation Commission 2014 RTP/SCS[5], (f) Merced County Association of Governments 2014 RTP/SCS[6], (g) San Joaquin Council of Governments (COG) 2014 RTP/SCS[7]; (h) Stanislaus Council of Governments (COG) 2014 RTP/SCS[8]; and (i) Tulare County Association of Governments 2014 RTP/SCS[9]

[5] http://www.maderactc.org/wp-content/uploads/2014/07/MCTC-2014-Final-RTP-SCS.pdf (last accessed on May 11, 2016)

[6] http://www.mcagov.org/DocumentCenter/View/314 (last accessed on May 11, 2016)

[7] http://www.sjcog.org/DocumentCenter/View/484 (last accessed on May 11, 2016)

[8] http://www.stancog.org/pdf/rtp/chapter-6-transportation-plan-and-policies.pdf (last accessed on May 11, 2016)

[9] http://www.tularecog.org/wp-content/uploads/2015/06/Final-2014-Regional-Transportation-Plan-Sustainable-Communities-Strategy-FULL-DOCUMENT.pdf (last accessed on May 11, 2016)

Table 14.2 I-5/SR 99 Goods Movement Corridor Study Strategic Programs

Strategic Program	Strategic Goal Addressed
I-5/SR 99 Roadway Pavement and Bridge Maintenance	Infrastructure
Overweight/ oversize policy to allow heavier/longer trucks on I-5 in both directions between San Joaquin County boundary to Kern County boundary (exact boundaries of this project can be identified during future project development)	Economic Competitiveness, Environment
Truck only Toll Lanes on I-5 between I-5 and I-205 junction in San Joaquin County and I-5 and SR 99 junction in Kern County	Mobility/Reliability, Environment, Innovative Technology and Practices
Truck climbing lanes at steep locations such as Altamont Pass, Pacheco Pass and Tehachapi Passes (Grapevine area and SR 58 Eastbound).	Mobility/Reliability, Safety/ Security
I-5/SR 99 Capital Projects for Bottlenecks Congestion Relief	Mobility/Reliability
I-5/SR 99 Operational Projects for Bottlenecks Congestion Relief	Mobility/Reliability
I-5 to SR 99 Connector Capital and Operational Projects for Improved Accessibility	Mobility/Reliability, Economic Competitiveness
I-5/SR 99 Interchanges Reconfiguration Program for Key Freight Access Interchanges with Inadequate Design	Mobility/Reliability,
I-5/SR 99 Capital Projects for Safety Hotspots Alleviation	Safety/Security, Mobility/Reliability
I-5/SR 99 Operational Projects for Safety Hotspots Alleviation	Safety/Security
Container depot service near Stockton for Port of Oakland and in Shafter for Ports of Long Beach and Los Angeles service	Economic Competitiveness
Short-haul rail service between SJV region and Port of Oakland	Economic Competitiveness, Environment
Short-haul rail service between SJV region and Ports of Long Beach/Los Angeles	Economic Competitiveness, Environment
Caltrans' Truck Parking Information System on I-5	Safety/Security, Innovative Technology and Practices
Truck Platooning	Safety/Security, Mobility/Reliability, Innovative Technology and Practices

Source: (a) CalSTA and Caltrans, 2014 California Freight Mobility Plan[10]; (b) Fresno Council of Governments (COG) 2014 Regional Transportation Plan (RTP)[11]; (c) Kern Council of Governments (COG) 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS)[12]; (d) Kings County Association of Governments (CAG) 2014 Regional Transportation Improvement Program (RTIP)[13], I

[10] http://www.dot.ca.gov/hq/tpp/offices/ogm/ CFMP/Web/Display_VisionGoalsObj_ARCH_E_36x48.pdf#zoom=85 (last accessed on May 11, 2016)

[11] http://www.fresnocog.org/sites/default/files/publications/RTP/Final_RTP/2014_RTP_Chapter_Six_Final.pdf (last accessed on May 11, 2016)

[12] http://www.kerncog.org/images/docs/rtp/2014_RTP.pdf (last accessed on May 11, 2016)

[13] http://www.kingscog.org/vertical/sites/ percent7BC427AE30-9936-4733-B9D4-140709AD3BBF percent7D/uploads/Chap_3_-_Policy_Element_-_2014_Final_RTP.pdf (last accessed on May 11, 2016)

Madera County Transportation Commission 2014 RTP/SCS[14], (f) Merced County Association of Governments 2014 RTP/SCS[15], (g) San Joaquin Council of Governments (COG) 2014 RTP/SCS[16]; (h) Stanislaus Council of Governments (COG) 2014 RTP/SCS[17]; and (i) Tulare County Association of Governments 2014 RTP/SCS[18]

14.2 Performance Evaluation of Projects & Programs

The development and application of performance measures enable agencies to gauge system condition and use, evaluate transportation programs and projects, and help decision-makers allocate limited resources more effectively than would otherwise be possible.

Performance measures are typically applied for the following general purposes:

- **Linking Actions to Goals.** Performance measures can be developed and applied to help link plans and actions to state and federal goals and objectives;
- **Prioritizing Projects.** Performance measures can provide information needed to invest in projects and programs that provide the greatest benefits;
- **Managing Performance.** Applying performance measures can improve the management and delivery of programs, projects, and services. The right performance measures can highlight the technical, administrative, and financial issues critical to governing the fundamentals of any program or project;
- **Communicating Results.** Performance measures can help communicate the value of public investments in transportation. They can provide a concrete way for stakeholders to see how transportation investments contribute to transportation system performance; and
- **Strengthening Accountability.** Performance measures can promote accountability with respect to the use of taxpayer resources. They reveal whether transportation investments are providing the expected benefit or demonstrate need for improvement.

In this report, performance measures primarily serve as a prioritization tool.

As part of this Task, a preliminary list of performance measures was developed and shared with technical advisory committee and freight stakeholders. Due to the complexity and scale of the

[14] http://www.maderactc.org/wp-content/uploads/2014/07/MCTC-2014-Final-RTP-SCS.pdf (last accessed on May 11, 2016)

[15] http://www.mcagov.org/DocumentCenter/View/314 (last accessed on May 11, 2016)

[16] http://www.sjcog.org/DocumentCenter/View/484 (last accessed on May 11, 2016)

[17] http://www.stancog.org/pdf/rtp/chapter-6-transportation-plan-and-policies.pdf (last accessed on May 11, 2016)

[18] http://www.tularecog.org/wp-content/uploads/2015/06/Final-2014-Regional-Transportation-Plan-Sustainable-Communities-Strategy-FULL-DOCUMENT.pdf (last accessed on May 11, 2016)

project and program list, the final list of performance criteria, shown in Table 14.3 below, includes both quantitative and qualitative measures. These measures were selected in order to determine the impact of selected projects and programs on:

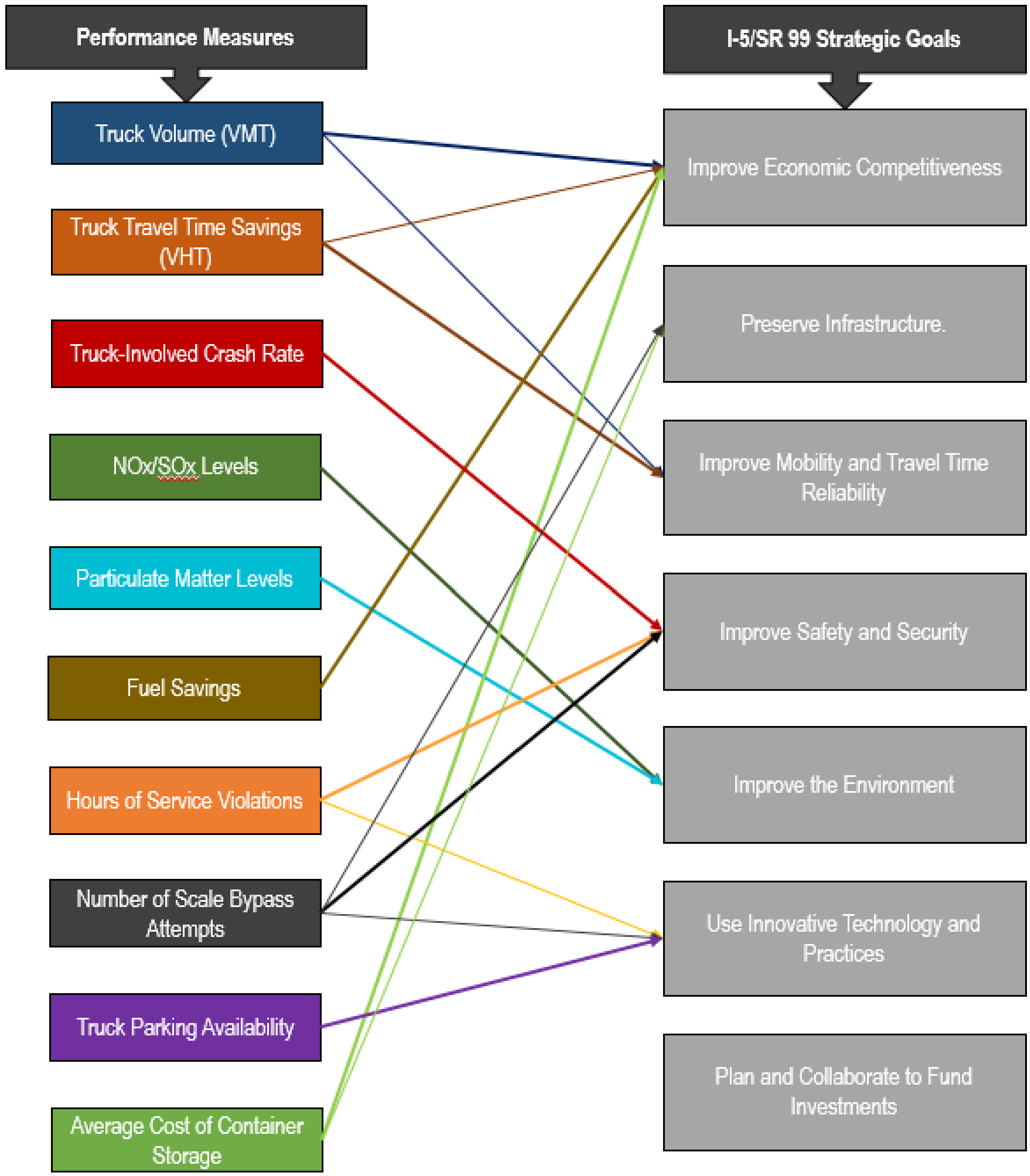
- Critical safety hot spots;
- Critical congestion hot spots;
- Reliable and accessible movement of goods;
- Air quality;
- Commercial vehicle regulation compliance, including hours of service and scale bypass rates; and
- Efficiency, including fuel efficiency and truck parking availability

Table 14.3 I-5/SR 99 Goods Movement Corridor Study Performance Measures

Targeted Metric	Performance Measure	Source	Quantitative or Qualitative
Reliability and Accessibility/Critical congestion hot spots	Truck Volume (VMT) Crash Rates	Valleywide model HERE Data	Quantitative
Reliability and Accessibility/Critical congestion hot spots	Truck Travel Time Savings (VHT)	Caltrans/Valleywide model	Quantitative
Reliability/Critical safety hot spots	Reliability Truck-involved crash rate (per miles traveled). Truck-involved crashes within X miles of an identified "hot" spot	Frequency of crashes and info about VHT related to crashes California TIMS	Qualitative Quantitative
Air Quality	Nox/Sox	Statewide model	Quantitative
Air Quality	PM	Statewide model	Quantitative
Efficiency	Fuel savings	Statewide model	Quantitative
Commercial vehicle regulation compliance	Hours of Service (HOS) compliance (percent OOS for HOS by # miles driven in CA)	CHP, FMCSA, ATRI	Qualitative Quantitative
Commercial vehicle regulation compliance	Minimize truck scale avoidance Number of scale bypass attempts	Ramp counts; local input	Quantitative Qualitative
Efficiency	Truck parking availability	Caltrans, private truck service providers	Quantitative if data collected
Efficiency	Access to equipment for exports; reduced costs for storing and accessing equipment	TBD	Qualitative

These performance measures are tied to the I-5/SR 99 strategic goals. With the exception of "plan and collaborate to fund investments," every strategic goal can be measured using one or more of the performance measures. The relationship between performance measures and strategic goals is shown in Figure 14.1 I-5/SR 99 Goods Movement Corridor Study Performance Measures Relationship to Strategic Goals below. In this Figure, bolded lines represent the strategic goal that is most directly impacts by each performance measure.

Figure 14.1 I-5/SR 99 Goods Movement Corridor Study Performance Measures Relationship to Strategic Goals



14.3 Shifting Trucks from I-5 to SR 99: Enhanced Connector Scenarios

Across San Joaquin Valley, I-5 has more capacity to provide safe and efficient goods movements for through traffic than SR 99 because:

In order to reduce congestion and encourage regional truck traffic to travel on I-5 and reserve the capacity of SR 99 for local traffic, some of the corridors between I-5 and SR 99 could be improved to provide accessibility and travel time reliability between freight generators in the region. To understand the dynamics of goods movement in the Valley and evaluate different scenarios, we used these available tools and data sources:

- Statewide Freight Forecasting Model (CSFFM), base year 2012
- Freight Analysis Framework (FAF 4.3 year 2012)
- Truck GPS sample data
- Local origin-destination surveys
- An enhanced database of classification counts (2012-2015)

There are limitations and constraints associated with each of the above that we considered in providing a reliable analysis. The FAF database is the main data source used to generate the origin-destination (OD) of commodities. It is based on establishment level commodity flow survey data. FAF zones are very large in California (6 zones) and do not provide sufficient detail for corridor-level analysis **(**Figure 14.2**)** The CSSFM 2.0 provides information about commodity flows and freight truck movement between counties, sub-counties, state gateways, and major intermodal facilities in the state. The structure of the model in the Valley is:

- 11 zones (two zones each in Kern, Fresno, and San Joaquin counties; and, one zone in each other county in the Valley)
- Two import/export gateways (Fresno Yosemite International Airport and Port of Stockton)
- Three rail/truck intermodal facilities (Stockton, Lathrop, and Fresno terminals)

CSFFM provides adequate information about regional goods movement; however, given the aggregate structure of the model, there are high intra-zonal trips associated with each zone that will not be assigned to the model network. GPS data provided an understanding of local truck movement patterns. While GPS sample data provides information about truck routing, it does not provide any information about truck cargo or characteristics of trucks. The sample might also be biased toward certain truck categories or trip types. Our experience shows that small owner operator trucks are underrepresented in available GPS truck samples. Long distance truck trips (longer than 500 hours) are also hard to identify since the truck driver must take a break after reaching Hours of Service or may stop for fuel or short breaks. Differentiating intermediate stops from the true origin and destination of the truck from GPS truck trajectories is challenging. Where available, local OD survey data was utilized in order to overcome the shortcomings of GPS data.

Table 14.4 shows the sum of all commodities shipped between the six FAF regions in California by truck in 2012. Table 14.5 shows estimated full truck load trips between these regions. It is not possible to distinguish less-than-full trucks from full truckloads in FAF. With the flows between FAF regions, the location of major freight generators in each region, and GPS data of truck OD distribution, we can understand the big picture of goods movement in San Joaquin Valley via I-5 and SR 99.

It is important to note that FAF does not cover total truck traffic. It only includes trucks that carry commodities (freight trucks). Total truck traffic includes the following beside:

- Empty trucks
- Local delivery trucks between other than for-hire trucks
- Postal service trucks (FedEx, UPS, USPS, and others)
- Non-freight trucks (moving trucks, utility trucks, landscaping, municipality trucks, maintenance trucks, tow trucks, construction trucks)
- According to Weigh-in-Motion (WIM)[19] data, up to 30 percent of truck traffic with three or more axles on major state facilities are empty trucks. The Traffic Activity Monitoring System (TAMS)[20] shows that non-freight truck traffic can contribute up to 50 percent of total truck traffic (including 2-axle pickup trucks) on state facilities near urban areas and up to 25 percent in rural areas. The current version of the CSFFM covers only freight trucks[21].

The target of analysis in this study is regional freight trucks on the I-5 and SR 99 corridor from SR 58 in Kern County to I-4 in San Joaquin County. To understand the overall truck traffic, we used a large set of recent classification count databases provided by MPOs in the Valley to post-process the model results and estimate total truck traffic as needed.

[19] http://www.dot.ca.gov/trafficops/wim/datawim.html

[20] http://freight.its.uci.edu/tams/index.jsp

[21] Detail analysis of WIM data is presented in Existing Conditions Report for I-5/ SR-99 Study, Cambridge Systematics, 2016.

Figure 14.2 FAF 4 (Year 2012) Regions

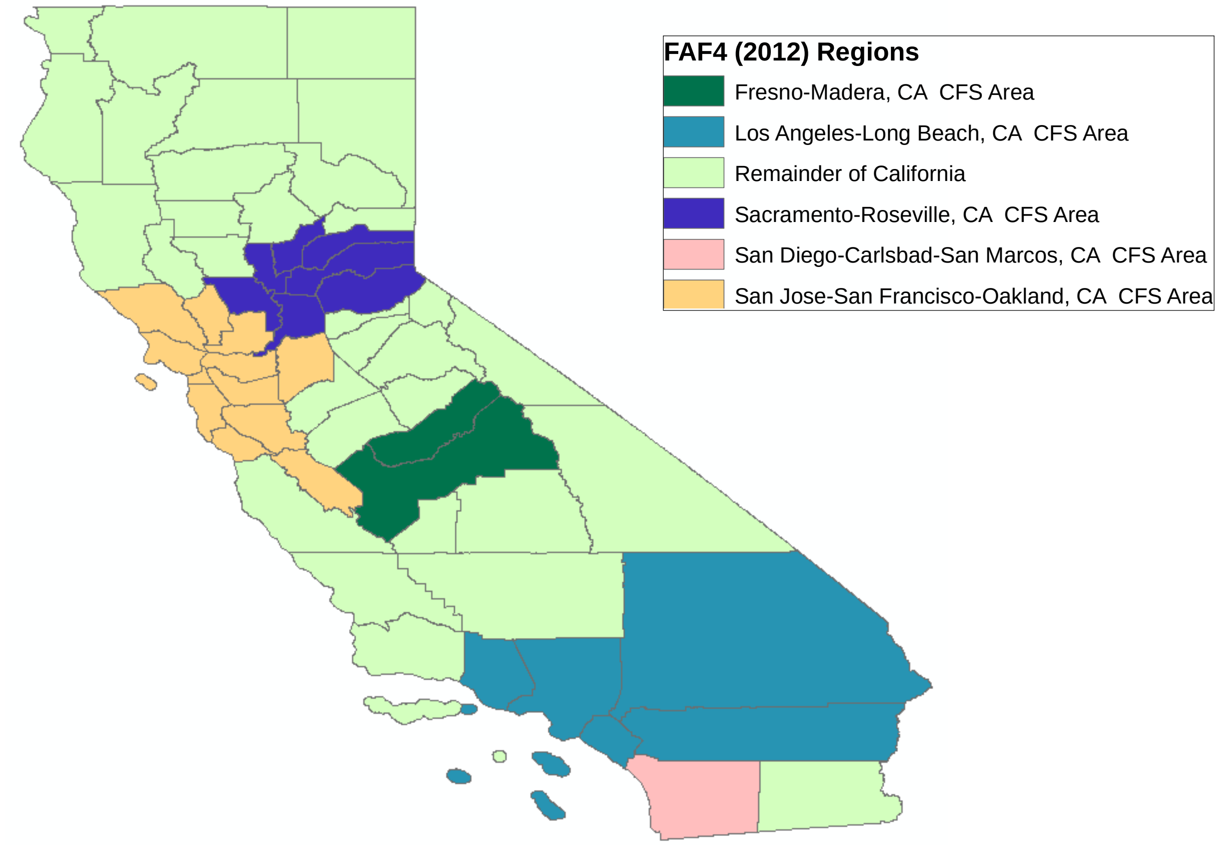


Table 14.4 Annual K-tons of Commodities Transported between FAF 4.3 Regions by Truck in 2012

From \ To	Fresno	Los Angeles	Rest of CA	Sacramento	San Diego	San Francisco	Arizona	Nevada	Oregon	Washington	Other States	Total
Fresno CA	20,398	1,426	10,656	383	136	3,204	247	151	148	302	1,576	38,627
Los Angeles	2,548	316,793	10,158	2,294	12,664	8,344	6,850	4,437	1,523	2,570	28,539	396,722
Rest of CA	13,571	15,357	108,755	6,672	1,211	11,324	1,177	2,794	1,380	1,141	5,883	169,265
Sacramento	1,140	1,000	7,174	34,396	179	8,825	123	734	292	310	1,254	55,428
San Diego	167	3,693	578	170	33,787	1,353	232	165	52	182	2,257	42,636
San Francisco	2,638	6,745	16,316	8,231	1,326	132,809	996	1,541	1,196	1,958	12,678	186,435
Arizona	104	4,353	775	146	402	774						6,553
Nevada	534	2,378	1,241	775	175	1,049						6,151
Oregon	295	1,849	1,482	774	84	1,456						5,941
Washington	131	1,969	428	359	267	1,635						4,790
Other States	2,052	39,187	4,660	2,083	2,190	10,453						60,623
Grand Total	43,578	394,750	162,224	56,283	52,420	181,227	9,625	9,822	4,591	6,463	52,186	973,169

Source: (FAF4, FHWA)

Table 14.5 Approximate Number of Daily Truck Loads between FAF 4.3 Regions in 2012

From \ To	Fresno	Los Angeles	Rest of CA	Sacramento	San Diego	San Francisco	Arizona	Nevada	Oregon	Washington	Other States	Total
Fresno CA	3,908	273	2,042	73	26	614	47	29	28	58	302	7,401
Los Angeles	488	60,700	1,946	440	2,427	1,599	1,313	850	292	492	5,468	76,015
Rest of CA	2,600	2,942	20,838	1,278	232	2,170	226	535	264	219	1,127	32,432
Sacramento	219	192	1,375	6,591	34	1,691	24	141	56	59	240	10,620
San Diego	32	708	111	33	6,474	259	44	32	10	35	432	8,169
San Francisco	505	1,292	3,126	1,577	254	25,447	191	295	229	375	2,429	35,722
Arizona	20	834	148	28	77	148	-	-	-	-	-	1,256
Nevada	102	456	238	148	33	201	-	-	-	-	-	1,178
Oregon	56	354	284	148	16	279	-	-	-	-	-	1,138
Washington	25	377	82	69	51	313	-	-	-	-	-	918
Other States	393	7,509	893	399	420	2,003	-	-	-	-	-	11,616
Grand Total	8,350	75,637	31,083	10,784	10,044	34,724	1,844	1,882	880	1,238	9,999	186,467

*Assuming 307 days per year and average payload of 17 tons per truck
Source: Derived from (FAF4, FHWA)

14.3.1 Through Trips and Local Trips in the Valley

To develop the big picture of goods movement patterns in the Valley, truck traffic was categorized based on the origin and destination of the trips:

- I-I trips or Internal-Internal: trips originating and destined inside the San Joaquin Valley
- I-X trips or Internal-External: trips originating inside San Joaquin Valley but destined outside of the Valley
- X-I trips or Internal-External: trips originating outside the San Joaquin Valley but destined inside the Valley
- X-X trips or External-External: trips originating and destined outside of the San Joaquin Valley

A combination of GPS data and CSFFM truck assignments provided an estimate of the distribution of trips on different segments of I-5 and SR 99. The data is aggregated to the regions shown in Figure 14.3**.** Overall, 50 percent of all freight trips in the Valley are type I-I, 35 percent are I-X or X-I and 15 percent are X-X.

As expected, the majority of truck trips (40-60 percent) on SR 99 are I-I trips representing less than 150 miles. Approximately 35 to 55 percent of heavy duty truck traffic on SR 99 are categorized as I-X or X-I trips, and approximately 5 percent of trips are X-X trips **(**Figure 14.4**)**

The share of X-X trips on northbound SR 99 is higher than southbound. The major origin-destinations of X-X trips on SR 99 fall into one of two categories, including:

- From Arizona/Nevada to Sacramento Valley/Bay Area
- From Los Angeles to Sacramento

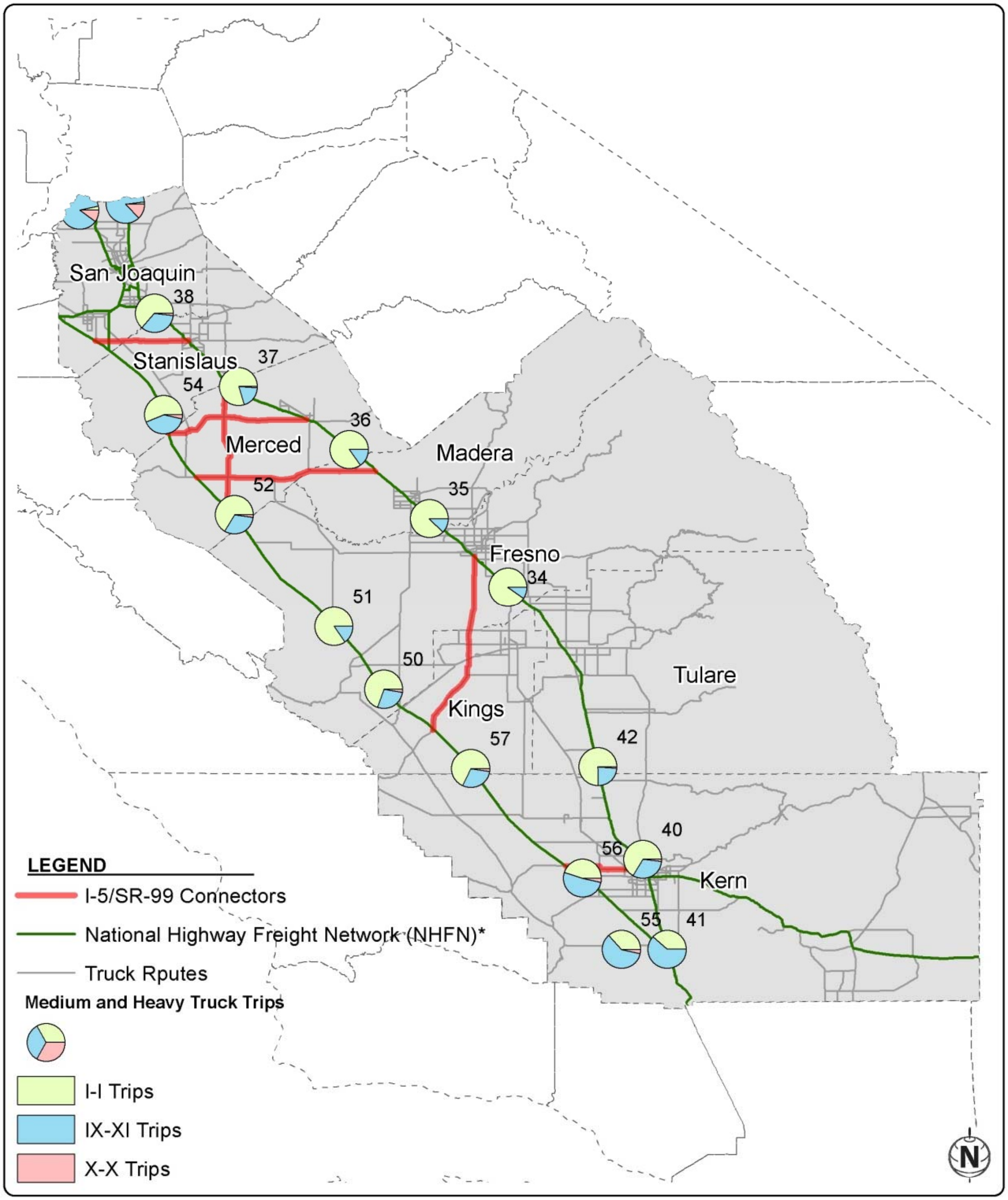
The above distribution is different for the portion of SR 99 in Bakersfield that is shared with SR 58. The share of through trips on this segment is up to 25 percent. Understanding the origin and destination of trips is important to this study in order to identify the maximum potential traffic shift from SR 99 to I-5 under each scenario for the I-5/SR 99 connectors.

Table 14.6 shows the average daily medium and heavy duty truck flows between different zones, based on FAF 4, 2012 data and CSFFM 2.0 model assignment.

Figure 14.3 Regions Boundaries for Goods Movement OD analysis

Source: FHWA, Cambridge Systematics

Figure 14.4 Existing I-5/SR 99 Segment Truck Trip Characteristics



Source: FHWA, California Statewide Freight Forecasting Model, StreetLight, Fehr and Peers

Table 14.6 Average Daily Medium and Heavy Duty Truck Flow for California Origin-Destination Pairs

Region	Bay Area (North)	Bay Area (South)	Central Coast (North)	Central Coast (South)	Northern California	Sacramento Valley	Sierras	Sacramento County	Fresno County	Kern County	Kings County	Madera County	Merced County	Stanislaus County	San Joaquin County	Tulare County	Los Angeles County	Orange County	Riverside County	Ventura County	San Bernardino County	Imperial County	San Diego County	Out of State	Grand Total
Bay Area (North)	4,320	430	10		60	150		90					10	10	80									160	**5,320**
Bay Area (South)	420	19,710	230		20	80		70	30	20	10	10	80	90	420									1,080	**22,270**
Central Coast (North)	10	210	3,070	70		10			10	40			40	10	10									80	**3,560**
Central Coast (South)			50	1,980					10	60	10						40		10	80	10			60	**2,310**
Northern California	60	20			4,360	290		60	10				10	20	70									3,640	**8,540**
Sacramento Valley	160	100	10		300	3,750	20	790	10	10		10	30	40	200									1,940	**7,370**
Sierras						20	710			20		10	10	20	20						30			350	**1,190**
Sacramento County	100	80			50	740		3,770	10	10		10	20	40	260									350	**5,440**
Fresno County		30	10	10	10	10		10	3,880	180	180	190	190	60	60	310	30				20			20	**5,200**
Kern County		20	30	50	10	10	20	10	180	6,610	80	20	90	40	50	240	460	20	50	20	340		10	130	**8,490**
Kings County		10		10					180	70	590		20	10	10	110	10								**1,020**
Madera County		10				10	10	10	190	20	10	420	90	30	30	40								10	**880**
Merced County	10	90	40		20	40	10	20	190	80	20	90	1,210	260	150	30	20				10			40	**2,330**
Stanislaus County	10	90	10		20	50	20	40	60	30	10	30	260	1,660	420	20								40	**2,770**
San Joaquin County	70	390	20		80	210	20	260	70	40	10	40	140	440	3,880	20	10							300	**6,000**
Tulare County									290	270	100	30	30	20	20	2,200	40				30			20	**3,050**
Los Angeles County				40					40	480	10		20	10	10	40	33,810	1,170	570	360	1,620	10	110	540	**38,840**
Orange County										10							1,170	8,340	270	10	290		110	90	**10,290**
Riverside County				10						50							570	260	7,630	20	1,580	80	190	3,890	**14,280**
Ventura County				80						20							350	10	20	2,340	50			50	**2,920**
San Bernardino County				10			20		20	300	10		10			30	1,650	320	1,650	50	12,200	20	120	7,420	**23,830**
Imperial County																	10		70		20	970	40	1,150	**2,260**
San Diego County										10							110	110	220		100	40	9,050	670	**10,310**
Out of state	160	1010	70	50	3550	2050	410	380	20	50		10	30	50	300	20	680	90	3860	50	7420	980	290	xxx	**22,030**
Grand Total	**5,320**	**22,200**	**3,550**	**2,310**	**8,480**	**7,420**	**1,240**	**5,510**	**5,200**	**8,380**	**1,040**	**870**	**2,290**	**2,810**	**5,990**	**3,060**	**38,960**	**10,320**	**14,350**	**2,930**	**23,720**	**2,100**	**9,920**	**22,530**	xxx

Source: California Statewide Freight Forecasting Model, StreetLight Fehr and Peers

Notes: Origin-Destination pairs with less than 10 trucks per day are shown as blank. Light duty trucks and small trucks (less than five axles) are not included

This table does not include trips with an origin and/or destination outside of California (IX-XI and X-X flows) – See below for more details

14.4 I-5/SR 99 connectors Scenarios

Based on truck GPS OD data and existing truck traffic, the following corridors were selected for this study. Except for the West Beltway, these corridors have existing count data, although the future alignment of some of them might be different in the future **(**Figure 14.5**)**. These connectors were selected as a subset of identified connectors to cover northern, central and southern regions of the Valley:

Kern County:
1. SR 58
2. West Beltway

Fresno/Kings County:
3. SR 41

Merced County:
4. SR 140
5. SR 152
6. SR 165

Stanislaus/San Joaquin County
7. SR 132

The West Beltway connector from SR 99 north of Bakersfield to I-5, would provide a bypass around the City of Bakersfield and thus relief to SR 99 and provide an important link across the Kern River from southwest Bakersfield to the Westside Parkway. Since this project proposed a completely new alignment, existing data is not available.

14.4.1 Performance Measures

We investigated the following variables to evaluate the minimum requirements and improvements for each of these corridors in order to provide desirable option for truckers. The following performance metrics were evaluated for each scenario:

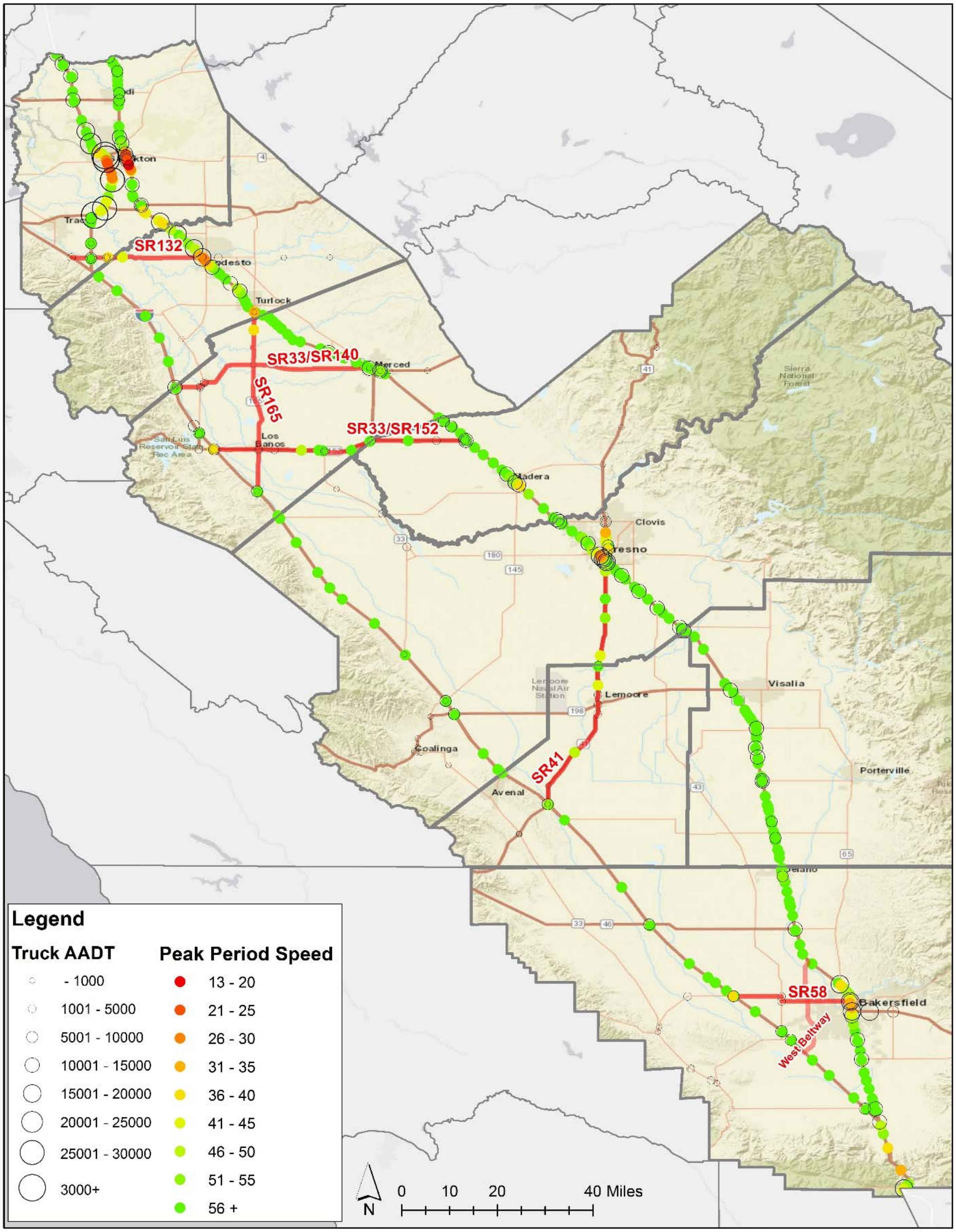
- Truck volume shifted between SR 99 and I-5
- Truck vehicle miles traveled (VMT)/vehicle hours traveled (VHT) change
- Truck average emission (CO_2, NOx) reduction

The feasibility and other impacts of each scenario were also taken into account, including:

- Travel time reliability /(congested Speed)
- Safety
- Economic
- Environmental

Figure 14.5 shows the congested speed (the minimum speed during AM or PM peak period) along SR 99, I-5, and the considered connectors.

Figure 14.5 Peak Period Congested Speeds and I-5/ SR 99 Connectors



Source: NPMRDS travel time data (October 2015) and HPMS classification count data (2015-16)

The change in trip routing patterns, annual VMT and number of trucks shifting from SR 99 to I-5 were initially estimated using the California statewide model. The model results were then adjusted using GPS truck routing trajectories and truck origin-destination surveys.

EMFAC2014 (v1.0.7) weighted average emission rates for CO_2 and NO_x (based on VMT in the air basin) for vehicle classes of T6 (Medium Heavy Duty Trucks-MHDT) and T7 (Heavy Heavy Duty Trucks – HHDT) in San Joaquin Valley air basin were used for this high-level analysis **(**Figure 14.6**,** Figure 14.7**)**.

Figure 14.6 Carbon Dioxide Rates for Heavy Duty Trucks

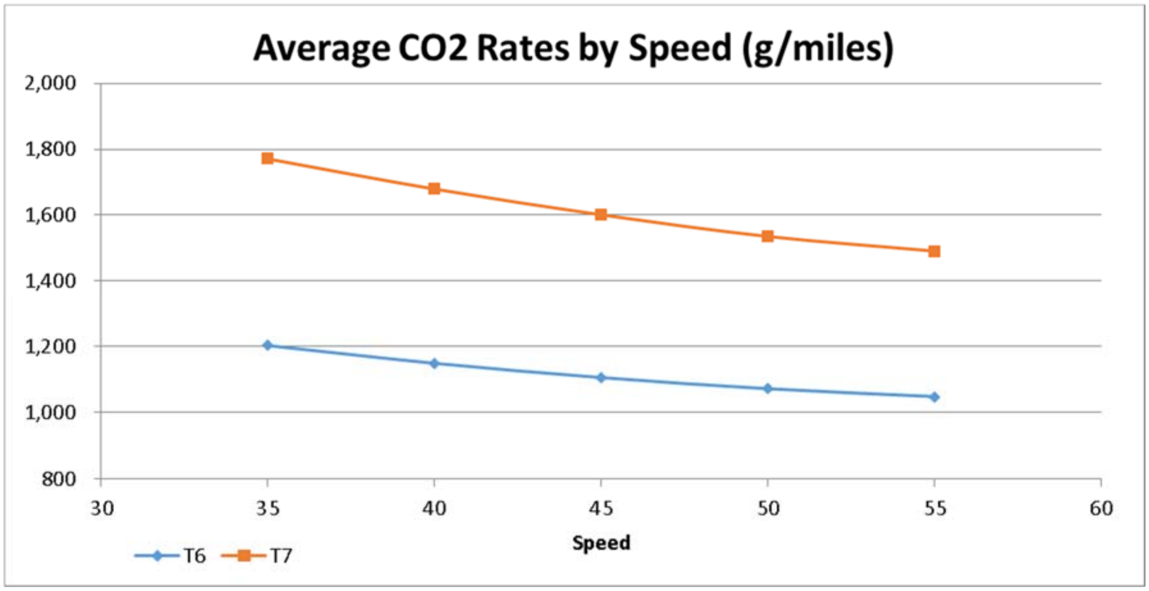
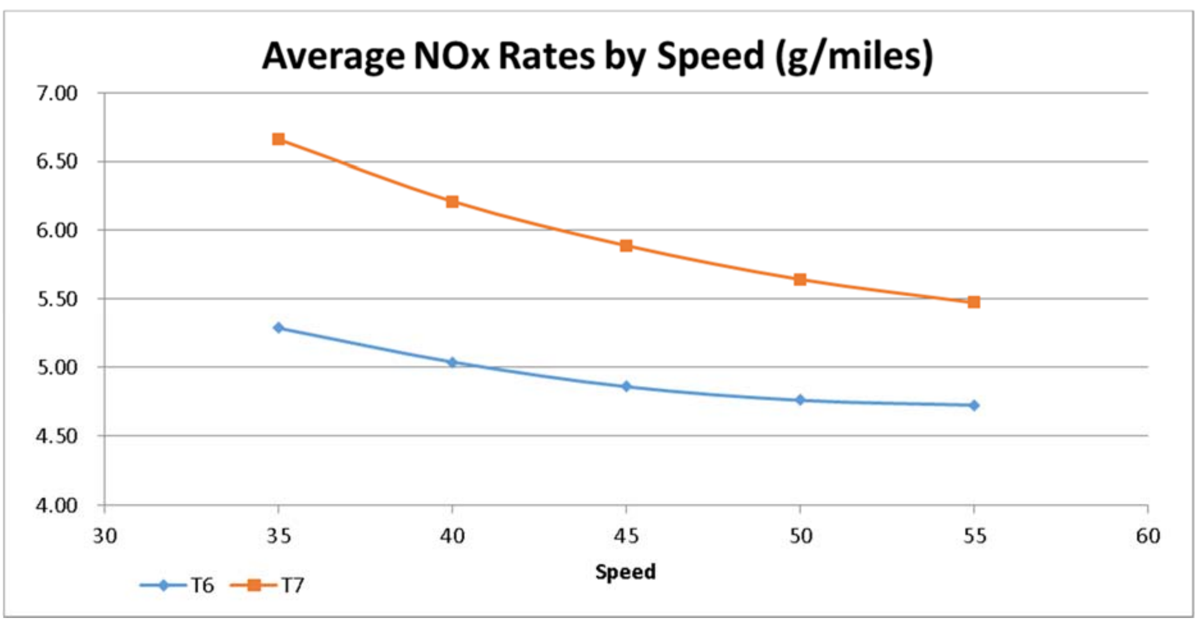


Figure 14.7 Nitrogen Oxide Rates for Heavy Duty Trucks



Source: EMFAC2014 annual rates for San Joaquin air basin for year 2015.

14.4.2 State Route 58 (Kern County)

Scenario Setting

The objective of this scenario is to improve the travel time on SR 58 so that, truckers are encouraged to shift their route from SR 99 to I-5 as possible. This is a high level analysis aiming to estimate the maximum potential traffic reduction on SR 99 under SR 58 improvement scenario. These improvements include reducing delay at all at grade intersections and increasing capacity to maintain free flow speed across the corridor. The most congested segment of SR 58 is between SR 58/Rosedale Hwy West and SR 58 Freeway East. As part of improvements under this scenario, the east and west side of SR 58 is connected with a separate right of way from SR 99. This project is currently approved and funded and known as "Centennial corridor" project.

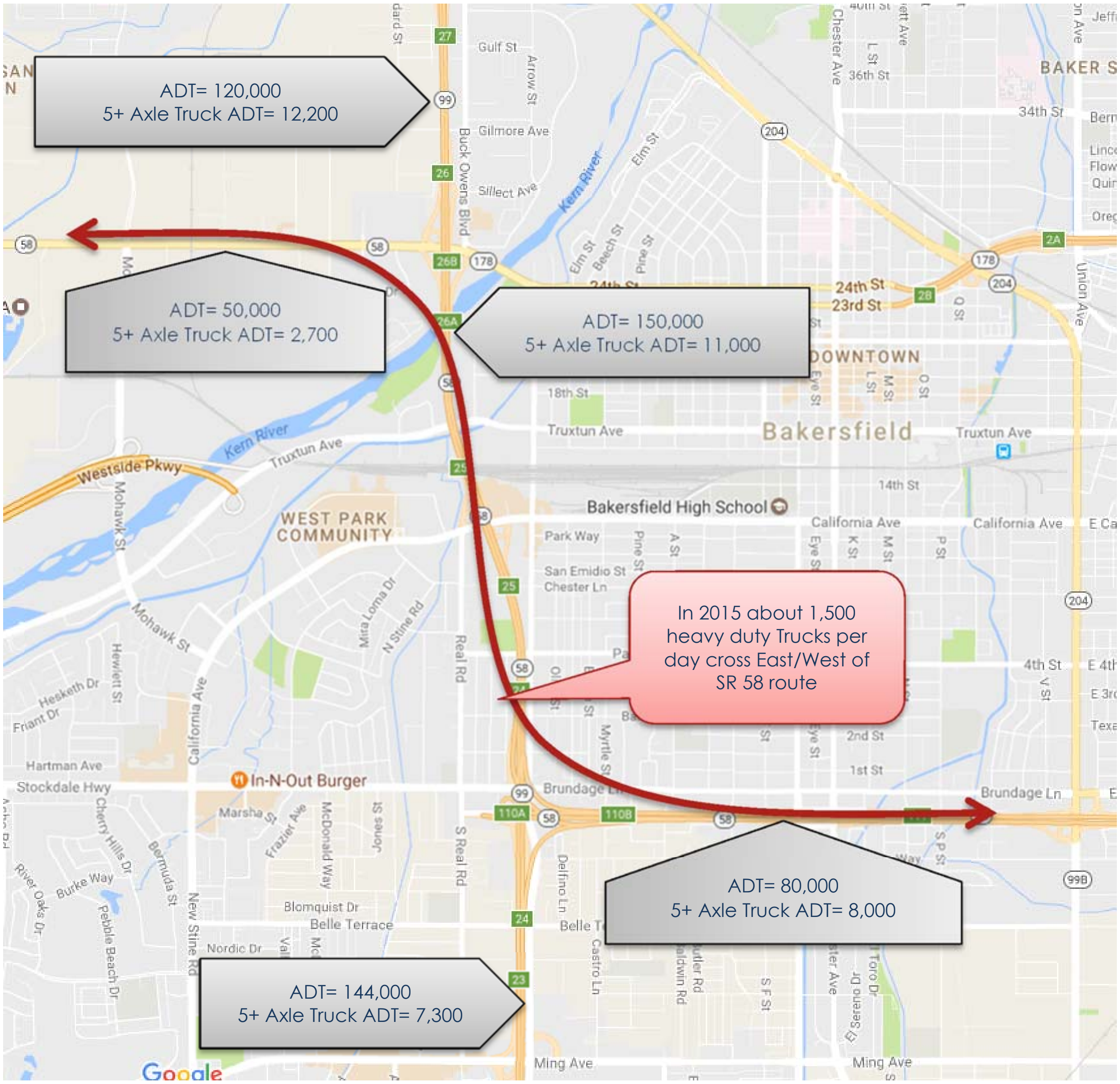
Existing Conditions

The SR 58 corridor between I-5 and SR 99 is approximately 20 miles long and serves many trucking-based industries along the route, especially near Bakersfield. In addition, the corridor is also central of three primary routes between oil fields west of I-5 and the Bakersfield metropolitan area with over ½ million people. SR 58 has different combination of users than other SR 99/I-5 connectors that were analyzed in this study, due to a significantly higher share of out of state trips. The truck traffic pattern on SR 58 is shown in Figure 14.8.

The California Department of Transportation, in cooperation with the City of Bakersfield, proposed the construction of the Centennial Corridor as a new east-west transportation corridor for State Route 58. Centennial Corridor would provide route continuity for State Route 58 by building a new freeway segment linking State Route 58 (East) with Interstate 5. To accommodate the new freeway segment, improvements on State Route 99 would also be constructed. The final EIR/EIS of the proposed project was published in December 2015 on Caltrans Website. With the existing alignment of SR 58, about two miles of this route has shared right-of-way with SR 99. This is one of the highly congested segments of SR 99, with a history of high collision volume.

Figure 14.8 highlights the congestion on a segment of SR 99 that is shared with SR 58 traffic; this is the busiest segment of SR 99 in the valley. There are three high volume interchanges located on this 2-mile stretch of SR 99, resulting in significant weaving movements. Once the Centennial Corridor project is completed, the eastern section of SR 58 (east of SR 99) and the western part (west of I-5) will be connected with new right-of-way. It will be slightly longer than the existing alignment.

Figure 14.8 Existing Truck traffic Pattern on SR 58 East and West Segment



Source: HPMS counts for year 2014(Gray Boxes), Fehr and Peers OD analysis (Red Boxes)

Feasibility and Impact Assessment

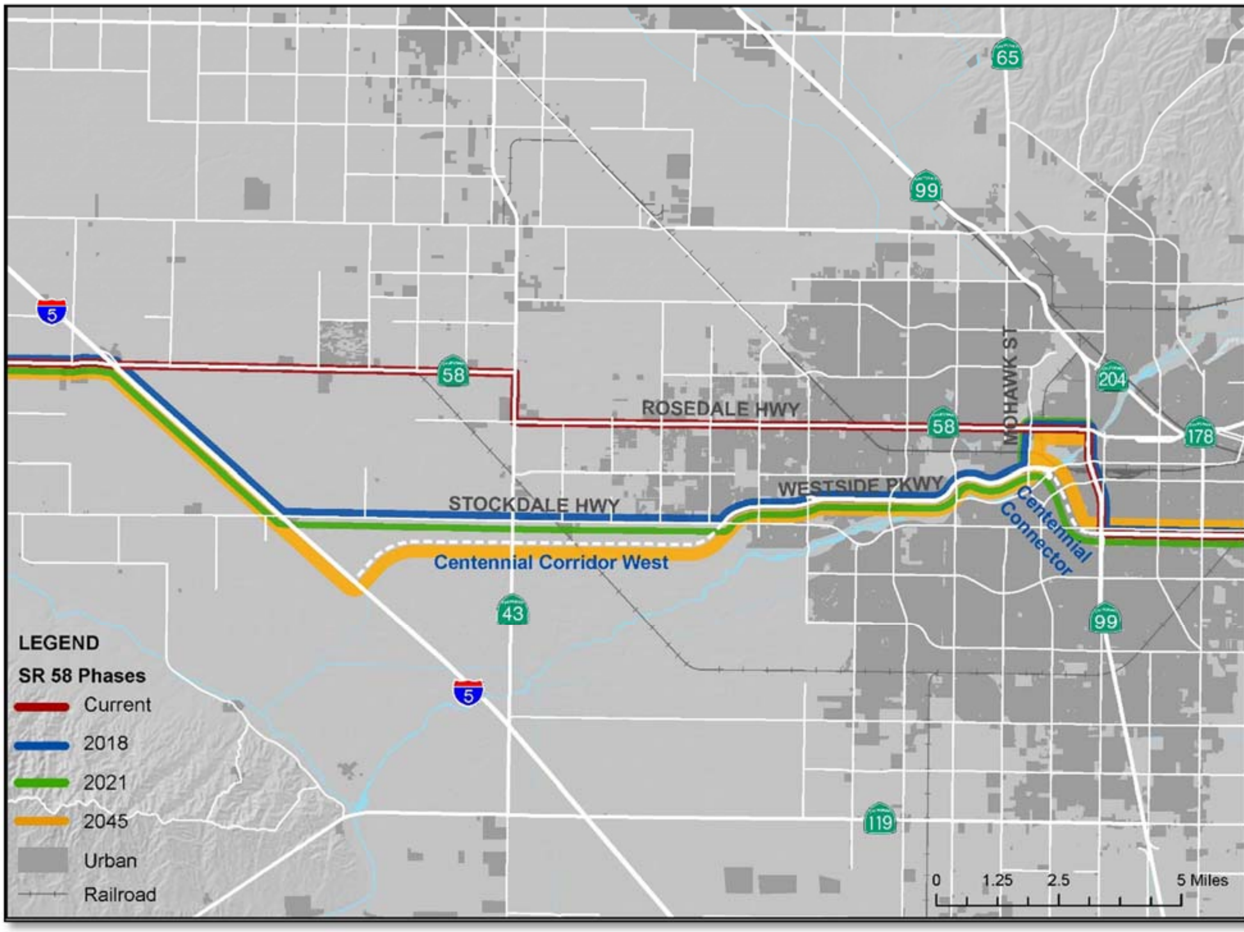
Approximately half of the route is a two-lane undivided rural highway with a 55 mph speed limit. From SR 99 west, approximately 9 miles of the route through west Bakersfield and Rosedale is heavily-populated and intersections are often signalized. About 5.8 miles of the road closest to SR 99 is four-to six lanes wide with a center median. The two lane segment connecting to I-5 is surrounded almost exclusively by agricultural-industrial land use. There is an active railroad right-of-way adjacent to SR 58 for approximately 6 miles heading east from I-5 to approximately Mayer Avenue, and there is one at-grade crossing less than one mile west of SR 99. Both ends of the connector are served by truck stops and there are gas stations at mid-points, such as near the intersection with SR 43.

Three projects are currently planned that affect this portion of SR 58 in the near-term. One phase of the "Centennial Corridor" project will extend the grade-separated portion of SR 58 that is east of SR 99 across to the west and connect to Westside Parkway. Presently, SR 58 is north-south along SR 99 for about two miles. Another near-term project will widen SR 58 between SR 43 and Allen Road near Rosedale.[22] The third widens SR 58 from I-5 to SR 43, including the 1-mile north-south segment that overlaps SR 43. In addition, a long-range plan to complete the "Centennial Corridor" project would extend SR 58 to I-5 along a different alignment to the south of Stockdale Highway. These projects are assumed under the SR 58 Improved Scenario, however they are not reflected in existing conditions and would not be comparable to the current route alignment; therefore, for this analysis the existing alignment of SR 58 represents the baseline condition.

Figure 14.9 illustrates planned changes in the future SR 58 alignment between SR 99 and I-5. The first phase was the Westside Parkway Freeway, a 7-mile, four- to eight-lane freeway completed in April 2015 that connects the existing SR 58 to SR 99 via Mohawk Street on the East end, and to I-5 via Stockdale Highway to the West. Since 2015, this corridor improvement has resulted in a shift of local traffic from SR 58 to Westside Parkway freeway. In 2018, Caltrans is scheduled to re-designate this route as SR 58. Today, through travel is being directed to use Westside Parkway by the online Google Maps application. In 2021, construction which has already began on the Centennial Connector phase, is scheduled to be complete. This segment will replace the remaining designation of SR 58 between I-5 and SR 99. The completion of this phase will eliminate all signalized intersections between I-5 and SR 99 except for one, and will likely become the preferred route of I-40 trucks destined for the Bay Area, North San Joaquin Valley, and Sacramento.

[22] State Route 58 (Rosedale Highway) Widening Project, Initial Study with Mitigated Negative Declaration/Environmental Assessment with Finding of No Significant Impact. Prepared by the State of California Department of Transportation and City of Bakersfield, 2012.

Figure 14.9 SR 58 Future Phases



Source: KernCOG.

The current SR 58 alignment faces some challenges as a through-route for trucks between SR 99 and I-5. A large portion of the route passes through the community of Rosedale. This segment features primarily residential and commercial-retail land use and includes schools. Despite this, the speed limit is relatively high (often 50 mph), the road is divided by a center median and left turns are often restricted or channelized through this segment. Improvements have been made to the route as part of the planned transfer of the right-of-way to the City and County.

Approximately 40,100 people live in Census block groups close to SR 58; however, the state route serves as the West gateway to the metropolitan area. Between 2009 and 2013, this corridor experienced 326 vehicle collisions, of which 17 involved trucks (approximately 5 percent). By far the most common crash types were rear-end collisions. These occur largely from Rosedale east to SR 99 and become heavily concentrated approaching SR 99. Rear-end crashes are commonly associated with abrupt changes in speed due to signals or traffic delays. A summary of crashes on this segment of SR 58 is shown in **Table 14.7.**

Table 14.7 Summary of Collisions on SR 58

	All Collisions			Truck Involved Collisions			
Corridor	All	Fatal	Severely Injured	All	Fatal	Severely Injured	Population Adjacent to Corridor
SR 58	326	6	20	17	0	3	40,110
SR 99/SR 58	181	3	9	24	1	3	

Source: TIMS database, 2009-2013

Performance Measures

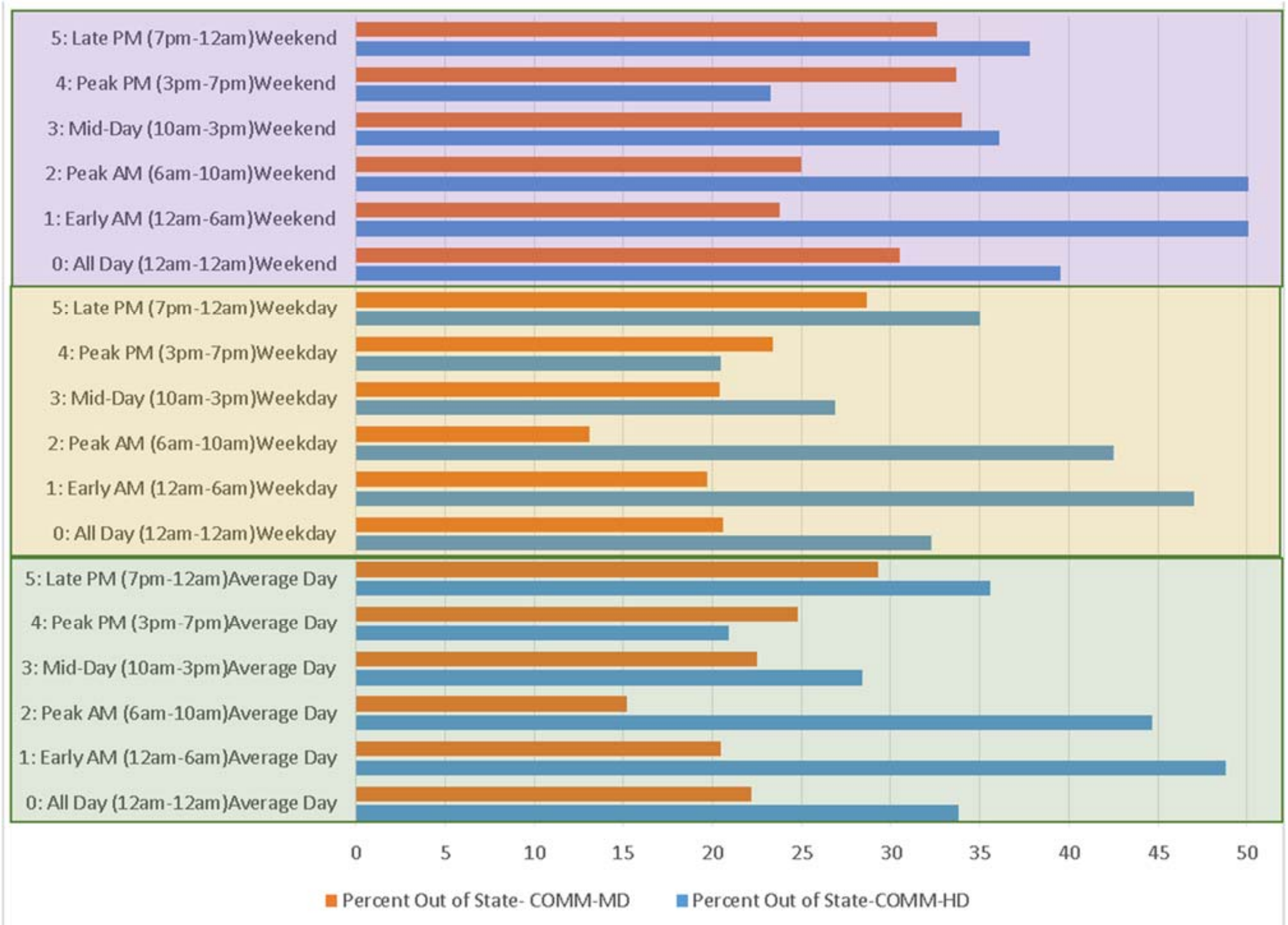
Truck ADT, speed, percentage change in VMT, and percentage change in emission for the SR 58 Scenario is presented in this section. The OD matrix from the California Statewide Freight Forecasting model (2012 model run), truck route selection patterns from StreetLight truck GPS data and intercept survey[23], and 2014 truck classification counts were used to forecast the shifted volume from SR 99. The GPS data significantly underestimated the share of long distance trips on SR 58 from other states. This was determined by comparing the GPS data with the 2008 origin-destination survey results, which stopped and surveyed nearly all of the trucks at rest stops over two 48-hour periods. KernCOG staff indicated that the 2008 survey data was more accurate. Therefore, we requested Streetlight to modify their algorithm to better estimate the true origin and destination of long distance truck trips[24].

Figure 14.10 shows the percent share of out of state (trips with either origin or destination out of California) Commercial Medium Heavy (MD) and Heavy (HD) Heavy duty trucks on SR 58 based on modified GPS data. This distribution is very close to the 2008 survey. A sample of 160,000 trips for HD and 60,000 trips for MD over six months from September 2015 to February 2016 were analyzed. There is a distinct pattern between weekdays and weekends and different times of day. The percent of out of state trucks on SR 58 are higher on weekends and generally higher in the AM than PM peak periods. On average, 34 percent of HD and 22 percent of MD trucks on SR 58 began or ended outside of California.

[23] KOA, 2008.

[24] In the original algorithm, if a truck does not move for more than one mile in five minutes, it is assumed that a new trip is started. Therefore, the "true" origin and destination of the trip was convoluted when the truck has to stop to rest or get fuel or reached the Hours of Service.

Figure 14.10 SR 58 Share of out of State Trucks by Time of Day and Day of Week



Source: StreetLight GPS Data.

Surveys identified that the truck traffic percentages on existing SR 58 West (Rosedale Highway), which is built as a local roadway, is as high as 16 percent of total traffic in the urban core of Bakersfield. Users currently experience delays from stop- and signal-controlled local streets. This is especially true on the 12-mile segment between State Route 43 and State Route 99, which has 18 signalized or 4-way stop controlled intersections, of which 16 operated at level of service D (25 to 35 seconds of delay) or worse during AM, PM or both peak hour periods. The projected level of service indicates that delay will worsen in the future due to estimated urban growth in the area [Centennial Corridor EIR/EIS, 2015].

There is also heavy traffic congestion on the shared portion of SR 58 and SR 99. The close spacing between interchanges of two segments of SR 58 (east and west) and California Avenue along a 2-mile stretch of SR 99 creates merge/diverge conflicts that result in a very high rate of collisions on this segment – the busiest segment of SR-99 South of Sacramento.

Although over 60 percent of the truck trips on the existing SR 58 corridor are intra-Kern county trips, it also serves as the main connection for trucks coming from other states via I-15 and I-40 to I-5 and heading to the Bay Area, Tracy/Patterson distribution center, and the Central Coast. The distribution of trucks on the segment of SR 58 between Fresno and Kings County is shown in Figure 14.11. We estimated the share of trucks on SR 58 from major origin-destination's flows using model route assignment and survey data. It is important to note that this analysis does not cover passenger trips and induced demand. These OD pairs are:

- Other States ←→ San Joaquin Valley, Bay area
- Los Angeles, Orange, Ventura County ←→ Kern County

The Centennial Corridor EIR/EIS report provided detailed analysis of VMT, greenhouse gas and federal criteria pollutant emissions for the proposed project. The Centennial Corridor is expected to improve local east-west circulation; facilitate congestion management; and, reduce commercial and regional commute time through a major freight corridor. Implementation of the project would help to reduce regional greenhouse gas and regional criteria pollutant emissions by promoting vehicle operational efficiency through reduced congestion and shorter vehicle trips, as well as reduced vehicle travel time by offering more direct roadway connections through the corridor.

For out of state trucks, the SR 58/I-5 route will provide a 12-mile shorter access to the Bay Area and Tracy/Patterson compared to SR 99 and is roughly equal in travel time with less local congestion to Lathrop, Stockton and Sacramento **(**Figure 14.12**)**. According to the analysis, the majority of these trucks (about 85 percent) are already using SR 58 as a dominant route to connect from I-15 and I-40 to I-5 and the Bay Area. It is estimated that about 100 Heavy duty trucks per day will shift their route from SR 99 to SR 58/I-5. Figure 14.12 shows the Kern COG staff analysis of travel times using Google Maps that indicates more than half of the through Valley and North Valley O/D truck trips will be diverted to I-5 based on faster travel time with the completion of the next phase of the Centennial Corridor project scheduled for 2021. This would also reduce through truck traffic filtering on SR-58, SR-46, SR-198, SR 152 and SR-4. Based on the Centennial Corridor EIR/EIS, by 2038, about 8,000 trucks per day will travel via SR 58.

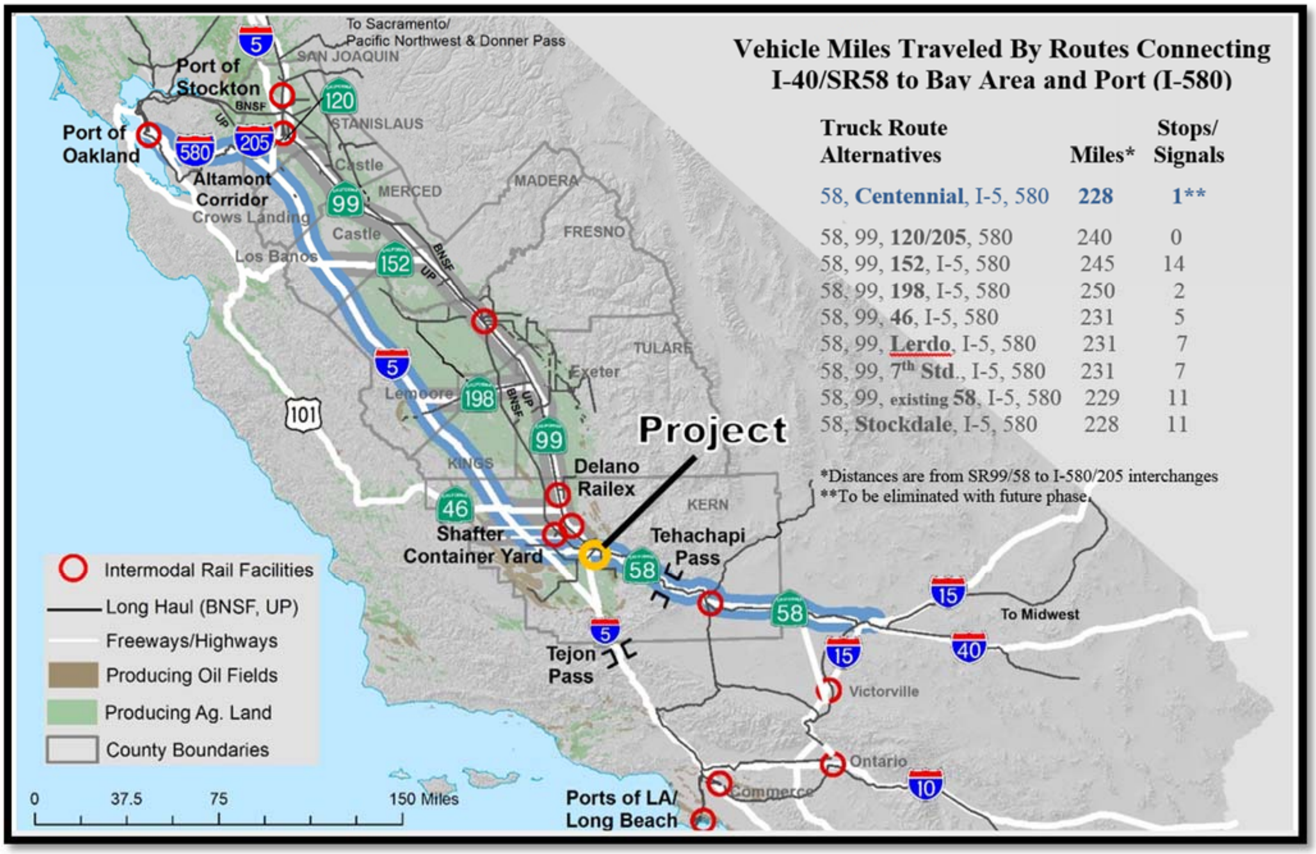
Table 14.8 SR 58 Conditions under Existing and Improved Scenario Truck ADT and Speed

Scenario	Existing		**Improved Scenario**	
Segment	SR 58 West of SR 99	SR 58 East of SR 99	SR 58 West of SR 99	SR 58 East of SR 99
Truck ADT	2,700	8,000	3,000	8,000
Number of Lanes	4	6	6	6
Congested Speed (mph)	<40	<45	55	55

Figure 14.11 Origin-Destination of Trucks under SR 58 Scenario

Source, Fehr and Peers, 2016.

Figure 14.12 Centennial Project Travel Time Impacts



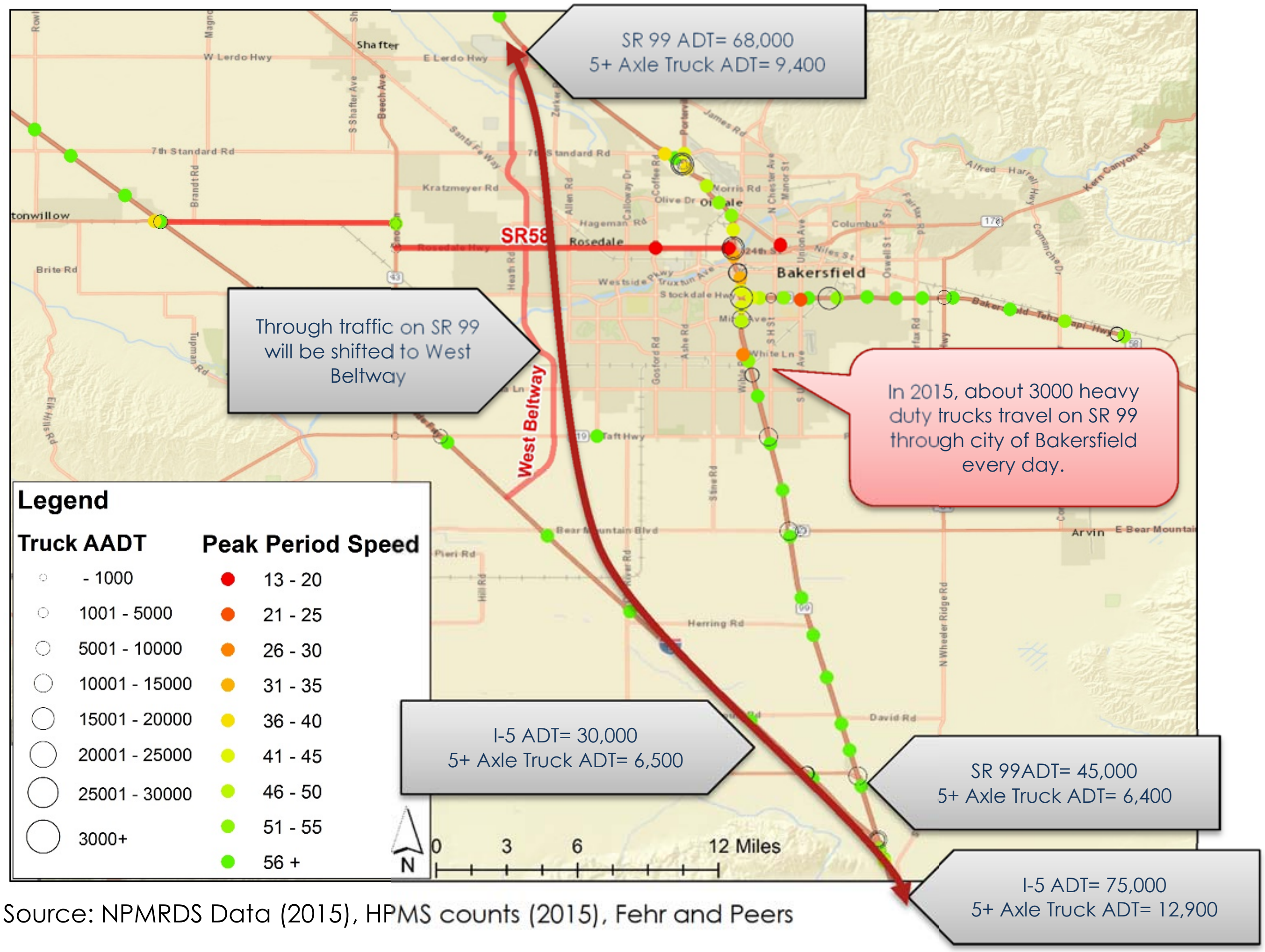
Source: KernCOG

14.4.3 West Bakersfield Beltway connector

Scenario Setting

The West Beltway would link SR 99 from north Bakersfield with Interstate 5 at the South Beltway, passing through the western portion of metropolitan Bakersfield. The County has adopted portions of the alignment for the West Beltway as a Specific Plan Line. This freeway would provide a bypass and thus relief to SR 99, and it would also provide an important link across the Kern River from southwest Bakersfield to the Westside Parkway. Figure 14.13 shows an estimated traffic pattern on SR 99 and the potential shift of heavy duty trucks from SR 99 to the West Beltway.

Figure 14.13 Heavy Duty Truck Traffic Pattern near West Beltway Corridor



Source: NPMRDS Data (2015), HPMS counts (2015), Fehr and Peers

The 10-mile stretch of SR 99 from White Lane to 7th Standard Road has the highest ADT and percent of heavy duty trucks along the corridor. This connector will significantly reduce traffic on this segment by diverting through traffic to the new West Beltway connector. Under existing conditions, about 3,000 heavy duty trucks (combined both directions) will be shifted from SR 99. The most important impact of this connector congestion reduction resulting in lower emissions and a lower risk of severe and fatal collisions along this critical artery in the City of Bakersfield. Based on initial modeling results, this connector may increase the truck traffic on the segments of SR 99 north of 7th Standard Road due to induced demand, which could reduce the overall travel time from the Sacramento Valley and the northern region of the San Joaquin Valley to freight clusters in Kern County and Southern California.

14.4.4 State Route 41 (Fresno and Kings Counties)

Scenario Setting

The objective of this scenario is to improve the travel time on SR 41 so that truckers are encouraged to shift their route from SR 99 to I-5 when possible. This is a high level analysis to estimate the maximum potential traffic reduction on SR 99 under an SR 41 improvement scenario. These improvements include reducing delay at all at-grade intersections and increasing capacity to maintain free-flow speed across the corridor. This corridor is the longest I-5/SR 99 connector, evaluated in this study. It provides a comparable route alternative to SR 99 from Southern California to the City of Fresno and other urban areas north of it **(**Figure 14.14**)**.

Existing Conditions

SR 41 is approximately 53.5 miles long running north-south between I-5 and SR 99. The route connects primarily agricultural and some industrial land uses between I-5 and SR 198. This segment also provides an important north-south route to reach industry in Lemoore and to the east in Hanford via SR 198. There are also major industrial centers at the northern end in and around Fresno, as well as access to SR 99. SR 198 is not analyzed further due to the higher shift potential of SR 41.

Feasibility and Impact Assessment

The route passes through a vast swath of agricultural land, as well as the City of Lemoore and nearby Hanford (via SR 198), both of which have industrial land use clusters that generate truck traffic. At its northern end, the corridor crosses SR 99 and provides direct access to Fresno and the industrial district just east of SR 41 and SR 99 via Van Ness Avenue. SR 41 becomes a limited-access highway with ramps and grade separation north of Central Avenue as it enters the Fresno area, a distance of at least 2.7 miles. The route is also grade-separated approaching SR 198 and Lemoore, a distance of about three miles. There are no at-grade railroad crossings on SR 41 between I-5 and SR 99.

There are several small towns along the corridor, some of which have a greater separation from the through-traffic on SR 41 than others. Kettleman City at the southern end of the corridor is compact, but SR 41 is the main thoroughfare with 2-way stops for all of the city streets; a nearby school and park could cause serious safety concerns for residents living on the east side of SR 41 should traffic volumes increase. The community of Stratford is also located immediately adjacent to SR 41, although most of the community is located on the east side of the route. There may be fewer pedestrian conflicts, but in both examples, left-turning traffic to and from the community may be at risk and would likely experience increased delay from regular volumes of through trucks without the addition of signals or roundabouts.

The City of Lemoore is developing on both sides of SR 41, but the highway is grade-separated through this area, including its junction with SR 198. Approaching Easton, SR 41 transitions to grade-separated again. In the at-grade segments, the route is infrequently crossed by major east-west roads, and those crossings are commonly 2-way stops. Some intersections should be considered for improvement or some form of traffic control in order to reduce the risk of crashes and minimize delay for turning traffic.

Figure 14.14 SR 41 Scenario- Distance Comparison

This segment is exclusively at-grade presently. There are amenities available to truck drivers at either end of the route, although facilities are sparse in between. There are a limited number of truck-serving facilities near SR 41 in Lemoore, including fuel and convenience stores at the Bush Street off-ramp. Additional facilities distributed along the route and/or added capacity near Lemoore for rest stops, fuel, and food options would improve the viability of this route.

Increasing heavy truck traffic on this route would have an impact on approximately 28,400 people who live in census block groups adjacent to SR 41. About half of those residents live in Fresno County and half in Kings County. In the period from 2009 and 2013, there were 455 collisions along the route. Trucks were involved in 63 of those collisions (14 percent). The two most common categories for crash type were rear-end and broadside collisions, which often occur clustered near intersections. Although collisions are dispersed across the entire corridor, there does appear to be a pattern of clustering near intersections, including minor roads where through traffic on SR 41 need not stop.

Table 14.9 Summary of Collisions on SR 41

	All Collisions			Truck Involved Collisions			
Corridor	All	Fatal	Severely Injured	All	Fatal	Severely Injured	Population Adjacent to Corridor
SR 41	55	29	40	69	9	9	28,460

Source: TIMS database, 2009-2013.

Figure 14.15 Origin-Destination of Trucks on SR 41 under Improved Scenario

Source, Fehr and Peers, 2016.

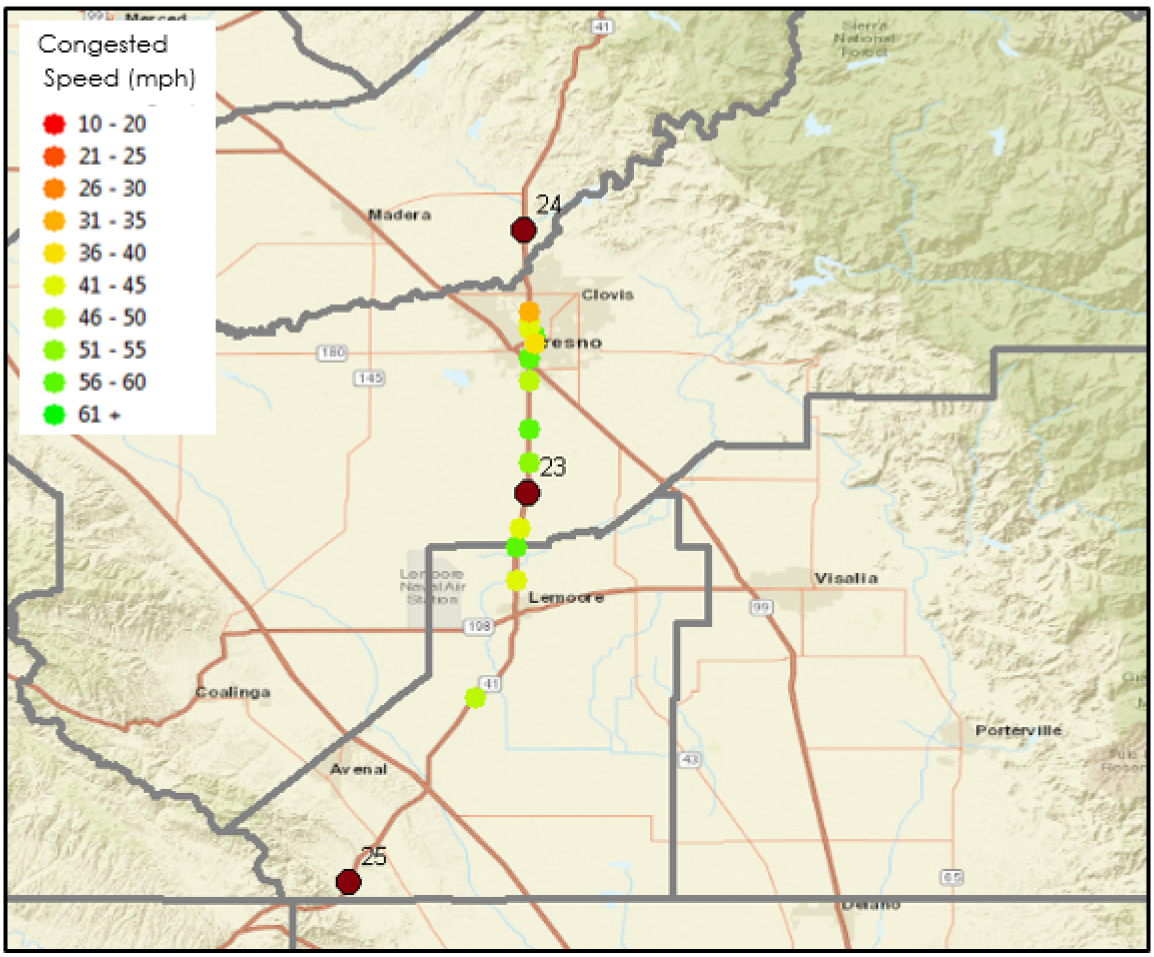
Performance Measures

Truck average daily traffic (ADT), travel time reliability, percentage change in VMT, and percentage change in emissions for the SR 41 Scenario are presented in this section. To forecast a shift in volume from SR 99 (to I-5) we used the OD matrix from the California Statewide Freight Forecasting model (2012 model run), truck route selection patterns from StreetLight truck GPS data, and 2014 truck classification counts. The distribution of trucks on the segment of SR 41 between Fresno and Kings County is shown in Figure 14.15. We estimated the share of trucks on SR 41 from major origin-destination's flows using model route assignment and GPS truck trajectory data. These OD pairs are:

- Fresno, Madera, Merced, San Joaquin County ←→ Southern California
- Fresno, Madera, Merced, Stanislaus, San Joaquin County ←→ Kern County

Figure 14.16 and **Table** 14.10 show the existing congested speed, capacity and improved scenario capacity, and posted speed.

Figure 14.16 Existing SR 41 Congested Speeds at Analyzed Locations



Source: NPMRDS, October 2015.

Table 14.10 SR 41 Conditions under Existing and Improved Scenarios

Scenario	Existing			Improved Scenario		
Segment	SR 41-Kings	SR 41 Fresno	SR 41 Madera	SR 41-Kings	SR 41 Fresno	SR 41 Madera
Truck ADT	950	2,500	870	950	2900	1000
Number of Lanes	2	2	4	4	4	4
Congested Speed (mph)	<45	<35	<50	55	55	55

Source: NPMRDS data, Caltrans classification counts, 2014,

These results are expected if another lane were added to each direction and the average speed of the through route increased to 55 mph. This analysis does not cover passenger trips and induced demand; it is expected that adding another lane to the SR 41 corridor would shift a significant number of passenger trips from SR 99.

Table 14.11 shows the expected changes to Truck VMT and emissions under the proposed scenario. Given the existing alignment of SR 41 for the above OD pairs, Route 41 is about 10 miles longer than SR 99. However, with the congestion on SR 99, it is expected that the travel time of this alternative would be not only shorter than SR 99, but also more reliable. With the improvement of SR 41, up to 400 freight trucks per day could be shifted from SR 99 to I-5. The trucks would travel a slightly longer distance; therefore, the VMT would increase. However, the higher rate of speed would result in fuel efficiency savings so less CO_2 would be generated. Reducing truck congestion on SR 99 would improve the safety and travel time reliability for the remaining users of SR 99.

Table 14.11 SR 41 Improved Scenario –VMT and emission change

Metric	Value
Average truck VMT	• 10 extra miles per trip • About extra $1.2*10^6$ VMT per year
Average truck VHT	• 11 min saving per peak hour trips • About 1000 hours saving per year
CO_2 reduction (during peak period)	• 8.6 million gallons reduction per each HHDT trip • 2.1 million gallons reduction per each MHDT trip • Total of 386 million gallons reduction per year reduction
NOx reduction (during peak period)	• 0.038 million gallons reduction per each HHDT trip • No significant reduction for MHDT trip during peak period • Total of 1.6 million gallons per year reduction

Notes:

1. 307 days of freight activity are assumed in a year.
2. The change in VMT is only calculated for regional goods movement. Local deliveries, service trucks and small trucks are not included in this analysis as they are not the target of the analyzed scenario. On average, 12% of truck VMT in the Valley is related to Medium Heavy duty trucks and 88% is related to HHDT.
3. VHT is calculated assuming 40% of trips are traveling during the peak periods under congested travel times.

14.4.5 State Route 140 (Merced County)

Scenario Setting

The objective of this scenario is to improve the travel time on SR 140 so that truckers are encouraged to shift their route from SR 99 to I-5 when possible. This is a high level analysis to estimate the maximum potential traffic reduction on SR 99 under an SR 140 improvement scenario. These improvements include reducing delay at all at-grade intersections and increasing capacity to maintain free-flow speed across the corridor.

Existing Conditions

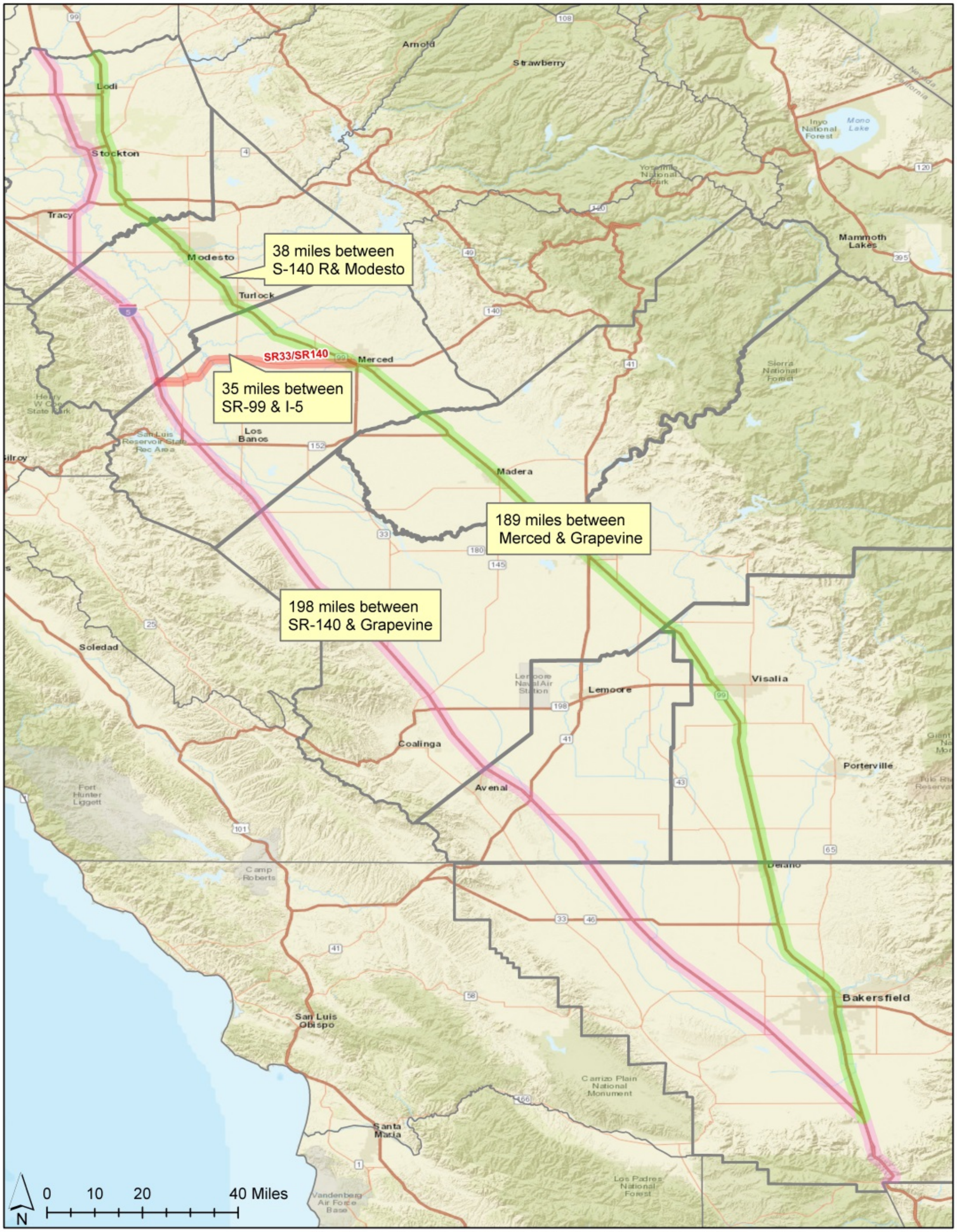
SR 140 between I-5 and SR 99 is a primarily east-west corridor of approximately 35 miles with heavy emphasis on agricultural traffic. The route provides connections mainly to agricultural-industrial land uses along its path as well as access to the Merced Regional Airport just south of SR 99. It is an important access route to Yosemite National Park, east on SR 99. For the cities of Gustine and Merced, it serves as a local commuter route. From Merced to Yosemite National Park, the primary use is for interregional travel with an emphasis on recreational and commuter traffic. In 2002, Caltrans staff prepared a Transportation Concept Report (TCR) for SR 140 to identify improvement priorities and planning strategies for this corridor.

Feasibility Assessment

There are no improvement projects currently planned for SR 140. The TCR identified that the Ultimate Transportation Corridor (UTC) for this segment is a 4-lane conventional highway. Currently, the route is almost exclusively an at-grade, undivided 2-lane rural highway. It passes primarily through agricultural areas although it also traverses the residential community of Gustine concurrent with SR 33. At the eastern end nearing the City of Merced, there is some residential development on the north side of the road and an elementary school on the south side. From post mile 35.79 through 43.70, the Atchinson, Topeka and Santa Fe Railroad tracks run parallel to this highway; thereby complicating the ability to acquire right-of-way for any expansion.

As the route is exclusively at-grade, there are several all-way, stop-controlled intersections, including the junction with SR 165 and Applegate Road. Some of these intersections could be reconstructed as truck-compatible roundabouts to improve safety for turning and cross traffic while reducing the need for through trucks to come to a complete stop. The route includes a number of turns and lower speed limits through the City of Gustine, including a stop-controlled intersection less than 150 feet from an active at-grade railroad crossing. Grade-separation for either the road or the double-tracked railroad could be difficult and prohibitively expensive. An alternative could be to route SR 140 down East Avenue to South Avenue instead of its present alignment. This would better separate the truck traffic from the center of town, and it would also provide a location to more safely cross the railroad by eliminating the left and right turns near the crossing. There are no other at-grade railroad crossings on the route.

Figure 14.17 SR 140 Scenario Route Alternatives



Trucks contribute to up to 13 percent of the traffic volumes. Amenities for truck operators are relatively sparse along this route. There are some gas stations at the intersection of I-5 and SR 140, limited services in Gustine, and services in Merced. However, there is little or nothing in the way of parking, fuel, or services along the route otherwise.

Increasing heavy truck traffic on SR 140 would have an impact on approximately 28,600 people who live in census block groups immediately adjacent to the route. There were 93 traffic collisions between 2009 and 2013, of which eight involved trucks. Collisions were generally distributed across crash types with concentrations of rear-end, broadside, and hitting fixed objects. There were no collisions in the northeast-southwest segment between Santa Fe Grade Road and Keaton Road, a section adjacent to a state park and completely devoid of development and cross-streets.

Table 14.12 Summary of Collisions on SR 140

	All Collisions			Truck Involved Collisions			
Corridor	**All**	**Fatal**	**Severely Injured**	**All**	**Fatal**	**Severely Injured**	**Population Adjacent to Corridor**
SR 140	»	2	11	8	1	2	28,616

Source: TIMS database, 2009-2013

Performance Measures

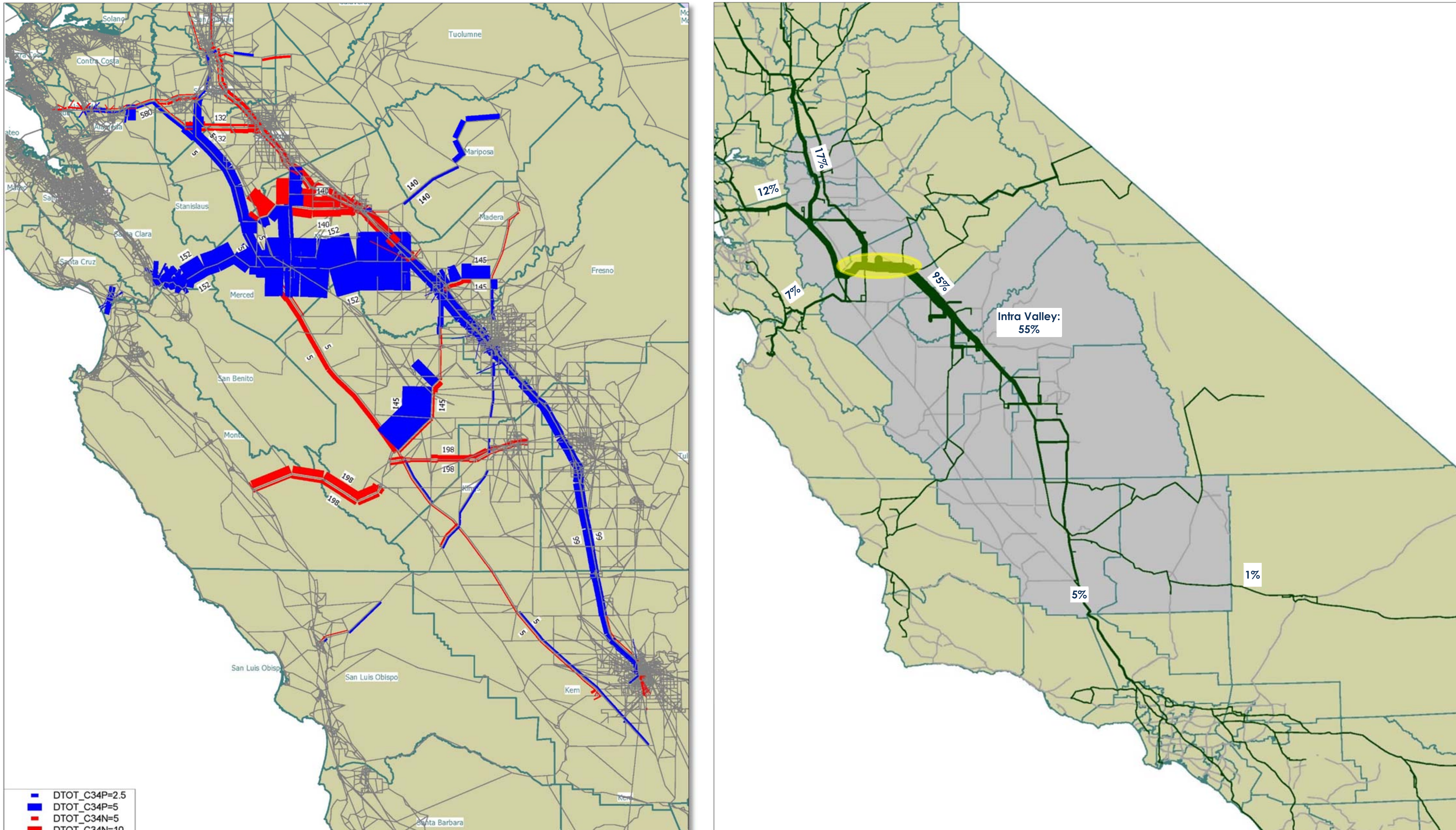
Truck ADT, speed, percentage change in VMT, and percentage change in emissions for the SR 140 Scenario is presented in this section. **Table 14.13** shows existing and projected Truck ADT and speed for SR 140 in Merced County.

The Caltrans study in 2002 reported LOS D or worse for segments of SR 140 near the City of Merced. Truck ADT, travel time reliability, change in VMT, and change in emissions for the SR 140 Scenario is presented in this section. To forecast the shifted volume from SR 99 (to I-5), we used the origin destination matrix from California Statewide Freight Forecasting model (2012 model run), truck route selection patterns from StreetLight truck GPS data and 2014 truck classification counts. The distribution of trucks on the segment of SR 140 in Merced County is shown in **Figure** 14.18.

We estimated the share of SR 140 from major origin-destination's flows using model route assignment and GPS truck trajectory data. These OD pairs are:

- Madera, Merced County ←→ Bay Area, Central Coast, Northern California
- Madera, Fresno, Tulare County ←→ Bay Area, Central Coast, Northern California, Stanislaus, San Joaquin County

Figure 14.18 Percent Difference (Red:-, Blue: +) Plot between SR 140 and Baseline (left) - Origin-Destination of Trucks on SR 140 (right)



Source: CSFFM 2.0, 2012

The distribution of trucks on the segment of SR 140 based on the above pairings is shown in Figure 14.18. For OD pairs with one end in Southern California, I-5 /SR 140 is about 30 to 40 miles longer than SR 99; therefore, it is not a desirable route. However, for OD pairs with one end in the Bay Area, SR 140 can be a viable option with a distance similar to SR 99. If 85 percent of trucks between the above OD pairs that currently use SR 99 shifted their route to SR 41, this would result in 75 fewer trucks per day on SR 99. This result is expected with the addition of another lane in each direction and an average speed of 55 mph. This analysis does not cover passenger trips and induced demand; it is expected that adding another lane to SR 140 corridor would shift a significant number of passenger trips from SR 99 if it included a bypass around Los Banos where heavy congestion occurs.

Table 14.13 SR 140 Conditions under Existing and Improved Conditions

Scenario	Existing	Improved Scenario
Segment	SR 140 East of SR 165	
Truck ADT	400	600
Number of Lanes	2	4
Congested Speed (mph)	<45	55

Table 14.14 SR 140 Improved Scenario Changes in VMT and Emissions

Metric	Value
Average truck VMT	• Similar distance for potential trips
Average truck VHT	• 15 min saving per peak hour trips to bay area • About 1000 hours saving per year
CO_2 reduction (during peak period)	• 12,000 gallons reduction per each HHDT trip to bay area • 6,000 gallons reduction per each MHDT trip to bay area • Total of 70 million gallons reduction per year reduction
NOx reduction (during peak period)	• 50 gallons reduction per each HHDT trip to bay area • 22 gallons reduction per each MHDT trip to bay area • Total of 3,000 gallons per year reduction

Notes:

- 307 days of freight activity are assumed in a year.
- The change in VMT is only calculated for regional goods movement. Local deliveries, service trucks and small trucks are not included in this analysis as they are not the target of the analyzed scenario. On average, 12 percent of truck VMT in the Valley is related to Medium Heavy duty trucks and 88 percent is related to HHDT.
- VHT is calculated assuming 40 percent of trips are traveling during the peak periods under congested travel times.

Table 14.14 shows the expected changes to Truck VMT and emissions under the proposed scenario. The truck volume and VMT information in this table is estimated based on post processed forecasts of Statewide Freight Forecasting Model for year 2012 to reflect the conditions in year 2015. As explained before the volume of CO2 and NOx are estimated using EMFAC average factors for each speed bin and truck classes and respective VMT change across the San Joaquin Valley. SR 140 improvement will change the trucks routing patterns in the valley.

14.4.6 State Route 152 (Merced County)

Scenario Setting

The objective of this scenario is to improve the travel time on SR 152 so that truckers are encouraged to shift their route from SR 99 to I-5 when possible. This is a high level analysis aiming to estimate the maximum potential traffic reduction on SR 99 under SR 152 improvement scenario. These improvements include reducing delay at all at-grade intersections and increasing capacity to maintain free-flow speed across the corridor.

Existing Conditions

SR 152 constitutes a major east-west route corridor in Northern California connecting SR 1 near the coast with SR 99 in the San Joaquin Valley. This route is one of three major highway connections between the Bay Area and I-5. District 4 identified SR 152 between I-5 and US 101 as a major trade corridor and has short-term and long-term plans to improve the capacity and operation of the route. In San Joaquin Valley, SR 152 (partially concurrent with SR 33) is an approximately 42-mile corridor from I-5 to SR 99 – roughly midway between Madera and Merced, and just south of Chowchilla.

From Fresno/Madera to the Bay Area, the SR 152/ I-5 route is slightly longer than the SR 99/SR 120 route Figure 14.19**)**. The route provides access to industrial land use in the City of Los Banos and agricultural areas along its entire length. There are no major industrial clusters directly on either end of the route. Nearby industrial clusters are located a few miles north of the SR 152/SR 99 interchange in Chowchilla, and nine miles to the south near the Madera Municipal Airport.

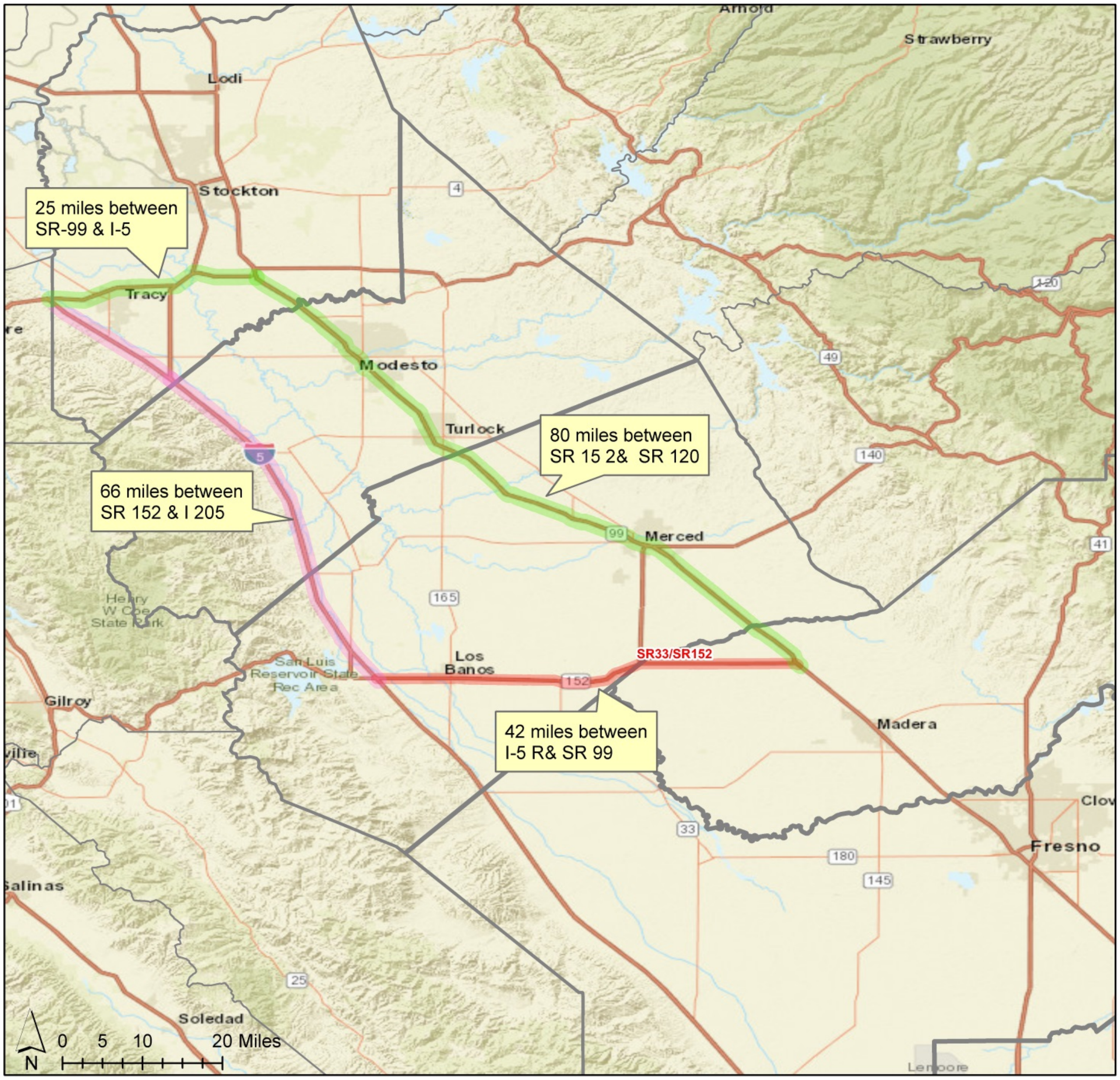
Feasibility Assessment

The entire corridor is a divided 4-lane highway that is often at-grade with grade separation at major intersections and junctions with other state routes, such as 33, 59, and 233. Access between SR 152 and SR 99 is limited to the southbound direction. The route passes primarily through agricultural-industrial land uses with the exception of the City of Los Banos. The approximately 4-mile stretch through the City abuts residential and commercial land uses. There are numerous signalized intersections and driveway cuts, a 2-way left-turn lane separates the road, and turning access is generally unrestricted. There are no railroad crossings along SR 152.

For eastbound trips heading north to Chowchilla or points on SR 99, trucks must use local routes like SR 233 or Road 16. SR 233 passes through the center of Chowchilla as a 4-lane arterial road surrounded by retail and residential land uses with parks and schools nearby. Road 16 is not a state highway but could provide an alternative truck route that avoids most residential areas and connects directly to the Chowchilla industrial cluster. Access to SR 99 northbound is available via Avenue 24.

There are some services available to trucks in the Los Banos area, and one truck stop located just east of SR 59. No other services are found immediately along the route.

Figure 14.19 SR 152 Scenario Distance comparison



Several projects are identified for SR 152. In the near-term, programmed improvements along the route include: traffic operation improvements on SR 152 in the City of Los Banos, widening the route between US 101 and the Merced-Fresno county line across I-5. Further in the future, a bypass around Los Banos is planned in two segments.

Approximately 36,200 people living in census block groups along SR 152 could be affected by an increase in truck traffic. The vast majority of these residents, about 30,200, live in Merced County while the remaining 6,000 reside in Madera County. Between 2009 and 2013, there were 334 collisions and 49 involved trucks, or about 10 percent. Total collisions were generally distributed evenly across the entire corridor except for the concentration in Los Banos. The most frequent type of crashes were rear-end collisions, which cluster in the area of Los Banos due to more conflict points that likely result in speed fluctuations as vehicles enter or exit the roadway more frequently.

Table 14.15 Summary of Collisions on SR 152

Corridor	All collisions			Truck involved collisions			Exposed
	All	Fatal	Severely injured	All	Fatal	Severely injured	Population
SR 152	334	15	27	49	4	8	36,268

Source: TIMS database 2009-2013,

Performance Measures

Truck ADT, travel time reliability, change in VMT, and change in emissions for the SR 152 Scenario are presented in this section. To forecast the volume shifted from SR 99, the OD matrix from the California Statewide Freight Forecasting model (2012 model run), truck route selection patterns from StreetLight truck GPS data and 2014 truck classification counts were used. Model results were adjusted to match 2014 truck counts. The distribution of trucks on the segment of SR 152 between Fresno and Kings County is shown inFigure 14.21. We estimated the share of SR 152 from major origin-destination's flows using model route assignment and GPS truck trajectory data. These OD pairs are:

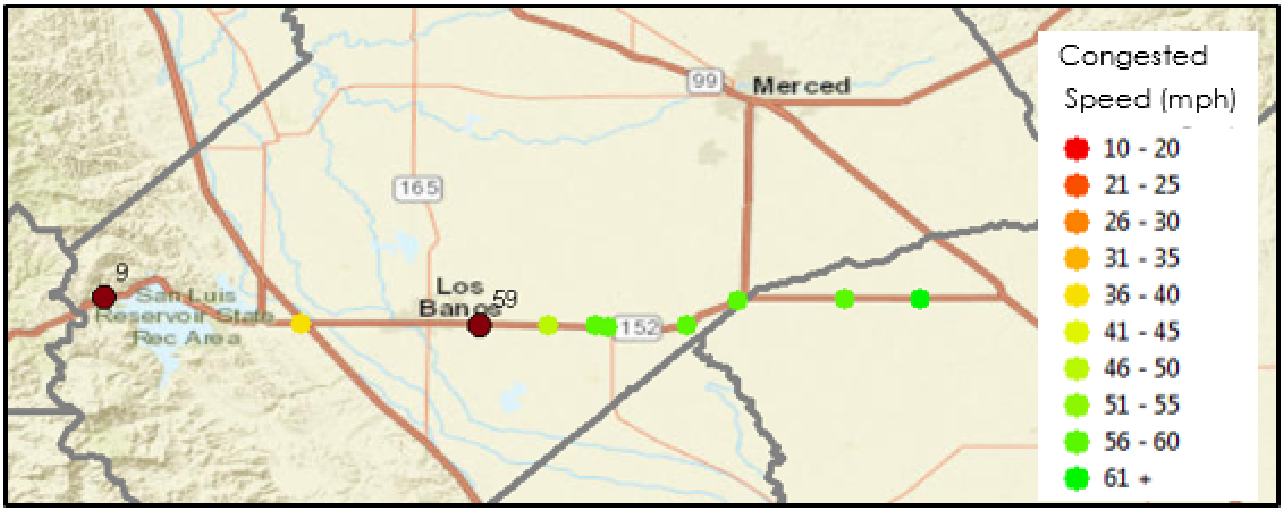
- Central parts of San Joaquin Valley ←→ Bay Area /Central Coast
- Madera, Merced, Stanislaus ←→ Southern California

SR 152 is a not a popular route to access Southern California from cities along SR 99, such as Modesto, Turlock, or Merced. The SR 152/I-5 route is about 50 miles longer than SR 99, and it has many at-grade intersections in the City of Los Banos, which may cause extra delays. Therefore, it is not anticipated that trucks between these OD pairs would shift their route from SR 99.

On the other hand, SR 152 is a popular route to access the Bay Area from the Fresno and Madera areas. For these OD pairs, the SR 152/I-5 route is about the same distance as the SR 99/I-205 route **(**Figure 14.19**)**. Under the SR 152 Improvement Scenario, the heavy duty truck traffic on this corridor would be up to 2.5 times higher than existing traffic. Our analysis indicates that some out-of-state trucks using SR 198 and SR 140 would be inclined to use SR 152 instead.

This analysis does not cover passenger trips and induced demand. It is possible that adding another lane to the SR 152 corridor would also shift a significant number of passenger trips from SR 99.

Figure 14.20 SR 152 Travel Speeds at Analyzed Locations

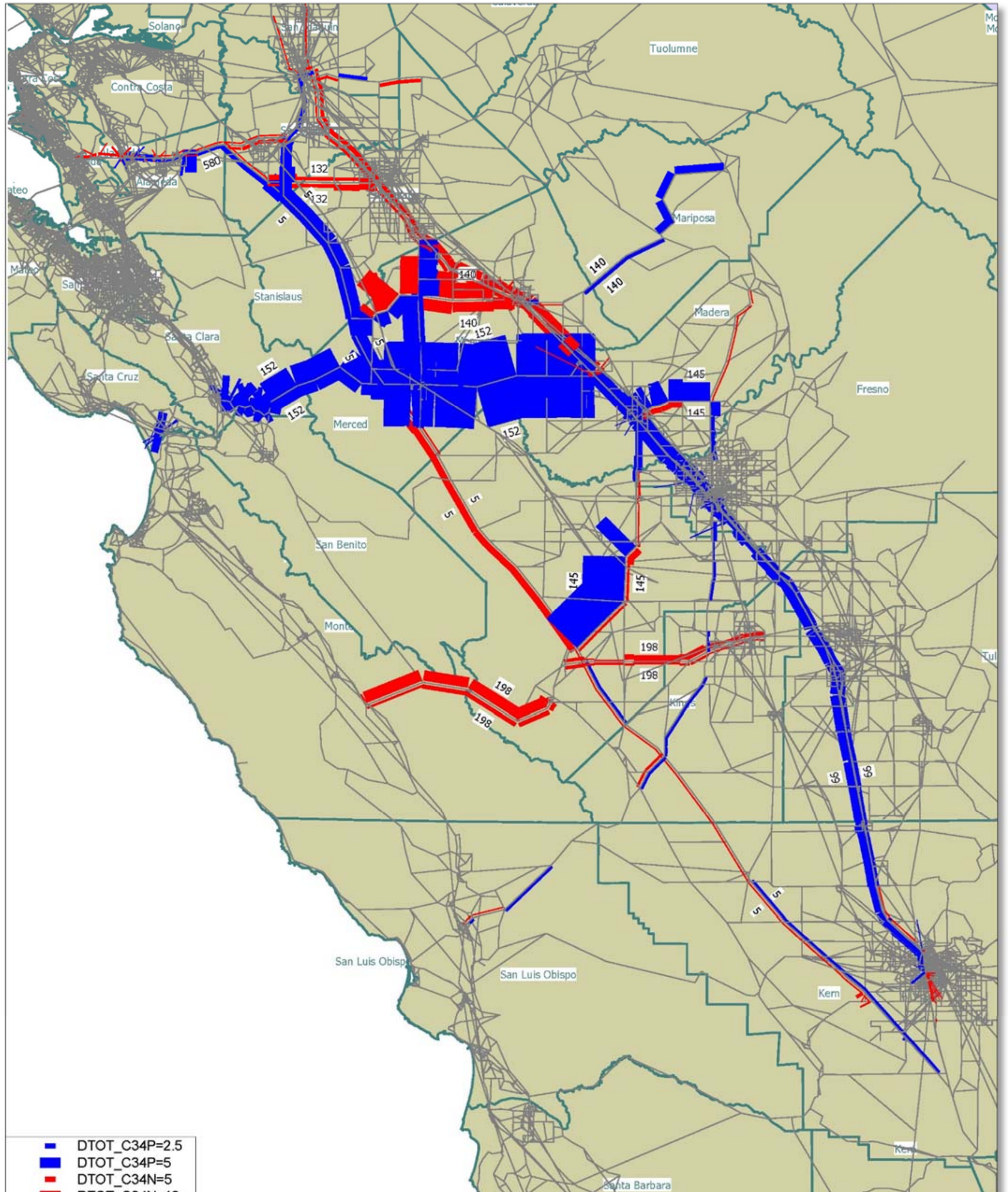


Source: NPMRDS, October 2015.

Table 14.16 SR 152 conditions under Existing and Improved Scenario

Segment	SR 152 East of SR 165	
Scenario	**Existing**	**Improved**
Truck ADT	2,100	4,500
Number of Lanes	4	6
Congested Speed (mph)	<45	55

Figure 14.21 Percent Difference (Red:-, Blue: +) plot between SR 152 and Baseline (left) - Origin-Destination of Trucks on SR 152 (right)



Source: CSFFM 2.0, 2012

Table 14.17 SR 152 VMT and Emission change under Existing Conditions

Metric	Value
Average truck VMT	• 5 miles longer trips from Central parts of San Joaquin Valley to Bay Area
Average truck VHT	• 15 min saving per peak hour trips to bay area • About 4000 hours saving per year
CO_2 reduction (during peak period)	• 12 million gallons reduction per each HHDT trip to bay area • 6 million gallons reduction per each MHDT trip to bay area • Total of 71 million gallons reduction per year reduction
NOx reduction (during peak period)	• 0.05 million gallons reduction per each HHDT trip • 0.02 million gallons reduction per each HHDT trip • Total of 0.27 million gallons per year reduction

Notes:

- 307 days are assumed in a year.
- The change in VMT is only calculated for regional goods movement. Local deliveries, service trucks and small trucks are not included in this analysis as they are not the target of the analyzed scenario. On average, 12 percent of truck VMT in the Valley is related to Medium Heavy duty trucks and 88 percent is related to HHDT.
- VHT is calculated assuming 40 percent of trips are traveling during the peak periods under congested travel times.

14.4.7 State Route 165 (Merced County)

Scenario Setting

The objective of this scenario is to improve the travel time on SR 165 so that truckers are encouraged to shift their route from SR 99 to I-5 when possible. This is a high level analysis to estimate the maximum potential traffic reduction on SR 99 under SR 165 improvement scenario. These improvements include reducing delay at all at-grade intersections and increasing capacity to maintain free-flow speed across the corridor.

Existing Conditions

SR 165 is approximately 38 miles long, making a north-south connection between I-5 and SR 99 near the City of Turlock. The route provides alternative north-south access to I-5 for industrial clusters near Turlock, as well as agricultural and industrial sites along SR 165. There are also many destinations around the area of Hilmar and Los Banos.

Feasibility Assessment

A PSR/PDS was completed for the realignment of SR 165 in Spring 2014. The route is almost exclusively a 2-lane, undivided rural highway passing through agricultural land uses. The route also passes through the center of the City of Los Banos, where it widens periodically at major intersections and includes a 2-way left-turn lane. SR 165 also passes through the center of Hilmar, a distance of approximately 1.3 miles, where it is surrounded by homes, commercial development, and schools. Major intersections in both communities are signalized with generally unrestricted left-turn access for driveways along SR 165. Outside of these communities, there are long stretches of the route that are uninterrupted by cross streets. 4-way stop-controlled intersections occur at both state routes and major local roads. There are no railroad crossings on SR 165.

Services for truck drivers are available in both of those communities, as well as limited options near the junctions with SR 99 and I-5. In between, there are two long stretches of possibly as many as 21 miles with no services or parking opportunities. Much of this corridor passes through a large state park, which may present challenges if the highway were considered for widening. There are presently no projects planned for SR 165 between I-5 and SR 99, although a by-pass project for the east-west SR 152 around Los Banos would create a new connection to SR 165.

Because much of the corridor allows for uninterrupted travel with relatively few conflicts from cross-traffic, the greatest value of improvements may come from converting all-way, stop-controlled intersections into truck-compatible roundabouts. Roundabouts reduce the risk of collision with turning vehicles and are beneficial for trucks, which would no longer have to come to a complete stop. While the all-way, stop-controlled intersections are relatively few given the length of the corridor, these locations interrupt through traffic and reduce the average speed and travel time for trucks.

The population of approximately 43,200 living along SR 165 includes 38,660 in Merced County and 4,600 in Stanislaus County. There were 259 collisions along SR 165 between 2009 and 2013, and 29 involved trucks (about 12 percent). Collisions were heavily clustered in the area of Los Banos and Hilmar where speeds are lower and there is a greater volume of traffic entering and exiting the roadway. There are substantially fewer collisions per mile in the central segment between Los Banos and SR 140, which is mostly undeveloped state parklands with no cross-streets. There is a notable small cluster of crashes where the road makes a curve near the intersection of Wolfsen Road. Safety warning and visibility improvements may reduce the risk of collisions with turning and entering vehicles on this curve.

Table 14.18 Summary of Collisions on SR 165

	All Collisions			Truck Involved Collisions			
Corridor	All	Fatal	Severely Injured	All	Fatal	Severely Injured	Population Adjacent to Corridor
SR 165	259	13	27	29	5	7	43,251

Source: TIMS database, 2009-2013.

Performance Measures

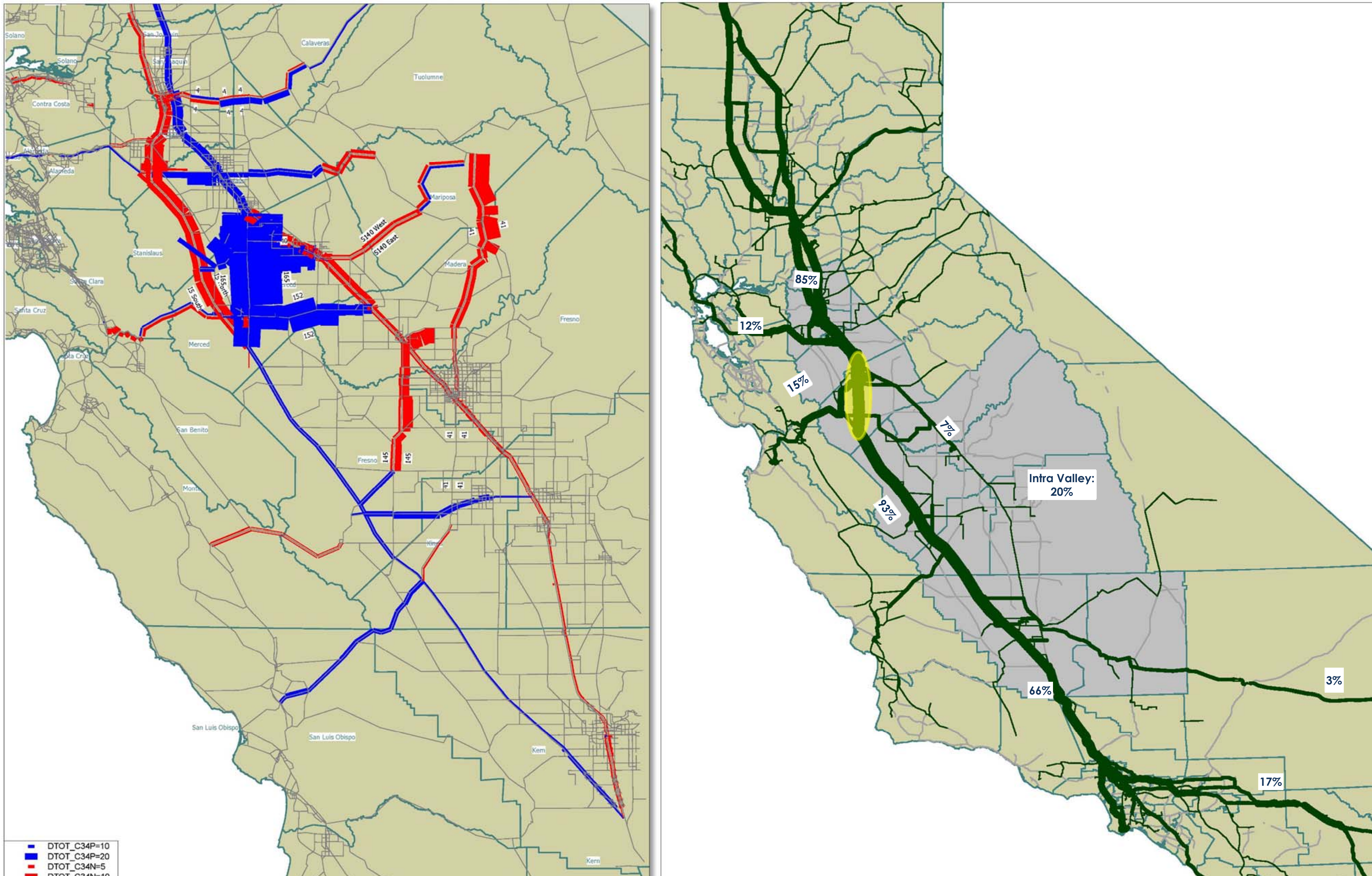
Truck ADT, travel time reliability, change in VMT, and change in emission for the SR 165 Scenario are presented in this section. To forecast the volume shifted from SR 99, the OD matrix from the California Statewide Freight Forecasting model (2012 model run), truck route selection patterns from StreetLight truck GPS data and 2014 truck classification counts were used. Model results were adjusted to match 2014 truck counts. The distribution of trucks on the segment of SR 165 in Merced

County south of SR 140 is shown in Figure 14.22. We estimated the share of SR 165 from major origin-destination's flows using model route assignment and GPS truck trajectory data. These OD pairs are:

- Madera, Merced, Stanislaus, San Joaquin County ←→ Southern California
- Other States, San Joaquin Valley ←→ Bay area / Sacramento Valley

Relative to SR 152 or SR 132, SR 165 provides better access for trips from/to southern California. Given the significantly higher frequency of trips from/to southern California, any network improvements that affect truck's routing from/to southern California would have higher impact on truck traffic shift. The existing SR 165/I-5 route has similar distance as SR 99 from northern San Joaquin valley to southern California. However, it has a lot of at-grade intersections in the City of Los Banos, which may cause extra delays. Under SR 165 improvement scenario the heavy truck traffic on SR 165 is almost doubled (104% increase on northbound and 50% increase on South bound, in Figure 14.22 Under this Scenario truck traffic on SR 99 between I-5 split and SR 165 in Kern, Tulare, Fresno and Madera County will be decreased by 3 to 10 percent; however, based on the model stochastic traffic assignment results **(**Figure 14.22**)** the truck traffic on SR 99 north of SR 165 might be increased due to a shift of some of the I-5 traffic. I-5 and SR 99 in San Joaquin County are almost parallel, which makes the traffic assignment algorithm overly sensitive to small changes. This connector would also provide a bypass for major congested urban areas across SR 99, such as Fresno and Bakersfield.

Figure 14.22 Percent Difference (Red:-, Blue: +) plot between SR 165 and Baseline (left) - Origin-Destination of Trucks on SR 165 (right)



Source: CSFFM 2.0, 2012.

This result is expected with the addition of another lane in each direction and an increase in the average speed to 55 mph. This analysis does not cover passenger trips and induced demand. It is possible that adding another lane to the SR 165 corridor would shift a significant number of passenger trips from SR 99.

Table 14.19 SR 165 Conditions under Existing and Improved Scenario *Truck ADT and Speed*

Scenario	Existing	Improved Scenario
Truck ADT	600	1,100
Number of Lanes	2	4
Congested Speed (mph)	<40	55

The origin-destination matrix from the California Statewide Freight Forecasting model (2012 model run), truck route selection patterns from StreetLight truck GPS data and 2014 truck classification counts were used to forecast the shifted volume from SR 99. Model results were adjusted to match 2014 truck counts. **Table 14.20** shows the expected changes to Truck VMT and emissions under the proposed scenario.

Table 14.20 SR 165 Conditions under Existing and Improved Scenario *Truck VMT and Emission Changes*

Metric	Value
Average truck VMT	• I-5/SR 165 route is about 7 miles shorter than SR 99 (between I-5/SR 99 split and Turlock)
Average truck VHT	• 15 min saving per peak hour trips to So-Cal* • About 1000 hours saving per year
CO_2 reduction (during peak period)	• 16,000 gallons reduction per each HHDT trip to So-Cal • 5,000 gallons reduction per each MHDT trip to So-Cal • Total of 90 million gallons reduction per year reduction
NOx reduction (during peak period)	• 62 gallons reduction per each HHDT trip to So-Cal • 40 gallons reduction per each MHDT trip to So-Cal • Total of 3,600 gallons per year reduction

* So-Cal: Southern California

Notes:

1. 307 days are assumed in a year.
2. The change in VMT is only calculated for regional goods movement. Local deliveries, service trucks and small trucks are not included in this analysis as they are not the target of the analyzed scenario. On average, 12 percent of truck VMT in the Valley is related to Medium Heavy duty trucks and 88 percent is related to HHDT.
3. VHT is calculated assuming 40 percent of trips are traveling during the peak periods under congested travel times.

14.4.8 State Route 132 (Stanislaus County)

Scenario Setting

The objective of this scenario is to improve the travel time on SR 132 so that truckers are encouraged to shift their route from SR 99 to I-5 when possible. This is a high level analysis aiming to estimate the maximum potential traffic reduction on SR 99 under an SR 132 improvement scenario. These improvements include reducing delay at all at-grade intersections and increasing capacity to maintain free-flow speed across the corridor.

Existing Conditions

SR 132 connects I-580, I-5 and SR 99 at the City of Modesto. The corridor between I-5 and SR 99 is 18.5 miles long with posted speeds ranging between 25 mph and 50 mph. It is located at the northern side of the San Joaquin Valley. Most of the route is an undivided, two-lane highway with at-grade crossings, although a few intersections, primarily near I-5, are grade separated. There are no railroad crossings along the route. SR 132 passes through almost entirely agricultural land and no communities except for the eastern most 1.5 miles in Modesto. Most intersections with cross-streets are two-way stop-controlled, but several locations have all-way stops. SR 132 becomes a grade-separated expressway approaching I-5 near I-580.

Feasibility Assessment

SR 132 provides an important east-west connection south of Stockton and connects with freight clusters in the Modesto area that are accessible from SR 99. There are agricultural sites along the route, but no other significant freight clusters. Services are very sparse and concentrated in Modesto, although there is a truck-serving gas station at the intersection with Hart Road.

Several projects have been identified for SR 132, although there may be some overlap between them. As a long range program, there are plans for widening the route between I-580 and SR 99. A more near term plan is the State Route 132 West Project to improve the connections with SR 99 and realign and widen the route for about a 3.5-mile stretch west of SR 99 by 2028. The purpose of the project is to improve regional and interregional circulation, relieve traffic congestion along existing State SR 132/Maze Boulevard, and improve operations for the transportation network in the area by creating a four-lane freeway/expressway on a new alignment.

There are approximately 14,000 people living in census block groups immediately adjacent to the corridor, including more than 11,000 in Stanislaus County and the rest in San Joaquin County. Between 2009 and 2013, 122 collisions occurred on SR 132 between I-580 and SR 99. About 17 percent of those collisions, or 21 incidents, involved trucks. The most prevalent type of crash was a broadside collision, which occurred most commonly at intersections and especially at two-way, stop-controlled intersections.

Table 14.21 Summary of Collisions on SR 132

Corridor	All Collisions			Truck Involved Collisions			Population Adjacent to Corridor
	All	Fatal	Severely Injured	All	Fatal	Severely Injured	
SR 165	122	4	21	21	2	5	14,097

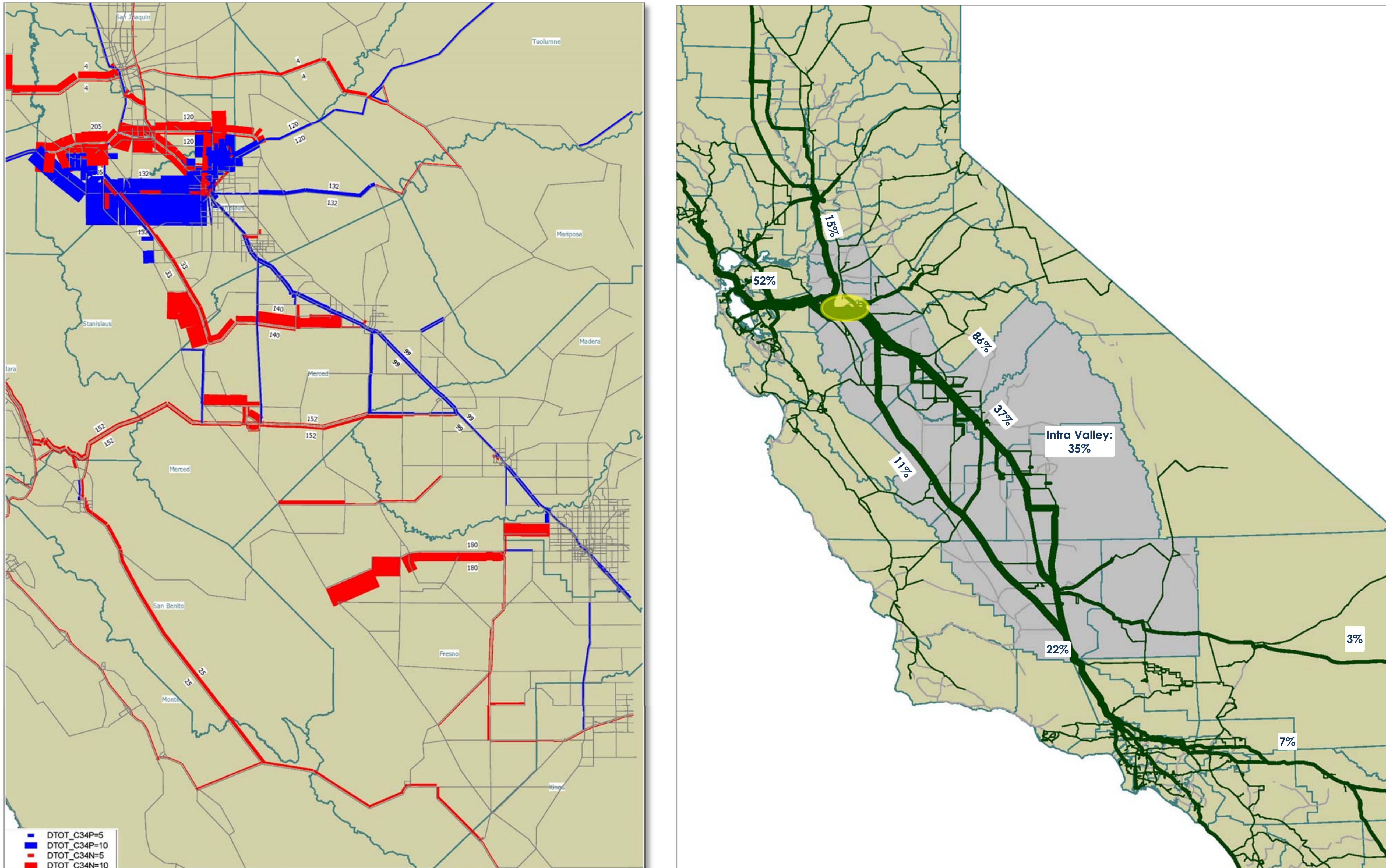
Source: TIMS database, 2009-2013.

Performance Measures

The segment of SR 99 between Ripon and Manteca is heavily congested and has a high number of recorded severe and fatal collisions. This scenario would enhance parallel access to SR-120/I-205 and improve the operation of the SR 99 and SR-120 interchange. This route is also three miles shorted than SR-120/I-205 to the Bay Area. For the most part, the route traverses rural areas with low traffic. The only hindrances include the connection with SR 99 and the segment between North Dakota Street and SR 99.

SR 132 is a popular alternate route to SR 205 for accessing the Bay Area from the Fresno and Madera areas. SR 132 is a less a popular route for accessing Southern California from the Modesto, Salida, Ripon freight clusters. The SR 132/I-5 route is approximately 25 miles longer than SR 99; however, during the peak period it is anticipated that the travel time savings will attract trucks to this route (as well as passenger vehicles).

Figure 14.23 Percent Difference (Red:-, Blue: +) plot between SR 132 and Baseline (left) - Origin-Destination of Trucks on SR 132 (right)



Source: CSFFM 2.0, 2012

Truck ADT, travel time reliability, change in VMT, and change in emissions for the SR 132 Scenario is presented in this section. To forecast the shifted volume from SR 99, origin destination matrix from California Statewide Freight Forecasting model (2012 model run), truck route selection patterns from StreetLight truck GPS data and 2014 truck classification counts are used. Model results are adjusted to match 2014 truck counts. The distribution of trucks on the segment of SR 132 in Stanislaus County east of SR 33 is shown inFigure 14.23. We estimated the share of SR 132 from major origin-destination's flows using model route assignment and GPS truck trajectory data. These OD pairs are:

- Other States, San Joaquin Valley ←→ Bay area
- South of San Joaquin County, Stanislaus County ←→ Southern California

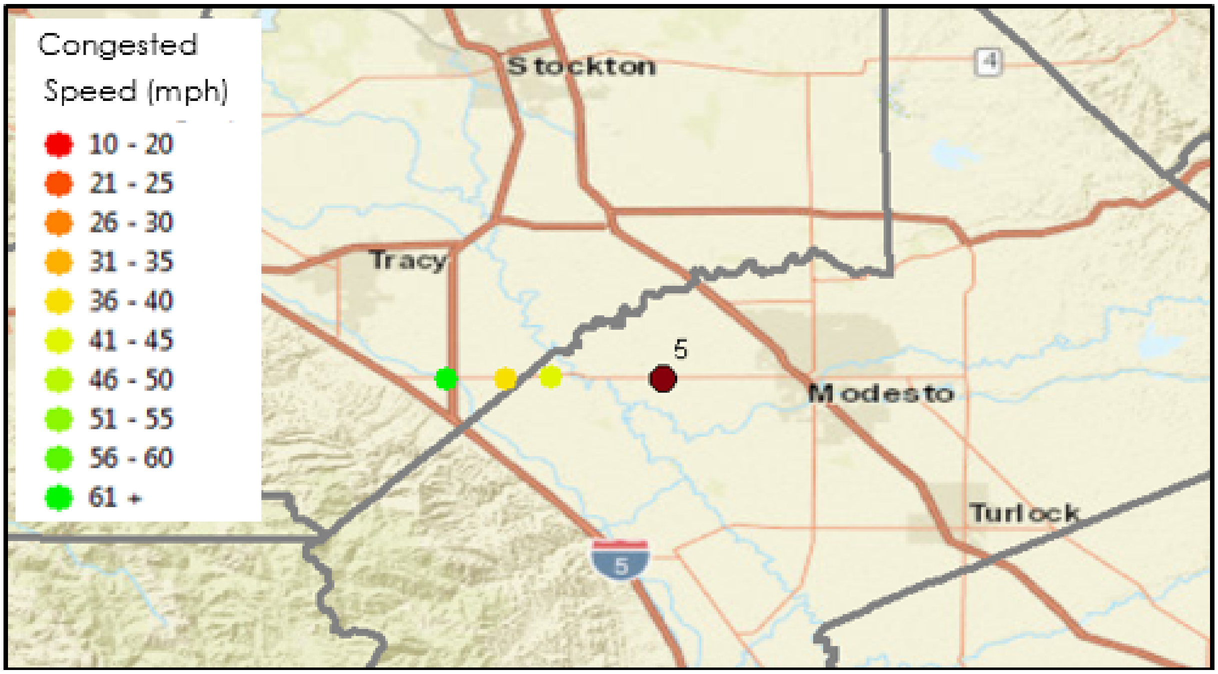
As show in Figure 14.23 under the SR 132 Improvement Scenario, the heavy duty truck traffic on this corridor would expect to increase by 11 percent. The reduction is more significant for eastbound than westbound. This improvement would result in a 10 percent reduction of heavy truck traffic on an 18 mile stretch of SR 99 between Modesto and SR-120/I-205. The heavy heavy duty truck ADT (5+ axels) on this segment of SR 99 is about 7,000. This result is expected with the addition of another lane in each direction and an increase in the average speed along the route to 55 mph. This analysis does not cover passenger trips and induced demand, it is possible that adding another lane to SR 152 corridor will shift significant number of passenger trips from SR 99.

Figure 14.24 shows existing truck speeds at select locations and **Table 14.22** show existing and projected Truck ADT and speed for segments in Merced County and Madera County.

Table 14.22 SR 132 Conditions under Existing and Improved Scenario Truck ADT and Speed

Scenario	Existing	Improved Scenario
Heavy Duty Truck ADT	1500	1650
Number of Lanes	mostly 2	4
Congested Speed (mph)	<40	55

Figure 14.24 SR 132 Travel Speeds at Analyzed Locations



Source: NPMRDS, October 2015.

The OD matrix from the California Statewide Freight Forecasting model (2012 model run), truck route selection patterns from StreetLight truck GPS data, and 2014 truck classification counts were used to forecast the shifted volume from SR 99. Model results were adjusted to match 2014 truck counts.

Table 14.23 SR 132 Improved Scenario –VMT and emission change

Metric	Value
Average truck VMT	• Similar distance for potential trips
Average truck VHT	• 10 min saving per peak hour trips to bay area • About 3,000 hours saving per year
CO2 reduction (during peak period)	• 2,000 gallons reduction per each HHDT trip to bay area • 600 gallons reduction per each MHDT trip to bay area • Total of 33 million gallons reduction per year reduction
NOx reduction (during peak period)	• 12 gallons reduction per each HHDT trip • Total of 0.2 million gallons per year reduction

Notes:

1. 307 days are assumed in a year.
2. The change in VMT is only calculated for regional goods movement. Local deliveries, service trucks and small trucks are not included in this analysis as they are not the target of the analyzed scenario. On average, 12 percent of truck VMT in the Valley is related to Medium Heavy duty trucks and 88 percent is related to HHDT.
3. VHT is calculated assuming 40 percent of trips are traveling during the peak periods under congested travel times.

14.4.9 Conclusion and Final Recommendations

The average daily truck traffic volume (5+ axles) on SR 99 in the Valley varies from 5,000 to 13,000 (5-21 percent of the AADT). Overall, the truck volume increases from north to south with the highest volumes occurring in Kern and Fresno Counties. The objective of this section is to evaluate various network improvements that could provide reasonable alternative truck routes to SR 99 thus reducing truck traffic congestion on SR 99. In addition to reducing congestion and improving safety and travel time reliability, these improvements would also improve resiliency and access.

The characteristics of truck traffic (Origin-Destination pattern and volume) on different segments of SR 99 vary. The unique characteristics of each segment make it difficult to compare them to one another as shown in **Table 14.24**.

Table 14.24 Summary of I-5/SR 99 Connector Scenarios

Connector	Primary Purpose	Length (Miles)	*Number of Interchanges
SR 58/ Centennial Corridor	• Separate SR 99 and SR 58 traffic • Accommodate out-of-state traffic to Bay Area and Central Coast	30	8
West Beltway	• Rerouting SR 99 through traffic to reduce congestion in Bakersfield	19	10
SR 41	• Alternative route from Southern California to Fresno and other urban areas north of it along SR 99	54	22
SR 140	• Alternative route to connect Merced and other urban areas north of Merced to SR 99	35	10 (bypass at Gustine)
SR 152	• Alternative route for Bay Area and Central Coast • Connect cities between Madera and Merced to I- 5	42	6 (bypass Los Banos)
SR 165	• Alternative route to connect Turlock, Modesto, and other cities in northern San Joaquin Valley to I-5	38	9 (bypass Los Banos and Hilmar)
SR 132	• Alternative to SR 120/ I-205 • Reduce congestion on SR 99 between Modesto and Manteca	20	7

*This is a very high level estimate

This is high level analysis focusing on the regional distribution and origin-destination of heavy heavy duty freight trucks (+5 axles). The local short haul trips of smaller trucks (trips less than 50 miles, trucks with less than 5 axles) are less likely to change their route under these analyzed scenarios. We acknowledge that the passenger trip behavior is not included in this analysis, and there might be significant change due to induced demand. **Table 14.25** shows the relative comparison of analyzed scenarios.

The West Beltway Scenario is by far the most beneficial scenario. Given the high volume of truck traffic between Southern California and the Central Valley and heavy congestion on SR 99 through the City of Bakersfield, this connector has the potential to save significant hours of delay by both reducing congestion and by also decreasing fatal and severe collisions that result in significant non-recurrent delay.

In central parts of San Joaquin Valley, the SR 152 improvements could provide the most benefit. This route continues to the Central Coast and provides and alternate route for I-205 to the Bay Area for trips originating in the southern parts of the Valley.

In the northern parts of San Joaquin Valley, the SR 132 Scenario is a close parallel alternative route to I-205/SR 120; therefore, it does not reduce much of the traffic on SR 99. However, it would provide significant congestion relief for SR 120.

Table 14.25 Summary of I-5/SR 99 Connectors Improvements Impacts

	Daily HDT Volume			Annual Reductions		
Project	**Existing**	**Proposed Scenario**	**CO2**	**NOx**	**Delay**	**SR 99 VMT**
SR 8	2700	3000			4.3	5.5
West Beltway	-	3000	-	-	70.1	32.2
SR 41	2500	2900	386	1.6	27.5	1.2
SR 140	400	600	71	0.3	1.4	-
SR 152	2100	4500	214	0.8	4.2	0.2
SR 165	600	1100	938	3.6	42.1	1.1
SR 132	1500	1650	33	0.2	3.2	-

*Million tons of CO2/ NOx, 1,000 hours of delay, million truck miles of VMT.

14.5 Opportunities for Increasing the Use of Rail

There is continuing interest in opportunities to shift highway trips to rail, centering on container drayage to and from the Ports of Oakland, Los Angeles, and Long Beach. While the project team knows of no detailed, active proposals for rail intermodal service between the ports and points in the San Joaquin Valley, some recent developments may be considered steps in that direction and may hold the potential of reducing truck VMT even without a modal shift.

Port of Oakland Developments

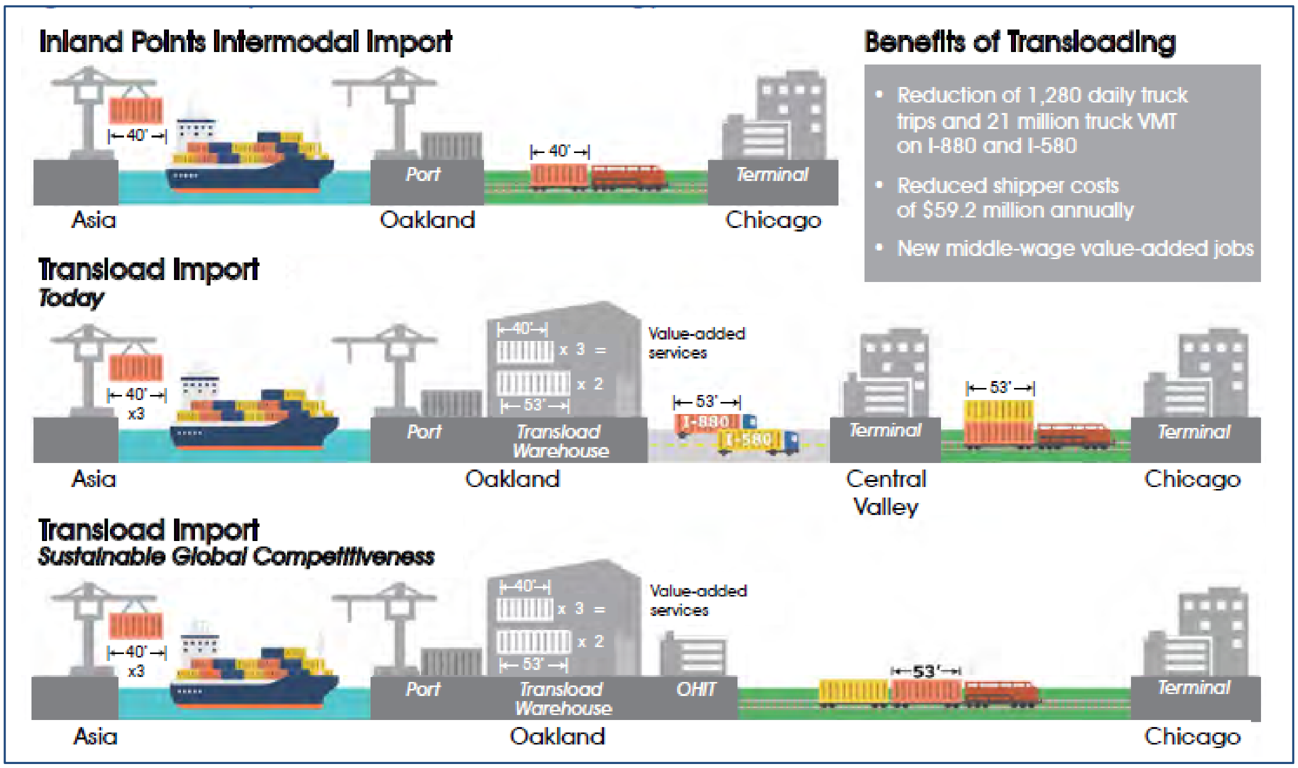
There are three relevant logistics projects in progress at or near the Port of Oakland:

- Construction on the Prologis Oakland Global Trade and Logistics Center began in late 2016. The first phase of 250,000 SF building is targeted for completion in mid-2017 with second and third phases to follow. The completed development is expected to have 979,000 SF of warehousing and distribution space.

- CenterPoint, in partnership with the Port of Oakland, is expected to break ground on the first 440,000-SF phase of its Seaport Logistics Complex in late 2017.
- The Port's Cool Port refrigerated warehouse (283,000 SF) is expected to start construction in March, 2017.

The Prologis and CenterPoint projects were cited in the 2016 San Francisco Bay Area Goods Movement Plan as having a significant potential to attract international cargo transloading **(**Figure 14.25**)** and reduce VMT on I-580. To the extent that this potential is realized, truck trips between Oakland and the San Joaquin Valley with cargo previously/subsequently moving to/from inland rail points would be replaced by direct rail from Oakland. The CoolPort project will be served by rail, and could divert some long-haul truck trips from refrigerated export sources outside California.

Figure 14.25 Oakland Logistics Transload Strategies



Source: 2016 2016 San Francisco Bay Area Goods Movement Plan.

Lathrop Developments

Shipper's Transport Express, Lathrop. Shipper's Transport Express (STE) has established an inland container depot and staging area at Lathrop **(**Figure 14.26**)**. STE drays containers between the depot and the Oakland International Container Terminal (OICT, operated by STE sister company SSA), with inland customers picking up or dropping off containers at Lathrop.

Figure 14.26 STE Lathrop Staging Yard

The Shipper's Transport Express (STE) depot at Lathrop (and the proposed depot at Shafter) will have three functions:

1. It will serve as a remote staging lot for the SSA terminal at Oakland. STE will dray loaded import containers to Lathrop instead of having drayage firms pick them up in Oakland. STE will also dray loaded export containers to Oakland.

2. It will function as an inland container depot, accepting empty import containers and providing empty containers for exports.

3. It will function as a chassis pooling location. Chassis are now provided and billed separately from containers.

The STE initiative should yield multiple benefits.

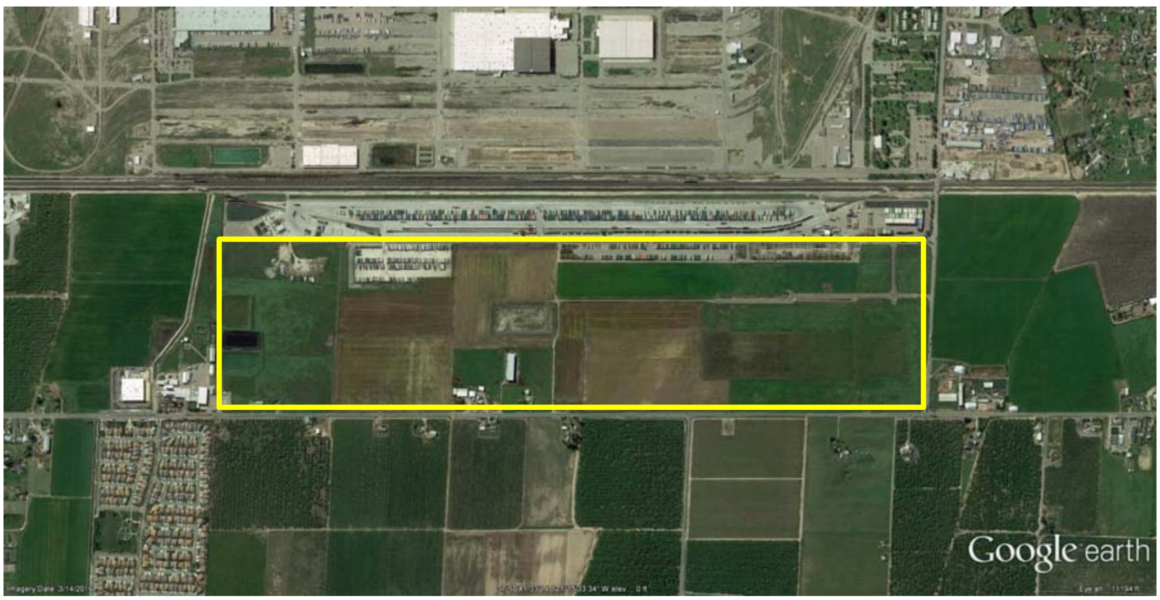
- Reduced empty container movements on I880/I238/I580/I205 between Oakland and Lathrop. While there will still be a need to periodically reposition empty containers to address imbalances, STE envisions that most Oakland-Lathrop trips will be loaded.

- Improved SJV empty container supply. To the extent that SSA client ocean carriers permit an inventory of empty containers to develop at Lathrop (and eventually at Shafter) export customers of those carriers will have the option to source containers locally.

The effectiveness of these strategies will depend on institutional factors as well as on the geographic and seasonal pattern of imports and exports. Ocean carriers must agree to the arrangements, including the use of inland points as satellite staging yards for loaded containers and the designation of those depots as container termination and supply points. Customers must also be willing to go along with the arrangements, including having STE perform the drayage between Oakland and Lathrop. Many importers and exporters have preferred drayage firms. The intermediate staging at Lathrop could also delay some high-priority import or export movements.

CenterPoint Manteca. CenterPoint Intermodal Center (CIC Manteca) is a proposed 190-acre logistics center east of the UP Lathrop intermodal terminal bounded by Roth Road, Airport Way, and Lathrop Road **(**Figure 14.27**)**. The site can have up to 3.1 million square feet of warehousing/DC space. The site is designed with direct access to the UP facility over private roads to minimize drayage costs.

Figure 14.27 CenterPoint Manteca (Approximate Site)



A with the Shafter developments discussed below, these initiatives may move the region closer to a short-haul intermodal service in two respects:

- Development of additional distribution center capacity immediately adjacent to intermodal rail facilities minimizes container drayage within the Valley for potential intermodal services.
- Development of Valley container depots and staging areas may encourage hub-and-spoke operations and facilitate reuse of import container for export loads to improve round-trip rail economics.

Shafter Developments

Shafter STE Staging Yard and Container Depot. STE is in the process of establishing an inland staging yard and container depot at Shafter, similar to the STE operation at Lathrop.

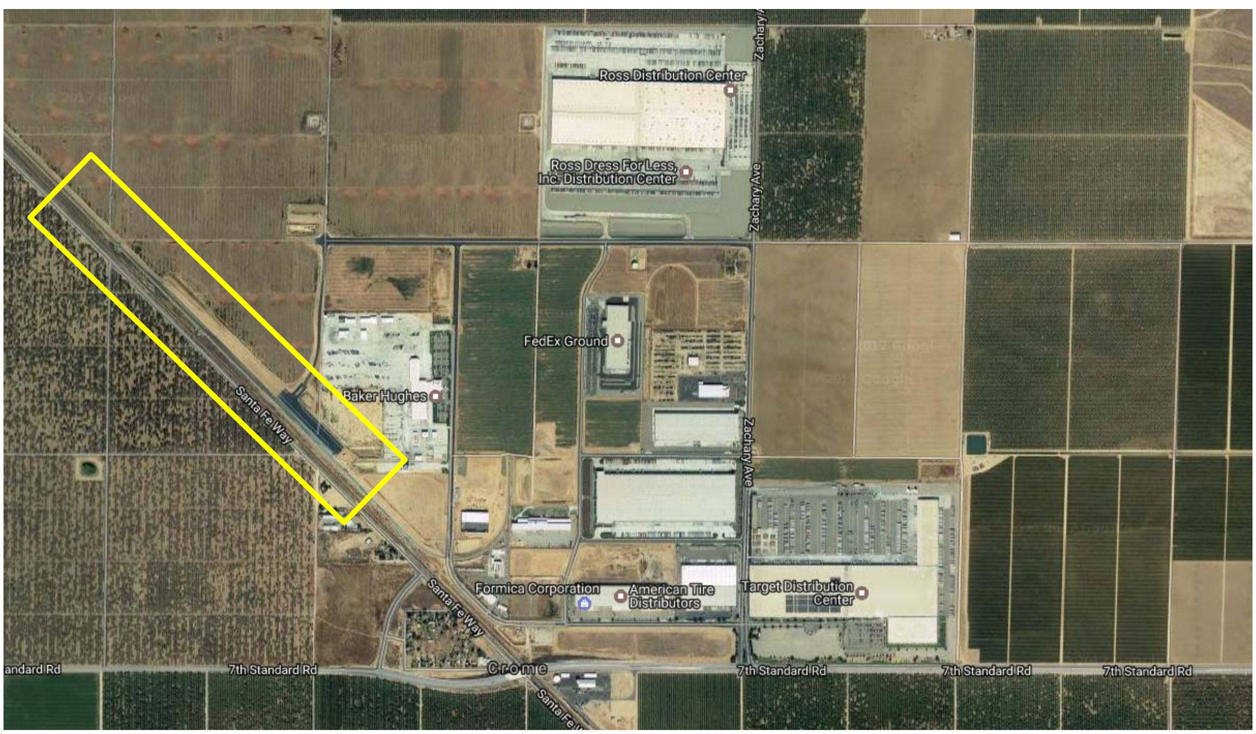
STE has proposed an incentive program for load matching based on potential GHG reductions, with public funds from the incentive to be used for capital improvements, or to support a rail service if a railroad chooses to participate.

As with the STE development at Lathrop, this initiative might be considered a step toward establishment of a rail intermodal service.

Shafter Rail Intermodal. There is a long-standing initiative to establish rail intermodal container service between the Ports of Los Angeles and Long Beach (LALB) and a site or sites at Shafter. Port rail shuttle interest, volume, and cost issues were addressed in a 2003 survey study conducted by Cambridge for SJCOG; a 2003 feasibility study conducted for SJCOG by Tioga and Railroad Industries: a 2006 study conducted by Tioga, Cambridge, and Railroad Industries for SJCOG; a 2008 feasibility study conducted for SCAG by Tioga, Railroad Industries, and Iteris; a 2008 study by WZI for the City of Shafter; and a 2009 study conducted by Moffat & Nichol for the City of Shafter.

The principal site of interest is at the Wonderful Industrial Park (former Paramount development) off 7th Standard Road **(**Figure 14.28**)**. This site is adjacent to several distribution centers and other facilities, and is connected to the BNSF main line.

Figure 14.28 Shafter Terminal Site (BNSF Railway)



Source: Google Maps 2017.

The BNSF site has been partially paved for use as a depot and staging facility by STE. As Figure 14.28 shows, the BNSF site is adjacent to recent distribution center developments, minimizing potential drayage costs.

There is a second potential site located on the UP main line about 7 miles east **(**Figure 14.29**)**. KernCOG reports that UP has preliminary plans for an intermodal facility there.

Figure 14.29 Second Shafter Site (UP Railroad – exact site not verified)

Source: Google Maps.

The LALB-Shafter intermodal service concept has been advanced as a means of reducing VMT and emissions from port container drayage. This analysis addresses the VMT reduction potential. A detailed emissions analysis is beyond the scope of this study. (The 2008 WZI study undertook a more extensive emissions analysis based on the proposal at that time.)

Proposed Shafter intermodal services face a significant economic challenges, as noted in previous studies. This analysis updates the available information on underlying costs to re-examine the rail-truck tradeoff. At the short length of haul, the terminal and drayage costs of rail intermodal service tend to outweigh the line-haul advantages, raising the underlying cost above the all-truck alternative. There are a very few short-haul intermodal services operating in the U.S. These include:

- CSX "Queen City Express", Port of Wilmington, NC to Charlotte, 228 miles
- Northwest Container Services, Portland-Tacoma-Seattle, 142-183 miles
- Heart of Georgia/Georgia Central, Savannah to Cordele, 210 miles
- NS, Savannah to Greer, 260 miles
- NS, Front Royal (VIP) to Port of Virginia, 210 miles

Other services are expected to begin operation in the near future:

- CSX Wilmington-Raleigh, NC, 199 miles, expected 2020
- CSX Savannah-Chatsworth, 350 miles, expected 2018

All of the existing short-haul intermodal services reviewed are, or will be, subsidized in the sense of not recovering their full costs from operating revenue. In many cases, the intermodal facilities in use were built with port funds or public funding, so the service does not need to recover those costs. In other cases, there may be operating subsidies, exemptions from some costs, or other arrangements to bring combined rail-truck intermodal rates below over-the-road drayage rates. The Northwest Container Services operation, for example, is subsidized by the ocean carriers who pay the rail switching and transfer costs at Tacoma and the costs of repositioning empty containers. Some CSX and NS services are reportedly incremental additions to existing trains and terminals rather than separate train operations.

14.5.1 Operational Context

To analyze the economics of a rail intermodal service between the Ports of Los Angeles/Long Beach and Shafter it is first necessary to establish the operational and commercial context.

The Ports of Los Angeles and Long Beach together have 15 marine container terminals, 14 of them served by on-dock rail facilities **(Figure 14.300)**.

Figure 14.300On-Dock and Support Rail Yards in San Pedro Bay

Legend

1 – Pier J On-Dock
2 – Pier G On-Dock
3 – Pier E On-Dock (MHT)
4 – Pier A On-Dock
5 – Pier T On-Dock
6 – Pier B Rail Yard
7 – TICTF Shared On-Dock
8 – Pier 300 On-Dock
9 – Pier 400 On-Dock
10 – WBICTF On-Dock
11 – WB-East (TraPac) On-Dock
12 – B200 Support Rail Yard (PHL Base)

Source: Parsons, 2011.

An import container destined for a San Joaquin Valley customer could arrive at any one of these terminals. The two ports together had 2,122 container vessel calls in 2015, an average of 41 per week. Because all major container shipping companies operate as parts of alliances and share vessel capacity, the containers of one carrier do not always arrive at the same terminal. The imported containers to be moved via rail to Shafter may therefore be scattered over multiple terminals.

Rail service to the port terminals and the on-dock rail transfers is provided by Pacific Harbor Lines (PHL). PHL receives trains from BNSF and UP and switches the cars into on-dock working tracks. PHL then repositions cars if needed for loading with import containers and reassembles the loaded cars into trains for BNSF and UP.

There are also two off-dock rail intermodal terminals used primarily for international containers. UP's near-dock International Container Transfer Facility (ICTF) is roughly five miles from port terminals. BNSF's off-dock Hobart facility is about 20 miles from port terminals. The Southern California Intermodal Gateway (SCIG), BNSF's proposed near-dock intermodal rail yard, would add capacity of 1.5 million lifts annually. However, this project, to date, has failed to obtain environmental clearance to proceed and is currently on hold. In addition to these primary intermodal yards in Los Angeles County, UP also handles intermodal containers at three additional yards, including the Los Angeles Transportation Center (LATC) Intermodal Rail Yard, the East Los Angeles (ELA) Intermodal Yard, and the Industry Intermodal Rail Yard **(Figure 14.31)**. In addition (not shown on the map), UP's San Bernardino Intermodal Yard provides additional capacity. Estimates of the existing capacities of near-dock and off-dock yards are shown in **Table 14.26**.

Table 14.26 Existing Capacities of Off-Dock Rail Yards

Union Pacific	Lifts per Year
East Los Angeles Yard	650,000
Los Angeles Transportation Center (LATC)	340,000
Intermodal Container Transfer Facility (ICTF)	822,000
City of Industry Yard	235,000
BNSF	
Hobart Yard	1,700,00
San Bernardino Intermodal Yard	660,000

Source: I-710 Technical Memorandum – I-710 Railroad Goods Movement Study, 2009.

Figure 14.31 Major Rail Yards in Los Angeles County

Source: Cambridge Systematics, Inc.

BNSF and UP operate separately, and a given import customer or ocean carrier may have business relationships with either or both. The potential rail intermodal facility site at the Wonderful Business Park at Shafter is served by BNSF; UP does not have access. KernCOG, however, reports that UP has prepared plans for a facility on their line adjacent to SR 99.

14.5.2 VMT Impacts

Table 14.27 displays estimated one-way VMT changes for diversion of highway drayage to rail intermodal/drayage combinations between the Ports of LA/LB and selected SJV destinations from Lebec to Visalia (points north of Visalia tend to be dominated by the Port of Oakland).

Table 14.27 Impact of Rail Service to Shafter on Truck Miles Traveled between the Ports of LA/LB and SJV Destinations

Importer or Exporter		VF Outdoor Distribution	Walmart	Sears	Target	Men's Warehouse	IKEA	
City		Visalia	Porterville	Delano	Shafter	Bakersfield	Lebec	Average
From Ports of LALB Via Highway								
Truck VMT		**208**	**204**	**166**	**147**	**133**	**109**	
	I710	19	19	19	19	19	19	
	I5 South of Kern Co.	74	74	74	74	74	74	
	I5 Total	90	90	90	90	90	89	
	I5 in SJV Study Area	**16**	**16**	**16**	**16**	**16**	**15**	
	SR99	**97**	**77**	**55**	**31**	**20**	**0**	
	Other	2	18	2	7	4	1	
From Ports of LALB Via Shafter Intermodal Terminal								
Truck VMT		**69**	**50**	**27**	**1**	**18**	**41**	
	I710	0	0	0	0	0	0	
	I5 South of Kern Co.	0	0	0	0	0	0	
	I5 in SJV Study Area	**0**	**0**	**0**	**0**	**0**	**1**	
	SR99	**59**	**0**	**16**	**0**	**9**	**32**	
	Other	10	50	11	1	9	8	
VMT Change								
Truck VMT		**-139**	**-154**	**-139**	**-146**	**-115**	**-68**	
	I710	**-19**	**-19**	**-19**	**-19**	**-19**	**-19**	
	I5 South of Kern Co.	-74	-74	-74	-74	-74	-74	
	I5 in SJV Study Area	**-16**	**-16**	**-16**	**-16**	**-16**	**-14**	
	SR99	**-38**	**-77**	**-39**	**-31**	**-11**	**32**	
	Other	**8**	**32**	**9**	**-6**	**5**	**7**	
I5/SR99 Corridor Net		**-54**	**-93**	**-55**	**-47**	**-27**	**18**	**-43**
Non-Corridor		**-85**	**-61**	**-84**	**-99**	**-88**	**-86**	**-84**
Total		-139	-154	-139	-146	-115	-68	-127

As **Table 14.27** indicates, using the Target distribution center (DC) at Shafter as an example, a rail intermodal service could offset up to 146 drayage truck miles on each one-way trip, the full distance from the ports to Shafter. Of this reduction, 47 miles would be eliminated on the I-5/SR 99 study corridors and 99 miles from outside of the study area, mostly on the I-710 and on I-5 corridors in Los Angeles County.

Points east, west, or south of Shafter have lower VMT reductions because an over-the-road truck may take a more direct route while the rail intermodal option must include drayage from Shafter. The VMT reduction for a Bakersfield destination (e.g. the Men's Warehouse DC) is estimated at 88 miles, 27 of which would be on the I-5 and SR 99 corridors within the Valley **(Table 14.27)**. Total VMT reduction can be estimated from the trip-by-trip reductions shown in and estimates of total annual trips.

14.5.3 VMT Impacts

The 2009 Moffat & Nichol report noted that customers in the Shafter/Tejon Ranch area received about 48,000 annual import containers, mostly trucked from the Ports of LA/LB. In 2015, the combined Ports of LA/LB import container volume was 28.5 percent higher than in 2009; and, the amount of throughput utilizing the on-dock rail facilities has grown by 1.6 percent.

Table 14.28 San Pedro Bay Ports On-Dock Rail Volume Growth (Containers)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
On-Dock	1,630,472	2,112,162	2,002,981	1,889,566	1,613,251	1,840,321	1,880,498	1,963,343	2,009,797	2,257,775	2,227,203
% On-Dock*	20.7 %	24.1 %	23.0 %	23.7 %	24.6 %	23.5 %	24.2 %	25.0 %	24.8 %	26.9 %	26.2 %
Near-/Off-Dock	1,539,578	1,634,898	1,602,158	1,472,364	1,002,043	912,306	771,687	879,381	850,234	814,919	692,974
% Near -/ Off-Dock*	19.5 %	18.7 %	18.4 %	18.5 %	15.3 %	11.7 %	9.9 %	11.2 %	10.5 %	9.7 %	8.2 %
TOTAL	3,170,050	3,747,060	3,605,139	3,361,930	2,615,294	2,752,627	2,652,185	2,842,724	2,860,031	3,072,694	2,920,177
% TOTAL*	40.2 %	42.8 %	41.4 %	42.2 %	39.8 %	35.2 %	34.1 %	36.2 %	35.3 %	36.6 %	34.4 %
SPB Total Throughput**	7,885,801	8,755,677	8,704,169	7,964,100	6,564,773	7,830,778	7,778,664	7,846,320	8,110,642	8,400,448	8,495,592

*%ages based on total SPB Ports throughput.

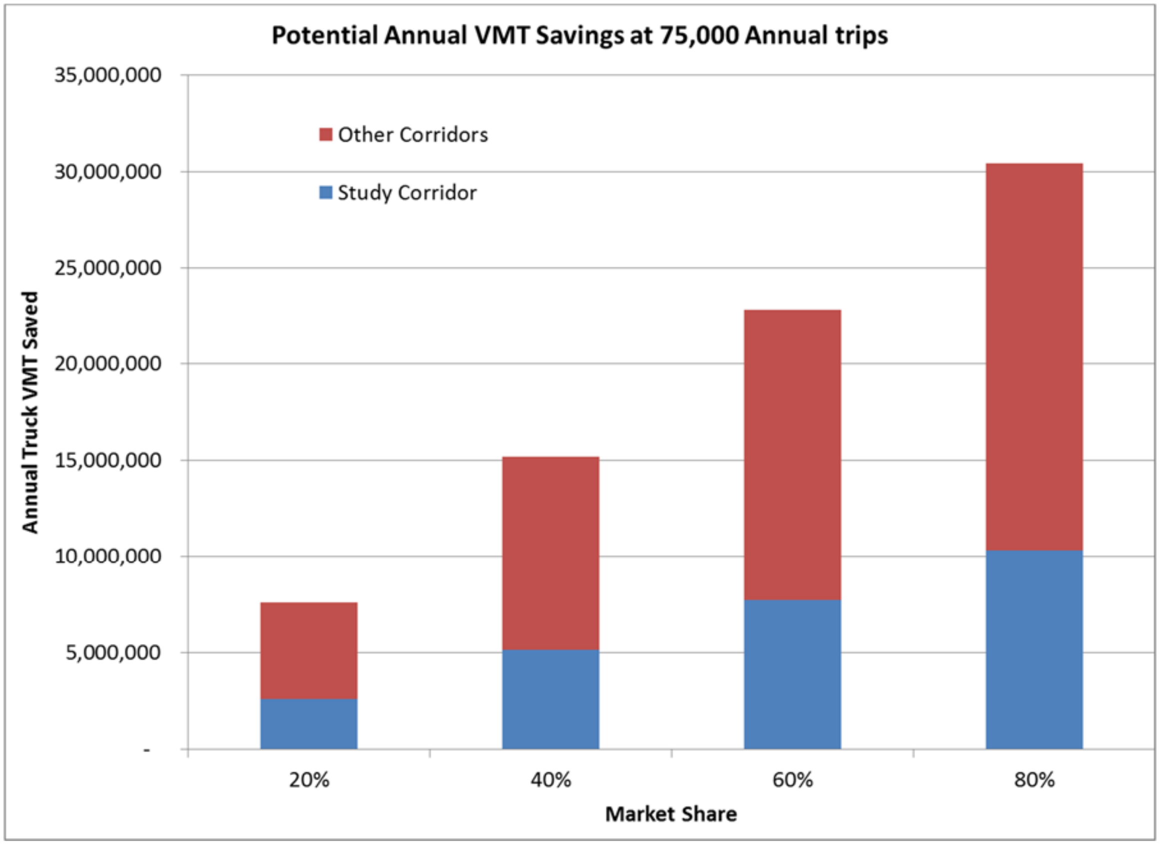
**Total SPB Ports container throughput calculated by dividing TEUs by 1.80 TEUs/container.

Source: Port of Long Beach

There has been substantial recent growth in Shafter-area distribution activity. Current local agency estimates indicate that the Shafter area importers are receiving approximately 300 containers per day (communication from KernCOG), which is reasonably consistent with a margin of growth beyond the pro-rated estimate of 247 per day derived above. An average of 300 per day over a 250-day year would yield an annual total of 75,000.

Given the variability of customer requirements and the pricing flexibility of motor carriers, a rail intermodal service could not be expected to attract the entire volume. **Figure 14.32** uses the 75,000 annual container estimate, and intermodal market shares ranging from 20 to 80 percent to display corresponding annual round-trip VMT savings at a one-way average of 43 VMT in the corridor and 84 VMT outside the corridor.

Figure 14.32 Conceptual Annual Round Trip VMT Savings from Shafter Intermodal Service



The totals range from 7.6 million total VMT avoided at a 20 percent market share to 30.4 million VMT reduction at an 80 percent share. About 34 percent of the VMT saved would be in the Valley.

A more detailed estimate of VMT savings would require:

- A detailed market study to establish potential volumes
- A detailed location study to establish the distribution of VMT savings per trip

Rail intermodal economics, addressed in the next section, will be a key factor in the ability of a rail intermodal service to attract a significant market share.

14.5.4 Cost Elements

Long-run economics are determined by the costs that operators and other participants incur and that form the basis for negotiated rates customers ultimately pay. This analysis of Shafter intermodal service costs focuses on these underlying costs for multiple reasons:

- There is little reliable information on actual rates. Most rates are contained in confidential agreements

- Participants have considerable latitude in the profit margins they seek over costs and the degree to which they attempt to recover a share of overhead or capital costs

The estimates below draw on cost estimates provided in earlier studies, costs available in public sources, and estimates provided in response to stakeholder contacts.

- Rail line haul cost factors have declined, particularly fuel costs, and productivity has increased. The 2008 cost estimates were adjusted to 2016 cost levels using the ratio of the Rail Cost Adjustment Factors for each year: 0.436 for 2008 and 0.356 for 2016.

- Over-the-road trucking costs have risen, although the increases have been tempered by decreased fuel costs. The analysis uses the 2016 American Transportation Research Institute estimates for over-the-road truckload costs in California of $1.593 per mile.

Rail intermodal service is a multi-step process by its nature, and each step has cost and service aspects.

- **Marine terminal operations.** Import containers are transferred from the vessel to the terminal container yard. This step is common to all intermodal service scenarios and is performed at the ocean carrier's expense, so the analysis does not include this cost.

- **On-dock rail transfer.** The marine terminal operator (MTO) charges to load rail cars on-dock, typically $130–150 per container at the Ports of Long Beach or Los Angeles. This cost could be billed to either the ocean carrier or the railroad, depending on the business relationship.

- **Port rail switching.** Pacific Harbor Lines (PHL) performs port-area rail switching and train breakup/assembly. The cost could be billed to BNSF or UP. The estimated cost of switching is currently about $10.89.

- **Rail line-haul.** A LA/LB ports-Shafter rail service would be about 190 miles via UP or 300 miles via BNSF (due to BNSF's routing through Barstow). Alternatively, the rail line haul could be about 185 miles from the ICTF or 280 miles from Hobart. The rail line-haul cost is the most difficult to estimate. The actual marginal cost depends on the number and type of cars and locomotives used. The average cost or full allocated cost also includes a share of track, maintenance, and overhead costs. There are strong economies of scale in train size. The 2008 SCAG study estimated the rail line-haul rate at $1.31 per container mile for a 100-container shuttle train and a 1.5 revenue to cost ratio. This estimate is equivalent to a cost-only estimate of $0.71 per container mile in 2016.

- **Intermodal terminal and lift.** Intermodal terminals are usually owned and maintained by the railroad and operated by contractors. The railroad bears the facility capital and maintenance costs, and the contractor charges the railroad a per-container lift fee. These costs are ordinarily part of the railroad's rate to the customer. There are economies of scale in intermodal terminal operations, with cost per lift declining from about $50 per container at small facilities to $40 at large ones.

- **Truck drayage.** Truck drayage costs include time spent at marine or rail terminals as well as the time spent driving. The time spent at the ultimate customer destination (e.g. an import distribution center) is the same for all scenarios. The truck-only scenario includes marine terminal time and driving time to the customer. The intermodal scenario may include drayage between the marine terminal and an off-dock rail terminal and a second drayage trip between the Shafter terminal and the customer. The analysis uses the ATRI 2016 cost estimate of $1.593 per mile and $65 per hour for waiting time at terminals (typical of trucking company charges for excess terminal time).
- **Chassis cost.** Current chassis pool rates are about $20 per day. The analysis allows one day of rental for each one-way highway trip, and a half-day of rental for each one-way intermodal trip.

14.5.5 Over-the-Road Trucking Option

The highway distance from Terminal Island between the Ports of LA/LB to Shafter is about 145 miles. The analysis allows for a 15-mile trip beyond the Shafter terminal to access a broader market and to remain comparable to a rail intermodal trip with drayage from Shafter to final destination, a total of 160 miles for the truck option. The truck option also includes waiting time at the marine terminal.

14.5.6 Intermodal Service Scenarios

Port to Rail Transfer

There are multiple ways to move an import container from a marine terminal onto a railcar and onto a train for Shafter, via on-dock rail or via near-/off-dock rail **(Figure 14.33)**. As indicated below these different strategies have implications for both cost and service.

On-dock rail transfer. On-dock transfer is typically the preferred strategy for loading and assembling trains of international containers. Efficient on-dock transfer ordinarily requires a large volume of containers for the same destination (e.g. Chicago) or at least for the same train (e.g. cars that will be sorted later at a rail block-swapping yard). Otherwise the cars must sit for multiple days and occupy valuable trackage while they are filled or smaller lots of cars must be switched and combined from multiple terminals.

It would be unlikely for the container volumes envisioned for a Shafter inland port to fill a train at a single marine terminal on a single day. Most likely, use of on-dock loading would entail switching cars from multiple terminals and assembling them on PHL trackage elsewhere.

Use of on-dock transfer would entail marine terminal operator transfer fees of $130 (minimum of range) per container lift and the Alameda Corridor fee of $46.52 per 40’ container.

The minimum cost of an on-dock transfer strategy would therefore be $176.52 ($130.00+$46.52) per container.

An on-dock strategy would also affect transit time and/or service frequency. On average under current conditions, containers experience a two-day dwell time on the marine terminal before being loaded on rail cars. The need to switch and assemble cars from multiple terminals would add at least a day to the time between the ports and Shafter. Another option would be to alternate ports or terminals. The NWCS service to Portland alternates between Seattle and Tacoma, which means next-day service alternates with second-day service. At San Pedro Bay, however, there are 14 on-dock rail terminals, so maintaining multiple weekly departures from each would still require some switching and assembly. The time between vessel arrival and train departure for Shafter under current conditions would therefore be 2 to 4 days to allow for both on-terminal dwell and switching and assembly.

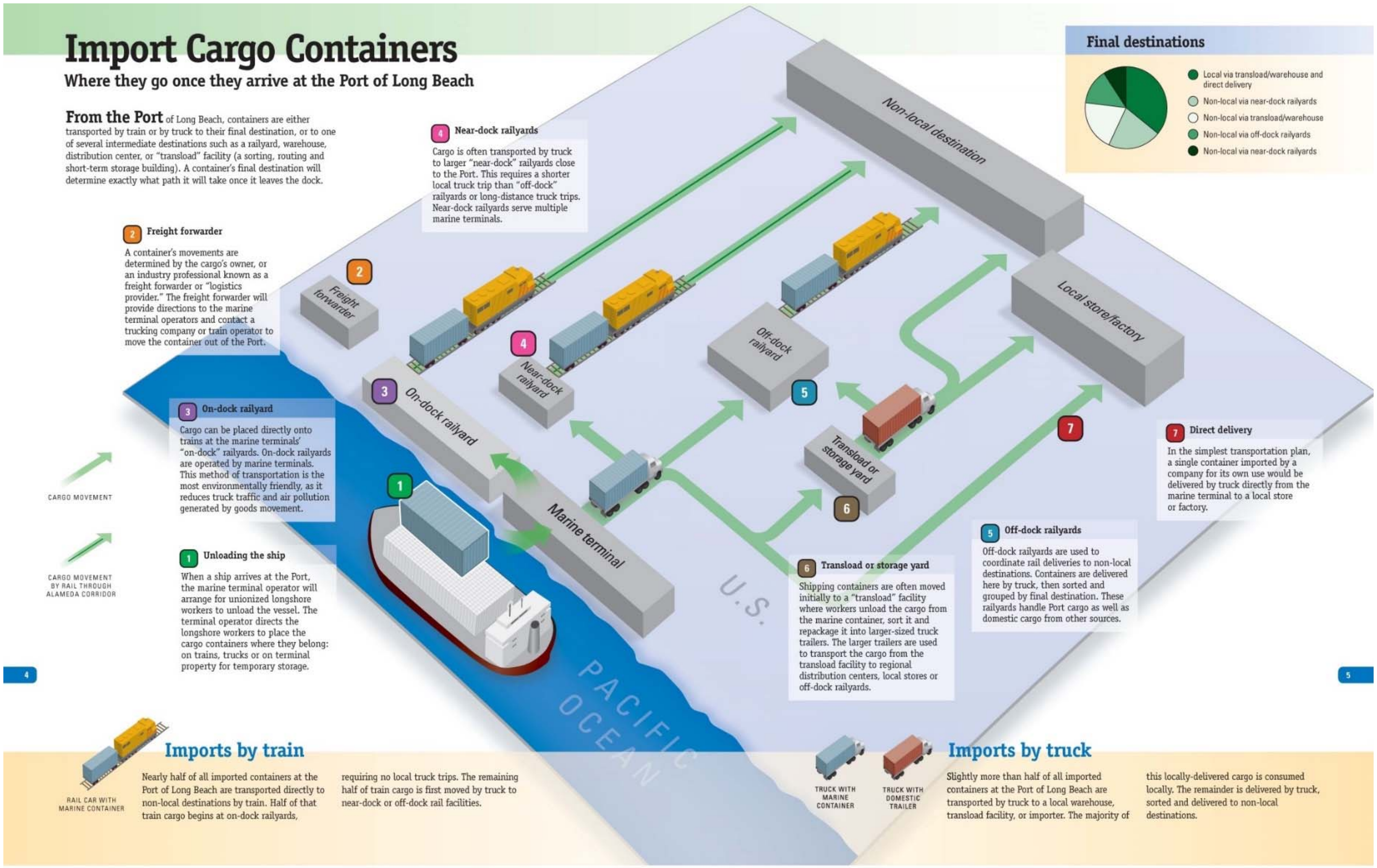
Off-terminal drayage. Import containers could be drayed to the ICTF or Hobart and loaded on Shafter trains there. The major components of drayage cost are miles traveled and turn time at port and rail terminals. According to the most recent ATRI estimates, operating costs average about $1.59 per mile. Drayage firms have recently been charging about $65 per hour for excess driver time at marine terminals so that figure was used as an estimate for the hourly cost of turn time. Typical turn times are about 1.5 hours at marine terminals and 0.5 hours at rail terminals.

The ICTF is about five miles from the ports, so one-way drayage costs would be about $137.95. BNSF's Hobart facility is about 20 miles from the ports, so underlying drayage costs to Hobart would be about $161.80. Note that most of the drayage cost is actually in the terminal turn times.

The existing Shafter terminal site served by BNSF would not be accessible via the UP at ICTF so Hobart would be the off-terminal drayage option. The lift cost at either facility is about $40, which would be included in the rail rate.

The impact on service would depend on how promptly containers were drayed from the marine terminal after they became available. The drayage trip may not add to the overall time, as the container would be at the rail terminal for an evening or night cut off the same day it was pulled from the marine terminal. If the container were drayed during the day shift at the marine terminal, however, it would be subject to the Traffic Mitigation Fee ("PierPASS" fee) of $140.98 per container. Avoiding this fee would require draying containers after 6 p.m., which could jeopardize same day train departures.

Figure 14.33 On-Dock, Near-Dock and Off-Dock Rail Yard Operations at Port of Long Beach



Rail Line-Haul Options

Intermodal "Shuttle" Trains. Most discussions of short-haul rail intermodal service to inland ports envision short, dedicated "shuttle" trains that move back and forth between the inland port and the marine terminals. The Shafter rail shuttle concept calls for 300 containers per ship[25] headed for the inland port equivalent to a train consisting of 30 five-platform double-stack cars, with a total length of 9,000 feet if the full volume moved on a single train. The 2008 Shafter emissions study envisioned two such trains daily. Rather than what is commonly envisioned as "shuttle" trains, these would be full-length double-stack trains requiring 5–6 locomotives each on the steep grades exiting the LA basin.

The assumption of 300 containers per vessel call going to Shafter may be optimistic. As of 2015 the average vessel at LA and LB unloaded about 2,000 import containers, so Shafter would have to receive 15 % of all imports to reach 300 containers per vessel.

One concept that could change this convention is a shorthaul rail option that considers scheduled, daily trains of only 1,500-2,000 feet in length from each on-dock rail facility. These trains would be assembled on a designated working track within each terminal. In order for a service like this to be fully considered, an inland port capable of handling that type of volume would need to be identified. The ideal location would: provide access to both Class I railroads; allow for one crew to deliver the train and return to the ports in a single shift; serve an inland market; and, result in a total reduction in truck VMT (meaning, cargo moved by train to an inland port would not be back-hauled to warehouses or distribution centers near the ports).

Existing Intermodal or Manifest Train Service. Another option would be to add Shafter-bound rail cars to existing UP or BNSF trains moving north from the ports rather than running separate shuttle trains. These trains could be either other intermodal trains or manifest trains (trains of mixed car types). In this scenario PHL would pull loaded Shafter cars from marine terminals and interchange them to UP and/or BNSF. UP or BNSF would then move the cars through their system as they would any other freight car and deliver them to Shafter.

This option would add 1–3 days of delay and incur switching costs, but would avoid a separate "train start" for a Shafter shuttle train and obviate any volume minimums. This strategy might also be considered as a start-up approach until volumes justified separate shuttle trains.

Rail Costs. In the 2008 SCAG study, rail line haul cost for moderate-sized 100 container trains was estimated at $146.27 for the 112 mile round trip between the ports and Ontario via UP, with a revenue/cost ratio of 1.5. This estimate is equivalent to a per-container cost of $0.87 per mile at 2008 cost levels. Rail costs have actually declined since 2008. The AAR Rail Cost Adjustment Factor for 2008 was .436, while by 2016 it had declined to .356. The $0.87 per mile in 2008 would therefore be equivalent to about $0.71 per mile in 2016.

[25] Inland Container Yard Concept presentation, 9/6/16.

14.5.7 Cost Comparisons

The cost estimates in **Table 14.29** can best be interpreted as the marginal costs of adding Shafter trips to existing operations. Both truck and rail operators would seek rates that provided a profit margin above these costs.

Table 14.29 Truck-Intermodal One-Way Cost Comparisons

Shafter Truck-Intermodal One-Way Cost Comparison				Highway Truck Drayage	BNSF On-Dock	BNSF Hobart	UP On-Dock	UP ICTF
			Rail Miles	0	300	280	185	190
			Truck Miles	160	15	35	15	20
Cost Factor	**Cost**	**Per**						
Alameda Corridor Fee - 40' bo:	$ 46.52	Unit			$ 46.52		$ 46.52	
Rail Intermodal Lift - Shafter	$ 50.00	Unit			$ 50.00	$ 50.00	$ 50.00	$ 50.00
Rail Intermodal Lift - Off-dock	$ 40.00	Unit				$ 40.00		$ 40.00
Rail Intermodal Lift - On-Dock	$ 130.00	Unit			$ 130.00		$130.00	
Truck Operating Cost	$ 1.59	Mile		$ 254.88	$ 23.90	$ 55.76	$ 23.90	$ 31.86
Truck Driver Terminal Time	$ 65.00	Hour						
Truck Turn Time at Port	1.5	Hour		$ 97.50		$ 97.50		$ 97.50
Truck Turn Time at Rail	0.5	Hour			$ 32.50	$ 65.00	$ 32.50	$ 65.00
Chassis Rental Cost	$20.00	Day		$20.00	$ 10.00	$ 10.00	$ 10.00	$ 10.00
Port Rail Switching Cost	$ 10.89	Unit			$ 10.89		$ 10.89	
Rail Line Haul Cost	$ 0.71	Mile			$ 213.27	$ 199.05	$131.52	$135.07
Underlying Cost Total				**$ 372.38**	**$ 517.08**	**$ 517.31**	**$435.32**	**$429.43**

As other studies have observed, the rail movement itself is relatively economical, although BNSF's circuitous route through Barstow adds substantial cost. The major cost difference between rail intermodal and truck options lies in the terminal, switching, and drayage costs at the end points.

14.5.8 Next Steps

Although the barriers to shorthaul rail continue to lessen, trucking to the Valley continues to be the preferred mode of transport to locations within 500 miles of California's ports due to costs and flexibility. The Valley should continue to monitor the development of inland port concepts and analyses, as well as railroad operating changes, port policies, shipper needs, and terminal operator business practices as they relate to shorthaul rail opportunities.

14.6 Strategic Program Performance Assessment

In addition to the above projects, a qualitative assessment was conducted on the strategic programs identified in Task 2 and 3 to enhance the qualitative assessment conducted in that document.

Table 14.30 I-5/SR 99 Goods Movement Corridor Study Strategic Programs Assessment

Strategic Program	Capital Cost	% Truck VMT Reduced	Public Funding Situation	Strategic Goal Addressed
I-5/SR 99 Roadway Pavement and Bridge Maintenance	» Mostly Low, Sometimes Medium	Not Applicable	Mostly Funded	Infrastructure
Overweight/ oversize policy to allow heavier/longer trucks on I-5 in both directions between San Joaquin County boundary to Kern County boundary (exact boundaries of this project can be identified during future project development)	Unknown; potential need to add dedicated lanes, reinforce bridges and lanes to carry heavier loads, and add ITS	High	Not Applicable	Economic Competitiveness, Environment
Truck only Toll Lanes on I-5 between I-5 and I-205 junction in San Joaquin County and I-5 and SR 99 junction in Kern County	High	Not Applicable	Unfunded	Mobility/Reliability, Environment, Innovative Technology and Practices
Truck climbing lanes at steep locations such as Altamont Pass, Pacheco Pass and Tehachapi Passes (Grapevine area and SR 58 Eastbound).	Medium	Not Applicable	Unfunded	Mobility/Reliability, Safety/ Security
I-5/SR 99 Capital Projects for Bottlenecks Congestion Relief	Mostly Medium	Not Applicable	Partially Funded	Mobility/Reliability
I-5/SR 99 Operational Projects for Bottlenecks Congestion Relief	Mostly Low	Not Applicable	Partially Funded	Mobility/Reliability
I-5 to SR 99 Connector Capital and Operational Projects for Improved Accessibility	Mostly Medium	Not Applicable	Partially Funded	Mobility/Reliability, Economic Competitiveness
I-5/SR 99 Interchanges Reconfiguration Program for Key Freight Access Interchanges with Inadequate Design	Mostly High, Sometimes Medium	Not Applicable	Partially Funded	Mobility/Reliability,

Strategic Program	Capital Cost	% Truck VMT Reduced	Public Funding Situation	Strategic Goal Addressed
I-5/SR 99 Capital Projects for Safety Hotspots Alleviation	Mostly Medium	Not Applicable	Partially Funded	Safety/Security, Mobility/Reliability
I-5/SR 99 Operational Projects for Safety Hotspots Alleviation	Mostly Low	Not Applicable	Partially Funded	Safety/Security
Container depot service near Stockton for Port of Oakland and in Shafter for Ports of Long Beach and Los Angeles service	Not Applicable	Low	Unfunded	Economic Competitiveness
Short-haul rail service between SJV region and Port of Oakland	High (if new rail intermodal facility is built), otherwise Low (mostly relating to Rolling Stock for Rail Shuttle)	High for mid-SJV locations, Low otherwise	Unfunded	Economic Competitiveness, Environment
Short-haul rail service between SJV region and Ports of Long Beach/Los Angeles	High (if new rail intermodal facility is built), otherwise Low (mostly relating to Rolling Stock for Rail Shuttle)	High for mid-SJV locations, Low otherwise	Unfunded	Economic Competitiveness, Environment
Caltrans' Truck Parking Information System on I-5	Medium	Not Applicable	Partially Funded	Safety/Security, Innovative Technology and Practices
Truck Platooning	Medium	Not Applicable	Not Applicable	Safety/Security, Mobility/Reliability, Innovative Technology and Practices

Source: (a) CalSTA and Caltrans, 2014 California Freight Mobility Plan[26]; (b) Fresno Council of Governments (COG) 2014 Regional Transportation Plan (RTP)[27]; (c) Kern Council of Governments (COG) 2014 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS)[28]; (d) Kings County Association of Governments (CAG) 2014 Regional Transportation Improvement Program (RTIP)[29], (e)

[26] http://www.dot.ca.gov/hq/tpp/offices/ogm/ CFMP/Web/Display_VisionGoalsObj_ARCH_E_36x48.pdf#zoom=85 (last accessed on May 11, 2016)

[27] http://www.fresnocog.org/sites/default/files/publications/RTP/Final_RTP/2014_RTP_Chapter_Six_Final.pdf (last accessed on May 11, 2016)

[28] http://www.kerncog.org/images/docs/rtp/2014_RTP.pdf (last accessed on May 11, 2016)

[29] http://www.kingscog.org/vertical/sites/ percent7BC427AE30-9936-4733-B9D4-140709AD3BBF percent7D/uploads/Chap_3_-_Policy_Element_-_2014_Final_RTP.pdf (last accessed on May 11, 2016)

Madera County Transportation Commission 2014 RTP/SCS[30], (f) Merced County Association of Governments 2014 RTP/SCS[31], (g) San Joaquin Council of Governments (COG) 2014 RTP/SCS[32]; (h) Stanislaus Council of Governments (COG) 2014 RTP/SCS[33]; and (i) Tulare County Association of Governments 2014 RTP/SCS[34]

30 http://www.maderactc.org/wp-content/uploads/2014/07/MCTC-2014-Final-RTP-SCS.pdf (last accessed on May 11, 2016)

31 http://www.mcagov.org/DocumentCenter/View/314 (last accessed on May 11, 2016)

32 http://www.sjcog.org/DocumentCenter/View/484 (last accessed on May 11, 2016)

33 http://www.stancog.org/pdf/rtp/chapter-6-transportation-plan-and-policies.pdf (last accessed on May 11, 2016)

34 http://www.tularecog.org/wp-content/uploads/2015/06/Final-2014-Regional-Transportation-Plan-Sustainable-Communities-Strategy-FULL-DOCUMENT.pdf (last accessed on May 11, 2016)

15.0Project Implementation

This section discusses a number of topics related to project implementation. First, the section identifies potential funding sources at the federal, State, regional, and local level that can be directed to the identified projects and strategic programs. Next, it describes potential barriers to project or program implementation.

15.1 Funding Availability

15.1.1 Federal Funding

In the fall of 2015, Congress passed the Fixing America's Surface Transportation (FAST) Act, ending the period of extensions of the past Federal surface transportation act and creating a new, long term funding program for the nation's transportation system. The FAST Act, signed by the President on December 4, 2015, provides multiple funding sources that could be used for the projects and programs identified in this study. The FAST Act represents approximately $225 billion in dedicated contract authority for the Federal-aid highway program. This is a 15 percent increase from FY 2015 realized after FY 2020. Approximately half of that funding increase will be used to support two new freight-specific funding programs, with the remainder providing a marginal increase to core highway program funding.

The first freight-related initiative is the Nationally Significant Freight and Highway Projects (NSFHP) Program, which has been renamed the Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE) Grant Program by the U.S. DOT. The FASTLANE Grant Program is a $4.5 billion program over five years which issues competitive discretionary grant funding. Projects can receive up to $500 million total and eligible projects must be anticipated to equal or exceed $100 million in cost, with a grant request of at least $25 million. There are three set-asides in this program. One is a ten percent set-aside for smaller projects that are under the $100 million total cost threshold, with a minimum $5 million grant request. The second is a 25 percent set-aside for projects in rural areas. The third is $500 million total set-aside for port, rail, and intermodal projects. Funds set aside for port, rail, and intermodal projects must improve freight movement on the National Highway Freight Network (discussed below) and must provide public benefits.

The first set of FASTLANE Grant awards totaling nearly $760 million was announced in July 2016. Out of the 212 applications asking for nearly $9.8 billion, the only project in California awarded funding was for construction of a one mile portion of SR 11 and southbound connectors for SR 905, 125, and 11 in Otay Mesa, CA.[35] Projects in the study region that sought funding included[36]:

- SR 99 Tagus 6-Lane Widening Project (TCAG;
- SR 99 Widening from 4 to 6 Lanes (MCTC); and
- SR58/SR99 Centennial Corridor Freight Corridor Improvements Project (City of Bakersfield)

Applications for a second round of FASTLANE Grants were announced in October 2016 with applications for the approximately $850 million due in December, 2016. It is anticipated that the majority of submissions for the second round of funding will be projects that did not receive an award in the first round.

The second potential funding source for I-5/SR 99 projects is the National Highway Freight Program (NHFP). The NHFP will provide $582.4 million to California over the next five years, with apportionment to states by formula based on the number of Primary Highway Freight Network miles in the state.[37] The Primary Highway Freight Network is one of four components of the National Highway Freight Network (NHFN). The other three components include:

- The remainder of the Interstate System not included in the Primary Highway Freight Network;
- Critical Urban Freight Corridors; and
- Critical Rural Freight Corridors

The entirety of I-5 and SR 99 in the study region part of the Primary Highway Freight System and thus are included as part of the NHFN. This means that projects on these roads are eligible for federal freight formula funds.

"Innovation" is another key theme found throughout the FAST Act. The FAST Act provides new funding for ITS projects such as vehicle-to-vehicle and vehicle-to-infrastructure technology as well as infrastructure maintenance systems, alternative charging systems, and information sharing systems that could involve a freight component. The bill also explicitly makes ITS-related projects eligible for funding under several formula programs including the NHFP and FASTLANE Program.

One new funding program in the Innovation Section is the Advanced Transportation and Congestion Management Technologies Deployment Program. This competitive grant program will focus on the development of pilot projects and model deployment sites for the installation and

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[35] Awarded $49.3 million. https://www.transportation.gov/buildamerica/FASTLANEgrants

[36] http://www.dot.ca.gov/hq/transprog/map21/implementation/fastlane-2016-pjt-app-submittals.pdf

[37] The Draft Comprehensive Freight Network developed by FHWA under MAP-21 forms the basis for the apportionment. California has 3,117.7 miles on that network, approximately 7.5 percent of the total. http://ops.fhwa.dot.gov/freight/infrastructure/pfn/state_maps/states/california.htm

operation of advanced transportation technology such as truck parking management systems or truck-only tolls lanes—both of which are under consideration as part of this project.

Finally, the Transportation Investment Generating Economic Recovery (TIGER) grant program is still active. The latest round of funding, awarded in July 2016, included four projects in California. None directly address conditions on I-5/SR 99 in the SJV region[38] but one of the four was a grade separation project targeted to freight needs.

15.1.2 State Funding

The Trade Corridor Improvement Fund (TCIF) was the last statewide freight investment program approved in California. Passed in November 2006 as part of the Proposition 1B bond package, it provided a total of $2.5 billion for infrastructure improvements along federally designated "Trade Corridors of National Significance" in California or other corridors with a high volume of freight movement. Most of the original TCIF funding has been allocated by the California Transportation Commission, with only small amounts available from project savings in the original allocations.

In 2014, the State passed a bill allowing the program to continue allocating funds transferred in from other programs.[39] The California Transportation Commission also amended the program in March 2016 to extend the allocation deadline from June 2016 to June 2019 and the deadline to begin construction from December 2016 to December 2019 for new TCIF projects.[40] Neither provided the TCIF with a significant, sustainable new funding source.

The state legislature and the governor continue to look for a comprehensive approach to meeting funding needs for the state's transportation system for the future that looks beyond current funding programs. Various funding proposals for TCIF have been included in the discussions, but at this time, no state action has been taken to renew TCIF funding.

One possible route forward for new state funding is through the use of money from California's Cap and Trade program, administered by the California Air Resources Board. Approximately 40 percent of the revenue from this source is unallocated. To receive funding from the legislature, projects will need to reduce greenhouse gas emissions and improve the environment. The two short-haul rail strategic programs that would help divert goods from truck to rail and thereby reduce emissions may be good candidates for this unallocated revenue, should the legislature elect to spend the money on transportation projects. Other strategic programs such as truck climbing lanes and truck

[38] A project in Live Oaks will improve and expand a one-mile stretch of SR 99. https://www.transportation.gov/sites/dot.gov/files/docs/TIGER percent20Fact percent20Sheets percent20-percent207-28.pdf

[39] http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201320140SB1228

[40] http://www.catc.ca.gov/meetings/agenda/2016Agenda/2016-03/59-4.15.pdf

platooning may also be eligible. Alternatively, this funding could help provide seed money for programs in the region that reduce greenhouse gas emissions from trucks such as anti-idling technology, truck stop electrification, or partial/full zero emissions vehicles.

Another potential state revenue source is the 25 percent of funds from the State Transportation Improvement Program (STIP) used to fund the Interregional Transportation Improvement Program (ITIP). ITIP funds are reserved for "projects that improve interregional movement for people and goods across California on the State Highway System." However due to a large reduction in STIP funding and a forecasted revenue reduction through 2020-21, the Draft 2016 ITIP[41] does not include any new programming. Other projects, specifically those addressing safety hot spots may be eligible for non-freight specific funding sources such as the Highway Safety Improvement Program (HSIP) since they would likely improve safety for all road users.

15.1.3 Regional and Local Funding

Regional and local freight transportation funding in the Central California Coast region is sparse. The largest local source of money for transportation projects comes through local sales tax measures passed at the county level. The Self-Help Counties Coalition (SHCC) is an organization representing the 20 local transportation agencies in counties where such a tax has passed. Table 15.1 below identifies counties in the study area that are members and relevant tax and revenue information.

Table 15.1 Local Sales Tax Measures for California SHCC Members

County	Sales Tax Name	Amount	Time Covered	Revenue	Funding Allocation (if known)
San Joaquin	Measure K	Half-cent	Renewed in 2006 for 30 years	$2.552 billion	Local Street Repairs/Safety (35%), Congestion Relief (32.5%), Rail Crossing Safety (2.5 %), Passenger, Rail, Bus, Bicycles (30%)
Madera	Measure T	Half-cent	Passed in 2006 for 20 years	$197 million	Commute Corridors/Farm to Market Program (51 %), Safe Routes to Schools and Jobs (44 %), Transit (2 %), Environmental Enhancements (2 %), Admin/Planning (1 %)
Merced	Measure V	Half-cent	Passed in 2016 for 30 years	$450 million	Local projects and alt modes (50%) Regional Projects (44%) Transit (5%) Administration (1%)
Fresno	Measure C	Half-cent	Renewed in 2007 for 20 years	$1.3 billion ($3.4 billion if leveraged for state/ federal funds)	Local Transportation Programs ($593.6 million), Regional Transportation Programs ($520.8 million) Public Transit ($412 million), Alternative Transportation ($102.5 million), Environmental Enhancement ($59.8 million), Admin/Planning ($25.6 million)
Tulare	Measure R	Half-cent	Passed in 2006 for 30 years	$652 million	Local Programs (35 %), Regional Projects (50 %),

[41] http://www.dot.ca.gov/hq/transprog/ocip/draft_2016_itip/draft_2016_itip.pdf.

County	Sales Tax Name	Amount	Time Covered	Revenue	Funding Allocation (if known)
					Transit/Bike/Environmental (14 %), Admin/Planning (1 %)

Source: http://www.selfhelpcounties.org/members.html and component Council of Governments.

This money could be used on local roads connecting to I-5 and SR 99 in support of interchange/intersection needs.

15.2 Barriers to Implementation

The largest barrier to achieving the projects identified in this study is funding. As discussed in Section 3.1, the inclusion of dedicated freight funding in the FAST Act provides some certainty for freight projects moving into the future. However, the I-5/SR 99 corridor is mainly rural and lacks the major congestion issues seen in California's more populated regions. Because of this, projects to expand I-5 and SR 99 are likely to struggle to attract significant funding. The Valley's position as a leading agricultural area adds to this need. The US Department of Agriculture projects agricultural exports from the U.S. to rise by $4.3 billion in 2017 over 2016 figures.[42]

However, changing national priorities following the 2016 election of Donald Trump may also have an impact on goods movement in the Valley. Numerous statements from Trump indicate that infrastructure spending will be a key focus in his administration.[43] Although the FAST Act is funded through 2020, additional funding or a change in priorities for grant programs may make additional funding available to road projects.

Additional barriers to implementation include a lack of community support for projects, which often relates closely with environmental impacts, such as traffic, noise, and air quality associated with building major infrastructure improvements.

[42] http://www.usda.gov/wps/portal/usda/usdahome?contentid=2016/11/0252.xml&contentidonly=true

[43] http://www.pbs.org/newshour/bb/trump-promises-make-infrastructure-major-focus/

16.0 Conclusions and Further Work

This final section provides recommendations for next steps. First, this section begins by providing a list of projects that are anticipated for implementation in the next five years. This was determined through review of the STIP or from information provided by the counties. Two leading project readiness determinants include environmental review and funding allocations. Second, this section considers longer term major improvement corridor-to-corridor connector projects. Lastly, this project points to road-to-rail mode shift and technological advancement opportunities that should be closely monitored. Please note that the SR 58 and Centennial Corridor improvements are included in Sections 4.1 and 4.2.

16.1 Ready-To-Go Projects

Table 16.1 below lists projects identified in Section 2 with a timeline of 0-5 years. The projects are segregated by county. For each of these projects, the table lists the estimated project cost, whether or not the project is included in the California State Transportation Improvement Program (STIP), the status of any required environmental review, and the overall project status or phase.

Table 16.1 I-5/SR 99 Goods Movement Corridor Study Projects: 5 Year Time Frame

County	Study ID	Project ID	Route or Facility ID	Title and Description	Total Project Cost (thousands)	Included in STIP?	Environmental Review Status?	Phase/Status
Fresno	FRE-03	FRE500766	SR 99	California High-Speed Rail Project-SR 99 Re-Alignment	$ 189,500	No		
Fresno	FRE-11	FRE500404	SR 99	Mountain View and SR 99 Overcrossing: Widen Overcrossing and Improve Ramps	$ 45,000	No		
Fresno	FRE-12	FRE500143	SR 99	NB SR 99 Herndon Off Ramp: Signalize & Widen Ramp	$ 1,000	No		
Fresno	FRE-21	15d	I-5	Widen I-5 between Kings County and Merced County lines	$ 198,000	No		
Fresno	FRE-26	99e	SR 99	Widen SR 99 from 6 to 8 lanes from Central Ave to Bullard Ave.	$ 283,000	No		
Kern	KER-02	KER08RTP020	SR 58	Centennial Corridor	$ 698,000	No		
Kern	KER-03	51 / KER08RTP114	Centennial Connector	Centennial Connector - SR 58/Cottonwood Rd to Westside Parkway	$ 698,000	Yes	ROD issued for Alternative B*	Programmed for $33 million in FY 18-19
Kern	KER-51	KER14RTP001	SR 46	Brown Material Rd to I-5 - interchange upgrade at 1-5 - Phase 4A	$ 27,000	Yes		
Madera	MAD-01	MAD417004	SR 99	SR 99: 4-Lane Freeway to 6-Lane Freeway Ave 12 to Ave 17	$ 91,010	No		
Madera	MAD-05	5335	SR 99	Madera – Widen to 6 Lanes from Ave. 12 to Ave. 17	Unknown	Yes	Anticipated ND/FONSI	Programmed for $1.545 million in FY 19-20
Madera	MAD-06	MAD417001	SR 99	Reconstruct Interchange	$ 68,000	No		

County	Study ID	Project ID	Route or Facility ID	Title and Description	Total Project Cost (thousands)	Included in STIP?	Environmental Review Status?	Phase/Status
Madera	MAD-07	6297	SR 99	South Madera - Widen to 6 Lanes from .7 miles north of Ave. 7 to Ave. 12	Unknown	No	Anticipated ND/FONSI	$1.5 million in FY 16-17 deleted
Madera	MAD-08	MAD418002	SR 99	Widen SR 99: In Fresno & Madera Counties, from south of Grantland Ave UC to north of Avenue 7	$ 54,000	No		
Merced	MER-03	0161A	SR 99	Highway 99: Livingston Widening Northbound	$ 42,870	Yes	Completed 6/14	Design/ROW in FY17-18
Merced	MER-04	0161B	SR 99	Highway 99: Livingston Widening Southbound	$ 38,950	Yes	Completed 6/14	ROW in FY16-17
San Joaquin	SJ-11	SJ07-2005	I-5	I-5 at Louise Avenue Interchange	$ 33,000	No		
San Joaquin	SJ-13	SJ11-3066	I-5	I-5 at Roth Road Interchange	$ 16,800	No		
San Joaquin	SJ-14	15b	I-5	Widen I-5 between SR 120 and I-205	$ 207,970	No		
San Joaquin	SJ-15	15a	I-5	Widen I-5 from 1 mile north of SR-12 to SR-120	$ 91,000	No		
San Joaquin	SJ-24	99a	SR 99	Widen SR 99 from French Camp Rd to Mariposa Rd 6 to 8 lanes, with new interchange	$ 100,000	No		
San Joaquin	SJ-26b	SJ11-2023	SR 99	SR 99 at Austin Road Interchange	$ 3,000	No		
San Joaquin	SJ-30	SJ11-2002	SR 99	SR 99 at Eight Mile Road Interchange	$ 65,900	No		
San Joaquin	SJ-31	SJ11-2008	SR 99	SR 99 at Gateway Boulevard Interchange	$ 9,930	No		
San Joaquin	SJ-33	SJ07-2015	SJ07-2015	SR 99 at Main Street/UPRR Interchange (Ripon)	$ 10,000	No		

County	Study ID	Project ID	Route or Facility ID	Title and Description	Total Project Cost (thousands)	Included in STIP?	Environmental Review Status?	Phase/Status
San Joaquin	SJ-34	SJ11-2001	SJ11-2001	SR 99 at Morada Interchange	$ 69,800	No		
San Joaquin	SJ-35	SJ 14-2001	SJ 14-2001	SR 99 at Raymus Expressway Interchange	$ 3,000	No		
San Joaquin	SJ-38	3045	3045	Turner Road Interchange Operational Improvements	$ 3,061	No		$3.061 million in FY 17-18 deleted
San Joaquin	SJ-25	26	26	Widen SR 12 between I-5 and SR 99	$ 60,000	No		
San Joaquin	SJ-26a	16	16	Widen SR 120 between I-5 and SR 99, with new interchange at SR 99	$ 115,191	No		
Stanislaus	STA-16	TIER II	SR 99	Interchange Ramp and Auxiliary Lane Improvements	$ 27,685	No		
Stanislaus	STA-17	SC02	SR 99	SR 99 & Hammett Rd	$ 95,524	No		
Stanislaus	STA-20	M15	SR 99	SR 99 & Briggsmore Interchange	$ 12,668	No		
Stanislaus	STA-23	T01	SR 99	Reconstruct Interchange at Fulkerth Road	$ 12,667	No		
Stanislaus	STA-26	M17	SR 99	Reconstruct to 8-lane Interchange - Phase II	$ 5,835	No		
Stanislaus	STA-29	P02	I-5	I-5 to Rogers Road: Interchange Improvements and Widen Sperry Ave	$ 17,505	No		
Stanislaus	STA-37	M02	SR 99	Widen from 6 to 8 lanes	$ 50,671	No		
Stanislaus	STA-40	99b	SR 99	Widen SR 99 from 6 to 8 lanes in Stanislaus County	$ 473,000	No		

County	Study ID	Project ID	Route or Facility ID	Title and Description	Total Project Cost (thousands)	Included in STIP?	Environmental Review Status?	Phase/Status
Stanislaus	STA-39	17	SR 132	Widen SR 132 connecting SR 99 and I-580	$ 100,000	No		
Tulare	TUL-16		SR 99	State Route 99/Betty Drive Interchange	$ 66,720	Yes		Programmed for $16.720 "Prior"
Tulare	TUL-17	PPNO 6369	SR 99	Prosperity to Ave 200	$3,000	Yes	E & P	FY 20-21
Tulare	TUL-18	PPNO 6400E	SR 99	Tagus 6-lane SB widening	$4,975	Yes	PS&E/ROW	FY 17-18
Tulare	TUL-19	PPNO 6400F	SR 99	Tagus 6-lane NB widening	$5,913	Yes	PS&E/ROW	FY 17-18,18-19

Source: http://www.catc.ca.gov/programs/STIP/2016_STIP/2016_STIP_Staff_Recommendations_042216.pdf Staff recommendations were adopted with changes (none that impact proposed projects above) in May 2016 per: http://www.catc.ca.gov/programs/STIP/2016_STIP/2016_STIP_Adoption_with_Changes_051816.pdf

*ROD online at: http://www.bakersfieldcity.us/civicax/filebank/blobdload.aspx?BlobID=29683

16.2 I-5 to SR 99 Connector Projects

Section 2 provided a detailed analysis of connector corridors. The results of this analysis were based on the following assumptions:

- Cross traffic conflict would be eliminated through the replacement of at-grade intersections with grade-separated interchanges
- Additional capacity would be added (typically one additional travel lane in each direction) in order to facilitate average travel speeds of 55 miles per hour along the full extent of the connector
- Each connector was analyzed individually to measure the full potential of each corridor

The following provides an overview of the anticipated benefits and the recommended next steps that should be considered.

16.2.1 Benefits of Enhanced Connectors

The results of the analysis shown in **Table 16.2** provides the maximum benefits anticipated for each corridor under existing conditions. Future growth is not assumed so the benefits below provide a conservative estimate of benefits. Also, this analysis only considered benefits to freight, and specifically, benefits associated with shifting heavy duty trucks from SR 99 to I-5. This analysis did not include potential benefits associated with shifting other traffic from SR 99 to I-5.

Table 16.2 Summary of I-5/SR 99 Connectors Improvements Impacts

Project	Length (Miles)	Number of Intersections	Major Urban Area	Daily Truck Change	Annual VHT (1,000s)	Annual SR 99 VMT (millions)	Annual CO^2 (million tons)*	Annual NOx (million tons)*
SR 58	30	8	Bakersfield	300	-13.1	-5.5	-	-
West Beltway	19	10	Bakersfield	3,000	-70.1	-32.2	-	-
SR 41	54	22	-	400	-27.5	-1.2	-386	-1.6
SR 140	35	10	Gustine	200	-1.4	-	-71	-0.3
SR 152	42	6	Los Banos	2,400	-4.2	-0.2	-214	-0.8
SR 165	38	9	Los Banos , Hilmar	500	-42.1	-1.1	-938	-3.6
SR 132	20	7	-	150	-3.2	-	-33	-0.2

*Emissions savings only calculated based on trucks shifted from SR 99. Additional benefits of reduced congestion on SR 99 are not included in the calculation.

Due to significant differences in costs associated with freeway widening and interchange improvements, it was not possible to perform even a high-level estimate of costs. For this study, we considered costs of widening projects contained in the STIPs and RTPs; however, the cost estimates can range from $5 – 20 million per mile for a new travel lane and from $50 – 140 million for a new interchanges.

16.2.2 Next Steps

First, a more comprehensive analysis of the purpose and need of these corridors should be conducted. The analysis should include the following components:

1. Full traffic analysis that considers all potential traffic shift
2. Analysis of future demand and associated benefits on the connector, I-5 and SR 99
3. Additional connectivity and access benefits that support local and regional land use development and planning efforts

Should the outcomes of these analyses support further consideration of one or more of the alignments, the next step would involve the development of alternatives along with high-level cost estimates.

Lastly, in order to ensure the most cost effective implementation of a corridor selected for improvement, the State, County and cities should incorporate the enhanced corridor into future plans and identify mechanisms for acquiring land and funding the project. This is especially important in rural areas where development has not yet occurred. Acquiring land in advance would minimize community impacts and overall project costs.

16.3 Funding Strategies

Projects in the I-5/SR 99 corridor are eligible for federal freight funding through the FAST Act but they will need to compete with other State and national priorities. In order to do so most effectively, it may be beneficial to seek funding for a group of projects at the same time in order to maximize the potential benefits and increase the benefit-cost ratio (BCR) of the set of projects. This is a key consideration if FASTLANE Grant funding is sought, as the BCR is a key component in the application.

16.3.1 Highway Infrastructure and Congestion Relief Bundle

Kern County has successfully sought significant amounts of federal funding to improve SR 58 through the City of Bakersfield. From a Valley-wide perspective, a group of SR 99 widening projects could be combined to create a highway infrastructure safety and congestion relief bundle, similar to what the I-95 Coalition successfully submitted for FASTLANE funding in 2016. The key to developing such a bundle is close collaboration between the counties, the selection of projects that have obtained, or are close to obtaining, environmental approval, are included in the STIP, and can begin construction within 24 months.

16.3.2 ITS – Technology Bundle

These projects and programs would focus on upgrading the ITS capabilities of the corridor in order to improve efficiency, capacity, and safety. Projects and programs include;

- Ramp metering at various locations in Kern County – Project KER-45)
- Caltrans' Truck Parking Information System on I-5 and SR 99 – Strategic Program
- Truck Platooning – Strategic Program

In addition to competing for freight formula funding or FASTLANE Grants, the technology focus of these projects allows them to seek additional funding sources. The Advanced Transportation and Congestion Management Technologies Deployment Program is one federal source of funding.[44] Traveler information systems, autonomous vehicle technology, and advanced transportation management technologies are all included as eligible activities. Eight projects received a grant in 2016 including $3 million for the Freight Advanced Traveler Information System (FRATIS) which uses automated optimized dispatching and traffic signal-vehicle speed coordination to reduce truck congestion and fuel usage in the Los Angeles area.[45] Denver, CO also received $6 million for a freight-focused project to improve travel time reliability along City arterials.

Additionally, the truck parking information system and truck platooning programs could seek funding from the private sector as both could include a revenue generating effect that would provide justification for private involvement.

16.3.3 Environmental Improvement Bundle

Projects could be eligible for money through the California Air Resources Board, as well as through the California Energy Commission. The Valley could also receive CMAQ funding (though most of the interchange projects and some of the widening projects might qualify for this also) for the following projects:

- SR 99 Re-Alignment (California High-Speed Rail Project)– Project FRE-03;
- Truck climbing lanes (Grapevine area and SR 58 Eastbound) – Strategic Program;
- Short-haul rail service between SJV region and Port of Oakland – Strategic Program; and
- Short-haul rail service between SJV region and Ports of Long Beach/Los Angeles – Strategic Program

[44] https://www.fhwa.dot.gov/fastact/factsheets/advtranscongmgmtfs.cfm

[45] https://www.transportation.gov/sites/dot.gov/files/docs/ATCMTD_One_Pager.pdf

These projects require continued monitoring, and in the case of the rail concepts, continued communication and collaboration with the rail operators, beneficial cargo owners, ports, and regulatory agencies.

16.3.4 Safety Improvement Bundle

Projects in this bundle are focused on improving safety in the Critical Safety Segments identified in Task 2 of this Study. Projects related to safety can seek funding from numerous additional sources such as the Highway Safety Improvement Program (HSIP) federal funds.

Table 16.3 identifies critical safety segments in each county and lists projects that would improve safety in those segments.

Table 16.3 I-5/SR 99 Projects to Address Critical Safety Segments

County	Critical Safety Segment	Project Description	Project Number	Timeframe
Fresno	SR 99 from SR 41 to Fresno/Madera County Line	Herndon Ave. off-ramp. Signalize and widen ramp.	FRE-12	0-5
Kern	SR 99 from I-5 to Ming Ave. Ming Ave. to SR 199 focal area	Ming Ave. Interchange project	KER-45e	16-24
Merced	SR 152 and Badger Flat Road	Los Banos Bypass Project Segment 1	5707A	6-15
		Los Banos Bypass Project Segment 2	5707B	25 +
		Los Banos Bypass Project Segment 3		25 +
San Joaquin	SR 99 from SR 12 to Galt/County Line	Widen SR 99 from Lodi to Sacramento County Line	3045	0-5
	I-5 from SR 4 to Stockton/ Monte Diablo Ave			
	I-5 from I-205 to SR 120	Widen I-5 between SR 120 and I-205	15b	0-5
	SR 99 from SR 120 to Stanislaus County Line			
	I-205 from I-5 to SR 580			
Stanislaus	SR 99 from SR 132 to San Joaquin County Line. Carpenter and Beckwith Road intersections.	Widen SR 99 from Carpenter Road to San Joaquin County Line to 8 lanes	ST06	25 +
		Widen SR 99 from Carpenter Road to Kansas Ave. to 8 lanes	ST05	25 +
Tulare	SR 99 from Kern County border to Visalia	Widen SR 99 from Avenue 200 to 1.2 mi. south of Avenue 280	99f	6-15
		Widen SR 99 from Kern County border to Avenue 200	99g	25 +

16.4 Continuing Partnerships and Collaborations

All of the projects identified in **Table 16.3** are fairly standard infrastructure improvements to highways, local roads, and intersections/interchanges. Caltrans and partner Councils of Governments in the San Joaquin Valley need to continue to work together to ensure that these priority projects remain regional freight priorities and to monitor their status as final design and construction begin.

The priority strategic programs are more varied than the projects and include a number of components or approaches that will require collaboration outside of those needed to advance standard infrastructure projects, as well as further analysis. For example, increasing truck parking and introducing ITS resources may work best as a public-private partnership. In a public-private partnership, the public and private sectors work cooperatively in the planning, financing, and construction of development projects adjacent to and integrated with transportation facilities. Public-private partnerships require financial buy-in from both sectors. The first step in obtaining buy in from the private sector is communication between the parties and ensuring business needs and concerns are heard and addressed. Truck parking includes a potential revenue-generator which is needed to attract private partners—truck stops with embedded ITS may attract more drivers due to the certainty of finding a space and thus drive revenue.

As for the corridor-to-corridor connector projects, many of these serve growing urban areas and have more utility than freight alone. It's important to understand which ones are most likely to be enhanced in order to ensure eligibility for freight funding through inclusion in the State's freight network.

Appendices:

A. References

B. Truck Generators

C. Goods Movement Excerpts from Agency Plans

D. Demonstration Project Report

Appendix A. REFERENCES

Reports and Planning Documents:

- Alameda County's Goods Movement Plan, prepared by CSI 2014
- California State Rail Plan, Caltrans, 2013
- Corridor System Management Plan I-5, Caltrans District 10, 2012
- Corridor System Management Plan I-5, Caltrans District 6, 2013
- Corridor System Management Plan SR-99, Caltrans District 10, 2002, 2008, 2011
- Corridor System Management Plan SR-99, Caltrans District 6, 2003
- Fresno COG Regional Transportation Plan, 2014
- I-5, SR-99 Origin and Destination Truck Study, KOA, 2009
- Kern COG Regional Transportation Plan/Sustainable Communities Strategies, 2014
- Kings County Regional Transportation Plan and Sustainable Communities Strategies, 2014
- Land of Risk/Land of Opportunity: Cumulative Environmental Vulnerability in California's San Joaquin Valley. UC Davis Center for Regional Change, 2011
- San Joaquin Corridor Strategic Plan, Caltrans, 2008
- San Joaquin Valley Interregional Goods Movement, prepared by FP & CSI et al, 2013
- Service Development Plan for San Joaquin Corridor, AECOM, 2013
- SR-99, SR-198 Gateways Truck Origin and Destination Study, F&P, 2015
- Tulare County Association of Governments Regional Transportation Plan, Goods Movement Chapter 2014
- The State of California Freight Mobility Plan, Caltrans, 2014
- Updated Business Plan for SR-99, Vol I, II, II, Caltrans, 2013

Data Sources:

1. Caltrans Performance Measurement System (PeMS), 2014 http://pems.dot.ca.gov/.
2. Weigh-in-Motion Data, available upon request from Caltrans Traffic Operation division, 2014, http://www.dot.ca.gov/hq/traffops/trucks/datawim/.
3. Freight Analysis Framework, FAF3, 2007, http://faf.ornl.gov/fafweb/Extraction1.aspx.
4. Freight Analysis Framework, FAF3, 2007, http://faf.ornl.gov/faf4/Extraction1.aspx.
5. StreetLight Data, Data Period: 2015: [3, 4, 5, 6] Copyright © 2011-2015.
6. Transportation Injury Mapping System (TIMS), 2009-2013, http://tims.berkeley.edu/.
7. Count data bases:
    a. Caltrans vehicle classification counts for 2013 and 2014 for state highways.
    b. District 6 vehicle classification counts for primary urban roads for 2014 and 2015.
    c. District 10 vehicle classification counts for primary urban roads for 2014 and 2015.
    d. Other counts collected by consultant team during between 2010-2015.
8. Websites that used to identify truck stops and rest stops:
    a. Caltrans Truck stops: http://dot.ca.gov/hq/traffops/trucks/routes/truck-stops.htm.
    b. http://www.truckstopguide.com/.
    c. http://www.truckmaster.com/truck-stop-in-ca.
    d. Jason's Law facilities and spaces shape file http://www.ops.fhwa.dot.gov/freight/infrastructure/truck_parking/index.htm.
9. California EDD: America's Labor Market Information System (ALMIS) Employer Database, 2011 First Edition, Geocoded by consultant team.

Appendix B. Truck Stops in San Joaquin valley

Figure Error! No text of specified style in document.**.1** **Truck Stops in San Joaquin Valley**

Name	No. of Spaces[a]	Type	County	Address
Rest Area	NA	Private	Kings	Coalinga/Avenal Southbound Rest Area
Hillcrest Travel Plaza	NA	Private	Kings	44779 S. Lassen Ave, Avenal, CA 93204
Valero #3074	NA	Private	Kern	3225 Buck Owens Blvd, Bakersfield, CA 93308
Bruce's Truck Stop	140	Private	Kern	8311 E Brundage Lane, Bakersfield, CA 93307
Bear Mountain Truck Stop	NA	Private	Kern	15840 Costajo Rd, Bakersfield, CA 93313
Pacific Pride	NA	Private	Kern	1841 W Mettler Frontage Rd, Bakersfield, CA 93305
Wal-Mart	NA	Private	Kern	2300 White Lane, Bakersfield, CA 93304
Kimber Renegade Shell	NA	Private	Kern	8200 Kimber Ave, Bakersfield, CA 93307
24/Seven Travel Plaza	200	Private	Kern	129 Weedpatch Hwy, Bakersfield, CA 93307
Mikuls Pumpkin Center Truck Terminal	NA	Private	Kern	
Flyers Energy	NA	Private	Kern	2023 Mettler Frontage Rd, Bakersfield, CA 93313
Pacific Pride	NA	Private	Kern	15840 Costajo St, Bakersfield, CA 93313
Flying J #613	250	Private	Kern	17047 Zachary Avenue, Bakersfield,CA 93308
Ahmed's	NA	Private	Madera	18208 Avenue 24, Chowchilla, CA 93610
Weigh Station	NA	Private	Madera	
Pacific Pride	NA	Private	Madera	22798 Rd 4, Chowchilla, CA 93610
Red Top Truck Stop	NA	Private	Madera	22798 Road 4 (Lincoln Rd), Chowchilla,CA 93610
Jayne Travel Center	NA	Private	Fresno	41027 S. Glen Ave, Coalinga,CA 93210
Pacific Pride	NA	Private	Kings	1130 Pickerell Avenue, Corcoran,CA 93212
Akal Travel Plaza	NA	Private	Kern	1640 Highway 99, Delano,CA 93215
Oasis Market & Truck Stop	NA	Private	Tulare	23215 Ave 56, Ducor,CA 93218
A & A Shell Food Mart	NA	Private	Tulare	23314 Ave 56, Ducor,CA 93218
Big B's Travel Center	NA	Private	Tulare	1164 N Front St, Earlimart,CA 93219
Pacific Pride	NA	Private	Tulare	1149 S Kaweah, Exeter,CA 93221

Name	No. of Spaces[a]	Type	County	Address
Renos Mega Mart Chevron	NA	Private	Fresno	1207 N St, Firebaugh,CA 93622
MBP Truck/Auto Plaza	NA	Private	Fresno	15838 Paul Negra Rd, Firebaugh,CA 93622
Burford's Star Mart #5	NA	Private	Fresno	2747 E Manning Ave, Fowler,CA 93625
Beacon 5th Wheel Truck Stop	NA	Private	Fresno	3767 S Golden State Blvd, Fresno,CA 93725
E-Z Trip	264	Private	Fresno	6725N Golden State Blvd, Fresno,CA 93722
RVJ's Truck Stop	NA	Private	Fresno	4021 S Maple Ave, Fresno,CA 93725
Fleet Card Fuels Fresno	NA	Private	Fresno	2898 E. Jensen Ave, Fresno,CA 93706
Seibert's Fuel Center	NA	Private	Fresno	2837 N Parkway Dr, Fresno,CA 93722
Pacific Pride	NA	Private	Fresno	2581 SE Ave, Fresno,CA 93706
Cal Fresno Oil	NA	Private	Fresno	3242 E Garrett Ave, Fresno,CA 93706
EZ Trip Golden State	NA	Private	Fresno	6639 N. Parkway Dr, Fresno,CA 93722
Pacific Pride	NA	Private	Fresno	3220 S Parkway Dr, Fresno,CA 95358
Pacific Pride	NA	Private	Kings	9535 E Third St, Hanford,CA 93230
Rest Area	NA	Private	Fresno	
Shop & Go #611	NA	Private	Fresno	38440 Highway 99, Kingsburg,CA 93631
Joe's Travel Plaza	NA	Private	San Joaquin	15600 S Harlan Rd, Lathrop,CA 95330
Pacific Pride	NA	Private	Kings	1735 W D St, Lemoore,CA 93245
Lindsay Food Mart	NA	Private	Tulare	235 N Fremont Dr, Lindsay,CA 93247
Livingston Travel Center	110	Private	Merced	
Flying J #617	187	Private	San Joaquin	15237 Thornton Road, Lodi,CA 95242
Pacific Pride	NA	Private	San Joaquin	351 N Beckman Rd, Lodi,CA 95240
3B's Truck/Auto Plaza	NA	Private	San Joaquin	14749 N. Thornton Road, Lodi,CA 95242
Pacific Pride	NA	Private	San Joaquin	14749 N Thornton Rd, Lodi,CA 95242
Pacific Pride	NA	Private	Madera	631 S Gateway Dr, Madera,CA 93637
Wal-Mart	NA	Private	Madera	1977 West Cleveland Ave, Madera,CA 93637
Pilot Travel Center #365	150	Private	Madera	22717 Avenue 18 1/2, Madera,CA 93637
Family Food Mart	NA	Private	Madera	28650 Avenue 12, Madera,CA 93637
Pacific Pride	NA	Private	Merced	1455 R St, Merced,CA 95340
Pacific Pride	NA	Private	Merced	385 S Hwy 59, Merced,CA 95341
Pacific Pride	NA	Private	Stanislaus	401 9th St, Modesto,CA 95350
Pacific Pride	NA	Private	Stanislaus	237 E Whitmore Ave, Modesto,CA 95358
Modesto Travel Plaza	NA	Private	Stanislaus	1201 7th St, Modesto,CA 95351
Pacific Pride	NA	Private	Stanislaus	320 Codoni Ave, Modesto,CA 95350

Name	No. of Spaces[a]	Type	County	Address
Wal-Mart	NA	Private	Stanislaus	2225 Plaza Parkway, Modesto,CA 95350
Pacific Pride	NA	Private	Stanislaus	226 N 2nd Street, Patterson,CA 95363
Westley Triangle Truck Stop	NA	Private	Stanislaus	
Bob's Truck Stop	NA	Private	Tulare	444 E Court Ave, Pixley,CA 93256
Texaco	NA	Private	Tulare	451 S Park Dr, Pixley,CA 93256
Pacific Pride	NA	Private	Tulare	73 W Vine St, Porterville,CA 93257
Wal-Mart	NA	Private	Kern	911 South China Lake Blvd, Ridgecrest,CA 93555
Love's Travel Stop	NA	Private	Stanislaus	1553 Colony Road, Ripon,CA 95366
Flying J #618	197	Private	Stanislaus	1501 N. Jack Tone Road, Ripon,CA 95366
Pacific Pride	NA	Private	Stanislaus	816 S Frontage Rd, Ripon,CA 95366
Jimco Truck Plaza	NA	Private	Stanislaus	1022 Frontage Rd, Ripon,CA 95366
Shane & Dave's Truck Shop	NA	Private	San Joaquin	3550 S Highway 99, Stockton,CA 95215
Vanco Truck & Auto Plaza	NA	Private	San Joaquin	1033 W Charter Way, Stockton,CA 95206
Pacific Pride	NA	Private	San Joaquin	5777 French Camp Rd, Stockton,CA 95201
Wal-Mart Supercenter	NA	Private	San Joaquin	3223 East Hammer Lane, Stockton,CA 95212
76 Express	NA	Private	San Joaquin	5777 S French Camp Rd, Stockton,CA 95206
Pacific Pride	NA	Private	San Joaquin	1033 W Charter Way, Stockton,CA 95206
Love's Travel Stop #392	NA	Private	Kern	2000 East Tehacapi Boulevard, Tehachapi,CA 93561
Rest Area	NA	Private	Tulare	Phillip Raine Rest Area SB
Town & Country Market	NA	Private	Tulare	412 S Burnett Rd, Tipton,CA 93272
Rest Area	NA	Private	Tulare	Phillip Raine Rest Area NB
Pacific Pride	NA	Private	San Joaquin	5491 F St, Tracy,CA 95201
Country Mart	NA	Private	San Joaquin	34243 S Chrisman Rd, Tracy,CA 95304
Tracy Truck & Auto Stop	NA	Private	San Joaquin	3940 N Tracy Blvd, Tracy,CA 95304
Pacific Pride	NA	Private	San Joaquin	34243 S Chrisman Rd, Tracy,CA 95304
RJ Travel Center	NA	Private	Tulare	36220 Highway 99, Traver,CA 93673
Rest Area	NA	Private	Stanislaus	SB
Pacific Pride	NA	Private	Stanislaus	309 S Tully, Turlock,CA 95380
Pacific Pride	NA	Private	Stanislaus	1001 S Berkeley Ave, Turlock,CA 95380
G&S(CFN Cardlock)	NA	Private	Stanislaus	725 N Tully Rd, Turlock,CA 95380
Rest Area	NA	Private	Stanislaus	NB

Name	No. of Spaces[a]	Type	County	Address
Goshen Arco Travel Plaza	NA	Private	Tulare	30821 Route 99, Visalia,CA 93279
Pacific Pride	NA	Private	Tulare	205 N Ben Maddoz Way, Visalia,CA 93292
Texaco Truck Stop #5	85	CT	Fresno	2747 E Manning Ave, Fowler, CA 93625, USA
Beacon 5th Wheel Truck Stop	40	CT	Fresno	3767 S Golden State Blvd, Fresno, CA 93725, USA
Kleins Truck Stop	150	CT	Fresno	6725 N Golden State Blvd, Fresno, CA 93722, USA
RVJ's Truck Stop	12	CT	Fresno	4021 S Maple Ave, Fresno, CA 93725, USA
Red Triangle (Exxon)	8	CT	Fresno	38440 6th St, Kingsburg, CA 93631, USA
Boyett Petroleum	50	CT	Fresno	3000 E Floral Ave, Selma, CA 93662, USA
Kailey's Break Place, Inc.	10	CT	Fresno	13025 S Van Horn Ave, Selma, CA 93662, USA
Truck Stops of America	165	CT	Kern	5800 N Wheeler Ridge Rd, Arvin, CA 93203, USA
Beacon Truck Stop	6	CT	Kern	3225 Buck Owens Blvd, Bakersfield, CA 93308, USA
Bear Mountain Truck Stop	50	CT	Kern	15840 Costajo Rd, Bakersfield, CA 93313, USA
Bruce's Truckstop	150	CT	Kern	8311 E Brundage Ln, Bakersfield, CA 93307, USA
Easy Trip Exxon	1	CT	Kern	29541 Stockdale Hwy, Bakersfield, CA 93314, USA
Flying J Travel Plaza #5320	250	CT	Kern	17047 Zachary Rd, Bakersfield, CA 93308, USA
Kimber Avenue Texaco	30	CT	Kern	8200 Kimber Ave, Bakersfield, CA 93307, USA
Renegade Truck Stop	20	CT	Kern	2023 Mettler Frontage Rd W, Bakersfield, CA 93313, USA
Bruce's Buttonwillow	55	CT	Kern	27780 Lagoon Dr, Buttonwillow, CA 93206, USA
Buttonwillow TA Travel Center	200	CT	Kern	27769 Lagoon Dr, Buttonwillow, CA 93206, USA
Akal Truck Stop	50	CT	Kern	Delano, CA, USA
Lost Hills TA Travel Center	80	CT	Kern	14814 Aloma St, Lost Hills, CA 93249, USA
Giant Truck Stop of Mojave	50	CT	Kern	16600 Sierra Hwy, Mojave, CA 93501, USA
Petro Stopping Center 28	420	CT	Kern	5821 Dennis McCarthy Dr, Arvin, CA 93203, USA
Beacon Truck Stop	10	CT	Kings	Kettleman City, CA 93239, USA

Name	No. of Spaces[a]	Type	County	Address
Ahmed's Exxon	15	CT	Madera	18208 Avenue 24, Chowchilla, CA 93610, USA
Pilot Travel Center #365	328	CT	Madera	22717 Ave 18 1/2, Madera, CA 93637, USA
San Luis Travel Plaza "Petro"	150	CT	Merced	28991 Gonzaga Rd, Santa Nella Village, CA 95322, USA
Pilot Travel Center	75	CT	Merced	29025 Plaza Dr, Santa Nella Village, CA 95322, USA
Rotten Robbie Truck/Auto Plaza	50	CT	Merced	12860 CA-33, Santa Nella Village, CA 95322, USA
TA Santa Nella Travel Center	206	CT	Merced	Santa Nella Blvd & I-5, Gustine, CA 95322, USA
Jahant Food & Fuel	25	CT	San Joaquin	24323 CA-99, Acampo, CA 95220, USA
Joe's Travel Plaza	2	CT	San Joaquin	15600 Harlan Rd, Lathrop, CA 95330, USA
3 B's Truck/Auto Plaza	12	CT	San Joaquin	14749 Thornton Rd, Lodi, CA 95242, USA
Flying J Travel Plaza	176	CT	San Joaquin	1501 Jack Tone Rd, Ripon, CA 95366, USA
Jimco Truck Plaza	30	CT	San Joaquin	1022 Frontage Rd, Ripon, CA 95366, USA
Joes's Travel Plaza	2	CT	San Joaquin	15600 Harlan Rd, Lathrop, CA 95330, USA
Vanco Truck & Auto Plaza	45	CT	San Joaquin	1033 W Charter Way, Stockton, CA 95206, USA
Country Mart Diesel & Gas	22	CT	San Joaquin	34243 N Chrisman Rd, Tracy, CA 95304, USA
Westley Triangle Truck Stop	100	CT	Stanislaus	7051 McCracken Rd, Westley, CA 95387, USA
Bob's Auto And Ts	25	CT	Tulare	444 E Court Ave, Pixley, CA 93256, USA
USA Petroleum #217	6	CT	Tulare	415 N Park Dr, Pixley, CA 93256, USA
C. Roche Truck Stop	80	CT	Tulare	1120 E Paige Ave, Tulare, CA 93274, USA
Tejon Pass	NA	CTR	Kern	3.5 mi. N. of Gorman
Buttonwillow	NA	CTR	Kern	2 mi. N. of Rte. 58 Interchange
Coalinga – Avenal	NA	CTR	Fresno	1.2 mi. N. of Lassen Avenue
John "Chuck" Erreca	NA	CTR	Merced	0.7 mi. N. of Fresno Co. Line
Westley	NA	CTR	Stanislaus	0.9 mi. S. of San Joaquin Co. Line
Boron	NA	CTR	Kern	3.9 mi. W. of Boron
Phillip S. Raine	NA	CTR	Tulare	2.5 mi. N. of Tipton
C. H. Warlow	NA	CTR	Tulare	At Dodge Avenue Near Kings River
Enoch Christoffersen	NA	CTR	Stanislaus	2.3 mi.S. of Turlock

CTR = Caltrans Truck Rest stop

CT = Caltrans Truck stop

a NA= There is no information about number of spaces

1.1 PeMS Detector Availability

Figure Error! No text of specified style in document.**.2 Details the number of detectors used to collect PeMS data available per study segment.**

Highway and County	Detectors	Highway and County	Detectors
CA-108	2	CA-41	60
Stanislaus	2	Fresno	56
CA-12	17	Kings	2
San Joaquin	17	Madera	2
CA-120	26	CA-46	6
San Joaquin	26	Kern	6
CA-132	17	CA-59	1
San Joaquin	11	Merced	1
Stanislaus	6	CA-88	10
CA-140	11	San Joaquin	10
Merced	11	CA-99	382
CA-145	2	Fresno	58
Madera	2	Kern	55
CA-152	12	Madera	26
Merced	12	Merced	96
CA-168	27	San Joaquin	114
Fresno	27	Stanislaus	30
CA-180	24	Tulare	3
Fresno	24	I-205	40
CA-184	2	San Joaquin	40
Kern	2	I-5	151
CA-198	2	Fresno	2
Tulare	2	Kern	11
CA-219	2	Merced	23
Stanislaus	2	San Joaquin	110
CA-33	2	Stanislaus	5
Merced	2	I-580	2
CA-4	29	San Joaquin	2
San Joaquin	29		

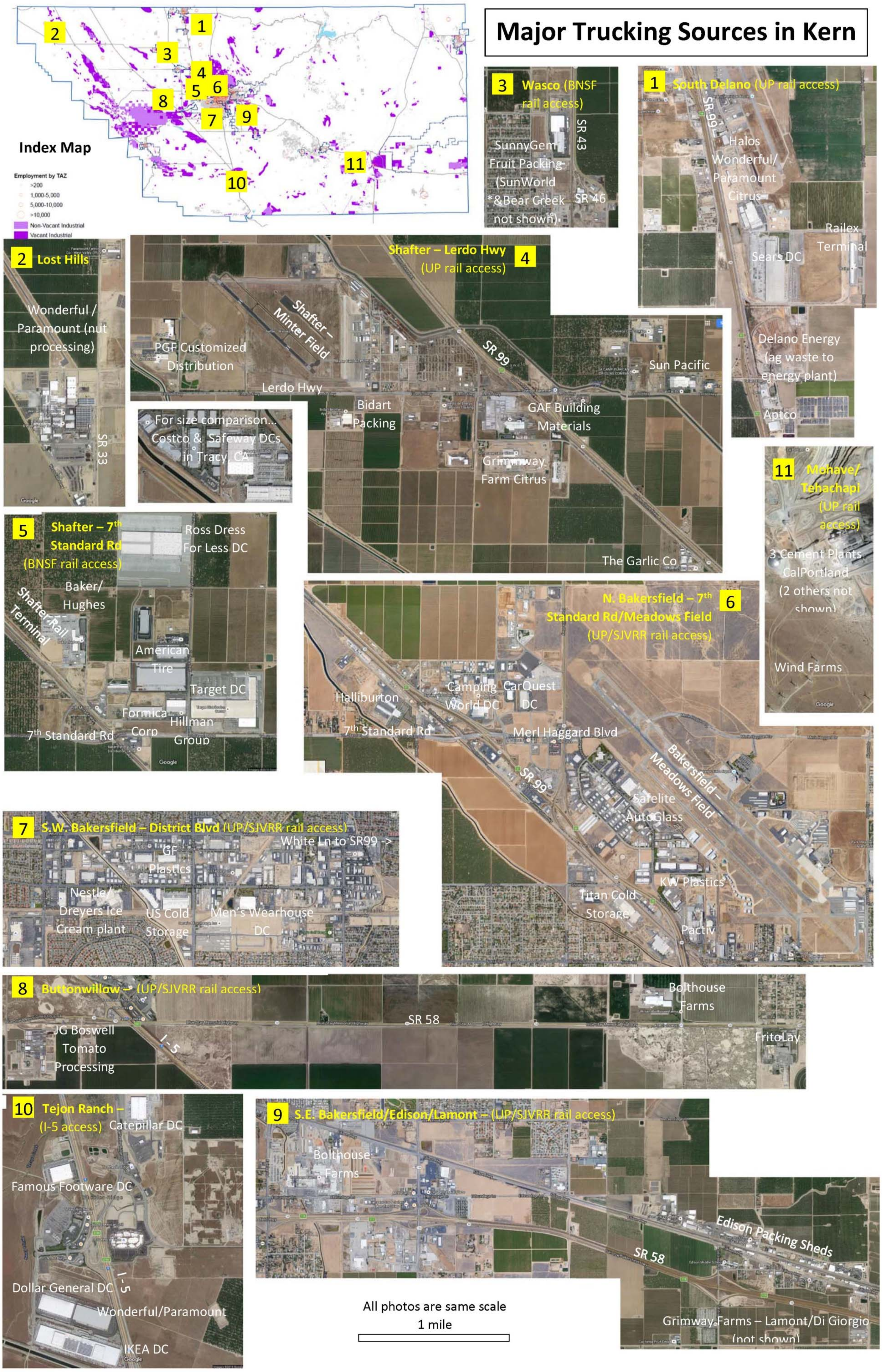
1.2 Major Freight Generators in San Joaquin Valley

This appendix provides further information about existing freight generators and major future industrial projects in each county. The information is provided by local jurisdictions.

Kern County

Figure Error! No text of specified style in document.**.3** **Kern County major freight generators**

Provided by KernCOG



San Joaquin County

- **Centerpoint Intermodal Center at Manteca**

This 190 Acre campus provides direct access to UP Intermodal facility. It is centrally located between I-5 and HWY 99 and will accommodating up to 3.1 Million SF with flexible layouts (Figure **Error! No text of specified style in document.**.4).

Figure Error! No text of specified style in document.**.4 Centerpoint Intermodal Center**
Provided by StanCOG

Stanislaus County

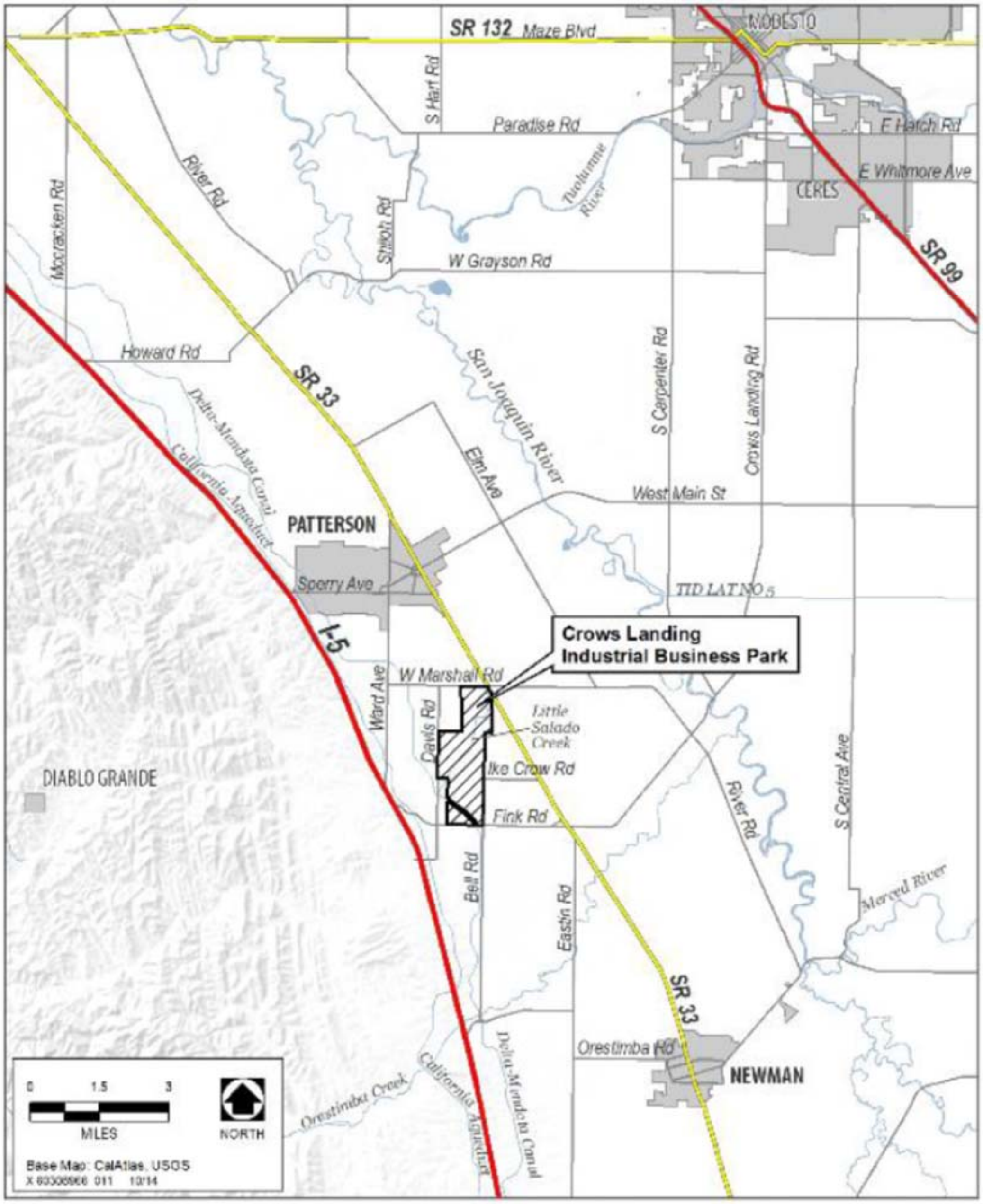
- Crows Landing Industrial Business Park (CLIBP)

The proposed CLIBP or "project" would be constructed within the boundaries of the former National Aeronautics and Space Administration (NASA) Crows Landing Air Facility. The approximately 1,532-acre project site is located in an unincorporated area of western Stanislaus County that is within 2 miles of Interstate 5 (I-5) and south of the Patterson city limits and its Urban Services Boundary/Sphere of Influence. The project site is bounded by Marshall Road to the north, Fink Road to the south, Bell Road to the east, and Davis Road to the west (Figure **Error! No text of specified style in document.**.3).

The County anticipates that development of the CLIBP at the former Crows Landing military site would require more than 30 years to reach full buildout, and the needs associated with parcel development will continue to evolve. Therefore, the proposed CLIBP does not offer specific parcels for development, but areas that can be sized based on the individual needs of site tenants and developers. The proposed CLIBP Specific Plan, which will be appended to the EIR, will provide objectives, goals, and policies for the approximately 1,532-acre site that will further the County's vision for the property. The Specific Plan would allow proposed tenants to develop parcels that are suitable for their diverse and unique needs. The County assumes that the proposed project would be developed in three, 10-year phases or an overall 30-year timeframe, and it would provide backbone on and off-site infrastructure and roadway improvements to meet the needs associated with each phase.

Figure Error! No text of specified style in document.**.5 Crows Landing Industrial Business Park**

Provided by StanCOG



Source: AECOM 2014.

- Beard Industrial Business Park

The Beard Industrial District is located in Modesto with easy access to Highway 99. Modesto, California is an ideal centralized location for Northern, Central California and West Coast Markets and is located approximately 80 miles from the Port of Oakland. It is also connects by M&ET with both BNSF & UP railroads (Figure **Error! No text of specified style in document.**.4). This project provides:

- ~2,000-Acre Industrial Business Park
- Industrial Warehouse Distribution, Manufacturing & Related Space totaling Over ±9 MSF
- Build-to-Suit Opportunities (25,000 to over 1 MSF)
- Home to several Fortune 500 Companies

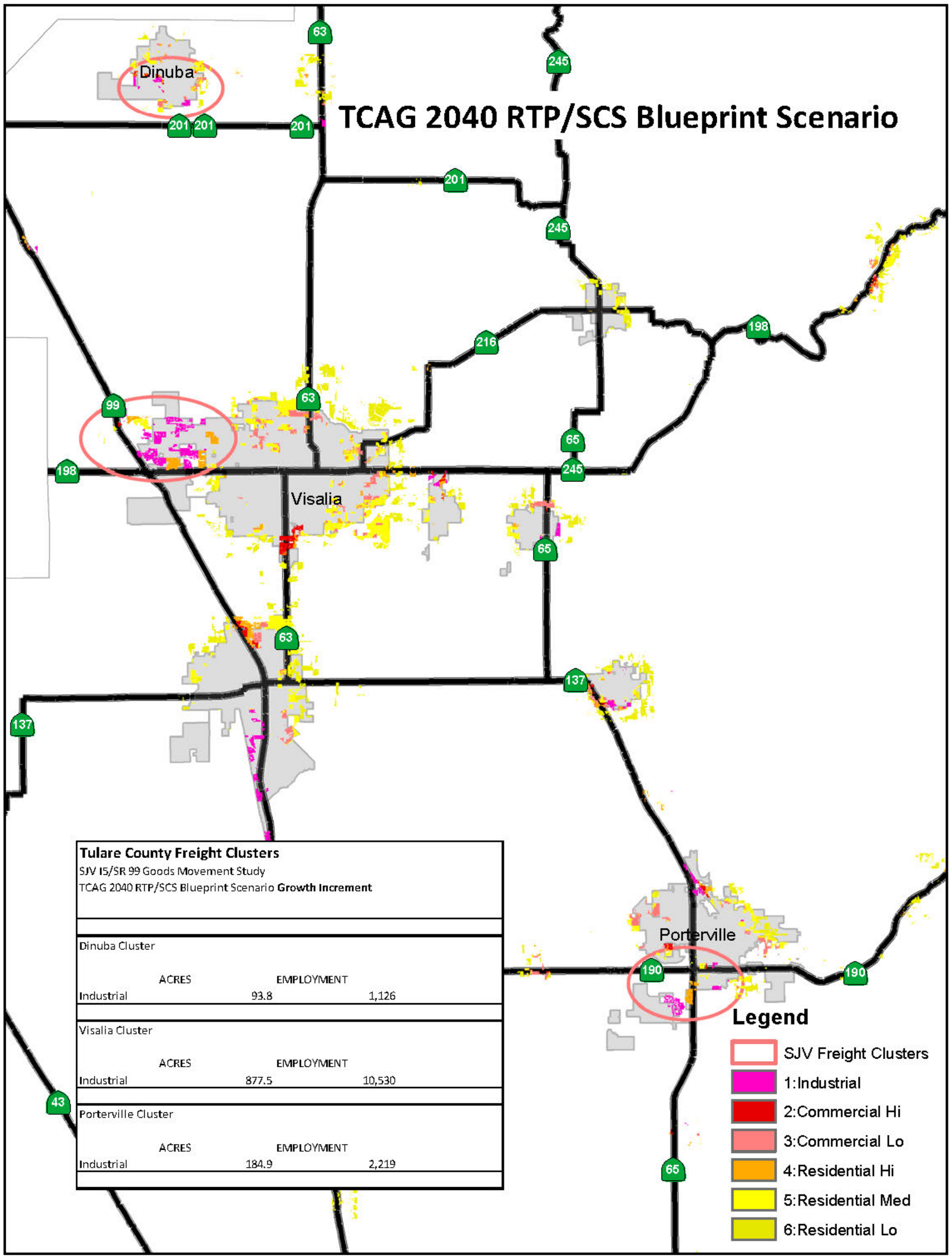
Figure Error! No text of specified style in document.**.6 Beard Industrial Business Park**
Provided by StanCOG

Source: CBRE

Tulare County

Figure Error! No text of specified style in document.**.7 Tulare County Freight Clusters**

Provided by TCAG



Appendix D. Goods Movement-Related Excerpts from Agency Plans

Different ways were used in the state and regional plans to develop goods movement-related strategic investments. Generally, the plans used the following terms with definitions as follows:

- A *goal* is the end toward which an effort is directed; it is general in application and timeless.
- A *policy* is a direction statement that guides present and future decisions on specific actions.
- An *action* is a specific activity in support of the policy.
- An *objective* is a result to be achieved by a stated point in time, realistically attained considering probable funding and political constraints.
- A *performance measure* is a quantitative system-level indicator of how actions in the plan support the goals.

All of the terms or concepts mentioned above were not described for all plans. The Appendix presents the vision statement or overall goal of the plans and the concepts the plans used in identifying goods movement-related strategic investments.

Vision Statement/Overall Goal of Plans

- Caltrans CFMP Vision: As the national gateway for international trade and domestic commerce, California enhances economic competitiveness by collaboratively developing and operating an integrated, multimodal freight transportation system that provides safe, sustainable freight mobility. This system facilitates the reliable and efficient movement of freight and people while ensuring a prosperous economy, social equity, and human and environmental health.
- Fresno COG RTP Vision: Fresno County will be composed of unique cities, communities and a diverse population in a connected high quality environment that accommodates anticipated population growth and is supported by: 1) a vibrant economy built on competitive strength, and world class education; 2) a healthy and sustainable environment where air, aquifers, surface waters, forests, soil, agriculture, open space and wildlife resources are enhanced and protected; and 3) a focus on Cultural and Community Stewardship where all people enjoy fundamental rights as members of a free society, and where the community takes ownership of problems and their solutions.
- Fresno COG RTP Policy Element: Three themes are indicated: 1) preservation of existing facilities and services, 2) sound financial leveraging of existing funding, and 3) connecting transportation needs with land use and air quality impacts.

- The Kern COG RTP/SCS seeks to: improve economic vitality; improve air quality; improve the health of communities; improve transportation and public safety; promote the conservation of natural resources and undeveloped land; increase access to community services; increase regional and local energy independence; and increase opportunities to help shape our community's future.

- The overall goal of Kings CAG RTIP is to develop a transportation system that encourages and promotes the safe and efficient development, management, and operation of surface transportation systems to serve the mobility needs of people and freight (including meeting the Americans with Disabilities Act requirements, accessible pedestrian walkways, and bicycle transportation facilities) and foster economic growth and development, while minimizing transportation-related fuel consumption and air pollution.

- The overall vision for the Madera CTC 2014 RTP/SCS is: A sound multimodal transportation system facilitating a vibrant economy, enhancing the physical and cultural environment, and ensuring a high quality of life for citizens in Madera County.

- The seven "vision themes" of the Merced CAG RTP/SCS are: 1) provide a goods system of roads that are well maintained, safe, efficient and meet the transportation demands of people and freight; 2) provide a transit system that is a viable choice; 3) support full-time employment with living wages; 4) preserve productive agricultural land/maintain strong agricultural economy and the quality of life that goes with it; 5) support orderly and planned growth that enhances the integration and connectivity of various modes of transportation; 6) support clean air and water and avoid, minimize or mitigate negative impacts to the environment; and 7) identify and allocate funding and ensure that transportation investments are cost-effective.

- The San Joaquin COG RTP/SCS reflects a region-specific, balanced multimodal plan that not only achieves the intent and promise of SB 375, but can be implemented through existing and planned programs or policies. This Plan embodies local visions through local input on the perspectives of economic development, environmental preservation, air quality, public health, environmental justice, and farmland conversation/preservation. The Plan can be considered the San Joaquin region's "statement of priorities" for the future transportation system from 2012 through 2040.

- The Stanislaus COG RTP/SCS or "Plan" presents a strategy to accommodate the significant expected growth in the region while promoting economic vitality, providing more housing and transportation choices, promoting healthy living, and improving communities through an efficient and well-maintained transportation network.

- The overall goal of the Tulare CAG RTP/SCS is to provide an efficient, integrated multimodal transportation system for the movement of people and goods that enhances the physical, economic, and social environment in the Tulare County region.

For Caltrans CFMP, Fresno COG RTP, San Joaquin COG RTP/SCS and Stanislaus COG RTP/SCS Only:

- **Economic Competitiveness-Related Goals and Objectives:**
  - Caltrans CFMP Goal - Improve the contribution of the California freight transportation system to support economic efficiency, productivity, and competitiveness.
    - » Caltrans CFMP Objective 1 – Build on California's history of investments to seek sustainable and flexible funding solutions with federal, private, and advocacy groups.
    - » Caltrans CFMP Objective 2 – Invest in freight projects that enhance economic activity, freight mobility, reliability, and global competitiveness.
  - Fresno COG RTP Goal 1: An efficient, safe, integrated, multimodal transportation system (repeated elsewhere in this document)
    - » Fresno COG RTP Objective 1: Develop an integrated multimodal transportation network that supports and enhances the region's economy and serves the needs of a growing and diverse population for transportation access to jobs, housing, recreation, commercial, and community services as well as goods movement. (repeated elsewhere in this document)
      - Relevant Policy 1: Integrate transportation modes through a coordinated transportation systems management process.
      - Relevant Policy 2: Work cooperatively with the private sector to ensure that the collected information accurately reflects existing and forecasted conditions that are of importance from a freight transportation perspective. (repeated elsewhere in this document)
      - Relevant Policy 3: Develop air transportation facilities and services that are complementary to other modes of transportation.
      - Relevant Policy 4: Decisions on improvements to the transportation system shall take into account the effective use of all modes and facilities.
    - » Fresno COG RTP Objective 2: Maintain and improve existing facilities as the basic system which will address existing and future travel demands. (repeated elsewhere in this document)
      - Relevant Policy: Manage the transportation system in a manner designed to increase operational efficiency, conserve energy and space, reduce air pollution and noise, and provide for effective goods movement, safety, personal mobility and accessibility. (repeated elsewhere in this document)

- Fresno COG RTP Goal 2: An integrated and efficient highways, streets and roads network. (repeated elsewhere in this document)

  - » Fresno COG RTP Objective: Develop and implement an integrated highways, streets and roads network that meets mobility needs for both urban and rural residents and the movement of goods. (repeated elsewhere in this document)

    - Relevant Policy 1: Improve the urbanized area circulation system, including the future urban freeway network.
    - Relevant Policy 2: Promote development of a highways, streets and roads network that provides for connectivity of the metropolitan network with the system outside the metropolitan network.
    - Relevant Policy 3: Develop a convenient, safe and efficient interface between transportation modes. (repeated elsewhere in this document)

- Fresno COG RTP Goal 3: Acceptable level-of-service (LOS) for the highways, streets and roads network. (repeated elsewhere in this document)

  - » Fresno COG RTP Objective: Maintenance of acceptable levels-of-service on the highways, streets and roads network that will allow for efficient movement of people and goods. (repeated elsewhere in this document)

    - Relevant Policy 1: Enhance the development of a highways and streets network which will relieve current and future congestion. (repeated elsewhere in this document)
    - Relevant Policy 2: Work cooperatively with the private sector to ensure that the mobility needs of the business community within Fresno County are addressed. (repeated elsewhere in this document)
    - Relevant Policy 3: Manage the highways, streets and roads network in a manner designed to increase operational efficiency, reduce air pollution and provide adequate mobility for both people and goods. (repeated elsewhere in this document)

- San Joaquin COG RTP/SCS Policy: Support economic vitality. (repeated elsewhere in this document)

  - » Relevant Strategy 1: Improve freight access to key strategic economic centers.

    - Relevant building block for aligning the sustainability goals with transportation investment strategies: Invests in infrastructure that improves access to intermodal facilities, airports, the Port of Stockton, and commercial hubs key to goods movement.

  - » Relevant Strategy 2: Support transportation improvements that improve economic competitiveness and/or revitalization of commercial corridors and strategic economic centers.

- Stanislaus COG RTP/SCS Goal: Foster job creation in agricultural and non-agricultural sectors, and encourage business attraction, retention, and expansion by improving quality of life through new and revitalized communities. (economic and community vitality) (repeated elsewhere in this document)

  » Stanislaus COG RTP/SCS Objective: Improve the movement of goods in the region by supporting the enhancement of goods by land (including rail) and air. (repeated elsewhere in this document)

    - Relevant Action 1: Provide guidance and assistance on any proposed project which will increase the use of rail to move goods.
    - Relevant Action 2: Adopt and integrate the regional expressway study into the RTP and local general plans.
    - Relevant Action 3: Identify high priority grade separation projects and capacity enhancements/operational strategies to improve travel times and increase safety.
    - Relevant Action 4: Work with the Modesto City-County Airport (MCCA) to develop opportunities to expand air transportation services, including corporate aviation and general aviation; also increase scheduled air carrier service between the MCCA and major airports.
    - Relevant Action 5: Implement projects to improve access to the MCCA.

- **Mobility, Accessibility and Congestion Relief-Related Goals and Objectives**

  - Caltrans CFMP Goal: Reduce costs to users by minimizing congestion on the freight transportation system.

    » Caltrans CFMP Objective 1 – Identify causes and solutions to freight bottlenecks.

    » Caltrans CFMP Objective 2 – Invest strategically to optimize system performance.

    » Caltrans CFMP Objective 3 – Develop, manage, and operate an efficient integrated freight system.

  - Fresno COG RTP Goal 1: An efficient, safe, integrated, multimodal transportation system (repeated elsewhere in this document)

    » Fresno COG RTP Objective 1: Develop an integrated multimodal transportation network that supports and enhances the region's economy and serves the needs of a growing and diverse population for transportation access to jobs, housing, recreation, commercial, and community services as well as goods movement. (repeated elsewhere in this document)

      - Relevant Policy: Pursue development of strategies and methods to enhance the efficient movement of freight through the multimodal network.

   » Fresno COG RTP Objective 2: Maintain and improve existing facilities as the basic system which will address existing and future travel demands. (repeated elsewhere in this document)

      - Relevant Policy: Manage the transportation system in a manner designed to increase operational efficiency, conserve energy and space, reduce air pollution and noise, and provide for effective goods movement, safety, personal mobility and accessibility. (repeated elsewhere in this document)

- Fresno COG RTP Goal 2: An integrated and efficient highways, streets and roads network. (repeated elsewhere in this document)

   » Fresno COG RTP Objective: Develop and implement an integrated highways, streets and roads network that meets mobility needs for both urban and rural residents and the movement of goods. (repeated elsewhere in this document)

      - Relevant Policy: Develop a convenient, safe and efficient interface between transportation modes. (repeated elsewhere in this document)

- Fresno COG RTP Goal 3: Acceptable level-of-service (LOS) for the highways, streets and roads network. (repeated elsewhere in this document)

   » Fresno COG RTP Objective: Maintenance of acceptable levels-of-service on the highways, streets and roads network that will allow for efficient movement of people and goods. (repeated elsewhere in this document)

      - Relevant Policy 1: Enhance the development of a highways and streets network which will relieve current and future congestion. (repeated elsewhere in this document)
      - Relevant Policy 2: Monitor levels of service on the streets and highways network within Fresno County to ensure safe and efficient movement of people and goods. (repeated elsewhere in this document)
      - Relevant Policy 3: Manage the highways, streets and roads network in a manner designed to increase operational efficiency, reduce air pollution and provide adequate mobility for both people and goods. (repeated elsewhere in this document)

- San Joaquin COG RTP/SCS Policy 1: Support economic vitality. (repeated elsewhere in this document)

   » Relevant Strategy: Promote safe and efficient strategies to improve the movement of goods by water, air, rail, and truck. (repeated elsewhere in this document)

      - Relevant building block for aligning the sustainability goals with transportation investment strategies: Emphasizes focus on a multimodal strategy of investments that de-emphasizes highway or roadway expansion but still delivers a system to reduce vehicle miles travelled and peak hour traffic congestion.

- San Joaquin COG RTP/SCS Policy 2: Maximize mobility and accessibility. (repeated elsewhere in this document)
  - » Relevant Strategy: Improve regional transportation system efficiency.
- Stanislaus COG RTP/SCS Goal: Improve the ability of people and goods to move between desired locations; and, provide a variety of transportation choices (mobility and accessibility). (repeated elsewhere in this document)
  - » Stanislaus COG RTP/SCS Objective 1: Implement complete streets projects to improve roadways impact of quality of life throughout the region and provide greater transportation choices.
  - » Stanislaus COG RTP/SCS Objective 2: Apply new technologies to make travel more reliable, convenient, and accessible for all modes. (repeated elsewhere in this document)
    - Relevant Action: Integrate ITS strategies into projects and programs.
  - » Stanislaus COG RTP/SCS Objective 3: Integrate the regional expressway study into the 2014 RTP/SCS and local general plans. (repeated elsewhere in this document)

- **Safety and Security-Related Goals and Objectives**
  - Caltrans CFMP Goal: Improve the safety, security, and resilience of the freight transportation system.
    - » Caltrans CFMP Objective 1 – Reduce rates of incidents, collisions, fatalities, and serious injuries associated with freight movement.
    - » Caltrans CFMP Objective 2 – Utilize technology to provide for the resilience and security of the freight transportation system.
  - Fresno COG RTP Goal 1: An efficient, safe, integrated, multimodal transportation system. (repeated elsewhere in this document)
    - » Fresno COG RTP Objective: Maintain and improve existing facilities as the basic system which will address existing and future travel demands. (repeated elsewhere in this document)
      - Relevant Policy 1: Manage the transportation system in a manner designed to increase operational efficiency, conserve energy and space, reduce air pollution and noise, and provide for effective goods movement, safety, personal mobility and accessibility. (repeated elsewhere in this document)
      - Relevant Policy 2: Maintain stringent safety requirements for all transportation modes, and identify problem (hazardous) locations and implement counter measures for anticipated problems wherever possible.

- Fresno COG RTP Goal 2: An integrated and efficient highways, streets and roads network. (repeated elsewhere in this document)
  - Fresno COG RTP Objective: Develop and implement an integrated highways, streets and roads network that meets mobility needs for both urban and rural residents and the movement of goods. (repeated elsewhere in this document)
    - Relevant Policy: Develop a convenient, safe and efficient interface between transportation modes. (repeated elsewhere in this document)
- Fresno COG RTP Goal 3: Acceptable level-of-service (LOS) for the highways, streets and roads network. (repeated elsewhere in this document)
  - Fresno COG RTP Objective: Maintenance of acceptable levels-of-service on the highways, streets and roads network that will allow for efficient movement of people and goods. (repeated elsewhere in this document)
    - Relevant Policy 1: Monitor levels of service on the streets and highways network within Fresno County to ensure safe and efficient movement of people and goods. (repeated elsewhere in this document)
    - Relevant Policy 2: Manage the highways, streets and roads network in a manner designed to increase operational efficiency, reduce air pollution and provide adequate mobility for both people and goods. (repeated elsewhere in this document)
- San Joaquin COG RTP/SCS Policy 1: Support economic vitality. (repeated elsewhere in this document)
  - Relevant Strategy: Promote safe and efficient strategies to improve the movement of goods by water, air, rail, and truck. (repeated elsewhere in this document)
- San Joaquin COG RTP/SCS Policy 2: Increase safety and security. (repeated elsewhere in this document)
  - Relevant Strategy 1: Facilitate projects that reduce the number of and severity of traffic incidents.
  - Relevant Strategy 2: Encourage and support projects that increase safety and security.
    - Relevant building block for aligning the sustainability goals with transportation investment strategies: Invests in high-tech applications or projects that allow motorists to choose travel options and allow local and state agencies to more quickly respond to incidents on the roadway.
  - Relevant Strategy 3: Improve communication and coordination between agencies and public for emergency preparedness. (repeated elsewhere in this document)

- Stanislaus COG RTP/SCS Goal 3: Operate and maintain the transportation system to ensure public safety and security; and improve the health of residents by improving air quality and providing more transportation options. (health and safety) (repeated elsewhere in this document)

  » All objectives and actions are transit oriented.

- **Freight System Infrastructure Preservation-Related Goals and Objectives**

  - Caltrans CFMP: Improve the state of good repair of the freight transportation system.

    » Caltrans CFMP Objective 1 – Apply sustainable preventive maintenance and rehabilitation strategies.

  - Fresno COG RTP Goal 1: An efficient, safe, integrated, multimodal transportation system. (repeated elsewhere in this document)

    » Fresno COG RTP Objective: Maintain and improve existing facilities as the basic system which will address existing and future travel demands. (repeated elsewhere in this document)

      - Relevant Policy 1: Continue support for the preservation of existing transportation facilities and, where practical, addressing transportation needs by using existing transportation modes efficiently.
      - Relevant Policy 2: Identify those transportation problems where transportation systems management can be effective.

  - Fresno COG RTP Goal 2: An integrated and efficient highways, streets and roads network. (repeated elsewhere in this document)

    » Fresno COG RTP Objective: Develop and implement an integrated highways, streets and roads network that meets mobility needs for both urban and rural residents and the movement of goods. (repeated elsewhere in this document)

      - Relevant Policy 1: Preserve and promote the use of existing transportation facilities where feasible.
      - Relevant Policy 2: Preserve rights of way for construction of future street and highway projects where feasible.

  - San Joaquin COG RTP/SCS Policy 1: Maximize mobility and accessibility. (repeated elsewhere in this document)

    » Relevant Strategy: Improve major transportation corridors to minimize impacts on rural roads.

- San Joaquin COG RTP/SCS Policy 2: Preserve the efficiency of the existing transportation system.
  - » Relevant Strategy 1: Optimize existing transportation system capacity through available and/or innovative strategies.
  - » Relevant Strategy 2: Support the continued maintenance and preservation of the existing transportation system.
    - Relevant building block for aligning the sustainability goals with transportation investment strategies: Underscore the importance of maintenance through recognition that routine and preventative maintenance is an integral piece toward transportation efficiency.
- Stanislaus COG RTP/SCS Goal: Maintain the transportation system in a state of good repair, and protect the region's transportation investments by maximizing the use of existing facilities. (system preservation)
  - » Stanislaus COG RTP/SCS Objective: Protect the region's investment by preserving the condition of the existing transportation system.
    - Relevant Action 1: Develop a comprehensive traffic management plan for the state highway system and regionally significant routes.
    - Relevant Action 2: Design and implement a countywide Pavement Management Plan to be used in establishing and prioritizing maintenance needs at the regional and local level.

- **Environmental Stewardship and Quality of Life-Related Goals and Objectives**
  - Caltrans CFMP Goal: Avoid and reduce adverse environmental and community impacts of the freight transportation system.
    - » Caltrans CFMP Objective 1 – Integrate environmental, health, and social equity considerations in all stages of freight planning and implementation.
    - » Caltrans CFMP Objective 2 – Conserve and enhance natural and cultural resources.
    - » Caltrans CFMP Objective 3 – Avoid and reduce air and water pollution, greenhouse gas (GHG) emissions, and other negative impacts associated with freight transportation by transforming the freight transportation system to be cleaner and more efficient
    - » Caltrans CFMP Objective 4 – Consider impacts and mitigation relative to the context of the project location.
    - » Caltrans CFMP Objective 5 – Develop an efficiency metric that captures the intensity of pollutants per unit of freight moved.

- Fresno COG RTP Goal 1: An efficient, safe, integrated, multimodal transportation system. (repeated elsewhere in this document)

  » Fresno COG RTP Objective: Maintain and improve existing facilities as the basic system which will address existing and future travel demands. (repeated elsewhere in this document)

  - Relevant Policy: Manage the transportation system in a manner designed to increase operational efficiency, conserve energy and space, reduce air pollution and noise, and provide for effective goods movement, safety, personal mobility and accessibility. (repeated elsewhere in this document)

- Fresno COG RTP Goal 2: Attainment and maintenance of federal and state ambient air quality standards (criteria pollutants) as set by the Environmental Protection Agency and the California Air Resources Board.

  » Fresno COG RTP Objective 1: Participate in and support the coordinated transportation and air quality planning efforts between the eight Valley Metropolitan Planning Organizations, Caltrans, the San Joaquin Valley Air Pollution Control District, the Federal Highway Administration, Federal Transit Administration, the California Air Resources Board, and local agencies charged with land use planning.

  - Relevant Policy 1: Participate in developing the transportation/air quality modeling protocol for State Implementation Plans (SIPs) with the San Joaquin Valley Air Pollution Control District.
  - Relevant Policy 2: Work with community members and organizations, including those that have been traditionally underrepresented, to provide outreach and involvement in relevant air quality policies, programs and issues.
  - Relevant Policy 3: Support the efforts of the San Joaquin Valley Air Pollution Control District to integrate appropriate policies and implementation measures identified in the Air Quality Guidelines for General Plans into local general plans.
  - Relevant Policy 4: Support the air pollution enforcement and educational efforts of the San Joaquin Valley Air Pollution Control District.
  - Relevant Policy 5: Continue Fresno COG's partnership with the San Joaquin Valley Air Pollution Control District as a Healthy Air Living Business Partner.

  » Fresno COG RTP Objective 2: Implement all appropriate Transportation System Management, Transportation Demand Management, and Transportation Control Measure strategies as technologically and economically feasible.

  - Relevant Policy 1: Ensure consistency between and among the goals, objectives, policies, and implementation measures of the Regional Transportation Plan, the Transportation Improvement Program, and State Implementation Plans (SIPs).
  - Relevant Policy 2: Improve vehicular flow and efficiency of the region's circulation system using intelligent transportation systems where feasible.

   » Fresno COG RTP Objective 3: Integrate land use planning, transportation planning, and air quality planning to make the most efficient use of public resources and to create a more healthy and livable environment.

      - Consider the air quality impacts of mobile sources when planning transportation systems to accommodate expected growth in the community. Thereby reducing the consumption and dependence upon non-renewable energy resources used by mobile sources of emissions.
      - Pursue non-single occupancy and lower/zero emission vehicle modes shall be pursued as preferred alternatives where feasible.
      - Support the development of infrastructure required for alternative fueled vehicles as well as zero emission vehicles.
      - Continue Fresno COG's established policy to fund cost-effective projects that facilitate air quality improvement through emission reductions with Congestion Mitigation and Air Quality Improvement funds.

- Fresno COG RTP Goal 3: Acceptable level-of-service (LOS) for the highways, streets and roads network. (repeated elsewhere in this document)

   » Fresno COG RTP Objective: Maintenance of acceptable levels-of-service on the highways, streets and roads network that will allow for efficient movement of people and goods. (repeated elsewhere in this document)

      - Relevant Policy: Manage the highways, streets and roads network in a manner designed to increase operational efficiency, reduce air pollution and provide adequate mobility for both people and goods. (repeated elsewhere in this document)

- San Joaquin COG RTP/SCS Policy 1: Enhance the environment for existing and future generations and conserve energy.

   » Relevant Strategy 1: Encourage efficient development patterns that maintain agricultural viability and natural resources.

   » Relevant Strategy 2: Enhance the connection between land use and transportation choices through projects supporting energy and water efficiency.

   » Relevant Strategy 3: Improve air quality by reducing transportation-related emissions.

- San Joaquin COG RTP/SCS Policy 2: Improve the quality of life for residents.

   » Relevant Strategy: Improve the connection between land use and transportation

      - Relevant building block for aligning the sustainability goals with transportation investment strategies: Increases active transportation project investments to facilitate public health and active communities.

- Stanislaus COG RTP/SCS Goal 1: Promote and provide equitable opportunities to access transportation services for all populations and ensure all populations share in the benefits of transportation improvements and provide a range of transportation and housing choices. (social equity)
  - » Stanislaus COG RTP/SCS Objective: Provide an equitable level of transportation for all modes for all users.
    - Action: Implement complete street projects that provide access to all users.
- Stanislaus COG RTP/SCS Goal 2: Consider the environmental impacts when making transportation investments and minimize direct and indirect impacts on clear air and the environment. (environmental quality)
  - » Stanislaus COG RTP/SCS Objective: Lower overall vehicle miles traveled, reduce greenhouse gas emissions, and improve overall air quality.
    - Relevant Action 1: Incorporate evaluation frameworks such as the Smart Mobility Framework (SMF) and/or Sustainable Transportation Analysis & Rating System (STARS).
- Stanislaus COG RTP/SCS Goal 3: Operate and maintain the transportation system to ensure public safety and security; and improve the health of residents by improving air quality and providing more transportation options. (health and safety) (repeated elsewhere in this document)
  - » All objectives and actions are transit oriented.

- **Innovative Technology and Practices-Related Goals and Objectives**
  - Caltrans CFMP Goal: Use innovative technology and practices to operate, maintain, and optimize the efficiency of the freight transportation system while reducing its environmental and community impacts.
    - » Caltrans CFMP Objective 1 – Support research, demonstration projects, development, and deployment of innovative technologies.
    - » Caltrans CFMP Objective 2 – Promote the use of advanced technologies within the freight industry to support the State Implementation Plan (SIP), attainment of California greenhouse gas reduction targets, and to reduce local air toxics.
    - » Caltrans CFMP Objective 3 – Support and incorporate the use of low carbon renewable fuels.
    - » Caltrans CFMP Objective 4 – Promote innovative technologies and practices utilizing real time information to move freight on all modes more efficiently.

- Stanislaus COG RTP/SCS Goal: Improve the ability of people and goods to move between desired locations; and, provide a variety of transportation choices (mobility and accessibility). (repeated elsewhere in this document)

  » Stanislaus COG RTP/SCS Objective: Apply new technologies to make travel more reliable, convenient, and accessible for all modes. (repeated elsewhere in this document)

    - Relevant Action: Integrate ITS strategies into projects and programs.

- **Planning, Collaboratio,n and Funding-Related Goals and Objectives**

  - Fresno COG RTP Goal 1: An efficient, safe, integrated, multimodal transportation system. (repeated elsewhere in this document)

    » Fresno COG RTP Objective 1: Develop an integrated multimodal transportation network that supports and enhances the region's economy and serves the needs of a growing and diverse population for transportation access to jobs, housing, recreation, commercial, and community services as well as goods movement. (repeated elsewhere in this document)

      - Relevant Policy 1: Work cooperatively with the private sector to ensure that the collected information accurately reflects existing and forecasted conditions that are of importance from a freight transportation perspective. (repeated elsewhere in this document)
      - Relevant Policy 2: Ensure that public and private transportation providers and other interested parties have an opportunity to provide input into the transportation planning process.

    » Fresno COG RTP Objective 2: Manage the financial resources which are available from government, the private sector, and users of the transportation system in a cost-effective manner to meet regional needs.

      - Relevant Policy 1: Procure and leverage federal, state and local transportation funding to the maximum degree possible, in order to develop a regional transportation network which serves the residents of the region in the most economical, effective and efficient manner possible.
      - Relevant Policy 2: Encourage new or reconstructed facilities to incorporate design standards which extend the life cycle and reduce maintenance costs.
      - Relevant Policy 3: Pursue additional funding sources for development of major transportation programs and projects. Work with all interest groups to reach consensus and initiate an active public information program regarding transportation funds needed.

- Fresno COG RTP Goal 2: Planning outcomes that are consistent with various planning efforts.

  » Fresno COG RTP Objective: Ensure consistency with emerging planning efforts.

    - Relevant Policy 1: Seek to ensure, during planning processes, that planning efforts are as consistent as feasible; such as: the Blueprint Planning Principles, Health in All Policies, the intent of SB375 (Senate Bill 375 also known as the Sustainable Communities Protection Act of 2008), Caltrans' Complete Streets Program, and statewide and federal air quality goals, etc.
    - Relevant Policy 2: Incorporate performance measures and outcomes as integral components in planning and programming processes as feasible.

- Fresno COG RTP Goal 3: Improved mobility and accessibility for all regardless of race, income, national origin, age, or disability.

  » Fresno COG RTP Objective: To incorporate concern for environmental justice[1] into transportation decisions.

    - Relevant Policy 1: Seek to ensure fair distribution[2] of the benefits and burdens of transportation projects, and seek to address the transportation needs of the disadvantaged communities through SCS Implementation Programs.
    - Relevant Policy 2: Seek to ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
    - Relevant Policy 3: Encourage local transportation agencies to leverage federal funding to address unique challenges of the low income, disabled and elderly populations.

- Fresno COG RTP Goal 4: A regional transportation network consistent with the intent of SB 375 (Senate Bill 375 also known as the Sustainable Communities Protection Act of 2008).

  » Fresno COG RTP Objective: Development of a regional transportation network which is environmentally sensitive and helps reduce greenhouse gas emissions wherever possible.

    - Relevant Policy 1: Under the direction of the Policy Board, identify and coordinate a strategy and methodology to assist member agencies in avoiding or fully mitigating all significant impacts of new transportation facilities on environmentally sensitive areas and natural resources by identifying potential policies and actions to minimize the loss of farmland associated with the construction of transportation facilities.

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[1] As per Fresno County RTP: Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

[2] As per Fresno County RTP: Fair treatment means no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies.

- Relevant Policy 2: Encourage infill development in areas that take advantage of remaining capacity in existing transportation facilities.
- Relevant Policy 3: Encourage energy conservation through alternatives to single occupancy vehicles, increased transportation efficiency and facility design.
- Relevant Policy 4: Project level decisions should give priority to safety, air pollution, noise and energy considerations.
- Relevant Policy 5: Support the implementation of Transportation System Management, Transportation Demand Management, and Transportation Control Measures that reduce emissions on the circulation system.
- Relevant Policy 6: Continue participation in the development of State Implementation Plans (SIP's) to attain the National Ambient Air Quality Standards (criteria pollutants) with the San Joaquin Valley Unified Air Pollution Control District.
- Relevant Policy 7: Continue to support coordinated transportation planning efforts between the eight Valley Metropolitan Planning Organizations (MPO's) located in the San Joaquin Valley nonattainment air basin.
- Relevant Policy 8: Endeavor to ensure the consistency of regional transportation planning efforts with applicable Federal, State, and local energy conservation programs, goals, and objectives.

– Fresno COG RTP Goal 5: Support cooperative efforts between local, state, federal agencies and the public to plan, develop and manage our transportation system.

» Fresno COG RTP Objective: Strengthen intergovernmental organizational relationships and lines of communication which foster an understanding and awareness of the overall impacts of transportation/land use/air quality decision making.

- Relevant Policy 1: Coordinate with other public agencies to ensure that the overall social, health, economic, energy and environmental effects of transportation decisions are understood, and given opportunity for input, by the general public and groups that have been traditionally underrepresented in planning processes.
- Relevant Policy 2: Work closely with local land use agencies to ensure that land use planning is coordinated with transportation planning to fully mitigate the traffic impacts of new development to the greatest degree possible.
- Relevant Policy 3: Ensure that existing and future land use plans of the communities within the region are recognized in the formulation of transportation decisions.
- Relevant Policy 4: Work together with the appropriate public agencies to identify and potentially preserve rights-of-way for construction of future transportation projects.
- Relevant Policy 5: Communicate with local land use agencies on the likely impacts of transportation policy decisions on land use and development; and strive for consistency (where appropriate) between transportation plans and programs and applicable land use and development plans.

- Fresno COG RTP Goal 6: An integrated and efficient highways, streets and roads network. (repeated elsewhere in this document)

  » Fresno COG RTP Objective: Develop and implement an integrated highways, streets and roads network that meets mobility needs for both urban and rural residents and the movement of goods. (repeated elsewhere in this document)

  - Relevant Policy 1: Continue work with member agencies to ensure that the inter and intra county movement of agricultural commodities remains a priority.
  - Relevant Policy 2: Prioritize transportation improvements that accommodate travel, while fostering the development of safety, maintenance and operational improvements on the streets and highways network within Fresno County.

- Fresno COG RTP Goal 7: Efficient use of available transportation funding.

  » Fresno COG RTP Objective: Pursue all possible federal, state and local transportation funding related to development, maintenance and rehabilitation of the highways and streets network.

  - Relevant Policy: Track overall transportation financing issues to ensure that Fresno County agencies are aware of, and able to react in a timely fashion to, any new or innovative financial strategies.

- Fresno COG RTP Goal 8: Acceptable level-of-service (LOS) for the highways, streets and roads network. (repeated elsewhere in this document)

  » Fresno COG RTP Objective: Maintenance of acceptable levels-of-service on the highways, streets and roads network that will allow for efficient movement of people and goods. (repeated elsewhere in this document)

  - Relevant Policy 1: Facilitate communication between Fresno COG and local land use agencies to analyze impacts on the regional transportation system during the decision making process.
  - Relevant Policy 2: Work cooperatively with the private sector to ensure that the mobility needs of the business community within Fresno County are addressed. (repeated elsewhere in this document)
  - Relevant Policy 3: Continue to coordinate regional transportation network planning with the eight Valley Regional Planning Agencies.
  - Relevant Policy 4: Monitor levels of service on the streets and highways network within Fresno County to ensure safe and efficient movement of people and goods. (repeated elsewhere in this document)

- San Joaquin COG RTP/SCS Policy 1: Increase safety and security. (repeated elsewhere in this document)
    - Relevant Strategy: Improve communication and coordination between agencies and public for emergency preparedness. (repeated elsewhere in this document)
- San Joaquin COG RTP/SCS Policy 2: Promote interagency coordination and public participation for transportation decision-making and planning efforts.
    - Relevant Strategy 1: Engage the public early, clearly, and continuously.
    - Relevant Strategy 2: Use a variety of methods to engage the public, encouraging representation from diverse income and ethnic backgrounds.
        - Relevant building block for aligning the sustainability goals with transportation investment strategies: Identifies land use patterns that encourage infill development and compact development.
- San Joaquin COG RTP/SCS Policy 3: Maximize cost-effectiveness.
    - Relevant Strategy 1: Support the use of state and federal grants to supplement local funding and pursue discretionary grant funding opportunities from outside the region.
    - Relevant Strategy 2: Support projects that maximize cost effectiveness.
    - Relevant Strategy 3: Maximize funding of existing transportation options.
- Stanislaus COG RTP/SCS Goal: Improve the ability of people and goods to move between desired locations; and, provide a variety of transportation choices (mobility and accessibility). (repeated elsewhere in this document)
    - Stanislaus COG RTP/SCS Objective: Integrate the regional expressway study into the 2014 RTP/SCS and local general plans. (repeated elsewhere in this document)
- Stanislaus COG RTP/SCS Goal 1: Foster job creation in agricultural and non-agricultural sectors, and encourage business attraction, retention, and expansion by improving quality of life through new and revitalized communities. (economic and community vitality) (repeated elsewhere in this document)
    - Stanislaus COG RTP/SCS Objective: Improve the movement of goods in the region by supporting the enhancement of goods by land (including rail) and air. (repeated elsewhere in this document)
        - Relevant Action 1: Continue participation in the San Joaquin Valley Goods Movement Task Force and associated Study.
        - Relevant Action 2: Adopt and integrate the regional expressway study into the RTP and local general plans.

- Stanislaus COG RTP/SCS Goal 2: Provide mixed land uses and compact development patterns, and direct development toward existing infrastructure to preserve agricultural land, open space, and natural resources. (sustainable development pattern)
  - » Stanislaus COG RTP/SCS Objective: Preserve farmland and natural resources by integrating land use and transportation planning.
    - Relevant Action 1: Coordinate with local agricultural, open space, and resource organizations to help reduce impacts on agricultural land, open space, and natural resources.
    - Relevant Action 2: Coordinate with LAFCO and utilize the Municipal Service Review process to better determine whether or not cities and special districts have the capacity and/or capabilities to provide the necessary municipal services within their respective boundaries.

For Kern COG RTP/SCS:

- **Note:** Although goods movement-related strategic actions are indicated, there are other Kern COG policies or actions that may affect goods movement. For example, one of the land use-related strategic actions is: "Promote land use along freight corridors that are compatible with goods movement traffic." There are other such actions.

- **All Goals**
  - Goal 1 (Mobility): Improve the mobility of people and freight.
  - Goal 2 (Accessibility): Improve accessibility to, and the economic wellbeing of major employment and other regional activity centers.
  - Goal 3 (Reliability): Improve the reliability and safety of the transportation system.
  - Goad 4 (Efficiency): Maximize the efficiency and cost effectiveness of the existing and future transportation system.
  - Goal 5 (Livability): Promote livable communities and satisfaction of consumers with the transportation system.
  - Goal 6 (Sustainability): Provide for preservation and expansion of the system while minimizing effects on the environment.
  - Goal 7 (Equity): Ensure an equitable distribution of the benefits among various demographic and user groups.

- **Goods Movement-Related Strategic Actions**
  - Action 1 (Relates to Mobility, Accessibility, Efficiency and Livability goals): Coordinate planning efforts to ensure efficient, economical, and environmentally sound movement of goods.

- Action 2 (Relates to Mobility, Accessibility, Efficiency and Livability goals): Encourage coordination and consultation between the public and private sectors to explore innovative and efficient goods movement strategies.
- Action 3 (Relates to Mobility, Accessibility, Efficiency and Livability goals): Identify opportunities for truck-to-rail and truck-to-intermodal mode shifts, and evaluate the contributions of truck traffic on regional air quality.
- Action 4 (Relates to Mobility, Accessibility, Efficiency and Livability goals): Encourage the use of rail and air for goods movement to reduce impacts to state and inter county routes and lessen air quality impacts.
- Action 5 (Relates to Mobility, Accessibility, Efficiency and Livability goals): Oppose higher axle load limits for the trucking industry on general purpose roadways.
- Action 6 (Relates to Mobility, Accessibility and Efficiency goals): Advocate programs and projects for the intermodal linkage of all freight transportation.
- Action 7 (Relates to Mobility, Accessibility and Efficiency goals): Consider constructing truck climbing lanes on eastbound SR 58 from General Beale Road to the Bena Road overcrossing.
- Action 8 (Relates to Mobility, Accessibility and Efficiency goals): Program Infrastructure improvements such as widening of Seventh Standard Road in response to proposed freight movements activities in the area.
- Action 9 (Relates to Mobility, Accessibility and Efficiency goals): Widen State Route 184 to four lanes to respond to increasing agriculture trucking activity.
- Action 10 (Relates to Mobility, Accessibility and Efficiency goals): Widen Wheeler Ridge Road to four lanes as a gap-closure measure to tie I-5 to SR 58 via SR184.
- Action 11 (Relates to Mobility and Efficiency goals): Develop an annual freight movement stakeholders group for coordination and expansion efforts.
- Action 12 (Relates to Mobility and Efficiency goals): Encourage communication between short-line rail operators, shippers, and economic development agencies.
- Action 13 (Relates to Mobility and Efficiency goals): Explore options for potential uses of the southern portion of Arvin Subdivision as identifies in the Kern County Rail Study Phase 2.
- Action 14 (Relates to Mobility, Reliability and Efficiency goals): Explore rail intermodal, transfer facility, and alternative transfer options for the region.
- Action 15 (Relates to Mobility, Reliability and Efficiency goals): Continue development of the Paramount Logistics Park for intermodal freight transfer activities.

- Action 16 (Relates to Mobility, Reliability and Efficiency goals): Continue development of the Delano RailEx Facility for intermodal freight shipping to the east coast.

- Action 17 (Relates to Mobility, Reliability and Efficiency goals): Expand rail service to existing distribution centers throughout Kern County when feasible.

- Action 18 (Relates to Mobility, Accessibility and Equity goals): Maintain liaison with Southern California Association of Governments and all San Joaquin Valley Councils of Government for efficient coordination of freight movement between regions and counties.

- Action 19 (Relates to Mobility, Accessibility and Equity goals): Work with other agencies to create an effective Central Valley-wide truck model to track regional commodity flows and to identify critical economic trends that will drive truck flows on regionally significant truck routes.

- Action 20 (Relates to Mobility, Reliability, Accessibility and Equity goals): Provide heavy truck access planning guidance, including a review of the current surface transportation act route system, review of geometric issues, and signaling for all routes identified as major local access routes, as well as the development of performance standards.

- Action 21(Relates to Mobility, Reliability, Accessibility and Equity goals): Add "missing links" (streets) to roadway network that reduce out of direction travel: Centennial Connector will provide a major free flow traffic connector that will improve air quality by reducing stop and go truck travel on local arterials. Hageman Flyover Project will provide another east/west connection over SR 99 to downtown Bakersfield central business district; Mohawk Street Extension provides an extension from Rosedale Highway south that connects to Truxtun Avenue accessing downtown Bakersfield.

For Kings CAG RTIP:

- **Note:** Although goods movement-related policy and objectives are indicated, there are other Kings CAG policies and objectives that may affect freight. For example, a transportation system management objective is: "Shorten the travel time required to move people and goods on the existing system." There are other such policies and their objectives.

- **Goods Movement-Related Policy:** Support the efforts of the trucking and rail industries to transport commodities safely and efficiently.

- **Goods Movement-Related Objectives:**

  - Objective 1: Designate and maintain regional and local truck routes to prevent major pavement deterioration on local streets and roads that are not designed for heavy truck traffic.

  - Objective 2: Where needed, widen regional highways to accommodate them to heavy truck traffic.

  - Objective 3: Support enforcement of local truck route ordinances.

- Objective 4: Develop plans to mitigate congestion on local streets and at intersections where heavy truck traffic occurs.
- Objective 5: Support efforts to require all trucks carrying hazardous materials to have a manifest, including identification and instructions for handling materials in case of spills. Also support efforts to improve hazardous waste containers so that spillage or leakage does not occur.
- Objective 6: Support truck weight fees that equitably provide for the highway maintenance costs resulting from heavy trucking.
- Objective 7: Encourage the improvement of railways with the end purpose of increasing the efficiency of goods movements.
- Objective 8: Support the installation of automatic grade protection devices at all grade crossings.
- Objective 9: Improve rail grade crossings as needed to improve traffic flows.
- Objective 10: Encourage the efficient movement of goods through California ports.
- Objective 11: In concert with Caltrans, the California Highway Patrol, and local jurisdictions, restrict roads available for hazardous waste trucking to mitigate potential adverse effects associated with transportation.

For Madera CTC RTP/SCS:

- **Note:** There were no goods movement specific goals or objectives. A majority of objectives that relate to goods movement are indicated.
- **All Goals:**
  - To promote Intermodal Transportation Systems that are Fully Accessible, Encourage Quality Growth and Development, Support the Region's Environmental Resource Management Strategies, and are Responsive to the Needs of Current and Future Travelers.
  - To Promote and Develop Transportation Systems that Stimulate, Support, and Enhance the Movement of People and Goods to Foster Economic Competitiveness of the Madera Region.
  - To Enhance Transportation System Coordination, Efficiency, and Intermodal Connectivity to Keep People and Goods Moving and Meet Regional Transportation Goals.
  - To Maintain the Efficiency, Safety, and Security of the Region's Transportation System.
  - To Improve the Quality of the Natural and Human Built Environment through Regional Cooperation of Transportation Systems Planning Activities.

- To Maximize Funding to Maintain and Improve the Transportation Network.
- To Identify Reliable Transportation Choices that Support a Diverse Population.
- To protect the environment and health of our residents by improving air quality and encouraging active transportation (non-motorized transportation, such as bicycling and walking).

- **Goods Movement-Related Objectives:**
  - Objective 1: Provide the Madera region with transportation mobility options necessary to carry out essential daily activities and support equitable access to the region's assets.
  - Objective 2: Shift investment strategies towards a variety of modes.
  - Objective 3: Improve and maintain an integrated transportation network that reduces congestion and minimizes safety issues.
  - Objective 4: Strive to create a fully "seamless" intermodal transportation system by addressing critical linkages between modes based upon public needs.
  - Objective 5: Maintain, repair and rehabilitate the existing and future regional transportation system.
  - Objective 6: Undertake transportation investments that enhance the future economic viability and performance of the transportation system.
  - Objective 7: Reduce the cost of doing business by providing for the efficient movement of goods, people and information.
  - Objective 8: Combine elements of priority projects to maximize funding and provide for a well-connected and seamless transportation system.
  - Objective 9: Improve the integration of land use, urban design, transportation, rural and environmental feature preservation, and economic development policies and decisions through incentives and/or policies.
  - Objective 10: Make transportation decisions that are compatible with air quality conformity objectives and the preservation of key regional ecosystems.
  - Objective 11: Improve marketing and the promotion of successful existing transportation services.
  - Objective 12: Conduct effective outreach to ensure fiscally sound transportation investments that result in improved system mobility and safety.

- Objective 13: Maintain partnership-based planning to achieve a social, economic and environmental well-being.

- Objective 14: Directly link land use, transportation, and air quality, thereby prompting reasonable growth management programs through development of the Congestion Management Program (CMP) that effectively utilizes new transportation funds, alleviates traffic congestion and related impacts, and improves air quality.

- Objective 15: Promote and conduct the effective dialogue with agencies, developers, and users or potential users to help guide investment discussions and maintain and improve the effectiveness of the transportation system.

For Merced CAG RTP/SCS:

- **Note:** Although goods movement-related goal and policies are indicated, there are other Merced CAG goals and policies that may affect freight. For example, under the goal to ensure a safe and efficient regional road system that accommodates the demand for movement of people and goods, there is a policy to maintain a level of service D on all regionally significant roads. This would also assist goods movement.

- **Goods Movement-Related Goal:** Provide a transportation system that enables safe movement of goods in and through Merced County.

- **Goods Movement-Related Policies:**

  - Policy 1: Provide an adequate regional road system for goods movement.

    - Action 1: Support and participate in the Valley-wide Goods Movement Study.

    - Action 2: Work with the Freight Advisory Committee to enhance and maintain a viable transportation system for freight and goods movement.

For Tulare CAG RTP/SCS:

- **Note:** Although goods movement-related goal, objective and policies are indicated, there are other Tulare CAG goals, objectives and policies that may affect freight. For example, under the goal to promote safe, economical, convenient rail systems and schedules that meet the needs of passenger and freight services in the region, there is an objective to support the maintenance, preservation, and expansion of freight rail systems in Tulare County.

- **Goods Movement-Related Goal 1:** Provide a transportation system that efficiently and effectively transports goods to, from, within and through Tulare County.

  - Objective: Encourage the interaction of truck, rail and air freight transportation.

    - Policy 1: Work with Caltrans and adjacent regions in the development of intermodal corridors.

    - Policy 2: Include comprehensive goods movement planning in the RTP.

    - » Policy 3: Implement the San Joaquin Valley Goods Movement Plan.

- **Goods Movement-Related Goal 2:** Improve goods movement within the region to increase economic vitality, meet the growing needs of freight and passenger services, and improve traffic safety, air quality and overall mobility.
  - Objective 1: Increase the use of freight rail transportation.
    - » Policy 1: Restore and maintain freight rail service in Tulare County as a significant transportation mode, providing service to commerce and industry.
    - » Policy 2: Coordinate with other agencies to restore and enhance rail service to existing facilities in order to attract new industries to Tulare County.
  - Objective 2: Support an efficient truck transportation system.
    - » Policy: Give special consideration to transportation projects that improve air quality and the operational efficiency of goods movement.

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Appendix D. Demonstration Project Report

San Joaquin Valley I-5/SR 99 Goods Movement Corridor Study

submitted to

Fresno Council of Governments

submitted by

Cambridge Systematics, Inc.

in association with

Fehr & Peers

The Tioga Group

CAMBRIDGE SYSTEMATICS

San Joaquin Valley I-5/SR 99 Goods Movement Study

Demonstration Project Report

submitted to

Fresno Council of Governments

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date

February 2017

Table of Figures

1.0 Demonstration Project Overview

As part of the I-5/SR 99 Goods Movement Study, this report describes elements of the specified defined Pilot Project Demonstration task, which will center on Truck Platooning. The basis for this Truck Platooning Demonstration was formulated by a Demonstration Working Group (DWG) that was established in January 2016. The DWG vetted four potential demonstration project options, including:

- Truck Platooning,
- Cargo Depot,
- Fog Detection Warning System, and
- Real-time Truck Parking Information.

The DWG selected truck platooning as the preferred demonstration project. This report will focus on that option.

The second option, cargo depot, focused on eliminating "empty" truck trips by providing locations inland from the Ports of Oakland and Los Angeles/Long Beach at Fish Camp and Shafter, respectively. The demonstration would have measured the effects of providing an inland cargo depot for returning empty marine containers and chassis, as well as for scheduling and picking up containers and chassis. The demonstration recommended by Kern County involved paying the cargo depot operator a fixed fee for each matched container/chassis. The DWG chose not to select this option due to funding challenges.

The third option, fog detection warning system, involved pushing fog warnings to drivers via commercially available smart phone applications. Due to the recent installation of the system and no recent fog events, Caltrans recommended that this idea not move forward until the detection equipment has proven to be successful.

The fourth option, real-time truck parking, falls within Caltrans/PATH's current work program. Caltrans has created a truck parking data base and continues to explore technologies for providing real-time truck parking information to the trucking community. Specific locations for testing a real-time parking application were explored, but no locations were found to be suitable for a demonstration at this time. Caltrans/PATH continue to explore and test different solutions.

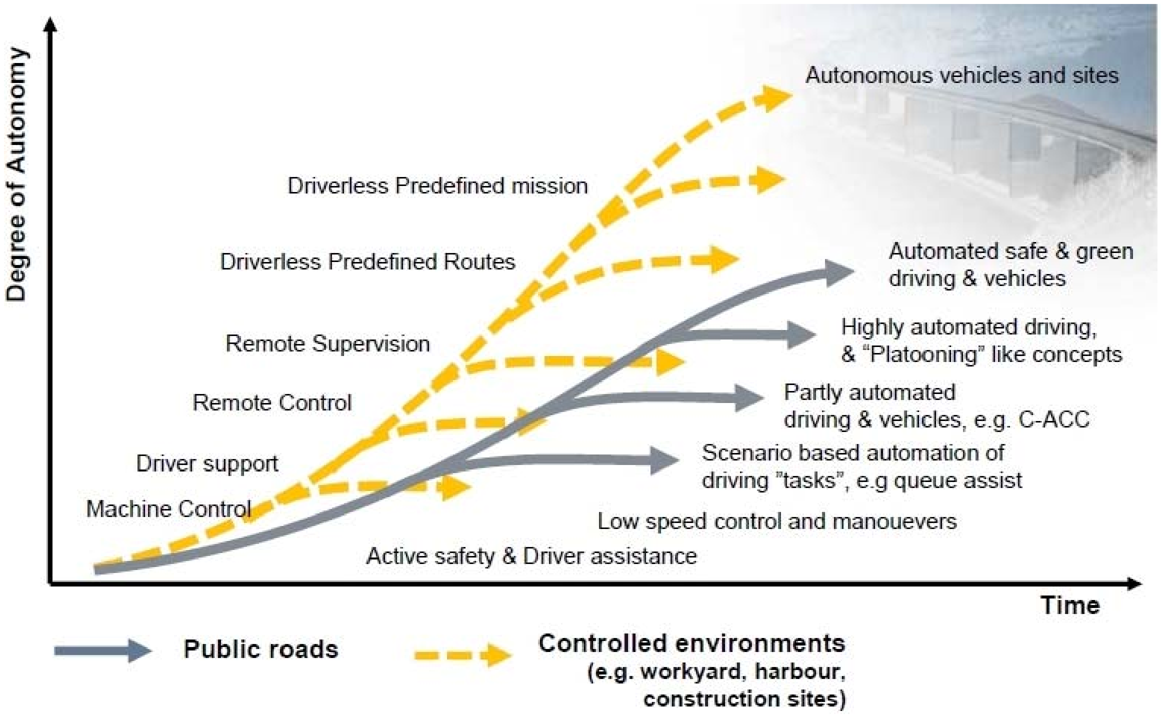
Two additional demonstrations suggested but not carried forward included Truck-Only Toll Lanes on I-5 (as suggested in the original Request for Proposals), and removing the truck reduced speed limit on I-5. For tolling, due to the lower traffic volumes in the general purpose lanes on I-5, trucks already travel at higher speeds than on SR 99 so toll lanes would not offer an incentive for trucks to choose to travel in a truck-only toll lane versus a general purpose lane. Further analysis of permitting over-weight/over-size (OW/OS) trucks, such as longer doubles, triple trailers and trucks in excess of 80,000 pounds in the truck-only lanes could attract trucks to utilize a truck-only toll lane, but demonstrating this option would require construction of a truck-only corridor and federal legislative approval to allow for OW/OS trucks on a federal interstate highway. For these reasons, this option was not carried forward. Regarding the second option considered but not carried forward, elimination of the truck speed limit would require legislative action in order to permit trucks to travel at the higher posted, general traffic speed limit on I-5. This demonstration could not occur within the Project schedule. However, this could be carried forward for testing by the Valley because of the potential safety benefits. The current speed limit for trucks on I-5 is 55 MPH as compared to 70 MPH for automobiles. The crash data indicates that this 15 MPH difference in travel speeds on a freeway with only two travel lanes in each direction through most of the Valley could be a contributor to the crashes. Such a demonstration could measure the crash benefits while also investigating the impacts such a change could have on air quality. Raising the truck speed limit could result in a loss of fuel efficiency and an increase in emissions. However, as truck engine technology continues to improve, original equipment manufacturers (OEMs) like Volvo continue to design engines to maintain a steady miles per gallon consumption for speeds between 55 and 70. The demonstration could measure not only safety benefits, but it could also measure the impacts on fuel consumption and emissions.

1.1 Autonomous Vehicle Technology and Trucks

The fast-moving national approvals on connected vehicle technologies, including truck platooning, was a key factor for the DWG's decision to move forward with a connected truck (also called truck platooning) demonstration. This demonstration could leverage two key current efforts centered in California – the Caltrans/PATH/Volvo truck platooning test program being sponsored by FHWA, and the commercial development of a prototype two-truck platooning system by Peloton in Menlo Park. Furthermore, this technology supports California's sustainable freight goal by reducing fuel consumption and emissions.

Today, vehicle automation technology developments are accelerating at a rate that transportation planners and regulatory agencies are challenged to keep pace with. In fact, most mid-rand and higher automobiles and trucks that will be sold in the 2017 model year will be equipped with at least three key building blocks of vehicle automation technologies, solid state radars, micro-video cameras, and advanced software. These technologies support applications such as Adaptive Cruise Control, Emergency Braking, and Lane Departure Warning. Figure 1.1 illustrates the expected technological developments over time of autonomous vehicle technologies.

Figure 1.1 Technological Progression of Autonomous Driving Technologies



Source: Volvo Corporation

In this environment, elements of the trucking industry, along with several major truck manufacturers, are pioneering developments into truck-specific automation technologies. For example, in 2015, Freightliner introduced its Inspiration Truck, which has been licensed by the State of Nevada as the first autonomous truck in the work to be licensed for testing on public roads.

Manpower issues and safety are the key drivers here for the trucking industry:

- There is a large truck driver shortage that is forecasted to worsen over the next decade. As a reference point, the median age of the driver force is about 50 years old, about 8 years older than the median work force age and over ten years in advance of the median age of the general population[1].
- Federal Motor Carrier Administration (FMCSA) Hours of Service (HOS) regulations provide time limitations (hours/day and hours/week), defined rest periods, and supporting guidance.
- A total of 3,852 people died in large truck crashes in 2015; Sixteen percent of these deaths were truck occupants, 69 percent were occupants of cars and other passenger vehicles, and 15 percent were pedestrians, bicyclists or motorcyclists[2].

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[1] Carter, Brian, YRC Worldwide, presentation to the Contractors Transportation Management Association, July 6-9, 2015

[2] U.S. Department of Transportation's Fatality Analysis Reporting System (FARS).

Autonomous truck technologies can alleviate labor and HOS issues through reductions in driver time at the wheel, and improvements in safe truck operation that can reduce or mitigate accidents and associated facilities and vehicle damage. While completely autonomous trucks on the road may not become acceptable for many years, "wireless truck trains", with a "pilot driver" in a lead truck, followed by two or three "driverless trucks," may be a development that is deployed in the 2020's on certain long-haul routes and/or dedicated truck lanes in the United States.

1.2 Truck Platooning

Over the last several years, both the private and public sectors have been conducting tests and introducing preliminary systems that can enable limited truck automation capabilities to support the deployment two- and three-truck "platoons" on public roads, in commercial operation, before this decade is out.

Truck platooning is a series of trucks following each other on the road, with acceleration and braking controlled automatically. When any truck's speed changes, the others behind it are instantly notified wirelessly and those trucks respond immediately by braking or accelerating. This allows for much closer following distances, which reduces wind resistance and increases the number of trucks that can fit on the road at high speeds. Current prototype systems still require manual steering by drivers in each truck, but eventually, only the lead truck would need manual steering while the platoon is in operation. An additional safety buffer is typically provided by integrating this with on-board active safety systems on the trucks. Note that these systems are intended for use on multi-lane divided highways at cruising speed.

Truck platooning results in approximate reductions in fuel and emissions of up to 10% for the platoon. Widespread use of platooning could also reduce shipping costs. There is also potential to increase roadway capacity through closer headways, although operational strategies need to be considered as well.

1.3 Regional Context – I-5 and California's Central Valley

Truck platooning would work well on the 298-mile segment of I-5 from Kern County to San Joaquin County. This long segment of I-5 provides two travel lanes for the most part, but it provides three to four travel lanes in the northern segment and three in the southern segments near I-580 and SR 99, respectively. I-5 through the Valley follows the back side of the Sierra Nevada mountain range, which provides a relatively flat and straight stretch of highway. On average, approximately 11 percent of the traffic on I-5 consists of heavy duty trucks, albeit, the volumes increase near I-580 in the northern part of the Valley and near the merge with SR 99 in the southern part of the Valley. Nearly half of the heavy duty trucks (approximately 6,000 daily) using I-5 through the Valley have origins or destinations beyond the Valley, such as Southern California, the Bay Area and Sacramento. Heavy duty trucks traveling long distances have the greatest incentive for becoming part of a two- or three-truck platoon because they receive the greatest benefits from platooning, most notably, fuel savings.

1.4 Organization of This Report

This report is organized as follows:

- **Section 2.0 -- Overview of Truck Platooning Technology**. This section describes in detail the technologies involved in truck platooning, and also presents a global technical snapshot of past and current truck platooning demonstrations.
- **Section 3.0 -- Truck Platooning Benefits**. This section covers expected benefits of platooning in four key areas: fuel/industry efficiency, congestion reduction/freeway throughput, safety and environmental benefits.
- **Section 4.0 -- Deployment Challenges**. This section covers expected deployment challenges in four key areas: regulatory and policy environment, industry acceptance, driver experience/human factors engineering and mixed flow traffic concerns.
- **Section 5.0 -- Demonstration Plan**. This section presents the plan for the one-day I-5 Stanislaw County Truck Platooning Demonstration that is being planned for spring, 2017.
- **Section 6.0 -- Demonstration Results**. This section was intended to present the results from the one-day I-5 Stanislaw County Truck Platooning Demonstration. This section remains incomplete due to the cancellation of the demonstration by the truck platooning vendor, Peloton Tech.

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2.0 Overview of Truck Platooning Technology

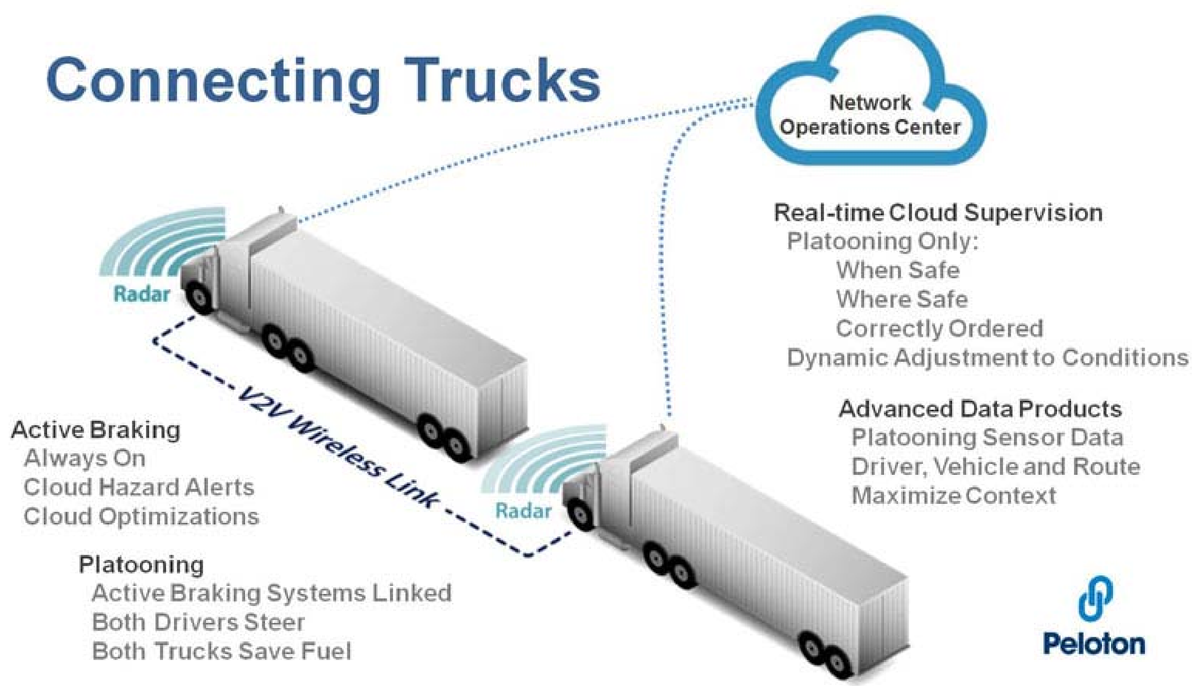
2.1 Technology

2.1.1 Core Technologies

A truck platoon as envisioned for the near-term is a series of trucks following each other on the road, with acceleration and braking controlled automatically (steering is still manual). When any truck's speed changes, the others behind it are instantly notified wirelessly, and those trucks respond immediately by braking or accelerating. This allows for much closer following distances, which reduces wind resistance and increases the number of trucks that can fit on the road at high speeds, thereby increasing roadway capacity.

The trucks in a platoon use vehicle-to-vehicle (V2V) communication in addition to forward sensors to help maintain constant clearance vehicle following at short gaps. The software and in-vehicle technology utilized by the each truck in the platoon is called Cooperative Adaptive Cruise Control, or CACC. CACC automatically ensures that the vehicle has information not just on the vehicle immediately in front (through sensors), but also on a leading vehicle or vehicles further in front, through vehicle to vehicle communications of key parameters such as position, velocity, acceleration. Figure 2.1 provides an overview of truck platooning technology. Note here that USDOT and industry have coined the term, "Connected Trucks," which covers a broad ranges of truck-centric V2V applications, with truck platooning being a major element.

Figure 2.1 Truck Platooning Technology Overview



Source: Peloton Corporation

2.1.2 Enabling Information & Communication Technology Infrastructure

The current national framework for the connected vehicle environment envisions the use of 5.9 GHz Dedicated Short Range Communication (termed, "DSRC"), cellular (e.g. 3G, 4G, LTE), or potentially other types of radio communication between vehicles themselves and the surrounding infrastructure. While some of the anticipated applications for connected vehicle-instrumented corridors could conceivably utilize non-DSRC communication to realize functionality, DSRC is the only option that would have specific impacts to the infrastructure.

DSRC has been established by the USDOT as a specifically allocated set of channels and frequencies for use in the anticipated connected vehicle world. It is also central to a continuing series of field evaluations and pilots being done by the USDOT. Recent estimates indicate that 20% of vehicles will be equipped with some form of connected vehicle technology by the year 2025. While other technologies could be considered to implement interconnectivity between vehicles, those that are conceived by the current USDOT sponsored connected vehicle program are the only ones that have an effort for national coordinated standards and non-proprietary (open) solutions.

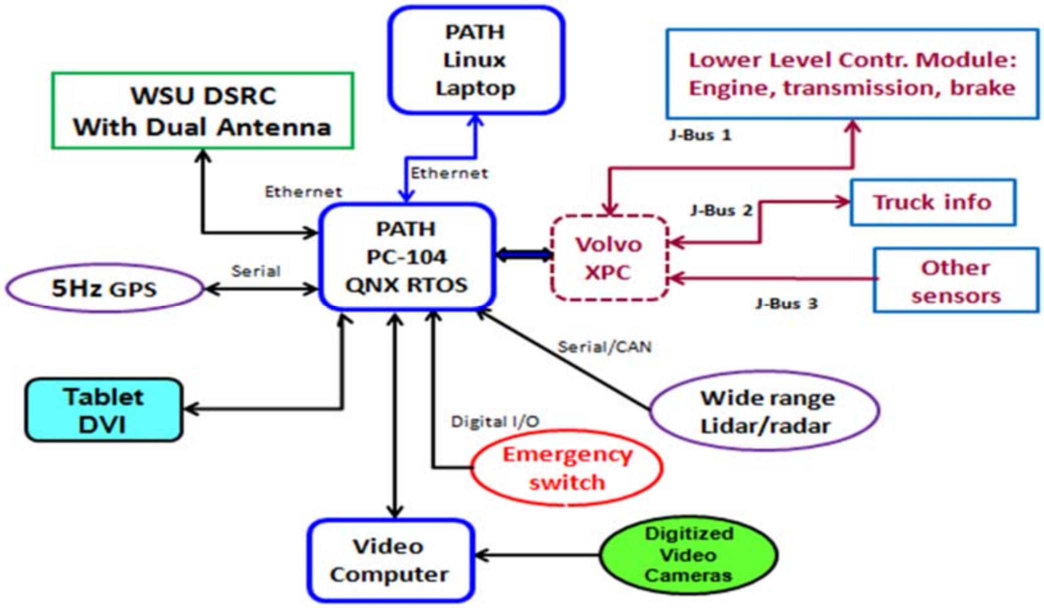
In regards to vehicles traveling on freeways and highways, on-board communications equipment would be integrated with application equipment and processors that would implement several envisioned application packages. Much of the enabling technology for the autonomous functions will reside in the vehicles themselves and will include, ultimately, a wide variety of OEM on-board vehicle systems. This on-board equipment and technology will communicate with a variety of operation centers and remotely situated application servers. The enabling architecture will likely utilize cellular and DSRC communication.

2.1.3 Example of Current Technology – the Caltrans Test Program

For the FHWA Exploratory Advanced Research Program, Caltrans -- supported by UC Berkeley PATH, Volvo, Cambridge Systematics and LA Metro – is leading a 3 year program to develop and test truck platooning technologies, including real-world road testing of 3-truck platooning on California highways that is currently being conducted, and which will conclude in spring, 2017.

This test program is implementing the V2V and CACC technologies as described above, with acceleration and braking wirelessly coordinated among three trucks in platoon formation. Figure 2.2 provides an overview of the truck platooning system architecture. In this diagram, the "J-Bus" refers to the trucks information network architecture that the system connects to by using a special interface computer designed by Volvo (the Volvo XPC) – this provides the key basis for this platooning system computer (the "PATH PC-104 QNX RTOS) to access the vehicles controls for acceleration and breaking. Additionally, the DSRC V2V communications is used here for each truck's platooning system to talk to each other – this is facilitated through the "WSU DSRC with Dual Antenna" that is mounted on each truck. Also, the RADAR/LIDAR sensors and video cameras required for the CACC to determine spacing and traffic conditions are outlined, with connections to appropriate computers for processing. Finally, an emergency switch to turn of the system is provided, as well as a driver display interface (Tablet DVI), a test system user interface (PATH Linux Laptop), and a GPS antenna.

Figure 2.2 California Test Program – Truck Platooning Technology Overview



Source: UC Berkeley -California PATH

2.2 Demonstrations

2.2.1 Caltrans Truck Platooning Test Program (FHWA Exhortatory Research)

As introduced previously in the technology section, the FHWA Exploratory Advanced Research Program, a consortium led by Caltrans, is leading a 3 year program to develop and test t3-truck platooning on California highways. An overview of the focus and attributes of this demonstration effort is provided in Table 1.

Table 2.1 Overview of the Caltrans Truck Platooning Demonstration
FWHA Sponsored

Participants	Configuration	Corridor	Vehicles & Equipment	Objectives	Design	Results
Testing Performed by UC Berkeley PATH and Volvo	Two and three-truck platoons, multiple configurations	I-580 in California between Dublin and Tracey	Volvo trucks	Perform high speed testing, longitudinal maneuvers (platoon splitting, platoon joining), fuel economy analysis, fault detection consideration	Engine control included both torque control and brake system control.	Testing planned for all 2016.

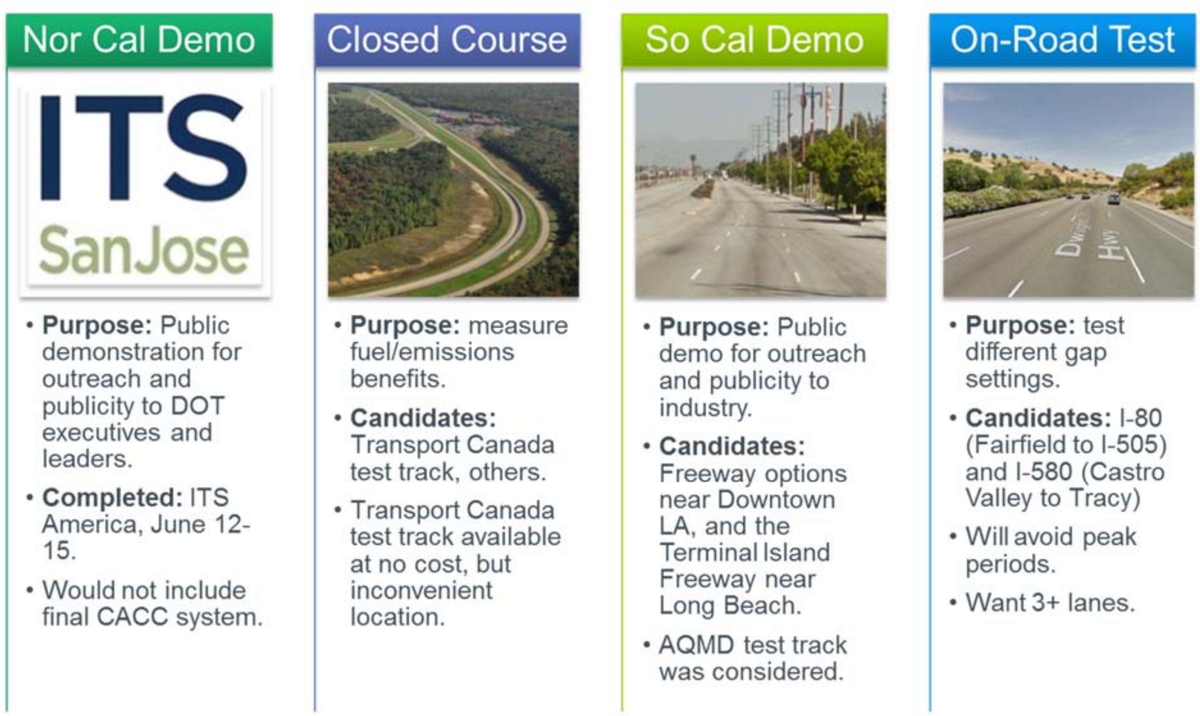
One of the primary reasons California is excited about this technology is because of its potential to be deployed on the future I-710 dedicated truck lanes that will be built in the Los Angeles port region in the 2020's, which will allow for truck connected vehicle technology to much more efficiently move regional freight out of the ports of LA and Long Beach. As such, the test is focusing on several focus areas to advance this goal:

- Examine port trucking companies' acceptance of truck platooning and explore driver preferences regarding Cooperative Adaptive Cruise Control (CACC) headways.
- Evaluate energy savings for different headways.
- Estimate CACC capacity, energy, and emissions benefits.
- Perform public demonstration of truck platooning in mixed freeway traffic

It is important to note here that this is not the first demonstration of this technology. One of the key new and unique elements of this demonstration is that testing will be conducted in real-world normal traffic environments on public freeways.

This demonstration had initially outlined four sets of tests/demonstrations – not including the new I-5 Stanislaw County demonstration that is now being added – which are summarized below in Figure 2.3.

Figure 2.3 California Truck Platooning Test Program Initial Tests/ Demonstrations



As detailed in this figure, there are two demos and two sets of major testing projects in this program. The team has already successfully held live demos at the ITS America Meeting in San Jose. Participants were able to ride on board three trucks that successfully platooned on San Jose freeways.

The next step was controlled course testing near Montreal which occurred in fall 2016, in cooperation with Transport Canada. The test program is currently undergoing the full-scale on-road testing of the 3-truck platoons, on freeways between the Bay Area and Sacramento.

Additionally, a major demonstration on a freeway in the LA port region is being planned by LA METRO for spring of 2017. At that time, the one-day I-5 Stanislaw County Truck Platooning Demonstration that is covered here in the report will also be conducted – leveraging the planned travel by the trucks on I-5 between the Bay Area and Los Angeles for the LA METRO demonstration.

It is also important to mention that there is a companion truck platooning test project to this effort also being sponsored by the FHWA Exploratory Research Program on the east coast. This project is being led by, Auburn University, and supported by Peterbelt, Peloton and ATRI. More information on this demonstration program is provided in the next section of this report in Figure 2.1.

2.2.2 Worldwide Survey of Other Truck Platooning Demonstrations

To date, in addition to the current California demonstration program previously described, eight other demonstrations/test programs have been, or are being conducted by multiple consortiums, public agencies and test partnerships around the globe. Figure 2.4 provides a comprehensive summary of each of these demonstration programs.

Figure 2.4 Summaries of the Other 8 Truck Platooning Demonstrations to Date

Texas Truck Platooning Test Program (IN CONCEPT DEVELOPMENT PHASE)

- **Participants:** Testing performed by the Texas Transportation Institute (TTI)
- **Configuration:** TBD
- **Corridor:** TBD in Texas
- **Vehicles and Equipment:** TBD – program includes multiple industry partners, including truck OEM's.
- **Objectives:** Test Level 2 truck platooning – an extension of cooperative adaptive cruise control that uses automated lateral and longitudinal vehicle control, while maintaining a tight formation of vehicles with short following distances
- **Design:** TBD – Concept of Operations currently under development
- **Results:** TBD.

FHWA Partial Automation for Truck Platooning – Alabama Test Program (IN-PROGRESS)

- **Participants:** Testing performed by University of Auburn and Peloton
- **Configuration:** Two-truck platoons
- **Corridor:** TBD
- **Vehicles and Equipment:** Peterbilt trucks with Meritor Wabco advanced brake system integration and Peloton prototype commercial-off-the-shelf two-truck platooning system
- **Objectives:** Test how the system reacts to passenger car cut-ins or other highway anomalies; test how to find similarly equipped vehicles on the road for the platoon; test improved fuel economy, test the role of the lead driver; estimate return on this investment..
- **Design:** Peloton prototype commercial-off-the-shelf two-truck platooning system technology, integrating vehicle-to-vehicle communications with adaptive cruise control
- **Results:** Currently in test phase

Nevada Truck Platooning Tests

- **Participants:** Testing performed by UC Berkeley PATH
- **Configuration:** Three-truck platoons, 6 meter spacing at 53 mph
- **Corridor:** SR 722 in Nevada
- **Vehicles and Equipment:** Freightliner trucks equipped with a Cummins C-Celect Engine ECU, a V2V communications system (Savari DSRC), a WABCO "Euro" E85, an accelerometer, a gyroscope, a PC104 control computer, Lidar sensors, and Radar sensors.
- **Objectives:** Perform high speed testing, longitudinal maneuvers (platoon splitting, platoon joining), fuel economy analysis, fault detection consideration.
- **Design:** Engine control included both torque control and brake system control.
- **Results:** Performance is sensitive to changes in roadway grade. Line-of-sight was necessary for reliable V2V communications, resulting in the middle truck's being offset laterally by 0.5 meters. First, second, and third truck achieved fuel savings of 4.54%, 11.91%, and 18.4% respectively.

Safe Road Train for the Environment (SARTRE), Aerodynamic Tests

- **Participants:** Volvo Trucks, Volvo Cars and SP (Sweden), Ricardo (UK), IKA (Germany), IDIADA, and Technalia (Spain).
- **Configuration:** Platoons of two trucks, followed by three passenger cars. Spacing of as little as 5 meters.
- **Corridor:** Fuel consumption was evaluated at the IDIADA high-speed test track in Spain.
- **Vehicles and Equipment:** Platoon operation based on radar data and Wi-Fi communication between trucks. Side radar units monitor traffic, forward-facing radar maintains vehicle spacing, and a camera measures position in the lane. A Wi-Fi antenna is mounted above the cabin for wireless communication to other platoon vehicles. New technologies were intentionally not developed for this project, as it was intended to be a demonstration of truck platooning using currently available technology. Acceleration and braking was controlled using radar, adaptive cruise control, and automated emergency braking. Steering control was provided using Volvo's Dynamic Steering system. The Radar and camera equipment is standard production technology, and the Wi-Fi communications use the 802.11p standard.
- **Objectives:** Test aerodynamic effects of platooning and resultant fuel savings.
- **Design:** Control system included steering, acceleration, and braking. Aerodynamic testing was performed at night to minimize fluctuations in temperature and wind.
- **Results:** At a spacing of 5 meters, fuel savings were 8% for the lead truck and 13% for the following truck. At a spacing of 25 meters, fuel savings were 1.5% for the lead truck and 7.5% for the following truck.

Safe Road Train for the Environment (SARTRE), CACC and ACC Tests

- **Participants:** Isuzu, HINO, FUSO, UD Trucks
- **Configuration:** Four-truck platoons. In one test headways are 1 second and speed is deliberately reduced from 80 kph (start) to 50 kph (finish).
- **Corridor:** Unspecified.
- **Vehicles and Equipment:** Four different trucks by four different manufacturers (Isuzu CYL, HINO FW1EXBL, FUSO FS55VVZ, UD Trucks QGK-CD), each approximately 12 meters and 10 tons. Vehicles included V2V communications antennas on the roof of the cabin, a GPS antenna on the top of the cabin, an acceleration sensor, yaw rate sensor, wheel sensor, Laser Radar (IBEO), 76G Millie wave radar, a GPS unit, Rapid Pro unit, Micro Auto Box unit, and HMI screen/indicator lamps.
- **Objectives:** Demonstrate feasibility of truck CACC technology and operation.
- **Design:** In ACC mode, truck control is handled using V2V distance sensors only. In CACC mode, truck control is handled using V2V distance sensors and wireless communication.
- **Results:** At 20 meter spacing, fuel savings were 8% on average. At 10 meters, fuel savings were 14% on average. At 5 meters, fuel savings were 16% on average.

Safe Road Train for the Environment (SARTRE), V2V Communications Tests

- **Participants:** SARTRE participants.
- **Configuration:** Platoons of two trucks followed by three passenger cars, at a spacing of 13 meters. Testing was performed at 50, 70, and 85 kph (6 minutes at each speed).
- **Corridor:** IDIADA test track in Spain
- **Vehicles and Equipment:** Trucks had two separate radios and antennas for V2V communication. Passenger cars only had one.
- **Objectives:** Investigate potential V2V issues in a platooning environment.
- **Design:** Data is broadcast to all vehicles, not relayed from one to another. Data was encrypted and communicated using 802.11p. Data was sent and received from the SARTRE CAN bus. The experiment did not focus on minimizing data volume or transmission needs. For time synchronization, a GPS/NTP method was used.
- **Results:** Side mirrors were tested as alternate mounting locations for antennas, but were ultimately not selected. Line-of-sight issues may have contributed to lost messages between vehicles in some configurations. Interruptions in V2V communications between vehicles were typically shorter than 100 ms.

Japanese Energy ITS Project

- **Participants:** Ministry of Economy, Trade, and Industry; New Energy and Industrial Technology Development Organization.
- **Configuration:** Four-truck platoons at 80 kph. In CACC mode, the spacing was 30 meters; in fully automated mode, the spacing was 4 meters. Additional demonstrations were performed with three- and four-truck platoons at 30, 10, and 4.7 meter spacings.
- **Corridor:** Tomei Expressway around Tokyo. 100 km segment. Traffic composed of 69% light vehicles and 31% heavy vehicles. Additional demonstrations performed at AIST test track.
- **Vehicles and Equipment:** Image processing, radar (front bumper mounted), laser scanner (front bumper mounted), V2V communications (antennas installed at rear corners of trailer), and Lidar cameras on the sides of the vehicle. Human-Machine interface includes in-vehicle display and additional indicators on the back of the leading vehicle trailer.
- **Objectives:** Demonstration of automated truck platoons and energy savings. Testing of obstacle avoidance and cut-in scenarios.
- **Design:** Steering and speed control automated. Image processing is used for lane-keeping. Radar, laser, and V2V data are used for gap/longitudinal control.
- **Results:** 13.7% fuel reduction for CACC mode, and 15.9% fuel reduction in fully automated mode. CO_2 emissions were reduced by 2.1% at 10-meter gaps, and 4.8% at 4-meter gaps.

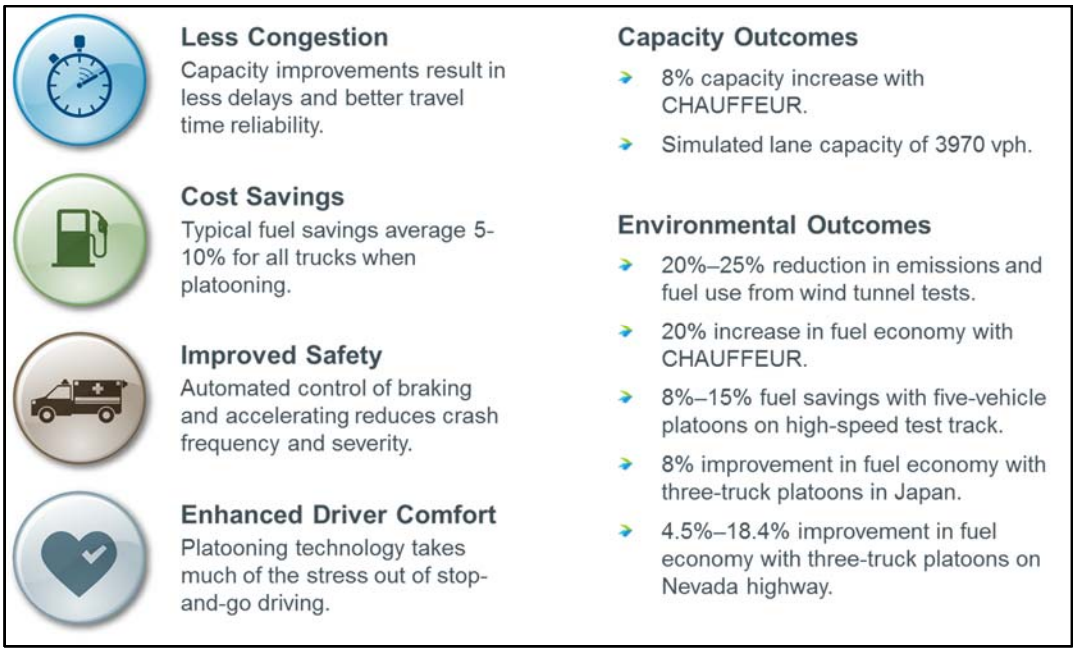
CHAUFFEUR Project

- **Participants:** European Union, Daimler Chrysler, Renault Recherche, IVECO, Centro Ricerche Fiat, WABCO, Bosch, ZF Lenksysteme, Central Research Laboratories, TUV Rheinland, PTV, Clifford Chance & Punder, and CSST.
- **Configuration:** Two-truck and three-truck platoons with 6-12 meter spacing..
- **Corridor:** Not specified.
- **Vehicles and Equipment:** DaimlerChrysler and IVECO trucks. Dedicated infrared image processing with two cameras, for measurement of tow bar angle and distance. 5.8 GHz V2V communication for platoon formation and coordination.
- **Objectives:** Proof of concept for "electronic tow bar" operation of trucks.
- **Design:** System controls lateral movement (lane keeping) and vehicle spacing, using a lane keeping system and cruise control. The infrared image processing uses a pattern of markers on the backside of the leading truck's trailer, arranged in an octagon.
- **Results:** Up to 20% reduction in fuel consumption.

3.0 Truck Platooning Benefits

Truck Platooning provides a series of key private sector and public sector benefits, which are summarized in Figure 3.1 below. Additional discussion of the fuel/industry efficiency, congestion reduction/freeway throughput, safety and environmental benefits are presented in the subsections below.

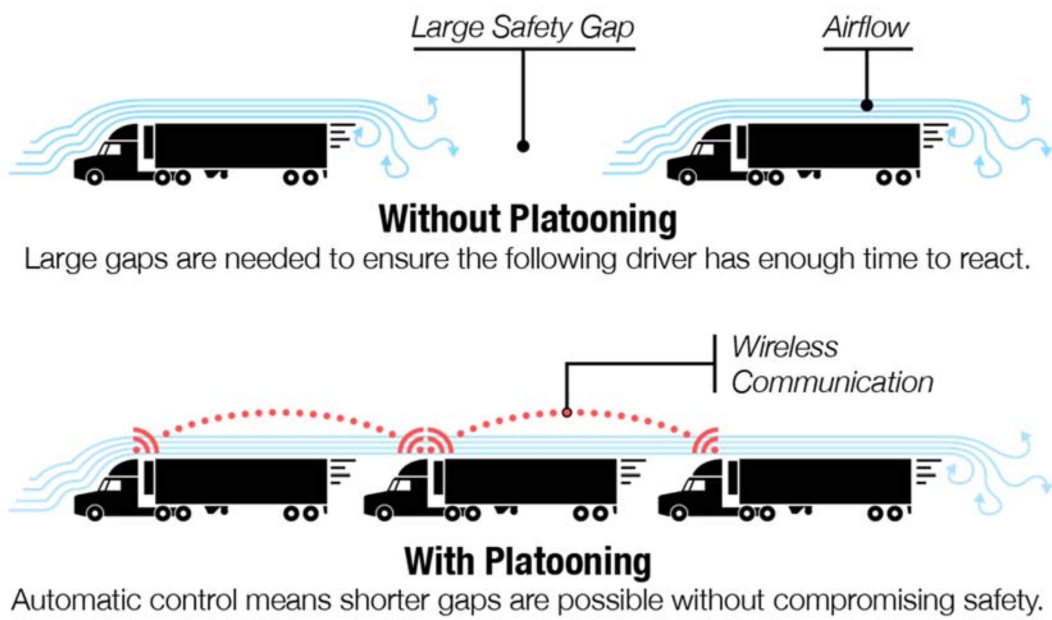
Figure 3.1 Summary of Truck Platooning Benefits



3.1 Fuel/Industry Efficiency

When trucks are platooning at highway speed, several academic and industry studies have demonstrated fuel economy improvements in the range of 4-8% for the lead truck and 10-12% for the following trucks (compared to driving the same route without platooning). For three truck platoons, cost savings due to reduced fuel usage approaches 10% on average for three trucks. These benefits are largely due to the aerodynamic characteristics of platoon, but also supported by more consistent use to acceleration and braking by the system versus human driving. Figure 3.2 provides further explanation of how these fuel efficiency benefits improved are achieved.

Figure 3.2 Explanation of Truck Platooning Efficiency Benefits



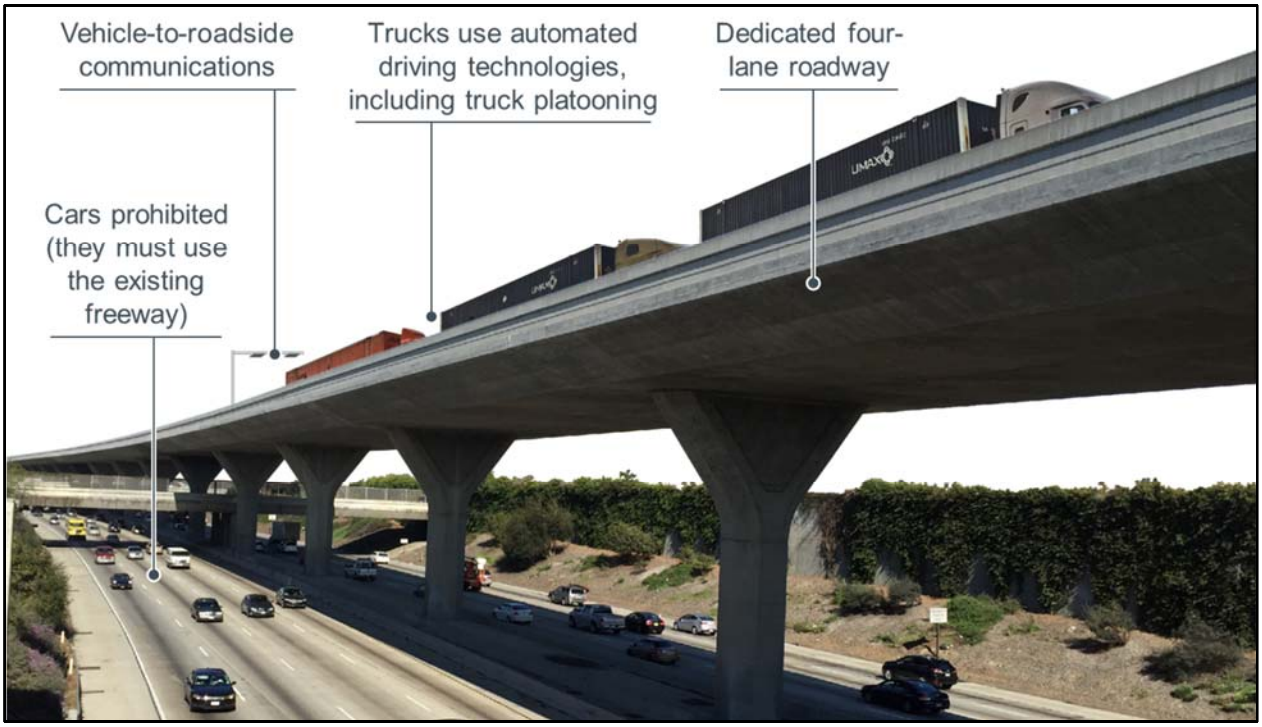
Additional benefits to industry focus on driver operations. Truck platooning can reduce stress on long-haul trips. And the future, as truck platooning moves to more advanced stages such as the truck train concept, a three truck platoon, with only a driver in the front truck, would both provide a driver cost reduction of 2/3. In an alternate version of this future truck train scenario, a "spare driver" could be resting in the sleeper cab for half the trip, and then take over in driving the "pilot truck" for the second half of the trip, thus expediting a long-haul trip consistent with FMCSA Hours of Service regulations.

3.2 Congestion Reduction/Freeway Throughput

On both long-haul freeway routes between major cities, as well as on dedicated truck freeways in major metropolitan regions, truck platooning, if utilized on a large scale, has the ability to increase truck and overall traffic throughput on a freeway. Referring back to Figure 3.2 above, this is illustrated by the significantly closer following distances in truck platoons – the effectively can allow more trucks to operate on freeway lane segments.

For example, as illustrated in Figure 3.3, the California Truck Platooning test is being conducted with an eye towards the mid-2020's, when LA Metro plans to construct an 18-mile truck-only lanes, grade-separated freeway – two lanes in each directions – between the regional ports and the center of the LA region on the I-710 Corridor. But even with this new facility, there is a concern that it will become congested by the mid 2030's. Therefore, connected vehicle technology, centered heavily on truck platooning, is viewed as a solution that might eventually – when trucks can drive autonomously – support up to 50% more trucks on the facility – essentially giving the facility the capacity equivalent of a 3rd lane of freeway in each direction.

Figure 3.3 LA METRO I–710 Dedicated Truck Lanes Platooning Concept



3.3 Safety

Truck platooning provides for steady state cruising operations, with precise control of acceleration and breaking; and reduced opportunities for driver fatigue. Given these attributes, truck platooning systems inherently reduce the common types of collisions involving heavy trucks -- end-to-end collisions -- while also reducing the impact of human error, which USDOT has found to account for 90 percent of crashes involving heavy trucks.

Cooperative braking means that platooning trucks stop in tandem more quickly and safely than trucks equipped with merely the best drivers or standalone automated or safety systems. In addition, it is assumed that trucks with platooning technology will be equipped with best-in-class active safety technologies for tractor-trailers including emergency braking and electronic stability control.

It follows that the crash avoidance technologies including in truck platooning and connected trucks can be expected to save lives, and significantly reduce accident and insurance costs for industry. Further research, as well as several years of initial deployment data, will be required to quantify these types of safety benefits.

3.4 Environmental

Environmental benefits from truck platooning correspond directly to reductions in fuel usage. The less fuel burned, the less emissions and C02 are released into the atmosphere.

4.0 Deployment Challenges

4.1 Regulatory and Policy Environment/Challenges

For the type of near-term, CACC-based truck platooning that is described in this report, which does not involve autonomous trucks with no drivers, and which will demonstrated in Spring 2017 on I-5 in Stanislaw County, the primary regulatory issue that must be address are state "anti-convoy" laws. Many states, including California, have anti-convoy laws that preclude truck platooning. In most cases, these laws were implemented by stated between the 1960's and 1980's to aid state enforcement agencies in combatting unsafe truck conveys, where truckers attempted to convoy in closely-spaced groups as a means to exceed speed limits and avoid citations.

California's Anti-Caravanning Law, enacted in the 1970's, requires a minimum spacing of 100 feet. For the current California Truck Platooning Test, the Project Team went to the state legislature, and were fortunately able to get language attached to a bill last year – which Governor Brown signed -- that allowed the team to proceed with this test program, and to then report back to the legislature with findings in late 2017.

For future truck platooning concepts that involve autonomous/driverless vehicles, such as the "truck train" concept described previous, changes to both state regulations and federal regulations will need to be addressed before such systems can operate across the nation. Interim test program legislation at the state level is a method that can support development and testing of these technologies. As mentioned previously, Nevada was the first state to legislate a test program that allows for limited testing of autonomous trucks on public roads.

At the federal level, the recent release by USDOT and The White House of the new Federal Automated Vehicles Policy[3]. This policy provides a high-level policy blueprint for government agencies and industry to work together to advance technologies, and develop more detailed regulations/rulemaking in the coming years. This policy document includes the following four primary elements:

- **Vehicle Performance Guidance for Automated Vehicles**: The guidance for manufacturers, developers and other organizations outlines a 15 point "Safety Assessment" for the safe design, development, testing and deployment of automated vehicles.

- **Model State Policy**: This section presents a clear distinction between Federal and State responsibilities for regulation of HAVs, and suggests recommended policy areas for states to consider with a goal of generating a consistent national framework for the testing and deployment of highly automated vehicles.

- **Current Regulatory Tools**: This discussion outlines DOT's current regulatory tools that can be used to accelerate the safe development of HAVs, such as interpreting current rules to allow for

[3] https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf

greater flexibility in design and providing limited exemptions to allow for testing of nontraditional vehicle designs in a more timely fashion.

- **Modern Regulatory Tools**: This discussion identifies potential new regulatory tools and statutory authorities that may aid the safe and efficient deployment of new lifesaving technologies.

4.2 Industry Acceptance

This section presents an overview of results that were developed regarding industry acceptance of truck platooning, and is largely based on subsections of the following report that were developed by California PATH, Cambridge Systematics, Volvo and Peloton for the California Truck Platooning test program:

- "Industry Needs and Opportunities for Truck Platooning," Caltrans, UC Berkeley PATH, Volvo Technology Americas, Cambridge Systematics, Peloton Technology, American Transportation Research Institute (ATRI), for the US Federal Highway Administration, February 2015.

4.2.1 California Truck Platooning Test. [4]

On behalf of the California Truck Platooning Team, in support of FHWA, Cambridge Systematics interviewed approximately twenty trucking companies in the LA port region to find out about their potential acceptance of this technology. The interviews were conducted in Southern California between January 5 and February 5, 2015, and were distributed chiefly to members of the Harbor Trucking Association (HTA). The digital survey was publicized via several emails to the association mailing list throughout January 2015 from the HTA President. Cambridge Systematics also sent a representative to the HTA meeting on the evening of January 28, 2015, to promote the survey and encourage attendees to participate.

The HTA survey respondents represented the views of one owner-operator, three company drivers and 13 fleet managers. Because of character of the trucking industry segment represented by the HTA, these were predominantly short-haul operations, approximately evenly distributed between local (trips less than 100 miles) and regional (100 to 499 mile trips), with only one inter-regional and one long-haul operator. Two of the respondents were frequent users of Advanced Cruise Control (ACC) and collision warning systems, and one was an infrequent user of ACC. Most of the others had either seen or heard of ACC and collision warning systems, but had not had direct experience with them.

The following provides a summary of the key findings from this this survey[5]:

[4] Reference: "Industry Needs and Opportunities for Truck Platooning," Caltrans, UC Berkeley PATH, Volvo Technology Americas, Cambridge Systematics, Peloton Technology, American Transportation Research Institute (ATRI), for the US Federal Highway Administration, February 2015.

[5] Ibid.

- The responses regarding willingness to pay for a truck platooning capability were somewhat inconsistent because the respondents appeared to misunderstand the concept of the payback period that was used in the survey. The longest payback period that was cited by a respondent was 60 months, but that respondent only indicated a willingness to pay $1000 for the system. On the other hand, a respondent who was willing to pay the highest price for the system ($5000) cited a payback period of nine months. Some cited payback periods as short as one month and a purchase price as low as $100. The mean value of payback period in the responses was 14 months (distorted by one outlier at 60 months), but among the fleet managers it was 8 months.

- Most were willing to pay between $100 and $1000 to purchase the system, but two respondents at $3000 and one at $5000 brought the mean value up to $1268. Of the nine respondents who showed an interest in paying for the system, the median price was $1000. There also seemed to be some confusion about the question regarding paying an annual subscription cost to use the system versus a one-time purchase cost, because five respondents cited the same cost for both. The preferences among the different types of subscription payment were scattered across the alternatives (fees per hour or per mile while in a platoon and fixed monthly and annual fees).

- The opinions about forming platoons with other trucks were also quite diverse, with similar numbers expressing willingness to form platoons with any fleet, with specific fleets with whom they have partnerships, and only within their own fleet. These respondents were also quite receptive to paying transfer fees among platooned truck operators to compensate for differences in energy savings. Two of the respondents were "very willing" and two others were "somewhat willing" to delay their departures to facilitate platooning.

- On the question of driver retention, three respondents thought that platooning would have a "very positive" effect and three more expected a "somewhat positive" effect, while only one thought the effect would be negative and four were neutral. Similarly, on the likelihood that drivers will use the platooning technology, three thought it "very likely" and three more thought it "likely", while two said only "somewhat likely" and three said "unlikely" or "not likely at all".

4.2.2 Volvo and Mack Fleet Customer Interactions[6]

- In October, 2014, some Volvo and Mack fleet customers were interviewed at the 2014 ATA Management Conference and Exhibition in San Diego, CA.

- Based on the limited results of the face-to-face interviews, the following observations were made:

- The larger fleet operators are likely to form the set of "early adopters" of the CACC technology.

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[6] Ibid.

- While most of the fleet managers had heard of the ACC and CACC, there seemed to be a limited understanding of the possibilities or implications of using the technology, so considerable attention needs to be devoted to educating them about these systems so that they can make informed decisions about its suitability for their use.

- Business models for enabling different operator-owned fleets to participate in a platoon were an issue of concern.

- Security of the futuristic information technology-based infrastructure that could support "ad hoc" platooning remained an issue for concerns, especially among competitor fleet operators.

- Modulating truck route times (e.g., departures, wait periods, etc.) to facilitate CACC coupling along the route did not appeal to the fleet operators, except when under some circumstances where all the vehicles from the fleet were for the same vendor.

- While the concepts of forming, joining, and dismembering a CACC coupled platoon of trucks appealed to the majority of the fleet operators, there was skepticism about its implementation and seamless operation on all routes (i.e., for all traffic on all freeways).

4.2.3 Peloton Technology Findings[7]

Peloton has developed an understanding of trucking fleets' interests and concerns regarding CACC based on face-to-face meetings with over 100 fleets during site visits and trade conferences. Some of the key takeaways from this understanding are summarized here:

- In general, fleets with relatively high densities of trucks along major freight corridors are most interested in near-term truck platooning, as they could deploy CACC with confidence in immediate savings and with minimal disruption to their existing operations. Of course, the largest private and for-hire U.S. fleets typically have high truck densities on freight corridors nationwide, yet some smaller fleets also maintain high truck densities on regional highways.

- Fleets of all types have expressed strong interest in using a single vehicle technology or integrated system to manage both active safety and fuel economy in trucks, particularly as these focus areas are becoming more data-intensive for fleet managers. Also, the bundling of safety and fuel economy benefits would potentially simplify the return on investment (ROI) analysis and therefore speed up the current rate of safety technology adoption, especially over the current pace of safety technologies. A CACC system could be a suitable comprehensive overarching solution for fleets.

- Other favorable perspectives about CACC offered by fleets include its tie-in to trucks' on-board data bus, a connection that is technically simple and requires low power; its foundational use of Adaptive Cruise Control (ACC) technology, as virtually all fleets Peloton has met with are familiar with ACC today (Peloton found that several fleets familiar with ACC are already installing it on 100% of their new trucks, while others see ACC as borderline cost-effective and

[7] Ibid.

could be swayed by additional savings leveraged by ACC); and CACC's elimination of human and delay from certain braking decisions. These perspectives are mentioned as notable aspects of fleets' general interest in CACC's safety and fuel savings potential.

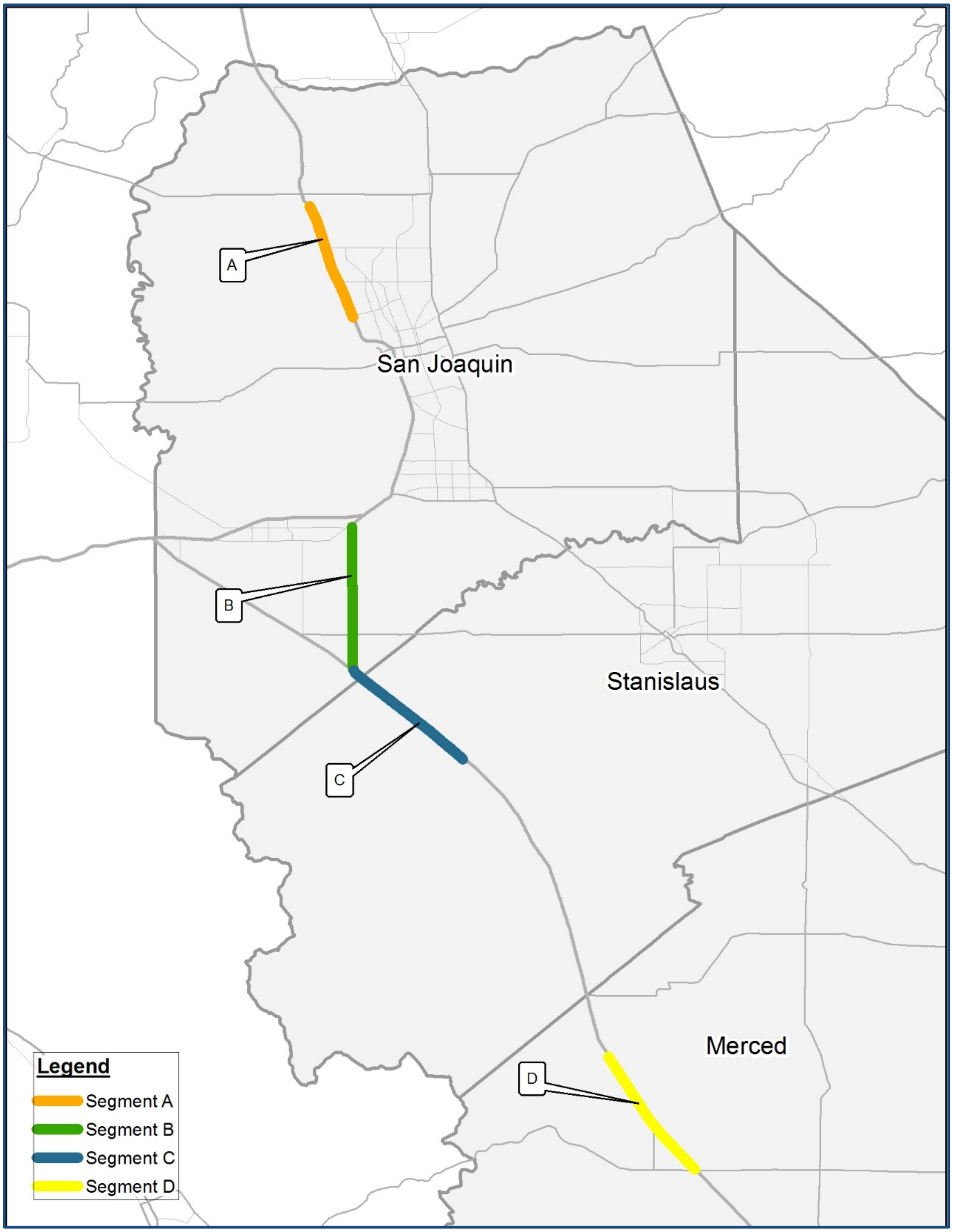
- Regarding concerns held by fleets, Peloton was interested to find that uncertainty about liability stands out as the reason for some fleets' reluctance to join platoons with trucks from other fleets. Even so, only two fleets – close competitors – expressed unwillingness to pair with one another, and even those indicated that it might be possible in the future. To the extent that cost savings from CACC as well as liability factors are clear to fleets, Peloton expects that financial considerations will eventually override any initial concerns about inter-fleet platooning even between competitors.
- Knowing that the second truck in a two-truck platoon benefits from higher fuel savings, some fleets were reticent at the idea of their truck being in the front truck in an inter-fleet platoon. After being presented with data showing front-truck fuel savings – roughly on par with side skirts, for example – and the logic that truck ordering could be based objectively on safety factors (i.e. risk reduction), fleets became less concerned about whether their truck would be in the front or rear.

5.0 Demonstration Plan

5.1 Location Selection

In September 2016, in collaboration with UC Davis PATH and the California Highway Patrol (CHP), several segments along I-5 were investigated as locations for the truck platoon demonstration to occur. Per the request of the CHP and PATH, a list of potential segments that provided light traffic volumes, long distance(s) between interchanges, easy roadway geometry for ride-alongs, and low crash rates were developed and provided for review by CHP, PATH and Peloton Tech.

Figure 5.1 Locations



The table below provides information about each of the potential candidate segments, including location, interchanges along the segment, collisions, congested locations, number of travel lanes, and current and planned construction activities.

Table 5.1 Segment Characteristics

	City	Country	Mile Markers	Interchanges	# Lanes	AADT	Critical Collisions	Critical Congestion
A	Stockton	San Joaquin	484.439 to 474.793	Highway 12 W 8 Mile Road W Hammer Lane W Benjamin Holt Drive W March Lane	6	50-145k	Yes, but only one location	Yes, at beginning and end of segment; speeds reduce to 35mph
B		San Joaquin	457.063 to 445.942	Keasson Road S Ahern Road/Highway 33 Durham Ferry Highway 132	4-6	22-30k	No	No
C		~90% in Stanislaus, rest in San Joaquin	445.492 to 436.631	Howard Road	4-8	30-50k	Yes, and truck involved	No
D	Gustine	Merced	412.776 to 402.408	Henry Miller Road Jensen Road	4	22-50k	Yes, and truck involved	No

Summary of Results:

A. Six lanes through the entire 10 mile segment and only one critical collision location; but, also highest traffic volumes, congested speeds and the most interchanges of the segments. (rank this option as 4th)

B. Lowest traffic volumes, no critical collisions or critical congestion identified; but, interchanges appear to be 2 miles apart and there are only four travel lanes provided for most of this segment.

C. Lowest number of interchanges (only one for this 9 mile stretch), no critical congestion and moderate traffic volumes with 4-8 lanes; critical collisions with trucks involved identified at two locations

D. Ten mile stretch with only two interchanges, fairly low traffic volumes and no critical congestion; 2 critical collision locations truck involved

Figure 5.2 Milepoints

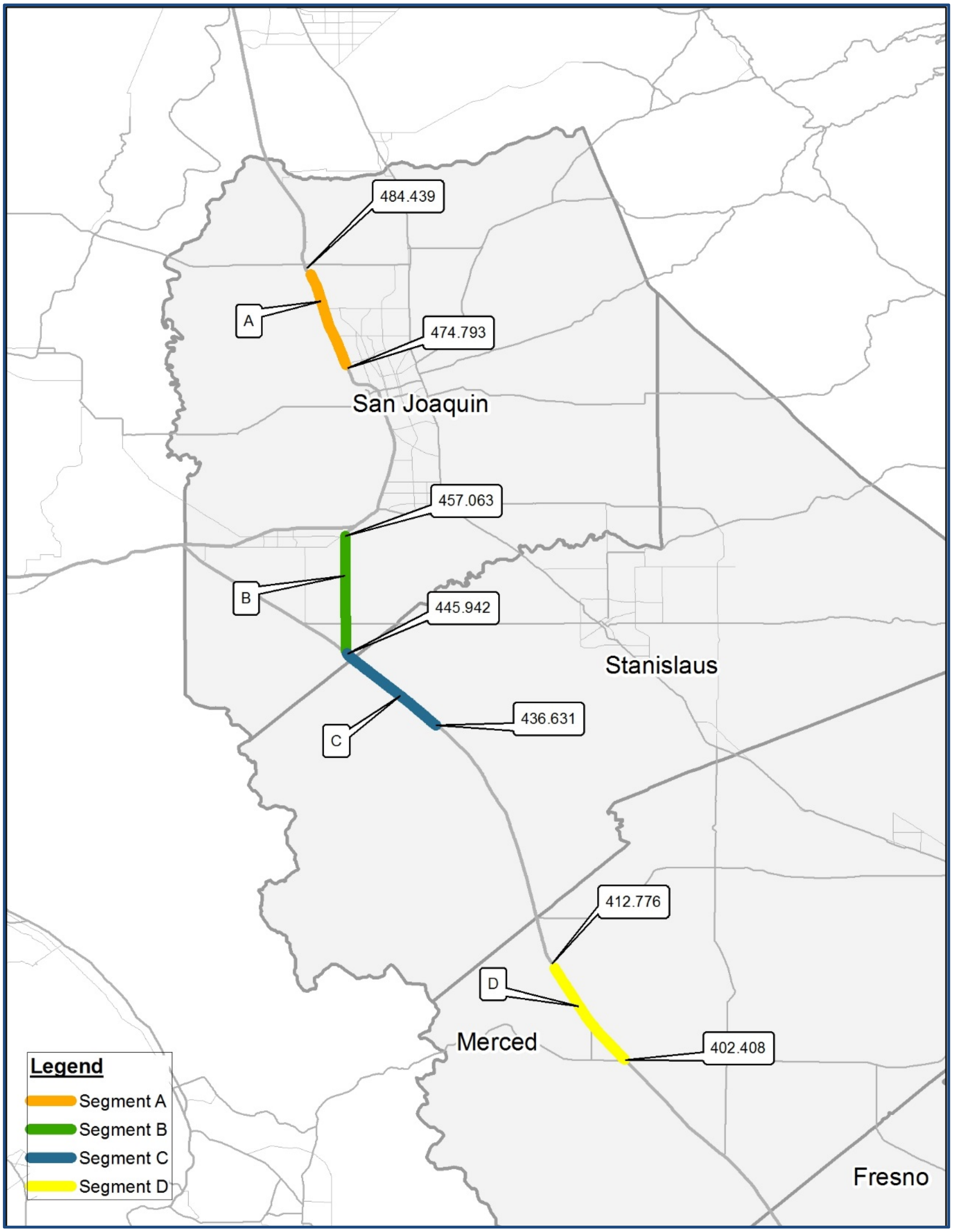


Figure 5.3 Through Lanes

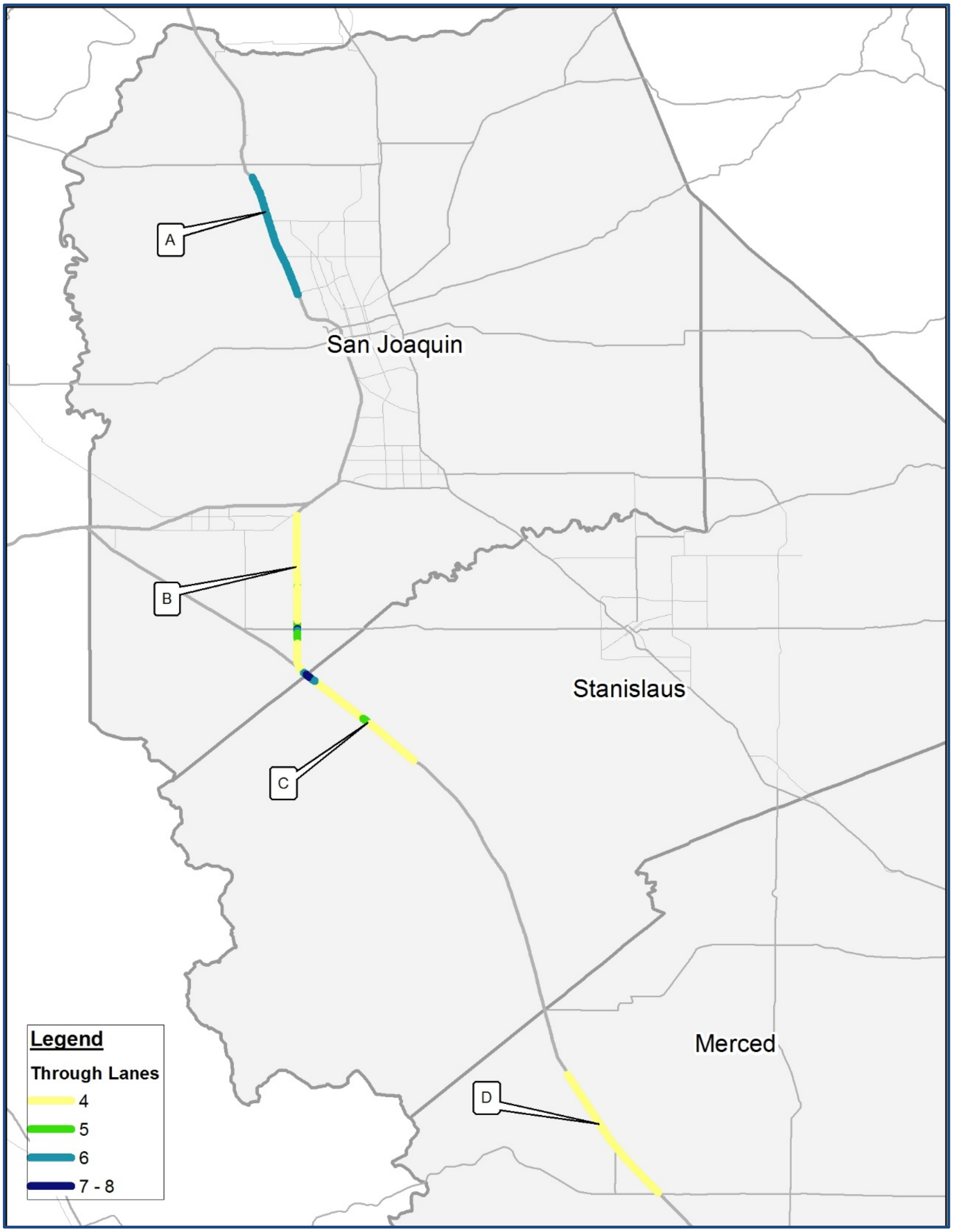


Figure 5.4 Critical safety Locations

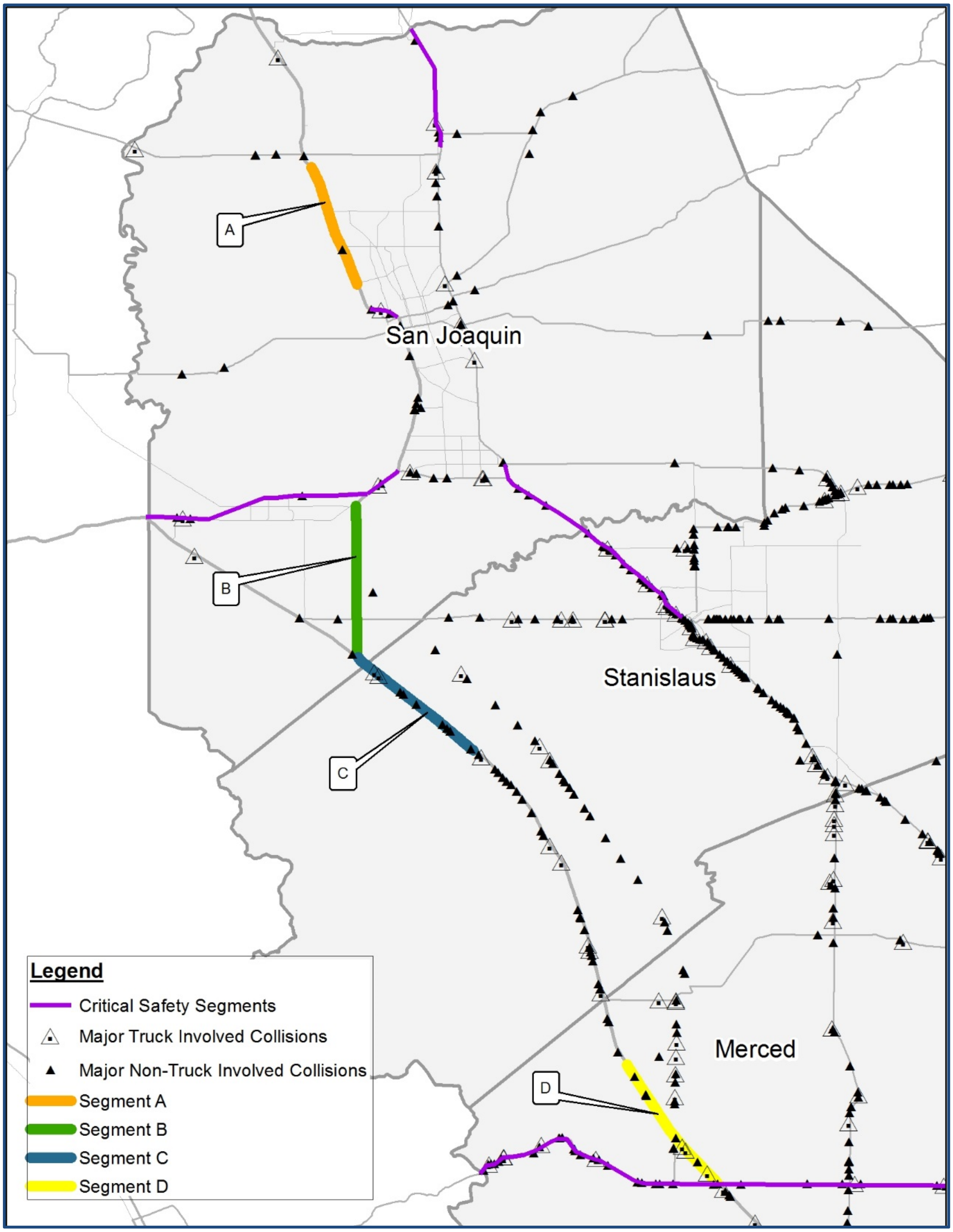


Figure 5.5 Critically Congested Locations

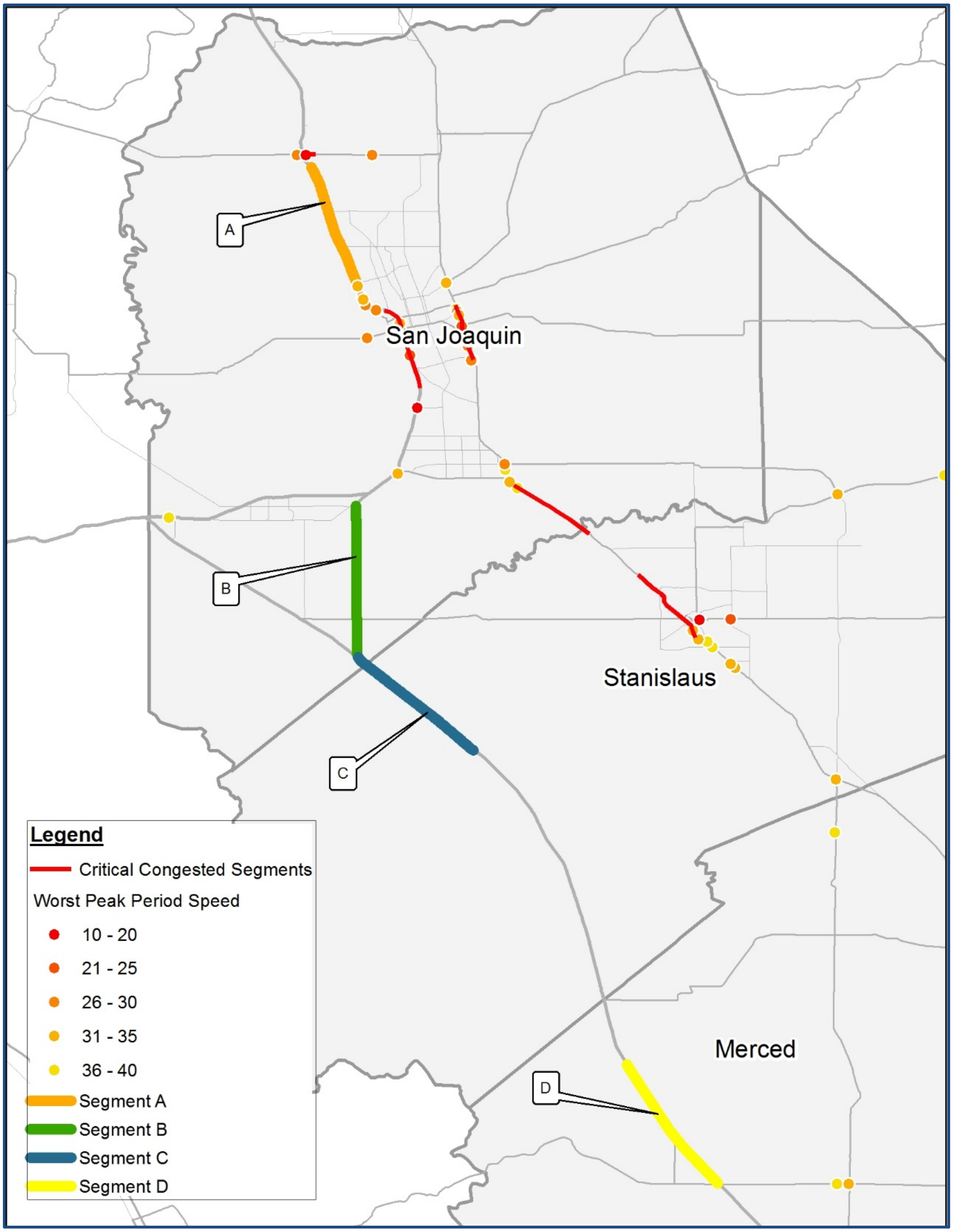


Figure 5.6 AADT, 2014 HPMS

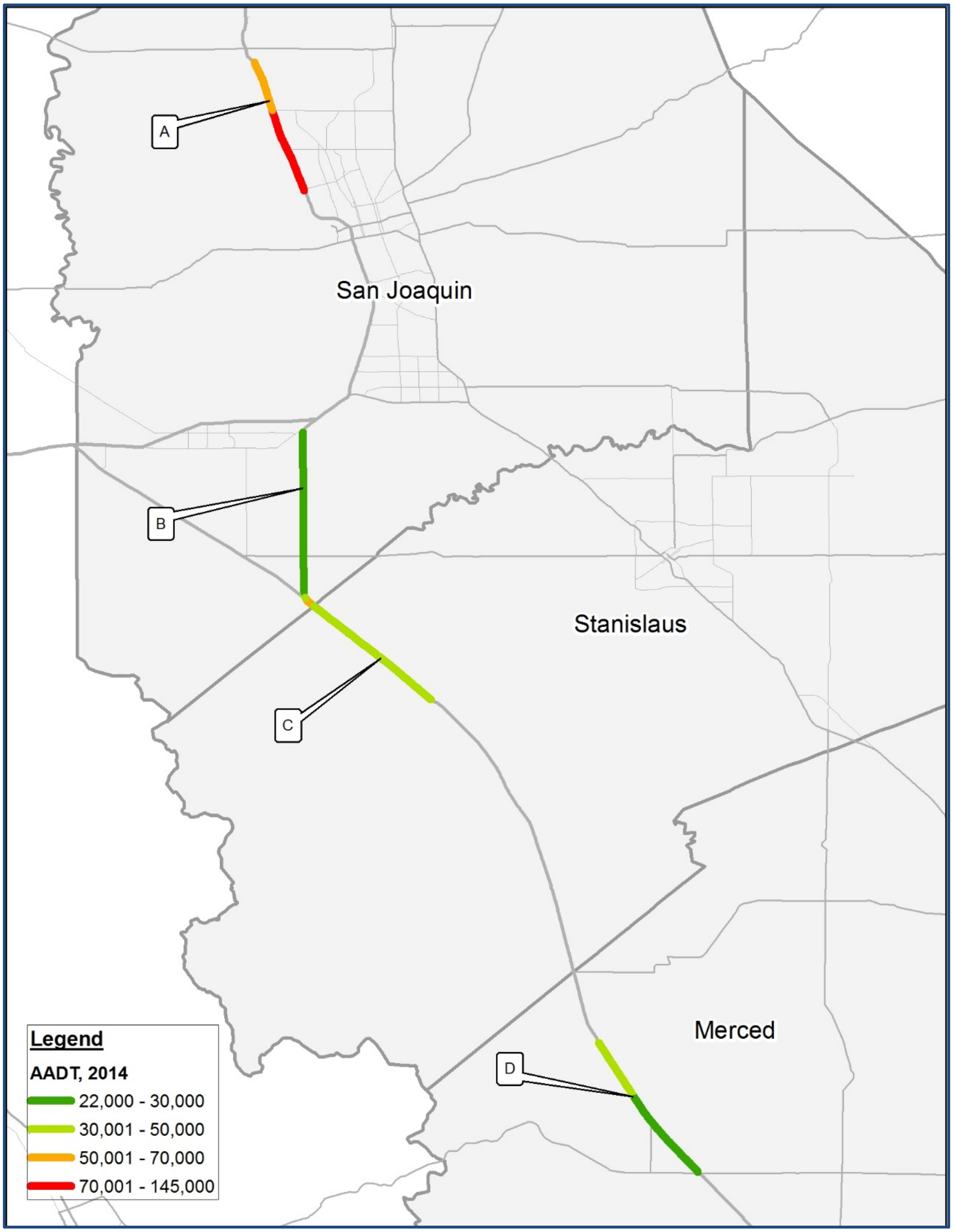
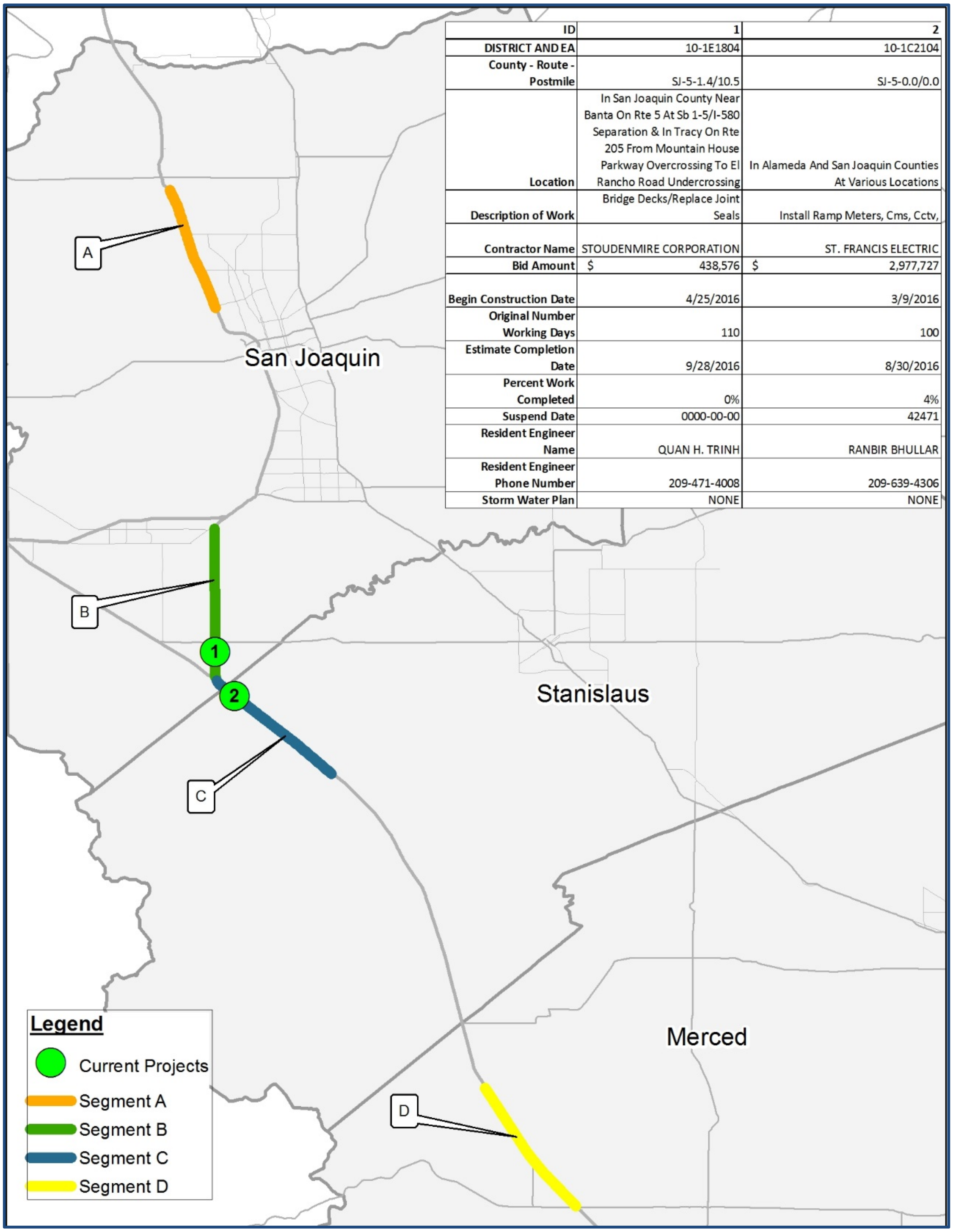
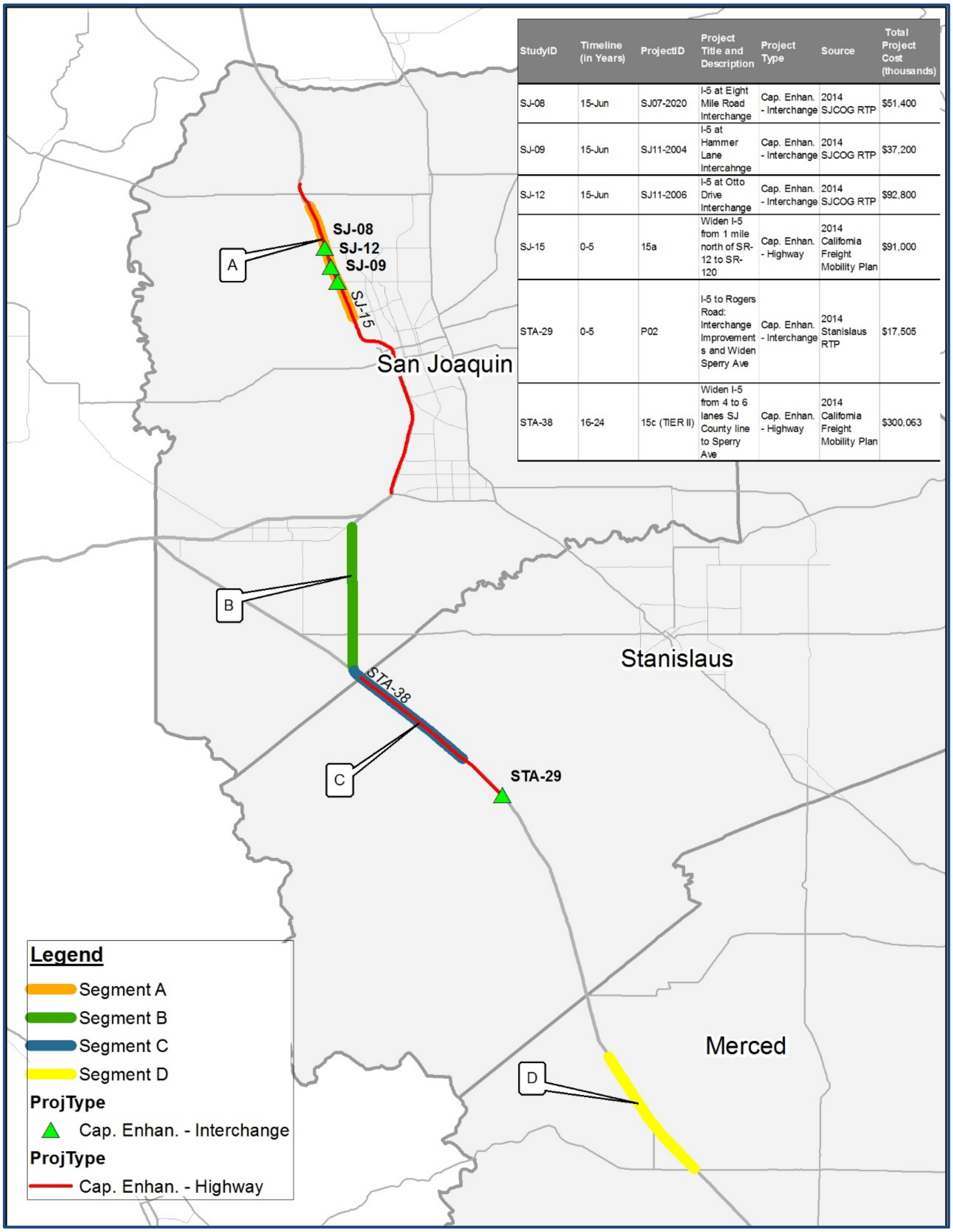


Figure 5.7 Current Projects



ID	1	2
DISTRICT AND EA	10-1E1804	10-1C2104
County - Route - Postmile	SJ-5-1.4/10.5	SJ-5-0.0/0.0
Location	In San Joaquin County Near Banta On Rte 5 At Sb 1-5/I-580 Separation & In Tracy On Rte 205 From Mountain House Parkway Overcrossing To El Rancho Road Undercrossing	In Alameda And San Joaquin Counties At Various Locations
Description of Work	Bridge Decks/Replace Joint Seals	Install Ramp Meters, Cms, Cctv,
Contractor Name	STOUDENMIRE CORPORATION	ST. FRANCIS ELECTRIC
Bid Amount	$ 438,576	$ 2,977,727
Begin Construction Date	4/25/2016	3/9/2016
Original Number Working Days	110	100
Estimate Completion Date	9/28/2016	8/30/2016
Percent Work Completed	0%	4%
Suspend Date	0000-00-00	42471
Resident Engineer Name	QUAN H. TRINH	RANBIR BHULLAR
Resident Engineer Phone Number	209-471-4008	209-639-4306
Storm Water Plan	NONE	NONE

Figure 5.8 Planned Projects



StudyID	Timeline (in Years)	ProjectID	Project Title and Description	Project Type	Source	Total Project Cost (thousands)
SJ-08	15-Jun	SJ07-2020	I-5 at Eight Mile Road Interchange	Cap. Enhan. - Interchange	2014 SJCOG RTP	$51,400
SJ-09	15-Jun	SJ11-2004	I-5 at Hammer Lane Intercahnge	Cap. Enhan. - Interchange	2014 SJCOG RTP	$37,200
SJ-12	15-Jun	SJ11-2006	I-5 at Otto Drive Interchange	Cap. Enhan. - Interchange	2014 SJCOG RTP	$92,800
SJ-15	0-5	15a	Widen I-5 from 1 mile north of SR-12 to SR-120	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$91,000
STA-29	0-5	P02	I-5 to Rogers Road: Interchange Improvements and Widen Sperry Ave	Cap. Enhan. - Interchange	2014 Stanislaus RTP	$17,505
STA-38	16-24	15c (TIER II)	Widen I-5 from 4 to 6 lanes SJ County line to Sperry Ave	Cap. Enhan. - Highway	2014 California Freight Mobility Plan	$300,063

5.2 Update of Locations

Following this review of potential locations on I-5 in the San Joaquin Valley, a truck platooning demonstration by PATH (sponsored and funded by LA METRO) occurred in Los Angeles County on

I-110 beginning at the Port of Los Angeles, traveling northbound approximately six miles, and then returning to the Port. The platoon of three trucks traveled in the third lane on this four-lane segment, which minimized the number of "cut-ins" from passenger cars entering and exiting the freeway. Based on this demonstration, PATH suggested that for an I-5 demonstration, additional three-lane segments should be considered. This has not been investigated, but it should be considered for any future truck platooning demonstration on I-5 in the San Joaquin Valley.