CORRIDOR SYSTEM MANAGEMENT PLAN (CSMP)
SAN DIEGO COUNTY I-805
FINAL REPORT

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System Metrics Group, Inc.

I-805 Corridor System Management Plan (CSMP)
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1. INTRODUCTION

This document represents the Final Report the San Diego Interstate 805 (I-805) Corridor System Management Plan (CSMP) developed on behalf of the San Diego Association of Governments (SANDAG) and the California Department of Transportation (Caltrans) by System Metrics Group, Inc. (SMG).

This report contains the results of a two-year study that included several key steps, including:

- Stakeholder Involvement (discussed below in this Section 1)
- Corridor Performance Assessment (Sections 2 and 3)
- Bottleneck Identification and Causality Analysis (Sections 4 and 5)
- Scenario Development and Analysis (Section 6)
- Conclusions and Recommendations (Section 7)

The I-805 CSMP is based on an internal Caltrans initiative and funded through a 2006 Finance Letter. In November 2006, voters approved Proposition 1B (The Reduction, Air Quality, and Port Security Bond Act of 2006). This ballot measure included a funding program to be deposited into a Corridor Mobility Improvement Account (CMIA).

For SANDAG or Caltrans to receive CMIA funding, the California Transportation Commission (CTC) required that project nominations describe how mobility gains would be maintained over time. CTC guidelines give priority to project nominations that have a CSMP. Hence, a CSMP aims to define how corridors will be managed over time, focusing on operational strategies in addition to already funded expansion projects. The goal is to get the most out of the existing system and maintain and/or improve corridor performance.

CMIA money is partially funding one project on I-805 linked to another CMIA-funded project on I-5. The project will construct high occupancy vehicle (HOV) lanes and direct access ramps (DAR) in the median of I-805 from Carroll Canyon Road in Sorrento Valley to the existing HOV lanes on I-5. Approximately, $82 million in CMIA funds have been adopted by the CTC for this project.

Even though San Diego was exempted from the requirement of developing and submitting a CSMP to the CTC, SANDAG, and Caltrans District 11 decided to develop it to evaluate the currently programmed and planned projects, modify them if needed, and potentially identify additional improvements to consider for future funding.

Other projects on I-805 for which CMIA funding was requested, but not adopted include two southbound auxiliary lanes from E Street to SR-54 in Chula Vista, and HOV lanes from Palomar Street in Chula Vista to SR-94 in the City of San Diego.

The I-805 CSMP involved corridor stakeholders throughout in two ways. First, a technical committee was formed and met on an almost monthly basis to discuss progress, technical challenges, data needs, and preliminary conclusions. This technical committee was comprised mainly of Caltrans and SANDAG professionals as well as the consulting team members.

Other corridor stakeholders, including representatives from cities bordering I-805, were debriefed at critical milestones. Feedback from these stakeholders helped solidify the findings of the performance assessment, bottleneck identification, and causality analysis given their intimate knowledge of local conditions. Moreover, various stakeholders have provided support and insight, and shared valuable field and project data without which this study would not have been possible.

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 undertaken by Cambridge Systematics, Inc., HNTB, Inc., and SMG, alternative investment strategies were modeled using the year 2006 as the base year and 2020 as the horizon year.

This CSMP 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, it is recommended that updates occur no less than every two to three years. To the extent possible, this document has been organized to facilitate such updates.

The following discussion provides background to the system management approach in general and CSMPs in particular.

What is a Corridor System Management Plan (CSMP)?

In November 2006, voters approved Proposition 1B (The Reduction, Air Quality, and Port Security Bond Act of 2006). This ballot measure included a funding program that to be deposited into a Corridor Mobility Improvement Account (CMIA). For a project to be nominated by a Caltrans district or regional agency, California Transportation Commission (CTC) CMIA guidelines require that the project nomination describe how mobility gains of urban corridor capacity improvements would be maintained over time.

The guidelines also stipulate that the CTC will give priority to project nominations that include a CSMP. A CSMP is a comprehensive plan for maintaining the congestion reduction and productivity improvements achieved on a CMIA corridor. CSMPs

incorporate all travel modes - including State highways and freeways, parallel and connecting Roadways, public transit (bus, bus rapid transit, light rail, intercity rail), carpool/vanpool programs, and bikeways. CSMPs also include intelligent transportation technologies such as ramp metering, coordinated traffic signals, changeable message signs for traveler information, and improved incident management.

This I-805 CSMP is the first attempt to integrate the overall concept of system management into SANDAG's planning and decision making processes for the corridor. The traditional planning approach identified localized freeway problem areas and then developed solutions to fix those problems often by building expensive capital improvement projects. The I-805 CSMP focuses on the system management approach with a greater emphasis on using on-going performance assessments to identify operational strategies that yield higher congestion reduction and productivity benefits relative to the amount of money spent.

What is System Management?

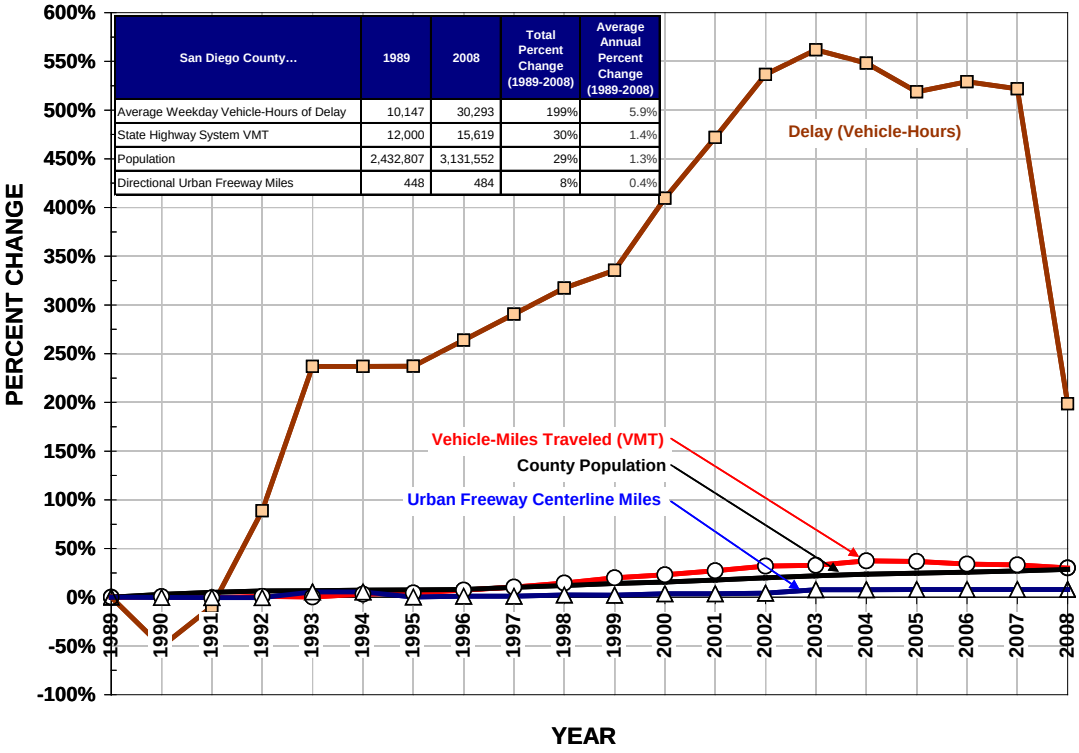
With the rising cost and complexity of construction and right of way acquisition, the era of large-scale freeway construction is ending. Compared to the growth of vehicle-miles traveled (VMT) and population, congestion is growing at a much higher rate.

Exhibit 1-1 shows San Diego County congestion (measured by average weekday recurring vehicle-hours of delay), VMT, and population between 1989 and 2008. Over that 20-year period, congestion nearly doubled from the 1989 congestion level (just under six percent per year). Over the same period, VMT and population rose by approximately one-third (1.4 percent per year). However, urban freeway miles barely grew at less than one-half a percentage point per year.

Clearly, infrastructure expansion has not kept pace with demographic and travel trends and is not likely to keep pace in the future. Therefore, if conditions are to improve, or at least not deteriorate as fast, a new approach to transportation decision making and investment is needed.

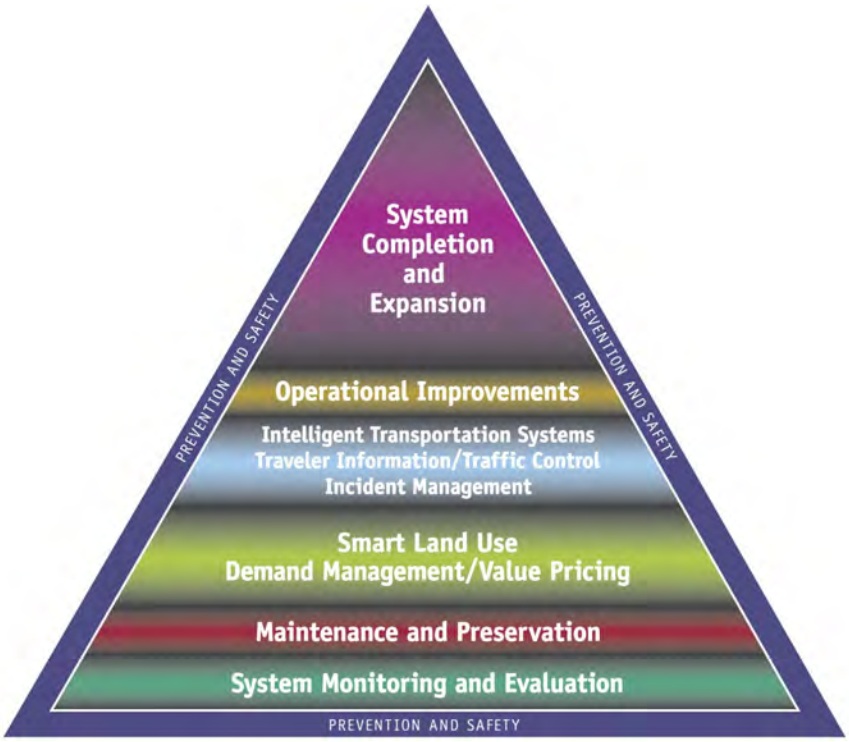
SANDAG and the State both recognize this dilemma. Caltrans, for example, has adopted a mission statement that embraces the concept of system management. This mission and its goals are supported by the system management approach illustrated in the System Management pyramid shown in Exhibit 1-2.

Exhibit 1-1: San Diego County Growth Trends 1989-2008



San Diego County...	1989	2008	Total Percent Change (1989-2008)	Average Annual Percent Change (1989-2008)
Average Weekday Vehicle-Hours of Delay	10,147	30,293	199%	5.9%
State Highway System VMT	12,000	15,619	30%	1.4%
Population	2,432,807	3,131,552	29%	1.3%
Directional Urban Freeway Miles	448	484	8%	0.4%

Exhibit 1-2: System Management Pyramid



System Management is being touted at the federal, state, regional, and local levels. It addresses both transportation demand and supply to get the best system performance possible. Ideally, SANDAG and Caltrans would develop a regional system management plan that addresses all components of the pyramid for an entire region comprehensively. However, because the system management approach is relatively new, it is prudent to apply it at the corridor level first.

The foundation of system management is monitoring and evaluation (shown as the base of the pyramid). This monitoring is done by comprehensive performance assessment and evaluation. Understanding how a corridor performs and why it performs the way it does is critical to creating appropriate strategies. Section 4 is dedicated to performance assessment. It would be desirable for SANDAG and Caltrans to update this performance assessment every two or three years to ensure that future corridor issues can be identified and addressed before breakdown occurs on the corridor.

A critical goal of system management is to "get the most out" of the existing system, or maximize system productivity. One would think that a given freeway is most productive during peak commute times. Yet, this is not true for heavy commute corridors. In fact, for San Diego's urban freeways that have been experiencing growing congestion, the opposite is true. When demand is the highest, the flow breaks down and productivity declines.

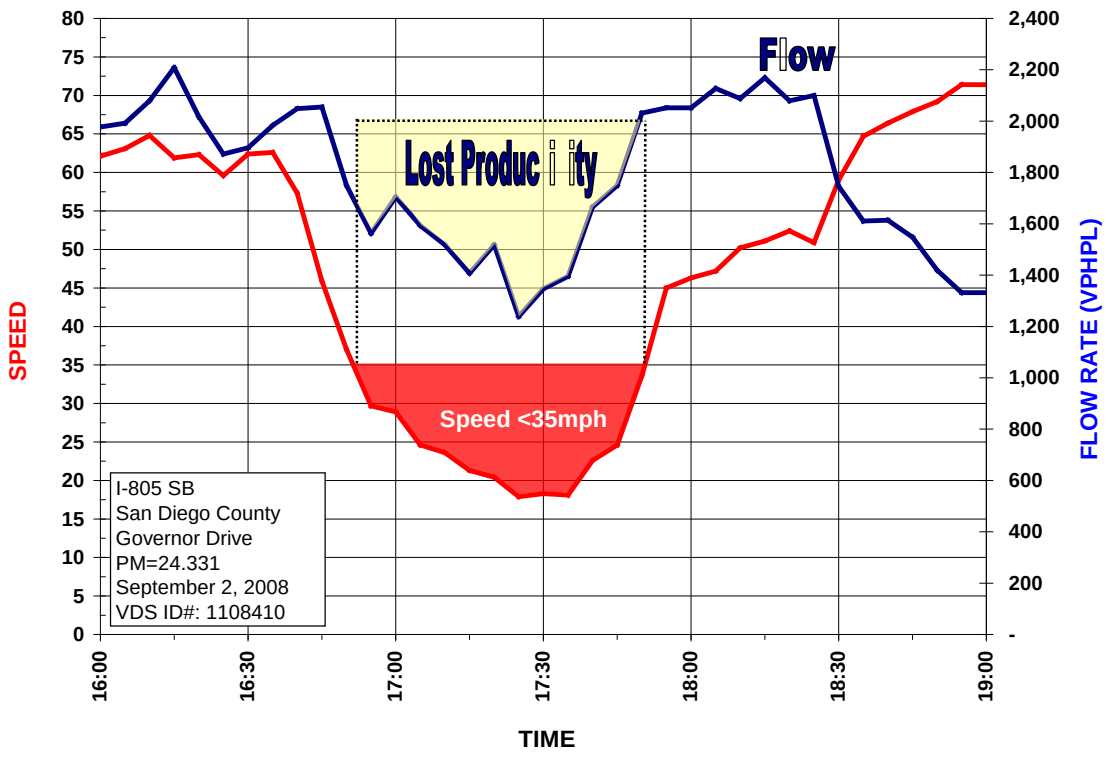
Exhibit 1-3 illustrates how congestion leads to lost productivity. The exhibit was created using observed I-805 data from a non-holiday weekday in September 2008 from the Freeway Performance Measurement System (PeMS). It shows speeds (in red) and flow rates (in blue) on southbound I-805 at Governor Drive just north of SR-52. This location is the most congested location on this corridor.

Flow rates (measured as vehicl7-per-hour-per-lane or vphpl) at Governor Drive average just over 2,000 vphpl between 4:00 PM and 4:45 PM, which is a typical peak period maximum flow rate. However, flow rates higher than this effective maximum flow cannot be sustained for a significant time.

Once volumes exceed this maximum rate, traffic breaks down and speeds plummet to below 35-45mph. Rather than being able to accommodate the same number of vehicles, flow rates also drop and vehicles back up creating what we know as congestion. In the example in Exhibit 1-3, throughput drops by nearly 25 percent on average during the peak period, and at 5:25 PM, it drops by nearly 40 percent. Since this is a four lane Road, it is as if one full lane were taken away during rush hour. Stated differently, just when the corridor needed the most capacity, it performed in the least productive manner and effectively lost lanes. This is a major cost of congestion that is rarely discussed or understood.

This is lost productivity. Where there is sufficient automatic detection, this loss in throughput can be quantified and presented as "Lost-Lane Miles". Discussed in more detail later in this report, the productivity losses on southbound I-805 were about 7.5 lane-miles during the PM peak period in 2006. This means that several hundred million dollars of previous investments on I-805 were idle when demand was at its highest. It is obvious that SANDAG and Caltrans need to leverage these past investments to the extent possible and this can be done in large part by operational strategies.

Exhibit 1-3: Productivity Loss During Severe Congestion

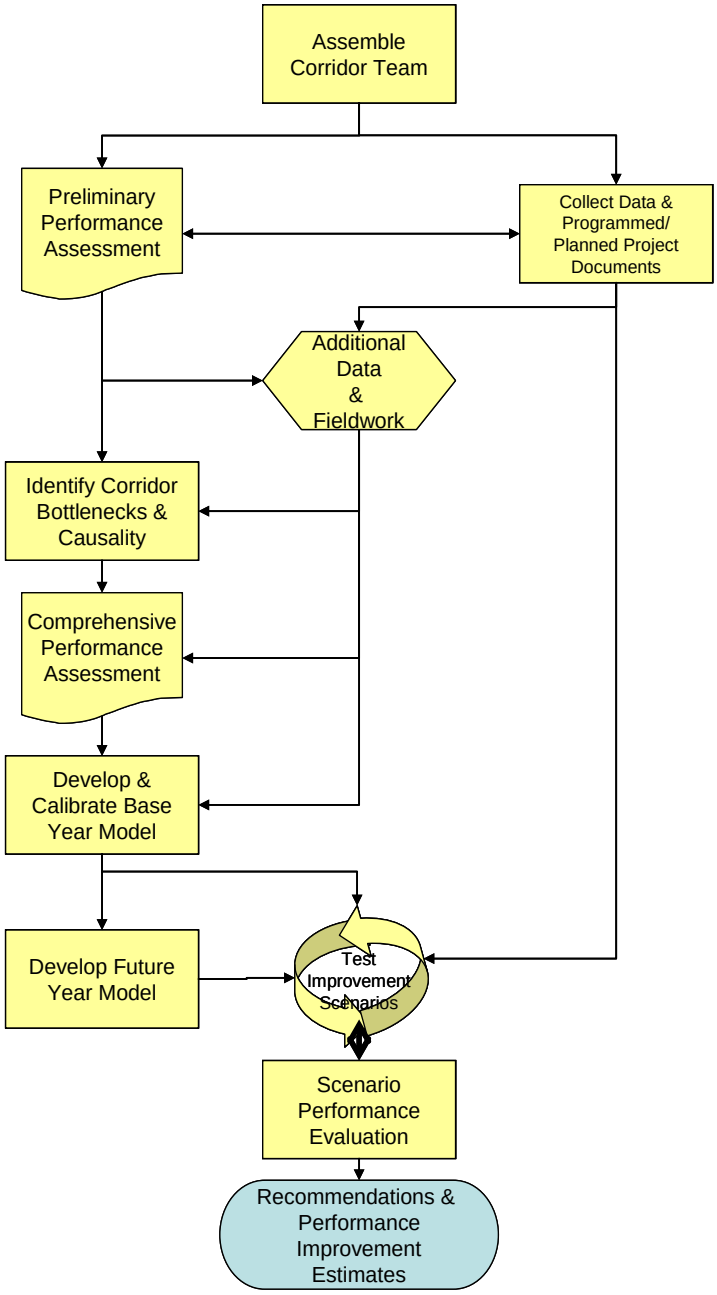


Infrastructure expansion, although still an important strategy (at the top of the pyramid in Exhibit 1-2), cannot be the only strategy used to meet the mobility needs of the region. System management is needed to get the most out of the current system and must be an important consideration as we evaluate the need for facility expansion investments. Simply stated, the system management philosophy begins by defining how the system is performing, understanding why it is performing that way, and then evaluating different strategies, including operations centric strategies, to address deficiencies. These strategies can then be evaluated using various tools to assess potential benefits to determine if these benefits are worthy of the associated strategy costs.

Study Approach

The I-805 CSMP study approach follows system management principles by placing an emphasis on performance monitoring and evaluation (the base of the pyramid in Exhibit 1-2), and on using lower cost operational improvements to maintain system productivity. Exhibit 1-4 is a flow chart that illustrates this approach. Each step of the approach is described following the chart.

Exhibit 1-4: Study Approach



Assemble Corridor Team

The first task in this effort was undertaken by SANDAG and Caltrans with the creation of the Project Development Team (PDT). The PDT met most months to review project progress and to provide feedback to the study team. At critical stages of the project, weekly telephone conference calls were held to ensure project delivery and to troubleshoot issues.

In addition to the PDT, SANDAG and Caltrans also identified cities and other major stakeholders along the I-805 corridor whose input would be needed at critical project junctures (e.g., performance assessments, scenario reviews, and final report). The stakeholders group was convened three times during the study period to receive local feedback on PDT issues and "buy off" at critical junctures.

Preliminary Performance Assessment

The Final Preliminary Performance Assessment was delivered to SANDAG in September 2008. The preliminary assessment presented a brief description of the corridor and existing projects along on or adjacent to I-805. A corridorwide performance assessment was completed for four key performance areas: mobility, reliability, safety, and productivity. Performance trends from was reported for 2005-2007. The assessment also included a preliminary bottleneck location assessment based on readily available existing data and limited field observations.

Collect Data and Programmed/Planned Project Information

In conjunction with the Preliminary Performance Assessment, SMG reviewed existing studies, plans and other programming documents to assess additional data collection needs for modeling and scenario development. One of the key elements of this study was to identify projects that would be implemented in the short- and medium-term time frames to be included in the TransModeler micro-simulation model developed by Cambridge Systematics, Inc.

Additional Data Collection and Fieldwork

A part of this effort was undertaken by Cambridge Systematics, Inc. to determine locations where additional manual traffic counts would be needed to calibrate the 2006 Base Year model. The manual counts were also used by SMG to identify bottleneck locations. Cambridge Systematics, Inc. also led efforts to collect corridor travel time data.

SMG conducted several field visits between July and December 2008 to collect travel time data, observe field conditions during peak periods, and to take video tapes of potential bottleneck locations. This travel time data was used to supplement the data collected by Cambridge Systematics, Inc.

This fieldwork was used to identify bottlenecks and assess the causes of the major bottlenecks on the corridor. This fieldwork will be discussed in relevant sections of this report.

Identify Corridor Bottlenecks and Causality

Building on the Preliminary Performance Assessment and the fieldwork, SMG identified major AM and PM peak period bottlenecks along the corridor. The team identified four major northbound AM bottlenecks (43rd Street., El Cajon Boulevard., and SR-52/Governor Dr.), and four major southbound PM bottlenecks (Governor Dr./SR-52, Mesa College Road., 47th St/Palm, and Bonita Road/E St/SR-54). These bottlenecks will be discussed in detail in Section 5 of this report.

Comprehensive Performance Assessment

Once the bottlenecks were identified and the causality of the bottlenecks determined, SMG prepared the Comprehensive Performance Assessment. This report builds on the Preliminary Performance Assessment except that it included the bottleneck causality findings – including performance results for each individual bottleneck area. It also included corridorwide performance results updated to reflect 2008 and 2009 conditions.

Develop and Calibrate Base Year Model

Using the bottleneck areas as the basis for calibration, Cambridge Systematics, Inc. developed a calibrated base year model for the year 2006. This model was calibrated against California and Federal Highway Administration (FHWA) guidelines for model calibration. In addition, the model as evaluated to ensure that each bottleneck area was represented in the model and that travel times and speeds were consistent with observed data. This process required several review iterations by SMG and the PDT.

Develop Future Year Model

Following the approval of the 2006 Base Year model, Cambridge Systematics, Inc. developed a 2020 Horizon Year model to be used to test the impacts of short-term programmed projects as well as future operational improvements including the impacts of improved incident management on the corridor.

Test Improvement Scenarios

The study team, led by SMG developed up to 15 scenarios to evaluate. Of these, 11 were selected for the final report. Short-term scenarios included programmed projects that would likely be completed within the next five years, and other operational improvements such as improved ramp metering.

Simulation results for each scenario were subjected to a benefit-cost evaluation to determine how much “bang for the buck” each scenario would deliver.

In addition to the short-term project testing, short-term projects were also tested using the 2020 forecast simulation model. This was to assess the medium-term impacts of these projects. Additional scenarios were developed and tested using only the 2020 model. These scenarios included programmed and planned projects that would not be completed within five years of 2006 and that would likely only experience benefits in the medium-term.

The scenario testing is presented in detail in Section 7 of this report.

Scenario Performance Evaluations

Once scenarios were developed and fully tested, SMG performed a detailed benefit-cost assessment using the Cal-B/C tool developed by SMG on behalf of Caltrans.

Final scenario performance can be found in Section 7 of this report.

Recommendations and Performance Improvement Estimates

SMG and HNTB, Inc. then developed final recommendations for future operational improvements that could reasonably be expected to maintain the mobility gains achieved by existing programmed and planned projects. Section 8 summarizes these findings.

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

2. *Corridor Description* describes the corridor, including the roadway facility, recent improvements, major interchanges and relative demands at these interchanges, relevant transit services serving freeway travelers, major Intermodal facilities around the corridor, special event facilities/trip generators, and an I-805 origin-destination demand profile from the SANDAG regional model.

3. *Corridor-Wide Performance and Trends* presents multiple years (2005-2009) of performance data for the freeway portion of the I-805 corridor. Statistics are included for the mobility, reliability, safety, and productivity performance measures.

4. *Bottleneck Identification and Performance* identifies bottlenecks, or choke points, on the I-805. 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 performance results for delay, productivity, and safety by major "bottleneck area", which allows for the relative prioritization of bottlenecks in terms of their contribution to corridor performance degradation.

5. *Causality Analysis* diagnoses the bottlenecks identified in Section 5 and identifies the causes of each bottleneck through additional data analysis and field observations. Most of the major bottleneck locations identified in this report were videotaped to verify our conclusions. Sections 5 and 6 provide input to selecting projects to address the critical bottlenecks, and they provide the baseline against which the micro-simulation models were validated.

6. *Scenario Development and Evaluation* discusses the scenario development approach and summarizes the expected future performance based on the TransModeler micro simulation model developed by Cambridge Systematics, Inc. for the I-805 corridor.

7. *Conclusions and Recommended Improvements* describes the projects and scenarios that were evaluated and recommends a phased implementation of the most promising set of strategies.

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 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 twelve-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 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 to the existing northbound I-5 HOV lane. This northern segment of the corridor has one HOV project with adopted CMIA funding.

According to 2008 traffic volumes from Caltrans, I-805 carries between 51,000 and 245,000 annual average daily traffic (AADT) 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.

I-805 is a Surface Transportation Assistance Act (STAA) state route (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 Caltrans 2008 Annual Average Daily Truck Traffic book on the California State Highway System, trucks make up about 6.3 percent of total daily traffic along the entire corridor, with the highest percentage (7.6 percent) occurring at the northern I-805 terminus with I-5 in Sorrento Valley. The segment between SR-905 and Telegraph Canyon Road in Chula Vista also reported truck percents exceeding seven percent. The I-5 location count was verified in 2007, and counts at Telegraph Canyon Road and SR-52 were validated in 2004. Most of the remaining counts were estimated in either 2003 or 2004.

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

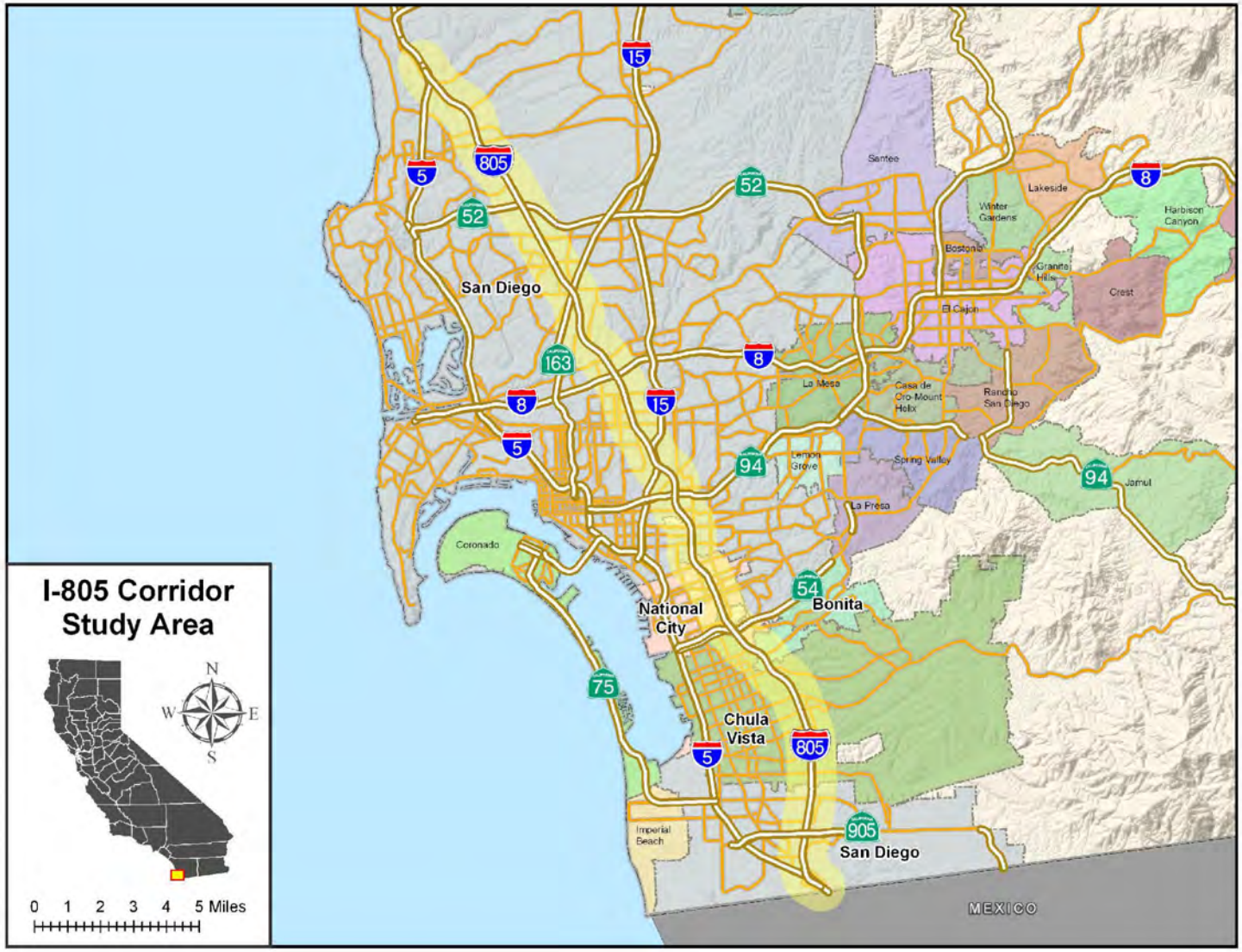


Exhibit 2-2: Corridor Lane Configuration

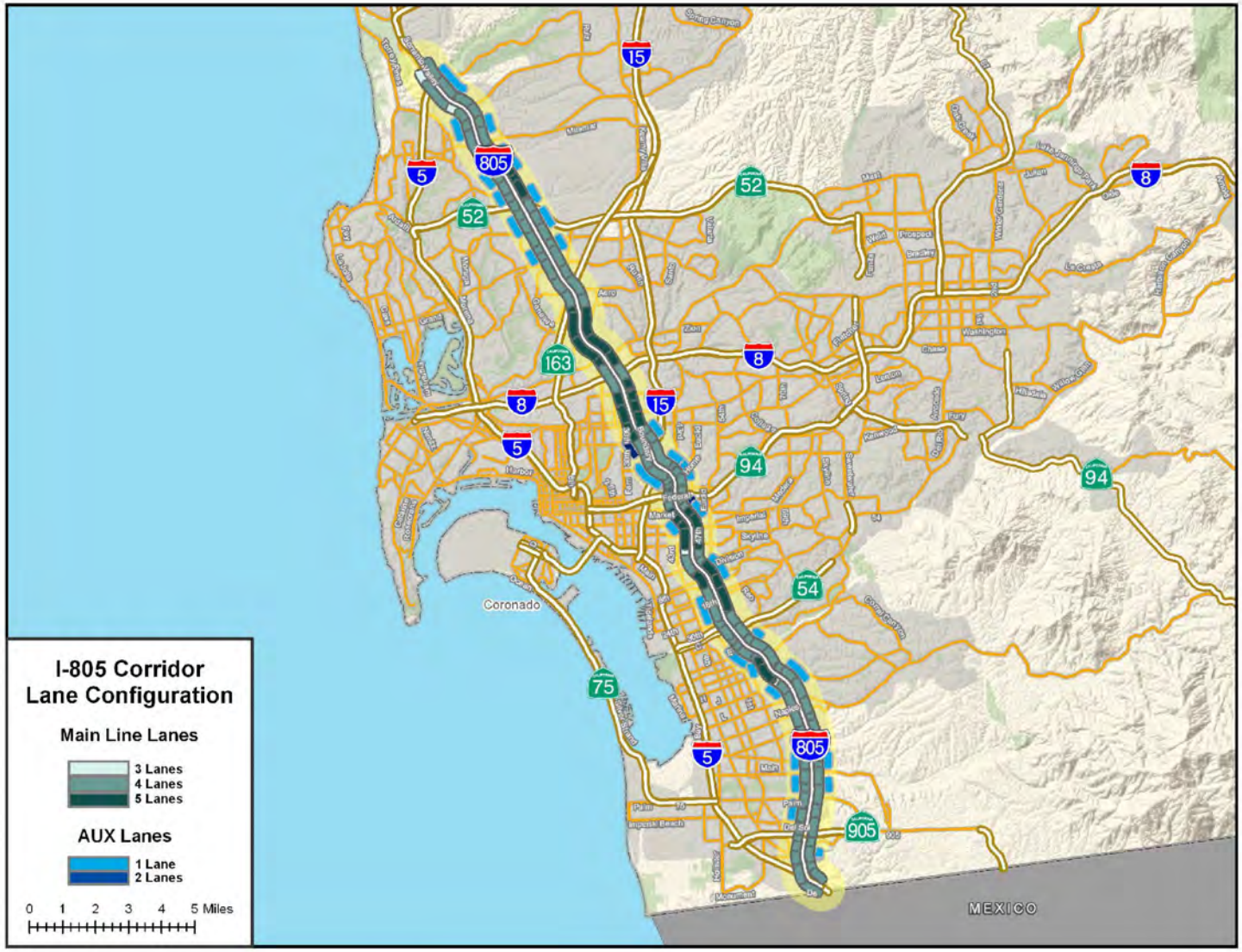
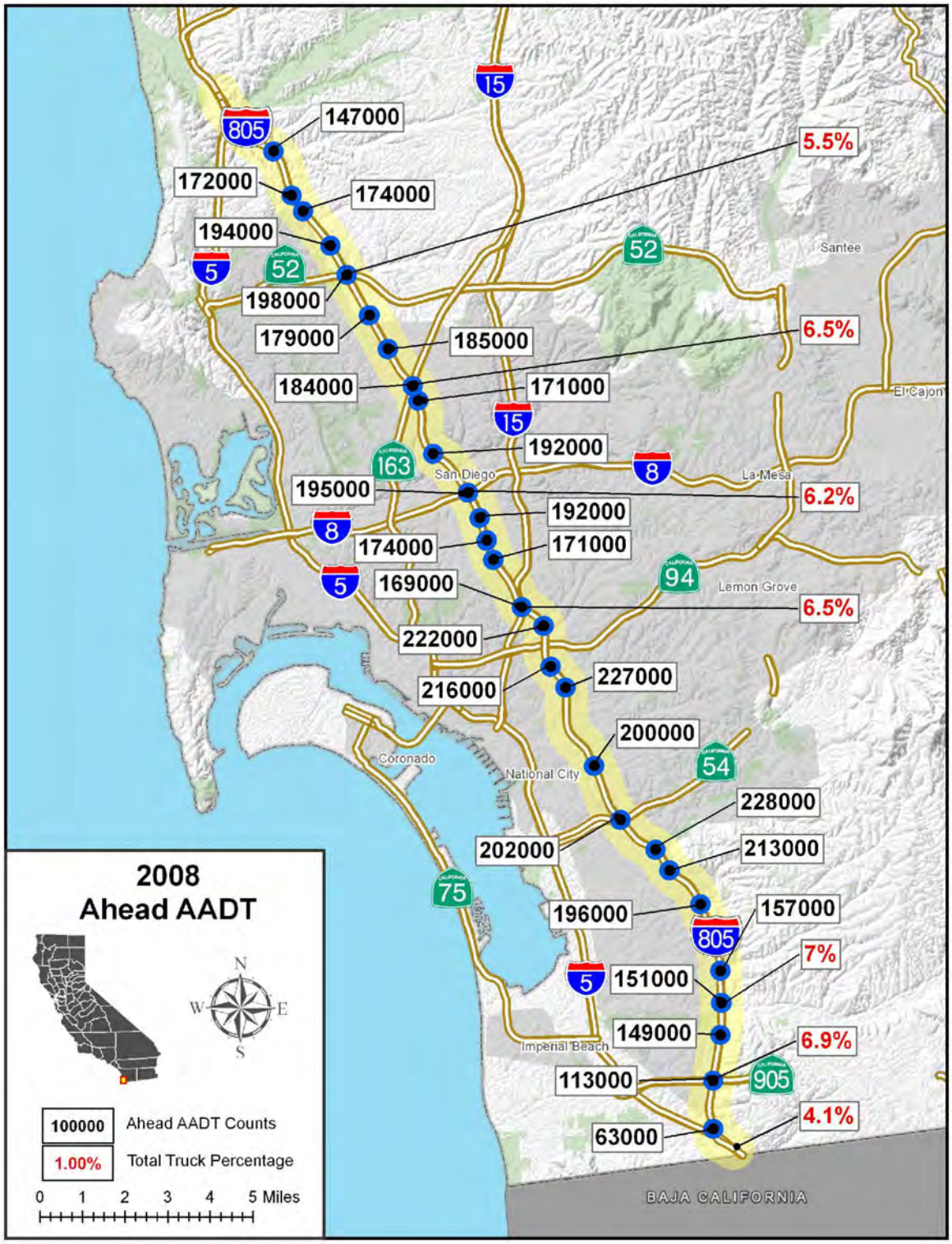
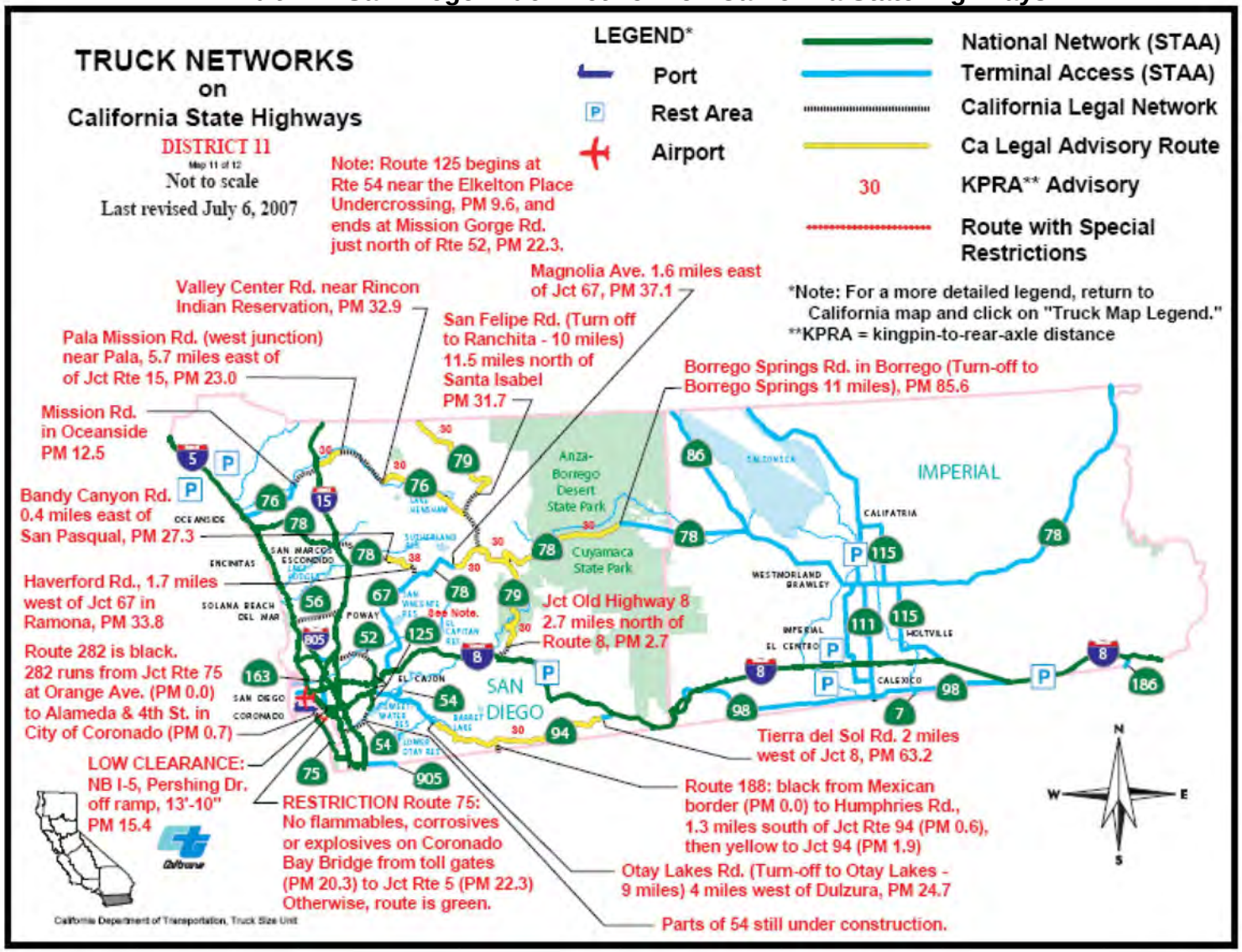


Exhibit 2-3: Major Interchanges, 2008 AADT, and Truck Percentages



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



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 recently completed projects 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.

Currently, SANDAG, Caltrans, and local cities are implementing the Traffic Light Synchronization Program (TLSP) being funded in part from the Highway Safety, Rehabilitation, and Preservation Account, which received this funding from the voter-approved Proposition 1B in 2006. This program funds traffic light synchronization projects and other technology-based improvements to improve safety, operations, and the effective capacity of local streets and Roads.

Adjacent to the I-805, there are five “East-West Metro Corridors” including Friars Road, , Linda Vista Road/Convoy Street, and Balboa Avenue, La Jolla Village Drive/Miramar Road, and Mira Mesa Boulevard. Additional corridors funded by the TLSP include Bonita Road in Chula Vista.

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

Corridor Transit Services

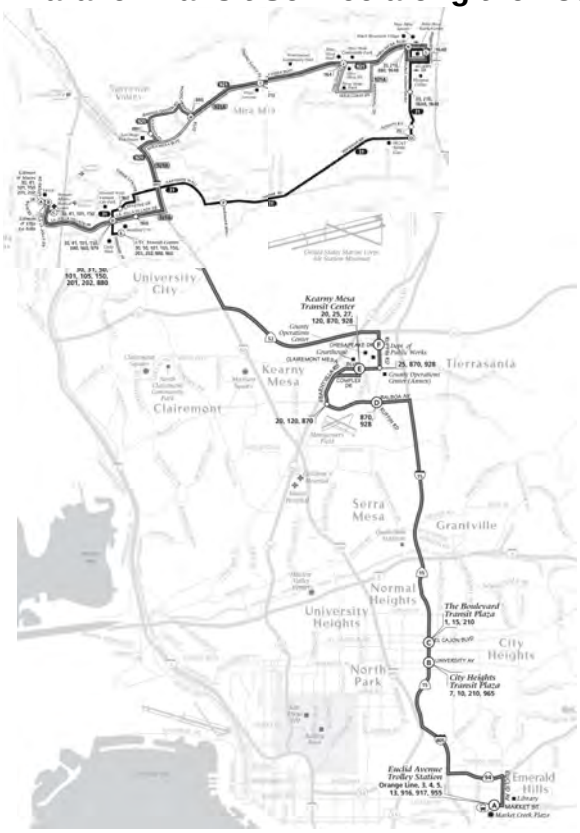
SANDAG has been the regional agency responsible for transit planning and funding administration in San Diego area since 2003. SANDAG shares planning responsibilities with Caltrans, the Metropolitan Transit System (MTS), and the North County Transit District (NCTD). The MTS includes five transit operators: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

MTS operates a weekday express bus (Route 960) that directly serves commuters who might drive on I-805 if the route did not exist. The route offers eight morning runs (5:09 AM to 7:08 AM) and six afternoon runs (3:20 PM to 5:50 PM) during the day and serves the following major stops:

- Euclid Avenue Trolley Station (Euclid Avenue/Market Street in Emerald Hills)
- City Heights Transit Plaza (University Avenue/SR-15 in City Heights)
- The Boulevard Transit Plaza (El Cajon Boulevard/SR-15 in Normal Heights)
- Balboa Avenue and Ruffin Road (Kearny Mesa)
- Kearny Mesa Transit Center (Claremont Mesa Boulevard/Complex Drive in Kearny Mesa)
- Ruffin Road and Chesapeake Drive (Kearny Mesa)
- University Towne Center (UTC) Transit Center (La Jolla Boulevard/Genesee Avenue in University City).

In addition to several local routes that bisect the I-805 corridor, local routes 31, 921, and 921A run between Mira Mesa and the UCSD with Routes 921 and 921 operating on I-805 for a portion of the route. These routes operate on 30-minute headways through most of the day. Route 921 operates on Saturday, but neither route provides Sunday or holiday service.

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



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 bisected by to the I-805 corridor just south of Sorrento Valley. The base is a major employer with approximately 16,000 Marines, Navy personnel, and civilians employed there.

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).

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

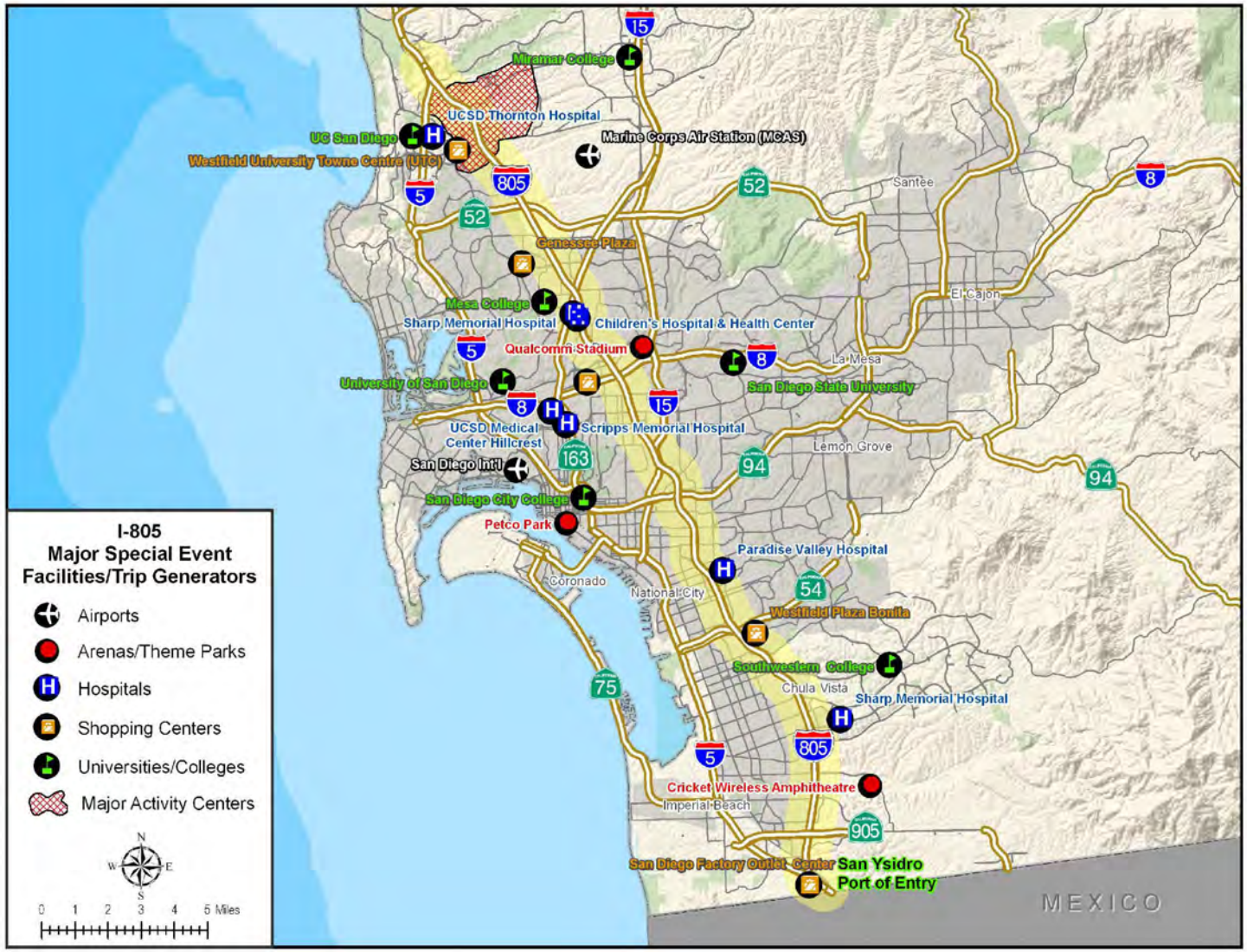
Medical Center with nearly 550 beds. The center is located approximately two miles from I-805 and adjacent to I-8/SR-163 in the Hillcrest Area. Scripps Memorial Hospital, which has about 375 beds, is also near the I-805 corridor. The hospital is located just two miles from the corridor on Genesee Avenue 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



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. SMG 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 SMG to enhance analysis specific to this corridor.

SMG 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 SMG. 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.

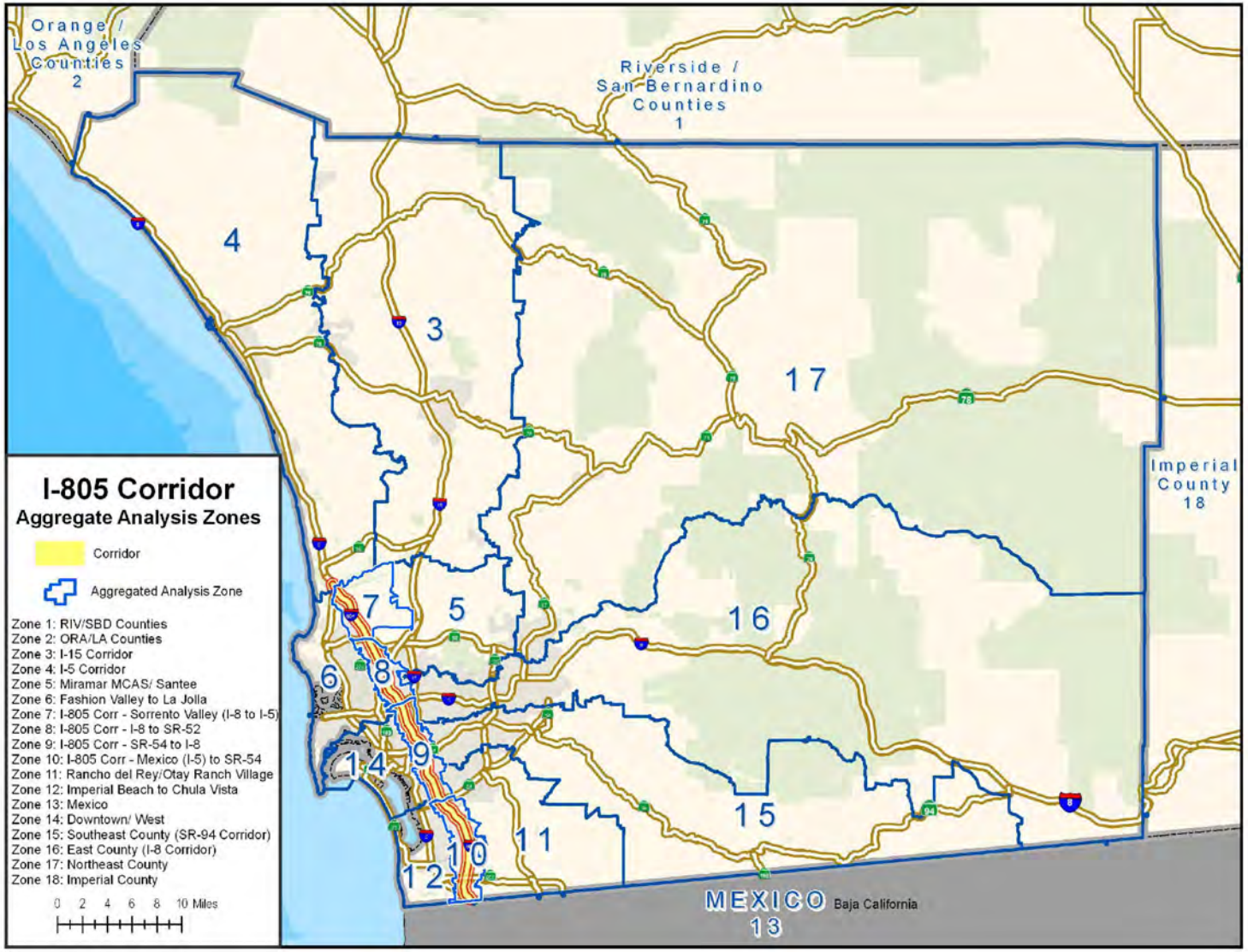
Sorrento Valley (zone # 7) produced the greatest percentage of PM peak period trips with 13 percent, but two other zones (#9 and #10) each produced greater than 10 percent of PM peak period trips. The single highest PM peak period OD pair was between Sorrento Valley (zone #7) and north along the I-5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



Source: SMG Analysis of SANDAG Regional Travel Demand Model Traffic Analysis Zones (TAZs).

Exhibit 2-10: AM 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						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		
	Larger Area Totals		30,532						52,227				22,890				12,705				118,354			
	Percent Larger Area		26%						44%				19%				11%				100%	Destination Totals		

Source: SMG Analysis of SANDAG Regional Travel Demand Model Origin-Destination Matrices.

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%	35,813	26%
	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%		
	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%	56,990	42%
	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%		
	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%	27,028	20%
	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%		
	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%	16,861	12%
	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%		
	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**	
	Larger Area Totals		**31,278**						**52,582**				**31,835**				**20,997**				**136,693**			
	Percent Larger Area		**23%**						**38%**				**23%**				**15%**				**100%**		**Destination Totals**	

Source: SMG Analysis of SANDAG Regional Travel Demand Model Origin-Destination Matrices.

3. CORRIDOR PERFORMANCE AND TRENDS

This section summarizes existing conditions on the I-805 corridor. The primary objectives of the performance measures are to provide a sound technical basis for describing traffic performance on the corridor. The measures in this section were estimated using the best available data. The following section summarizes the data used provides background information about the quality of that data used in the performance statistic estimates.

Existing Data Sources

This section discusses the data analyzed for the corridor performance assessment. The data sources include the following:

- Caltrans Highway Congestion Monitoring Program (HICOMP) report and data files (2004 to 2008)
- 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 3-1 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 3-2 and 3-3 further show how well the detectors are performing over a longer period from January 2006 to December 2009 for the entire I-805 corridor. The exhibits report the number of “good detectors” each day for the four-year period.

Exhibit 3-1: Sensor Status (October 2008)

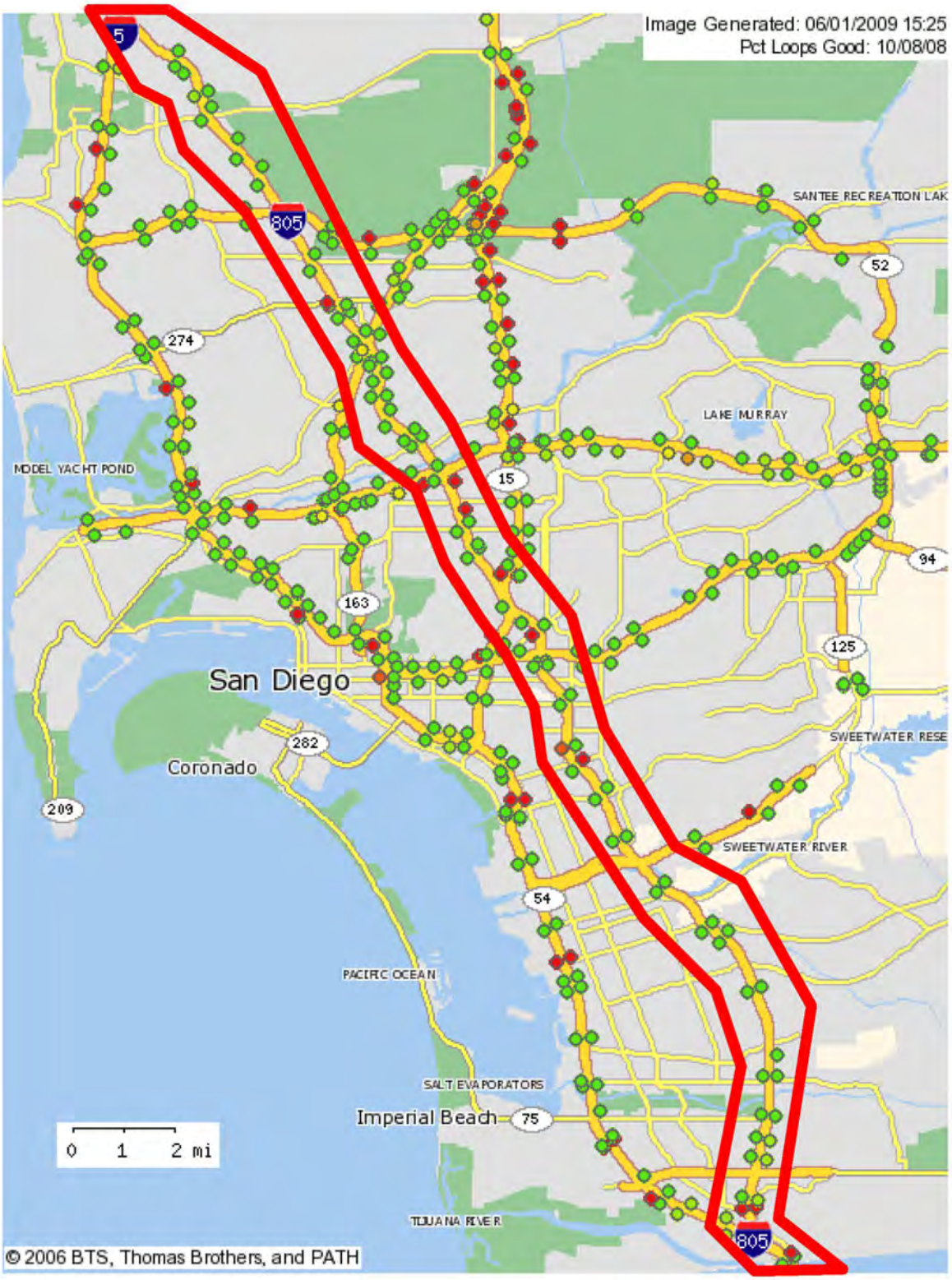
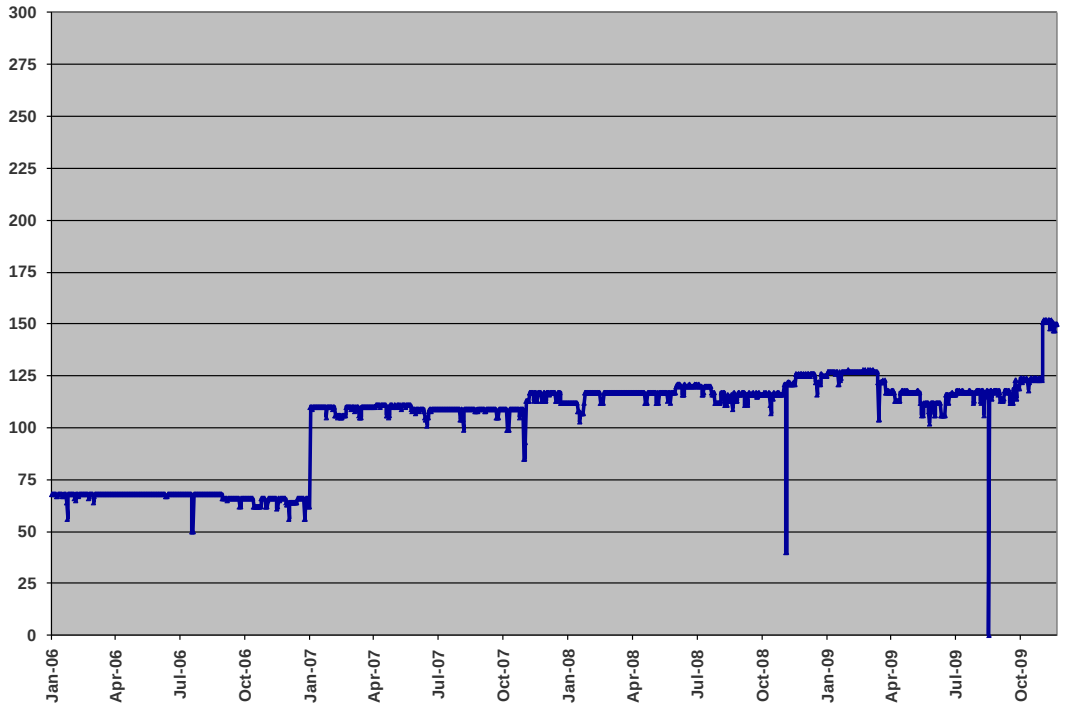
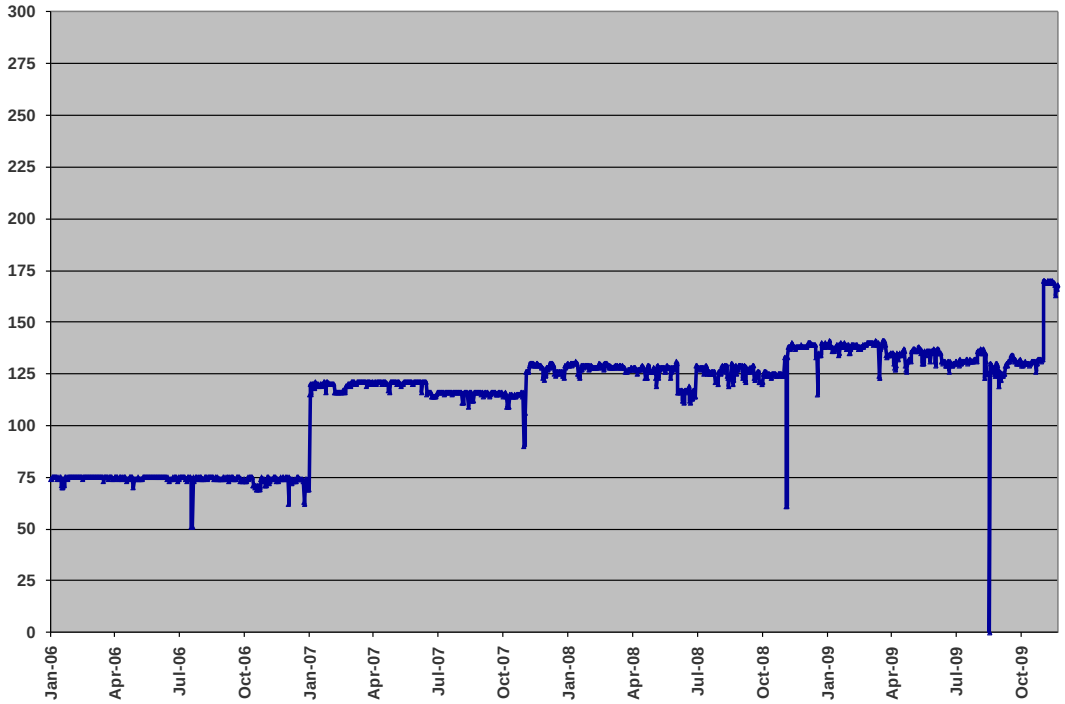


Exhibit 3-2: Northbound Number of Daily Good Detectors (2006-2009)



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

Exhibit 3-3: Southbound I-805 Number of Daily Good Detectors (2006-2009)



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

Note that the number of good detectors improved significantly during 2007 and continued through 2009. 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 corridor, we identified a number of detectors that were added to the corridor in 2007 through 2009. These are listed in Exhibit 3-4.

Exhibit 3-4: Detection Added (2007-2009)

Northbound

VDS	Location	Type	CA PM	Abs PM	Date Online
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
1119784	N 805 N/O 5/805	Mainline	0.47	0.321	6/18/2009
1119797	N805 N/O 5/805 MERGE	Mainline	R.781	0.632	6/18/2009
1120011	805 S L/Telegraph	Mainline	5.551	5.402	11/20/2009
1120272	L St/Telegraph Cyn	Mainline	6.21	6.061	11/20/2009
1120282	L St/Telegraph Cyn	On Ramp	6.21	6.061	11/20/2009
1120285	L St/Telegraph Cyn	Off Ramp	6.21	6.061	11/20/2009
1120025	805 NB SO H St	Mainline	6.74	6.591	11/20/2009
1120300	East H ST	On Ramp	7.026	6.877	11/20/2009
1120303	East H ST	Off Ramp	7.026	6.877	11/20/2009
1120256	E St/Bonita Rd	Mainline	7.926	7.777	11/20/2009
1120263	E St/Bonita Rd	On Ramp	7.926	7.777	11/20/2009
1120266	E St/Bonita Rd	Off Ramp	7.926	7.777	11/20/2009
1120033	805 NB NO Bonita Rd	Mainline	8.25	8.101	11/20/2009
1120060	NB 805 N/O 54	Mainline	9.45	9.301	11/20/2009
1120234	NB 805 N/O 54	Fwy-Fwy	9.45	9.301	11/20/2009
1119383	NB 805 S/O 15	Mainline	14.356	14.207	7/22/2009
1120074	NB 805 N/O BALBOA	Mainline	22	21.851	6/30/2009
1117850	NB 805 @ BALBOA	Mainline	21.47	21.323	8/18/2007

Southbound

VDS	Location	Type	CA PM	Abs PM	Date Online
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
1119790	S805 N/O 5/805 MERGE	Mainline	R.78	0.631	6/18/2009
1119804	S805 S/O PALM AVE	Mainline	2.502	2.353	6/18/2009
1120004	S805 S/O L/Telegraph	Mainline	5.55	5.401	11/20/2009
1120291	L St/Telegraph RD	Mainline	6.211	6.062	11/20/2009
1120018	805 SB SO H St	Mainline	6.74	6.591	11/20/2009
1120040	805 SB NO Bonita Rd	Mainline	8.25	8.101	6/30/2009
1120052	S805 S/O SWEETWATER	Mainline	8.951	8.802	6/30/2009
1120067	SB 805 N/O 54	Mainline	9.451	9.302	6/30/2009
1119477	SB 805 fr 43rd ST	Fwy-Fwy	11.093	10.944	2/19/2009
1120247	EB BALBOA/805 SB	On Ramp	21.471	21.322	11/20/2009
1120249	EB BALBOA/805 SB	Off Ramp	21.471	21.322	11/20/2009
1120081	SB 805 S/O 52	Mainline	23.26	23.111	6/30/2009

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

Finally, an analysis of gaps without detection is shown in Exhibit 3-5. 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 3-5: Gaps in Detection (December 2009)

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)

Corridor Performance Assessment

This section summarizes existing conditions on the I-805 corridor. As mentioned previously, the primary objectives of the performance measures are to provide a sound technical basis for describing traffic performance on the corridor. The performance assessment focused on five major performance 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.

<u>Delay</u>

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, SMG used the 60 mph threshold speed and the observed number of vehicles reported by detection systems. The congestion results from HICOMP and sensors are difficult to compare due to these methodological differences, so they are discussed separately in this assessment. In summary:

- The PM peak period experiences significantly more congestion than the morning peak. This is typical for an urban area corridor that serves a large number of work trips.

- Congestion on the corridor increased markedly from 2005 to 2007. After 2007, congestion decreased through 2009, most likely due to the global financial meltdown and the associated recession. As of the end of 2009, congestion levels had still not reached 2006 or 2007 levels.

- During the peak 2006 and 2007 levels, congestion for the two peak periods caused upwards of 10,000 daily vehicle hours of delay. By 2009, they caused less than 5,000 daily vehicle hours of delay.

Caltrans HICOMP

The HICOMP report has been published by Caltrans annually since 1987.[1] 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 results 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

[1] Located at http://www.dot.ca.gov/hq/traffops/sysmgtpl/HICOMP/

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 always be validated by using additional information and fieldwork. SMG conducted extensive field visits in the summer through winter of 2008 to validate the results discussed in this section.

Exhibit 3-6 shows the yearly estimated delay trends from 2004 to 2008. 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 that northbound AM congestion has eased over the last four years, while southbound PM congestion has grown.

Exhibit 3-6: HICOMP Delay 2004-2008

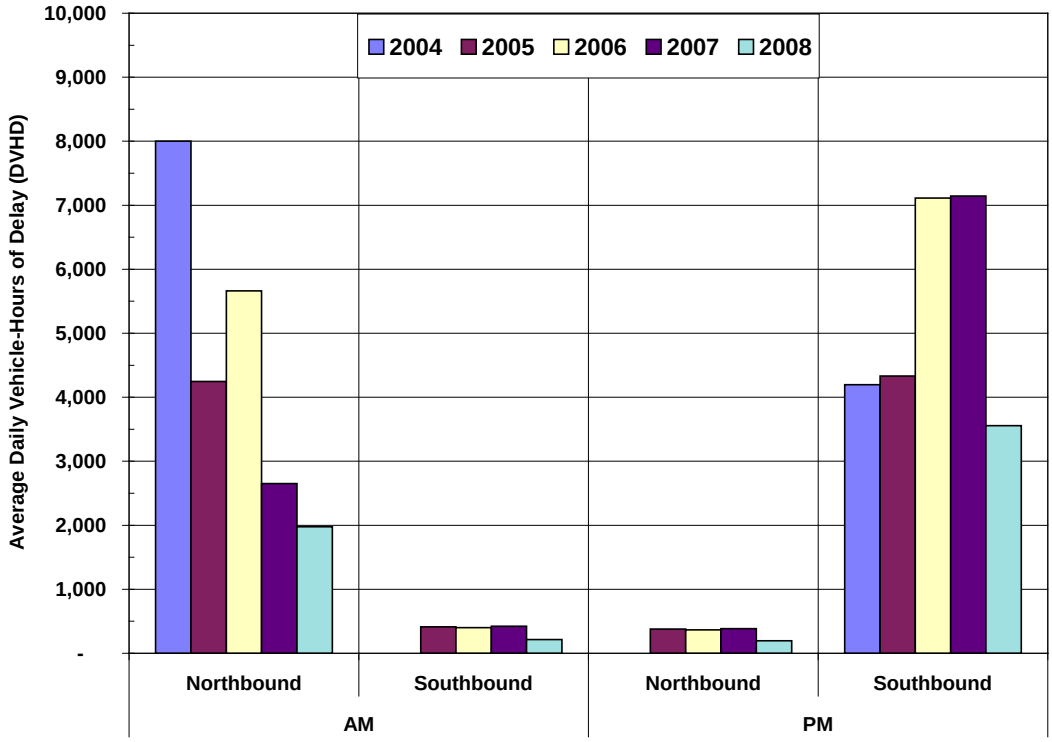


Exhibit 3-7 shows a complete list of congested segments examined by the HICOMP report for the I-805 corridor. A congested segment may vary in distance or size from one year to the next as well as from day-to-day. Exhibit 3-7 attempts to standardize the list of congested segments to facilitate comparisons 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 3-11 for the northbound and southbound direction.

The maps in Exhibits 3-8 and 3-9 show the 2007 AM and PM peak period delay listed in Exhibit 3-7. 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 3-8 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 (just south of the I-805/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 3-9 indicates that two major southbound recurring bottlenecks may exist upstream to I-8. 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 3-9 also indicates 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.

Exhibit 3-7: HICOMP Delay by Segment 2004-2008

Direction of Travel	Period	From PM	To PM	Congestion Start Location	Queue End Location	2004	2005	2006	2007	2008
Northbound	AM	5.3	10.9	47th St	Naples St (Chula Vista)	4,351	2,512	3,663	1,338	1,099
		9.9	26.6	B/n SR-54 & Plaza Blvd (Chula Vista)	Via Sorrento Pkway	3,650				
		6.1	15.6	Telegraph Canyon Rd (Chula Vista)	I-15					
		15.6	17.4	I-15	El Cajon Blvd		272	371	391	105
		20.1	23.5	SR-163	SR-52		1,461	1,627	924	774
	PM	26.2	29.3	La Jolla Village Dr	I-5		377	366	386	195
AM PEAK PERIOD SUMMARY						8,001	4,623	6,027	3,038	2,172
Southbound	AM	6.1	3.4	Telegraph Canyon Rd (Chula Vista)	Main St (Chula Vista)		414	402	423	214
	PM	28.0 - 27.7	25.1	Nobel Dr	I-5 Area (Sorrento Valley Rd/ Mira Mesa Blvd)	1,332	935	1,050	854	606
		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	240
		18.5	10.3	Plaza Blvd	Murray Ridge Rd		2,049	4,029	4,244	2,147
		10.3	6.8-7.6	H Street/ Bonita Rd (south of SR-54)	Plaza Blvd	1,253	1,107	1,470	1,674	563
PM PEAK PERIOD SUMMARY						4,196	4,745	7,514	7,566	3,770
TOTAL CORRIDOR CONGESTION						12,196	9,368	13,541	10,604	5,942

Exhibit 3-8: 2007 AM Peak Period HICOMP Congested Segments Map

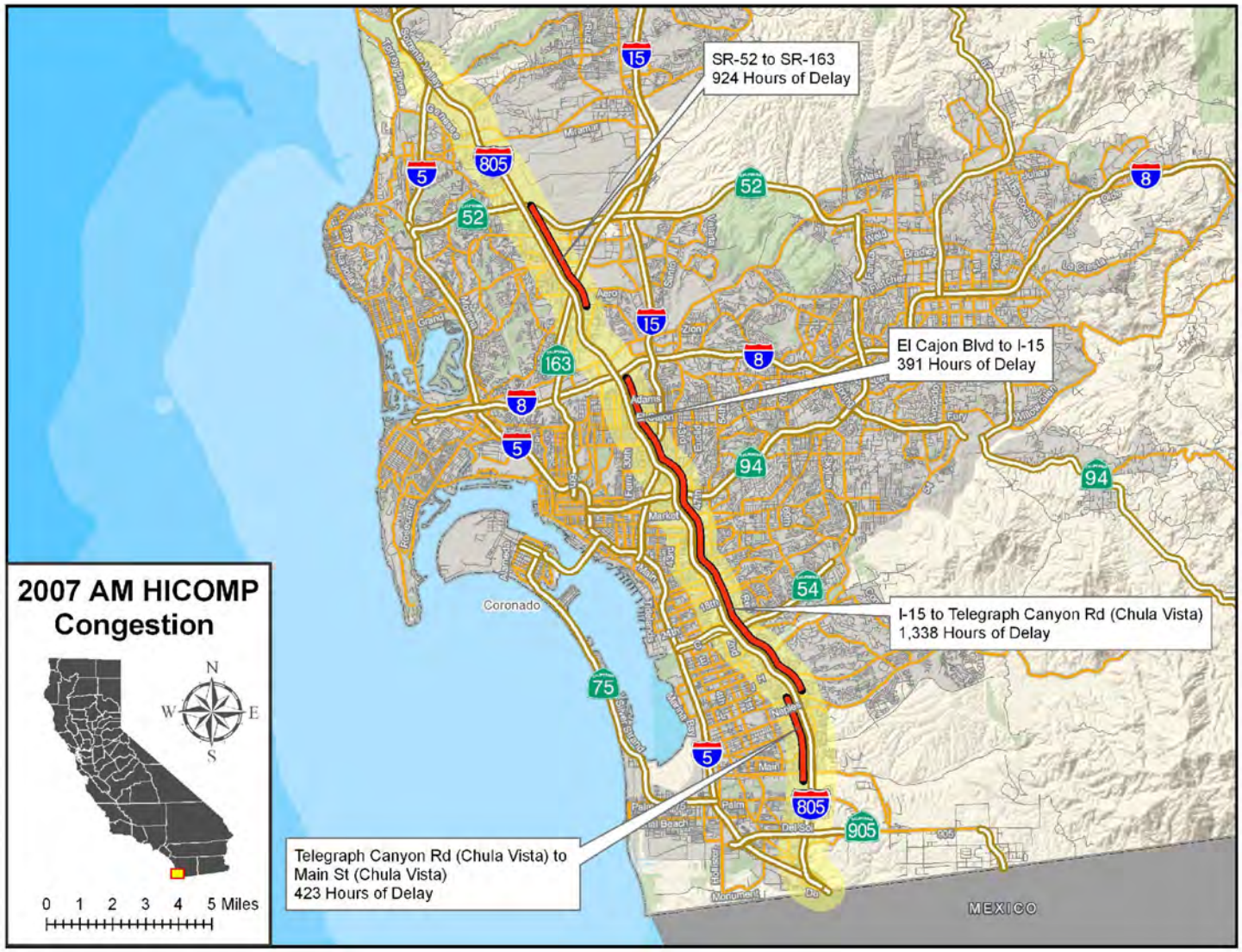
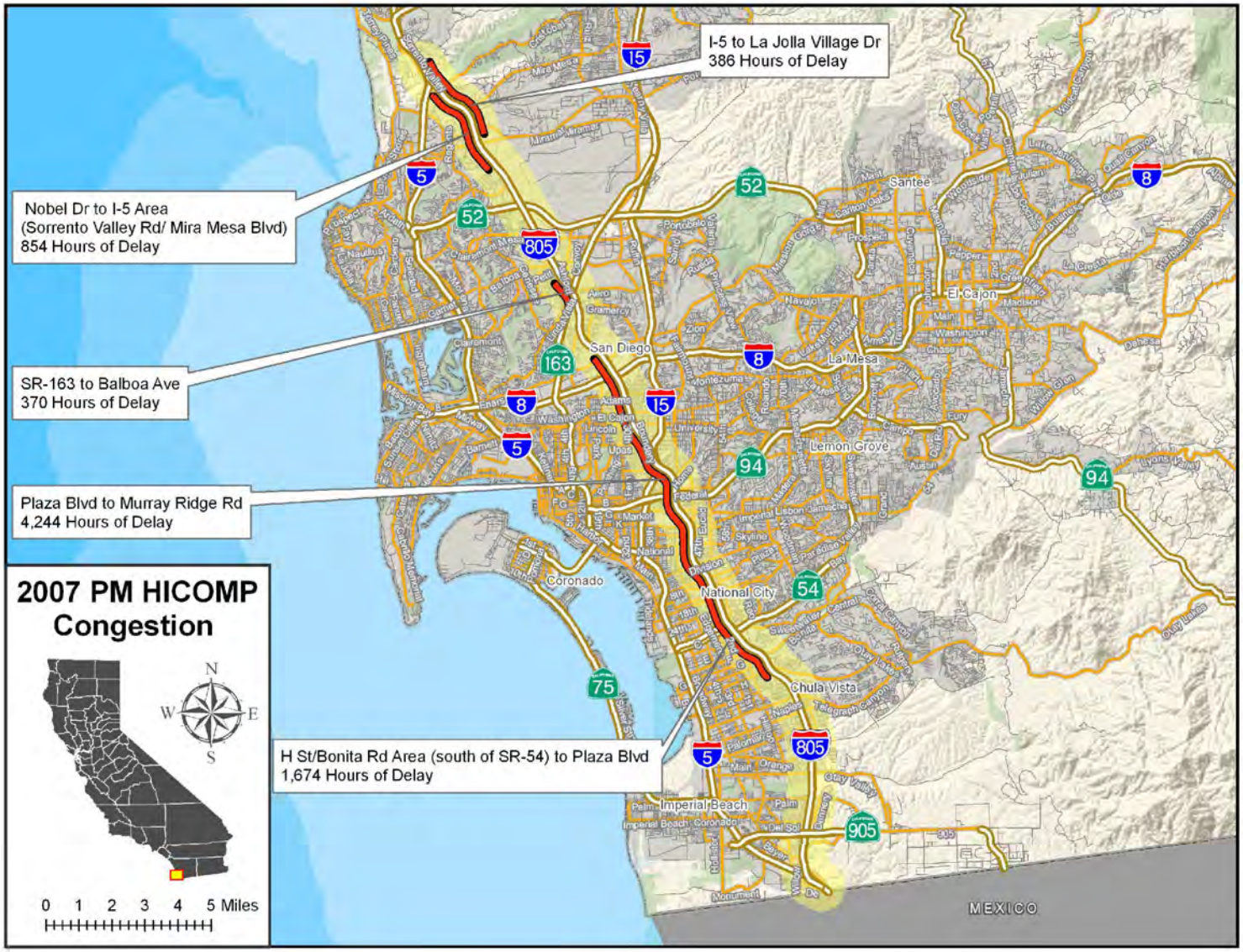


Exhibit 3-9: 2007 PM Peak Period HICOMP Congested Segments Map



Freeway Automatic Detector Data

Using freeway detector data accessed via PeMS, delay is summarized in different ways, which is not possible when using probe vehicle data. SMG filtered the PeMS dataset to exclude data deemed to be of poor quality.

Performance assessments were conducted for the five-year period between 2005 and 2009. 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 estimated delay by period for the I-805 corridor is shown in Exhibits 3-10 and 3-11. The exhibits show a five-year trend in weekday (i.e., excluding Saturdays, Sundays, and holidays) delay for the entire corridor in the northbound and southbound directions respectively. The exhibits also show a three-month moving average that reduces the day-to-day variations and more easily illustrates the seasonal and annual changes in congestion.

Consistent with the HICOMP data, the detector data show 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 results, the sensor data suggest that the highest daily weekday congestion occurs during the PM peak period in the southbound direction (see Exhibit 3-11), 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 and 2009, particularly during the summer months.

Exhibit 3-10: Northbound Average Daily Delay by Time Period (2005-2009)

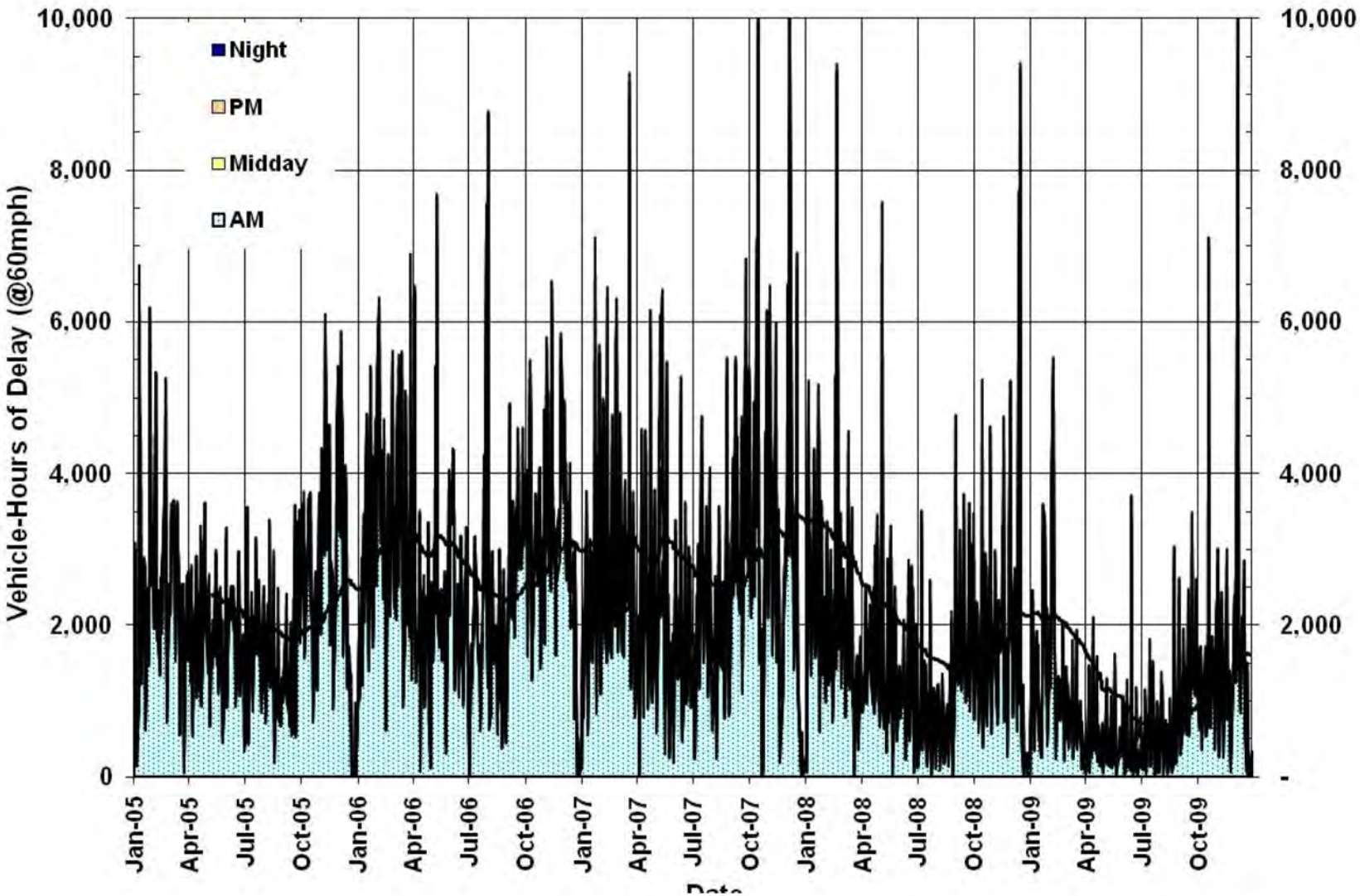


Exhibit 3-11: Southbound I-805 Average Daily Delay by Time Period (2005-2009)

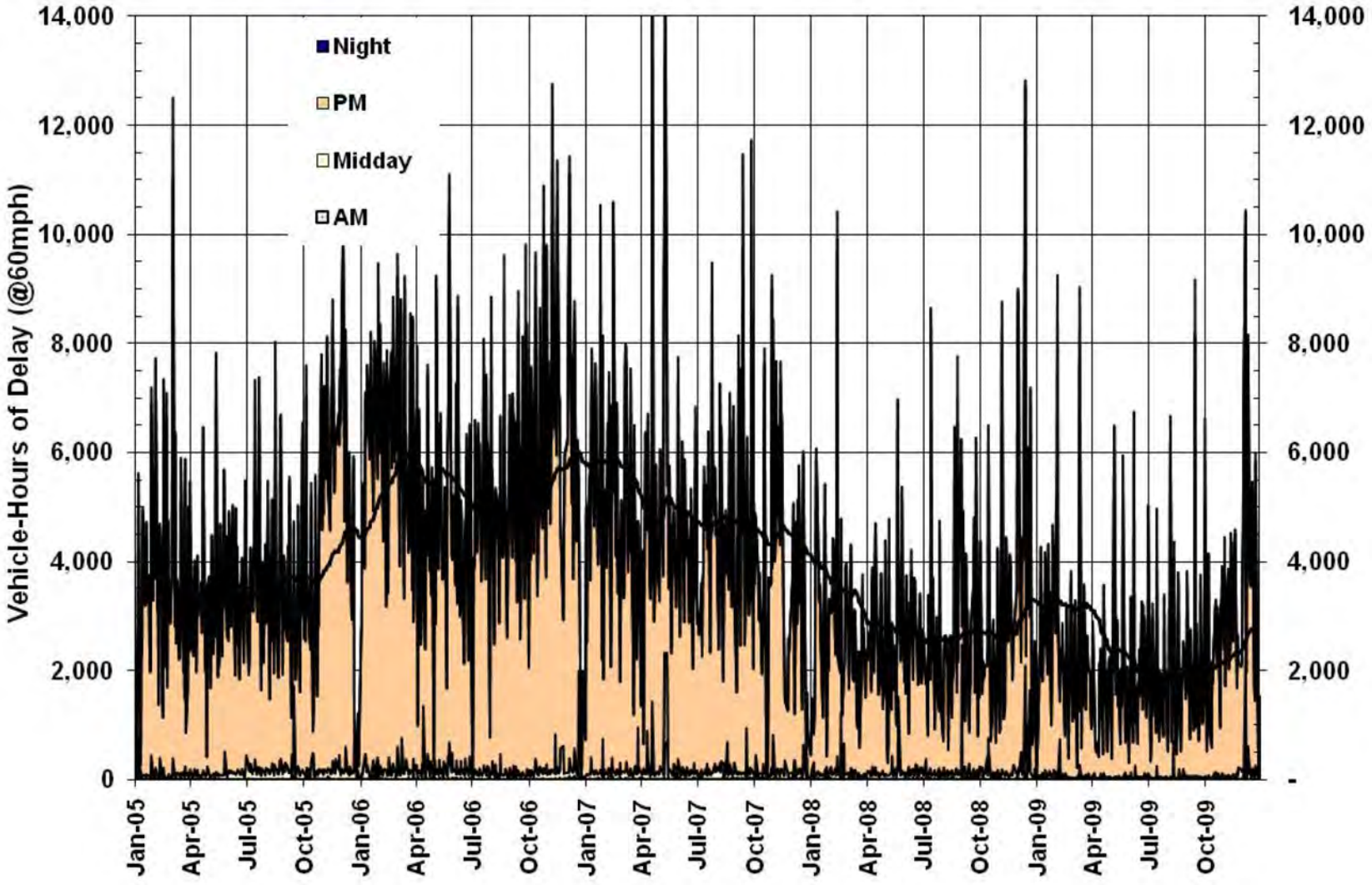
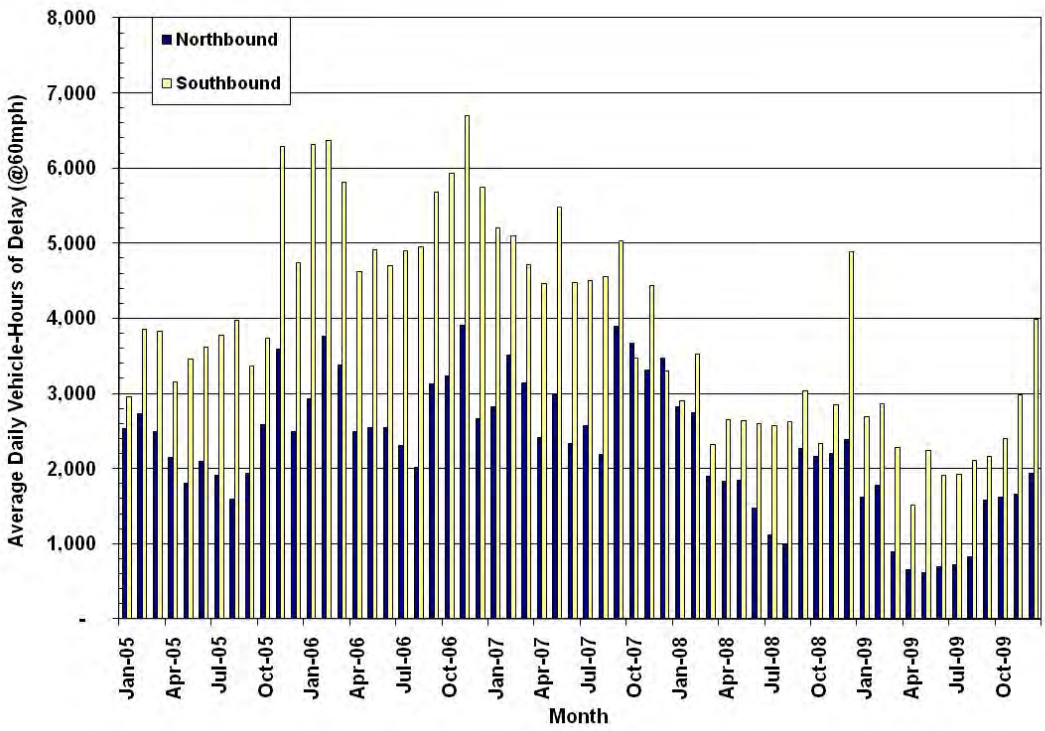


Exhibit 3-12 depicts average daily weekday delay by month for each direction of travel. This exhibit again illustrates that the PM peak delay in the southbound direction is high and that seasonal peaking occurs during the winter months.

Exhibit 3-12: Average Weekday Delay by Month (2005-2009)



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 3-13:

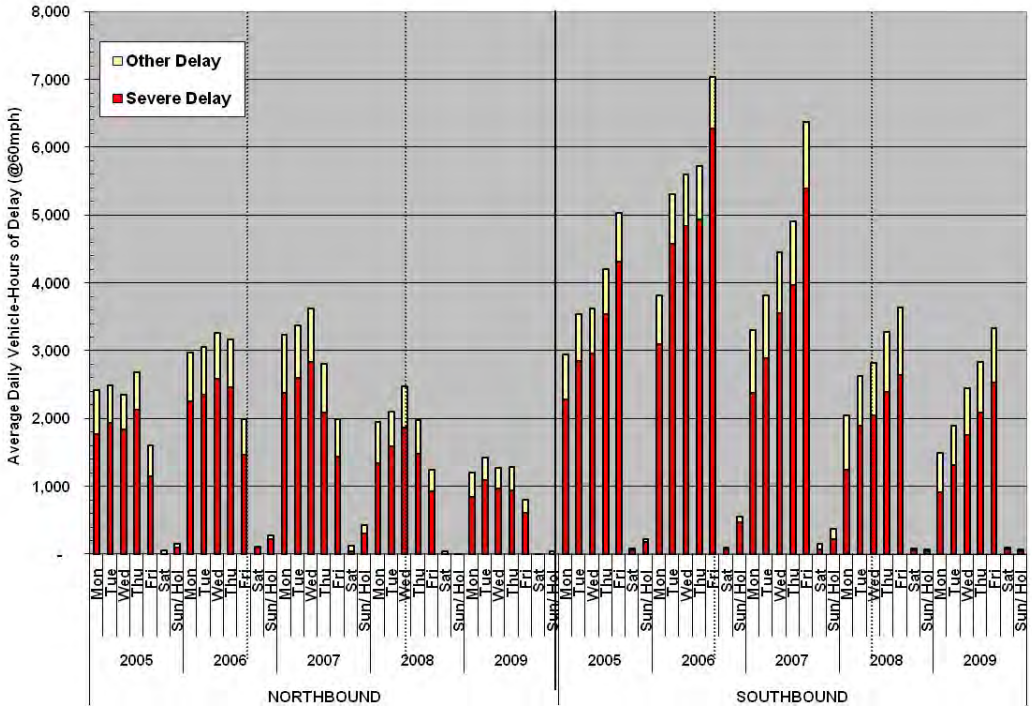
- Severe delay – delay occurring when speeds are below 35 mph
- Other delay – delay occurring when speeds are between 35 and 60 mph.

Severe delay in Exhibit 3-13 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. A few notes about Exhibit 3-13:

- Severe delay makes up about 80 percent of all weekday delay on the corridor in either the northbound or the southbound directions.
- Fridays in the southbound direction experience the highest delays, probably due to weekend travel to Mexico or other recreational destinations. The second highest delays generally occurred on Thursdays.

- The downward trend is clear from 2007 to 2009. For the entire year, the average daily delay reached 7,000 hours. This average includes all weekdays in the year as opposed to Exhibit 3-12, which presented monthly averages.

Exhibit 3-13: Average Delay by Day of Week by Severity (2005-2009)



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 3-14 and 3-15, which summarize weekday delays by time of day for the five years. Exhibit 3-14 shows the northbound average weekday hourly delay from 2005 through 2009. Peak hourly northbound delay is approximately 1,100 vehicle-hours at 7:00 AM. Exhibit 3-15 shows the southbound average weekday hourly delay from 2005 through 2009. 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 continual decrease in congestion between 2006 and 2009. The duration of the peak periods did not significantly change during the three-year period between 2005 and 2007. However, in 2008 the peak period declined approximately 30 minutes and again by another 30 minutes in 2009. In 2005, the peak period began around 5:00AM, but by 2009, the peak period began at 6:00AM. The end time of 9:30AM appears to have remained consistent. The PM peak period shows a similar trend – starting later in the afternoon, but ending around the same time for the entire five-year period.

Exhibit 3-14: Northbound I-805 Average Weekday Hourly Delay 2005-2009

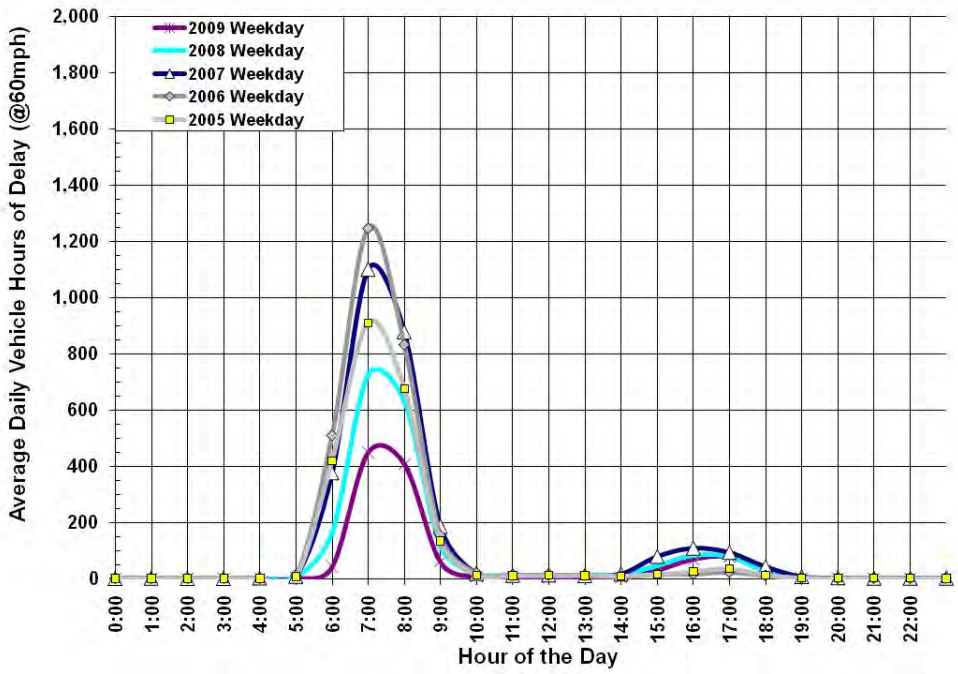
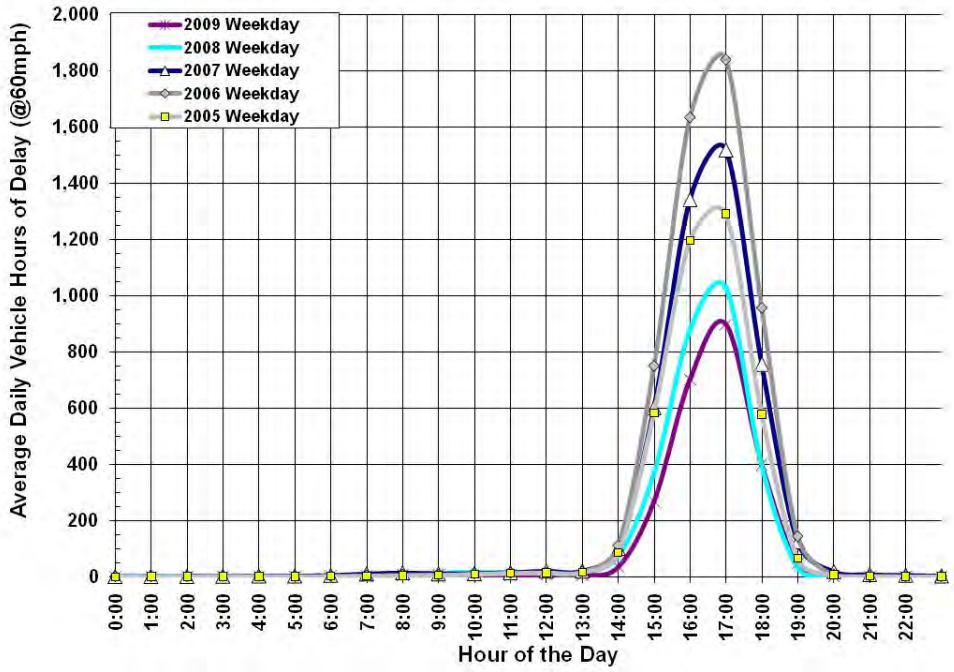


Exhibit 3-15: Southbound I-805 Average Weekday Hourly Delay 2005-2009



Travel Time

The travel time is the average time to traverse the entire 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 3-16 and 3-17 summarize the travel times estimated for the corridor by hour of day for the five-year period.

Similar to delay, travel times diminished significantly in 2009. AM peak period travel time dropped from 40 minutes in 2005 and 2006 to less than 30 minutes in 2008, but grew slightly to 32 minutes in 2009. Similarly, PM peak period travel times declined to around 35 and 33 minutes in 2008 and 2009 respectively, from almost 50 minutes in 2005 and 2006.

Exhibit 3-16: Northbound I-805 Travel Time by Time of Day 2005-2009

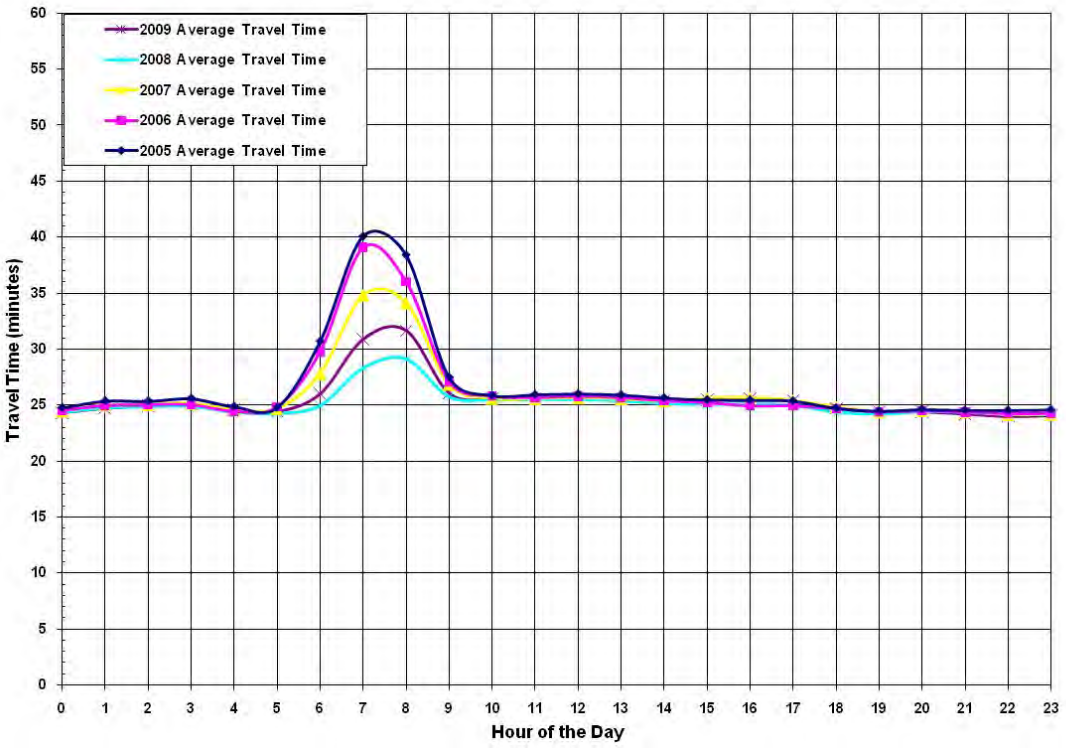
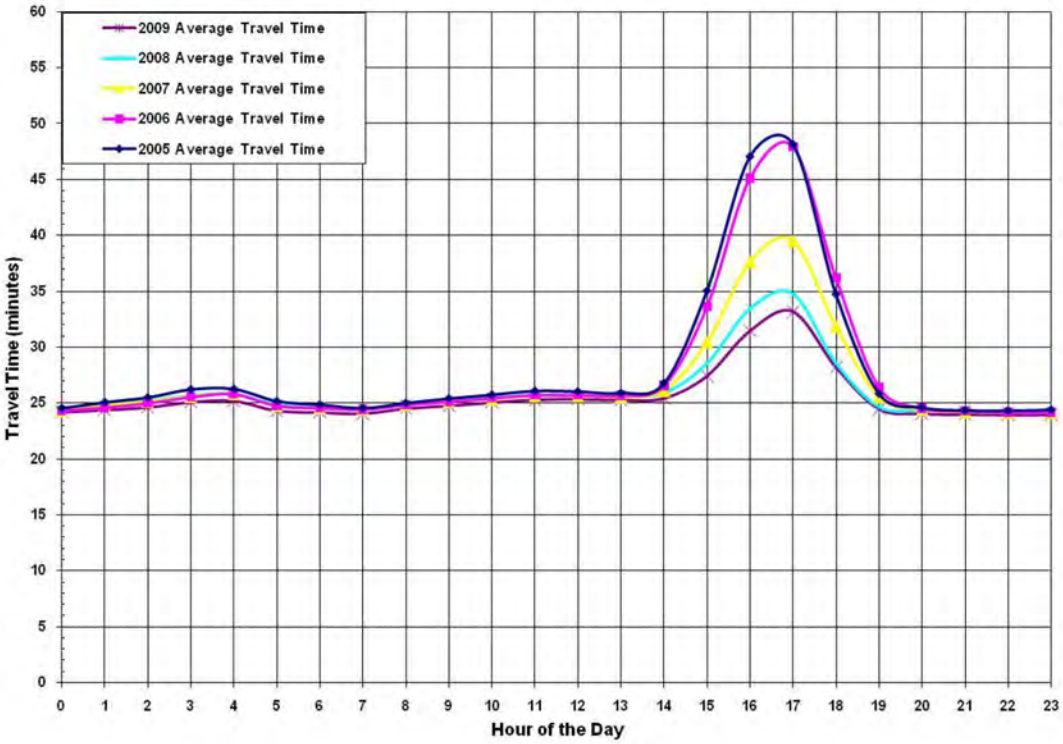


Exhibit 3-17: Southbound I-805 Travel Time by Time of Day 2005-2009



Reliability

Reliability captures the degree of predictability in the public's travel time. Reliability focuses on how travel time varies from day to day and reflects the impacts of accidents, incidents, weather, and special events. Improving reliability is an important goal for transportation agencies and efforts to accomplish this include incident management, traveler information, and special event planning. To measure reliability, SMG used the "buffer index" metric, which reflects the additional time required (over and beyond the average) to ensure an on-time arrival 95 percent of the time (or one day a month).

The buffer index uses the 95th percentile travel time as the maximum acceptable travel time that most people would experience on the corridor. In other words, if a person must be on time 95 days out of 100 (or 19 out of 20 monthly workdays), then that person must add additional time to their average expected travel time to ensure an on-time arrival. That additional time is called the buffer time. 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 3-18 to 4-27 on the following pages illustrate the estimated travel time variability along I-805 on non-holiday weekdays for the period 2005-2009. The year 2006 is the base year for the micro-simulation modeling work since it reflected more "normal" travel conditions, so that year was reviewed more closely during the model calibration phase of the study.

For the northbound direction, the 7:00 AM peak hour was the slowest and the most unreliable. In 2005 (Exhibit 3-18), motorists driving the entire length of the corridor had to add 11 minutes to their average commute time of 40 minutes (for a total travel time of 51 minutes) to ensure that they arrived on time 95 days out of 100 (or 19 days out of 20 typical workdays.

In 2006 (Exhibit 3-19), the time needed to for a 95th percentile on-time arrival increased to 53 minutes, but by 2007 (Exhibit 3-20), this declined to 47 minutes, and further declined to 38 minutes in 2008 (Exhibit 3-21). By 2009, buffer travel times decreased to 34 minutes (Exhibit 3-22).

In the southbound direction during the 5:00 PM peak hour (Exhibit 3-23), a driver needed to add 22 minutes to an average travel time of 48 minutes to ensure an on-time arrival in 2005. This corresponds to a total travel time of 70 minutes. The following years experienced a gradual decline in travel times except 2009, which showed a slight increase. Travel time in 2006 declined to approximately 63 minutes (Exhibit 3-24); 2007 travel times declined to 51 minutes (Exhibit 3-25); 2008 travel times declined even further to 48 minutes (Exhibit 3-26); and 2009 travel times increased back to 51 minutes (Exhibit 3-27)

Exhibit 3-18: Northbound I-805 Travel Time Variability (2005)

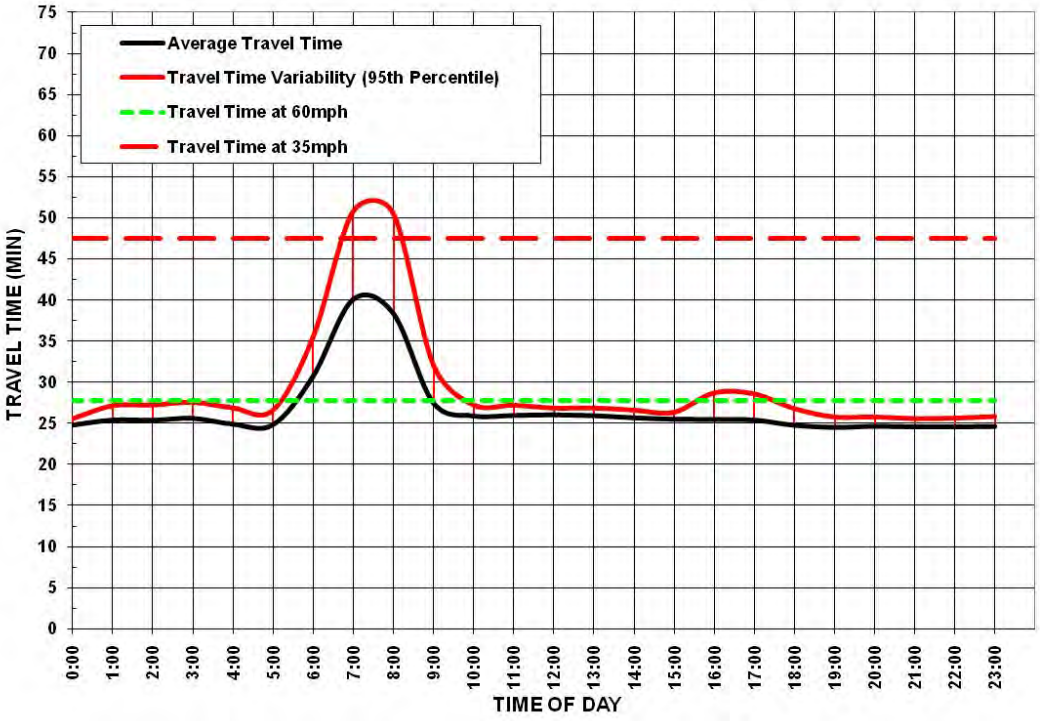


Exhibit 3-19: Northbound I-805 Travel Time Variability (2006)

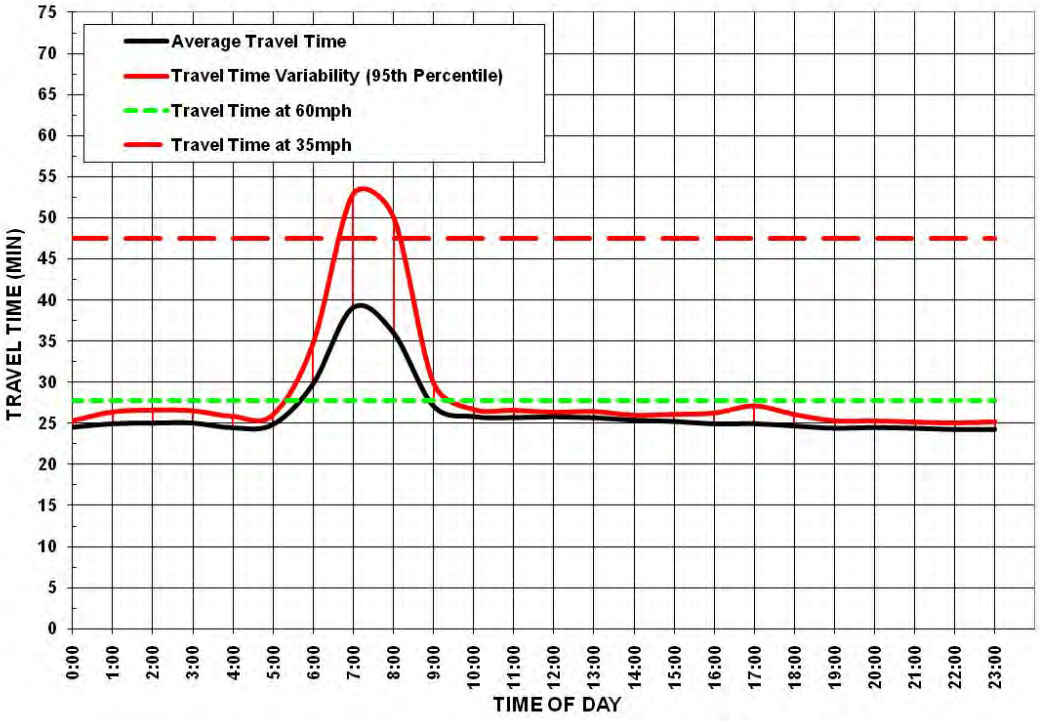


Exhibit 3-20: Northbound I-805 Travel Time Variability (2007)

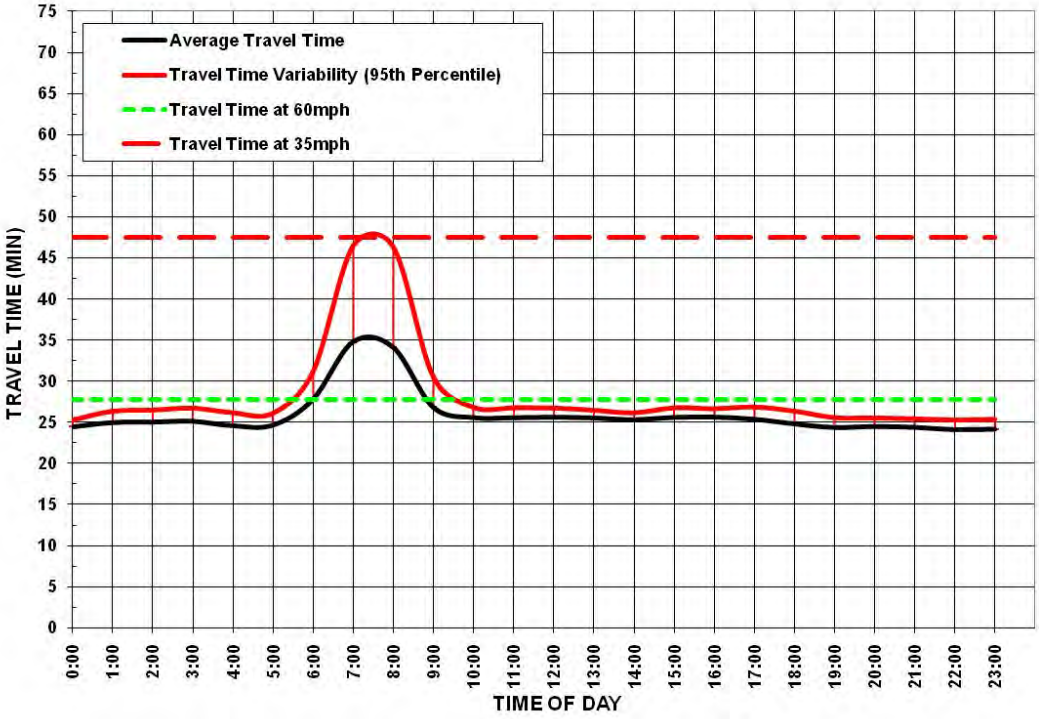


Exhibit 3-21: Northbound I-805 Travel Time Variability (2008)

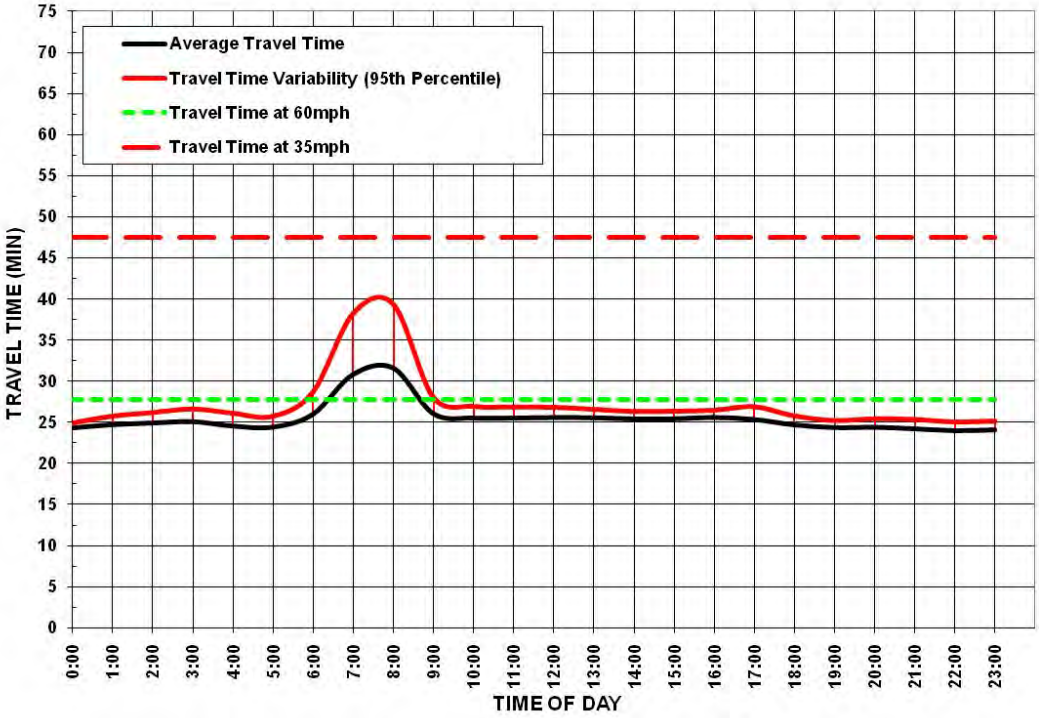


Exhibit 3-22: Northbound I-805 Travel Time Variability (2009)

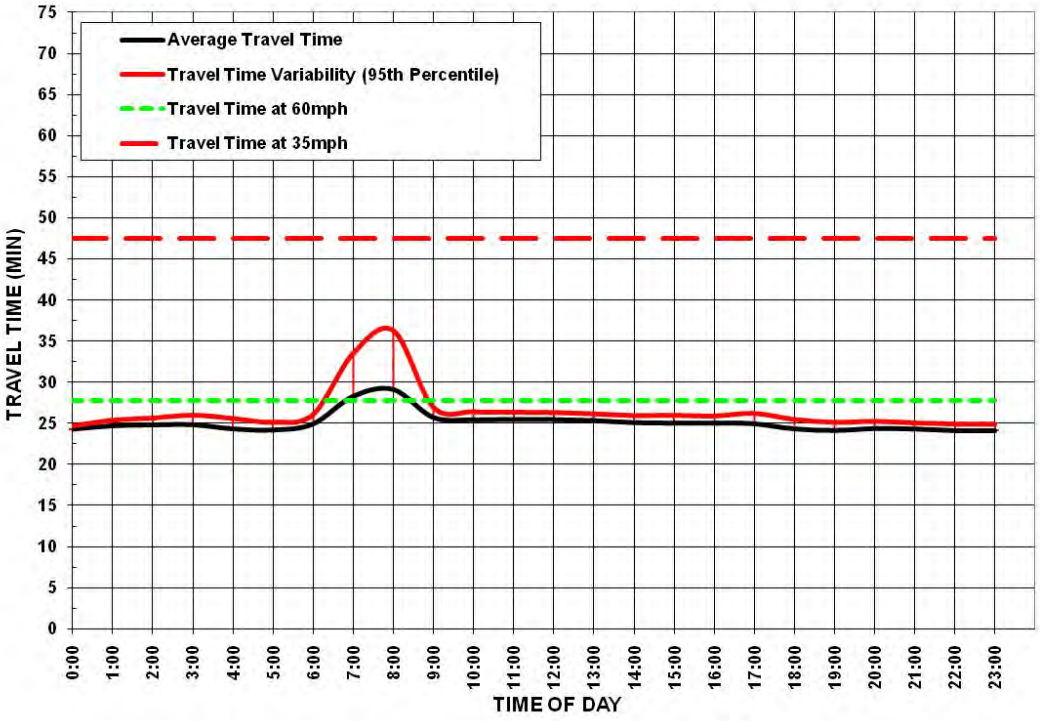


Exhibit 3-23: Southbound I-805 Travel Time Variability (2005)

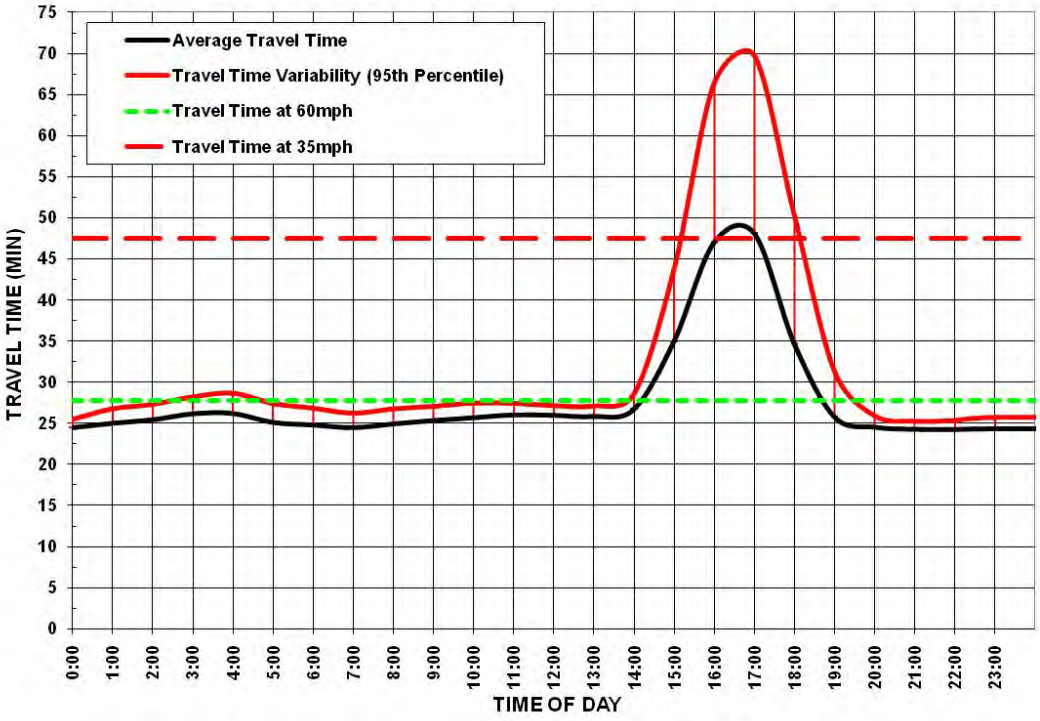


Exhibit 3-24: Southbound I-805 Travel Time Variability (2006)

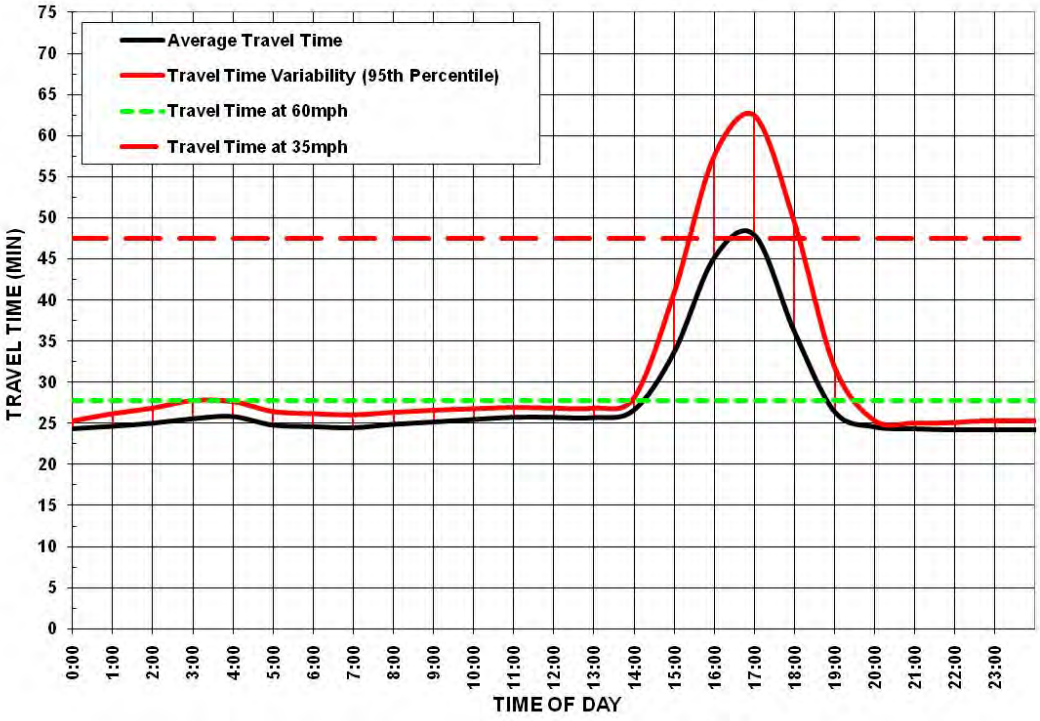


Exhibit 3-25: Southbound I-805 Travel Time Variability (2007)

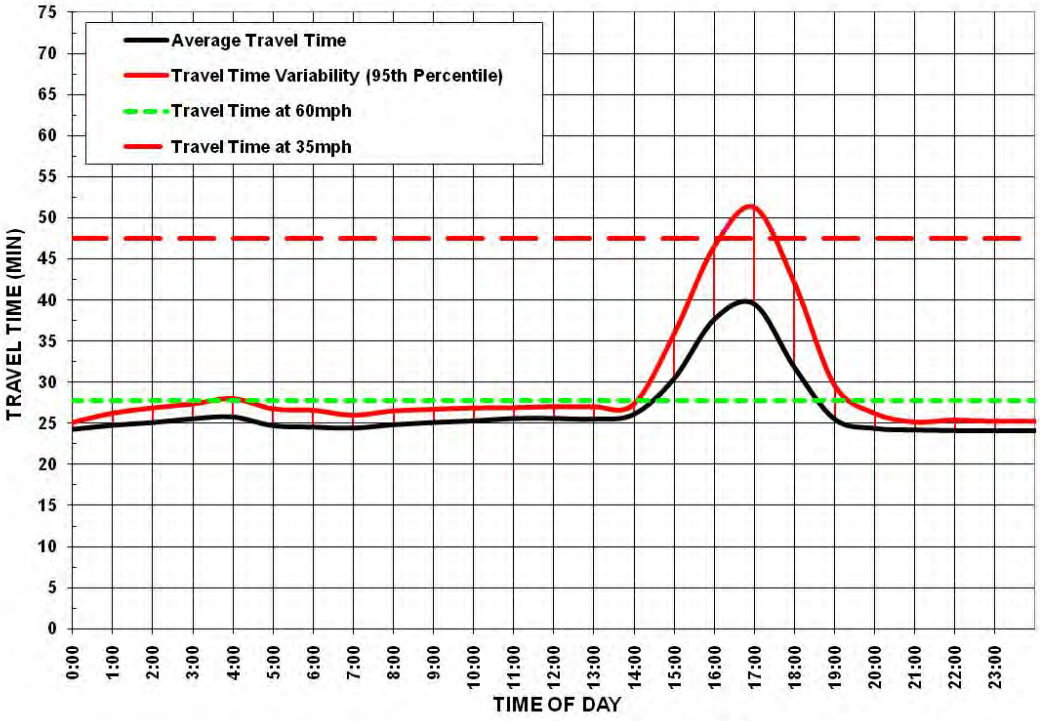


Exhibit 3-26: Southbound I-805 Travel Time Variability (2008)

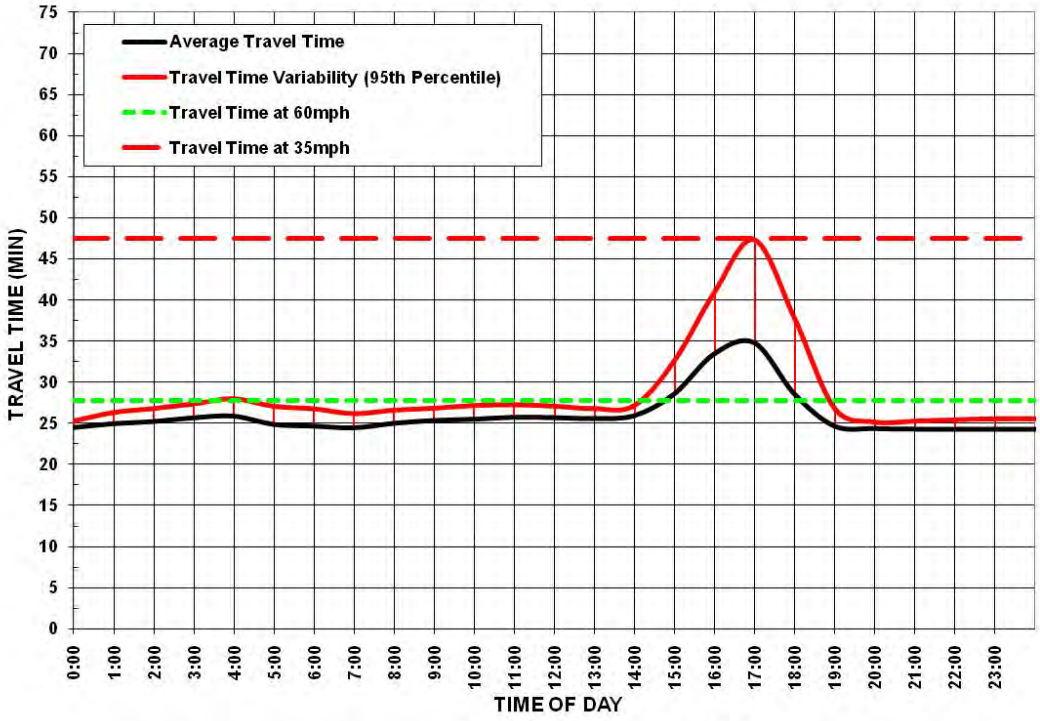
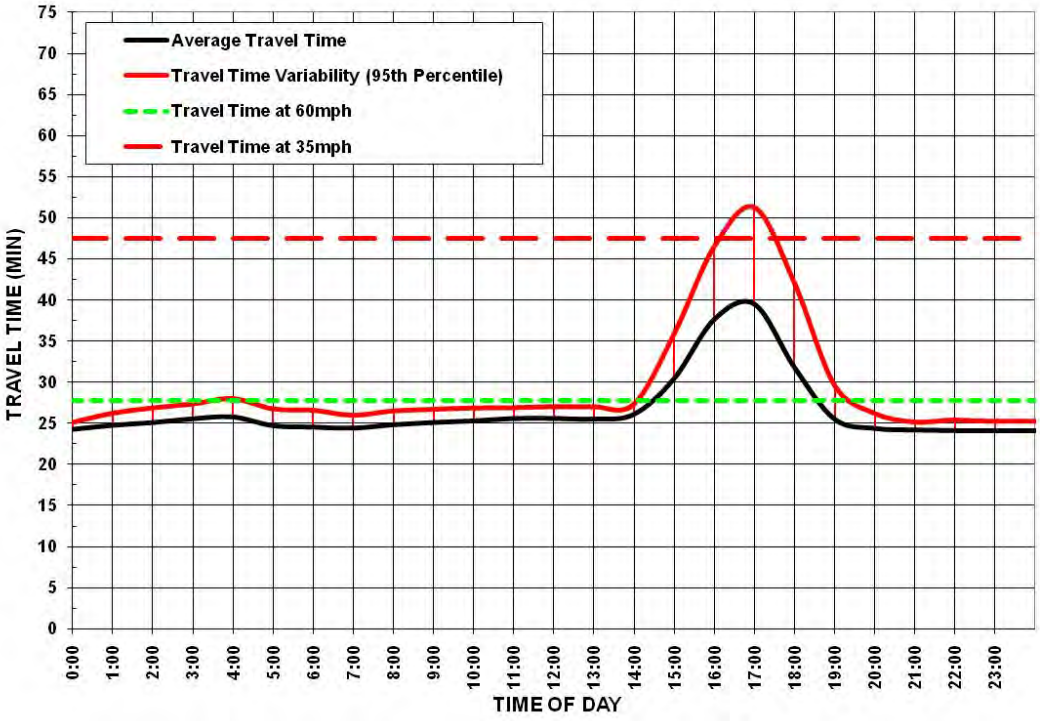


Exhibit 3-27: Southbound I-805 Travel Time Variability (2009)



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 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 3-28 and 3-29 summarize I-805 northbound and southbound collisions by month. Caltrans typically analyzes the latest three-year safety data. The latest TASAS data available from January 1, 2004 through December 31, 2008 were analyzed and summarized. This five-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 3-28: Northbound I-805 Monthly Collisions 2004-2008

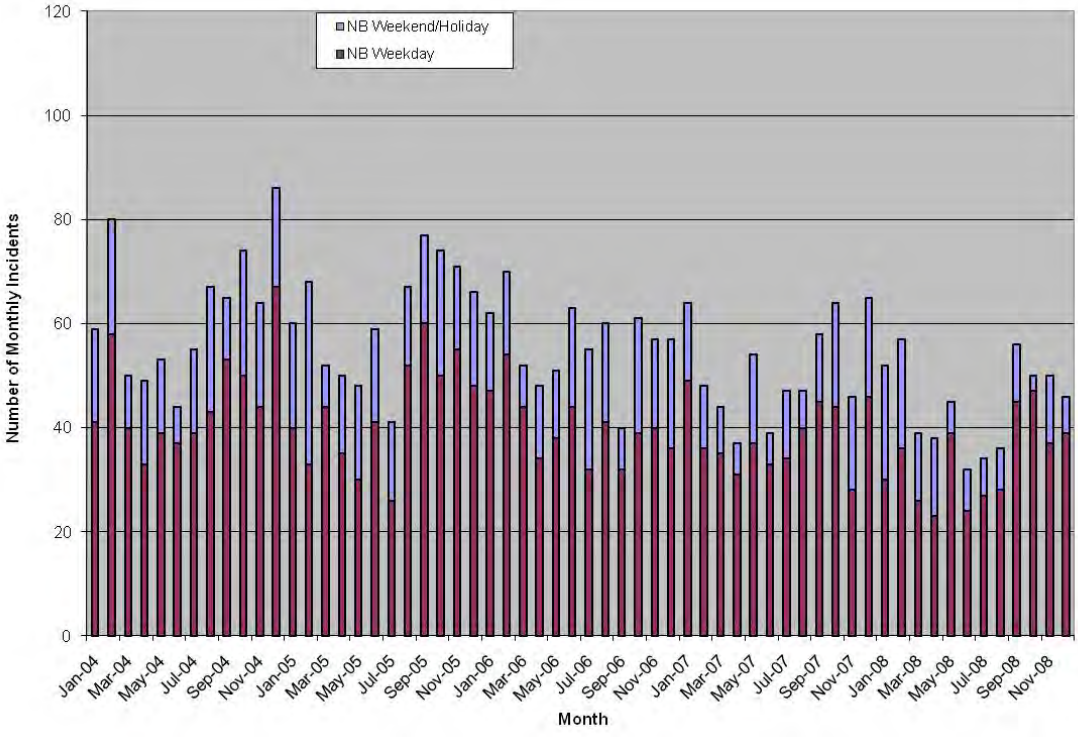
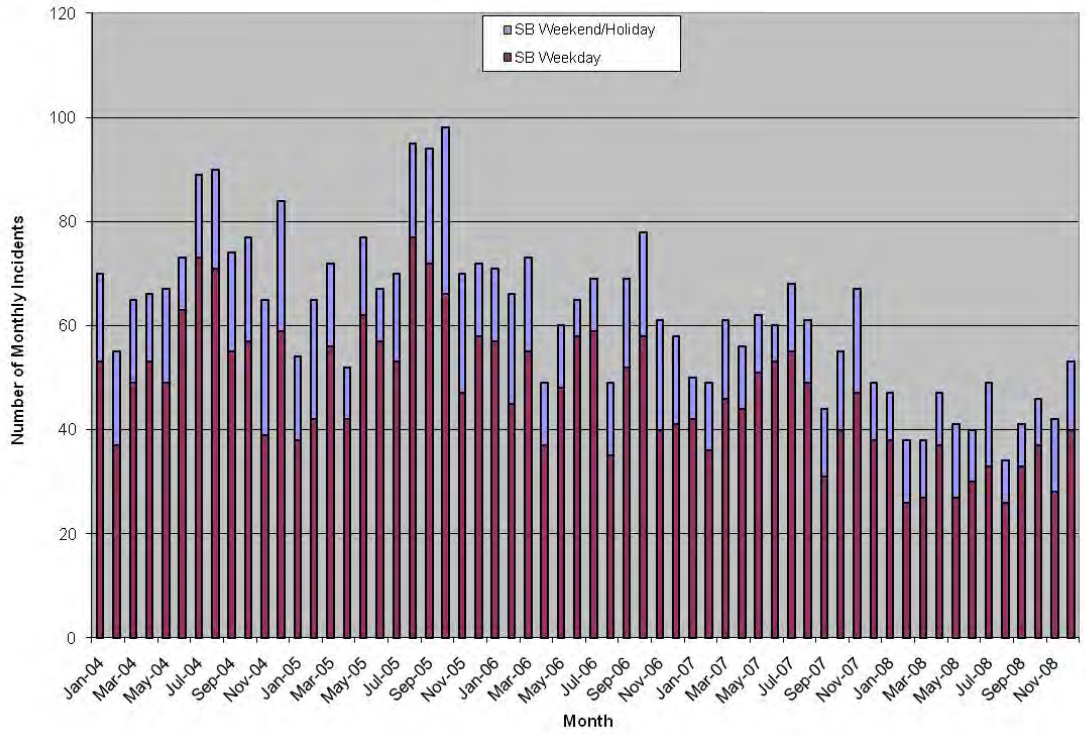


Exhibit 3-29: Southbound I-805 Monthly Collisions 2004-2008



The exhibits show that from 2004 to 2008, the number of accidents declined significantly. In 2004, northbound weekday accidents averaged around 45 per month (or just over two per weekday), while southbound weekday accidents averaged around 55 per month (2.4 per day). By 2008, the northbound number of weekday accidents declined dramatically to around 33 per month (1.5 per day) with the southbound declining to 32 per month (1.4 per day). These trends are consistent with the mobility findings, which suggest that overall travel times and reliability have improved along the corridor.

Weekends showed a similar trend declining from 18 northbound/southbound accidents per month in 2004 to 11 per month by 2008 (2.1 per weekend day down to 1.4). Weekend accident patterns were similar for both the north and southbound directions.

A large number of incidents 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, northbound collisions do not concentrate on a particular day of the week.

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 3-30. 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 3-31 summarizes the estimated 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 has shown continual improvements from 2006 to 2009 with the exception of the AM peak period where lost lane-miles showed a modest increase between 2006 and 2007.

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 3-30: Lost Productivity Illustrated

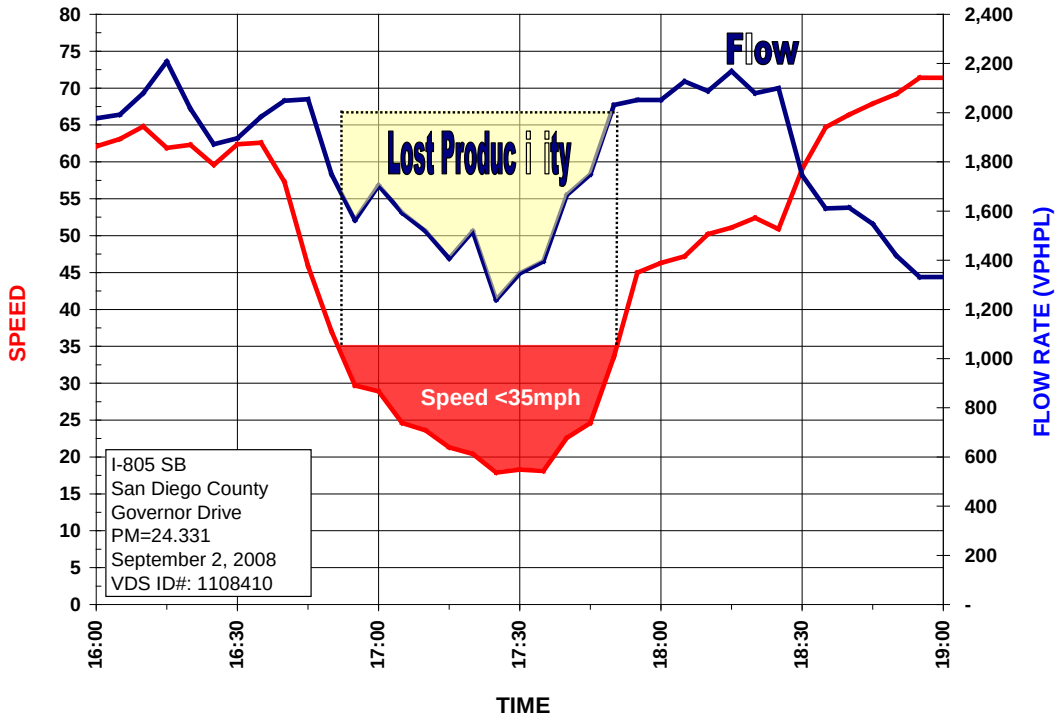
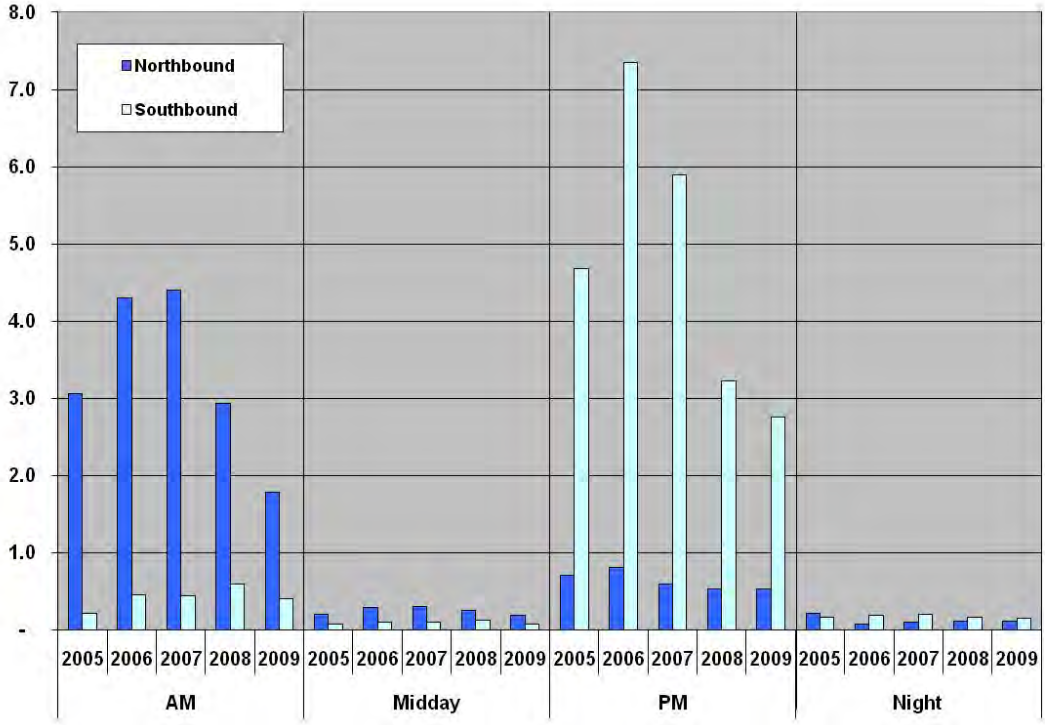


Exhibit 3-31: Average Lost Lane-Miles by Direction, Time Period, and Year



Pavement Condition

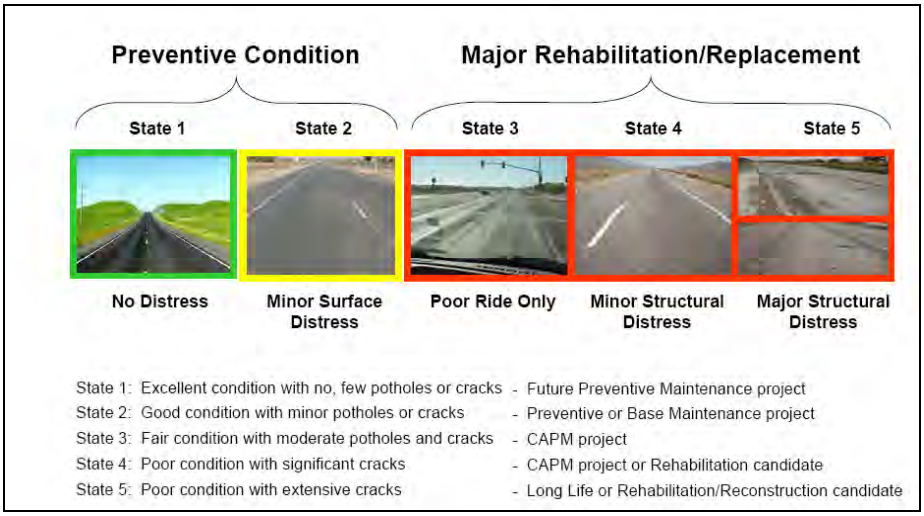
The condition of the roadway pavement (or ride quality) on the corridor can influence its traffic performance. Rough or poor pavement conditions can decrease the mobility, reliability, safety, and productivity of the corridor, whereas smooth pavement can have the opposite effect. Pavement preservation 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 3-32 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 3-32: 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.

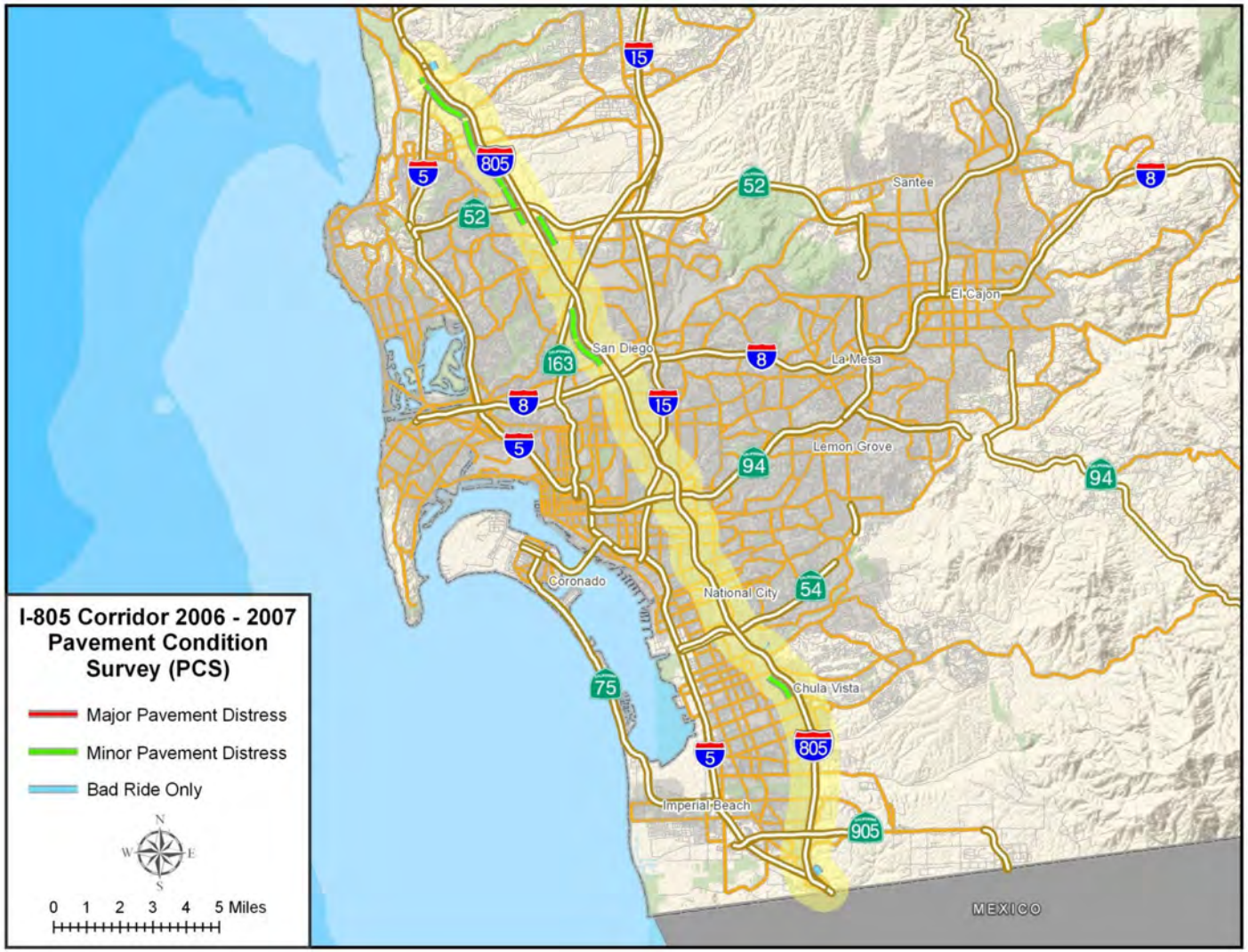
Exhibit 3-33 shows pavement distress along the I-805 corridor according to the 2007 PCS data. The three categories shown represent the three distressed conditions requiring major rehabilitation or replacement and were presented above in Exhibit 3-32.

The pavement along the I-805 corridor is in good condition. The corridor does not show 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 that have bad ride quality issues.

Exhibit 3-33 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.

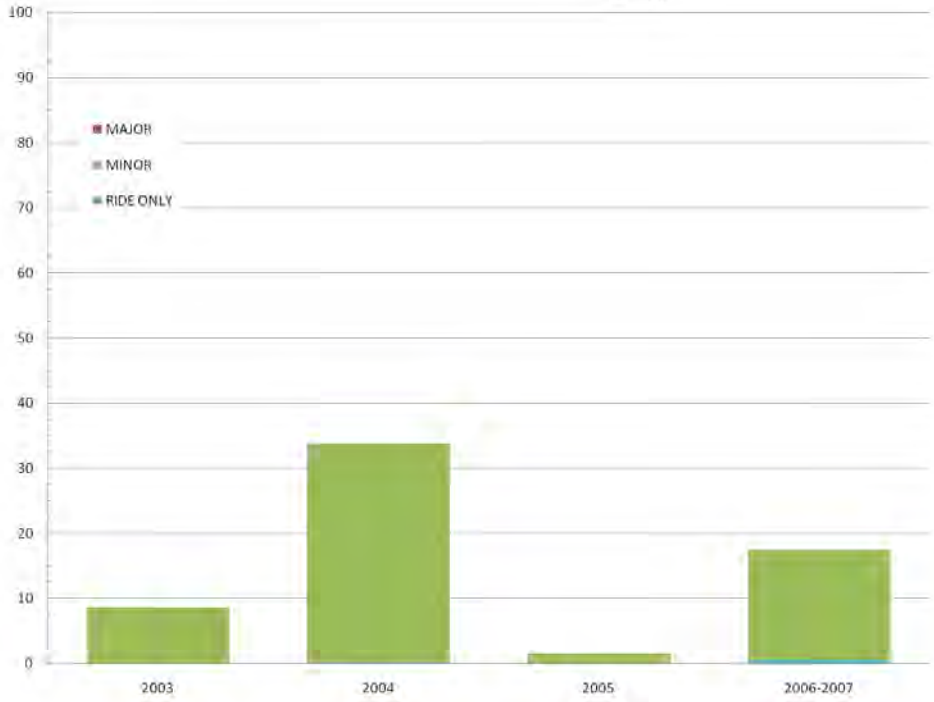
This is illustrated more clearly in Exhibit 3-35, which shows the percent mix of type of distress over time. The pavement issues on the I-805 corridor have been almost exclusively minor pavement distress.

Exhibit 3-33: Distressed Lane-Miles 2006-2007



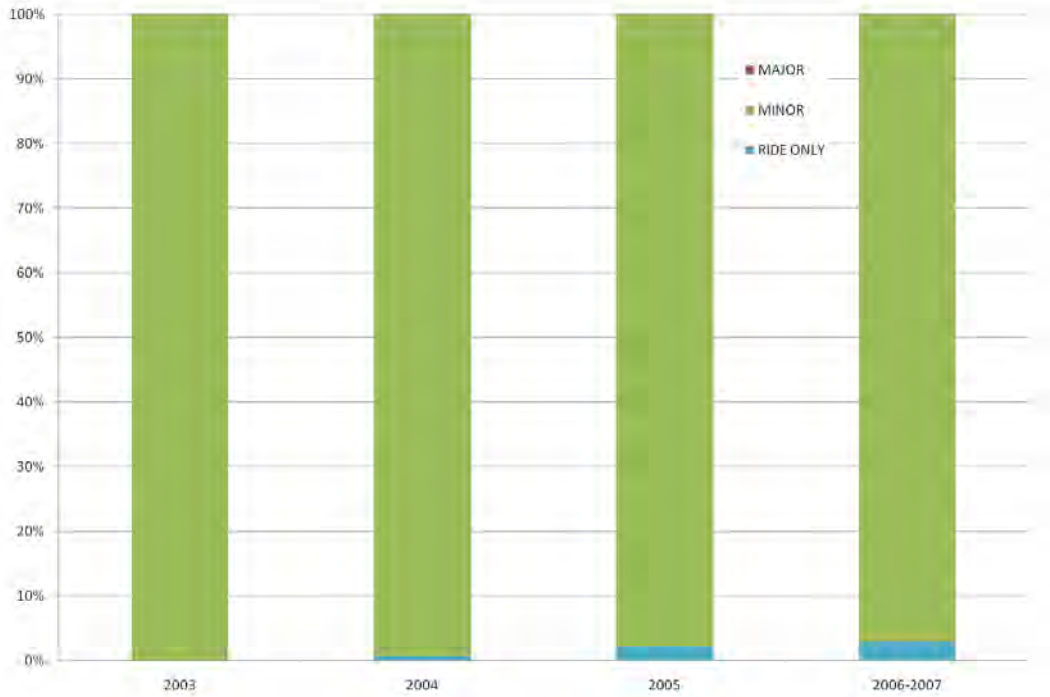
Source: SMG mapping of 2007 Pavement Condition Survey data

Exhibit 3-34: Distressed Lane-Miles Trends on the I-805 Corridor



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

Exhibit 3-35: Distressed Lane-Miles by Type on the I-805 corridor



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

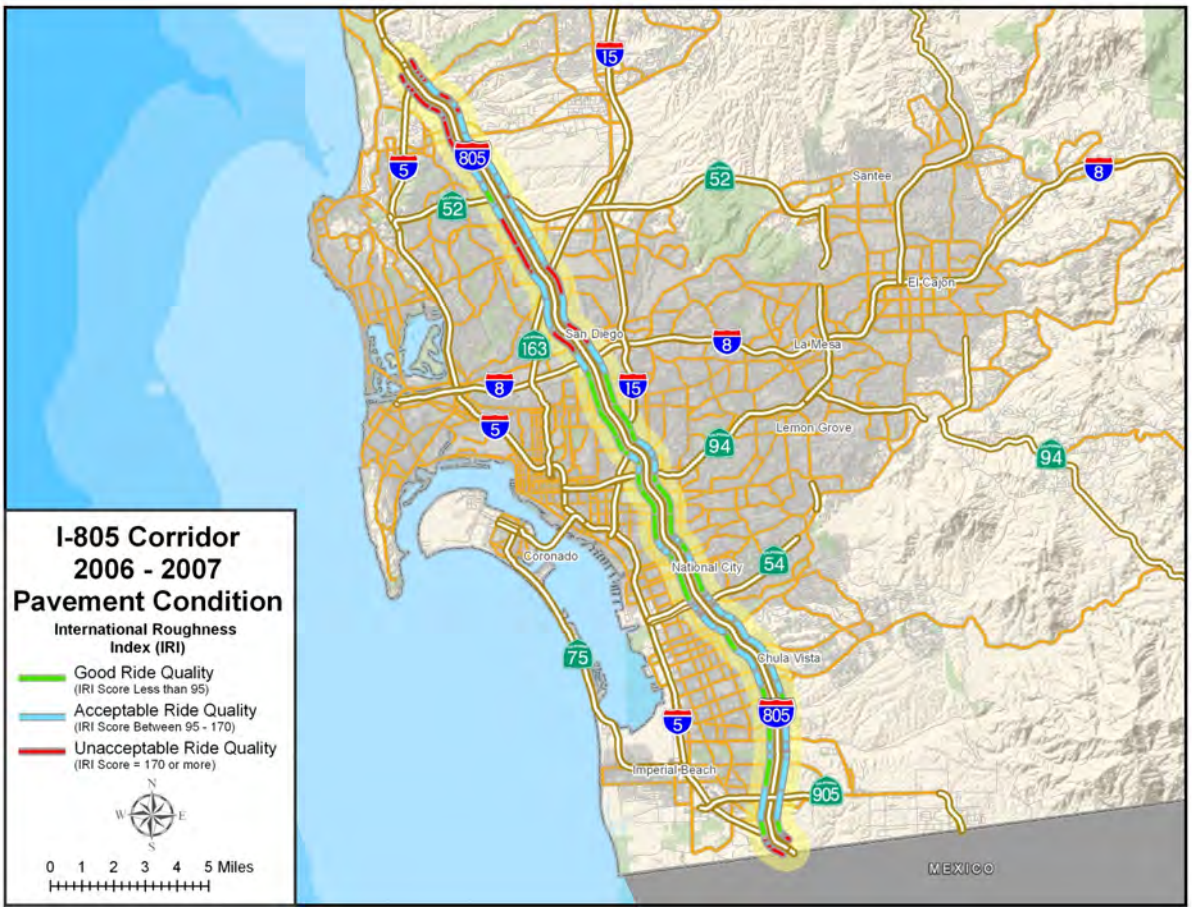
Exhibit 3-36 shows IRI for the lane with the poorest pavement condition in each freeway segment along the corridor. Pavement investment decisions are made on this basis. As the exhibit shows, the corridor has mostly good and acceptable ride quality.

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 3-37, most of the poor ride quality occurs in sections with minor pavement distress, so few lane-miles exhibit only ride issues.

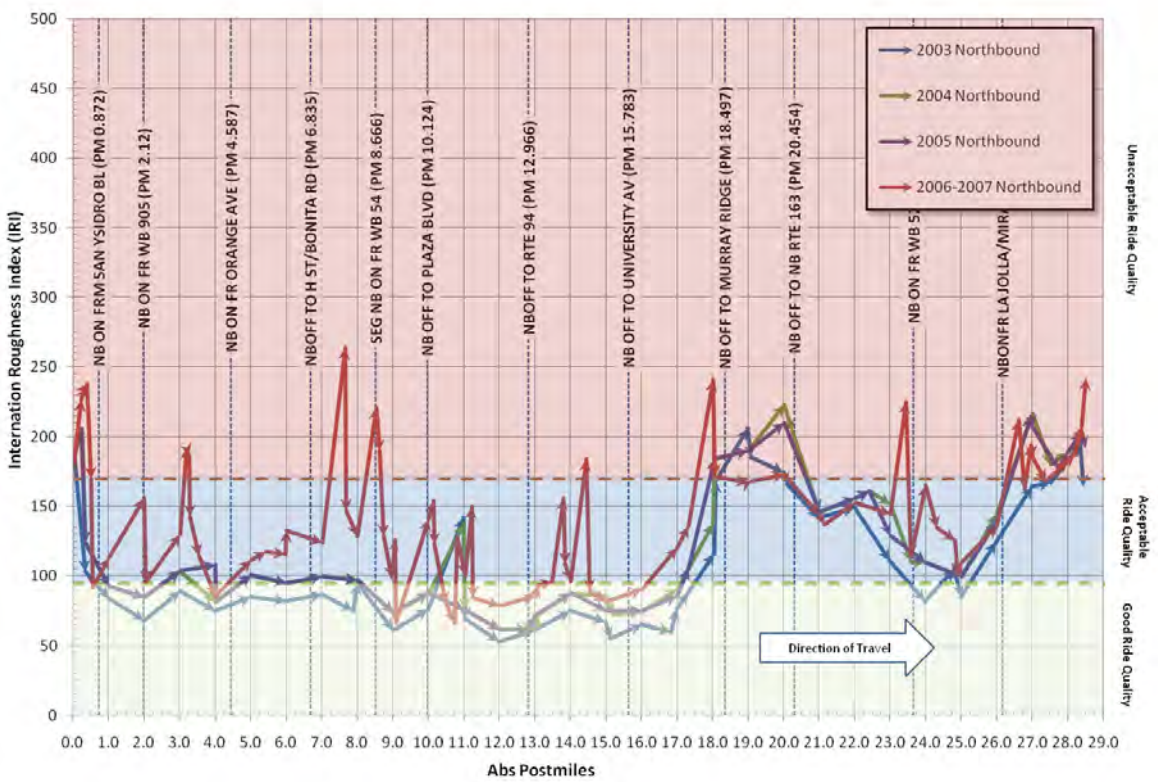
Exhibit 3-36: Corridor IRI for the 2006-07 Period



Source: SMG mapping of 2007 Pavement Condition Survey data

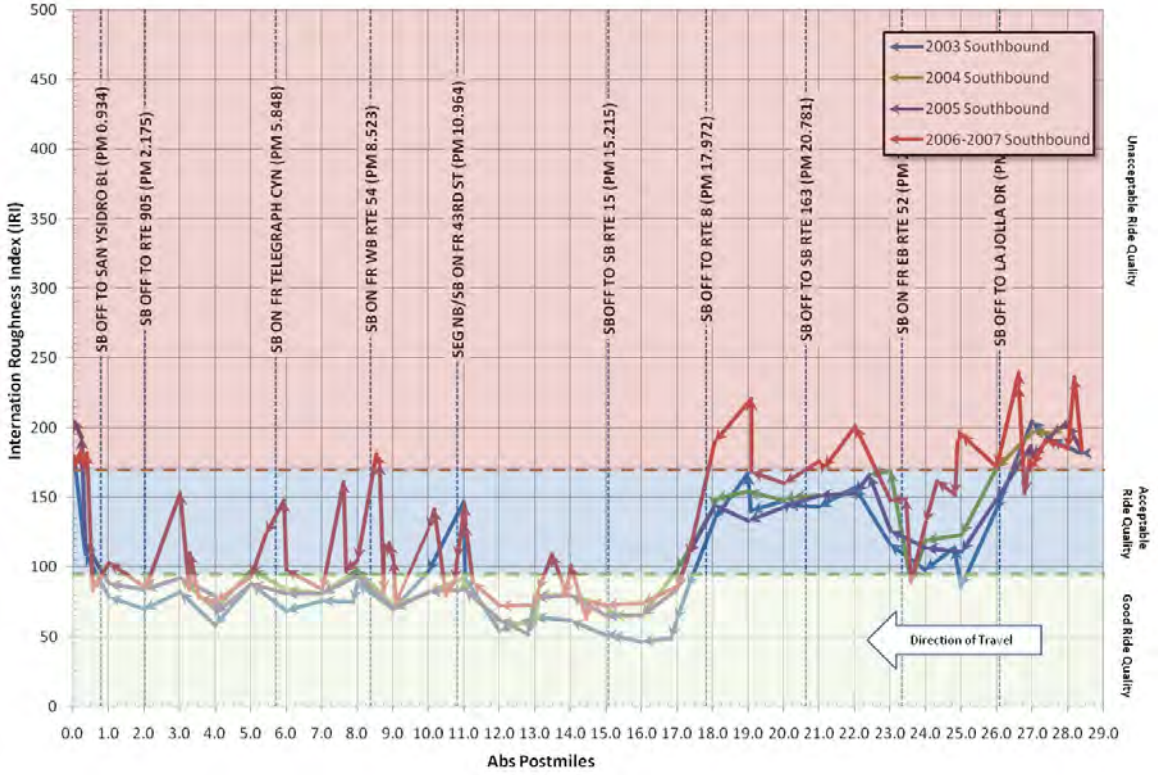
Exhibits 3-37 and 3-38 present ride conditions for the I-805 corridor using IRI from the last four pavement surveys. The information is presented by postmile and direction. The exhibits include color-coded bands to indicate the three ride quality categories defined by Caltrans: good ride quality (green), 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 3-37: Northbound I-805 Corridor IRI 2003-2007



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

Exhibit 3-38: Southbound I-805 Corridor IRI 2003-2007



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

4. BOTTLENECK IDENTIFICATION & PERFORMANCE

The I-805 bottlenecks were identified and verified during the fall of 2008 based on a variety of data sources, including HICOMP, probe vehicle runs, automatic sensor data, and consultant team field counts. These multiple data sources were used to validate findings to ensure consistent findings. System Metrics Group, Inc. (SMG) conducted numerous field observations, videotaping major bottlenecks to document the locations. Finally, the findings were presented to the SANDAG Project Delivery Team (PDT) for review, feedback, and validation.

These efforts resulted in confirming consistent sets of bottlenecks for both directions of the freeway. Exhibit 4-1 summarizes the bottleneck locations identified in this analysis and their estimated delays while Exhibit 4-2 is a map showing these locations.

Exhibit 4-1: Bottleneck Locations and Bottleneck Areas

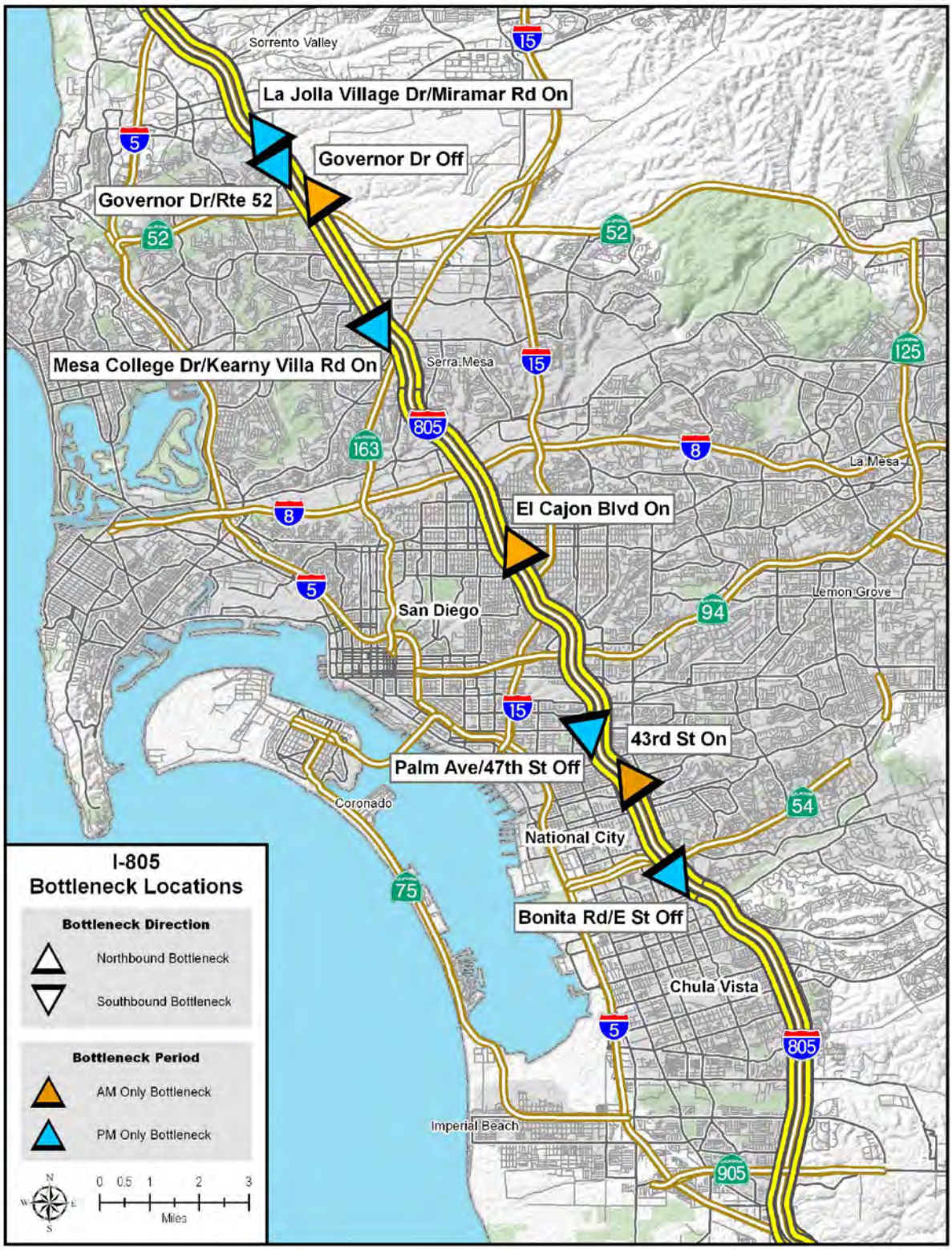
NORTHBOUND BOTTLENECKS

From		To		Distance	Bottleneck Area	Bottleneck Location	Active Period		Annual Vehicle-Hours of Delay	
Abs	CA	Abs	CA				AM	PM	AM	PM
0.0	0.0	11.6	11.7	11.6	I-5 (in San Ysidro) to 43rd St On	43rd St On	✓		160,717	5,305
11.6	11.7	16.4	16.5	4.8	43rd St On to El Cajon Blvd	El Cajon Blvd On	✓		142,380	1,807
16.4	16.5	24.1	24.3	7.7	El Cajon Blvd to Governor Dr Off	Governor Dr Off	✓		253,147	769
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		✓	21,561	69,424
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			182	3,448
						TOTAL ANNUAL DELAY			577,986	80,753

SOUTHBOUND BOTTLENECKS

From		To		Distance	Bottleneck Area	Bottleneck Location	Active Period		Annual Vehicle-Hours of Delay	
Abs	CA	Abs	CA				AM	PM	AM	PM
28.7		24.5	24.7	4.2	I-5 (in Sorrento Valley) to Governor Dr/SR-52	Governor Dr/ SR-52		✓	2,106	294,394
24.5	24.7	19.5	19.6	5.0	Governor Dr/ SR-52 to Mesa College/Kearny Villa On	Mesa College Dr/ Kearny Villa Rd On		✓	302	127,315
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		✓	1,137	316,685
11.9	12.1	7.1	8.0	4.8	Palm/47th Off to Bonita Rd/E St Off	Bonita Rd/E St Off		✓	1,337	285,222
7.1	8.0	0		7.1	Bonita Rd/H St. Off to I-5 (in San Ysidro)	Not a bottleneck area			2,023	9,735
						TOTAL ANNUAL DELAY			6,905	1,033,351

Exhibit 4-2: Map of Bottleneck Locations



Northbound Bottlenecks

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

- 43rd Street On
- El Cajon Boulevard 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

Bottleneck Identification

SMG used data analysis and extensive field verification to identify and verify potential bottleneck locations (i.e., places with mobility constraints). All bottleneck locations were filmed and photographed to both to document the field visits as well as to assist the modeling team in calibrating the micro-simulation model used in the study. The field visits were carried out during the summer, fall, and winter of 2008. SMG presented the findings to the Project Delivery Team (PDT) for further review and feedback.

SMG consulted a variety of data sources to identify bottlenecks:

- 2007 Highway Congestion Monitoring Program (HICOMP) report
- probe vehicle data
- Automatic detection data
- aerial photos
- field observations.

HICOMP

The team began the problem area identification by reviewing the 2007 Caltrans HICOMP report. Congested queues form upstream from bottlenecks, which are located "at the front" of the congested segment. Exhibits 4-3 and 4-4 show the HICOMP congestion maps with circles overlaid to indicate potential bottleneck locations. Bottleneck areas are identified with blue circles in the northbound direction and red circles in the southbound direction. As discussed in the previous section, the HICOMP report for District 11 may rely on data obtained from a limited number of days.

In 2007 for the AM peak period (Exhibit 4-3), 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 Boulevard. Exhibit 4-3 also shows a smaller southbound bottleneck between Main Street and Telegraph Canyon Road in Chula Vista. This southbound bottleneck was not confirmed by any of the other sources or by field investigations.

Exhibit 4-3: 2007 HICOMP AM Congestion Map with Potential Bottlenecks

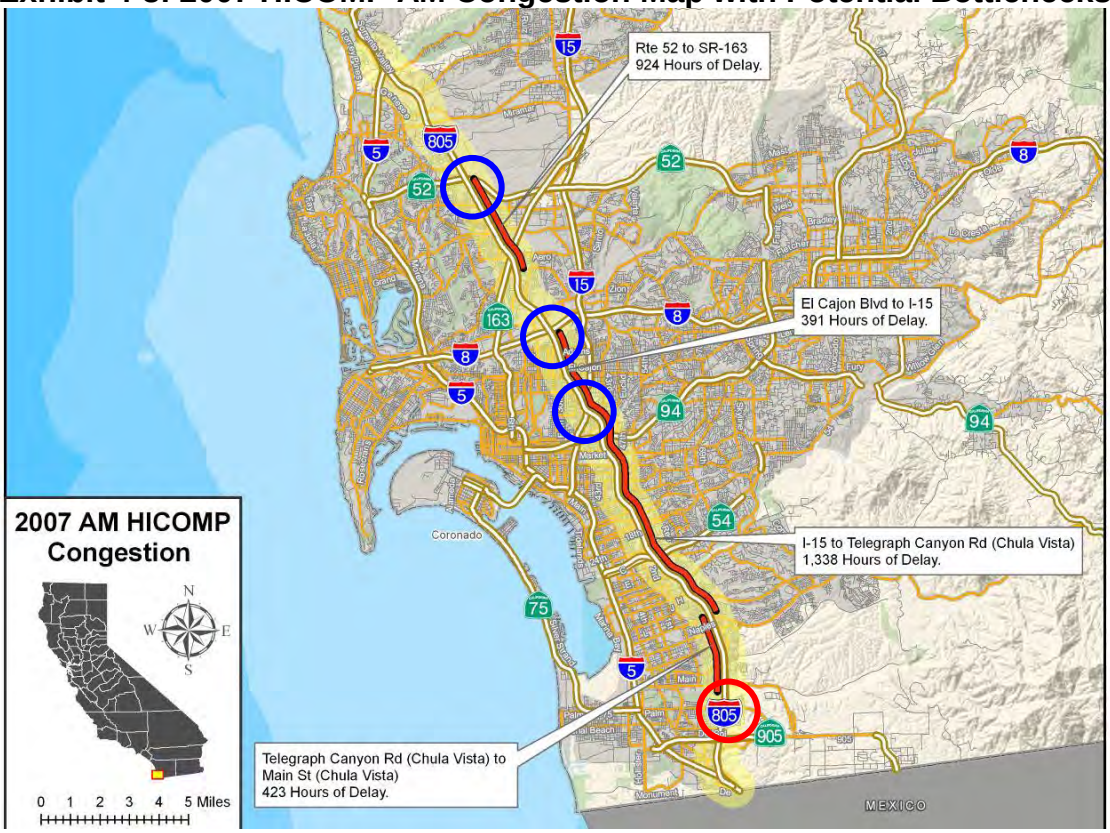
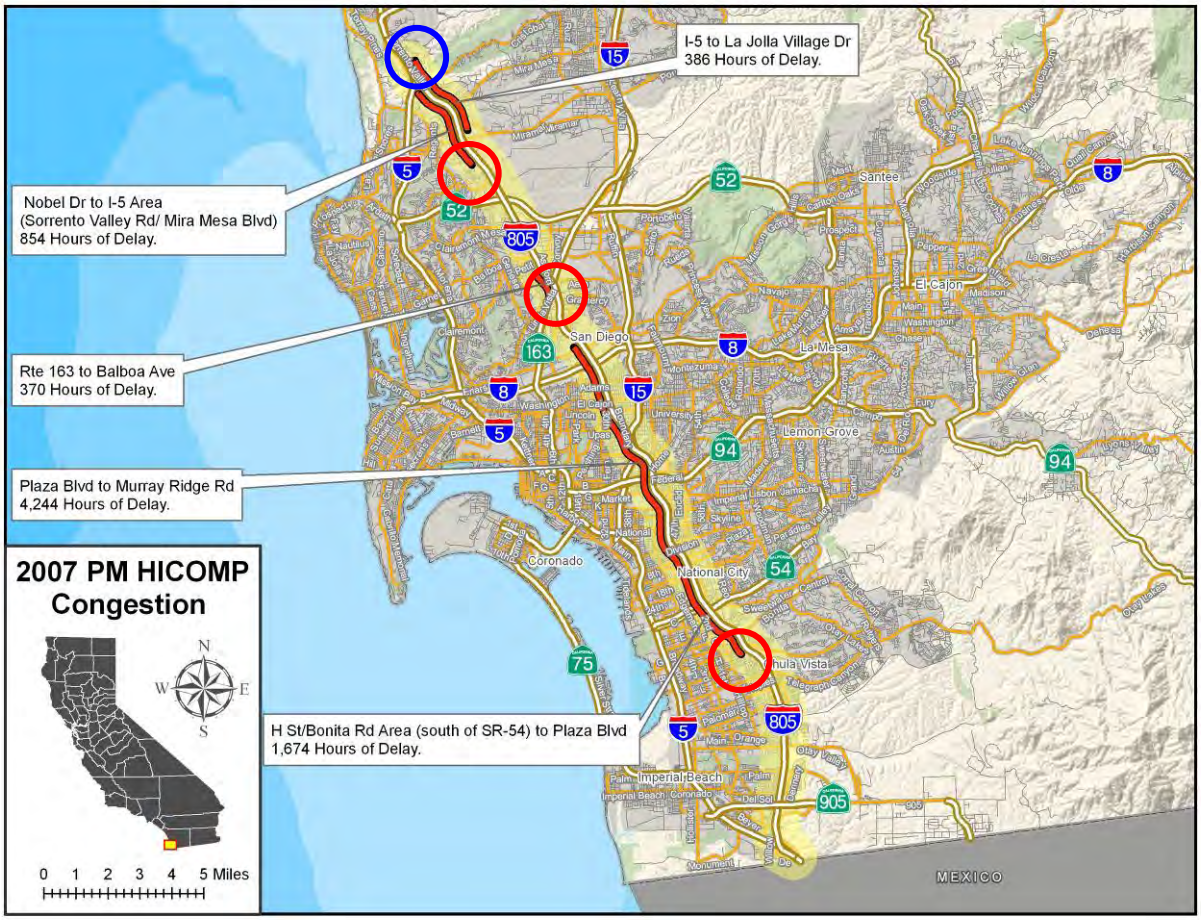


Exhibit 4-4 shows PM peak period bottlenecks using data from the 2007 HICOMP report. As discussed in Section 3, the PM peak period tends to be more congested than the AM peak period, which is shown in both HICOMP and sensor data.

There are three major southbound bottlenecks and one minor northbound bottleneck. The largest bottleneck is located at Plaza Boulevard and extends north to Murray Ridge Road. The next largest begins at the SR-54/I-805 interchange near H Street/Bonita Road and merges with the first bottleneck. The third bottleneck begins at Nobel Drive and extends north toward the I-5/I-805 interchange. 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 the I-5 interchange in the Sorrento Valley Area that extended south to La Jolla Village Drive.

All these bottlenecks were confirmed and refined by subsequent data analysis and field verification.

Exhibit 4-4: 2007 HICOMP PM Congestion Map with Potential Bottlenecks



Probe Vehicle Runs

SMG used probe vehicle data collected by Caltrans District 11 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 various electronic devices (e.g., tachograph and global positioning system) along the corridor 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.

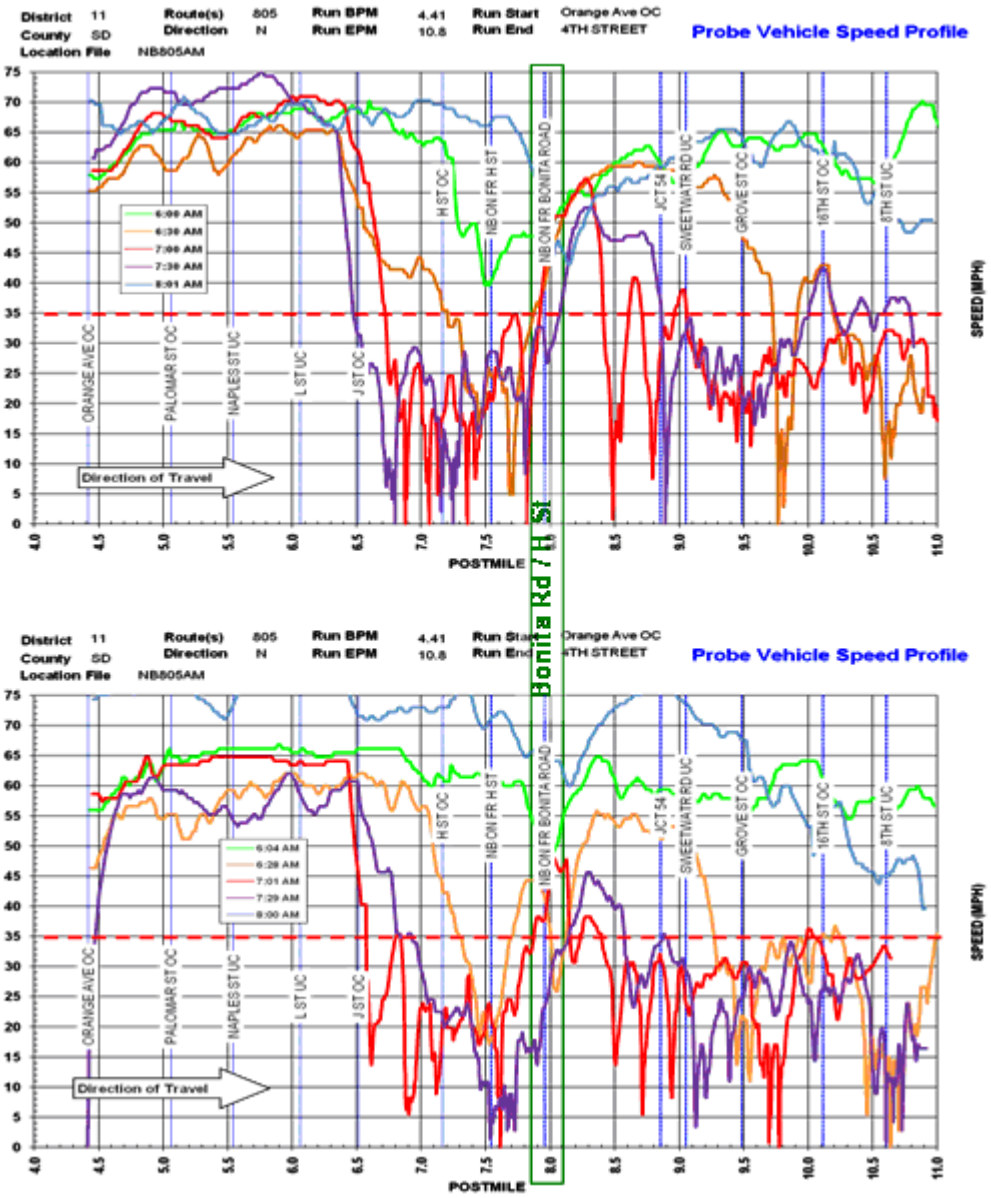
Northbound HICOMP

Caltrans District 11 collected northbound 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 out of the 29 miles in the study corridor). 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 a limited number of additional probe runs using GPS equipment during field visits.

Exhibit 4-5 illustrates the I-805 northbound probe vehicle runs performed by Caltrans in the fall 2007 at various times 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. As indicated in the exhibit, one northbound bottleneck is evident. This bottleneck occurs at the Bonita Road on-ramp. The decline shown on the right of Exhibit 4-5 also shows evidence of another bottleneck north of postmile 11.0. This bottleneck is not shown on the exhibit since the probe vehicles exited the freeway before reaching the bottleneck.

Caltrans did not identify congestion during the spring 2008 probe runs, so the data is not shown in this report. During the field visit, SMG identified no northbound PM peak congestion, so the GPS-collected data is also not shown in this report.

Exhibit 4-5: Northbound I-805 Sample Probe Vehicle Runs – 2007



Southbound HICOMP

Caltrans District 11 collected southbound probe vehicle data on November 14 and 15, 2007 and on March 25 and 26, 2008 from Plaza Boulevard to H Street (approximately three miles of the study corridor). The southbound probe runs occurred between approximately 3:30 PM and 7:30 PM. In addition to these probe vehicle runs, SMG performed additional probe runs using GPS equipment.

Exhibit 4-6 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 southbound bottleneck evident. This bottleneck occurs at the Bonita Road off-ramp. Although not plotted, 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.

Exhibit 4-6: Southbound I-805 Sample Probe Vehicle Runs – 2007

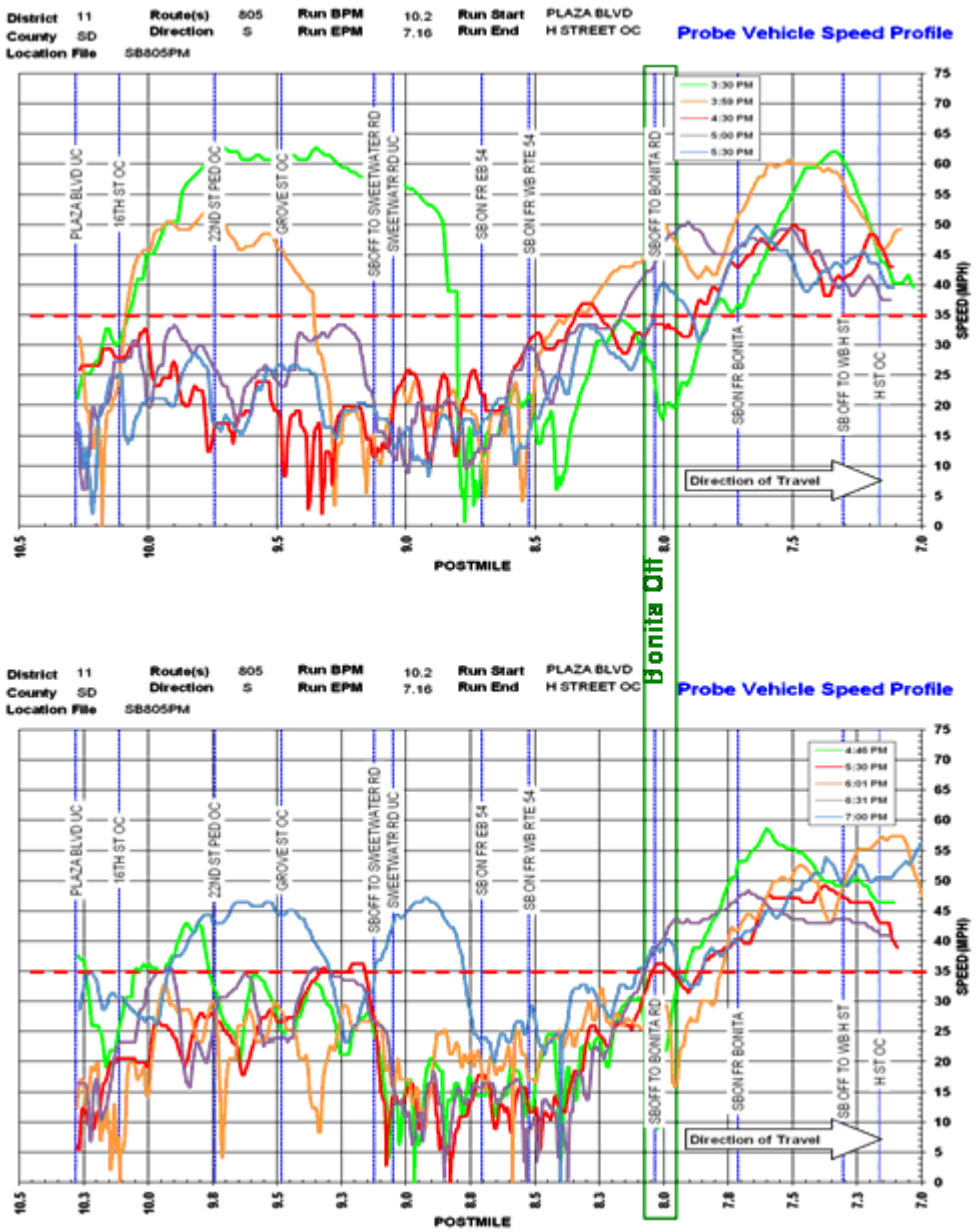


Exhibit 4-7 shows GPS data from the SMG southbound PM peak period probe runs taken on July 16, 2008 from the I-5 interchange in Sorrento Valley to Orange Avenue in Chula Vista between 3:15 PM and 6:45 PM. These limited runs confirm findings from both the Caltrans District 11 probe runs and from the automatic data reviewed in PeMS.

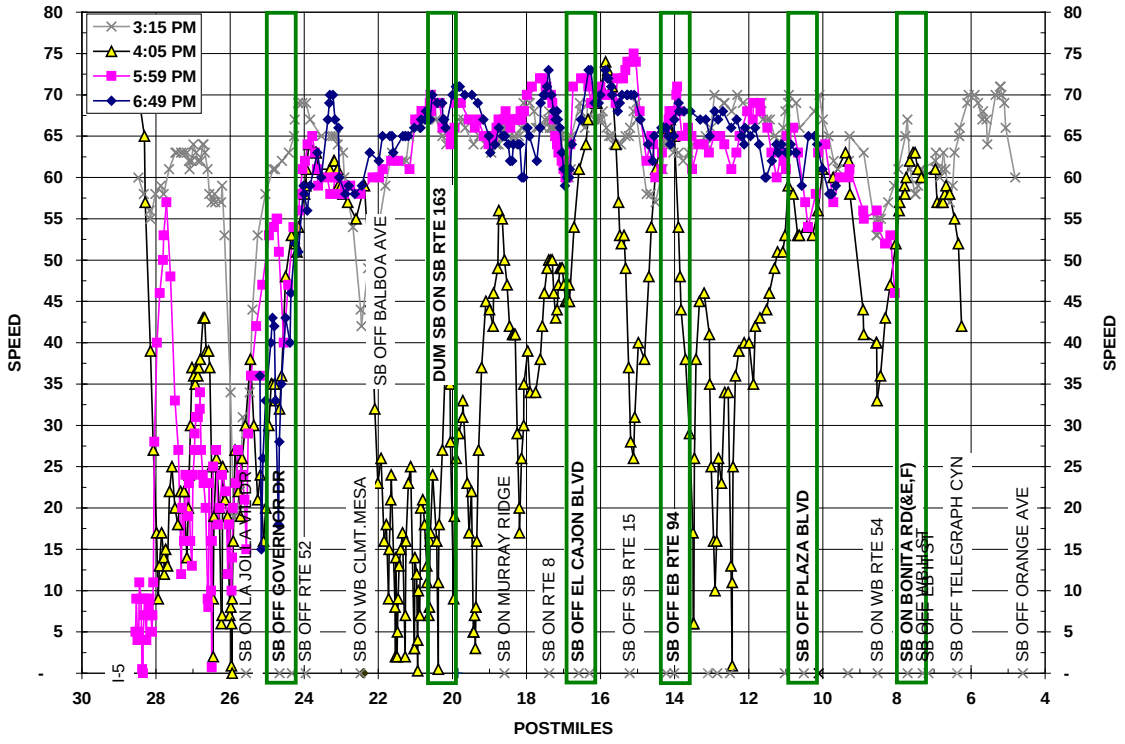
The SMG probe runs confirm findings from the District 11 probe runs and HICOMP that congestion results from slowing at Bonita Road in the southbound direction during the PM peak period.

A smaller potential bottleneck identified by this field visit lies at El Cajon Boulevard, which is located approximately 0.8 mile south of the I-8 interchange.

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. This bottleneck corresponds to the major HICOMP bottleneck that starts at Nobel Drive. This was the most congested segment during the site visits.

Exhibit 4-7: Southbound I-805 GPS Probe Vehicle Runs – July 16, 2008



Source: System Metrics Group, Inc.

Automatic Detection Data

PeMS provides speed profile plots that are 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.

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 Automatic Detection

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 4-8 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 4:00 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 4-9 is the speed profile for the same two days in October 2008. This plot shows 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 previous section of this report.

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 4-10 and 4-11 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 4-12 illustrates the weekday averages by each quarter of 2007. Three of the four bottleneck locations are identified (minus the Bonita Road bottleneck), further

validating the reoccurring pattern of the northbound bottleneck locations. The quarterly data shows a fourth bottleneck at Claremont Mesa Boulevard. This bottleneck is often hidden by the queues from the SR-52 off-ramp bottleneck.

Exhibit 4-8: Northbound I-805 Speed Contour Plots – October 2007

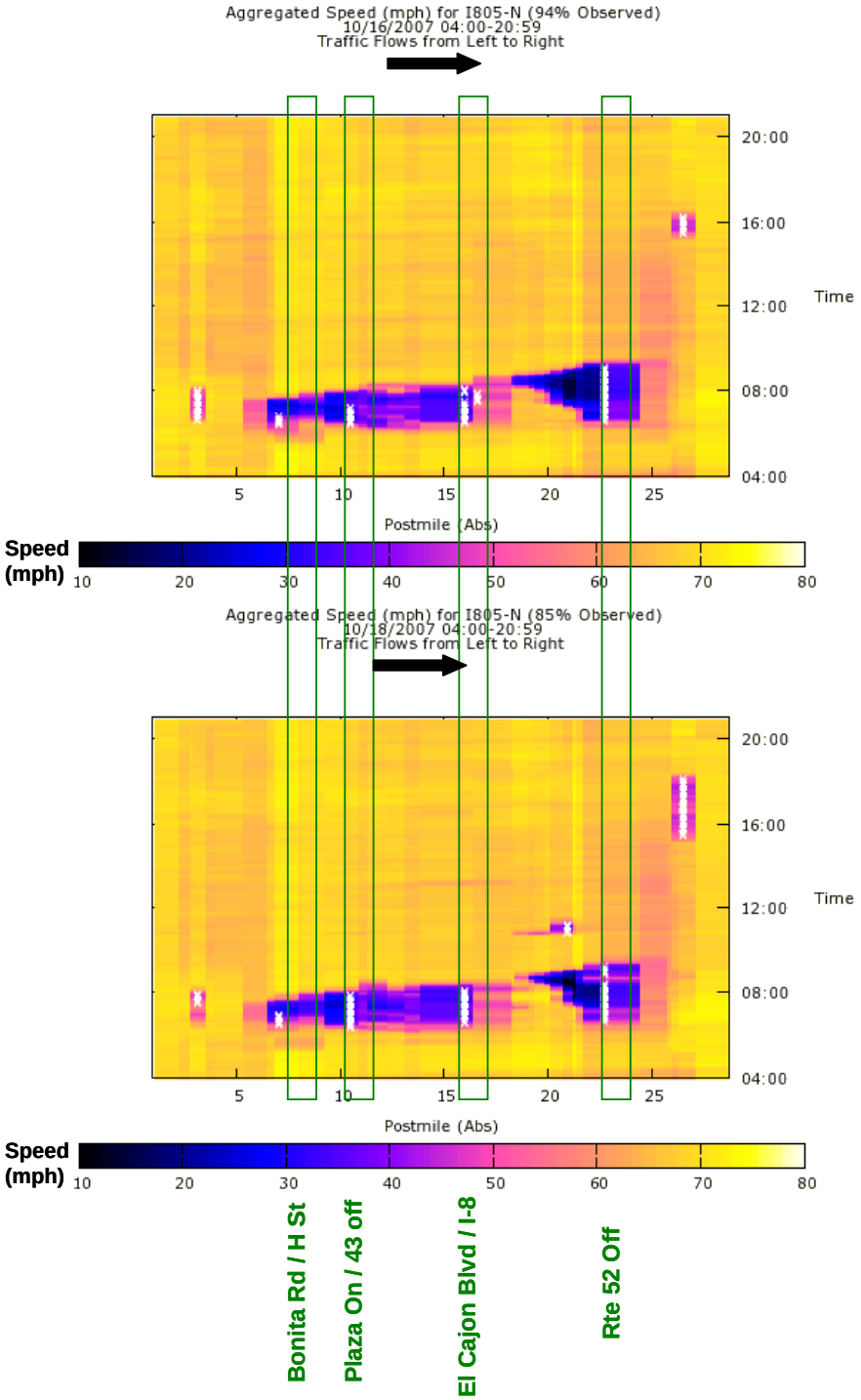


Exhibit 4-9: Northbound I-805 Speed Profile Plots – October 2007

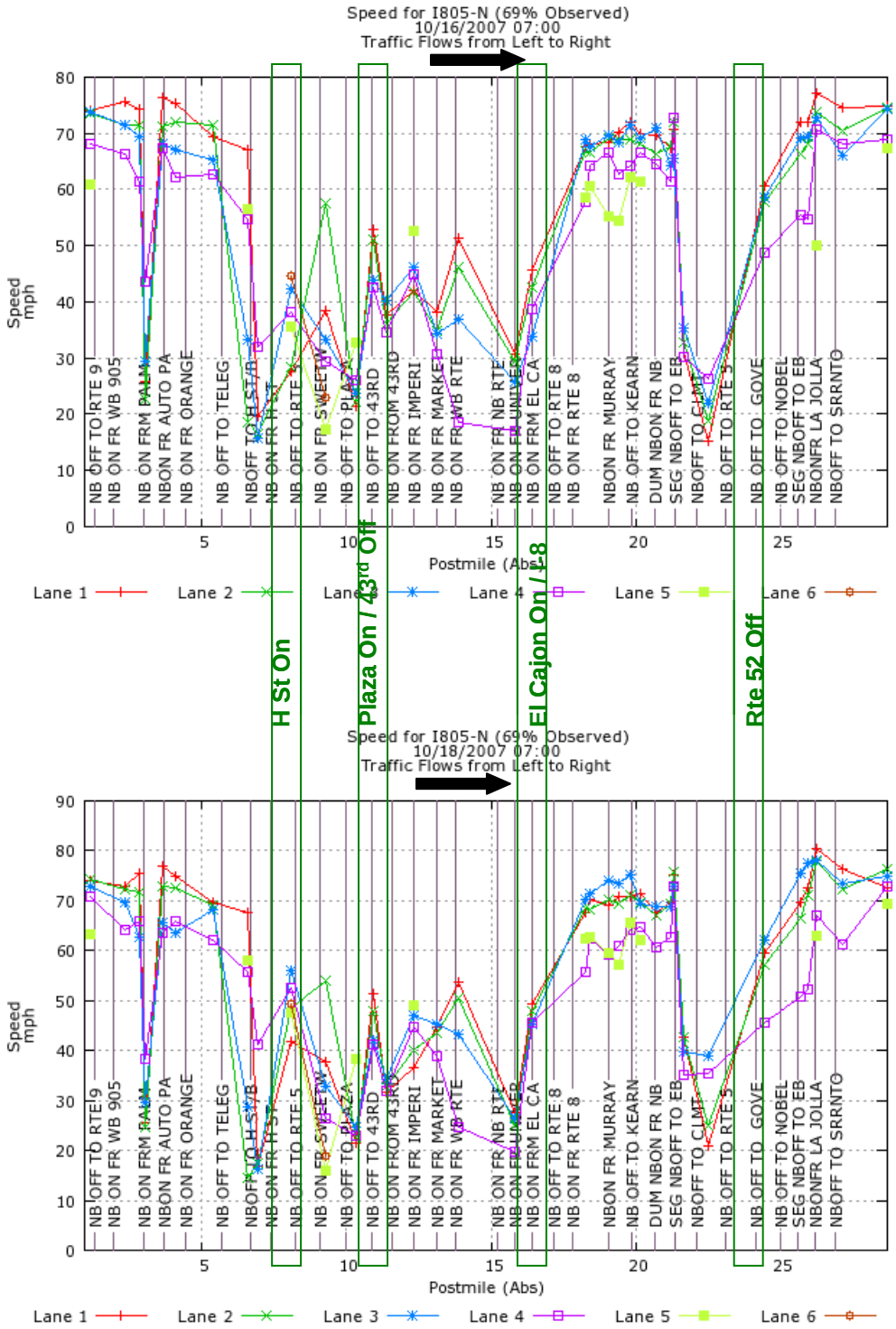


Exhibit 4-10: Northbound I-805 Speed Contour Plots – November 2007

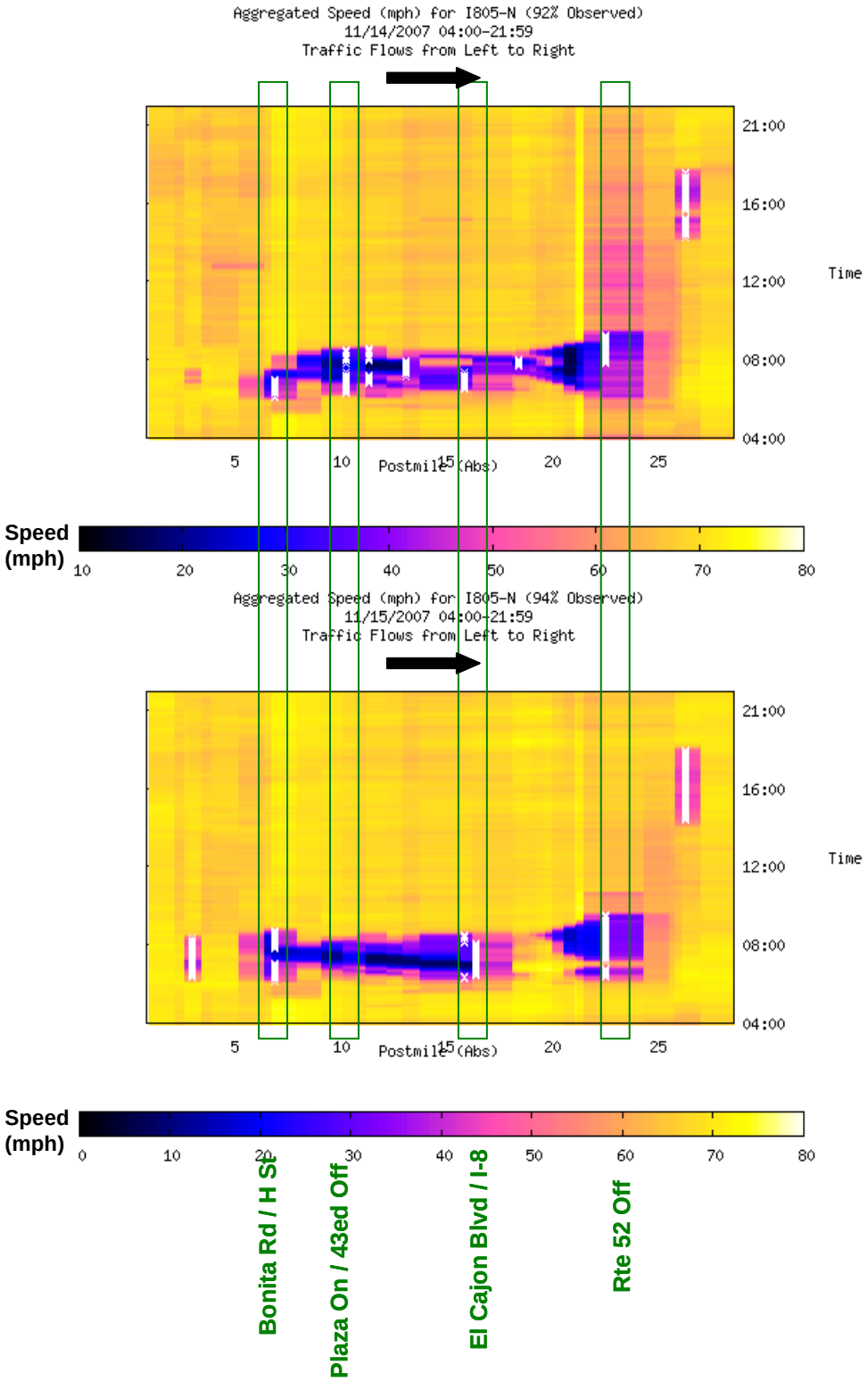


Exhibit 4-11: Northbound I-805 Speed Profile Plots – November 2007

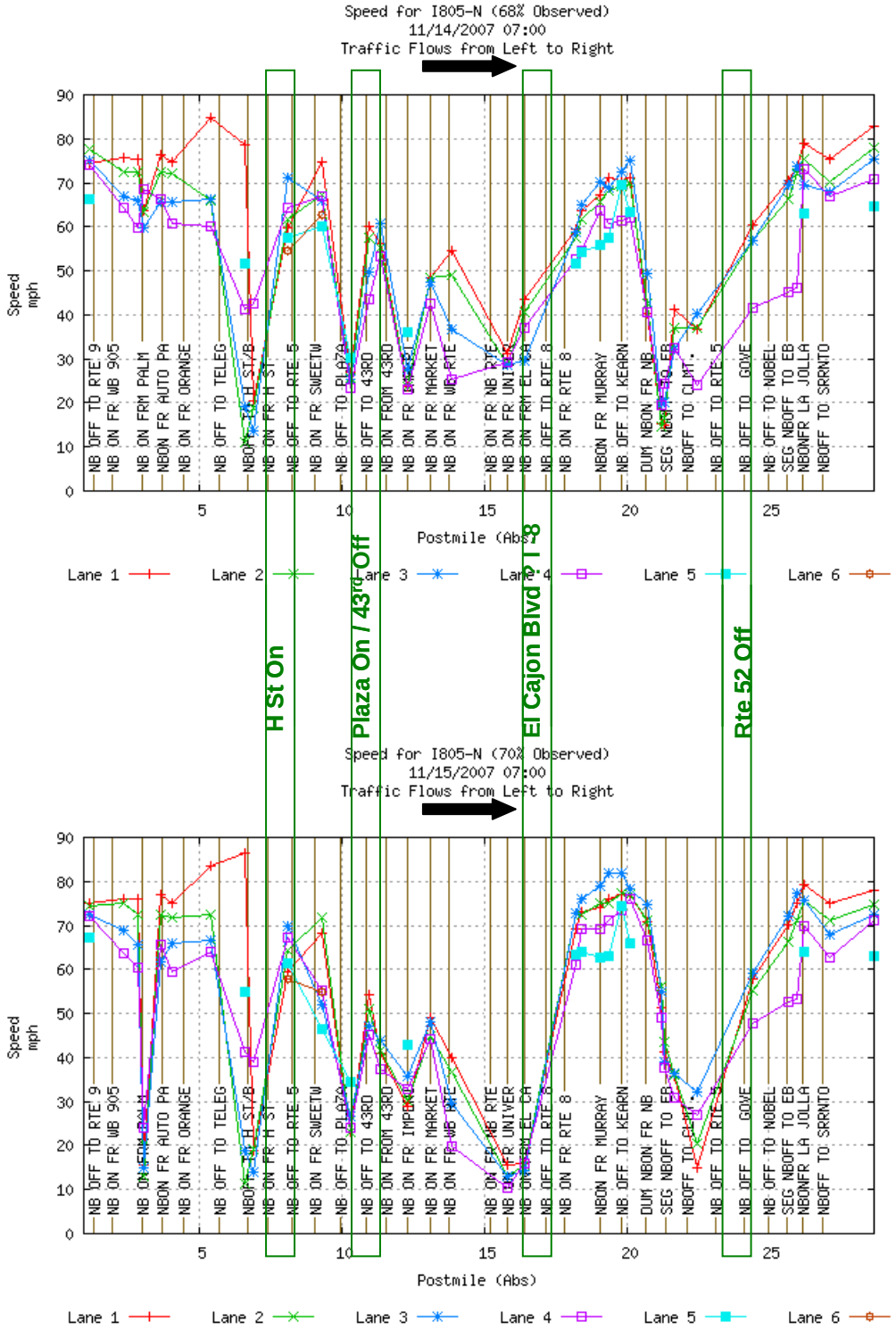
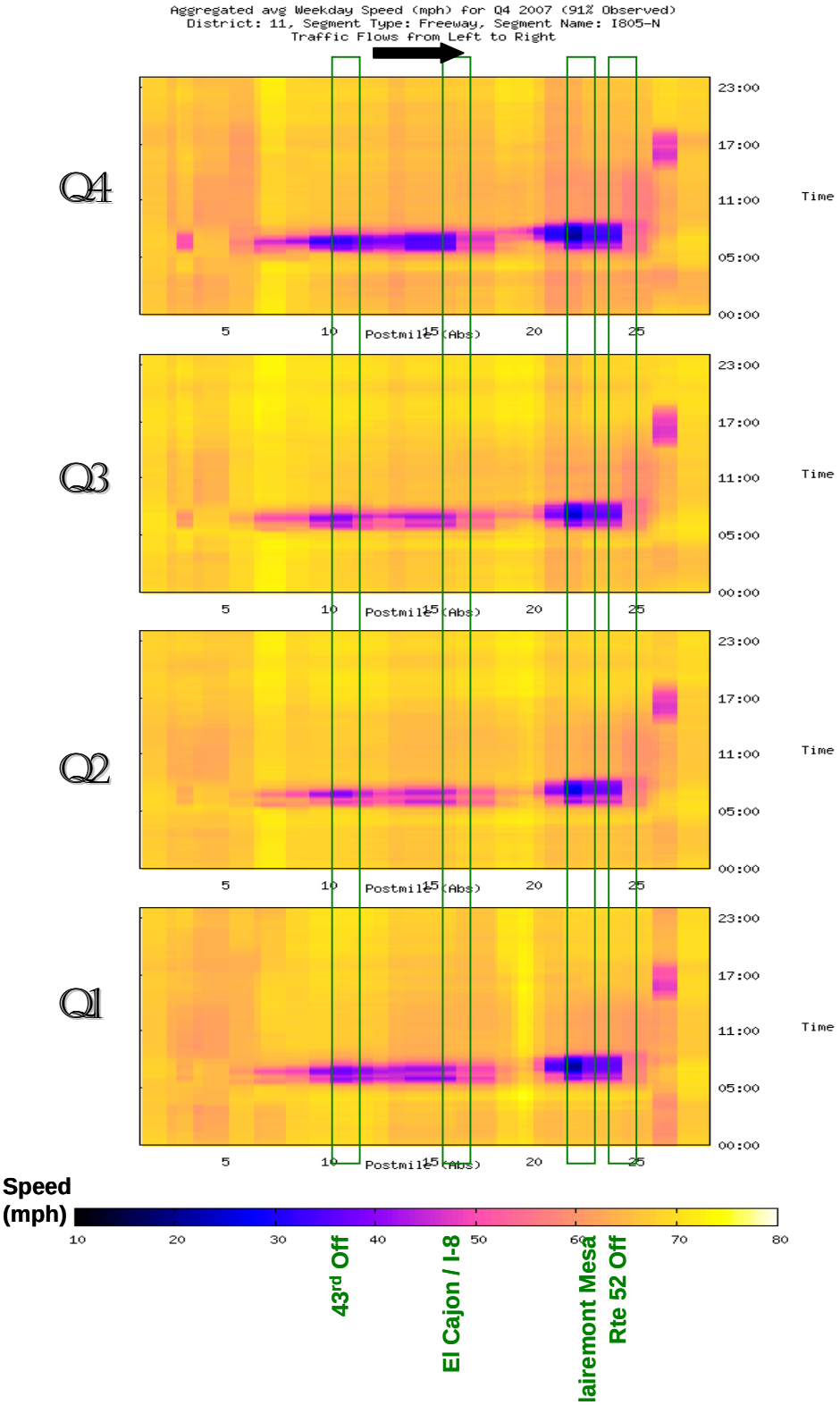


Exhibit 4-12: Northbound I-805 Long (Speed) Contours – 2007 Quarterly Average



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 Boulevard (just south of the I-805/I-8 interchange).

Consistent with multiple SMG field visits, 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 Automatic Detection

SMG analyzed speed contour and speed profile plots for sample days in October and November 2007 for the southbound direction. Exhibits 4-13 and 4-14 show the southbound speed contour and profile plots. Traffic moves left to right on all three plots.

As indicated in the exhibits, the first major southbound bottleneck identified from the plots is at Bonita Road where SR-54 merges onto southbound I-805.

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.

A third major bottleneck is located at the Governor Drive southbound on-ramp and the SR-52 off-ramp from I-805. Sensor data analysis suggests that this one of the most congested bottlenecks on the corridor.

A fourth bottleneck is located at Sorrento Valley Road just south of the I-5 interchange.

There is a smaller bottleneck at El Cajon Boulevard, but PeMS data shows it is not as consistent as the other bottlenecks. This is particularly evident in the “long contour” plots shown in Exhibit 4-16.

Exhibit 4-13: Southbound I-805 Speed Contour Plots – October 2007

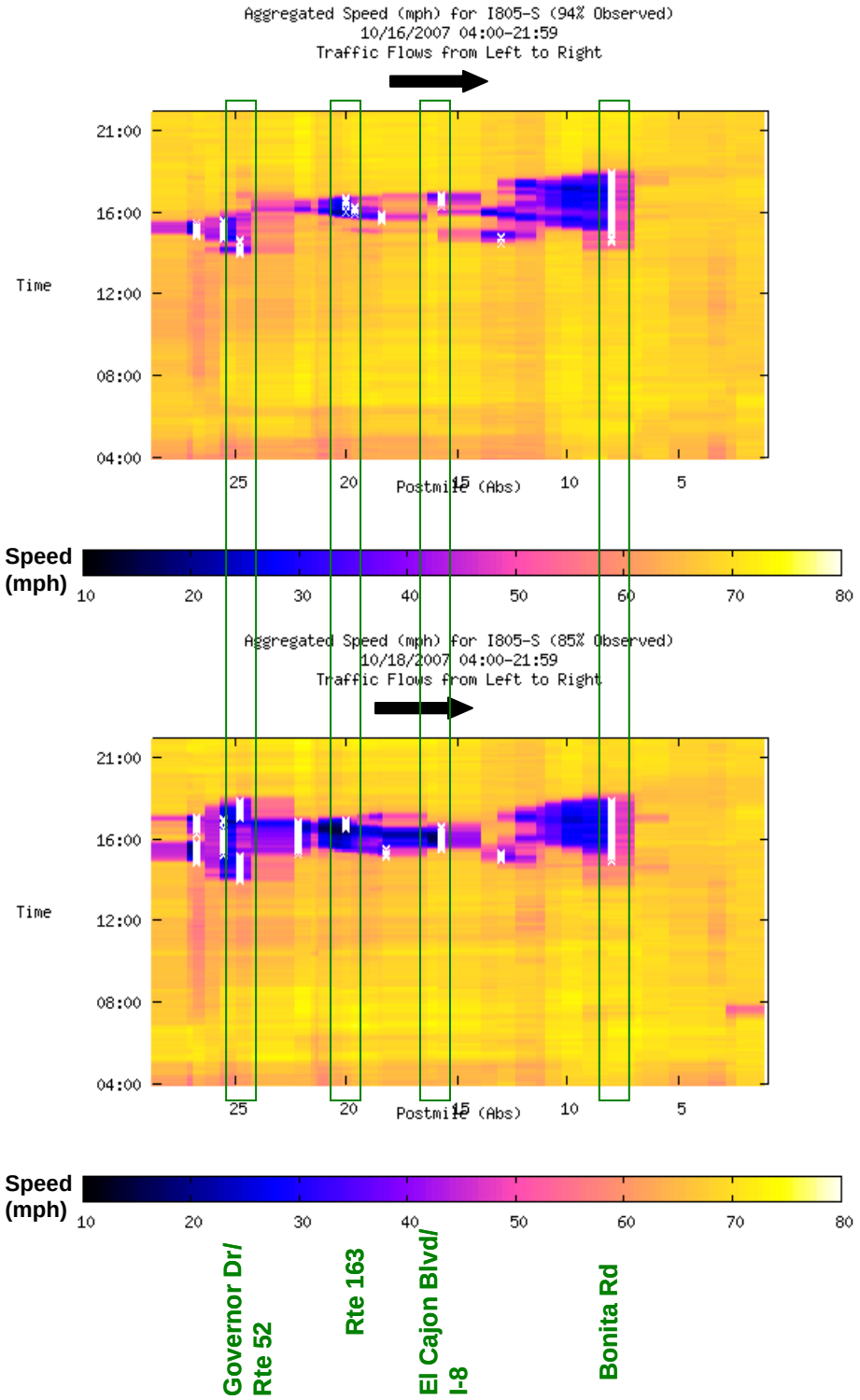


Exhibit 4-14: Southbound I-805 Speed Profile Plots – October 2007

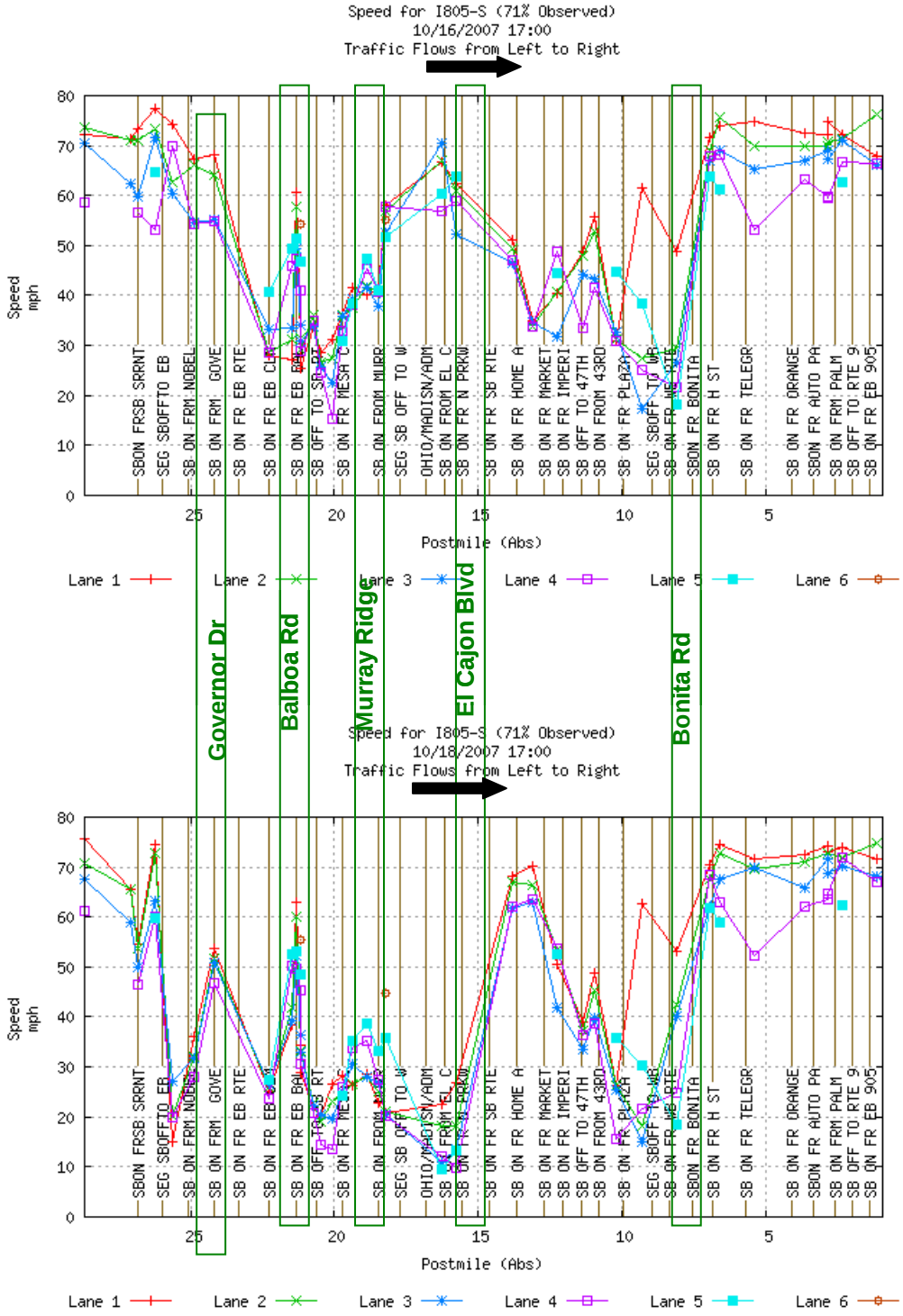


Exhibit 4-15: Southbound I-805 Speed Contour Plots – November 2007

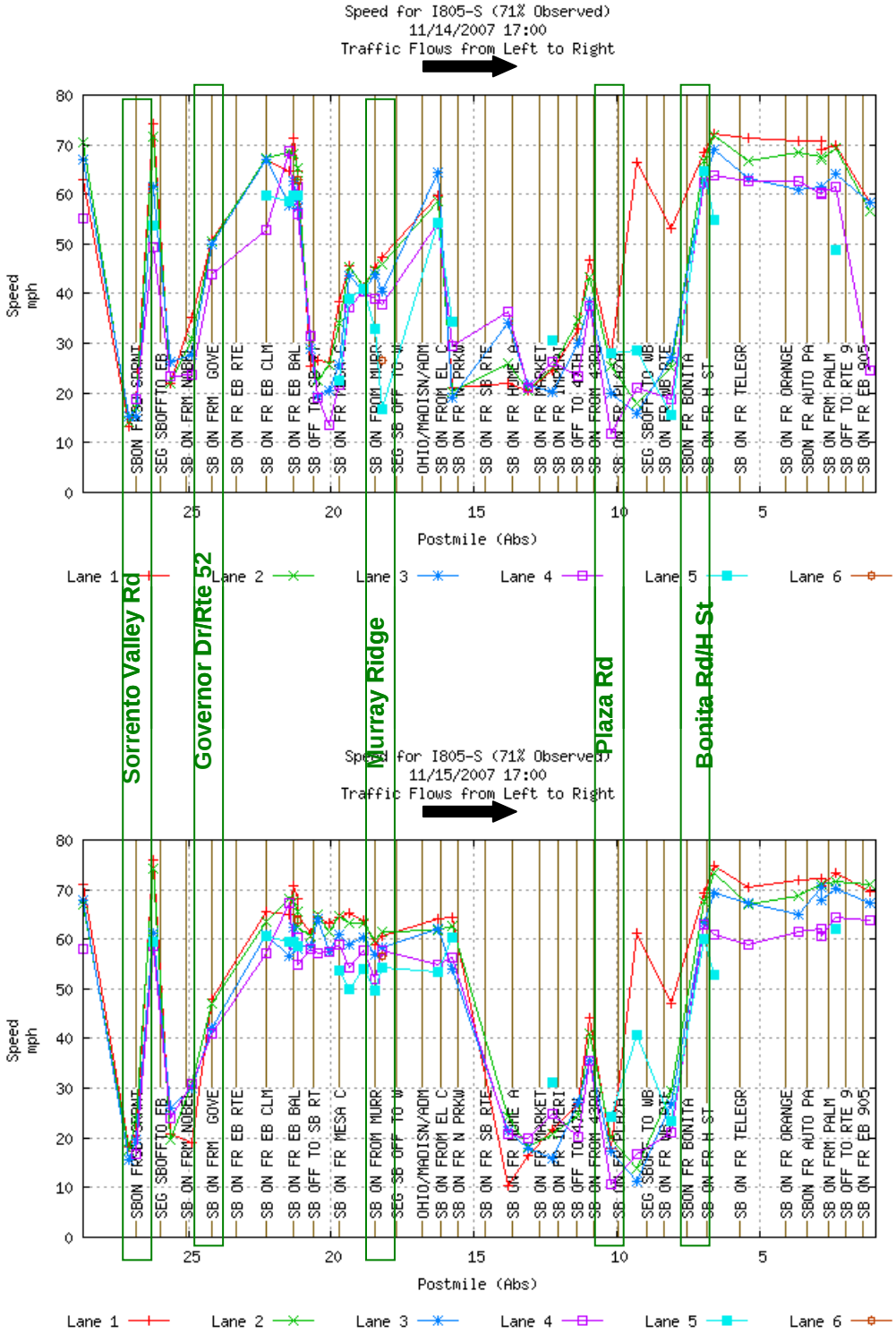
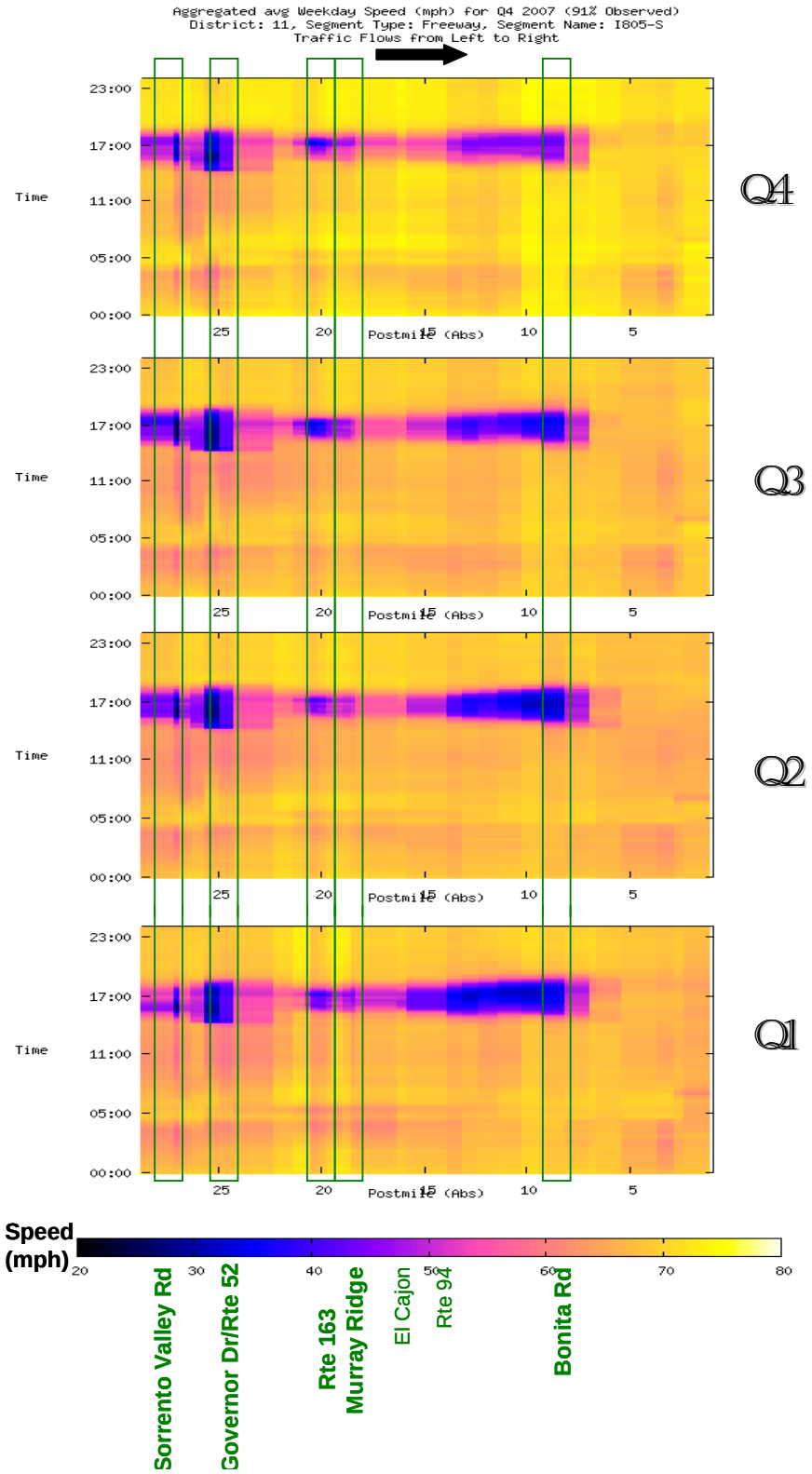


Exhibit 4-16: Southbound I-805 Long (Speed) Contours – 2007 Quarterly Average



Bottleneck Area Performance

Once the bottlenecks were identified and confirmed using the multiple data sources and field investigations, the corridor was divided into "bottleneck areas." A bottleneck area is defined as the area from one major bottleneck to the next major upstream bottleneck. By segmenting the corridors into bottleneck areas, performance statistics presented earlier for the entire corridor can be estimated for each bottleneck area so that the relative contribution of each area to corridor degradation can be gauged. The performance statistics that lend themselves to such segmentation include:

- Delay
- Productivity
- Safety.

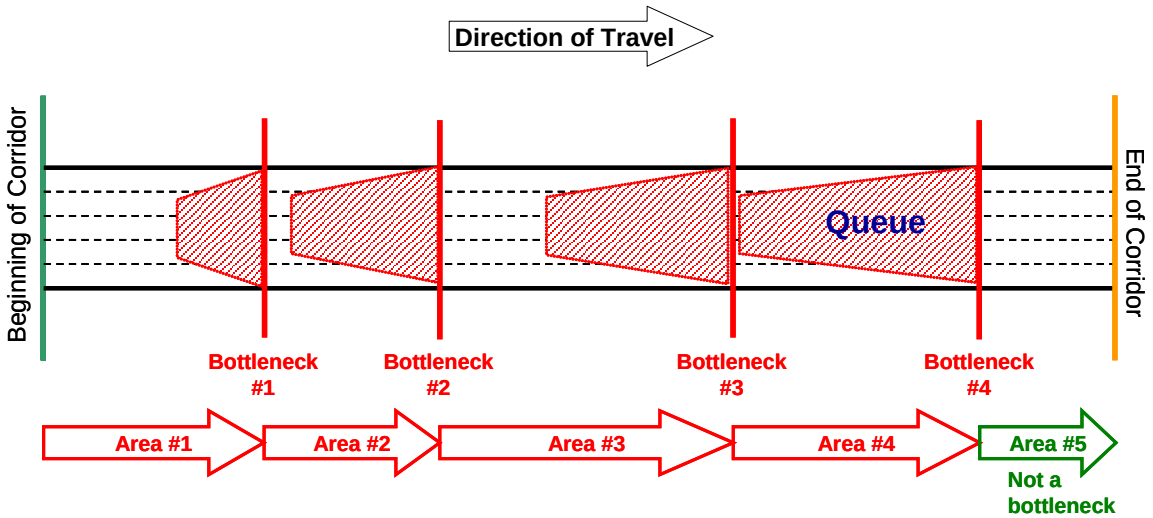
Exhibit 4-17 illustrates the concept of bottleneck areas. The location of the bottlenecks is represented by the red lines, and the bottleneck area is represented by the arrows. The exhibit also shows that the definition of the bottleneck does not necessarily reflect the length of the traffic queue caused by that bottleneck.

There is a practical reason for creating bottleneck areas. Because queue lengths for a given bottleneck vary from day-to-day, defining a fixed bottleneck area that completely encompasses the maximum possible queue upstream to the next bottleneck location allows performance statistics to be calculated over time. This definition provides a standard length for current and future performance evaluations.

The list in Exhibit 4-1 above 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 4-17: Illustrative 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.

Exhibit 4-18 shows the estimated vehicle-hours of delay experienced by each bottleneck area. Exhibit 4-19 shows the delay normalized by 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.

Exhibits 4-18 and 4-19 reveal a similar patterns, but with subtle differences. The northbound bottleneck area at La Jolla Village Drive experienced the most estimated delay per lane mile than any other segment on the corridor in either direction. This differs from the delay Exhibit 4-18, which shows the most delay occurring at the Governor Drive/SR-52 bottleneck area.

The bottleneck area at Governor Drive/SR-52, however, experienced the greatest northbound estimated delay 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 4-20 shows that estimated 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 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).

Similarly, in the southbound direction (Exhibit 4-21), 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 4-18: Northbound I-805 Annual Vehicle-Hours of Delay (2007)

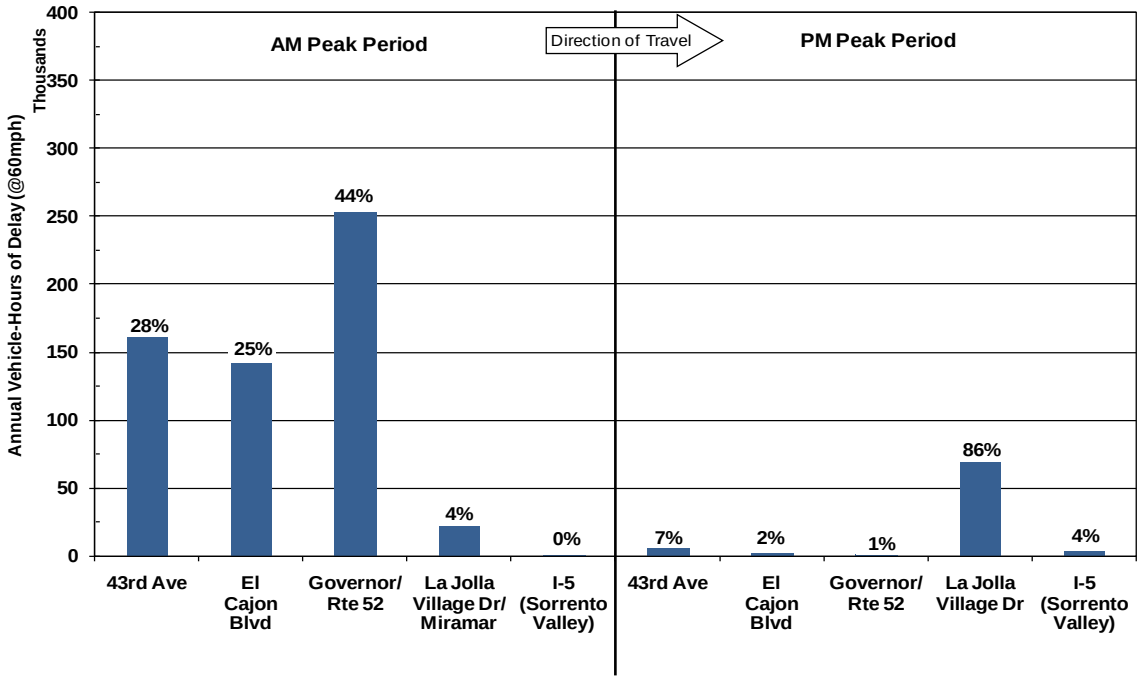


Exhibit 4-19: Northbound I-805 Delay per Lane-Mile (2007)

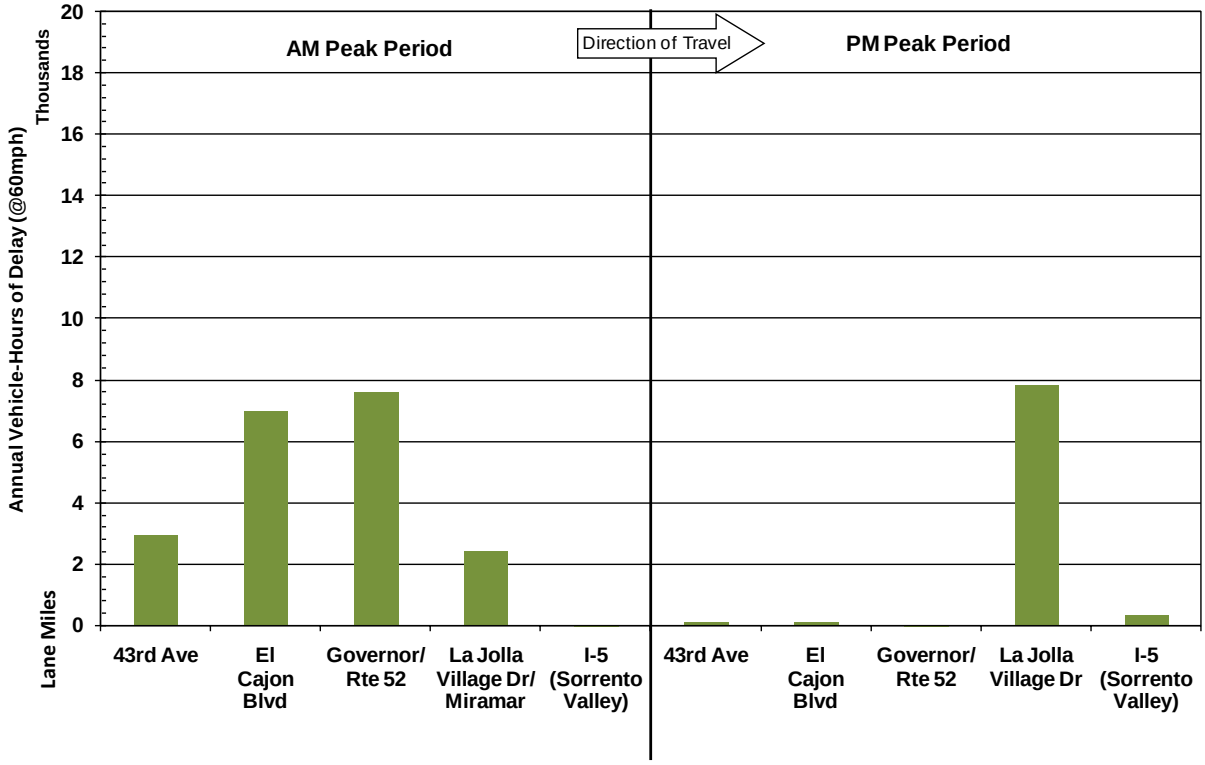


Exhibit 4-20: Southbound I-805 Annual Vehicle-Hours of Delay (2007)

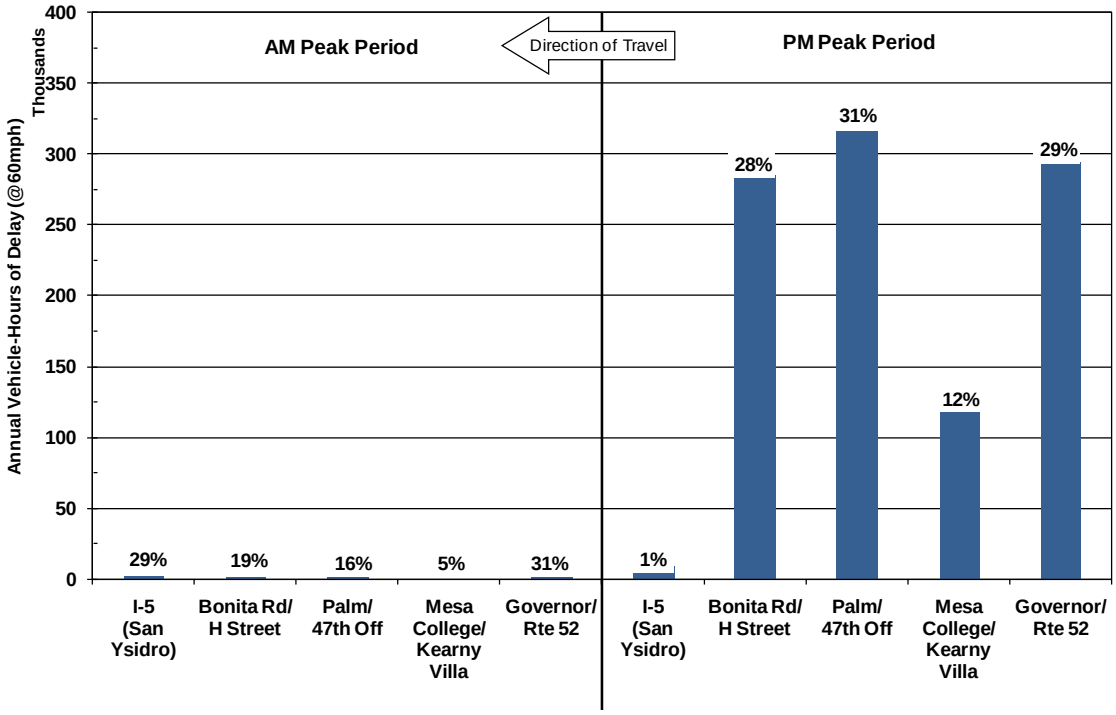
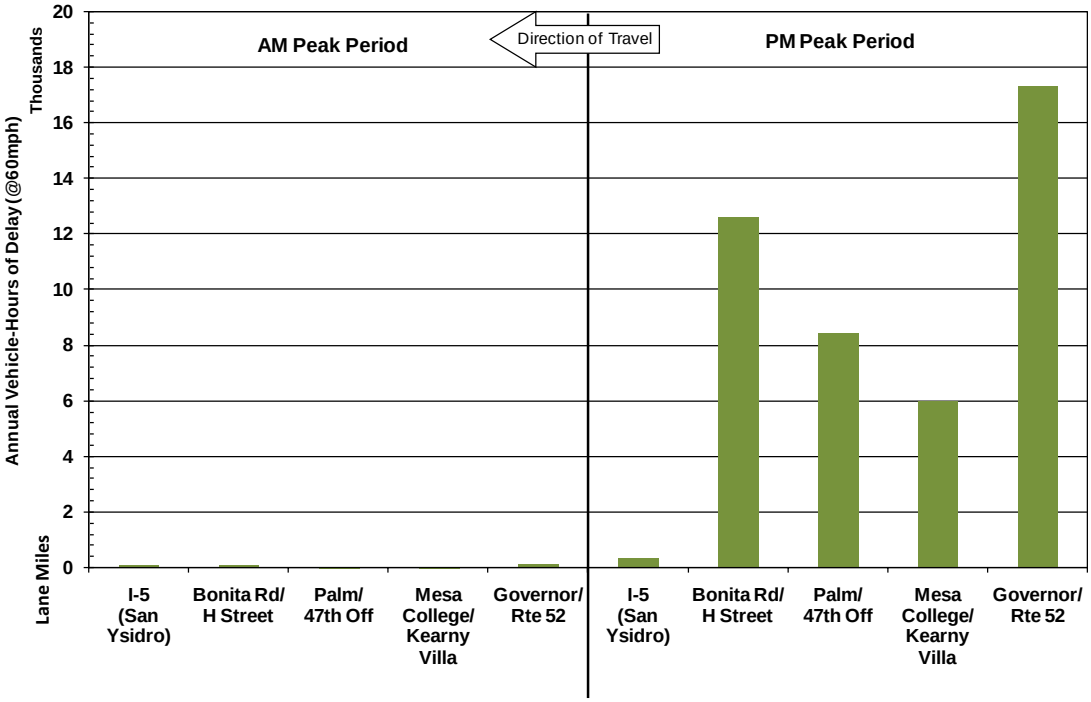


Exhibit 4-21: Southbound I-805 Delay per Lane-Mile (2007)



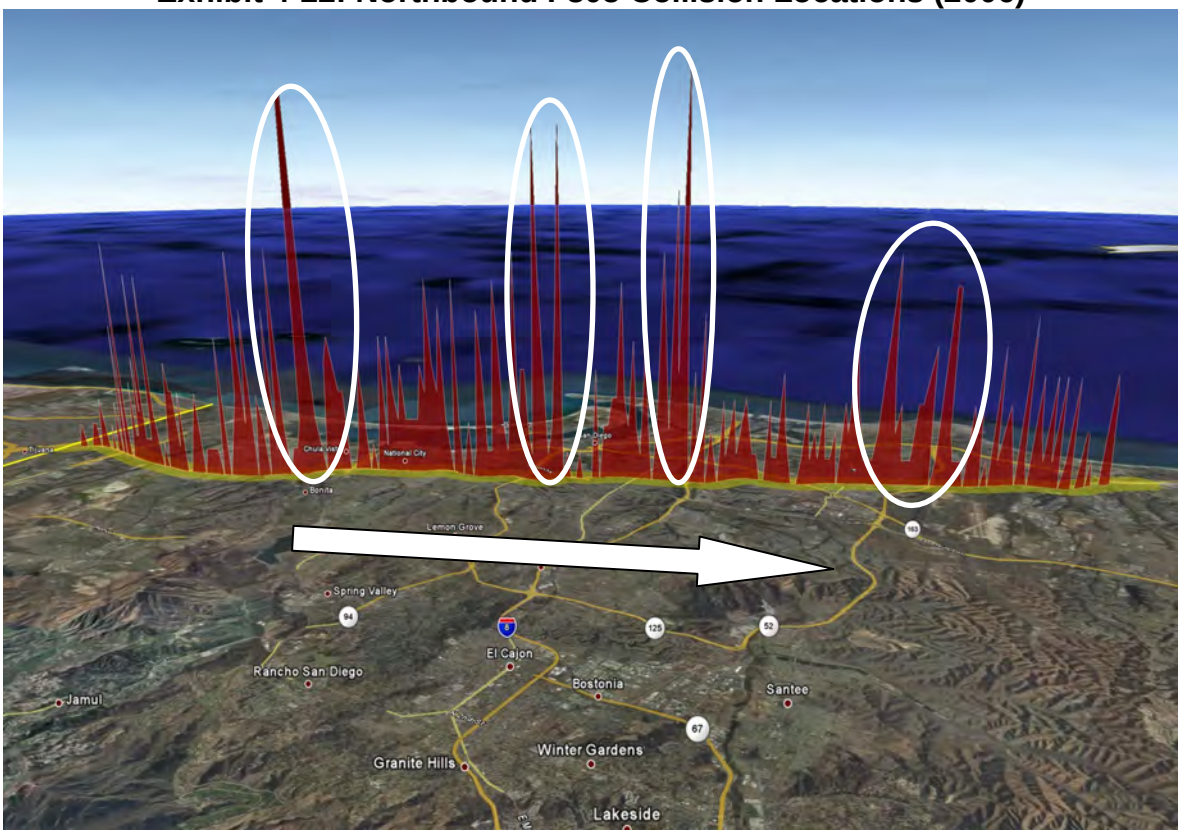
Safety by Bottleneck Area

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 4-22 shows the location of all collisions on 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 important than the concentration. As Exhibit 4-22 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.

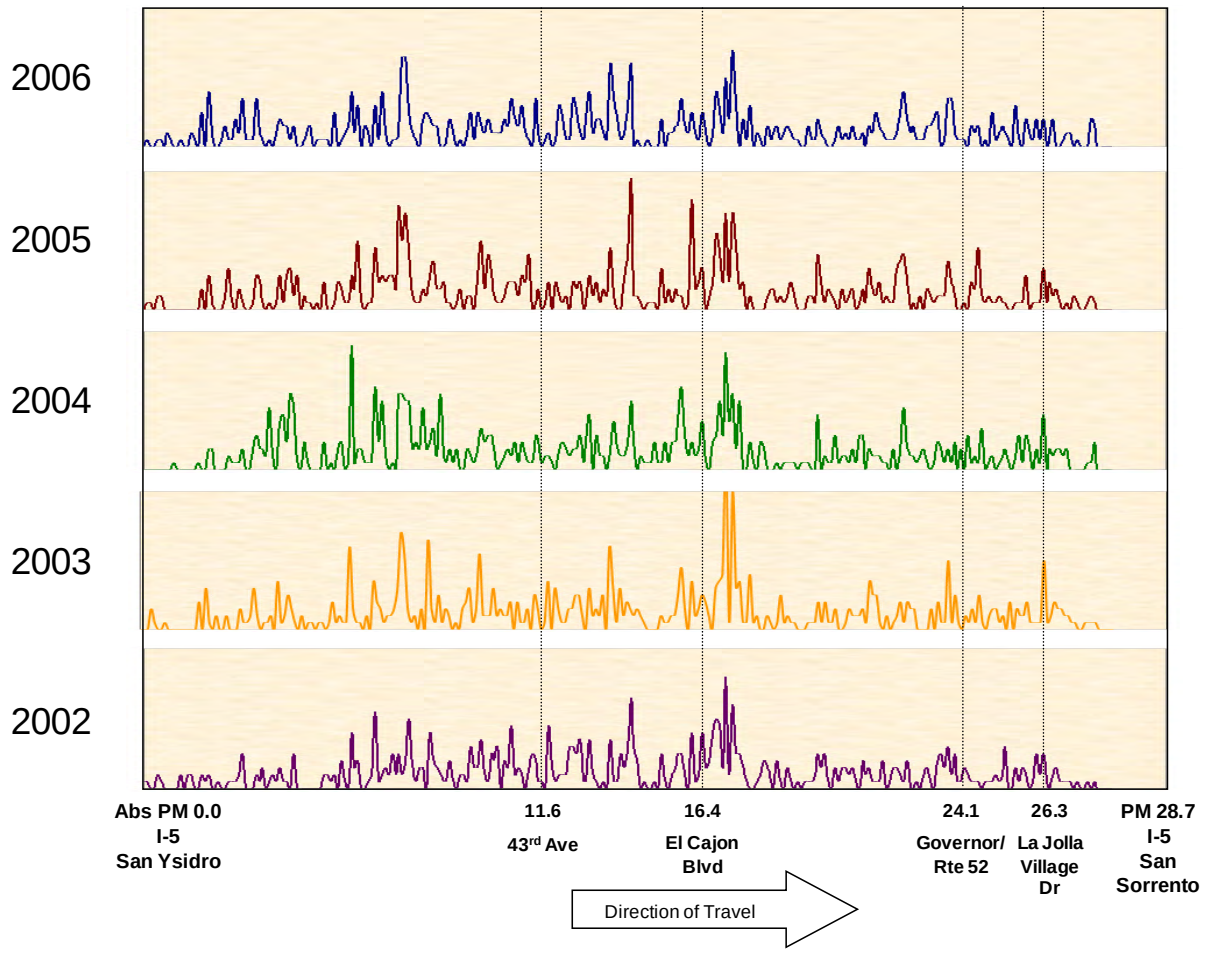
Exhibit 4-22: Northbound I-805 Collision Locations (2006)



Source: SMG analysis of TASAS data

Exhibit 4-23 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. This exhibit suggests that the high accident locations identified in 2006 (Exhibit 4-22) 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). Exhibit 4-23 also shows that the pattern of collisions has stayed fairly consistent from one year to the next.

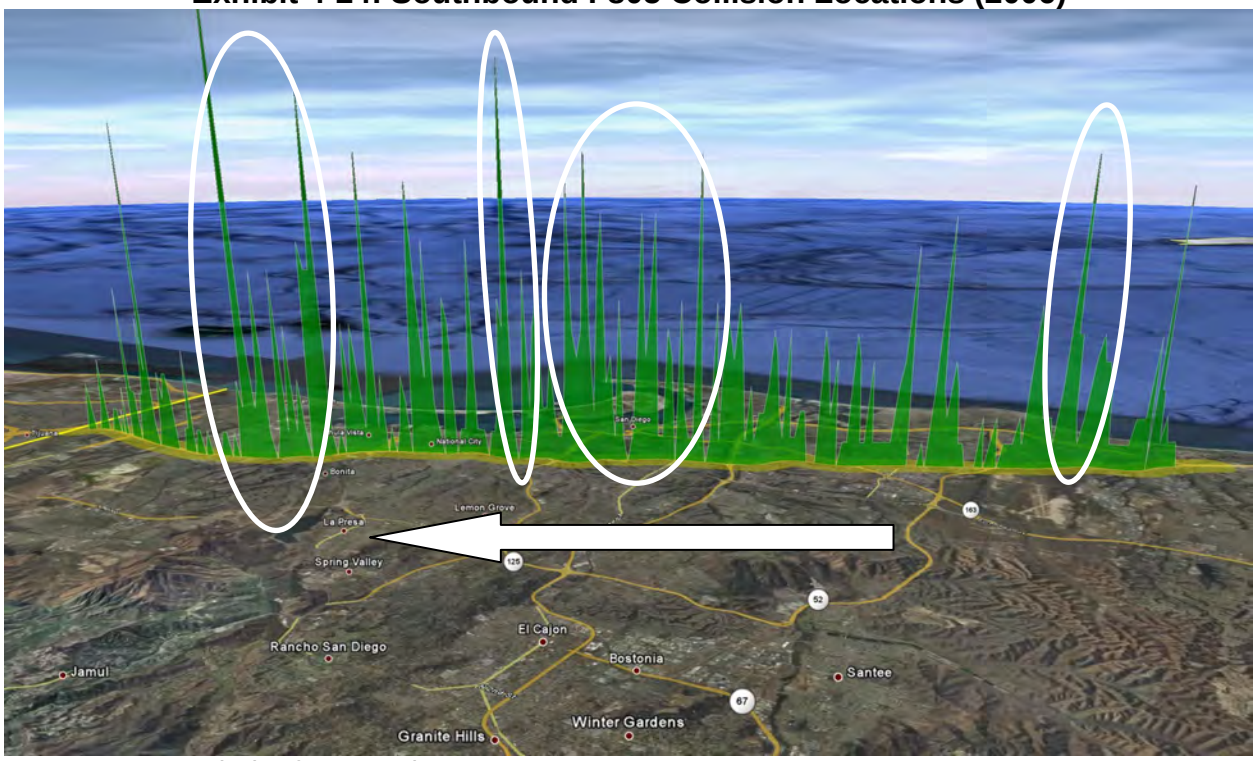
Exhibit 4-23: Northbound I-805 Collisions (2002-2006)



Source: SMG analysis of TASAS data

Exhibit 4-24 shows the same 2006 collision data for southbound I-805. 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 4-24 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 Road.

Exhibit 4-24: Southbound I-805 Collision Locations (2006)



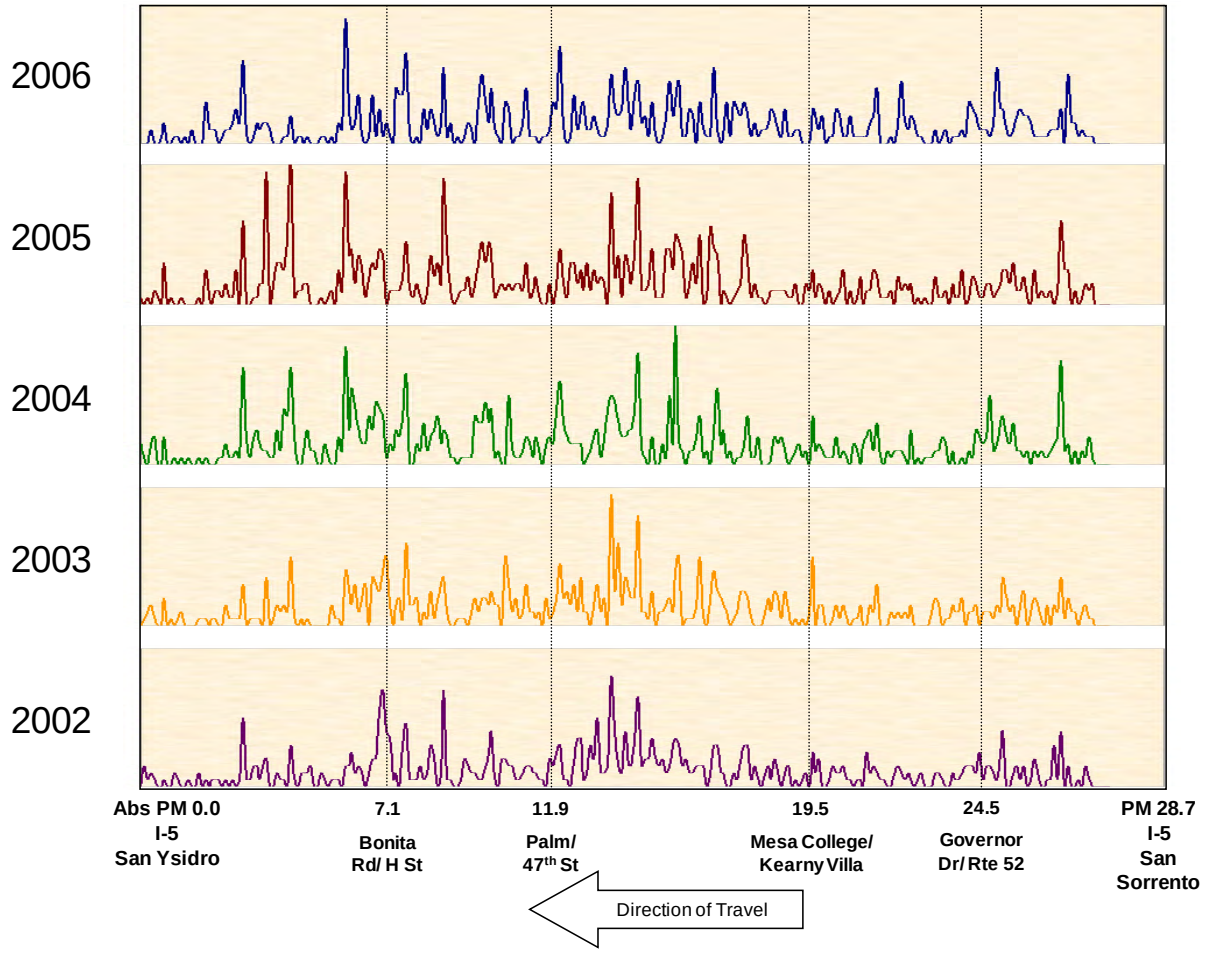
Source: SMG analysis of TASAS data

Exhibit 4-25 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 4-24 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 Road (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 4-26 and 4-27 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 bottleneck areas that show the most accidents – 43rd Street in the northbound

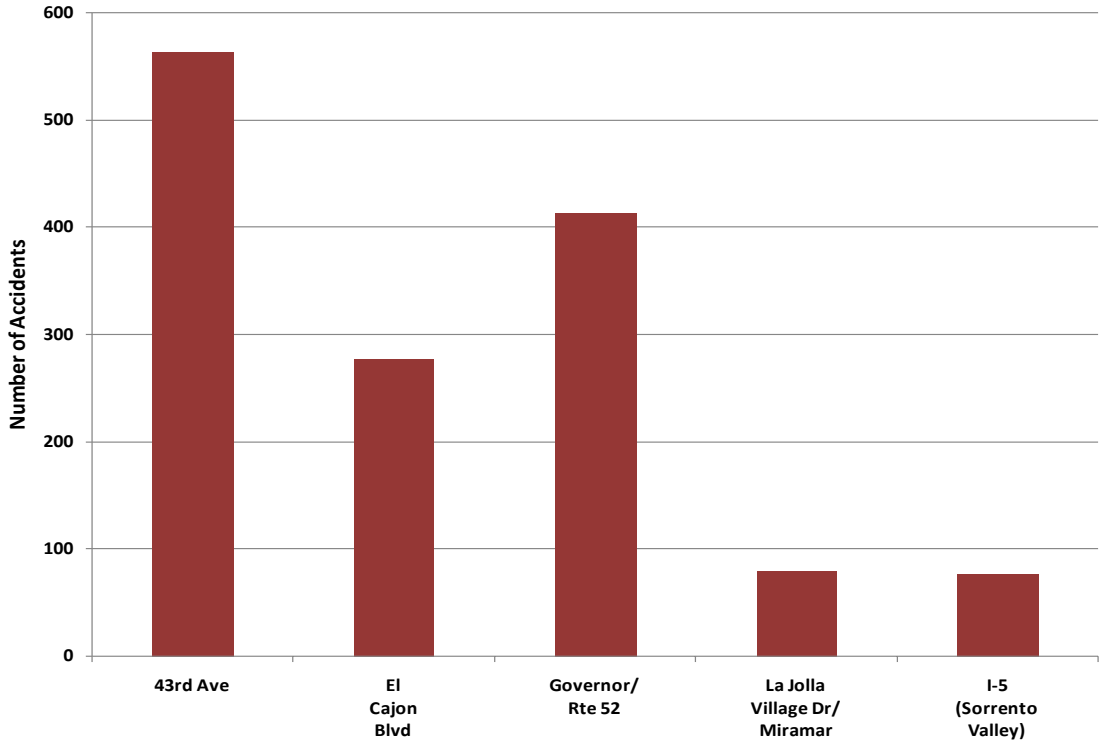
direction and Palm/47th Street in the southbound – are also the longest bottleneck areas in terms of distance.

Exhibit 4-25: Southbound I-805 Collision Locations (2002-2006)



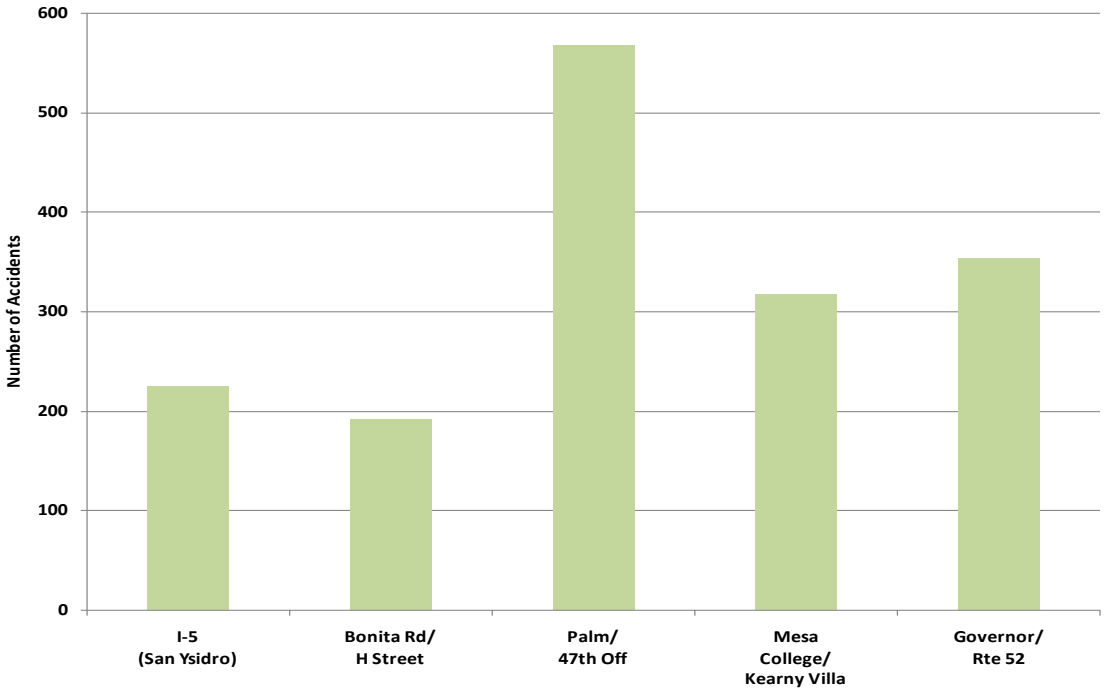
Source: SMG analysis of TASAS data

Exhibit 4-26: Northbound I-805 Total Accidents (2005-2006)



Source: SMG analysis of TASAS data

Exhibit 4-27: Southbound I-805 Total Accidents (2005-2006)



Source: SMG analysis of TASAS data

Productivity by Bottleneck Area

The productivity of a corridor is defined as the percent utilization of a facility or mode under peak conditions. Productivity is estimated 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 4-28 and 4-29 show the estimated productivity losses for both directions of the I-805 corridor.

The northbound bottleneck area at Governor Drive/SR-52 experienced the worst productivity on the study corridor in either direction. The estimated productivity loss of 2.1 lane-miles during the AM peak period 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 4-28: Northbound I-805 Lost Lane-Miles (2007)

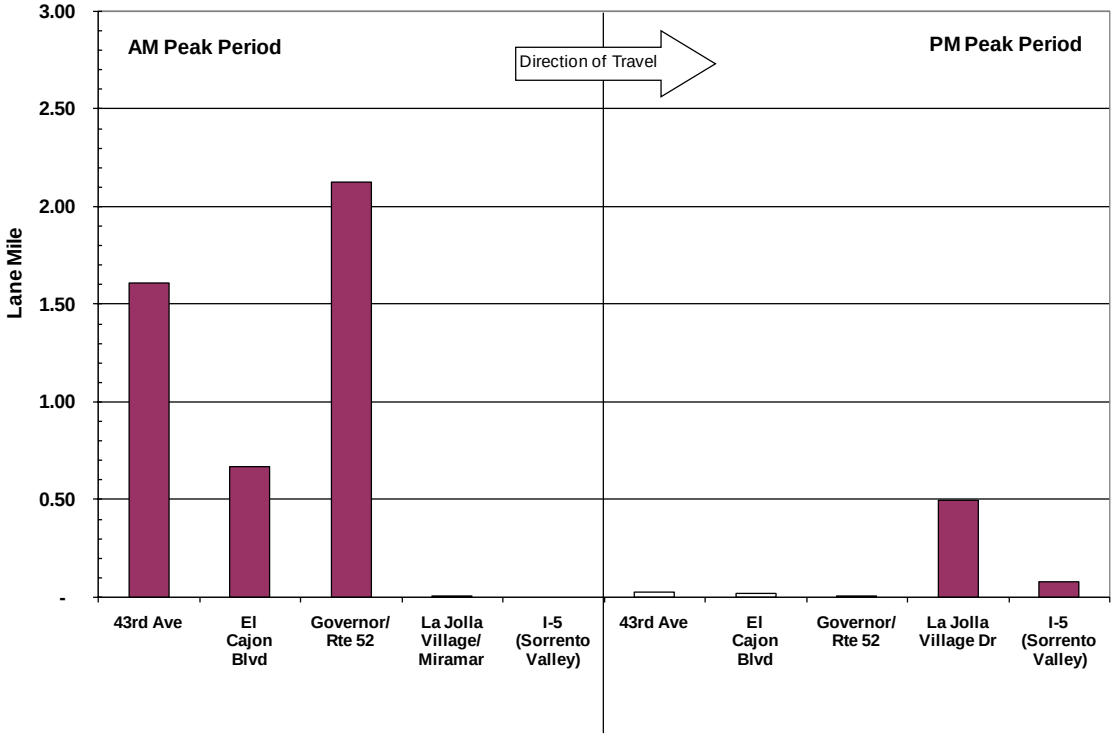
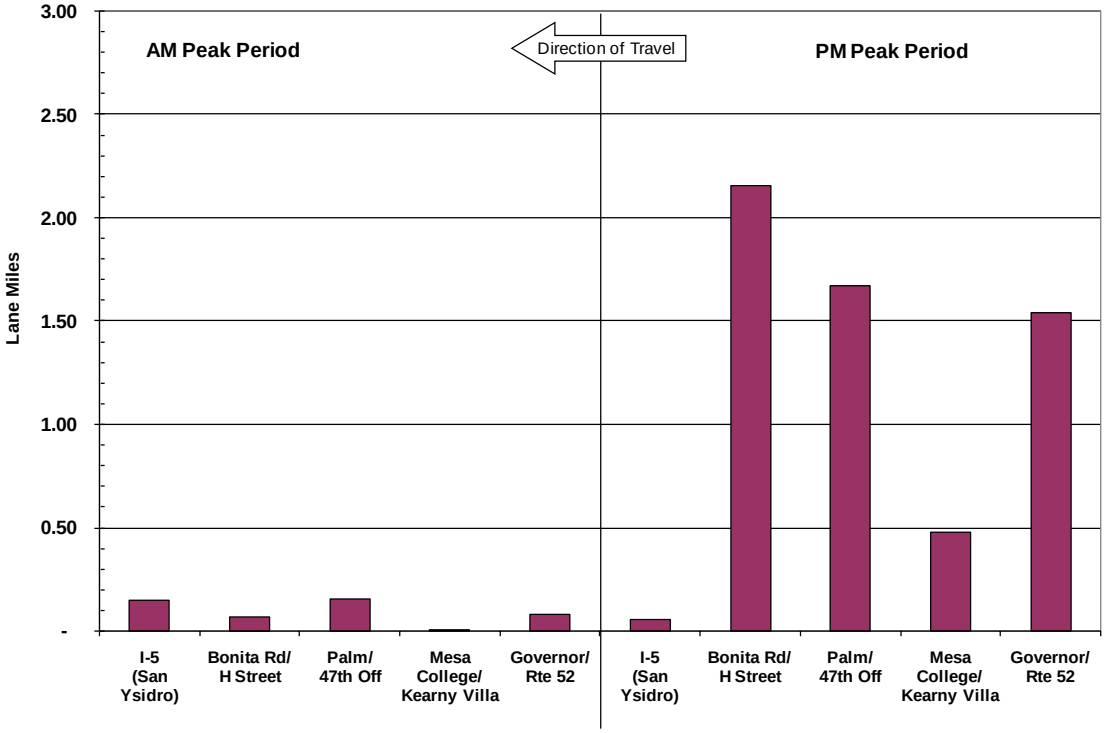


Exhibit 4-29: Southbound I-805 Lost Lane-Miles (2007)



5. BOTTLENECK 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 Bottleneck Causality

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.

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 Street 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 Boulevard 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 3-10) indicates that a high number of AM trips are generated in this zone and at Telegraph Canyon Road to the south. The Plaza Boulevard on-ramp just south of the bottleneck adds 920 peak hour vehicles according to data obtained from Caltrans[2]. 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 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.

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

Exhibit 5-2 shows two photographs taken during the October 23, 2008 field visit. The top photograph faces north approaching the 43rd Street off-ramp from the Plaza Street 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 5-3 is a video showing traffic emerging from the northbound bottleneck at the 43rd Street location. The video was filmed between 6:00 and 9:00 AM on October 23, 2008 during a field visit. The camera was located on the Logan Street overpass facing south while filming the northbound traffic during the peak AM commute period. This video shows the effects of traffic merging on the I-805 from the 43rd Street and 47th Street on ramps.

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

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

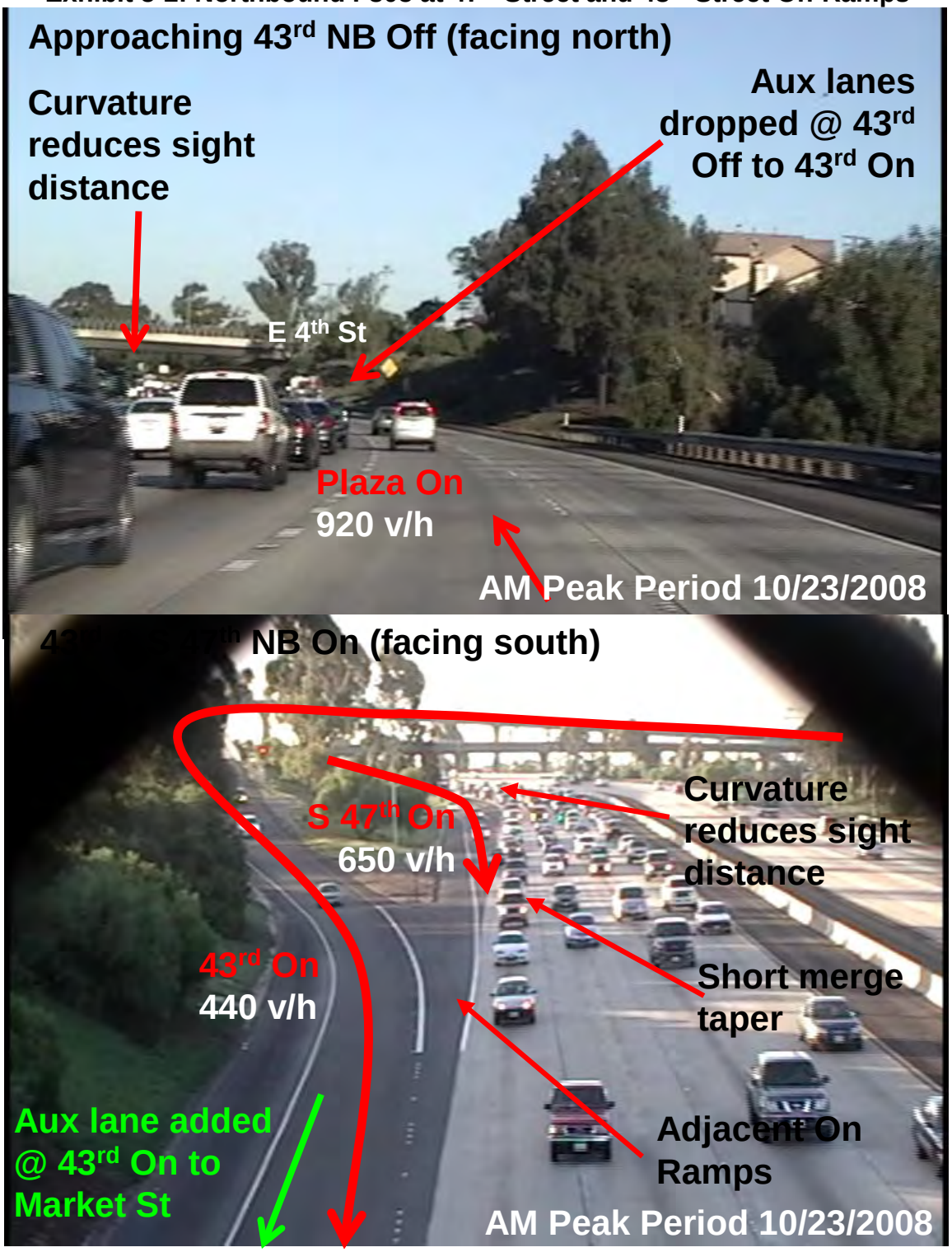


Exhibit 5-3: Northbound I-805 43rd Street On Video

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

Exhibit 5-4 is an aerial photograph of the El Cajon Boulevard 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 3-10) indicates that the two single highest AM peak period trip producing zones lie south of this bottleneck. According to Exhibit 3-10, 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 5-4, 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 Boulevard, which backs up to this location.

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 5-5 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 5-5 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 Boulevard, particularly in the years 2006 and 2007 when traffic was much heavier than recent travel volumes.

Exhibit 5-6 is a video showing the formation of the bottleneck at the El Cajon Boulevard location. The video was filmed on October 24, 2008 starting around 8 AM. The camera was located on the Adams Street overpass facing the southbound direction of the I-805 to film the oncoming northbound traffic.

Exhibit 5-4: Northbound I-805 at El Cajon Boulevard

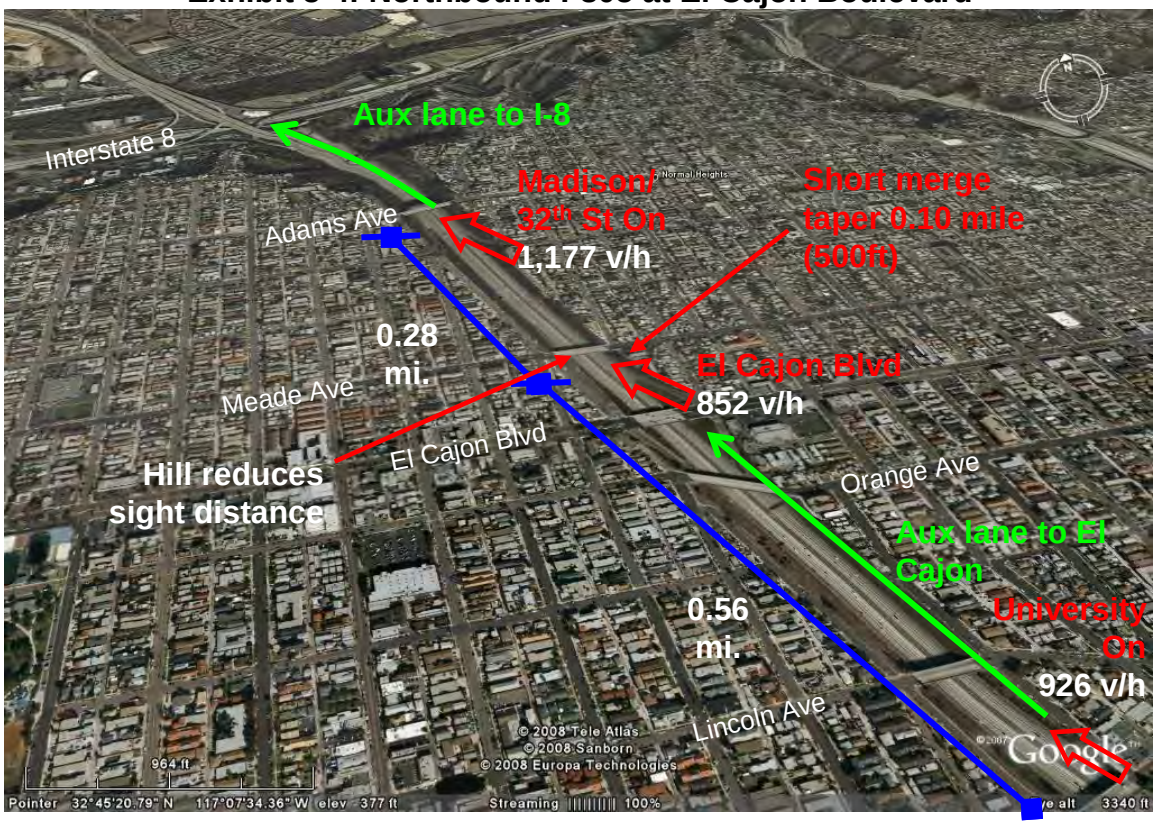


Exhibit 5-5: Northbound I-805 at El Cajon On-Ramp

Exhibit 5-6: Northbound I-805 El Cajon Boulevard On Video

Governor Drive Off (AbsPM=24.1 CaPM=24.3)

Exhibit 5-7 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.[3] The queue on the SR-52 westbound ramp typically backs up onto the SR-52 westbound general purpose lane.

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

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 5-8 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.

Exhibit 5-9 is a video showing bottleneck formation at the Governor Drive/SR-52 location. The video was filmed during a field visit on October 23, 2008 around 7:00 AM. The video camera was located on a hillside embankment along the I-805 southbound direction. The camera was positioned facing in the I-805 southbound direction while filming northbound traffic across the freeway.

Exhibit 5-7: Northbound I-805 Governor Drive/SR-52

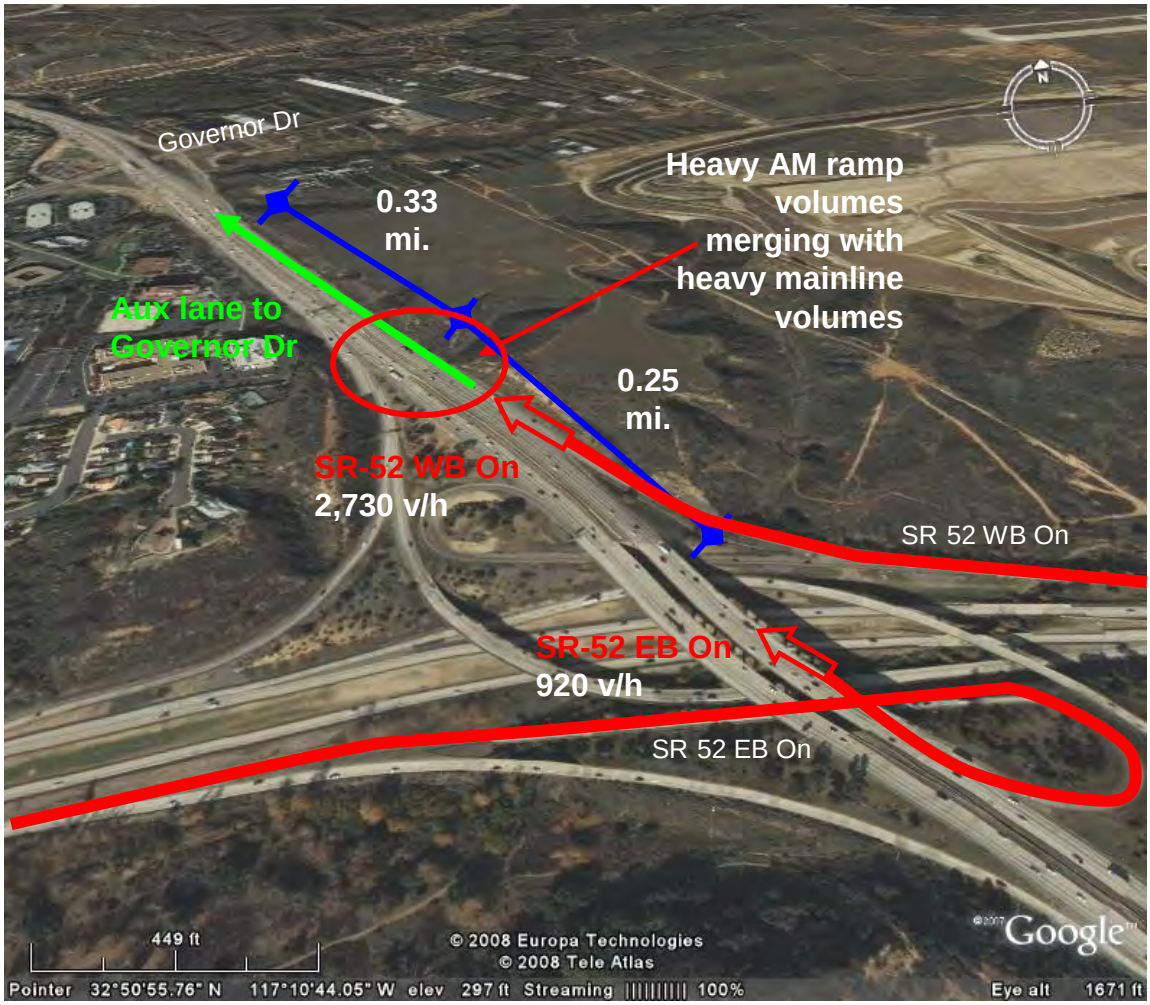


Exhibit 5-8: Northbound I-805 at Governor Drive Off-Ramp

Exhibit 5-9: Northbound I-805 Governor Drive Off Video

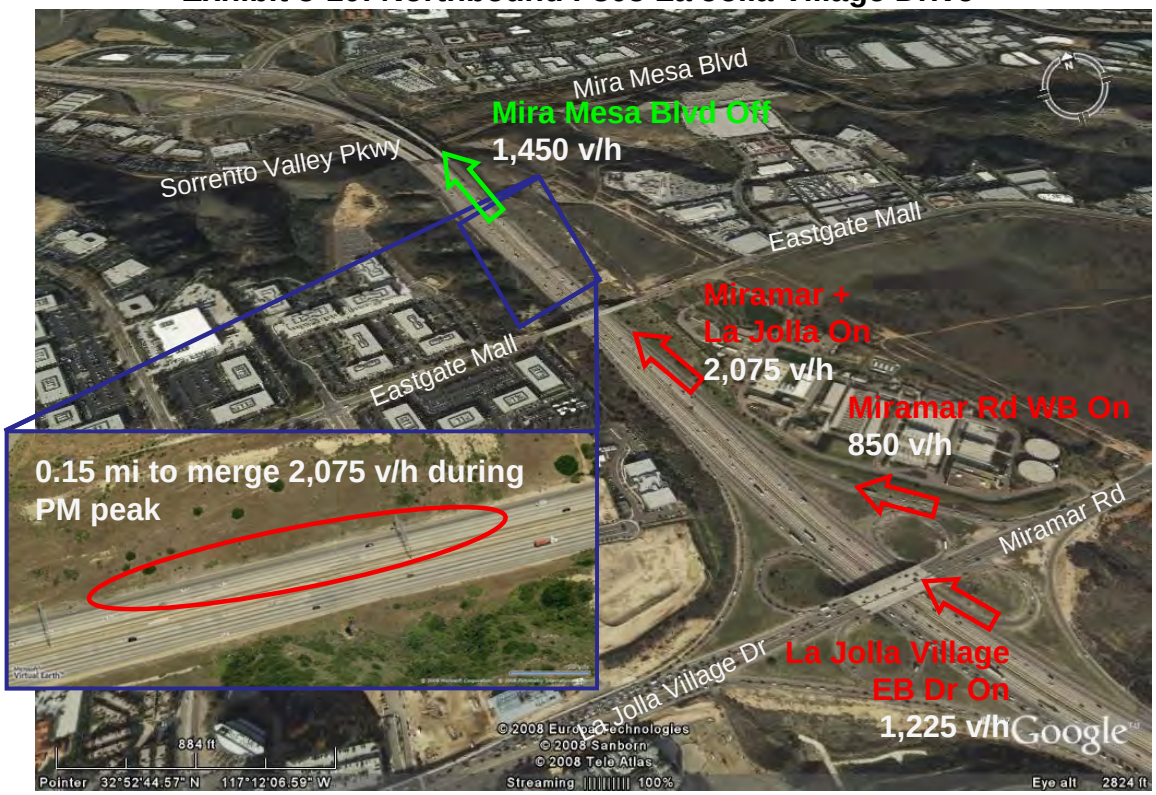
La Jolla Village Drive/Miramar Road On (AbsPM=26.3 CaPM=26.4)

Exhibit 5-10 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 Boulevard 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[4]

There was no field video filmed for the bottleneck that forms on the I-805 between La Jolla Village Drive and Miramar Road.

Exhibit 5-10: Northbound I-805 La Jolla Village Drive



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

Southbound Bottleneck Causality

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 5-11 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 5-12 is a photograph taken during the July 16, 2008 field visit showing the issues at Governor Drive.

Exhibit 5-13 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 5-13 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 three and 4 lanes.

Exhibit 5-14 is a video showing a bottleneck formation at the Governor Drive/SR-52 location. This video was taken on October 23, 2008 starting at approximately 2:30 PM. The camera was located on the hillside embankment along the I-805 southbound direction, positioned facing the southbound direction of the I-805.

Exhibit 5-11: Southbound I-805 at Governor Drive/SR-52

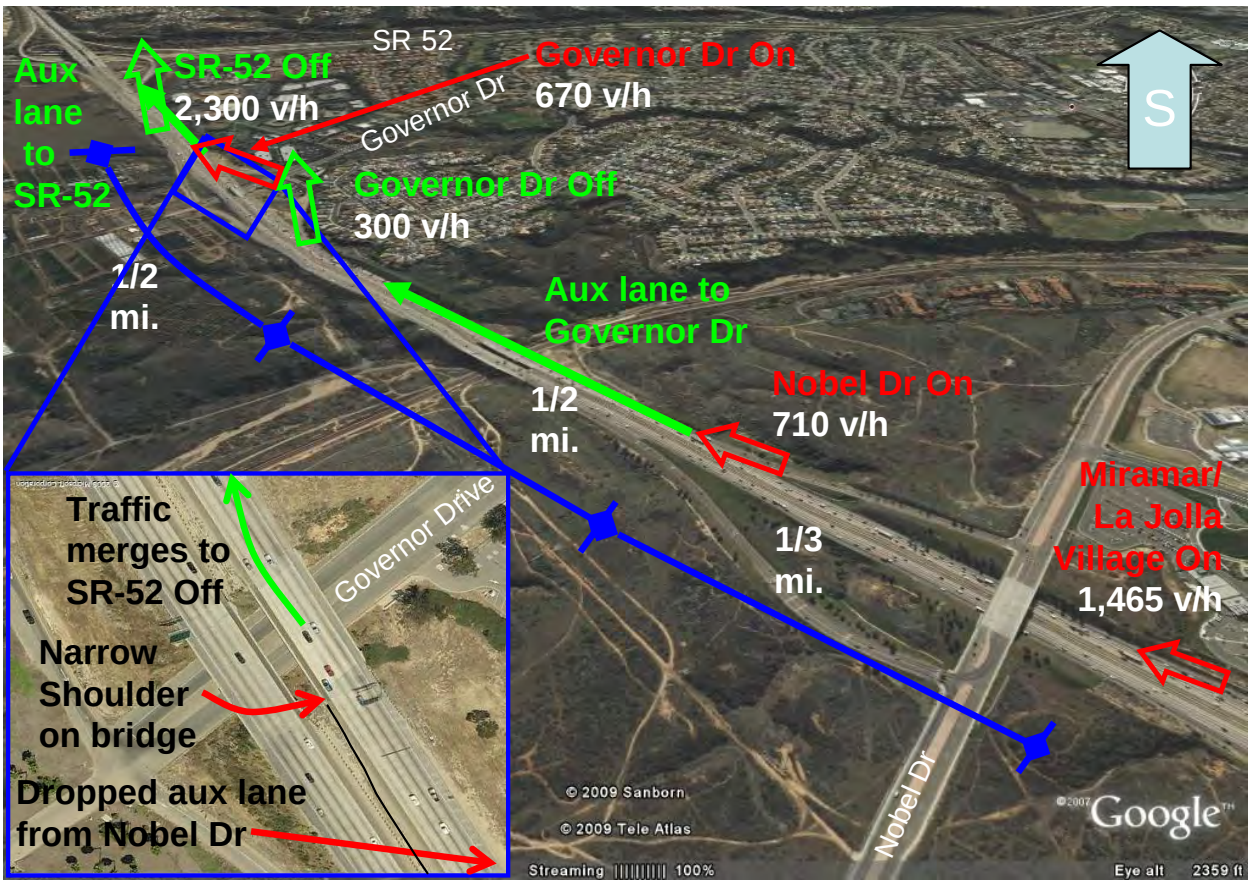


Exhibit 5-12: Southbound I-805 Approaching Governor Drive

Exhibit 5-13: Southbound I-805 at Governor Drive

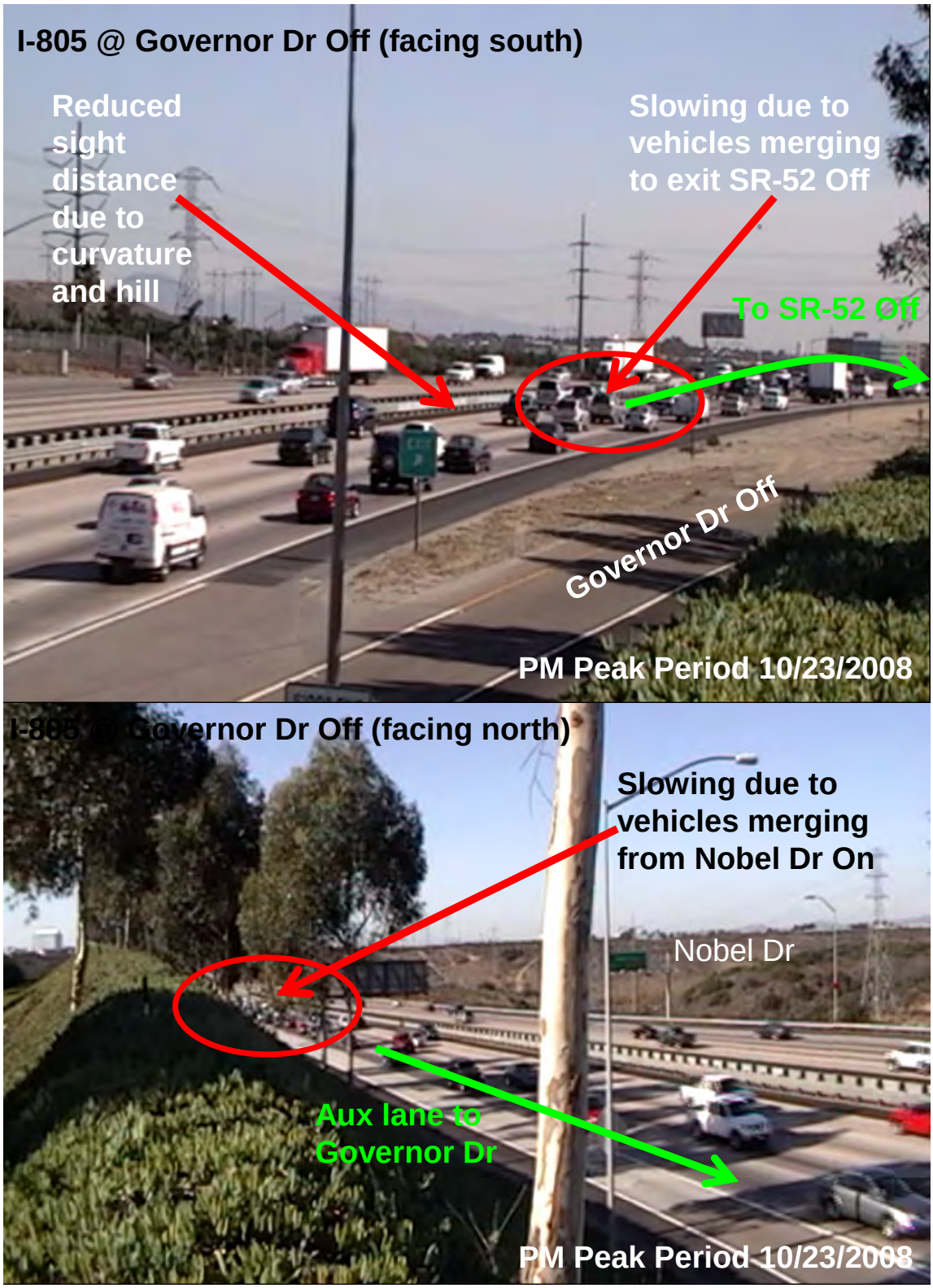


Exhibit 5-14: Southbound I-805 Governor Drive/SR-52 Video

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

Exhibit 5-15 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 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 5-16 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 5-17 is a video that shows the bottleneck formation located at Mesa College drive and Kearny Villa Road On Ramp. The video was filmed during a field visit on December 9, 2008 around 4:30 PM. The video camera was located on the northbound side of the I-805 and was facing south while filming the southbound traffic.

Exhibit 5-15: Southbound I-805 at Mesa College Drive/Kearny Villa Road On

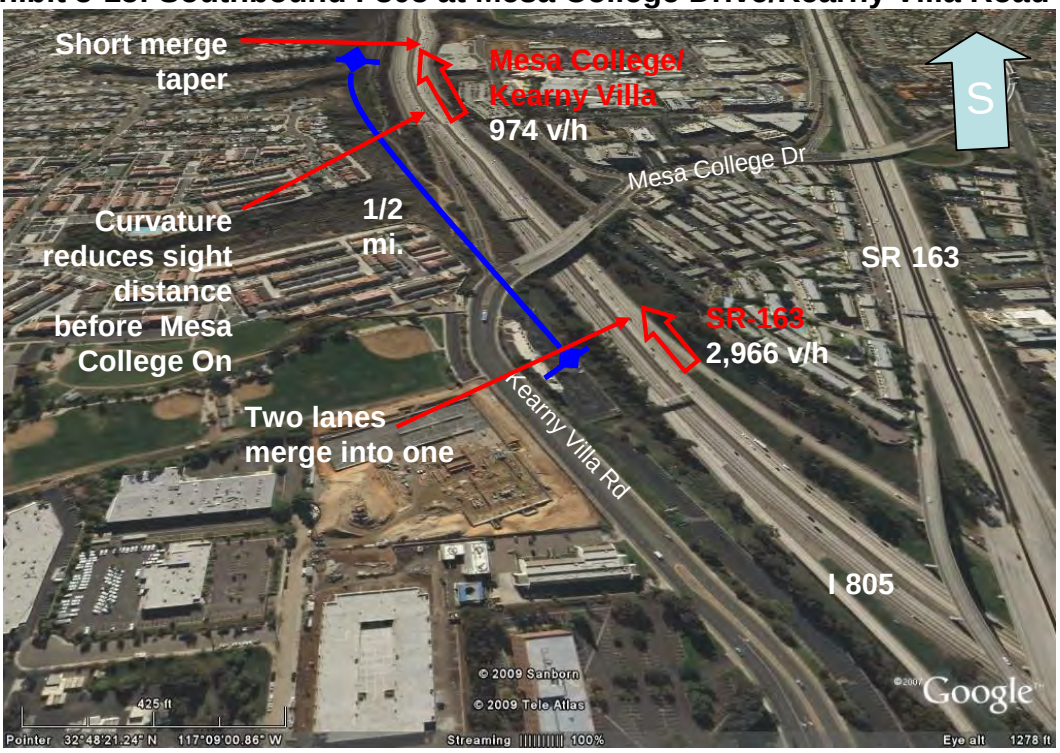


Exhibit 5-16: Southbound I-805 at SR-163 On

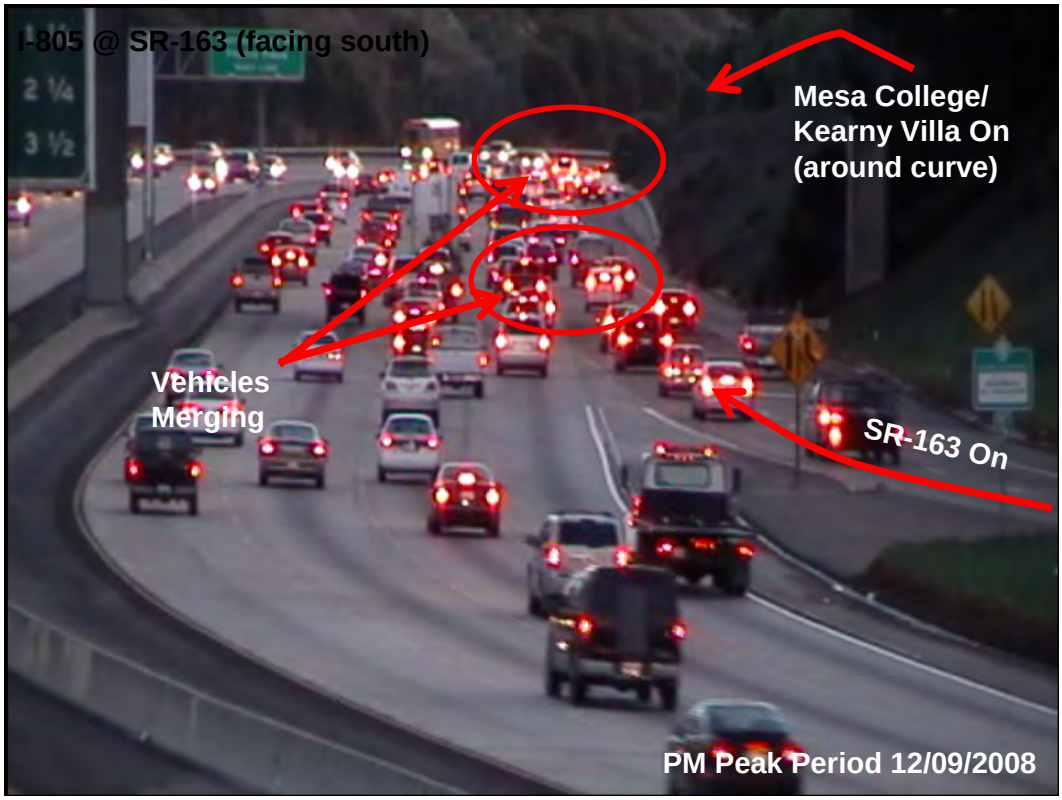


Exhibit 5-17: Southbound I-805 Mesa College Drive/Kearny Villa Road On Video

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

Exhibit 5-18 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.

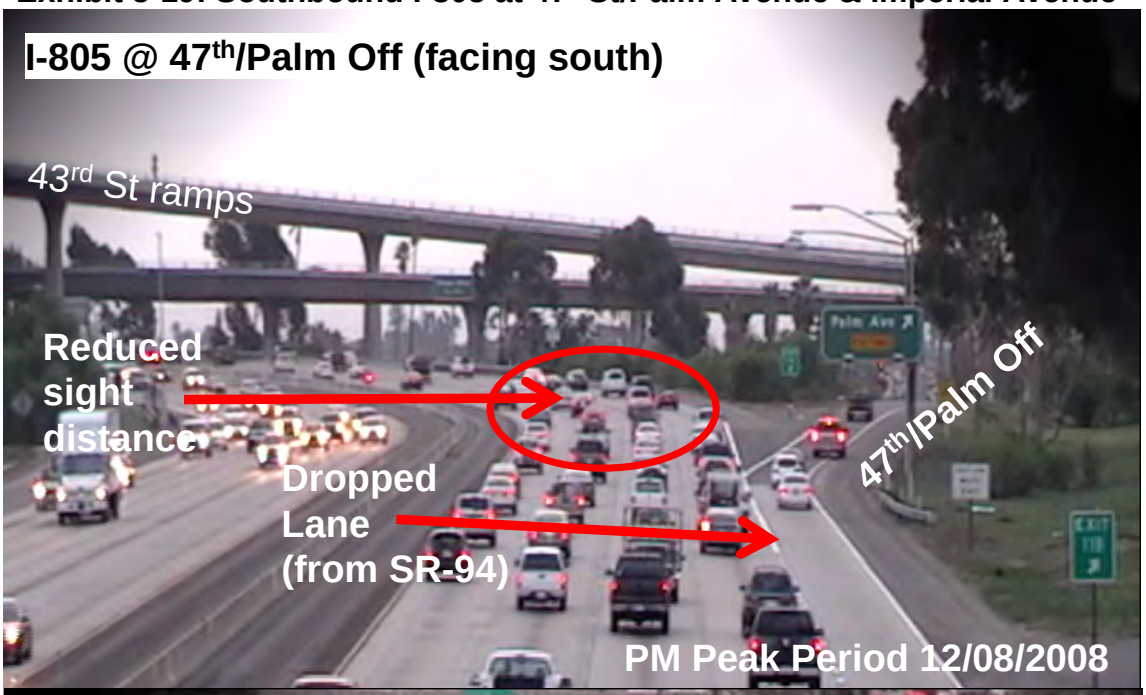
Exhibit 5-19 is a frame from a video taken on December 8, 2008 during the PM peak period. This exhibit shows two pictures, the top frame facing south toward the 47th/Palm exit, and the bottom picture facing north toward Imperial Avenue.

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 5-20 is a video showing the formation of the bottleneck located near the 43rd Street/47th Street /Palm Street Off Ramp location. The video was filmed on December 8 2009 around 5 PM. The camera was located on the Logan Avenue overpass facing south filming the I-805 southbound traffic.

Exhibit 5-18: Southbound I-805 at 43rd/47th/Palm

Exhibit 5-19: Southbound I-805 at 47th St/Palm Avenue & Imperial Avenue



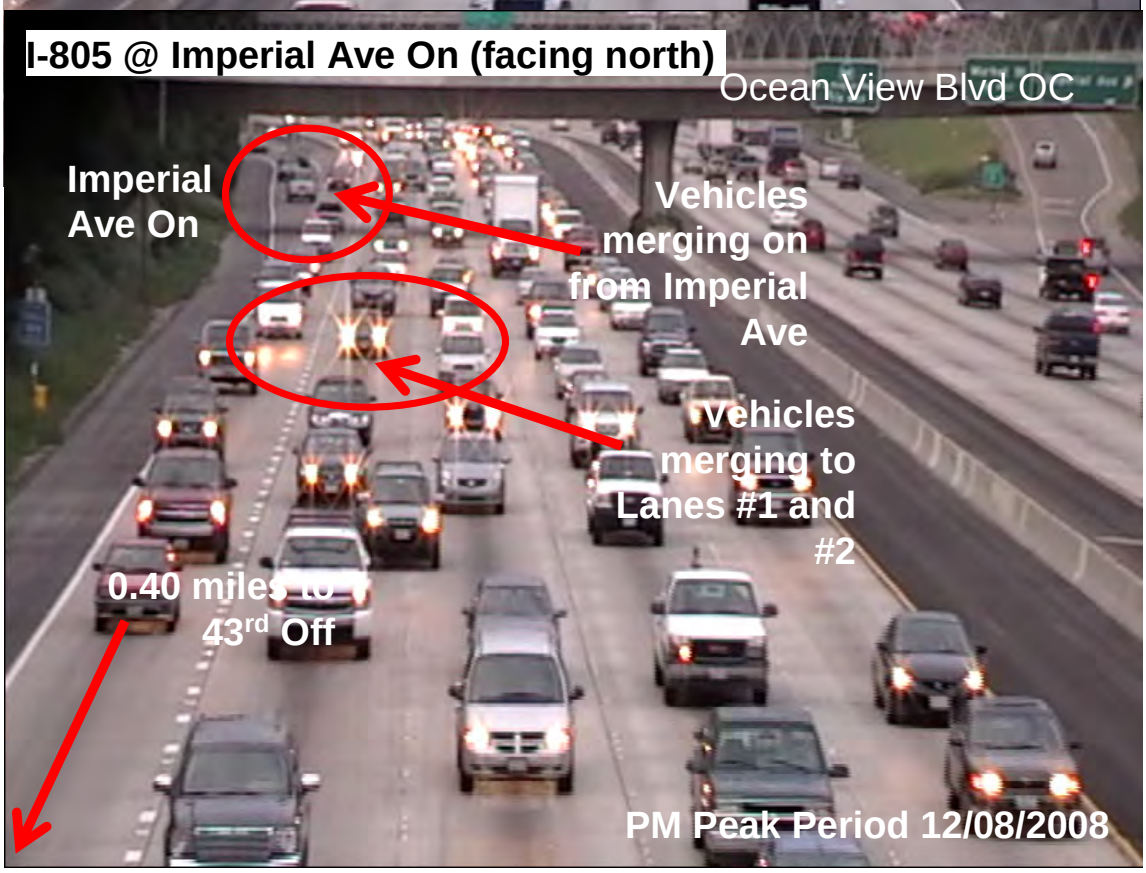


Exhibit 5-20: Southbound I-805 Palm Avenue/47th Street Off Video

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

Exhibit 5-22 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 5-22 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 5-22 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 5-23 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 5-24 is a video showing the formation of the bottleneck located at the Bonita/E Street and SR-54. The video was filmed on October 24 2009 around 4:00 PM during a field visit. The camera was located along the I-805 southbound embankment facing south.

Exhibit 5-21: Southbound I-805 Bonita/E Street & SR-54

Exhibit 5-22: Southbound I-805 at SR-54 and at Bonita Road Off

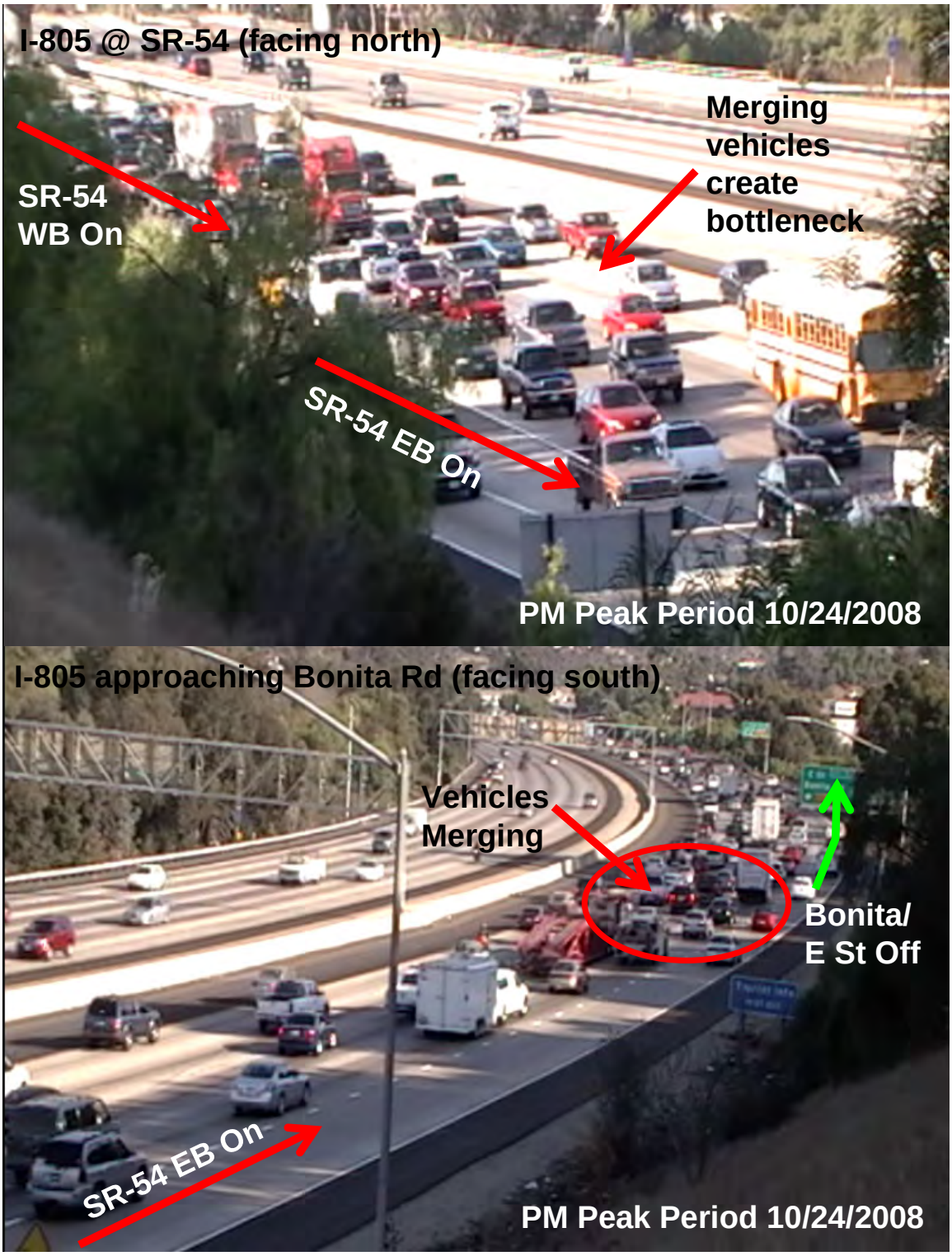


Exhibit 5-23: Southbound I-805 Approaching Bonita Road Off

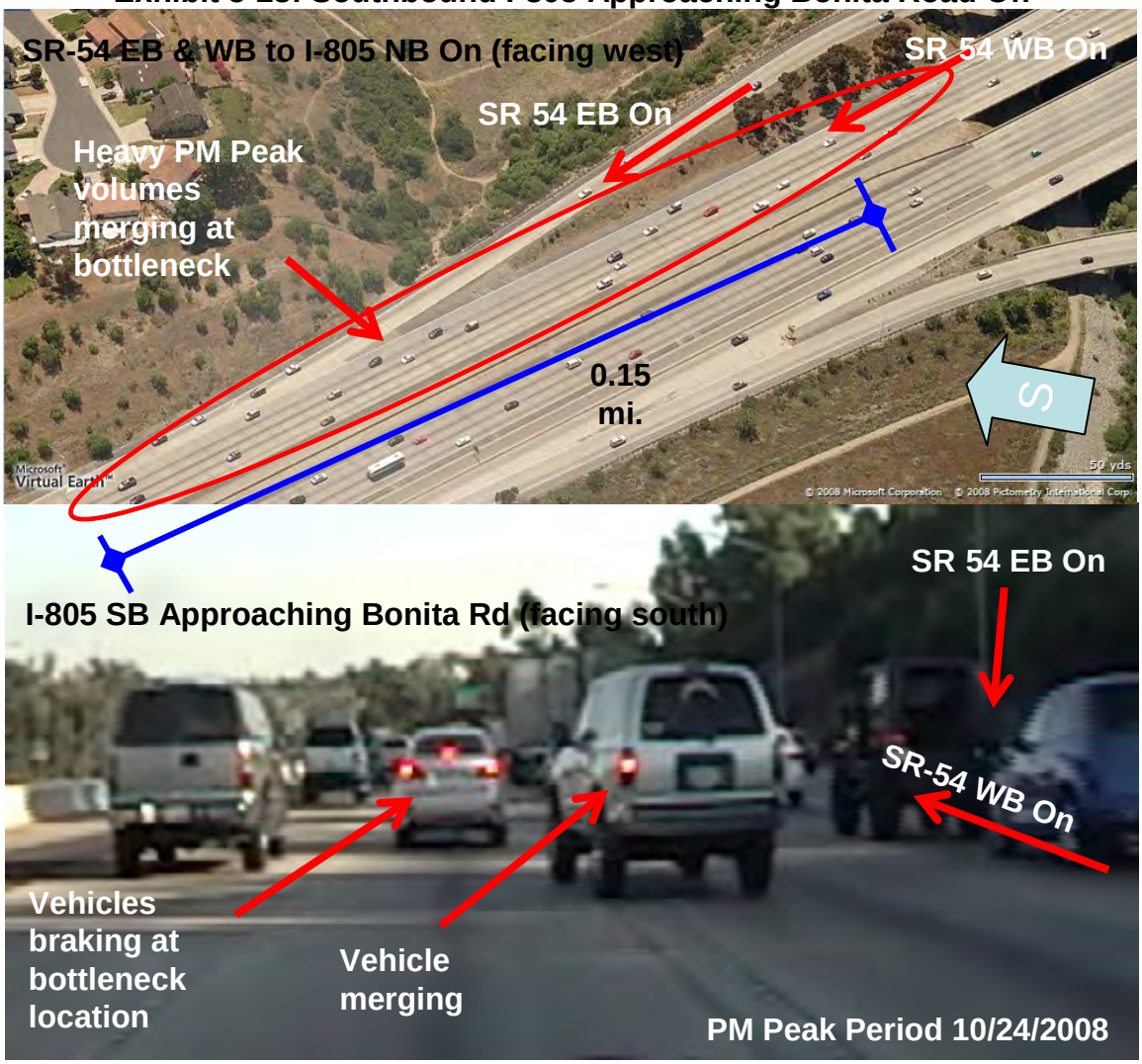


Exhibit 5-24: Southbound I-805 Bonita Road/E Street Off Video

6. SCENARIO DEVELOPMENT AND MICRO-SIMULATION

This section describes the logic behind developing the scenarios that were evaluated by Cambridge Systematics, Inc. using the Transmodeler microsimulation model. Several steps were required to evaluate improvement projects, including:

- The development of a traffic model based on current and medium-term demands
- Combining projects in a logical manner into "scenarios" for modeling and testing
- Evaluating model scenario outputs and summarizing results
- Conducting a benefit cost assessment of scenarios

Traffic Model Development

In order to evaluate the effectiveness of any proposed project or set of projects, an I-805 traffic model was developed by Cambridge Systematics, Inc. using the Caliper TransModeler micro-simulation software on behalf of SANDAG and Caltrans.

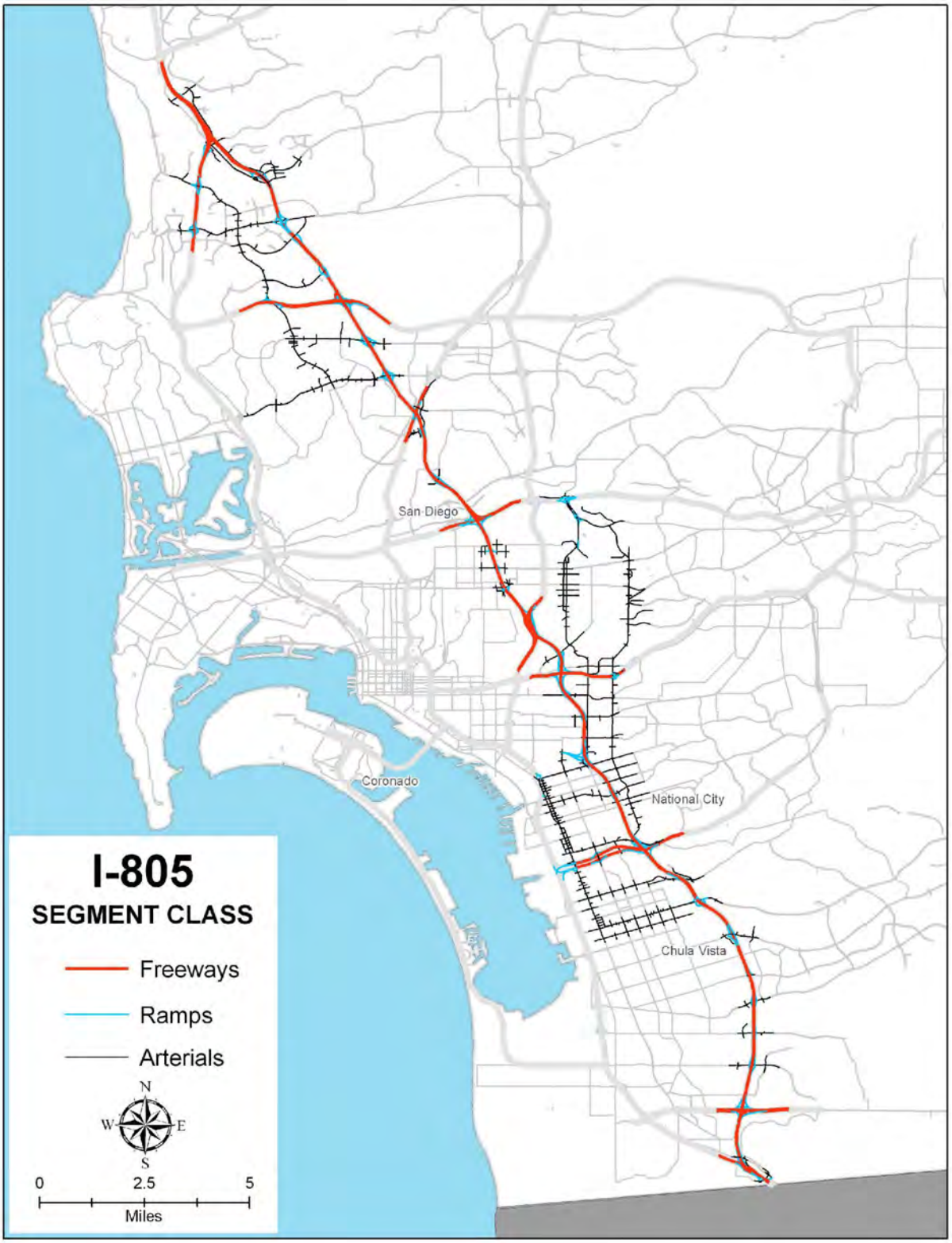
It is important to note that micro-simulation models are complex to develop and calibrate for large urban corridors such as the I-805 corridor. However, it is one of the only tools capable of providing a reasonable approximation of bottleneck formation and queue development. Therefore, such tools help quantify the impacts of operational strategies, which traditional travel demand models cannot.

Exhibit 6-1 shows the Roadway network included in the model. Note that only certain arterials were included. These were selected primarily due to their significance to the I-805 corridor as a parallel diversion route when congestion becomes severe. Adding more arterials would have challenged the calibration process and delayed the overall project. However, all freeway interchanges (See Section 3 for a list of connecting freeways) were included as well as on and off-ramps.

The model was calibrated against 2006 conditions. This was a resource intensive effort, requiring several iterations of submittal and review cycles until the model reasonably matched bottleneck locations and relative severity. Once calibration was approved, a 2020 model was also developed based on SANDAG's travel demand model demand projections.

These two models were then used to evaluate different scenarios (combinations of projects) to quantify the associated congestion relief benefits and to compare total project costs against their benefits.

Exhibit 6-1: Micro-Simulation Model Network



Scenario Development Framework

SMG, in coordination with SANDAG and Caltrans, developed a framework for combining projects into scenarios. It would be ideal to evaluate every possible combination of projects, but that is impossible, since if one starts with just ten potential projects, there would be over 1,000 combinations to evaluate. Clearly, the budget and schedule did not permit such an exhaustive effort.

Instead, projects were combined into "scenarios" based on a number of factors, including:

- Operational projects were combined separately from expansion projects in order to distinguish between their benefits
- Projects that were fully programmed and funded were combined separately from projects that were not
- Short-term projects to be delivered by 2014 were used to develop scenarios to be tested with the 2006 model
- Medium-term projects to be delivered by 2020 were used to develop scenarios to be tested with the 2020 model.

SMG and the PDT technical advisory committee assumed that projects delivered before 2014 could reasonably be evaluated by using the 2006 base year model. As described before, 2006 demands and associated congestion exceed even the 2009 numbers. As such, 2006 reasonably reflects 2010 or even 2011 conditions.

The 2020 forecast year for the I-805 study was consistent with the SANDAG 2020 regional travel demand model origin-destination matrices used to develop the 2007 Regional Transportation Plan (RTP). Given that this model was developed before the economic recession, SMG believes that the demands reasonably reflect conditions beyond 2020, perhaps as far as 2025.

When SANDAG updates their RTP, it may wish to update the micro-simulation model with revised demand projections. Project lists used to develop scenarios were provided by SANDAG and Caltrans from the Regional Transportation Improvement Program (RTIP), the Regional Transportation Plan (RTP), and other sources (e.g., special studies). Projects not deemed to directly affect mobility or that were not expected to be delivered by 2020 were eliminated. For instance, sound wall, landscaping, or minor arterial improvement projects were not considered since micro-simulation models cannot evaluate them.

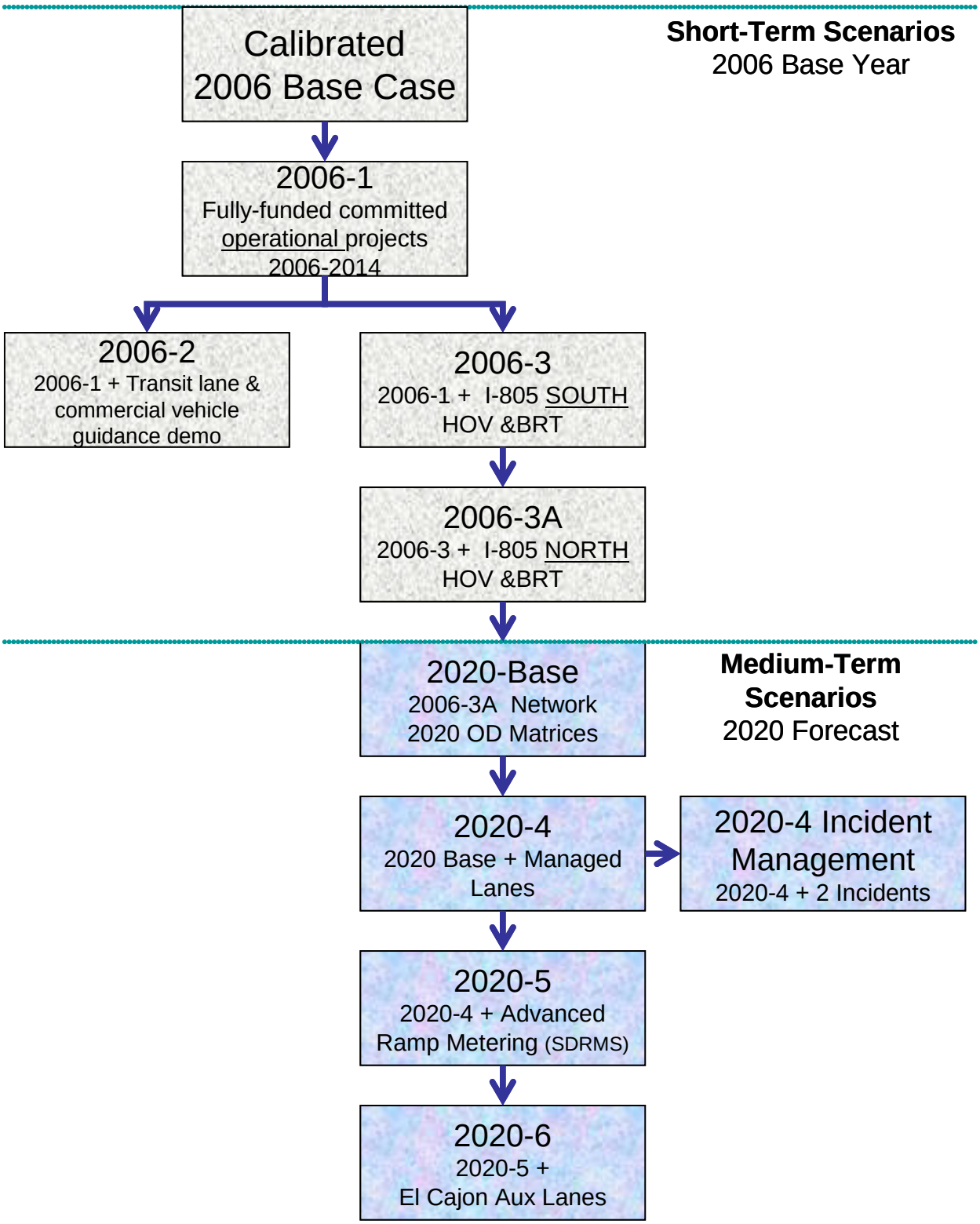
The results of this review were summarized in a memorandum in September 2008 (*I-805 CSMP – Review of Existing Studies & Documents Memorandum". September*

2008). Appendix A of this final report is a matrix from that memorandum listing the documents examined as a part of that review. The matrix also summarizes the studies and provides the years for baseline year and forecast year analysis, if that information was available. This review was the basis for subsequent project discussions.

Note that the scenario testing performed for the I-805 CSMP differed from traditional "alternatives evaluations" done for Major Investment Studies (MIS) or Environmental Impact Reports (EIRs). An MIS or EIR focuses on identifying alternative solutions to address current or projected corridor problems, so each alternative is evaluated separately and results among competing alternatives are compared resulting in a locally preferred alternative. In contrast, for the I-805 CSMP, scenarios build on each other in that a scenario contains the projects from the previous scenario plus one or more projects. This difference is important since CSMPs are new and are often confused with alternatives studies.

Exhibit 6-2 summarizes the modeling approach used and scenarios tested. It also provides a general description of the projects included in the 2006 and 2020 micro-simulation runs. Appendix B provides the detailed list of projects included in each scenario.

Exhibit 6-2: Micro-Simulation Modeling Approach



Short-Term Scenario Evaluation Results (2006)

Exhibits 6-3 and 6-4 show the delay results by facility type for all short-term (i.e., 2006 Base Year) scenarios evaluated for the AM peak period and PM peak period respectively. Exhibits 6-5 and 6-6 are charts showing the delay results by bottleneck area – again, for the AM and PM periods, respectively.

Exhibit 6-7 is a table showing the net percent change in delay for each scenario by direction, time period, and bottleneck area. The net percent change is based on the difference in delay for the current scenario less the delay from the previous scenario. For example, since scenario 2006-2 is a temporary demonstration project, the net results of scenario 2006-3 are based on the difference between 2006-3 ("HOV and Bus Rapid Transit [BRT] South") and 2006-1 (programmed operational projects).

For every scenario, the modeling team also produced traffic profiles generally referred to as speed contour diagrams. The speed contour diagrams for each scenario are presented in Exhibit C.

All results were scrutinized to make sure they are consistent with general traffic engineering principles.

Exhibit 6-3: AM Peak Micro-Sim Delay Results by Short-Term Scenario (2006)

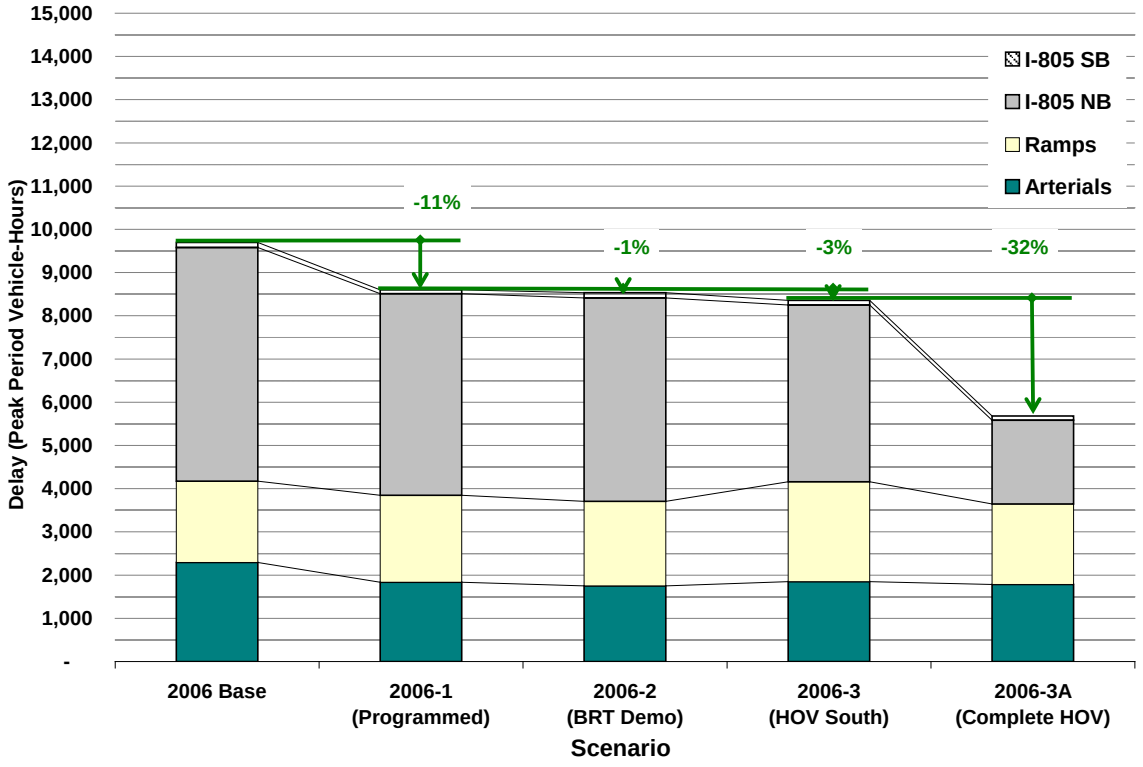


Exhibit 6-4: PM Peak Micro-Sim Delay Results by Short-Term Scenario (2006)

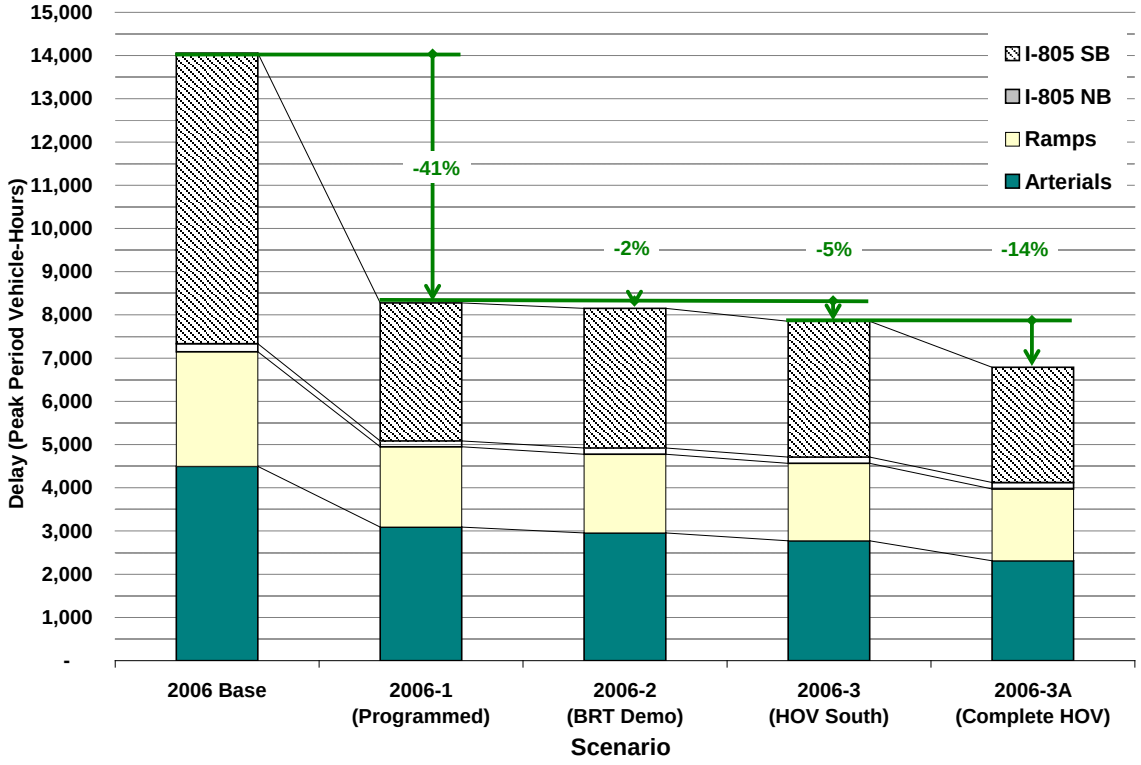


Exhibit 6-5: Northbound Delay Results by Scenario and Bottleneck Area (2006)

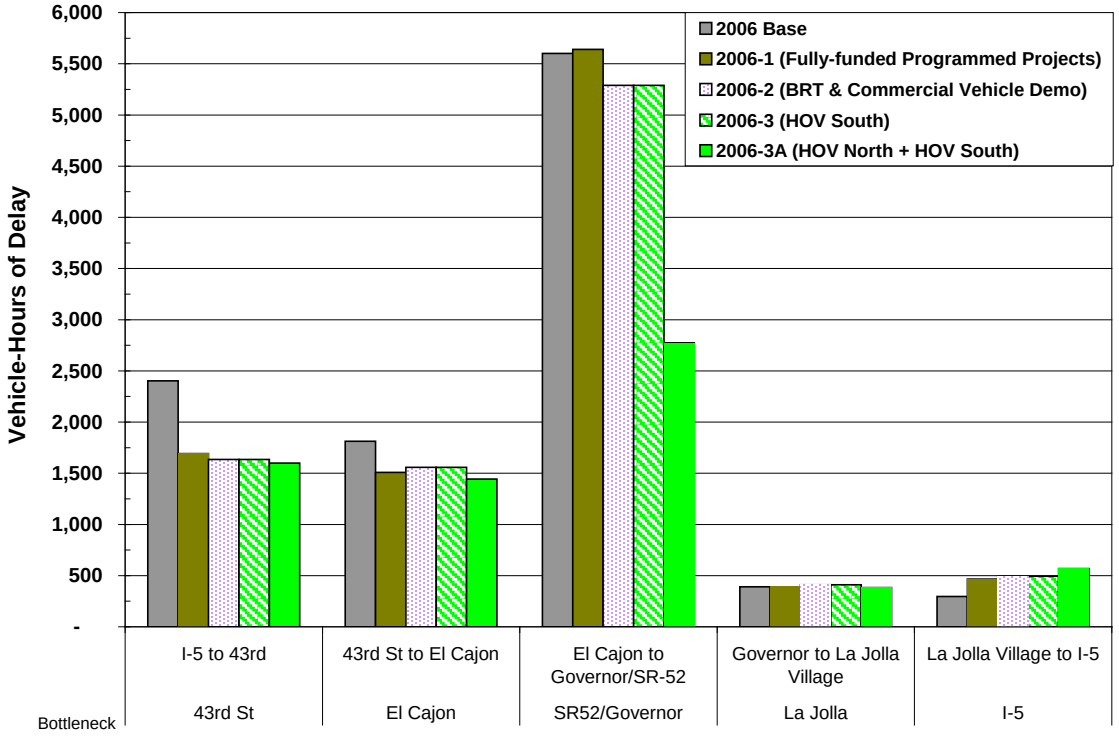
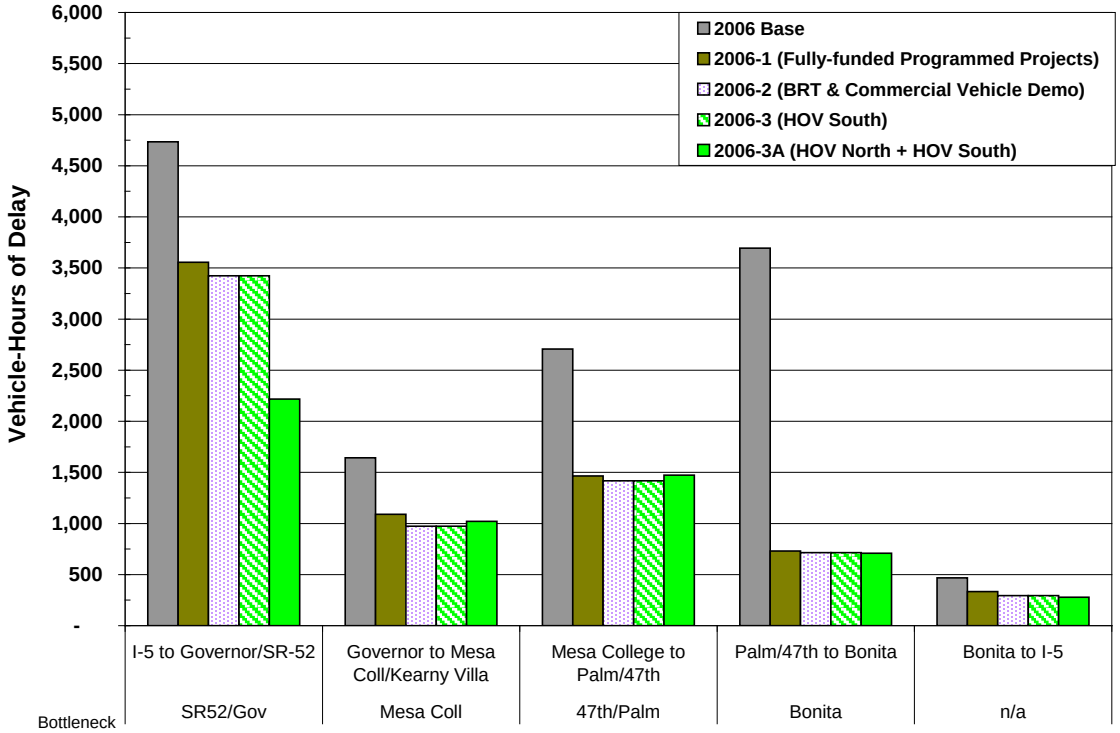


Exhibit 6-6: Southbound Delay Results by Scenario and Bottleneck Area (2006)



Scenario 2006-1 includes all mobility related, fully-funded programmed operational projects slated for completion before 2014. Operational projects were grouped to differentiate benefits of operational strategies from benefits associated with expansion projects. Scenario 2006-1 projects included:

- southbound auxiliary lanes currently being constructed between SR-54 and H Street in Chula Vista
- northbound and southbound high occupancy vehicle (HOV) lanes in the median of I-805 from the existing quarter-mile HOV terminus on I-805 at I-5 to Carroll Canyon Road on I-805
- northbound and southbound direct access ramps (DARs) from Carroll Canyon Road to the HOV lanes on I-805
- Several arterial Traffic Light Synchronization Program (TLSP) projects on major east-west and I-805 parallel arterials in the City and County of San Diego. The TLSP program is a statewide effort funded in part from Proposition 1B. The purpose of the program is to fund signal timing projects and other technology-based improvements to improve safety, operations, and the effective capacity of local streets and roads.

The models estimate that this scenario will reduce overall delay on the corridor by almost 30 percent, most of which occurs in the PM peak period (41 percent as shown in Exhibit 6-4). This large PM peak period reduction is due largely to the southbound auxiliary lanes at SR-54/H Street, which almost eliminates the southbound PM "Bonita Road/H St" bottleneck related delays (an 81 percent reduction as shown in Exhibit 6-6). Also, note that impressive delay reductions are achieved on the arterials, mainly due to the TLSP projects (Exhibits 6-3 and 6-4).

Scenario 2006-2 is a short-term Bus Rapid Transit and commercial vehicle guidance technology demonstration project. It was compared to Scenario 2006-1 since the southbound auxiliary lane project is expected to be completed by 2012. This scenario produces modest improvements in delay with most occurring at the northbound AM SR-52/Governor Drive and southbound PM Mesa College locations (Exhibits 6-5 and 6-6). Note that this is a low cost project (See discussion in benefit/cost section of this report).

Scenario 2006-3 consists of scenario 2006-1 (fully-funded operational projects) and the first phase of HOV lanes on the corridor, which is the south portion of this project between Telegraph Canyon Road in Chula Vista and SR-94 in San Diego. Scenario 2006-3 produced modest overall reductions in congestion. This is likely because the programmed projects of scenario 2006-1 – especially the southbound auxiliary lanes between SR-54 and H Street.

Scenario 2006-3A represents the completion of the north portion of the I-805 HOV facility from Telegraph Canyon Road in Chula Vista north to the I-805/I-5 terminus in Sorrento Valley. The model projects this to be the second highest congestion reduction short-term scenario, especially in the AM peak period, where delay is expected to be reduced by more than 30 percent incrementally as shown in Exhibit 6-3. The biggest reductions occur at the SR-52/Governor Drive bottleneck for both the AM northbound and PM southbound directions.

Medium-Term Scenario Evaluation Results (2020)

The 2020 baseline scenario, against which medium-term scenarios were compared, is the 2020-3A scenario, which includes the completed I-805 corridor HOV lanes and BRT service. Exhibits 6-8 and 6-9 show the delay results of the medium-term scenario results by facility type (mainline, arterials, ramps, and managed lanes. They also show the 2006 Base results for reference purposes.

Exhibits 6-10 and 6-11 are charts showing the medium-term delay results by bottleneck area for the AM and PM periods, respectively.

Exhibit 6-7: AM Peak Micro-Simulation Delay by Medium-Term Scenario (2020)

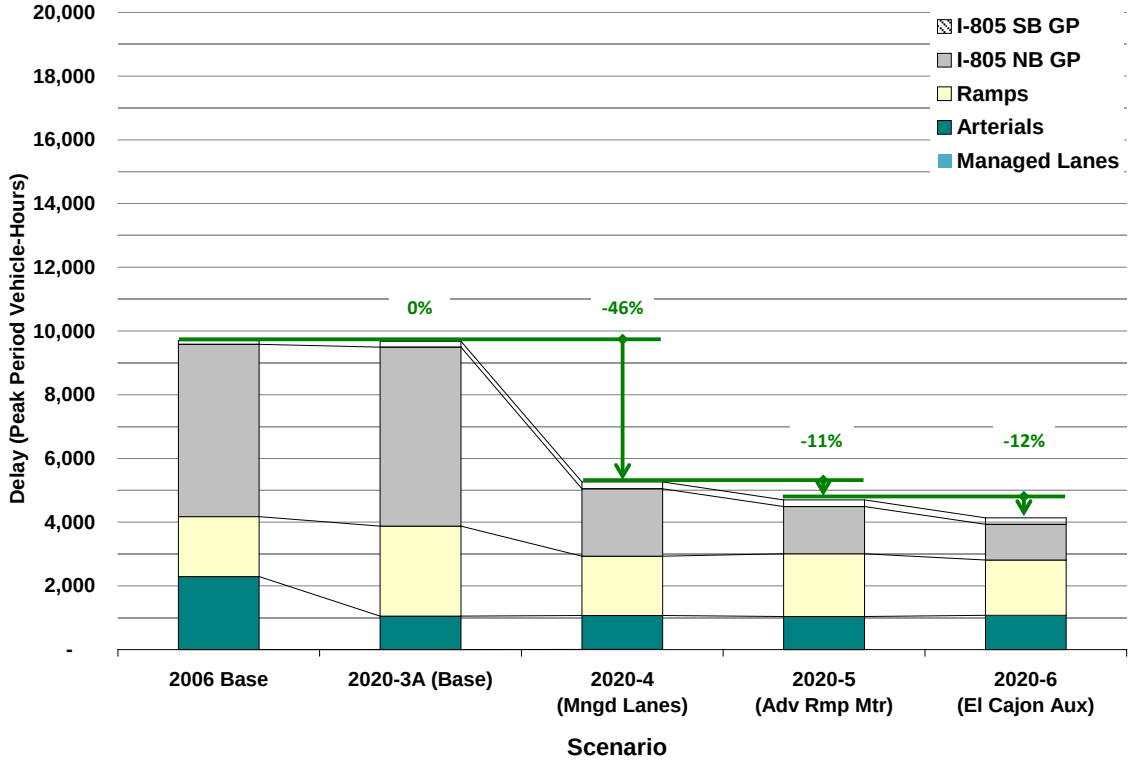


Exhibit 6-8: PM Peak Micro-Simulation Delay by Medium-Term Scenario (2020)

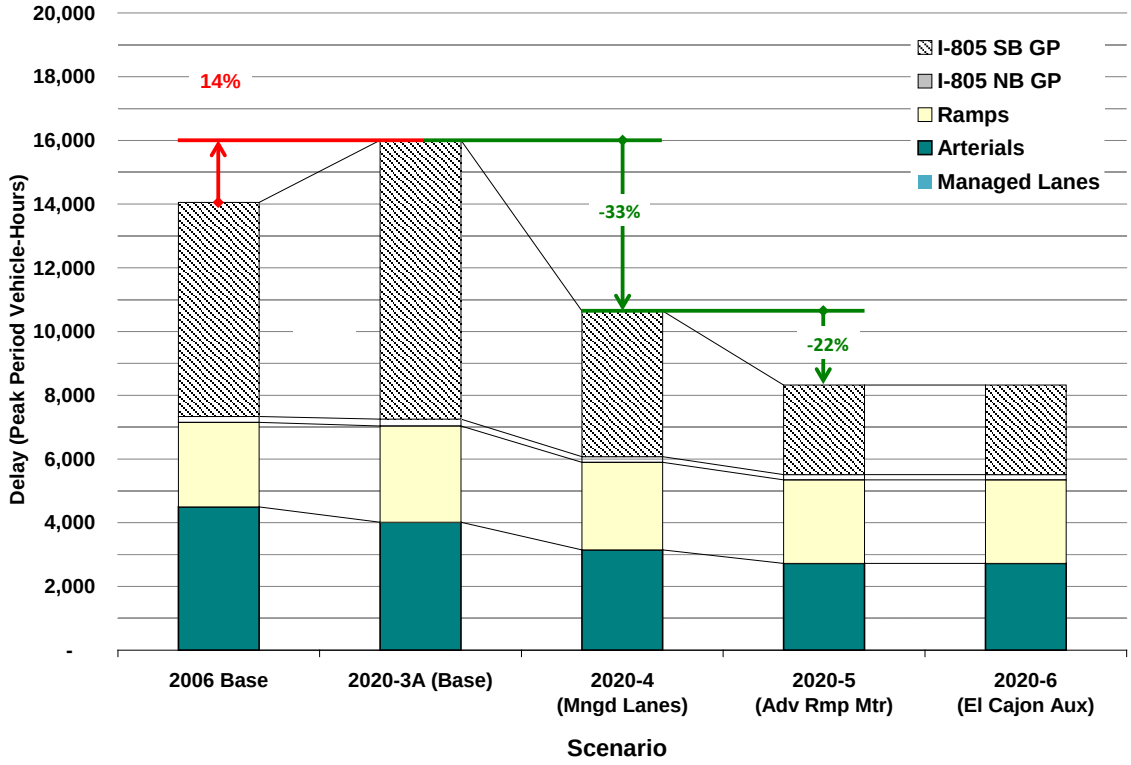


Exhibit 6-9: Northbound Delay Results by Scenario and Bottleneck Area (2020)

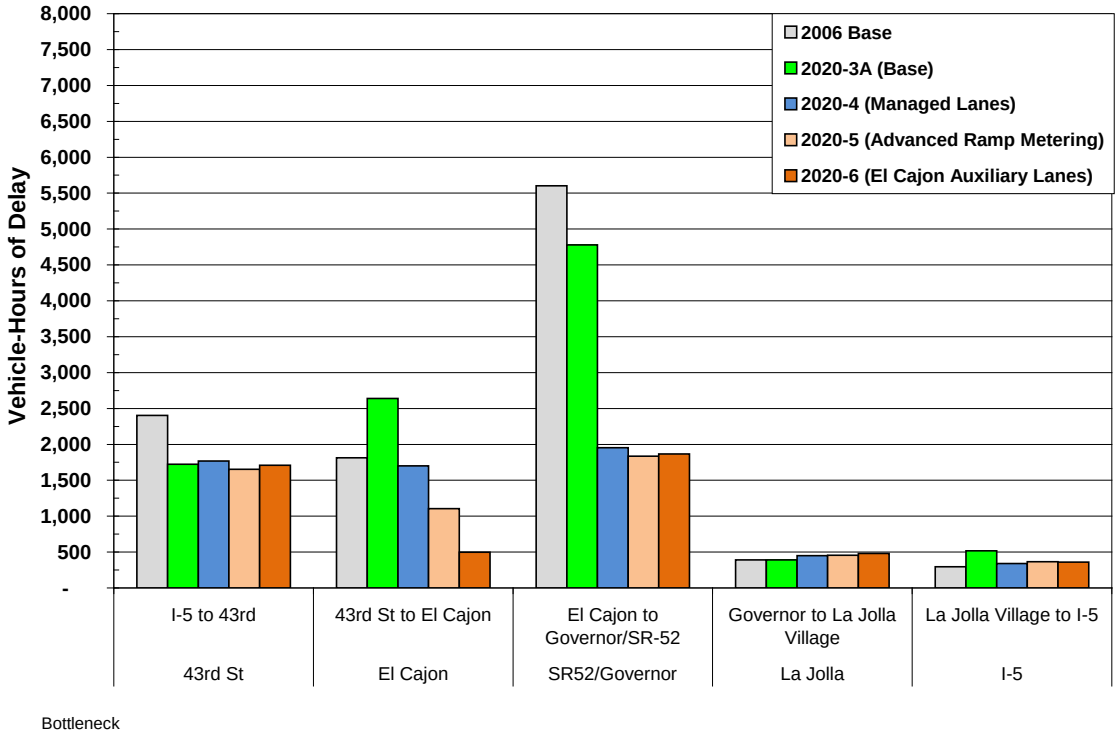
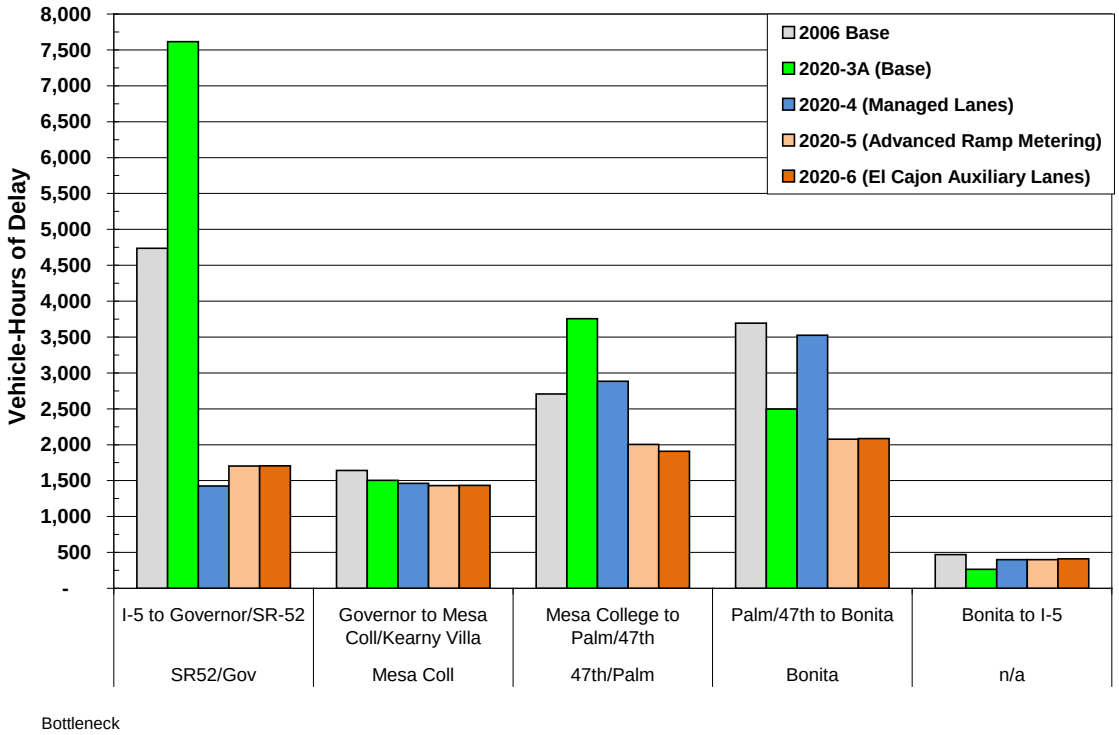


Exhibit 6-10: Southbound Delay Results by Scenario and Bottleneck Area (2020)



The following summarizes the findings of the medium-term scenario evaluations:

The 2020 baseline scenario (2020-3A) projects delays will increase by 2020 to be equal to or higher than the 2006 base. In other words, congestion will return to 2006 conditions by 2020 even with the short-term projects. This is expected since population and travel demand growth will lead to additional congestion by 2020. Note that the PM peak period delay is expected to surpass 2006 base year by almost 15 percent as shown in Exhibit 6-8.

Scenario 2020-4 represents the managed lanes scenario both at the southern and northern sections of the corridor. This scenario significantly reduces congestion. In the AM peak period, this scenario is expected to reduce congestion by more than 40 percent with an additional 30 percent reduction in the PM peak period. Once the projects are delivered, overall congestion ends up significantly lower than the 2006 base.

Scenario 2020-5 is the implementation of advanced ramp metering over and beyond the projects in 2020-4. The results show a further impressive improvement in delay of approximately 11 and 22 percent for northbound and southbound respectively. Note that there are several advanced ramp metering systems deployed around the world and for modeling purposes, we used one called ALINEA. This one has been deployed in Europe and Asia and was readily available for modeling. However, it is used as a proxy and is not specifically recommended. Caltrans and SANDAG should evaluate different algorithms and implement the one they deem to provide the best benefits.

Scenario 2020-6 builds on 2020-5, and is the construction of northbound auxiliary lanes at El Cajon Boulevard just south of the I-805/I-8 interchange. This project affects the northbound AM direction and time period, so no PM impacts were simulated. This scenario reduces delay beyond the 2020-5 scenario by 12 percent as shown in Exhibit 6-7. Clearly, the largest delay reductions occur at the El Cajon bottleneck in the northbound AM peak where congestion goes down by 62 percent.

Two incident scenarios were tested based on the 2020-4 scenario to evaluate the non-recurrent delay reductions resulting from improved incident management (IM) strategies. In the first scenario ("No IM"), one accident was simulated in each of the AM and PM peak period models. The AM "accident" was simulated in the northbound direction near Claremont Mesa Boulevard, and the PM accident was simulated in the southbound direction around Imperial Boulevard. The second scenario ("With IM") simulated accidents at the same locations, but with improved IM response times.

The accidents were simulated at the beginning of the AM and PM peak periods to allow enough time for model clearance and system recovery. The first IM scenario was a two-lane closure for the first 45 minutes (7:00-7:45 AM NB and 4:00-4:45 SB PM). The

remaining lanes were set to have a maximum speed of 30mph, and the incident zone for both scenarios was 200 feet.

The second, “with IM”, scenario was a two-lane closure for the first 30 minutes and a one-lane closure for the next 15 minutes. Managed lanes were open to all traffic (no vehicular restrictions) within 15 minutes of the accident in the “No IM” scenario, and within 10 minutes in the “with IM” scenario.

With no IM, the first scenario produced a nine percent increase in overall corridor congestion. The southbound PM accident modestly increased congestion. This difference could be due to any number of factors including the locations and times of the two simulated accidents.

The improved IM scenario, showed only a two percent increase in congestion. Based on these two simulation runs, improved incident management can produce up to a 14 percent reduction in non-recurrent congestion.

Benefit-Cost Analysis

Following an in-depth review of micro-simulation results by SMG and the SANDAG technical committee, SMG performed a benefit-cost analysis (BCA) for each scenario. The BCA analysis uses conservative benefit assumptions, and the benefit estimates are based solely on congestion relief. There are other benefits not captured by this analysis, including benefits to transit users. Medium-term benefits beyond the modeled period are also not captured. For example, the benefits to be achieved by deploying a system for bus rapid transit to meet other transit and accessibility needs are not estimated.

The *California Life-Cycle Benefit/Cost Analysis Model* (Cal-B/C v4.0)[5] developed on behalf of Caltrans by SMG estimates benefits in four key areas: travel time savings, vehicle operating cost savings, emission reduction savings, and accident reduction savings. Project costs were developed from SANDAG and Caltrans project planning and programming documents.

For a more detailed description of Cal-B/C v4.0, definitions of outputs, and the detailed results for each I-805 CSMP scenario evaluated, please see Appendix D at the end of this report.

Exhibit 6-11 shows the estimated results of the BCA for the I-805 CSMP. A B/C greater than 1.0 means that a scenario returns greater benefits than it cost to construct or implement the projects in that scenario. It is important to consider the total benefits that a project brings. For example, a large capital expansion project such as adding managed lanes (Scenario 2020-4), can cost a great deal and have a low B/C ratio, but brings much higher absolute benefits to I-805 users.

In the short-term, the operational projects fully funded and programmed and evaluated as part of scenario 2006-1 show a high 5.0 B/C ratio. This indicates that the region is tackling its most pressing congestion areas on I-805 via operational strategies.

The southern HOV scenario provides a modest B/C ratio of 0.2. The reasons for this low return on investment are two-fold:

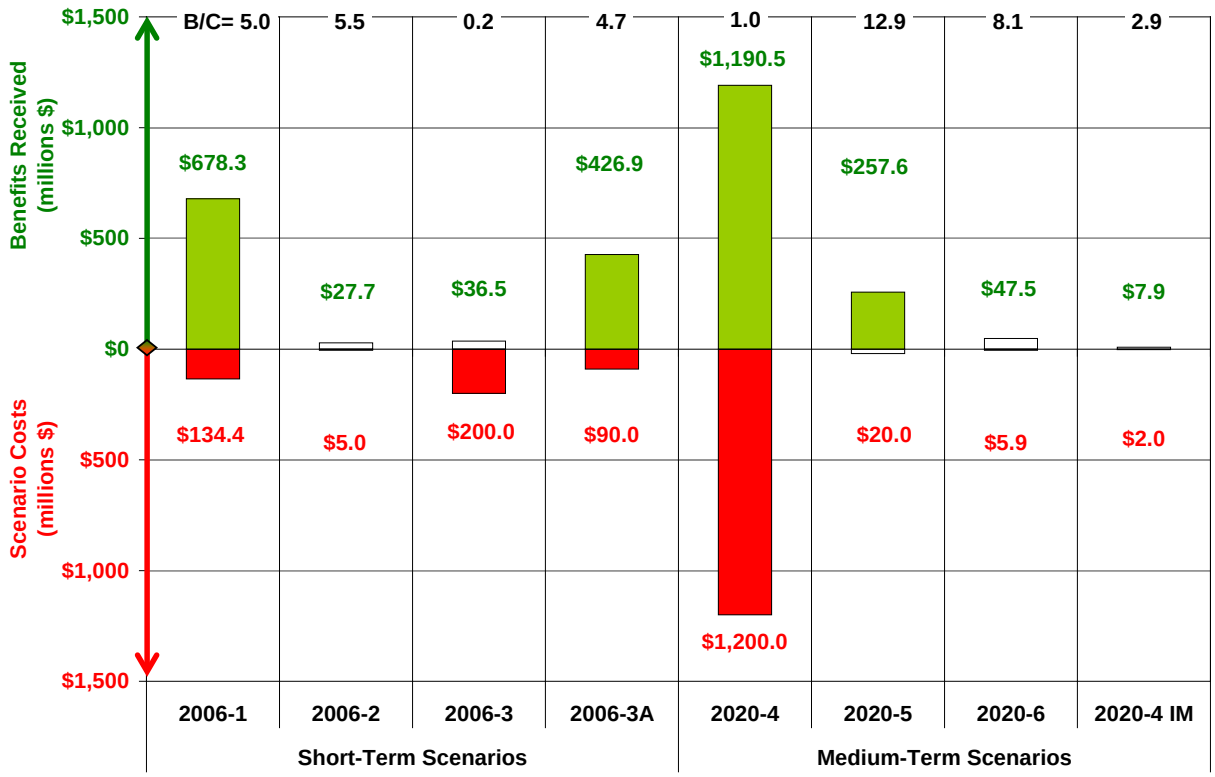
- Scenario 2006-1 already addressed a large part of the congestion in the southern section of the corridor. As such, the HOV project cannot reduce congestion significantly beyond that.
- The southern HOV cost is relatively high at $200 million.

[5] A complete copy of Cal-B/C v4.0, the User's Guide, and detailed technical documentation can be found at http://www.dot.ca.gov/hq/tpp/offices/ote/benefit.html.

In contrast, the northern HOV scenario projects a B/C ratio of 4.7, which is high for an HOV project. Part of the reason is the relatively low cost of $90 million required to fund this project. Also, note that Scenario 2006-1 does not significantly reduce congestion on the northern section of the corridor and therefore the HOV addition can provide more congestion relief.

In the medium-term, advanced ramp metering and El Cajon auxiliary lanes (i.e., scenarios 2020-5 and 2020-6) provide the largest benefits relative to costs (12.9 and 8.1 respectively). On the other hand, the managed lane provide for a B/C ratio of only 1.0, reflecting the high costs of $1.2 billion. However, the managed lane benefits do not fully account for the transit benefits and are likely to grow over time (i.e., beyond 2020).

Exhibit 6-11: Scenario Benefit/Cost (B/C) Results



7. CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the conclusions and recommendations based on the analysis discussed so far. It is important to note that many of these conclusions are based primarily on the micro-simulation model results. System Metrics Group, Inc. (SMG) helped review the model results and believe that both the calibration and scenario results are reasonable. However, SANDAG and Caltrans should always be cautious to make decisions based on modeling alone, especially complex models such as this one.

Based on the results, we offer the following conclusions and recommendations:

- *Short-term* – The short-term scenarios mostly show superior return on investment for public funds:

  - Three of the four short-term scenarios showed a benefit cost ratio of over 4.5. For those, every dollar invested is projected to provide 4.5 dollars or more in public benefits.

  - The only project with a low projected return is the southern HOV project (i.e., scenario 2006-3). The reason it does not produce significant returns is that a lot of the congestion in the southern section is relieved by the auxiliary project to address the existing bottleneck at H Street/Bonita. However, we note that this southern HOV project is needed regardless since it will become part of the managed lanes to be delivered by 2020.

    The CSMP process and findings provide opportunities to examine future sequencing/phasing of projects and revisit how project priorities are planned and programmed for the I-805 corridor. Since the auxiliary lane projects will be delivered by 2011, SANDAG can wait to ensure that southbound PM peak congestion is significantly relieved first. If true, then SANDAG should consider implementing the northern HOV project first. If not, SANDAG can revisit the model work and make adjustments as appropriate.

  - The combination of all four short-term scenarios is expected to reduce congestion by more than 50 percent. This reduction reflects improved mobility on the mainline, ramps, and arterials combined.

- *Medium-term* – By 2020, corridor mobility will again worsen due to projected increases in demand. Projected delay by 2020 is almost 15 percent higher than base year 2006 conditions. However, SANDAG and Caltrans will by then have implemented a series of new projects that will mitigate the impacts of the increased demand as follows:

- The northern and southern managed lane completions will reduce congestion by a third, albeit at a high cost. Due to this cost, the managed lane scenario only provides a benefit cost ratio of 1.0. Note that the benefits of this project will go way beyond 2020. Moreover, the traffic model understates the transit benefits since it models vehicles and vehicle flow. In addition, the benefits do not include the revenues generated from the managed lanes, which presumably will be used to fund additional transportation improvements in the region. Overall, large expansion projects do not generally generate high benefit cost ratios, primarily because they are expensive.

- Two additional operational strategies tested for the medium-term show excellent potential. The first represents the implementation of advanced ramp metering for the entire corridor. The second reflects the construction of auxiliary lanes northbound at El Cajon. Both reflect superior returns on investment and should be seriously considered for funding.

- Finally, improved incident management also shows promise, providing an estimated benefit cost ratio of almost 4.0. Again, this is a high return on investment, which does not even take into consideration the expected improvement in reliability.

This is the first generation CSMP for the I-805 corridor. It is important to stress that CSMPs should be updated on a regular basis. This is particularly important since Caltrans is seeking to better coordinate planning and operational processes to improve system management.

CSMPs, or a variation thereof, should become the normal course of business that is based on detailed performance assessments, an in-depth understanding of the reasons for performance deterioration, and an analytical framework that allows for evaluating complementary operational strategies that maximize the productivity of the current system.

Appendix A: I-805 Document Review Summary

Ref #	Title	Document Type and Summary (Corridor/Project Specific)	Producing Agency	Year	Baseline Year/Data	Forecast Data? Year(s)	Notes
1	I-805 Corridor System Management Plan (CSMP) - Project Schedule	Gantt Chart; project schedule outlines the various tasks associated with I-805 CSMP. The schedule shows a project start of June 2008 with an anticipated completion date of January 2010.	HNTB on behalf of SANDAG	2008	N/A	N/A	
2	I-805 BOSS Project between Palomar Street and La Jolla Village Drive	Technical Memorandum; provides initial guidance to project stakeholders on the specific planning, schedule, and deliverables needed to initiate the I-805 BOSS project development process.	prepared by CH2MHILL for SANDAG	February 2008	N/A	N/A	Memorandum summarizes BOSS project alternatives
3	North Feature Maps	North Feature Maps show Alternative 5 Preliminary Design plans for a Caltrans project on the I-805 (PM 23.3/27.7) and SR-52 (PM 3.5/4.1) between the SR-52 and the Mira Mesa Boulevard interchange.	Caltrans	2008	N/A	N/A	
4	South Feature Maps	South Feature Maps come in three different sets of preliminary design plans for the I-805 Managed Lanes South Project.	Caltrans	2008	N/A	N/A	
5	I-805 Managed Lanes Projects. Problems Options Plans (P-O-P) Process	Report; describes the Problems Options Plans (P-O-P) Process, which Caltrans employed to identify the appropriate set of projects to be implemented under the I-805 Managed Lanes Project	Prepared by Caltrans and URS for SANDAG	June 11, 2008	N/A	N/A	
6	I-805 Managed Lanes Corridor Conceptual Options	Table; compares the project costs of the conceptual options proposed for the I-805 Managed Lanes Corridor project	Caltrans and SANDAG	2007	2006$	N/A	
7	I-805 Managed Lanes South Project SR 905 to SR 15 Purpose and Need	Purpose and Need Statement; identifies the project purpose of the I-805 Managed Lanes South Project as maintaining or improving traffic operations on the south corridor from the interchange at SR 905 to SR 15 through the year 2030	Caltrans and SANDAG	March 28, 2007	2007	2030	
8	I-805 Managed Lanes - South Project List of Activities	Table; lists all the tasks associated with the I-805 Managed Lanes South Project, along with their status, the corresponding WBS Code, the responsible party, and the task manager.	Caltrans and SANDAG	N/A	N/A	N/A	
9	I-805 Managed Lanes South Project Direct Access Ramp (DAR) Study	Report; purpose was to evaluate and select DAR locations from Beyer Avenue to SR-15 in San Diego.	Prepared by Caltrans and URS for SANDAG	July 2007	2005	2030	Project cost expressed in 2006 dollars
10	Interstate 805 Managed Lanes North Project Direct Access Ramp (DAR) Technical Analysis Summary	Report; summarizes data used to evaluate and select DAR locations between SR-52 and the I-5/I-805 Separation, north of Mira Mesa Boulevard in San Diego	Prepared by Caltrans and URS for SANDAG	August 31, 2007	2005	2030	Project cost expressed in 2006 dollars
11	I-805 Project Study Report (Project Development Support) EA08160K	Project Study Report; addresses freeway improvements to I-805 north of State Route 905 and builds on the freeway improvement recommendations of the I-805/5 South Corridor Study.	Caltrans and SANDAG	January 2007	2000	2030	
12	Project Study Report in San Diego on Route 805 from 0.7KM South to 2.0 KM North of the Mira Mesa Boulevard Undercrossing	Project Study Report; identifies improvements that address existing and future deficiencies at the Mira Mesa Blvd/Sorrento Valley Road Interchange on I-805.	Prepared by RICK Engineering for Caltrans and the City of San Diego	August 2007	2005	2030	Project costs expressed in 2006 and 2010 dollars
13	Attachments to the Project Study Report in San Diego on Route 805 from 0.7KM South to 2.0 KM North of the Mira Mesa Boulevard Undercrossing	Technical documents; includes maps that illustrate proposed improvements, existing and projected traffic volumes, and a detailed breakdown of costs associated with each improvement alternative	Prepared by RICK Engineering for Caltrans and the City of San Diego	August 2007	2005	2030	

Ref #	Title	Document Type and Summary (Corridor/Project Specific)	Producing Agency	Year	Baseline Year/Data	Forecast Data? Year(s)	Notes
14	I-805 South Corridor Auxiliary Lane Improvements	Exhibits. First exhibit forecasts average daily traffic on I-805 from Bonita Road/E Street in 2030; the rest of the exhibits show average travel time and travel time variability on I-805 between Home Ave. and Orange Ave in 2005.	Caltrans	July 2007	N/A	N/A	
15	Project Report in San Diego County on Routes 5, 15, and 805 – EA 29000	Project Report; proposes to install vehicle detection stations for Routes 5, 15, and 805. The study identified one no-build alternative and the preferred alternative, referred to as Alternative A. Alternative A involves the installation of Vehicle Detection Stations (Radar Detectors) in up to 77 different locations along routes 5, 15, and 805.	Caltrans	November 2007	N/A	N/A	
16	I-805 Corridor Deficiency Study Summary (Draft)	Study; identifies the reasons and constraints that affect travel characteristics along the I-805 corridor. Study identifies four specific locations along the I-805 corridor and predicts their conditions if no improvements are made to the corridor by 2030.	Caltrans	2004	2003	2030	
17	RTP Appendix A. The Scenarios – Projects, Costs, and Phasing	The Appendix includes the Revenue Constrained Plan, Reasonably Expected Revenue, and Unconstrained Needs scenarios of the 2030 San Diego Regional Transportation Plan.	SANDAG	2007	2006	2030	
18	The I-805 CSMP Project List provided by SANDAG	Table; I-805 CSMP Related Caltrans RTIP Projects	SANDAG	2008	N/A	N/A	
19	Active Traffic Management (ATM): The Next Step in Congestion Management	Study examined congestion management experiences of other countries on freeway facilities. Scan sought information on how agencies approach highway congestion, actively manage/ operate fwy facilities, plan/design managed lanes. international.fhwa.dot.gov/pubs/pl07012/	FHWA	April 2008	N/A	N/A	
20	Active Traffic Management (ATM)	PowerPoint Presentation by Ted Trepanier. The presentation introduces an implementation plan for ATM strategies in the state of Washington.	Washington State DOT	April 2008	N/A	N/A	
21	Active Traffic Management at Mn/DOT	PowerPoint Presentation by Kenneth Buckeye. The presentation focuses on the various operational strategies that MnDOT has implemented to date, in addition to those that are scheduled for implementation	Minnesota DOT	N/A	N/A	N/A	
22	Annual Summary of HOV Lane Operations 2007	Report; provides information regarding traffic volumes in HOV and main lanes, occupancy ratios, accident data, and composition of traffic traveling in HOV lanes of I-5, I-15, and SR-54 within District 11	Caltrans D11	2007	N/A	N/A	Report reflects changes in HOV lanes throughout San Diego County since the previous 2005 report.
23	District 11 – Interstate 805 Transportation Concept Summary (Draft)	Transportation Concept Summary; presents a list of recommended improvements for the I-805 corridor.	Caltrans D11	August 2007 (Draft)	2006	2030	
24	I-805 Risk Assessment Plan	Table; Caltrans compiled a list of risk events for the I-805 Risk Assessment Plan	Caltrans	N/A	N/A	N/A	
25	Email Addressed to Steve Lutz from Chuck Davis dated April 18, 2008 with Subject: re: Today's CSMP Meeting	Email; identifies projects that may affect the I-805 corridor	Caltrans	April 2008	N/A	N/A	
26	Fall 2007 Top 10 Congested Segments	Maps; two maps indicate the top ten congested segments in San Diego County in the year 2007 during the autumn months	Caltrans D11	March 2008	N/A	N/A	

Appendix B: Detailed Scenario Descriptions

This appendix describes the scenarios and the projects from the Regional Transportation Improvement Program (RTIP), Regional Transportation Plan (RTP), and other plans (e.g., State Highway Operations and Preservation Program or SHOPP) that are used to build the scenarios to be tested using the TransModeler microsimulation model developed by Cambridge Systematics, Inc.

Exhibit B-1 shows the scenarios for both the 2006 base year and 2020 horizon year forecast. It lists codes (shown in Exhibit B-2) for each programmed or planned project and the bottleneck locations that each project is expected to influence.

Exhibit B-1: Scenario Descriptions

			NORTHBOUND				SOUTHBOUND				
			AM			PM	PM				
Short-Term Scenario	Long Term Scenario	Scenario Description	43rd St (AbsPM 11.60)	El Cajon Blvd (AbsPM 16.40)	Governor Dr (AbsPM 24.10)	La Jolla Village Dr (AbsPM 26.30)	Governor Dr (AbsPM 24.50)	Mesa College/ Kearny Villa (AbsPM 19.50)	47th St/Palm (AbsPM 11.85)	Bonita Rd/H St (AbsPM 7.10)	Other (e.g., done separately as needed or left out)
2006-1	**2020-1**	Fully funded programmed operational projects delivered in/after 2006 or to be delivered through 2014, not including HOV projects.				ST-6	ST-5			ST-1, 2	ST-3,4,7,8 & TLSP
2006-2	**n/a**	Scenario 2006-1 + dedicated transit lane demo using vehicle guidance technology	ST-10	ST-10	ST-10	ST-10	ST-10	ST-10	ST-10	ST-10	
2006-3	**n/a**	Scenario 2006-1 plus fully funded HOV for southern portion of corridor + BRT	ST-12, 13, 14, 15	ST-13, 14	ST-14	ST-14	ST-14	ST-14	ST-12, 13, 14, 15	ST-12, 13, 14, 15	ST-11
2006-3A	**2020-2**	Scenario 2006-3 plus fully funded HOV + BRT for northern portion of corridor (i.e., n/o SR-94)	MT-5/6	MT-5/6	MT-5/6, MT-40/41	MT-5/6, MT-40/41	MT-5/6, MT-40/41	MT-5/6	MT-5/6	MT-5/6	ST-11
2006-4	**2020-3**	Scenario 2006-4 plus advanced ramp metering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Exhibit B-2: Projects Included in the I-805 Scenarios

Responsible Agency/ Project ID	EA Number/ Source	Project Location	Project Limits From-To	Project Description
Caltrans				
ST-1	276204	I-805	0.1km north of Telegraph Canyon Rd UC to 0.4km north of Bonita Rd UC	Install ramp meters and ramp HOV lanes
ST-2	081644	I-805/ SR-54	0.3mi north of H St OC/0.1mi west of I-805/SR-54 SEP to 0.2mi north of I-805/SR-54 SEP/0.5mi east of I-805/SR-54 SEP	Construct two southbound auxiliary lanes
ST-3	263901	I-805	0.5km south of Plaza Blvd UC	Revise Interchange
ST-4	273604	I-805	47th St UC	Install traffic signals
ST-5	089751	I-805	0.2km south of Nobel Dr OC to 0.1km north of Eastgate Mall OC	Interchange improvements and road widening
ST-6	2T0400	I-805	0.6km north of La Jolla Village Dr OC to 2.5km north of Mira Mesa Blvd UC	Construct HOV and DAR
MT-5/6	081610/ 081620	I-805	0.3km south of NW Conn OC SR-94 to Fairmount Ave/Mission Gorge	Construct HOV/auxiliary lanes corridor study, MIDDLE; Construct Managed and HOV lanes SOUTH
Chula Vista				
ST-7	RTIP	Broadway	Palomar to "C" St	Upgrade traffic signal coordination at locations identified by the City's Traffic Monitoring Program to reduce congestion and intersection delays
ST-8	RTIP	H Street	I-805 to I-5	Upgrade traffic signal coordination at locations identified by the City's Traffic Monitoring Program to reduce congestion and intersection delays
SANDAG				
ST-10	RTIP	I-805	Chula Vista to Sorrento Valley	Provide dedicated transit lane demonstration using vehicle guidance technology Provide value pricing program evaluation for goods movement/freight operations limited to medium duty commercially operated vehicles.
ST-11	RTP	I-5/I-805	North to North & South to South	HOV connectors
ST-12	RTP	I-805	Palomar St to SR-94	Improve existing 8F to 8F + 2HOV
ST-13	RTP	I-805 @ SR-94	North to West & East to South	HOV connectors
ST-14	RTP (RTIP SAN47)	BRT	Otay Mesa to Sorrento Mesa via I-805/I-15/SR-52	Route 680 - Provide 10 minute peak headways
ST-15	RTP (RTIP SAN47)	BRT	Otay Mesa to Downtown San Diego via I-805/SR-94	Route 628 - Provide 10 minute peak and 30 minute off-peak headways
MT-40/41	RTP (RTIP-CAL78B)	I-805	SR-52 to Carroll Canyon Carroll Canyon to I-5	Improve existing 8F to 8F + 2HOV Improve existing 8F to 8F + 4ML

ST = Short-Term fully-funded project to be constructed/implemented between 2006 and 2014.
MT = Mid-Term project to be constructed/implemented between 2014 and 2020.

Appendix C: Micro-Simulation Speed Contour Results

This appendix contains speed contour plots for each of the scenarios for the I-805 corridor System Management Plan (CSMP). These exhibits are based on output from the Transmodeler microsimulation model runs performed by Cambridge Systematics, Inc.

The rows in the exhibits are the 5-minute speeds produced by the microsimulation model. The columns are the "detector" locations, which have been placed at key locations in the model to capture speed estimates. The columns show the equivalent Freeway Performance Measurement System (PeMS) detector identification code, the absolute postmile along the corridor and the nearest cross-street name.

The cells in exhibits are color-coded as follows:

29	- Speeds <30mph
40	- Speeds <40mph
50	- Speeds <50mph

The exhibits in this appendix are listed as follows:

- Exhibit C-1: NB AM 2006 Base Year Simulation Speed Contours
- Exhibit C-2: NB AM Scenario 2006-01 Speed Contours
- Exhibit C-3: NB AM Scenario 2006-02 Speed Contours
- Exhibit C-4: NB AM Scenario 2006-03 Speed Contours
- Exhibit C-5: NB AM Scenario 2006-03A Speed Contours
- Exhibit C-6: SB PM 2006 Base Year Simulation Speed Contours
- Exhibit C-7: SB PM Scenario 2006-01 Speed Contours
- Exhibit C-8: SB PM Scenario 2006-02 Speed Contours
- Exhibit C-9: SB PM Scenario 2006-03 Speed Contours
- Exhibit C-10: SB PM Scenario 2006-03A Speed Contours
- Exhibit C-11: NB AM 2020-3A (Base) Speed Contours
- Exhibit C-12: NB AM Scenario 2020-04 Speed Contours
- Exhibit C-13: NB AM Scenario 2020-05 Speed Contours
- Exhibit C-14: NB AM Scenario 2020-06 Speed Contours
- Exhibit C-15: NB AM Scenario No Incident Management Speed Contours
- Exhibit C-16: NB AM Scenario With Incident Management Speed Contours
- Exhibit C-17: SB PM 2020-3A (Base) Speed Contours
- Exhibit C-18: SB PM Scenario 2020-04 Speed Contours
- Exhibit C-19: SB PM Scenario 2020-05 Speed Contours
- Exhibit C-20: SB PM Scenario No Incident Management Speed Contours
- Exhibit C-21: SB PM Scenario With Incident Management Speed Contours

Exhibit C-1: NB AM 2006 Base Year Simulation Speed Contours

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	I-15	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Clairemont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	61	61	62	54	52	62	61	50	60	61	43	66	62	63	63	64	60	58	63	62	68	67
6:05	64	60	62	48	52	64	63	56	62	64	46	64	62	54	63	63	63	54	64	65	68	66
6:10	65	61	62	42	54	65	60	55	62	[illegible]	[illegible]	[illegible]	57	62	61	63	60	57	63	63	69	67
6:15	63	60	63	47	51	63	60	54	62	[illegible]	[illegible]	[illegible]	56	59	62	64	62	59	65	64	68	66
6:20	64	59	63	43	50	62	57	44	60	63	38	65	56	56	63	63	63	51	64	65	70	66
6:25	65	61	63	38	51	63	51	33	62	62	32	65	54	38	61	63	60	50	64	62	67	67
6:30	63	61	63	40	48	62	36	33	63	62	33	64	55	35	62	61	60	57	63	64	68	66
6:35	64	58	62	35	48	63	30	32	63	62	32	63	51	31	62	62	62	53	64	65	68	65
6:40	64	61	62	43	47	62	24	30	59	62	31	64	26	27	61	62	60	53	61	64	69	66
6:45	64	60	62	44	47	62	23	30	62	60	37	64	18	28	61	62	45	63	62	64	68	65
6:50	61	58	63	39	46	63	22	29	62	61	35	62	19	29	62	63	16	61	63	64	68	66
6:55	61	61	61	37	48	52	22	28	63	60	39	51	18	27	60	62	16	58	64	62	68	66
7:00	62	59	61	40	42	51	23	26	57	54	35	27	18	29	61	62	18	55	65	65	69	65
7:05	65	60	64	46	52	36	22	27	58	26	30	48	20	40	61	30	18	51	65	62	67	66
7:10	63	57	62	47	53	17	22	28	59	19	31	57	25	38	60	19	17	55	64	64	68	65
7:15	63	58	62	39	47	16	25	25	53	19	32	65	24	33	60	18	16	59	63	64	69	66
7:20	63	57	60	47	49	17	22	27	36	20	39	57	21	32	61	17	15	54	62	62	68	66
7:25	64	59	62	53	49	17	23	28	27	21	39	58	22	35	61	19	16	53	62	64	68	65
7:30	63	59	63	48	46	17	22	25	28	23	38	42	23	38	60	19	16	53	64	63	70	66
7:35	62	56	62	51	48	17	21	27	35	23	39	29	25	37	62	20	18	56	62	64	67	65
7:40	63	58	63	44	50	17	23	25	52	24	36	19	22	39	63	22	16	54	64	64	68	65
7:45	64	59	62	52	53	17	22	27	54	24	39	15	23	36	62	19	17	50	60	66	70	66
7:50	63	58	64	52	54	17	23	25	58	22	35	16	19	37	61	17	16	58	62	64	70	67
7:55	62	59	63	51	53	33	23	28	58	22	39	15	23	36	60	19	17	58	61	63	69	66
8:00	63	57	62	55	51	34	24	29	56	26	58	15	24	35	63	20	18	57	63	64	68	65
8:05	63	60	61	57	50	23	22	40	54	49	58	16	27	39	61	20	16	57	64	65	69	67
8:10	63	59	57	62	53	21	21	55	54	62	55	16	22	32	60	19	15	49	62	62	68	66
8:15	63	58	53	59	48	20	23	57	56	64	60	16	23	36	62	18	16	58	59	63	69	66
8:20	62	56	63	56	54	24	22	31	50	62	59	17	24	36	63	18	15	58	62	64	68	67
8:25	61	59	62	62	54	34	25	30	54	64	60	16	22	35	61	19	16	56	61	62	67	66
8:30	64	57	63	58	51	58	23	31	49	60	60	17	22	39	61	17	17	53	63	62	68	65
8:35	64	59	63	56	51	63	24	31	57	58	59	15	23	41	62	23	16	56	64	63	68	65
8:40	60	58	61	57	53	57	24	31	58	62	58	15	23	35	62	18	16	57	64	62	69	65
8:45	62	56	62	55	52	62	33	31	45	64	61	16	23	33	64	19	16	55	63	61	68	65
8:50	63	59	63	51	51	63	57	34	46	61	63	16	23	37	61	18	20	60	63	61	65	64
8:55	63	55	64	57	50	59	62	44	59	63	61	17	24	37	62	22	18	58	63	62	67	64

Direction of Travel

Exhibit C-2: NB AM Scenario 2006-01 Speed Contours

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	I-15	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Clairemont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	62	62	61	52	51	64	64	54	64	64	51	[illegible]	61	62	63	63	62	55	65	64	68	66
6:05	61	62	63	50	53	63	62	54	62	[illegible]	[illegible]	[illegible]	59	63	62	62	63	47	64	63	67	66
6:10	67	62	63	53	50	66	64	56	61	[illegible]	[illegible]	[illegible]	61	63	62	64	64	48	64	63	67	65
6:15	66	60	61	49	54	64	61	57	63	63	58	66	61	62	62	64	62	58	63	62	66	65
6:20	64	60	59	38	49	63	62	47	62	61	46	63	56	62	61	63	59	50	64	65	67	65
6:25	62	61	61	50	49	60	57	43	63	64	35	65	53	39	61	62	59	61	65	63	67	65
6:30	61	61	63	55	50	62	49	42	61	63	33	64	33	34	61	61	58	54	61	63	67	66
6:35	64	60	63	52	49	63	34	45	64	64	30	63	21	31	62	62	60	54	64	63	67	66
6:40	63	61	62	57	49	62	39	45	60	62	32	66	19	29	62	59	48	49	65	64	67	65
6:45	66	59	63	55	49	63	49	33	63	61	33	58	18	30	61	63	19	56	59	61	67	66
6:50	64	60	59	51	50	64	44	32	59	61	30	41	19	28	62	62	16	52	64	62	66	66
6:55	64	61	64	46	51	61	48	28	61	60	34	28	19	31	61	50	18	58	64	59	67	65
7:00	64	57	61	52	51	61	41	28	61	53	30	20	19	30	62	19	16	52	66	61	68	65
7:05	63	57	63	50	48	61	48	26	61	32	30	27	19	32	61	19	17	55	64	62	66	65
7:10	64	56	64	53	53	57	57	25	57	17	31	57	20	33	59	19	16	45	62	63	68	67
7:15	63	56	63	55	54	59	46	28	56	19	35	52	21	33	62	19	15	48	63	60	68	66
7:20	63	58	61	59	53	64	44	35	43	19	35	33	21	34	62	18	14	58	61	59	69	67
7:25	63	59	62	60	51	60	54	37	27	21	35	42	20	35	62	17	14	58	64	61	67	66
7:30	63	60	63	58	49	63	62	52	33	21	39	21	24	35	61	18	16	56	62	64	67	67
7:35	63	57	63	63	52	60	63	56	59	21	43	18	23	37	63	20	16	52	64	60	67	66
7:40	64	58	64	56	54	62	54	48	57	29	36	17	21	35	62	19	15	59	59	61	67	66
7:45	65	58	63	57	53	59	61	44	53	51	35	15	23	34	62	19	16	55	59	64	67	65
7:50	65	58	64	60	54	60	61	48	57	61	35	15	26	37	61	17	16	63	63	64	66	66
7:55	61	56	63	57	53	61	59	48	61	60	29	17	25	37	62	20	14	55	62	62	67	66
8:00	61	59	61	60	52	63	53	49	57	62	40	19	24	38	60	19	14	55	59	62	67	66
8:05	63	57	62	61	52	62	61	46	48	63	55	20	26	35	62	18	16	56	58	62	66	66
8:10	66	60	63	57	49	62	63	56	61	64	62	18	23	33	62	18	14	50	61	63	67	64
8:15	61	58	64	63	52	61	59	46	59	63	62	41	25	35	62	20	15	57	51	63	67	65
8:20	62	59	63	62	56	62	64	57	60	63	63	50	27	33	61	20	17	54	61	63	66	65
8:25	64	60	62	56	52	64	63	56	59	62	62	63	21	28	63	20	17	49	63	64	67	65
8:30	64	60	63	59	51	62	60	48	61	64	61	60	21	31	63	19	18	57	63	60	67	65
8:35	65	58	62	57	53	63	61	59	63	64	57	60	22	31	63	19	17	51	62	63	66	66
8:40	63	57	61	56	49	62	59	58	60	62	61	60	21	36	62	21	18	51	63	63	68	65
8:45	63	59	64	56	54	62	59	53	62	62	62	61	26	38	62	21	17	57	64	62	66	67
8:50	61	58	64	55	51	63	60	55	55	64	61	64	31	32	62	18	14	58	61	62	68	65
8:55	66	60	64	59	55	60	62	45	54	65	64	65	30	32	62	17	18	57	62	63	68	67

Direction of Travel

Exhibit C-3: NB AM Scenario 2006-02 Speed Contours

Direction of Travel

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	I-15	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Clairemont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	64	63	62	51	52	62	62	58	61	63	54	65	61	62	62	62	61	54	64	64	66	65
6:05	64	61	62	57	53	64	[illegible]	[illegible]	[illegible]	60	47	65	58	62	62	63	62	60	65	64	67	65
6:10	65	62	64	53	53	63	[illegible]	[illegible]	[illegible]	62	49	64	61	59	62	63	61	57	64	64	66	67
6:15	65	60	61	58	51	64	60	54	[illegible]	64	55	63	53	61	62	64	60	54	65	64	68	66
6:20	62	60	64	41	46	63	61	51	61	59	46	65	58	52	61	63	61	49	63	62	68	66
6:25	62	59	62	55	50	61	58	48	60	61	35	64	56	38	61	58	59	53	62	63	66	66
6:30	63	61	61	49	50	64	47	34	61	61	31	62	49	32	61	61	62	53	63	62	68	65
6:35	64	60	62	52	47	61	58	29	62	63	30	64	29	29	61	63	59	46	61	63	66	66
6:40	62	60	62	56	49	62	55	29	60	64	29	65	22	28	59	60	61	47	64	64	68	65
6:45	63	61	60	58	51	63	58	27	62	43	32	64	20	28	61	61	33	49	64	62	67	67
6:50	63	59	61	54	52	60	52	29	62	20	33	64	19	29	61	60	16	51	63	62	67	67
6:55	64	61	62	52	46	64	44	29	60	18	30	62	18	28	61	47	19	47	63	64	67	65
7:00	63	58	63	55	47	63	49	27	60	17	31	65	19	28	58	24	19	54	63	62	68	67
7:05	64	58	62	49	51	60	56	25	28	18	29	64	19	32	61	18	14	55	64	64	67	65
7:10	64	59	60	56	54	58	56	26	24	17	33	66	25	32	62	20	17	57	64	64	68	66
7:15	61	60	62	56	51	59	54	25	22	18	30	66	59	30	62	20	15	51	65	64	68	66
7:20	62	57	60	60	48	63	58	18	23	17	38	67	61	42	62	21	15	53	62	61	65	66
7:25	63	57	61	57	51	59	59	16	29	20	34	63	56	54	61	16	17	57	61	64	67	66
7:30	64	58	62	61	50	64	58	20	26	20	38	64	53	37	61	23	14	57	61	62	66	64
7:35	64	57	60	60	54	61	61	23	31	20	34	63	55	36	62	19	17	54	61	63	67	66
7:40	64	60	62	61	52	61	57	24	31	20	30	62	53	40	62	18	16	58	63	63	67	65
7:45	62	57	64	58	50	62	55	24	28	22	34	63	36	40	61	20	15	58	63	63	67	66
7:50	62	58	63	60	50	61	61	23	28	20	32	59	31	35	61	16	15	55	63	59	67	65
7:55	63	58	63	50	51	59	56	26	30	21	34	64	31	32	63	19	16	52	64	61	66	65
8:00	63	59	61	61	50	63	52	45	28	22	40	62	27	34	63	18	16	59	65	62	67	66
8:05	63	58	63	60	53	64	62	54	50	21	44	63	23	33	62	21	16	56	59	64	68	67
8:10	63	59	61	60	50	62	61	53	60	26	54	60	19	36	61	18	15	60	62	64	67	66
8:15	62	58	63	59	52	60	63	51	60	62	44	37	22	35	62	21	15	55	62	63	67	64
8:20	64	60	62	59	50	65	62	51	62	62	58	35	24	34	61	17	17	59	61	63	68	65
8:25	62	59	63	62	51	62	63	54	59	64	64	55	25	33	63	22	17	55	62	63	67	66
8:30	65	59	62	61	54	62	63	52	59	65	63	66	24	32	63	15	22	58	63	62	66	64
8:35	65	58	62	57	52	59	62	52	61	64	61	64	25	31	63	23	17	48	63	63	67	65
8:40	64	58	63	59	54	61	61	46	59	65	62	64	26	30	63	17	17	58	62	61	66	65
8:45	64	58	63	58	54	60	62	52	59	63	64	63	28	29	62	17	18	58	62	62	67	65
8:50	63	61	62	58	54	63	60	54	59	64	61	64	23	31	63	20	17	59	59	59	66	64
8:55	64	59	60	52	53	63	61	56	61	64	63	63	23	32	62	20	17	61	63	64	67	64

Exhibit C-4: NB AM Scenario 2006-03 Speed Contours

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	I-15	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Clairemont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	64	62	63	49	54	62	64	58	63	62	55	6[illegible]	58	63	62	63	63	51	65	64	68	66
6:05	63	61	62	52	51	62	62	55	61	[illegible]	[illegible]	[illegible]	63	63	63	63	62	51	64	64	67	66
6:10	61	64	63	50	52	61	62	55	60	[illegible]	[illegible]	[illegible]	62	62	63	64	60	54	61	63	65	67
6:15	63	61	63	48	52	62	61	55	61	63	51	66	63	63	64	66	63	56	65	63	67	66
6:20	64	64	59	38	47	60	62	60	63	63	39	65	56	48	62	65	60	53	64	66	68	66
6:25	60	59	61	45	49	60	59	42	60	63	41	64	54	34	63	62	60	56	63	63	65	65
6:30	63	59	60	47	49	60	60	46	60	61	28	64	44	27	63	63	60	48	65	63	67	65
6:35	64	58	60	48	51	56	58	47	58	60	28	55	24	24	62	62	62	52	65	64	67	66
6:40	64	61	60	52	51	62	61	52	59	61	30	61	18	27	60	63	61	54	65	64	68	66
6:45	64	61	63	41	50	60	59	48	61	63	31	42	18	26	60	61	52	54	65	63	67	63
6:50	63	62	61	41	50	55	61	41	56	62	32	33	18	27	62	63	36	54	65	63	68	65
6:55	63	59	62	50	50	59	60	41	59	62	33	20	19	25	62	63	18	43	65	63	68	66
7:00	63	57	62	49	53	54	57	40	59	63	28	44	18	27	62	61	17	45	66	61	67	66
7:05	63	58	59	45	51	49	59	37	55	61	26	44	18	32	61	43	16	53	65	62	67	67
7:10	62	58	61	44	53	43	53	40	55	60	25	36	20	32	62	16	18	48	65	64	68	66
7:15	63	57	64	57	55	53	56	35	56	52	36	41	21	30	62	23	16	56	60	63	67	65
7:20	61	61	62	56	52	51	60	49	55	36	38	21	21	28	61	17	14	53	64	60	67	67
7:25	63	59	60	51	52	60	62	51	55	29	37	21	20	31	62	17	16	59	62	62	67	66
7:30	65	56	64	47	52	51	60	48	56	44	36	18	20	33	61	18	15	55	64	64	68	65
7:35	62	58	62	53	51	58	62	49	56	53	35	22	22	32	62	17	15	54	63	61	66	65
7:40	63	58	61	42	51	56	61	53	60	58	34	18	23	32	63	22	17	54	63	62	68	65
7:45	64	57	60	51	50	52	62	50	58	62	34	20	23	31	62	17	15	56	64	59	68	66
7:50	62	58	63	58	50	51	60	50	57	60	41	24	23	32	62	18	16	50	63	64	69	67
7:55	63	57	63	57	52	60	61	51	56	63	49	30	34	31	60	18	15	61	63	64	68	66
8:00	63	59	62	43	50	55	61	57	59	63	61	39	32	36	61	20	15	57	62	63	66	65
8:05	63	57	64	53	49	55	60	54	61	63	62	61	53	36	62	19	15	57	61	64	67	65
8:10	66	57	62	50	50	56	60	54	57	61	59	57	63	57	62	17	14	51	60	63	67	66
8:15	63	58	63	49	51	59	61	52	59	64	60	61	64	63	62	18	15	56	59	62	67	65
8:20	64	56	62	51	54	61	61	59	60	62	61	60	65	64	62	18	14	58	63	63	66	65
8:25	63	60	63	55	54	59	61	55	60	63	64	57	61	55	63	16	18	61	62	62	67	66
8:30	63	60	64	48	52	60	62	54	58	63	62	64	49	58	63	22	17	55	63	63	66	65
8:35	63	60	63	51	50	58	62	58	59	64	61	65	53	43	61	18	16	53	61	63	66	64
8:40	64	61	59	51	53	58	62	50	60	65	59	64	45	42	63	19	15	58	63	63	67	66
8:45	64	59	63	51	51	60	61	54	58	63	60	65	44	40	62	18	16	57	63	64	67	66
8:50	63	58	63	53	55	62	62	52	61	62	60	64	47	47	62	18	17	58	63	62	67	66
8:55	63	57	61	48	51	60	62	43	59	63	63	62	49	39	62	20	16	55	64	61	66	65

Direction of Travel

Exhibit C-5: NB AM Scenario 2006-03A Speed Contours

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	I-15	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Claremont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	63	62	63	48	53	58	63	54	62	64	54	64	62	62	63	62	61	48	66	64	67	67
6:05	64	60	59	52	52	62	63	55	62				63	60	62	64	64	53	63	64	69	67
6:10	62	63	62	51	53	62	63	59	61				55	60	63	64	60	59	65	62	67	66
6:15	64	62	61	44	52	63	62	56	61	63	57	66	60	60	61	64	61	52	64	63	68	68
6:20	65	59	60	39	48	60	62	52	62	62	57	66	62	58	63	63	61	48	63	61	67	66
6:25	65	60	59	40	50	57	61	49	60	62	38	65	57	45	61	63	59	50	62	60	66	65
6:30	64	60	60	45	54	56	60	42	56	62	32	62	57	45	60	61	61	48	62	61	66	65
6:35	63	63	59	38	48	59	58	47	59	63	30	64	44	33	61	64	63	52	61	64	66	65
6:40	62	59	63	40	48	59	59	53	61	62	30	62	33	30	61	62	57	52	62	62	68	66
6:45	63	61	63	45	49	59	60	45	59	62	27	63	22	28	61	61	60	52	64	63	69	67
6:50	63	61	58	40	50	61	59	39	60	61	30	64	19	27	61	62	60	47	63	62	67	67
6:55	61	60	62	44	48	57	61	34	57	61	27	64	19	27	62	63	58	51	63	63	67	67
7:00	64	60	62	47	53	55	60	36	61	61	28	55	18	29	61	62	62	47	62	61	68	65
7:05	62	58	61	47	54	53	61	31	55	62	28	36	19	32	61	59	62	43	65	57	67	65
7:10	63	58	61	48	54	45	55	37	57	59	31	40	19	31	60	64	62	48	61	46	67	66
7:15	63	59	60	53	52	46	57	31	53	59	27	47	19	31	60	64	63	51	63	45	67	65
7:20	63	58	61	52	55	54	57	46	48	47	36	25	24	34	61	64	64	54	60	57	67	66
7:25	61	58	61	53	49	46	61	53	58	57	31	20	21	32	61	66	66	47	63	55	66	64
7:30	64	59	63	59	56	58	60	46	59	58	33	16	20	35	60	64	63	51	62	44	68	66
7:35	62	58	62	57	48	59	62	47	55	63	36	15	22	34	60	63	63	51	57	35	68	66
7:40	63	56	64	53	53	50	61	54	58	62	43	16	23	37	62	64	63	54	30	58	68	67
7:45	63	59	61	60	51	58	61	47	56	60	53	17	24	37	63	63	64	53	50	54	68	65
7:50	62	60	61	53	52	61	62	52	57	64	59	15	23	33	62	64	64	55	56	60	67	67
7:55	62	59	64	58	53	58	61	49	53	60	59	17	22	34	62	64	65	55	59	63	67	67
8:00	63	58	64	53	52	55	62	54	54	58	59	36	23	35	62	65	64	56	58	62	67	67
8:05	63	58	63	52	51	60	63	55	59	65	58	32	23	34	60	65	64	58	63	64	67	66
8:10	63	57	64	46	48	61	63	60	61	63	63	41	24	38	60	64	64	55	60	65	67	65
8:15	63	59	63	55	52	58	60	57	60	62	62	53	24	32	63	66	65	53	59	64	67	65
8:20	63	57	62	54	52	51	61	55	58	63	59	58	25	32	62	65	65	52	61	60	67	66
8:25	63	59	61	48	53	59	62	45	57	63	61	61	24	32	61	65	65	53	63	63	68	66
8:30	64	58	63	55	50	57	62	55	58	62	59	56	25	31	61	64	64	56	62	60	66	65
8:35	65	57	62	50	53	55	64	57	59	63	61	63	22	31	64	65	62	60	62	61	67	66
8:40	64	58	62	51	51	62	61	60	56	64	63	65	23	36	61	65	65	60	63	62	65	64
8:45	63	57	62	47	50	56	63	60	60	63	61	65	27	34	63	65	65	56	63	63	68	66
8:50	64	61	61	50	53	61	63	52	55	63	61	64	55	30	63	66	65	60	62	62	67	65
8:55	65	58	65	48	51	57	62	58	60	63	60	63	55	39	62	65	65	59	61	61	66	65

Direction of Travel

Exhibit C-6: SB PM 2006 Base Year Simulation Speed Contours

Segment	JCT I-5	Mira Mesa Blvd	Sorrento Valley Rd	Miramar Rd	Nobel Dr	Governor Dr	Claremont Mesa	Balboa Ave	Mesa College Dr	Murray Ridge Rd	El Cajon Blvd	University Ave	Home Ave	Market St	Imperial Ave	47th St	Plaze Blvd	SR-54	Bonita Rd	East H St	Telegraph Canyon	Palm Ave	San Ysidro
Detector	1114649	1108551	1113473	1108413	1108764	1108410	1108398	1108395	1108393	1108391	1111542	1111543	1111544	1111545	1111546	1111547	1111548	1114370	1114363	1114396	1114402	1114376	1114356
Time Period (p.m.)	28.7	27.1	26.8	25.8	24.9	24.2	22.3	21.3	19.7	18.5	16.3	15.8	13.8	13.1	12.3	11.4	10.2	9.3	8.1	6.6	5.4	2.4	1.2
15:00	66	64	66	57	42	49	62	63	35	61	62	63	50	61	62	57	59	55	43	63	65	61	67
15:05	66	64	66	60	42	48	51	62	34	[illegible]	[illegible]	[illegible]	[illegible]	45	60	60	61	53	43	53	65	67	67
15:10	65	68	66	55	35	48	62	62	37	[illegible]	[illegible]	[illegible]	[illegible]	53	55	58	62	54	39	54	65	62	68
15:15	64	66	67	58	34	47	59	63	33	56	62	64	44	52	60	48	61	54	37	64	65	65	66
15:20	64	66	66	60	35	43	61	62	34	53	61	62	48	46	60	49	62	55	35	66	66	64	68
15:25	64	63	66	52	30	46	62	63	39	58	63	59	51	60	59	51	54	48	37	61	65	63	67
15:30	64	65	67	46	32	46	61	62	45	48	63	62	39	49	53	50	61	47	39	63	64	63	69
15:35	65	65	66	44	28	41	55	64	46	34	59	61	48	43	55	48	61	54	37	61	64	63	68
15:40	64	65	65	35	24	49	57	63	51	35	61	62	51	45	59	58	59	39	38	61	65	62	66
15:45	65	61	66	30	26	49	58	62	40	38	57	54	45	40	61	60	59	34	40	65	64	61	66
15:50	66	58	65	27	27	46	55	63	34	33	59	59	42	35	63	56	61	30	38	61	66	62	67
15:55	65	60	64	26	27	42	59	62	32	37	59	61	40	36	61	57	60	27	34	64	64	64	68
16:00	64	55	47	26	25	46	53	62	32	39	62	58	37	35	61	58	53	27	38	53	64	64	67
16:05	64	55	37	21	25	48	60	64	33	49	63	62	44	34	57	59	38	24	39	62	65	64	68
16:10	66	46	30	23	28	48	60	63	34	49	64	63	43	33	59	56	27	22	37	63	66	66	68
16:15	65	39	25	24	27	44	59	63	36	50	62	63	56	37	58	55	20	22	37	61	66	65	66
16:20	65	32	22	24	28	47	57	63	32	55	64	62	53	41	49	36	20	19	37	64	64	65	69
16:25	64	30	21	25	28	48	51	63	33	56	62	66	55	43	33	22	18	22	38	62	65	66	67
16:30	65	36	23	24	29	47	55	62	36	52	62	65	45	40	23	19	18	20	37	62	65	63	66
16:35	64	41	25	23	29	50	61	61	34	44	61	64	59	36	21	18	20	21	39	62	65	66	66
16:40	64	38	25	25	28	45	61	62	34	48	63	65	55	34	19	20	21	21	37	63	65	67	67
16:45	64	40	25	24	28	50	60	63	41	39	61	63	52	29	20	21	18	23	38	59	63	64	68
16:50	64	45	26	23	27	47	60	64	43	39	64	65	55	30	19	19	19	26	33	48	65	64	67
16:55	63	43	27	23	26	47	62	62	44	37	62	64	46	26	18	20	24	22	37	32	64	66	67
17:00	63	35	23	23	26	47	64	64	49	35	63	65	45	25	20	20	19	23	35	24	66	64	67
17:05	65	45	27	23	26	46	62	64	50	36	62	64	32	31	20	20	22	21	36	31	63	61	66
17:10	64	45	27	23	24	46	62	64	52	38	60	64	32	26	21	21	21	22	40	51	64	65	66
17:15	64	48	27	24	26	48	63	63	49	41	65	65	30	27	21	25	21	26	36	61	65	64	68
17:20	64	47	28	22	27	48	61	63	61	34	62	64	27	26	23	24	24	25	38	61	64	65	67
17:25	64	48	28	23	25	50	63	63	56	40	61	64	30	30	21	28	24	27	39	64	65	62	68
17:30	65	45	30	23	27	47	62	63	58	42	63	63	32	33	21	37	22	24	38	60	65	66	67
17:35	65	44	27	23	25	48	63	63	52	46	62	62	54	29	26	38	21	28	39	59	66	65	66
17:40	64	49	27	24	26	50	62	64	57	39	62	63	50	41	31	37	24	26	37	62	65	64	67
17:45	64	54	37	23	24	48	62	63	61	42	59	60	59	41	38	40	23	23	40	63	66	62	67
17:50	65	62	43	22	25	43	63	64	59	44	64	63	49	53	48	47	23	26	36	64	65	63	66
17:55	66	60	47	22	26	49	61	62	56	43	64	63	52	47	63	52	25	26	39	64	64	61	67
18:00	65	56	47	25	26	46	61	62	63	44	61	60	53	53	64	60	25	26	38	62	66	62	68
18:05	66	66	56	24	24	48	62	63	65	54	59	62	51	48	61	60	29	24	37	61	65	63	68
18:10	66	63	56	24	29	50	61	63	64	60	65	65	49	48	65	62	38	25	38	56	65	63	67
18:15	66	61	52	26	28	49	63	63	64	58	62	63	56	51	63	55	43	28	35	58	66	63	67
18:20	66	63	57	26	28	48	63	62	63	60	64	64	58	54	64	61	54	27	36	65	65	63	67
18:25	64	67	59	26	29	47	62	64	64	58	62	62	58	52	62	63	60	33	37	65	67	64	67
18:30	65	64	59	25	30	47	62	63	64	61	61	63	63	58	63	61	61	39	37	64	66	65	68
18:35	66	67	65	28	28	46	62	63	62	58	62	63	57	60	64	54	58	39	37	61	66	66	67
18:40	65	66	66	27	27	44	61	63	63	60	59	58	60	60	62	62	59	50	42	57	66	66	67
18:45	65	63	67	29	28	49	63	64	64	62	61	63	63	63	62	59	61	55	37	60	66	65	67
18:50	66	65	67	27	28	48	62	63	65	61	62	64	56	64	64	60	60	58	37	64	66	62	67
18:55	65	66	67	31	30	47	64	63	65	61	61	63	52	65	65	60	60	58	37	60	66	64	66

Direction of Travel

Exhibit C-7: SB PM Scenario 2006-01 Speed Contours

Segment	JCT I-5	Mira Mesa Blvd	Sorrento Valley Rd	Miramar Rd	Nobel Dr	Governor Dr	Clairemont Mesa	Balboa Ave	Mesa College Dr	Murray Ridge Rd	El Cajon Blvd	University Ave	Home Ave	Market St	Imperial Ave	47th St	Plaze Blvd	SR-54	Bonita Rd	East H St	Telegraph Canyon	Palm Ave	San Ysidro
Detector	1114649	1108551	1113473	1108413	1108764	1108410	1108398	1108395	1108393	1108391	1111542	1111543	1111544	1111545	1111546	1111547	1111548	1114370	1114363	1114396	1114402	1114376	1114356
Time Period (p.m.)	28.7	27.1	26.8	25.8	24.9	24.2	22.3	21.3	19.7	18.5	16.3	15.8	13.8	13.1	12.3	11.4	10.2	9.3	8.1	6.6	5.4	2.4	1.2
15:00	65	65	66	64	49	46	52	63	48	37	63	62	51	53	58	58	63	54	55	62	64	64	67
15:05	65	62	65	66	56	45	56	62	46	43	62	61	46	60	58	55	60	52	54	63	65	64	68
15:10	64	62	65	63	52	49	63	63	48	50	[illegible]	[illegible]	[illegible]	[illegible]	64	58	59	52	53	58	64	66	67
15:15	64	63	64	61	49	43	56	62	46	46	[illegible]	[illegible]	[illegible]	[illegible]	61	61	61	51	53	51	64	61	68
15:20	65	65	65	62	39	43	59	62	47	45	61	60	47	56	62	54	60	53	55	57	64	61	67
15:25	63	63	65	63	33	45	55	63	48	51	65	60	48	58	63	57	59	51	54	62	65	62	67
15:30	64	64	64	64	36	45	55	63	46	42	62	59	54	40	63	61	60	57	58	58	65	61	67
15:35	64	61	61	63	27	48	62	64	46	37	64	62	51	41	60	57	62	48	54	57	64	64	69
15:40	65	63	65	45	26	47	54	62	46	39	64	63	49	38	49	57	59	54	44	58	65	64	68
15:45	64	60	63	31	26	46	60	63	46	38	60	57	54	37	57	60	62	53	50	37	65	64	68
15:50	65	63	62	26	25	44	53	63	46	45	61	57	57	36	63	59	60	52	50	39	64	64	67
15:55	65	59	63	24	24	43	56	62	45	41	62	52	51	36	63	52	61	52	45	56	65	61	67
16:00	64	58	53	20	23	45	52	62	43	38	63	62	53	36	60	58	58	50	46	55	65	64	67
16:05	65	60	38	20	23	49	56	62	47	37	65	63	45	36	55	54	58	52	48	54	64	60	67
16:10	64	56	31	20	26	50	58	61	47	49	65	63	58	46	40	58	58	54	51	53	66	63	67
16:15	63	43	25	21	27	48	60	60	45	48	63	64	52	46	44	60	58	50	52	58	65	60	66
16:20	64	33	20	21	26	47	61	62	47	49	63	64	47	38	52	59	60	51	52	53	65	64	68
16:25	64	33	23	20	26	47	53	62	47	37	64	64	48	38	50	56	63	51	46	60	64	66	68
16:30	63	42	25	20	26	48	53	62	47	40	63	64	48	47	57	58	60	52	43	61	64	65	67
16:35	64	37	21	20	27	48	59	62	47	50	64	64	47	53	54	61	62	53	50	51	64	63	67
16:40	62	38	23	21	28	46	55	63	47	47	64	64	45	52	41	59	60	55	45	45	64	63	66
16:45	64	36	22	21	27	46	56	62	43	48	66	65	57	56	50	57	58	52	47	58	64	63	67
16:50	63	39	25	20	25	45	55	62	45	51	63	66	50	62	59	59	63	53	46	58	65	65	68
16:55	64	40	24	21	26	50	56	62	46	45	64	64	56	63	59	61	62	55	48	51	64	65	68
17:00	64	44	26	21	28	46	57	64	46	41	64	66	53	56	61	56	60	58	53	50	64	62	67
17:05	66	45	27	21	24	47	62	64	46	38	65	66	51	63	63	53	61	56	51	57	64	62	66
17:10	64	49	32	22	25	49	62	61	47	33	64	65	58	65	63	63	64	59	56	55	65	64	66
17:15	64	44	29	23	25	44	61	63	47	38	65	64	51	61	65	62	64	56	59	55	65	61	67
17:20	64	48	34	22	23	42	58	63	47	43	62	61	62	62	61	59	65	54	62	61	65	61	67
17:25	64	48	33	22	25	49	58	64	47	47	63	61	55	63	63	59	62	56	60	60	66	64	68
17:30	64	50	31	21	24	49	58	64	49	47	65	64	54	65	63	60	63	58	57	59	64	62	68
17:35	65	46	29	20	25	47	62	65	47	50	64	65	55	64	64	61	63	56	59	56	65	64	67
17:40	65	45	27	22	24	46	62	63	49	54	64	64	55	65	63	60	63	57	58	52	66	65	68
17:45	63	46	29	22	25	50	58	63	48	60	63	64	45	60	64	59	63	59	58	57	65	64	68
17:50	63	44	28	21	24	45	60	62	46	54	63	63	53	64	64	51	63	57	57	60	65	67	67
17:55	64	44	28	20	25	46	63	64	46	53	64	63	52	64	64	62	65	59	59	57	65	64	67
18:00	65	48	27	21	25	41	62	64	49	51	64	62	56	64	64	60	65	57	58	63	65	63	68
18:05	66	58	35	20	24	47	58	63	54	55	61	60	55	65	65	59	61	57	59	61	65	65	67
18:10	65	66	53	21	25	46	62	63	51	59	63	60	52	66	65	62	63	57	55	58	66	63	68
18:15	66	66	62	22	30	46	63	63	52	56	63	63	59	63	64	60	61	56	59	61	66	64	68
18:20	64	66	68	25	28	49	57	63	51	58	64	62	49	65	63	55	59	55	56	60	67	65	66
18:25	64	65	66	25	28	47	58	63	52	57	63	61	54	65	64	62	62	56	60	62	64	64	68
18:30	64	66	66	43	28	48	60	61	50	54	66	63	55	64	64	60	62	58	59	54	65	65	67
18:35	67	65	65	52	29	46	61	62	49	59	65	64	57	66	64	61	60	59	58	59	66	65	67
18:40	65	67	64	64	36	47	61	64	55	56	64	62	55	66	65	61	63	59	62	62	65	62	68
18:45	65	67	67	66	51	55	62	63	52	59	64	63	60	66	65	61	64	58	61	63	66	65	70
18:50	66	67	67	65	65	59	61	63	52	61	65	62	56	65	64	60	62	59	62	61	64	65	68
18:55	63	65	66	66	64	57	61	64	52	61	63	63	57	65	64	54	59	55	59	61	66	65	68

Direction of Travel

Exhibit C-8: SB PM Scenario 2006-02 Speed Contours

Segment	JCT I-5	Mira Mesa Blvd	Sorrento Valley Rd	Miramar Rd	Nobel Dr	Governor Dr	Claremont Mesa	Balboa Ave	Mesa College Dr	Murray Ridge Rd	El Cajon Blvd	University Ave	Home Ave	Market St	Imperial Ave	47th St	Plaze Blvd	SR-54	Bonita Rd	East H St	Telegraph Canyon	Palm Ave	San Ysidro
Detector	1114649	1108551	1113473	1108413	1108764	1108410	1108398	1108395	1108393	1108391	1111542	1111543	1111544	1111545	1111546	1111547	1111548	1114370	1114363	1114396	1114402	1114376	1114356
Time Period (p.m.)	28.7	27.1	26.8	25.8	24.9	24.2	22.3	21.3	19.7	18.5	16.3	15.8	13.8	13.1	12.3	11.4	10.2	9.3	8.1	6.6	5.4	2.4	1.2
15:00	64	64	66	64	44	47	59	62	46	54	65	63	42	43	61	59	64	51	56	58	64	64	67
15:05	64	63	65	61	49	47	60	64	50	44	64	57	55	44	64	57	62	52	55	64	63	65	68
15:10	64	66	66	65	51	45	48	62	48	51	63	59	48	56	62	62	63	55	53	59	64	60	67
15:15	65	64	63	63	51	51	51	62	49	54	64	61	51	[illegible]	63	56	61	53	52	62	64	64	67
15:20	64	63	63	63	52	46	57	62	47	42	63	[illegible]	[illegible]	[illegible]	63	62	60	55	49	63	65	65	67
15:25	64	64	64	64	56	47	58	64	47	38	63	[illegible]	[illegible]	[illegible]	63	63	61	57	54	61	63	65	66
15:30	64	66	65	64	55	48	58	62	46	36	64	63	57	[illegible]	52	55	58	56	52	56	63	63	66
15:35	64	65	64	62	48	46	57	63	47	39	62	63	54	45	54	55	58	52	45	53	63	60	67
15:40	65	61	64	63	32	49	58	62	45	35	61	57	53	38	61	58	59	51	43	55	64	60	65
15:45	63	59	60	52	30	46	57	62	45	29	64	60	45	36	58	56	58	52	45	53	64	65	69
15:50	63	63	64	40	28	45	55	64	39	30	64	61	37	40	47	51	61	50	48	41	62	62	67
15:55	64	58	60	36	25	46	58	62	36	32	63	56	33	33	46	48	61	51	52	51	64	64	67
16:00	64	64	63	32	25	45	60	62	39	34	63	62	35	36	41	53	57	50	49	58	64	63	68
16:05	63	65	66	24	26	42	58	62	36	29	64	62	52	37	42	57	55	51	53	58	64	61	67
16:10	64	65	64	23	25	48	51	63	35	30	65	62	52	43	49	54	57	53	47	48	63	63	66
16:15	63	65	64	21	28	46	49	63	31	33	65	65	56	52	54	57	55	54	50	52	63	62	68
16:20	64	60	48	22	25	45	58	64	31	40	63	64	61	58	57	57	60	53	45	49	63	58	67
16:25	62	55	31	22	24	48	59	63	39	37	64	63	59	62	58	58	62	55	43	45	63	62	66
16:30	64	41	27	22	25	47	53	62	44	32	63	64	54	63	57	60	60	52	48	48	63	63	66
16:35	64	40	27	22	25	43	58	62	44	34	64	65	58	55	60	57	61	51	54	46	63	62	66
16:40	64	40	22	21	25	44	54	62	43	33	65	63	47	57	60	58	60	55	48	56	63	65	68
16:45	65	34	21	21	25	47	59	62	44	33	63	65	62	54	61	58	63	56	48	56	64	64	67
16:50	65	42	24	20	27	51	61	64	47	35	65	62	60	63	61	60	63	52	50	53	63	65	68
16:55	64	37	24	20	27	43	54	63	48	39	65	65	55	60	61	59	61	54	52	50	65	63	69
17:00	65	38	24	21	28	44	61	64	47	42	63	64	55	64	64	62	62	51	53	57	63	64	66
17:05	65	42	23	22	27	50	56	62	44	44	63	62	56	64	61	61	64	55	59	62	65	62	66
17:10	64	43	30	22	26	50	58	62	46	35	62	64	54	61	63	61	64	54	57	56	63	62	68
17:15	64	49	32	23	27	44	61	63	50	41	59	63	53	60	63	61	65	57	58	55	63	60	66
17:20	64	48	32	22	27	45	59	63	50	50	64	63	45	63	65	56	65	57	59	56	64	63	67
17:25	65	50	34	22	25	50	61	63	50	49	64	62	57	64	64	61	64	57	60	61	65	65	66
17:30	65	52	35	21	25	43	63	64	51	55	65	62	51	62	63	61	63	58	60	61	64	65	68
17:35	66	48	31	21	23	45	61	63	52	54	66	63	51	63	63	60	65	58	58	62	64	60	67
17:40	64	46	30	20	24	46	63	64	50	59	64	63	55	63	64	60	64	58	60	59	64	65	68
17:45	63	42	24	20	24	46	62	63	49	55	63	62	55	63	63	59	63	57	60	63	65	62	67
17:50	64	41	23	21	25	46	63	63	46	48	63	63	56	62	64	57	63	55	59	61	63	64	67
17:55	65	43	28	20	25	38	60	64	47	51	63	63	54	60	63	61	62	58	58	62	64	65	67
18:00	64	46	24	20	24	47	60	63	51	56	62	61	42	63	63	57	64	57	58	60	64	62	67
18:05	64	47	36	20	26	42	64	64	56	58	63	63	58	65	65	59	61	58	56	56	64	64	67
18:10	64	56	38	20	27	45	63	63	52	61	65	64	53	66	64	59	63	55	58	61	63	63	67
18:15	64	51	34	21	29	49	60	64	53	59	63	62	54	65	65	60	62	59	60	58	66	63	68
18:20	65	52	38	21	30	47	56	62	53	60	66	62	57	65	64	59	62	58	58	58	63	66	68
18:25	65	61	44	21	28	48	60	63	53	58	64	62	57	65	65	63	62	56	61	61	65	65	67
18:30	65	66	49	21	27	49	60	62	55	59	65	63	60	65	63	60	62	57	64	63	64	66	69
18:35	65	65	63	24	29	46	61	64	56	52	64	62	60	66	65	62	62	59	60	64	66	64	66
18:40	64	67	66	28	28	47	53	63	54	56	63	62	59	66	64	64	63	58	59	61	64	61	68
18:45	65	66	66	39	28	47	61	64	57	59	64	62	56	65	65	63	64	60	61	62	64	64	68
18:50	66	67	67	63	31	45	56	63	56	59	65	62	59	66	65	62	63	58	61	65	65	64	66
18:55	65	67	67	66	40	48	61	64	52	58	64	65	57	66	66	62	62	60	62	63	64	61	67

Direction of Travel

Exhibit C-9: SB PM Scenario 2006-03 Speed Contours

Segment	JCT I-5	Mira Mesa Blvd	Sorrento Valley Rd	Miramar Rd	Nobel Dr	Governor Dr	Clairemont Mesa	Balboa Ave	Mesa College Dr	Murray Ridge Rd	El Cajon Blvd	University Ave	Home Ave	Market St	Imperial Ave	47th St	Plaze Blvd	SR-54	Bonita Rd	East H St	Telegraph Canyon	Palm Ave	San Ysidro
Detector	1114649	1108551	1113473	1108413	1108764	1108410	1108398	1108395	1108393	1108391	1111542	1111543	1111544	1111545	1111546	1111547	1111548	1114370	1114363	1114396	1114402	1114376	1114356
Time Period (p.m.)	28.7	27.1	26.8	25.8	24.9	24.2	22.3	21.3	19.7	18.5	16.3	15.8	13.8	13.1	12.3	11.4	10.2	9.3	8.1	6.6	5.4	2.4	1.2
15:00	65	65	64	63	30	50	57	63	52	50	61	47	49	60	59	56	59	50	54	60	64	62	68
15:05	65	64	62	57	27	47	61	64	49	45	62	63	53	56	63	61	61	[illegible]	52	58	64	62	67
15:10	64	67	67	59	27	45	56	61	54	50	62	57	41	50	[illegible]	[illegible]	[illegible]	[illegible]	54	46	63	64	68
15:15	64	65	65	63	25	44	59	65	47	53	64	58	48	44	60	58	61	[illegible]	54	63	64	65	66
15:20	62	66	65	55	27	45	55	62	51	33	66	65	47	46	59	58	58	50	53	59	65	65	66
15:25	64	62	63	59	27	45	48	62	48	32	64	63	52	58	59	56	57	50	56	60	64	63	68
15:30	64	65	66	48	26	47	56	63	45	39	62	62	50	50	60	57	60	51	51	58	66	62	68
15:35	64	57	62	41	26	44	50	63	43	38	58	43	44	49	61	62	60	54	50	48	64	63	67
15:40	64	61	63	30	25	47	57	62	39	31	64	36	51	40	61	61	57	51	52	53	64	66	68
15:45	65	64	64	26	25	44	55	62	37	31	64	55	42	47	57	56	58	50	52	57	64	65	67
15:50	63	64	62	26	24	46	53	62	34	39	64	60	50	46	45	56	58	50	47	55	63	64	66
15:55	65	61	59	24	24	42	57	63	33	37	63	58	38	44	51	58	58	51	50	56	65	64	66
16:00	63	59	46	20	24	42	46	63	31	42	62	57	56	43	44	52	55	51	51	54	63	64	67
16:05	64	55	35	20	25	39	52	63	38	34	62	61	49	45	42	58	57	51	54	53	64	62	65
16:10	64	43	27	21	26	44	53	63	38	39	65	62	54	48	43	59	57	54	48	60	64	63	68
16:15	64	40	22	22	27	48	57	63	36	33	65	64	55	50	49	61	59	54	45	56	64	61	66
16:20	64	35	22	21	27	49	61	63	39	33	64	65	47	43	50	55	60	54	43	55	63	60	66
16:25	63	41	23	21	31	46	59	63	43	38	65	64	54	50	57	59	57	52	47	51	63	62	67
16:30	65	40	25	21	29	47	55	62	42	37	65	65	55	60	61	61	62	51	45	58	64	63	68
16:35	63	37	24	22	27	49	59	62	33	33	64	64	55	62	51	61	58	54	50	51	63	64	65
16:40	65	35	23	23	29	48	55	63	40	32	64	64	53	63	58	59	59	53	50	55	63	66	69
16:45	64	41	25	23	28	48	60	63	38	31	64	64	55	62	61	59	61	52	51	59	63	63	66
16:50	63	36	22	22	28	45	57	63	38	31	65	66	55	62	61	60	62	55	50	55	65	60	66
16:55	65	34	21	22	28	46	57	62	35	38	64	64	57	63	54	61	63	53	50	56	64	65	67
17:00	65	37	25	23	27	49	60	64	37	37	63	64	53	63	57	47	61	53	52	54	64	62	67
17:05	65	44	29	22	27	46	57	61	42	38	59	66	47	63	62	57	62	57	55	60	63	63	68
17:10	65	48	34	20	27	46	61	63	43	34	63	65	55	63	62	60	60	54	58	57	64	63	65
17:15	66	48	29	22	26	47	59	64	46	32	65	64	54	61	58	60	63	57	59	59	63	61	68
17:20	65	44	32	23	26	50	60	64	50	33	64	64	58	61	62	58	62	55	56	56	65	65	68
17:25	65	50	36	22	26	49	62	64	50	37	63	64	49	59	63	61	62	55	58	57	64	60	66
17:30	63	47	31	22	27	48	62	63	49	41	64	63	54	62	62	59	61	58	56	62	64	64	68
17:35	63	46	27	22	26	45	58	63	49	43	65	63	48	62	61	62	62	53	58	63	65	64	68
17:40	64	44	31	21	26	46	58	63	49	46	63	64	54	63	63	62	62	57	59	60	64	64	68
17:45	63	43	30	22	25	47	61	63	50	56	60	60	52	62	63	61	61	58	59	63	65	63	66
17:50	65	45	30	21	24	49	61	63	50	60	64	63	50	58	63	61	64	58	57	58	64	62	68
17:55	65	48	33	19	25	47	63	64	48	53	63	63	51	61	61	59	61	57	56	62	64	62	67
18:00	66	45	30	20	26	44	56	63	53	51	65	63	52	63	64	63	63	57	58	61	65	66	67
18:05	65	52	33	20	25	47	62	64	53	59	63	62	47	63	63	62	63	57	55	62	65	66	68
18:10	65	51	33	20	25	49	62	65	57	57	65	62	56	63	62	60	61	56	61	59	64	66	68
18:15	65	58	32	21	27	49	58	63	54	61	65	62	58	63	63	61	61	58	59	61	65	63	68
18:20	66	63	49	20	28	47	61	62	53	55	62	62	50	65	64	60	60	58	60	62	65	63	68
18:25	65	65	58	21	27	50	61	64	52	59	63	62	60	65	63	64	61	55	55	60	64	65	67
18:30	65	68	66	22	29	49	59	62	52	59	65	60	55	62	64	61	62	58	58	58	64	65	68
18:35	64	65	65	25	31	51	62	64	55	57	62	63	56	64	63	61	62	58	60	63	65	67	68
18:40	66	66	66	31	32	48	61	62	57	56	64	63	57	63	63	61	61	57	59	61	65	64	68
18:45	66	66	66	42	30	50	61	62	53	60	65	64	54	64	63	61	60	56	60	63	64	66	70
18:50	65	66	67	64	32	46	62	64	58	61	64	64	55	65	63	62	61	58	58	62	65	64	68
18:55	66	68	66	63	46	50	63	63	57	62	64	64	61	64	63	60	64	58	60	61	65	63	69

Direction of Travel

Exhibit C-10: SB PM Scenario 2006-03A Speed Contours

Segment	JCT I-5	Mira Mesa Blvd	Sorrento Valley Rd	Miramar Rd	Nobel Dr	Governor Dr	Clairemont Mesa	Balboa Ave	Mesa College Dr	Murray Ridge Rd	El Cajon Blvd	University Ave	Home Ave	Market St	Imperial Ave	47th St	Plaze Blvd	SR-54	Bonita Rd	East H St	Telegraph Canyon	Palm Ave	San Ysidro
Detector	1114649	1108551	1113473	1108413	1108764	1108410	1108398	1108395	1108393	1108391	1111542	1111543	1111544	1111545	1111546	1111547	1111548	1114370	1114363	1114396	1114402	1114376	1114356
Time Period (p.m.)	28.7	27.1	26.8	25.8	24.9	24.2	22.3	21.3	19.7	18.5	16.3	15.8	13.8	13.1	12.3	11.4	10.2	9.3	8.1	6.6	5.4	2.4	1.2
15:00	62	66	64	63	52	46	53	63	46	42	61	61	50	54	57	58	61	53	53	56	64	66	68
15:05	64	66	64	64	55	47	57	63	48	34	64	55	48	51	61	58	61	53	51	57	63	61	67
15:10	64	67	66	64	56	44	59	62	48	40	63	62	60	52					52	61	65	63	66
15:15	64	66	65	62	53	44	58	64	51	39	63	62	46	62					53	55	64	63	68
15:20	65	66	64	63	41	47	57	63	52	39	62	62	41	61	62	57	58	52	53	57	64	62	68
15:25	65	66	64	63	43	45	55	63	48	41	64	62	49	51	62	56	57	53	52	59	63	65	67
15:30	66	67	66	63	40	46	58	63	48	41	63	64	56	60	60	60	59	51	54	60	66	65	68
15:35	64	67	65	65	37	39	56	62	44	41	63	60	53	63	60	60	57	53	48	59	64	65	68
15:40	66	63	63	62	35	46	54	63	46	35	64	59	53	61	59	55	55	50	45	55	64	64	66
15:45	64	64	62	58	31	43	48	62	45	39	63	62	48	49	61	58	57	55	51	55	64	64	66
15:50	66	68	66	47	30	46	46	62	44	31	65	62	43	42	60	58	56	52	50	53	63	62	67
15:55	63	65	63	39	32	42	56	61	36	43	64	63	47	40	56	59	59	50	51	55	63	62	68
16:00	65	63	63	29	32	43	57	63	36	32	64	56	49	38	53	56	57	53	51	59	65	65	67
16:05	63	64	63	28	28	41	60	61	36	34	65	64	57	40	51	55	59	52	52	60	65	61	67
16:10	64	64	63	28	27	49	55	62	39	39	61	63	56	49	46	54	58	53	48	55	63	62	66
16:15	65	67	63	28	28	48	62	63	40	37	64	63	60	59	54	59	59	53	46	59	63	60	67
16:20	65	67	64	27	27	44	57	63	43	31	62	61	53	54	54	58	62	53	45	57	63	64	66
16:25	63	65	62	28	28	48	58	63	44	27	64	63	53	56	56	58	60	55	51	59	64	65	66
16:30	63	66	62	25	30	49	58	63	42	35	64	65	50	58	55	56	61	53	46	59	64	62	68
16:35	65	67	64	28	28	47	58	63	39	37	66	65	57	60	56	60	62	50	45	50	63	61	65
16:40	64	66	65	28	28	45	62	62	34	33	65	65	52	60	60	58	61	50	48	55	62	61	66
16:45	64	66	65	27	27	46	57	61	34	36	64	65	55	59	59	61	61	53	53	51	64	63	67
16:50	63	66	62	25	29	44	56	62	38	34	64	64	56	63	61	58	60	53	56	59	65	63	66
16:55	64	66	64	25	28	46	58	63	37	40	64	64	54	59	62	60	59	54	52	56	64	65	68
17:00	64	67	63	23	28	47	55	63	33	36	64	64	60	59	61	60	62	55	50	53	62	65	67
17:05	66	67	63	26	30	47	51	62	35	30	61	64	47	62	63	63	63	55	53	59	64	61	66
17:10	63	65	64	29	28	45	60	63	31	30	64	65	57	62	61	59	63	58	59	58	65	64	67
17:15	64	68	64	29	28	44	61	64	36	31	63	65	50	63	62	58	61	55	58	54	64	62	68
17:20	64	65	64	32	26	48	63	64	43	37	65	64	55	64	63	60	62	53	57	58	66	63	66
17:25	64	65	63	40	27	46	59	64	45	39	64	62	52	63	63	59	64	57	57	57	66	64	67
17:30	65	65	64	38	27	42	62	63	49	42	63	63	47	59	62	60	62	57	58	59	65	63	67
17:35	65	66	65	36	27	45	60	63	50	42	64	62	54	63	62	60	62	57	56	53	64	64	67
17:40	64	66	64	36	27	43	62	63	47	42	62	61	54	62	61	59	60	58	58	62	65	64	67
17:45	64	65	64	38	28	47	62	64	49	48	62	64	52	61	62	61	60	56	54	54	63	65	67
17:50	65	66	64	39	27	45	61	63	49	55	64	64	53	64	62	62	61	56	57	61	64	62	67
17:55	64	63	64	39	28	45	62	64	50	48	65	61	60	62	62	61	61	57	57	61	65	59	65
18:00	64	61	64	40	28	45	61	63	51	49	65	64	54	63	62	61	63	55	59	58	65	63	66
18:05	64	65	64	38	28	46	63	62	53	60	65	64	57	66	64	60	61	55	59	60	65	63	67
18:10	65	64	62	49	31	49	61	62	52	59	65	59	56	65	62	59	63	57	58	57	65	64	66
18:15	64	67	65	57	37	51	59	63	51	56	64	63	56	65	63	63	62	57	58	61	65	65	68
18:20	66	66	65	63	39	45	59	63	51	56	64	60	58	63	63	60	60	56	57	59	64	65	67
18:25	66	67	64	64	44	47	60	64	54	60	64	62	57	63	62	63	60	55	56	61	65	63	66
18:30	64	66	64	64	57	51	62	64	57	59	64	64	55	63	62	61	62	56	58	53	64	65	67
18:35	65	66	65	63	60	51	62	63	56	61	65	64	53	65	64	63	60	55	59	60	64	65	67
18:40	66	64	64	62	61	53	63	64	54	58	64	64	51	65	63	63	62	56	62	61	64	64	66
18:45	66	67	65	64	62	58	63	62	56	62	63	62	60	64	63	62	62	56	59	59	65	64	67
18:50	66	67	64	64	61	58	63	63	52	59	64	63	53	64	64	62	60	58	57	63	65	65	67
18:55	65	67	64	64	61	56	60	64	54	58	63	63	53	64	64	62	60	55	55	62	65	63	66

Direction of Travel

Exhibit C-11: NB AM 2020-3A (Base) Speed Contours

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	I-15	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Clairemont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	64	57	61	52	56	63	62	59	63	64	54	67	63	64	62	64	61	59	65	64	69	69
6:05	64	61	61	50	51	57	61	55	60	64	57	66	[illegible]	[illegible]	[illegible]	[illegible]	62	53	62	63	70	69
6:10	62	61	61	51	52	55	57	36	59	60	36	64	59	61	61	62	61	49	63	63	69	68
6:15	62	60	62	46	52	56	57	30	59	62	29	65	59	57	62	62	58	48	63	63	68	69
6:20	65	60	62	50	50	58	57	24	56	60	29	63	60	41	63	63	61	49	61	62	68	68
6:25	64	58	62	55	50	52	57	23	58	59	29	65	60	32	62	62	61	57	61	57	67	70
6:30	61	60	62	42	51	54	55	21	59	58	28	64	61	33	61	63	59	54	62	62	67	68
6:35	63	62	60	45	48	60	55	21	58	36	30	65	58	32	63	60	58	52	62	64	69	70
6:40	66	58	59	45	51	54	56	20	60	25	28	65	60	30	62	62	61	55	64	56	69	68
6:45	61	61	63	48	48	59	55	21	59	20	26	64	60	29	60	62	61	46	62	62	68	70
6:50	62	59	60	42	52	57	54	21	57	16	27	66	59	31	62	60	58	44	61	58	68	69
6:55	63	58	62	41	50	61	52	21	60	16	27	64	46	32	62	62	61	54	60	53	68	69
7:00	61	59	61	43	49	59	46	22	39	16	27	65	35	32	61	60	61	50	62	59	68	67
7:05	61	60	63	49	49	56	58	20	17	14	28	65	30	33	61	64	42	50	61	59	69	69
7:10	59	61	61	54	51	56	63	19	16	16	26	66	32	33	62	62	15	47	55	48	69	68
7:15	61	59	62	56	49	62	62	30	17	16	29	65	37	34	62	62	20	50	59	58	68	69
7:20	62	60	62	58	53	59	61	44	20	17	34	64	29	32	62	60	16	46	61	44	69	67
7:25	59	59	61	54	56	57	64	52	20	16	41	58	24	33	62	22	17	46	54	37	67	67
7:30	61	59	61	57	54	55	61	60	20	17	45	36	21	36	60	20	16	52	62	34	68	68
7:35	61	61	64	57	55	61	61	55	20	17	43	19	21	32	60	19	17	46	60	61	67	68
7:40	62	59	64	51	52	60	54	50	34	17	42	15	22	35	62	19	16	53	55	60	68	67
7:45	63	57	62	53	52	61	62	45	57	19	39	15	22	33	62	19	16	54	61	46	69	68
7:50	58	59	63	53	54	60	62	54	59	20	39	15	21	35	61	19	19	55	41	36	68	68
7:55	60	58	59	59	53	57	59	51	59	39	36	16	21	34	62	21	16	50	56	22	67	67
8:00	62	57	63	53	55	60	60	47	58	58	38	14	23	32	63	21	15	49	62	21	70	70
8:05	61	59	63	56	55	58	63	59	60	62	37	15	21	33	62	19	15	55	57	25	68	69
8:10	62	61	64	58	53	58	61	54	60	62	54	17	20	30	62	18	16	49	60	26	67	69
8:15	61	58	63	59	52	58	61	54	60	63	57	15	20	35	61	18	14	51	61	26	67	69
8:20	63	59	64	61	54	56	60	50	55	63	55	17	21	32	63	17	16	50	62	47	67	67
8:25	62	60	63	54	52	55	62	56	58	62	55	16	22	33	57	25	16	55	62	45	69	70
8:30	61	59	65	54	52	55	63	53	57	63	57	16	23	33	17	20	17	52	64	41	67	67
8:35	60	58	62	55	53	62	62	55	60	63	53	17	22	32	22	21	18	45	61	39	66	67
8:40	61	60	63	59	55	57	61	56	60	60	55	17	20	33	19	22	18	53	57	55	67	66
8:45	62	58	62	56	55	60	61	53	59	63	58	16	22	35	22	18	18	54	61	32	68	69
8:50	63	60	63	57	55	59	62	59	60	63	61	17	23	32	22	21	17	53	59	42	69	69
8:55	61	58	62	52	55	56	62	50	57	64	62	17	22	35	19	19	18	56	63	28	66	70

Direction of Travel

Exhibit C-12: NB AM Scenario 2020-04 Speed Contours

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	I-15	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Clairemont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	64	63	67	58	55	62	65	65	62	65	62	66	61	57	63	64	62	65	66	66	68	69
6:05	63	61	65	57	50	61	[illegible]	[illegible]	[illegible]	[illegible]	59	65	58	50	63	62	63	62	64	64	69	69
6:10	63	62	65	47	51	58	[illegible]	[illegible]	[illegible]	[illegible]	55	67	63	46	63	64	61	61	62	64	69	69
6:15	64	61	65	54	49	53	65	63	61	63	43	66	60	47	62	63	63	60	64	66	70	69
6:20	65	61	66	49	47	52	62	64	58	61	45	64	52	49	62	60	59	53	63	61	69	69
6:25	63	61	65	48	49	57	65	64	63	63	41	66	51	41	62	62	59	58	63	63	67	68
6:30	63	59	66	45	50	54	65	64	63	64	42	65	52	33	63	62	62	57	64	56	69	68
6:35	62	63	65	49	52	58	65	64	63	63	55	65	59	29	62	63	62	58	63	57	69	69
6:40	64	62	67	53	47	58	64	65	61	65	59	66	53	29	62	63	61	48	63	61	68	68
6:45	66	61	63	46	52	56	64	64	63	63	51	66	54	31	63	62	60	54	55	59	67	69
6:50	62	59	66	44	52	47	64	64	60	63	58	65	55	32	62	64	61	49	56	50	68	69
6:55	64	62	64	49	51	60	65	66	59	65	54	65	61	29	61	63	60	54	63	64	68	68
7:00	61	56	66	43	49	61	67	65	61	63	55	67	60	28	61	59	58	59	65	59	70	70
7:05	61	57	66	52	51	53	65	65	61	63	62	67	56	27	61	60	62	45	62	63	68	69
7:10	63	57	65	50	51	47	63	64	49	63	60	64	44	26	62	64	59	40	42	64	70	69
7:15	62	54	65	51	51	38	64	58	55	63	61	62	37	26	61	63	63	32	29	56	69	68
7:20	64	55	65	49	52	40	59	60	31	65	63	65	25	25	61	63	64	38	24	58	68	67
7:25	63	57	65	54	52	29	62	61	29	64	61	62	26	26	62	63	64	36	20	47	68	68
7:30	64	58	67	50	52	43	62	58	34	64	56	53	23	26	60	64	61	50	20	64	68	68
7:35	62	58	66	54	49	44	63	59	33	64	59	27	22	27	61	63	61	40	23	55	68	67
7:40	65	55	67	51	48	43	63	64	45	64	60	11	24	29	60	63	63	52	44	55	69	67
7:45	61	56	67	51	49	36	65	65	46	65	64	12	23	25	61	64	61	47	52	56	69	67
7:50	62	58	64	57	51	40	59	63	47	61	60	13	24	25	63	65	63	42	57	59	69	67
7:55	63	59	64	55	52	48	64	63	40	64	61	14	24	26	62	63	62	40	62	64	70	68
8:00	63	57	67	45	50	43	63	62	49	63	56	13	24	27	63	65	62	47	62	64	69	67
8:05	62	58	65	56	50	40	61	63	49	65	60	14	22	27	62	62	62	43	60	64	68	67
8:10	62	58	67	50	49	47	64	61	47	65	59	13	20	25	62	60	63	38	58	58	68	66
8:15	63	59	65	55	47	36	63	63	49	64	61	13	24	26	62	62	61	38	55	43	68	68
8:20	62	57	63	60	49	44	64	62	46	64	58	14	24	26	63	66	64	34	55	35	68	67
8:25	63	58	65	54	52	50	62	64	30	65	60	14	22	26	62	65	64	37	62	40	67	66
8:30	62	58	65	53	49	44	63	61	26	66	62	13	22	27	62	64	63	36	52	64	69	69
8:35	62	59	64	48	48	47	63	63	23	66	62	13	24	28	63	63	64	33	49	65	68	67
8:40	63	57	65	50	50	42	61	61	25	66	60	15	23	26	62	64	61	43	53	55	68	68
8:45	62	60	66	56	49	42	63	64	24	65	62	15	20	24	61	65	61	36	61	65	67	65
8:50	63	56	67	54	47	47	63	64	24	67	63	13	20	27	62	63	63	45	54	52	68	67
8:55	61	57	65	53	47	46	62	64	25	65	63	13	24	26	61	64	62	56	64	49	70	68

Direction of Travel

Direction of Travel

Exhibit C-13: NB AM Scenario 2020-05 Speed Contours

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	15 St	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Claremont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	64	64	66	55	52	62	65	64	65	63	62	65	61	55	63	64	62	65	66	65	70	71
6:05	62	61	65	48	54	61	65	65	63	66	53	[illegible]	61	48	62	64	59	61	65	66	69	70
6:10	64	61	65	46	52	57	65	64	60	[illegible]	[illegible]	[illegible]	64	55	63	60	62	59	65	61	68	67
6:15	65	62	65	48	50	56	65	64	61	62	55	65	57	50	61	63	60	52	62	60	67	68
6:20	63	64	66	48	48	59	65	65	61	64	53	65	53	47	61	63	60	59	64	61	69	68
6:25	63	62	67	56	50	55	65	64	61	61	50	65	61	50	61	62	56	47	63	60	67	68
6:30	64	63	64	45	50	57	63	63	58	62	60	65	59	45	62	63	59	60	63	60	69	70
6:35	64	62	65	49	49	60	65	63	61	62	56	66	52	46	61	64	63	54	66	62	71	71
6:40	62	60	66	47	49	55	66	66	61	62	49	66	59	46	63	61	60	51	66	61	68	69
6:45	65	62	67	47	50	58	65	66	62	64	52	64	56	50	61	60	56	36	63	54	70	68
6:50	62	60	65	43	50	55	63	65	64	63	55	64	53	52	63	64	57	37	59	59	67	69
6:55	62	60	67	51	49	58	63	64	60	64	55	65	56	47	62	62	61	37	60	44	70	68
7:00	61	59	65	47	49	54	66	65	59	64	51	65	61	52	61	62	60	52	63	51	69	68
7:05	61	58	66	57	48	44	64	65	61	63	58	65	56	51	61	60	60	48	63	30	67	67
7:10	62	57	65	55	52	42	65	64	55	59	59	66	39	49	63	64	61	35	61	37	69	67
7:15	63	56	65	52	50	39	62	61	55	65	61	62	35	47	62	64	63	32	46	49	68	67
7:20	62	58	65	58	48	48	64	63	40	64	59	62	29	36	61	62	62	31	29	60	69	69
7:25	63	59	66	53	46	44	63	61	36	62	58	61	34	29	63	64	61	34	31	62	69	67
7:30	60	58	68	49	52	42	65	60	39	65	61	61	30	28	60	64	61	33	40	61	69	68
7:35	61	58	66	54	53	48	62	62	34	62	61	64	30	32	61	62	60	53	61	37	69	68
7:40	62	57	65	58	50	51	59	64	42	63	61	47	29	29	60	64	60	38	62	53	68	67
7:45	63	58	65	53	49	47	63	62	46	64	60	30	28	29	60	63	63	41	57	36	67	68
7:50	63	59	64	57	51	44	63	62	45	62	59	15	27	28	62	63	63	30	53	59	69	66
7:55	62	57	66	52	48	38	62	62	55	63	60	13	26	29	61	63	61	35	48	61	69	67
8:00	62	57	66	58	53	42	64	61	48	62	60	13	28	31	61	64	64	36	58	49	68	67
8:05	64	57	67	57	48	43	63	63	41	64	59	14	25	30	61	61	63	36	53	63	68	67
8:10	64	59	66	57	49	48	63	64	38	66	61	13	29	32	61	63	63	31	48	45	69	65
8:15	61	57	66	57	49	49	63	61	46	64	61	15	29	32	63	64	60	36	29	64	68	68
8:20	62	58	67	52	48	50	64	64	38	65	60	13	27	29	62	62	64	43	33	52	68	67
8:25	63	57	65	55	50	50	65	60	37	66	60	14	25	31	61	64	61	40	65	41	69	67
8:30	63	59	67	46	48	44	63	60	34	65	61	14	26	31	63	62	60	46	60	56	67	66
8:35	63	58	66	58	45	46	64	62	32	66	62	14	28	32	62	62	62	38	57	56	67	67
8:40	63	58	66	51	51	46	63	62	31	67	61	15	29	32	62	63	57	34	36	62	70	67
8:45	65	61	66	55	51	35	63	62	36	65	61	36	28	30	63	64	62	39	38	63	69	68
8:50	63	57	66	52	51	46	65	64	33	67	64	41	26	32	63	65	64	40	53	59	68	68
8:55	61	57	66	55	50	44	65	64	32	65	62	53	25	30	62	65	63	34	60	63	68	68

Direction of Travel

Exhibit C-14: NB AM Scenario 2006-06 Speed Contours

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	15 St	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Claremont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	63	62	64	57	60	63	65	64	64	63	63	66	65	65	65	62	63	64	65	65	68	68
6:05	66	61	65	51	61	58	65	65	64	65	59	66	65	63	63	63	61	59	64	63	69	69
6:10	63	61	64	48	61	59	64	63	58				66	65	63	63	60	59	65	64	69	70
6:15	63	60	64	54	64	54	64	64	61	61	55	65	62	64	64	64	59	57	64	61	69	69
6:20	64	62	65	46	58	57	64	63	59	64	55	65	64	63	62	65	63	47	66	64	68	68
6:25	64	63	64	52	59	60	64	65	62	65	52	66	60	64	62	63	61	57	63	64	70	69
6:30	64	60	64	46	60	54	64	65	59	63	50	65	64	63	63	64	59	53	62	65	69	70
6:35	62	61	65	45	59	58	62	64	62	64	52	65	65	63	62	63	59	54	66	60	69	69
6:40	65	63	63	49	62	55	66	65	65	63	50	66	66	63	63	60	57	49	64	59	70	69
6:45	63	62	66	52	59	54	64	65	60	65	57	65	64	62	62	65	57	43	57	60	69	70
6:50	63	64	64	44	60	58	64	62	60	63	56	65	64	64	62	65	61	54	61	43	68	67
6:55	64	62	66	49	60	57	66	65	62	59	46	65	62	62	62	62	61	51	65	41	69	70
7:00	62	59	64	49	59	53	63	64	61	61	46	67	60	64	61	61	60	42	56	60	69	69
7:05	64	57	66	57	57	47	63	64	58	61	37	66	60	64	62	62	62	35	58	51	67	68
7:10	63	57	66	47	59	41	62	62	43	64	43	63	48	63	61	63	60	29	59	39	68	69
7:15	62	56	66	48	59	39	64	59	37	65	59	63	38	62	60	63	62	32	57	36	68	68
7:20	62	55	66	48	59	39	62	63	28	65	61	63	41	63	62	63	63	32	47	30	69	67
7:25	61	56	63	54	58	39	64	64	39	62	60	63	43	62	60	65	62	29	45	26	69	68
7:30	63	58	66	51	57	44	60	64	43	65	61	63	43	62	61	63	62	32	49	26	69	68
7:35	61	56	65	51	57	42	65	64	43	64	61	63	46	64	60	63	64	36	53	32	69	68
7:40	63	57	67	57	60	49	62	61	46	65	62	62	42	63	62	63	63	38	61	38	69	68
7:45	62	59	67	57	60	48	64	64	46	65	58	60	41	62	62	65	61	43	60	58	69	67
7:50	62	57	64	59	60	39	62	61	45	64	60	64	29	63	61	62	61	46	57	64	68	67
7:55	63	56	66	58	59	45	63	61	42	63	61	61	22	62	61	63	62	31	65	60	70	68
8:00	63	57	66	54	57	43	62	62	45	63	56	60	23	63	59	62	63	39	54	60	67	67
8:05	62	58	65	54	59	47	62	62	38	63	61	61	29	61	61	65	62	30	61	55	68	68
8:10	62	60	68	56	61	45	63	63	45	64	60	62	32	62	60	61	60	34	56	56	68	66
8:15	64	60	66	56	56	48	66	66	42	66	64	63	29	63	60	63	62	32	50	40	68	67
8:20	63	58	65	57	59	45	64	64	49	66	58	63	39	63	62	63	62	29	57	47	69	66
8:25	62	60	65	57	56	49	62	63	37	63	62	65	42	65	62	64	64	27	37	60	69	68
8:30	62	56	67	55	59	44	64	63	31	65	62	64	57	64	63	63	60	28	27	62	67	66
8:35	62	59	66	55	58	48	63	64	35	67	62	64	58	64	63	62	62	30	24	50	68	68
8:40	63	59	66	50	58	49	64	64	51	65	61	64	57	63	62	63	63	30	23	27	67	67
8:45	61	58	67	55	59	47	66	62	49	67	61	66	57	64	63	64	63	33	25	24	68	67
8:50	63	60	65	55	59	44	64	62	30	66	61	64	50	64	63	64	64	43	32	23	68	66
8:55	63	59	67	52	59	43	63	61	27	66	63	64	56	64	62	66	63	40	50	23	68	66

Direction of Travel

Exhibit C-15: NB AM Scenario No Incident Management Speed Contours

Direction of Travel

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	15 St	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Clairemont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	64	63	65	56	51	59	65	65	63	65	59	64	62	56	63	65	62	65	67	66	70	71
6:05	61	64	66	46	52	58	65	6[illegible]	[illegible]	[illegible]	[illegible]	66	59	47	62	65	63	58	64	66	69	70
6:10	63	62	65	53	48	56	65	6[illegible]	[illegible]	[illegible]	55	66	60	46	61	62	61	57	65	64	68	69
6:15	63	61	65	52	46	59	63	64	61	64	57	65	59	43	63	63	63	53	62	63	68	69
6:20	63	63	67	51	51	53	64	65	61	59	53	66	59	39	62	61	57	48	61	59	68	69
6:25	63	62	66	55	49	61	65	65	59	63	36	65	59	43	63	64	61	40	59	62	68	68
6:30	65	62	64	53	51	57	65	64	62	63	48	65	54	40	61	63	60	37	63	61	68	68
6:35	65	61	66	45	49	57	66	64	61	62	56	63	54	39	62	62	59	36	59	50	68	68
6:40	63	61	66	49	48	56	65	64	62	63	60	64	53	33	62	63	59	39	59	44	68	69
6:45	64	63	66	49	52	58	64	64	58	65	60	65	55	30	61	61	59	47	55	52	69	68
6:50	63	62	67	50	46	57	65	65	62	64	56	64	51	29	61	63	59	55	60	63	68	69
6:55	64	62	68	51	51	55	65	65	61	64	58	66	58	28	62	60	59	50	58	51	69	68
7:00	64	58	64	52	47	57	42	67	64	62	53	66	58	30	62	63	59	45	62	64	69	68
7:05	62	57	64	57	46	53	24	65	63	64	61	67	61	35	60	62	61	40	63	50	68	68
7:10	62	58	66	52	51	47	23	66	59	66	61	65	54	36	63	64	59	34	61	52	68	68
7:15	62	56	67	57	52	39	21	64	60	66	63	64	42	37	62	63	60	34	48	61	68	69
7:20	62	59	66	51	50	27	24	65	56	64	59	62	34	30	61	63	62	32	32	43	70	69
7:25	62	57	67	60	48	16	24	67	62	65	61	63	29	28	61	64	62	32	41	36	69	68
7:30	63	57	65	48	51	15	21	66	61	65	63	64	25	27	61	62	61	32	47	48	68	68
7:35	62	58	65	52	49	15	20	65	62	66	63	64	24	27	64	64	63	32	50	48	68	67
7:40	62	57	65	57	51	15	19	66	59	65	63	64	25	27	61	64	63	31	50	35	68	67
7:45	63	56	65	50	52	15	41	59	54	62	61	65	22	29	62	63	61	33	55	38	69	67
7:50	62	57	64	54	47	20	35	56	42	65	60	52	24	27	63	64	63	33	28	54	68	68
7:55	62	58	66	55	49	22	50	40	29	62	61	38	23	25	60	63	61	32	49	39	69	69
8:00	62	59	65	52	47	20	56	42	27	64	60	19	20	25	60	62	61	33	51	51	68	69
8:05	61	58	63	54	52	21	56	53	29	64	61	13	21	27	61	61	63	34	47	59	69	67
8:10	62	57	65	53	45	18	63	51	27	65	61	13	24	27	63	64	62	38	50	57	68	67
8:15	63	60	65	55	46	33	63	61	25	67	61	13	26	30	63	64	62	35	59	63	68	69
8:20	61	57	65	55	46	48	64	62	24	64	62	15	25	28	63	65	64	38	61	62	67	66
8:25	64	60	64	54	46	46	65	61	21	65	61	13	22	27	60	64	63	61	62	62	67	66
8:30	63	59	66	57	50	39	65	63	25	66	57	13	23	26	62	61	59	40	64	64	69	67
8:35	63	58	66	54	52	37	64	63	21	66	60	14	22	25	62	64	59	38	59	63	68	68
8:40	63	57	65	56	48	45	66	61	24	65	63	15	21	26	63	62	62	30	61	64	68	67
8:45	61	57	64	55	48	45	62	64	25	64	63	12	21	24	62	64	62	33	62	62	68	68
8:50	62	61	65	54	47	42	64	64	26	64	60	13	21	26	63	64	62	54	64	62	67	67
8:55	62	57	67	48	50	49	64	65	24	67	61	14	22	26	62	63	62	60	64	63	69	66

Exhibit C-16: NB AM Scenario with Incident Management Speed Contours

Segment	San Ysidro	Palm Ave	Telegraph Canyon	East H St	Bonita Rd	SR-54	Plaze Blvd	47th St	Imperial Ave	Market St	Home Ave	15 St	University Ave	El Cajon Blvd	Murray Ridge Rd	Balboa	Claremont Mesa	Governor Dr	Nobel Dr	Miramar Rd	Mira Mesa Blvd	JCT I-5
Detector	1114333	1114409	1114382	1114389	1114341	1114350	1108448	1108446	1108443	1108441	1108408	1111572	1108405	1108403	1108572	1108575	1108577	1108580	1111553	1108582	1108653	1114648
Time Period (a.m.)	1.2	2.4	5.4	6.6	8.1	9.3	10.3	11.4	12.3	13.1	13.9	15.2	15.8	16.4	19.1	21.2	22.5	24.5	25.1	26.0	27.1	28.7
6:00	63	64	64	57	54	61	66	65	62	65	61	66	61	57	64	64	62	66	67	66	69	69
6:05	63	65	64	51	52	56	66	65	64	67	61	67	59	48	63	63	62	59	64	65	68	69
6:10	61	62	65	51	49	62	65	66	61	64	48	65	56	52	63	61	61	62	66	60	69	68
6:15	65	59	66	53	49	56	63	65	63	62	56	65	60	36	61	64	60	43	62	65	69	69
6:20	63	62	63	52	49	54	65	65				65	57	39	62	61	57	51	65	53	69	70
6:25	63	61	67	55	45	57	67	66				64	60	36	62	62	62	50	65	63	69	68
6:30	63	64	67	46	49	59	64	65	61	65	50	66	55	33	62	60	56	50	59	62	68	70
6:35	63	62	64	55	49	63	65	65	62	62	53	65	55	31	61	63	59	54	63	50	69	69
6:40	65	61	67	47	52	60	66	65	64	66	56	65	53	29	62	63	60	50	62	64	69	68
6:45	65	62	65	54	54	51	64	64	59	64	55	66	59	29	61	62	60	56	63	64	68	70
6:50	63	63	65	52	50	56	65	65	61	64	42	67	58	27	63	61	59	38	63	62	69	68
6:55	63	63	66	49	47	57	64	65	63	63	51	65	58	26	62	63	61	34	64	63	68	68
7:00	64	60	66	48	50	50	42	66	64	64	52	63	50	28	62	61	62	36	55	61	68	69
7:05	62	57	66	45	51	50	25	67	61	64	57	66	51	27	61	61	60	44	64	37	68	68
7:10	63	57	66	53	50	41	23	65	61	65	60	64	44	27	62	59	60	32	65	36	68	67
7:15	62	57	67	55	52	45	22	65	62	64	60	63	33	25	61	61	59	35	42	32	70	68
7:20	63	57	66	56	51	26	20	65	61	64	62	63	27	27	62	63	61	38	48	54	67	68
7:25	62	58	66	50	50	15	18	65	62	62	61	62	23	24	61	63	60	36	55	61	70	68
7:30	61	57	67	50	50	14	30	64	57	65	60	62	21	27	63	64	61	35	60	62	69	68
7:35	62	56	67	52	53	17	28	63	59	64	61	62	24	27	61	63	62	33	59	60	68	67
7:40	62	57	66	47	51	17	27	64	37	65	62	46	25	27	62	62	62	37	63	60	68	65
7:45	63	57	66	52	48	21	33	51	37	63	59	31	23	26	63	63	64	35	60	57	69	68
7:50	63	58	67	50	48	21	35	44	37	63	61	18	23	27	61	63	62	47	52	41	68	67
7:55	61	58	66	49	51	24	56	41	26	63	60	13	27	29	60	59	62	51	63	52	70	67
8:00	63	57	63	47	50	44	60	43	25	63	61	14	26	27	62	62	59	42	54	64	68	67
8:05	62	59	64	59	50	36	62	52	25	62	59	14	24	26	61	65	63	33	58	56	68	67
8:10	62	57	65	51	47	33	64	62	25	65	58	14	24	28	63	63	64	35	52	60	68	67
8:15	61	58	66	53	49	38	65	61	25	63	63	13	22	26	63	64	61	34	35	64	69	66
8:20	63	59	65	55	47	39	64	62	24	64	60	13	21	28	61	62	62	36	37	52	67	67
8:25	62	56	65	55	49	48	66	64	29	66	62	13	23	27	62	64	63	34	61	63	68	67
8:30	65	58	68	55	48	45	65	62	34	66	58	15	23	27	62	63	59	34	51	53	69	68
8:35	62	57	66	50	49	47	64	64	28	66	61	14	21	27	63	63	63	35	47	63	68	67
8:40	64	57	67	53	49	44	64	62	32	67	61	14	21	26	63	65	64	41	53	57	67	66
8:45	62	59	67	54	51	45	64	64	34	64	60	13	23	27	62	64	63	34	65	60	68	65
8:50	64	60	67	50	52	41	62	63	33	65	61	13	22	26	62	65	62	37	63	62	67	66
8:55	62	58	65	54	51	44	65	62	26	67	64	12	22	25	62	64	63	55	54	43	68	67

Direction of Travel

Exhibit C-17: SB PM 2020-3A (Base) Speed Contours

Direction of Travel

Segment	JCT I-5	Mira Mesa Blvd	Sorrento Valley Rd	Miramar Rd	Nobel Dr	Governor Dr	Clairemont Mesa	Balboa Ave	Mesa College Dr	Murray Ridge Rd	El Cajon Blvd	University Ave	Home Ave	Market St	Imperial Ave	47th St	Plaza Blvd	SR-54	Bonita Rd	East H St	Telegraph Canyon	Palm Ave	San Ysidro
Detector	1114649	1108551	1113473	1108413	1108764	1108410	1108398	1108395	1108393	1108391	1111542	1111543	1111544	1111545	1111546	1111547	1111548	1114370	1114363	1114396	1114402	1114376	1114356
Time Period (p.m.)	28.7	27.1	26.8	25.8	24.9	24.2	22.3	21.3	19.7	18.5	16.3	15.8	13.8	13.1	12.3	11.4	10.2	9.3	8.1	6.6	5.4	2.4	1.2
15:00	67	66	66	32	28	40	59	62	48	57	63	59	49	34	44	46	56	51	50	53	64	63	67
15:05	65	65	65	27	29	42	61	62	45	[illegible]	[illegible]	[illegible]	[illegible]	34	41	50	50	47	51	51	62	64	67
15:10	67	65	64	24	28	43	58	62	42	[illegible]	[illegible]	[illegible]	[illegible]	34	35	54	44	49	54	57	63	62	68
15:15	66	65	46	21	28	39	52	63	46	50	59	62	33	35	33	57	38	47	52	53	63	63	66
15:20	65	58	29	21	28	45	57	63	46	49	62	60	33	30	33	51	34	45	50	58	62	65	67
15:25	65	41	23	21	26	44	60	62	46	52	63	58	30	35	29	53	35	47	49	53	64	65	67
15:30	65	33	19	24	26	41	58	62	44	49	63	55	29	36	28	47	28	47	48	49	62	63	67
15:35	65	27	19	22	27	41	59	62	44	57	62	54	28	31	27	48	25	48	50	51	64	64	67
15:40	67	22	19	22	26	42	57	63	42	56	63	53	28	31	27	45	24	44	52	59	63	64	66
15:45	65	21	18	22	26	44	60	63	46	54	63	59	30	32	28	41	22	46	51	55	64	60	66
15:50	66	22	19	23	26	41	60	63	46	56	61	47	28	31	27	44	22	46	50	56	64	63	67
15:55	66	23	20	21	30	40	59	62	45	56	62	29	28	32	29	49	21	44	51	54	63	62	69
16:00	65	22	18	23	27	38	54	63	43	55	63	23	29	34	27	50	21	44	53	53	64	61	65
16:05	65	19	17	25	28	42	57	62	45	43	61	22	31	36	28	54	21	47	47	54	64	60	67
16:10	65	19	18	22	27	43	62	63	47	45	63	22	30	32	25	46	19	47	55	53	63	63	66
16:15	43	21	19	23	28	39	55	62	46	46	63	22	31	29	25	39	19	44	50	55	64	58	66
16:20	29	21	19	22	28	41	56	62	46	50	63	29	29	30	23	34	19	48	50	55	62	61	66
16:25	26	21	19	23	27	45	60	63	46	54	64	62	29	27	25	31	20	47	49	55	62	62	65
16:30	22	22	19	22	29	45	62	63	46	50	62	62	29	25	24	28	21	47	44	60	63	63	67
16:35	22	23	19	23	29	45	61	62	47	50	64	64	29	26	24	30	19	50	49	50	64	64	67
16:40	22	24	21	23	29	44	58	63	47	53	63	64	32	30	24	29	19	47	47	51	63	64	67
16:45	21	20	18	24	29	44	58	63	44	52	64	64	30	30	23	26	20	45	52	52	64	64	66
16:50	20	23	21	24	29	44	59	62	45	48	63	64	42	27	23	26	19	50	49	55	63	63	66
16:55	21	21	19	25	30	43	58	63	47	54	63	65	54	27	24	28	20	49	48	48	64	64	65
17:00	20	24	20	23	29	42	60	63	46	46	63	64	39	27	24	34	19	48	51	48	64	64	66
17:05	20	25	20	23	30	42	62	62	47	51	63	63	38	27	26	34	18	48	54	49	64	65	67
17:10	18	22	21	25	28	45	62	64	48	48	61	63	34	30	24	32	20	48	52	59	64	65	67
17:15	18	25	22	24	28	46	62	63	46	55	63	64	33	29	26	37	21	49	45	60	64	62	67
17:20	21	26	22	22	27	42	60	63	47	56	64	63	32	30	26	43	23	47	47	56	62	61	67
17:25	20	25	20	23	27	44	63	64	47	59	60	63	30	27	28	40	24	47	49	54	62	60	66
17:30	21	23	20	22	25	41	62	63	48	59	63	64	30	31	29	42	25	47	54	57	61	61	66
17:35	20	24	20	23	25	38	61	63	46	54	65	62	30	34	28	42	26	43	54	59	64	63	67
17:40	20	21	19	21	25	34	63	63	48	58	63	62	31	34	27	42	28	45	51	51	64	63	65
17:45	22	22	20	22	26	29	66	65	46	49	65	61	33	31	27	41	27	48	56	59	63	62	66
17:50	22	22	19	20	24	33	63	64	48	59	63	63	38	32	29	40	28	45	54	59	64	65	66
17:55	20	19	18	21	23	34	64	64	50	58	62	63	36	34	31	43	33	48	57	48	64	63	68
18:00	19	21	19	19	24	33	63	63	48	55	64	63	41	38	47	46	39	45	57	60	64	64	66
18:05	19	21	19	21	25	32	62	63	53	61	62	61	47	47	53	51	40	48	59	55	65	64	67
18:10	20	22	19	22	22	34	64	63	50	59	63	62	56	50	57	57	46	47	58	57	62	64	67
18:15	19	24	21	23	24	37	64	64	50	56	64	63	50	51	45	53	56	48	52	58	64	65	66
18:20	23	19	19	23	25	35	64	64	50	59	65	64	44	52	54	48	48	47	57	56	64	66	67
18:25	25	19	18	25	28	32	63	63	53	60	65	63	55	47	56	49	50	49	60	59	64	64	67
18:30	41	21	20	24	25	42	63	63	50	61	64	60	50	50	62	54	55	49	55	52	64	63	66
18:35	60	23	20	23	28	41	64	64	51	59	65	62	55	52	62	54	57	52	56	57	63	63	67
18:40	67	19	18	23	29	46	61	63	50	62	63	60	49	51	61	54	58	50	54	55	64	64	66
18:45	66	22	21	24	32	47	61	63	51	60	63	62	47	42	61	59	60	52	57	52	62	64	67
18:50	67	20	18	25	31	50	61	63	51	61	63	62	49	45	62	57	54	49	57	56	64	64	67
18:55	66	21	20	24	30	45	60	64	51	59	63	57	49	46	60	59	55	48	57	61	63	66	67

Exhibit C-18: SB PM Scenario 2020-04 Speed Contours

Segment	JCT I-5	Mira Mesa Blvd	Sorrento Valley Rd	Miramar Rd	Nobel Dr	Governor Dr	Clairemont Mesa	Balboa Ave	Mesa College Dr	Murray Ridge Rd	El Cajon Blvd	University Ave	Home Ave	Market St	Imperial Ave	47th St	Plaze Blvd	SR-54	Bonita Rd	East H St	Telegraph Canyon	Palm Ave	San Ysidro
Detector	1114649	1108551	1113473	1108413	1108764	1108410	1108398	1108395	1108393	1108391	1111542	1111543	1111544	1111545	1111546	1111547	1111548	1114370	1114363	1114396	1114402	1114376	1114356
Time Period (p.m.)	28.7	27.1	26.8	25.8	24.9	24.2	22.3	21.3	19.7	18.5	16.3	15.8	13.8	13.1	12.3	11.4	10.2	9.3	8.1	6.6	5.4	2.4	1.2
15:00	66	65	65	53	58	62	59	60	47	42	63	63	59	58	[illegible]	64	30	50	50	59	64	59	67
15:05	63	66	66	55	57	58	55	63	43	39	64	[illegible]	[illegible]	[illegible]	[illegible]	64	29	45	52	64	66	63	66
15:10	64	66	66	57	59	60	48	61	49	36	64	[illegible]	[illegible]	[illegible]	[illegible]	66	31	47	51	61	64	60	67
15:15	65	66	65	56	60	64	51	56	44	47	64	64	63	57	62	63	23	45	50	63	65	55	65
15:20	64	64	65	57	57	63	50	51	42	46	64	47	53	60	63	51	25	47	48	64	65	63	66
15:25	66	65	66	56	59	61	55	56	40	43	65	34	51	55	63	27	24	49	53	62	64	61	67
15:30	64	66	66	58	56	59	47	58	42	36	64	45	61	55	58	26	27	49	49	60	64	60	67
15:35	62	64	65	60	59	62	40	49	42	33	63	49	61	55	57	19	27	47	51	65	65	62	68
15:40	64	65	65	56	59	62	53	42	42	37	64	40	58	54	32	20	27	47	46	66	64	61	67
15:45	65	65	65	58	61	63	55	55	36	39	62	38	60	52	26	22	28	51	33	64	66	58	67
15:50	64	65	65	59	57	62	55	55	34	41	64	53	63	49	26	21	29	52	40	64	66	62	68
15:55	64	65	66	61	55	58	53	54	35	37	64	44	56	58	29	20	25	48	35	61	65	61	67
16:00	64	66	66	58	58	59	49	61	33	35	63	48	59	48	26	18	26	48	36	63	63	61	66
16:05	65	66	66	51	58	62	58	64	34	38	63	46	57	47	22	18	27	51	38	65	66	57	67
16:10	65	65	65	53	58	63	62	63	37	41	63	64	61	49	19	17	26	49	36	66	65	59	67
16:15	64	64	64	55	60	62	62	63	41	38	64	65	63	39	18	19	24	47	40	61	64	61	67
16:20	65	64	64	57	55	60	60	61	46	43	64	65	65	30	24	18	27	52	43	62	65	58	66
16:25	65	62	62	53	55	61	59	61	52	46	64	66	61	35	20	17	23	45	42	64	64	62	67
16:30	65	64	63	50	54	60	52	62	47	56	66	67	64	34	19	18	23	51	39	63	63	57	66
16:35	65	63	65	51	54	57	55	61	47	55	64	66	64	35	20	17	26	50	45	64	64	57	66
16:40	65	64	64	52	56	57	52	62	47	55	64	66	63	31	19	20	25	51	41	64	65	59	67
16:45	66	64	65	55	53	60	48	63	50	53	65	66	63	35	23	17	21	51	45	60	63	61	66
16:50	65	65	65	54	52	53	46	63	48	49	64	64	61	38	21	17	27	50	43	62	64	61	66
16:55	66	64	65	52	58	59	43	64	47	49	65	66	59	36	19	16	28	51	39	63	64	56	67
17:00	64	64	64	53	50	61	47	63	51	57	65	66	66	29	18	18	26	49	45	63	62	58	66
17:05	65	65	64	56	59	57	57	63	52	45	64	65	64	32	23	19	25	50	42	65	64	62	67
17:10	64	65	66	55	58	61	58	63	51	54	63	66	63	38	29	20	26	50	49	66	64	61	67
17:15	64	66	66	56	59	62	62	64	54	62	64	65	56	41	27	19	28	50	46	64	65	61	66
17:20	66	65	64	52	59	62	60	63	48	58	64	65	62	47	25	20	25	49	47	64	65	61	66
17:25	62	65	65	55	59	63	59	64	53	56	65	65	66	56	30	21	28	50	46	64	65	59	67
17:30	65	64	65	51	57	55	62	63	53	56	64	64	63	59	39	24	28	47	48	63	65	59	66
17:35	66	64	66	56	57	63	57	62	51	57	65	65	59	59	58	28	32	50	48	63	64	63	65
17:40	64	65	64	57	58	65	62	64	51	53	64	64	63	59	65	35	29	48	47	63	64	58	65
17:45	65	65	65	55	56	59	62	64	53	60	65	65	63	64	66	55	30	51	49	62	64	59	68
17:50	65	64	65	54	53	61	63	64	50	57	65	66	55	61	65	65	28	49	46	61	65	57	66
17:55	65	65	66	52	54	56	62	63	52	61	65	64	65	59	66	66	28	48	49	61	65	60	67
18:00	65	65	66	52	57	58	63	62	55	59	65	64	64	61	66	66	34	49	53	63	65	62	67
18:05	66	64	65	54	61	62	62	63	54	62	65	65	64	61	66	66	33	49	55	65	65	60	66
18:10	66	65	65	56	58	61	60	63	56	63	64	65	62	63	65	66	38	50	47	64	65	61	67
18:15	65	66	65	55	58	57	57	64	59	61	66	65	65	64	68	66	48	51	56	65	65	62	66
18:20	66	65	66	55	57	61	61	63	57	61	65	64	62	58	65	67	64	48	57	65	66	60	68
18:25	66	66	65	55	57	64	52	63	57	62	64	65	57	61	66	66	61	53	57	65	65	60	66
18:30	65	67	66	56	61	61	54	62	56	61	65	65	62	59	66	65	62	52	55	64	64	57	65
18:35	67	68	67	57	59	60	55	61	57	64	65	65	66	61	66	66	63	53	59	66	66	59	67
18:40	65	65	65	57	59	63	62	63	54	60	65	65	63	62	66	66	65	54	56	65	66	61	67
18:45	64	65	65	59	61	62	59	64	57	60	65	64	60	60	65	66	64	48	54	65	65	62	67
18:50	66	66	65	60	60	64	61	63	59	54	65	65	65	61	67	66	64	52	57	65	64	62	66
18:55	65	66	66	58	58	65	63	64	54	60	63	65	64	61	65	67	67	51	56	66	65	63	66

Direction of Travel

Exhibit C-19: SB PM Scenario 2006-05 Speed Contours

Segment	JCT I-5	Mira Mesa Blvd	Sorrento Valley Rd	Miramar Rd	Nobel Dr	Governor Dr	Clairemont Mesa	Balboa Ave	Mesa College Dr	Murray Ridge Rd	El Cajon Blvd	University Ave	Home Ave	Market St	Imperial Ave	47th St	Plaze Blvd	SR-54	Bonita Rd	East H St	Telegraph Canyon	Palm Ave	San Ysidro
Detector	1114649	1108551	1113473	1108413	1108764	1108410	1108398	1108395	1108393	1108391	1111542	1111543	1111544	1111545	1111546	1111547	1111548	1114370	1114363	1114396	1114402	1114376	1114356
Time Period (p.m.)	28.7	27.1	26.8	25.8	24.9	24.2	22.3	21.3	19.7	18.5	16.3	15.8	13.8	13.1	12.3	11.4	10.2	9.3	8.1	6.6	5.4	2.4	1.2
15:00	66	66	67	57	58	60	54	62	50	54	64	64	56		64	65	58	49	48	65	63	60	65
15:05	64	67	67	58	58	60	47	62	47	59					63	65	36	48	49	62	64	60	66
15:10	63	65	65	57	57	63	53	62	44	52					63	65	31	46	51	64	65	59	66
15:15	64	65	65	57	57	61	56	63	40	51	64	64	54	54	65	65	26	46	48	65	65	61	67
15:20	66	66	65	59	60	63	56	62	45	55	64	64	57	57	65	65	25	48	52	63	65	63	66
15:25	63	66	65	57	58	63	42	62	47	56	63	64	62	59	64	65	30	51	51	63	63	62	67
15:30	63	66	65	58	61	58	47	60	45	55	63	63	65	58	66	65	30	44	51	63	65	61	67
15:35	63	65	65	54	60	61	50	56	52	44	64	64	62	58	64	65	30	46	52	65	65	62	68
15:40	65	66	65	57	59	58	52	53	49	46	63	63	60	60	64	66	29	51	48	64	64	62	67
15:45	64	65	65	56	59	63	42	61	47	50	64	63	61	53	58	65	28	50	48	64	64	61	68
15:50	63	65	66	53	60	58	39	60	47	53	65	64	53	61	64	64	24	48	47	64	65	63	67
15:55	63	65	65	56	56	59	52	53	44	52	64	63	54	58	63	65	29	48	51	63	64	60	66
16:00	64	64	66	56	58	61	46	50	46	50	64	62	62	58	63	53	25	48	50	62	64	57	66
16:05	65	64	64	53	58	61	51	45	45	54	64	65	64	58	64	47	27	50	52	64	65	62	67
16:10	64	64	64	52	58	60	57	57	41	48	65	65	63	58	64	48	24	51	47	64	64	63	66
16:15	64	64	62	52	55	62	59	62	49	45	62	65	64	59	65	44	25	50	49	61	64	59	67
16:20	65	64	63	51	54	59	59	63	50	48	64	65	65	56	63	25	24	49	50	63	63	55	68
16:25	66	65	63	48	54	61	61	62	53	55	62	66	64	57	64	20	22	50	48	63	63	60	67
16:30	65	64	61	52	53	60	61	64	51	51	65	66	64	62	65	20	23	51	46	59	65	61	65
16:35	65	66	62	52	56	61	57	62	48	56	65	66	61	58	63	17	23	49	46	63	63	62	66
16:40	66	64	58	47	57	62	59	63	48	55	63	65	64	57	58	19	25	51	48	58	64	63	66
16:45	66	66	60	48	51	60	62	62	50	56	53	65	66	61	39	17	25	50	46	60	64	61	65
16:50	64	67	63	54	50	55	53	63	53	54	57	64	66	62	45	21	25	50	47	62	64	62	65
16:55	65	65	62	57	53	56	51	61	52	50	66	66	64	60	55	21	24	49	49	64	64	61	68
17:00	66	66	62	51	57	60	42	62	50	54	66	66	62	63	63	20	24	48	50	65	65	62	67
17:05	66	66	64	55	58	60	50	63	48	56	65	65	64	60	64	19	28	54	51	63	65	60	66
17:10	64	66	66	53	59	61	57	63	52	57	62	64	63	60	64	20	24	49	53	62	64	61	67
17:15	65	65	65	53	58	62	61	63	52	56	64	65	62	63	62	22	31	49	53	65	63	58	67
17:20	65	66	64	49	56	62	63	63	50	53	65	64	63	61	65	31	29	47	51	66	66	62	66
17:25	65	67	67	57	57	59	62	63	53	58	63	64	65	62	64	40	27	52	51	63	64	61	66
17:30	65	66	67	56	56	64	62	63	54	57	65	64	63	60	65	64	27	44	49	65	65	61	67
17:35	65	65	66	55	61	62	61	63	48	60	65	65	61	62	66	64	27	49	52	64	65	56	65
17:40	63	66	65	59	57	63	63	65	52	60	65	65	61	59	67	65	27	50	52	57	64	58	67
17:45	65	65	64	59	58	62	62	64	55	61	64	65	63	58	66	66	32	52	54	65	64	56	67
17:50	65	65	65	58	56	60	61	65	54	57	64	64	66	60	66	66	37	50	55	66	64	63	65
17:55	65	66	66	59	59	64	61	63	48	54	65	67	61	62	65	65	55	49	54	63	64	63	68
18:00	64	65	65	59	57	62	62	65	54	58	64	64	64	62	65	66	63	48	56	65	64	59	67
18:05	65	66	66	56	57	61	62	64	55	61	64	66	64	62	66	66	65	50	53	66	65	58	66
18:10	65	65	65	54	63	64	62	63	57	60	65	64	60	61	66	66	64	49	56	65	65	63	66
18:15	65	65	65	58	62	63	61	63	56	59	64	65	66	61	66	66	63	50	58	65	64	60	66
18:20	66	65	65	55	61	62	61	63	56	60	65	65	65	62	65	66	62	49	54	66	65	62	68
18:25	65	66	65	57	58	62	58	62	58	62	65	63	66	62	65	66	64	52	58	65	64	63	67
18:30	66	65	65	57	61	63	60	63	54	61	64	64	66	62	66	66	64	51	54	63	65	63	67
18:35	65	64	65	58	63	63	62	63	55	59	66	65	64	58	66	67	64	51	59	66	65	61	65
18:40	66	66	65	52	60	62	61	62	56	60	64	64	65	62	66	67	65	55	57	64	66	64	66
18:45	66	65	65	54	61	65	61	64	55	61	64	64	64	63	65	65	65	49	55	65	65	62	66
18:50	65	65	64	55	61	62	58	62	56	63	65	65	64	62	66	66	65	48	55	66	64	63	67
18:55	66	66	65	53	59	62	59	63	52	59	65	65	65	65	67	66	66	53	56	65	66	61	67

Direction of Travel

Exhibit C-20: SB PM Scenario No Incident Management Speed Contours

Segment	JCT I-5	Mira Mesa Blvd	Sorrento Valley Rd	Miramar Rd	Nobel Dr	Governor Dr	Clairemont Mesa	Balboa Ave	Mesa College Dr	Murray Ridge Rd	El Cajon Blvd	University Ave	Home Ave	Market St	Imperial Ave	47th St	Plaze Blvd	SR-54	Bonita Rd	East H St	Telegraph Canyon	Palm Ave	San Ysidro
Detector	1114649	1108551	1113473	1108413	1108764	1108410	1108398	1108395	1108393	1108391	1111542	1111543	1111544	1111545	1111546	1111547	1111548	1114370	1114363	1114396	1114402	1114376	1114356
Time Period (p.m.)	28.7	27.1	26.8	25.8	24.9	24.2	22.3	21.3	19.7	18.5	16.3	15.8	13.8	13.1	12.3	11.4	10.2	9.3	8.1	6.6	5.4	2.4	1.2
15:00	64	66	66	56	58	62	54	62	44	46	63	63	59	47	63	65	44	47	50	66	65	59	66
15:05	64	66	67	58	60	63	42	62	43	39	[illegible]	[illegible]	[illegible]	[illegible]	63	65	33	46	51	62	65	59	68
15:10	64	65	64	58	60	54	53	61	42	38	[illegible]	[illegible]	[illegible]	[illegible]	65	65	29	48	54	65	65	62	68
15:15	65	66	66	58	58	61	56	58	46	45	64	63	63	[illegible]	62	66	26	45	48	66	66	62	68
15:20	65	66	66	59	58	61	48	43	48	40	63	64	47	53	65	65	25	47	46	64	65	62	68
15:25	64	65	66	53	56	61	46	47	45	48	64	65	58	52	64	63	25	48	50	64	65	60	67
15:30	64	65	65	57	56	59	45	43	48	42	64	61	63	60	65	62	26	48	53	62	65	62	66
15:35	64	65	66	56	59	59	51	29	46	43	65	65	61	48	65	60	24	49	51	64	64	63	66
15:40	63	65	65	56	61	61	43	28	38	38	64	64	53	44	61	33	28	48	49	63	65	60	66
15:45	64	65	66	56	57	60	48	32	37	42	64	65	62	52	58	22	25	46	48	60	64	62	68
15:50	64	66	65	55	60	63	48	47	38	30	63	64	64	58	57	19	29	49	47	65	65	61	67
15:55	65	66	66	52	57	63	45	34	37	42	60	63	60	62	43	19	26	50	42	64	65	61	65
16:00	64	64	64	54	58	63	59	28	38	40	44	67	60	53	32	19	27	49	47	64	65	59	67
16:05	64	64	64	51	53	63	59	24	45	35	31	67	56	58	24	20	28	49	42	64	64	58	67
16:10	65	64	64	54	62	60	62	23	51	39	24	67	63	42	27	19	28	52	49	64	64	57	66
16:15	65	64	65	50	55	60	59	33	52	48	26	67	61	47	23	18	26	51	50	62	65	60	67
16:20	64	65	66	54	56	56	56	52	49	48	21	69	62	41	23	19	26	51	45	53	64	58	65
16:25	65	64	65	53	58	59	55	62	46	45	24	68	64	46	23	18	24	51	45	55	64	59	66
16:30	65	66	66	52	54	61	54	62	50	48	25	68	66	53	24	18	24	51	41	63	64	57	65
16:35	66	64	60	54	57	63	56	63	50	47	25	68	62	58	23	18	24	50	44	63	63	58	67
16:40	66	65	61	45	56	61	55	62	51	56	25	69	61	45	21	19	21	50	45	64	63	60	66
16:45	66	65	63	50	53	60	56	60	52	55	30	65	64	38	23	17	23	52	42	64	63	60	65
16:50	65	65	63	46	55	61	56	62	34	66	30	41	64	51	20	19	25	49	42	62	64	62	67
16:55	64	65	66	52	55	51	53	62	24	65	52	50	63	61	26	18	24	49	44	64	65	58	67
17:00	64	63	63	54	56	53	59	63	25	62	66	67	65	60	21	18	22	49	49	65	64	60	67
17:05	63	65	64	58	58	62	55	62	24	58	64	65	62	56	23	17	27	50	46	62	65	61	66
17:10	64	66	65	49	61	60	54	63	27	61	65	65	61	52	23	18	26	51	48	64	63	63	67
17:15	66	64	64	50	56	53	62	65	23	64	64	64	65	47	23	22	26	50	47	60	65	62	66
17:20	64	66	65	55	57	60	56	63	28	51	64	66	63	54	26	22	26	49	46	61	65	61	67
17:25	66	64	64	53	57	59	60	63	41	55	64	65	62	61	33	21	25	46	47	60	64	58	67
17:30	65	65	65	55	58	56	63	63	43	54	64	64	56	60	42	26	29	49	50	65	65	61	67
17:35	65	66	66	60	58	59	62	64	46	60	63	64	64	60	58	28	30	50	53	63	64	62	67
17:40	64	65	65	56	58	61	60	63	47	61	65	65	64	60	65	38	30	48	55	66	66	61	66
17:45	66	66	66	58	56	58	59	63	51	61	63	63	66	61	65	56	28	49	58	63	62	61	66
17:50	63	66	65	51	60	59	61	62	52	58	64	65	64	62	49	66	30	49	50	64	63	60	66
17:55	63	63	65	54	58	59	61	63	54	60	64	64	64	56	37	64	34	45	53	65	64	62	67
18:00	65	66	65	56	57	61	60	64	55	60	64	63	63	63	54	65	30	46	52	67	66	61	65
18:05	66	66	66	54	62	60	59	65	56	59	65	65	65	60	67	67	36	51	48	65	66	63	67
18:10	63	64	65	55	58	62	53	62	56	58	66	66	65	61	66	67	53	50	43	65	66	60	66
18:15	64	65	65	59	57	61	60	63	54	62	64	64	64	61	67	66	63	52	50	63	65	60	68
18:20	64	64	65	56	61	62	58	64	56	62	65	64	64	63	66	65	64	49	53	64	64	60	67
18:25	65	65	66	52	60	64	60	63	58	62	65	65	63	58	66	66	62	51	56	64	65	59	67
18:30	66	65	65	52	59	63	62	64	57	60	66	66	66	63	66	65	61	48	58	64	64	60	65
18:35	66	67	66	58	60	63	58	63	58	61	64	63	62	59	67	67	48	51	53	65	66	64	66
18:40	64	67	65	57	61	64	60	63	58	61	64	65	60	59	66	66	62	50	57	65	65	62	67
18:45	66	66	65	57	57	64	60	62	58	60	64	64	58	58	64	66	60	51	51	65	66	60	67
18:50	66	66	66	58	62	65	62	63	56	62	64	65	64	60	67	67	60	49	53	66	64	61	67
18:55	65	65	65	56	59	64	57	65	56	61	65	64	63	60	66	66	64	50	56	64	65	63	68

Direction of Travel

Exhibit C-21: SB PM Scenario with Incident Management Speed Contours

Direction of Travel

Segment	JCT I-5	Mira Mesa Blvd	Sorrento Valley Rd	Miramar Rd	Nobel Dr	Governor Dr	Clairemont Mesa	Balboa Ave	Mesa College Dr	Murray Ridge Rd	El Cajon Blvd	University Ave	Home Ave	Market St	Imperial Ave	47th St	Plaze Blvd	SR-54	Bonita Rd	East H St	Telegraph Canyon	Palm Ave	San Ysidro
Detector	1114649	1108551	1113473	1108413	1108764	1108410	1108398	1108395	1108393	1108391	1111542	1111543	1111544	1111545	1111546	1111547	1111548	1114370	1114363	1114396	1114402	1114376	1114356
Time Period (p.m.)	28.7	27.1	26.8	25.8	24.9	24.2	22.3	21.3	19.7	18.5	16.3	15.8	13.8	13.1	12.3	11.4	10.2	9.3	8.1	6.6	5.4	2.4	1.2
15:00	64	64	65	58	57	61	41	61	49	33	63	64	63	57	63	65	40	47	50	64	64	60	67
15:05	63	66	65	54	62	62	55	61	44	32	62	[illegible]	[illegible]	[illegible]	64	66	32	50	53	65	64	63	66
15:10	64	65	66	55	56	58	53	63	39	37	63	[illegible]	[illegible]	[illegible]	63	65	28	47	48	64	65	60	66
15:15	65	67	67	60	55	60	45	61	43	36	64	63	61	5[illegible]	64	65	25	48	49	62	65	60	66
15:20	64	63	65	57	58	61	49	60	44	40	63	60	60	54	64	66	26	50	55	64	65	60	66
15:25	63	65	66	58	60	61	46	55	45	40	63	61	41	47	62	65	28	46	47	61	63	57	66
15:30	64	65	65	56	58	60	49	53	42	53	65	65	55	40	64	63	25	49	46	63	64	62	66
15:35	64	66	66	55	53	62	44	57	39	47	63	62	63	44	62	57	24	47	52	65	64	60	66
15:40	64	65	64	58	57	60	39	47	34	51	64	64	60	57	64	29	27	49	47	64	64	61	66
15:45	65	64	65	57	61	61	40	39	29	49	63	64	62	56	64	22	27	48	53	62	66	60	67
15:50	65	66	66	57	60	62	47	25	32	54	63	64	64	61	65	20	29	47	50	65	64	60	68
15:55	65	66	66	57	57	64	52	28	31	54	64	64	62	58	53	20	28	48	50	63	64	60	66
16:00	66	68	67	51	58	61	53	32	29	59	45	67	63	60	30	19	26	48	50	65	63	62	67
16:05	65	65	65	54	57	62	62	30	30	57	27	68	54	58	26	19	27	49	50	64	65	58	66
16:10	65	64	64	53	59	62	54	35	30	56	26	68	62	56	24	19	25	51	50	60	65	58	66
16:15	64	64	64	52	56	63	58	40	38	36	26	68	61	48	24	19	23	49	51	61	64	59	67
16:20	66	65	65	52	55	62	56	57	47	46	27	69	64	54	22	19	22	49	47	64	64	60	65
16:25	65	65	65	49	51	59	52	45	49	49	23	67	62	61	22	17	23	49	46	62	64	60	66
16:30	65	65	65	52	56	60	60	35	50	57	23	68	64	57	20	17	24	48	41	63	64	59	66
16:35	64	65	59	53	54	63	56	32	51	54	23	67	63	41	18	25	23	47	47	65	64	60	67
16:40	66	64	59	55	56	60	56	46	54	45	23	68	63	35	25	19	24	47	45	57	64	60	67
16:45	65	64	62	51	52	60	59	60	51	55	26	65	63	40	23	18	24	50	44	65	63	62	65
16:50	66	65	65	52	55	59	46	61	50	61	35	65	61	40	19	19	22	52	47	61	64	61	66
16:55	64	65	64	54	53	59	56	63	47	57	65	66	65	47	21	18	22	49	48	65	64	56	66
17:00	64	64	65	53	56	58	58	62	50	50	65	66	63	54	21	19	22	49	46	64	64	60	67
17:05	64	65	65	56	56	59	60	62	47	38	65	64	60	47	22	18	24	49	49	64	64	61	68
17:10	65	66	65	52	56	59	62	63	48	41	64	64	64	55	22	19	25	51	51	62	63	61	66
17:15	66	65	66	59	60	61	60	64	52	50	63	65	62	54	22	19	27	48	51	65	64	62	66
17:20	64	64	65	53	58	63	58	63	52	60	64	64	63	55	23	20	26	48	54	63	65	61	67
17:25	65	66	65	58	60	62	62	62	50	59	65	66	64	53	25	19	25	48	54	64	64	60	66
17:30	65	65	65	55	62	63	64	63	52	58	65	65	60	58	29	20	30	46	51	65	66	60	65
17:35	64	65	65	55	62	61	62	64	52	61	65	65	59	54	42	21	28	46	51	64	65	60	67
17:40	65	65	65	59	59	56	60	63	50	57	66	66	62	62	47	21	26	49	50	64	64	58	67
17:45	65	65	65	58	55	62	62	64	52	57	63	64	62	61	63	23	28	48	54	65	66	58	66
17:50	65	66	66	56	57	61	60	63	52	60	64	65	62	61	65	42	31	49	52	65	66	62	66
17:55	64	64	65	58	61	63	59	64	53	59	63	64	61	61	65	64	27	50	52	65	65	63	67
18:00	65	65	66	57	58	60	58	63	55	54	65	65	65	61	66	66	26	50	55	62	64	61	66
18:05	64	65	65	61	62	62	59	64	54	58	65	65	65	62	65	67	27	53	56	65	65	60	66
18:10	65	66	66	58	57	64	53	62	56	59	63	64	64	62	67	66	32	48	53	64	65	60	66
18:15	65	66	66	57	58	64	49	62	56	61	64	65	65	63	66	65	33	47	53	66	65	60	66
18:20	67	65	65	58	56	64	60	63	55	60	65	64	66	62	66	67	35	49	54	65	65	60	67
18:25	67	66	66	59	62	63	59	63	55	60	64	64	64	63	66	67	44	51	54	62	64	59	65
18:30	66	65	65	58	58	64	57	63	57	63	65	65	61	64	67	65	59	49	53	65	65	64	66
18:35	65	64	64	56	57	63	61	63	55	60	64	65	62	62	66	66	63	49	56	65	65	63	65
18:40	66	64	65	53	58	63	61	64	57	61	63	63	64	63	66	66	64	51	51	65	65	60	66
18:45	64	65	65	55	60	63	60	64	54	62	65	64	65	62	66	67	65	50	57	66	65	61	66
18:50	66	65	65	58	59	64	58	63	56	59	65	65	66	64	66	67	63	52	57	66	66	61	67
18:55	66	65	66	58	58	62	61	64	59	62	65	64	65	64	67	66	65	51	57	64	66	62	67

Appendix D: Benefit-Cost Analysis Results

This appendix provides more detailed Benefit-Cost Analysis (BCA) results than found in Section 6 of the main body of the I-805 Corridor System Management Plan (CSMP) Final Report. The BCA results for this CSMP were estimated by using the *California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C) Version 4.0* developed for the California Department of Transportation (Caltrans) by System Metrics Group, Inc. (SMG).

Caltrans uses Cal-B/C to conduct investment analyses of projects proposed for the interregional portion of the State Transportation Improvement Program (STIP), the State Highway Operations and Protection Program (SHOPP), and other ad hoc analyses requiring BCA. Cal-B/C is a spreadsheet-based tool that can prepare analyses of highway, transit, and passenger rail projects. Users input data defining the type, scope, and cost of projects. The model calculates life-cycle costs, net present values, benefit-cost ratios, internal rates of return, payback periods, annual benefits, and life-cycle benefits. Cal-B/C can be used to evaluate capacity expansion projects, transportation management systems (TMS), and operational improvements.

Cal-B/C measures, in constant dollars, four categories of benefits:

- Travel time savings (reduced travel time and new trips)
- Vehicle operating cost savings (fuel and non-fuel operating cost reductions)
- Accident cost savings (safety benefits)
- Emission reductions (air quality and greenhouse gas benefits).

Each of these benefits was estimated for the peak period for the following categories:

- **Life-Cycle Costs** - present values of all net project costs, including initial and subsequent costs in real current dollars.
- **Life-Cycle Benefits** - sum of the present value benefits for the project.
- **Net Present Value** - life-cycle benefits minus the life-cycle costs. The value of benefits exceeds the value of costs for a project with a positive net present value.
- **Benefit/Cost Ratio** - benefits relative to the costs of a project. A project with a benefit-cost ratio greater than one has a positive economic value.
- **Rate of Return on Investment** - discount rate at which benefits and costs are equal. For a project with a rate of return greater than the discount rate, the benefits are greater than costs and the project has a positive economic value. The user can use rate of return to compare projects with different costs and different benefit flows over different time periods. This is particularly useful for project staging.
- **Payback Period** - number of years it takes for the net benefits (life-cycle benefits minus life-cycle costs) to equal the initial construction costs. For a project with a payback period longer than the life-cycle of the project, initial construction costs are not recovered. The payback

period varies inversely with the benefit-cost ratio. A shorter payback period yields a higher benefit-cost ratio.

The model calculates these results over a standard 20-year project life-cycle, itemizes each user benefit, and displays the annualized and life-cycle user benefits. Below the itemized project benefits, Cal-B/C displays three additional benefit measures:

- **Person-Hours of Time Saved** - reduction in person-hours of travel time due to the project. A positive value indicates a net benefit.
- **Additional CO2 Emissions (tons)** -additional CO2 emissions that occur because of the project. The emissions are estimated using average speed categories using data from the California Air Resources Board (CARB) EMFAC model. This is a gross calculation because the emissions factors do not take into account changes in speed cycling or driver behavior. A negative value indicates a project benefit. Projects in areas with severe congestion will generally lower CO2 emissions.
- **Additional CO2 Emissions (in millions of dollars)** - valued CO2 emissions using a recent economic valuing methodology.

A copy of Cal-B/C v4.0, the User's Guide, and detailed technical documentation can be found at the Caltrans' Division of Transportation Planning, Office of Transportation Economics website at http://www.dot.ca.gov/hq/tpp/offices/ote/benefit.html.

The exhibits in this appendix are listed as follows:

- Exhibit D-1: Scenario 2006-1 Benefit-Cost Analysis Results
- Exhibit D-2: Scenario 2006-2 Benefit-Cost Analysis Results
- Exhibit D-3: Scenario 2006-3 Benefit-Cost Analysis Results
- Exhibit D-4: Scenario 2006-3A Benefit-Cost Analysis Results
- Exhibit D-5: Scenario 2020-4 Incident Management Benefit-Cost Analysis Results
- Exhibit D-6: Scenario 2020-4 Benefit-Cost Analysis Results (Incremental)
- Exhibit D-7: Scenario 2020-5 Benefit-Cost Analysis Results (Incremental & Cumulative)
- Exhibit D-8: Scenario 2020-6 Benefit-Cost Analysis Results (Incremental & Cumulative)

Exhibit D-1: Scenario 2006-1 Benefit-Cost Analysis Results

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INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$134.4
Life-Cycle Benefits (mil. $)	$678.3
Net Present Value (mil. $)	$543.9
Benefit / Cost Ratio:	5.0
Rate of Return on Investment:	37.2%
Payback Period:	3 years

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$29.3	$585.8
Veh. Op. Cost Savings	$3.3	$66.9
Accident Cost Savings	$0.0	$0.0
Emission Cost Savings	$1.3	$25.5
TOTAL BENEFITS	$33.9	$678.3
Person-Hours of Time Saved	3,391,214	67,824,271
Additional CO_2 Emissions (tons)	-15,423	-308,455
Additional CO_2 Emissions (mil. $)	-$0.5	-$9.4

Incremental Costs (mil. $)	$134.4
Incremental Benefits (mil. $)	$678.3
Incremental Benefit / Cost Ratio:	5.0

Exhibit D-2: Scenario 2006-2 Benefit-Cost Analysis Results

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INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$139.4
Life-Cycle Benefits (mil. $)	$706.0
Net Present Value (mil. $)	$566.6
Benefit / Cost Ratio:	5.1
Rate of Return on Investment:	37.4%
Payback Period:	3 years

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$30.1	$603.0
Veh. Op. Cost Savings	$3.7	$74.4
Accident Cost Savings	$0.0	$0.0
Emission Cost Savings	$1.4	$28.6
TOTAL BENEFITS	$35.3	$706.0
Person-Hours of Time Saved	3,490,488	69,809,759
Additional CO_2 Emissions (tons)	-17,159	-343,170
Additional CO_2 Emissions (mil. $)	-$0.5	-$10.4

Incremental Costs (mil. $)	$5.0
Incremental Benefits (mil. $)	$27.7
Incremental Benefit / Cost Ratio:	5.5

Exhibit D-3: Scenario 2006-3 Benefit-Cost Analysis Results

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INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$339.4
Life-Cycle Benefits (mil. $)	$742.5
Net Present Value (mil. $)	$403.1
Benefit / Cost Ratio:	2.2
Rate of Return on Investment:	15.2%
Payback Period:	7 years

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$31.9	$637.4
Veh. Op. Cost Savings	$3.8	$75.9
Accident Cost Savings	$0.0	$0.0
Emission Cost Savings	$1.5	$29.1
TOTAL BENEFITS	$37.1	$742.5
Person-Hours of Time Saved	3,689,875	73,797,504
Additional CO_2 Emissions (tons)	-17,471	-349,430
Additional CO_2 Emissions (mil. $)	-$0.5	-$10.6

Incremental Costs (mil. $)	$200.0
Incremental Benefits (mil. $)	$36.5
Incremental Benefit / Cost Ratio:	0.2

Exhibit D-4: Scenario 2006-3A Benefit-Cost Analysis Results

3

INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$429.4
Life-Cycle Benefits (mil. $)	$1,169.3
Net Present Value (mil. $)	$740.0
Benefit / Cost Ratio:	2.7
Rate of Return on Investment:	19.6%
Payback Period:	5 years

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$48.4	$967.8
Veh. Op. Cost Savings	$7.3	$145.3
Accident Cost Savings	$0.0	$0.0
Emission Cost Savings	$2.8	$56.3
TOTAL BENEFITS	$58.5	$1,169.3
Person-Hours of Time Saved	5,602,400	112,048,009
Additional CO_2 Emissions (tons)	-33,501	-670,014
Additional CO_2 Emissions (mil. $)	-$1.0	-$20.3

Incremental Costs (mil. $)	$90.0
Incremental Benefits (mil. $)	$426.9
Incremental Benefit / Cost Ratio:	4.7

Exhibit D-5: Scenario 2020-4 Benefit-Cost Analysis Results (Incremental)

3

INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$1,200.0
Life-Cycle Benefits (mil. $)	$1,190.5
Net Present Value (mil. $)	-$9.5
Benefit / Cost Ratio:	1.0
Rate of Return on Investment:	3.9%
Payback Period:	14 years

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$50.6	$1,011.4
Veh. Op. Cost Savings	$6.4	$128.3
Accident Cost Savings	$0.0	$0.0
Emission Cost Savings	$2.5	$50.8
TOTAL BENEFITS	$59.5	$1,190.5
Person-Hours of Time Saved	5,854,661	117,093,224
Additional CO_2 Emissions (tons)	-29,701	-594,011
Additional CO_2 Emissions (mil. $)	-$0.9	-$18.0

Exhibit D-6: Scenario 2020-4 (Incident Management) Benefit-Cost Analysis Results

Scenario 2020-4 Incident Management (incremental)
ASSUMES 30 INCIDENTS PER YEAR

3

INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$10.0
Life-Cycle Benefits (mil. $)	$7.9
Net Present Value (mil. $)	-$2.1
Benefit / Cost Ratio:	0.8
Rate of Return on Investment:	1.5%
Payback Period:	18 years

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$0.4	$7.1
Veh. Op. Cost Savings	$0.0	$0.6
Accident Cost Savings	$0.0	$0.0
Emission Cost Savings	$0.0	$0.2
TOTAL BENEFITS	$0.4	$7.9
Person-Hours of Time Saved	41,173	823,462
Additional CO_2 Emissions (tons)	-143	-2,851
Additional CO_2 Emissions (mil. $)	-$0.0	-$0.1

Exhibit D-7: Scenario 2020-5 Benefit-Cost Analysis Results (Incremental & Cumulative)

Scenario 2020-5 (incremental)

3

INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$20.0
Life-Cycle Benefits (mil. $)	$257.6
Net Present Value (mil. $)	$237.6
Benefit / Cost Ratio:	12.9
Rate of Return on Investment:	95.2%
Payback Period:	2 years

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$11.0	$219.7
Veh. Op. Cost Savings	$1.4	$27.8
Accident Cost Savings	$0.0	$0.0
Emission Cost Savings	$0.5	$10.0
TOTAL BENEFITS	$12.9	$257.6
Person-Hours of Time Saved	1,271,798	25,435,958
Additional CO_2 Emissions (tons)	-6,406	-128,128
Additional CO_2 Emissions (mil. $)	-$0.2	-$3.9

Scenario 2020-5 (cumulative)

3

INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$1,220.0
Life-Cycle Benefits (mil. $)	$1,448.1
Net Present Value (mil. $)	$228.1
Benefit / Cost Ratio:	1.2
Rate of Return on Investment:	6.0%
Payback Period:	12 years

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$61.6	$1,231.1
Veh. Op. Cost Savings	$7.8	$156.1
Accident Cost Savings	$0.0	$0.0
Emission Cost Savings	$3.0	$60.8
TOTAL BENEFITS	$72.4	$1,448.1
Person-Hours of Time Saved	7,126,459	142,529,182
Additional CO_2 Emissions (tons)	-36,107	-722,139
Additional CO_2 Emissions (mil. $)	-$1.1	-$21.9

Incremental Costs (mil. $)	$20.0
Incremental Benefits (mil. $)	$257.6
Incremental Benefit / Cost Ratio:	12.9

Exhibit D-8: Scenario 2020-6 Benefit-Cost Analysis Results (Incremental & Cumulative)

Scenario 2020-6 (incremental)

3

INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$5.9
Life-Cycle Benefits (mil. $)	$47.5
Net Present Value (mil. $)	$41.6
Benefit / Cost Ratio:	8.1
Rate of Return on Investment:	59.2%
Payback Period:	2 years

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$2.3	$45.6
Veh. Op. Cost Savings	$0.1	$1.7
Accident Cost Savings	$0.0	$0.0
Emission Cost Savings	$0.0	$0.2
TOTAL BENEFITS	$2.4	$47.5
Person-Hours of Time Saved	263,977	5,279,537
Additional CO_2 Emissions (tons)	-363	-7,254
Additional CO_2 Emissions (mil. $)	-$0.0	-$0.2

Scenario 2020-6 (cumulative)

3

INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$1,225.9
Life-Cycle Benefits (mil. $)	$1,495.6
Net Present Value (mil. $)	$269.7
Benefit / Cost Ratio:	1.2
Rate of Return on Investment:	6.4%
Payback Period:	12 years

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$63.8	$1,276.7
Veh. Op. Cost Savings	$7.9	$157.8
Accident Cost Savings	$0.0	$0.0
Emission Cost Savings	$3.1	$61.0
TOTAL BENEFITS	$74.8	$1,495.6
Person-Hours of Time Saved	7,390,436	147,808,719
Additional CO_2 Emissions (tons)	-36,470	-729,393
Additional CO_2 Emissions (mil. $)	-$1.1	-$22.2

Incremental Costs (mil. $)	$5.8
Incremental Benefits (mil. $)	$47.5
Incremental Benefit / Cost Ratio:	8.1