Final Report

Subregional Freight Movement Truck Access Study

Prepared for:

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San Bernardino Associated Governments

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1. EXECUTIVE SUMMARY

The Inland Empire area, and especially the western San Bernardino and Riverside County area, continues to be one of the highest growth areas in southern California and is expected to continue its growth at a rapid pace in the future. Based on observation of current conditions and trends as well as future projections, it has become evident that a great deal of this future traffic growth will be related to goods movement and truck trips.

The growth in truck movements will be related to both local developments as well as regional through trips. There are numerous existing and proposed developments in the study area with heavy truck trip generation potential. These include major industrial and warehousing facilities in Ontario, Fontana and other cities, rail intermodal facilities, international airports with significant existing and proposed air cargo facilities, large regional truck stops and service facilities and others.

To gain a better understanding of trucking issues in the western San Bernardino and Riverside County area, Southern California Association of Governments (SCAG) and the San Bernardino Associated Governments (SANBAG) initiated the Subregional Freight Movement Truck Access Study. The main goal of the project was to help develop strategies and planning tools to improve the forecasting of goods movement and trucking trends and to better characterize truck access to intermodal facilities and truck activity centers in the western San Bernardino and Riverside county area. The major study tasks were as follows:

- Document the designated truck routes and restrictions.
- Research and document truck trip generation rates from national, regional and local sources.
- Collect and assemble truck classification counts from local and regional sources.
- Identify high truck-related accident locations.
- Conduct trucker surveys and shipper/carrier surveys.
- Identify potential future truck-related problem areas and facilities.

An important trucking issue is the locations of truck probations and connectivity of designated truck routes for major truck movements. All study area jurisdictions were inventoried for official truck routes and truck restricted areas. The collected data were incorporated into GIS and truck route maps were developed. The analysis indicated that for the most part, the locally designated truck routes are contiguous and provide good connectivity across jurisdictional boundaries and there are very few locations with truck restrictions.

Existing heavy-duty-truck volumes were obtained through available local and regional data sources, were compiled, summarized and diagramed. Results indicated that areas in Ontario and Fontana with heavy concentrations of industrial/warehousing activity also have the highest concentration of heavy duty truck volumes and truck percentages on arterials.

Detailed new vehicle classification counts were conducted at the three major interchanges along the I-15 Freeway at SR-210, I-10 and SR-60. Analysis of the traffic counts identified some notable truck travel patterns in the study area. Counts indicated that the mid-day period (11 AM to 1 PM) has the heaviest concentration of trucks, 29 percent higher than the AM peak and 67 percent higher than the PM peak.

A significant "S"-shaped pattern of two-way truck movements was identified that showed heavy volumes of trucks moving between the SR-60 Freeway west of I-15 and the I-10 Freeway east of I-15, using the short segment of I-15 connecting these two freeways. Truck volumes on this segment of I-15 constitute as much as 16 to 18 percent of the total freeway volumes.

Truck-related accident data were compiled for the study area. Results indicated that for the period of 1999 to 2002 truck-related accidents had remained relatively steady and showed an overall decrease in truck-related accidents involving fatalities.

The increased importance of trucks activity in transportation planning and traffic engineering has contributed to a need for specific trip generation data that can be used to estimate truck traffic volumes. The most recent local and national efforts in the development of truck trip generation rates were documented and presented, including SCAG's Regional Model rates, recent comprehensive efforts by the City of Fontana, the Ports of Los Angeles (POLA) and Long Beach (POLB), and Ontario Airport.

As part of the study, surveys of local trucking companies and shipper/receiver businesses within the study were conducted by sending total of 405 surveys to various companies from which a total of 37 (approximately 9 percent) of the surveys were returned. Survey results were tabulated, however due to the low sample/return rates, the results were determined to be statistically not significant.

To further analyze the truck movements in the study area, generalized truck volumes from SCAG's 2000 and 2030 HDT model were analyzed. The results indicated a significant increase in truck trip generation from 2000 to 2030. Truck trip generation in the study area is expected to double by 2030 compared to only a projected 40 percent growth in truck trips for the entire SCAG Region. The western Riverside County area is expected to be a major generator and attractor of truck trips in the future.

In portions of the subregion which have high truck volumes or heavy concentrations of truck activity, roadway geometric deficiencies or operational problems can impede truck movements, causing safety hazards, recurring or incidental congestion and reduced traffic efficiency. Based on the SCAG 2030 forecast truck volumes, arterial streets which are expected to have high truck volumes were identified in this study, which could be candidates for future roadway improvements.

The various results of this study will be used to provide input data for the development, improvement and validation of truck forecasting components in local and regional travel demand models.

2. INTRODUCTION

The Inland Empire area, and especially the western San Bernardino and Riverside County area, continues to be one of the highest growth areas in southern California and is expected to continue its growth at a rapid pace in the future. Freeway and arterial facilities in the area are in need of improvements to deal with existing problems and anticipated future growth. Based on observation of current conditions and trends as well as future projections, it has become clearly evident that a great deal of this future traffic growth will be related to goods movement and truck trips. The growth in truck movements will be related to both local developments as well as regional through trips. There are numerous existing and proposed developments in the study area with heavy truck trip generation potential. These include major industrial and warehousing facilities in Ontario, Fontana and other cities, rail intermodal facilities, major existing (Ontario) and proposed (San Bernardino) airports with major cargo facilities, truck stops and service facilities and others.

The effect of trucks on transportation infrastructure in the Inland Empire is becoming an increasingly important issue. Unfortunately the current local and regional forecasting tools do not provide enough customized information on goods movement patterns, or magnitude of truck trips and their travel trends. There is a clear need to properly quantify the vehicular traffic and especially truck traffic generation and the dynamics of interaction among existing and future developments. SCAG regional forecasts show the possibility of 80 to 200 percent growth in truck traffic along the various corridors in this area. These projections show that by 2020, east-west truck traffic along the I-210, I-10 and SR-60 corridors can grow by as much as an additional 60,000 daily trucks, exhibiting the highest growth in trucks of any corridor in the six-county SCAG region. The second highest growth in regional truck trips will also be in the Inland Empire area along the combined north-south I-15 and I-215 corridors, which is projected to carry an additional 37,000 daily truck trips by 2020.

While these are alarming growth figures, they are relatively aggregate regional projections. There is a clear need for the development of more accurate and facility-specific set of goods movement and trucking projection that are based on recent, defensible data and locally derived information. The Inland Empire area for nearly 20 years, with the various generations of the RIVSAN model, has been at the forefront of developing customized local travel demand projections that are based on locally supported data. Recent work by SCAG to develop the subregional heavy duty truck (HDT) trip tables for the RIVSAN model using a disaggregation of the SCAG regional HDT trip tables as part of the East Valley project, was a good starting point. This effort, however, was only able to “scratch the surface” of developing localized goods movement and truck forecasting processes and tools.

Better truck forecasting tools can help identify which arterials or freeways may require capacity improvements or where new truck-exclusive facilities may be needed. They can help prioritize improvements based on projected needs. Better forecasting tools can identify both local and regional truck trends and help develop specific access

improvements to major trucking activity centers such as airports, intermodal facilities, truck service centers, and other major generators.

Therefore the main goal of this project was to help develop strategies and planning tools to improve the forecasting of goods movement and trucking trends and to better characterize truck access to intermodal facilities and truck activity centers in the western San Bernardino and Riverside county area.

A comprehensive and accurate process of forecasting goods movement and truck activity in the Inland Empire area requires large amounts of high-quality locally collected and developed existing truck volume data as well as a sizeable and detailed data base on trucking activity patterns and profiles.

These and many other issues were observed, researched and analyzed in this study, as follows:

- Designated truck routes and restrictions were documented.
- Truck trip generation rates were researched and documented from national, regional and local sources.
- Truck classification counts were assembled and collected from many local and regional sources.
- High truck-related accident locations were documented.
- New vehicle classification counts were collected at the major interchanges.
- Trucking activity documentation was done through two major efforts including trucker surveys and shipper/carrier surveys.
- Potential future truck-related problem areas and facilities were identified based on regional traffic projections.

3. TRUCK ROUTES, RESTRICTIONS AND EXISTING TRUCK VOLUME DATA

The consultant team conducted an extensive data collection effort to summarize existing trucking information within the study area. The study area, also referred to as the "West Valley" region, as indicated in Figure 1, is generally bounded by the Los Angles/San Bernardino County line to the west, south of SR-60 to the south, Rialto/Fontana City boundary to the east and the San Bernardino National Forest to the north.

The definition of heavy-duty trucks (HDT) in the study is consistent with the definition of SCAG's Regional Transportation Plan (RTP) and the Regional Travel Demand Model, which is designed to develop forecasts of heavy-duty trucks in the following three Gross Vehicle Weight (GVW) categories:

- Light-Heavy: 8,500 to 14,000 pounds GVW
- Medium-Heavy: 14,000 to 33,000 pounds GVW
- Heavy-Heavy: over 33,000 pounds GVW

Representatives of light-heavy duty trucks typically include two-axle and three-axle panel trucks (e.g. UPS, Fedex), utility service vehicles and bobtails. Medium-heavy duty trucks typically include three-axle and some four axles trucks such as bobtails with chassis and empty flatbeds. Heavy-heavy duty trucks typically include bobtails with containers, liquid bulk, full flatbeds and other multi-axle units.

3.1 Truck Routes/Restrictions

The consultant team contacted all study area jurisdictions and inventoried official truck routes and truck restricted areas. Truck routes permit the travel of trucks on certain local streets. Municipal codes for the study area cities generally break down local streets into two categories: restricted streets and truck routes. It is unlawful to drive or propel vehicles above a certain weight – between 1.5 to 8 tons, depending upon the city – over or across restricted streets. Vehicles above these weight limits are restricted to using designated truck routes (often referred to as unrestricted streets).

In some cases, cities break truck routes into more than one category. Montclair, for instance, designates two different kinds of truck routes. Vehicles between 5 tons and 8 tons may use intermediate routes; vehicles above 8 tons may only use streets designated as unrestricted truck routes.

Some municipal codes contain exceptions allowing vehicles above the weight restriction to use restricted streets as direct ingress or egress routes between unrestricted streets and pick up or delivery sites.

Figure 1 shows the existing truck routes within the study area. Route information is categorized by jurisdiction within the West Valley region. As shown, the truck route system within the study area is relatively contiguous and continuous across the multi-jurisdictional region. This enables relatively free movement of heavy-duty trucks on surface streets and easy access to the regional state and interstate freeway system.

Figure 2 summarizes current truck restrictions within the study area. As can be seen, there are currently very few routes with official truck restrictions in the study area. Majority of the restrictions are on north-south streets and within the unincorporated areas of County of San Bernardino on the west side of the City of Fontana and on a few streets on the west side of the City of Chino.

These truck restrictions could be incorporated within the model network of the updated CTP travel demand model to disallow the assignment of heavy duty trucks onto these arterials.

Figure 1. Truck Routes

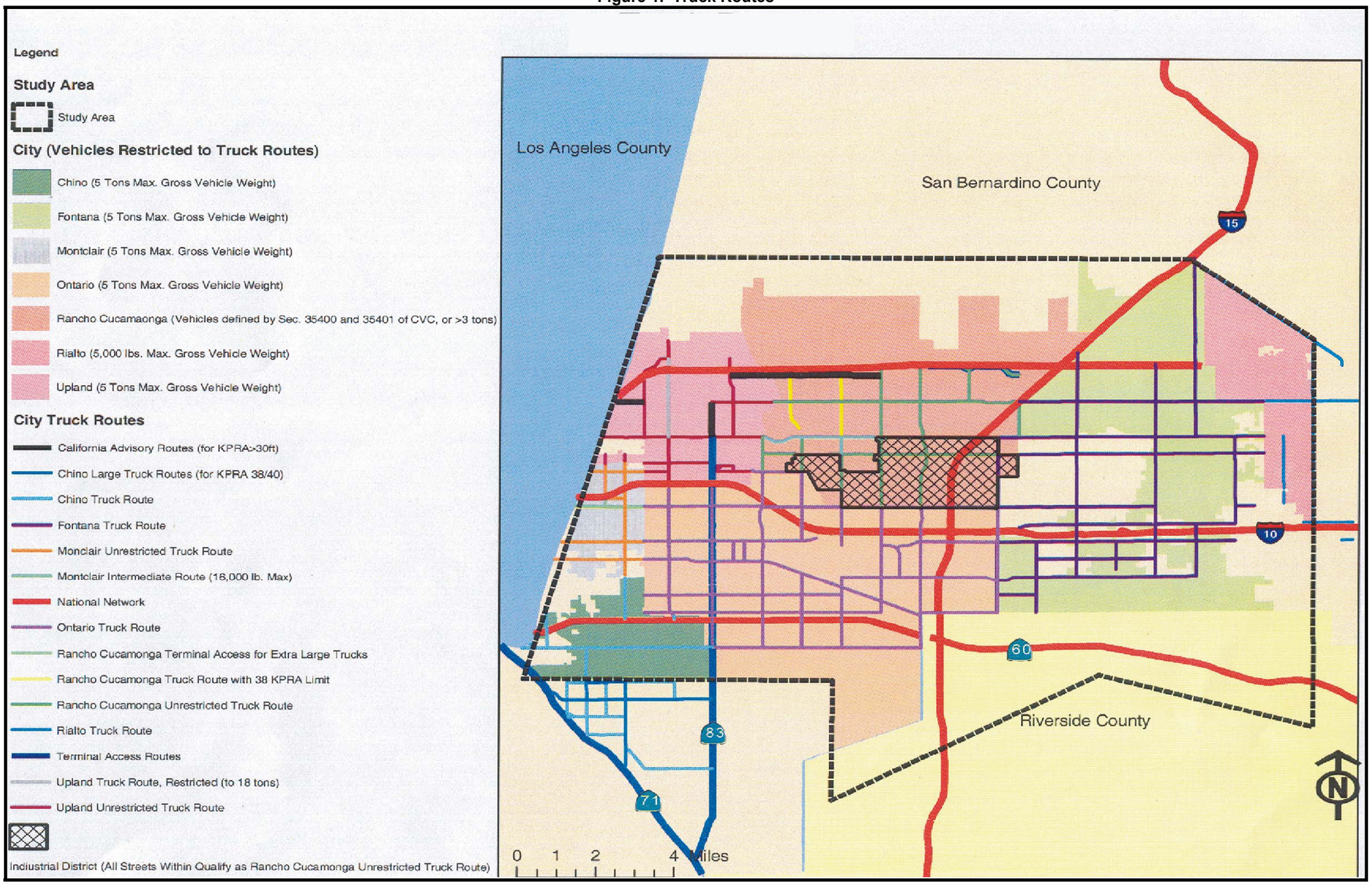
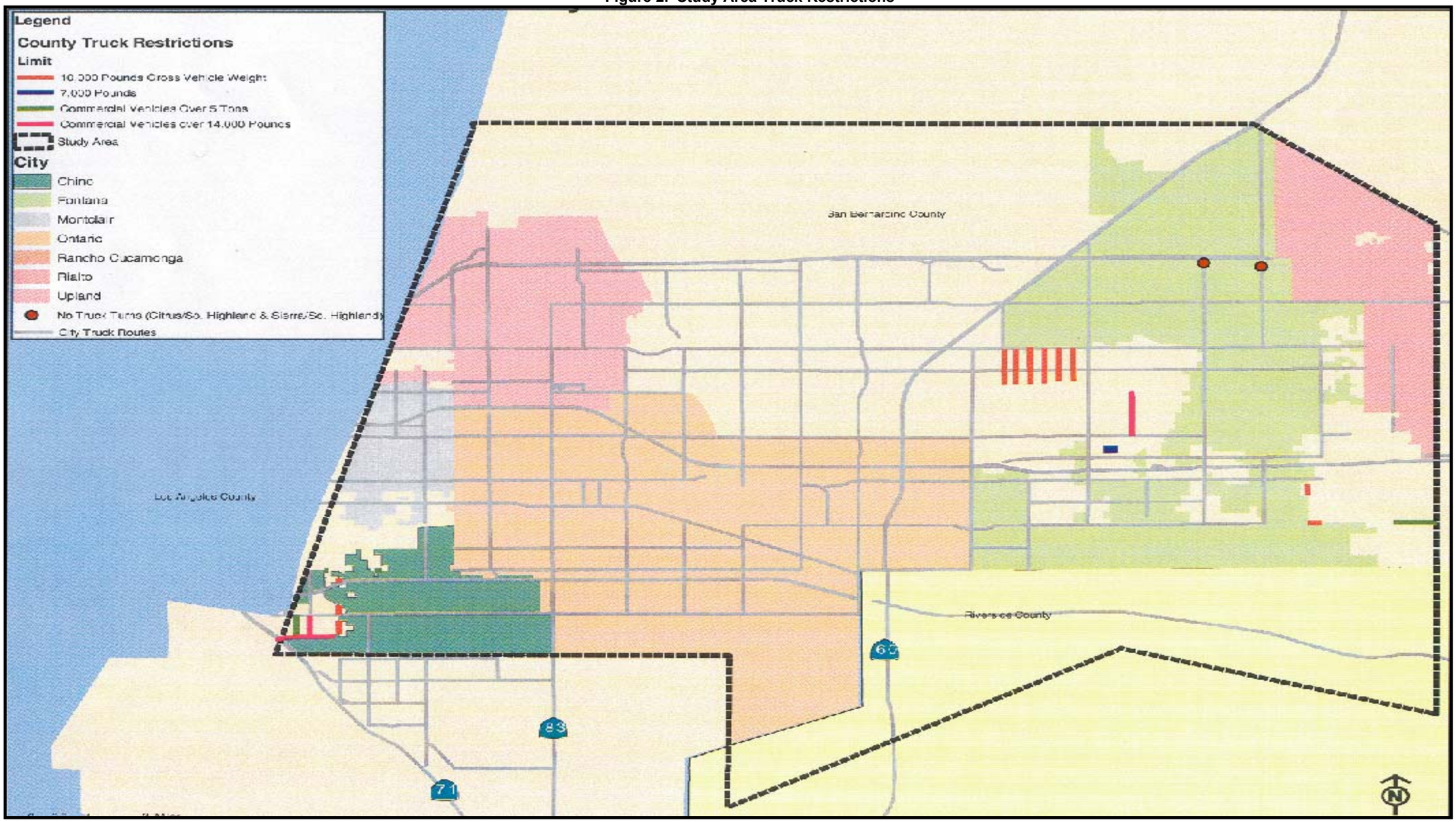


Figure 2. Study Area Truck Restrictions



3.2 Existing Truck Volumes and Percentages

Existing heavy-duty-truck volumes for the arterials in the study area were obtained through available local and regional data from 2002 and 2003. The consultant team researched and gathered available information from various sources which are as follows:

- Caltrans Truck Counts – Caltrans' Website
- City of Chino – for counts within City of Chino
- Southland Car Counters and Counts Unlimited – for counts within City of Ontario and City of Fontana
- SCAG Goods Movement Truck Count Study

Figures 3 and 4 summarize the locations and range of daily heavy duty truck (HDT) volumes for the northbound/southbound and eastbound/westbound directions, respectively. Figures 5 and 6 summarize the percent HDTs out of total vehicle volumes for the northbound/southbound and eastbound/westbound directions, respectively.

As shown in Figures 3 and 4, the highest daily truck volumes are generally concentrated around the intersection of I-15 and I-10. Highest truck volumes along heaviest truck routes are as high as 10,000 to 15,000 daily truck trips. In the northbound direction highest truck volumes are along Etiwanda Avenue, Milliken/Hamner avenues and to some extent along Haven Avenue near the Ontario Airport. In the southbound direction, the heaviest truck volumes are along Etiwanda Avenue and Milliken/Hamner avenues. For westbound and eastbound traffic, the highest truck volumes are along Jurupa Avenue from Archibald to Etiwanda and to some extent along Slover Avenue east of I-15.

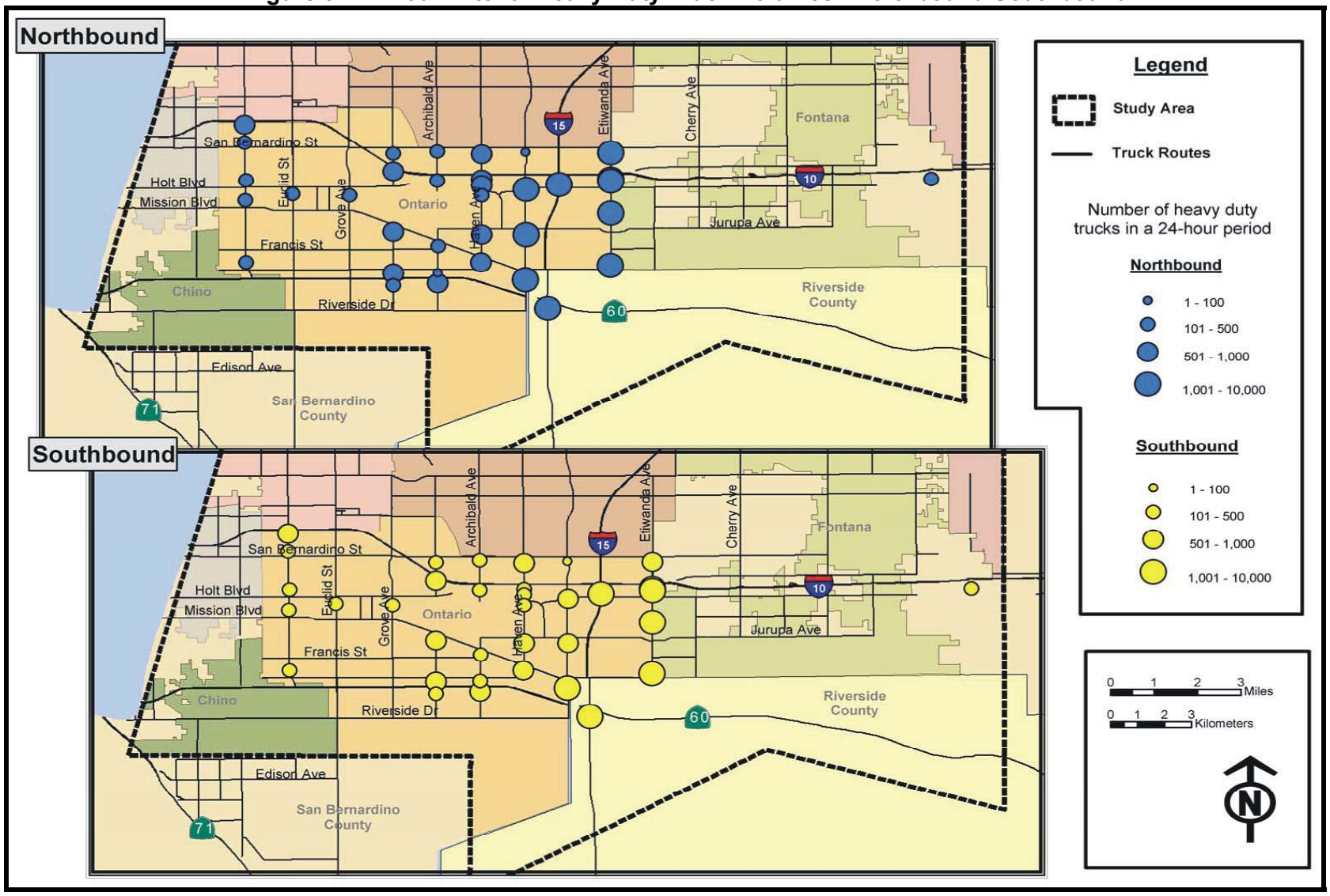
As shown in Figures 5 and 6, the highest percentages of truck trips on a daily basis are again clearly along Etiwanda Avenue, between San Bernardino Street and the Riverside County line, in the north-south direction and on Jurupa Avenue, between Archibald Avenue and Etiwanda Avenue, in the east-west direction. Highest truck percentages along heaviest truck routes are as high as 15 to 20 percent of total daily traffic.

Additional detailed truck volumes and truck percentages for the AM peak period (6-9 AM) and PM peak period (3-7 PM) are presented in Appendix A to this report.

3.3 Historical Truck Related Accidents

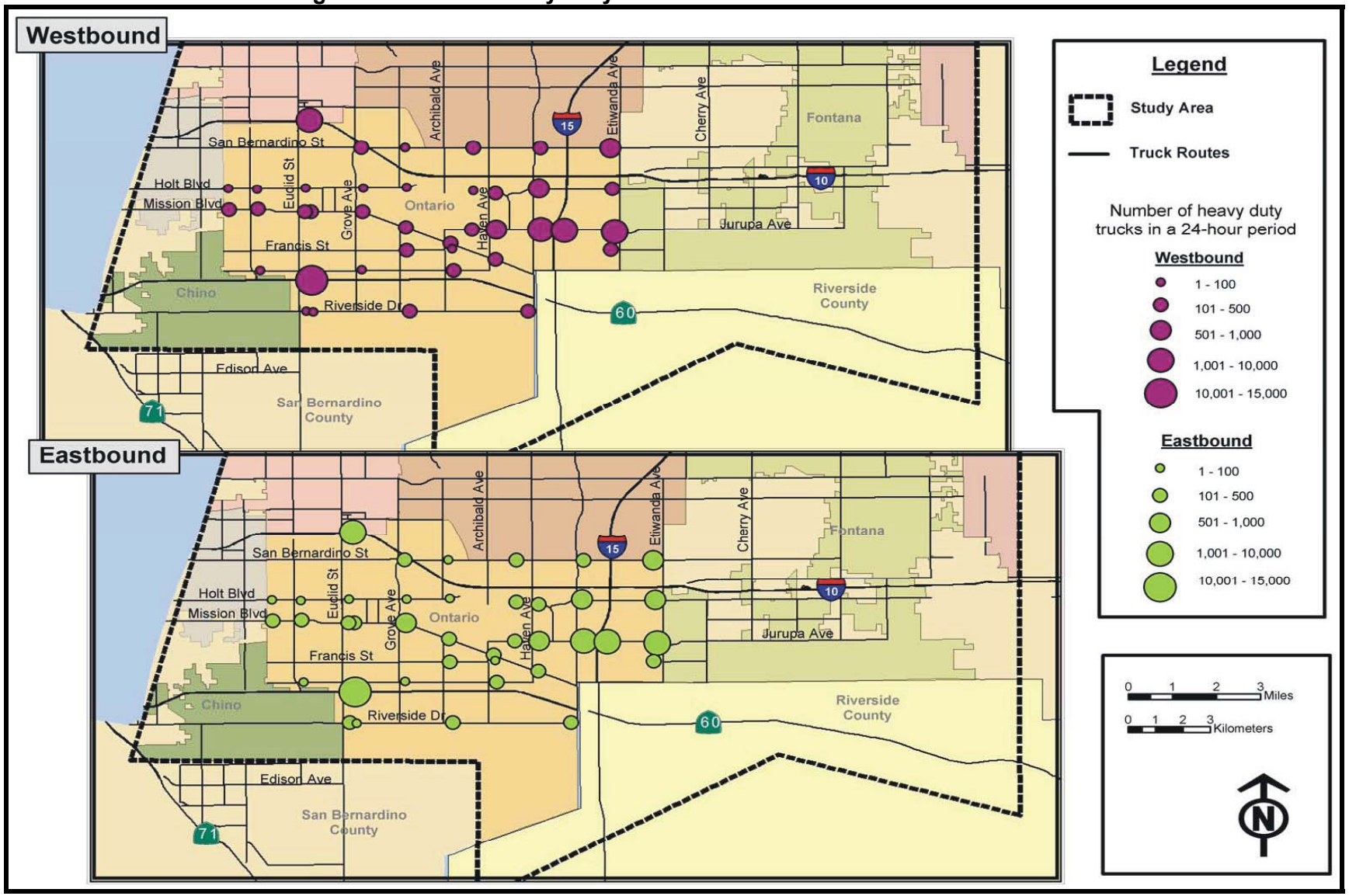
Traffic incidents are major reasons for non-recurring traffic congestion on the highway system. Research has shown that travel time delays due to congestion caused by traffic incidents accounts for as much as one half of total delay experienced by motorists. Incidents involving trucks are especially significant, since they typically results in larger highway closures and longer recovery times. Identification of truck-related accident rates and highway locations with higher truck-related incidents can help plan for specific improvements to help reduce traffic delays.

Figure 3. 24 Hour Arterial Heavy Duty Truck Volumes –Northbound/Southbound



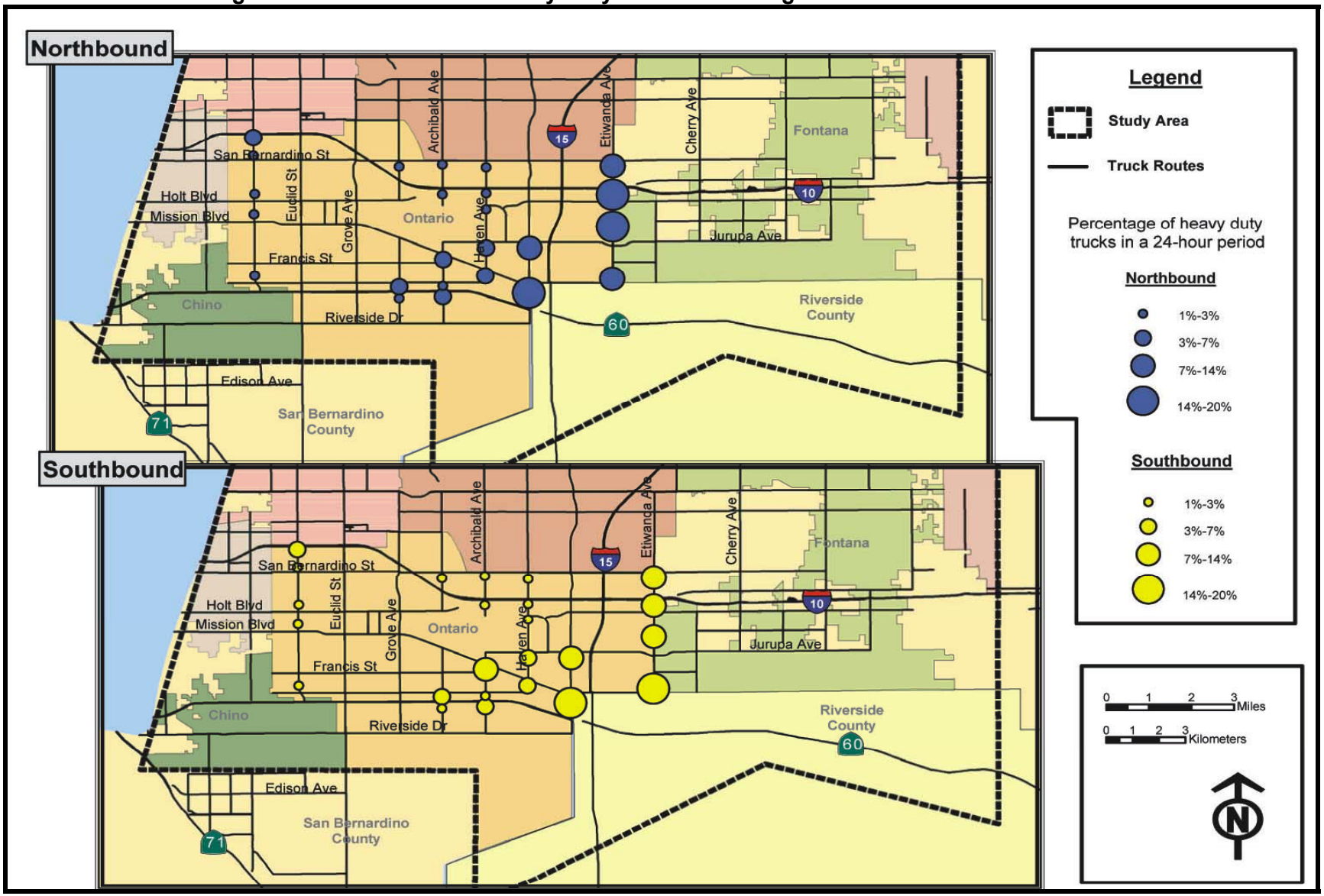
Source: Parsons Brinckerhoff

Figure 4. 24 Hour Heavy Duty Truck Volumes – Westbound/Eastbound



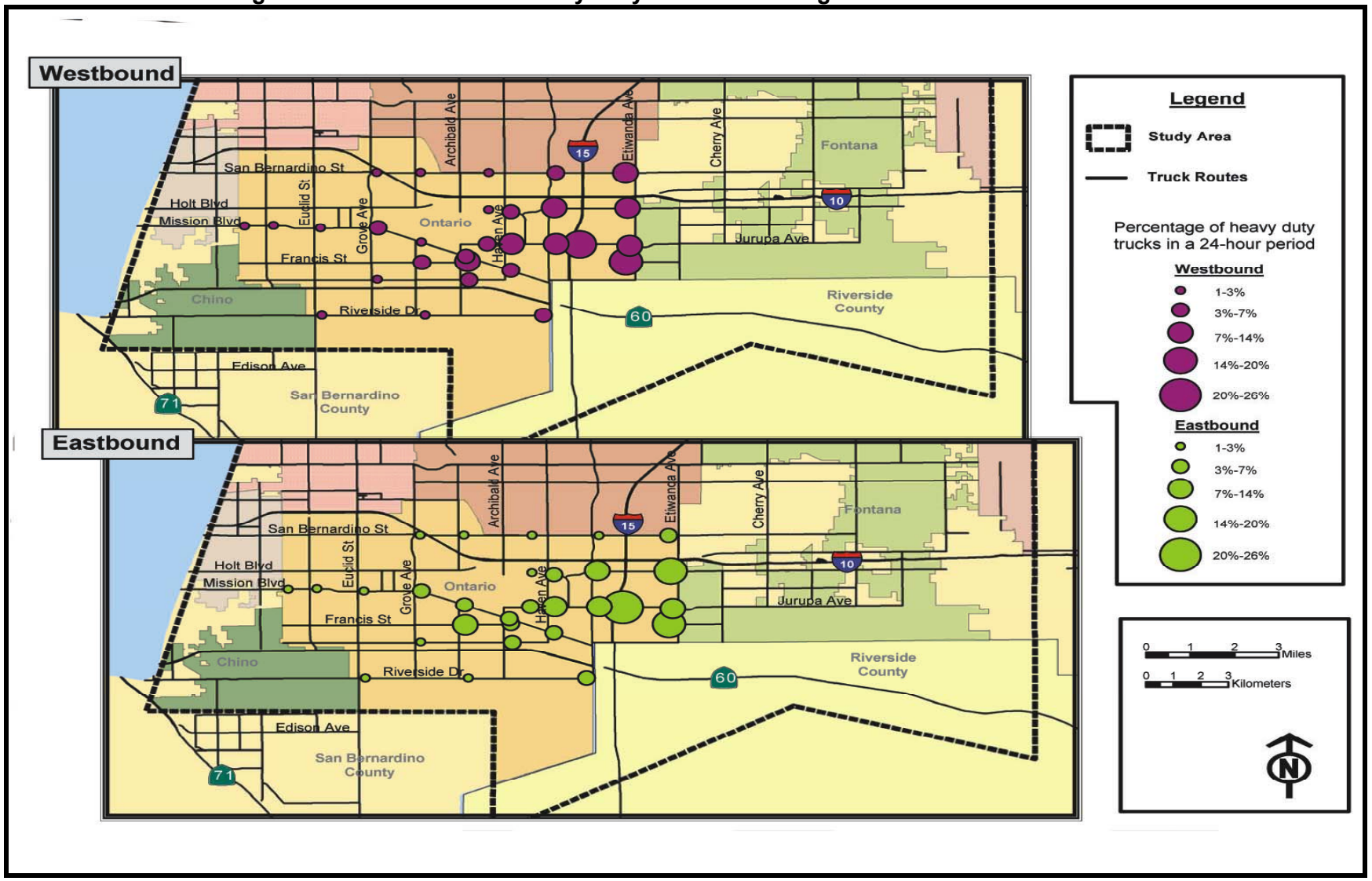
Source: Parsons Brinckerhoff

Figure 5. 24 Hour Arterial Heavy Duty Truck Percentages – Northbound/Southbound



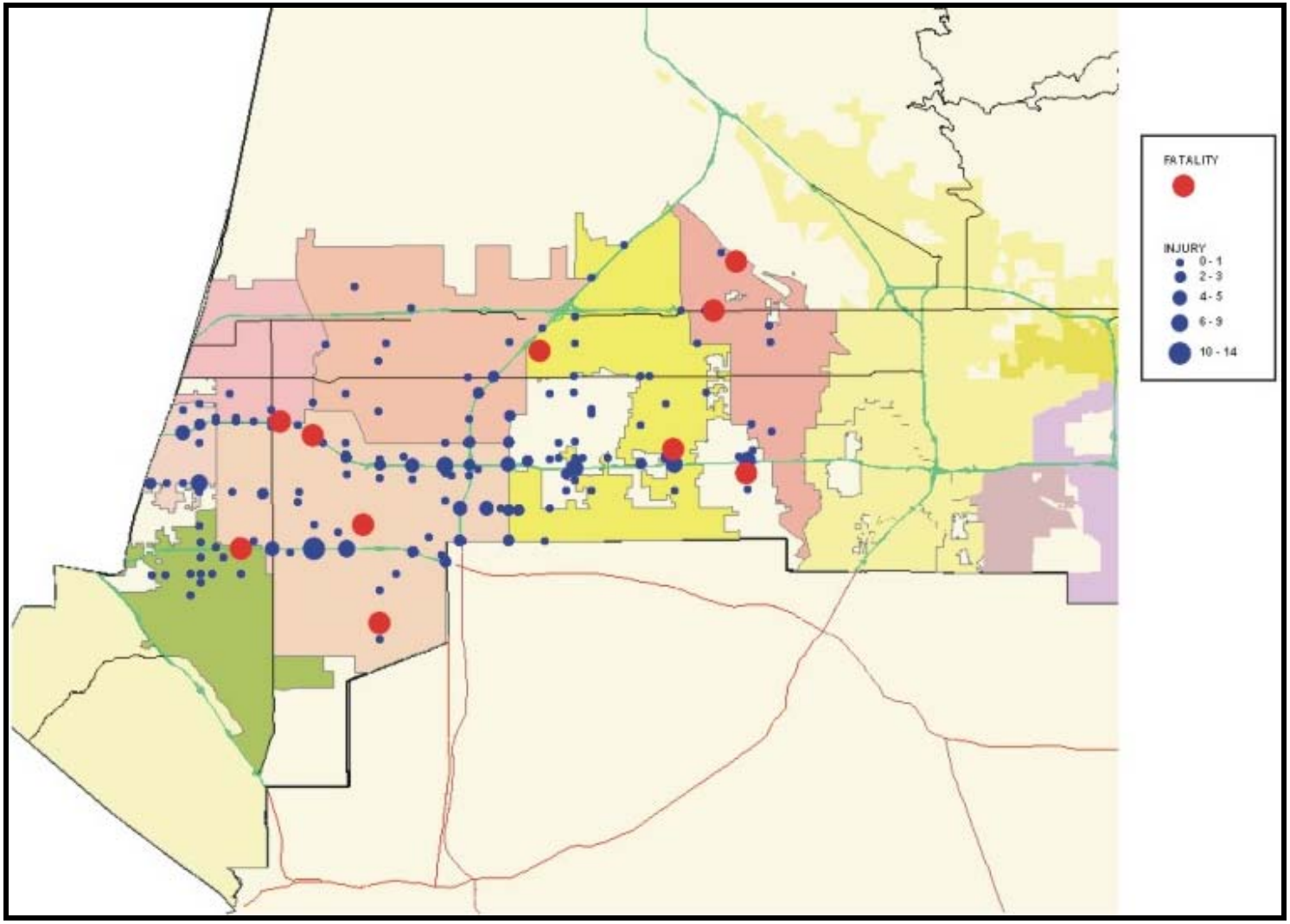
Source: Parsons Brinckerhoff

Figure 6. 24 Hour Arterial Heavy Duty Truck Percentages – Westbound/Eastbound



Source: Parsons Brinckerhoff

Figure 7. 2002 Truck Related Accident Frequency



Historical accident data were obtained through the Statewide Integrated Traffic Reporting System (SWITRS) database maintained by California Highway Patrol. Table 1 summarizes the accident data within San Bernardino and Riverside Counties. The historical accident data collected during the period of Year 1999 and 2002, show that truck-related accidents within San Bernardino and Riverside counties have decrease from 63 fatalities to 59 fatalities in 2000, to 47 fatalities for both 2001 and 2002. However, truck related accidents which resulted in personal injuries have increased slightly from 1,105 in Year 1999 to 1,062 in Year 2000, 1,133 in Year 2001 and 1,122 in Year 2002.

Given the general increase in traffic volumes and truck traffic experienced in the past years, it can be concluded that the rate of total truck related (both fatality and injury) accidents must have decreased in the past several years. However, without further investigation and identification of locations of these accidents, it is unclear what the specific reasons for these decreases are.

Table 1. Historical Truck Related Accident Summary

Year	Fatality	Injury
2002	47	1,122
2001	47	1,133
2000	59	1,062
1999	63	1,105

Source: Statewide Integrated Traffic Reporting System

Figure 7 shows the location of truck-related accidents throughout the study area, which resulted in either fatalities or personal injuries. The data shown for 2002 highlights that a substantial number of truck-related accidents occur on freeways.

3.3 Freeway Interchange Traffic Counts

As seen from the previous section, historical traffic counts in the study area revealed that truck volumes are particularly heavy along the I-15 Freeway corridor, especially between the SR-60 and SR-210 freeways. Therefore, as part of an original comprehensive data collection effort for this study, new traffic and truck classification counts were conducted at major freeway-freeway interchanges along the I-15 Freeway. Three interchanges were selected to be surveyed. They include:

- I-15/I-10 Interchange
- I-15/I-210 Interchange
- I-15/SR-60 Interchange

Comprehensive vehicular classification counts were conducted in June of 2003 at the three freeway interchanges listed above. For highest accuracy, all counts were conducted using visual and manual methods, as opposed to mechanical (tube and/or machine) counts. The count effort covered two-hour periods during morning, midday and afternoon peak periods as follows:

- Morning: 6 – 8 AM
- Midday: 11 AM – 1 PM
- Afternoon: 4 – 6 PM

Using manual methods, traffic classification counts for all freeway to freeway ramp connector movements, as well as mainline approach and departure legs, were collected. The complete results of the classification count effort are included in the Appendix, along with detailed graphics on individual freeway-freeway interchanges.

In order to identify significant truck travel patterns along the I-15 corridor, the total vehicular and truck volumes were combined into one single graphic for each of the three time periods. Figures, 8, 9 and 10 summarizes the traffic counts at the Interchanges for the two-hour AM, midday and PM peak periods, respectively. The figures summarize total traffic volumes, HDT volumes and HDT percentages for all freeway-to-freeway ramp movements as well as freeway mainlines both upstream and downstream from the interchanges for the two-hour periods.

As can be seen from these figures, truck volumes and percentages on both mainline and ramp connectors are generally higher during the mid-day period compared to either AM or PM periods. This is consistent with previously identified trends in many other regional efforts, which have verified that truck volumes typically peak between the mid-day hours of 10 AM and 2 PM, and that truckers given the choice generally try to stay away from peak traffic conditions.

Figure 8. I-15 Interchanges AM Peak Period Traffic Volumes

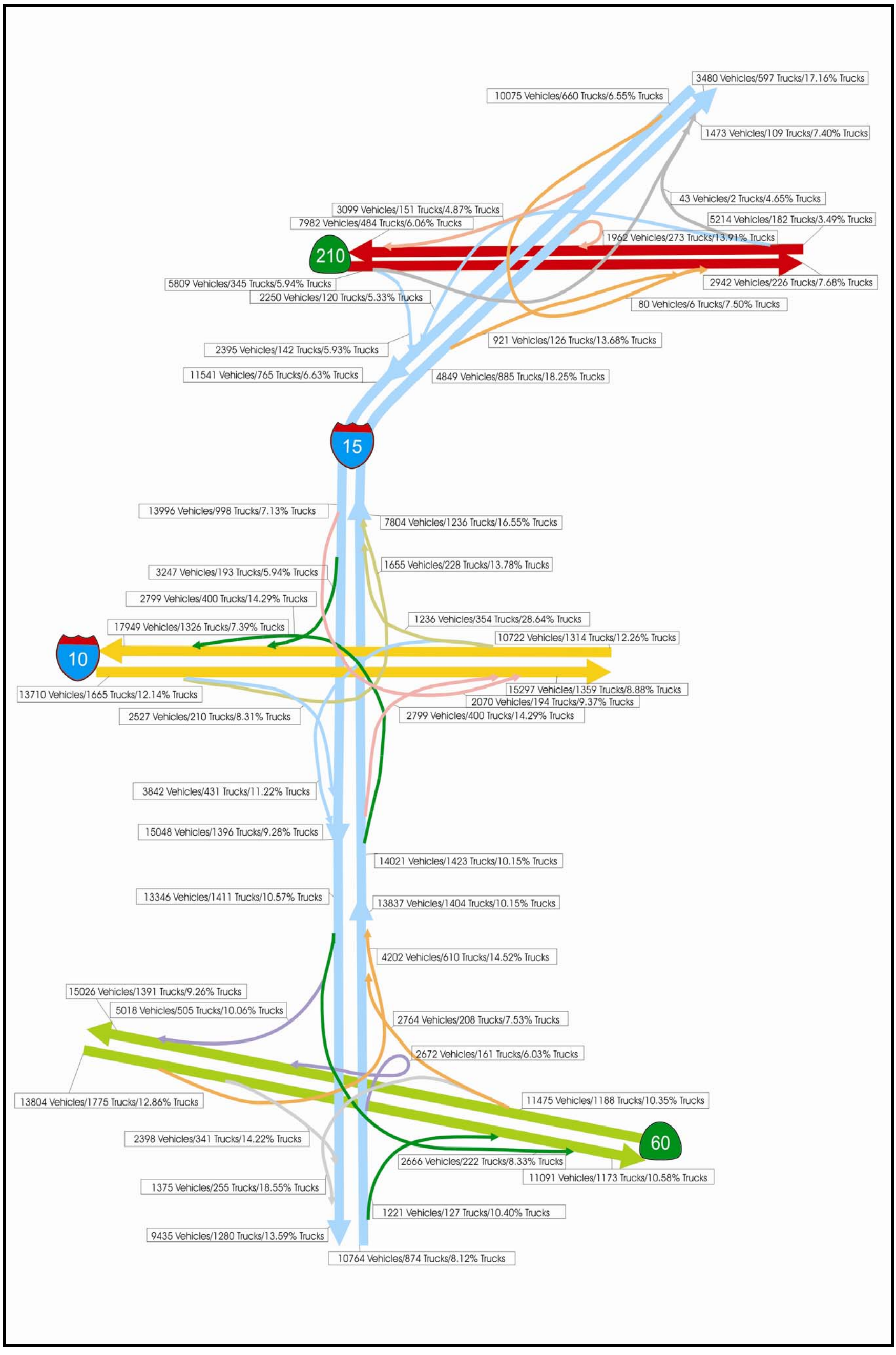


Figure 9. I-15 Interchanges Midday Peak Period Traffic Volumes

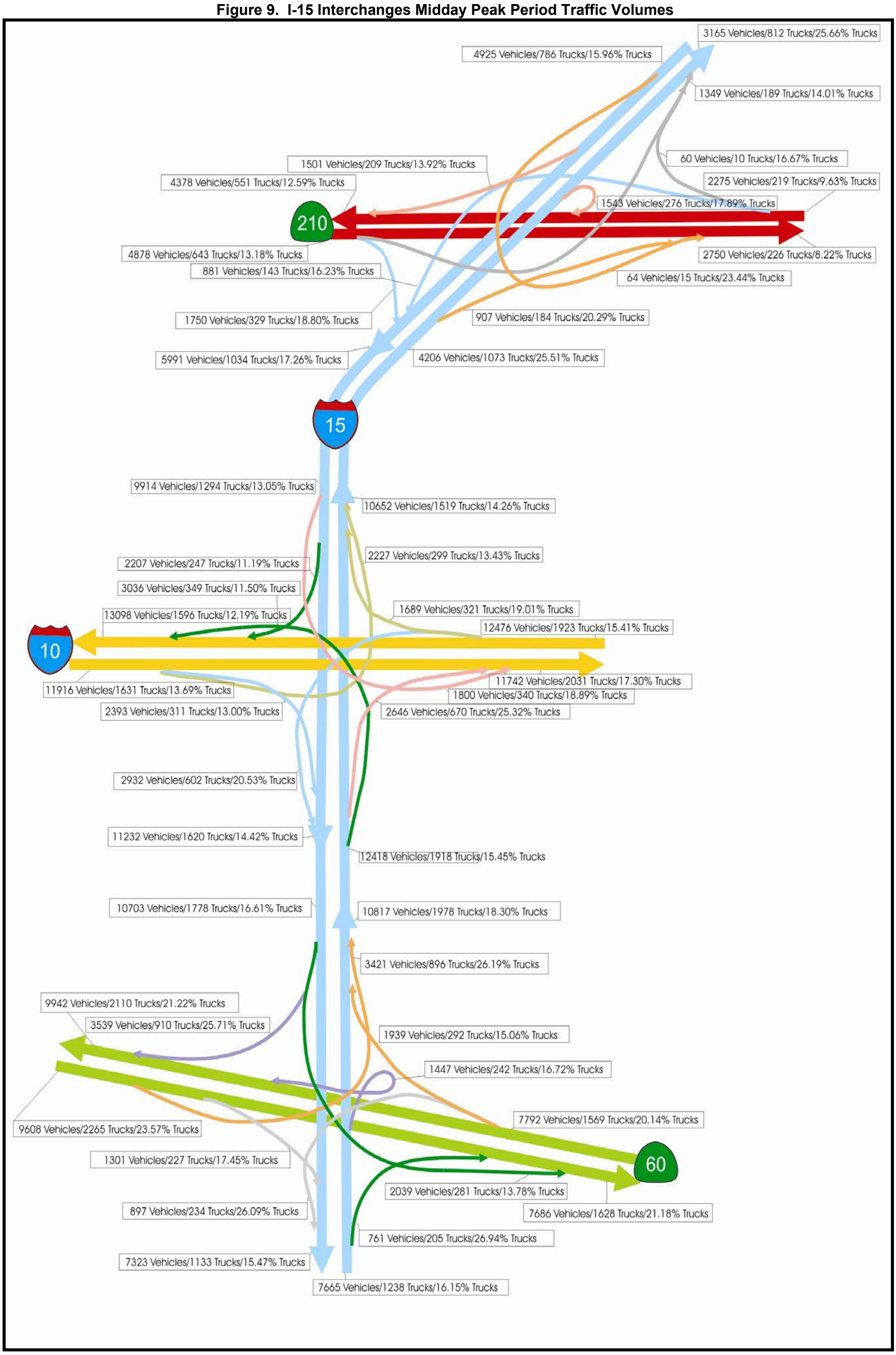
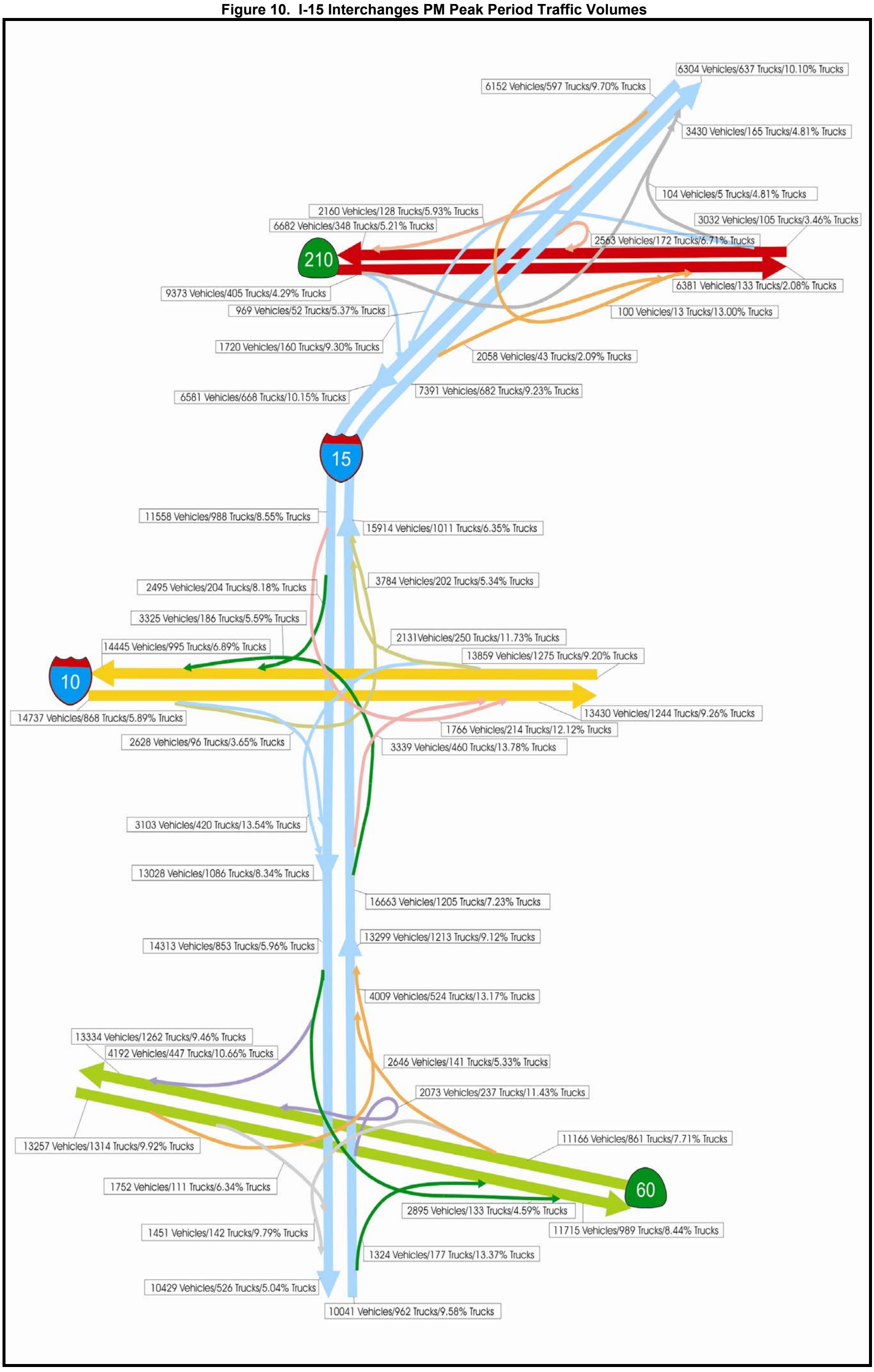


Figure 10. I-15 Interchanges PM Peak Period Traffic Volumes



The segment of I-15 between I-10 and SR-60 carries the heaviest two-way truck volumes. The following is a summary of the total two-way traffic volumes and HDT volumes on this segment for the three peak periods.

- AM: total vehicles = 28,100 HDT = 2,820 % HDT = 10.0%
- Mid-day: total vehicles = 22,600 HDT = 3,650 % HDT = 16.2%
- PM: total vehicles = 28,700 HDT = 2,180 % HDT = 7.6%

As can be seen, the overall results are fairly intuitive, as summarized below:

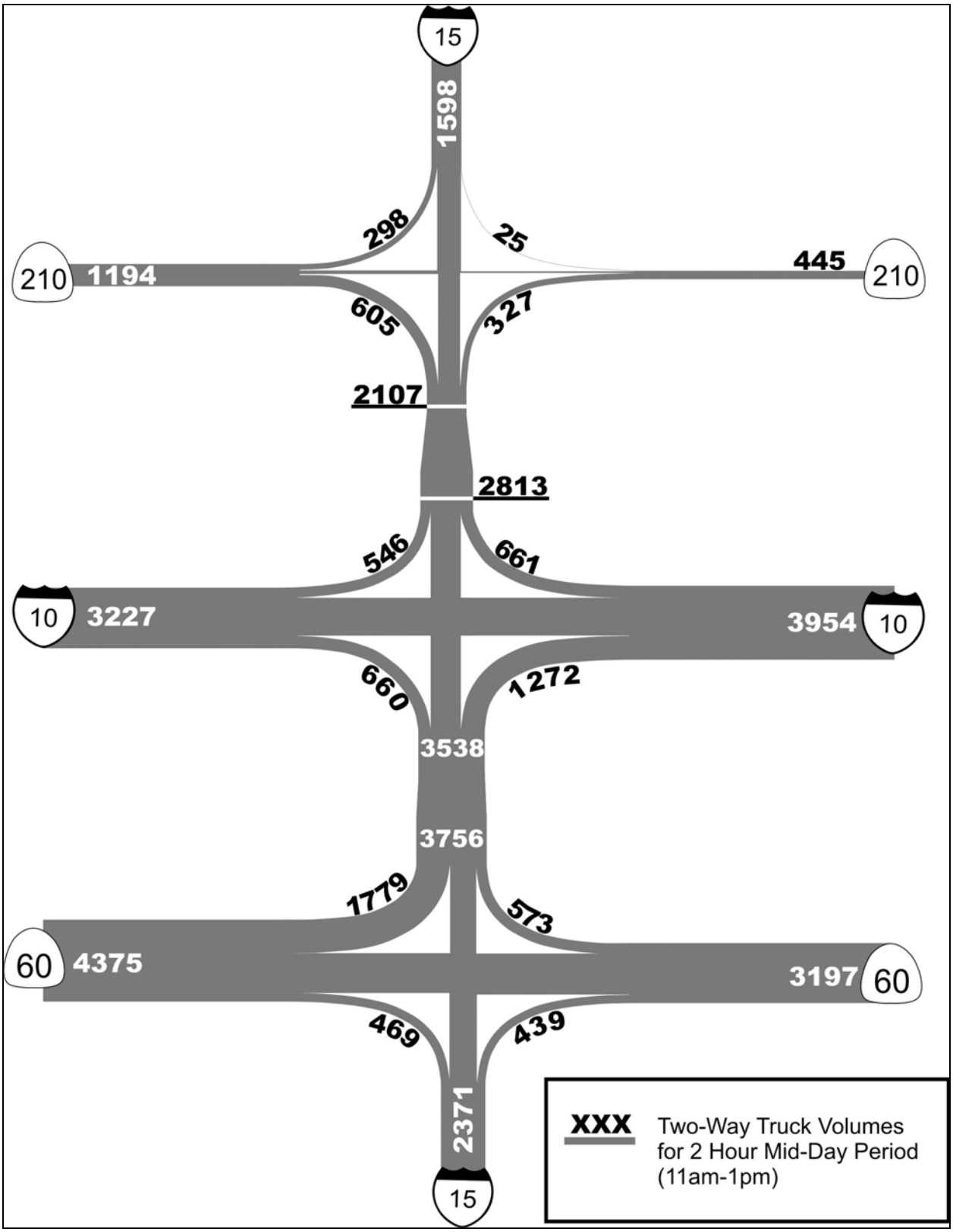
- Total vehicular volumes are higher in the AM and PM peaks compared to the mid-day (, with the PM peak slightly higher than the AM)
- HDT volumes are the highest in the mid-day period (29% higher than AM and 67% higher than PM)
- HDT volumes are higher in the AM than the PM peak (29%)
- HDT percentages are the highest in the mid-day, where the heavy vehicles constitute over 16% of the total traffic, whereas in the AM and PM peaks, HDTs are 10 percent or less

A closer look at the two-hour mid-day period, which as stated above includes the highest volumes of trucks, reveals the following:

- The heaviest one-way north-south truck volume is 1,918 trucks on I-15 northbound between I-10 and SR-60, with the second highest 1,778 southbound on the same segment
- The heaviest one-way truck volume on any of the east-west freeways is 2,265 trucks eastbound on SR-60 approaching I-15, with the second heaviest, 1,923 westbound SR-60 approach to I-15
- The heaviest connector ramp truck volume is 910 trucks from southbound I-15 to westbound Sr-60, with second highest being 869 trucks on the corresponding reverse movement from eastbound SR-60 to northbound I-15
- The second set of highest connector ramp truck volumes are 670 and 602 trucks, from northbound I-15 to eastbound I-10 and the reverse, from westbound I-10 to southbound I-15

Figure 11 illustrates a summary of the magnitude and patterns of the heavy duty truck movements for the mid-day period. Band widths in this graphic are proportional to the volumes of trucks during the two-hour mid-day period. As seen on this figure and from

Figure 11. Truck Movement Summary at I-15 Interchanges



the above observations, a very significant "S"-shaped truck movement pattern exists during the two-hour mid-day peak period. It is very clear that heavy volumes of trucks travel eastbound on SR-60, then use the short (less than 4-miles) segment of I-15 to connect with I-10 destined to points east. In the reverse direction, large volumes of trucks travel westbound on I-10, then southbound on I-15 and eventually transitioning to westbound SR-60 destined to points west.

Other secondary observations from the mid-day volumes include:

- The highest truck percentage on any mainline segment is 25.7 percent trucks on I-15 northbound, north of SR-210, with second highest at 25.5 percent trucks on I-15 northbound, south of SR-210. This is an indication of large volumes of trucks destined to north San Bernardino County and possibly out of state during the mid-day period

- Analyzing the east-west truck patterns west of the I-15 on the three freeways, it can be seen that during the mid-day period, more trucks leave the study area (4,530-- eastbound) than enter (4,257--westbound), which is a ratio of 52/48 percent.

- Analyzing the east-west truck patterns east of the I-15 on the three freeways, it can be seen that during the mid-day period, the same pattern as above is true with slightly more trucks leaving the study area (3,885-- eastbound) than entering (3,711--westbound), which is a ratio of 51/49 percent.

- West of the I-15, 50% of the east-west truck volume is carried by SR-60 Freeway, while east of the I-15, 52 percent of the east-west truck volume is carried on the I-10 Freeway

- West of the I-15, trucks are 16 percent of the total east-west traffic, while east of the I-15 trucks are 18 percent of the total east-west traffic along the three freeways

These observations of truck volumes, percentages and travel patterns will be useful in planning and prioritizing freeway ramp and mainline improvements and for verification of truck patterns in model validation processes.

4. TRUCK TRIP GENERATION RATES

The increased importance of trucks in transportation planning and traffic engineering has contributed to a need for trip generation data that can be used to estimate truck traffic volumes. Some of the truck trip generation data needs are as follows:

- Planning for major corridor, subregional, or regional roadway improvements and maintenance requirements.
- Development of truck routes
- Forecasting regional truck travel demand to meet federal and state transportation planning mandates
- Estimating the impacts of new and expanding development on local traffic patterns.
- Estimating the needs for access improvements and parking facilities for major freight terminals, freight activity centers, warehouses, retail and office buildings.

This section of the report presents some of the most recent local and national efforts in the development of truck trip generation rates.

One of the generalized sources of truck trip generation rates in the region is the Southern California Association of Governments (SCAG) Heavy Duty Truck (HDT) model, which is used for forecasting regional movements of heavy-duty trucks. SCAG HDT model includes four main components: trip generation, trip distribution, time of day factoring, and traffic assignment.

As discussed in Chapter 2, SCAG's HDT internal trip generation model is designed to forecast three types of heavy-duty trucks by gross vehicle weight (GCW), including light-heavy, medium-heavy and heavy-heavy trucks. Truck classifications in the model are based on GVW because the model produces vehicle emissions data that are used for air quality analysis, consistent with the Air Resources Board methodologies.

In the SCAG Regional Model, truck trips are generated based on a cross-classification methodology, which applies the truck trip rates to number of households and employment categories at Traffic Analysis Zone (TAZ) level. The employment categories (by SIC code) are as follows:

- Agriculture/Mining and Construction
- Retail
- Government
- Manufacturing
- Transportation
- Wholesale
- Other

The trip rates are split into weight classes and different employment categories as presented in Table 2. The SCAG Regional HDT rates were developed based on a combination of national research of other truck models and trip generation data developed from surveys of trucking activities conducted in southern California.

Table 2. Daily HDT Trip Rates for Internal Truck Trip Generation

Land Use Category	Light HDT	Medium HDT	Heavy HDT
Households	0.0390	0.0087	0.0023
Agriculture/Mining and Construction	0.0513	0.0836	0.0569
Retail	0.0605	0.0962	0.0359
Government	0.0080	0.0022	0.0430
Manufacturing	0.0353	0.0575	0.0391
Transportation/Utility	0.2043	0.0457	0.1578
Wholesale	0.0393	0.0660	0.0633
Other	0.0091	0.0141	0.0030

Note: Trip rates are per employee for all categories except for households which are per dwelling unit
Source: SCAG Regional Travel Demand Model

The SCAG HDT model is developed to address overall regional truck activity issues at a macro scale and is generally not accurate and detailed enough for micro-scale traffic engineering applications, especially at major truck and cargo activity centers. Hence, several local agencies have developed more customized truck trip generation rates and focused models. These include the Ports of Los Angeles (POLA) and Long Beach (POLB), Ontario Airport, City of Fontana and San Bernardino Associated Governments (SANBAG).

POLA and POLB marine container terminals, truck trip generation are estimated using a model which considers existing terminal operation/throughput. The model called "Quicktrip" was developed and validated against gate transaction data and gate counts. Figure 12 illustrates the Quicktrip model inputs and outputs. The model includes the following input factors:

- Peak week/average week ratio within the peak month (derived from gate transaction data)
- Peak day/average day ratio within the peak week - dependent upon number of days the terminal is open per week (derived from gate transaction data)
- Annual or monthly Truck Equivalent Unit (TEU) throughput
- TEU-to-lift conversion factor (derived from throughput data)
- Cargo "splits" – percent via on-dock rail, off-dock rail, local, and empties across the wharf

- Number of operating days during the week
- Percent of throughput moved each shift (for the day, second & hoot shifts)
- Local and empty container leakage (from throughput data)
- Percent street turns and chassis re-use (estimated)

It should be noted that the results from the Ports of LA and LB trip generation model have been incorporated into the SCAG HDT model.

It is generally recognized that much more extensive research needs to be conducted to refine the SCAG Regional Model's HDT trip generation rates, as other improvements are being implemented to the model. SCAG has been programming additional funds to augment the current trip generation research by conducting statistically significant trip generation surveys of the various industries and land uses throughout the region in the near future. This work will be performed as part of the on-going model improvement program.

Figure 12. POLA and POLB Marine Terminal Trip Generation (QuickTrip)

MOFFATT & NICHOL ENGINEERS — THE PORT OF LONG BEACH

"QUICKTRIP 2000", VERSION 12.12.00

THROUGHPUT & TRIP GENERATION MODEL FOR

EXISTING TERMINALS

Terminal:	
User:	
Date:	

INPUT

Note: For Trip Generation Calculations Only, Italicized Inputs May be Ignored

1	Enter Gross Terminal Area (Acres)		
2	Enter Berth Length (Feet)		
3	Enter Dockside Crane Gauge (feet)		
	Calculated Area of Wharf (Acres)		0
4	Enter Gate Area, (Acres)		
5	Enter Area of Buildings & Parking (Acres)		
6	Enter Railyard Area, (Acres)		
7	Enter Dynamic Capacity of Railyard (1=low 2=high)		
8	Enter Ratio (Average TEU/Container)		
	Calculated Net Container Storage Area, (Acres)		0
9	Enter Peak Monthly Throughput, in TEU's, If Known		

		% of Total Throughput	Dwell (days)
10	Enter Throughput Distribution & Dwell (Over the Dock)		
10a	Local Imports	28.6%	6
10b	Local Exports	11.3%	10
10c	Empties	25.6%	15
10d	Transhipment	0.0%	5
10e	Intermodal Imports - On Dock	18.5%	2
10f	Intermodal Imports - Off Dock	5.6%	1
10g	Intermodal Exports - On Dock	8.5%	5
10h	Intermodal Exports - Off Dock	1.9%	4
	Check Total (Must = 100%)	100.0%	

11	Enter Gate Data				
11a	Number of Days Per Week Gate Will Be Open	5			
		DAY	2ND	HOOT	CHECK
11b	Allocation of Gate Traffic By Shift	60%	20%	20%	100%

12	Variable Factors		
12a	Percent of Import/Export (Landside) Box Re-Use	20%	Default = 10%
12b	Percent of Intermodal (Landside) Chassis Re-Use	20%	Default = 25%
12c	Peak Week / Average Week Ratio	1.00	Default = 1.08
12d	Percent Double Cycle Trucks	45%	Default = 25%
12e	Percentage of Weekly Gate Traffic Allocated to Weekend	15%	
12f	Use Day Peaking Factor? (1=Yes, 2=No)	2	
12g	Local Empty Loss Factor	10%	
12h	Intermodal Empty Return Factor, Percent	51%	

The Institute of Transportation Engineers (ITE) has for many years developed and maintained a trip generation manual, which is the National standard for traffic engineering. This document however, has a relatively limited data base on truck trip generation. A major part of the truck trip generation data in the current ITE Manual comes from a more than decade old study conducted by the City of Fontana. In response to very large and growing number of heavy duty truck generators, the City of Fontana recently conducted another major truck trip generation study, which is intended to ultimately be incorporated into the ITE Manual. The purpose of study was to evaluate the vehicle characteristics of several land use categories that typically generate significant volumes of truck traffic. The trip generation rates were developed based on the ITE trip generation methodology. The trip generation rates are estimated for the following land use categories:

- Warehousing (ITE code 150)
- General Light Industrial (ITE code 110)
- General Heavy Industrial (ITE code 120)
- Industrial Park (ITE code 130)
- Truck Sales and Leasing (not an ITE category)
- Used Truck Lots (not an ITE category)
- Truck Terminal (ITE code 030)
- Truck Stops (not an ITE category)

Trip generation rates are calculated for the three independent variables, including:

- Number of employees
- Gross building area, measured in 1,000 square feet (KSF)
- Acres

The statistics are calculated for five periods:

- Daily (24-hour)
- a.m. peak hour street
- p.m. peak hour street
- a.m. peak hour site
- p.m. peak hour site

For all periods, except daily, trip generation rates are calculated for total vehicle trips (including passenger vehicles) and truck trips (excluding passenger vehicles). As an example, the trip generation rates for Light Warehouse are presented in figures 13 and 14.

Figure 13. Truck Mix – Light Warehouse

	Recommended Large Truck Mix (%)							
	Lge 2 Ax	3 Axle	4+ Axle	Total				
	24.7	20.6	54.6	100.0				
	Pass Veh	Lge 2 Ax	3 Axle	4+ Axle	Total			
	80.3	5.2	4.5	10.0	100.0			
	Site Entering & Exiting							
	a.m.				p.m.			
	Total Enter	Total Exit	Large Truck Enter	Large Truck Exit	Total Enter	Total Exit	Large Truck Enter	Large Truck Exit
Split	73.97	26.03	62.07	37.93	23.81	76.19	45.45	54.55
	Street Entering & Exiting							
	a.m.				p.m.			
	Total Enter	Total Exit	Large Truck Enter	Large Truck Exit	Total Enter	Total Exit	Large Truck Enter	Large Truck Exit
Split	73.77	26.23	65.22	34.78	20.00	80.00	31.58	68.42

Source: Fontana Trip generation Study

Figure 14. Truck Trip Generation Rates for Light Warehouse

Statistics	No. of Employees	Gross Building Area (KSF)	Acres
Weighted Average Trips	3.713	1.659	35.874
Mean Trip Rate	6.755	1.710	37.111
Standard Deviation	6.868	.638	14.695
Linear Regression			
Coefficient	1.149	-3.676	-63.690
y Intercept	286.492	1334.121	1151.451
r Squared	.700	.791	.606
Logarithmic Regression			
Coefficient	1.003	.991	.855
y Intercept	296.840	4156.615	2444.849
r Squared	.642	.838	.597
Trip Rates			

Source: Fontana Trip generation Study

Another truck trip generation study was conducted as part of San Bernardino East Valley Traffic and Truck Study for Major Development Initiatives project. Based on the data collected at the Burlington Northern and Santa Fe (BNSF) railroad intermodal facility, the truck trip generation rates were calculated given the number of "lifts" at the facility and "gate" counts. A "lift" is defined as movement of a unit on or off of a railroad car which is the fundamental unit of activity at intermodal facilities. A "gate count" is defined as the number of trucks entering and leaving the facility.

Total BNSF truck gate moves, including the remote lots, were collected and a gate-to-lift ratio of approximately 1.47 was estimated. This ratio can then be used to estimate the truck gate moves.

As part of the Ontario Airport Master Plan and the related planned major air cargo facilities, truck trip generation rates were calculated by Meyer, Mohaddes Associates for various types of air cargo activity. These trip generation rates use annual tons of cargo as the independent variable and provide the number of total daily trucks to and from the cargo facility.

Truck and auto trip generation rates were developed for three types of air cargo activities: air freight and mail (belly) cargo, all-cargo express and international cargo. The trip generation rates are provided in Table 3.

Table 3. Air Cargo Facility Airport Trip Generation

	Autos	Trucks
Air freight and mail (belly) cargo	3.4 Vehicles Per Ton	6.0 Vehicles Per Ton
All-cargo express	3.4 Vehicles Per Ton	1.2 Vehicles Per Ton
International cargo	3.713 per Employee	0.14 Vehicles Per Ton

Source: Draft Ontario Master Plan

Finally, a rich source of truck trip generation data is the National Cooperative Highway Research Program (NCHRP) Synthesis 298, "Truck Trip Generation Data, A Synthesis of Highway practice". The report provides truck trip generation data from many cities and region in the country such as Chicago, IL, Phoenix, AZ, Atlanta, GA, Buffalo, NY and Alameda County, CA.

5. SHIPPERS AND CARRIERS ORIGIN/DESTINATION SURVEYS FOR MODEL DATA UPGRADES

As part of the Sub-Regional Freight Movement Study, the consultant team conducted detailed surveys of local trucking companies and shipper/receiver businesses within the West San Bernardino Valley Region. Trucking company surveys are used to develop and/or augment regional truck trip generation rates, to develop customized local trip generation rates, as well as to develop data on truck travel patterns for special trip generators. The survey questionnaires and format were developed based on meetings between consultant and agency staffs. Samples of the survey questionnaire for trucking company and the shipper/receiver are provided for reference.

A total of 405 questionnaires/surveys were sent to various businesses including those obtained through the California Trucking Association (CTA), City of Ontario and City of Rancho Cucamonga. A total of 37 (approximately 9 percent) of the surveys were returned. Traditionally, these types of surveys typically yield relatively low return rates. It is expected that the low return rate for this specific survey may be attributable to other recent surveys that were conducted. Therefore, businesses may have viewed this effort redundant.

The consultant team performed a brief summary analysis of the survey results, however it should be noted that due to the low sample/return rate, the results are statistically not significant. Tables 2 and 3 summarizes some of the main questions/replies for both the trucking company survey and shipper/receiver survey, respectively. A total of 17 trucking-company surveys were received/summarized.

5.1 Truck-Stop User Survey

Surveys were conducted at the TA Travel Center in Ontario as shown in Figure 15 on June 13, 2003 (Friday). The truck stop is located at the I-10/Milliken Avenue off-ramp, on the south side of the freeway. The truck stop lies near two other freeways: I-15 and SR-60. Milliken Avenue is the closest off-ramp west of the I-15/I-10 interchange. The truck stop is approximately six miles north of the SR-60/Milliken Avenue off-ramp.

Figure 15. Location of Truck Stop for Survey

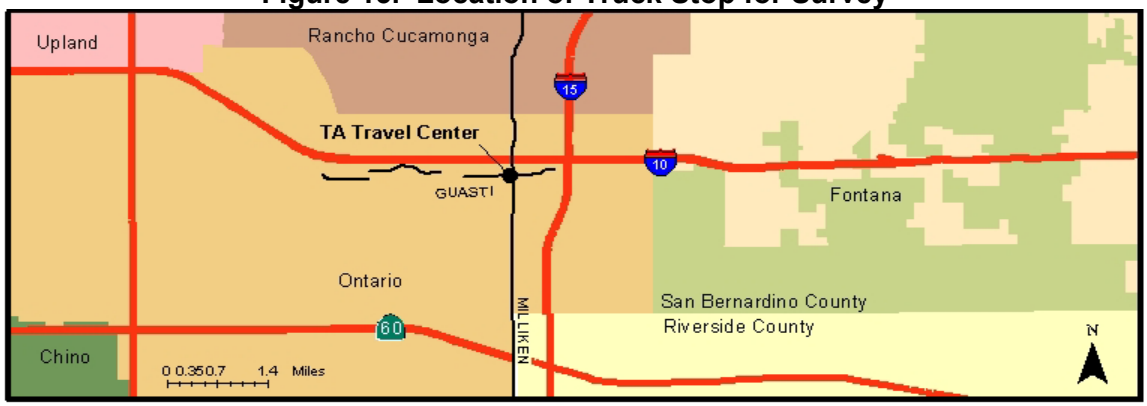


Table 2 Trucking Company Survey Summary

What type of trucking services do you offer?

Trucking Service	Percentage
LTL	15%
Truckload	27%
Refrigerated	6%
Flatbed	6%
Tank	9%
Bulk	3%
Parcel	6%
Drayage	9%
Agricultural	0%
Other	18%
Total	100%

What truck types do you operate?

Truck Type	Percentage
Straight	13%
Tractor-trailers	65%
Doubles	10%
Others	12%
Total	100%

About how many trips do you make within the study area each day?

Average 15

About how many trips do you make to and from the study area each day?

Average 8

About how many trips do you make transiting through the study area each day?

Average 12

About what percentage of your outbound trips from each facility go to:

Trip destination	Percentage
With the study area	19%
Elsewhere in San Bernardino County	8%
Elsewhere in Riverside County	8%
Orange County	7%
San Diego County	8%
Los Angeles County	10%
Ventura County	2%
Outside of SCAG Modeling Region	5%
Beyond California	33%
Total	100%

If located elsewhere in So. Cal., about what percentage of your outbound trips from each facility go to:

Trip destination	Percentage
With the study area	6%
Elsewhere in San Bernardino County	11%
Elsewhere in Riverside County	8%
Orange County	18%
San Diego County	8%
Los Angeles County	26%
Ventura County	3%
Outside of SCAG Modeling Region	14%
Beyond California	6%
Total	100%

Table 3 Shipper/Receiver Survey Summary

What is the normal year-round employment at this facility?

Average 95

What type of trucking services do you use for your business?

Trucking Service	Percentage
LTL	24%
Truckload	27%
Refrigerated	6%
Flatbed	6%
Tank	4%
Bulk	4%
Parcel	13%
Drayage	10%
Agricultural	3%
Other	1%
Total	100%

In what truck types do you receive inbound shipments?

Truck Type	Percentage
Straight	21%
Tractor-trailers	76%
Doubles	3%
Others	0%
Total	100%

About how many inbound truck trips does this facility receive in an average week?

Average 169

In what truck types do you ship outbound shipments?

Truck Type	Percentage
Straight	24%
Tractor-trailers	69%
Doubles	6%
Others	1%
Total	100%

About how many outbound truck trips does this facility generate in an average week?

Average 192

About what percentage of your fleet's outbound truck trips go to:

Trip destination	Percentage
With the study area	11%
Elsewhere in San Bernardino County	8%
Elsewhere in Riverside County	8%
Orange County	7%
San Diego County	6%
Los Angeles County	18%
Ventura County	3%
Outside of SCAG Modeling Region	18%
Beyond California	22%
Total	100%

About what percentage of your own fleet's trips go to:

Trip destination	Percentage
With the study area	19%
Elsewhere in San Bernardino County	13%
Elsewhere in Riverside County	13%
Orange County	8%
San Diego County	10%
Los Angeles County	16%
Ventura County	4%
Outside of SCAG Modeling Region	8%
Beyond California	11%
Total	100%

The truck stop provided the following services:

- Free short-term parking (under four hours)
- Long-term and overnight parking (for a fee)
- Laundry
- Drivers' lounge
- Convenience store
- Diesel fuel pumps
- Gasoline pumps
- Truck maintenance facilities
- Full service dining
- Fast food restaurants
- Private showers

Four surveyors conducted 98 interviews between 7:00 AM and 2:00 PM. The surveyors approached truck drivers as they entered or exited the travel center's main building. The surveyors also questioned trucks drivers using the two outside rest areas adjacent to the building.

The manager of the facility prohibited the surveyors from approaching truck drivers at the diesel fuel pump stations due to safety considerations. This restriction limited the surveyors' ability to obtain a more representative sample of truck drivers. Customers had the option of paying for fuel directly at the pumps. Consequently, many of the truck drivers who stopped at the travel center to fuel their vehicles never entered the main building. A large number of truck drivers using the truck stop, therefore, were never approached by the surveyors.

This limitation may have created a survey bias towards certain kinds of truck trips. Surveyors were limited to questioning truck drivers who planned to stay long enough to use the facilities in the main building. Surveyors encountered large numbers of truck drivers, for instance, who planned to stay overnight or were waiting to receive another assignment from their dispatcher.

The following discussion summarizes the survey results.

5.2 Vehicle Types

The first questions asked drivers the vehicle type and the weight of their truck. The majority of respondents drove larger trucks. Most drivers described their trucks as tractor trailers (3+ axle) with a gross vehicle weight between 60,000 and 80,000 lbs. The results is presented in Table 4 and 5.

Table 4 Summary of Type of Vehicles

Vehicle Type	Number of Responses	Percentage of Total Reponses
Single Unit (2-axle, 6 tires)	1	1%
Single Unit (3-axle)	0	0%
Tractor Trailer	95	97%
Tandem Trailer	1	1%
No response	1	1%
Total	**98**	**100%**

Table 5 Summary of Gross Vehicle Weight

Gross Vehicle Weight	Number of Responses	Percentage of Total Reponses
8,500 – 14,000 lbs.	0	0%
14,000-33,000 lbs.	2	2%
33,000-60,000 lbs.	6	6%
60,000 – 80,000 lbs.	82	84%
No response	8	8%
Total	**98**	**100%**

5.3 Arrival and departure times

Surveyors then asked truck drivers when they arrived at the stop and when they expected to leave. Nearly one-third of all truck drivers surveyed expected to spend under two hours at the stop. Almost half expected to spend less than eight hours at the truck stop. Six percent did not respond to the question.

The remaining half of respondents either planned to spend over eight hours at the facility or did not know when they would leave. This relatively high percentage could reflect restrictions (discussed above) that limited surveyors to questioning drivers entering the stop's main facilities. Many of the drivers questioned used the truck stop as a waiting place until they received the next assignment from their dispatcher.

The responses to questions about the duration of stay are summarized in Table 6.

Table 6 Duration at Stop

Vehicle Type	Number of Responses	Percentage of Total Reponses
< 2 hours	31	32%
2-8 hours	14	14%
8-24 hours	16	16%
24-48 hours	6	6%
>48 hours	2	2%
Did not know	23	24%
No response	6	6%
Total	**98**	**100%**

5.4 Length of Trip

Surveyors also asked drivers where they made their last stop and where they expected to stop next. The table below examines how many trips began in the SCAG model area and how many trips were expected to end in the SCAG model area. Table 7 provides the responses which are categorized using the following terms:

Internal to internal trips: Trips that began in the SCAG model area and were expected to end within the SCAG model area.

Internal to external trips: Trips that began within the SCAG model area and were expected to end outside the SCAG model area.

External to internal trips: Trips that began outside the SCAG model area and were expected to end within the SCAG model area.

External to external trips: Trips that began outside the SCAG model area and were expected to end outside the SCAG model area.

Table 7 Scope of Trip (SCAG Model Area)

Trip Type	Number of Responses	Percentage of Total Reponses
Internal to Internal	17	17%
Internal to external	36	37%
External to internal	10	10%
External to external	12	12%
Did not know/no response	23	24%
Total	**98**	**100%**

A majority of truck drivers (53%) stated that their trips started within the SCAG model area (internal to internal and internal to external trips).

Nearly half of all trips were expected to end outside the SCAG model area (internal to external and external to external trips).

Just over a quarter of all trips were expected to end inside the SCAG model area (internal to internal and external to internal trips). The largest category was internal to external trips; 37% of those interviewed started their trips within the SCAG model area and expected to end their trips outside the model area.

The Table 8 summarizes how many trips began in the Inland Empire (defined here as Riverside and San Bernardino Counties) and how many were expected to end within the Inland Empire. The highest category consisted of truck drivers with trips beginning and ending outside of the Inland Empire; 40% of all respondents were making external to external trips.

23% of all trips began within the Inland Empire. 61% percent of all trips were expected to end outside the Inland Empire.

Table 8 Scope of Trip (Inland Empire)

Trip Type	Number of Responses	Percentage of Total Reponses
Internal to Internal	2	3%
Internal to external	21	21%
External to internal	11	11%
External to external	40	41%
Did not know/no response	23	24%
Total	**98**	**100%**

5.5 Commodity Carried

The survey also asked “What type of commodity are you carrying?” Surveyors provided truckers a list of commodities from which to choose. The two most common responses were “Food, Heath and Beauty Products” or “Manufactured Goods or Equipment”; together, these two categories constituted over half of all responses. The third highest category was “Miscellaneous”, with 20% of all responses. The remaining commodity categories received between 1-4% of all responses. Table 9 provides a summary of responses.

Table 9 Summary of Commodities Transported

Type of Commodities	Number of Responses	Percentage of Total Reponses
Farm Products	1	1%
Forrest Products	1	1%
Metals and Materials	3	3%
Food, Health and Beauty	28	29%
Textiles	1	1%
Tobacco Products	0	0%
Wood Products	3	3%
Printed Matter	1	1%
Chemical Products	2	2%
Refined Petroleum or Coal	1	1%
Rubber, Plastic, or Styrofoam	3	3%
Clay, Concrete, Glass, or	1	1%
Manufactured Goods or	25	26%
Wastes	0	0%
Miscellaneous	20	20%
Unclassified Cargo	1	1%
Hazardous Materials	0	0%
Did Not Know	4	4%
No response	3	3%
Total	**98**	**100%**

5.6 Suggestions for Improving the Truck Network and Facilities

The final question asked “Any suggestions to improve transportation for truckers in the area?” Surveyors allowed truckers to provide more than one suggestion to this question. After aggregating similar responses, the surveys produced 177 distinct suggestions. The most common suggestion was to raise speed limits for trucks. 41 drivers answered the question with this suggestion. The next most common responses dealt with increasing the number of truck facilities, providing truck lanes, and improving roads. Table 10 summarizes the suggestions surveyors received to the final question.

The transcripts of replies from the truck-stop surveys are provided in Appendix B.

Table 10 Summary of Suggestions

Suggestions	# of Drivers Who Made Suggestion	% of Total Responses
Allow higher speed limits for trucks	41	23%
Add more truck stops (especially in Los	14	8%
Increase the number of truck facilities	13	7%
Provide truck lanes	11	6%
Improve roads	10	6%
Provide more parking areas	6	3%
Provide highway mile markers	5	3%
Improve driver education about truckers	5	3%
Create exclusive truck tunnels	4	2%
Allow trucks to use flashers uphill	3	2%
Locate warehouses outside of cities	3	2%
Lower fuel prices	3	2%
Number the freeway exits	3	2%
Remove parking fees	3	2%
Allow trucks in left lands	2	1%
Provide easier access to on/off ramps	2	1%
Provide more smoking areas	2	1%
Improve security in truck lots	2	1%
Widen lanes in Los Angeles area	2	1%
Allow trucks in HOV lanes	1	<1%
Improve exit signs	1	<1%
Have trucks use left lanes	1	<1%
Allow higher speed limits for trucks (in	1	<1%
Improve Highway 2 for better access to Palmdale	1	<1%
Improve rail crossing safety	1	<1%
Increase maximum drive time to greater than 10 hours	1	<1%
Increase truck access to restaurants	1	<1%
Increased manning at facilities	1	<1%
Offer inexpensive parking	1	<1%
Lane closure signs should provide more time to change lanes	1	<1%
Less traffic	1	<1%
Make curves long enough for extended	1	<1%
Modernize scale houses	1	<1%
Offer more affordable hotels	1	<1%
Provide more emergency facilities	1	<1%
Build more frontage roads	1	<1%
Employ more people at fueling stations	1	<1%
Create more rest areas	1	<1%
Provide radio announcements about impending construction	1	<1%
Reduce fines	1	<1%

5.7 Regional Trucking Activity Patterns

To further analyze the truck movements in the study area, some generalized results from the SCAG 2000 and 2030 HDT model were used. The 2000 and 2030 daily HDT trips generated for the Traffic Analysis Zones (TAZs) in the study area presented in Figures 16 and 17, respectively. TAZs are color-coded by the intensity of HDT trip generation. As seen on Figure 16, currently the highest HDT generating TAZs are concentrated along the industrial/warehousing/commercial corridors between SR-210 and SR-60, generally in Ontario, Upland and Fontana. Figure 17 shows that the HDT trips are expected to increase significantly from 2000 to 2030. The existing high-intensity HDT generators are expected to stay heavy and intensify, at the same time significantly high future HDT trip generation is projected for Riverside County areas north and SR-91 and south of SR-60.

The SCAG HDT trip tables generated by these TAZs were aggregated into five areas as follows:

- Study Area
- San Bernardino Valley
- Western Riverside County
- Rest of SCAG Region (Los Angeles, Orange, Ventura, north/east San Bernardino Valley and Coachella Valley)
- Outside SCAG Region

The HDT trip interchanges among the five areas are presented in Table 11. As results indicate, the truck trip generated in the study area is expected to almost double by 2030. This is significant as compared to the projected nearly 40 percent growth for HDT for the entire six-county SCAG region. As shown in this table, a major attraction and production area for HDT trips in 2030 is expected to be the Western Riverside County area as was clearly illustrated in Figure 17.

To identify the expected future patterns of truck movements, a series of select-link analyses were conducted for the PM peak period using the SCAG 2030 regional model. The select-link analysis identifies the origin and destination of all vehicles passing through a specific highway segment. For this study, segments along the San Bernardino-Los Angeles county line were selected, on the following freeways:

- I-215
- I-10
- SR-60

The results of select-link analyses for the above locations are graphically presented in Figure 18, 19 and 20, respectively. The widths of bands are proportional to the HDT volumes, with blue and red colors indicating westbound and eastbound HDT volumes respectively. It should be noted that the 2030 network includes the fully completed and extended SR-210 Freeway to San Bernardino.

Some key observations from this analysis are summarized below:

- Trucks are expected to use I-210 to access the I-10 through San Bernardino and Highland.
- A significant volume of trucks on I-10 will come from the I-210 via SR-57.
- I-10 will remain the most heavily used truck route at the County line, but all three east-west freeways will fairly evenly share the overall HDT load.
- The same “S”-shaped two-way truck movement pattern that exists today is expected to occur in 2030 between SR-60 and I-10.

Figure 16. 2000 HDT Trip Generation

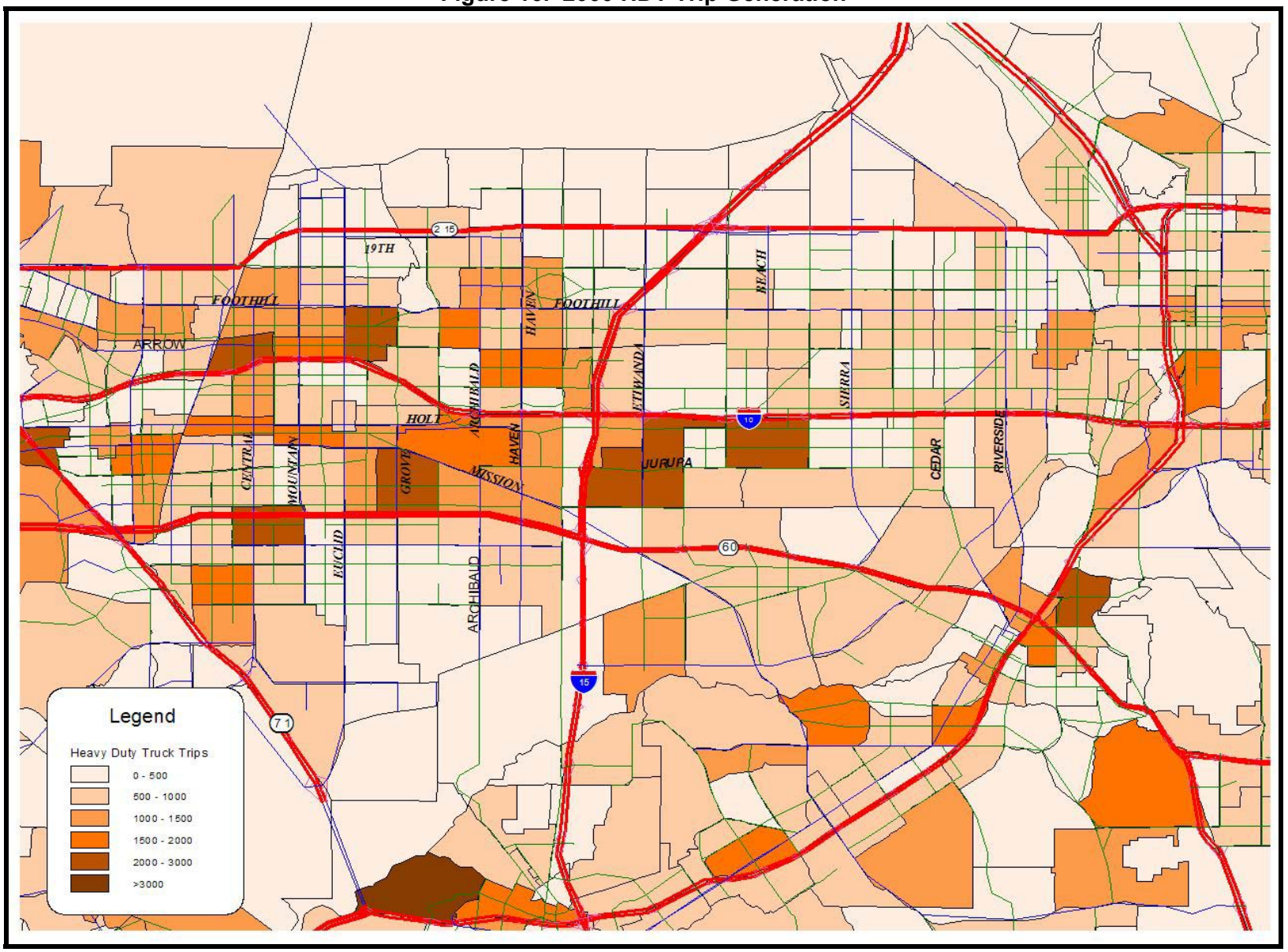


Figure 17. 2030 HDT Trip Generation

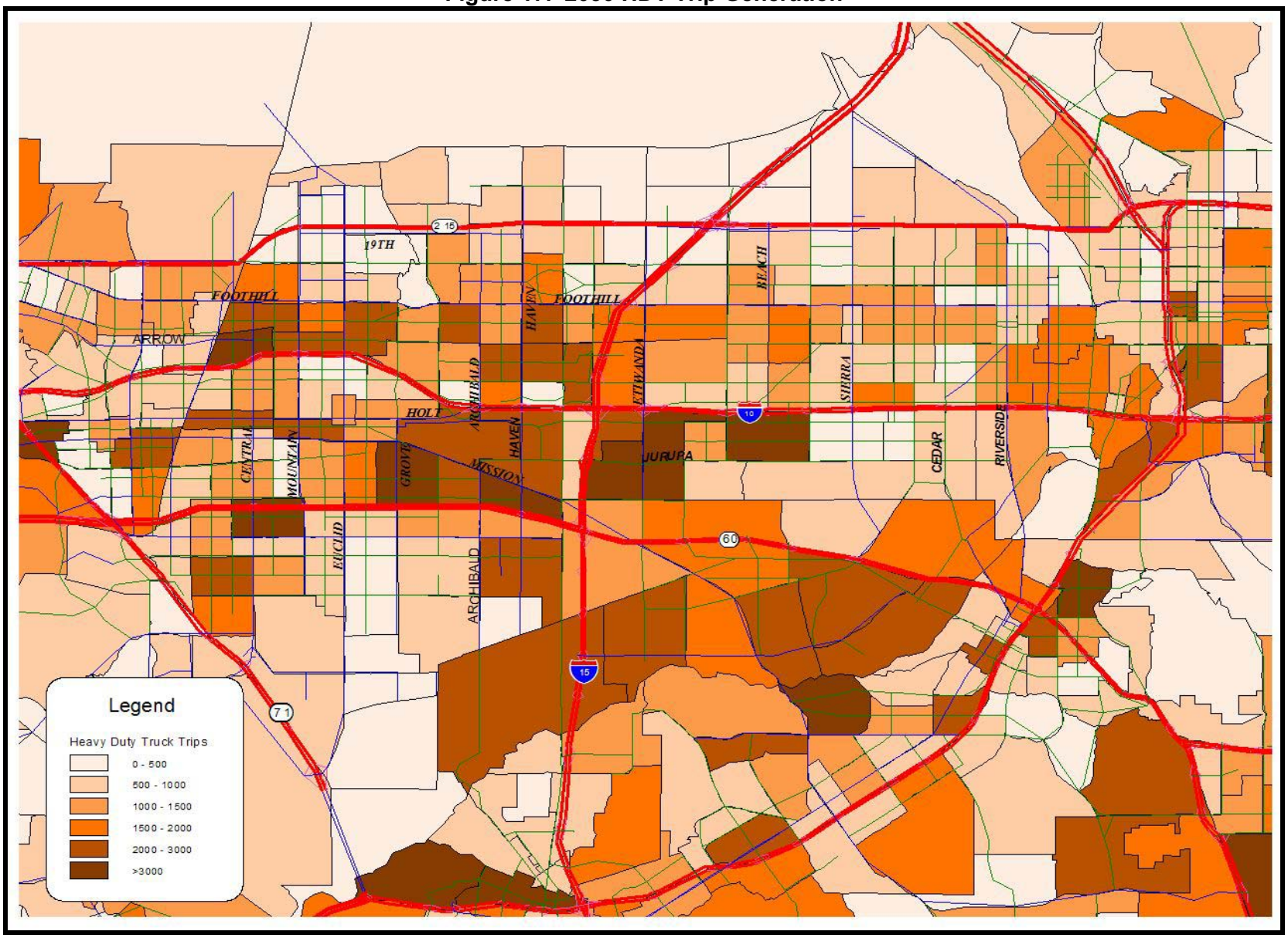


Table 11. Regional HDT Trips Interchanges

2000 Inter-County HDT Trips						
	Study Area	**San Bernardino Valley**	**Western Riverside County**	**Rest of SCAG Region**	**Outside SCAG Region**	**TOTAL**
Study Area	31,300	3,600	5,000	16,100	1,400	*57,400*
San Bernardino Valley	3,600	18,500	3,700	4,400	400	*30,600*
Los Angeles County	12,200	2,500	4,700	630,900	20,500	*670,800*
Ventura	100	100	100	49,900	900	*51,100*
Orange County	4,000	1,200	4,300	197,400	5,500	*212,400*
Western Riverside County	5,100	3,700	40,000	9,900	2,000	*60,700*
Coachella/Idyllwild	200	200	600	19,400	400	*20,800*
Victor Valley/Barstow/Morongo	500	600	400	16,100	300	*17,900*
Outside SCAG Region	1,900	400	1,800	29,700	6,700	*40,500*
TOTAL	*58,900*	*30,800*	*60,600*	*973,800*	*38,100*	*1,162,200*

2030 Inter-County HDT Trips						
	Study Area	**San Bernardino Valley**	**Western Riverside County**	**Rest of SCAG Region**	**Outside SCAG Region**	**TOTAL**
Study Area	30,000	3,200	60,000	15,200	1,100	*109,500*
San Bernardino Valley	3,100	4,300	38,900	9,400	300	*56,000*
Los Angeles County	13,100	5,900	12,900	803,900	22,600	*858,400*
Ventura	1,900	2,000	2,500	58,100	900	*65,400*
Orange County	2,700	1,300	3,800	246,400	5,900	*260,100*
Western Riverside County	60,000	38,900	15,900	21,300	1,200	*137,300*
Coachella/Idyllwild	100	200	1,100	37,700	100	*39,200*
Victor Valley/Barstow/Morongo	900	600	900	38,300	100	*40,800*
Outside SCAG Region	2,200	500	2,000	38,200	6,800	*49,700*
TOTAL	*114,000*	*56,900*	*138,000*	*1,268,500*	*39,000*	*1,616,400*

Figure 18. 2030 PM HDT Truck Trips Select-Link Analysis on I-215

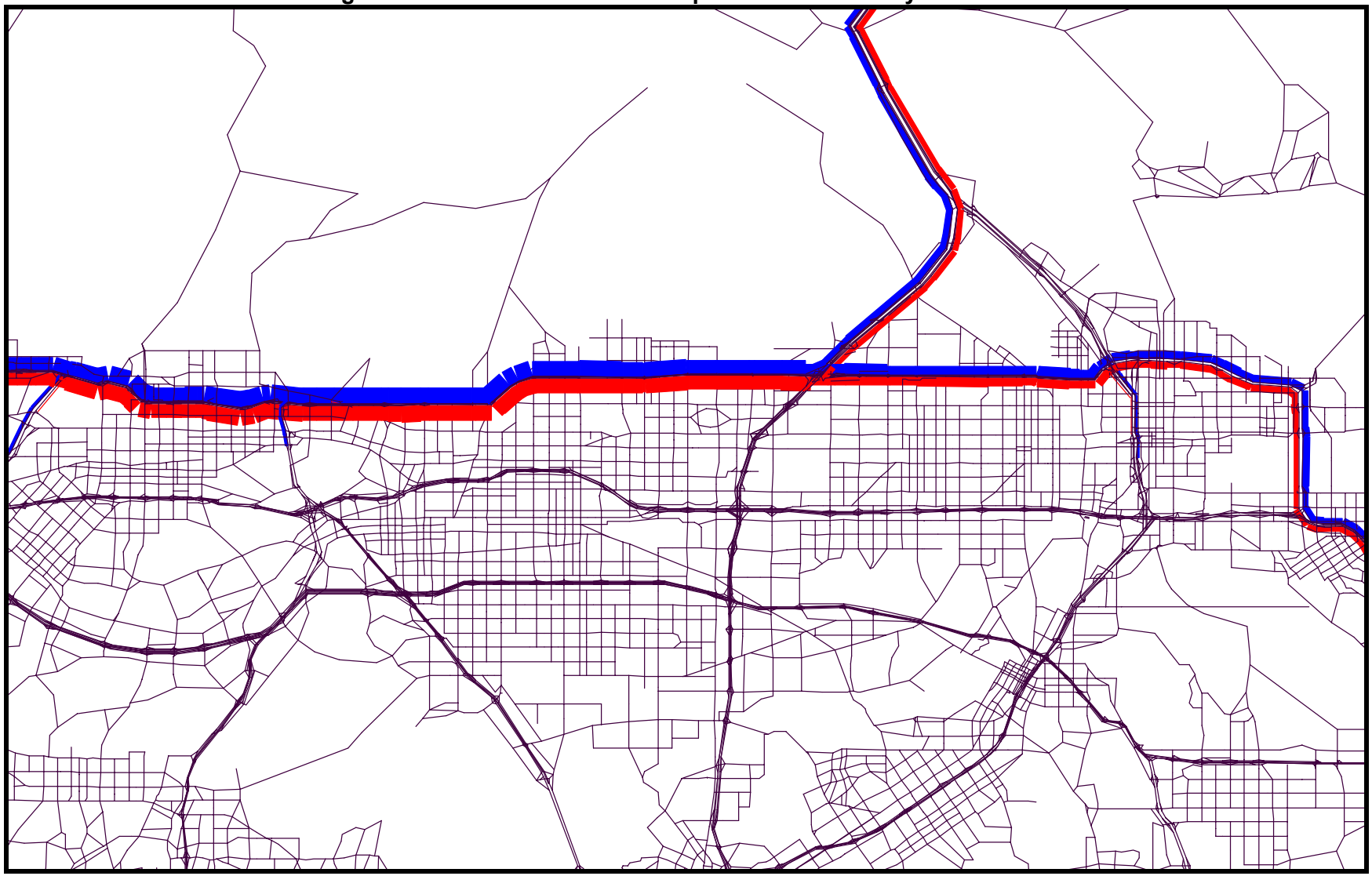


Figure 19. 2030 PM HDT Truck Trips Select-Link Analysis on I-10

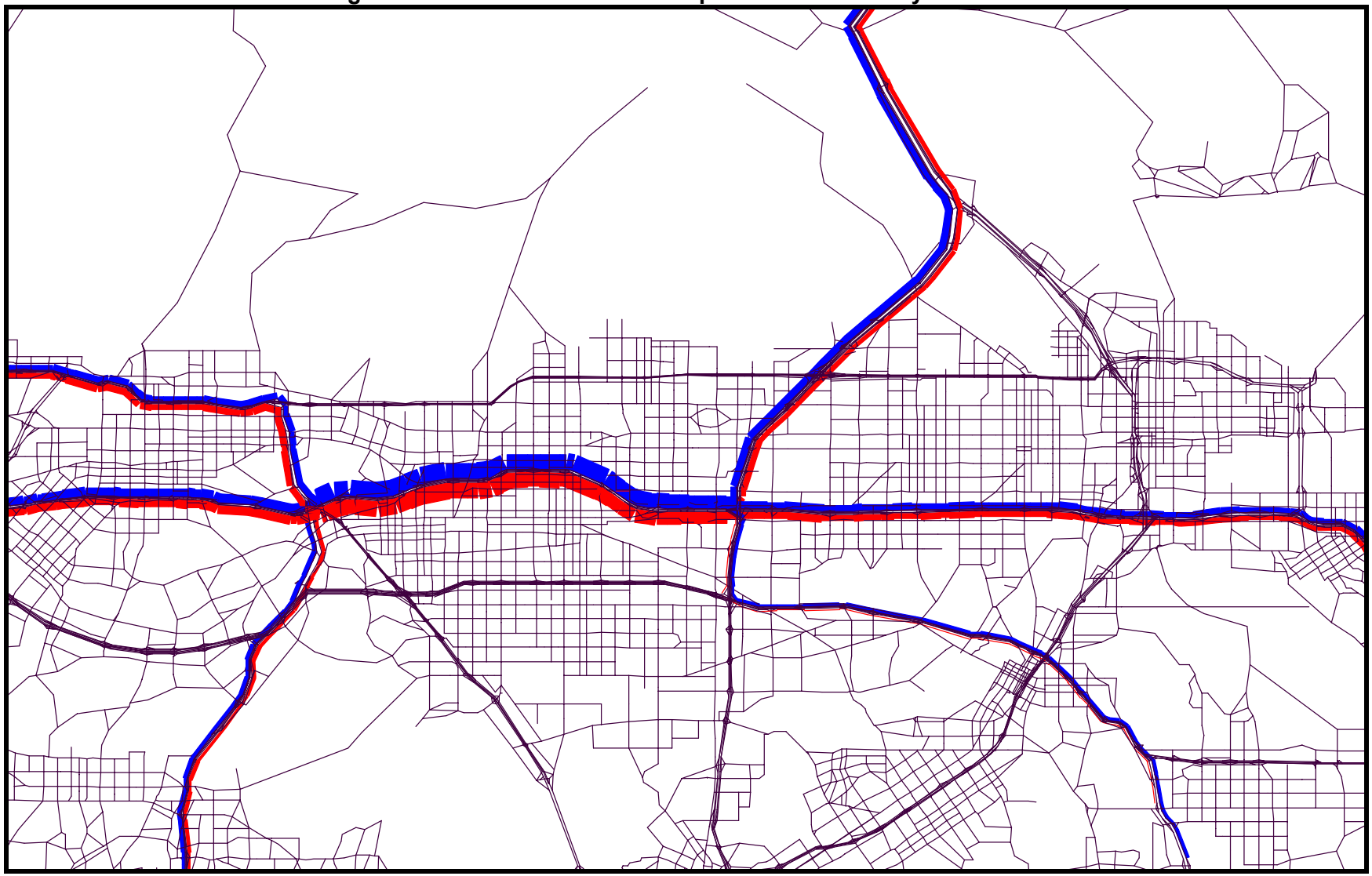
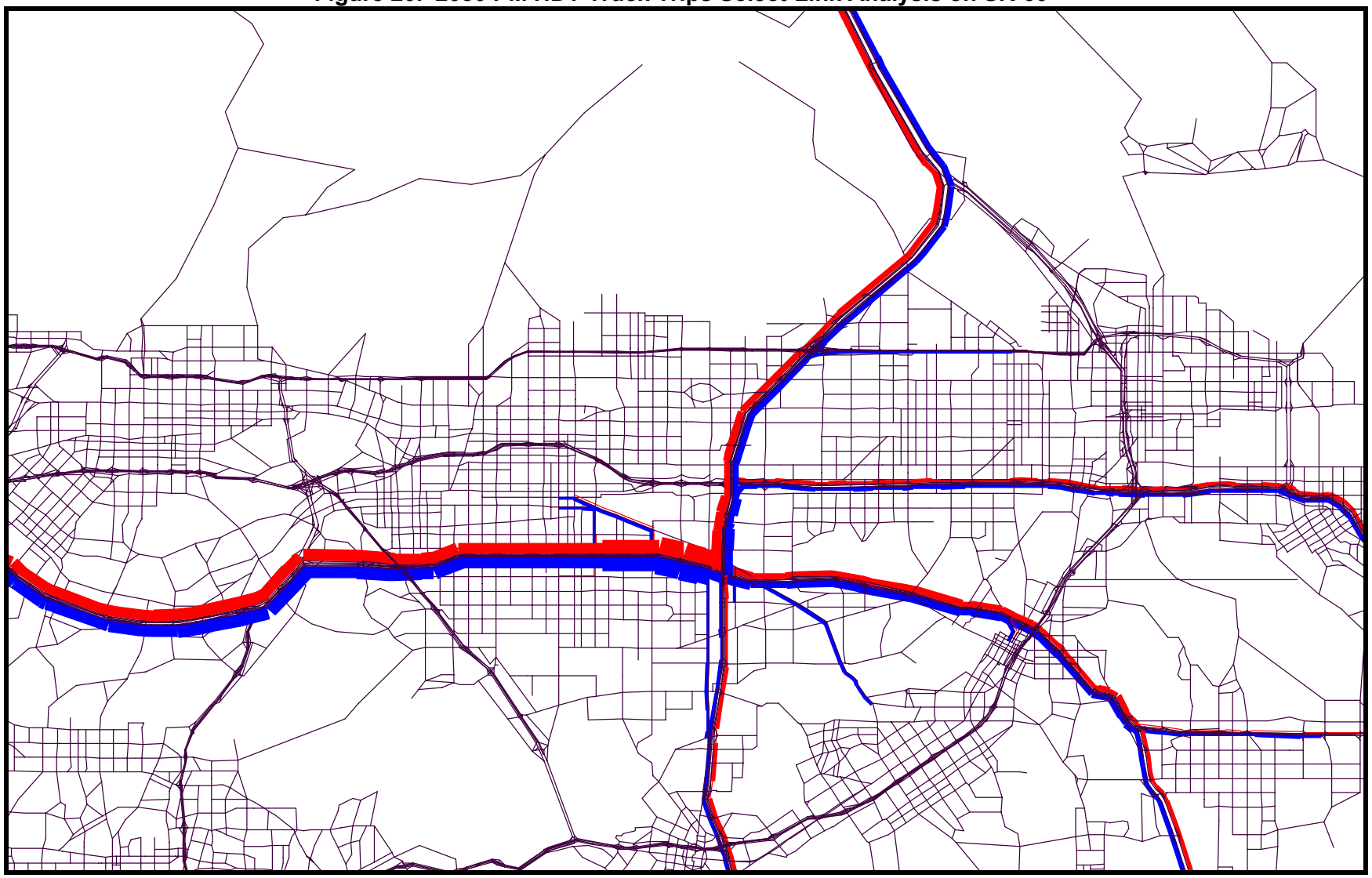


Figure 20. 2030 PM HDT Truck Trips Select-Link Analysis on SR-60



The breakdown of the peak hour port truck trips to various subares and counties of the region are presented in Table 12. POLA and POLB truck trips are expected to increase by more than 100 percent by year 2030. However, comparing the POLA and POLB HDT trips to total HDT trips in the region shown in Table 11, it can be seen that contrary to some perceptions, port-related truck trips are not a very significant percentage of overall regional HDT trips. Furthermore, it is shown that HDT trips between the ports and the study area constitute only about 4 percent of the total HDT trips generated at the ports of Los Angeles and Long Beach.

Table 12. POLA and POLB Peak Hour HDT Truck Trips

	1999			2030			Percent Difference		
	From/To POLA & POLB			From/To POLA & POLB			From/To POLA & POLB		
	AM Peak Hour	MD Peak Hour	PM Peak Hour	AM Peak Hour	MD Peak Hour	PM Peak Hour	AM Peak Hour	MD Peak Hour	PM Peak Hour
Study Area	151	208	140	346	428	260	129%	106%	86%
San Bernardino Valley	9	8	6	15	19	10	67%	138%	67%
Los Angeles County	2,923	3,909	2,640	7,592	8,785	6,059	160%	125%	130%
Ventura	11	14	7	21	25	16	91%	79%	129%
Orange County	91	123	80	248	284	169	173%	131%	111%
Western Riverside County	3	3	2	1	1	2	-67%	-67%	0%
Coachella/Idyllwild	0	0	0	0	0	0	N/A	N/A	N/A
Victor Valley /Barstow/Morongo	78	156	132	164	232	183	110%	49%	39%
Outside SCAG Region	368	495	230	593	721	381	61%	46%	66%
TOTAL	3,634	4,916	3,237	8,980	10,495	7,080	147%	113%	119%

Source: POLA and POLB Master Plans

6. ROADWAY AND OPERATIONAL IMPEDIMENTS TO TRUCK ACTIVITY

In parts of the subregion which have high truck volumes or heavy concentrations of truck activity, roadway geometric deficiencies or operational problems can impede truck movements, thereby causing safety hazards, recurring or incidental congestion and reducing efficiency. For this purpose it is useful to identify arterial locations which are expected to have high truck volumes in the study area in the future.

To focus on the most significant future truck issues this analysis considered the SCAG 2030 daily truck forecasts for only the medium-heavy and heavy-heavy duty trucks. These projections were used to identify the locations which are expected to have the highest future truck activity. The results are presented in Figure 21. As shown, the major study area arterials with projected significant levels of medium- and heavy-duty truck volumes are:

- Mission Boulevard between Central Avenue and Limonite Ave.,
- Sierra Avenue – Armstrong Rd. between I-10 and SR-60,
- Cedar Avenue – Market Street between I-10 and SR-60,
- Riverside Avenue between I-10 and SR-60,
- Etiwanda Avenue between I-10 and SR-60,
- Jurupa Avenue between Etiwanda Avenue and Haven Avenue,
- Haven Avenue between Mission Boulevard and Arrow Route,
- Archibald Avenue between Mission Boulevard and Schleisman Road,
- Hamner Avenue between Norco Dr. and Jurupa Avenue.

As can be seen, these locations correspond closely with the high volume/percentage locations identified earlier in this report. The heavy truck volumes on Sierra, Cedar and Riverside avenues also point to the importance and need of additional north-south connectivity between San Bernardino and Riverside counties through the Jurupa Hills. This was the subject of a north-south corridor study sponsored by SANBAG, RCTC and the City of Fontana in late 1990's, which analyzed and quantified the future deficiencies in the corridor and made recommendations for corridor level capacity improvements.

To rank the projected truck-heavy arterials, by level of severity, the 2030 daily forecast minimum, maximum and weighted average (by length) medium- and heavy-heavy duty truck traffic volumes for the above roadways are presented in Table 13. and sorted by the weighted average truck volumes. The table shows that Mission Boulevard is expected to have the highest truck volumes and the longest truck-heavy segments.

As the future improvements are considered for the above roadways, roadway geometric deficiencies or operational problems should be eliminated by considering the following strategies:

- Adequate off-street loading or staging areas

- Curbside loading areas
- Sufficient street width
- Adequate driveway design
- Adequate lane widths
- Adequate curb return radius
- Improved arterial access to freeway ramps
- Elimination of Excessive grade on freeway on/off-ramps
- Sufficient storage length in turning lanes
- Adequate pavement section for the truck volume
- Appropriate signal timing

Figure 21. 2030 Forecast Medium-Heavy and Heavy-Heavy Duty Vehicles Traffic Volumes

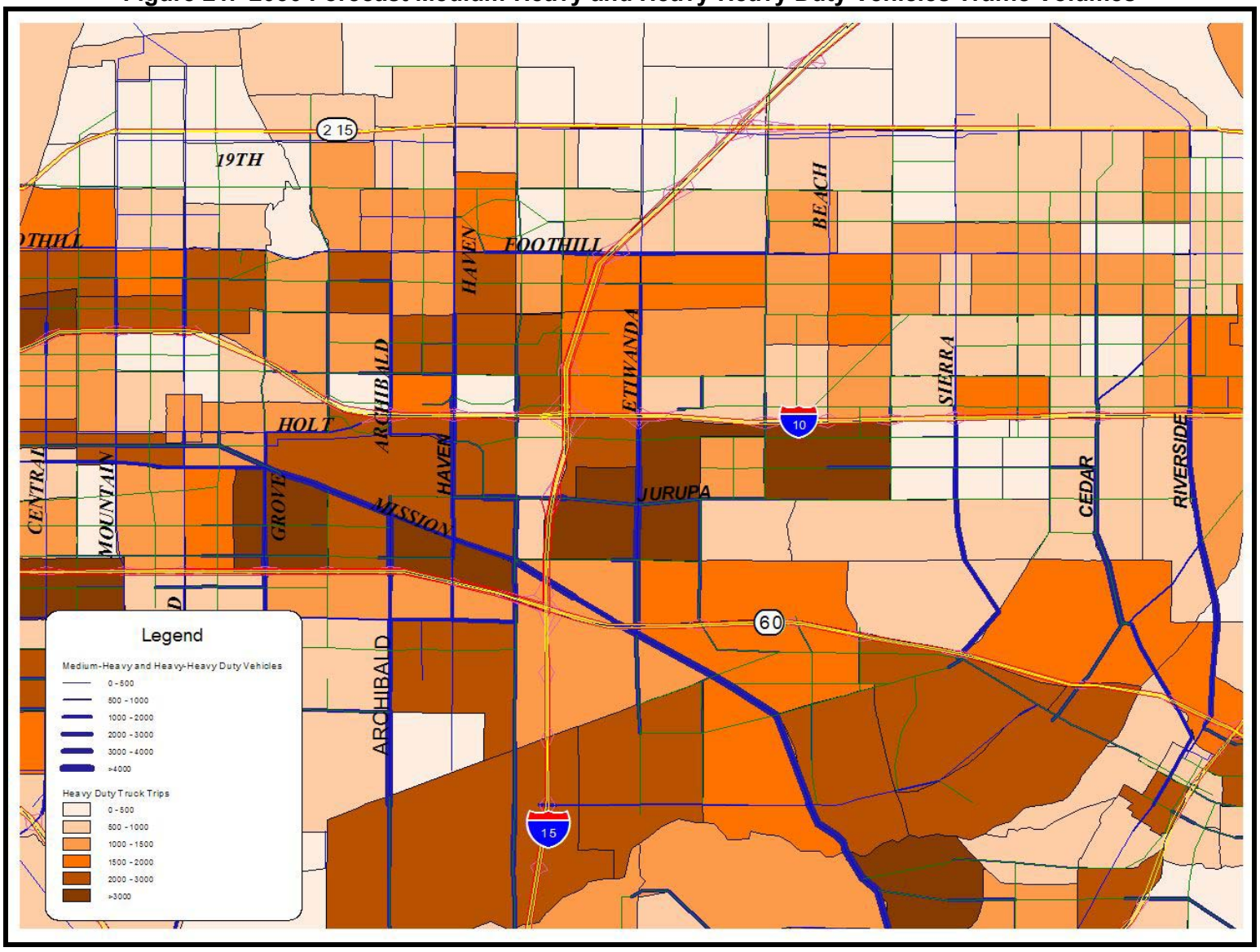


Table 13 2030 Daily High Truck Traffic Volume Arterial Street

Roadway	Segment	Distance (Miles)	Min.	Max.	Weighted Average
Mission Boulevard	Central Ave. and Limonite Ave.	14.2	309	7,367	4,329
Etiwanda Avenue	I-10 and SR-60	4.2	474	5,921	3,551
Archibald	Mission Blvd. and Schleisman Rd.	5.5	1,988	7,419	3,349
Cedar Avenue – Market Street	I-10 and SR-58	4.5	2,436	4,064	3,326
Riverside Avenue	I-10 and SR-59	5.7	134	4,227	3,142
Sierra Avenue – Armstrong Rd.	I-10 and SR-57	4.1	2,072	3,227	2,926
Hammner Avenue	Norco Dr. and Jurpa Ave.	5.4	1,829	3,949	2,799
Haven Avenue	Mission Blvd. and Arrow Rte.	4.0	603	4,483	2,782
Jurpa Avenue	Etiwanda Ave. and Haven Ave.	3.0	1,656	4,464	2,493

7. CONCLUSION

One of the main objectives of this study is to compile data and inputs to support the upgrade and refinement of the regional and subregional travel demand models and forecasting tools. Based on the findings of this study, which strongly suggest a significant expected growth in future goods movement and truck trips in the study area and the importance of gaining a good understanding of truck travel patterns, it is recommended that a more robust and detailed sub-regional heavy duty truck model component be developed for the Inland Empire Area. This sub-regional model should be based on the SCAG regional HDT model with focus for the San Bernardino and Riverside counties. Orange County Transportation Authority (OCTA) and Los Angeles County Metropolitan Transportation authority (LAMTC) have also recently developed such sub-regional HDT model components.

The findings from this project and other reference sources identified in this study, can be used to further refine the development of a sub-regional HDT model. The following table provides a summary of some of the key data items and surveys, which were developed as part of this study (referenced by report section) and identifies the subject areas where these products/data can be applied to develop, refine and/or upgrade the subregional travel demand model.

Table 14 Applications of Study Products for Model Upgrade

Report Section	Data Item/Survey Instrument	Application for Model Upgrade
2	Designated Truck Routes and Truck Restrictions	Coding of designated routes on model network
2	Existing and New Truck Classification Counts	Model Validation as well as developing truck turn penalties at the major freeway interchanges
3	Truck Trip Rates	Subregion-specific truck trip generation rates
4	Shipper/Receiver Surveys/ Other Surveys	Truck origin/destination trip tables for model validation
2 & 5	Trucking firm and cargo facility surveys	Locating and development of truck trip generation rates and distribution patterns for special truck trip generators, such as major truck stops, rail yards, commercial centers, truck facilities, air cargo facilities, etc.
5	Roadway and Operational Impediments to trucks	Identifying existing and expected future high truck travel corridors

APPENDIX A

APPENDIX B