FINAL

CORRIDOR SYSTEM MANAGEMENT PLAN (CSMP)
SAN DIEGO COUNTY I-805
COMPREHENSIVE PERFORMANCE ASSESSMENT
AND
CAUSALITY REPORT

August 4, 2009

System Metrics Group, Inc.

Table of Contents

List of Exhibits

1. INTRODUCTION

This document represents the final Comprehensive Performance Assessment and Causality Report for the I-805 Corridor System Management Plan (CSMP) for the San Diego Association of Governments (SANDAG). This CSMP is based on an internal Caltrans initiative and funded through the 2006 Finance Letter. The Corridor Mobility Improvement Account (CMIA) funding on I-805 also provides secondary support for this CSMP effort.

On the I-805 corridor, the CMIA will partially fund one project related to the I-5 North Coast Corridor project to construct northbound and southbound high occupancy vehicle (HOV) lanes in the median of I-805 from the existing 0.6-mile HOV facility on I-805 south of I-5 to Carroll Canyon Road on I-5. The project will also build northbound on and southbound off direct access ramps (DARs) from Carroll Canyon Road to the HOV lanes on I-805. Eighty-two million dollars in CMIA funds has been adopted by the CTC for this project.

Other projects on I-805 for which CMIA funding was requested, but not adopted include:

- Two southbound auxiliary lanes from E St to State Route 54 (SR-54)
- HOV lanes from Palomar Street to SR-94.

This "Comprehensive Performance Assessment and Causality Report" builds on the "Preliminary Performance Assessment" submitted to SANDAG in September 2008.

The main purpose of the Comprehensive Performance Assessment is to detail the performance of the corridor so that future investment decisions can build on its findings and conclusions, and investment alternatives are tested to ensure reasonable returns on investment for public funds.

This report presents performance measurement findings, identifies bottlenecks that lead to less than optimal performance, and diagnoses the causes for these bottlenecks in detail. In related tasks being undertaken by Cambridge Systematics, Inc., HNTB, Inc., and System Metrics Group, Inc., alternative investment strategies will be modeled using the year 2007 as the base year and evaluated to understand their relative benefits and eventually develop a recommended implementation plan for existing and potential future funding.

This report and the associated CSMP (eighth milestone in the CSMP guidelines) should be updated by SANDAG and Caltrans on a regular basis since corridor performance can vary dramatically over time due to changes in demand patterns, economic conditions, and delivery of projects and strategies among others. Such changes could influence the conclusions of the CSMP and the relative priorities in investments.

Therefore, updates should probably occur no less than every two to three years. To the extent possible, this document has been organized to facilitate such updates.

The remainder of this report is organized into four sections (Section 1 is this introduction):

2. *Corridor Description*
   This section describes the corridor, including the roadway facility, major interchanges and relative demands at these interchanges, rail and transit services along the freeway facility, major Intermodal facilities around the corridor, and special event facilities/trip generators. This section has been expanded since the Preliminary Performance Assessment milestone to include a subsection on corridor demand profiles.

3. *Corridor-Wide Performance and Trends*
   This section presents multiple years of performance data for the freeway portion of the defined CSMP corridor. Statistics are included for the mobility, reliability, safety, and productivity performance measures. Wherever possible, this section has been expanded from the preliminary performance assessment by adding performance results through June 2008 (i.e., mid-year). A new section on pavement conditions on the freeway was also added.

4. *Bottleneck Identification*
   This section identifies the locations of bottlenecks, or choke points, on the freeway facility. These bottlenecks are generally the major cause for mobility and productivity performance degradations and are often related to safety degradations as well. This section has also been augmented. It now has performance results for delay, productivity, and safety by major "bottleneck area." This addition allows for the relative prioritization of bottlenecks in terms of their contribution to corridor performance degradation.

5. *Causality Analysis*
   This section diagnoses the bottlenecks identified in Section 4 and identifies the causes of each bottleneck through additional data analysis and significant field observations. Most of the major bottleneck locations identified in this report were videotaped to verify our conclusions. Sections 4 and 5 provide input to selecting projects to address the critical bottlenecks. Moreover, they provide the baseline against which the micro-simulation models will be validated. Finally, this section represents the seventh milestone of the CSMP development process.

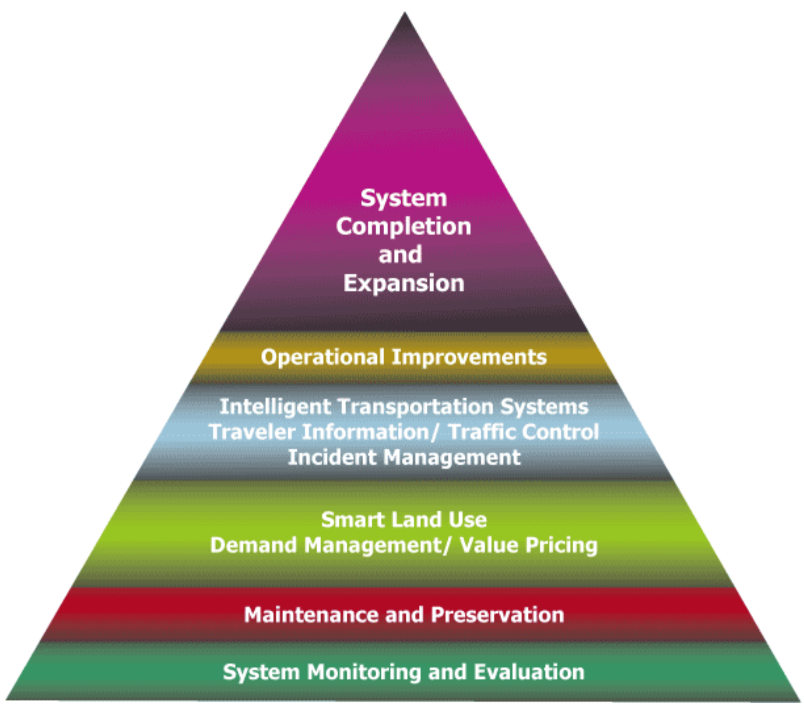
The remainder of this introduction provides some background on system management, a framework that eventually led to the CSMP requirement. It also includes a discussion on data sources and the state of detection on the I-805 freeway facility.

Background

Over the last few years, Caltrans and its stakeholders and partner agencies have been developing and committing to a framework called "System Management" which is depicted in Exhibit 1-1. This framework aims to get the most of our transportation infrastructure through a variety of strategies, not just through the traditional and increasingly expensive expansion projects. System management has been embraced by the current California Administration as part of its Strategic Growth Plan and by SANDAG, the Metropolitan Planning Organization for San Diego County.

One major new aspect of system management is an increased focus on operational strategies and investments. Operational solutions are generally less expensive, can often be implemented much faster, and can produce results that, when compared to traditional expansion projects, often provide much higher returns on the scarce transportation funding available. Partly because of the focus on operational strategies, system management relies on much more detailed data.

Exhibit 1-1: System Management Pyramid



The base of the system management "pyramid" is titled "System Monitoring and Evaluation." It is the foundation of all other decisions, and it includes identifying problems, evaluating solutions (and combinations thereof), and eventually funding the most promising strategies. This document represents the first version of this foundation for the defined I-805 Corridor.

Existing Data Sources

The available data analyzed for the comprehensive performance assessment includes the following sources:

- Caltrans Highway Congestion Monitoring Program (HICOMP) report and data files (2004 to 2007)
- Caltrans Freeway Performance Measurement System (PeMS)
- Caltrans District 11 probe vehicle runs (electronic tachometer runs)
- Caltrans Traffic Accident Surveillance and Analysis System (TASAS) from PeMS
- Various traffic study reports
- Aerial photographs and Caltrans photologs
- Internet (e.g., SANDAG and San Diego Transit websites).

Details for each data source are provided in their applicable sections of this report. However, given the need for comprehensive and continuous monitoring and evaluation, detection coverage and quality are discussed in more detail below.

Freeway Detection Status

Exhibit 1-2 depicts the corridor freeway facility with the detectors in place as of October 8, 2008. This data was chosen randomly to provide a snapshot of the detection status. The exhibit shows that there are many detectors on the mainline, almost all functioning well and producing reasonably reliable data (based on the green color). Furthermore, it illustrates some seemingly small gaps between detectors at some locations.

Exhibits 1-3 and 1-4 further show how well the detectors are performing over a longer period from January 2006 to December 2008 for the entire I-805 Corridor. The exhibits report the number of "good detectors" each day for the three-year period.

Exhibit 1-2: I-805 Sensor Status (October 2008)

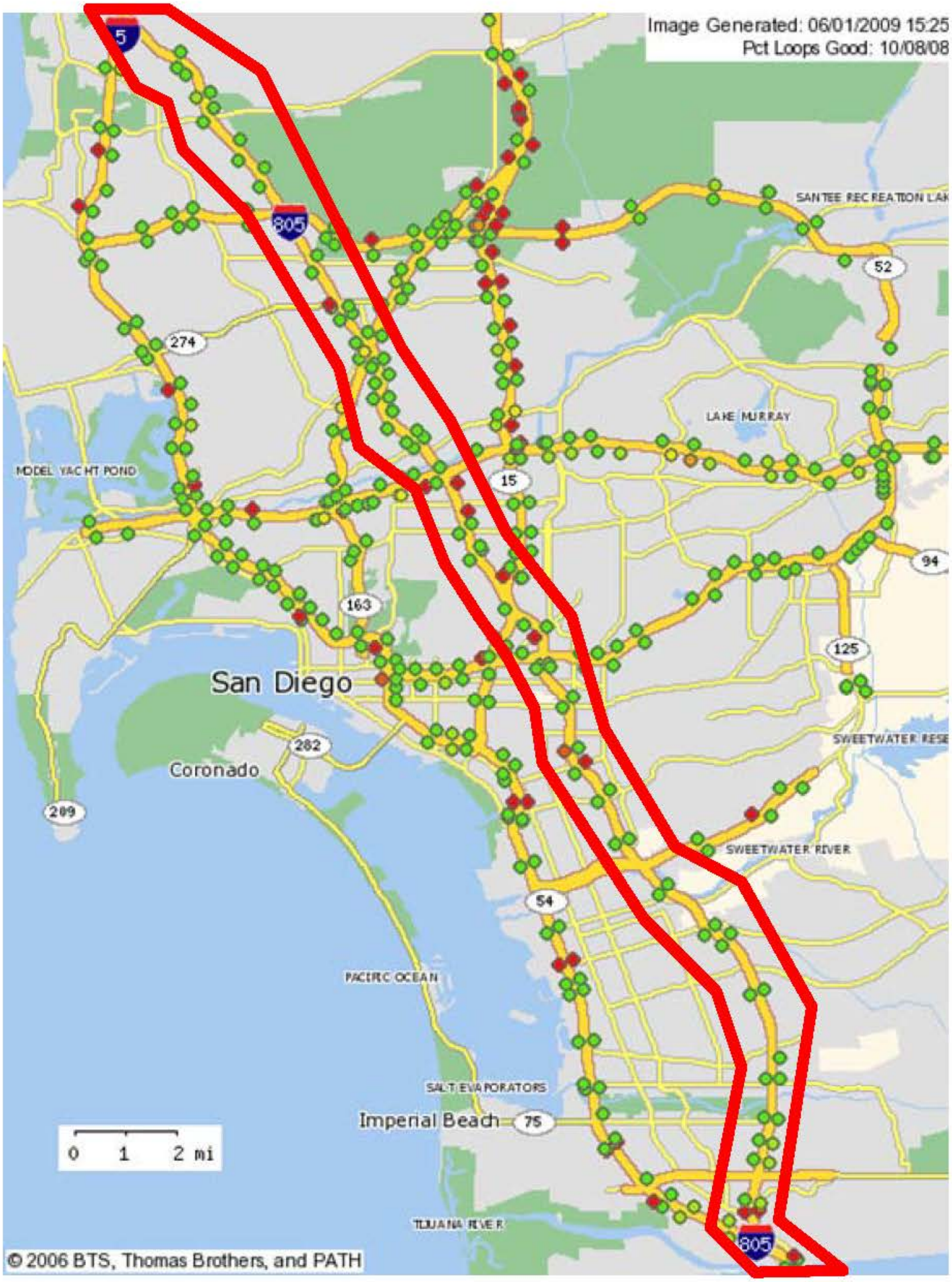
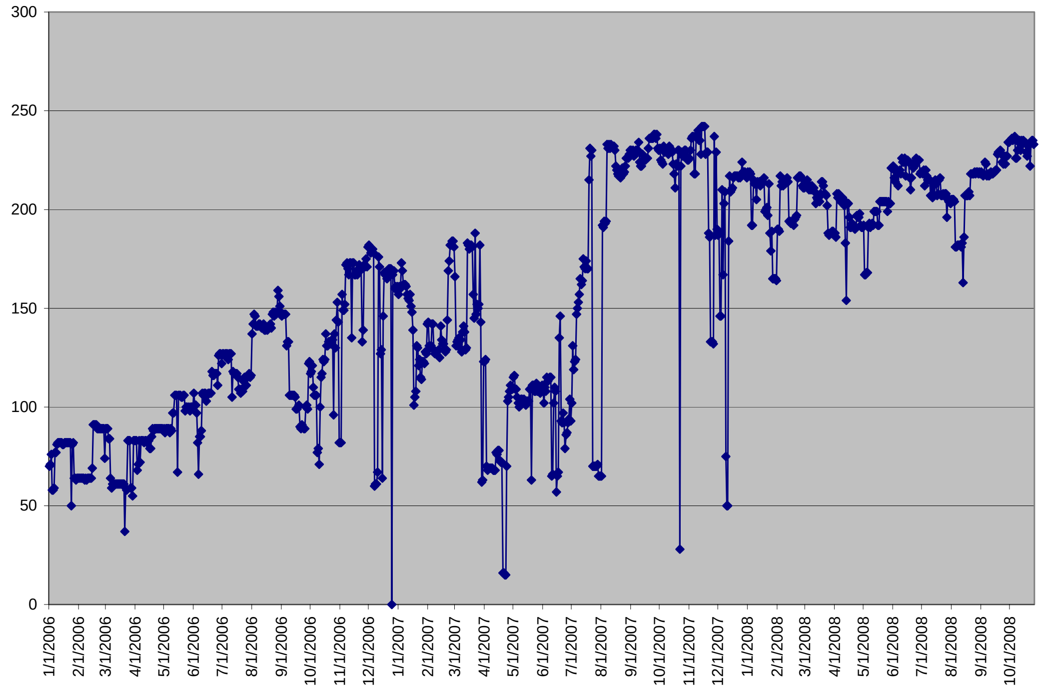
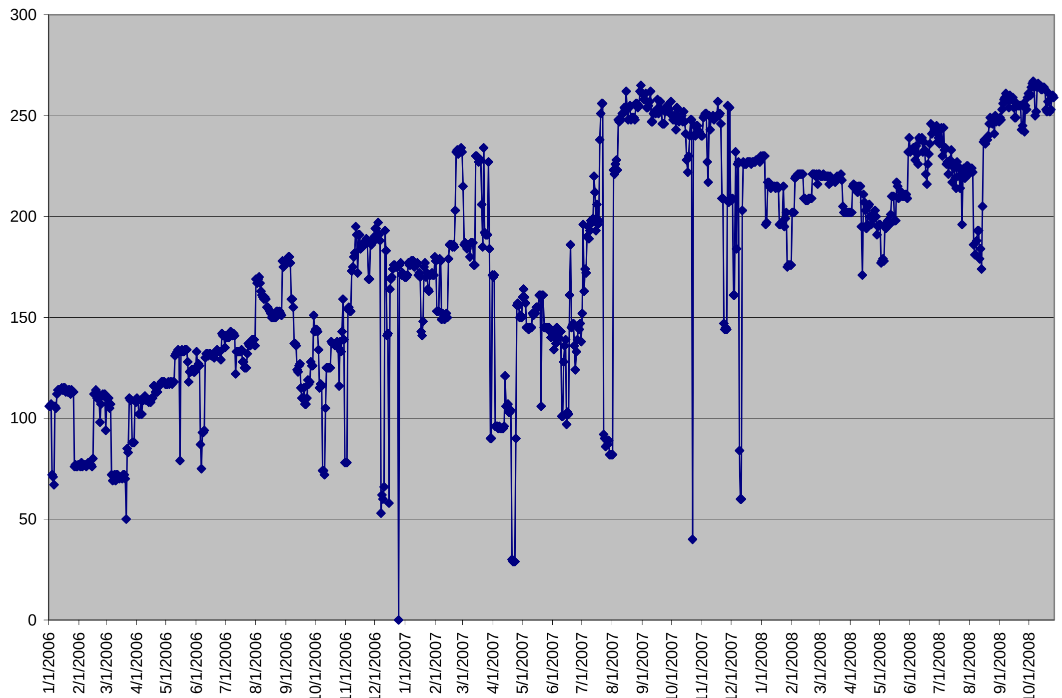


Exhibit 1-3: Northbound I-805 Number of Daily Good Detectors (2006-2008)



Source: System Metrics Group, Inc. (using PeMS data)

Exhibit 1-4: Southbound I-805 Number of Daily Good Detectors (2006-2008)



Source: System Metrics Group, Inc. (using PeMS data)

Note that the number of good detectors improved significantly during the latter half of 2007 and continued through 2008. Part of the increased detection quality may be attributed to improved maintenance of the existing detection. This trend is encouraging, which should allow for detailed future analyses. By comparing detectors in detail for the I-805 study corridor, we identified a number of detectors that were added to the corridor in 2007 and 2008. These are listed in Exhibit 1-5.

Exhibit 1-5: I-805 Detection Added (2007-2008)

VDS	Location	Type	CA PM	Abs PM	Date Online
NORTHBOUND					
1118663	805 NB Beyer Blvd	Mainline	1.11	0.964	4/16/2008
1118677	805 NB N/O 905	Mainline	2.12	1.967	4/16/2008
1116415	N805 off E st/bypass	Mainline	7.08	6.931	11/18/2008
1117980	NB 805 @ DIVISION	Mainline	11.09	10.943	7/14/2007
1119373	NB805 off 43rd st	Fwy-Fwy	11.09	10.943	11/18/2008
1118908	N 805 N/O University	Mainline	16.08	15.931	6/28/2008
1118915	N 805 N/O El Cajon	Mainline	16.83	16.677	6/28/2008
1118924	NB 805 S/O 8	Mainline	17.36	17.215	6/28/2008
1118934	NB 805 on to 8	Mainline	17.37	17.217	6/28/2008
1118020	NB 805 S/O BALBOA	Mainline	21.35	21.199	7/14/2007
1117850	NB 805 @ BALBOA	Mainline	21.47	21.323	8/18/2007
SOUTHBOUND					
1118656	805 SB Beyer	Mainline	1.11	0.964	4/16/2008
1118670	805 SB N/O 905	Mainline	2.12	1.967	4/16/2008
1117979	SB 805 @ DIVISION ST	Mainline	11.09	10.942	7/14/2007
1118894	SB 805 S/O 15	Mainline	14.36	14.207	6/28/2008
1119397	SB 805 N of 15	Mainline	15.38	15.231	11/18/2008
1119398	SB 805 to SB15 CONN	Fwy-Fwy	15.38	15.231	11/18/2008
1117857	SB 805 N/0 BALBOA	Mainline	21.33	21.183	8/18/2007
1118013	SB 805 S/O BALBOA	Mainline	21.34	21.192	7/14/2007
1118957	EB BALBOA/805 SB	Mainline	21.64	21.486	6/28/2008
1118950	WB BALBOA/805 SB	Mainline	21.72	21.566	6/28/2008

Source: System Metrics Group, Inc. (using PeMS data)

Finally, an analysis of gaps without detection is shown in Exhibit 1-6. There are several segments extending over 0.75 miles without detection in each direction. These should be considered for deployment of additional detection when funding becomes available.

Exhibit 1-6: I-805 Gaps In Detection (December 2008)

Location		Abs PM		Length (Miles)
From	To	From	To	
NORTHBOUND				
n/o of San Ysidro Blvd (ML)	805 NB n/o 905 (ML)	1.151	1.967	**0.816**
to 805 NB (ML)	805 NB (ML)	2.851	3.65	**0.799**
to 805 NB (ramp)	s/o Telegraph Cyn (ML)	4.438	5.401	**0.963**
s/o Telegraph Cyn (ML)	s/o East H Street (ML)	5.401	6.591	**1.19**
N805 off E St/bypass (ML)	n/o Bonita Rd (ML)	6.931	8.101	**1.17**
n/o Bonita Rd (ML)	n/o SR-54 (ML)	8.101	9.301	**1.2**
Home Ave (ML)	NB 805 @ 15 (ML)	13.886	15.171	**1.285**
NB 805 on to 8 (ML)	8 (ML)	17.217	18.241	**1.024**
WB Balboa Ave (FR)	EB Clairmont Mesa (ML)	21.656	22.481	**0.825**
Clairemont Mesa Blvd (FR)	Governor Dr (FR)	22.702	24.275	**1.573**
NB 805 @ Nobel Dr (ML)	Seg WB Miramar Rd (ML)	25.101	25.958	**0.857**
n/o of Miramar Rd (ML)	Mira Mesa Blvd (ML)	26.251	27.114	**0.863**
Mira Mesa Blvd (ML)	NB at JCT I-5 (ML)	27.114	28.661	**1.547**
SOUTHBOUND				
n/o San Ysidor Blvd (ML)	805 SB n/ 905 (ML)	1.151	1.967	**0.816**
Oran/Olym to 805 SB (ML)	n/o Main St (ML)	2.851	3.631	**0.78**
Oran/Olym to 805 SB (FR)	s/o Telegraph Cyn (ML)	4.084	5.401	**1.317**
s/o Telegraph Cyn (ML)	s/o East H Street (ML)	5.401	6.591	**1.19**
H St (ML)	n/o Bonita Rd (ML)	6.932	8.101	**1.169**
n/o Bonita Rd (ML)	n/o SR-54 (ML)	8.101	9.301	**1.2**
n/o SR-54 (ML)	Plaza Blvd (ML)	9.301	10.211	**0.91**
47th St (ML)	Imperial Ave (ML)	11.351	12.271	**0.92**
Imperial Ave (ML)	Market St (ML)	12.271	13.111	**0.84**
SB 805 s/o 15 (ML)	SB 805 N of 15 (ML)	14.207	15.231	**1.024**
El Cajon Blvd (ML)	n/o 8 (ML)	16.291	18.241	**1.95**
Clairemont Mesa Blvd (FR)	Governor Dr (FR, ML)	22.604	24.182	**1.578**
Nobel Dr (OR)	WB La Jolla Village Dr (OR)	24.851	25.608	**0.757**
WB Mira Mesa Blvd (ML)	SB at Junction I-5 (ML)	27.066	28.662	**1.596**

Source: System Metrics Group, Inc. (using PeMS data)

NOTE: The next page is intentionally left blank so that updates can be inserted to the detection analysis results presented in the last four exhibits (Exhibits 1-3 through 1-6) and discuss the ramifications of its findings (e.g., have the gaps been filled, is detector reliability improving or diminishing, etc.). Similar placeholder pages have been inserted throughout the document for future updates.

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2. CORRIDOR DESCRIPTION

The I-805 Corridor is approximately 29 miles long and runs from I-5 at the San Ysidro Port of Entry at Post Mile (PM) 0.000, to the I-5 Interchange near Sorrento Valley at PM 28.874. As shown in Exhibit 2-1, the I-805 Corridor passes through the cities of Chula Vista, National City, and San Diego.

Corridor Roadway Facility

Approximately every three miles, the I-805 Corridor has a major freeway-to-freeway interchange with another state highway including:

- I-5 (John J. Montgomery Freeway in the south and San Diego Freeway in the north) is a north-south interstate serving California from Mexico to Oregon. Regionally, it connects Mexico to the rest of California through San Diego.
- SR-905 (Otay Freeway) is an east-west state highway that connects I-805 and I-5 to the Otay Mesa Port-of-Entry (POE) with Mexico. Currently, this is the only POE for trucks in the San Diego area. In December 2008, the U.S. Department of State issued a Presidential permit for a new border crossing at the Otay Mesa East POE.
- SR-54 (South Bay Freeway) is an east-west state highway connecting Chula Vista and National City at I-5 to El Cajon.
- SR-94 (Martin Luther King Freeway) is an east-west state highway connecting Lemon Grove and the City of San Diego at I-5 near downtown San Diego.
- SR-15 is a north-south continuation of I-15 through San Diego. The combination of SR-15 and I-15 connects San Diego with Riverside County.
- I-8 (Mission Valley Freeway) is an east-west freeway connecting the Ocean Beach community in San Diego to El Cajon in the east. I-8 serves as the major east-west travel corridor between San Diego and Arizona.
- SR-163 (Cabrillo Freeway) is a north-south freeway that connects I-15 in the north to downtown San Diego.
- SR-52 is an east-west scenic route running from La Jolla and I-5 in the west to Santee in the east.

As depicted in Exhibit 2-2, I-805 is an eight to 12-lane freeway with a concrete median barrier that separates northbound and southbound traffic for most of the corridor. The exhibit shows the lanes in each direction, so five lanes in the exhibit represent a ten-lane freeway. There are auxiliary lanes along many sections of the corridor, but they are not continuous nor are they always available for both sides of the freeway. There are no extensive High Occupancy Vehicle (HOV) lanes on the corridor, although there is a quarter-mile segment of HOV lane on northbound I-805 at the northernmost terminus before transitioning into the existing northbound I-5 HOV lane. As mentioned in the introduction, this northern segment of the corridor has one HOV project with adopted CMIA funding.

According to the 2007 Caltrans Annual Traffic Volumes Report, the I-805 Corridor carries between 53,000 and 245,000 annual average daily traffic (AADT)[1] as shown in Exhibit 2-3. The highest AADT occurs between H Street and Bonita Road, while the lowest occurs at the junction of I-5 at the International Border with Mexico. In general, the heaviest volumes of travel occur between Telegraph Canyon Road and SR-15.

I-805 is a Surface Transportation Assistance Act (STAA) state route (see Exhibit 2-4), which means that trucks may operate on the corridor. Exhibit 2-3 also shows trucks as a percentage of AADT (listed as total truck percentage). According to the 2006 Caltrans Annual Average Daily Truck Traffic book, trucks make up about 6.3 percent of total daily traffic along the entire corridor, with the highest percentage (6.5 percent) of trucks occurring at the I-5 interchange in the northern portion of the corridor. Around Auto Parkway Drive and Main Street, the City of Chula Vista also shows a high percentage (6.5 percent) of truck traffic compared to other areas on the corridor. Most of the truck percentages were estimated in 2003 or 2004. The truck percentages at SR-52 were verified in 2004.

[1] AADT is the total annual volume of vehicles counted divided by 365 days.

Exhibit 2-1: Map of I-805 Study Area

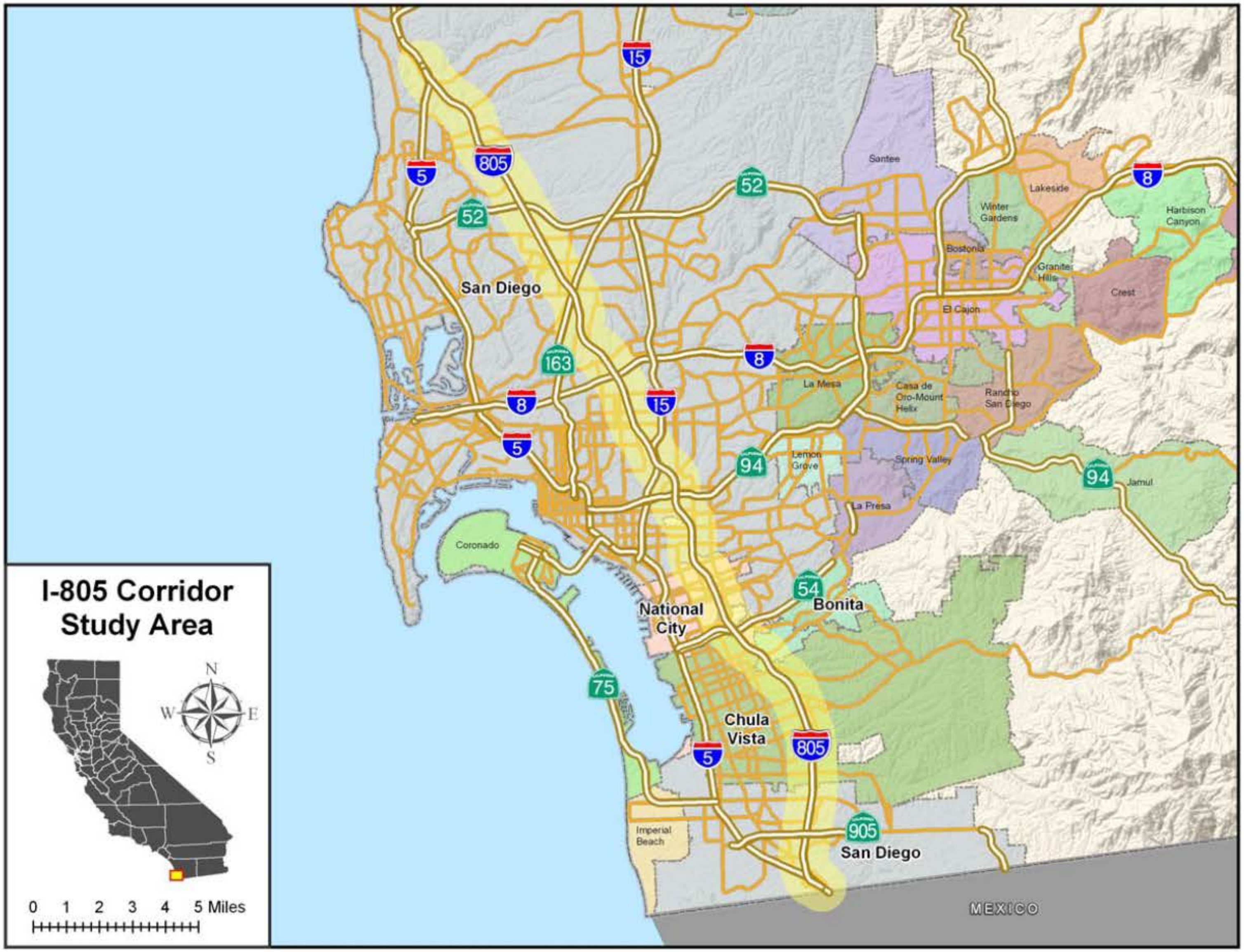


Exhibit 2-2: I-805 Corridor Lane Configuration

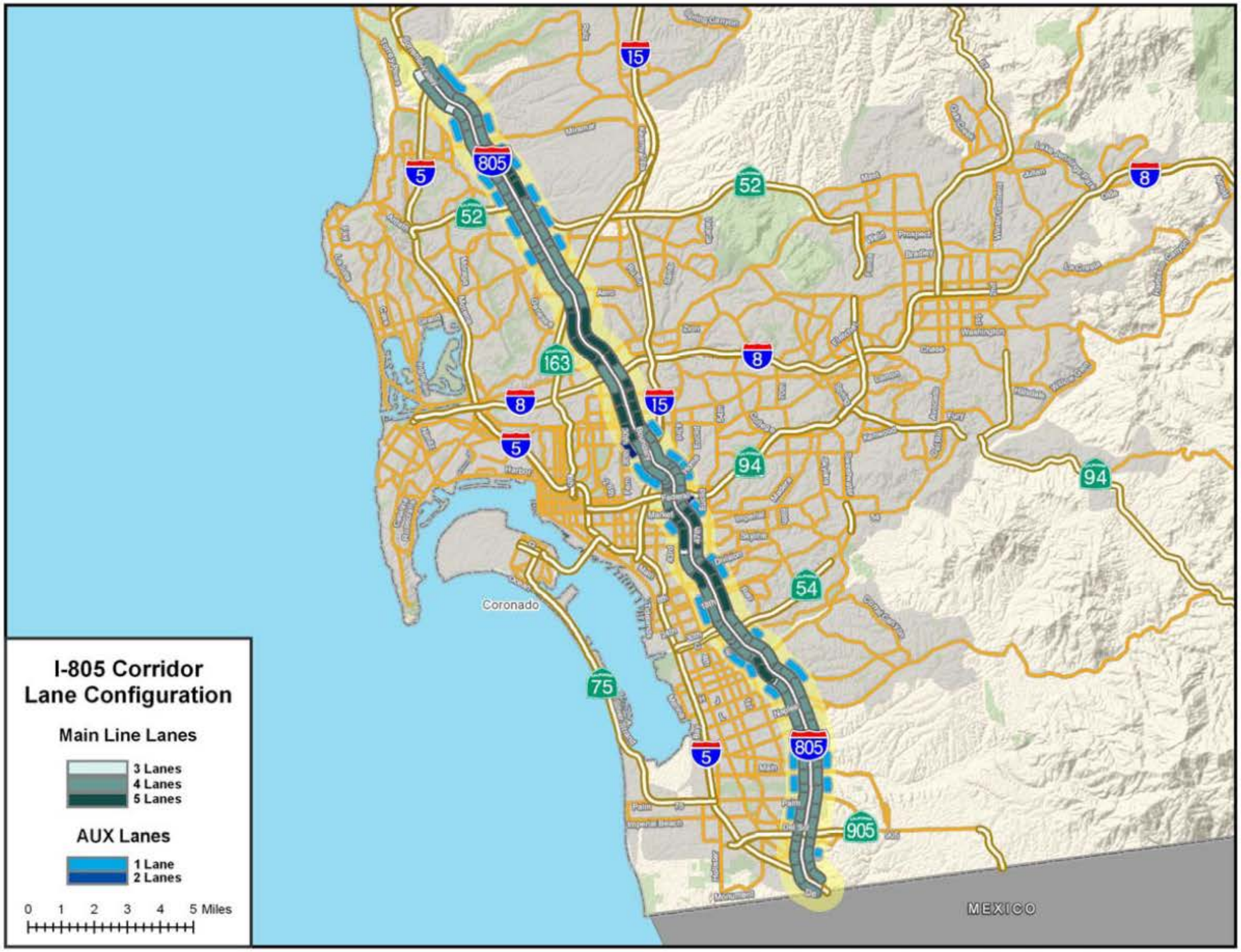
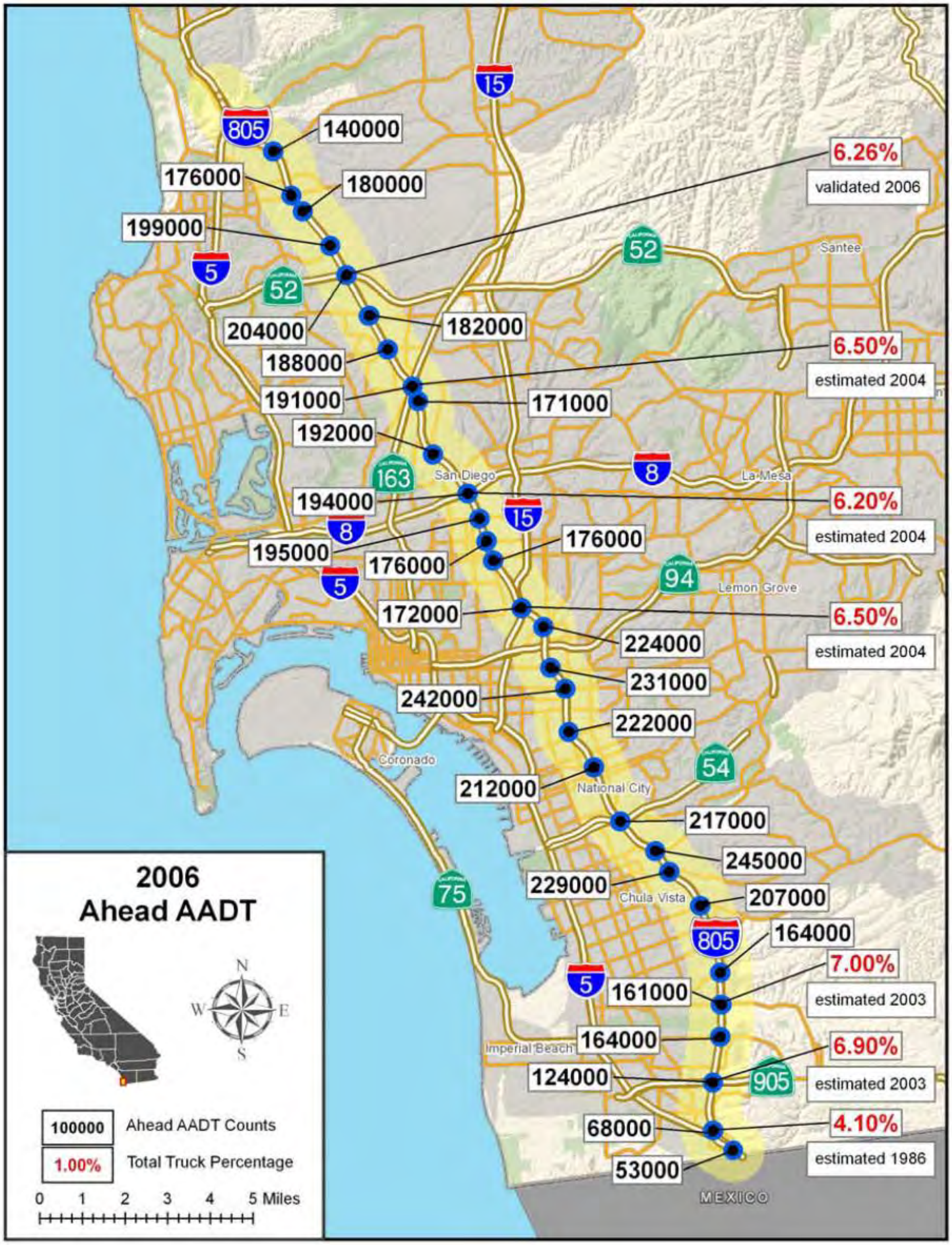
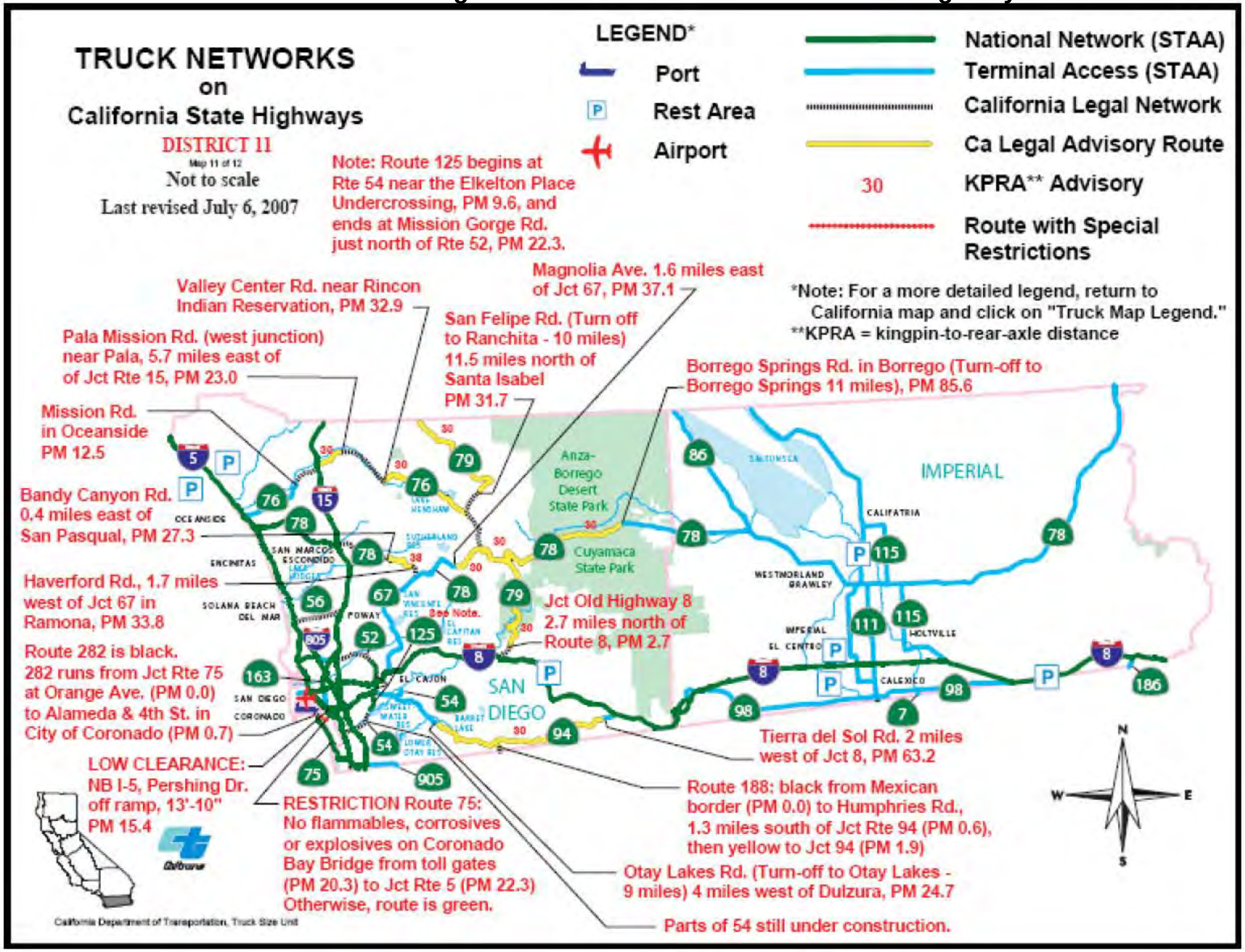


Exhibit 2-3: I-805 Corridor Major Interchanges, AADT and Truck Percentages



Source: AADT and truck percentages are from the Caltrans Traffic and Vehicle Data Systems Unit

Exhibit 2-4: San Diego Truck Network on California State Highways



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Recent Roadway Improvements

In the spring of 2007, Caltrans completed the I-5/I-805 interchange improvement that consisted of a separate freeway bypass system from the junction of I-5/I-805 to the Del Mar Heights Road Interchange. The southbound facility and Carmel Mountain Road interchange opened to traffic in spring 2007, while the northbound facility opened in 2005.

A CMIA project extending the I-5 HOV lane from Via de la Valle to Manchester Road was completed in June 2008. With the completion of a CMIA-funded HOV project on I-805, a continuous 10-mile HOV facility will be available for vehicles using I-805.

Other projects that have recently been completed include the I-805/Orange Ave/Olympic Parkway and I-805/Main Street interchange projects. A number of other local roadway projects critical to I-805 freeway performance include the Vista Sorrento Parkway, Sorrento Valley Road Closure, Mira Sorrento Place.

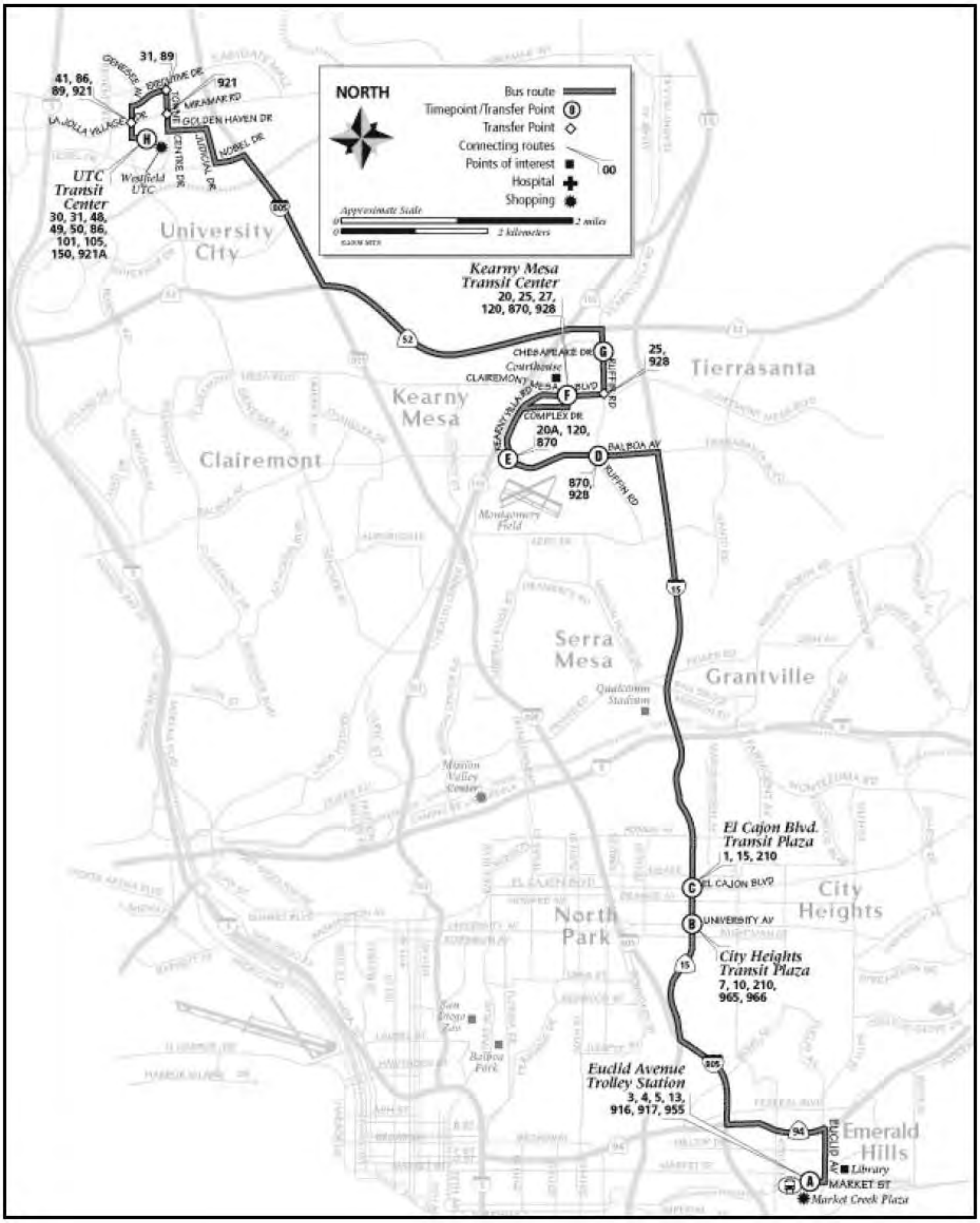
Finally, there are several ongoing ramp metering projects being undertaken along the corridor.

Corridor Transit Services

SANDAG has been the regional agency responsible for transit planning and funding administration in San Diego area since 2003. SANDAG shares planning responsibilities with Caltrans, the Metropolitan Transit System (MTS), and the North County Transit District (NCTD). The MTS includes five transit operators: Chula Vista Transit, MTS Contract Services, National City Transit, San Diego Transit Corporation, and San Diego Trolley, Inc.

On the I-805 Corridor, there is a weekday express bus (SR-960 shown in Exhibit 2-5) that provides service to commuters who might travel along I-805 if the bus SR-did not exist. This route has six or seven runs during the morning and afternoon peak periods between Emerald Hills and University City.

Exhibit 2-5: Parallel Transit Service along the I-805 Corridor



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Intermodal Facilities

One major commercial airport and two smaller general aviation airports lie near the I-805 Corridor. There are also two major military airfields in San Diego.

Marine Corps Air Station (MCAS) Miramar is located adjacent to the I-805 corridor just south of Sorrento Valley. Though not producing commercial or general aviation trips, this major military facility is a major employment facility with approximately 16,000 Marines, Navy personnel, and civilians who work at MCAS Miramar.

Approximately seven miles west of the I-805 Corridor, the San Diego International Airport (SAN) is linked to I-805 by several other freeways. Exhibit 2-6 shows the location of the airport. SAN hosts air carrier, general aviation, air taxi, and air cargo services. Twenty-four commercial passenger and commuter air carriers serve SAN as well as six cargo carriers.

As of 2007, the San Diego International Airport was the 30th largest airport in the United States in terms of passenger enplanements. Approximately 50,000 people arrive or depart through SAN on an average day and more than 18.3 million passengers passed through SAN in 2007.

Exhibit 2-6: Airports near the I-805 Corridor

Exhibit 2-7 shows the numbers of passengers boarding flights at SAN during the five-year period from 2002 to 2006. Over that period, passenger boardings grew from almost 7.4 million in 2002 to more than 8.7 million in 2006. The County of San Diego owns two general aviation airports for private and smaller commercial aircraft. One is Montgomery Field in the Kearny Mesa Area at Aero Drive. The second, Brown Field, is a port-of-entry airport located near the Mexican Border off SR-905 and approximately 2.5 miles east of I-805.

Exhibit 2-7: SAN Passenger Boarding Statistics

	2002	2003	2004	2005	2006
Passenger Boardings	7,392,389	7,565,196	8,135,832	8,628,648	8,724,442
Difference		172,807	570,636	492,816	95,794
Percent Difference		2%	8%	6%	1%

Source: Federal Aviation Administration (FAA) Air Carrier Activity Information System (ACAIS).

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Special Event Facilities/Trip Generators

Exhibit 2-8 on page 28 identifies several major facilities that have the potential to generate trips along the I-805 Corridor. Other areas, such as the employment sites in Sorrento Valley also have the potential to generate trips.

There are three major universities and several community colleges near the I-805 Corridor. The most significant given its size and proximity to a key interchange is the University of California, San Diego (UC San Diego). UC San Diego has undergraduate, masters, and doctoral degree programs for more than 26,000 students. It is located near the I-5/I-805 interchange at the northern end of the corridor in Sorrento Valley, approximately two miles from I-805.

The University of San Diego is a private university with undergraduate, masters, and doctoral degree programs with more than 7,000 students. The university is located in the Linda Vista Area, approximately 2.5 miles from I-805 on Linda Vista Road.

The third university is San Diego State University (SDSU), which has about 35,000 students. SDSU is a public university offering undergraduate, masters, and doctoral degree degrees. It lies adjacent to I-8 on College Ave, approximately four miles east of the I-805 Corridor.

The corridor also serves four two-year community colleges:

- *Mesa College* is the largest of San Diego's community colleges. With approximately 22,000 students, it has the potential to produce many trips on the I-805 Corridor. The college lies less than one mile west of the I-805 Corridor on Mesa College Drive in the Linda Vista Area.
- *Southwestern College* serves approximately 18,000 students and lies just over three miles east of the corridor adjacent to East H Street and Telegraph Canyon Road in Chula Vista.
- *San Diego City College* has approximately 15,000 students. San Diego City College lies approximately three miles from the I-805 Corridor near Balboa Park in downtown San Diego.
- *Miramar College* has approximately 12,000 students. The college is located approximately 5.5 miles east of the I-805 Corridor just off I-15 in Mira Mesa.

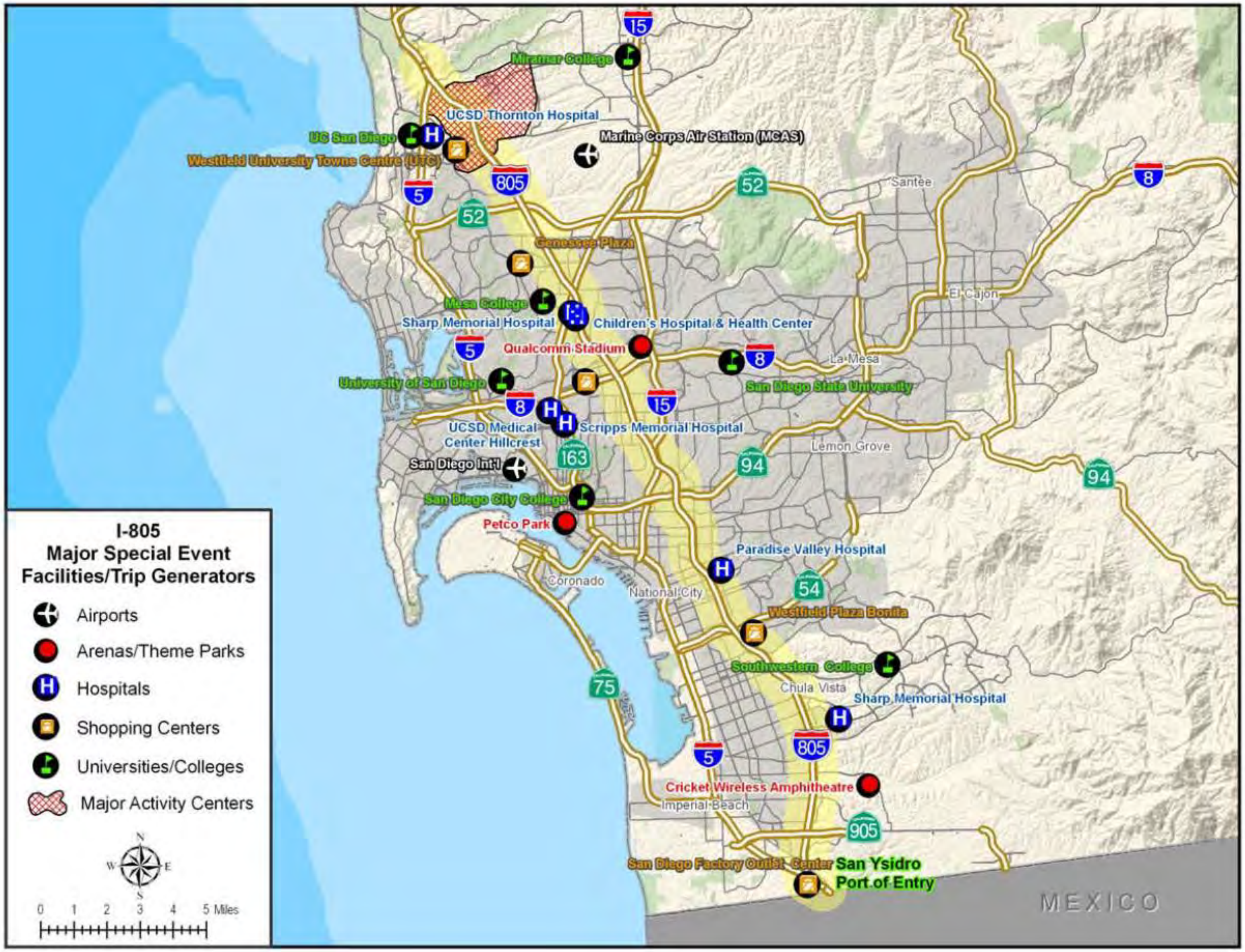
Exhibit 2-8 also shows regional hospitals near the I-805 Corridor. The combination of Sharp Memorial Hospital with 330 beds and the Children's Hospital and Health Center with nearly 300 beds next door is the largest medical destination along the corridor. Both hospitals are found adjacent to the corridor on Mesa College Drive in the Kearny Mesa Area. The largest single medical facility in the region is the UC San Diego Medical Center with nearly 550 beds. The center is located approximately two miles from I-805 and adjacent to I-8/SR-163 in the Hillcrest Area. Scripps Memorial Hospital, which has about 375 beds, is also near the I-805 Corridor. The hospital is located just two miles from the corridor on Genesee Avenue in La Jolla.

Sorrento Valley near the I-5 interchange is a major regional employment center, which is a major trip generator for the I-805 corridor. The entire Mission Valley Area also serves as a major trip generator near the corridor. Located along I-8, the Mission Valley Area has several office parks, shopping malls, and residential developments. A notable feature of the area is Qualcomm Stadium, where both the San Diego Chargers National Football League (NFL) professional football team and the SDSU Aztecs football team play. Other sporting and special events are also held at Qualcomm Stadium.

There are a number of other shopping malls located near the I-805 Corridor. The largest of these are shown in Exhibit 2-8.

As discussed earlier in the section on airports, the Marine Corps Air Station (MCAS) Miramar is a major employment facility. MCAS Miramar is accessed via Miramar Road and is home to the 3rd Marine Aircraft Wing and supporting units. There are approximately 16,000 Marines, Navy personnel, and civilians who work at MCAS Miramar.

Exhibit 2-8: Major Special Event Facilities/Trip Generators



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Demand Profiles

An analysis was conducted to identify the number of trips that use the I-805 corridor. Using SANDAG's 2006 Base Year travel demand model, SANDAG staff was able to identify all origins and destinations (ODs) that produce trips using I-805 during the AM and PM peak periods. The ODs were first identified by the Traffic Analysis Zones (TAZs) used in the SANDAG model. The study team then aggregated the ODs into 18 larger analysis zones as shown on the map in Exhibit 2-9.

These larger zones do not represent any official SANDAG or Caltrans analysis areas, but were chosen by the study team to enhance analysis specific to this corridor.

The study team further aggregated these zones into four larger regional areas. These four areas also do not represent official SANDAG or Caltrans analysis areas, but were chosen by the study team. These zones are represented in the tables in Exhibits 2-10 and 2-11. The tables summarize the aggregated results for the AM and PM peak periods, respectively.

Exhibit 2-10, showing the AM summary, indicates that nearly 14 percent of all trips using I-805 begin north of the corridor and end somewhere adjacent to the corridor (shown by the dark green shading with diagonal lines). More than 4,000 of these (3.4 percent of total trips) begin somewhere along the I-5 corridor and end in Sorrento Valley (map zone #4 to map zone #7 shown in Exhibit 2-9).

In total, the nearly 44 percent of all AM peak period trips using I-805 ended somewhere adjacent to the corridor with 18 percent of all trips ending in the Sorrento Valley area (map zone #7). Another 26 percent ended in the northern area of the corridor or entirely north of the corridor.

Just over one-third of all trips using I-805 originated in zones adjacent to the corridor, with around 12 percent originating in the area between SR-54 and I-8. Other zones producing significant AM trips include the Rancho del Rey/Otay Ranch Village communities (zone #11) and zones near Santee and Marine Corps Air Station (MCAS) Miramar along I-15 (zone #5).

In the PM peak period shown in Exhibit 2-11, three larger areas accounted for just fewer than 40 percent of all trips using I-805. Trips originating and ending adjacent to the corridor accounted for 13 percent of all PM trips. PM trips originating in the I-805 corridor and ending in northern areas accounted for nearly 12 percent of trips, as did trips originating in the northern areas and ending in the I-805 corridor.

When total destinations are taken into account, the I-805 corridor accounted for 38 percent of all PM destinations. Areas north and south of the corridor each accounted for 23 percent of all trips.

Within these percentages, zone #9, adjacent to the corridor between SR-54 and I-8 received the greatest percentage of trips with 13 percent of total trips. The communities of Rancho del Rey and Otay Ranch Village off Telegraph Canyon Road received 11 percent of PM period trips, with Sorrento Valley also having 11 percent destined for that zone.

The I-805 corridor area produced 42 percent of PM peak period trips according to the results shown in Exhibit 2-11. Northern areas not adjacent to the corridor produced an additional 26 percent of all PM trips, with areas to the south generating another 20 percent.

Sorrento Valley (zone # 7) produced the greatest percentage of PM peak period trips with 13 percent, but two other zones (#9 and #10) each produced greater than 10 percent of PM peak period trips. The single highest PM peak period demand OD pair was between Sorrento Valley (zone #7) and north along the I-5 corridor (zone #4) with nearly 3,300 trips (around 2.4 percent of all PM trips).

Based on this analysis, there is a strong relationship not only for travel within the corridor (i.e., among zone #s 7, 8, 9, and 10), but also between the I-805 corridor and zones in the northern part of the corridor. In particular, zone #4 along the I-5 corridor tends to produce and attract significant numbers of trips. Sorrento Valley (zone #7) tends to draw most trips.

The southern end of the corridor (zone #s 11, 12, 13, and 14) also tend to produce significant numbers of trips, with most of these destined for zones adjacent to the corridor.

Significantly, the I-15 corridor (zone #3) did not produce a significant number of trips that used the I-805 corridor. The east county zones (with the exception of zone #16) tended to produce the fewest trips using the I-805 Corridor.

Exhibit 2-9: Aggregate Analysis Zones for Demand Profile Analysis

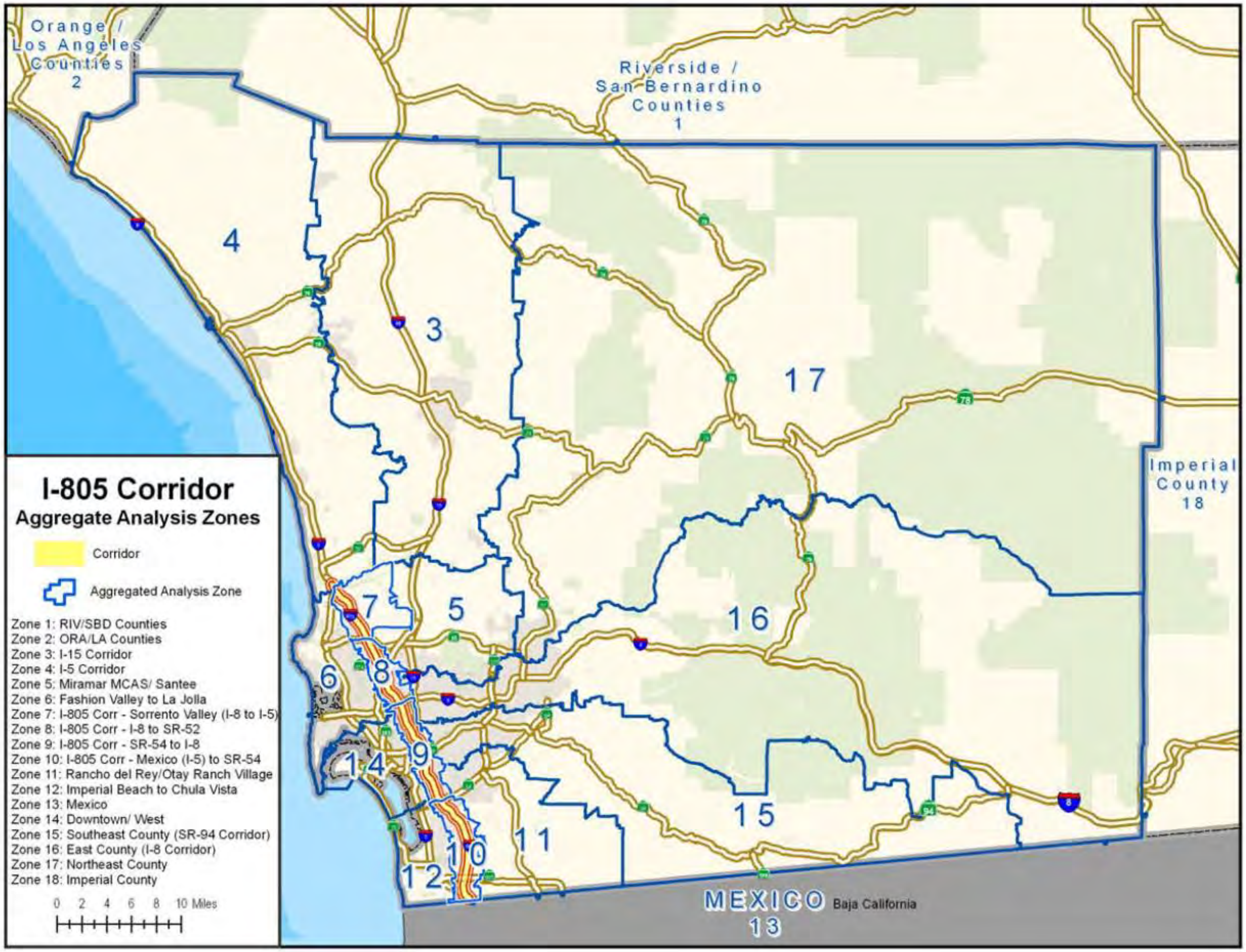

Exhibit 2-10: AM Peak Origins-Destinations by Aggregated Analysis Zone

	Destination Zone / Origin Zone		RIV/SBD Counties 1	ORA/LA Counties 2	I-15 Corridor 3	I-5 Corridor 4	Miramar MCAS/ Santee 5	Fashion Valley to La Jolla 6	Sorrento Valley (I-8 to I-5) 7	I-8 to SR-52 8	SR-54 to I-8 9	Mexico (I-5) to SR-54 10	Rancho del Rey/Otay Ranch Vlg 11	Imperial Beach to Chula Vista 12	Mexico 13	Downtown/ West 14	Southeast County (SR-94 Corridor) 15	East County (I-8 Corridor) 16	Northeast County 17	Imperial County 18	Origin Zone Totals	Percent of Origin Trips	Larger Area Totals	Percent Larger Area
			NORTH & WEST OF CORRIDOR						I-805 CORRIDOR				SOUTH & WEST OF CORRIDOR				EAST OF CORRIDOR							
NORTH & WEST OF CORRIDOR	RIV/SBD Counties	1						22	210	11	63	66	113	64	49	12	51	1			662	1%	29,858	25%
	ORA/LA Counties	2					307	86	317	162	66	39	90	8	63	30	75	344	18	171	1,776	2%		
	I-15 Corridor	3					35	159	1,385	140	378	251	352	193	437	70	216	28	1	-	3,645	3%		
	I-5 Corridor	4					2,168	677	4,069	1,364	409	141	246	34	327	153	281	1,358	107	7	11,342	10%		
	Miramar MCAS/ Santee	5		293	1	925	18	143	1,528	156	807	403	423	293	233	145	278	99	0	1	5,745	5%		
	Fashion Valley to La Jolla	6	-	29	1	114	200	315	1,557	1,162	1,261	405	479	98	54	132	377	494	8	1	6,687	6%		
I-805 CORRIDOR	Sorrento Valley (I-8 to I-5)	7	5	289	234	1,390	885	1,089	913	983	652	216	289	310	101	488	374	963	78	7	9,266	8%	39,936	34%
	I-8 to SR-52	8	1	89	20	409	116	566	1,004	234	559	179	226	203	67	328	334	696	27	2	5,060	4%		
	SR-54 to I-8	9	63	158	398	432	1,395	2,306	1,439	1,473	1,268	955	916	1,115	232	743	456	1,161	77	1	14,589	12%		
	Mexico (I-5) to SR-54	10	77	111	290	197	672	698	641	352	886	1,978	1,450	528	436	1,087	390	1,106	118	3	11,021	9%		
SOUTH & WEST OF CORRIDOR	Rancho del Rey/ Otay Ranch Village	11	190	379	624	608	1,304	1,418	1,263	800	1,126	1,679	472	943	709	1,874	201	746	43	1	14,379	12%	28,320	24%
	Imperial Beach to Chula Vista	12	9	0	42	1	304	165	826	269	528	574	755	1	173	11	174	186	15	0	4,030	3%		
	Mexico	13	13	15	646	148	714	246	621	350	284	362	399	71	-	42	205	825	164	0	5,104	4%		
	Downtown/ West	14	0	39	0	107	101	247	816	519	931	935	881	33	27	34	95	39	2		4,806	4%		
EAST OF CORRIDOR	Southeast County (SR-94 Corridor)	15	47	362	221	605	690	628	1,294	863	712	597	336	707	357	157	0	190	2		7,770	7%	20,241	17%
	East County (I-8 Corridor)	16		748	2	1,341	451	388	2,700	1,626	1,014	726	505	586	555	303	104	4			11,053	9%		
	Northeast County	17		93	0	159	18	29	441	92	93	100	59	58	193	25	3	-			1,362	1%		
	Imperial County	18		41		2	0	0	3	1	1	1	0	0	5	0					55	0%		
	Destination Totals		406	2,646	2,479	6,436	9,380	9,185	21,028	10,558	11,036	9,605	7,991	5,244	4,021	5,634	3,612	8,238	660	195	118,354	100%	118,354	100%
	Percent of Dest Trips		0%	2%	2%	5%	8%	8%	18%	9%	9%	8%	7%	4%	3%	5%	3%	7%	1%	0%	100%	Origin Totals / Destination Totals		
	Larger Area Totals		30,532						52,227				22,890				12,705				118,354			
	Percent Larger Area		26%						44%				19%				11%				100%			

Exhibit 2-11: PM Peak Origins-Destinations by Aggregated Analysis Zone

	Origin Zone \ Destination Zone		NORTH & WEST OF CORRIDOR						I-805 CORRIDOR				SOUTH & WEST OF CORRIDOR				EAST OF CORRIDOR							
			RIV/SBD Counties	ORA/LA Counties	I-15 Corridor	I-5 Corridor	Miramar MCAS/ Santee	Fashion Valley to La Jolla	Sorrento Valley (I-8 to I-5)	I-8 to SR-52	SR-54 to I-8	Mexico (I-5) to SR-54	Rancho del Rey/Otay Ranch Vlg	Imperial Beach to Chula Vista	Mexico	Downtown/ West	Southeast County (SR-94	East County (I-8 Corridor)	Northeast County	Imperial County	Origin Zone Totals	Percent of Origin Trips	Larger Area Totals	Percent Larger Area
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18				
NORTH & WEST OF CORRIDOR	RIV/SBD Counties	1						2	7	5	60	66	160	14	37	8	60	1			419	0%		
	ORA/LA Counties	2					368	52	483	121	169	111	311	9	25	38	299	666	86	74	2,812	2%		
	I-15 Corridor	3					7	72	578	92	489	285	596	67	719	57	305	12	1	0	3,277	2%		
	I-5 Corridor	4					1,213	302	2,442	632	571	211	553	14	149	130	598	1,418	173	2	8,408	6%	35,813	26%
	Miramar MCAS/ Santee	5		255	16	1,993	22	202	1,393	179	1,458	626	1,157	269	643	249	777	458	19	0	9,715	7%		
	Fashion Valley to La Jolla	6	22	69	118	505	202	362	1,778	1,004	2,591	701	1,423	157	197	350	1,241	433	28	0	11,181	8%		
I-805 CORRIDOR	Sorrento Valley (I-8 to I-5)	7	139	247	1,082	3,279	1,607	917	1,083	1,100	1,251	496	1,022	488	453	616	1,159	2,543	350	2	17,834	13%		
	I-8 to SR-52	8	10	150	112	1,293	176	1,268	1,541	278	1,456	338	805	238	274	438	1,103	1,581	88	1	11,149	8%	56,990	42%
	SR-54 to I-8	9	84	101	485	569	1,221	1,629	1,108	912	1,737	1,277	1,549	891	335	849	919	1,133	93	0	14,891	11%		
	Mexico (I-5) to SR-54	10	58	52	239	175	535	635	360	280	1,274	2,785	2,358	711	567	1,456	700	836	95	1	13,116	10%		
SOUTH & WEST OF CORRIDOR	Rancho del Rey/ Otay Ranch Village	11	121	109	349	286	661	748	488	365	1,083	1,503	510	798	457	1,414	368	630	62	0	9,952	7%		
	Imperial Beach to Chula Vista	12	27	11	89	33	296	242	529	374	1,135	650	905	1	230	24	390	272	30	0	5,239	4%	27,028	20%
	Mexico	13	69	104	446	336	337	81	172	105	325	583	1,140	54	-	18	480	693	196	7	5,148	4%		
	Downtown/ West	14	0	28	5	155	128	177	781	694	1,012	1,369	1,926	37	71	45	203	51	7	-	6,689	5%		
EAST OF CORRIDOR	Southeast County (SR-94 Corridor)	15	42	98	211	340	515	422	620	482	761	488	296	459	226	155	0	137	2		5,253	4%		
	East County (I-8 Corridor)	16		343	4	1,319	147	712	1,582	981	1,671	1,086	739	481	756	467	211	1			10,499	8%	16,861	12%
	Northeast County	17		19	0	86	1	20	118	38	131	113	37	32	142	29	2				770	1%		
	Imperial County	18		302	0	10	1	1	13	3	2	2	3	1	1	1					340	0%		
	Destination Totals		572	1,890	3,156	10,381	7,436	7,845	15,075	7,644	17,174	12,689	15,490	4,721	5,282	6,343	8,813	10,866	1,230	89	136,693	100%	136,693	100%
	Percent of Dest Trips		0%	1%	2%	8%	5%	6%	11%	6%	13%	9%	11%	3%	4%	5%	6%	8%	1%	0%	100%	Origin Totals \ Destination Totals		
	Larger Area Totals		31,278						52,582				31,835				20,997				136,693			
	Percent Larger Area		23%						38%				23%				15%				100%			

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3. CORRIDOR-WIDE PERFORMANCE AND TRENDS

This section summarizes existing conditions on the I-805 Corridor. The primary objectives of the performance measures used are to provide a sound technical basis for describing traffic performance on the corridor.

The performance measures focus on four key areas:

- **Mobility** describes how well people and freight move along the corridor
- **Reliability** captures the relative predictability of travel along the corridor
- **Safety** provides an overview of collisions along the corridor
- **Productivity** describes the productivity loss due to traffic inefficiencies
- **Pavement Condition** describes the structural adequacy and ride quality of the pavement.

MOBILITY

The mobility performance measures are both measurable and straightforward for documenting current conditions. They can also be forecasted, which makes them useful for future comparisons. Two primary measures are typically used to quantify mobility: delay and travel time.

Delay

Delay is defined as the observed travel time less the travel time under non-congested conditions, and is reported as vehicle-hours of delay. Delay can be computed for severely congested conditions using the following formula:

$$(\text{Vehicles Affected per Hour})\times(\text{SegmentLength})\times(\text{Duration})\times\left[\frac{1}{(\text{Congested Speed})}-\frac{1}{(\text{Threshold Speed})}\right]$$

In the formula above, the *Vehicles Affected per Hour* value depends on the methodology used. Some methods assume a fixed flow rate (e.g., 2,000 vehicles per hour per lane), while others use a measured or estimated flow rate. The segment length is the distance under which the congested speed prevails. The duration is how long the congested period lasts (measured in hours), with the congested period being the amount of time spent below the threshold speed. The threshold speed is the speed under which congestion is considered to occur. Any speed can be used, but two commonly used threshold speeds are 35 mph and 60 mph.

Caltrans defines the threshold speed as 35 mph and assumes a fixed 2,000 vehicles per hour per lane are experiencing the delay to estimate severe delay for reporting congestion for the statewide Highway Congestion Monitoring Report (HICOMP).

In calculating total delay, PeMS uses the 60 mph threshold speed and the observed number of vehicles reported by detection systems. The congestion results of HICOMP and PeMS are difficult to compare due to these methodological differences, so they are discussed separately in this assessment.

Caltrans HICOMP

The HICOMP report has been published by Caltrans annually since 1987.[2] Delay is presented as average daily vehicle-hours of delay (DVHD). In HICOMP, Caltrans attempts to capture recurrent congestion during "typical" incident-free weekday peak periods. Recurrent delay is defined in HICOMP as a condition where speeds drop below 35 mph for a period of 15-minutes or longer during weekday AM or PM commute periods.

Caltrans District 11 uses a combination of probe vehicle runs and archived intelligent transportation system (ITS) data for HICOMP reporting. The district conducts probe vehicle runs one to four days during the year. Ideally, two days of data collection are performed in the spring and two in the fall of the year, but resource constraints may affect the number of runs carried out during a given year. As shown in the PeMS data later in this section, congestion levels vary from day to day and depend on any number of factors including collisions, weather, and special events. Probe vehicle drivers abort runs if collisions or other unusual conditions occur.

In District 11, ITS data are collected for spring and fall Tuesdays, Wednesdays, and Thursdays and a sample of days that lie within one standard deviation of average speeds and flows are used for analysis. This data is considered to represent "typical", "recurrent" conditions.

It should be noted that the trends are affected by the quality of the data available in individual years. Data collection may be limited, so HICOMP results for an individual corridor should be validated by using additional information and fieldwork. This will be done in the comprehensive assessment for the I-805 Corridor.

Exhibit 3-1 shows the yearly delay trends from 2004 to 2007. Both AM and PM peak periods for both directions along the corridor are shown. As indicated in the exhibit, the congestion is directional on the I-805 Corridor – morning congestion occurs in the northbound direction and afternoon congestion occurs in the southbound direction. The exhibit also highlights an unusual trend. AM congestion in the northbound direction has eased over the last four years, while PM congestion in the southbound direction has grown.

[2] Located at <www.dot.ca.gov/hq/traffops/sysmgtpl/HICOMP/index.htm>

Exhibit 3-1: Average Daily Vehicle-Hours of Delay

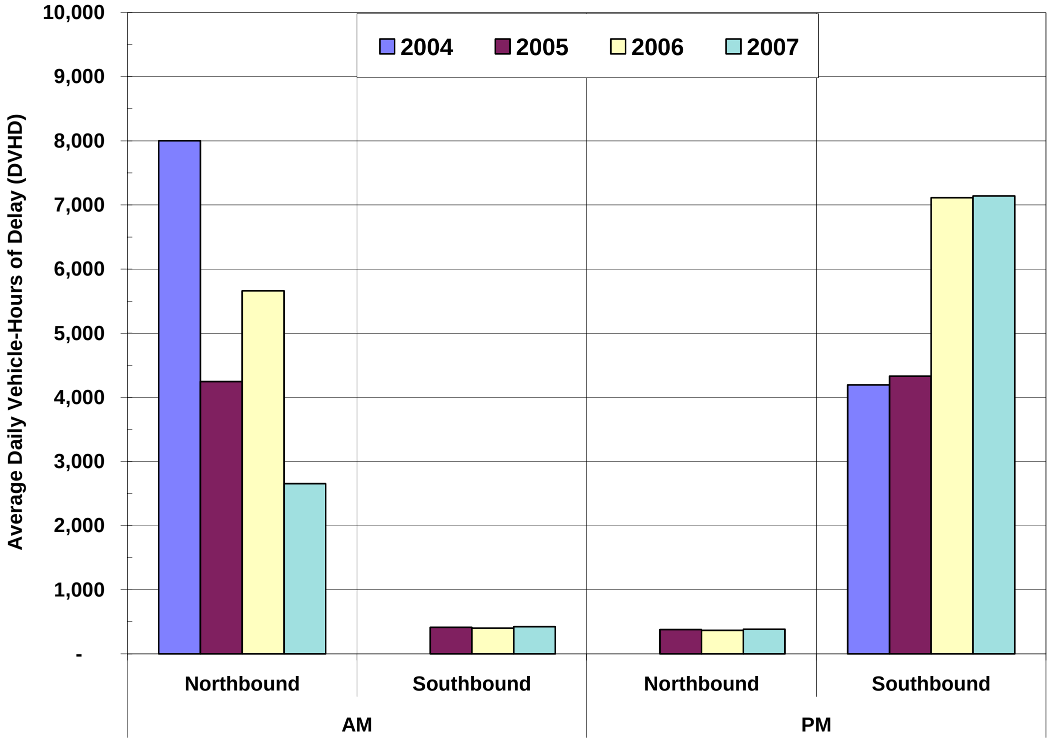


Exhibit 3-2 shows a complete list of congested segments reported by the HICOMP report for the I-805 Corridor. A congested segment may vary in distance or size from one year to the next as well as from day-to-day. Exhibit 3-2 attempts to standardize the list of congested segments to facilitate comparisons from one year to the next.

The most congested segment on the corridor was in the southbound direction during the PM peak period between Murray Ridge Road and Plaza Boulevard. This eight-mile congested segment crosses over I-8, SR-163, I-15 and SR-94, which may explain why congestion in the southbound direction during the PM peak period has increased. Delay in the northern sections of I-805 (i.e., north of SR-163) generally decreased in both directions for both time periods. This could be due to the completion of the I-5/I-805 widening project in April of 2007, which added a separate freeway bypass system from I-5/I-805 to the Del Mar Heights Road Interchange. The combination of the Murray Ridge Road/Plaza Boulevard congested segment and the completion of the I-5/I-805 widening project help explain the diverging trends shown in Exhibit 3-1 for the northbound and southbound direction.

Exhibit 3-2: HICOMP Hours of Delay for Congested Segments 2004-2007

Direction of Travel	Period	From PM	To PM	Congestion Start Location	Queue End Location	2004	2005	2006	2007
Northbound	AM	5.3	10.9	47th St	Naples St (Chula Vista)	4,351			
		9.9	26.6	Via Sorrento Pkway	B/n SR-54 & Plaza Blvd (Chula Vista)	3,650			
		6.1	15.6	I-15	Telegraph Canyon Rd (Chula Vista)		2,512	3,663	1,338
		15.6	17.4	El Cajon Blvd	I-15		272	371	391
		20.1	23.5	SR-52	SR-163		1,461	1,627	924
	PM	26.2	29.3	I-5	La Jolla Village Dr		377	366	386
AM PEAK PERIOD SUMMARY						8,001	4,623	6,027	3,038
Southbound	AM	6.1	3.4	Telegraph Canyon Rd (Chula Vista)	Main St (Chula Vista)		414	402	423
	PM	28.0 - 27.7	25.1	Nobel Dr	I-5 Area (Sorrento Valley Rd/ Mira Mesa Blvd)	1,332	935	1,050	854
		23.6	9.9	B/n SR-54 & Plaza Blvd	Governor Dr	1,610			
		21.1	20.2	SR-163	Balboa Ave		239	563	370
		18.5	10.3	Plaza Blvd	Murray Ridge Rd		2,049	4,029	4,244
		10.3	6.8-7.6	H Street/ Bonita Rd (south of SR-54)	Plaza Blvd	1,253	1,107	1,470	1,674
PM PEAK PERIOD SUMMARY						4,196	4,745	7,514	7,566
TOTAL CORRIDOR CONGESTION						12,196	9,368	13,541	10,604

The maps in Exhibits 3-3 and 3-4 show the 2007 AM and PM peak period delay listed in Exhibit 3-2. The approximate locations of the congested segments, the duration of congestion, and the reported recurrent daily delay are shown on the maps.

The HICOMP report results shown in Exhibit 3-3 indicate that during the AM peak period; there may be major northbound bottlenecks near SR-52, and I-15. A smaller northbound bottleneck may exist at El Cajon Boulevard (near the I-8 interchange). There is also minor congestion reported between Main Street and Telegraph Canyon Road in Chula Vista.

In the PM peak period, Exhibit 3-4 indicates that two major southbound recurring bottlenecks that create queues upstream to I-8 may exist. The most significant may be near Plaza Boulevard and another occurs just south of the SR-54 interchange near the Bonita Road and H Street interchanges.

Exhibit 3-4 also indicates that there may be southbound PM bottlenecks at SR-163 and around Nobel Drive. One northbound PM bottleneck may also exist near the I-5 interchange in Sorrento Valley. These bottlenecks will be discussed in more detail in Section 4 of this report when more detailed probe vehicle and PeMS data are reviewed.

Exhibit 3-3: 2007 AM Peak Period HICOMP Congested Segments Map

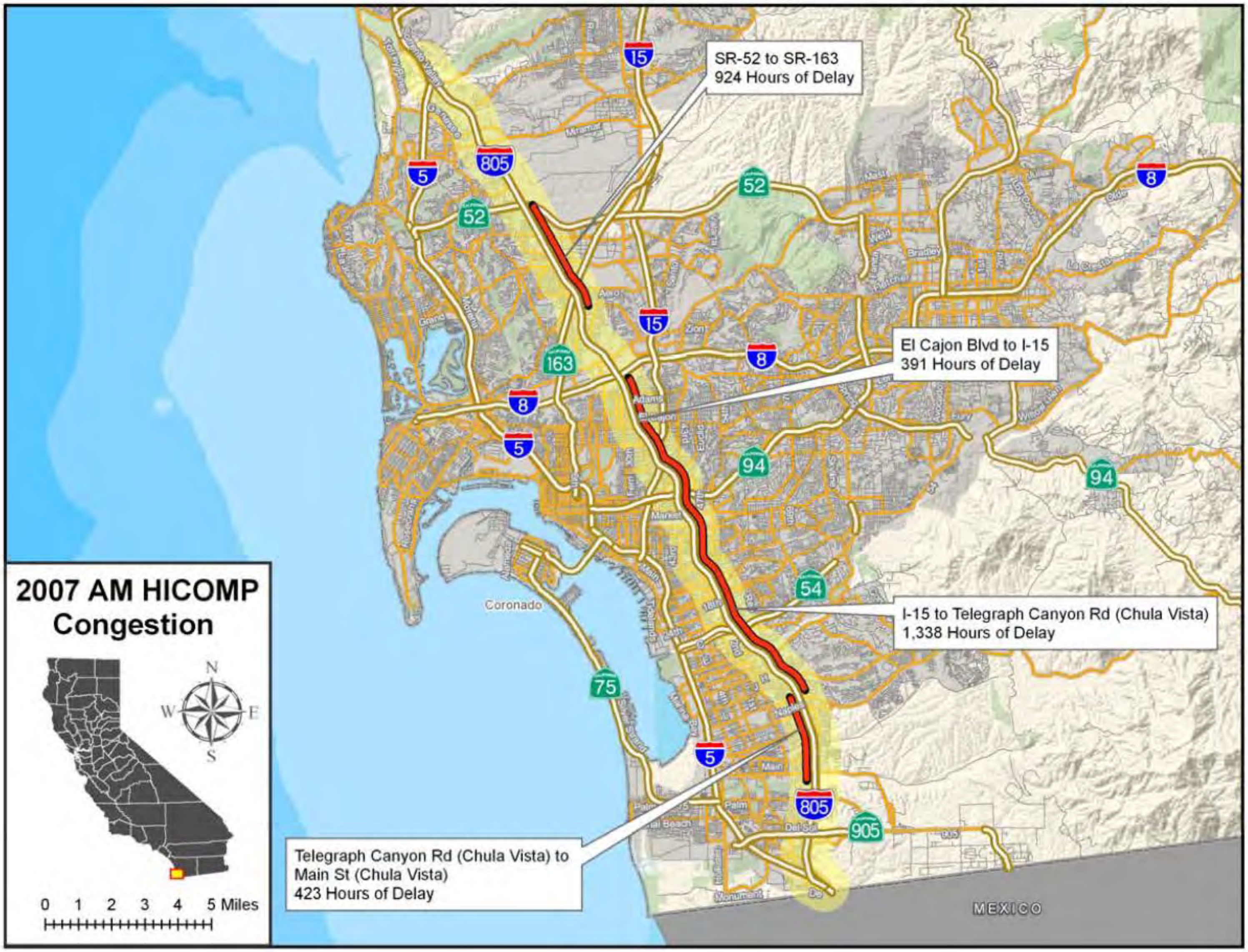
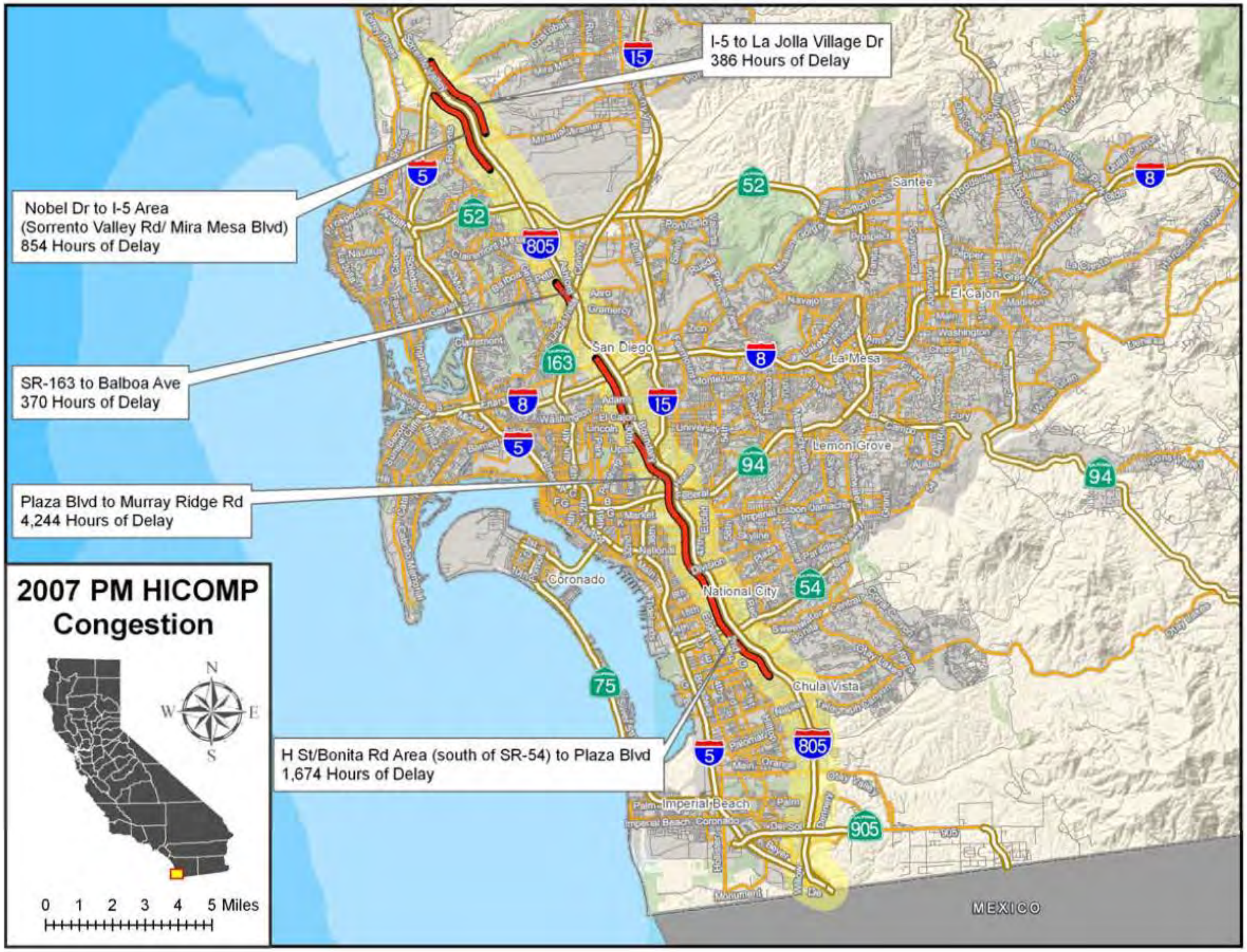


Exhibit 3-4: 2007 PM Peak Period HICOMP Congested Segments Map



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Freeway Performance Measurement System (PeMS)

Using freeways detector data discussed in Section 1 and accessed via PeMS, delay is computed for every day and summarized in different ways, which is not possible when using probe vehicle data.

Performance assessments were conducted initially for the three-year period between 2005 and 2007. These assessments were recently updated through December 2008. Unlike HICOMP, where delay is considered for speeds below 35 mph and applied to an assumed capacity volume of 2,000 vehicles per hour, delays presented in this section represent the difference in travel time between actual conditions and free-flow conditions at 60 mph, applied to the actual output flow volume collected from a vehicle detector station. The total delay by period for the I-805 for each direction is shown in Exhibits 3-5 and 3-6.

The performance assessment includes four years of PeMS data filtered to exclude data considered to be of poor quality. The study team used estimated or imputed data for sensors with sufficient observed data to provide for reasonable estimates.

Exhibits 3-5 and 3-6 show a four-year trend in weekday (i.e., excluding weekends and holidays) delay for the entire corridor in the northbound and southbound directions respectively. The exhibits also show a 90-day moving average that reduces the day-to-day variations and more easily illustrates the seasonal and annual changes in congestion over time.

Consistent with the HICOMP data, the PeMS data shows a directional congestion pattern with the northbound direction experiencing greater congestion during the AM peak and the southbound direction experiencing more congestion during the PM peak. Also consistent with the HICOMP data for 2005-2007, the PeMS data suggests that the highest daily weekday congestion occurs during the PM peak period in the southbound direction (see Exhibit 3-6), which is about two-thirds higher than the AM peak period delay. Note that the HICOMP data indicates that the delays during the AM peak in the northbound direction were even larger in 2004. Delay in both directions remained constant between 2005 and 2007 but declined considerably in 2008, particularly during the summer months.

Exhibit 3-5: I-805 Northbound Average Daily Delay by Time Period (2005-2008)

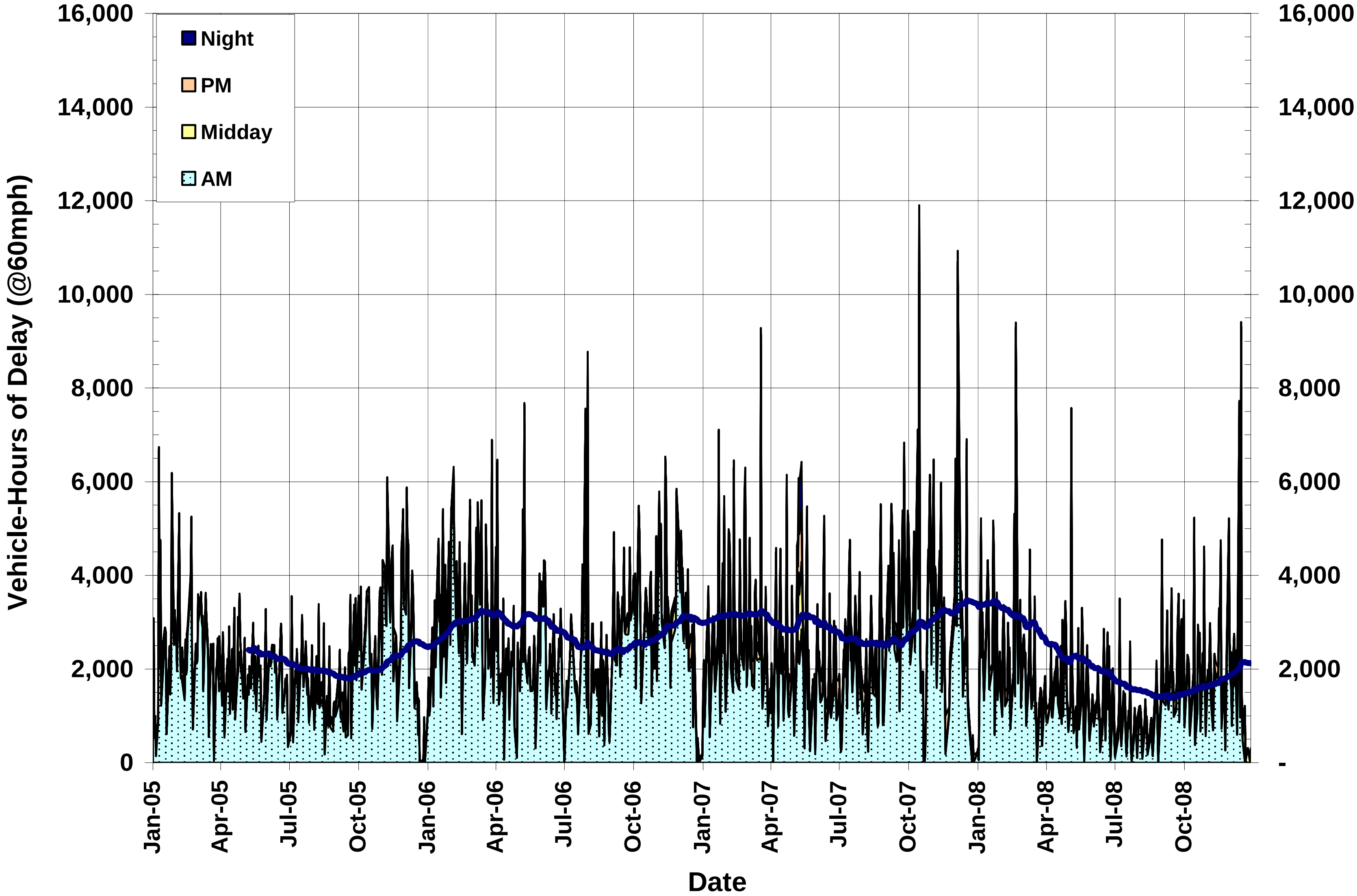


Exhibit 3-6: I-805 Southbound Average Daily Delay by Time Period (2005-2008)

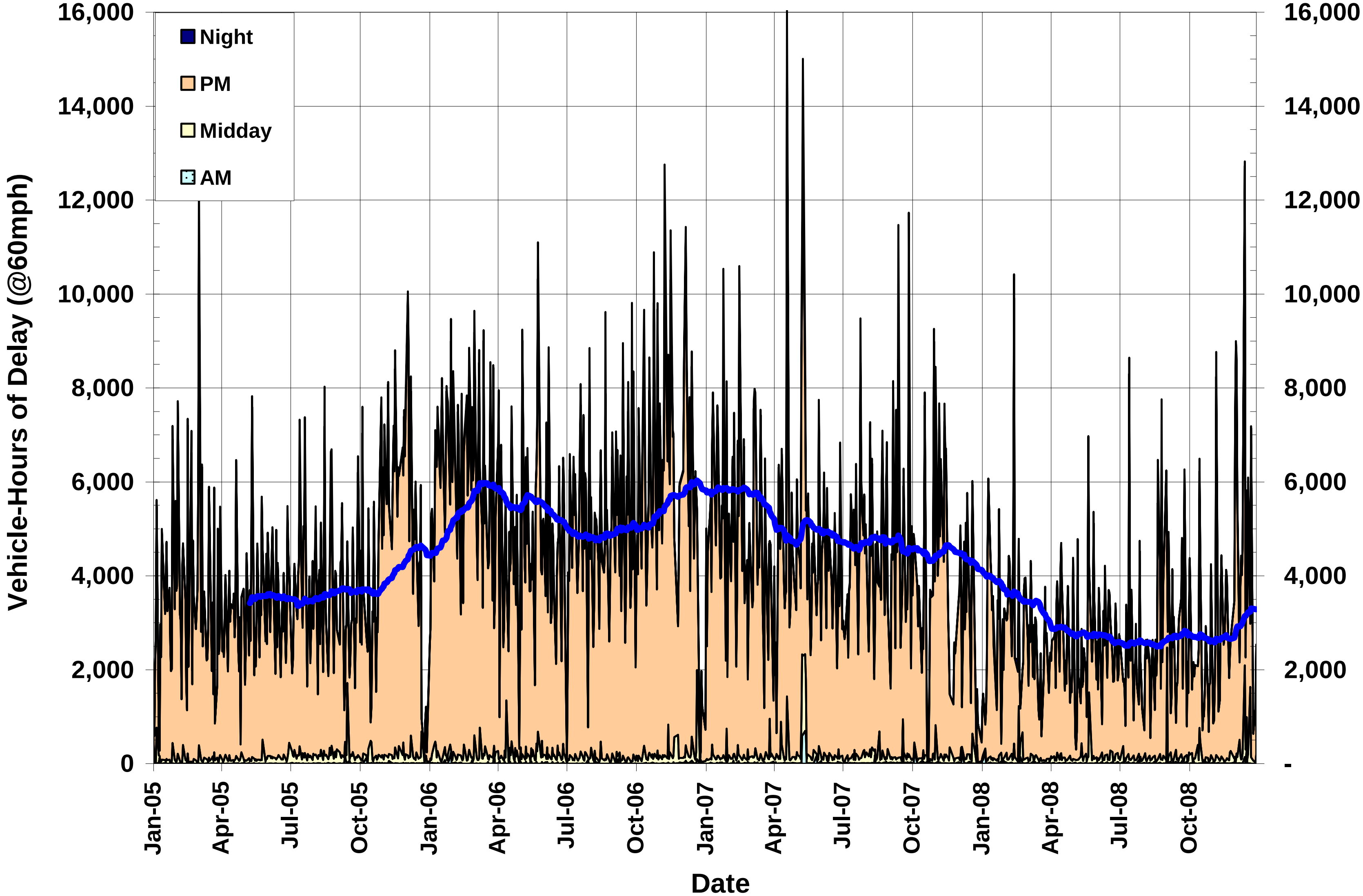
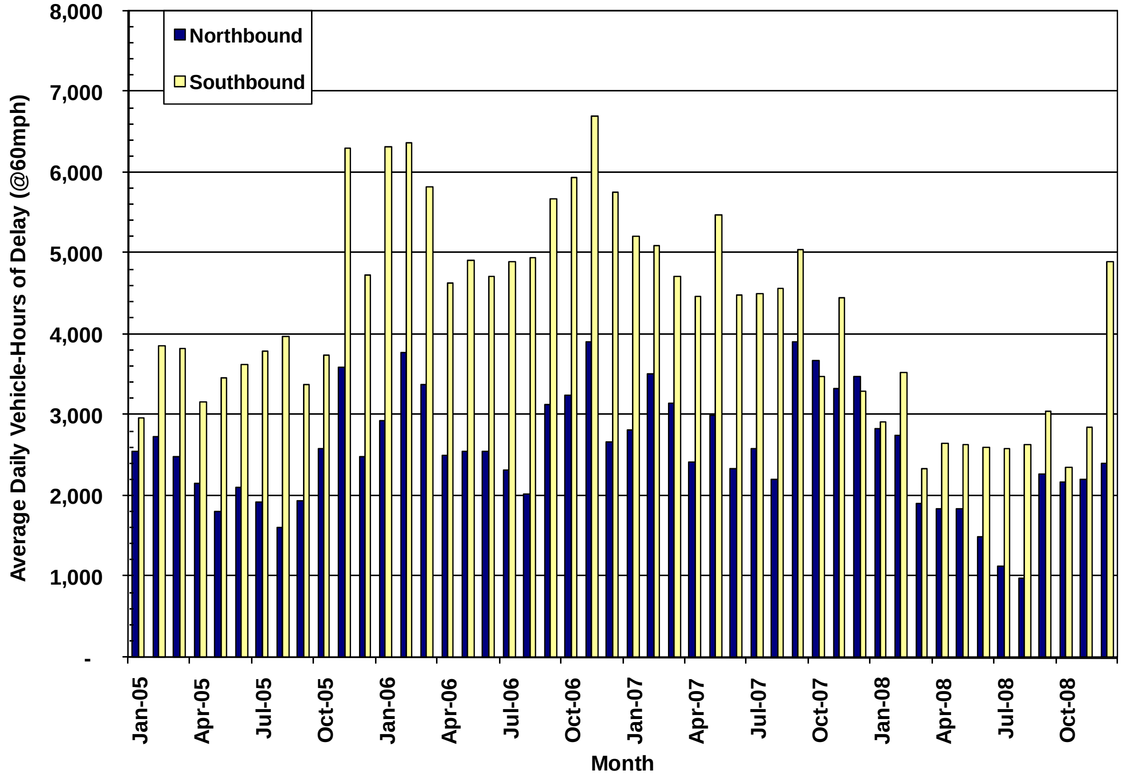


Exhibit 3-7 depicts average daily weekday delay by month for each direction of travel. This exhibit again illustrates that the PM peak delay in the southbound direction is high and that seasonal peaking occurs during the winter months.

Exhibit 3-7: I-805 Average Weekday Delay by Month (2005-2008)

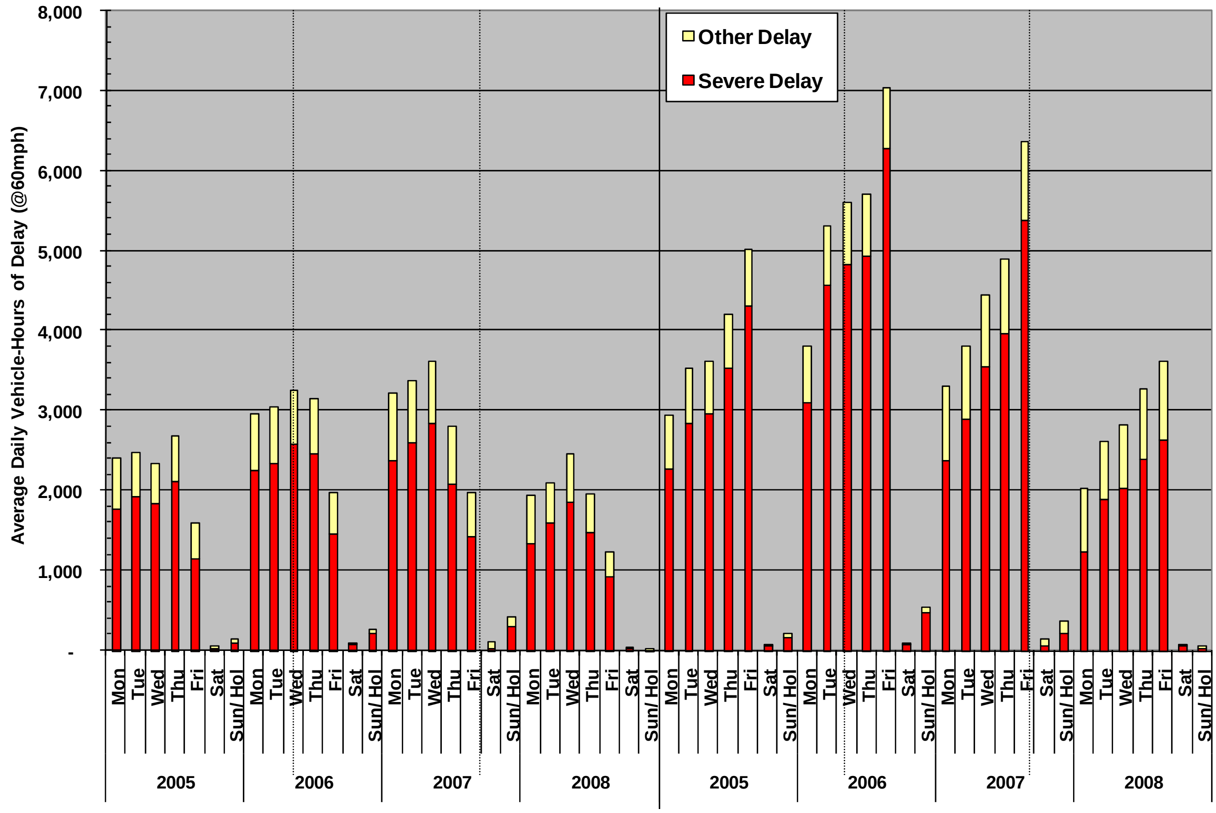


Delays presented to this point represent the difference in travel time between "actual" conditions and free-flow conditions at 60 mph. This delay can be segmented into two components as shown in Exhibit 3-8:

- Severe delay – delay occurring when speeds are below 35 mph
- Other delay – delay occurring when speeds are between 35 and 60 mph.

Severe delay in Exhibit 3-8 represents breakdown conditions and is the focus of most congestion mitigation strategies. "Other" delay represents conditions approaching or leaving the breakdown congestion, or areas that cause temporary slowdowns rather than widespread breakdowns. Exhibit 3-8 shows that severe delay makes up about 80 percent of all weekday delay on the corridor in either the northbound or the southbound directions. In the southbound direction, the level of congestion grows during the workweek with Fridays experiencing unusually high total delays. This may indicate that the corridor is used for weekend travel to Mexico or other recreational destinations. In contrast, the northbound direction shows steady delays throughout the workweek with the exception of lower delays on Fridays. Delays are minimal on weekends in both directions.

Exhibit 3-8: I-805 Average Delay by Day of Week by Severity (2005-2008)



Although combating congestion requires the focus on severe congestion, it is important to review "other" congestion and understand its trends. This could allow for proactive intervention before the "other" congestion turns into severe congestion.

Another way to understand the characteristics of congestion and related delays is shown in Exhibits 3-9 and 3-10, which summarize weekday delays by time of day for the four years analyzed. Exhibit 3-9 shows the northbound average weekday hourly delay from 2005 through 2008. Peak hourly delay in the northbound direction is approximately 1,100 vehicle-hours at 7:00 AM. Exhibit 3-10 shows the southbound average weekday hourly delay from 2005 through 2008. Peak hourly delay in the southbound direction is slightly above 1,500 vehicle-hours, which occurs at 5:00 PM.

Both directions show an increase in congestion between 2005 and 2006, but a decrease in congestion from 2006 to 2007 and from 2007 to 2008. The duration of the peak periods does not appear to have grown during the four-year period. The AM peak period begins at around 5:00 AM and ends around 9:30 AM and the PM peak period begins just after 2:00 PM and ends around 7:00 PM in the evening.

Exhibit 3-9: Northbound Average Weekday Hourly Delay 2005-2008

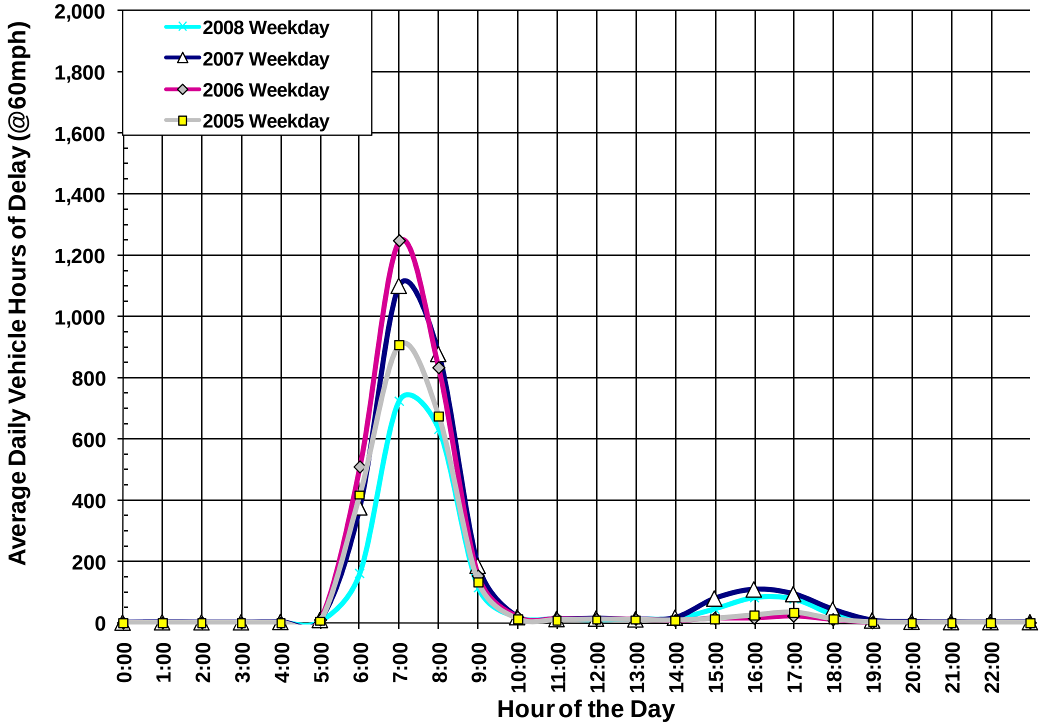
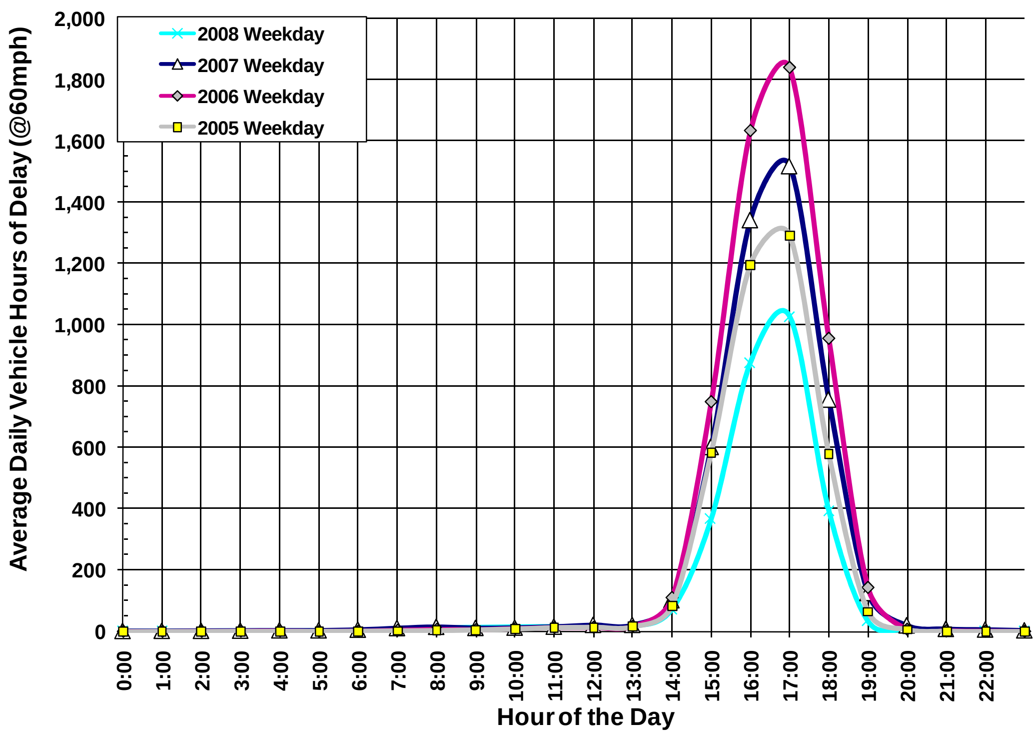


Exhibit 3-10: Southbound Average Weekday Hourly Delay 2005-2008



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Travel Time

The travel time analysis uses PeMS data to estimate the time it takes for a vehicle to drive along the corridor. The southernmost detector is located near San Ysidro Boulevard approximately one mile north of the International Border. To estimate travel time on the I-805 Corridor, data is used for the 28 miles between San Ysidro Boulevard and the I-805 merge at I-5 in Sorrento Valley in North San Diego. If vehicles traveled at 60 mph, the travel time would be 28 minutes.

Exhibits 3-11 and 3-12 summarize the travel times estimated for the corridor using the PeMS data. As shown in the exhibits, travel along the corridor takes about 25 minutes in the off-peak periods. This corresponds to an average speed of about 67 mph.

Exhibits 3-11 and 3-12 illustrate that travel times for both directions have decreased between 2005 and 2008. During the AM peak hour starting at 7:00 AM, travel time is estimated to be roughly 31 minutes in 2008 (see Exhibit 3-11). This is 22.5 percent lower than the 40 minutes estimated for 2005 and 2006. In the PM peak hour, which starts at 5:00 PM, travel time is estimated to have been longer (35 minutes) in 2008 than for the AM peak hour (31 minutes). However, this is a larger reduction (nearly 27 percent) compared to the travel time of 48 minutes estimated for 2005 and 2006.

The average traveler experiences a southbound PM commute that is 4 minutes longer than the northbound AM commute.

Exhibit 3-11: Northbound Travel Time by Time of Day 2005-2008

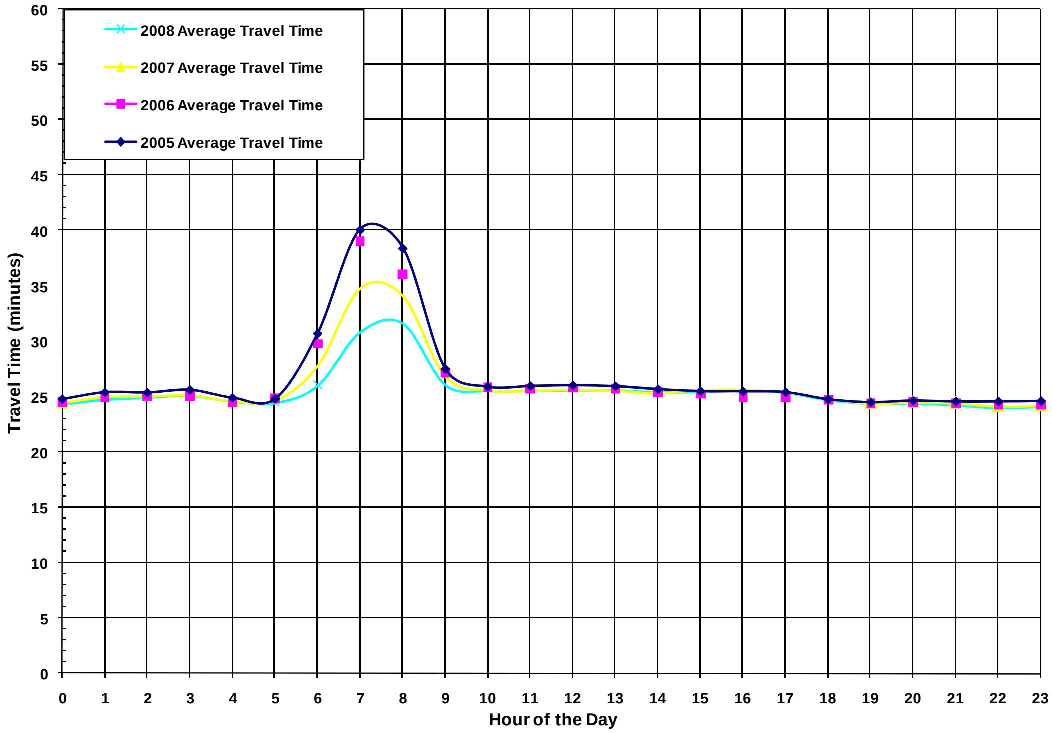
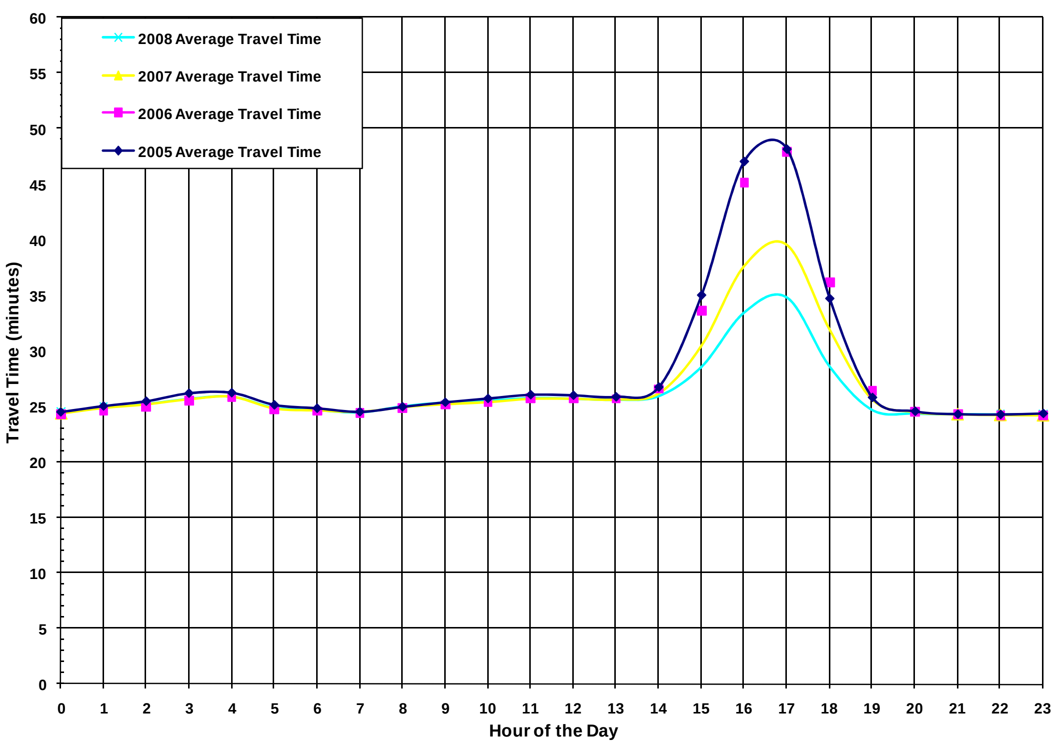


Exhibit 3-12: Southbound Travel Time by Time of Day 2005-2008



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RELIABILITY

Reliability captures the degree of predictability in the public's travel time. Unlike mobility, which measures the rate of travel, the reliability measure focuses on how travel time varies from day to day. To measure reliability, the study team used statistical measures of variability on the travel times estimated from the PeMS data. The 95th percentile was chosen to represent the maximum travel time that most people would experience on the corridor. Severe events, such as fatal collisions, could cause longer travel times, but the 95th percentile was chosen as a balance between extreme events and a "typical" travel day.

Exhibits 3-13 to 3-20 on the following pages illustrate the variability of travel time along the I-805 Corridor on weekdays for the years 2005, 2006, 2007, and 2008. Exhibits 3-13 through 3-16 show travel time variability for the northbound direction in 2005, 2006, 2007, and 2008, respectively. Exhibits 3-17 through 3-20 show the southbound direction for the same four years.

For the northbound direction, the 7:00 AM peak hour was the most unreliable in addition to being the slowest hour. In 2005 (shown in Exhibit 3-13), motorists driving the entire length of the corridor had to add 11 minutes to an average travel time of 40 minutes (for a total travel time of 51 minutes) to ensure that they arrived on time 95 percent of the time. This is 23 minutes longer than the 28-minute travel time at 60 mph. In 2006 (Exhibit 3-14), the time needed to arrive on time 95 percent of the time increased to 53 minutes, but by 2007 (Exhibit 3-15), this declined to 47 minutes, and further declined to 38 minutes in 2008 (Exhibit 3-16). The improvement in 2007 could be attributed to the opening of the I-5/I-805 interchange in Sorrento Valley in the spring of 2007.

In the southbound direction during the 5:00 PM peak hour (Exhibit 3-17), a driver needs to add 22 minutes to an average travel time of 48 minutes to ensure an on-time arrival 95 percent of the weekdays in 2005. This corresponds to a total travel time of 70 minutes. The following years experienced a gradual decline in travel times. Travel time in 2006 declined to approximately 63 minutes (Exhibit 3-18); 2007 travel times declined to 51 minutes (Exhibit 3-19); and 2008 travel times declined even further to 48 minutes (Exhibit 3-20).

Exhibit 3-13: Northbound Travel Time Variability (2005)

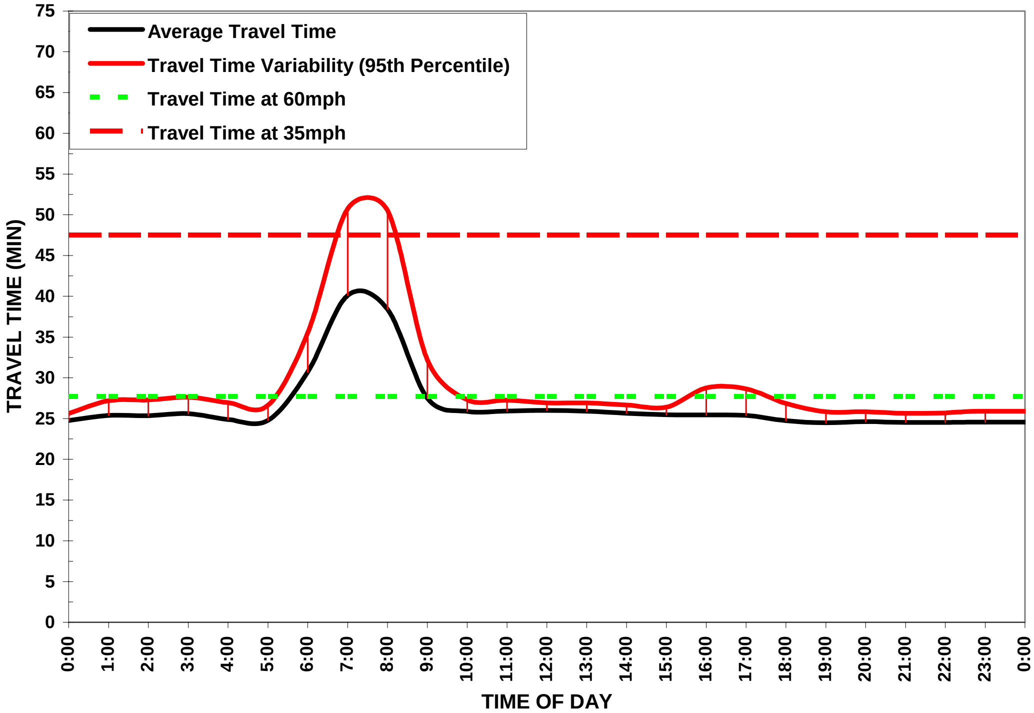


Exhibit 3-14: Northbound Travel Time Variability (2006)

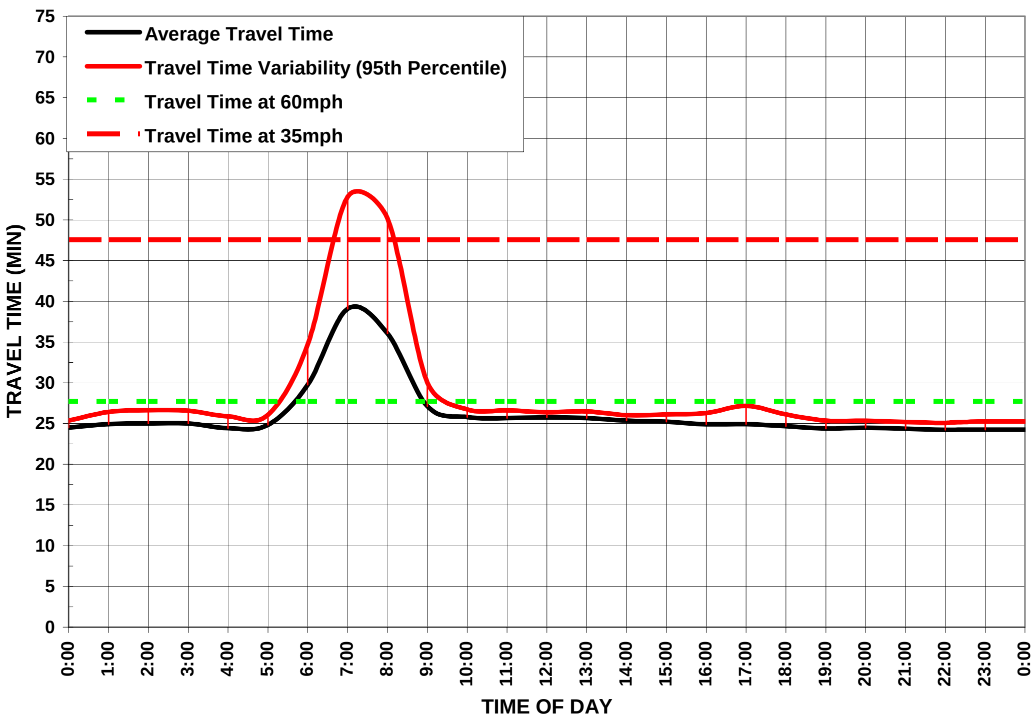


Exhibit 3-15: Northbound Travel Time Variability (2007)

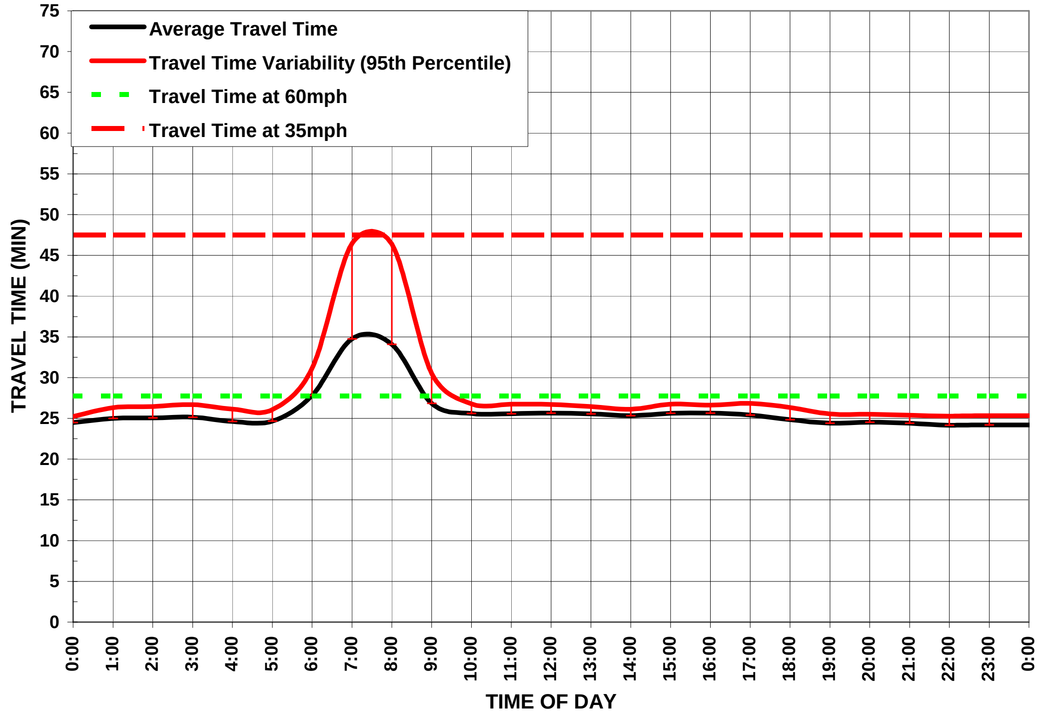


Exhibit 3-16: Northbound Travel Time Variability (2008)

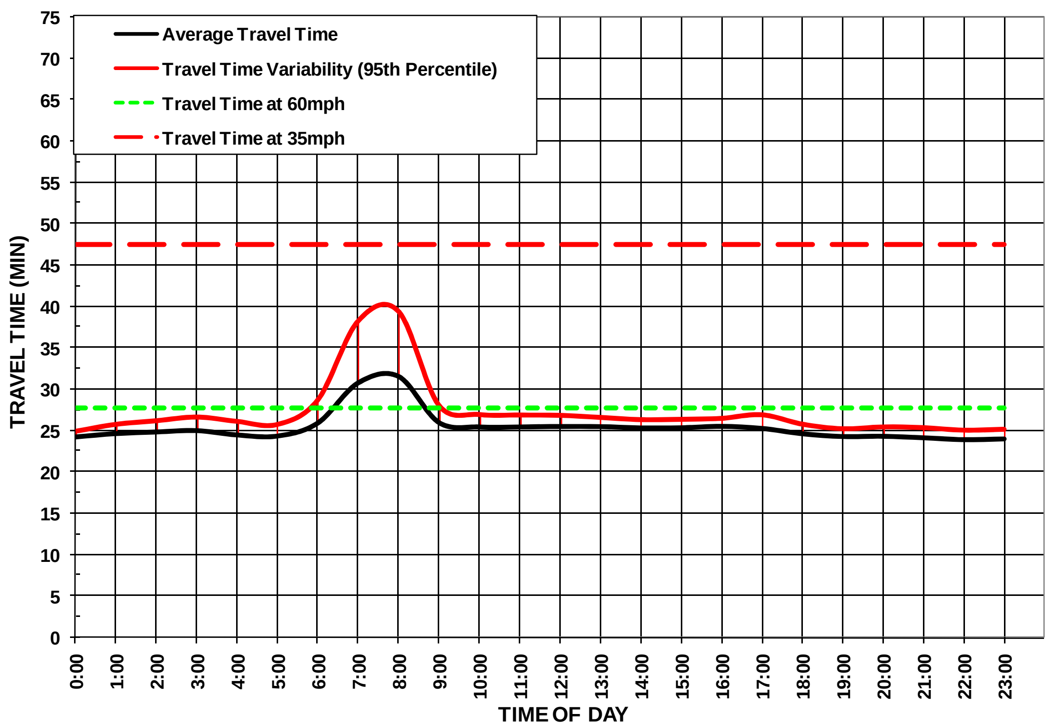


Exhibit 3-17: Southbound Travel Time Variability (2005)

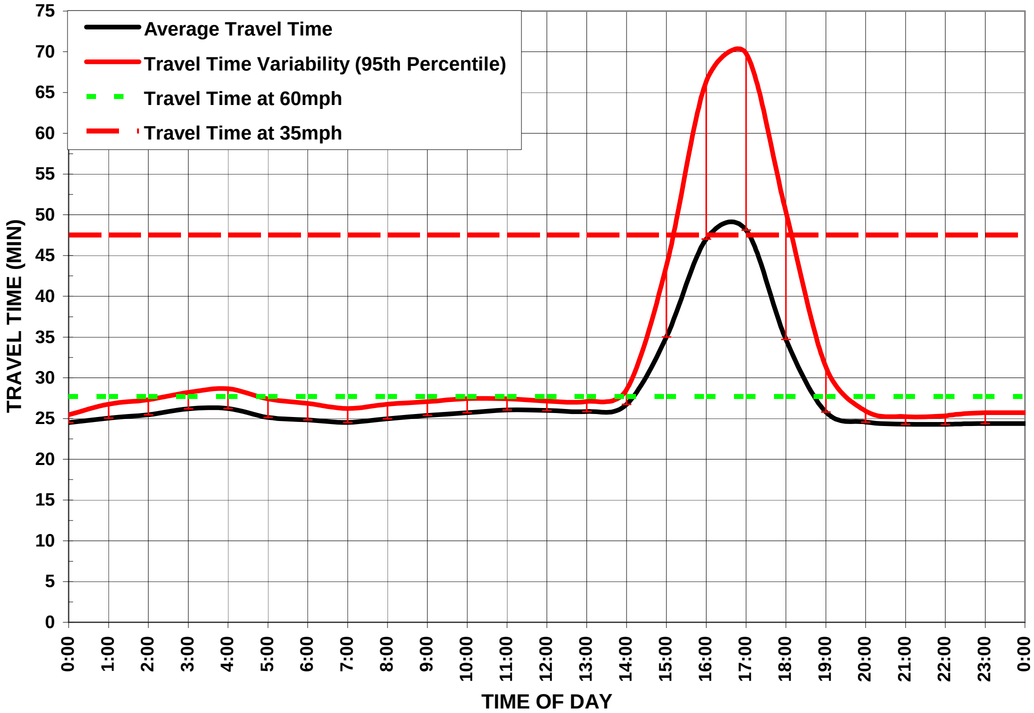


Exhibit 3-18: Southbound Travel Time Variability (2006)

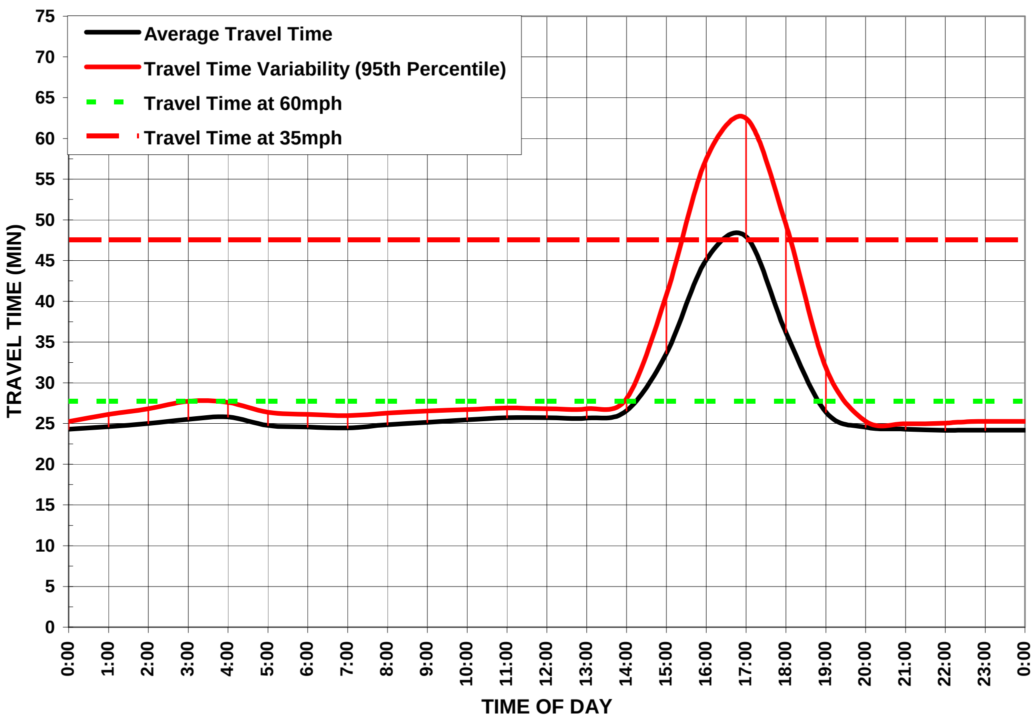


Exhibit 3-19: Southbound Travel Time Variability (2007)

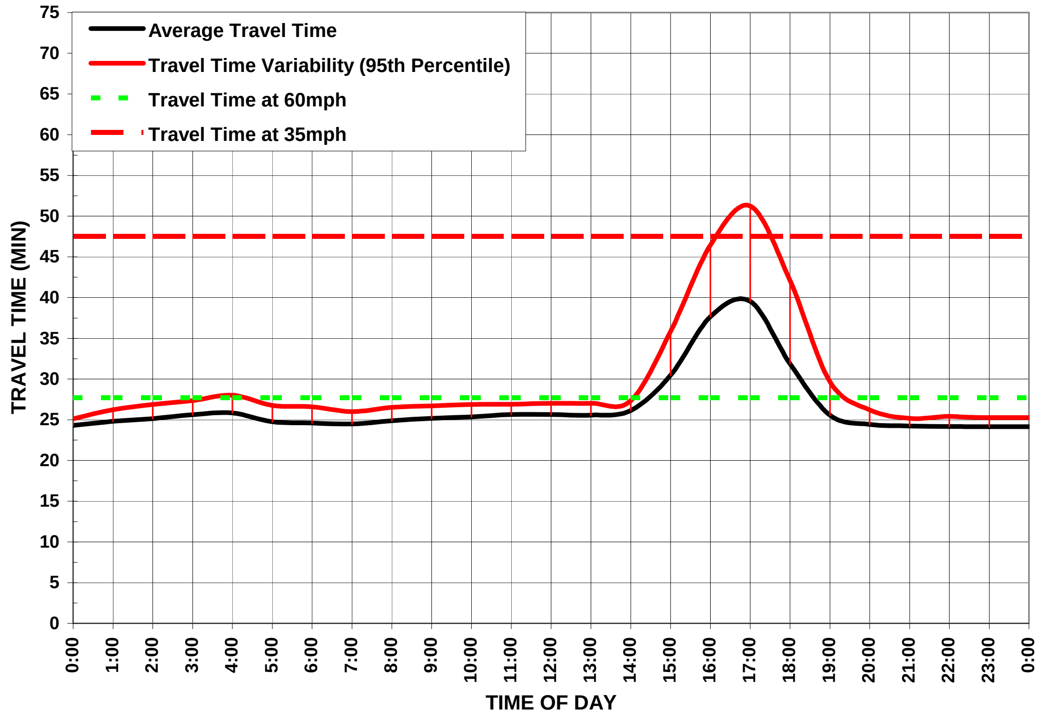
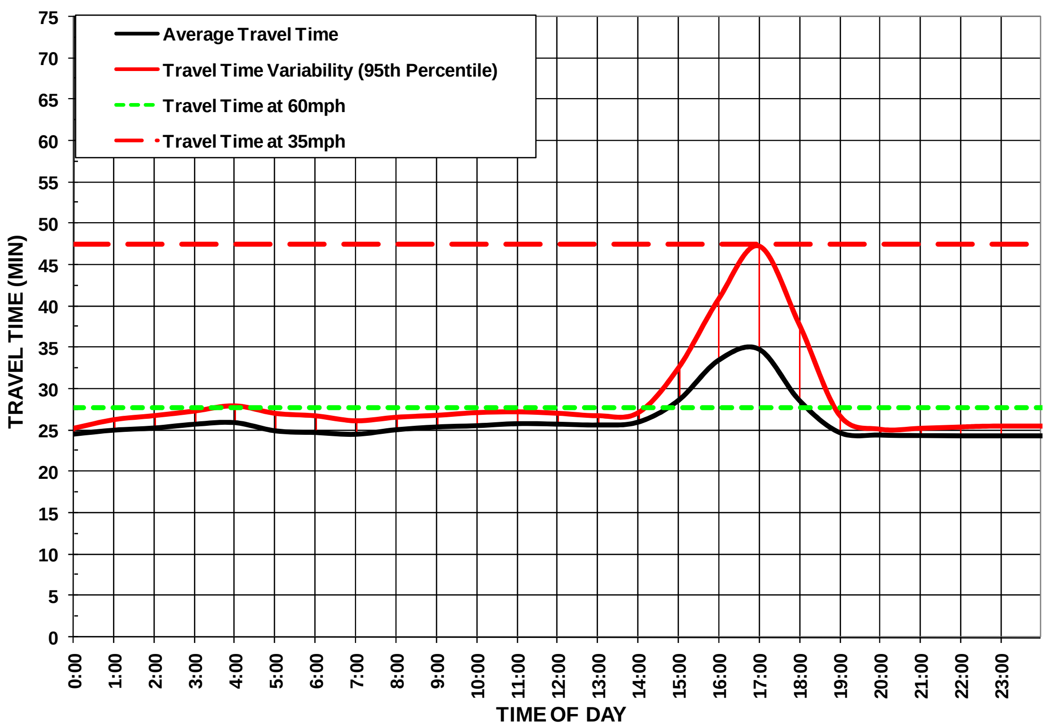


Exhibit 3-20: Southbound Travel Time Variability (2008)



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SAFETY

Collision data in terms of the number of accidents and accident rates from the Caltrans Traffic Accident Surveillance and Analysis System (TASAS) were used for the safety measure. TASAS is a traffic records system containing an accident database linked to a highway database. The highway database contains description elements of highway segments, intersections and ramps, access control, traffic volumes and other data. TASAS contains specific data for accidents on state highways. Accidents on non-state highways are not included (e.g., local streets and roads).

The safety assessment in this report is intended to characterize the overall accident history and trends in the corridor, and to highlight notable accident concentrations or patterns that are readily apparent. This report is not intended to supplant more detailed safety investigations routinely performed by Caltrans staff.

Exhibits 3-21 and 3-22 summarize I-805 northbound and southbound collisions by month. Caltrans typically analyzes the latest three-year safety data. The latest PeMS TASAS data available from January 1, 2004 through December 31, 2006 were analyzed and summarized. This three-year period is shifted one year earlier than the other analyses because of data availability. The TASAS data reported in PeMS is comprehensive and does not rely on the availability of automatic detection systems.

Exhibit 3-21: Northbound Monthly Collisions 2004-2006

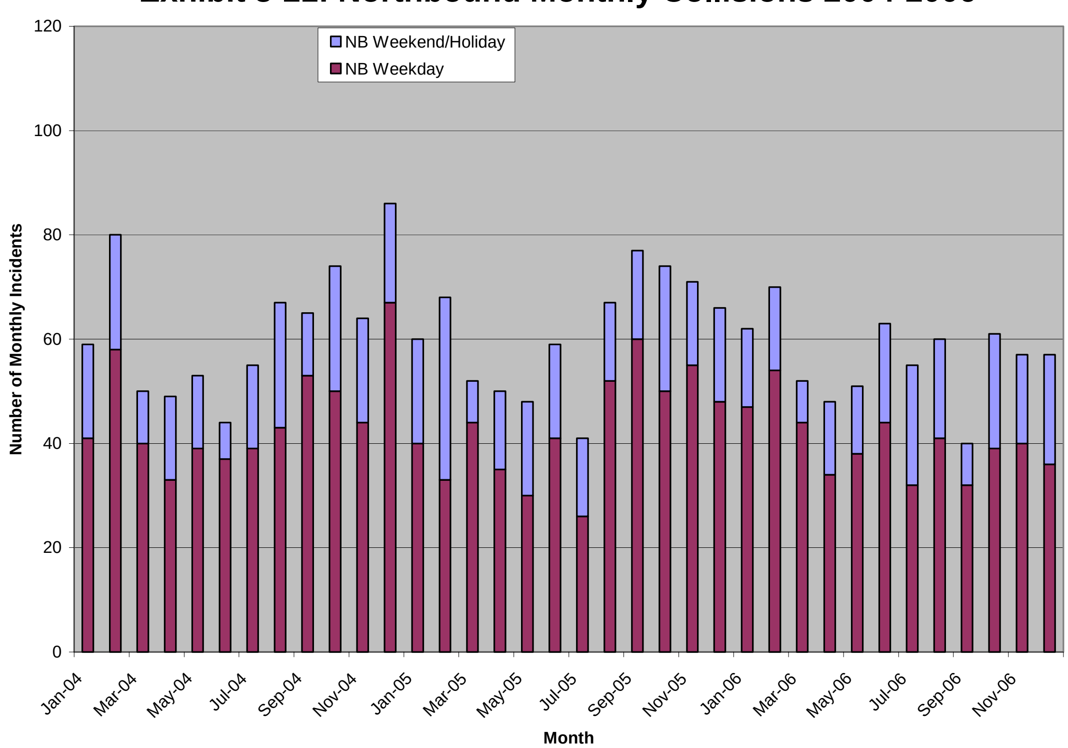
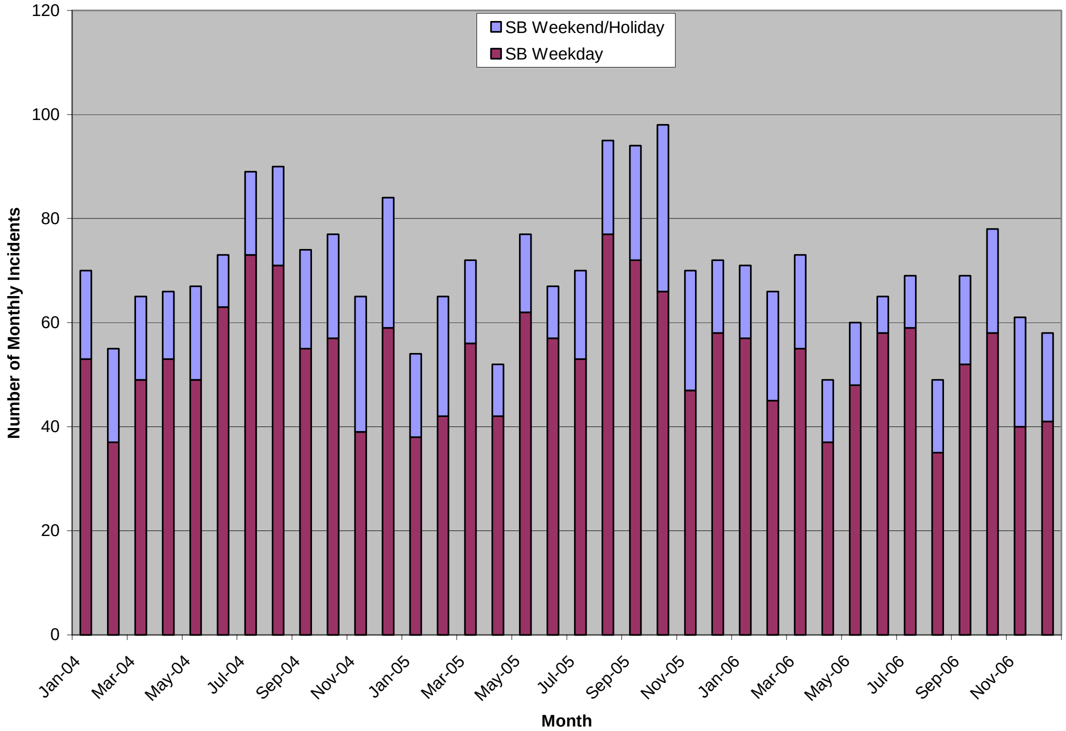


Exhibit 3-22: Southbound Monthly Collisions 2004-2006



The exhibits show that from 2004 to 2006, the southbound direction of the I-805 Corridor experienced 17 percent more incidents than the northbound direction. There was an average of 70 collisions per month in the southbound direction compared to 60 in the northbound direction. The higher number of collisions in the southbound direction is comparable with congestion concentrating in the southbound direction during the PM peak period. A large number of incidences in the southbound direction, about 20 percent, occurred on Fridays. This is consistent with earlier findings that suggest the corridor is used for weekend trips to Mexico or other recreational destinations. Additionally, an analysis of the travel patterns shows a positive relationship between Friday-travel and months when national holidays are observed. Unlike the southbound direction, collisions in the northbound direction do not concentrate on a particular day of the week.

Between 2004 and 2006, overall collisions decreased in both directions, by nine percent in the northbound direction and by 12 percent in the southbound direction. These trends are consistent with the PeMS mobility findings, which suggest that overall travel times and reliability have improved along the corridor.

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PRODUCTIVITY

Productivity is a system efficiency measure used to analyze the capacity of the corridor. It is defined as the ratio of output (or service) per unit of input. In the case of transportation, productivity is the number of people or vehicles served divided by the level of service provided (e.g., roadway capacity).

For the corridor analysis, productivity is defined as the percent utilization of a facility or mode under peak conditions. Highway productivity is calculated as actual volume divided by the capacity of the highway. Travel demand models generally do not project capacity loss for highways, but detailed micro-simulation tools can forecast productivity. For highways, productivity is particularly important because the lowest "production" from the transportation system occurs often when capacity is needed the most.

This loss in productivity example is illustrated in Exhibit 3-23. As traffic volumes increase to the capacity limits of a roadway, speeds decline rapidly and throughput drops dramatically. This loss in throughput is the lost productivity of the system. There are a few ways to estimate productivity losses. Regardless of the approach, productivity calculations require good detection or significant field data collection at congested locations. One approach is to convert this lost productivity into "equivalent lost lane-miles." These lost lane-miles represent a theoretical level of capacity that would need to be added in order to achieve maximum productivity. For example, losing six lane-miles implies that congestion has caused a loss in capacity roughly equivalent to lane along a six-mile section of freeway.

Equivalent lost lane-miles is computed as follows (for congested locations only):

$$LostLaneMiles = \left(1 - \frac{ObservedLaneThroughput}{2000vphpl}\right) \times Lanes \times CongestedDistance$$

Exhibit 3-24 summarizes the productivity losses on the I-805 Corridor for both directions of travel over the four years analyzed. The trends in the productivity losses are comparable to the delay trends. The largest productivity losses occurred in the PM peak hours in the southbound direction, which is the time period and direction that experienced the most congestion. Productivity during the PM peak in both directions improved from 2006 to 2007 and from 2007 to 2008. Productivity during the AM peak also improved in the northbound direction from 2007 to 2008, but remained about the same in the southbound direction.

Strategies to combat such productivity losses are primarily related to operations. These strategies include building new or extending auxiliary lanes, developing more aggressive ramp metering strategies without negatively influencing the arterial network, and improving incident clearance times.

Exhibit 3-23: Lost Productivity Illustrated

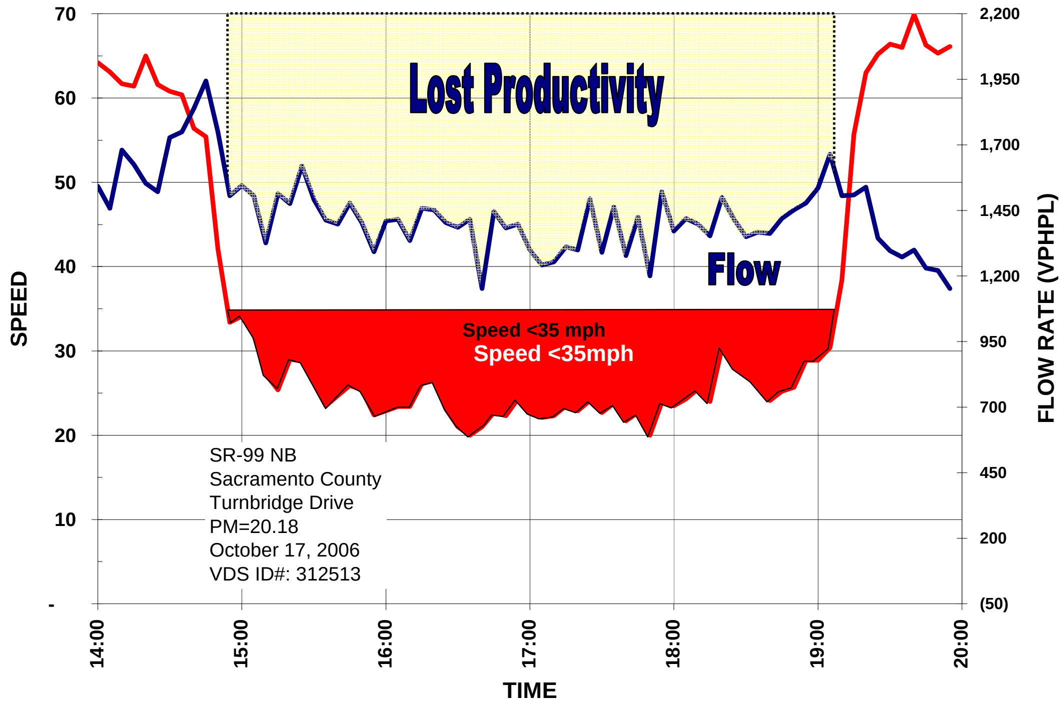
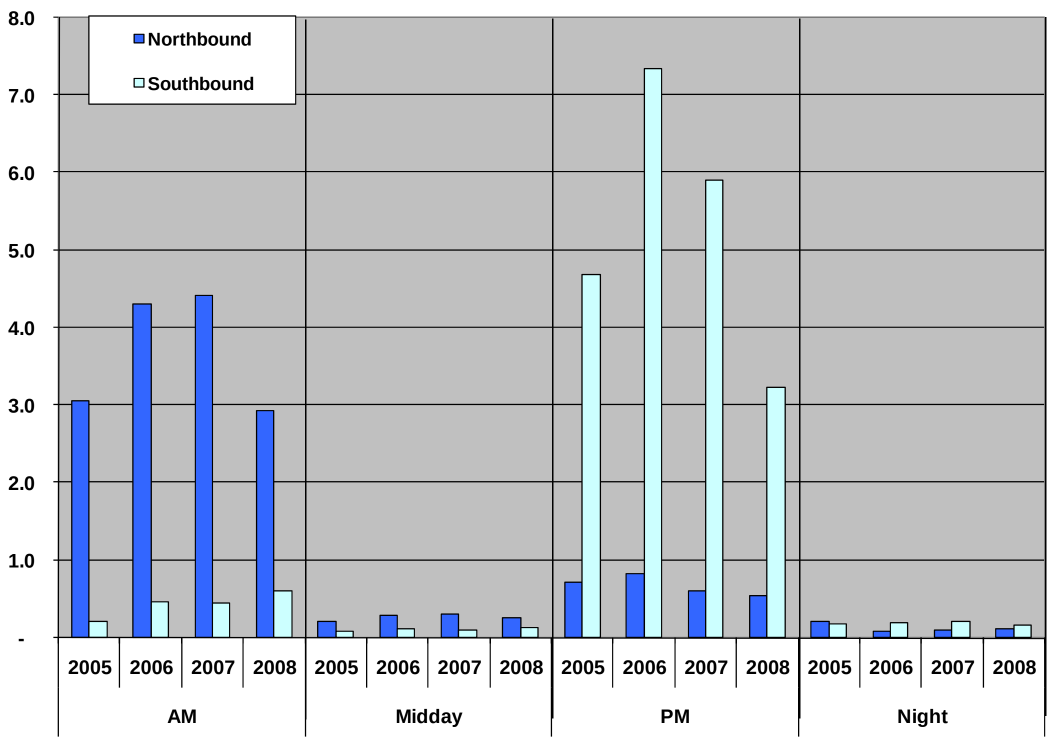


Exhibit 3-24: Average Lost Lane-Miles by Direction, Time Period, and Year



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PAVEMENT CONDITION

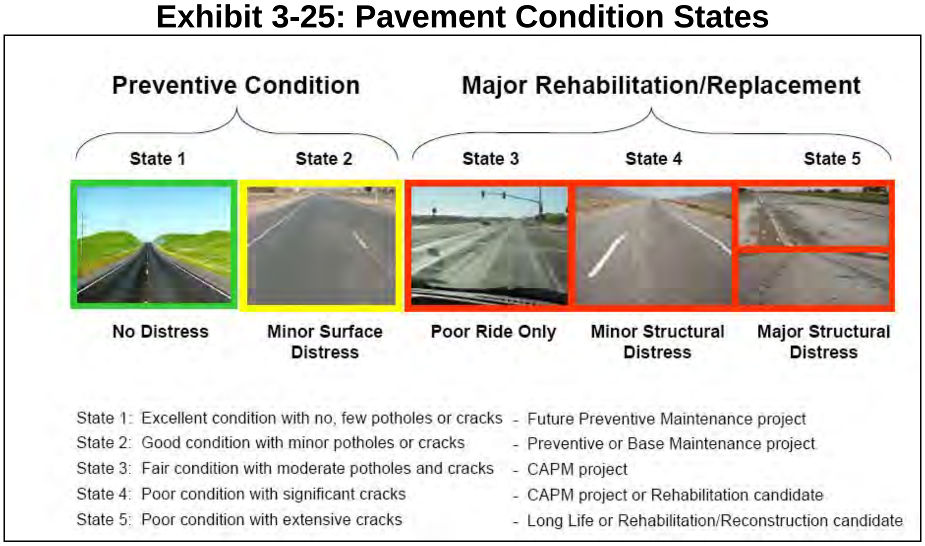
The condition of the roadway pavement (or ride quality) on the corridor can influence its traffic performance. Rough or poor pavement conditions can decrease the mobility, reliability, safety, and productivity of the corridor, whereas smooth pavement can have the opposite effect. Pavement preservation refers to maintaining the structural adequacy and ride quality of the pavement. It is possible for a roadway section to have structural distress without affecting ride quality. Likewise, a roadway section may exhibit poor ride quality, while the pavement remains structurally adequate.

Pavement Performance Measures

Caltrans conducts an annual Pavement Condition Survey (PCS) that can be used to compute two performance measures commonly estimated by Caltrans: distressed lane-miles and International Roughness Index (IRI). Although Caltrans generally uses distressed lane-miles for external reporting, this report uses the Caltrans data to present results for both measures.

Using distressed lane-miles allows us to distinguish among pavement segments that require only preventive maintenance at relatively low costs and segments that require major rehabilitation or replacement at significantly higher costs. All segments that require major rehabilitation or replacement are considered distressed. Segments with poor ride quality are also considered to be distressed. Exhibit 3-25 provides an illustration of this distinction. The first two pavement conditions are considered roadway that provides adequate ride quality and is structurally adequate. The remaining three conditions are included in the calculation of distressed lane-miles.

Exhibit 3-25: Pavement Condition States



Source: Caltrans Division of Maintenance, 2007 State of the Pavement Report

IRI distinguishes between smooth-riding and rough-riding pavement. The distinction is based on measuring the up and down movement of a vehicle over pavement. When such movement is measured at 95 inches per mile or less, the pavement is considered good or smooth-riding. When movements are between 95 and 170 inches per mile, the pavement is considered acceptable. Measurements above 170 inches per mile reflect unacceptable or rough-riding conditions.

Existing Pavement Conditions

The most recent pavement condition survey, completed in November 2007, recorded 12,998 distressed lane-miles statewide. Unlike prior surveys, the 2007 PCS included pavement field studies for a period longer than a year, due to an update in the data collection methodology. The survey includes data for 23 months from January 2006 to November 2007.

The fieldwork consists of two parts. In the first part, pavement raters visually inspect the pavement surface to assess structural adequacy. In the second part, field staff uses vans with automated profilers to measure ride quality. The 2007 PCS revealed that the majority of distressed pavement was on freeways and expressways (Class 1 roads). This is the result of approximately 56 percent of the State Highway System falling into this road class. As a percentage of total lane miles for each class, collectors and local roads (Class 3 roads) had the highest amount of distress.

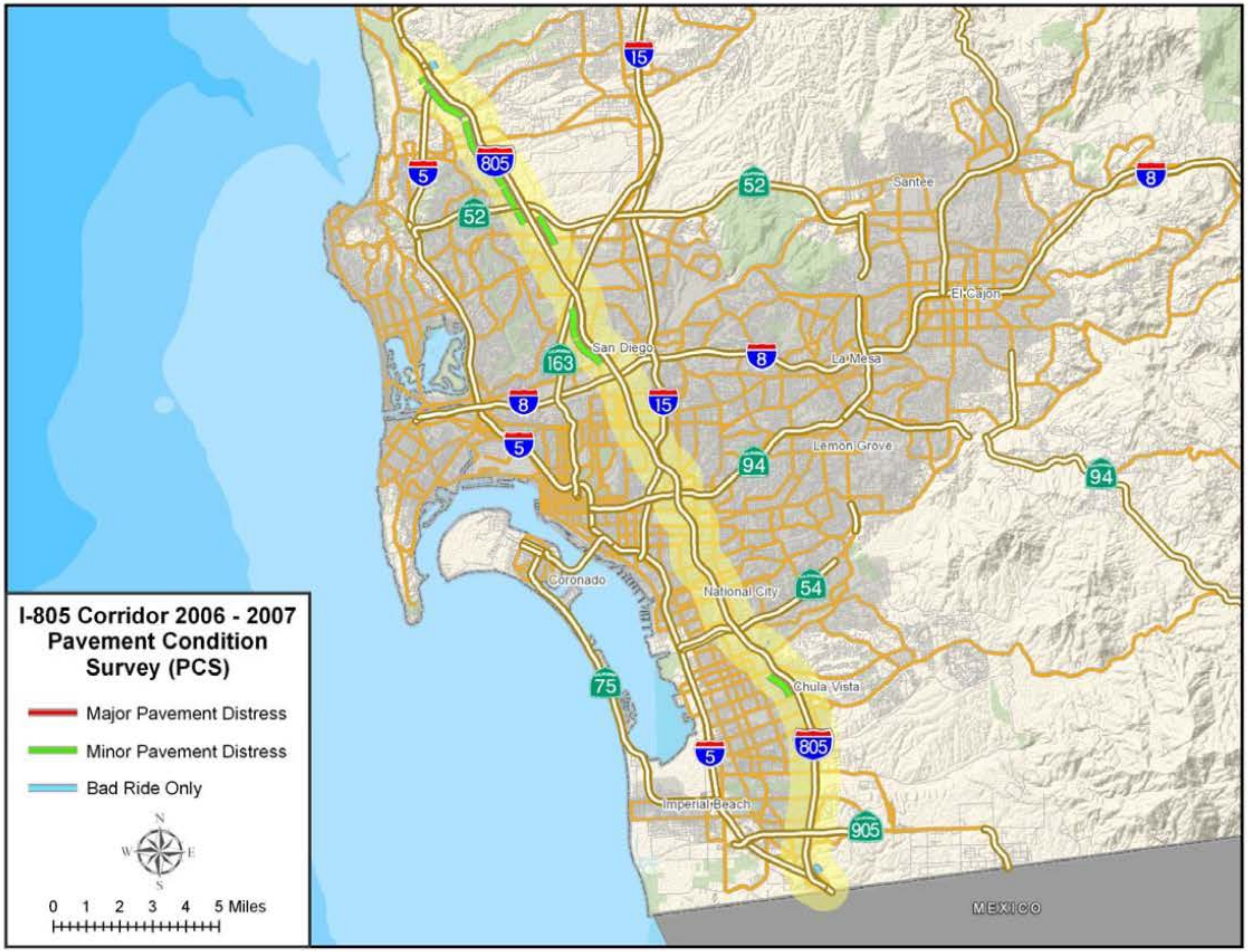
Exhibit 3-26 shows pavement distress along the I-805 Corridor according to the 2007 PCS data. The three categories shown represent the three distressed conditions requiring major rehabilitation or replacement. These were presented earlier in Exhibit 3-25.

The pavement along the I-805 Corridor is in good condition. None of the corridor shows major pavement distress. Minor pavement distress occurs north of I-8, particularly in the southbound direction. Another spot of minor pavement distress is found near Chula Vista. The rest of the corridor is not distressed, with the exception of two small sections at the northern and southern ends of the corridor that have bad ride quality issues.

Exhibit 3-27 shows results from prior pavement condition surveys along the I-805 Corridor. Although the number of distressed lane-miles has increased since 2005, it is in line with previous years and a small portion of the corridor. The exhibit also shows that pavement conditions along the corridor have been managed over the years not to exceed minor pavement distress.

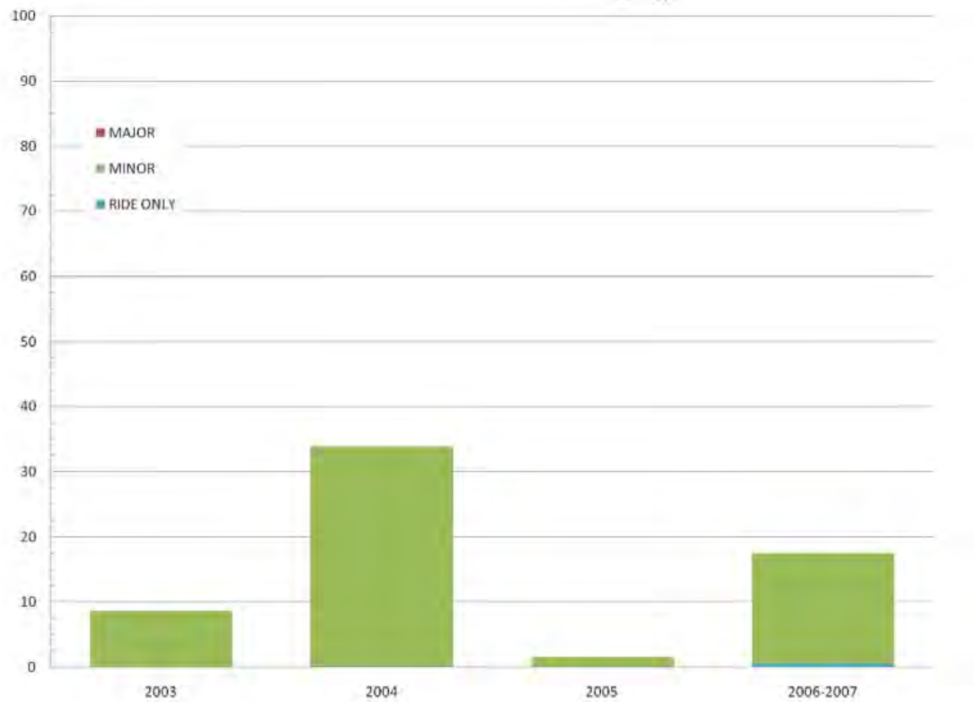
This is illustrated more clearly in Exhibit 3-28, which shows the percent mix of type of distress over time. The pavement issues on the I-805 Corridor have been almost exclusively minor pavement distress.

Exhibit 3-26: Distressed Lane-Miles on I-805 Corridor for 2006-2007



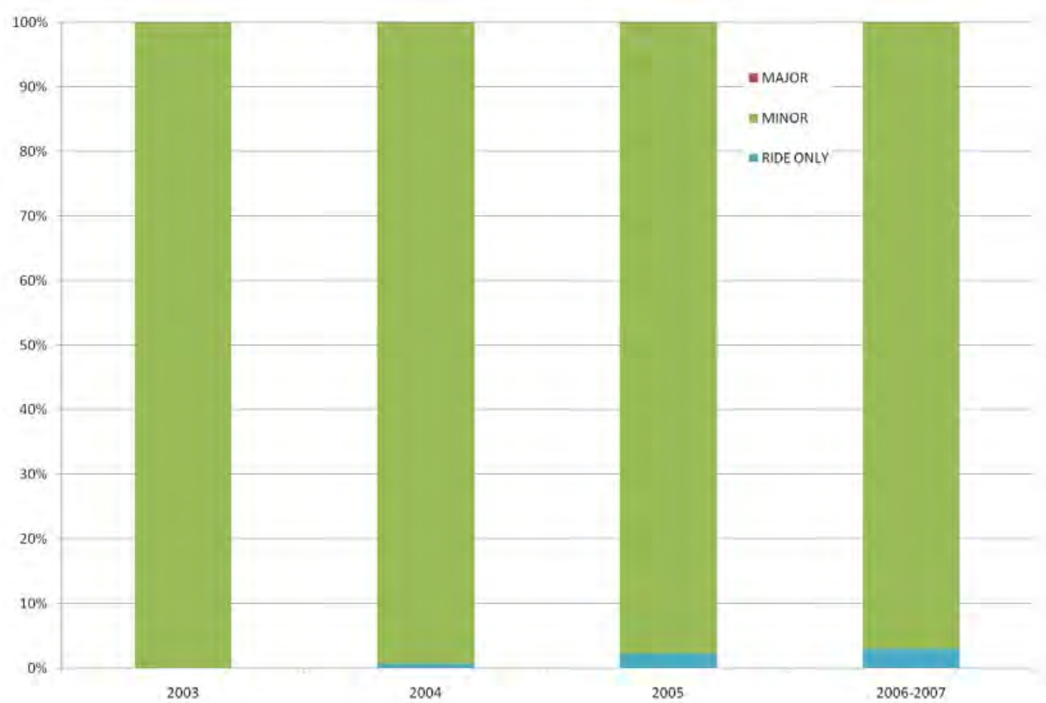
Source: SMG mapping of 2007 Pavement Condition Survey data

Exhibit 3-27: Distressed Lane-Miles Trends on the I-805 Corridor



Source: SMG analysis of 2003 to 2007 Pavement Condition Survey data

Exhibit 3-28: Distressed Lane-Miles by Type on the I-805 Corridor



Source: SMG analysis of 2003 to 2007 Pavement Condition Survey data

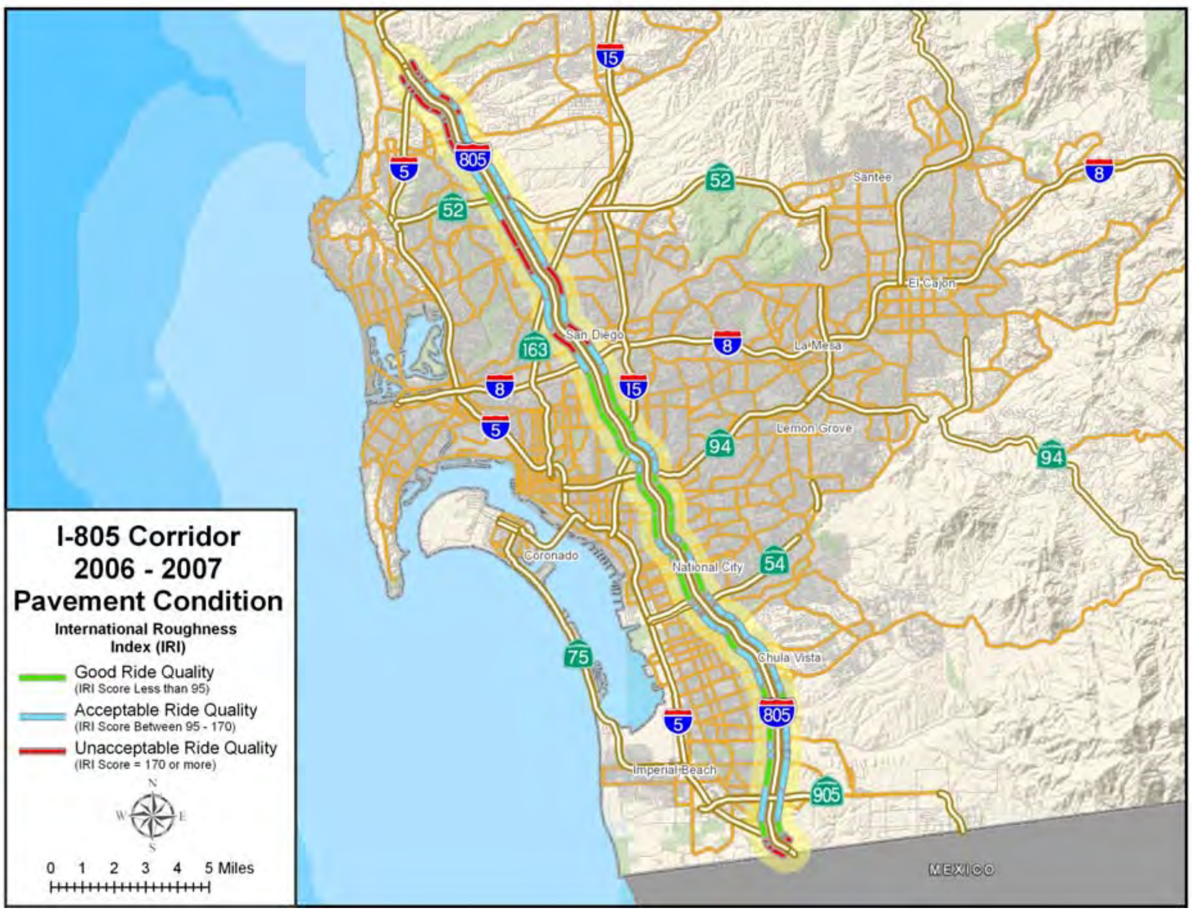
Exhibit 3-29 shows IRI for the lane with the poorest pavement condition in each freeway segment along the corridor. Pavement investment decisions are made on this basis. As the exhibit shows, the corridor has mostly good and acceptable ride quality.

When all lanes are considered, the study corridor comprises roughly 229 lane-miles, of which:

- 119 lane-miles, or 52 percent, are considered to have good ride quality (IRI ≤ 95)
- 94 lane-miles, or 41 percent, are considered to have acceptable ride quality (95 < IRI ≤ 170)
- 16 lane miles, or seven percent, are considered to have unacceptable ride quality (IRI > 170)

The only sections with unacceptable ride quality occur north of I-8 and near the border with Mexico. As can be seen in Exhibit 3-29, most of the poor ride quality occurs in sections with minor pavement distress, so few lane-miles exhibit only ride issues.

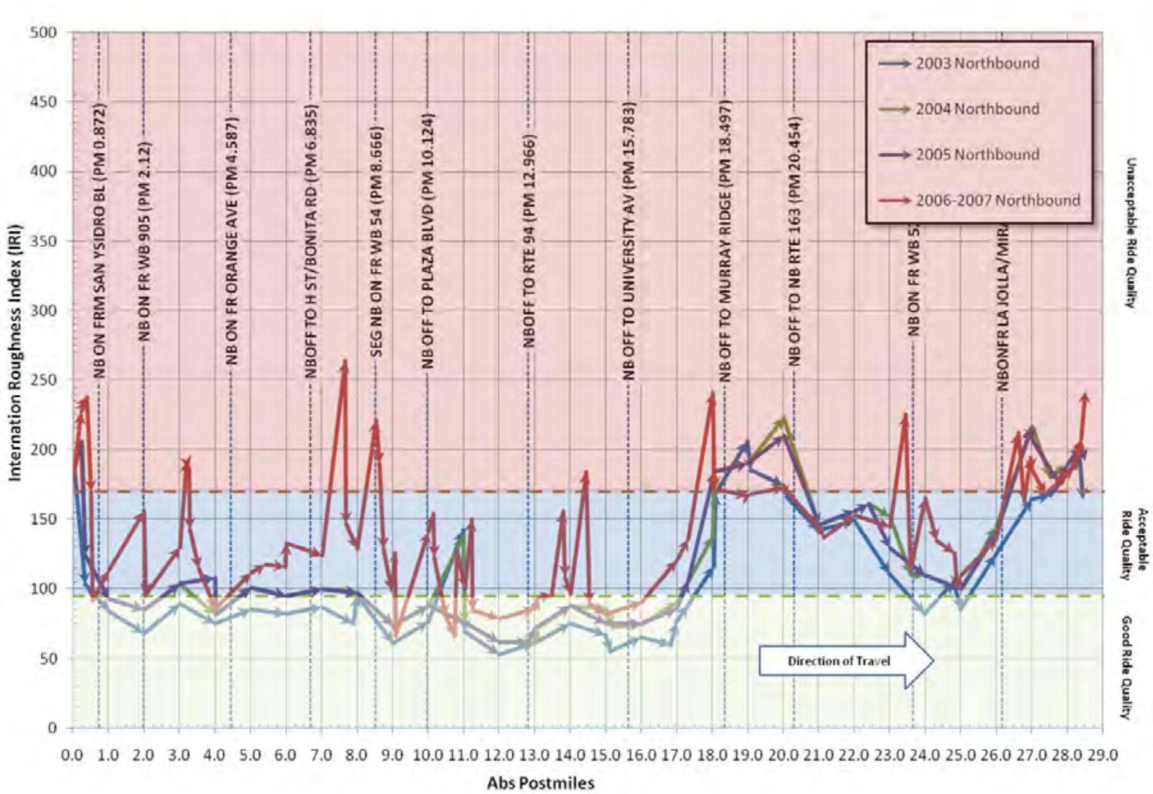
Exhibit 3-29: I-805 Corridor IRI for the 2006-07 Period



Source: SMG mapping of 2007 Pavement Condition Survey data

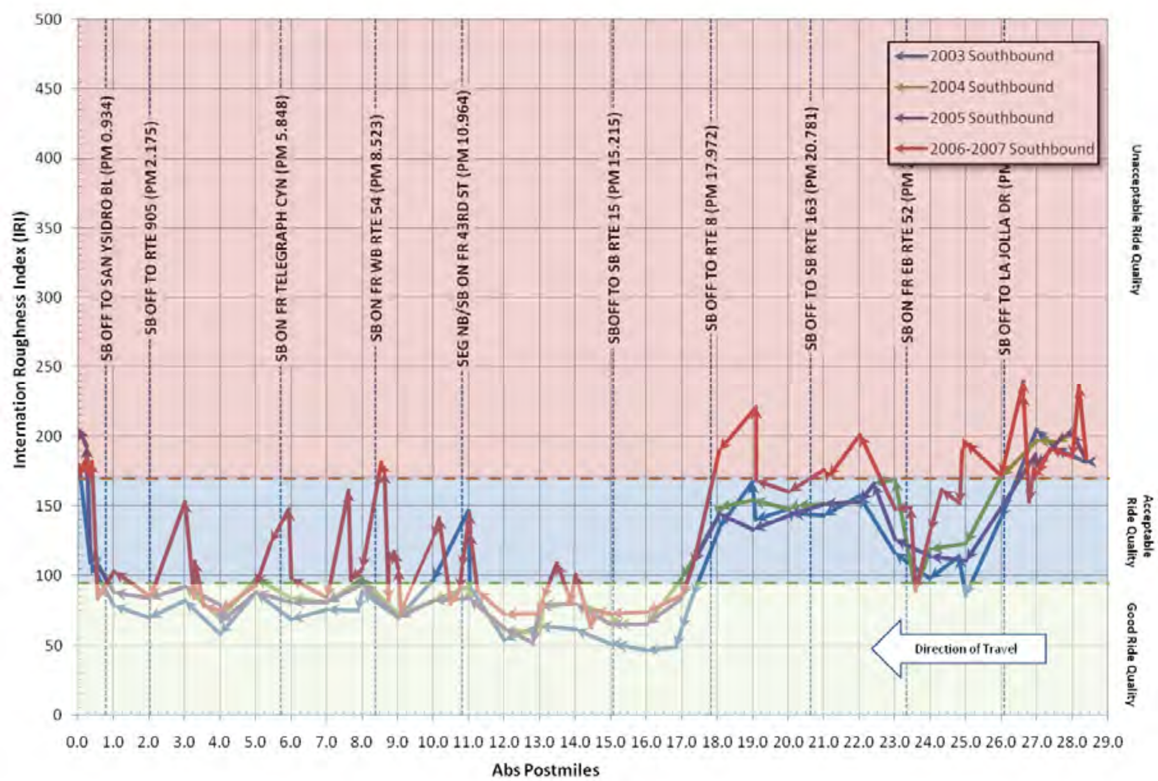
Exhibits 3-30 and 3-31 present ride conditions for the I-805 Corridor using IRI from the last four pavement surveys. The information is presented by postmile and direction. The exhibits include color-coded bands to indicate the three ride quality categories defined by Caltrans: good ride quality (green), acceptable ride quality (blue), and unacceptable ride quality (red). The surveys show consistent patterns of good, acceptable, and unacceptable ride quality. Ride quality has worsened slightly over the last few surveys, but this is expected with the aging of the freeway. The exhibits exclude a number of sections that were not measured or had calibration issues (i.e., IRI = 0) in the 2006-07 Period.

Exhibit 3-30: Northbound I-805 Corridor IRI 2003-2007



Source: SMG analysis of 2003 to 2007 Pavement Condition Survey data

Exhibit 3-31: Southbound I-805 Corridor IRI 2003-2007



Source: SMG analysis of 2003 to 2007 Pavement Condition Survey data

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4. BOTTLENECK IDENTIFICATION AND ANALYSIS

Potential bottlenecks were identified in the Preliminary Performance Assessment document in September 2008, which was finalized for this report. They were identified based on a variety of data sources, including HICOMP, probe vehicle runs, and PeMS. Limited field observations were made as well, but not enough to verify each bottleneck. Since that time, additional field visits have been done to validate the bottleneck locations and additional data analysis of Caltrans traffic counts, supplemental consultant team counts, and additional PeMS data have been conducted since the Preliminary Performance Assessment. These efforts resulted in confirming consistent sets of bottlenecks for both directions of the freeway.

As discussed in Section 3 (See Exhibits 3-9 and 3-10), the I-805 corridor experiences strong time-of-day peaking with a northbound direction AM peak period and a southbound PM peak period. The Governor Drive/SR-52 and Bonita Road/SR-54 bottlenecks were active during both peak periods, with the Governor Drive/SR-52 bottleneck being a significant bottleneck.

Northbound Bottlenecks

Starting from I-5 in San Ysidro and moving northbound, the following major bottlenecks were identified:

- 43rd Street On
- El Cajon Blvd On
- Governor Drive Off
- La Jolla Village Drive/Miramar Road On (active during the PM peak period only)

Secondary northbound bottlenecks exist at Bonita Road/E Street and at SR94/Market Street. The Bonita Road/E Street bottleneck produces little delay compared to the other bottlenecks, while he SR-94/Market Street bottleneck is frequently overwhelmed by the El Cajon bottleneck.

Southbound Bottlenecks

Starting from the I-5 in Sorrento Valley and moving southbound, the following major bottlenecks were identified:

- Governor Drive/SR-52
- Mesa College Drive/Kearny Villa Road On
- Palm Ave/47th Street Off
- Bonita Road/E Street Off

ANALYSIS OF BOTTLENECK AREAS

Once the bottlenecks were identified, the corridor is divided into "bottleneck areas." A bottleneck area is the area from one major bottleneck to the next major bottleneck location. By segmenting the corridors into bottleneck areas, performance statistics presented earlier for the entire corridor can be shown by bottleneck area. This way, the relative contribution of each bottleneck area to the degradation of the corridor performance can be gauged. The performance statistics that lend themselves to such segmentation include:

- Delay
- Productivity
- Safety.

Exhibit 4-1 on the following page illustrates the concept of bottleneck areas. The location of the bottlenecks is represented by the red lines, and the bottleneck area is represented by the arrows. Exhibit 4-1 also illustrates that the definition of the bottleneck does not necessarily reflect the length of the traffic queue caused by that bottleneck. There is a practical reason for this to calculate performance statistics over time because queue lengths can vary from day to day and from year to year. In order to see how bottleneck performance changes over time, it is necessary to have a fixed definition of the length of the bottleneck. This definition provides that standard length for current and future performance evaluations.

Exhibit 4-2, also on the following page, is a table summarizing the major bottleneck areas on the corridor. The table lists each bottleneck, describes the location of the bottleneck area, and provides the postmiles in both the PeMS absolute postmile system and the California postmile system. The table also shows when each bottleneck is primarily active. Exhibit 4-3 is a map that shows these major locations.

The list in Exhibit 4-2 does not represent all potential bottlenecks on the corridor. Some secondary bottlenecks may also exist, but they were determined to contribute small levels of delay compared to these larger bottlenecks.

Secondary northbound bottlenecks exist at Bonita Road/E Street and at SR94/Market Street. The Bonita Road/E Street bottleneck produces little delay compared to the other bottlenecks and is more intermittent in nature. The SR-94/Market Street bottleneck is frequently overwhelmed by the El Cajon bottleneck.

Exhibit 4-1: Illustrative Bottleneck Areas

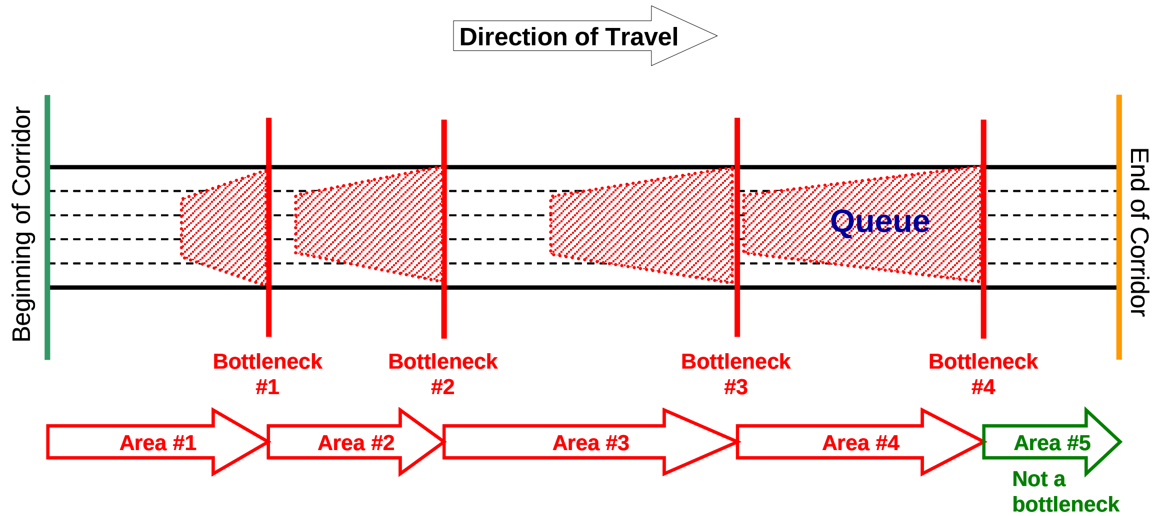


Exhibit 4-2: I-805 Bottleneck Locations and Bottleneck Areas

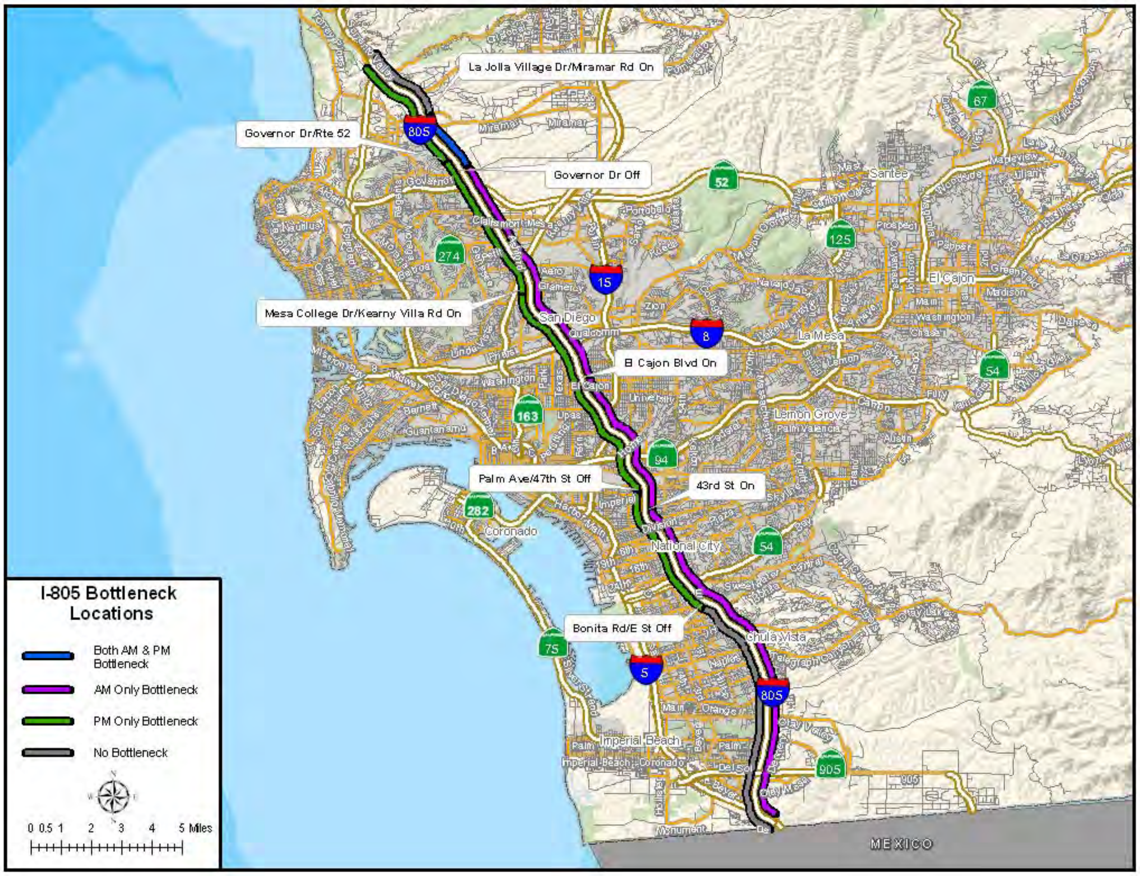
NORTHBOUND BOTTLENECKS

From		To		Distance	Bottleneck Area	Bottleneck Location	Active Period	
Abs	CA	Abs	CA				AM	PM
0.0	0.0	11.6	11.7	11.6	I-5 (in San Ysidro) to 43rd St On	43rd St On	✓	
11.6	11.7	16.4	16.5	4.8	43rd St On to El Cajon Blvd	El Cajon Blvd On	✓	
16.4	16.5	24.1	24.3	7.7	El Cajon Blvd to Governor Dr Off	Governor Dr Off	✓	
24.1	24.3	26.3	26.4	2.2	Governor Dr Off to La Jolla Village Dr Off	La Jolla Village Dr/Miramar Rd On		✓
26.3	26.4	28.7	28.8	2.4	La Jolla Village Dr Off to I-5 (in Sorrento Valley)	Not a bottleneck area		

SOUTHBOUND BOTTLENECKS

From		To		Distance	Bottleneck Area	Bottleneck Location	Active Period	
Abs	CA	Abs	CA				AM	PM
28.7		24.5	24.7	4.2	I-5 (in Sorrento Valley) to Governor Dr/Rte 52	Governor Dr/Rte 52		✓
24.5	24.7	19.5	19.6	5.0	Governor Dr/Rte 52 to Mesa College/Kearny Villa On	Mesa College Dr/Kearny Villa Rd On		✓
19.5	19.6	11.9	12.1	7.7	Mesa College/Kearny Villa On to Palm/47th St Off	Palm Ave/47th St Off		✓
11.9	12.1	7.1	8.0	4.8	Palm/47th Off to Bonita Rd/E St Off	Bonita Rd/E St Off		✓
7.1	8.0	0		7.1	Bonita Rd/H St. Off to I-5 (in San Ysidro)	Not a bottleneck area		

Exhibit 4-3: I-805 Map of Bottleneck Locations and Bottleneck Areas



Mobility by Bottleneck Area

Mobility describes how efficiently the corridor moves vehicles. To evaluate how well each bottleneck area moves vehicles, vehicle-hours of delay were calculated for each segment. The results reveal the areas of the corridor that experience the worst mobility.

Exhibits 4-4 and 4-6 illustrate the vehicle-hours of delay experienced by each bottleneck area. These exhibits reiterate the directional pattern of travel on I-805. As depicted in Exhibit 4-4, delay in the northbound direction is concentrated in the AM peak with over seven times more delay than the PM peak. The bottleneck area at Governor Drive/SR-52 experienced the greatest delay in the northbound direction with roughly 250,000 annual vehicle-hours of delay, or 44 percent of the corridor's northbound delay during the AM peak. The El Cajon location accounted for 25 percent. There may be secondary bottlenecks around I-15, SR-94, and Home Avenue that may contribute to this delay at El Cajon, but they were deemed small. The 43rd Avenue bottleneck contributed 28 percent to the northbound AM delay total, and a secondary bottleneck at the Bonita Road on-ramp at SR-54 may have added some delay to this total, but it too was deemed less significant than the 43rd Street bottleneck.

Exhibit 4-6 shows that delay in the southbound direction is concentrated during the PM peak. During the PM peak, three bottleneck areas exhibited approximately similar levels of delay according to the 2007 PeMS data ranging between 28 percent and 31 percent of total southbound PM period delay. The bottleneck area at Palm/47th Street experienced the greatest southbound delay with over 315,000 annual vehicle-hours of delay (31 percent), followed by the bottleneck areas at Governor Drive/SR-52 (29 percent), and at Bonita Road/E Street (28 percent).

Exhibit 4-4: Northbound I-805 Annual Vehicle-Hours of Delay (2007)

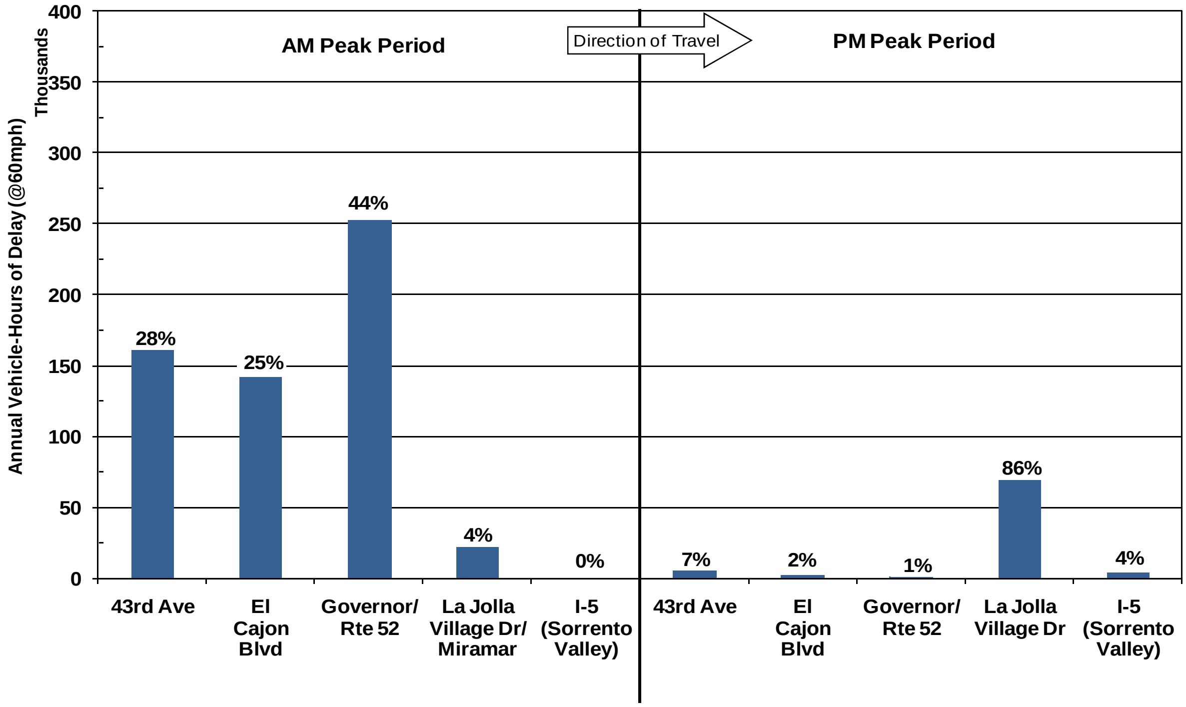
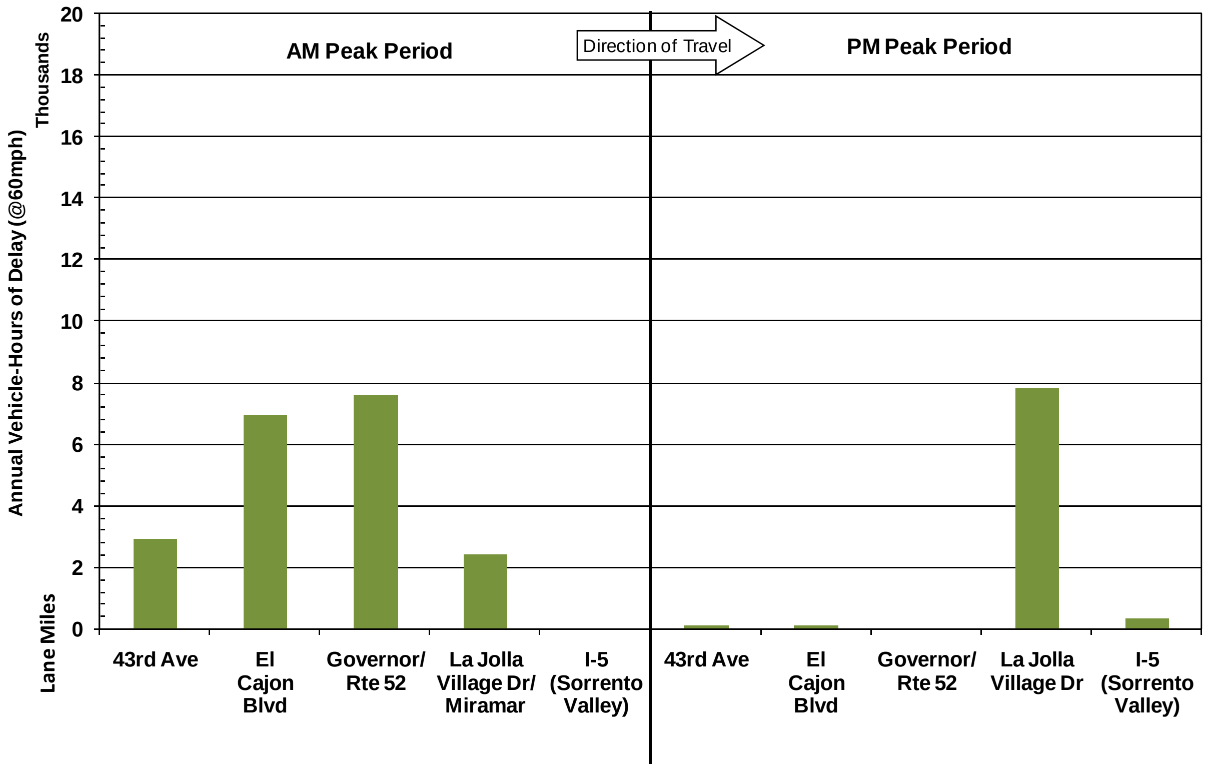


Exhibit 4-5: Northbound I-805 Delay per Lane-Mile (2007)



Exhibits 4-5 and 4-7 have been normalized to reflect delay per lane-mile. The delay calculated for each bottleneck area was divided by the total lane-miles for each bottleneck area to obtain delay per lane-mile. The results of these exhibits reveal a similar pattern of overall delay shown in Exhibits 4-5 and 4-7 with subtle differences. In the northbound direction (Exhibit 4-5), the bottleneck area at La Jolla Village Drive experienced the most delay per lane mile than any other segment on the corridor in either direction. This is different from the delay illustrated in Exhibit 4-4, which shows the most delay occurring at the Governor Drive/SR-52 bottleneck area.

Similarly, in the southbound direction (Exhibit 4-7), the bottleneck area at Governor Drive/SR-52 experienced the highest delay per lane-mile, which differs slightly from the delay illustrated in Exhibit 4-6 that identifies Palm/47th Street as the segment with the highest delay.

Exhibit 4-6: Southbound I-805 Annual Vehicle-Hours of Delay (2007)

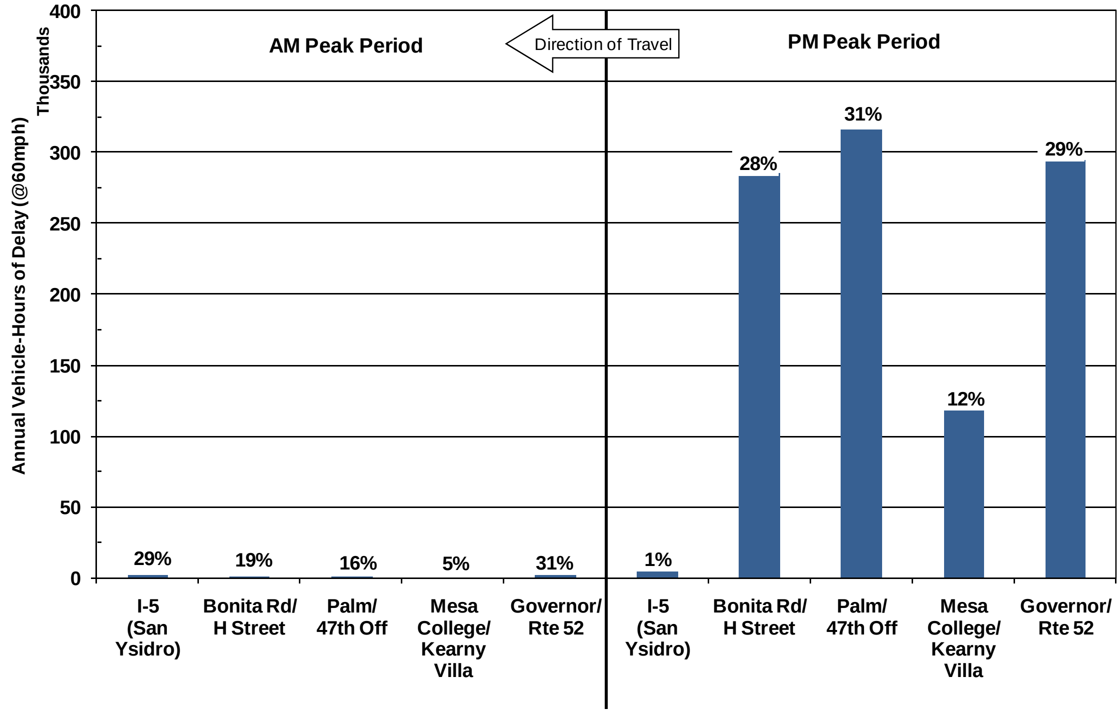
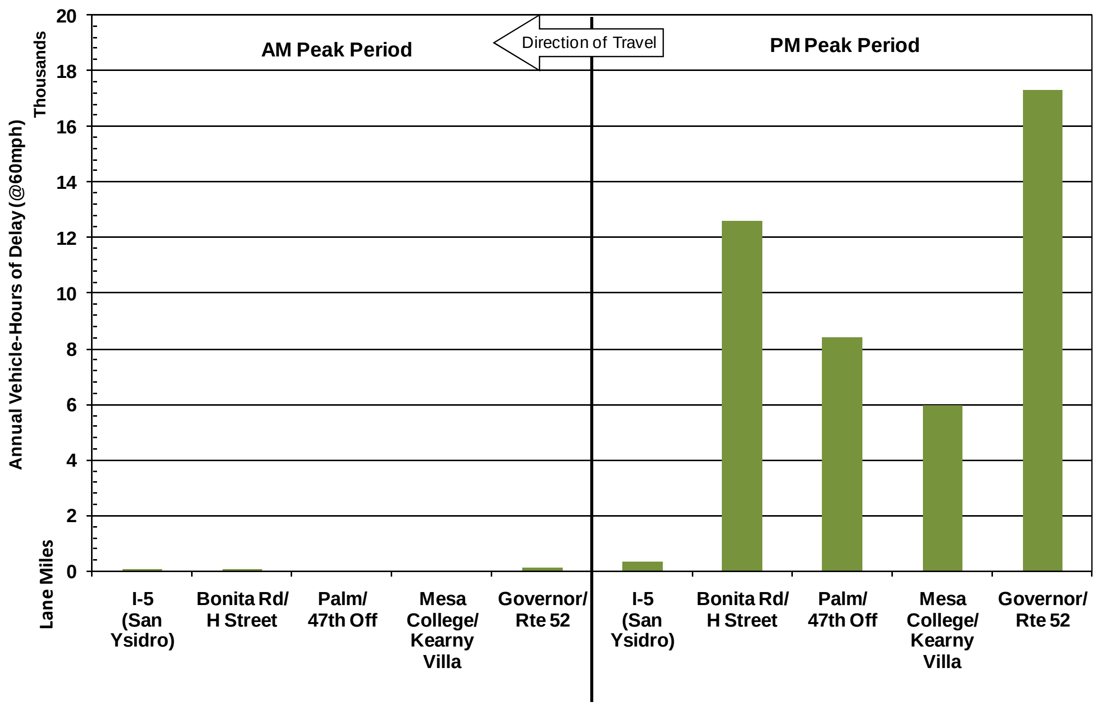


Exhibit 4-7: Southbound I-805 Delay per Lane-Mile (2007)



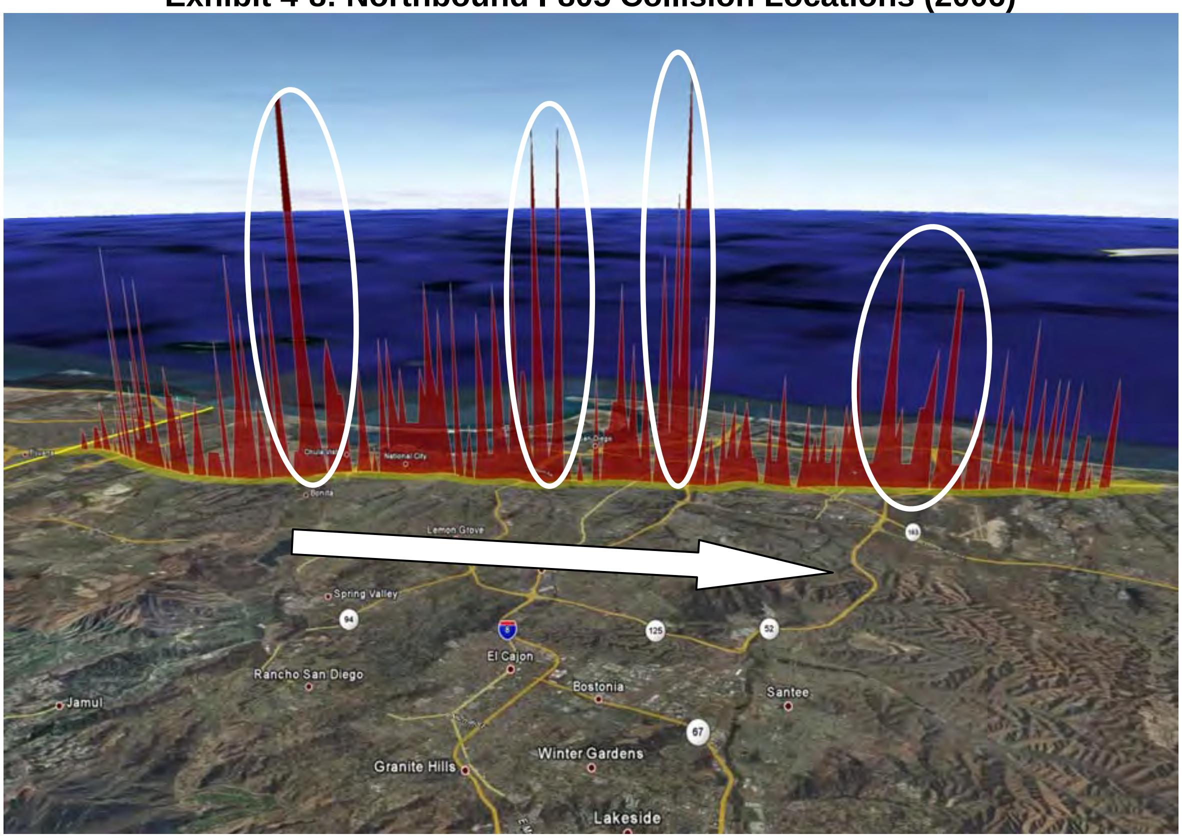
Safety by Bottleneck Area

The safety assessment in this report is intended to characterize the overall accident history and trends in the corridor, and to highlight notable accident concentration locations or patterns that are readily apparent. The following discussion examines the pattern of collisions by bottleneck area.

Exhibit 4-8 shows the location of all collisions plotted along the I-805 Corridor in the northbound direction. The spikes show the total number of collisions (fatality, injury, and property damage only) occurring within 0.1 mile segments during 2006. The highest spike corresponds to roughly 14 collisions in a single one-tenth mile location. The size of the spikes is a function of how collisions are grouped. If the data were grouped in 0.2 mile segments, the spikes would be higher.

The magnitude of these spikes is less interesting than the concentration. As Exhibit 4-8 shows, a large group of collisions occurred at four notable locations in 2006. Moving northbound, the first location is near H Street and Bonita Road followed by SR-94 and I-15 Interchanges; the I-8 Interchange; and near Clairemont Mesa Boulevard and SR-52.

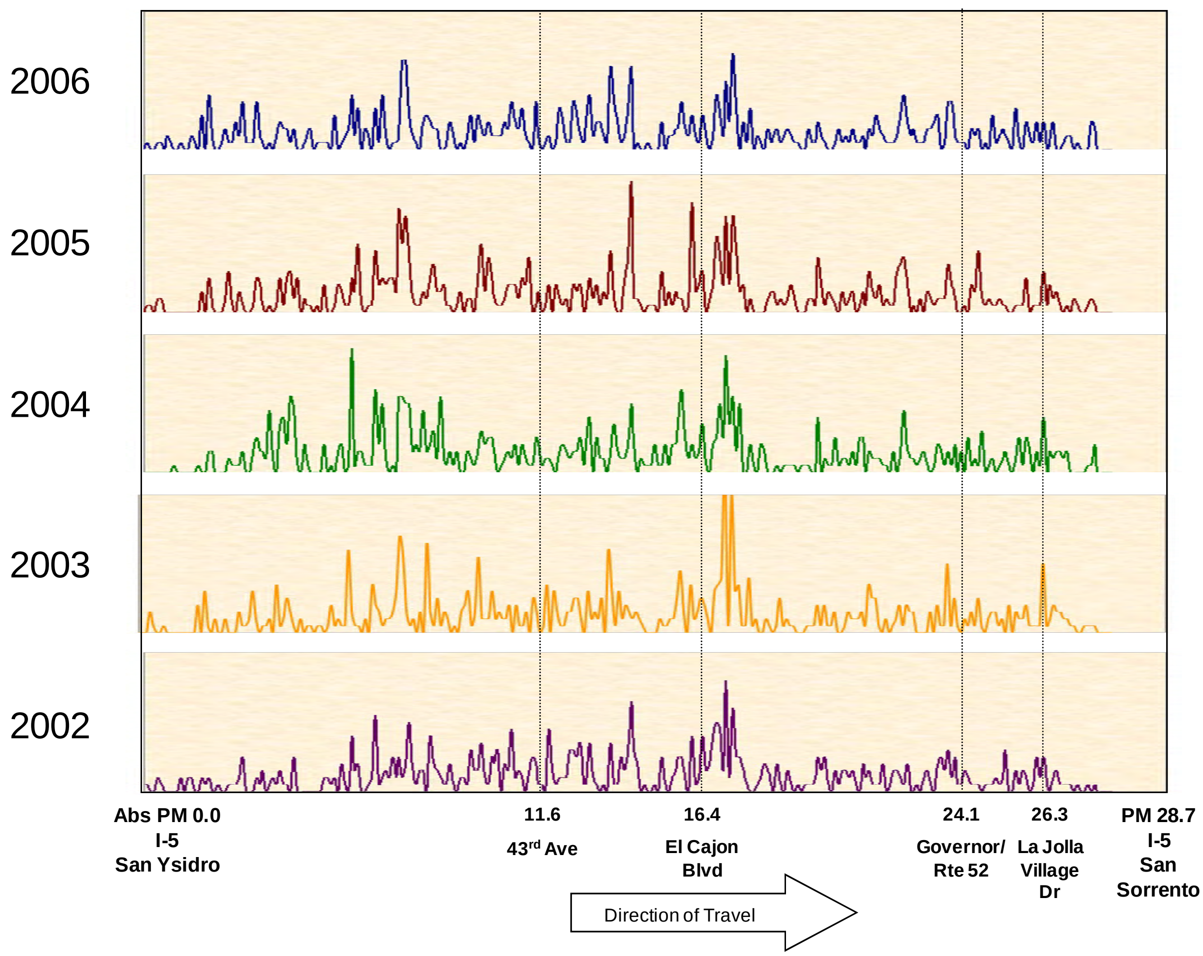
Exhibit 4-8: Northbound I-805 Collision Locations (2006)



Source: SMG analysis of TASAS data

Exhibit 4-9 illustrates the same data for the five-year period between 2002 and 2006. The vertical lines in the exhibit separate the corridor by bottleneck area. Exhibit 4-9 suggests that the high accident locations identified in 2006 (Exhibit 4-8) were the same in the preceding years. Moving northbound, the first high accident location occurred near H Street and Bonita Road (PM 7.6), followed by SR-94 and I-15 Interchanges (PM 13.7-14.3); the I-8 Interchange (PM 17.3); and near Clairemont Mesa Boulevard and SR-52 (PM 22.3-23.6). Between 2003 and 2005, there is a spike at La Jolla Village Drive (PM 26.3), which is also a bottleneck location. The exhibit also shows that the pattern of collisions has stayed fairly consistent from one year to the next.

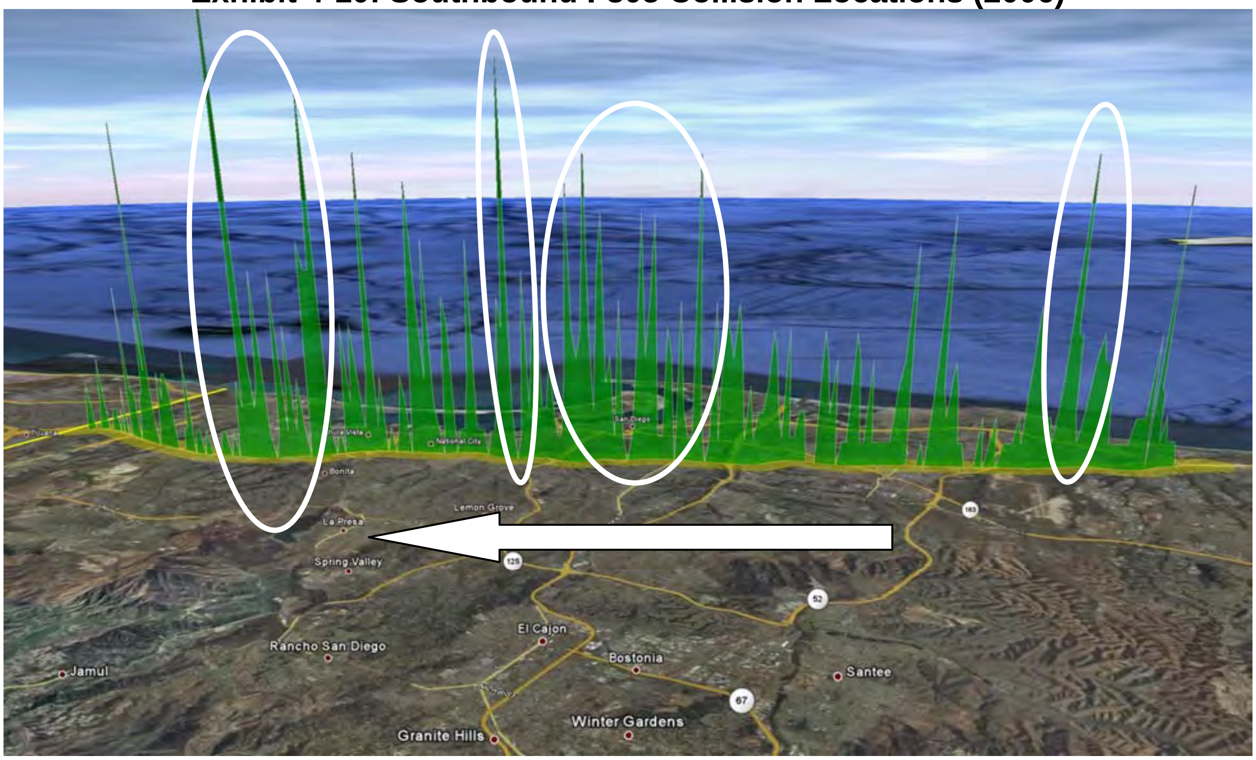
Exhibit 4-9: Northbound I-805 Location of Collisions (2002-2006)



Source: SMG analysis of TASAS data

Exhibit 4-10 shows the same 2006 collision data for the I-805 in the southbound direction. The largest spike in this exhibit corresponds roughly to 18 collisions per 0.1 miles. The southbound direction experienced more accidents than the northbound direction as evident by the overall height of the spikes. Exhibit 4-10 groups the high accident locations into four clusters. Moving southbound, these clusters are around Nobel Drive and Governor Drive; between El Cajon Boulevard and SR-15; at Palm/47th Street; and between Bonita Road and Telegraph Canyon.

Exhibit 4-10: Southbound I-805 Collision Locations (2006)

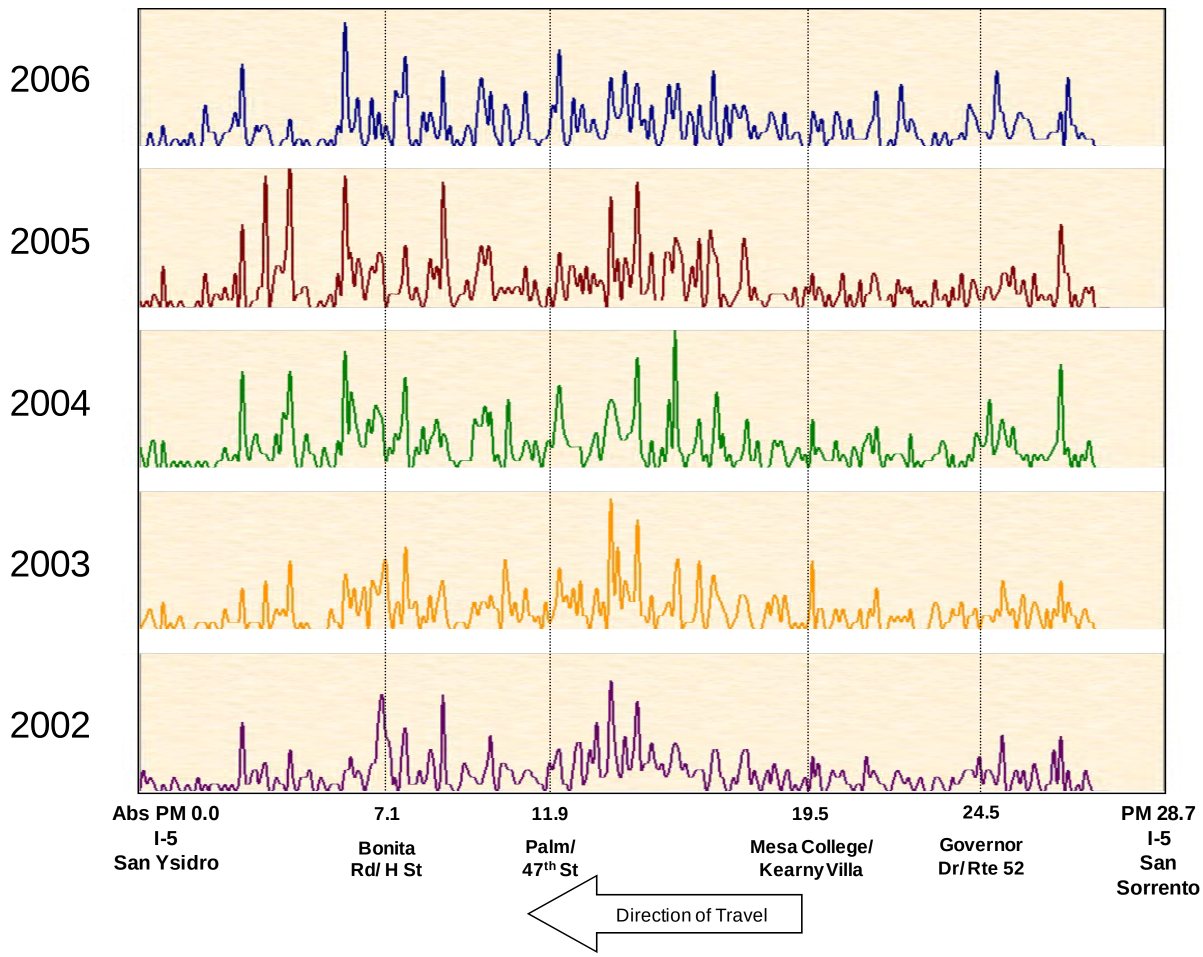


Source: SMG analysis of TASAS data

Exhibit 4-11 shows the trend of collisions for the southbound direction from 2002 to 2006 period. The pattern of collisions has been fairly steady from one year to the next. The high accident locations depicted in Exhibit 4-10 reappear in the preceding years. These locations are around Nobel Drive/Governor Drive (PM 25.1); between El Cajon Boulevard (PM 16.5) and SR-15 (PM 14.6); at Palm/47th Street (PM 11.9); and between Bonita Road (PM 7.8) and Telegraph Canyon (PM 6.0). In many cases, a spike in the number of collisions occurs in the same location as a bottleneck. For example, a spike occurs near Palm/47th Street, which is also a bottleneck location.

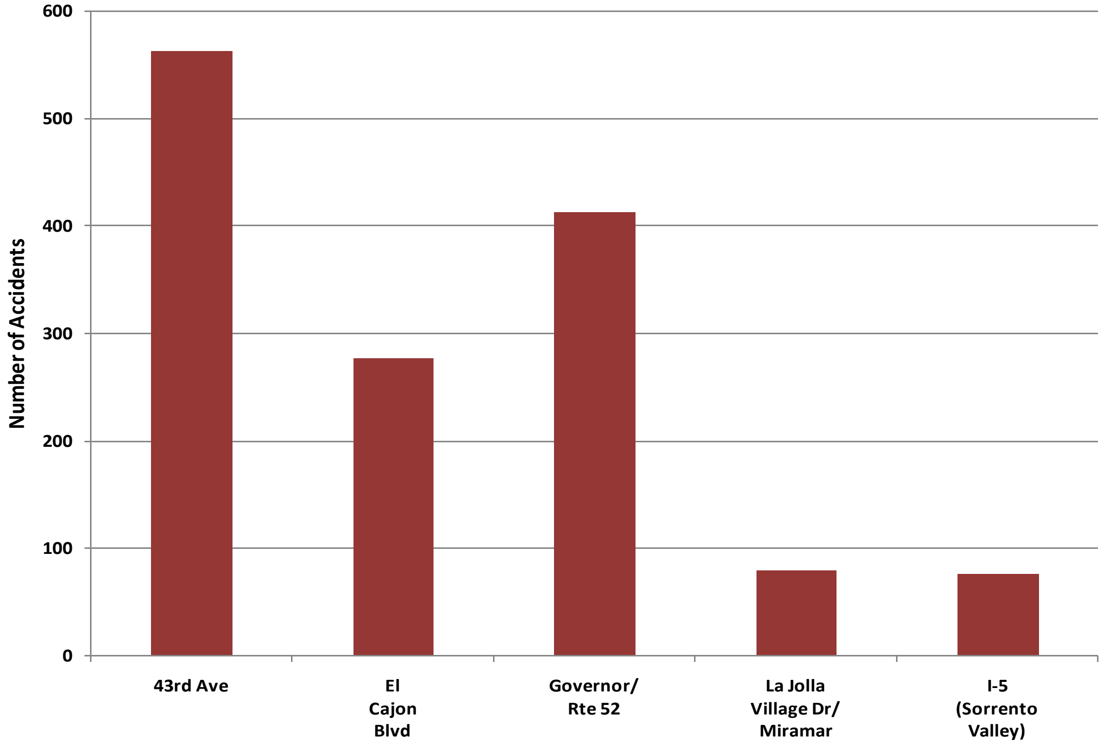
Exhibits 4-12 and 4-13 summarize the total number of accidents reported in TASAS by bottleneck area. The bars show the total of accidents that occurred in 2005 and 2006, the latest two years available in TASAS. The bottleneck areas that show the most accidents – 43rd Street in the northbound direction and Palm/47th Street in the southbound – are also the longest bottleneck areas in terms of distance.

Exhibit 4-11: Southbound I-805 Collision Locations (2002-2006)



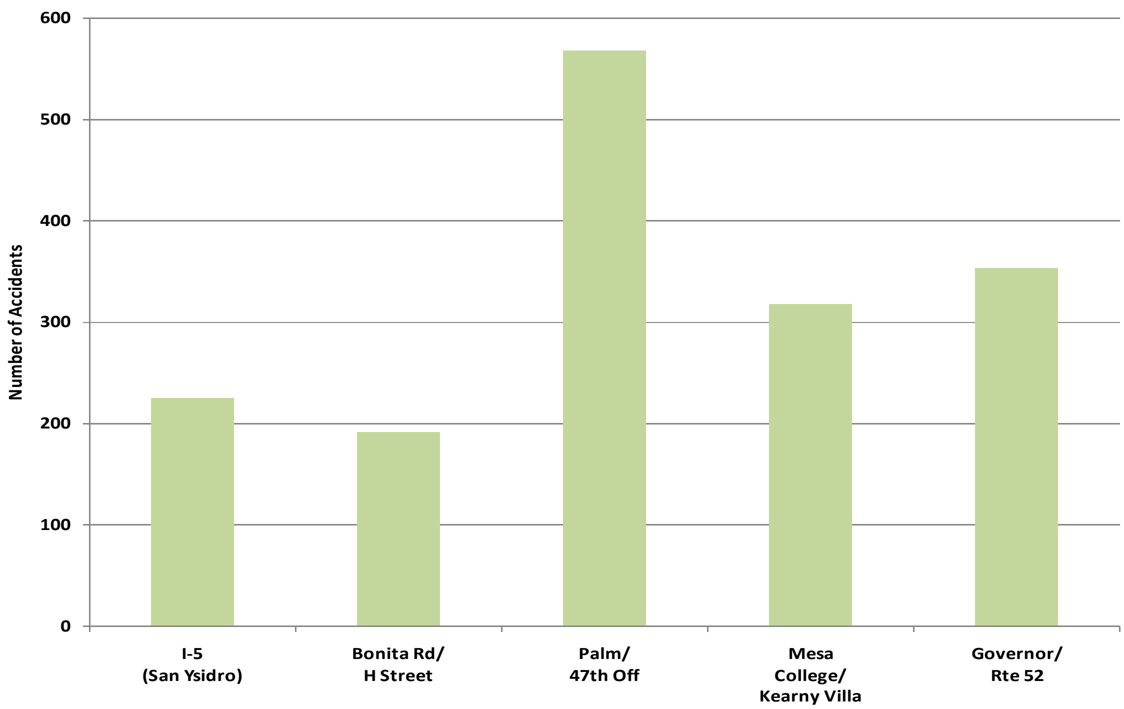
Source: SMG analysis of TASAS data

Exhibit 4-12: Northbound I-805 Total Accidents (2005-2006)



Source: SMG analysis of TASAS data

Exhibit 4-13: Southbound I-805 Total Accidents (2005-2006)



Source: SMG analysis of TASAS data

Productivity by Bottleneck Area

As previously discussed in Section 3, the productivity of a corridor is defined as the percent utilization of a facility or mode under peak conditions. Productivity is measured by calculating the lost productivity of the corridor and converting it into "lost lane-miles." These lost lane-miles represent a theoretical level of capacity that would have to be added in order to achieve maximum productivity.

Exhibits 4-14 and 4-15 show the productivity losses for both directions of the corridor. In the northbound direction, the bottleneck area at Governor Drive/SR-52 experienced the worst productivity of area on the study corridor in either direction. It experienced a productivity loss of 2.1 lane-miles during the AM peak period, which is equivalent to saying that this segment lost about half its capacity during the peak period. During the PM peak period, the northbound direction experienced relatively high productivity with all segments of the corridor experiencing less than a half-mile of productivity loss.

In the southbound direction, the bottleneck area at Bonita Road/E Street experienced the greatest productivity loss during the PM peak (2.1 lost lane-miles), followed by Palm/47th Street (1.7 lost lane-miles), and Governor/SR-52 (1.5 lost lane-miles).

Note that the segments of the corridor with the highest productivity losses coincide with the segments that experienced high levels of annual vehicle-hours of delay.

Exhibit 4-14: Northbound I-805 Lost Lane-Miles (2007)

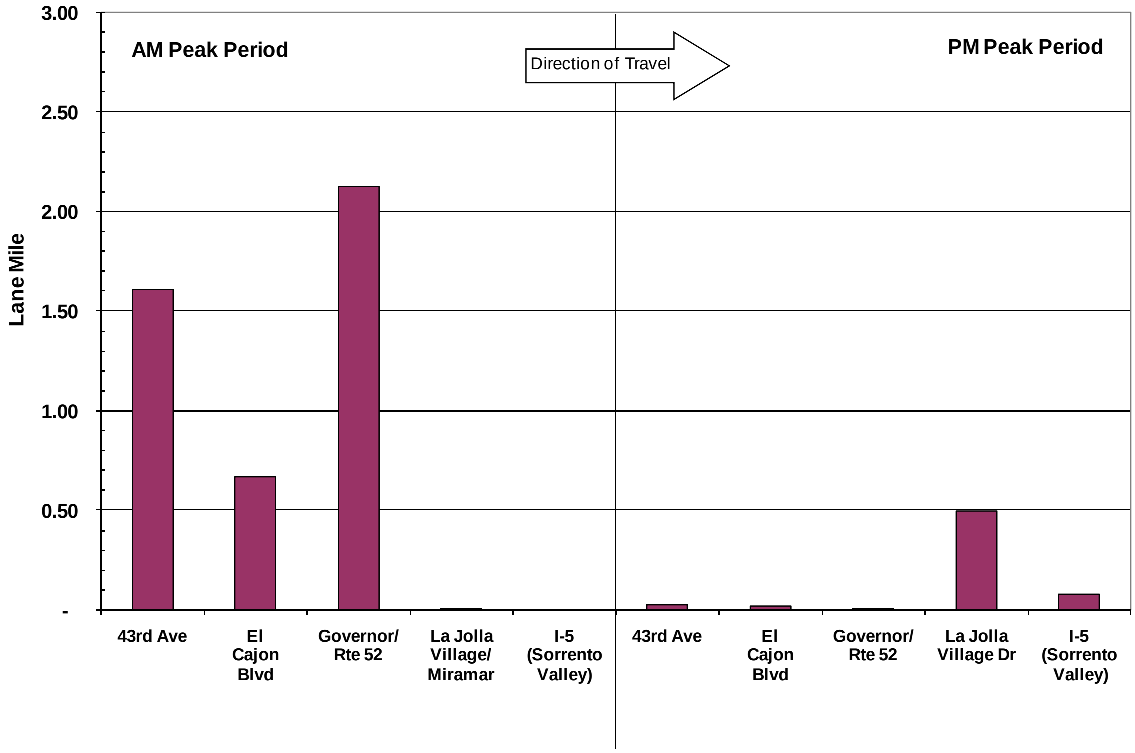
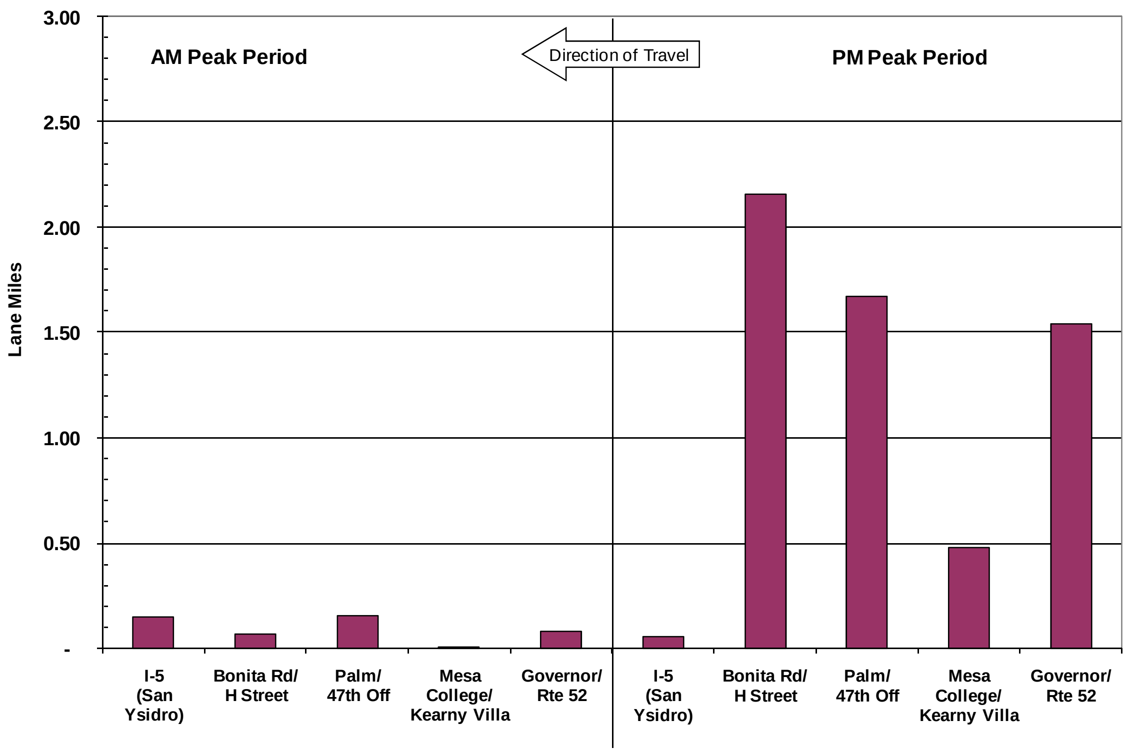


Exhibit 4-15: Southbound I-805 Lost Lane-Miles (2007)



Page Intentionally Left Blank for Future Updates on Bottleneck Identification, Bottleneck Area Definition, and Performance Measures by Bottleneck Area

5. CAUSALITY ANALYSIS

Major bottlenecks are the primary cause of corridor degradation and the resulting congestion and lost productivity. After identifying the major bottleneck areas and the relative amount degradation that each area contributes to the corridor, the specific location and the causes of each major bottleneck are identified.

The specific location of each major bottleneck is verified by multiple field observations on separate days. The cause(s) of each major bottleneck is also identified by field observations and additional traffic data analysis. For the I-805 study corridor in 2008, field observations were conducted by the project consultant team on the weekdays of July 16, August 7, October 9, October 23, September 10, and December 8-9 during the AM and PM peak hours.

By definition, a bottleneck is a condition where traffic demand exceeds the capacity of the roadway facility. In most cases, the cause of bottlenecks is related to a sudden reduction in capacity, such as roadway geometry, heavy merging and weaving, and driver distractions; or a surge in demand that the facility cannot accommodate. In many cases, it is a combination of increased demand and capacity reductions. Below is a summary of the causes of the bottleneck locations.

Northbound Bottlenecks and their Causes

The I-805 Corridor has largely directional traffic congestion, with the northbound direction being mostly congested during the AM peak period and the southbound direction showing only PM peak period congestion. In the northbound direction, however, there is one PM peak period bottleneck.

The previous section identified the following four major northbound bottlenecks:

- *43rd Street On*
- *El Cajon Boulevard On*
- *Governor Drive Off*
- *La Jolla Village Drive Off*

The first three bottlenecks are active in the AM peak period only, while the La Jolla Village Drive bottleneck is active only in the PM peak period. The most significant of these northbound bottlenecks is at Governor Drive, accounting for about 44 percent of all delay on the corridor in 2007.

There are secondary northbound bottlenecks at Bonita Road/E Street, I-15, and Home Avenue, but these were considered much smaller in impact compared to the other northbound bottlenecks. These smaller bottlenecks are described briefly in the following paragraphs.

The Bonita Road/E Street bottleneck is caused where the two-lane collector from H Street tapers into the number 4 travel lane. On-ramp traffic from H Street is currently unmetered.

A secondary bottleneck that can be overwhelmed by the El Cajon bottleneck lies just south of R-94/Market St where the short auxiliary lane traps off to Market Street and the lane number 5 traps to the SR-94 eastbound off-ramp. Serious operational issues may occur at this location due to the change of six lanes down to four lanes, with the number 4 lane carrying heavy SR-94 westbound traffic to downtown.

The major bottlenecks are discussed in the sections below.

43rd Street On (AbsPM=11.6 CaPM=11.7)

Exhibit 5-1 is an aerial photograph of the 43rd Street bottleneck location of I-805 northbound. As discussed in the previous section, this bottleneck location accounted for approximately 161,000 annual vehicle-hours of weekday delay in 2007 (about 28 percent of northbound AM delay). The primary bottleneck is at the 43rd Street On-ramp with the secondary queue forming upstream at the 43rd Avenue Off-ramp.

The primary cause of this bottleneck is that the capacity of I-805 is reduced from five to four general purpose lanes at the 43rd Street off-ramp. The fifth lane was added at SR-54, one and a half miles south of this location. An additional auxiliary lane was added at the Plaza Blvd on-ramp just half a mile south of the 43rd Street off-ramp to facilitate merging. However, both these lanes end at 43rd Street, forcing vehicles from Plaza Boulevard to merge onto the mainline.

The high mainline volumes at this location in conjunction with the lost physical capacity create the bottleneck. The demand profile discussion in Section 2 of this report (Exhibit 2-10) indicates that a high number of AM trips are generated in this zone and at Telegraph Canyon Road to the south. The Plaza Blvd on-ramp just south of the bottleneck adds 920 peak hour vehicles according to data obtained from Caltrans[3]. Two adjacent on-ramps at 47th Street On and 43rd Street exacerbate the bottleneck by adding a combined 1,090 peak hour vehicles as illustrated in Exhibit 5-1.

Finally, there are additional features of this location that contribute to the bottleneck. The curvature of the roadway decreases the sight distance at the location where the capacity decreases from five lanes plus one auxiliary lane to four lanes. Just north of this curvature are the two adjacent on-ramps. The 47th Street on-ramp has a relatively

[3] California Department of Transportation (Caltrans) and URS Corp. Interstate 805 Managed Lanes South Project Final Existing Conditions & Traffic Operations Analysis Report. July 2, 2009.

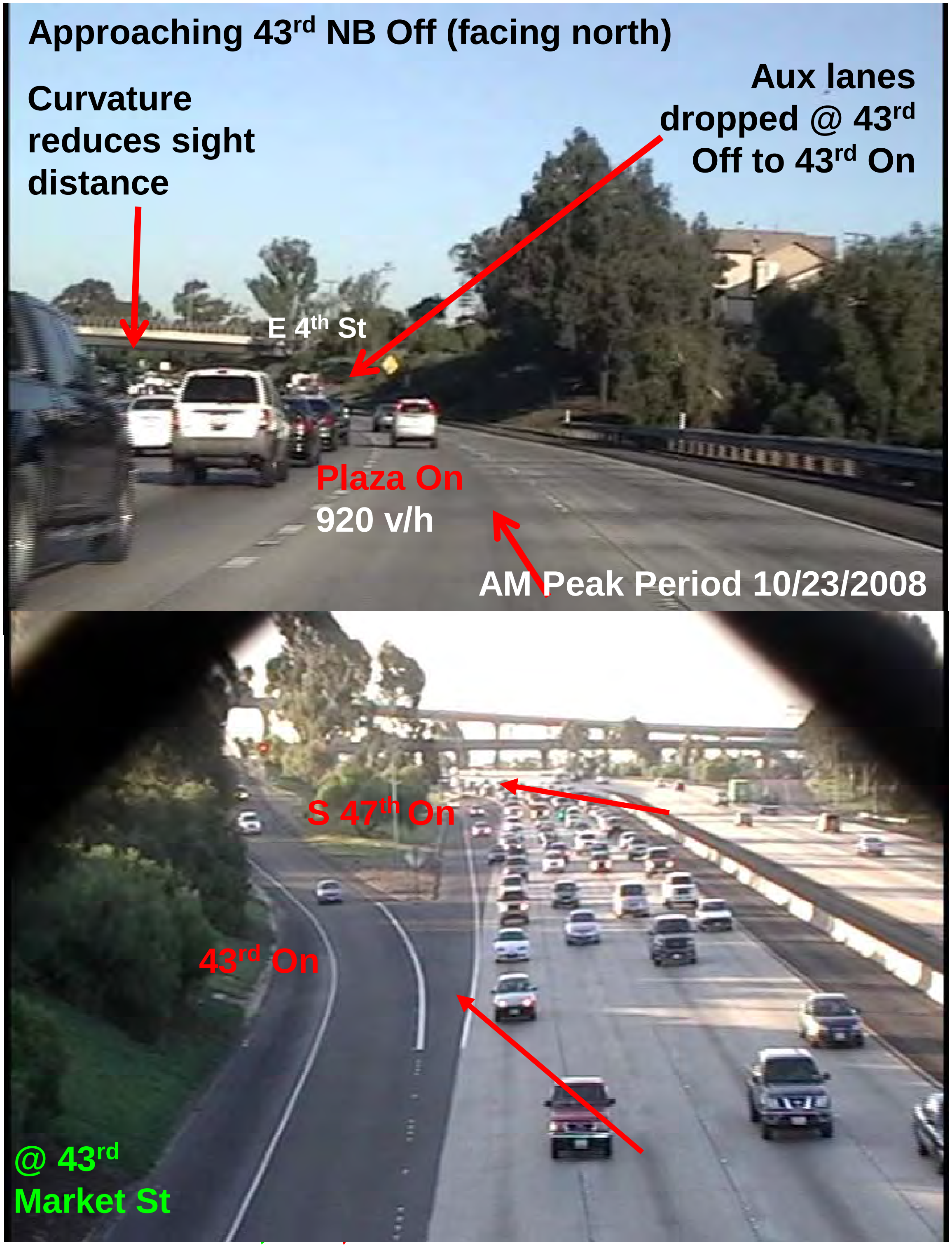
short 0.15 mile merge taper that forces merging vehicles into the already congested mainline lanes. In addition, a field visit performed on October 23, 2008 noted that vehicles platooning from that on-ramp contributed to merging problems.

Exhibit 5-2 shows two photographs taken during the October 23, 2008 field visit. The top photograph faces north approaching the 43rd St off-ramp from the Plaza St on-ramp. In this photograph, one can see the two auxiliary lanes that terminate at 43rd Street off. These two lanes carry few vehicles while the general purpose lanes are congested. The bottleneck is exacerbated by the curvature and the merging of 918 vehicles per hour from Plaza On during the peak hour at this location.

The bottom photograph in Exhibit 5-2 is facing south, but shows the northbound 47th and 43rd Street on-ramps. In this photograph, one can see the vehicles emerging from the bottleneck at the 47th Street on-ramp. The field visit noted that once vehicles round the curve and use the additional capacity provided by the auxiliary lane starting at the 43rd Street on-ramp, the bottleneck dissipates.

Exhibit 5-1: Northbound I-805 at 43rd Street

Exhibit 5-2: Northbound I-805 at 47th Street and 43rd Street On-Ramps



El Cajon Blvd On (AbsPM=16.4 CaPM=16.5)

Exhibit 5-3 is an aerial photograph of the El Cajon Blvd bottleneck location. This bottleneck location accounted for approximately 142,000 annual vehicle-hours of weekday delay in 2007 (about 25 percent of northbound AM delay).

The primary cause of this bottleneck is that there is no auxiliary lane from the El Cajon on-ramp to facilitate the merge into the mainline traffic. The El Cajon on-ramp has a relatively short 500 foot merge taper that forces merging vehicles into the already congested mainline lanes. There is an auxiliary lane staring about half a mile upstream from University Avenue to El Cajon and one that begins approximately a quarter of a mile downstream at the Madison/32nd Street on-ramp to I-8.

The high mainline volumes at this location in conjunction with the four general purpose lanes create the bottleneck. The demand profile analysis presented in Section 2 of this report (Exhibit 2-10) indicates that the two single highest AM peak period trip producing zones lie south of this bottleneck. According to Exhibit 2-10, more than 50 percent of all vehicle demand on the I-805 corridor is generated south of this bottleneck.

The University Avenue on-ramp, half a mile upstream of the bottleneck, adds 928 peak hour vehicles (at 8:00 AM) according to Caltrans ramp counts taken in 2005. Just downstream at the Madison/32nd Street on-ramp, an additional 1,177 vehicles per hour (at 7:00 AM) are added to the traffic flow. As shown in Exhibit 5-3, El Cajon alone adds an additional 852 vehicles per hour during the peak AM hour at 7:00 AM according to the Caltrans counts.

There may be a stand-alone bottleneck upstream at Imperial and Market. However, the analysis indicates the major bottleneck occurs at El Cajon Blvd, which backs up to this location. The temporal loading of traffic at these locations will be evaluated to determine this causality.

Additional features of this location that contribute to the bottleneck include a hill that crests at the Meade Avenue overcrossing just north of the El Cajon on-ramp. This vertical curve limits the sight distance, preventing drivers from seeing vehicles merging onto the freeway at Madison/32nd Street. Furthermore, this crest is where the El Cajon on-ramp taper ends. The field visit on October 24, 2008 noted that vehicles merging from El Cajon onto the freeway at this crest created slowing (though no significant bottleneck was witnessed on this day).

Exhibit 5-4 shows two photographs taken during the October 24, 2008 field visit. The top photograph faces south showing the El Cajon northbound on-ramp. One can see a platoon of vehicles attempting to merge onto the freeway even though the ramp is metered. There is slowing in the number 3 and 4 lanes while the outer number 1 and 2 lanes are still free flow. During the 2008 field visits, there were no bottlenecks witnessed at El Cajon, even though the data from 2006 and 2007 showed significant bottleneck formation at this location.

The bottom photograph in Exhibit 5-4 is facing south during the beginning of the peak period on October 24, 2008. This picture also shows the short merge taper and vehicles braking just under the Meade Avenue Bridge as cars merge from El Cajon onto the mainline. Once over the crest at Meade Avenue, the bottleneck dissipates.

South of this location there may exist other northbound AM bottlenecks at I-15, SR-94, and at Home Avenue. These bottlenecks did not contribute significantly to the overall corridor delay and were frequently overwhelmed by the bottleneck at El Cajon Blvd, particularly in the years 2006 and 2007 when traffic was much heavier than recent travel volumes.

Exhibit 5-3: Northbound I-805 at El Cajon Blvd

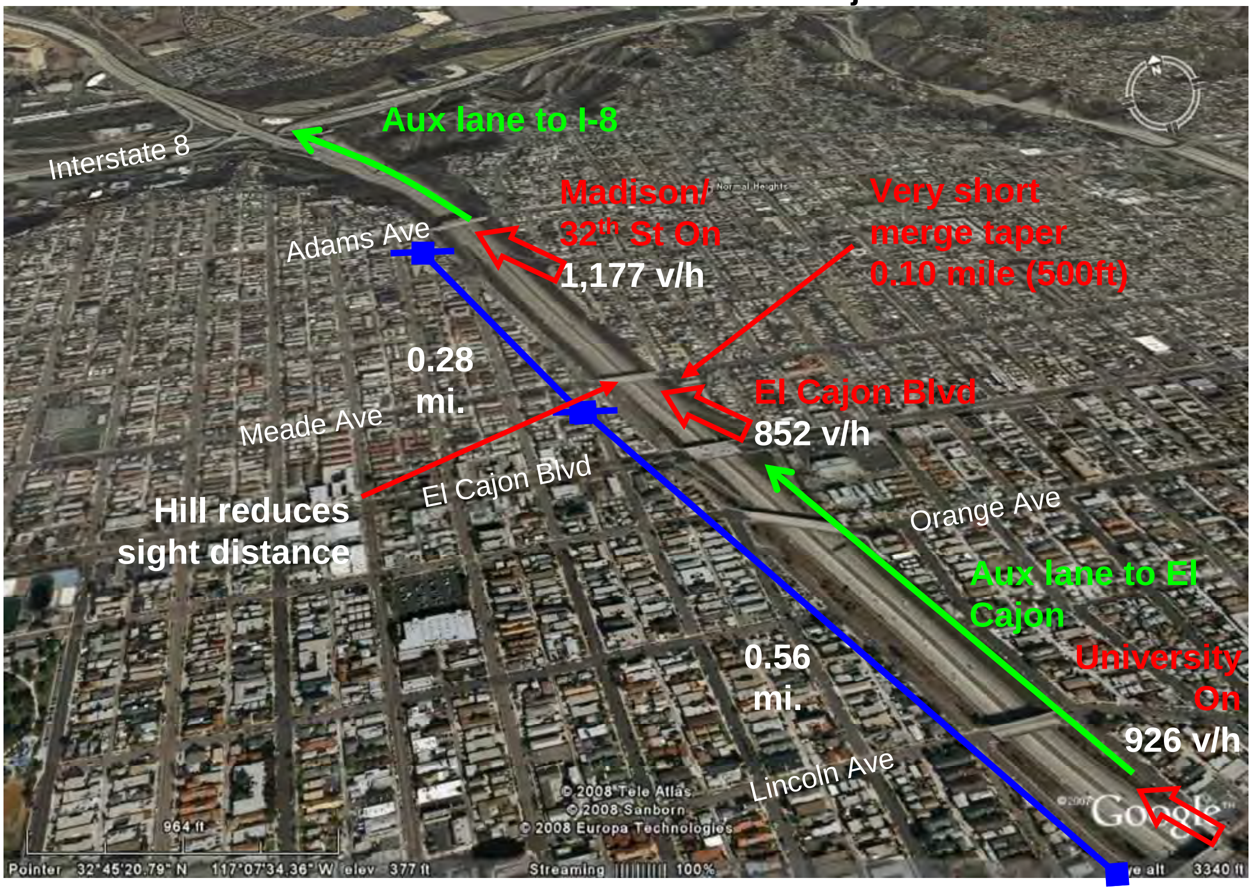


Exhibit 5-4: Northbound I-805 at El Cajon On-Ramp

Governor Drive Off (AbsPM=24.1 CaPM=24.3)

Exhibit 5-5 is an aerial photograph of the Governor Drive/SR-52 bottleneck location in northbound I-805 direction. This location accounted for just over 253,000 annual vehicle-hours of weekday delay in 2007 (about 44 percent of northbound AM delay). It is the largest single bottleneck location in the northbound direction in terms of delay.

The primary cause of this bottleneck is that the one-third of a mile auxiliary lane from SR-52 to Governor Drive is overwhelmed by the demand from the SR-52 westbound on-ramp to northbound I-805. Governor Drive is not a major destination for AM traffic and over 2,700 peak hour vehicles attempt to merge onto I-805 northbound from westbound SR-52.[4] The queue on the SR-52 westbound ramp typically backs up onto the SR-52 westbound general purpose lane.

In addition, the SR-52 eastbound on-ramp to I-805 northbound is just a quarter mile upstream of this ramp and adds 920 vehicles per hour during the AM peak hour (at 8:00 AM) according to Caltrans ramp counts taken in 2005.

Exhibit 5-6 is a photograph taken on August 8, 2008 showing the SR-52 on-ramp in the northbound I-805 direction just south of Governor Drive. This picture shows heavy traffic in the number 3 and 4 lanes and a complete breakdown in traffic at the merge point. Additional field visits validated that the bottleneck dissipates just after the Governor Drive off-ramp.

[4] California Department of Transportation (Caltrans) and URS Corp. Interstate 805 Managed Lanes North Project Final Existing Conditions & Traffic Operations Analysis Report. June 26, 2009.

Exhibit 5-5: Northbound I-805 Governor Drive/SR-52

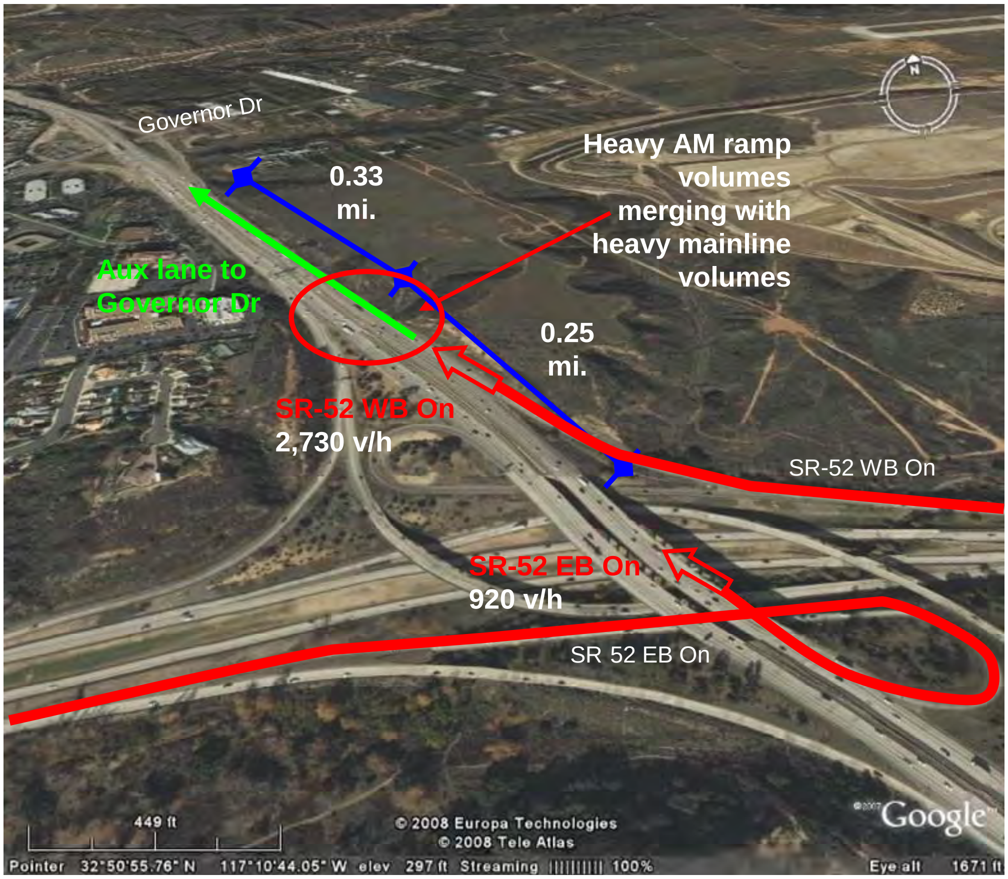
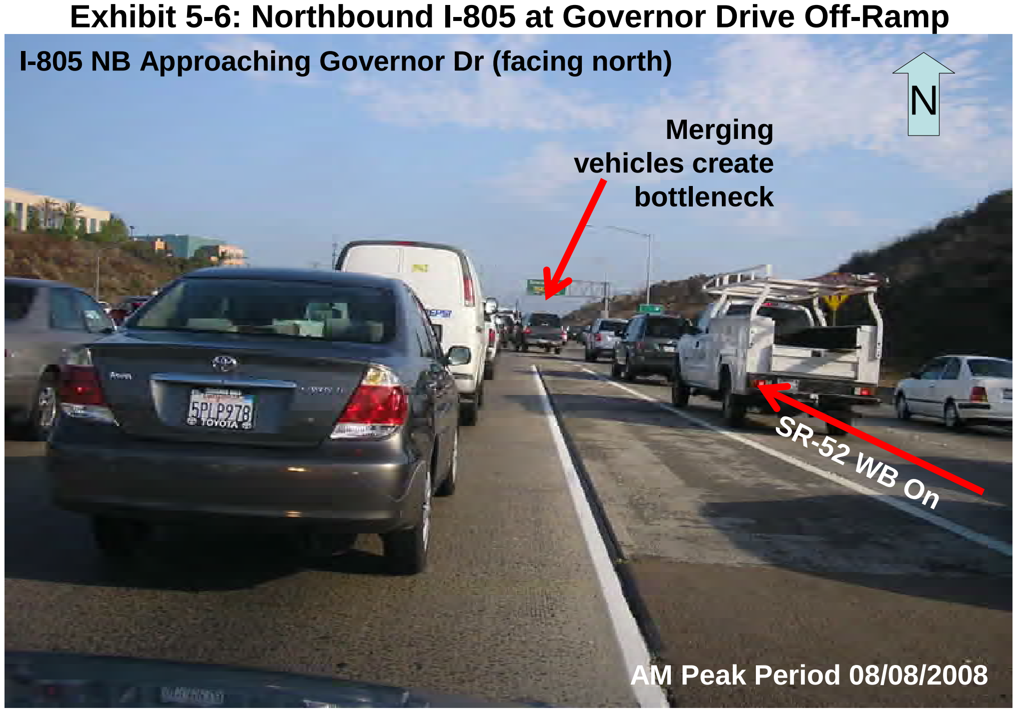


Exhibit 5-6: Northbound I-805 at Governor Drive Off-Ramp

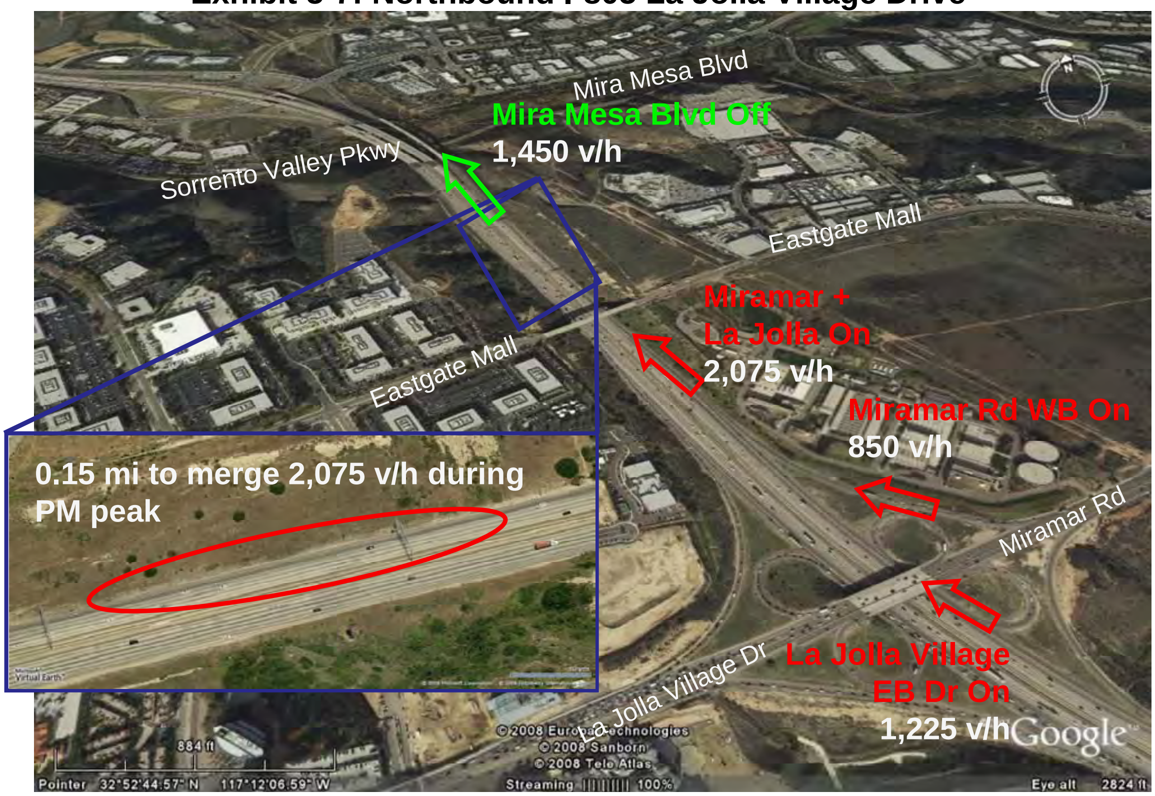


La Jolla Village Drive/Miramar Road On (AbsPM=26.3 CaPM=26.4)

Exhibit 5-7 shows two aerial photographs of the area showing the bottleneck location of I-805 northbound between the La Jolla Village Drive and Miramar Road on-ramp and the Mira Mesa Blvd off-ramp in Sorrento Valley. This location is the only northbound bottleneck that is active during the PM peak period, accounting for approximately 69,000 annual vehicle-hours of weekday delay in 2007 (about 86 percent of northbound PM delay on the corridor). The Sorrento Valley area of the I-805 corridor is the largest single employment center adjacent to the corridor.

The primary cause of this bottleneck is that the 0.15-mile auxiliary lane from the La Jolla Drive/Miramar Road on-ramp to the Mira Mesa off-ramp is overwhelmed by the 2,075 peak PM hour vehicles that merge onto I-805 from La Jolla Village Drive and Miramar Road[5]

Exhibit 5-7: Northbound I-805 La Jolla Village Drive



[5] Count data from Caltrans/URS. June 26, 2009. Miramar/La Jolla Village ramp volumes from Caltrans District 11 Traffic Operations.

Southbound Bottlenecks and their Causes

The bottleneck identification section of this report identified the following four southbound bottlenecks:

- *Governor Drive/SR-52*
- *Mesa College Drive/Kearny Villa Road On*
- *Palm Avenue/47th Street Off*
- *Bonita Road/E Street Off*

All four of these bottlenecks are active during the PM peak period only. Only the Mesa College Drive/Kearny Villa Road on-ramp is not a significant bottleneck in terms of delay in 2007, comprising only around 12 percent of southbound PM period congestion. The remaining three bottlenecks each comprise around 30 percent of total southbound PM period delay in 2007.

<u>Governor Drive/SR-52 (AbsPM=24.5 CaPM=24.7)</u>

Exhibit 5-8 is an aerial photograph of the southbound Governor Drive/SR-52 bottleneck location. This location accounted for approximately 294,000 annual vehicle-hours of weekday delay in 2007 (about 28 percent of Southbound AM delay).

The primary cause of this bottleneck is that the auxiliary lane from Nobel Drive upstream and approximately half a mile north ends at Governor Drive, creating weaving issues for the vehicles attempting to merge into the general purpose lanes from Nobel Drive. The high mainline volumes at this location in conjunction with the lost physical capacity create the bottleneck.

Other geometric characteristics may contribute to the bottleneck. The SR-52 off-ramp is half of a mile downstream of the Governor Drive off-ramp. There are traffic conflicts attempting to merge right to exit to SR-52. In addition, there is an uphill grade and a narrowing of the roadway at the Governor Drive bridge that creates sight restrictions, which compound the merging issues.

These physical constraints are located downstream of one of the region's major employment centers in Sorrento Valley. La Jolla Village Drive/Miramar Road adds 2,075 vehicles per hour during the peak PM hour according to Caltrans data. Nobel Drive just north of Governor Drive adds an additional 670 vehicles per hour.

These vehicles, particularly from Nobel Drive, have trouble merging into the general purpose lanes and conflict with traffic attempting to merge right to exit to SR-52. Exhibit 5-9 is a photograph taken during the July 16, 2008 field visit showing the issues at Governor Drive.

Exhibit 5-10 is two photographs taken during the October 23, 2008 field visit. The top photograph faces south approaching the Governor Drive off-ramp. In this photograph, one can see the number 4 lane is “stop and go” and there is conflict between vehicles attempting to merge to SR-52 and vehicles attempting to merge to the free-flow number 1 and 2 lanes. On this day, the bottleneck formed further north closer to Nobel Drive, but on other days, the bottleneck formed at this location.

The bottom photograph in Exhibit 5-10 is facing north on the same day, and shows the southbound I-805 towards the Nobel Drive on-ramps. This picture shows vehicles emerging from the bottleneck and conflicts between vehicles from the Nobel on-ramp and the La Jolla Village/Miramar on-ramps in the number 3 and 4 lanes.

Exhibit 5-8: Southbound I-805 at Governor Drive/SR-52

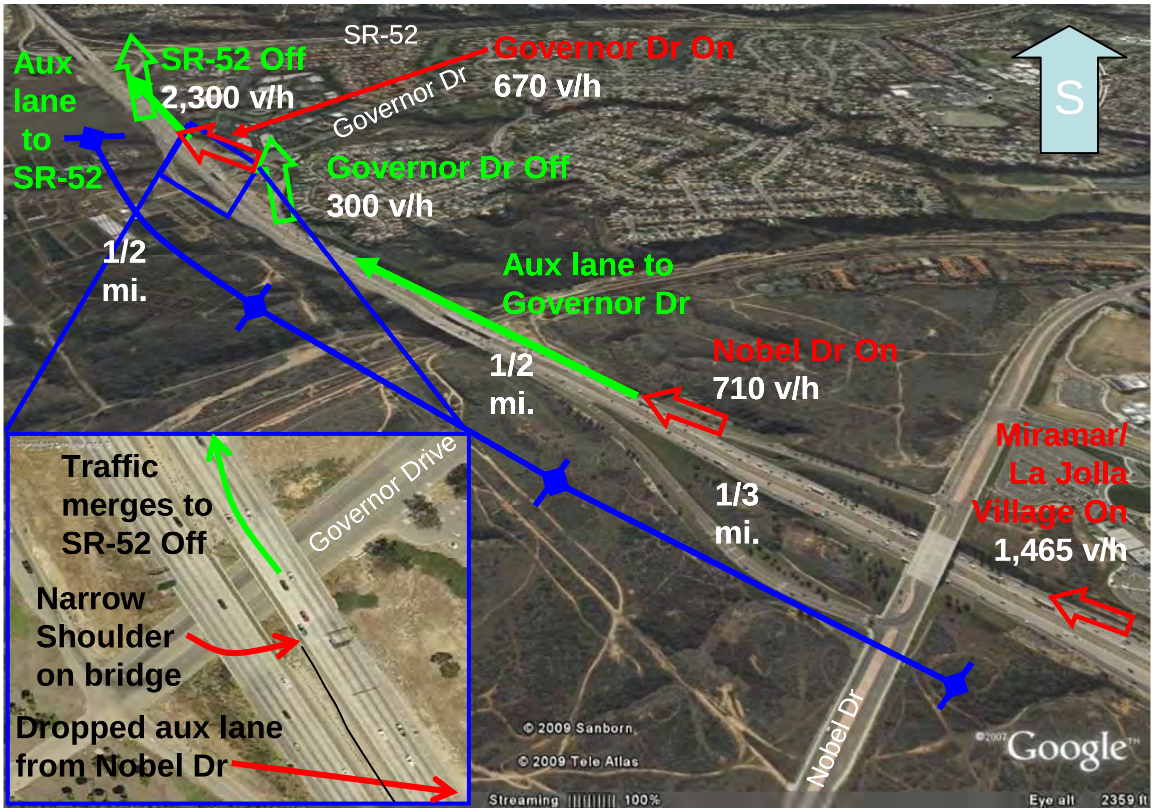


Exhibit 5-9: Southbound I-805 Approaching Governor Drive

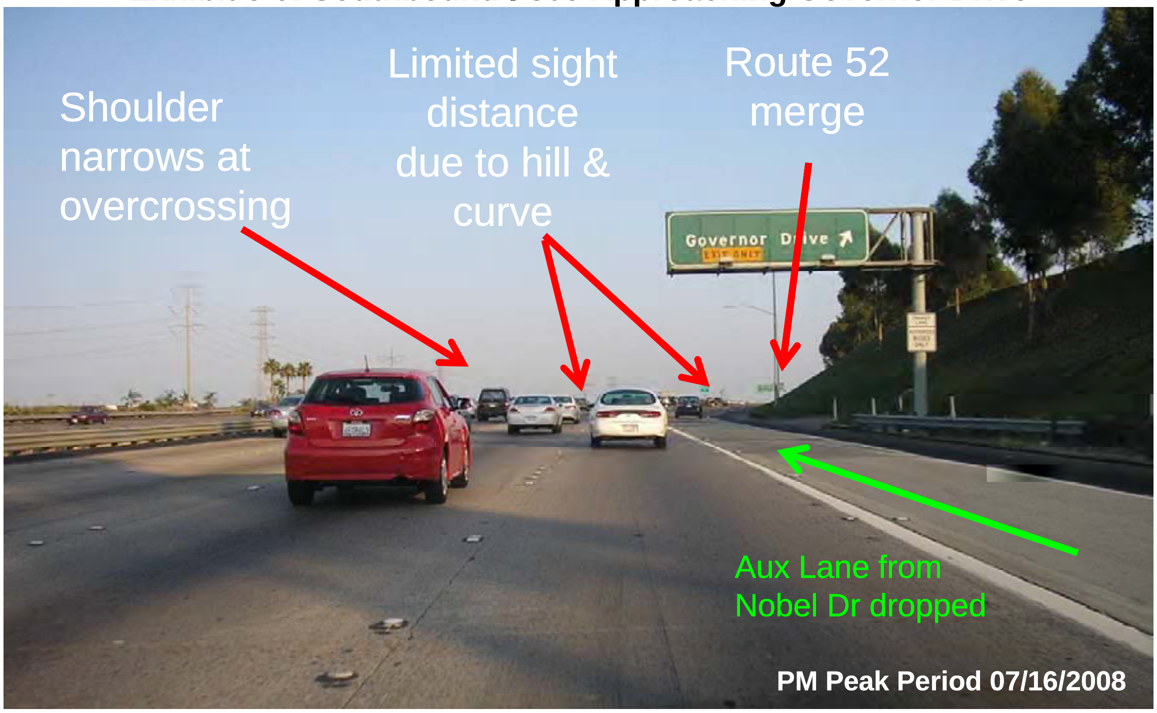
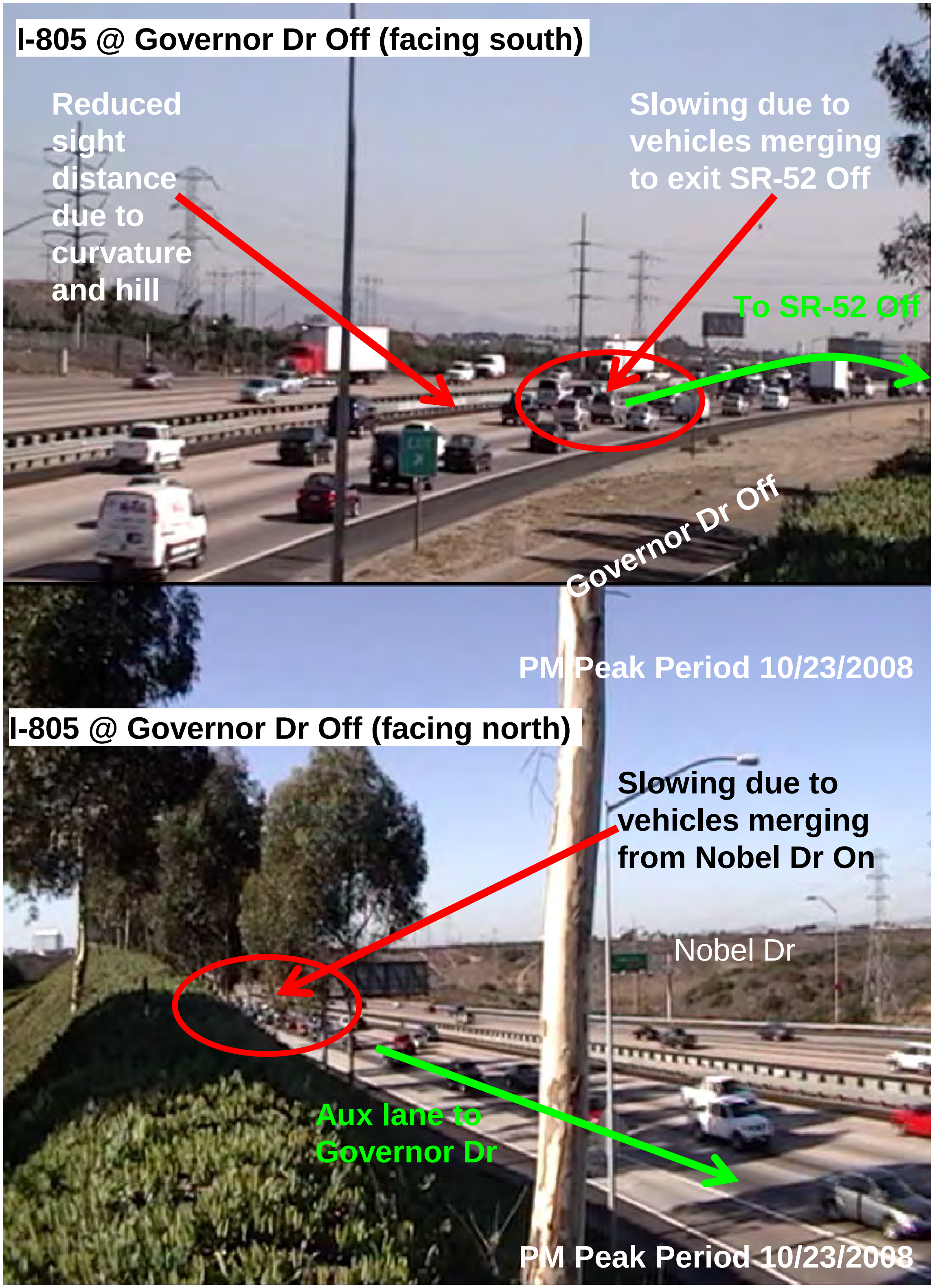


Exhibit 5-10: Southbound I-805 at Governor Drive



Mesa College Drive/Kearny Villa Road On (AbsPM=19.5 CaPM=19.6)

Exhibit 5-11 is an aerial photograph of the Mesa College Drive and Kearny Villa Road bottleneck location just south of SR-163. This bottleneck location accounted for approximately 127,000 annual vehicle-hours of weekday delay in 2007 (about 12 percent of southbound PM delay). This is the least significant of the southbound PM bottlenecks.

There are several causes of this bottleneck. SR-163 is a major freeway that loads 2,966 PM peak hour vehicles (at 3:00 PM) onto I-805 according to Caltrans counts conducted in 2005. The Mesa College/Kearny Mesa on-ramp is located just ½ mile down stream of the SR-163 ramp, around a hidden curve, and has a relatively short 500 foot merge taper that forces merging vehicles into the mainline lanes.

Exhibit 5-12 is a photograph taken on December 9, 2008 during the PM peak period. This picture facing south at the SR-163 on-ramp shows vehicles already backing up from the Mesa College/Kearny Mesa on-ramp upstream toward SR-163. It also shows the conflicts from the SR-163 traffic attempting to merge onto I-805 southbound.

Exhibit 5-11: Southbound I-805 at Mesa College Drive/Kearny Villa Road On

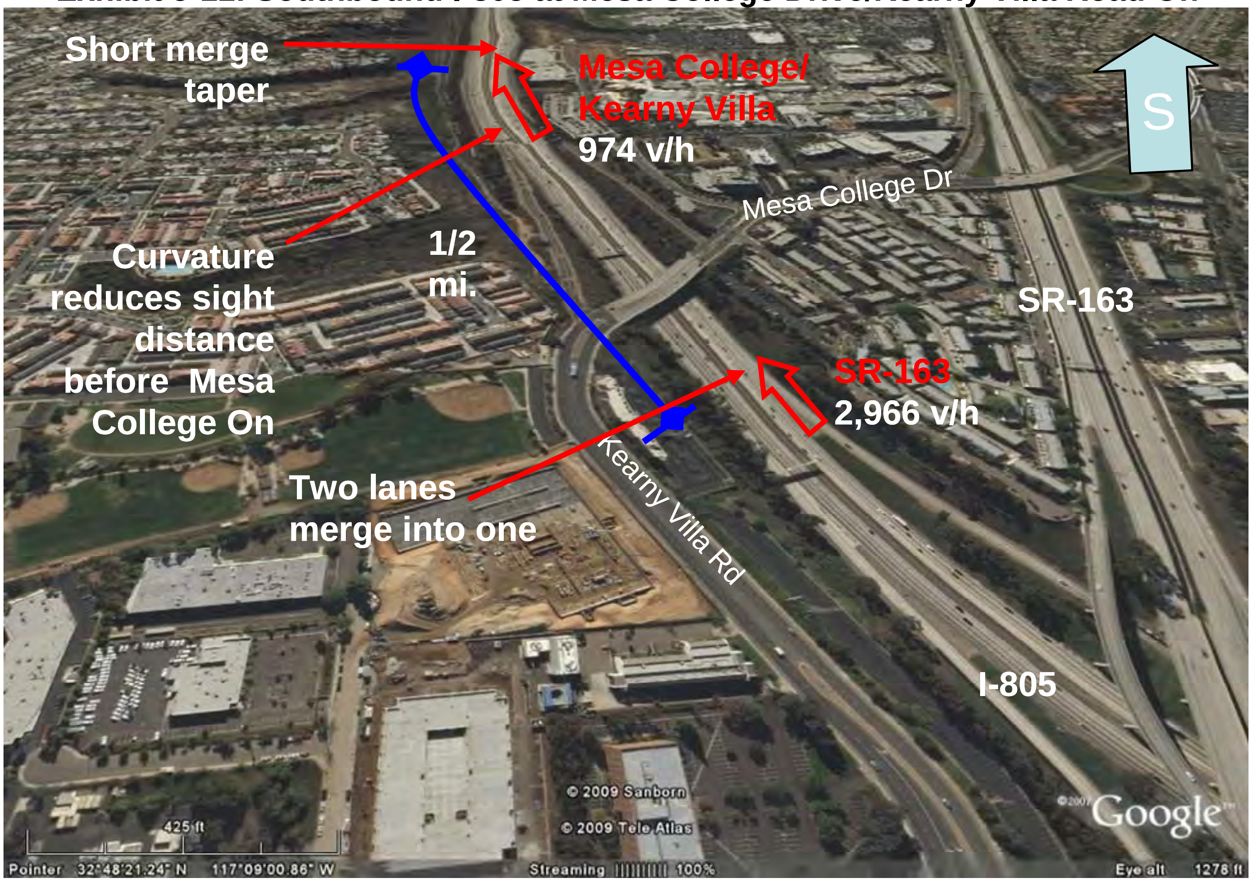


Exhibit 5-12: Southbound I-805 at SR-163 On

Palm Avenue/47th Street Off (AbsPM=11.9 CaPM=12.1)

Exhibit 5-13 is an aerial photograph of the bottleneck location at the 47th Street/Palm Avenue/43rd Street bottleneck location. This location accounted for nearly 317,000 annual vehicle-hours of weekday delay in 2007 (about 31 percent of southbound PM delay). It is the largest single bottleneck location in the southbound direction in terms of delay, though just slightly larger than the Governor/SR-52 and Bonita/E Street bottlenecks.

There are several causes for this bottleneck. The primary cause is that the lane from SR-94 ends at the 47th/Palm off-ramp reducing the number of lanes from five to four. Heavy southbound volumes on I-805 have to merge into the remaining four lanes.

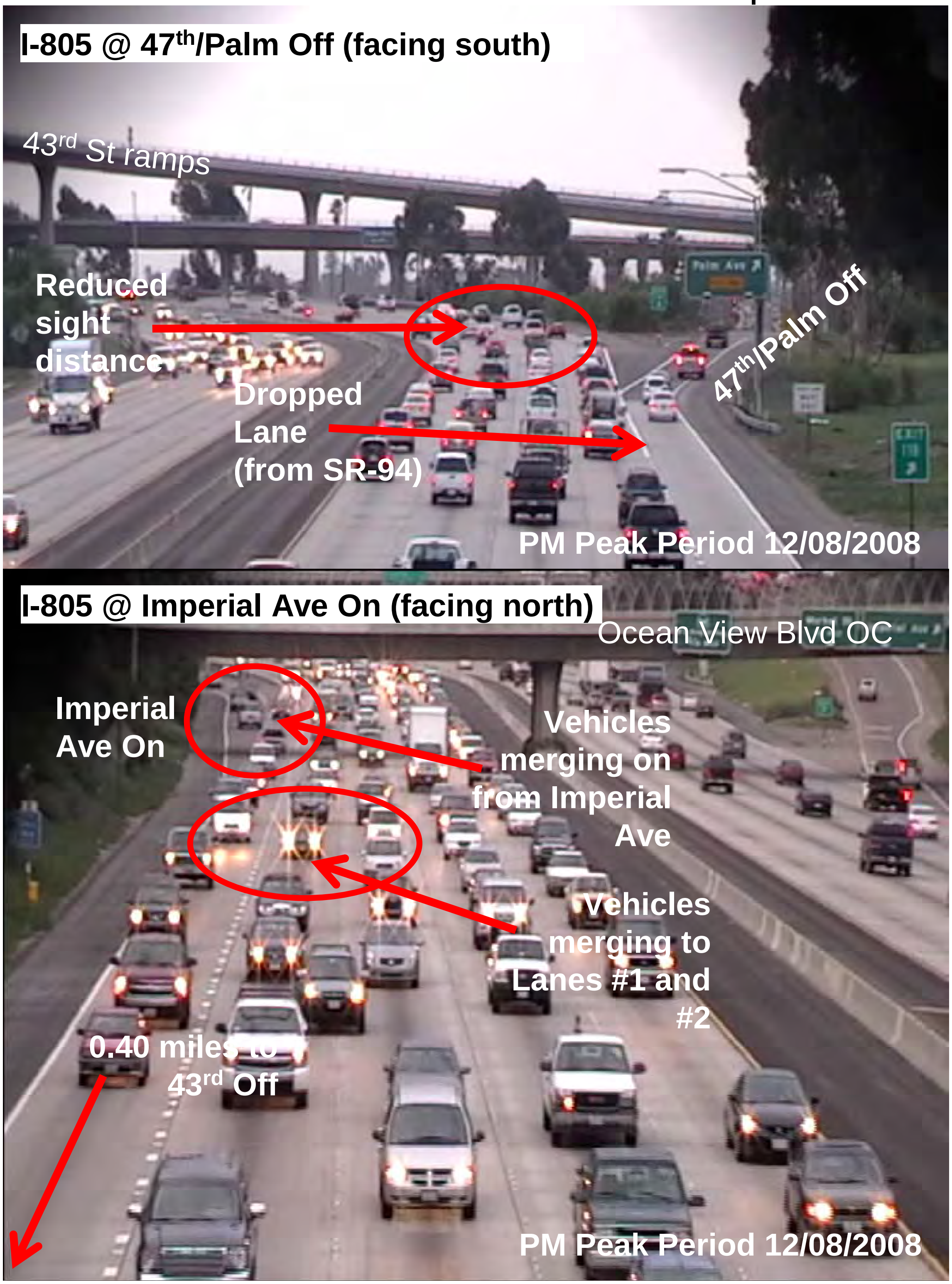
In addition, vehicles from the Imperial southbound on-ramp merge into the mainline lanes as vehicles merge from the "lost" lane to lanes #1 and #2. The Imperial Avenue off-ramp from I-805 was observed to back onto I-805. Finally, slowing was observed due to the curvature of I-805 that limited sight distance just south of 47th/Palm SB Off.

Exhibit 5-14 is a frame from a video taken on December 8, 2008 during the PM peak period. This exhibit shows two pictures, the top frame facing south toward the 47th/Palm exit, and the bottom picture facing north toward Imperial Avenue.

The southbound picture shows the curvature that may contribute to slowing. Some slowing was observed at this location. However, the northbound image shows the merging occurring just north of the 47th Street/Palm off-ramp. There is merging from Imperial Avenue as well as merging from the #3, #4, and #5 lanes to the #1 and #2 lanes to avoid the dropped lane.

Exhibit 5-13: Southbound I-805 at 43rd/47th/Palm

Exhibit 5-14: Southbound I-805 at 47th St/Palm Avenue& Imperial Avenue



Bonita Road/E Street Off (AbsPM=7.1 CaPM=8.0)

Exhibit 5-15 is an aerial photograph showing the bottleneck location at the Bonita Road/E Street off-ramp just south of the SR-54 interchange. This bottleneck accounts for approximately 285,000 annual vehicle-hours of weekday delay in 2007 (about 28 percent of southbound PM delay). This bottleneck can be much larger on some days with the queue extending north into the 47th/Palm bottleneck described above.

The primary cause of this bottleneck is the high volume merging onto I-805 SB from SR-54 EB that brings traffic from downtown San Diego. The SR-54 WB on-ramp also carries heavy volumes and both merge onto I-805 within 0.15 miles of each other.

The one-third mile long auxiliary lane between the SR-54 WB on-ramp and the Bonita Road/E Street off-ramp, also has merging conflicts.

During the PM peak period, SR-54 can load 3,775 vehicles to I-805 during the 3:00 PM hour according to the Caltrans' Interstate 805 Managed Lanes South Project Final Existing Conditions & Traffic Operations Analysis Report. The eastbound SR-54 ramp brings 2,070 vehicles per hour with only a 0.15-mile merge to accommodate this traffic. The demand profile analysis from Section 2 of this report also indicated that a relatively significant percentage of trips using I-805 in the PM peak period originate in downtown San Diego and would likely use SR-54 for their travel.

Exhibit 5-16 is two photographs taken during the field visit on October 24, 2008. The top picture faces north to the SR-54 and shows the traffic merging from both SR-54 on-ramps. One can see the merging conflicts as the SR-54 EB traffic attempts to merge into the general purpose lanes. On this day, this picture captured the precise point at which the number 1 and 2 lanes emerged out of the bottleneck into free-flow speeds.

The bottom photograph in Exhibit 5-16 faces south toward the Bonita/E Street off-ramp. In this picture, the number 1 and 2 lanes are at free-flow, but the number 3 and 4 lanes are still experiencing slowing due to merging conflicts from the vehicles on the SR-54 EB ramp attempting to merge onto I-805 southbound and vehicles attempting to merge onto the auxiliary lane to exit at Bonita Road/E Street.

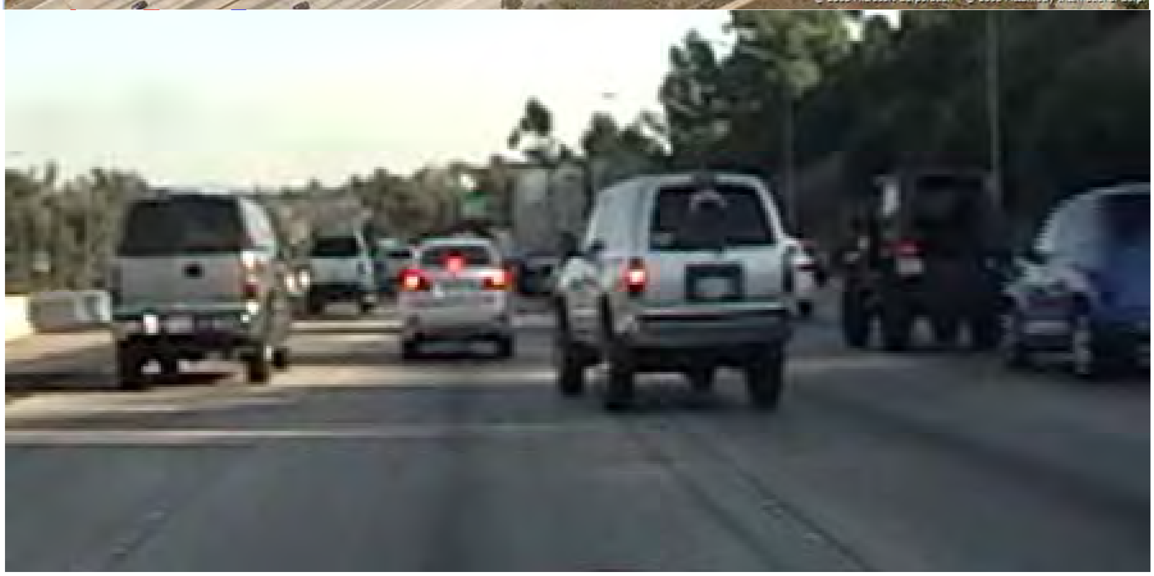
Exhibit 5-17 shows two photographs. The upper photograph is an aerial showing the short 0.15 mile merge point for the SR-54 EB merge that brings traffic from downtown San Diego to I-805. The bottom photograph, taken on October 24, 2008, shows the traffic merging dynamics that create the bottleneck.

In the northbound AM direction, this location was also active in the year 2006, but contributed less than ten percent to the overall corridor delay. The cause of the northbound AM congestion was conflict caused by vehicles merging from Bonita Road/H Street on-ramp to the mainline lanes and from the mainline lanes onto the SR-54 off-ramp just three-tenths of a mile north of the Bonita on-ramp.

Exhibit 5-15: Southbound I-805 Bonita/E Street & SR-54

Exhibit 5-16: Southbound I-805 at SR-54 and at Bonita Road Off

Exhibit 5-17: Southbound I-805 approaching Bonita Road Off



APPENDIX

This appendix is an updated version of Section 4 of the Preliminary Performance Assessment document developed and submitted to Caltrans in September 2008. It is included as a reference to allow for future updates. The analysis identified potential bottlenecks based on a number of data sources and very limited field observations. However, it represented the foundation for the conclusions in Section 4 of this Comprehensive Performance Assessment report, which built on the original findings and then revised and/or confirmed these conclusions with significant field observations and additional data analysis.

A4. BOTTLENECK ANALYSIS

This section presents preliminary performance assessment results from the bottleneck analysis. The study team has identified potential bottleneck locations (i.e., places with mobility constraints), and documented these locations with data.

The study team consulted a variety of data sources to identify bottlenecks:

- 2007 Highway Congestion Monitoring Program (HICOMP) report
- Probe vehicle data
- Freeway Performance Measurement System (PeMS)
- Aerial photos and field observations.

HICOMP

The team began the identification process by reviewing the latest (2007) Caltrans HICOMP report.[6] Congested queues form upstream from bottlenecks, which are located at the front of the congested segment. The Exhibits A4-1 and A4-2 show the HICOMP congestion maps with circles overlaid to indicate potential bottleneck locations. Northbound bottleneck areas are identified with blue circles and southbound direction bottlenecks with red circles. The HICOMP report for District 11 may rely on data obtained from a limited number of days, which is discussed in more detail in Section 3 of the Preliminary Performance Assessment.

In 2007 for the AM peak period (Exhibit A4-1), two major potential bottleneck locations were reported for the northbound direction (at I-15 and SR-52), along with one smaller bottleneck at El Cajon Blvd. Exhibit A4-1 also shows a smaller bottleneck in the southbound direction between Main Street and Telegraph Canyon Road in Chula Vista.

Exhibit A4-2 shows three major PM peak period bottlenecks in the southbound direction and one minor one in the northbound direction. The largest bottleneck is located at Plaza Blvd and extends north to Murray Ridge Road. The second largest begins at the SR-54/I-805 interchange near Bonita Road/E Street and merges with the first bottleneck. The third begins at Nobel Drive and extends north to I-5. A smaller southbound PM bottleneck is located at SR-163 extending north to Balboa Avenue. In the northbound (off-peak) direction, there was a small bottleneck reported at I-5 in the Sorrento Valley Area extending south to La Jolla Village Drive.

[6] Statewide Highway Congestion Monitoring Program Report. For details, see section 3 of this report.

Exhibit A4-1: 2007 HICOMP AM Congestion Map with Potential Bottlenecks

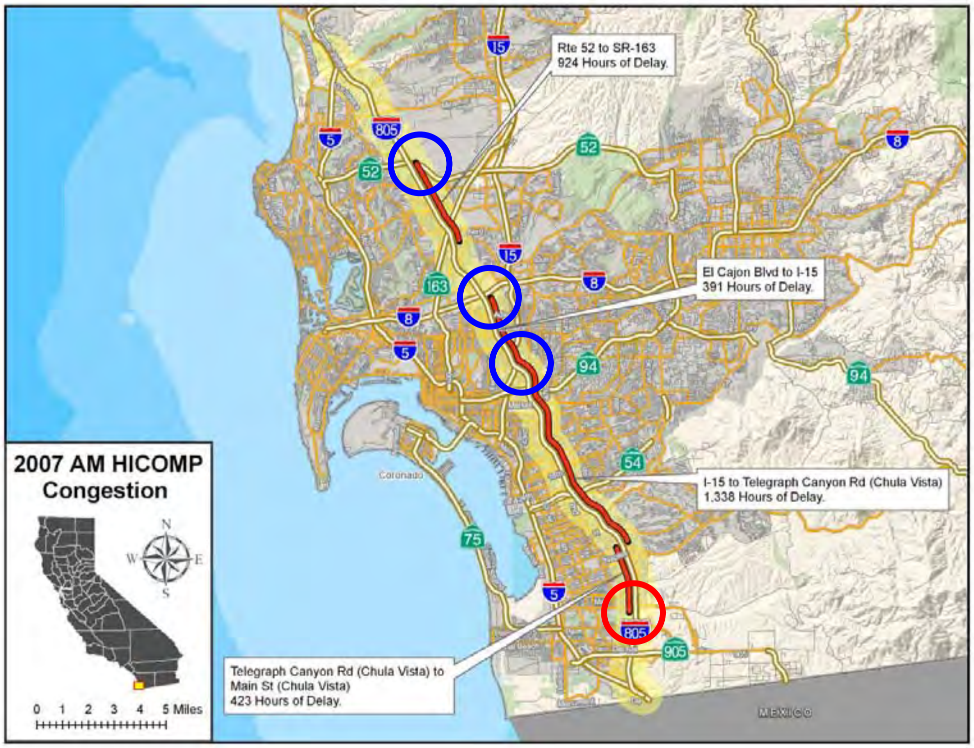
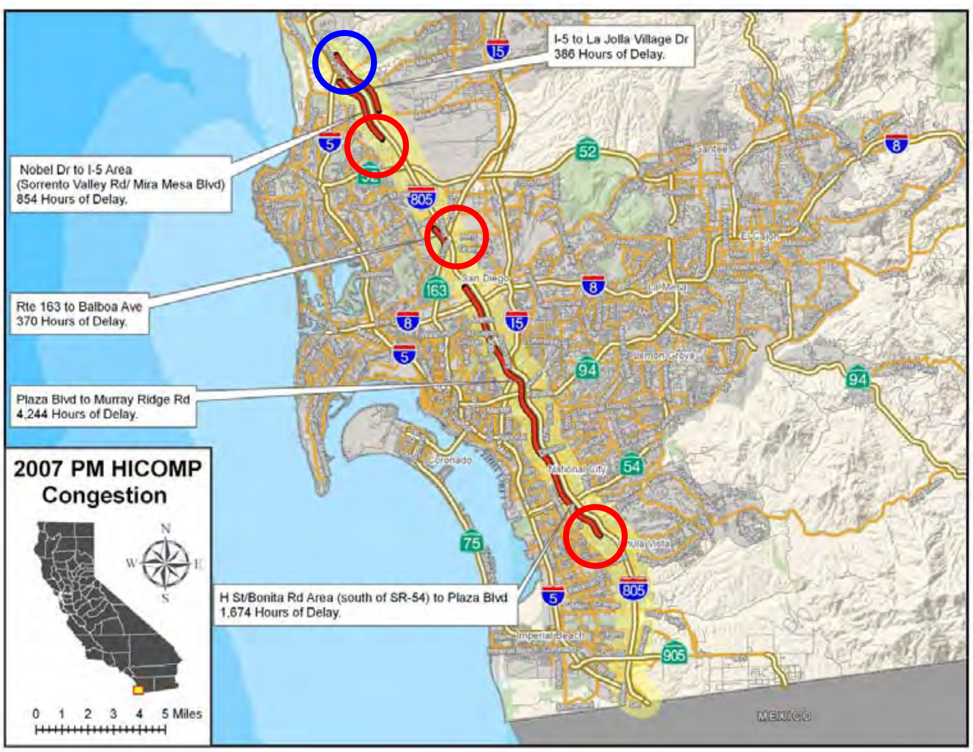


Exhibit A4-2: 2007 HICOMP PM Congestion Map with Potential Bottlenecks



Probe Vehicle Runs

SMG used probe vehicle data collected by Caltrans District 11, other study team members, and conducted additional analyses to verify the bottlenecks identified in the HICOMP data.

Probe vehicle runs provide speed plots across the corridor for various departure times. Caltrans collects the data by driving a vehicle equipped with an electronic data collection device (e.g., tachograph, global positioning system) along a route at various departure times (usually at 10 to 20 minute intervals). The vehicles are driven in a middle lane to capture "typical" conditions during the peak periods. Actual speeds are recorded as the vehicle traverses the corridor. Bottlenecks can be found at the downstream end of a congested location where vehicles accelerate from congested speeds (e.g., below 35 mph) to a higher speed within a very short distance.

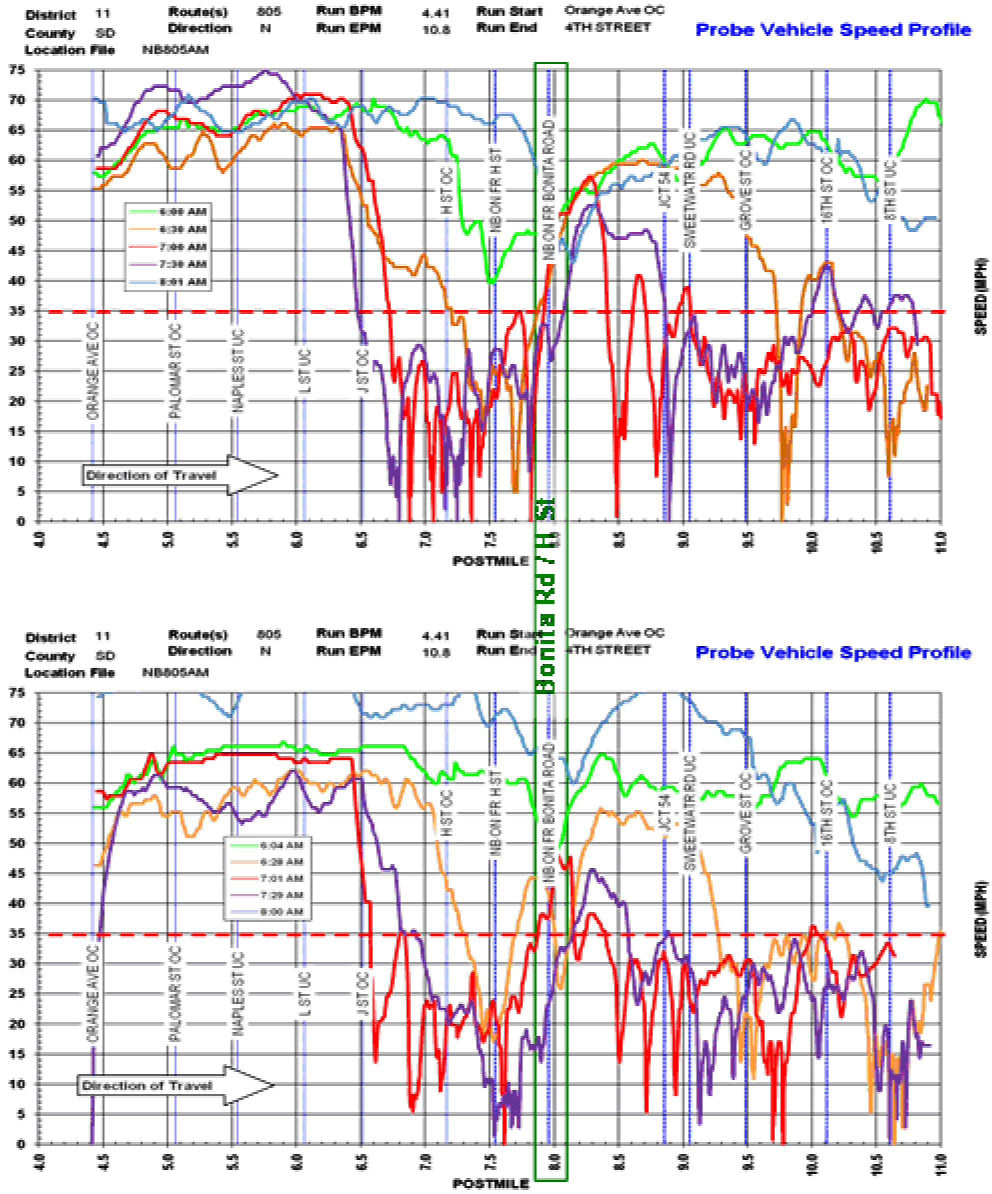
<u>NORTHBOUND</u>

In the northbound direction, Caltrans District 11 collected probe vehicle data on October 16 and 18, 2007 as well as on May 2 and 3, 2008 from Orange Avenue to 4th Street (a stretch of approximately six miles). The northbound probe runs were performed starting at about 4:45 AM and lasted until 8:30 AM. In addition to these probe vehicle runs, SMG staff carried out additional probe runs on field visits on some probe runs using GPS equipment during a field visit on July 16, 2008 to see if any PM peak period congestion could be identified.

Exhibit A4-3 illustrates the I-805 northbound probe vehicle runs performed by Caltrans on October 16 and 18, 2007 at various times intervals during the AM peak period. Probe runs between 4:45 AM and 6:00 AM are not shown, because no congestion was recorded during this time period. There are slow speeds and one bottleneck appears in the northbound direction at the Bonita Road on-ramp. However, this bottleneck was not verified by other data sources as will be discussed in later sections of this report. The congestion shown on the right of Exhibit A4-3 also shows evidence of another bottleneck north of Postmile 11.00. This bottleneck is not shown on the exhibit since the probe vehicles exited the freeway before encountering the bottleneck.

Caltrans did not identify congestion during the spring 2008 probe runs, so the data is not shown in this report.

Exhibit A4-3: Northbound Sample Probe Vehicle Runs – 2007



SOUTHBOUND

In the southbound direction, Caltrans District 11 collected probe vehicle data on November 14 and 15, 2007 and on March 25 and 26, 2008 from Plaza Blvd to H Street (a stretch of approximately three out of 29 miles in the study corridor). The southbound probe runs were done between approximately 3:30 PM and 7:30 PM. In addition to these probe vehicle runs, SMG staff performed a few probe runs using GPS equipment on July 16, 2008 during the PM peak period to validate these findings.

Exhibit A4-4 illustrates the I-805 southbound probe vehicle runs collected by Caltrans on November 14 and 15 at various time intervals during the PM peak period. As indicated, there are slow speeds and one bottleneck evident in the southbound direction. This bottleneck occurs at the Bonita Road off-ramp. Although not plotted, the spring 2008 probe runs also indicate slowing at this location. It is important to note that this location has the highest AADT of any location on the I-805 Corridor. AADT volumes are shown in Exhibit 2-2.

Exhibit A4-4: Southbound Sample Probe Vehicle Runs – 2007

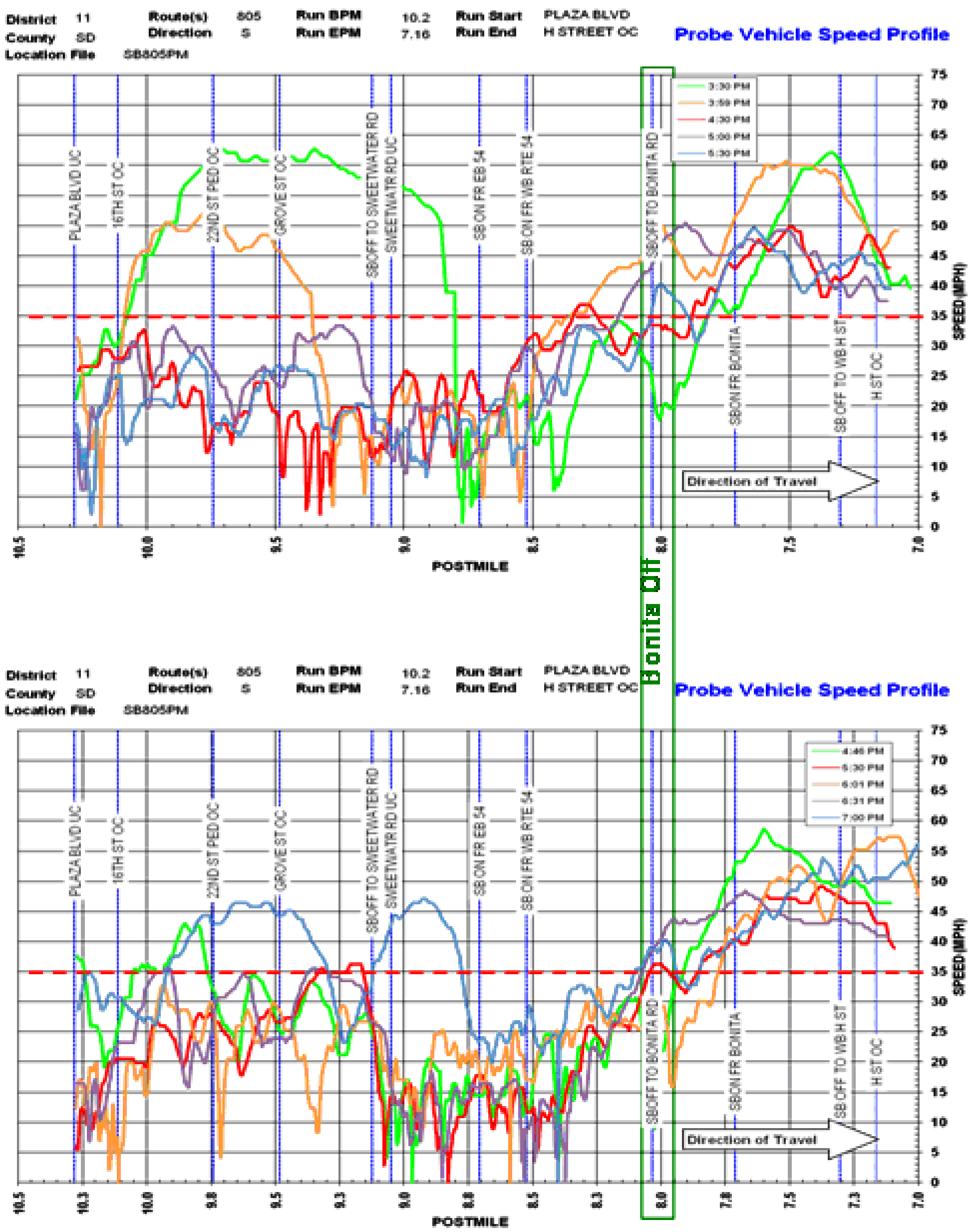


Exhibit A4-5 shows GPS data from the SMG southbound PM peak period probe runs taken on July 16, 2008 from the I-5 interchange in Sorrento Valley to Orange Avenue in Chula Vista between 3:15 PM and 6:45 PM. These limited runs confirm findings from both the Caltrans District 11 probe runs and from PeMS.

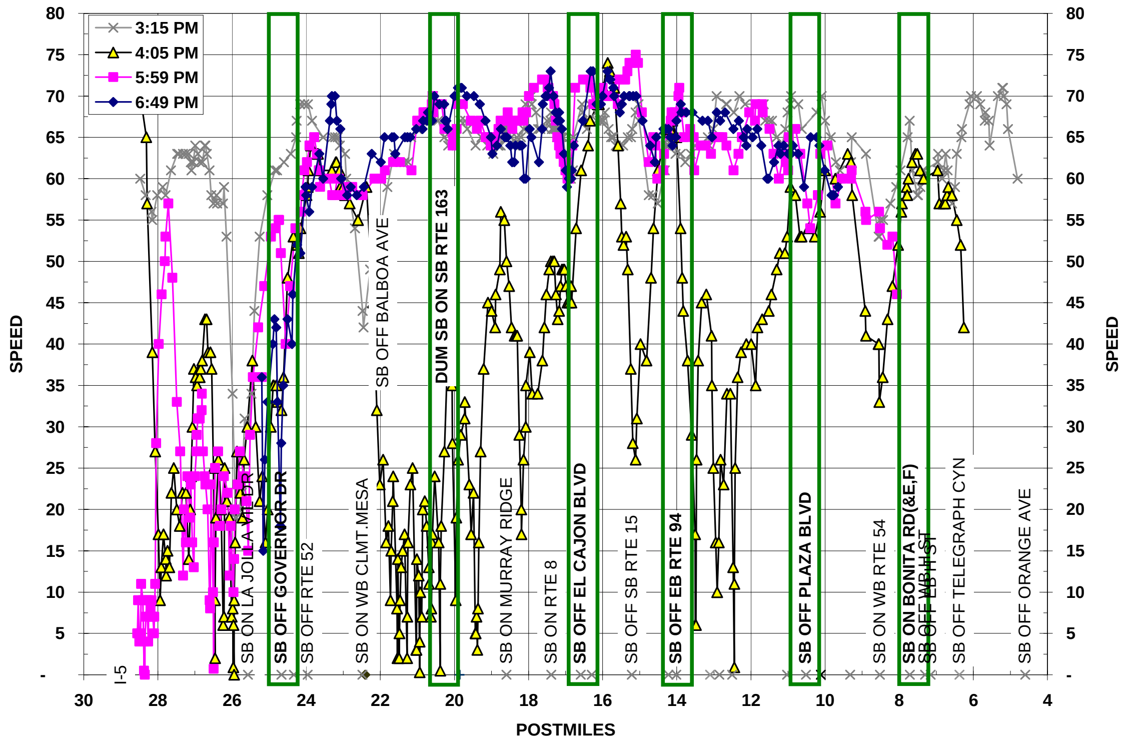
Exhibit A4-5 confirms findings from the District 11 probe runs and HICOMP that congestion results from slowing at Bonita Road in the southbound direction during the PM peak period. The exhibit also confirms the HICOMP bottleneck at Plaza Blvd, which is likely caused by merging onto SR-54. Plaza Blvd is ½ mile north of the SR-54 interchange. This area has one of the highest AADTs on the corridor (See Exhibit 2-2).

A smaller potential bottleneck identified by this field visit lies at El Cajon Blvd, which is located approximately 0.8 mile south of the I-8 interchange. This bottleneck may be caused by the loss of the auxiliary lane between the I-8 southbound on-ramp to I-805 and the southbound off-ramp to El Cajon Blvd. Slowing caused by heavy trucks while merging onto I-805 from I-8 up the steep grade may also contribute to the congestion at this location.

A third bottleneck identified during the SMG field visit is between Mesa College Drive/Kearny Villa Road and Murray Ridge Road interchanges, which lie just south of the SR-163 interchange. The HICOMP data does not show this bottleneck, although the portion from SR-163 to Balboa is shown as a minor bottleneck in the HICOMP data.

The fourth southbound PM bottleneck from the SMG field visit occurred at Governor Drive (shown in Exhibit A4-5). This bottleneck corresponds to the major HICOMP bottleneck that starts at Nobel Drive. It is confirmed by the PeMS analysis, which is discussed in detail in the next section. This was the most congested segment during the July 16, 2008 site visit. Every run of the day was congested.

Exhibit A4-5: Southbound Probe Vehicle Runs – July 16, 2008



Source: System Metrics Group, Inc.

Freeway Performance Measurement System (PeMS)

PeMS provides speed profile plots that are very similar to probe vehicle graphs. The PeMS speed profile plots can also be used to identify potential bottleneck locations. Unlike probe vehicle runs, each speed plot displays a single time snapshot across the corridor and separate plots are developed for each 5-minute interval. For example, an 8:00 AM plot shows the speed at 8:00 AM for one end of the corridor and at 8:00 AM for the other.

With probe vehicle runs, the time advances as the vehicle drives down the corridor, so the time at the end of the corridor is equal to the departure time plus the travel time. Despite this technical difference, both PeMS speed profile plots and probe vehicle graphs can be used to identify problem areas. PeMS also aggregates speed profile plots into speed contour plots that show how speeds change over time.

NORTHBOUND

To cover areas where no probe run data was collected and to validate the results of the probe runs discussed in the previous section, the same days were selected from PeMS.

Two types of PeMS plots were used: speed contour plots (which show speeds for all times at each postmile) and speed profiles for all lanes at a single time of day.

Exhibit A4-6 shows the PeMS speed contour bottleneck plots for Tuesday, October 16, 2007 and Thursday, October 18, 2007 – the same days that Caltrans District 11 ran the fall probe vehicle runs for the HICOMP data collection. Along the vertical axis is the time from 4 AM to 8:00 PM. The horizontal axis shows the corridor postmiles from I-5 interchange at the San Ysidro International Border with Mexico to the I-5 interchange in the City of San Diego in the Sorrento Valley Area. The various colors are the average speeds corresponding to the color speed chart shown at the bottom of the diagram. Dark blue and black areas represent congested areas where speeds drop below 45 mph.

Exhibit A4-7 is the speed profile for the same two days in October 2008, showing each lane along the entire corridor. It shows the speeds at 7:00 AM in the morning, which is the peak hour identified in the main body of the report (see Exhibits 3-11 and 3-13 for delay and travel time data respectively).

Two additional days were selected from November 2007 (same days selected for southbound probe vehicle run data collection) to examine and confirm the trends identified in the October sample days. Exhibits A4-8 and A4-9 provide speed contours and speed profiles for weekday samples on Wednesday, November 14, 2007 and Thursday, November 15, 2007. The sample days show the same bottleneck locations, indicating a pattern of recurring bottlenecks.

In addition to multiple days, averages over longer time periods were also analyzed. Exhibit A4-10 illustrates the weekday averages by each quarter of 2007 and 2008. Three of the four bottleneck locations are identified, further validating the reoccurring pattern of the bottleneck locations in the northbound direction. The quarterly data shows a fourth bottleneck at Claremont Mesa. This bottleneck is often hidden by the queues from the SR-52 off-ramp bottleneck.

Exhibit A4-6: PeMS Northbound I-805 Speed Contour Plots – October 2007

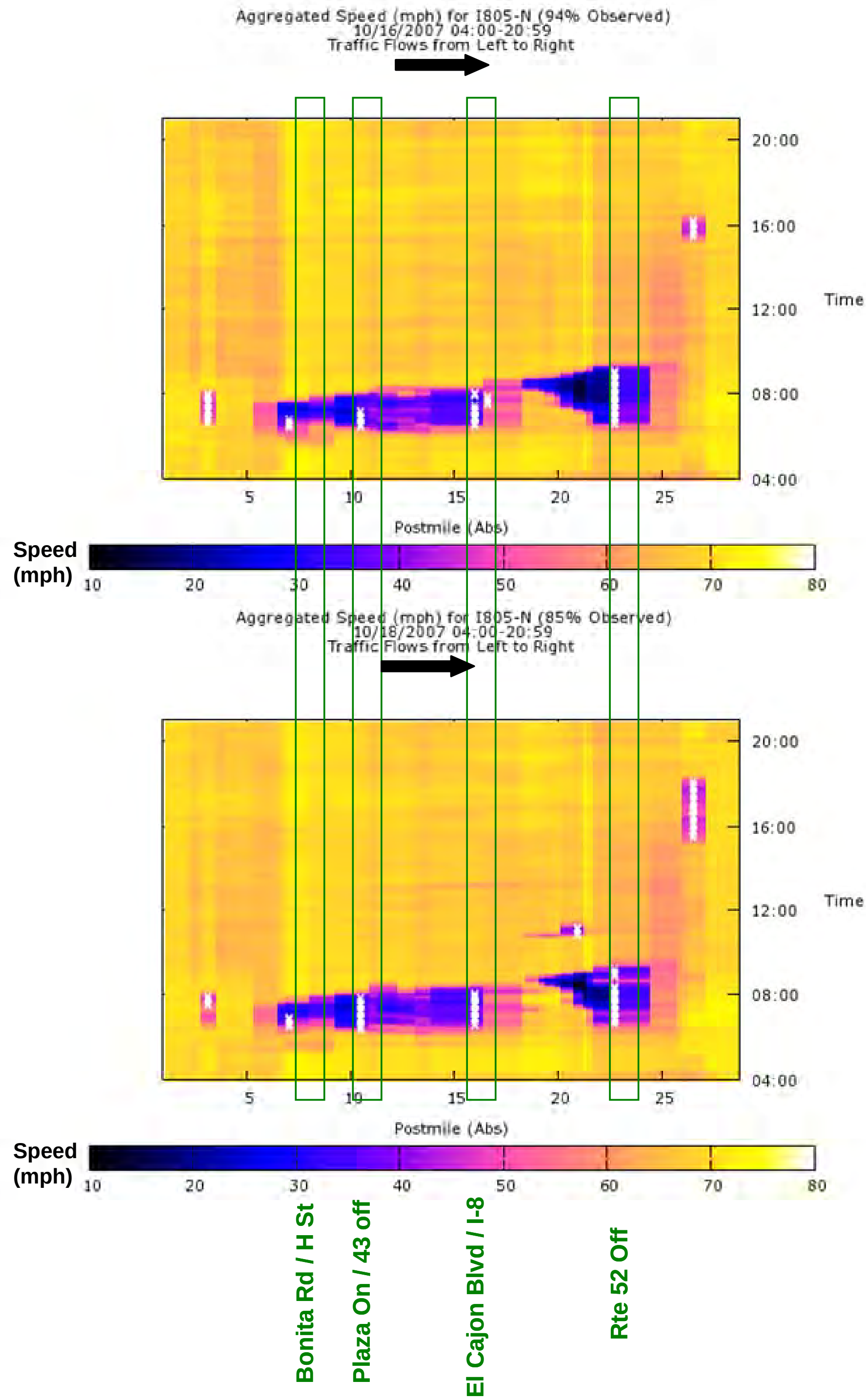


Exhibit A4-7: PeMS Northbound I-805 Speed Profile Plots – October 2007

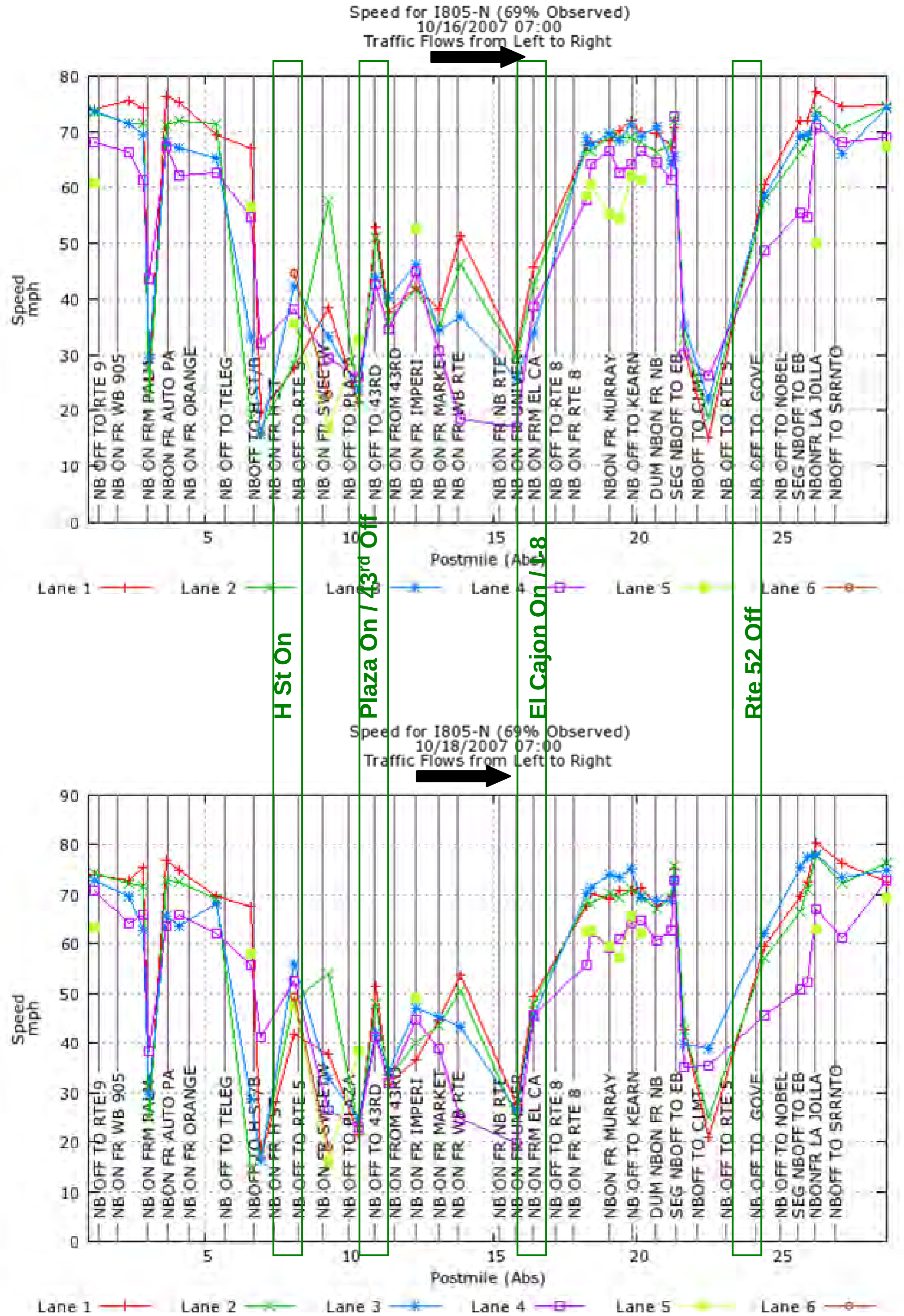


Exhibit A4-8: PeMS Northbound I-805 Speed Contour Plots – November 2007

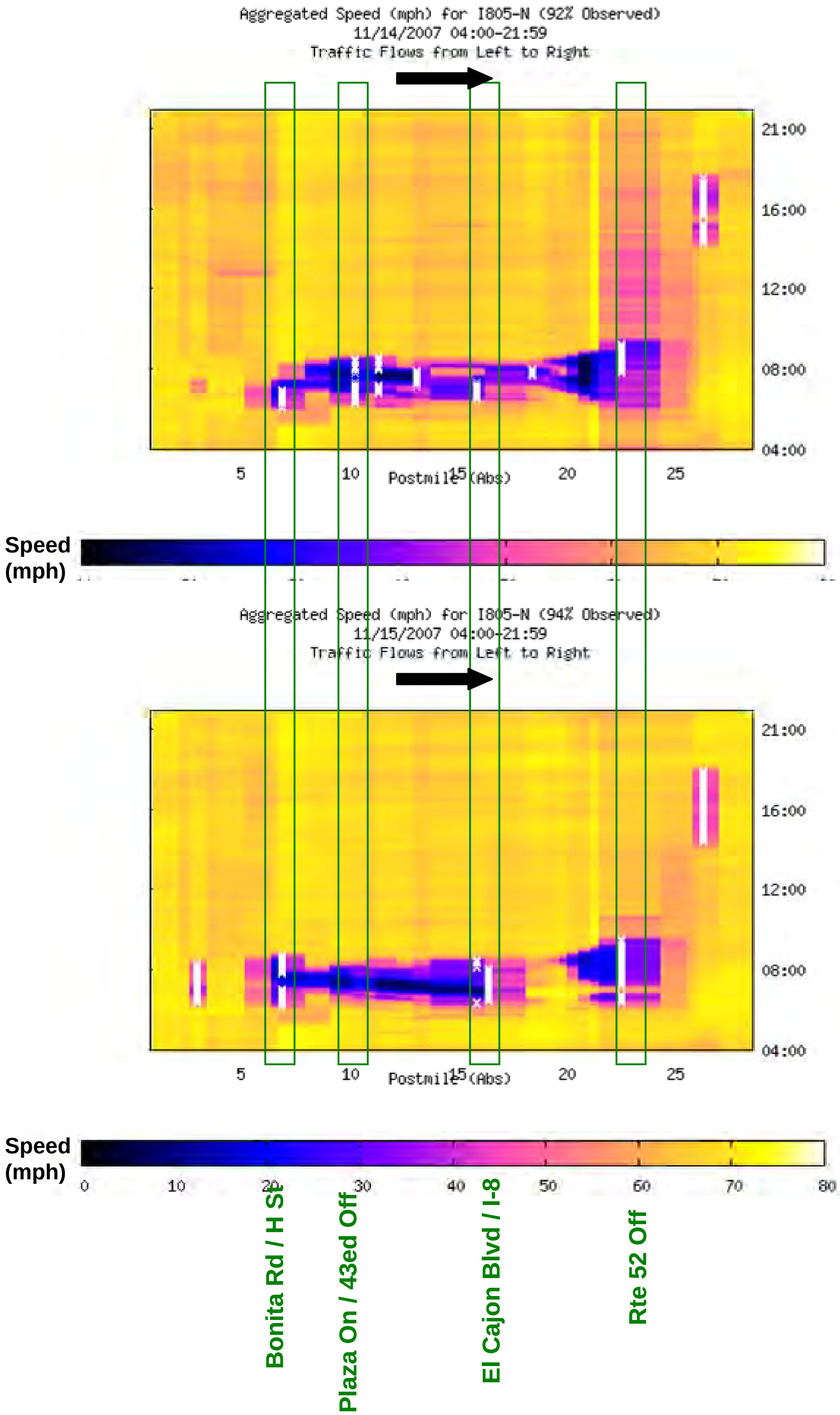


Exhibit A4-9: PeMS Northbound I-805 Speed Profile Plots – November 2007

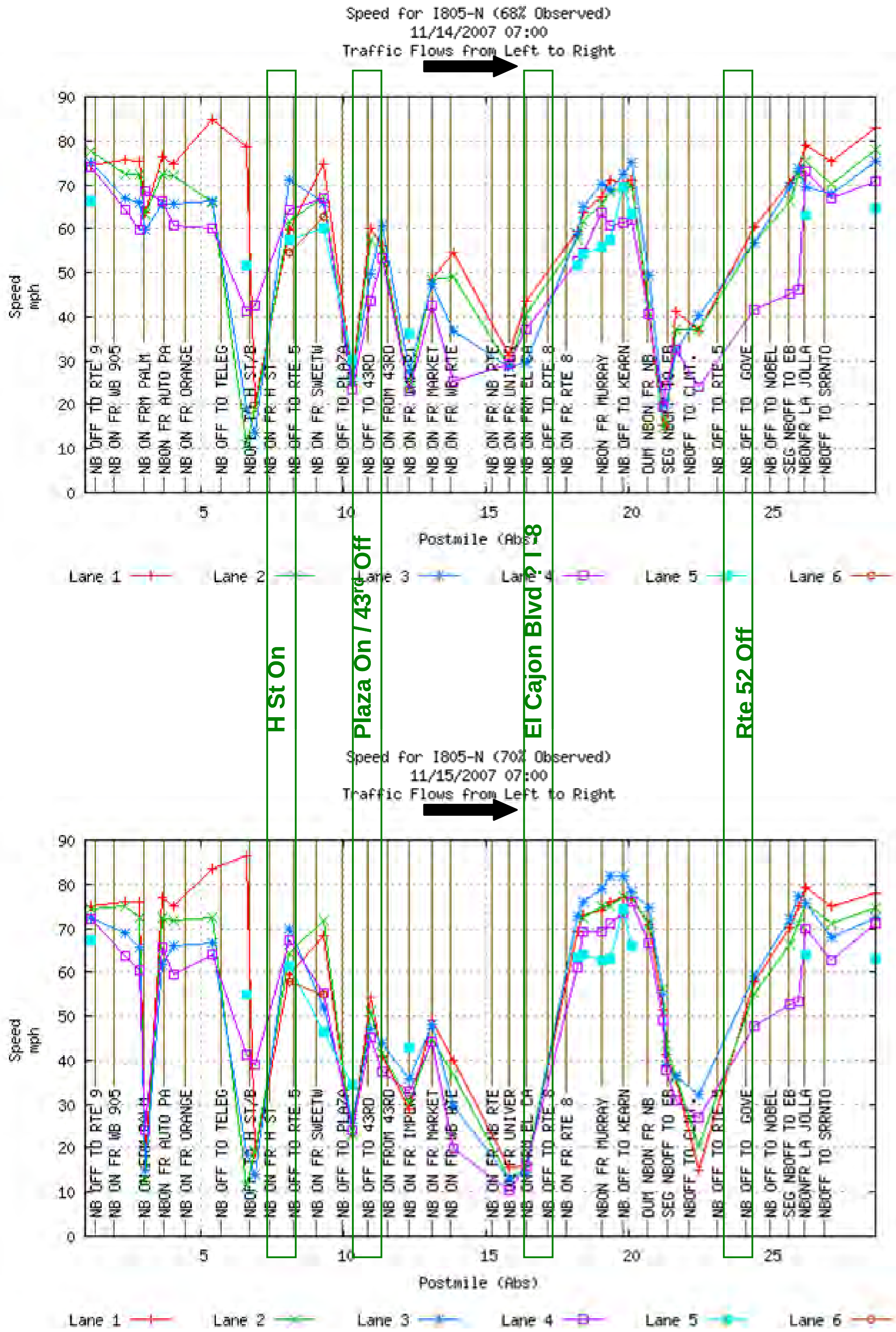
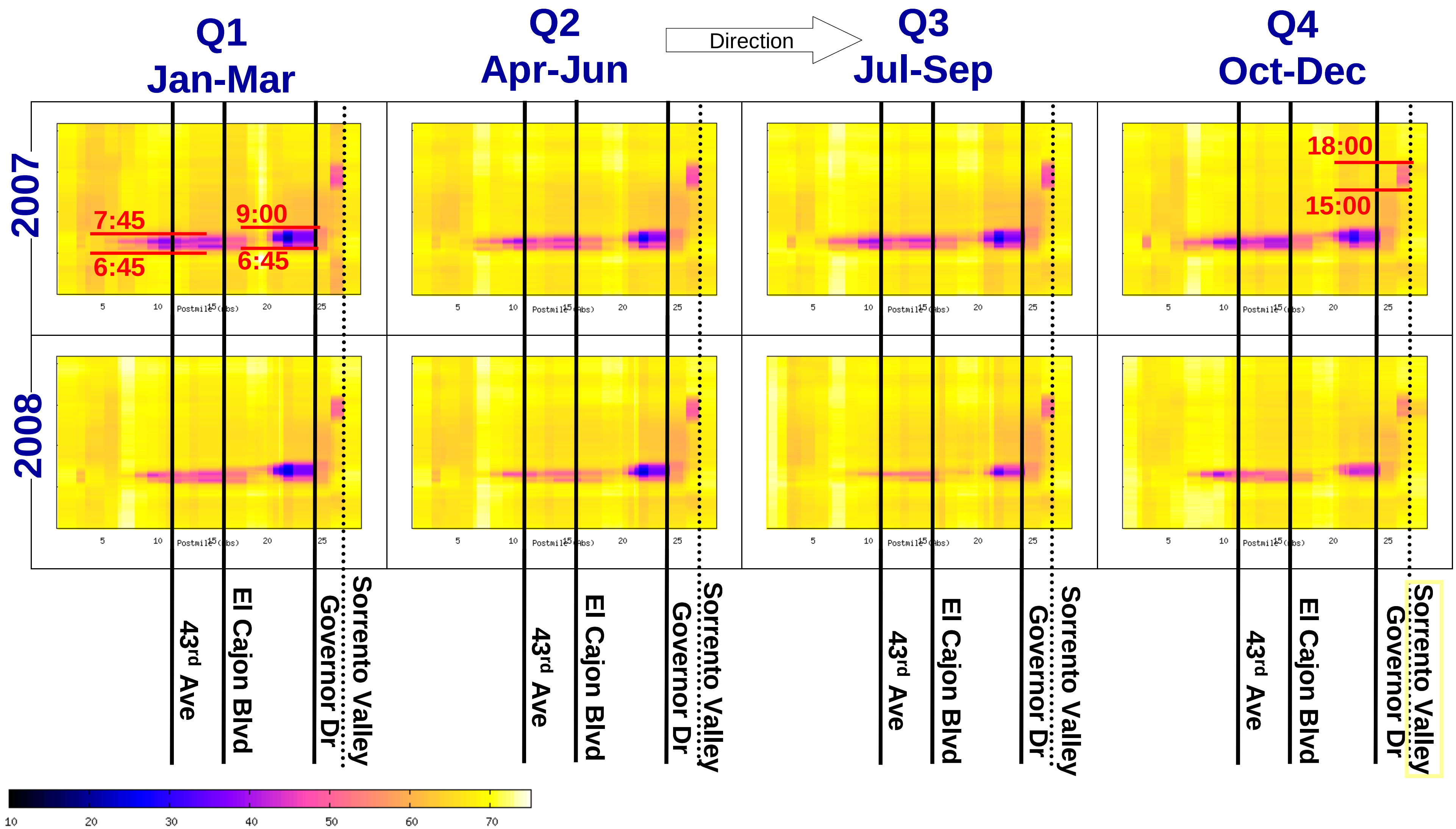


Exhibit A4-10: PeMS NB I-805 Weekday Speed Contours – 2007/08 Avg. by Quarter



The daily PeMS data validate the Bonita Road bottleneck identified from the northbound AM probe vehicle, but this bottleneck disappears in the quarterly data. The daily and quarterly PeMS data validate the bottlenecks identified from the HICOMP data near SR-52 and El Cajon Blvd (just south of the I-8 interchange).

Consistent with the July 2008 SMG field visit, the PeMS analysis did not reveal significant traffic congestion in the northbound PM period. There are some slower speeds around Sorrento Valley Road near the I-5 interchange, but the speeds did not appear to slow below 35 mph for the days analyzed.

SOUTHBOUND

The study team analyzed speed contour and speed profile plots for sample days in October and November 2007 for the southbound direction. Exhibits A4-11 to A4-13 show the southbound speed contour and profile plots. Traffic moves left to right on all three plots. Similar to the northbound PeMS speed contour analysis results, the PeMS southbound speed contour analysis results indicate reoccurring bottleneck locations across multiple weekdays and quarterly averages.

Exhibit A4-11: PeMS Southbound I-805 Speed Contour Plots – October 2007

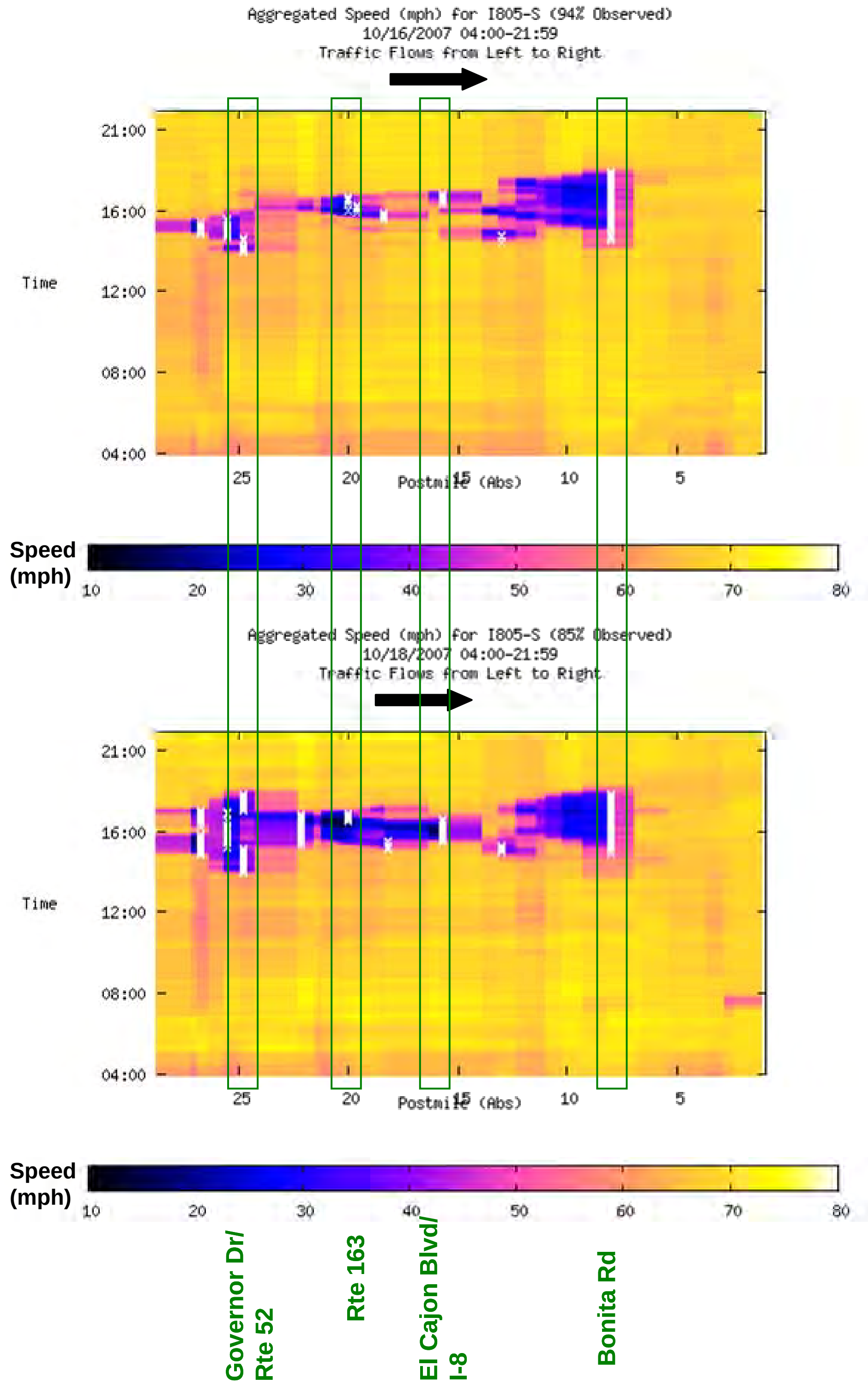


Exhibit A4-12: PeMS Southbound I-805 Speed Profile Plots – October 2007

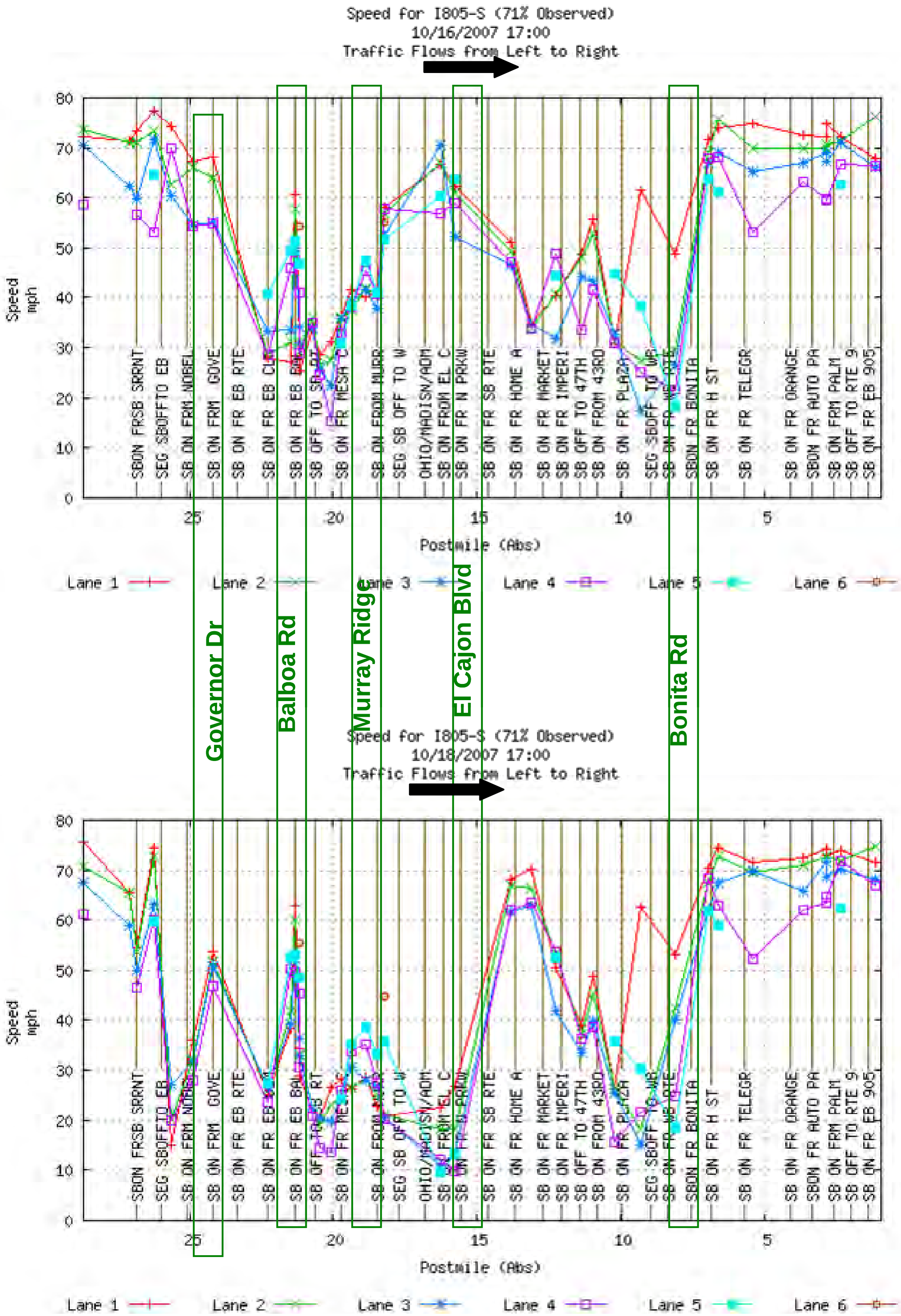


Exhibit A4-13: PeMS Southbound I-805 Speed Contour Plots – November 2007

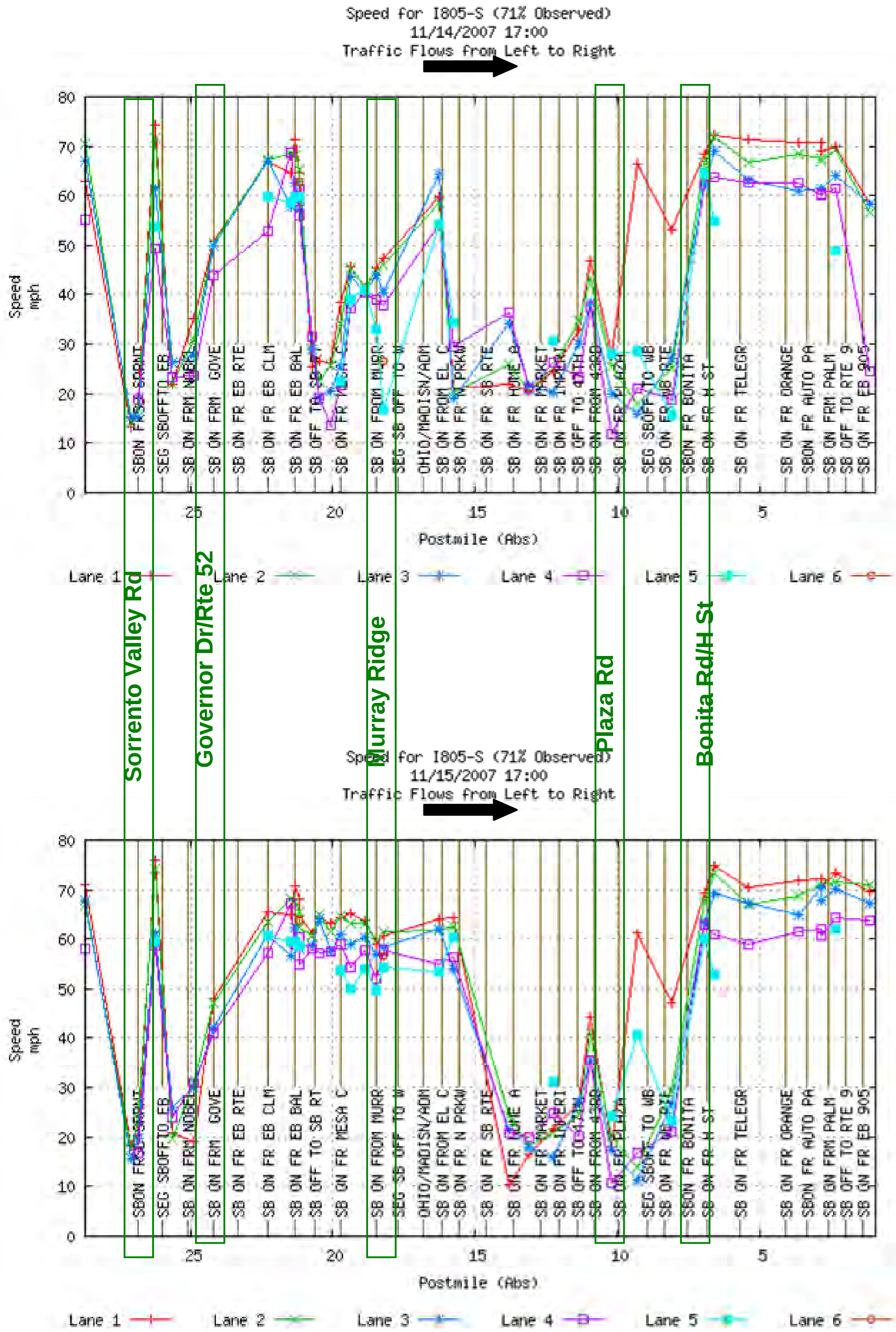
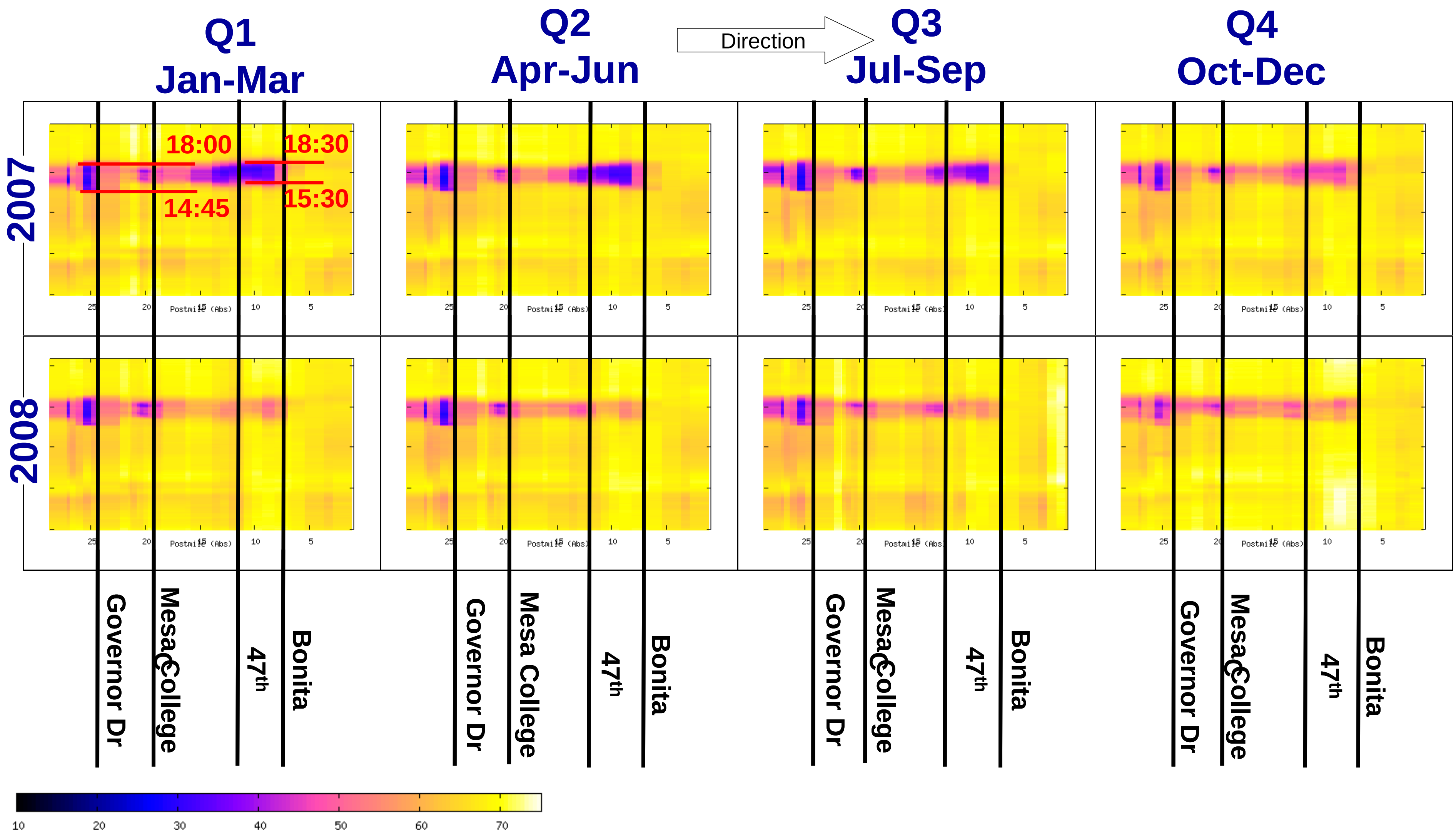


Exhibit A4-14: PeMS SB I-805 Weekday Speed Contours – 2007/08 Avg. by Quarter



As indicated in the exhibits, the first major southbound bottleneck identified from the PeMS data plots is at Bonita Road where SR-54 merges onto I-805 southbound. This bottleneck was confirmed on the field visit in July 2008.

A second bottleneck is shown at SR-163. Some slowing is also identified near Murray Ridge Road, which lies just south of the SR-163 and Mesa College Drive on-ramps to I-805 south. This bottleneck is also shown in the HICOMP report data. More field visits and document review are needed to assess the causality of this bottleneck.

A third major bottleneck is located at the Governor Drive southbound on-ramp and the SR-52 off-ramp from I-805.

A fourth bottleneck is located at Sorrento Valley Road just south of the I-5 interchange. Further analysis is needed to assess the causality of this bottleneck, but it may be due to merging from I-5.

There is a smaller bottleneck at El Cajon Blvd. This bottleneck was identified during the field visit, but the PeMS data shows it is not as consistent as the other bottlenecks. This is particularly evident in the “long contour” plots shown in Exhibit A4-14. The bottleneck is likely caused by the merge of I-8 traffic onto I-805 southbound just north of the El Cajon Blvd interchange.

Bottleneck Summary

Exhibit A4-15 summarizes the potential bottleneck locations based on the four sources described earlier: 2007 HICOMP report, Caltrans District 11 probe vehicle runs, SMG field visit, and PeMS speed plots and speed contour plots. These bottlenecks may be revised following further field reviews and after feedback is received from SANDAG, Caltrans District 11, and other stakeholders. SMG staff has not verified all of the bottlenecks shown in the exhibit through field visits. Additional data and extensive field reviews will be necessary to confirm their locations and identify their causes.

Exhibit A4-15: I-805 Bottleneck Summary

Period	Dir	Bottleneck Segment	PeMS Absolute Postmile		Caltrans Postmile		Bottleneck Location	Queue End Location	HICOMP	Probe Runs		PeMS
			Low PM	High PM	Low PM	High PM				Caltrans D11	SMG Field Visit	
AM	Northbound	1	6.0	15.5	6.1	15.6	I-15	Telegraph Canyon Rd	X		Not Performed	
			6.6	7.9	6.8	8.0	Bonita Rd/H St (s/o SR-54)	J St OC		X		
			6.8	10.2	6.9	10.3	Plaza Blvd	Bonita Rd/H St (s/o SR-54)				X
			10.2	16.4	10.3	16.5	El Cajon Blvd	Plaza Blvd				X
		2	15.5	17.3	15.6	17.4	El Cajon Blvd	I-15	X			
		3	18.5	23.4	18.6	23.5	Governor Dr/Rte 52	SR-163/Clairemont Mesa	X			X
	SB	4	3.3	6.0	3.4	6.1	Telegraph Canyon Rd	Main St	X			
PM	NB	5	26.0	29.2	26.2	29.3	I-5	La Jolla Village Dr	X			
	Southbound	6	7.1	13.8	7.2	13.9	Bonita Rd/H St (s/o Rte 54)	Rte 94	X	X	X	X
		7	18.2	20.7	18.3	20.8	I-8/Murray Ridge	Rte 163/Balboa	X		X	X
		8	24.4	27.5	24.5	27.6	Governor Dr/Rte 52	Sorrento Valley Rd	X		X	X
		9	26.9	29.0	27.0	29.1	Sorrento Valley Rd	Mira Mesa Blvd			X	X