RCTC TRUCK STUDY

Task 3 - Nexus Study

Technical Memorandum Addendum
Updated Data

Prepared for:

RIVERSIDE COUNTY TRANSPORTATION COMMISSION

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FINAL

March 20, 2025

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1 INTRODUCTION

The purpose of this study is to update the previously approved Nexus Study technical memorandum due to the rampant growth of logistic distribution centers in Riverside County. The previously approved Nexus Study, as part of the Riverside County Transportation Commission (RCTC) Truck Study, was released in April 2019 and approved by the Commission on May 8, 2019. This project update uses a similar methodology as the approved study but utilizes the latest Southern California Association of Governments (SCAG) and California Employment Development Department (EDD) data available. Revised growth forecasts of logistic facilities in Riverside County are used in a systematic identification of impacts from future logistic locations.

This technical memorandum will address key study questions as defined by RCTC:

1) How have truck travel patterns changed?
    - Where is additional logistic warehouse growth occurring?
    - Where are new roadway deficiencies due to congestion?
2) How are logistic warehouses impacting the freeway network?
3) How are trucks impacting the San Gorgonio Pass and Coachella Valley?
4) An increase in freight truck (including light-heavy, medium-heavy, and heavy-heavy duty commercial trucks) travel is affecting Riverside County. What is the total increase of freight truck Vehicle Miles Traveled (VMT) in the region?

1.1 STUDY METHODOLOGY

Answering the study's key questions required updating the base data sets from SCAG and EDD. The base data sets from the previously approved Nexus Study were the SCAG 2016 Regional Transportation Plan (RTP) / Sustainable Communities Strategy (SCS) and 2016 EDD. SCAG's most recently adopted[1] RTP/SCS is the 2020 Connect SoCal, and the EDD releases new employment estimate data annually. To facilitate the use of the new data, the study base year was updated from 2016 to 2019, and the horizon forecast year was changed from 2040 to 2045.

The information used from the SCAG RTP/SCS was derived through the inputs and outputs of their travel demand model (TDM). Generally, the RTP/SCS contains new updates to:

- Transportation infrastructure.
- Land use, population, and employment.
- Policies addressing transportation and land use.

The RTP TDM transportation networks, which include roadways and transit, have incorporated new infrastructure projects constructed between 2016 and 2019, as well as future year modifications to proposed regional plan projects. Updates included pertain to current and

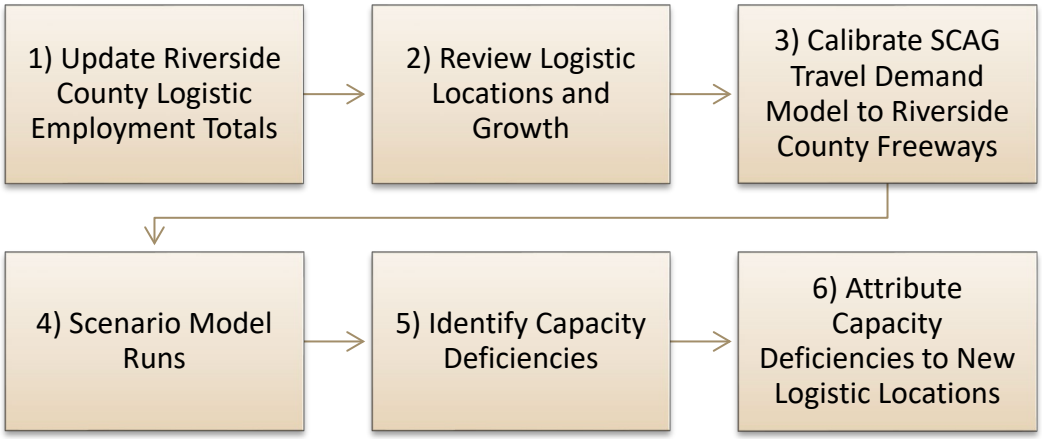
[1] At the start of the study update, the 2020 Connect SoCal was the most recent adopted RTP/SCS. During the study update, SCAG adopted their 2024 RTP/SCS.

future year land use, population, and employment within the SCAG region, including growth in Riverside County population, warehousing square footage, and warehousing employment.

The 2020 RTP includes proposed policies and programs to reduce passenger car VMT and greenhouse gas (GHG) emissions to achieve the GHG targets set by the California Air Resources Board (CARB) as dictated by Senate Bill (SB) 375. Policies that focus on the reduction of automobile travel do not necessarily influence truck travel due to the nature of freight delivery logistics. This can impact the study 1) when looking at the share of truck VMT growth as compared to automobile VMT, and 2) when considering the number of congestion-deficient segments in the horizon year.

The study followed a generalized six-step path as shown in Figure 1-1. Each step is discussed in greater detail throughout this memorandum. The study first reviewed and updated the Riverside County warehousing employment totals in the SCAG model and reviewed logistic locations to ensure recent developments were captured. The SCAG model was then calibrated to Riverside County freeway traffic volumes and travel speeds to more accurately reflect current conditions. Three different model runs were conducted to provide the necessary data for identifying capacity deficiencies and to determine how much of those deficiencies were attributed to new logistic developments.

Figure 1-1: Project Methodology



1.2 Synthesis of Previous Work

The impact of trucks and other traffic associated with warehousing and logistics uses have increasingly emerged as issues of concern in Riverside County, especially as more of these types of developments emerge. The issue of adequate mitigation of the effects of these uses on regional freeway systems culminated with a multi-party lawsuit involving mitigation efforts of the Highland Fairview development in Moreno Valley. As part of a settlement agreement between the respective parties to the lawsuit, RCTC conducted a regional truck study in April

2019 to verify the cumulative impact of warehousing and logistics uses on the Riverside County freeway system to form a basis for establishing a regional logistics mitigation fee. This Nexus Study was a critical milestone in the RCTC Truck Study and the Development and Implementation of the Regional Logistics Mitigation Fee work effort.

The previous Task 3: Nexus Study Technical Memorandum verified the anticipated rate of growth in warehousing and logistics-related development in Riverside County. The studies also quantified the associated level of traffic impacts on the Riverside County highway system because of the expected growth in warehousing and logistics activities. The previous study determined the amount of money each new warehousing or logistics development should pay instead of building actual freeway improvements to mitigate the traffic impacts associated with the development's generation of truck trips. The findings of this study, summarized below, provided the framework for implementing a program to collect impact fees that would contribute to mitigating the truck traffic impacts associated with new warehousing and logistics developments in Riverside County.

Logistics Growth

The previous study inventoried existing logistics facilities and confirmed the forecast growth of those facilities through year 2040. The confirmed growth percentages for the number of employees and square footage for logistics facilities are as follows:

- Warehouse Employee Growth (2016 to 2040): 155 percent
- Warehouse Growth in Square Footage (2016 to 2040): 59 percent

Traffic Impacts

The SCAG regional travel demand model was the primary tool used to identify existing and future impacts related to truck trips associated with the growth in logistics. The model was adjusted and refined to reflect the unique trip generation characteristics of warehousing and logistics developments (i.e. different peak periods, seasonality, significant truck traffic, off-peak distribution, etc.).

Existing (2016) and future (2040) traffic volumes on each freeway link in Riverside County were derived from the model and compared to the carrying capacity of each respective freeway link (calculated the volume-to-capacity ratio to identify impacts). A total of 19 freeway segments along the I-15, SR-60, I-215, and SR-91 within Riverside County were analyzed to identify:

- Critical volume-to-capacity ratios (deficient segments)
- Percent deficiency attributed to new development
- Percent growth of new logistics trucks
- Percent deficiency attributed to new logistics trucks (by peak hour)
- Percent deficiency attributed to new logistics trucks (total)

- Weighted average highest percent deficiency attributed to new logistics trucks

Freeway Mitigation Concepts and Associated Costs

Using the identified deficient freeway segments and the percentage of those deficiencies attributed to new warehouse and logistics developments, the previous study then reviewed funded and/or programmed improvements, prepared new design concepts, and estimated costs to mitigate impacts related to new logistics and warehousing developments.

The previous study calculated a total estimated cost of $385,335,000 in minimum mitigation improvements to counter the impacts of new development on Riverside County Freeways. The percentages attributed to new logistics trucks in the traffic analysis were then used to calculate the fair share of costs for impacts associated with new logistics developments. The total estimated cost of $47,841,100, or 12.4 percent of the total cost, was determined to be the maximum share of the costs attributable to mitigating the cumulative regional impacts of new warehousing and logistics developments in Riverside County.

Funding Sources

- The previous study identified potential funding sources for the implementation of identified improvement projects, including Fixing America's Surface Transportation Act (FAST), Nationally Significant Freight and Highway Projects (NSFHP), and the Advanced Technology and Congestion (ATC) funding programs.
- Road Repair and Accountability Act of 2017 (SB 1): Identified four potential funding sources (Local Partnership Program (LPP) county allocated, Trade Corridor Enhancement Program (TCEP), Solutions for Congested Corridors Program (SCCP), and LPP competitive)

Logistics Mitigation Fee

The previous study identified the Logistics and Warehouse Impact Fee for Riverside County by dividing the project costs for mitigation attributable to new logistics development by the forecasted amount of new warehousing and logistics facilities in square feet. The resulting fee per square foot of gross floor area was $1.28. "The calculated fee represents the maximum fee permissible under California law if it was adopted.

2 LOGISTIC GROWTH FORECAST

The first step for this current study update was to update the logistics growth forecast. Data was collected from SCAG and EDD to reevaluate the growth in the warehousing area and employment and to review the location of the logistic centers and growth. This study update is built on the data decisions from the previous study regarding source data quality. Furthermore, it did not evaluate previously identified but unused sources or new sources of data.

SCAG data was retrieved from the current SCAG RTP/ SCS, Connect SoCal (2020-2045), adopted on September 3, 2020. The SCAG RTP/SCS land use, population, and employment forecast is regarded as the official forecast for the region. RTP forecasts and models start from the latest observed data and information before forecasting future year scenarios. The 2020 Connect SoCal RTP/SCS forecast has a base year of 2016 and a forecast year of 2045. This study update uses the 2019 forecast year as its "current" year because it is the latest available forecast before the pandemic near-term influences that the SCAG model would not have been able to predict.

California EDD's Labor Market Information Division estimates of employment by Metropolitan Statistical Areas (MSA) and industry classification (NAICS – North American Industry Classification System) were used to evaluate the growth in logistic warehousing employment. SCAG employment uses EDD as a source of information but is a point-in-time forecast and can differ due to update frequencies. SCAG must also reconcile other data sources such as parcel land use data and other employment sources when siting jobs to areas below the MSA level.

2.1 RIVERSIDE LOGISTIC EMPLOYMENT

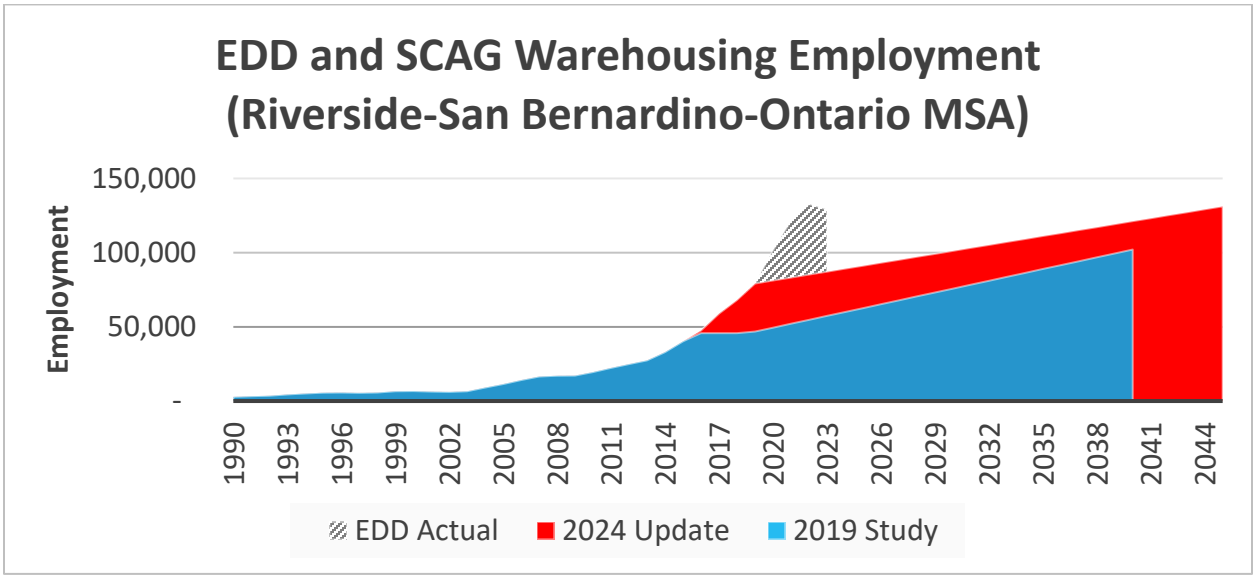
Recent EDD data and trends were used to adjust the SCAG employment data forecasts for use in this study update. SCAG employment data is used within the SCAG model to estimate the number of truck trips generated from areas with warehousing. Accurately reflecting the growth in employment using the EDD trends is a crucial step in determining capacity deficiencies due to logistic centers.

Figure 2-1, shows a combination of EDD data and SCAG data for the Riverside-San Bernardino-Ontario MSA warehousing from the previous study (2019), this current study update (2024), and the most recent EDD estimates. The previous study, illustrated in blue, aligned with EDD trends until 2016 when it stayed flat, eventually increasing linearly to align with the overall SCAG forecasted employment in 2040. This study update used a similar methodology, following EDD trends to the current year of 2019 and growing linearly to the overall SCAG forecasted employment in 2045. Note with the latest SCAG RTP/SCS, the forecast horizon year was extended from 2040 to 2045. The gray hatched area shows the EDD employment trend from 2019 to 2023.

The historical EDD data shows four different growth trends. From 1990 to approximately 2003, minimal growth occurred with around 4,000 new jobs. Over the next decade to approximately

2013, about 2,000 jobs were added per year in the region. Warehouse growth escalated quickly to 2016, with the addition of over 6,600 jobs per year. Rampant growth occurred from 2016 to 2022, with over 14,000 jobs per year added, partially fueled by pandemic changes in shopping patterns and logistic shipping patterns. Post-pandemic changes are slowly emerging now, with employment slightly decreasing from 2022 to 2023, but it is too early to determine the implications of that one-year decrease and its influence on future projections. Looking at broader trends, over the past 20 years, warehousing employment has grown in the MSA from 6,600 employees to 129,000.

Figure 2-1: EDD and SCAG Warehousing and Other Transportation Employment (Riverside-San Bernardino-Ontario MSA, 1990-2023)



This 2024 study update utilizes the base data from the SCAG RTP/SCS, Connect SoCal (2020-2045), and adjusts those forecasts to include the strong growth trend from 2016 to 2019 shown above. The SCAG RTP/SCS forecast also extends the previous study's future growth totals from the year 2040 to 2045. The data shows that the Riverside-San Bernardino-Ontario MSA continues to be a key logistic growth area for serving Southern California.

The EDD data for Southern California demonstrated that the SCAG warehousing employment forecast data was disproportionately low for the Riverside and San Bernardino areas (SCAG warehouse area and employment shown in Table 2-1). The EDD 2019 data provides employment totals for both the full industry category of Transportation, Warehousing, and Utilities and the industry subcategory of Warehousing and Storage employees. The EDD data indicates that the Riverside / San Bernardino MSA has a ratio of 54 percent of Warehousing and Storage employment to Transportation, Warehousing, and Utilities employment. To keep the SCAG data inputs consistent with EDD data, this ratio was applied to SCAG transportation

employment to determine new warehousing employment totals (Table 2-1). New employment control totals for Riverside provided a square foot per employee ratio similar to national data trends[2]. Some additional location-specific modifications to existing land use areas and employment are described in Section 2.2 and are incorporated in the table below.

Table 2-1: SCAG Warehouse Employment, 2019

	SCAG Warehouse Area (SQFT)	SCAG Warehouse Employment	SCAG SQFT/Emp	Readjusted Employment	Readjusted SQFT/Emp
Riverside	74,728,707	7,671	9,742	28,381	2,633
San Bernardino	120,526,800	21,388	5,635	49,443	2,438
Total	195,255,507	29,059	6,719	77,824	2,509

Source: SCAG 2020 RTP/SCS Heavy Duty Truck Model, EDD

Table 2-2 provides the adjusted SCAG warehouse area and employment for Riverside County including total growth from 2019 to 2045. Warehouse area grows 55 percent over the 26 years and employment nearly doubles with an 81 percent increase.

Table 2-2: Updated SCAG Warehouse Trends in Riverside County 2019 & 2045

Year	Warehousing Area (SQFT)	Employment	SQFT/Emp
2019	75,316,167	28,378	2,654
2045	116,998,380	51,396	2,276
2019-2045 Growth	41,682,213	23,018	

Source: Adjusted SCAG 2020 RTP/SCS Heavy Duty Truck Model

In comparison to the 2019 study, shown in Table 2-3, this update accounts for the significant growth in warehousing with additional growth of 12 million square feet of warehouse area from 2016 to 2019. The horizon year extension from 2040 to 2045 adds 16 million square feet of area.

[2] US EIA 2018 Commercial Buildings Energy Consumption Survey estimated warehouse and storage buildings at 2,222 sf per worker. https://www.eia.gov/consumption/commercial/data/2018/#b11-b14

Table 2-3: SCAG Warehouse Area - Study Comparison

2019 Study		2024 Update		Growth
Year	Warehouse Area (SQFT)	**Year**	Warehouse Area (SQFT)	Warehouse Area (SQFT)
2016	63,309,990	**2019**	75,316,167	12,006,177
2040	100,642,169	**2045**	116,998,380	16,356,211
Growth	37,332,179	**Growth**	41,682,213	4,350,034

Source: SCAG 2016 RTP/SCS Heavy Duty Truck Model and SCAG 2020 RTP/SCS Heavy Duty Truck Model

2.2 Logistic Locations and Growth

Growth in logistic locations within Riverside County has been considerable, with the continued rise of e-commerce over the last decade and a considerable growth spurt fueled by the pandemic. This study reviewed the locations of growth within the SCAG forecast region to ensure the existing and future models had addressed the following cases of potential error:

- Locations where the SCAG forecast indicated considerable growth in logistic jobs. These areas were visually inspected to determine whether aerial imagery confirmed additional warehouse areas.
- Areas in and around logistic center Traffic Analysis Zones (TAZs) (i.e., areas with warehousing employment) with no logistic employment. A reasonable assumption was made that logistic companies may expand into similar areas as other companies.

Sections below will discuss the areas and changes in the bullets above and provide updated current and future logistic center locations and their growth.

2.2.1 Riverside Logistic Center Growth

Riverside's growth in warehousing can also be seen visually by reviewing Google Earth images from 2004 to 2023 in Figure 2-2. For geographic orientation, the satellite images have the I-215 corridor cutting diagonally from southeast to northwest, the SR 60 near the top of the image, and the March Air Reserve Base (ARB) roughly center.

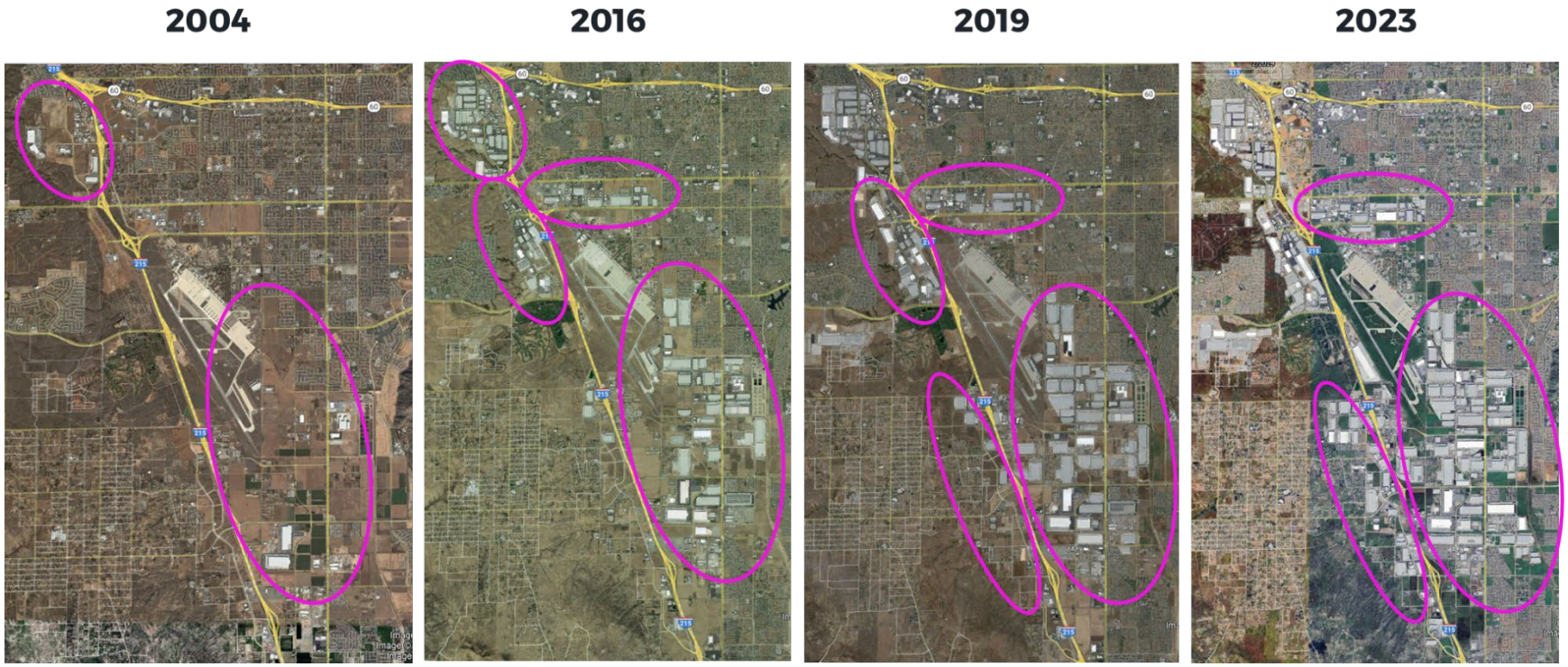
- **2004:** Along the I-215 corridor in 2004, there is some warehousing to the west of I-215 near the I-215/SR 60 interchange and some warehousing to the southeast of the March ARB.
- **2004 – 2016:** In the 12 years from 2004 to 2016, tremendous growth occurs in the area near the I-215/SR 60 interchange as well as growth in the location west of the I-215 between Van Buren Boulevard and Cactus Ave and along Cactus Ave north of March

ARB. The area to the southeast of March ARB continues to densify during this 12-year period.

- **2016 – 2019:** In the brief three years between the previous study's base year of 2016 and this study's base year of 2019, additional growth occurs in the southeast March ARB location, Cactus Ave, and the area west of I-215 between Van Buren Blvd and Cactus Ave. During this same period, warehousing starts to appear west of I-215 near the interchange of Harley Knox Blvd down to Placentia Ave.
- **2019 – 2023:** In the four years from 2019 to 2023, we see continued infill east of I-215 along Cactus Ave, continued infill south of March ARB, and tremendous growth to the west of I-215 between the Harley Knox Blvd and Placentia Ave interchanges.

In just 20 years, the entire area around March ARB developed from an area with few warehouses to a large logistic and warehouse distribution area.

Figure 2-2: Riverside Warehouse Growth Using Satellite Imagery



Map data: (2004) Google, Maxar Technologies, U.S. Geological Survey, Landsat/Copernicus; (2016) Google, Landsat/Copernicus; (2019) Google; (2023) Google, Airbus, Maxar Technologies

2.2.2 Review of Growth Locations

Locations were reviewed that had large warehouse square footage area differences between base year 2016 and forecast year 2019 in the SCAG data. The review identified two areas needing modification in the World Logistics Center site (TAZ 43338000 & TAZ 43344000) near SR 60 & World Logistics Center Parkway. SCAG's 2019 land use forecast indicated development had occurred on these sites. However, aerial imagery identified that no development had taken place. For 2019, the warehousing growth was removed from these TAZs, but in 2045, the significant growth for these zones was left as originally forecasted based on the anticipated future development of this site.

2.2.3 Review of Logistic Center Areas

Locations in and around existing logistics developments were reviewed to identify missing locations. Nine locations were identified that had no logistic employment, but logistic centers were visible from aerial imagery. In these cases, warehousing and employment data have been added to the SCAG forecast data based on the approximate size of the warehouse in the imagery. If the 2045 SCAG forecast does not indicate additional growth in the zone, the 2019 assumption has been carried forward to 2045. If the 2045 forecast shows additional growth, the growth has been assumed to capture the missing warehouse location.

Table 2-4 contains the adjustments made to the logistic center employment in the SCAG forecast. The data is organized by SCAG TAZ with county location noted for reference. The SCAG Transportation and Utility Employment for the zone is listed in the first data column and the forecast number of warehouse employees are listed in the second data column. The final data column shows the manual adjustments made to the warehouse employees for the study model runs. Highlighted notes are listed below:

- TAZ 43183000 – This TAZ highlights how quickly areas are changing. Small adjustments were made in this zone for 2019, but between 2019 and 2024 an additional 10 industrial / warehousing buildings were built north of The Crossings of Corona.
- TAZ 43255000 - Two newer logistic buildings, built in 2019, are located just east of I-215 off of E Alessandro Blvd.
- TAZ 43259000 – New logistics building built in 2018 in an existing industrial park north of SR 60 and east of I-215 near the Riverside County boundary.
- TAZ 43270000 – New logistics building built in 2017/2018 just north of March ARB.
- TAZ 43285000 – New logistics building built in 2018 just east of March ARB.

Table 2-4: Logistic Center Employment Adjustments (2019)

SCAG Tier 1 TAZ	County	SCAG Transportation and Utility Employment	SCAG Total Warehouse Employees	Adjusted Total Warehouse Employees
43171000	Riverside	16	0	6
43183000	Riverside	78	0	23
43184000	Riverside	101	0	51
43225000	Riverside	235	1	94
43231000	Riverside	323	2	16
43255000	Riverside	305	0	153
43259000	Riverside	346	3	173
43270000	Riverside	0	0	44
43285000	Riverside	128	0	128
53795000	San Bernardino	894	0	86

2.2.4 Logistic Center Locations (2019)

Figure 2-3, shown in Section 2.2.5, shows the warehouse locations in year 2019 by SCAG TAZ. TAZs are used to aggregate the amount of warehouse square footage in the area. The TAZs are symbolized based on the amount of square footage contained within those polygons and then shaded using a graduation of color from yellow (lower amounts of square footage) to dark red (higher amounts of square footage). Overall, TAZ square footage is not accounted for in the color scheme and should be interpreted appropriately. A smaller zone that is dark red indicates the overall compactness and density of warehousing in that area. A larger zone that is yellow, meaning smaller amounts of square footage, may stand out on the map due to the size of the zone, but the warehousing could be relatively compact in a small subsection of the zone.

In Riverside County, the key warehousing areas can be seen along major freeways for accessibility such as I-215, SR 60, SR 91, and I-15. A large concentration of warehousing is located in the northwest corner of the County near Ontario at the interchange of I-15 and SR 60.

2.2.5 Logistic Center Locations (2045)

Figure 2-4 shows the warehouse locations in horizon year 2045 with the warehouse square footage area aggregated into the SCAG TAZ's. As compared to 2019, a considerable amount of growth occurs along the I-215 corridor near March ARB. Some of this growth, however, has already occurred between 2019 to 2023. The largest change in warehousing growth area is along SR 60 at the World Logistics Center site and through the San Gorgonio pass.

When comparing the 2045 map to the 2019 map, some of the colors may not appear to have changed. This, however, does not mean growth did not occur in these TAZs. Rather, the scale of the map shows for each unique color a range of 1,000,000 square feet, which is a significant amount of warehouse area. A TAZ could still be growing but not change color because of the overall increase of map scale.

Figure 2-3: Warehouse Locations (2019)

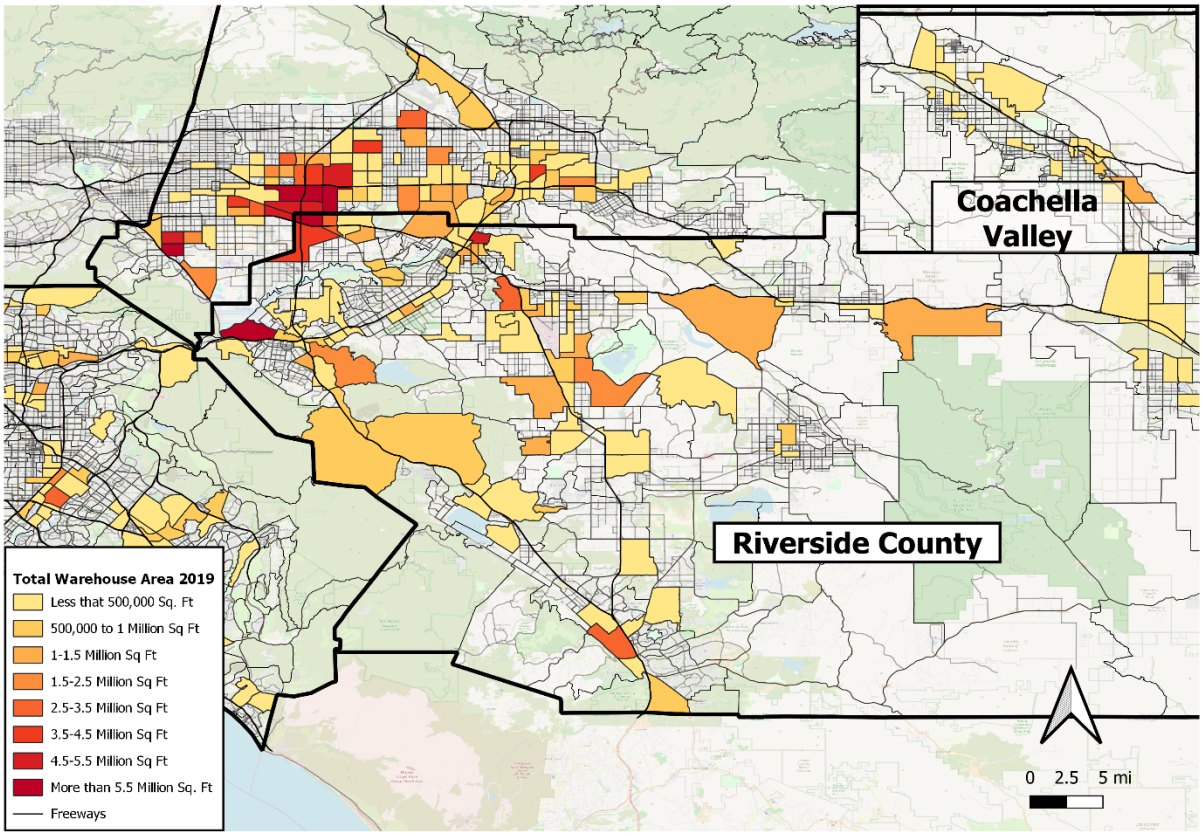
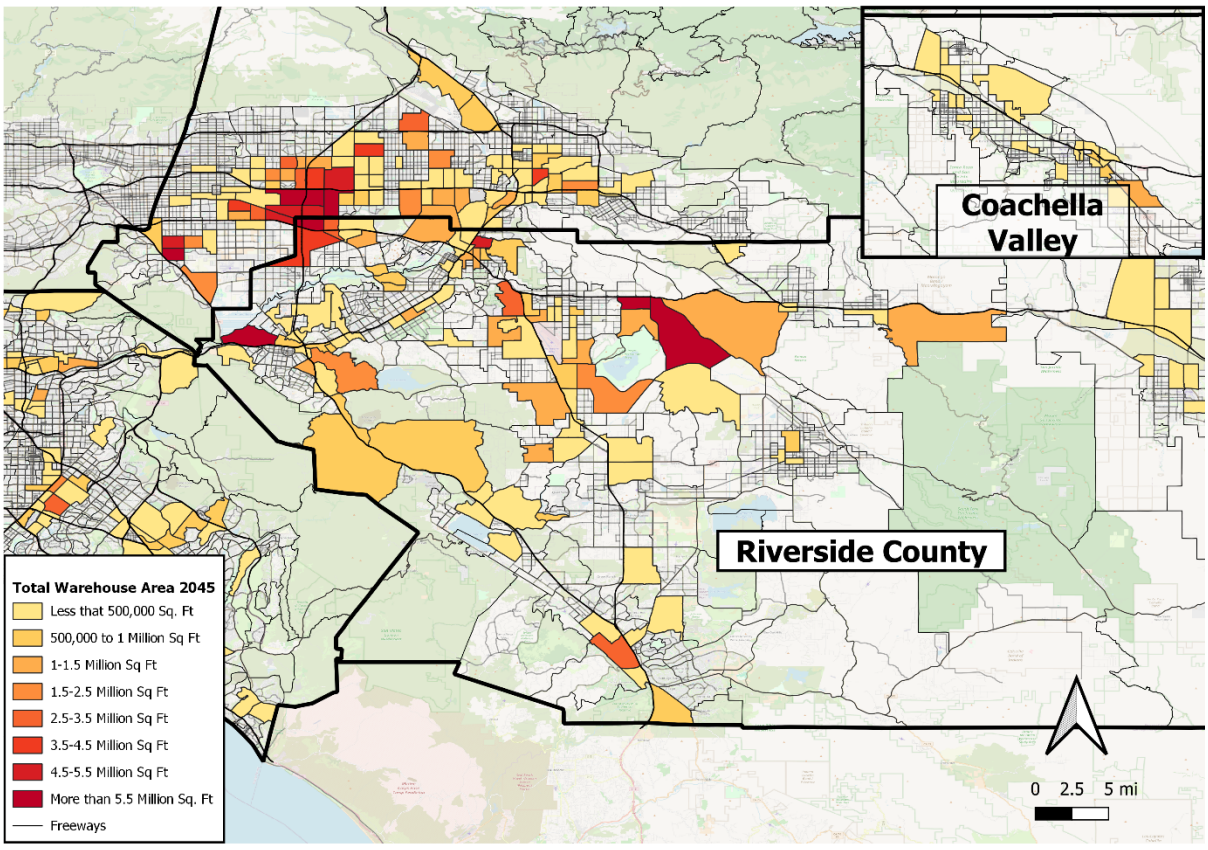


Figure 2-4: Warehouse Locations (2045)

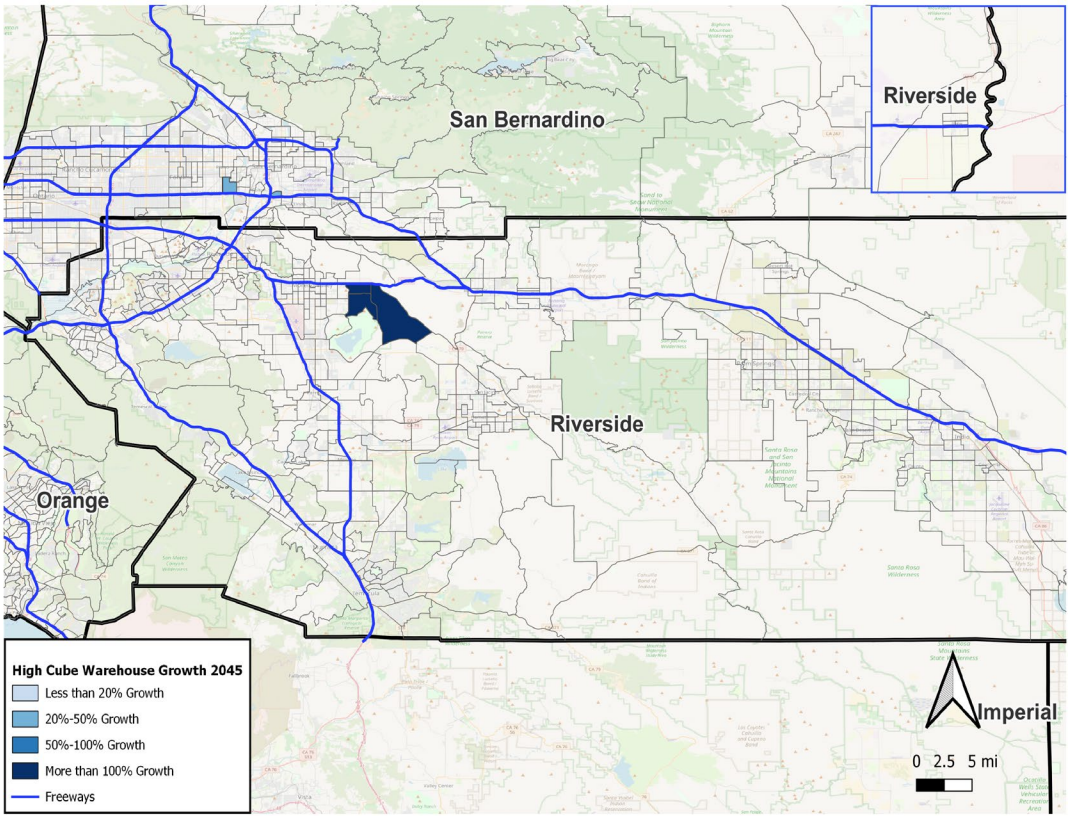


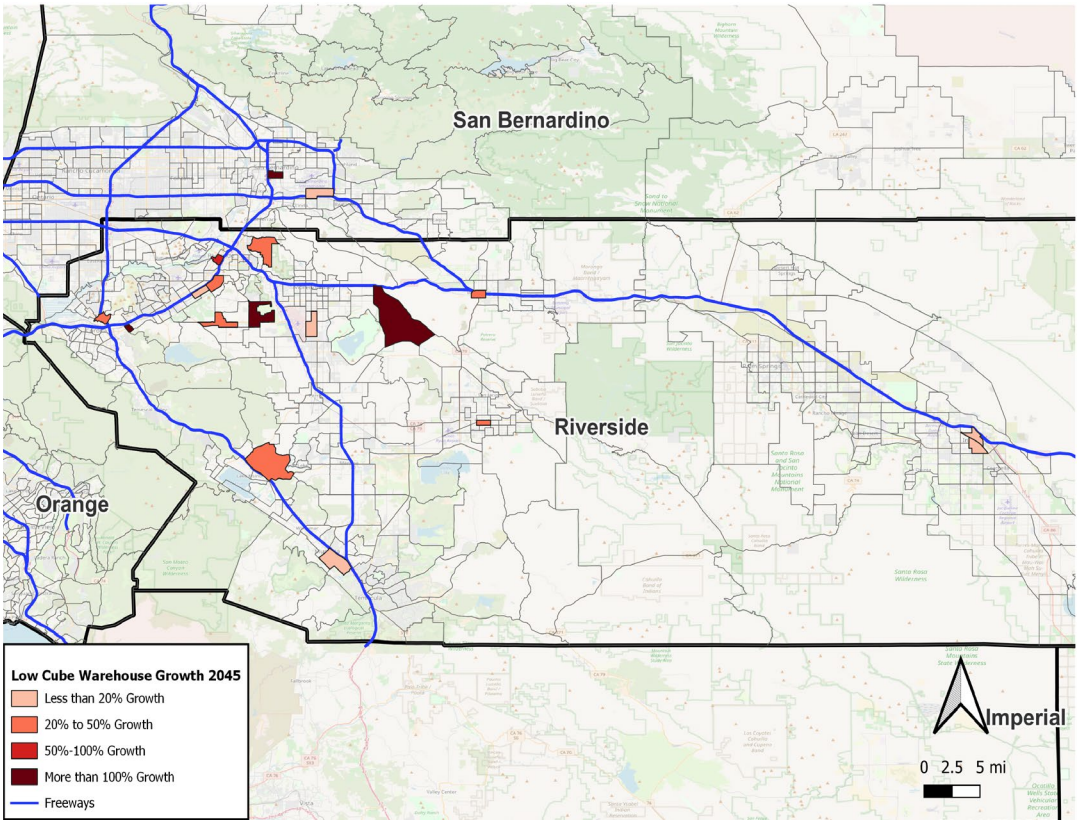
2.2.6 Logistic Center Growth (2019 – 2045)

Logistic center locations were discussed in Section 2.2.4 for year 2019 and Section 2.2.5 for year 2045. The logistic center growth between those years is shown below, in Figure 2-5, where the growth is split out between two logistic center size categories – high cube and low cube. High cube centers generally have a minimum gross floor area of 200,000 square feet and a ceiling height of at least 24 feet. Low cube warehousing fills the remainder of the warehousing.

SCAG's forecast shows the majority of growth occurring along SR 60 in and around the World Logistics Center site. Growth also occurs along the fringes of already developed warehousing parks on I-215 and within growing communities along I-15.

Figure 2-5: Warehouse Growth (2019-2045)





Detailed growth data is provided for TAZs in Riverside County with warehouse growth by employment in Table 2-5. Area growth is given for low cube warehousing in 2019 and 2045, high cube warehousing in 2019 and 2045, and the total area change in thousand square feet of gross floor area and percent of total growth. Even if there is no change in square footage, areas may still grow in employment through greater utilization of existing space.

The top three growth areas are:

1) TAZ 43344000 – Significant growth location as part of the World Logistics Center along SR 60
2) TAZ 43336000 – Significant growth location as part of the World Logistics Center along SR 60
3) TAZ 43255000 – Growth on the east edge of the TAZ near the I-215 logistic warehousing area. Some of this growth was picked up via manual edits described in Section 2.2.3.

Table 2-5: Warehouse Growth by TAZs in Riverside County (in thousand square feet gross floor area), 2019-2045

TAZ ID	Low Cube 2019	Low Cube 2045	High Cube 2019	High Cube 2045	Total Area Change 2019-2045	Percent of Total Growth	Total Employment Change 2019-2045	Percent of Total Growth
43123000	294	294	3,923	3,923	0		310	1.4%
43125000	727	727	5,048	5,048	0		30	0.1%
43130000	988	988	2,050	2,050	0		161	0.7%
43134000	574	574	474	474	0		12	0.1%
43136000	233	233	289	289	0		5	0.0%
43148000	1,313	1,313	4,437	4,437	0		163	0.7%
43168000	367	367	491	491	0		217	0.9%
43171000	14	19	0	0	5	0.0%	7	0.0%
43174000	181	181	207	207	0		38	0.2%
43178000	61	61	0	0	0		23	0.1%
43184000	122	713	0	0	590	1.4%	909	4.0%
43187000	340	340	0	0	0		82	0.4%
43225000	226	240	0	0	14	0.0%	26	0.1%
43230000	55	74	0	0	18	0.0%	3	0.0%
43231000	38	60	0	0	22	0.1%	34	0.1%
43232000	86	114	0	0	29	0.1%	3	0.0%
43236000	165	165	0	0	0		230	1.0%
43249000	1,976	1,976	3,197	3,197	0		269	1.2%
43251000	164	164	403	403	0		11	0.0%
43255000	367	1,385	0	0	1,018	2.4%	1,568	6.8%
43259000	415	547	0	0	132	0.3%	209	0.9%

TAZ ID	Low Cube 2019	Low Cube 2045	High Cube 2019	High Cube 2045	Total Area Change 2019-2045	Percent of Total Growth	Total Employment Change 2019-2045	Percent of Total Growth
43260000	1,000	1,000	2,031	2,031	0		108	0.5%
43261000	163	163	0	0	0		175	0.8%
43264000	0	0	851	851	0		185	0.8%
43267000	107	107	1,038	1,038	0		15	0.1%
43276000	117	117	0	0	0		4	0.0%
43285000	307	360	0	0	53	0.1%	85	0.4%
43286000	149	149	0	0	0		12	0.1%
43302000	0	0	1,072	1,072	0		58	0.3%
43305000	0	0	604	604	0		4	0.0%
43336000	2	46	938	12,500	11,606	27.8%	4,248	18.5%
43338000	0	0	0	1,100	1,100	2.6%	748	3.3%
43344000	0	155	0	26,800	26,955	64.7%	12,192	53.1%
43345000	163	163	0	0	0		27	0.1%
43364000	293	293	331	331	0		49	0.2%
43366000	66	89	0	0	22	0.1%	40	0.2%
43393000	104	104	0	0	0		4	0.0%
43399000	122	162	0	0	41	0.1%	3	0.0%
43410000	116	133	251	251	17	0.0%	26	0.1%
43415000	421	421	2,992	2,992	0		68	0.3%
43420000	383	383	0	0	0		5	0.0%
43452000	96	129	343	343	32	0.1%	15	0.1%
43545000	232	232	0	0	0		105	0.5%
43563000	274	288	308	308	14	0.0%	80	0.3%
43568000	101	116	0	0	15	0.0%	108	0.5%
43571000	0	0	594	594	0		44	0.2%
43572000	122	122	0	0	0		27	0.1%
43578000	145	145	1,130	1,130	0		87	0.4%
43592000	478	478	742	742	0		114	0.5%
Total	13,669	15,889	33,745	73,207	41,682	100.0%	22,946	100.0%

3 SCAG TRAVEL DEMAND MODEL

The adopted SCAG Travel Demand Model, obtained from SCAG on October 11, 2023, was used to assess current and future travel conditions. The SCAG travel demand model was adopted on September 3, 2020, as part of the RTP/SCS - Connect SoCal (2020-2045). The 2020 Connect SoCal RTP/SCS forecast has a base year of 2016 and a forecast year of 2045. This study update uses 2019 as its "current" year as it occurs before near-term pandemic influences that the SCAG RTP forecast would not be able to account for or predict. This study also uses model changes in a version of the SCAG model post-2020 RTP that resolved an issue with time-of-day models.

The SCAG travel demand model encompasses six counties (Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura) and 191 cities. Given the breadth of the area and the focus on 2019 instead of the 2016 base year, the study team first reviewed the travel demand model validation for Riverside County only.

3.1 VALIDATION DATA

Validation data was collected from several sources to compare to the estimated SCAG travel volumes.

- SCAG maintains travel data for validation and had recently updated validation counts to 2019 for the region as part of their 2024 RTP model update. SCAG traffic counts include collected or estimated vehicle classification breakdowns for light heavy-duty trucks (LHDT), medium heavy-duty trucks (MHDT), and heavy heavy-duty trucks (HHDT).
- Replica is a 3rd party big data vendor that provides current travel estimates based on the fusion of location data from devices, consumer and residential data, built environment data, economic activity, and ground truth data into travel demand models. Replica data does not fully distinguish LHDT from automobiles and; therefore, can only be used in limited validation and calibration applications.
- The Caltrans Performance Measurement System (PeMS) is a repository of observed freeway travel counts from several types of sensors. This study collected Vehicle Detector Stations (VDS), Weigh-in-Motion (WIM), and Traffic Census Station count data for trucks and loop detector volumes and speeds by time of day. PeMS compiles 30-second data of vehicle flows from the VDSs and reports them in five-minute intervals by the 13 vehicle types defined by the Federal Highway Administration (FHWA). Truck volumes estimated by the PeMS system were utilized to collect truck counts on stations without truck volume reports.

SCAG model estimated truck volumes are reported by gross vehicle weight rating (GVWR) class categories that are consistent with CARB Emission Factors (EMFAC) vehicle classes. GVWR is not

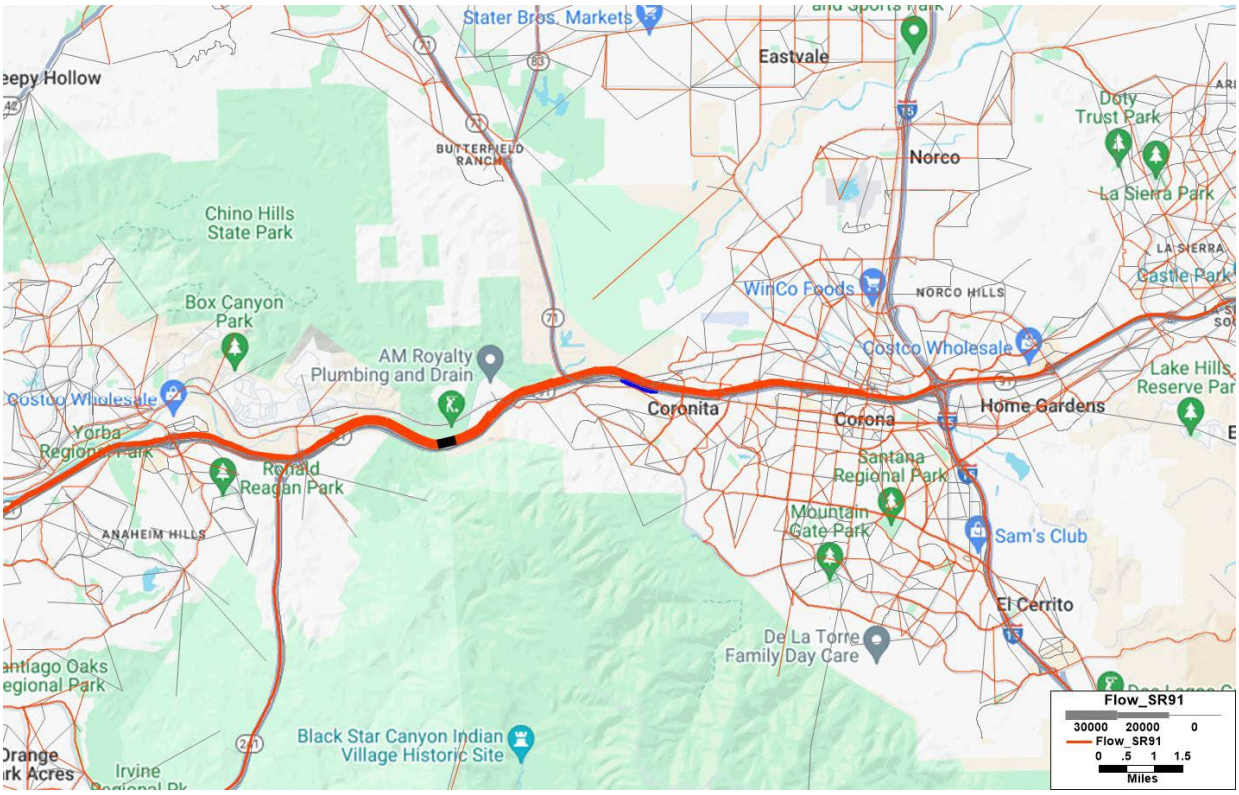
an observable vehicle trait, such as number of axles, making validation comparisons of model results to observed data more difficult to compare.

3.2 Model Calibration

Review of the preliminary validation of the model versus observed data revealed some areas within the SCAG model that needed further evaluation and calibration.

- Warehouse and employment data were updated as discussed in the previous section for overall warehouse employment in Riverside County, locations that showed no or little warehouse area as compared to aerial imagery, and locations of growth inconsistent with aerial imagery.
- Review of model estimated speeds as compared to PeMS loop detector speeds on Riverside freeways identified the need to adjust model parameters. Modeled speeds were being overestimated as compared to observed data which would identify too few congested locations. Freeway capacity per lane was adjusted to be consistent with changes made for the 2024 RTP model. Input network free-flow speeds were also compared to PeMS loop detector free-flow speeds. Where necessary, free flow speeds were adjusted to be more consistent with PeMS.
- Time of day volumes showed an overestimation of AM and PM travel-making as compared to PeMS loop detector volumes. Tour time-of-day model was calibrated to better match the observed temporal share of highway counts. The work location choice model was moderately adjusted to lessen the influence of county-to-county commute patterns during the morning and evening time periods on peak period volumes as indicated by the observed data.
- In review of congestion locations, external market size errors in both 2019 inputs and 2045 outputs that were causing an overestimation of I-10 volumes in the westbound direction were identified and fixed.
- In review of truck volumes as compared to SCAG counts, county-to-county truck travel was overestimated through the SR 91 between Corona, western Riverside, and western San Bernardino to/from Orange County and southern Los Angeles County. Model select link analyses, as shown in Figure 3-1, were compared to Replica select link analyses for SR 91 links near Green River Rd. Factors were introduced within the SCAG truck model to reduce the flows between these areas.

Figure 3-1: SR 91 near Green River Rd Truck Traffic Origins and Destinations



3.3 Final Model Validation

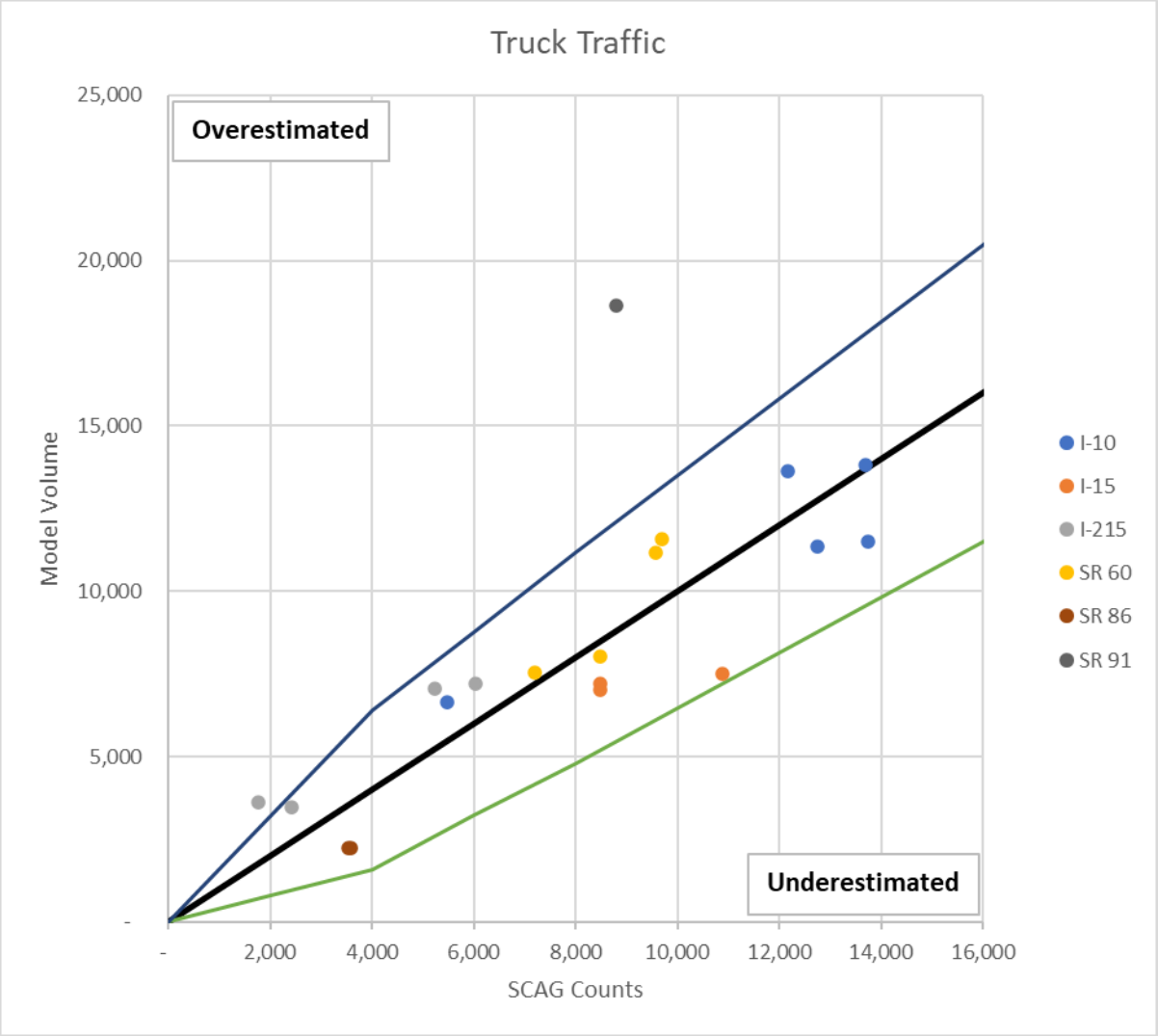
After completion of the model calibration, the SCAG model for Riverside County was reviewed for truck travel and all vehicle travel in year 2019 to ensure the model fell within an appropriate standard deviation when compared to SCAG traffic count data. Generally, a well-fit model resembles a forty-five-degree line where the model replicates the traffic count without overfitting. Overfitting is a statistical phenomenon in which a model is forced to replicate counts perfectly but loses its ability to forecast new conditions dynamically. During calibration, care is made to provide additional understanding within the model without forcing a fit. Additional items looked at are 1) a balance of overestimated and underestimated locations where there is not a bias in either direction and 2) minimal outliers.

While additional items were reviewed during validation, three key charts are shown below to represent the goodness of fit of truck counts in Riverside County and overall freeway travel speeds.

Truck counts in Figure 3-2 show that most counts fall within an acceptable standard deviation from the forty-five-degree line, balance of overestimated and underestimated counts, and only one major outlier. The truck count locations are color-coded by freeway to determine if there is

a bias on one freeway or another. The one major outlier is on SR 91, which is a key location for external county flows. Changes were made in calibration to bring this location further in line, as noted in the previous section, but additional changes would be needed to the overall SCAG truck model to address this without overfitting the model.

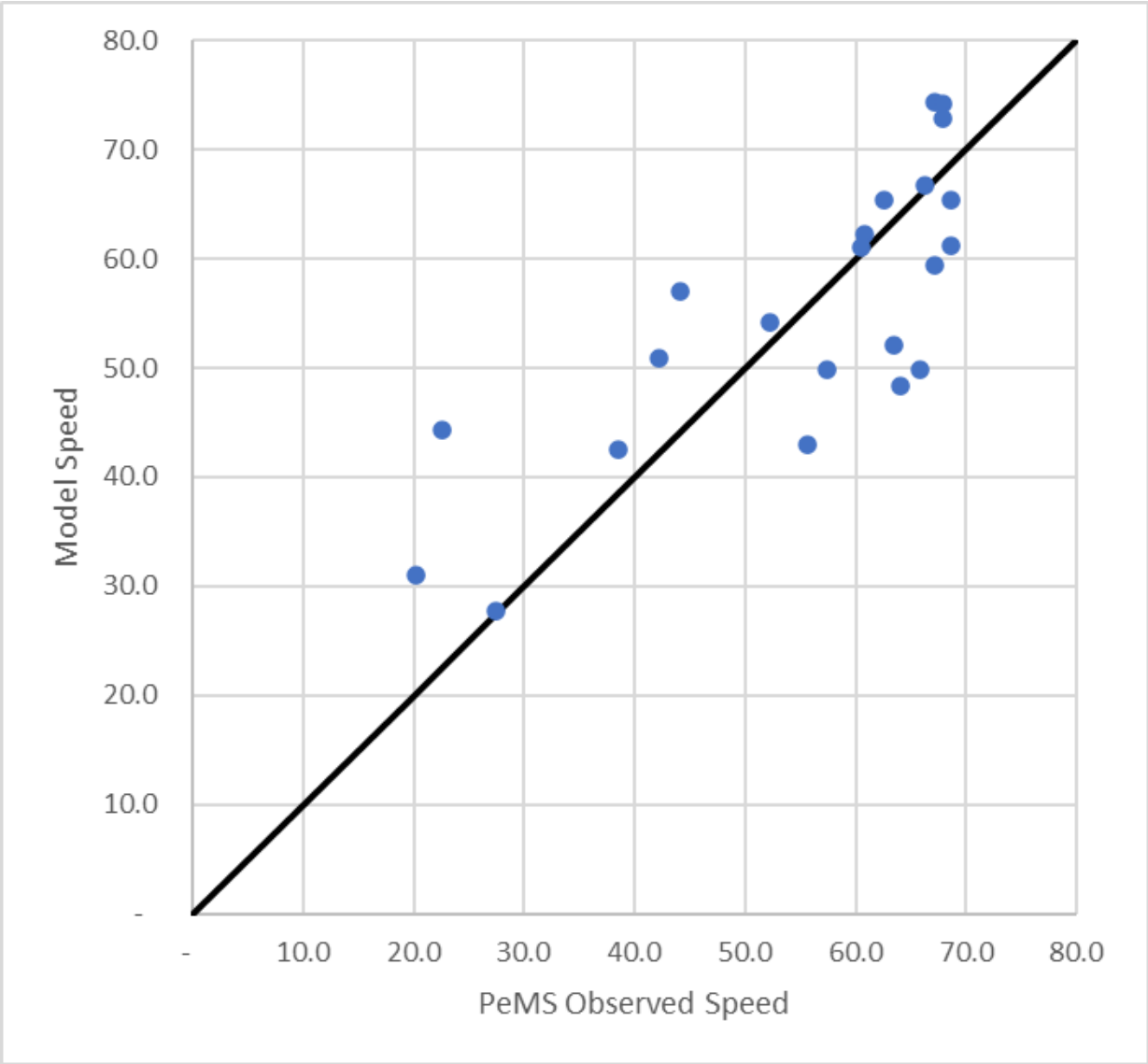
Figure 3-2: Heavy Duty Truck Validation - Model versus SCAG Truck Counts (2019)



Source: 2020 SCAG RTP/SCS travel demand model (modeled year - 2019); SCAG validation counts (observed year - 2019)

The second focal point was to ensure the model reflected appropriate freeway travel speeds in the AM and PM periods. Travel speeds are important due to the step of identifying congested segments for deficiency analysis. Figure 3-3 shows the AM travel speed comparison to PeMS and Figure 3-4 shows the PM travel speed comparison to PeMS. Both figures show well-balanced over/under-estimated locations with few outliers.

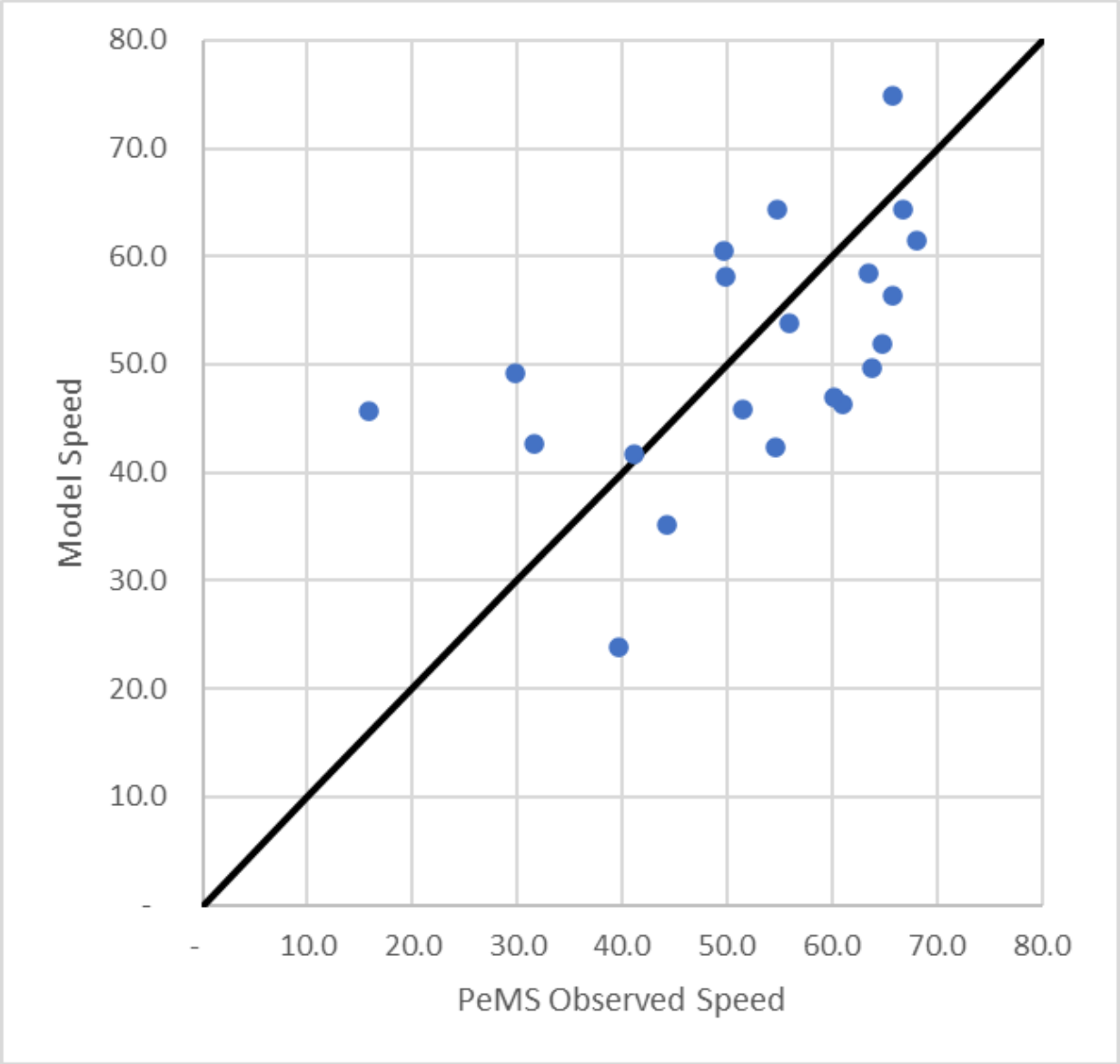
Figure 3-3: AM Peak Period Model vs PeMS Speeds (2019)



Source: 2020 SCAG RTP/SCS travel demand model (modeled year - 2019); Caltrans Performance Measurement System (PeMS[3]) (observed year - 2019)

[3] https://pems.dot.ca.gov/

Figure 3-4: PM Peak Period Model vs PeMS Speeds (2019)



Source: 2020 SCAG RTP/SCS travel demand model (modeled year - 2019); Caltrans Performance Measurement System (PeMS[4]) (observed year - 2019)

3.4 SCAG SCS Policies Impacting VMT

SCAG's 2020 Connect SoCal RTP/SCS includes policies, programs, and projects aimed at reducing the use of passenger vehicles and overall GHG emissions associated with vehicle use to meet reduction targets specified in SB 375. While most of these policies, programs, and projects will not directly impact truck trips, there may be ancillary impacts due to goals to reduce auto VMT. As auto VMT is reduced but truck VMT stays the same, it will appear that truck VMT has increased because people will see fewer autos on the roads than trucks. The increase in rideshare and work-from-home opportunities and the rise in e-commerce and at-

[4] https://pems.dot.ca.gov/

home deliveries will change the ratio of auto to truck VMT and may result in changes to land use, where we see truck VMT increase in residential areas. Additionally, the goal to reduce auto VMT may result in a shift of funding prioritization from freeway projects to transit and bike and pedestrian capital projects within the region. Below is a summary of policies, programs, and projects (refer to the RTP/SCS for more details).

Pricing Strategies

- Mileage-based user fees (MBUF), which apply a 1.5-cent fee per mile to vehicle trips
    - Auto operating costs are projected to increase in future years independent of an MBUF application
- Job center parking fees increasing by 50 percent in 2025 within 16 job centers
- Area-based fees of $4 for trips entering downtown Los Angeles and West Lost Angeles
- Transportation Network Company (TNC) fee of $0.05 per mile starting in 2021
- Express Toll Lane expansion

Infrastructure Projects

- Express Toll Lane expansion
- New transit capital projects
- Improved bike and pedestrian infrastructure
- Multi-modal dedicated lanes

Travel Demand Management

- Telecommute policies for businesses, including co-working centers in Lake Elsinore, Temecula-Murietta, Downtown Riverside, Moreno Valley, and Corona
    - Work-from-home increases for future years were also projected before pandemic-influenced shifts
- Park and Ride locations
- Commute benefit ordinance in Los Angeles
- Rideshare
- Average vehicle ridership increases for job centers (21 job centers)

Virtual and Internet Policies

- Encouragement of telemedicine for virtual healthcare requiring no travel
- E-commerce encouragement to reduce passenger vehicle travel to retail areas

- Telecommute or work from home encouragement to reduce commuting impacts

Transit and Other Policies

- Parking deregulation in transit priority areas
- Micro-mobility and bike share around transit priority area (TPA) transit stations
- Safe routes to school

4 CAPACITY-DEFICIENT FREEWAYS

The RCTC Congestion Management Program defines the minimum Level of Service (LOS) thresholds for a freeway as LOS E. Deficient links in this study were defined as any freeway link exceeding a traffic volume to roadway capacity (V/C) ratio of 1.0, which are also categorized as LOS F. This study used the re-calibrated 2020 SCAG RTP/SCS travel demand model described in Section 3 as the source of information used to determine LOS. The SCAG model was run for the study base year 2019 to identify where current deficient segments are located. The second model run was for the horizon year 2045 and accounted for the SCAG land use, population, and employment growth but held roadway and transit improvements constant from 2019. The second model run assessed the change and increase in deficient segments.

4.1 Existing Deficiencies (Modeled 2019)

Riverside County traffic continued to grow from 2016 to 2019[5], showing similar overall congestion locations to the previous study along SR 91 west of I-15 in Corona and east of I-15, and along the I-215 / SR 60 path near UC Riverside (UCR). Where locations are similar between the previous study and the current study update, the extent of the congestion has grown in most locations. Additional congestion locations were identified along I-15 in southern Corona and Temecula. The congestion maps also identify segments that are at the minimum LOS threshold of LOS E, shown in orange in the following maps. While these are not identified as deficiencies, they are notable areas to watch for future issues. Areas such as through the San Gorgonio Pass, Coachella Valley, and towards the County and State Line in Blythe are relatively congestion-free. The LOS E segments through the cities of Banning and Beaumont and through the San Timoteo Badlands are a product of an issue[6] in the SCAG model that was unable to be resolved for this study but is no longer present in the 2024 SCAG RTP/SCS model version.

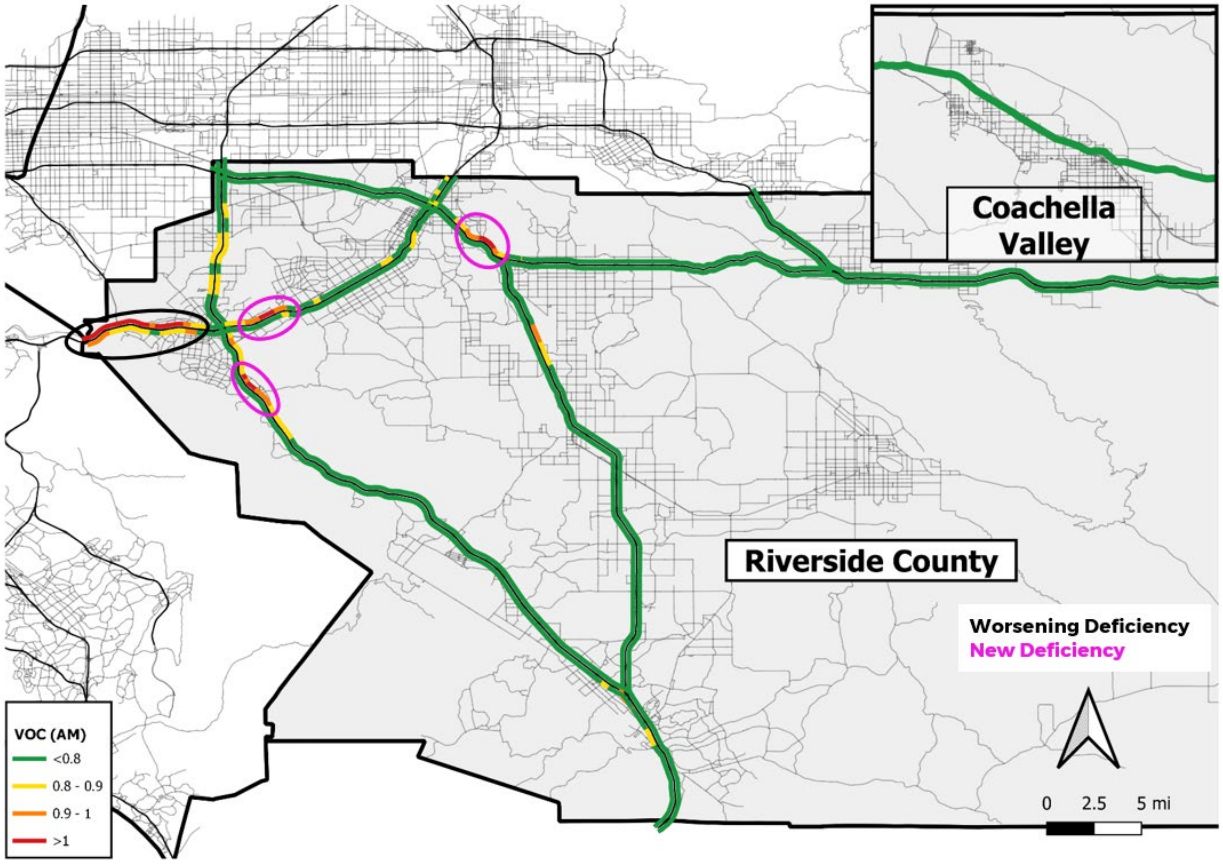
4.1.1 AM Peak Existing Deficiencies (Modeled 2019)

AM congestion, shown in Figure 4-1, previously was only seen on SR 91 WB west of I-15 in Corona. Previously identified deficiencies in the figure are highlighted by black circles. The 2019 model run analysis identifies four locations of deficiency, with new locations highlighted by pink circles:

1) Extended congestion conditions on WB SR 91 through Corona
2) I-215 / SR 60 westbound near UCR
3) I-15 northbound in southern Corona
4) SR 91 westbound just east of I-15

[5] The previous study adopted in 2019 used 2016 as the study current year, and this study uses 2019 as the current year.
[6] Model issue not present in 2045 model runs.

Figure 4-1: 2019 AM Peak Congestion



4.1.2 PM Peak Existing Deficiencies (Modeled 2019)

PM congestion, shown in Figure 4-2, has more deficient locations than AM congestion. As compared to the previous study, similar congestion locations are noted in black circles in the figure:

1) SR 91 in both eastbound and westbound directions through Corona
2) Small congestion pockets on SR 91 in both eastbound and westbound directions just east of I-15
3) I-215 / SR 60 westbound and eastbound near UCR

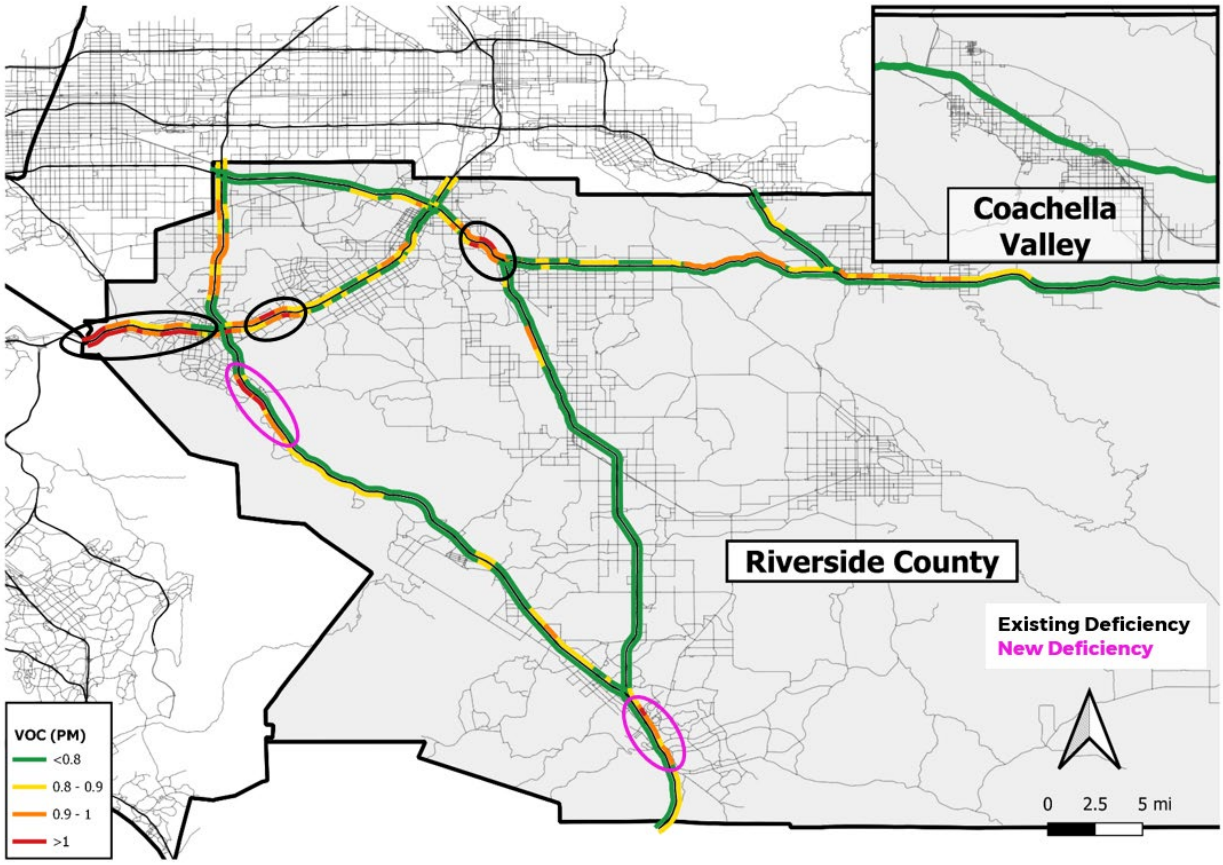
Additional deficiencies are noted in pink circles in the figure, and all differences between the previous study and the current study update are as follows:

1) Added: I-15 southbound through southern Corona
2) Added: I-15 northbound near the I-215 Interchange

3) Removed: I-15 in Jurupa Valley
4) Removed: I-215 near the Riverside / San Bernardino County line

The areas where a deficiency was removed still have higher LOS values with deteriorated service; they are just not deemed deficient.

Figure 4-2: 2019 PM Peak Congestion



4.2 Future Deficiencies (Modeled 2045)

The 2020 SCAG RTP/SCS travel demand model was applied to the horizon year 2045 where land use, population, and employment followed the SCAG forecast, but roadway networks were held at the study base year of 2019. Controlling the model inputs in this way provides insights as to where congestion deficiencies may occur without additional infrastructure improvements. Infrastructure projects that were completed between 2019 and the current year of 2024, such as the I-15 Express Lanes through the cities of Corona and Norco, were not included in the modeling but were considered during the analysis. Congestion deficiencies where Express Lanes were built were not included in the deficient segment list.

The 2019 to 2045 growth of land use, population, and employment resulted in an increase in Riverside County freeway traffic, specifically a passenger car VMT increase of 14 percent and a truck VMT increase of 72 percent.

Congested areas were generally in similar locations as the previous study but expanded and worsened. Additional congestion locations were identified along I-15 in southern Corona, along I-15 between Lake Elsinore and the Riverside County line, and along I-215 between I-15 and SR 60. The congestion maps also identify segments that are at the minimum LOS threshold of LOS E, shown in orange in the following maps. While these are not identified as deficiencies, they are notable areas to watch for future issues. The freeway sections through the San Gorgonio Pass, in Coachella Valley, and towards the County / State line are relatively congestion-free.

4.2.1 AM Peak Future Deficiencies (Modeled 2045)

Future 2045 AM peak congestion is shown in Figure 4-3. The black circles show the deficiency locations identified in the previous study:

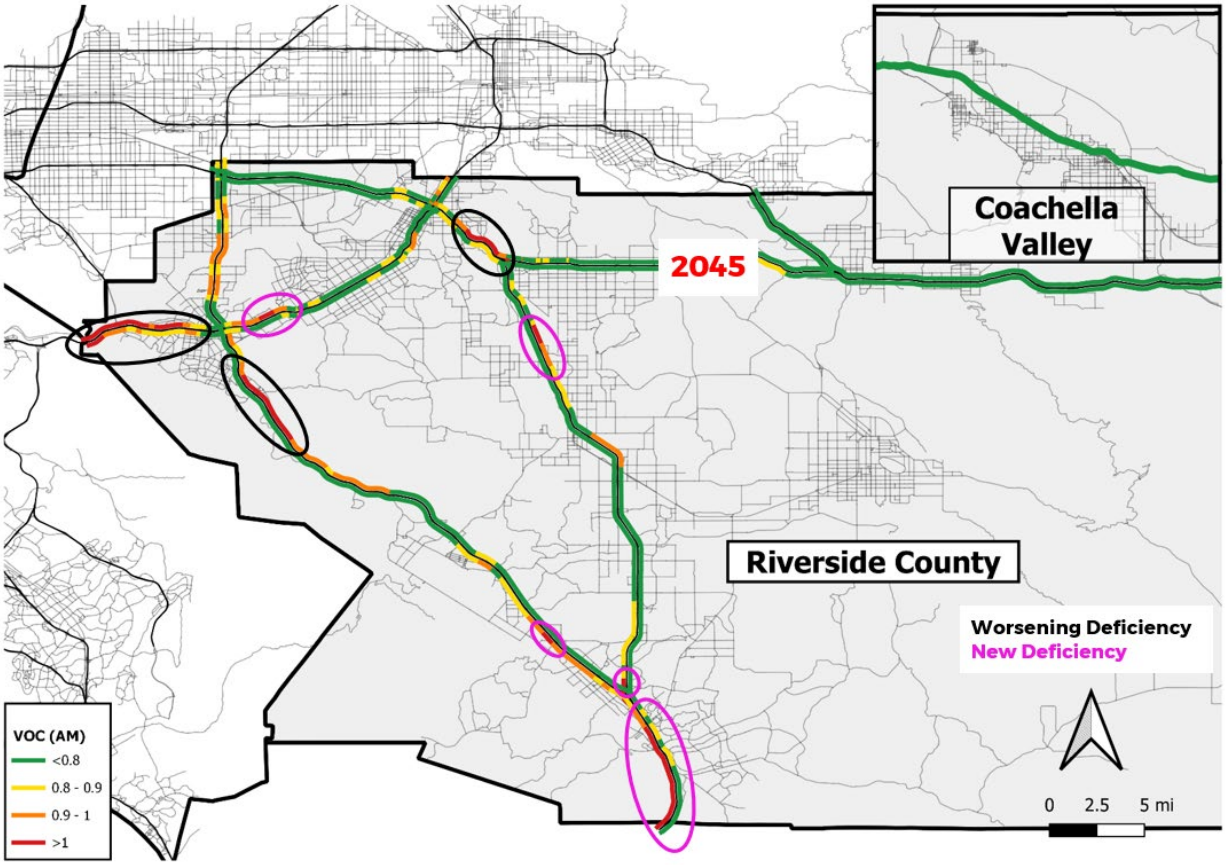
1) SR 91 west of I-15
2) I-15 in south Corona, expanded from a small section to a much larger length
3) I-215 just west of the I-215/SR 60 interchange

While these locations were previously identified, the extent of the congestion increased. Extended congestion conditions are located on I-215 / SR 60 westbound near UCR, I-15 northbound in southern Corona, and SR 91 northbound through Corona.

The current study update identifies five additional locations of deficiency as shown in the pink circles in Figure 4-3.

1) I-215
    a. I-215 northbound near March ARB
    b. I-215 southbound in Murrieta at the I-15 interchange
2) I-15 southbound
    a. The majority of the southbound freeway in Temecula and down to the Riverside County Line
    b. A small section of deficiency in Wildomar
3) SR 91 westbound just east of I-15

Figure 4-3: 2045 AM Congestion



4.2.2 PM Peak Future Deficiencies (Modeled 2045)

Future 2045 PM peak congestion is shown in Figure 4-4. The black circles show the deficiency locations identified in the previous study. While these locations were previously identified, the extent of the deficiency is typically greater in this study update.

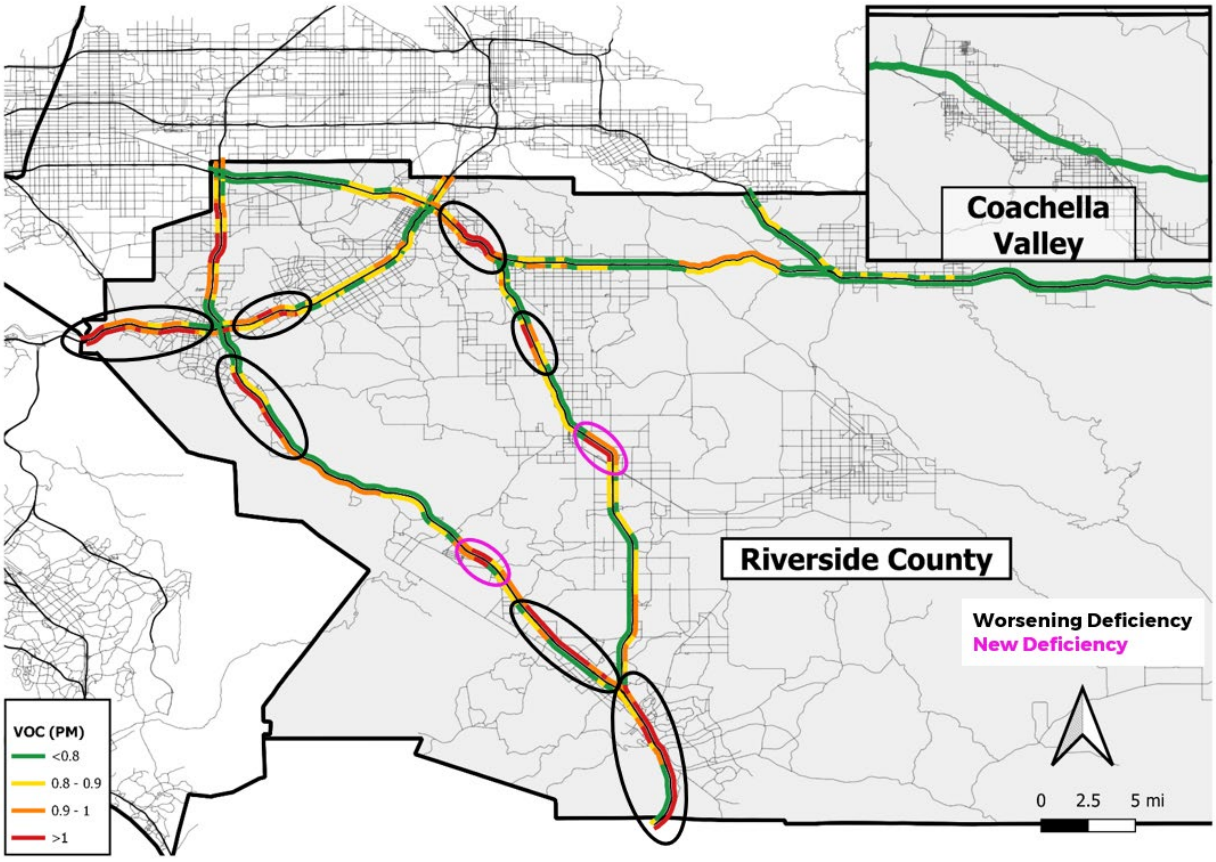
1) I-215 just west of the I-215/SR 60 interchange
2) I-215 northbound near March ARB
3) I-15
    a. Southbound in south Corona
    b. Northbound in Temecula
    c. Northbound in Murrieta and Wildomar

4) SR 91
    a. West of I-15
    b. Just east of I-15
5) Removed: I-15 in Jurupa Valley – this still shows as a deficiency in the model due to not including new infrastructure projects along this section of roadway
6) Removed: I-215 near the Riverside / San Bernardino County line
7) Removed: SR 60 near I-215/SR 60/SR 91 interchange

The current study update identifies two additional locations of deficiency as shown in the pink circles in Figure 4-3

1) I-215 southbound in Perris
2) I-15 in Lake Elsinore

Figure 4-4: 2045 PM Congestion



4.3 Capacity Deficient Freeway Segments

Combining the horizon year 2045 deficient freeway segments from AM and PM peaks in Sections 4.2.1 and 4.2.2 provided a collective list of segments for congestion mitigation. Table 4-1 presents the list of segments broken out by freeway, direction, and relative start and end points with each segment labeled with a Project ID. The segments are mapped in Figure 4-5 and Figure 4-6 using the Project ID notation. These same segments are used later in Section 6 to determine the extent of logistic center impacts on freeway deficiencies.

Table 4-1: Capacity Deficient Segments on Riverside County Freeways

Name	Direction	Start	End	Project ID
I-15	NB	Temescal Canyon Rd	Cajalco Rd	1A
		Cajalco Rd	E Ontario Ave	1B
		Railroad Canyon Rd	N Main St	3A
		Murrieta Hot Springs Rd	Kalmia St	5A
		California Oaks Rd	Bandy Canyon Rd	5B
		Rainbow Valley Blvd (County Line)	I-215	7A
	SB	E Ontario Ave	Cajalco Rd	2A
		Cajalco Rd	Weirick Rd	2B
		Weirick Rd	Temescal Canyon Rd	2C
		N Main St	Railroad Canyon Rd	4A
		Wildomar Trail	Clinton Keith Rd	6A
		Winchester Rd	Rainbow Valley Blvd (County Line)	8A
I-215	NB	SR 60 Interchange	University Ave	9A
		Harley Knox Blvd	Van Buren Blvd	11A
		I-15	Murrieta Hot Springs Rd	15A
	SB	MLK Blvd	Fair Isle Dr	10A
		SR 60 Interchange	SR 60 Interchange	10B
		Van Buren Blvd	Harley Knox Blvd	12A
		Redlands Ave	Hwy 74	14A
		North of Murrieta Hot Springs Rd	Date St	16A
SR-91	EB	Riverside County Line West	SR 71	17A
		SR 71 East Ramp	Serfas Club Dr	17B
		W 6th St Ramp	Lincoln Ave	17C
		S Lincoln Ave	W Grand Blvd	17D
		I-15	S Promenade Ave	19A

Name	Direction	Start	End	Project ID
		Magnolia Ave	La Sierra Ave	19B
	WB	S Lincoln Ave	Auto Center Dr	18A
		Auto Center Dr	Riverside County Line	18B
		Buchanan St	McKinley St	20A

Figure 4-5: Freeway Deficiency Locations, Northwest Riverside County

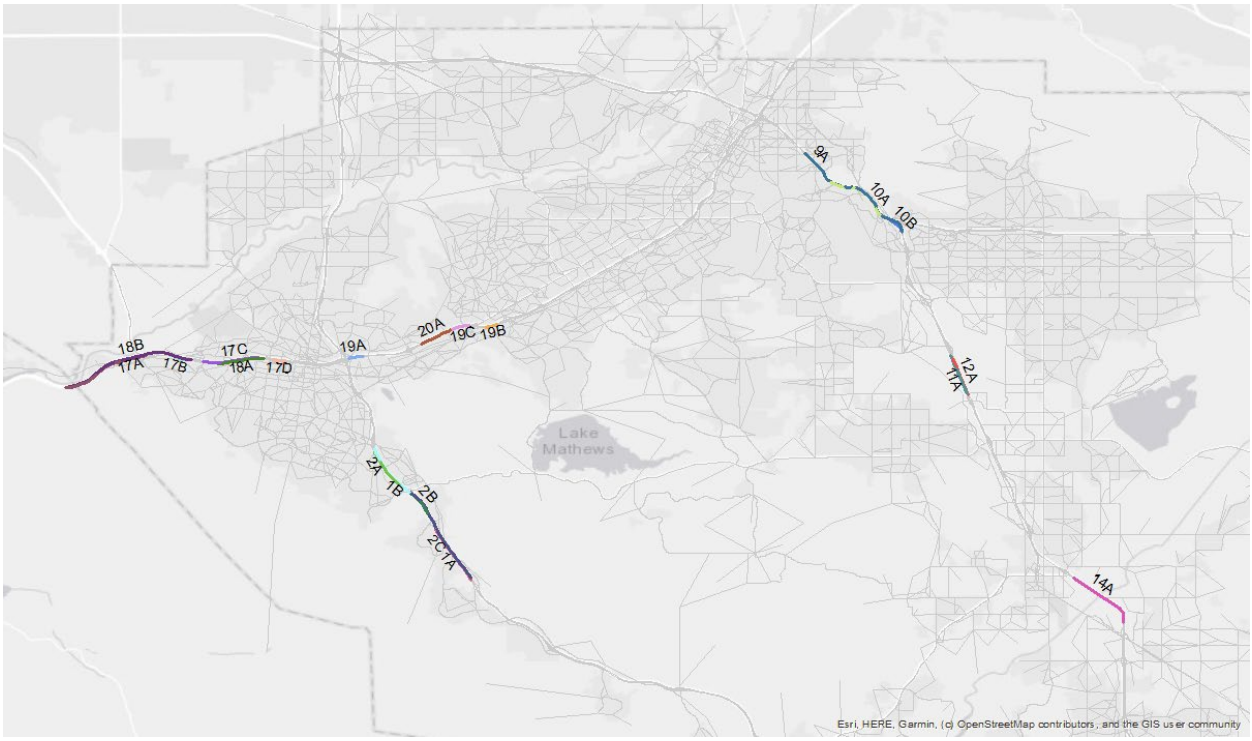


Figure 4-6: Freeway Deficiency Locations, Southwest Riverside County

5 IMPACT OF TRUCKS ON RIVERSIDE COUNTY FREEWAYS

Logistic center development impacts are better understood after understanding the context of overall truck impacts on Riverside County Freeways. This section will analyze the number of trucks traveling on area freeways, the percentage of trucks in comparison to passenger cars, and the amount of truck VMT. The original study did not analyze LHDT and MHDT in its discussion of truck impacts. This analysis provides an additional layer of potential impacts beyond the freeways identified as deficient in Section 4 - Capacity-Deficient Freeways. Large numbers of trucks on a roadway may warrant pavement improvements or reinforcements to specific lanes and/or interchange and ramp reconfigurations. Passenger vehicle versus truck ratios can also identify where safety improvements may be needed to resolve potential conflicts.

5.1 TRUCK DEFINITIONS

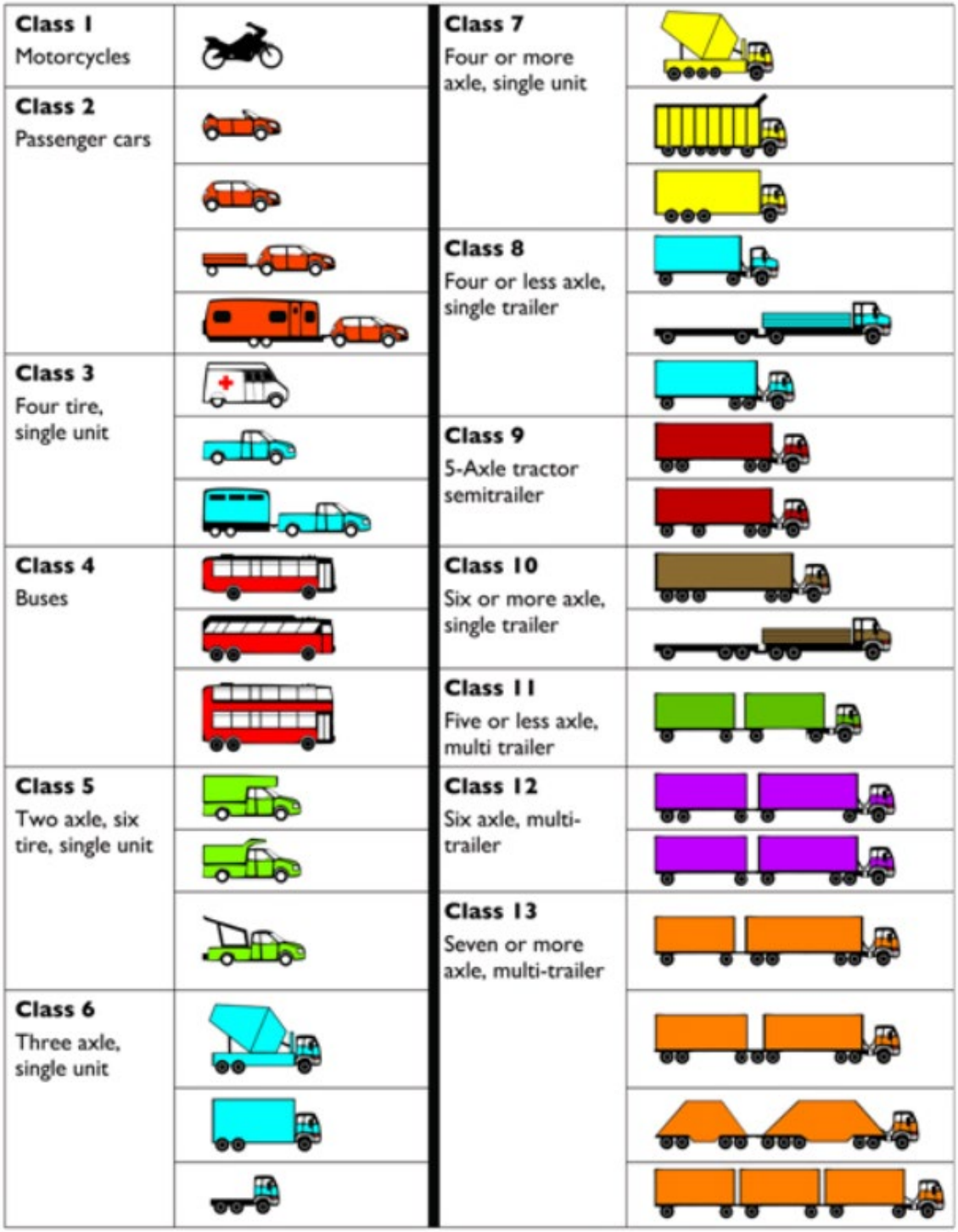
Before discussing truck volumes and truck percentages, it is important to understand what a truck is. There are multiple ways of defining truck and vehicle classifications, such as by the number of axels, by truck weight categories, or by the overall look and configuration of the truck and trailer type. The SCAG ABM links their modeled truck classes to the CARBs emission software EMFAC[7], which uses truck weight categories based on the truck emission profiles. CARB weight classes are categorically named LHDT, MHDT, and HHDT. The truck weights are grouped by gross vehicle weight rating and are shown in Table 5-1. FHWA vehicle classes, shown in Figure 5-1, do not precisely conform to weight categories as there are a mixture of axels and truck configurations within a truck weight class category, leading to overlapping FHWA classes assigned to each weight class category.

Table 5-1: SCAG Truck Categories

Truck Weight Class Category	Gross Vehicle Weight Rating (lbs.)	Equivalent FHWA Vehicle Classes
LHDT	8,501 to 14,000	3, 5
MHDT	14,001 to 33,000	5-8
HHDT	over 33,000	7-13

[7] https://arb.ca.gov/emfac/ The model name “EMFAC” is derived from the term EMission FACtor

Figure 5-1: FHWA 13 Vehicle Category Classification



Source: FHWA[8]

[8] https://www.fhwa.dot.gov/policyinformation/tmguide/tmg_2013/vehicle-types.cfm

5.2 Truck Flows

One of the primary outputs of the SCAG travel demand model are the flows, or volumes, of vehicles assigned to each roadway. Traffic flows are assigned by vehicle class, and trucks are assigned using the truck classes described in the last section in Table 5-1. Maps can be utilized to visualize the impacts of each individual vehicle class, helping understand the magnitude of truck flow impacts. This section reviews where truck flows are the highest for 2019 and 2045 and compares the difference between the two years.

5.2.1 Existing Truck Flows (Modeled 2019)

Daily truck flows for year 2019 are shown in Figure 5-2 for western Riverside and Figure 5-3 for eastern Riverside. Daily bi-directional freeway truck flows are depicted in a variety of colors, with yellow, teal, and medium blue segments representing lesser truck flows and darker blue, purple, and black representing greater truck flows. Each color classification represents a range of 5,000 trucks. Significant truck flows are seen on I-10 through the San Gorgonio pass, on the chronically congested location of I-215/SR 60 near UCR, on SR 60 towards Ontario, and SR 91 through Corona.

Figure 5-2: Daily Truck Flows in Western Riverside (2019)

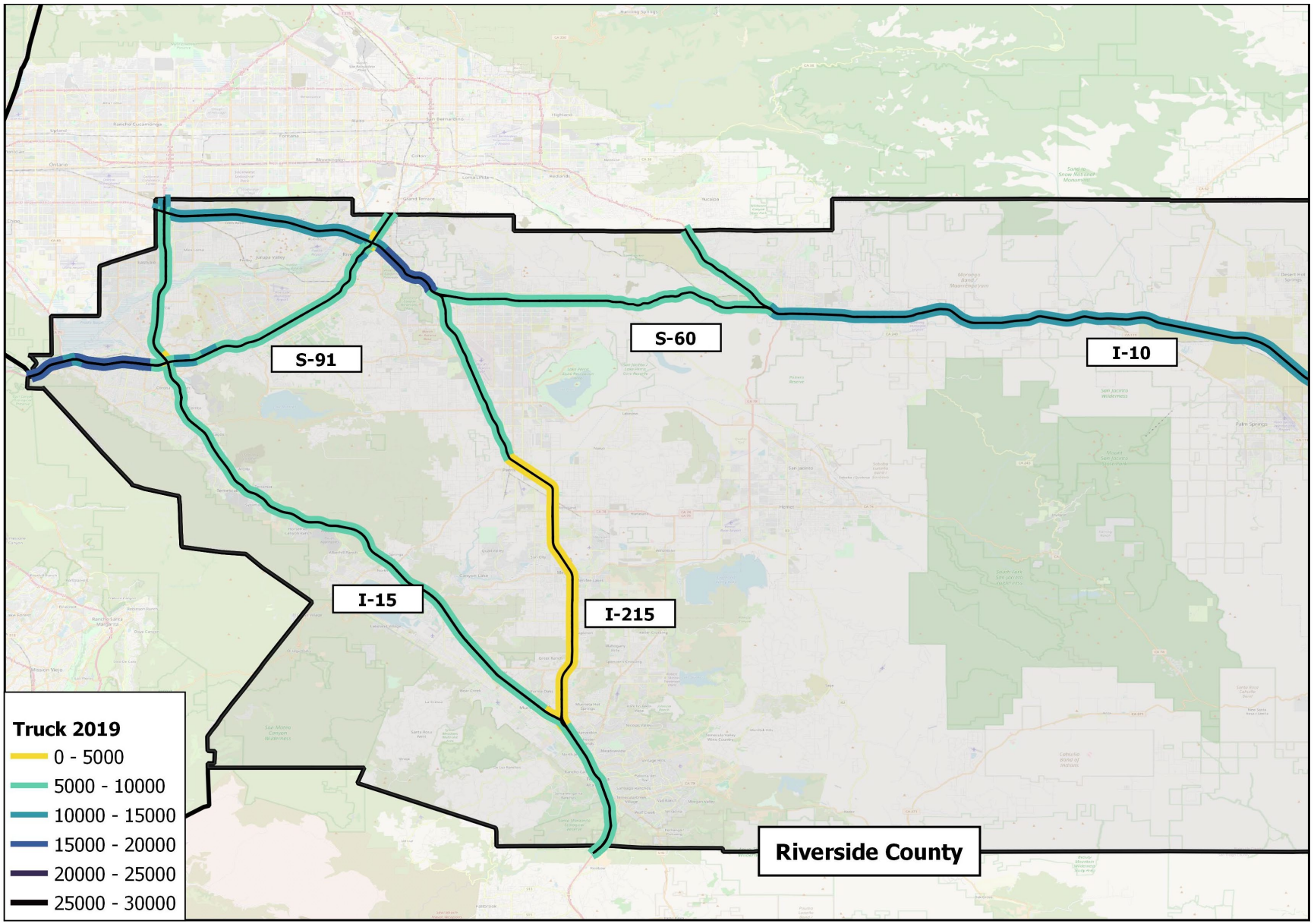
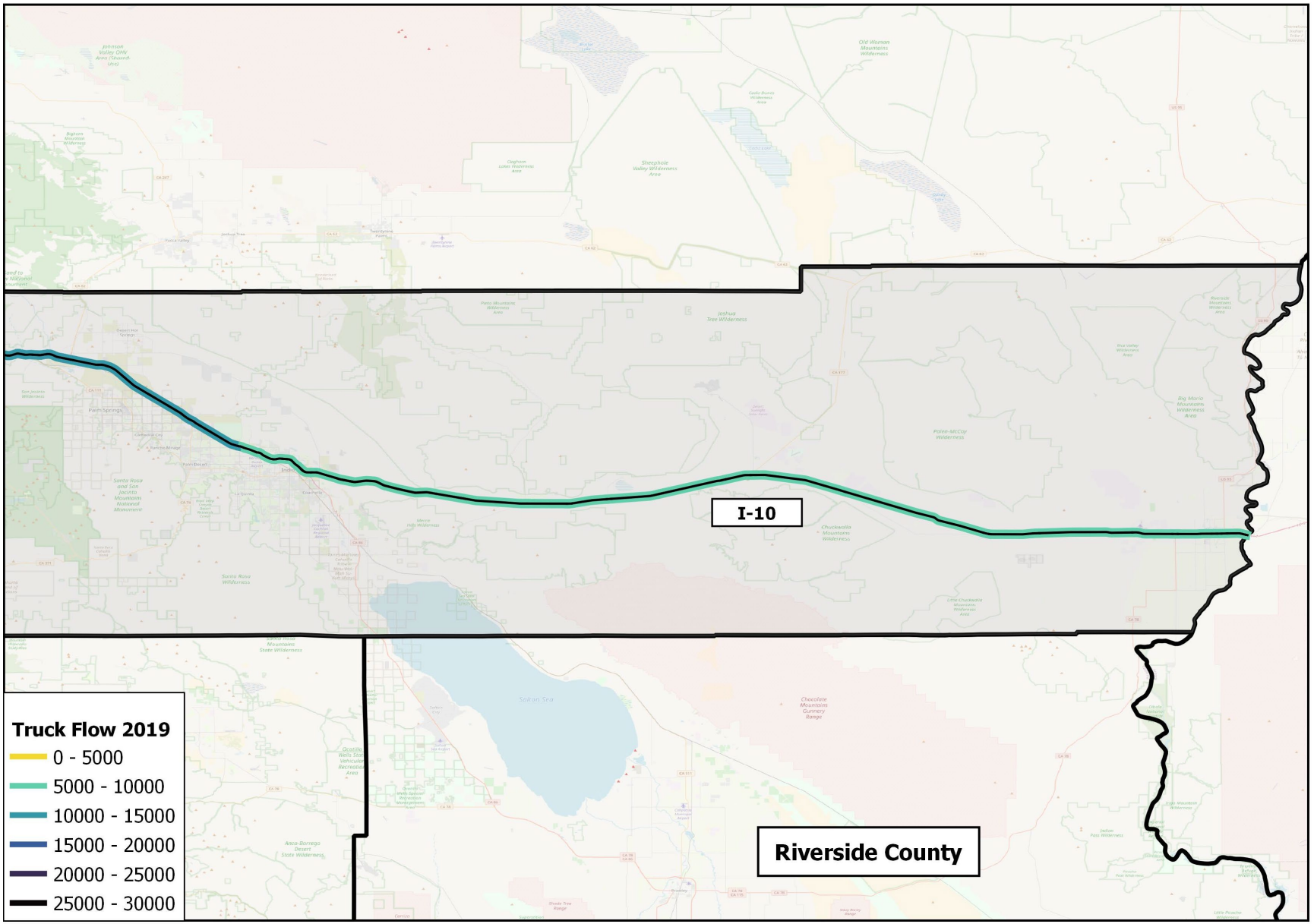


Figure 5-3: Daily Truck Flows in Eastern Riverside (2019)



5.2.2 Future Truck Flows (Modeled 2045)

Daily truck flows for year 2045 are shown in Figure 5-4 for western Riverside and Figure 5-5 for eastern Riverside. Daily bi-directional freeway truck flows are depicted in a variety of colors, with yellow, teal, and medium blue segments representing lesser truck flows and darker blue, purple, and black representing greater truck flows. Each color classification represents a range of 5,000 trucks. Like the 2019 truck flows in the previous section, significant truck flows are seen on I-10 through the San Gorgonio pass, on the chronically congested location of I-215/SR 60 near UCR, on SR 60 towards Ontario, and on SR 91 through Corona.

Figure 5-4: Daily Truck Flows in Western Riverside (2045)

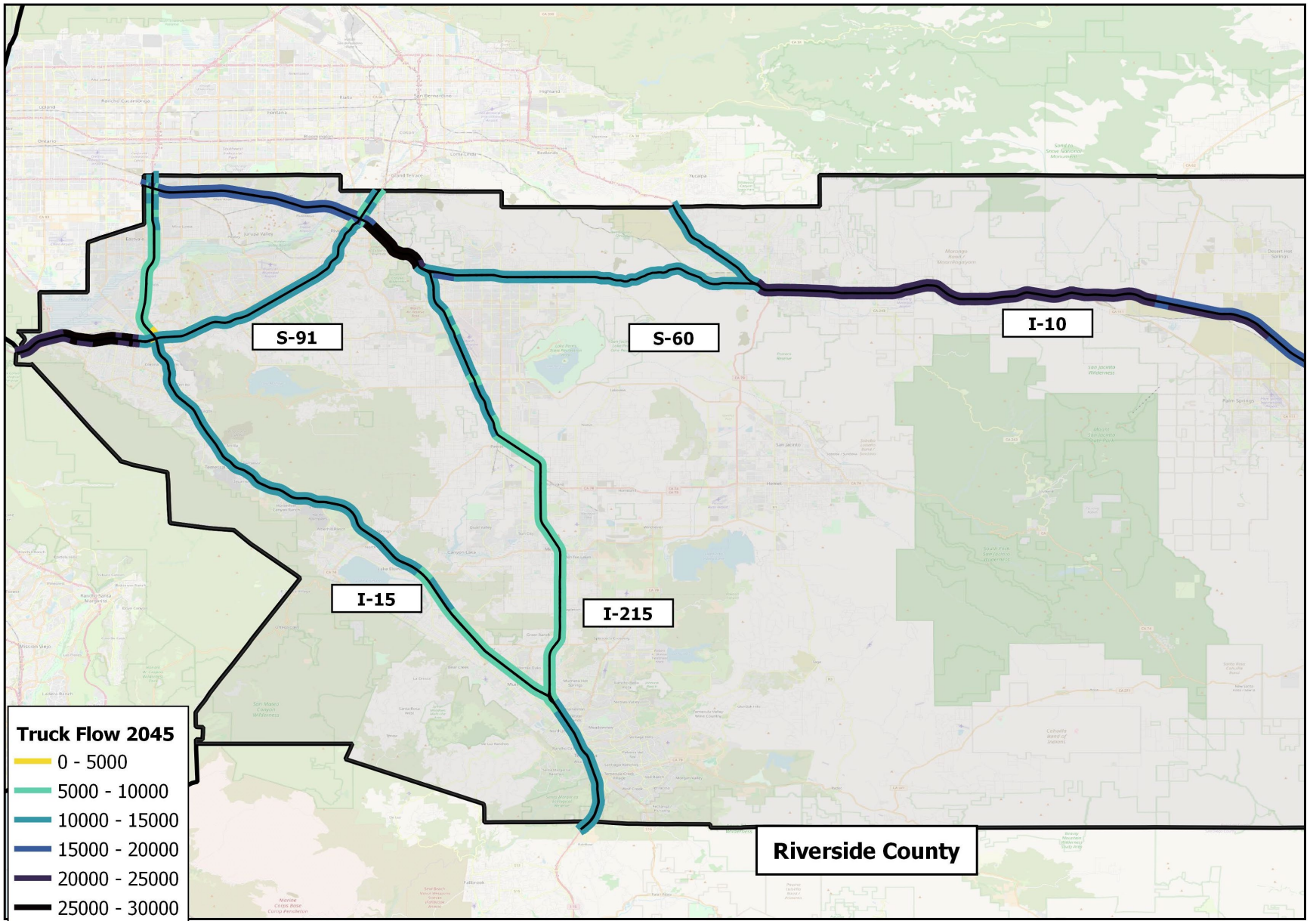
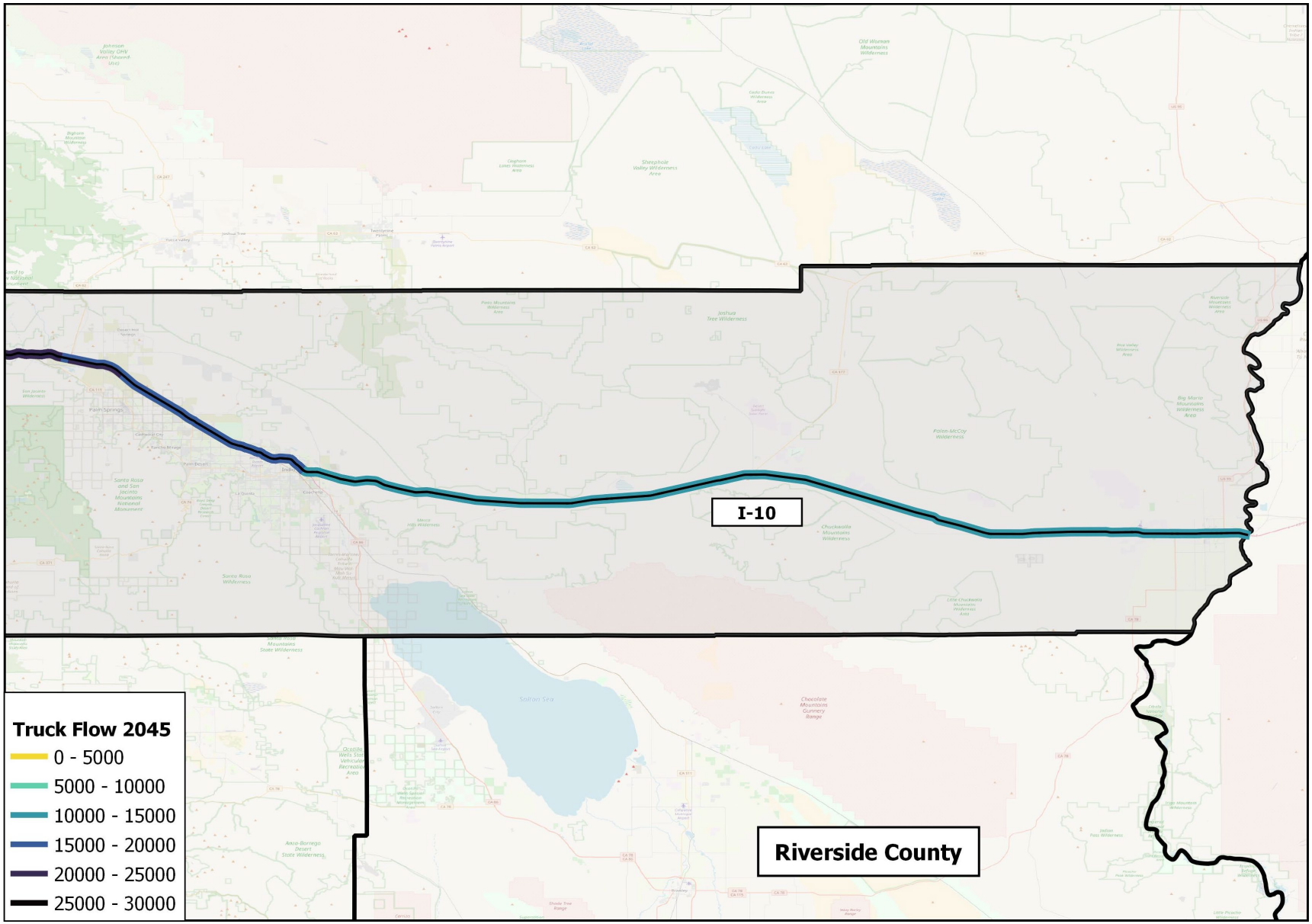


Figure 5-5: Daily Truck Flows in Eastern Riverside (2045)



5.2.3 Truck Flow Growth (Modeled 2019 – 2045)

The magnitudes of truck flows analyzed in the previous two sections indicate where there may be impacts from the volume of trucks on freeways. In this Section, the difference in truck flows is shown in Figure 5-6 for western Riverside County and in Figure 5-7 for eastern Riverside County, demonstrating where truck volumes are growing the most. Daily bi-directional freeway truck flows are shown ranging from yellow segments, indicating lower truck volume growth, to purple segments, showing higher truck volume growth. Each color classification represents a range of 2,500 trucks. Higher growth in external truck flows across the California state line are seen influencing I-10 in eastern Riverside County but also in western Riverside County across SR 60 and I-10 to/from San Bernardino County. The highest growth is seen on I-10 through Coachella Valley and the San Gorgonio Pass, on the chronically congested location of I-215/SR 60 near UCR, and on SR 91 through Corona.

Truck VMT is a measure of the total miles traveled by trucks and is calculated by multiplying the number of trucks on a freeway link by the length of that link. Adding together the totals for each freeway link provides the VMT for the region. Figure 5-6 and Figure 5-7 show high truck volume growth along with long roadway lengths, significantly contributing to the overall truck VMT growth in the region. However, while high truck volume growth on long roadway segments substantially contributes to overall truck VMT growth, all truck volume growth still adds to truck VMT growth.

Figure 5-6: Growth in Western Riverside Daily Truck Flows (2019-2045)

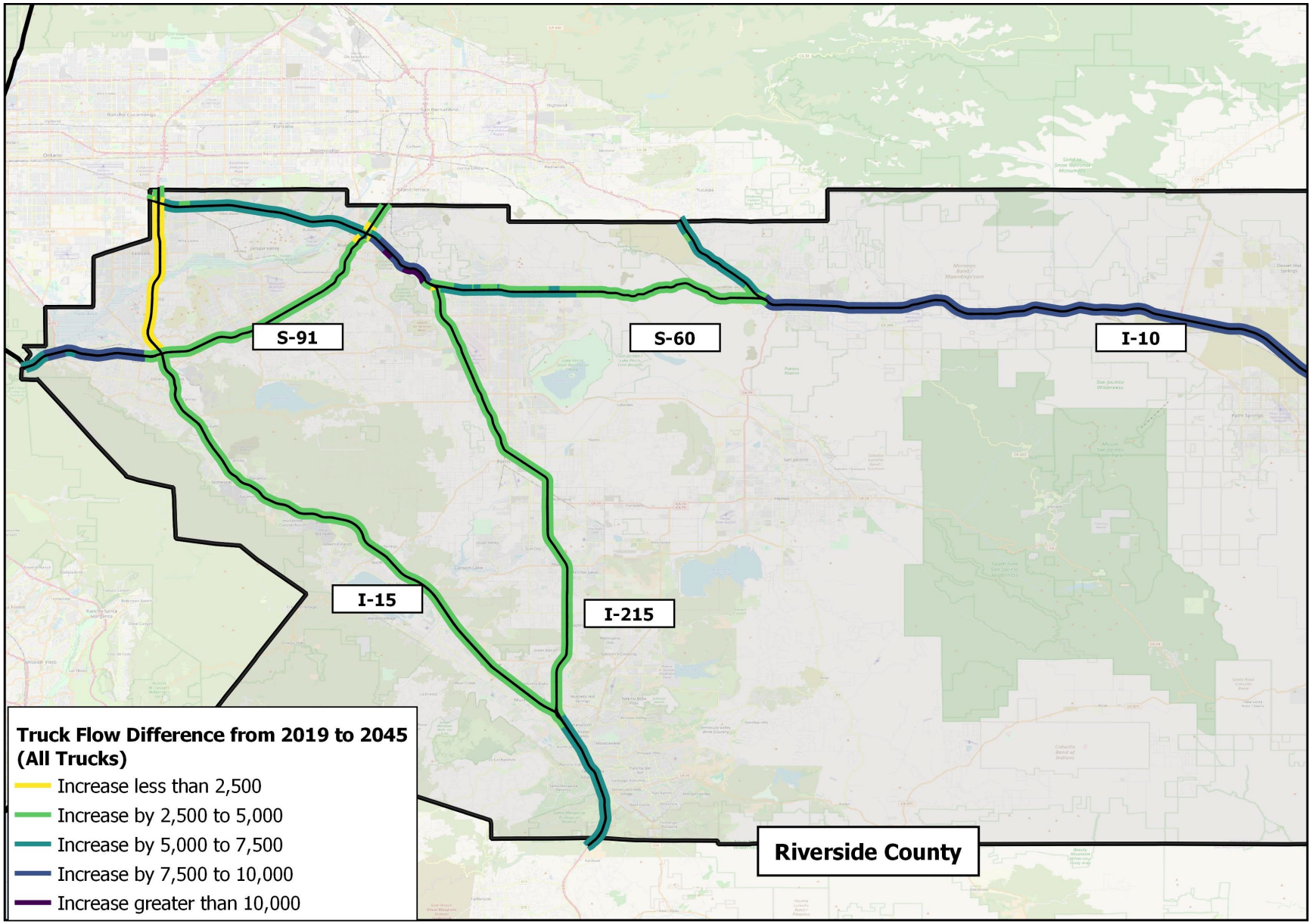
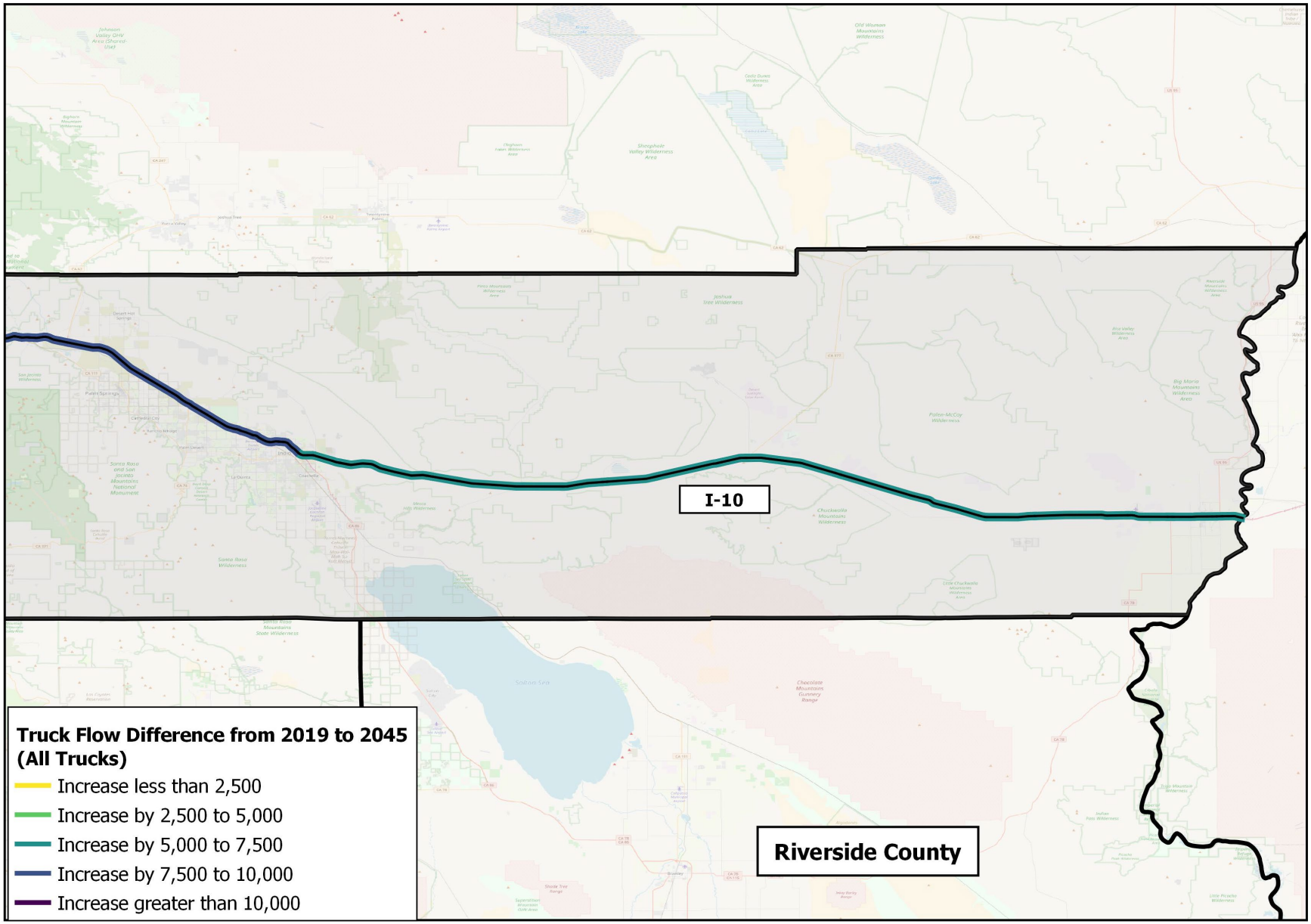


Figure 5-7: Growth in Eastern Riverside Daily Truck Flows (2019-2045)



The total truck flow differences shown in Figure 5-6 and Figure 5-7 are made up of LHDT, MHDT, and HHDT flows. The following two sections break out the truck types to provide more details.

LHDT and MHDT Flow Growth (Modeled 2019-2045)

LHDT and MHDT growth in western Riverside is shown in Figure 5-8 and in eastern Riverside is shown in Figure 5-9. Nearly every freeway in Riverside County shows low truck volume growth, as indicated by the segments in yellow, except near the Riverside-San Diego County line. LHDTs tend to be more locally serving and, therefore, have a greater impact on arterials than freeway segments. A key consideration is that e-commerce impacts on local truck logistics are an area SCAG is exploring to improve in their TDM.

HHDT Flow Growth (Modeled 2019-2045)

Figure 5-10 and Figure 5-11 show the HHDT growth in western Riverside County and eastern Riverside County, respectively. Daily bi-directional freeway truck flows range from low truck volume growth in yellow, to high truck volume growth in purple. Each color classification represents a range of 2,500 trucks.

Higher growth in external truck flows across the California state line influences I-10 in east Riverside County and in western Riverside across SR 60 and I-10 to/from San Bernardino County. The highest growth is seen on I-10 through Coachella Valley and the San Gorgonio Pass and on the chronically congested location of I-215/SR 60 near UCR.

Figure 5-8: Growth in Western Riverside LHDT/MHDT Daily Truck Flows (2019-2045)

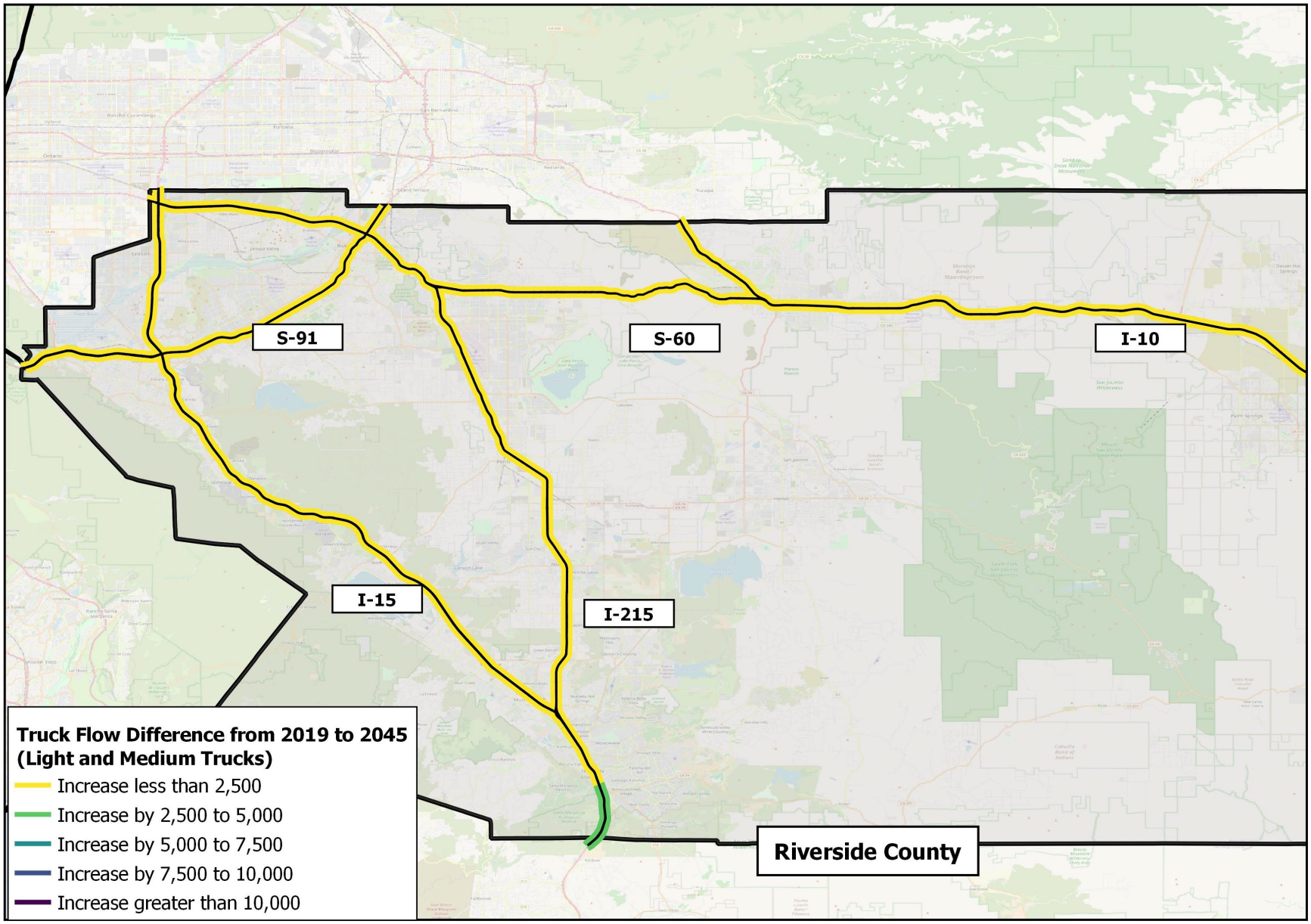


Figure 5-9: Growth in Eastern Riverside LHDT/MHDT Daily Truck Flows (2019-2045)

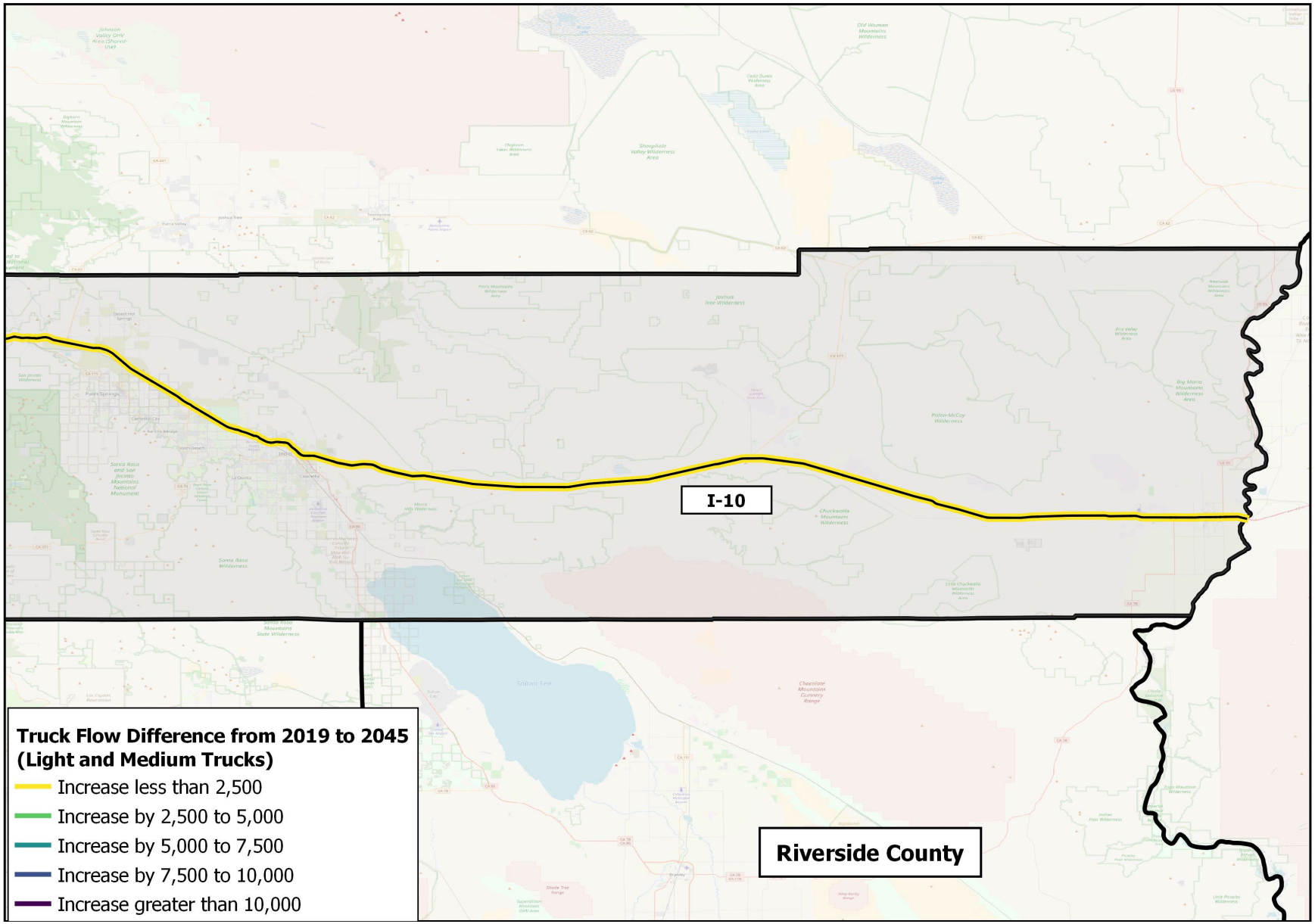


Figure 5-10: Growth in Western Riverside HHDT Daily Truck Flows (2019-2045)

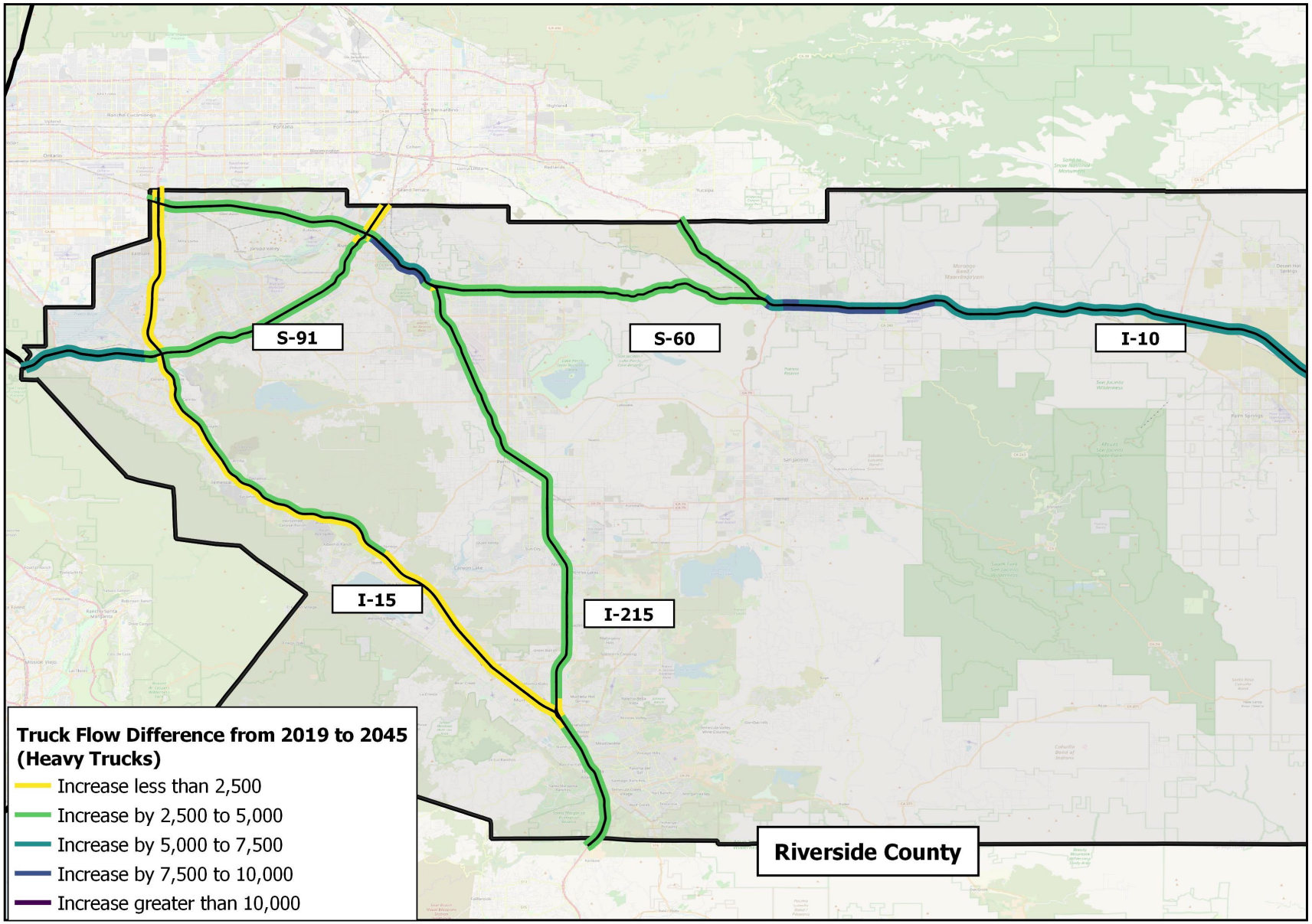
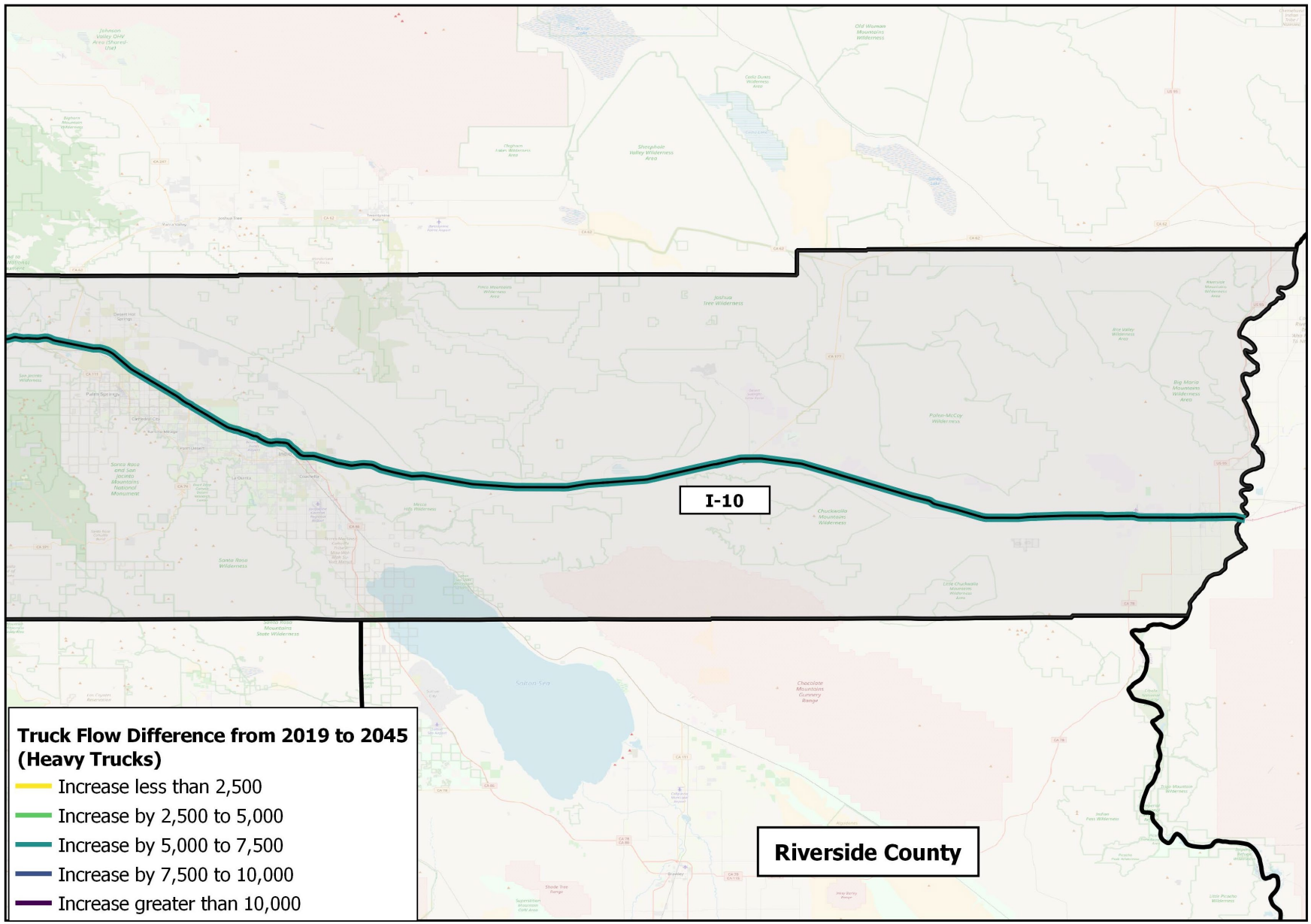


Figure 5-11: Growth in Eastern Riverside HHDT Daily Truck Flows (2019-2045)



5.3 Truck Percentages

Section 4, Capacity-Deficient Freeways, provided insights as to where there were freeway deficiencies based on traffic volumes from both passenger vehicles and trucks. However, on freeway sections not identified as deficient, the absence of traffic congestion does not negate all substantial impacts imparted by trucks. The Riverside County freeway system and the percentage of trucks to overall traffic volume is shown in Figure 5-12 for current year 2019. In the figure, along the dark green line, there is a lower percentage of trucks to the overall volume. As the color scale changes to dark red, the percentage of trucks increases. The majority of western Riverside County is between ten to thirty percent trucks. However, in eastern Riverside County, closer to the border with Arizona, there are greater percentages of trucks on I-10. On these roadway sections, there may be other impacts beyond congestion-related impacts that may need to be addressed. Roadway modifications may include design changes to reduce the conflicts between trucks and automobiles, pavement reinforcements, and/or roadway interchange design changes.

Figure 5-12: Truck Volume Percentages on Riverside County Freeways (2019)

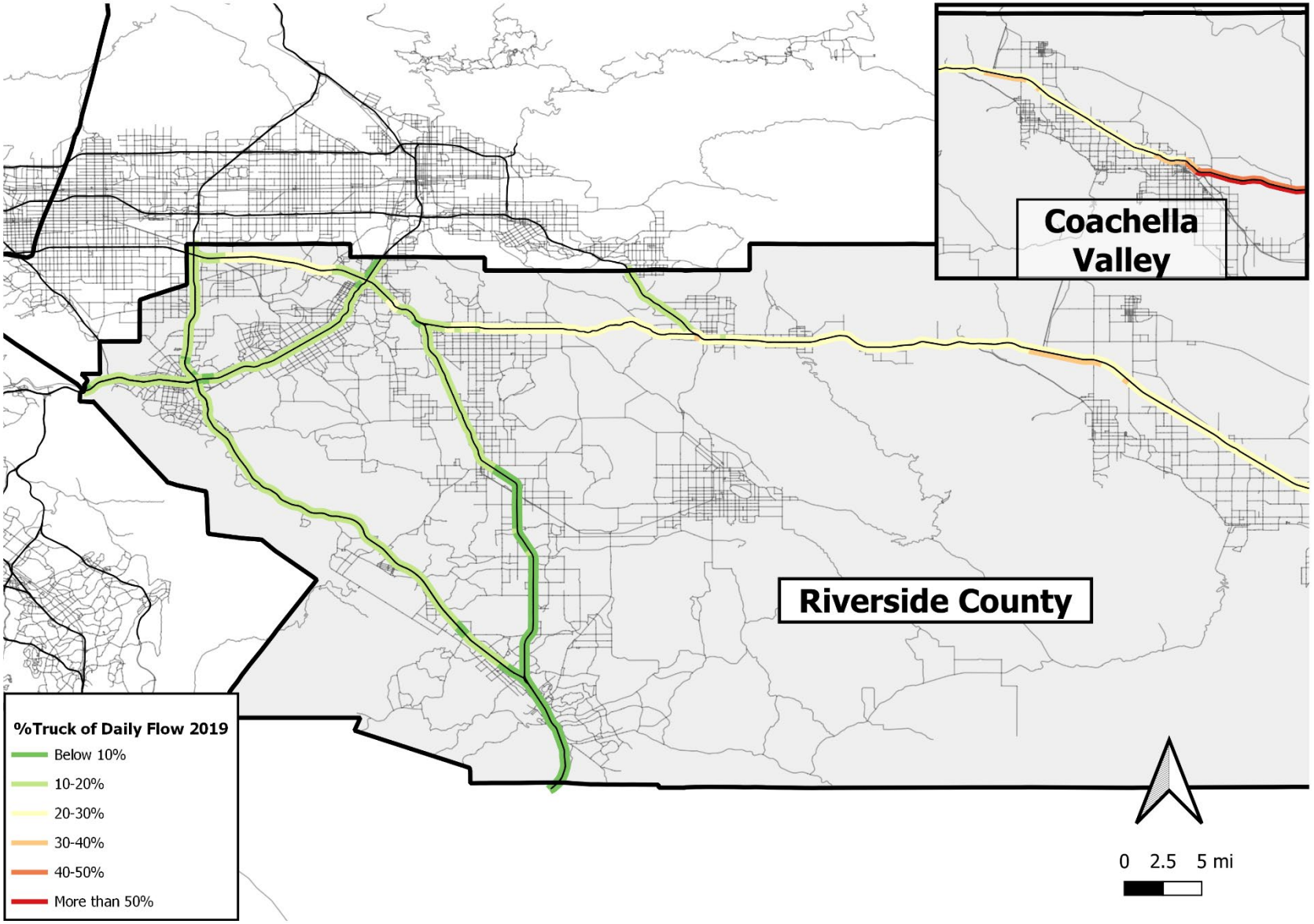
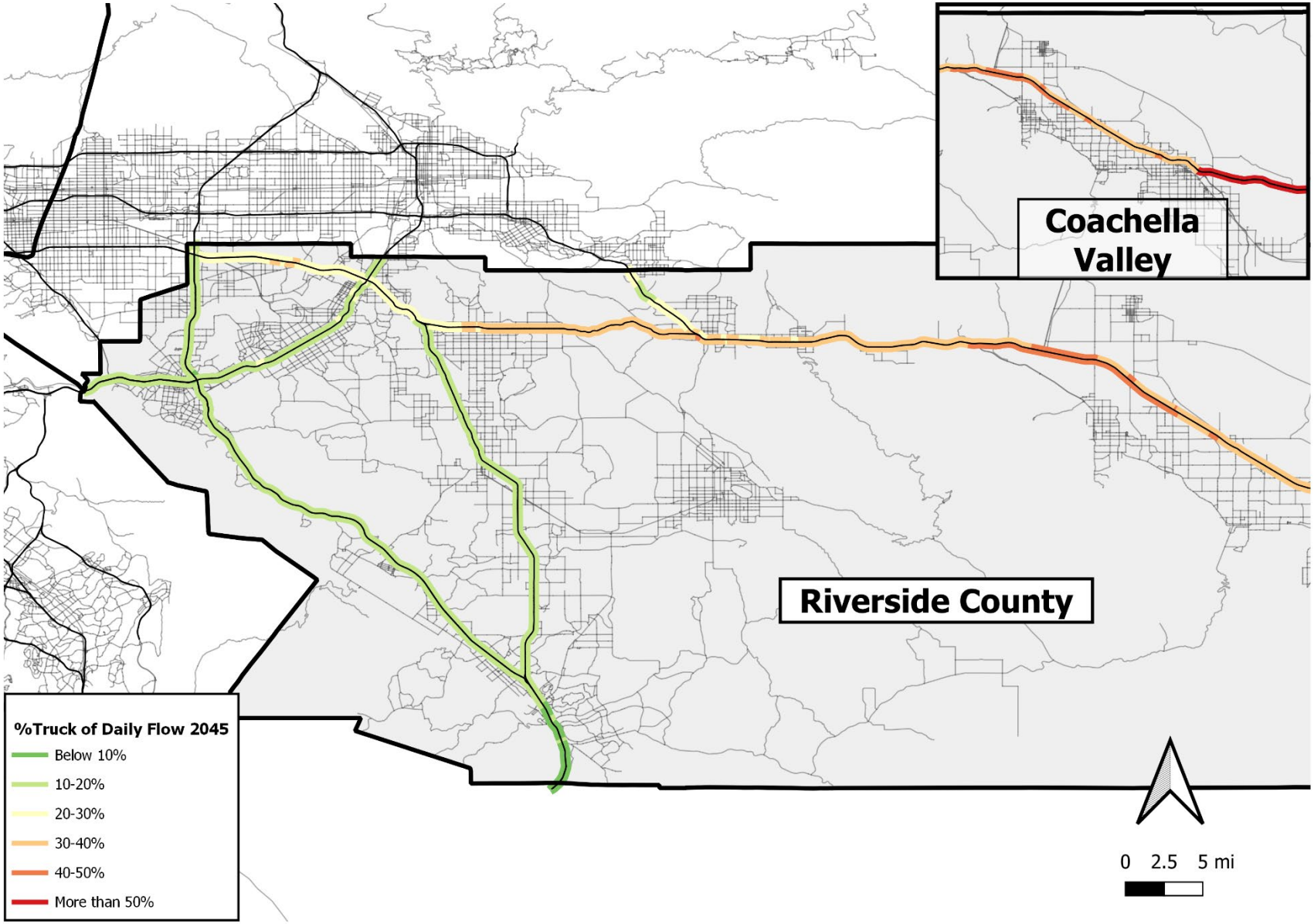


Figure 5-13 shows the truck volume percentages of daily flow for future year 2045. In comparison to the current year, 2019, we see larger percentages of trucks along key freeways traversing from the Riverside / Arizona state line, across I-10 through the Coachella Valley and San Gorgonio Pass and continuing across SR 60 into Moreno Valley and Ontario. For the western portion of Riverside County, warehousing growth in the County and correlated increase in trucks from 2019 to 2045 offset county population growth, resulting in similar truck volume percentages. As mentioned previously, SCAG includes future VMT policies that aim to reduce the amount of auto vehicle miles traveled to hit GHG emission targets set by CARB within the SCAG RTP. These policies would influence auto travel more than truck travel and potentially result in increases in the truck volume percentage. Regardless, there is an increase in truck flows in the future, and there will be a continual increase in conflicts between auto and truck traffic in areas that may not have specific capacity deficiencies.

Figure 5-13: Truck Volume Percentages on Riverside County Freeways (2045)



5.4 TRUCK VMT

Truck VMT are the byproduct of truck trips generated from and destined to land uses within Riverside County and through Riverside to or from surrounding areas. The analysis in this section provides a viewpoint of:

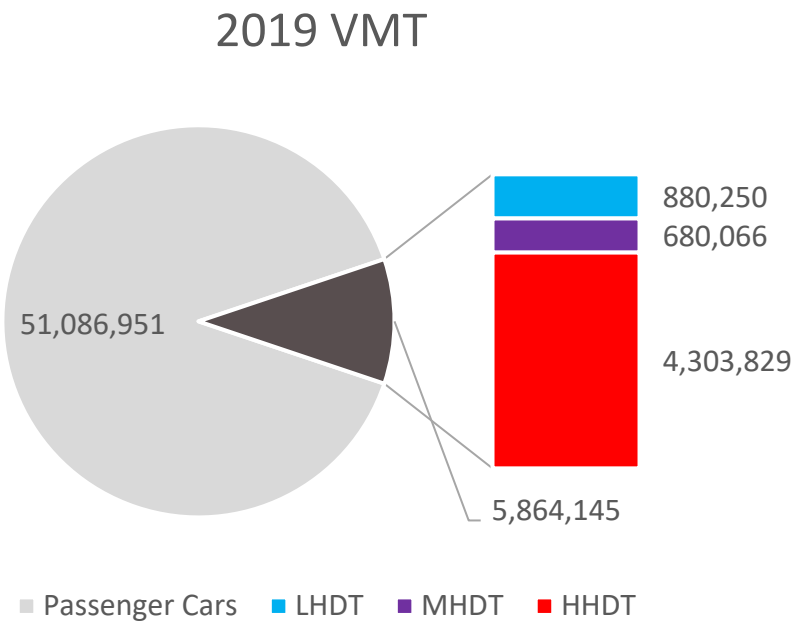
- What share of VMT is attributed to trucks as compared to passenger vehicles?
- How much truck VMT is allocated to heavy heavy-duty trucks?
- How much are VMT and Truck VMT predicted to grow from 2019 to 2045?

This analysis only includes passenger cars and trucks from the SCAG travel demand model and does not include other modes such as buses.

5.4.1 Truck VMT – All facilities

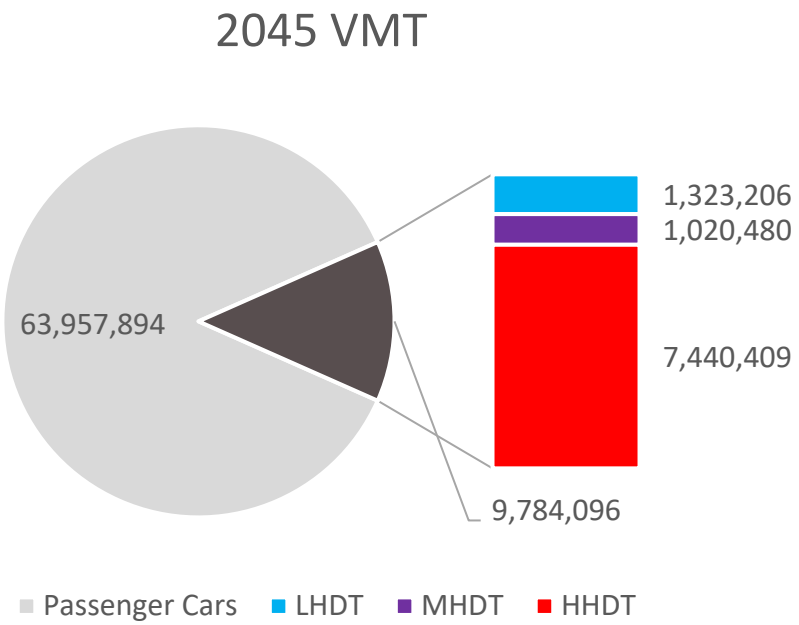
Riverside County 2019 VMT for all facilities, shown in the pie chart in Figure 5-14, totals 57 million. The pie chart shows the breakdown for all vehicle classes with passenger cars, 51 million, shown in the light grey large wedge and trucks in the dark grey small wedge at 5.9 million. Passenger cars make up the vast majority of VMT at 89.7 percent of overall VMT in the county with truck VMT at 10.3 percent. Truck VMT is broken out in the stacked bar chart for each truck vehicle type, (LHDT, MHDT, HHDT) as defined earlier in Section 5.1. HHDT are the vast share of the overall truck VMT at 73.4 percent.

Figure 5-14: VMT by Vehicle Class on All Facilities (2019)



By 2045, Riverside County VMT for all facilities, shown in Figure 5-15, increases 16.8 million VMT to 73.7 million. The pie chart shows the breakdown for all vehicle classes with 64 million from passenger cars, shown in the large light grey wedge, and trucks with 9.8 million, shown in the small dark grey wedge. Passenger cars make up the vast majority of VMT, comprising 86.7 percent of overall VMT in the county. However, truck VMT increased at a faster rate, changing from 10.3 percent in 2019 to 13.3 percent in 2045. Truck VMT is further broken down in the stacked bar chart for each truck vehicle type (LHDT, MHDT, HHDT) as defined earlier in Section 5.1. Heavy-duty trucks make up the vast share of the overall truck VMT, comprising 76 percent.

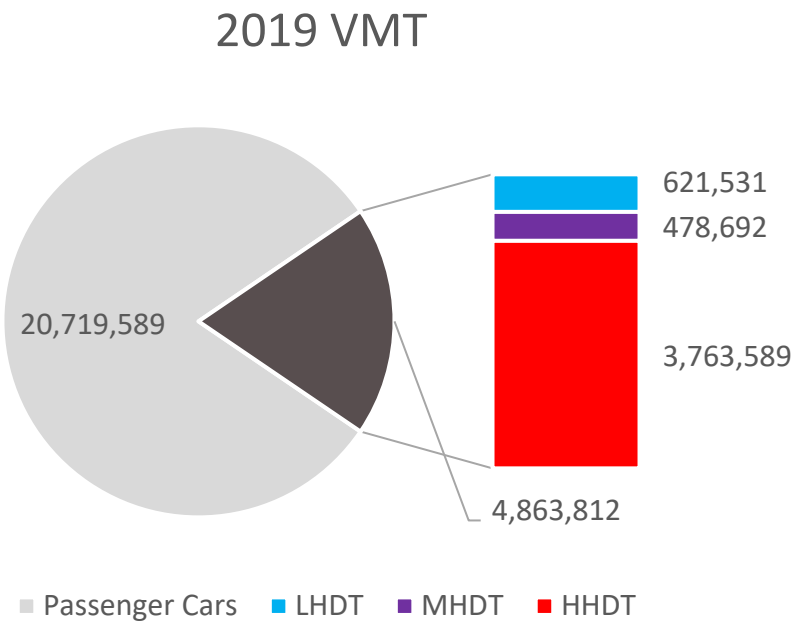
Figure 5-15: VMT by Vehicle Class on All Facilities (2045)



5.4.2 Truck VMT – Freeways

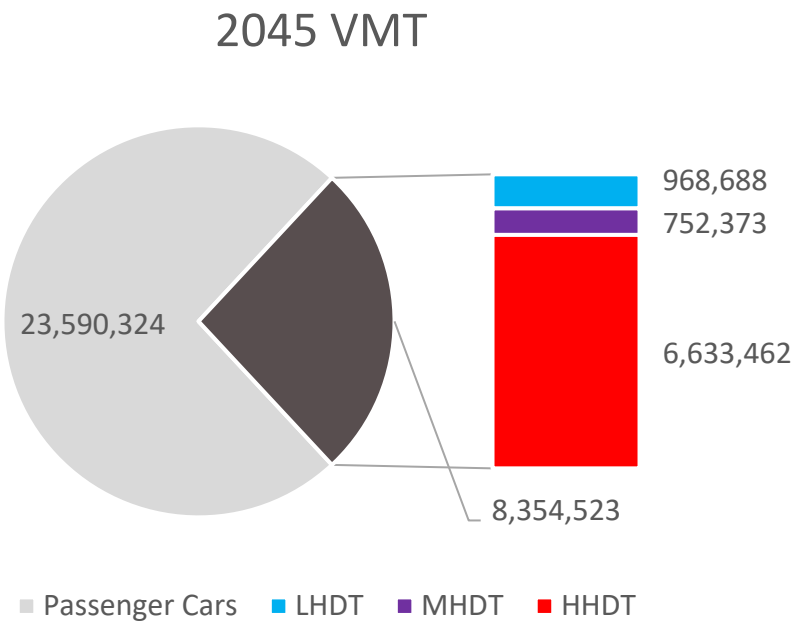
Riverside County 2019 VMT for freeways, shown in the pie chart in Figure 5-16, totals 25.6 million. The pie chart shows the breakdown for all vehicle classes with passenger cars, 20.7 million, shown in the light grey large wedge and trucks in the dark grey small wedge at 4.9 million. Passenger cars account for the vast majority of VMT, making up 81 percent of overall VMT in Riverside County. Truck VMT accounts for 19 percent of overall VMT in the county, meaning about one in every five lanes is filled with trucks on Riverside County freeways. Freeway truck VMT is much higher than on other facilities, with 83 percent of truck travel taking place on freeways, mostly due to the nature of longer haul freight in comparison to shorter non-commute household trips. Truck VMT is broken out in the stacked bar chart for each truck vehicle type, (LHDT, MHDT, HHDT) as defined earlier in Section 5.1. HHDT are the vast share of the overall truck VMT at 77.4 percent.

Figure 5-16: VMT by Vehicle Class on Freeway (2019)



By 2045, Riverside County VMT on freeways, shown in Figure 5-17, increases greatly from 6.4 million VMT to 31.9 million. The pie chart shows the breakdown for all vehicle classes with passenger cars, 23.6 million, shown in the light grey large wedge and trucks in the dark grey small wedge at 8.4 million. Passenger cars make up the vast majority of VMT at 73.8 percent of overall VMT in the county, however, truck VMT climbed at a faster rate increasing from 19.0 percent in 2019 to 26.2 percent in 2045 with an increase of 3.5M VMT. The freeway truck VMT share equates to about one in every four lanes being filled with trucks on Riverside County freeways. Truck VMT is broken out in the stacked bar chart for each truck vehicle type (LHDT, MHDT, HHDT) as defined earlier in Section 5.1. HHDT are the vast share of the overall truck VMT at 79.4 percent.

Figure 5-17: VMT by Vehicle Class on Freeways (2045)



6 IMPACT OF NEW LOGISTICS DEVELOPMENT

Previous Sections provided details on logistic locations and growth (Section 2), locations of freeway capacity deficiencies within Riverside County (Section 4), and additional truck impact information regarding where trucks are traveling, how they have grown, percent of traffic that are trucks, and overall magnitude (Section 5). This Section combines those analyses to determine how the new logistic developments are impacting freeways and in particular capacity deficient freeway segments.

6.1 IMPACT ESTIMATION PROCESS

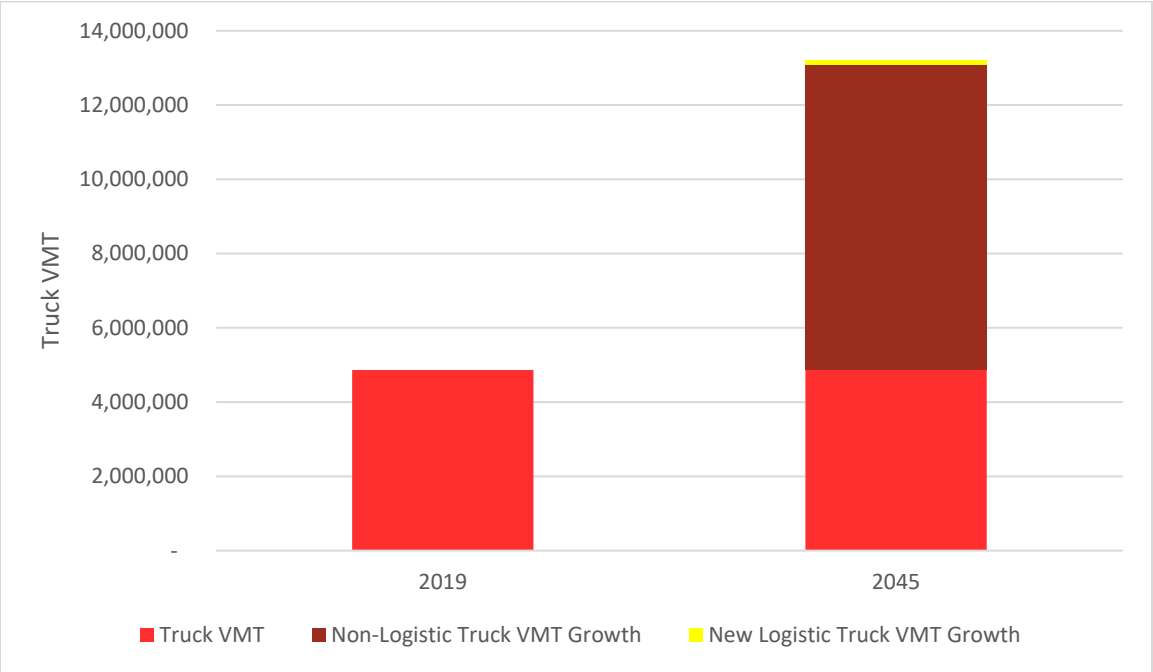
To determine the impact of new logistic developments on freeway deficiencies, the logistic center truck trips must be isolated from other trucks and vehicles. Using the 2045 model run results analyzed in earlier Sections, new logistic truck trips were isolated and assigned to the travel network on top of all the other trip purposes. A select zone assignment[9] applied to all TAZs with new logistic center truck trips was used to provide logistic travel volumes. To determine the logistic center share of deficient roadways, the new logistic truck volume was compared to the excess traffic volume causing the deficiency.

6.2 TRUCK FREEWAY IMPACT

The growth in new logistics locations in Riverside County has an overall impact on the freeways, both from the long-haul shipments into the County to the warehouse locations and the transload local shipments to stores and homes throughout Southern California. As noted in Section 2, Logistic Growth Forecast, an additional 41.7 million square feet of warehousing and an additional 23,000 employees from 2019 to 2045 will be added to the County. This growth in warehouse space and employees will generate an additional 15,700 truck trips in the County, leading to 122,000 additional truck VMT. Figure 6-1 illustrates the truck VMT in Riverside County for 2019 and 2045, breaking down how much of the 2045 VMT is due to logistics warehouses in Riverside. Note the additional growth in 2045 also has truck impacts from trucks travel through the Riverside area or trucks generated from other businesses, such as manufacturing companies.

[9] A select zone assignment provides travel path results for trips originating from or destined to a selected zone.

Figure 6-1: Riverside County Logistic Truck VMT Growth



6.3 New Logistics Trucks Impact

Through the analysis of freeway segments and the assessment of new logistic impacts, there are several categories of possible outcomes:

1) No Deficiency Identified:
   a) 2019 Condition: Freeway volumes are below capacity.
   b) 2019-2045 Growth Impact: New development growth does not cause the segment to exceed capacity.
   c) Result: No deficiencies identified. Some locations in the County have sufficient capacity to handle the additional development and logistic truck growth.
2) Deficiency Created by New Growth:
   a) 2019 Condition: Freeway volumes are below capacity.
   b) 2019-2045 Growth Impact: New development growth creates a deficiency.
   c) Result: 100 percent of the deficiency is attributed to new development, and the logistic truck share can be estimated.
3) Existing Deficiency Worsened by New Growth:
   a) 2019 Condition: Freeway volumes exceed capacity, resulting in a deficiency.

b) 2019-2045 Growth Impact: New development growth adds to the existing deficiency.

c) Result: The percent of the deficiency attributable to new growth is calculated based on the share of new growth to the total amount of traffic above the roadway capacity.

Three scenario model runs provided the traffic data to apply the category outcomes above. A base 2019 model run from the SCAG TDM, a 2045 model run holding roadway conditions at 2019 but allowing land, population, and employment to grow to 2045, and a 2045 model run described in Section 6.1 that evaluated only the new logistic center growth. Analysis of those model runs provided the deficiency attributable to new logistics trucks for the deficient segments identified and listed in Table 4-1.

The analysis followed a multipart process:

1) As described above, freeway segments in Riverside County with new or increased deficiencies in either peak hour in 2045, relative to the existing condition in 2019, were identified as deficient segments.

2) For each deficient segment, the share of logistics related truck trips was multiplied by the share of deficiencies attributable to all future growth to determine the percent of each deficiency specifically attributable to new logistics related truck trips.

3) Steps 1 and 2 were done for both AM and PM peak hour traffic, and then the peak hour with the highest percent attributable was selected to represent the segment.

4) Continuous sequences of segments were grouped for the purposes of assigning the percent of freeway capacity deficiencies attributable to new logistics development in Riverside County. Where multiple deficient segments were grouped, a weighted percent attributable was calculated based on the respective segment percent attributable and the length of each segment.

Table 6-1 displays the data applied in the process described above. The table shows the critical Volume to Capacity ratios, deficiencies, and percent attributable to logistic trucks for each deficient segment and group of segments in Riverside County. It is important to note that the attributable share shown in the table is only for new logistic trucks and not all logistic trucks in the County. Also, combining multiple segments into a weighted value may combine high and low values may mask the highest shares.

Generally, every grouped segment has a portion of its deficiency attributable to new logistics trucks. The highest shares of deficiencies associated with logistic trucks are found at:

1) Project ID 10: I-215 southbound from MLK Blvd to SR 60 Interchange – 10.3 percent
2) Project ID 9: I-215 northbound from SR 60 to University – 10.2 percent
3) Project ID 19: SR-91 eastbound from I-15 to La Sierra Ave – 5.8 percent

New logistic warehouse growth is responsible for 2 percent of future freeway deficiencies. This does not account for the growth that has already occurred in the County from 2016 to 2019.

Table 6-1: Deficient Segment Locations and Percent Attributable to New Logistics Development in Riverside County

Project ID	Route Name	Dir	Critical Segment		2019 GP Lanes	Segment Length	V/C Ratio				Percent Deficiency Attributable to New Development		New Logistics Trucks as Percent of 2016 to 2040 Growth		Percent Deficiency Attributable to New Logistics Trucks by Peak Hour		Percent Deficiency Attributable to New Logistics Trucks	Weighted Average Highest % Deficiency Attributable to New Logistics Trucks
			Start	End			2019 AM V/C	2019 PM V/C	2045 AM V/C	2045 PM V/C	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour		
							(A)		(B)		(C) = 100%, for (A) < 1.0 and (B) > 1.0 (C) = [(B)-(A)]/[(B)-1], for (A) > 1.0		(D)		(E) = (C) * (D)		(F) = Max (E)	
1	I-15	NB	Temescal Canyon Rd On Ramp	Weirick Rd Off Ramp	3	1.8	0.86	0.71	1.03	0.80	100%	No Deficiency	2.5%	1.3%	2.5%	No Deficiency	2.5%	2.8%
			Weirick Rd Off Ramp	Weirick Rd On Ramp	3	0.6	0.84	0.70	1.02	0.79	100%	No Deficiency	2.5%	1.3%	2.5%	No Deficiency	2.5%	
			Weirick Rd On Ramp	Cajalco Rd Off Ramp	3	0.4	0.98	0.77	1.14	0.86	100%	No Deficiency	3.0%	1.3%	3.0%	No Deficiency	3.0%	
			Cajalco Rd Off Ramp	Cajalco Rd On Ramp	3	0.6	0.97	0.75	1.10	0.84	100%	No Deficiency	3.2%	1.3%	3.2%	No Deficiency	3.2%	
			Cajalco Rd On Ramp	Foothill Pkwy Off Ramp	3	0.5	1.02	0.79	1.16	0.87	86%	No Deficiency	3.0%	1.4%	2.6%	No Deficiency	2.6%	
			Foothill Pkwy Off Ramp	Foothill Pkwy On Ramp	3	0.6	0.98	0.74	1.13	0.83	100%	No Deficiency	3.0%	1.4%	3.0%	No Deficiency	3.0%	
			Foothill Pkwy On Ramp	E Ontario Ave Off Ramp	3	0.2	1.06	0.81	1.22	0.88	74%	No Deficiency	3.4%	1.6%	2.5%	No Deficiency	2.5%	
			E Ontario Ave Off Ramp	E Ontario Ave	3	0.2	0.96	0.74	1.16	0.79	100%	No Deficiency	3.4%	1.6%	3.4%	No Deficiency	3.4%	
2	I-15	SB	E Ontario Ave On Ramp	Foothill Pkwy Off Ramp	4	0.3	0.49	0.92	0.61	1.02	No Deficiency	100%	2.2%	1.2%	No Deficiency	1.2%	1.2%	1.1%
			Foothill Pkwy Off Ramp	Foothill Pkwy On Ramp	3	0.5	0.58	1.01	0.68	1.10	No Deficiency	94%	2.2%	1.4%	No Deficiency	1.3%	1.3%	
			Foothill Pkwy On Ramp	Cajalco Rd Off Ramp	3	0.4	0.62	1.04	0.72	1.17	No Deficiency	77%	2.2%	1.2%	No Deficiency	0.9%	0.9%	
			Cajalco Rd Off Ramp	Cajalco Rd On Ramp	3	0.4	0.57	1.00	0.71	1.11	No Deficiency	100%	2.1%	1.1%	No Deficiency	1.1%	1.1%	
			Cajalco Rd On Ramp	Weirick Rd Off Ramp	3	0.8	0.59	1.03	0.72	1.13	No Deficiency	76%	2.1%	1.1%	No Deficiency	0.9%	0.9%	
			Weirick Rd On Ramp	Temescal Canyon Rd Off Ramp	3	1.9	0.54	0.92	0.69	1.01	No Deficiency	100%	2.1%	1.1%	No Deficiency	1.1%	1.1%	
3	I-15	NB	Railroad Canyon Rd On Ramp	N Main St Off Ramp	3	1.2	0.76	0.81	0.89	1.07	No Deficiency	100%	2.2%	1.0%	No Deficiency	1.0%	1.0%	1.0%
4	I-15	SB	N Main St On Ramp	Railroad Canyon Rd Off Ramp	3	1.1	0.70	0.88	0.96	1.08	No Deficiency	100%	1.9%	1.1%	No Deficiency	1.1%	1.1%	1.1%
5	I-15	NB	Murrieta Hot Springs Rd On Ramp	California Oaks Rd Off Ramp	3	0.6	0.48	0.85	0.59	1.02	No Deficiency	100%	1.7%	0.7%	No Deficiency	0.7%	0.7%	0.9%
			California Oaks Rd On Ramp	Clinton Keith Rd Off Ramp	4	2.4	0.45	0.86	0.56	1.10	No Deficiency	100%	2.2%	0.9%	No Deficiency	0.9%	0.9%	

Project ID	Route Name	Dir	Critical Segment		2019 GP Lanes	Segment Length	V/C Ratio				Percent Deficiency Attributable to New Development		New Logistics Trucks as Percent of 2016 to 2040 Growth		Percent Deficiency Attributable to New Logistics Trucks by Peak Hour		Percent Deficiency Attributable to New Logistics Trucks	Weighted Average Highest % Deficiency Attributable to New Logistics Trucks
			Start	End			2019 AM V/C	2019 PM V/C	2045 AM V/C	2045 PM V/C	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour		
							(A)		(B)		(C) = 100%, for (A) < 1.0 and (B) > 1.0 (C) = [(B)-(A)]/[(B)-1], for (A) > 1.0		(D)		(E) = (C) * (D)		(F) = Max (E)	
			Clinton Keith Rd Off Ramp	Clinton Keith Rd On Ramp	3	0.6	0.44	0.84	0.55	1.06	No Deficiency	100%	2.1%	0.9%	No Deficiency	0.9%	0.9%	
			Clinton Keith Rd On Ramp	Wildomar Trail Off Ramp	4	0.8	0.61	0.99	0.75	1.22	No Deficiency	100%	2.1%	1.0%	No Deficiency	1.0%	1.0%	
			Wildomar Trail Off Ramp	Wildomar Trail On Ramp	3	0.7	0.53	0.87	0.66	1.08	No Deficiency	100%	2.1%	1.0%	No Deficiency	1.0%	1.0%	
			Wildomar Trail On Ramp	Bundy Canyon Rd Off Ramp	3	0.6	0.57	0.89	0.69	1.14	No Deficiency	100%	2.2%	0.9%	No Deficiency	0.9%	0.9%	
6	I-15	SB	Wildomar Trail On Ramp	Clinton Keith Rd Off Ramp	4	0.8	0.80	0.75	1.09	0.99	100%	No Deficiency	1.6%	0.9%	1.6%	No Deficiency	1.6%	1.6%
7	I-15	NB	Rainbow Valley Blvd (County Line)	Rainbow Valley Blvd On Ramp	4	0.3	0.40	0.81	0.70	1.24	No Deficiency	100%	0.3%	0.4%	No Deficiency	0.4%	0.4%	0.4%
			Rainbow Valley Blvd On Ramp	Border Patrol Off Ramp	4	0.7	0.40	0.81	0.70	1.31	No Deficiency	100%	0.3%	0.3%	No Deficiency	0.3%	0.3%	
			Border Patrol Off Ramp	Border Patrol On Ramp	4	0.6	0.40	0.81	0.70	1.20	No Deficiency	100%	0.3%	0.4%	No Deficiency	0.4%	0.4%	
			Border Patrol On Ramp	Temecula Pkwy Off Ramp	4	1.8	0.40	0.81	0.70	1.31	No Deficiency	100%	0.3%	0.3%	No Deficiency	0.3%	0.3%	
			Temecula Pkwy Off Ramp	Temecula Pkwy On Ramp	4	0.6	0.36	0.73	0.64	1.06	No Deficiency	100%	0.3%	0.3%	No Deficiency	0.3%	0.3%	
			Temecula Pkwy On Ramp	Rancho California Rd Off Ramp	5	1.0	0.53	0.91	0.80	1.22	No Deficiency	100%	0.4%	0.3%	No Deficiency	0.3%	0.3%	
			Rancho California Rd Off Ramp	Rancho California Rd	4	0.3	0.50	0.81	0.76	1.06	No Deficiency	100%	0.4%	0.3%	No Deficiency	0.3%	0.3%	
			Rancho California Rd	Rancho California Rd On Ramp	4	0.3	0.53	0.84	0.79	1.07	No Deficiency	100%	0.5%	0.4%	No Deficiency	0.4%	0.4%	
			Rancho California Rd On Ramp	Winchester Rd Off Ramp	5	1.1	0.63	0.94	0.90	1.15	No Deficiency	100%	0.5%	0.4%	No Deficiency	0.4%	0.4%	
			Winchester Rd Off Ramp	Winchester Rd	4	0.3	0.52	0.83	0.74	1.11	No Deficiency	100%	0.5%	0.4%	No Deficiency	0.4%	0.4%	
			Winchester Rd	Winchester Rd On Ramp	4	0.2	0.55	0.95	0.77	1.14	No Deficiency	100%	0.6%	0.5%	No Deficiency	0.5%	0.5%	
			Winchester Rd On Ramp	Elm St	5	1.0	0.63	1.05	0.86	1.24	No Deficiency	84%	0.6%	0.5%	No Deficiency	0.4%	0.4%	
8	I-15	SB	Winchester Rd	Winchester Rd On Ramp	4	0.3	0.78	0.67	1.02	0.96	100%	No Deficiency	0.5%	0.5%	0.5%	No Deficiency	0.5%	0.4%
			Winchester Rd On Ramp	Rancho California Rd Off Ramp	4	1.2	0.82	0.71	1.09	1.04	100%	100%	0.5%	0.5%	0.5%	0.5%	0.5%	

Project ID	Route Name	Dir	Critical Segment		2019 GP Lanes	Segment Length	V/C Ratio				Percent Deficiency Attributable to New Development		New Logistics Trucks as Percent of 2016 to 2040 Growth		Percent Deficiency Attributable to New Logistics Trucks by Peak Hour		Percent Deficiency Attributable to New Logistics Trucks	Weighted Average Highest % Deficiency Attributable to New Logistics Trucks
			Start	End			2019 AM V/C	2019 PM V/C	2045 AM V/C	2045 PM V/C	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour		
							(A)		(B)		(C) = 100%, for (A) < 1.0 and (B) > 1.0 (C) = [(B)-(A)]/[(B)-1], for (A) > 1.0		(D)		(E) = (C) * (D)		(F) = Max (E)	
			Rancho California Rd Off Ramp	Rancho California Rd On Ramp	4	0.6	0.71	0.55	1.01	0.88	100%	No Deficiency	0.4%	0.4%	0.4%	No Deficiency	0.4%	
			Rancho California Rd On Ramp	Temecula Pkwy Off Ramp	5	1.0	0.76	0.59	1.11	0.92	100%	No Deficiency	0.4%	0.4%	0.4%	No Deficiency	0.4%	
			Temecula Pkwy Off Ramp	Temecula Pkwy On Ramp	4	0.6	0.64	0.42	1.07	0.74	100%	No Deficiency	0.3%	0.3%	0.3%	No Deficiency	0.3%	
			Temecula Pkwy On Ramp	Rainbow Valley Blvd Off Ramp	4	3.0	0.71	0.47	1.18	0.80	100%	No Deficiency	0.3%	0.3%	0.3%	No Deficiency	0.3%	
			Rainbow Valley Blvd Off Ramp	Rainbow Valley Blvd (County Line)	4	0.3	0.71	0.47	1.15	0.80	100%	No Deficiency	0.3%	0.3%	0.3%	No Deficiency	0.3%	
9	I-215	NB	Hwy 60 Interchange	Box Springs Rd	2	0.7	1.03	0.96	1.12	1.12	72%	100%	1.2%	1.7%	0.9%	1.7%	1.7%	10.2%
			Box Springs Rd	Box Springs Rd On-Ramp	4	0.1	1.07	1.06	1.16	1.16	60%	65%	12.2%	13.8%	7.3%	9.0%	9.0%	
			(blank)	0	4	0.2	0.96	0.95	1.06	1.04	100%	100%	12.2%	13.8%	12.2%	13.8%	13.8%	
			Box Springs Rd On-Ramp	Central Avenue/Watkins Drive Off-Ramp	4	0.4	1.02	1.02	1.13	1.14	86%	86%	12.1%	14.2%	10.4%	12.2%	12.2%	
			Central Avenue/Watkins Drive Off-Ramp	Central Avenue/Watkins Drive On-Ramp	3	0.5	1.07	1.03	1.12	1.12	45%	74%	11.8%	13.9%	5.4%	10.3%	10.3%	
			Central Avenue/Watkins Drive On-Ramp	Martin Luther King Boulevard Off-Ramp	4	0.8	0.93	0.91	1.03	1.01	100%	100%	12.0%	13.2%	12.0%	13.2%	13.2%	
			Martin Luther King Boulevard Off-Ramp	Martin Luther King Boulevard On-Ramp	3	0.5	0.92	0.93	1.03	1.06	100%	100%	11.7%	12.9%	11.7%	12.9%	12.9%	
			Martin Luther King Boulevard On-Ramp	University Ave Off-Ramp	4	0.2	0.88	0.91	0.97	1.02	No Deficiency	100%	13.3%	14.4%	No Deficiency	14.4%	14.4%	
			University Ave Off-Ramp	University Ave	3	0.2	1.01	1.05	1.09	1.13	85%	60%	13.4%	14.4%	11.3%	8.7%	11.3%	
10	I-215	SB	MLK Blvd	Central Avenue/Watkins Drive Off-Ramp	4	0.7	0.59	1.00	0.83	1.09	No Deficiency	96%	11.0%	13.1%	No Deficiency	12.6%	12.6%	10.3%
			Central Avenue/Watkins Drive Off-Ramp	Central Avenue/Watkins Drive On-Ramp	4	0.5	0.58	0.99	0.82	1.07	No Deficiency	100%	11.0%	13.1%	No Deficiency	13.1%	13.1%	
			Central Avenue/Watkins Drive On-Ramp	Fair Isle Dr Off-Ramp	5	0.4	0.57	0.98	0.80	1.08	No Deficiency	100%	11.1%	13.4%	No Deficiency	13.4%	13.4%	
			Fair Isle Dr Off-Ramp	Fair Isle Dr	5	0.2	0.58	0.97	0.82	1.09	No Deficiency	100%	11.0%	13.4%	No Deficiency	13.4%	13.4%	
			Hwy 60 Interchange	Hwy 60 Interchange	2	0.5	0.53	0.98	0.85	1.03	No Deficiency	100%	-0.5%	-4.9%	No Deficiency	0.0%	0.0%	

Project ID	Route Name	Dir	Critical Segment		2019 GP Lanes	Segment Length	V/C Ratio				Percent Deficiency Attributable to New Development		New Logistics Trucks as Percent of 2016 to 2040 Growth		Percent Deficiency Attributable to New Logistics Trucks by Peak Hour		Percent Deficiency Attributable to New Logistics Trucks	Weighted Average Highest % Deficiency Attributable to New Logistics Trucks
			Start	End			2019 AM V/C	2019 PM V/C	2045 AM V/C	2045 PM V/C	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour		
							(A)		(B)		(C) = 100%, for (A) < 1.0 and (B) > 1.0 (C) = [(B)-(A)]/[(B)-1], for (A) > 1.0		(D)		(E) = (C) * (D)		(F) = Max (E)	
11	I-215	NB	Harley Knox Blvd On-Ramp	Van Buren Blvd Off-Ramp	4	1.2	0.91	0.72	1.10	0.93	100%	No Deficiency	1.2%	1.7%	1.2%	No Deficiency	1.2%	1.2%
12	I-215	SB	Van Buren Blvd On-Ramp	Harley Knox Blvd Off-Ramp	4	1.3	0.49	0.94	0.69	1.10	No Deficiency	100%	1.5%	1.5%	No Deficiency	1.5%	1.5%	1.5%
14	I-215	SB	Redlands Ave On-Ramp	Hwy 74 Off-Ramp	4	2.0	0.44	0.75	0.68	1.03	No Deficiency	100%	1.0%	1.1%	No Deficiency	1.1%	1.1%	1.1%
15	I-215	NB	I-15	Murrieta Hot Springs Rd Off-Ramp	2	0.6	0.53	0.90	0.77	1.04	No Deficiency	100%	0.5%	0.4%	No Deficiency	0.4%	0.4%	0.4%
16	I-215	SB	North of Murrieta Hot Springs Rd	Murrieta Hot Springs Rd	2	0.4	0.80	0.54	1.03	0.78	100%	No Deficiency	0.5%	0.6%	0.5%	No Deficiency	0.5%	0.5%
			Murrieta Hot Springs Rd	Murrieta Hot Springs Rd On-Ramp	2	0.3	0.88	0.60	1.06	0.84	100%	No Deficiency	0.5%	0.6%	0.5%	No Deficiency	0.5%	
			Murrieta Hot Springs Rd On-Ramp	I15 SB	2	1.1	0.94	0.69	1.11	0.92	100%	No Deficiency	0.5%	0.6%	0.5%	No Deficiency	0.5%	
			(blank)	Date St	5	0.3	0.91	0.70	1.09	0.96	100%	No Deficiency	0.7%	0.7%	0.7%	No Deficiency	0.7%	
17	SR-91	EB	Riverside County Line West	Green River Rd Off-Ramp	5	0.3	1.02	1.26	1.05	1.26	51%	1%	2.8%	3.3%	1.4%	0.0%	1.4%	1.4%
			(blank)	0	5	0.8	0.99	1.29	1.01	1.28	100%	-2%	2.8%	3.3%	2.8%	0.0%	2.8%	
			Green River Rd Off-Ramp	Green River Rd On-Ramp	5	0.6	0.95	1.15	0.95	1.14	No Deficiency	-7%	2.8%	3.3%	No Deficiency	0.0%	0.0%	
			Green River Rd On-Ramp	Hwy 71	6	0.8	0.89	1.07	0.91	1.08	No Deficiency	17%	2.7%	3.3%	No Deficiency	0.6%	0.6%	
			Hwy 71 East Ramp	Serfas Club Dr	6	0.5	0.89	1.05	0.92	1.06	No Deficiency	12%	4.0%	4.1%	No Deficiency	0.5%	0.5%	
			W 6th St Off-Ramp	W 6th St On-Ramp	5	0.4	0.84	1.00	0.87	1.01	No Deficiency	92%	4.0%	3.9%	No Deficiency	3.6%	3.6%	
			W 6th St On-Ramp	Lincoln Ave	6	0.8	0.86	1.02	0.90	1.04	No Deficiency	46%	4.0%	3.9%	No Deficiency	1.8%	1.8%	
			S Lincoln Ave	W Grand Blvd	5	0.4	0.94	1.06	0.95	1.08	No Deficiency	16%	4.3%	4.1%	No Deficiency	0.7%	0.7%	
18	SR-91	WB	S Lincoln Ave	Maple Street Off-Ramp	5	0.6	1.08	0.94	1.09	0.95	14%	No Deficiency	3.7%	3.5%	0.5%	No Deficiency	0.5%	0.1%
			Maple Street Off-Ramp	Auto Center Dr Off-Ramp	5	0.4	1.08	0.94	1.09	0.94	14%	No Deficiency	3.7%	3.5%	0.5%	No Deficiency	0.5%	
			Auto Center Dr Off-Ramp	Auto Center Dr	5	0.5	1.05	0.89	1.04	0.89	-9%	No Deficiency	3.7%	3.5%	0.0%	No Deficiency	0.0%	

Project ID	Route Name	Dir	Critical Segment		2019 GP Lanes	Segment Length	V/C Ratio				Percent Deficiency Attributable to New Development		New Logistics Trucks as Percent of 2016 to 2040 Growth		Percent Deficiency Attributable to New Logistics Trucks by Peak Hour		Percent Deficiency Attributable to New Logistics Trucks	Weighted Average Highest % Deficiency Attributable to New Logistics Trucks
			Start	End			2019 AM V/C	2019 PM V/C	2045 AM V/C	2045 PM V/C	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour		
							(A)		(B)		(C) = 100%, for (A) < 1.0 and (B) > 1.0 (C) = [(B)-(A)]/[(B)-1], for (A) > 1.0		(D)		(E) = (C) * (D)		(F) = Max (E)	
			Auto Center Dr On-Ramp	Corona Freeway Off-Ramp	6	1.0	1.05	0.90	1.05	0.92	-1%	No Deficiency	3.9%	3.7%	0.0%	No Deficiency	0.0%	
			Corona Freeway Off-Ramp	Corona Freeway On-Ramp	5	0.7	1.10	0.91	1.09	0.93	-8%	No Deficiency	2.9%	3.2%	0.0%	No Deficiency	0.0%	
			Corona Freeway On-Ramp	Green River Rd Off-Ramp	6	0.5	1.13	0.96	1.13	0.99	-2%	No Deficiency	2.9%	3.3%	0.0%	No Deficiency	0.0%	
			Green River Rd Off-Ramp	Green River Rd On-Ramp	5	0.6	1.24	1.03	1.24	1.03	-2%	-13%	3.0%	3.3%	0.0%	0.0%	0.0%	
			Green River Rd On-Ramp	(blank)	5	0.7	1.41	1.10	1.40	1.11	-1%	5%	3.0%	3.3%	0.0%	0.2%	0.2%	
			(blank)	Riverside County Line	5	0.2	1.20	1.10	1.22	1.11	10%	11%	3.0%	3.3%	0.3%	0.4%	0.4%	
19	SR-91	EB	I-15	S Promenade Ave	4	0.4	0.77	1.01	0.86	1.04	No Deficiency	66%	9.9%	9.9%	No Deficiency	6.5%	6.5%	5.8%
			Magnolia Ave	La Sierra Ave	3	0.3	0.77	1.00	0.82	1.05	No Deficiency	100%	9.9%	9.2%	No Deficiency	9.2%	9.2%	
			(blank)	(blank)	3	0.5	0.80	1.04	0.84	1.07	No Deficiency	37%	8.2%	8.9%	No Deficiency	3.3%	3.3%	
20	SR-91	WB	Buchanan St	(blank)	3	0.3	1.09	1.13	1.11	1.12	16%	-4%	6.5%	7.1%	1.0%	0.0%	1.0%	1.6%
			(blank)	McKinley St	3	0.6	1.03	1.06	1.04	1.05	28%	-27%	6.5%	7.1%	1.8%	0.0%	1.8%	

The previous study analyzed the improvement projects that could be included in the fee program to alleviate the freeway deficiencies identified. This study did not redevelop project concepts for the existing, expanded, or new deficiencies. While Table 6-2 replicates and reports on the comparison to the previous study, this is an incomplete picture of the impact of new logistics trucks on the Riverside County freeways.

Projects from the previous study were first matched to the current study's deficiencies. The previous study's projects numbers nine and eleven were not identified as deficiencies in the current study and were dropped from the analysis and shown as N/A for new logistics shares in Table 6-2. After removing those two projects, the previous study's overall new logistics attributable project cost weighted share dropped from 12.4 percent to 9.9 percent as the SR 60 project that dropped had both large attributable truck shares and high project concept costs. Combining the new logistics attributable shares with the previous study's cost estimates[10] provided an updated overall new logistics attributable share of 5.1 percent. It is important to note that:

1) The shrinkage in the new logistics attributable share is due mainly to the fact that some of the growth in logistics development within the previously identified deficient segments has already occurred and is no longer considered new in the analysis.
2) The attributable share is only for new logistic center locations and trucks and does not identify the extent of the impact from all warehousing locations.

To provide a more direct comparison, new project concepts should be developed, and new attributable shares should be calculated.

[10] The previous study cost estimates were escalated to 2023-year dollars to account for inflation.

Table 6-2: Capacity Deficient Segment Improvement Project Logistics Cost Share Comparison to Previous Study

						Current Study		Prior Study		
Current Study Project ID	Prior Study Project ID	Route Name	Dir	Beginning	End	New Logistics Attributable Share	New Logistics Cost Share[11]	Conceptual Cost Estimate[11]	New Logistics Attributable Share	New Logistics Cost Share[11]
7	1	I-15	NB	SR-79 S	Rancho California Rd	0.4%	$ 194,697	$ 48,014,025	0.7%	$ 341,850
				Rancho California Rd	Winchester Rd					
5	3			Clinton Keith Rd	Baxter Rd	0.9%	$ 90,879	$ 9,812,950	0.3%	$ 25,175
2	7		SB	Cajalco Rd	Indian Truck Trail	1.1%	$ 529,249	$ 50,118,125	2.2%	$ 1,086,500
2	8			El Cerrito Rd	Cajalco Rd	1.1%	$ 156,174	$ 13,790,600	1.4%	$ 188,150
#N/A	9	SR-60	EB	Rubidoux Blvd	Market St	#N/A	$ -	$ 53,310,050	31.8%	$ 16,962,650
				Market St	Main St					
9	10	I-215	NB	Box Springs Rd	Central Ave / Watkins Dr	11.4%	$ 4,007,599	$ 35,129,725	30.0%	$ 10,550,975
				Central Ave / Watkins Dr	Martin Luther King					
9	10c			Martin Luther King	SR-91	12.9%	$ 9,385,027	$ 72,982,325	13.3%	$ 9,695,025
#N/A	11			Center St Off-Ramp	Riverside County Line/Iowa Ave	#N/A	$ -	$ 55,930,900	11.8%	$ 6,595,850
10	12		SB	Martin Luther King	Sycamore Canyon Rd	12.8%	$ 2,279,052	$ 17,758,975	57.1%	$ 10,146,850
12	13			Van Buren Blvd	Case Rd	1.2%	$ 1,569,280	$ 126,358,625	4.4%	$ 5,611,375
19	16	SR-91	EB	On-Ramp from SB I-15	On-Ramp from NB I-15	6.5%	$ 656,787	$ 10,084,575	7.5%	$ 756,575
19	18			Pierce St	Magnolia St	9.2%	$ 1,585,086	$ 17,278,000	8.3%	$ 1,428,350
	Total Project Cost Estimates							**$ 510,568,875**	**12.4%**	**$ 63,389,325**
	Total Project Cost Estimates (Unmatched Shares Excluded)					**5.1%**	**$ 20,453,828**	**$ 401,327,925**	**9.9%**	**$ 39,830,825**

[11] Costs in table inflated from previous study to 2023 dollars using the US Army Corp of Engineers Construction Cost Index for roads, railroads, and bridges.

7 SUMMARY

The RCTC Truck Study with updated data from the 2020 SCAG RTP/SCS, EDD, and recent logistic center developments shows there are extraordinary growth patterns in warehouse developments and employment, expanded and new freeway deficiencies in western Riverside County, external flows into Riverside County through Coachella Valley and the San Gorgonio pass represent a considerable amount of the future traffic, and freeway truck VMT is slated to increase faster than passenger vehicle VMT.

The current study had four key study questions which were reviewed in the previous Sections and summarized here:

1. How have patterns changed?

   Warehousing has rapidly increased along the I-215 corridor from SR 60 to south of March ARB. Over the past 20 years, warehousing employment has grown in the Riverside-San Bernardino-Ontario MSA from 6,600 employees to 129,000 with over 14,000 jobs being added per year from 2016 to 2022.

   As the I-215 warehousing area consumes the remaining available land, new growth areas are predicted to be along SR 60 in the World Logistics Center site. Potential growth is seen through the SR 60 San Gorgonio Pass cities and areas of Beaumont, Banning, and Cabazon.

   New freeway deficiencies, in addition to expanded deficiencies at most of the previously identified locations, are see on I-215 in Perris and by March ARB and on I-15 in Lake Elsinore and Murietta.

   Truck volume and trips have increased significantly, with an estimated rise of 29 percent in truck VMT[12] over the past decade. This surge in truck traffic underscores the substantial growth in the region. However, as the warehousing sector matures and available land becomes scarcer, the rate of new growth is expected to shrink and each additional year of growth will likely contribute a smaller overall growth percentage.

2. How are logistic warehouses impacting the freeway network?

   New logistic warehouse growth is responsible for two percent of future freeway deficiencies. Logistic center and employment growth that has already occurred in the County from 2016 to 2019 is accounted for in the existing traffic patterns and identification of freeway deficiencies but no longer counted as part of new growth.

   The highest truck flows in 2045 in the County are found along I-10 and SR 60 including the highest growth in truck flows from 2019 to 2045.

[12] Average Truck VMT growth between 2013 and 2023 according to data from the Caltrans Performance Monitoring System for Riverside County.

3. How are trucks impacting the San Gorgonio Pass and Coachella Valley?

   Large external truck inflows along I-10 represent over 50 percent of future daily traffic into the Coachella Valley and 20-40 percent through Coachella Valley and the San Gorgonio Pass. With heavy-duty trucks consuming up 2.5x more space than a typical passenger vehicle, additional impacts and conflicts with cars will be prevalent in this area.

4. An increase in freight truck (including LHDT, MHDT, and hhdt) travel is affecting Riverside County. What is the total increase of freight truck VMT in the region?

   Freeway truck VMT grows from 19.0 percent of overall Riverside County freeway VMT in model year 2019 to 26.2 percent in 2045, a total overall increase of 38 percent over 26 years. Truck travel in 2045 is estimated to be 8.4 million VMT with HHDT representing the vast share of the overall truck VMT at 79.4 percent. HHDT are expected to grow at a faster rate between year 2019 and 2045 than LHDT and MHDT, growing at 76 percent over 26 years compared to 56 percent, respectively.

8 ABBREVIATIONS AND ACRONYMS

ARB	Air Reserve Base
ATC	Advanced Technology and Congestion
CARB	California Air Resources Board
EDD	Employment Development Department
EFMAC	Emission Factors
FAST	Fixing America's Surface Transportation Act
GHG	Greenhouse Gas
GVWR	Gross Vehicle Weight Rating
HHDT	Heavy Heavy-Duty Trucks
LHDT	Light Heavy-Duty Trucks
LOS	Level of Service
LPP	Local Partnership Program
MBUF	Mileage-based user fees
MHDT	Medium Heavy-Duty Trucks
MSA	Metropolitan Statistical Area
NAICS	North American Industry Classification System
NSFHP	Nationally Significant Freight and Highway Projects
PeMS	Performance Measurement System
RCTC	Riverside County Transportation Commission
RTP	Regional Transportation Plan
SB	Senate Bill
SCAG	Southern California Association of Governments
SCCP	Solutions for Congested Corridors Program
SCS	Sustainable Communities Strategy
TAZ	Traffic Analysis Zone
TCEP	Trade Corridor Enhancement Program
TDM	Travel Demand Model

TNC	Transportation Network Company
TPA	Transit Priority Area
UCR	UC Riverside
V/C	Traffic Volume to Roadway Capacity
VDS	Vehicle Detector Stations
VMT	Vehicle Miles Traveled
WIM	Weigh-in-Motion