Mobility Performance Report 2009

CALIFORNIA DEPARTMENT OF TRANSPORTATION

February 2011

CALIFORNIA DEPARTMENT OF TRANSPORTATION
MOBILITY PERFORMANCE REPORT 2009

Prepared by the

Division of Traffic Operations

Prepared for

Business, Transportation and Housing Agency

February 2011

CONTENTS

TABLES

MAPS

SUMMARY

The "Mobility Performance Report 2009" (MPR 2009) is a new report prepared by the California Department of Transportation (Caltrans) that provides transportation system performance information at a statewide level and by Caltrans district. The MPR 2009 presents freeway performance information in terms of annual vehicle hours of delay (AVHD), lost productivity, and bottleneck locations, and it quantifies the cost of congestion in terms of extra fuel consumed, time lost, and emissions of carbon dioxide (CO_2).

The MPR 2009 provides information that will be useful to transportation system managers in setting priorities, determining effective strategies, and directing resources to improve mobility where it is most needed. The MPR 2009 also satisfies Caltrans' statutory obligation to report congestion data, as described in Government Code section 14032.6:

> The department shall, within existing resources, collect, analyze, and summarize highway congestion data and make it available upon request to California regional transportation planning agencies, congestion management agencies, and transit agencies.

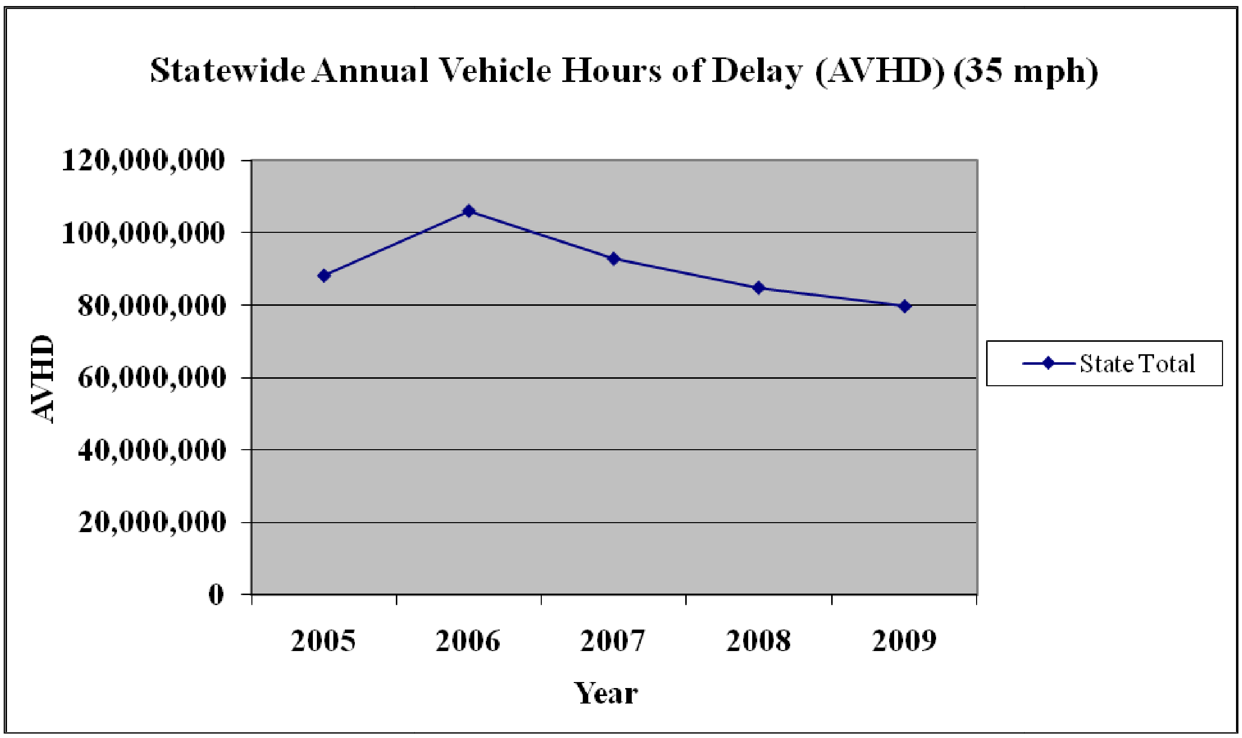
The MPR 2009 employs a new, standardized statewide methodology for measuring freeway traffic congestion using automatically collected traffic data that is reported every day of the year, twenty-four hours a day. This standardized methodology found 79.8 million AVHD below 35 miles per hour (mph) and 195 million AVHD below 60 mph. The delay below 35 mph equates to the consumption of 137 million gallons of fuel, at a cost to motorists of $411 million, and adds 1.3 million tons of CO_2 emissions into the air. The cost in terms of lost time caused by sub-35-mph congestion was $1.3 billion, or $3.5 million a day.

STATEWIDE ANNUAL VEHICLE HOURS OF DELAY BY DISTRICT

District	2009 AVHD (35 mph)	Percent of State Total (35 mph)	2009 AVHD (60 mph)	Percent of State Total (60 mph)
3	3,227,000	4.0	9,296,000	4.8
4	16,911,000	21.2	40,102,000	20.6
6	720,000	0.9	3,537,000	1.8
7	39,441,000	49.4	90,243,000	46.3
8	4,547,000	5.7	15,498,000	7.9
10	1,596,000	2.0	5,325,000	2.7
11	3,613,000	4.5	9,193,000	4.7
12	9,736,000	12.2	21,792,000	11.2
Total	79,791,000	100.0	194,986,000	100.0

The MPR 2009 represents the completion of a transition to an improved way of measuring congestion. The MPR's methodology supplants one that primarily relied upon a few days of manually collected data samples using "floating vehicles." Because of the methodological change, direct comparison of this report with the data compilation it replaces—the "State Highway Congestion Monitoring Program Annual Data Compilation" (HICOMP Annual Data Compilation)—is not possible. Utilizing the MPR 2009 methodology to look at previous years' data reveals that over the last five years, the State experienced its highest level of delay in 2006 and has experienced decreasing levels of delay in each succeeding year. From 2008 to 2009, statewide delay decreased by approximately 6 percent. Since the 2006 peak, statewide delay has decreased by approximately 25 percent.

STATEWIDE CONGESTION TREND, 2005–2009



CHAPTER 1

INTRODUCTION

SECTION 1.1. BACKGROUND

The "Mobility Performance Report 2009" (MPR 2009) is a new report prepared by the California Department of Transportation (Caltrans) that provides transportation system performance information at a statewide level and by Caltrans district. The MPR 2009 presents freeway performance information in terms of annual vehicle hours of delay (AVHD), lost productivity, and bottleneck locations, and it quantifies the cost of congestion in terms of extra fuel consumed, time lost, and emissions of carbon dioxide (CO_2).

The MPR 2009 provides information that will be useful to transportation system managers in setting priorities, determining effective strategies, and directing resources to improve mobility where it is most needed. The MPR 2009 also satisfies Caltrans' statutory obligation to report congestion data, as described in Government Code section 14032.6:

> The department shall, within existing resources, collect, analyze, and summarize highway congestion data and make it available upon request to California regional transportation planning agencies, congestion management agencies, and transit agencies.

The MPR 2009 has been developed to report performance information based on a new, rich data set: traffic data collected every day of the year, twenty-four hours a day, by automated vehicle detector stations (VDS). The methodology for collecting and analyzing these data is explained in Section 1.2. The VDS-collected data set enables new kinds of temporal and spatial analysis beyond what was previously possible, and the large size of the data set enables greater confidence in its accuracy. Caltrans' previous annual congestion data compilation, the "State Highway Congestion Monitoring Program Annual Data Compilation" (HICOMP Annual Data Compilation), was primarily based on a few days of manually collected data samples using "floating vehicles," also known as probe or tachometer ("tach") vehicle runs. Differences in these two methodologies are explained in Section 1.2.1.

The MPR 2009, the first issuance of this new report, lays the foundation for future years' reports but does not include the full spectrum of performance measures envisioned for this document. For example, next year's report is expected to include listings and maps of congested freeway segments. Future reports will provide congestion causality analysis. In addition, the MPR 2009 primarily presents congestion information about State freeways in Districts 3, 4, 6, 7, 8, 10, 11, and 12, the districts where VDS are installed. District 5 has a small number of VDS, and it will be included in this report once detection coverage is expanded.

Ultimately, the annual MPR will provide information about the transportation system as a whole throughout California, including not only State facilities but additional transportation facilities as well. See Section 1.3 for details about the intended evolution of this report.

SECTION 1.2. METHODOLOGY

In 2009, Caltrans established a standardized statewide methodology for measuring freeway traffic congestion using automatically collected traffic data from VDS. Caltrans collects data from VDS on major freeway corridors throughout California's major urban areas, covering more than 3,750 directional miles. VDS collect traffic data over all lanes, twenty-four hours a day, throughout the year.

Traffic activates the VDS devices embedded in or placed alongside freeways. Communication equipment transmits occupancy and volume data from the roadside controllers to the regional Transportation Management Centers (TMCs) every 30 seconds. The data are then sent to the Caltrans Performance Measurement System (CT PeMS), which runs diagnostics on the data and stores the data in 5-minute bins. The stored data are used by engineers, planners, designers, consultants, commercial navigation firms, traffic media companies, and others interested in traffic conditions and performance. The data can be analyzed to calculate a number of performance measures. The performance measures in this report are described in Section 1.2.2.

Automated detection reduces data collection costs, promotes self-reliance for congestion monitoring, allows a statewide standardized methodology for measuring traffic performance, and establishes a reliable trend line for future monitoring. However, until Caltrans has full (100 percent) detection coverage on its congested urban freeways, using VDS data presents two challenges: (1) congestion will not be reported for the small percentage (currently less than 10 percent) of congested freeway locations without VDS, and (2) when new VDS are activated, data will be reported only for the part of the year after that activation date. For the MPR 2009, the latter challenge was significant because many of the Proposition 1B Corridor Mobility Improvement Account detection projects were completed after January 1, 2009. In these project areas, there is incomplete traffic information for 2009. To estimate what the congestion levels would have been for the full year, the data that were collected after the VDS were activated were extrapolated to a full 12 months. This extrapolation was done for Districts 4 and 8, where the majority of new VDS have been recently installed.

In District 4, large segments of State Route 4 (SR–4), SR–24, Interstate 80 (I–80) on the San Francisco-Oakland Bay Bridge, U.S. Highway 101 (US–101), and I–580 had VDS activated in late 2009 and early 2010. Other freeways had spot locations in which new VDS were installed. The new VDS activated in District 4 after October 2009 were isolated and analyzed to determine congestion in those locations, and these data were extrapolated to estimate 12 months' worth of delay. In District 8, large segments of I–10, I–15, and I–215 had VDS activated in July and November 2009 and in February 2010. The new VDS activated on these routes were analyzed for the periods in which they were active, and these data were extrapolated to estimate 12 months' worth of delay.

1.2.1. Methodology Evolution

The MPR 2009 represents the completion of a transition to an improved way of measuring congestion. Traditionally, the annual congestion report that Caltrans produced was based on data collected through floating vehicles, also known as probe or tach vehicle runs. Collecting data in this matter is relatively time-consuming and expensive, which meant that these vehicle runs were typically conducted only once or twice a year on each urban freeway segment and only during weekday peak traffic periods.

About a decade ago, Caltrans evaluated its congestion-monitoring program and asked stakeholders, including external partners such as metropolitan planning organizations, how they would like to see the annual congestion data compilation evolve. Many regional partners expressed the need for congestion information during off-peak periods and during weekends. Concurrently, Caltrans had been investing (and continues to invest) in automated detection systems, such as inductive loop detectors, side-fire radar, and magnetometers, which provide more cost-effective methods of data collection that is "24/7," as described in the previous section. Caltrans has made this investment in detection systems to improve system monitoring and evaluation capabilities, enabling better-informed and more efficient management of the State's transportation system. The data collected by these detection systems also enables the type of analysis requested by Caltrans' partners. Caltrans has been working to transition the methodology of its annual congestion data compilation towards utilization of automatically collected detector data and away from probe vehicle runs.

The recent editions of the HICOMP Annual Data Compilation were based on a mix of detector and probe vehicle run data as detection systems expanded at different rates in different Caltrans districts and as familiarity with data analysis through the CT PeMS grew. This transitional period ended in 2009, with all districts using a consistent, standardized methodology utilizing detection data. To mark the end of this period and the beginning of a new way of presenting transportation performance information, the Caltrans annual congestion data compilation was renamed the MPR.

This section compares in detail the differences between the traditional methodology of using floating vehicles to collect data and the new methodology utilizing VDS-collected data.

1.2.1.1. Data Set. Traditionally, the HICOMP Annual Data Compilation relied on floating vehicles to collect traffic data for congestion analysis. A floating vehicle is a specially instrumented vehicle that records information about what happens to that vehicle at the specific time when it is driven on a specific day. The vehicles were typically driven only once or twice a year on a particular freeway segment because of cost and time constraints. The probe vehicle runs were typically conducted on Tuesdays, Wednesdays, or Thursdays during peak periods to measure congestion levels. No data were collected for other days of the week, including weekends, nor during off-peak periods, such as late at night. The probe vehicles would only collect information for the lane in which the vehicle was driven, typically the No. 2 or No. 3 lane.

Probe vehicle runs were also meant to capture only weekday recurrent congestion (congestion that occurs regularly during peak periods because of traffic demand exceeding roadway capacity). Vehicle runs were not to be conducted when construction activities, accidents, or other incidents could be influencing traffic.

As discussed in the previous section, the MPR 2009 relies on data from VDS devices that collect traffic data automatically during all hours of the day, every day, across all lanes. Most types of VDS collect volume and occupancy data, so the number of vehicles in each lane is measured as well as how long each vehicle remains over the detector, from which speed is derived. VDS data include all measured congestion, recurrent and nonrecurrent. Nonrecurrent congestion is caused by holiday traffic, maintenance, construction, accidents or other traffic incidents, or special events.

The main limitations of this methodology are that VDS are not currently installed on all freeways where delay occurs (although coverage is more than 90 percent) and VDS must be properly maintained to ensure quality data. The CT PeMS performs diagnostics to determine whether a detector is working ("good") or not working ("bad"). The MPR 2009 does not include observed data from "bad" detectors, but it does include imputed data for these detectors (estimated data for what traffic should have been based on historical trends and neighboring "good" detectors). The better VDS are maintained, the higher the quality of data used in the MPR. For 2009, approximately 75 percent of the State's detectors were in "good" health.

Even with these limitations, the VDS-collected data provide a much larger data set than did the probe vehicle runs, and the data enable additional performance measurement. For instance, it is possible to analyze performance differences by lane, by time of day, by day of week (including weekends), and by month of year. Furthermore, the VDS data are analyzed in a standardized way to calculate performance measures, as described below.

1.2.1.2. Calculating Delay. Traditionally, an average daily delay figure was calculated based on the few days of floating vehicle data collected for each freeway segment in most districts. These data were taken to represent what had occurred every day of the year, and the data for a single lane were taken to represent conditions in all lanes.

The HICOMP Annual Data Compilation calculated daily vehicle hours of delay (DVHD) using the following formula:

Delay = vehicles per hour per lane x number of lanes x duration of congestion x
f(average travel time-threshold travel time)

The inputs to this formula were not standardized across all Caltrans districts. Because a floating vehicle cannot count the number of vehicles on the road with it, an assumption must be made about the vehicle flow in each lane. Most districts assumed a flow of 2,000 vehicles per hour per lane (VPHPL) and some assumed 2,200 VPHPL. Now, through research done using VDS-collected data, it is thought that these assumptions led to an overestimation of vehicle flow and delay.

The MPR 2009 utilizes the following calculation, computed in the CT PeMS on the VDS data, to determine the AVHD:

Delay = actual volume x [(length ÷ actual speed) – (length ÷ threshold speed)]

Here, the actual volume (the number of vehicles in each lane) is known because Caltrans' VDS provide vehicle counts. The summation is over all 5-minute periods where the average travel time is greater than the threshold travel time as derived from speed. Length refers to the freeway segment assigned to a particular VDS (determined by the distance to the neighboring upstream and downstream VDS). This methodology is standardized across all districts, promoting consistency and equity. Because delay is calculated for every day of the year, the amount of delay for the whole year—AVHD—can be presented.

1.2.1.3. Summary of Methodological Differences. To summarize, the major differences in the old and new methodology are as follows:

- The MPR 2009 is prepared using data collected automatically by VDS, while past HICOMP Annual Data Compilations primarily used floating vehicle data (recent data compilations used a mix of VDS-collected and floating vehicle data).
- The MPR 2009 information is based on data from every day of the year, in all lanes, for locations where VDS are installed. The information in the HICOMP Annual Data Compilation was primarily based on a few days' worth of data, collected for one lane of an urban freeway facility where a floating vehicle run was conducted.
- The MPR 2009 reports AVHD because delay is known for every day of the year, while past HICOMP Annual Data Compilations presented average DVHD because delay was usually only measured on a few days of the year using floating vehicles.
- The MPR 2009 reports all delay (recurrent and nonrecurrent) for all days of the week, while the HICOMP Annual Data Compilation included only recurrent weekday delay.
- The MPR 2009 uses actual volume on a facility to determine delay, collected through the VDS, while the HICOMP Annual Data Compilation floating vehicle methodology used an estimated volume that varied by district.

Because of the marked differences in methodology between the MPR 2009 and the HICOMP Annual Data Compilation, comparison of the congestion information between the two is not recommended. However, for reference, the HICOMP Annual Data Compilation DVHD figures from 2000 to 2008 can be found in Appendix C, with discussion of their relationship to the MPR 2009 findings. The trend analysis offered in the body of this report was performed by analyzing VDS data from the previous four years using the standardized MPR methodology.

1.2.2. Performance Measures in This Report

Once the automatically collected data are in the CT PeMS, several performance measures are calculated and reported. The main measure of congestion consists of total vehicle hours of delay (VHD), or the extra time spent in traffic beyond what people would experience in free-flow conditions. Delay is determined by calculating the difference between the observed travel time on the segment (as calculated from speed) and the travel time at two benchmark speeds, 35 mph and 60 mph. These speeds are chosen as benchmarks because they distinguish heavy congestion from light congestion. The hours of delay are then multiplied by the vehicle flow on the facility to produce VHD.

The disbenefits of congestion are derived from the total VHD at the 35-mph threshold speed. These disbenefits are presented in three categories: (1) extra fuel burned, (2) the cost of lost time (opportunity cost in terms of wages and salaries), and (3) extra vehicle emissions of CO_2. These calculations assume that gasoline is priced at a statewide average of $3.00 a gallon and statewide travel time is priced at $15.90 for each vehicle hour of delay, which includes an average vehicle occupancy of 1.15 and a 9 percent truck volume. The amount of extra fuel burned is assumed as 1.719 gallons of fuel for each vehicle hour of delay. The amount of extra vehicle emissions of CO_2 is derived from the figure of 19.4 pounds of CO_2 produced for each gallon of gasoline burned. See Appendix A for more details on these calculations, including source information.

Lost productivity, expressed in lost-lane-mile hours, is the cumulative difference between the traffic capacity at a location and the observed flow during congestion. When the average speed drops below the speed threshold (35 mph or 60 mph), fewer vehicles pass by the location during each unit of time than would under free-flow conditions. The reduced flow on the facility is then divided by the capacity (highest sustainable hourly flow) to achieve lost-lane-mile hours. Lost productivity is the optimal metric for comparing the effectiveness of various transportation system management and transportation demand management strategies.

A bottleneck is defined as a persistent and significant drop in speed between two locations on a freeway. Bottlenecks are determined by the Bottleneck Identification Algorithm in the CT PeMS. This algorithm looks at speeds along a facility and declares a bottleneck at a location where there has been a drop in speed of at least 20 mph between the current detector and the detector immediately upstream. This speed drop must persist for at least five out of any seven contiguous 5-minute data points, and the speed at the detector in question must be below 40 mph. While the CT PeMS identifies the detector locations where these conditions are met, these bottleneck locations are only approximated and their exact locations and causes can be determined only through field survey. The topmost bottleneck locations are presented for each district with automated detection in order of AVHD below 60 mph. Each district's bottleneck AVHD figures represent the sum of the delay from the morning and evening peak periods and from the midday period. (In the past, only the morning and afternoon commute periods were monitored. With automated detection data, midday congestion is also monitored and included as part of the total delay at each of the bottleneck locations.)

SECTION 1.3. MPR DEVELOPMENT: PLANNED IMPROVEMENTS

The MPR 2009 uses a new methodology for reporting congestion that has been under development for the past five years. However, the actual implementation of this methodological change has revealed several areas for future improvement. Furthermore, the MPR is ultimately envisioned as more than a freeway congestion report—it is meant to be a comprehensive transportation system performance report. This section explains some of the areas for improvement that have been identified to both enhance the MPR's congestion information and to expand its scope. The improvements listed below will be phased in as resources allow. These improvements are listed in the anticipated order in which they will be addressed.

1.3.1. Evaluating Congestion by Lane

The HICOMP Annual Data Compilation used the metric "congested directional miles" because it was mostly limited to sampling a single lane a few times a year; all traffic lanes were assumed to have the same amount of delay. The HICOMP Annual Data Compilation included tables and maps depicting these congested directional miles for each Caltrans district. Automated traffic data provide the ability to evaluate delay lane by lane. The 2009 data revealed instances where some lanes were below the 35-mph threshold and other lanes were above it, resulting in an average speed above 35 mph, whereas it is likely the probe vehicle run methodology would have assumed all lanes to be below 35 mph. In such cases, lane-by-lane differences can be meaningful. However, evaluating freeway congestion by lane and then presenting congested lane mile information in tables and maps is a time-consuming process. To conduct such lane-by-lane analysis over an entire year, programming improvements to the CT PeMS are necessary to streamline the process. Another benefit of lane-by-lane analysis is that it will facilitate the inclusion of high-occupancy vehicle (HOV) lane performance information within the MPR.

1.3.2. Improving MPR Maps

The MPR 2009 district bottleneck maps do not show the location, travel direction, or the periods of sub-35-mph congestion. Additional experience using automated traffic data will enable the MPR to feature such maps, which can serve as quick references for where mobility improvements should be focused. As congestion monitoring changes from directional miles to lane miles, as described above, the MPR will need to include maps that distinguish congestion by lane.

1.3.3. Including Additional Performance Measures

VDS data can be analyzed in numerous ways. Additional performance measures, including travel-time reliability, will be included in future MPRs. The appropriate measures will be determined through a collaborative process between Caltrans Headquarters, districts, and outside stakeholders.

1.3.4. Enhancing Lost Productivity Analysis

Lost productivity is a metric that can lose meaning when aggregated at the district and statewide levels. Conceptually, lost productivity can be viewed as the number of miles of new freeway lanes that would be necessary to build for the traffic volume to travel at an efficient speed. Lost productivity enables comparison between operational improvements that achieve efficiencies and capital projects that construct additional lanes. More study is needed to determine how this metric can evolve to provide corridor-level information within the MPR.

1.3.5. Performing Causality Analysis

The MPR 2009 does not identify the causes of reported congestion, although some suspected causes of bottlenecks are given in the bottleneck section of each district chapter. Methods for performing causality analysis are being developed to distinguish between incident-related and recurrent congestion. Caltrans is developing two tools to enable causal analysis:

(1) The Transportation Management Center Activity Log (TMCAL) will be the first statewide database for tracking traffic management actions by TMC operators. Integrating the TMCAL archive into the CT PeMS will provide additional incident information that can be used in determining incident-related traffic congestion.

(2) Caltrans' experimental WeatherShare project is successfully joining Caltrans' roadway weather information stations with weather data from State and federal forests and other agencies, mapping real-time weather conditions to State highways to assist in managing traffic demand and maintenance needs. Integrating the WeatherShare archive into the CT PeMS will enable analysis of highway performance during specific weather conditions.

1.3.6. Utilizing Additional Sources of Automated Traffic Data to Measure Congestion

Caltrans has several innovative partnerships for traffic data acquisition. Partnerships with the San Francisco Bay Area Metropolitan Transportation Commission allow the commission to install and operate toll tag readers on State freeways and bridges in exchange for traffic management data from those readers. The Bay Area Metropolitan Transportation Commission also has hundreds of Doppler radar technology traffic sensors on State freeways, as does the Ventura County Transportation Commission. Caltrans has five partnerships with the Federal Highway Administration and NAVTEQ (formerly Traffic.Com) in various urban regions. Some of these data sources are yet to be integrated into the CT PeMS. Caltrans is also pursuing a wide-area deployment of Bluetooth reader technology to obtain traffic management data between urbanized areas. In addition, Caltrans is conducting a pilot project to allow acceptance and integration of non-Caltrans-collected traffic flow data, such as global positioning system-supplied travel times, into the CT PeMS. These additional data sources can greatly expand the geographical areas where traffic data are available, enabling a more comprehensive picture of statewide congestion.

1.3.7. Adding Facilities and Modes

Caltrans and the San Diego Association of Governments have been developing an arterial version (called aPeMS) of the freeway-based CT PeMS. Parallel road traffic data enable corridor system managers to manage traveler delay more effectively. Caltrans and the San Diego Association of Governments are also developing a transit version (called the tPeMS) of the CT PeMS. As transit performance data becomes available, transportation system managers will be able to make intermodal decisions to minimize traveler delay. Archiving these arterial and transit data will enable the MPR to represent traffic congestion better, not only the traffic congestion on freeways but also on the entire transportation network.

1.3.8. Using the MPR Methodology to Develop More Frequent Corridor Management Reports

As Caltrans implements Corridor System Management Plans, the standardized MPR methodology will allow corridor managers to take the regular "pulse" of their corridors to identify trends quickly. Regularly monitoring congestion data by corridor enables system managers to evaluate the effectiveness of their strategies by comparing the changes in congestion before and after implementation. Monthly congestion trend analysis is particularly appropriate for the high-priority corridors identified for real-time transportation system management in the Proposition 1B bond program. The MPR methodology can be replicated to perform this more frequent analysis.

CHAPTER 2

STATEWIDE FINDINGS

This chapter presents 2009 highway congestion data at a statewide level. Table 2.1–1, Table 2.1–2, and Table 2.1–3 list California's AVHD by Caltrans district, by day of week, and by time of day. Trend analysis using the MPR's standardized methodology is presented in Figure 2.1–1 and Figure 2.1–2 to compare the 2009 findings with those of past years. This chapter also includes in Section 2.2 the estimated costs associated with highway congestion (in the form of extra fuel burned, time lost, and vehicle CO_2 emissions) and in Section 2.3, lost productivity analysis.

Chapters 3 through 10 present 2009 highway congestion data by Caltrans district for the districts that have automated detection. The district-wide data are presented by county, by day of week, and by time of day. These chapters also include estimated highway congestion costs, lost productivity analysis, and bottleneck locations.

Please note that Caltrans' previous congestion data compilation, the HICOMP Annual Data Compilation, reported delay in terms of DVHD using a different method of data collection that primarily relied on floating vehicles. Data comparisons between the HICOMP Annual Data Compilation and the MPR 2009 are not recommended because of the methodological differences. See Section 1.2.1 for more information.

SECTION 2.1. ANNUAL VEHICLE HOURS OF DELAY

Table 2.1–1 lists the statewide AVHD for 2009 by Caltrans district. Delay varied significantly by district. District 7 (Los Angeles area) had 49 percent of the State's measured traffic congestion at the 35-mph threshold in 2009. District 4 (San Francisco Bay Area) and District 12 (Orange County) comprised another 33 percent. Thus, more than 80 percent of California's highway vehicle delay at the 35-mph threshold came from these three districts.

Table 2.1–1

STATEWIDE ANNUAL VEHICLE HOURS OF DELAY BY DISTRICT

District	2009 AVHD (35 mph)	Percent of State Total (35 mph)	2009 AVHD (60 mph)	Percent of State Total (60 mph)
3	3,227,000	4.0	9,296,000	4.8
4	16,911,000	21.2	40,102,000	20.6
6	720,000	0.9	3,537,000	1.8
7	39,441,000	49.4	90,243,000	46.3
8	4,547,000	5.7	15,498,000	7.9
10	1,596,000	2.0	5,325,000	2.7
11	3,613,000	4.5	9,193,000	4.7
12	9,736,000	12.2	21,792,000	11.2
Total	79,791,000	100.0	194,986,000	100.0

Figure 2.1–1 displays the statewide congestion trend from 2005 to 2009, expressed in AVHD. Over these last five years, the State experienced its highest level of delay in 2006 and has experienced decreasing levels of delay in each succeeding year. From 2008 to 2009, statewide delay decreased by approximately 6 percent. Since the 2006 peak, statewide delay has decreased by approximately 25 percent.

Figure 2.1–1

STATEWIDE CONGESTION TREND, 2005–2009

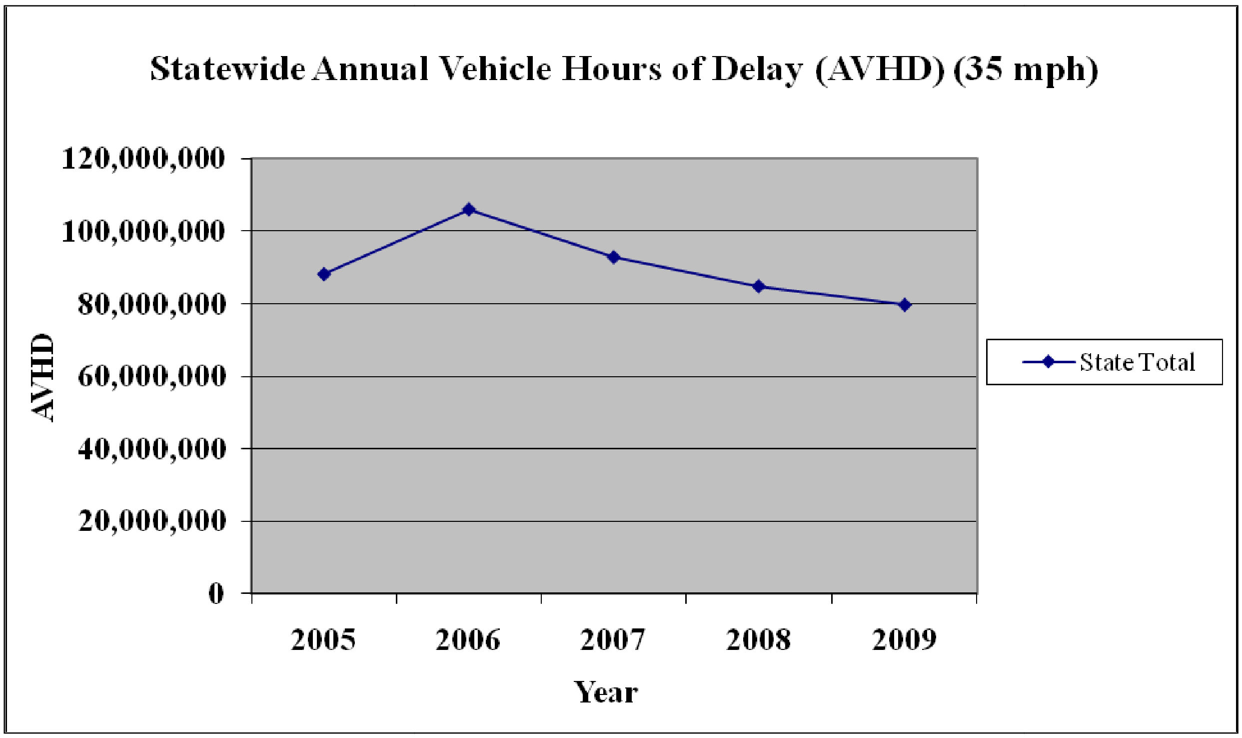


Figure 2.1–2 displays the AVHD trends from 2005 to 2009 for each Caltrans district with automated detection, except for Districts 6 and 10. For Districts 6 and 10, the deployment of new automated detection has made it difficult to identify the true congestion trend because most freeways were unmonitored only a few years ago.

Consistent with the statewide trend, Districts 7 and 4 experienced their highest levels of delay in 2006. District 7 has had slight increases in its delay levels from 2007 to 2008 and from 2008 to 2009, while District 4 had a slight decrease in its delay levels from 2007 to 2008 but a slight increase from 2008 to 2009. District 12 has experienced a different trend, with its highest level of delay occurring in 2007 and declining since then. Districts 8 and 11 followed the statewide trend of having delay increase from 2005 to 2006 and then decline each year thereafter. District 3 has experienced a declining trend since 2005.

Figure 2.1–2

ANNUAL VEHICLE HOURS OF DELAY BY DISTRICT, 2005–2009

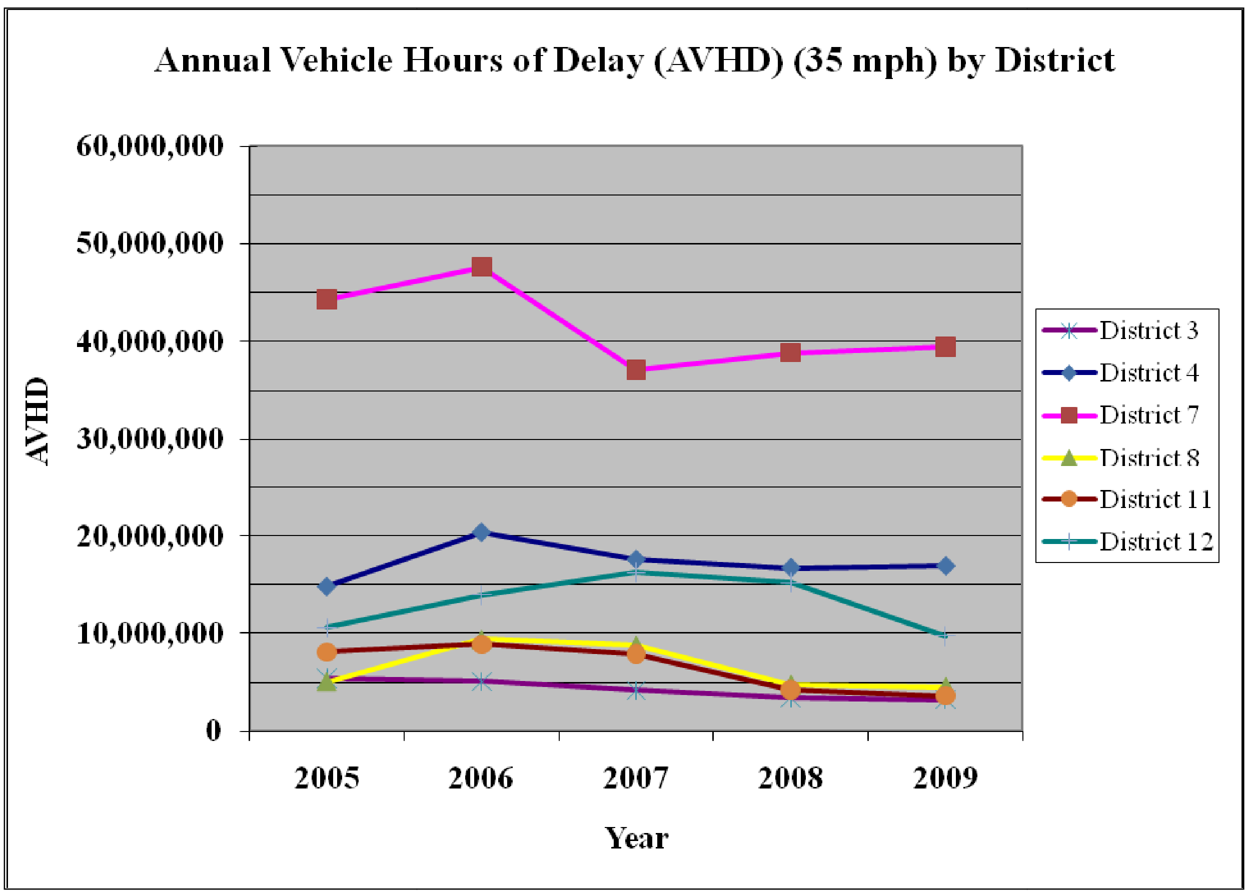


Table 2.1–2 lists the statewide AVHD by day of week during 2009. For example, the "Sunday" listing of 3,432,000 represents the sum of the VHD at the 35-mph threshold for all Sundays in 2009.

For California, the level of delay increased steadily from Sunday to Friday, which was the most congested day of the week in 2009. Weekend delay made up approximately 12 percent of the total statewide delay. The day with the least amount of congestion was Sunday.

Table 2.1–2

STATEWIDE ANNUAL VEHICLE HOURS OF DELAY BY DAY OF WEEK

Day	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
Sunday	3,432,000	4.3	8,478,000	4.3
Monday	9,799,000	12.3	29,621,000	15.2
Tuesday	12,967,000	16.3	31,728,000	16.3
Wednesday	14,748,000	18.5	34,727,000	17.8
Thursday	15,454,000	19.4	35,052,000	18.0
Friday	17,205,000	21.6	41,100,000	21.1
Saturday	6,187,000	7.8	14,281,000	7.3
Total*	79,791,000	100.0	194,986,000	100.0

* The Day of Week figures do not sum exactly to the Total because of rounding to the nearest thousand.

Table 2.1–3 lists statewide annual delay by time of day, looking at weekdays only. The most congested weekday period in 2009 was the evening peak period from 3:00 p.m. to 6:59 p.m., having approximately half of the total weekday delay, followed by the morning peak period from 6:00 a.m. to 9:59 a.m. The day and night off-peak periods both had lower levels of delay, with the night off-peak period having the least amount.

Table 2.1–3

STATEWIDE ANNUAL VEHICLE HOURS OF DELAY BY WEEKDAY TIME OF DAY

Time	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
6:00 AM to 9:59 AM	17,085,000	24.3	42,530,000	24.7
10:00 AM to 2:59 PM	11,634,000	16.6	36,511,000	21.2
3:00 PM to 6:59 PM	35,506,000	50.6	76,629,000	44.5
7:00 PM to 5:59 AM	5,947,000	8.5	16,557,000	9.6
All Weekdays	70,172,000	100.0	172,227,000	100.0

SECTION 2.2. DISBENEFITS OF CONGESTION

In 2009, Californians lost 79.8 million vehicle hours caused by congestion below 35 mph.

2.2.1. Cost in Extra Fuel Burned

Californians burned 137 million gallons of extra fuel during 2009 because of congestion, which produced costs for motorists of $411 million. This cost was determined by assuming 1.719 gallons of extra fuel consumed for each hour of delay and an average gasoline price of $3.00 a gallon.

2.2.2. Cost in Time Lost

The cost of lost time (opportunity cost in terms of wages and salaries) caused by sub-35-mph congestion statewide was $1.3 billion for 2009, or $3.5 million a day. This cost assumes an opportunity cost of congestion of $15.90 for each vehicle hour of delay with an average vehicle occupancy of 1.15 and a 9 percent truck volume.

2.2.3. Cost in Vehicle Emissions

The estimated delay at 35 mph created excess fuel consumption statewide that added 1.3 million tons of CO_2 emissions into the air, compared with what would have been emitted at free-flow speeds. This cost assumes 1.719 gallons of extra fuel consumed for each hour of delay and 19.4 pounds of CO_2 produced for each gallon of gasoline burned. Pounds are converted to tons (U.S., short) by dividing by 2,000.

SECTION 2.3. LOST PRODUCTIVITY

Lost productivity reflects the loss of capacity experienced during congested conditions as compared with free-flow conditions. The results are presented in terms of equivalent lost-lane-mile hours. Conceptually, this is the reduced flow experienced when speeds drop and the number of vehicles passing a certain point begins to decline. The CT PeMS calculates the ratio between the measured flow during congested conditions to the maximum observed flow for that location. The CT PeMS then multiplies one minus this ratio by the length of the freeway segment to determine the number of equivalent lane-mile hours lost because of congestion.

Table 2.3 lists the 2009 statewide total of lost-lane-mile hours by district, at both the 35-mph and 60-mph thresholds. District 7 had the most lost-lane-mile hours, followed by District 4. The lost productivity figures for District 3 and District 10 are suspected to be inflated as a result of a few incorrectly configured detectors in El Dorado County and Merced County, respectively. This issue is explained in greater detail in Chapters 3 and 8.

Table 2.3

STATEWIDE LOST PRODUCTIVITY BY DISTRICT

District	Lost Productivity at 35 mph		Lost Productivity at 60 mph	
	Number of Lost-Lane-Mile Hours	Percent of Statewide Lost-Lane-Mile Hours	Number of Lost-Lane-Mile Hours	Percent of Statewide Lost-Lane-Mile Hours
3	77,000	6.4	2,037,000	16.5
4	234,000	19.4	2,073,000	16.8
6	94,000	7.8	1,006,000	8.2
7	542,000	44.9	3,601,000	29.2
8	62,000	5.1	841,000	6.8
10	25,000	2.1	1,478,000	12.0
11	46,000	3.8	454,000	3.7
12	128,000	10.6	851,000	6.9
Total	1,208,000	100.0	12,341,000	100.0

CHAPTER 3

DISTRICT 3: SACRAMENTO AREA

Caltrans District 3 is comprised of the following eleven counties: Butte, Colusa, El Dorado, Glenn, Nevada, Placer, Sacramento, Sierra, Sutter, Yolo, and Yuba. Caltrans has not installed any VDS in Butte, Colusa, Glenn, or Sierra counties.

SECTION 3.1. DISTRICT 3 ANNUAL VEHICLE HOURS OF DELAY

Table 3.1–1 lists the AVHD by county within District 3. Sacramento County is the largest county in the district, and it was the most congested. Yolo County was second in 35-mph congestion (severe congestion) and Placer County was second at the 60-mph level (light congestion).

Table 3.1–1

DISTRICT 3 ANNUAL VEHICLE HOURS OF DELAY BY COUNTY

County	2009 AVHD (35 mph)	Percent of District Total (35 mph)	2009 AVHD (60 mph)	Percent of District Total (60 mph)
El Dorado	117,000	3.6	710,000	7.6
Nevada	2,000	0.1	10,000	0.1
Placer	500,000	15.5	1,637,000	17.6
Sacramento	1,875,000	58.1	5,238,000	56.3
Sutter	51,000	1.6	169,000	1.8
Yolo	653,000	20.2	1,450,000	15.6
Yuba	28,000	0.9	82,000	0.9
Total	3,227,000*	100.0	9,296,000	100.0

* The County figures for AVHD at 35 mph do not sum exactly to the Total because of rounding to the nearest thousand.

Table 3.1–2 lists the District 3 annual delay by day of week during 2009. For example, the "Sunday" listing of 246,000 represents the sum of the VHD in District 3 at the 35-mph threshold for all Sundays in 2009.

As it did statewide, the District 3 level of delay increased steadily from Sunday to Friday, which was the most congested day of the week on average. In total, weekend delay made up approximately 17 percent of all district delay, higher than the statewide average. The day with the least amount of congestion was Sunday.

Table 3.1–2

DISTRICT 3 ANNUAL VEHICLE HOURS OF DELAY BY DAY OF WEEK

Day	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
Sunday	246,000	7.6	731,000	7.9
Monday	355,000	11.0	1,300,000	14.0
Tuesday	520,000	16.1	1,437,000	15.5
Wednesday	541,000	16.8	1,486,000	16.0
Thursday	568,000	17.6	1,558,000	16.8
Friday	703,000	21.8	2,001,000	21.5
Saturday	293,000	9.1	784,000	8.4
Total*	3,227,000	100.0	9,296,000	100.0

* The Day of Week figures to not sum exactly to the Total because of rounding to the nearest thousand.

Table 3.1–3 lists the District 3 annual delay by time of day, looking at weekdays only. The most congested weekday period in the district in 2009 was the evening peak period from 3:00 p.m. to 6:59 p.m., having more than half of the total weekday delay at 35 mph. Differing from the statewide average, the midday period from 10:00 a.m. to 2:59 p.m. had more hours of delay than the morning peak period. The night off-peak period had the least amount of delay.

Table 3.1–3

DISTRICT 3 ANNUAL VEHICLE HOURS OF DELAY BY WEEKDAY TIME OF DAY

Time	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
6:00 AM to 9:59 AM	477,000	17.7	1,577,000	20.3
10:00 AM to 2:59 PM	544,000	20.2	1,977,000	25.4
3:00 PM to 6:59 PM	1,406,000	52.3	3,392,000	43.6
7:00 PM to 5:59 AM	261,000	9.7	837,000	10.8
All Weekdays	2,688,000	100.0	7,783,000	100.0

SECTION 3.2. DISTRICT 3 DISBENEFITS OF CONGESTION

In 2009, Californians in District 3 lost 3.2 million vehicle hours because of congestion at the 35-mph threshold. District 3's congestion represents 4 percent of the statewide total.

3.2.1. Cost in Extra Fuel Burned

Californians in District 3 burned 5.5 million gallons of extra fuel during 2009 because of congestion at the 35-mph threshold, which produced costs for motorists of $16.6 million.

3.2.2. Cost in Time Lost

The cost of lost time (opportunity cost in terms of wages and salaries) caused by sub-35-mph congestion in District 3 was $51.3 million for 2009, or $141,000 a day.

3.2.3. Cost in Vehicle Emissions

The estimated delay at 35 mph created excess fuel consumption in District 3 that added 54,000 tons of CO_2 emissions into the air, compared with what would have been emitted at free-flow speeds.

SECTION 3.3. DISTRICT 3 LOST PRODUCTIVITY

Table 3.3 lists the lost-lane-mile hours for District 3 by county, at both the 35-mph and 60-mph thresholds. The numbers presented for El Dorado County are suspected to be inflated as a result of improperly configured detectors in the South Lake Tahoe area. The detectors in question are installed on conventional highway sections of US–50, where the speed limit is below 60 mph and traffic is meant to be traveling at reduced speeds. These detectors are currently being evaluated to correct their configuration.

Table 3.3

DISTRICT 3 LOST PRODUCTIVITY BY COUNTY

County	Lost Productivity at 35 mph		Lost Productivity at 60 mph	
	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours
El Dorado	35,000	45.5	383,000	18.8
Nevada	<1,000	0.1	11,000	0.5
Placer	9,000	11.7	564,000	27.7
Sacramento	25,000	32.5	656,000	32.2
Sutter	4,000	5.2	156,000	7.7
Yolo	3,000	3.9	252,000	12.4
Yuba	<1,000	0.6	15,000	0.7
Total	77,000*	100.0	2,037,000	100.0

* The County figures for Lost Productivity at 35 mph do not sum exactly to the Total because of rounding to the nearest thousand.

SECTION 3.4. DISTRICT 3 BOTTLENECKS

Table 3.4 lists District 3's top ten freeway bottleneck locations in 2009, identified by county, route, and post mile. Each of these bottlenecks will be examined by the district to determine whether a plan can be implemented to alleviate the bottleneck in the future. A map of these top bottleneck locations can be found at the end of this chapter.

Explanation of Bottlenecks

The suspected causes of the bottlenecks listed in Table 3.4 are summarized here. The magnitude of delay experienced in District 3 was smaller than in districts with major urban areas, such as neighboring District 4. Nonetheless, Sacramento County is a medium-sized urban area and experienced congestion levels higher than the more rural districts, such as District 10 to the south.

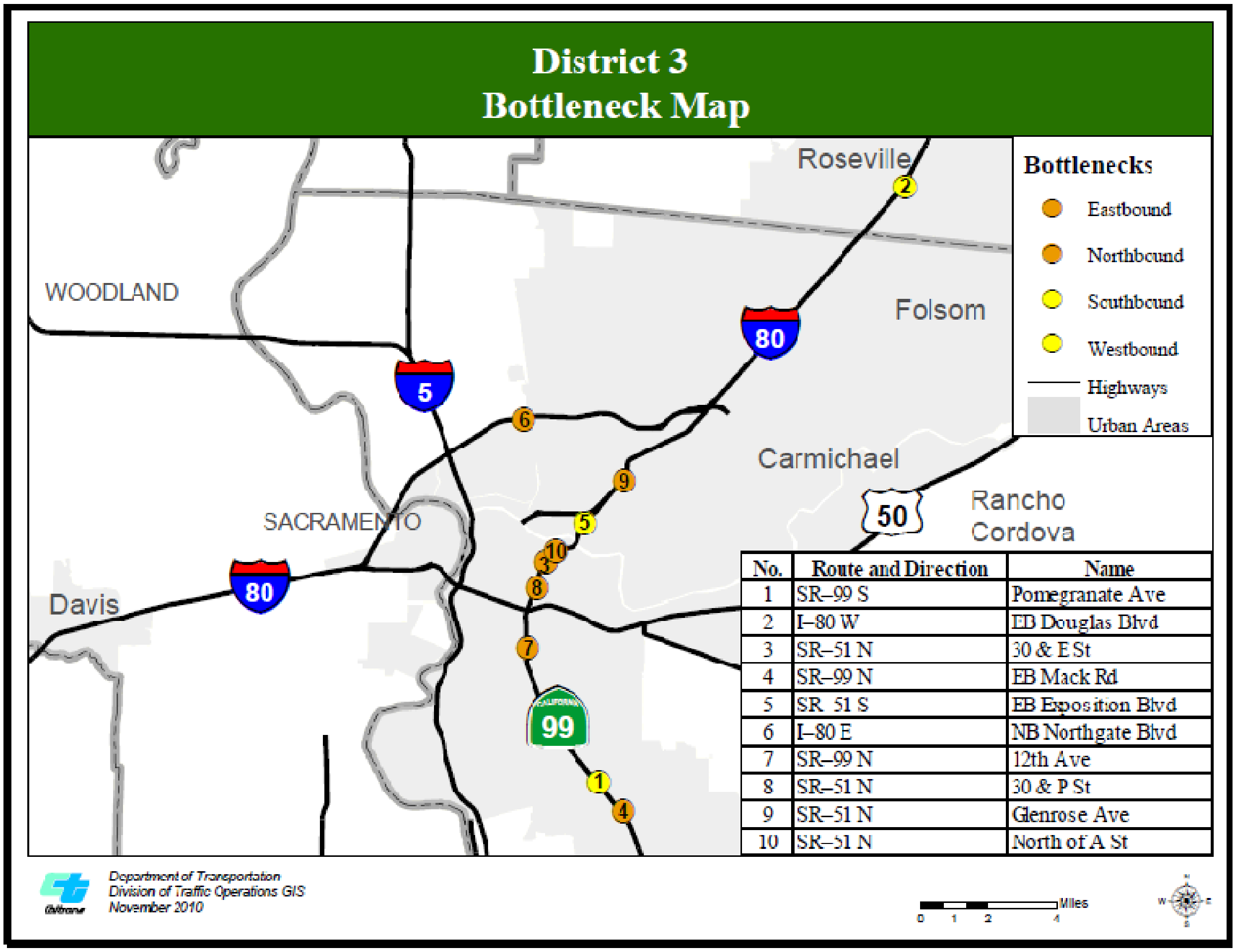
- The suspected causes of bottlenecks Nos. 1, 3, 4, 5, 8, and 10 are lane drops at nearby or downstream locations.
- The suspected cause of bottlenecks Nos. 6 and 9 is road geometry.
- The suspected causes of bottleneck No. 7 are the high volume of traffic exiting to US–50 and the high volume of traffic entering the facility at 12th Street.
- The suspected cause of bottleneck No. 2 is construction to eliminate a lane drop from the Douglas interchange to the Riverside interchange.

Table 3.4

DISTRICT 3 BOTTLENECKS

No.	County	Route and Direction	Post Mile	Name	2009 AVHD (60 mph)
1	Sacramento	SR–99 S	18.61	Pomegranate Ave	251,000
2	Placer	I–80 W	1.855	EB Douglas Blvd	188,000
3	Sacramento	SR–51 N	1.5	30 & E St	131,000
4	Sacramento	SR–99 N	17.46	EB Mack Rd	116,000
5	Sacramento	SR–51 S	3.32	EB Exposition Blvd	90,000
6	Sacramento	I–80 E	M5	NB Northgate Blvd	86,000
7	Sacramento	SR–99 N	23.21	12th Ave	77,000
8	Sacramento	SR–51 N	0.68	30 & P St	69,000
9	Sacramento	SR–51 N	5.1	Glenrose Ave	54,000
10	Sacramento	SR–51 N	2	North of A St	50,000

SECTION 3.5. DISTRICT 3 BOTTLENECK MAP



No.	Route and Direction	Name
1	SR–99 S	Pomegranate Ave
2	I–80 W	EB Douglas Blvd
3	SR–51 N	30 & E St
4	SR–99 N	EB Mack Rd
5	SR 51 S	EB Exposition Blvd
6	I–80 E	NB Northgate Blvd
7	SR–99 N	12th Ave
8	SR–51 N	30 & P St
9	SR–51 N	Glenrose Ave
10	SR–51 N	North of A St

CHAPTER 4

DISTRICT 4: SAN FRANCISCO BAY AREA

Caltrans District 4 is comprised of the following nine counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma.

SECTION 4.1. DISTRICT 4 ANNUAL VEHICLE HOURS OF DELAY

Table 4.1–1 lists the AVHD by county within District 4. More than 50 percent of vehicle delay in District 4 occurred in Alameda County and in Santa Clara County. San Francisco County, which has relatively few freeway miles, had a similar amount of delay as Contra Costa County and San Mateo County. This indicates that there were higher concentrations of congestion on the fewer freeway miles in San Francisco County.

Table 4.1–1

DISTRICT 4 ANNUAL VEHICLE HOURS OF DELAY BY COUNTY

County	2009 AVHD (35 mph)	Percent of District Total (35 mph)	2009 AVHD (60 mph)	Percent of District Total (60 mph)
Alameda	5,550,000	32.8	13,230,000	33.0
Contra Costa	2,257,000	13.3	5,284,000	13.2
Marin	440,000	2.6	1,239,000	3.1
Napa	2,000	0.0	33,000	0.1
San Francisco	2,139,000	12.6	4,509,000	11.2
San Mateo	1,851,000	10.9	3,745,000	9.3
Santa Clara	3,180,000	18.8	7,966,000	19.9
Solano	1,100,000	6.5	2,736,000	6.8
Sonoma	393,000	2.3	1,360,000	3.4
Total	16,911,000*	100.0	40,102,000	100.0

* The County figures for AVHD at 35 mph do not sum exactly to the Total because of rounding to the nearest thousand.

Table 4.1–2 lists the District 4 annual delay by day of week during 2009. For example, the "Sunday" listing of 822,000 represents the sum of the VHD in District 4 at the 35-mph threshold for all Sundays in 2009.

As it did statewide, the District 4 level of delay increased steadily from Sunday to Friday, which was the most congested day of the week on average. In total, weekend delay made up approximately 12 percent of all district delay, similar to the statewide average. The day with the least amount of congestion was Sunday.

Table 4.1–2

DISTRICT 4 ANNUAL VEHICLE HOURS OF DELAY BY DAY OF WEEK

Day	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
Sunday	822,000	4.9	1,817,000	4.5
Monday	2,000,000	11.8	5,963,000	14.9
Tuesday	2,744,000	16.2	6,764,000	16.9
Wednesday	3,050,000	18.0	7,126,000	17.8
Thursday	3,344,000	19.8	7,495,000	18.7
Friday	3,711,000	21.9	8,439,000	21.0
Saturday	1,238,000	7.3	2,496,000	6.2
Total*	16,911,000	100.0	40,102,000	100.0

* The Day of Week figures do not sum exactly to the Total because of rounding to the nearest thousand.

Table 4.1–3 lists the District 4 annual delay by time of day, looking at weekdays only. The most congested weekday period in the district in 2009 was the evening peak period from 3:00 p.m. to 6:59 p.m., having more than half of the total weekday delay at the 35-mph threshold. The morning peak period had approximately one quarter of the delay. The midday and night off-peak periods both had lower levels of delay, with the night off-peak period the least.

Table 4.1–3

DISTRICT 4 ANNUAL VEHICLE HOURS OF DELAY BY WEEKDAY TIME OF DAY

Time	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
6:00 AM to 9:59 AM	3,694,000	24.9	9,736,000	27.2
10:00 AM to 2:59 PM	2,160,000	14.5	7,069,000	19.8
3:00 PM to 6:59 PM	7,809,000	52.6	15,754,000	44.0
7:00 PM to 5:59 AM	1,187,000	8.0	3,230,000	9.0
All Weekdays	14,850,000	100.0	35,789,000	100.0

SECTION 4.2. DISTRICT 4 DISBENEFITS OF CONGESTION

In 2009, Californians in District 4 lost 16.9 million vehicle hours because of congestion at the 35-mph threshold. District 4's congestion represents 21.2 percent of the statewide total.

4.2.1. Cost in Extra Fuel Burned

Californians in District 4 burned 29.1 million gallons of extra fuel during 2009 because of congestion at the 35-mph threshold, which produced costs for motorists of $87.2 million.

4.2.2. Cost in Time Lost

The cost of lost time (opportunity cost in terms of wages and salaries) caused by sub-35-mph congestion in District 4 was $268.9 million for 2009, or $737,000 a day.

4.2.3. Cost in Vehicle Emissions

The estimated delay at 35 mph created excess fuel consumption in District 4 that added 282,000 tons of CO_2 emissions into the air, compared with what would have been emitted at free-flow speeds.

SECTION 4.3. DISTRICT 4 LOST PRODUCTIVITY

Table 4.3 lists the lost-lane-mile hours for District 4 by county, at both the 35-mph and 60-mph thresholds. Alameda County had the highest amount of lost productivity in the district in 2009.

Table 4.3

DISTRICT 4 LOST PRODUCTIVITY BY COUNTY

County	Lost Productivity at 35 mph		Lost Productivity at 60 mph	
	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours
Alameda	113,000	48.1	578,000	27.9
Contra Costa	24,000	10.1	215,000	10.4
Marin	2,000	0.8	142,000	6.9
Napa	<1,000	0.0	1,000	0.1
San Francisco	40,000	16.9	181,000	8.7
San Mateo	13,000	5.7	183,000	8.8
Santa Clara	33,000	14.1	478,000	23.1
Solano	8,000	3.3	246,000	11.9
Sonoma	2,000	1.0	49,000	2.3
Total	234,000*	100.0	2,073,000	100.0

* The County figures for Lost Productivity at 35 mph do not sum exactly to the Total because of rounding to the nearest thousand.

SECTION 4.4. DISTRICT 4 BOTTLENECKS

Table 4.4 lists District 4's top twenty freeway bottleneck locations in 2009, identified by county, route, and post mile. Each of these bottlenecks will be examined by the district to determine whether a plan can be implemented to alleviate the bottleneck in the future. A map of these top bottleneck locations can be found at the end of this chapter.

Explanation of Bottlenecks

The suspected causes of the bottlenecks listed in Table 4.4 are summarized here. District 4 has projects in design or construction for the top ten bottlenecks that were identified on the 2008 top ten list. Several of the locations identified in the 2009 top twenty bottlenecks list have projects in the planning, design, or construction stage, and these projects are mentioned here, as well.

- Bottlenecks Nos. 3, 4, 15, and 18 on I–80 will be addressed by a project from Carquinez Bridge to Powell Street to design an Integrated Corridor Management system to improve safety and operations. The suspected cause of bottleneck No. 3 is a lane drop combined with high traffic demand. The suspected cause of bottleneck No. 4 is high demand for the I-80/I–580/I–880 connectors, which backs up traffic into the Powell Street area.

- The suspected cause of bottlenecks Nos. 1 and 20 is high traffic demand exceeding capacity in this area. Eastbound I–580 from Portola Avenue to Hacienda Road is under construction to install HOV/express lanes.

- The suspected cause of bottleneck No. 2 is a lane drop with high traffic demand approaching the SR–92/I–880 interchange. On northbound I–880, there is an SR–92/I–880 interchange modification project under construction.

- The suspected cause of bottleneck No. 5 is that the three bores at the Caldecott Tunnel are not providing enough capacity for both directions. The fourth bore of the Caldecott Tunnel project is underway.

- The suspected cause of bottleneck No. 8 is high traffic demand approaching the SR–92 interchange. A widening project on US–101 from SR–92 to Broadway is under construction.

- The suspected cause of bottleneck No. 9 is high traffic demand exceeding capacity at the bottleneck between De La Cruz and SR–87.

- The suspected cause of bottleneck No. 10 is high traffic demand. There is a 23rd Avenue/I–880 interchange modification project underway at this location.

- The suspected cause of bottleneck No. 11 is a lane drop at 98th Avenue combined with high traffic demand. A southbound I–880 project is in design to extend the HOV lane from Marina Boulevard to Hegenberger Boulevard.

- The suspected cause of bottleneck No. 12 is demand exceeding capacity at Wilford. Rohnert Park is the closest existing detector to this location. HOV lane projects are underway on US–101 between Redwood Highway and Santa Rosa Avenue.

- The suspected cause of bottleneck No. 13 is demand exceeding the capacity of the five-lane section of the San Francisco-Oakland Bay Bridge during the morning commute.

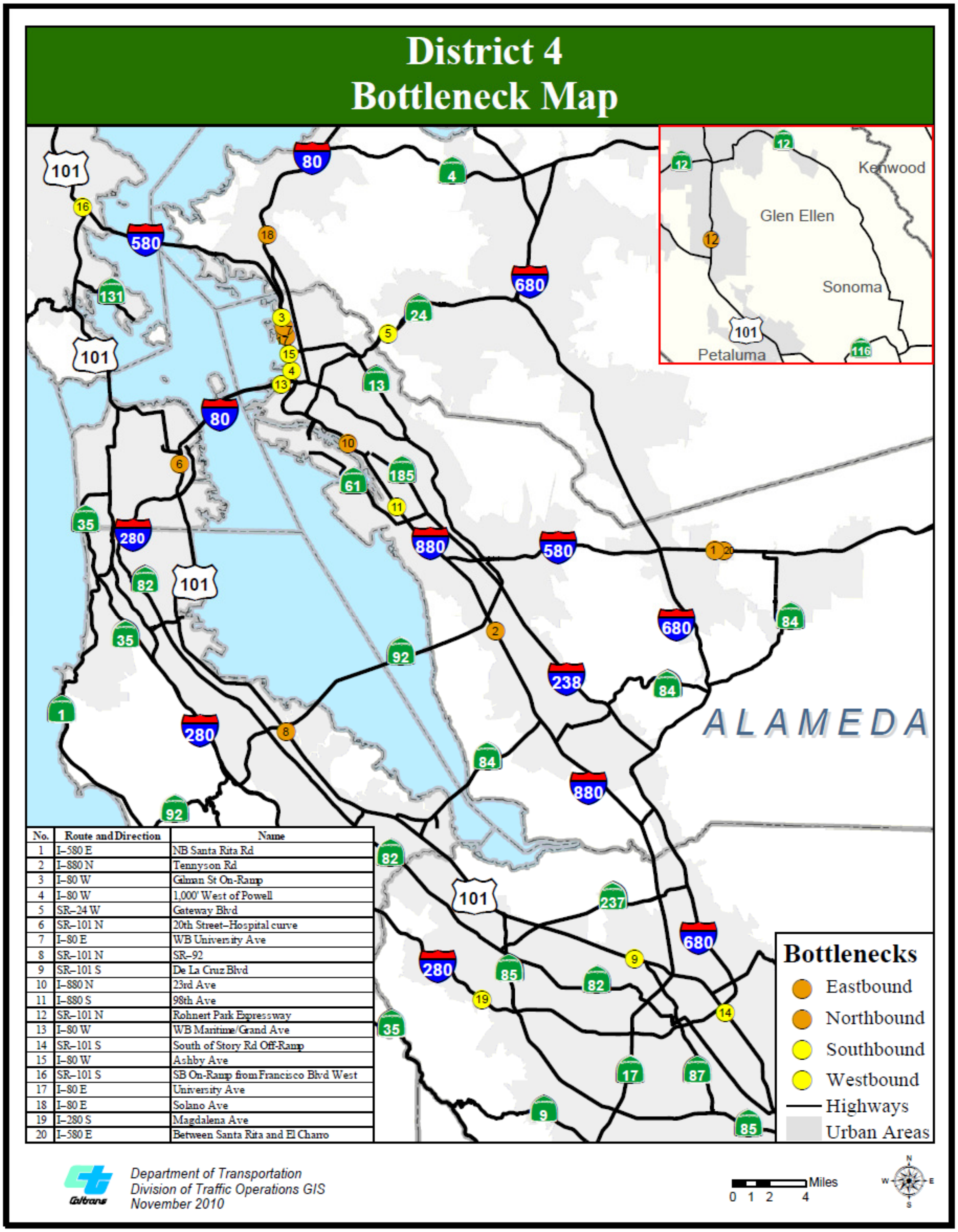
- The suspected cause of bottleneck No. 14 is high traffic demand reaching the main bottleneck between the I–280/I–680 interchange and Tully Road. On southbound US–101, there is an improvement project to add a lane between the lane drop south of Story Road to Capitol Expressway.
- The suspected cause of bottleneck No. 16 is heavy on-ramp traffic. During 2009, an HOV gap closure project provided an HOV lane between San Pedro and I–580. In addition, a project is in construction on US–101 to improve interchange capacity at the I–580 interchange.
- The suspected cause of bottleneck No. 19 is a lane drop before Magdalena Avenue.

Table 4.4

DISTRICT 4 BOTTLENECKS

No.	County	Route and Direction	Post Mile	Name	2009 AVHD (60 mph)
1	Alameda	I–580 E	23.40	NB Santa Rita Rd	454,000
2	Alameda	I–880 N	15.80	Tennyson Rd	345,000
3	Alameda	I–80 W	6.64	Gilman St On-Ramp	320,000
4	Alameda	I–80 W	3.64	1,000' West of Powell	312,000
5	Contra Costa	SR–24 W	1.11	Gateway Blvd	305,000
6	San Francisco	SR–101 N	3.80	20th Street-Hospital curve	281,000
7	Alameda	I–80 E	6.14	WB University Ave	181,000
8	San Mateo	SR–101 N	11.62	SR–92	153,000
9	Santa Clara	SR–101 S	40.59	De La Cruz Blvd	149,000
10	Alameda	I–880 N	29.10	23rd Ave	147,000
11	Alameda	I–880 S	24.60	98th Ave	144,000
12	Sonoma	SR–101 N	14.00	Rohnert Park Expressway	134,000
13	Alameda	I–80 W	2.41	WB Maritime/Grand Ave	131,000
14	Santa Clara	SR–101 S	34.50	South of Story Rd Off-Ramp	123,000
15	Alameda	I–80 W	4.61	Ashby Ave	118,000
16	Marin	SR–101 S	9.96	SB On-Ramp from Francisco Blvd West	102,000
17	Alameda	I–80 E	5.58	University Ave	98,000
18	Contra Costa	I–80 E	3.41	Solano Ave	97,000
19	Santa Clara	I–280 S	12.90	Magdalena Ave	95,000
20	Alameda	I–580 E	17.20	Between Santa Rita and El Charro	94,000

SECTION 4.5. DISTRICT 4 BOTTLENECK MAP



No.	Route and Direction	Name
1	I–580 E	NB Santa Rita Rd
2	I–880 N	Tennyson Rd
3	I–80 W	Gilman St On-Ramp
4	I–80 W	1,000' West of Powell
5	SR–24 W	Gateway Blvd
6	SR–101 N	20th Street–Hospital curve
7	I–80 E	WB University Ave
8	SR–101 N	SR–92
9	SR–101 S	De La Cruz Blvd
10	I–880 N	23rd Ave
11	I–880 S	98th Ave
12	SR–101 N	Rohnert Park Expressway
13	I–80 W	WB Maritime/Grand Ave
14	SR–101 S	South of Story Rd Off-Ramp
15	I–80 W	Ashby Ave
16	SR–101 S	SB On-Ramp from Francisco Blvd West
17	I–80 E	University Ave
18	I–80 E	Solano Ave
19	I–280 S	Magdalena Ave
20	I–580 E	Between Santa Rita and El Charro

CHAPTER 5

DISTRICT 6: FRESNO-BAKERSFIELD AREA

Caltrans District 6 is comprised of the following five counties: Fresno, Kern, Kings, Madera, and Tulare. Caltrans has not installed any VDS in Kings County.

SECTION 5.1. DISTRICT 6 ANNUAL VEHICLE HOURS OF DELAY

Table 5.1–1 lists the AVHD by county within District 6. Fresno County and Kern County had the dominate percentage of delay in the district in 2009.

Table 5.1–1

DISTRICT 6 ANNUAL VEHICLE HOURS OF DELAY BY COUNTY

County	2009 AVHD (35 mph)	Percent of District Total (35 mph)	2009 AVHD (60 mph)	Percent of District Total (60 mph)
Fresno	379,000	52.6	1,712,000	48.4
Kern	282,000	39.2	1,159,000	32.8
Madera	46,000	6.4	460,000	13.0
Tulare	13,000	1.8	205,000	5.8
Total	720,000	100.0	3,537,000*	100.0

* The County figures for AVHD at 60 mph do not sum exactly to the Total because of rounding to the nearest thousand.

Table 5.1–2 lists the District 6 annual delay by day of week during 2009. For example, the "Sunday" listing of 30,000 represents the sum of the VHD in District 6 at the 35-mph threshold for all Sundays in 2009.

Differing from the statewide average, the day with the most delay at the 35-mph threshold in District 6 was Tuesday, followed closely by Thursday. In total, weekend delay made up approximately 9 percent of all district delay at 35 mph, lower than the statewide average. The day with the least amount of congestion was Sunday.

Table 5.1–2

DISTRICT 6 ANNUAL VEHICLE HOURS OF DELAY BY DAY OF WEEK

Day	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
Sunday	30,000	4.1	252,000	7.1
Monday	111,000	15.5	552,000	15.6
Tuesday	150,000	20.8	607,000	17.1
Wednesday	137,000	19.0	597,000	16.9
Thursday	144,000	20.0	615,000	17.4
Friday	112,000	15.6	609,000	17.2
Saturday	36,000	5.0	305,000	8.6
Total	720,000	100.0	3,537,000	100.0

Table 5.1–3 lists the District 6 annual delay by time of day, looking at weekdays only. Differing from the statewide average, the most congested weekday period in the district in 2009 at the 35-mph threshold was the night off-peak period from 7:00 p.m. to 5:59 a.m. The midday period and evening peak period had more delay than the morning peak period. District 6 had relatively low levels of total delay compared with more urban, populous districts.

Table 5.1–3

DISTRICT 6 ANNUAL VEHICLE HOURS OF DELAY BY WEEKDAY TIME OF DAY

Time	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
6:00 AM to 9:59 AM	83,000	12.7	526,000	17.7
10:00 AM to 2:59 PM	163,000	25.0	855,000	28.7
3:00 PM to 6:59 PM	167,000	25.6	781,000	26.2
7:00 PM to 5:59 AM	240,000	36.8	818,000	27.4
All Weekdays	653,000	100.0	2,980,000	100.0

SECTION 5.2. DISTRICT 6 DISBENEFITS OF CONGESTION

In 2009, Californians in District 6 lost 720,000 vehicle hours because of congestion at the 35-mph threshold. District 6's congestion represents 0.9 percent of the statewide total.

5.2.1. Cost in Extra Fuel Burned

Californians in District 6 burned 1.2 million gallons of extra fuel during 2009 because of congestion at the 35-mph threshold, which produced costs for motorists of $3.7 million.

5.2.2. Cost in Time Lost

The cost of lost time (opportunity cost in terms of wages and salaries) caused by sub-35-mph congestion in District 6 was $11.4 million for 2009, or $31,000 a day.

5.2.3. Cost in Vehicle Emissions

The estimated delay at 35 mph created excess fuel consumption in District 6 that added 12,000 tons of CO_2 emissions into the air, compared with what would have been emitted at free-flow speeds.

SECTION 5.3. DISTRICT 6 LOST PRODUCTIVITY

Table 5.3 lists the lost-lane-mile hours for District 6 by county, at both the 35-mph and 60-mph thresholds. Kern County accounted for almost half of the lost-lane-mile hours in the district in 2009.

Table 5.3

DISTRICT 6 LOST PRODUCTIVITY BY COUNTY

	Lost Productivity at 35 mph		Lost Productivity at 60 mph	
County	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours
Fresno	26,000	27.9	425,000	42.2
Kern	46,000	49.7	450,000	44.7
Madera	20,000	21.7	68,000	6.8
Tulare	<1,000	0.7	64,000	6.3
Total*	94,000	100.0	1,006,000	100.0

* The County figures for Lost Productivity do not sum exactly to the Total because of rounding to the nearest thousand.

SECTION 5.4. DISTRICT 6 BOTTLENECKS

Table 5.4 lists District 6's top ten freeway bottleneck locations in 2009, identified by county, route, and post mile. Each of these bottlenecks will be examined by the district to determine whether a plan can be implemented to alleviate the bottleneck in the future. A map of these top bottleneck locations can be found at the end of this chapter.

Explanation of Bottlenecks

The suspected causes of the bottlenecks listed in Table 5.4 are summarized here. The magnitude of delay experienced in District 6 was smaller than in districts with larger urbanized areas, such as District 4 and 7. The number of days in which these bottlenecks were active was also lower, meaning that some of these bottlenecks might not have been entirely related to recurrent congestion but might have had other nonrecurrent causes.

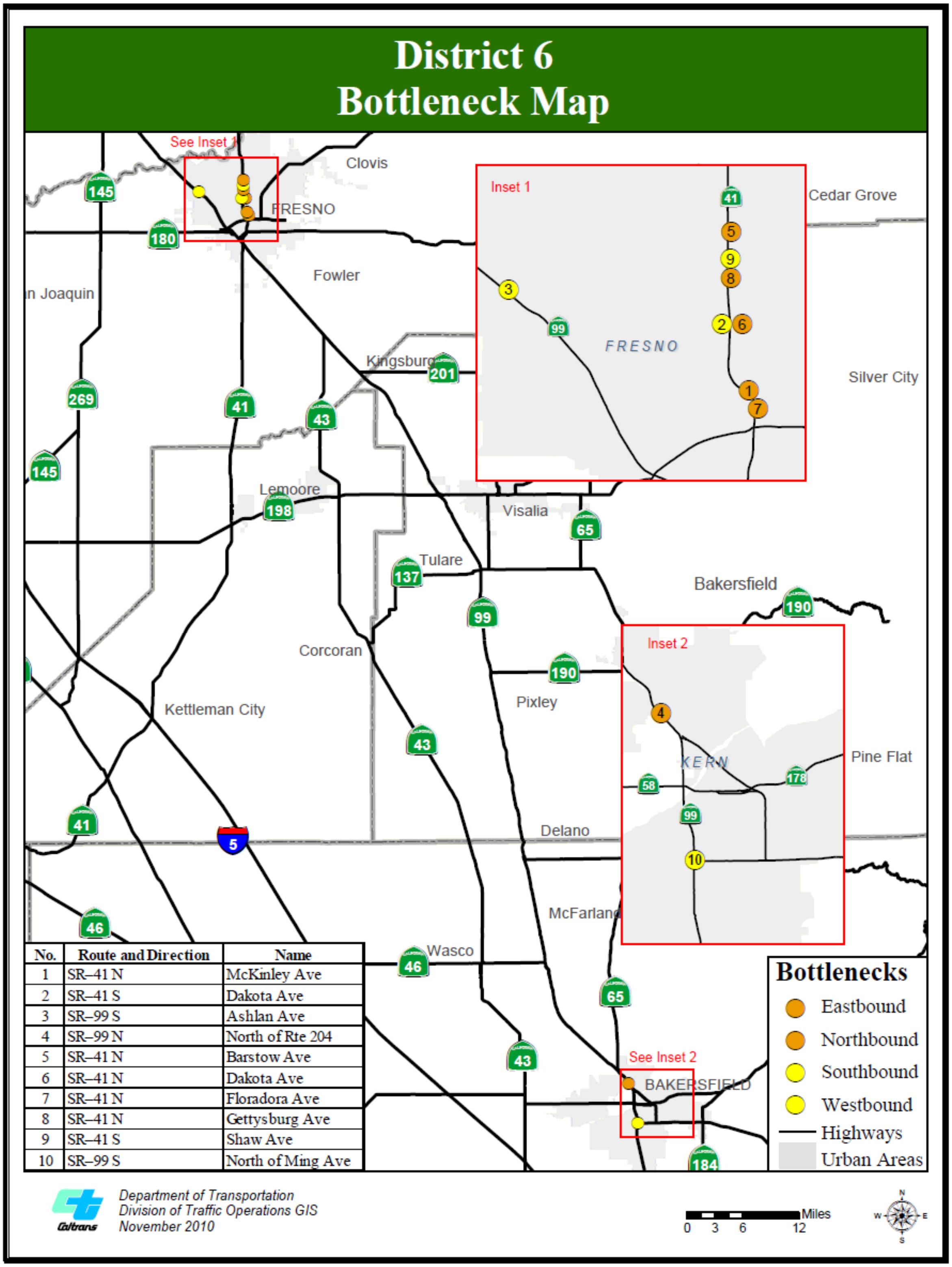
- The suspected cause of bottlenecks Nos. 1 and 7 on northbound SR–41 at McKinley Avenue and Floradora Avenue, respectively, is weaving traffic from the interchange with SR–180, a major east-west freeway in Fresno.
- The suspected cause of bottlenecks Nos. 2 and 9 on southbound SR–41 at Dakota Avenue and Shaw Avenue, respectively, is demand exceeding capacity.
- The suspected cause of bottlenecks Nos. 5, 6 and 8 on northbound SR–41 at Barstow Avenue, Dakota Avenue, and Gettysburg Avenue, respectively, is demand exceeding capacity.
- The suspected cause of bottleneck No. 3 on southbound SR–99 at Ashlan Avenue is merging traffic from the Ashlan Avenue on-ramp in combination with changes in the roadway horizontal alignment.
- The suspected cause of bottleneck No. 4 on northbound SR–99 between the SR–204 on-ramp and the Olive Avenue off-ramp is high traffic volumes exiting onto Olive Avenue, causing the off-ramp traffic to back up onto the freeway.
- The suspected cause of bottleneck No. 10 on southbound SR–99 north of Ming Avenue in Bakersfield is a lane drop that occurs near this location, where the mainline narrows from four lanes to three lanes.

Table 5.4

DISTRICT 6 BOTTLENECKS

No.	County	Route and Direction	Post Mile	Name	2009 AVHD (60 mph)
1	Fresno	SR–41 N	25.3405	McKinley Ave	18,000
2	Fresno	SR–41 S	26.951	Dakota Ave	4,000
3	Fresno	SR–99 S	26.961	Ashlan Ave	3,000
4	Kern	SR–99 N	27.952	North of Rte 204	2,000
5	Fresno	SR–41 N	28.98	Barstow Ave	2,000
6	Fresno	SR–41 N	26.95	Dakota Ave	2,000
7	Fresno	SR–41 N	24.97	Floradora Ave	2,000
8	Fresno	SR–41 N	27.98	Gettysburg Ave	2,000
9	Fresno	SR–41 S	28.395	Shaw Ave	1,000
10	Kern	SR–99 S	23.534	North of Ming Ave	1,000

SECTION 5.5. DISTRICT 6 BOTTLENECK MAP



No.	Route and Direction	Name
1	SR–41 N	McKinley Ave
2	SR–41 S	Dakota Ave
3	SR–99 S	Ashlan Ave
4	SR–99 N	North of Rte 204
5	SR–41 N	Barstow Ave
6	SR–41 N	Dakota Ave
7	SR–41 N	Floradora Ave
8	SR–41 N	Gettysburg Ave
9	SR–41 S	Shaw Ave
10	SR–99 S	North of Ming Ave

CHAPTER 6

DISTRICT 7: LOS ANGELES-VENTURA AREA

Caltrans District 7 is comprised of two counties, Los Angeles and Ventura.

SECTION 6.1. DISTRICT 7 ANNUAL VEHICLE HOURS OF DELAY

Table 6.1–1 lists the AVHD by county within District 7. Los Angeles County is the most populated county in California, and it had the highest urban freeway traffic congestion statewide in 2009.

Table 6.1–1

DISTRICT 7 ANNUAL VEHICLE HOURS OF DELAY BY COUNTY

County	2009 AVHD (35 mph)	Percent of District Total (35 mph)	2009 AVHD (60 mph)	Percent of District Total (60 mph)
Los Angeles	39,087,000	99.1	87,536,000	97.0
Ventura	354,000	0.9	2,707,000	3.0
Total	39,441,000	100.0	90,243,000	100.0

Table 6.1–2 lists the District 7 annual delay by day of week during 2009. For example, the "Sunday" listing of 1,501,000 represents the sum of the VHD in District 7 at the 35-mph threshold for all Sundays in 2009.

District 7 was consistent with the statewide trend of delay growing from Sunday to Friday, which was the most congested day on average. In total, weekend delay made up approximately 12 percent of all district delay at the 35-mph threshold. The day with the least amount of congestion was Sunday.

Table 6.1–2

DISTRICT 7 ANNUAL VEHICLE HOURS OF DELAY BY DAY OF WEEK

Day	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
Sunday	1,501,000	3.8	3,248,000	3.6
Monday	5,017,000	12.7	13,762,000	15.2
Tuesday	6,470,000	16.4	14,866,000	16.5
Wednesday	7,376,000	18.7	16,366,000	18.1
Thursday	7,703,000	19.5	16,502,000	18.3
Friday	8,254,000	20.9	18,680,000	20.7
Saturday	3,121,000	7.9	6,820,000	7.6
Total*	39,441,000	100.0	90,243,000	100.0

* The Day of Week figures to not sum exactly to the Total because of rounding to the nearest thousand.

Table 6.1–3 lists the District 7 annual delay by time of day, looking at weekdays only. The evening peak period from 3:00 p.m. to 6:59 p.m. was the most congested period on average in the district in 2009, having just under half of the district's delay. The morning peak period had approximately one quarter of the district's delay.

Table 6.1–3

DISTRICT 7 ANNUAL VEHICLE HOURS OF DELAY BY WEEKDAY TIME OF DAY

Time	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
6:00 AM to 9:59 AM	8,908,000	25.6	20,060,000	25.0
10:00 AM to 2:59 PM	5,690,000	16.3	15,902,000	19.8
3:00 PM to 6:59 PM	17,330,000	49.8	36,926,000	46.1
7:00 PM to 5:59 AM	2,891,000	8.3	7,287,000	9.1
All Weekdays	34,819,000	100.0	80,175,000	100.0

SECTION 6.2. DISTRICT 7 DISBENEFITS OF CONGESTION

In 2009, Californians in District 7 lost 39.4 million vehicle hours because of congestion at the 35-mph threshold. District 7's congestion represents 49.4 percent of the statewide total.

6.2.1. Cost in Extra Fuel Burned

Californians in District 7 burned 67.8 million gallons of extra fuel during 2009 because of congestion at the 35-mph threshold, which produced costs for motorists of $203.4 million.

6.2.2. Cost in Time Lost

The cost of lost time (opportunity cost in terms of wages and salaries) caused by sub-35-mph congestion in District 7 was $627.1 million for 2009, or $1.7 million a day.

6.2.3. Cost in Vehicle Emissions

The estimated delay at 35 mph created excess fuel consumption in District 7 that added 658,000 tons of CO_2 emissions into the air, compared with what would have been emitted at free-flow speeds.

SECTION 6.3. DISTRICT 7 LOST PRODUCTIVITY

Table 6.3 lists the lost-lane-mile hours for District 7 by county, at both the 35-mph and 60-mph thresholds.

Table 6.3

DISTRICT 7 LOST PRODUCTIVITY BY COUNTY

County	Lost Productivity at 35 mph		Lost Productivity at 60 mph	
	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours
Los Angeles	536,000	98.9	3,432,000	95.3
Ventura	6,000	1.1	169,000	4.7
Total	542,000	100.0	3,601,000	100.0

SECTION 6.4. DISTRICT 7 BOTTLENECKS

Table 6.4 lists District 7's top twenty freeway bottleneck locations in 2009, identified by county, route, and post mile. Each of these bottlenecks will be examined by the district to determine whether a plan can be implemented to alleviate the bottleneck in the future. A map of these top bottleneck locations can be found at the end of this chapter.

Explanation of Bottlenecks

The suspected causes of the bottlenecks listed in Table 6.4 are summarized here. As it is the most populous district in the State and is densely populated, District 7 experienced bottlenecks with the highest delay figures in the State. The number of days in which these bottlenecks were active was also high compared with other districts, which indicates that these bottlenecks were related to recurrent congestion and influenced by incidents.

- The suspected cause of bottlenecks Nos. 1 and 10 is the merging of vehicles from one facility to another. For example, at the Dodger Stadium bottleneck, traffic from multiple lanes of northbound I–110 attempts to merge onto northbound I–5 through a tight connector.

- The suspected cause of bottlenecks Nos. 2, 5, 14, and 17 is traffic merging onto the facility from the on-ramp, creating a situation where demand exceeds capacity. For example, at the Rose Hill bottleneck on southbound I–605, traffic merges from the Rose Hill on-ramp to the main line.

- The suspected causes of bottlenecks Nos. 3, 7, 8, 11, and 15 are lane drops. For example, at the Paramount bottleneck on eastbound SR–60, the number of lanes drops from five to four.

- The suspected cause of bottlenecks Nos. 6, 9, and 19 is a change in the roadway geometry combined with a high number of trucks on the facility. For example, at the Moraga bottleneck on northbound I–405, there is an upgrade topography combined with high truck volumes.

- The suspected causes of bottlenecks Nos. 4, 12, 13, 18, and 20 are lane drops combined with demand exceeding capacity, usually because of merging traffic from on-ramps. For example, at the eastbound I–10 bottleneck at Lark Ellen, demand exceeds capacity during the afternoon peak period where the number of lanes drops from five to four.

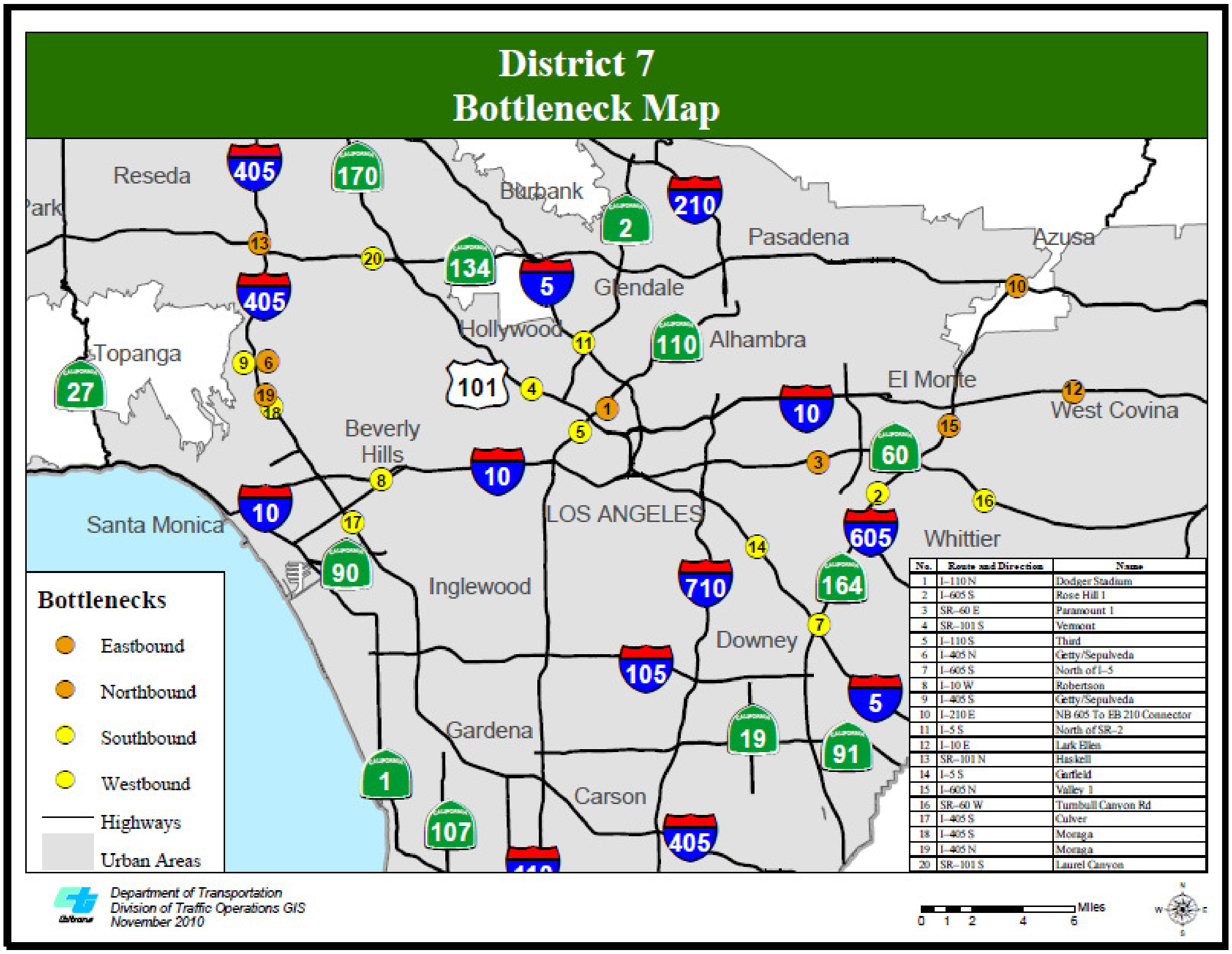
- The suspected cause of bottleneck No. 16 is a lane drop combined with high truck volumes.

Table 6.4

DISTRICT 7 BOTTLENECKS

No.	County	Route and Direction	Post Mile	Name	2009 AVHD (60 mph)
1	Los Angeles	I–110 N	24.46	Dodger Stadium	957,000
2	Los Angeles	I–605 S	R15.48	Rose Hill 1	946,000
3	Los Angeles	SR–60 E	R7.74	Paramount 1	764,000
4	Los Angeles	SR–101 S	4.2	Vermont	626,000
5	Los Angeles	I–110 S	23.05	Third	619,000
6	Los Angeles	I–405 N	34.71	Getty/Sepulveda	580,000
7	Los Angeles	I–605 S	R9.75	North of I–5	551,000
8	Los Angeles	I–10 W	R7.81	Robertson	488,000
9	Los Angeles	I–405 S	34.73	Getty/Sepulveda	428,000
10	Los Angeles	I–210 E	R36.6	NB 605 To EB 210 Connector	411,000
11	Los Angeles	I–5 S	22.76	North of SR–2	403,000
12	Los Angeles	I–10 E	35.9	Lark Ellen	383,000
13	Los Angeles	SR–101 N	17.59	Haskell	374,000
14	Los Angeles	I–5 S	10.76	Garfield	372,000
15	Los Angeles	I–605 N	R19.365	Valley 1	370,000
16	Los Angeles	SR–60 W	14.98	Turnbull Canyon Rd	370,000
17	Los Angeles	I–405 S	27.35	Culver	366,000
18	Los Angeles	I–405 S	33.42	Moraga	354,000
19	Los Angeles	I–405 N	33.42	Moraga	347,000
20	Los Angeles	SR–101 S	12.75	Laurel Canyon	342,000

SECTION 6.5. DISTRICT 7 BOTTLENECK MAP



No.	Route and Direction	Name
1	I–110 N	Dodger Stadium
2	I–605 S	Rose Hill 1
3	SR–60 E	Paramount 1
4	SR–101 S	Vermont
5	I–110 S	Third
6	I–405 N	Getty/Sepulveda
7	I–605 S	North of I–5
8	I–10 W	Robertson
9	I–405 S	Getty/Sepulveda
10	I–210 E	NB 605 To EB 210 Connector
11	I–5 S	North of SR–2
12	I–10 E	Lark Ellen
13	SR–101 N	Haskell
14	I–5 S	Garfield
15	I–605 N	Valley 1
16	SR–60 W	Turnbull Canyon Rd
17	I–405 S	Culver
18	I–405 S	Moraga
19	I–405 N	Moraga
20	SR–101 S	Laurel Canyon

CHAPTER 7

DISTRICT 8: SAN BERNARDINO-RIVERSIDE AREA

Caltrans District 8 is comprised of two counties, Riverside and San Bernardino.

SECTION 7.1. DISTRICT 8 ANNUAL VEHICLE HOURS OF DELAY

Table 7.1–1 lists the AVHD by county within District 8. Congestion was heaviest in Riverside County, nearly double that of San Bernardino County. The commute from the residential areas of Riverside County into the employment areas of Los Angeles County and Orange County was heavier than the same commute from San Bernardino County, thus accounting for the higher congestion levels coming out of Riverside County.

Table 7.1–1

DISTRICT 8 ANNUAL VEHICLE HOURS OF DELAY BY COUNTY

County	2009 AVHD (35 mph)	Percent of District Total (35 mph)	2009 AVHD (60 mph)	Percent of District Total (60 mph)
Riverside	3,206,000	70.5	10,205,000	65.8
San Bernardino	1,341,000	29.5	5,294,000	34.2
Total	4,547,000	100.0	15,498,000*	100.0

* The County figures for AVHD at 60 mph do not sum exactly to the Total because of rounding to the nearest thousand.

Table 7.1–2 lists the District 8 annual delay by day of week during 2009. For example, the "Sunday" listing of 227,000 represents the sum of the VHD in District 8 at the 35-mph threshold for all Sundays in 2009.

Consistent with the statewide average, the most congested day of the week in the district in 2009 was Friday. Differing from the statewide trend, Thursday had lower congestion than Wednesday and Tuesday. In total, weekend delay made up approximately 14 percent of all district delay at the 35-mph threshold, slightly higher than the statewide average. The day with the least amount of congestion was Sunday.

Table 7.1–2

DISTRICT 8 ANNUAL VEHICLE HOURS OF DELAY BY DAY OF WEEK

Day	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
Sunday	227,000	5.0	1,001,000	6.5
Monday	609,000	13.4	2,538,000	16.4
Tuesday	712,000	15.7	2,322,000	15.0
Wednesday	800,000	17.6	2,597,000	16.8
Thursday	655,000	14.4	2,045,000	13.2
Friday	1,146,000	25.2	3,573,000	23.1
Saturday	400,000	8.8	1,423,000	9.2
Total*	4,547,000	100.0	15,498,000	100.0

* The Day of Week figures to not sum exactly to the Total because of rounding to the nearest thousand.

Table 7.1–3 lists the District 8 delay by time of day. The most congested weekday period in the district in 2009 was the evening peak period from 3:00 p.m. to 6:59 p.m., having approximately 40 percent of the total weekday delay. The morning peak period and day off-peak period had similar delay figures. The night off-peak period had the least amount of delay.

Table 7.1–3

DISTRICT 8 ANNUAL VEHICLE HOURS OF DELAY BY WEEKDAY TIME OF DAY

Time	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
6:00 AM to 9:59 AM	1,059,000	27.0	3,122,000	23.9
10:00 AM to 2:59 PM	823,000	21.0	3,292,000	25.2
3:00 PM to 6:59 PM	1,736,000	44.3	4,999,000	38.2
7:00 PM to 5:59 AM	304,000	7.8	1,660,000	12.7
All Weekdays	3,922,000	100.0	13,073,000	100.0

SECTION 7.2. DISTRICT 8 DISBENEFITS OF CONGESTION

In 2009, Californians in District 8 lost 4.5 million vehicle hours because of congestion at the 35-mph threshold. District 8's congestion represents 5.7 percent of the statewide total.

7.2.1. Cost in Extra Fuel Burned

Californians in District 8 burned 7.8 million gallons of extra fuel during 2009 because of congestion at the 35-mph threshold, which produced costs for motorists of $23.4 million.

7.2.2. Cost in Time Lost

The cost of lost time (opportunity cost in terms of wages and salaries) caused by sub-35-mph congestion in District 8 was $72.3 million for 2009, or $198,000 a day.

7.2.3. Cost in Vehicle Emissions

The estimated delay at 35 mph created excess fuel consumption in District 8 that added 76,000 tons of CO_2 emissions into the air, compared with what would have been emitted at free-flow speeds.

SECTION 7.3. DISTRICT 8 LOST PRODUCTIVITY

Table 7.3 lists the lost-lane-mile hours for District 8 by county, at both the 35-mph and 60-mph thresholds. Riverside County had approximately three-quarters of the lost-lane-mile hours at 35 mph in 2009, but the lost-lane-mile hours for both District 8 counties were almost equal at 60 mph.

Table 7.3

DISTRICT 8 LOST PRODUCTIVITY BY COUNTY

	Lost Productivity at 35 mph		**Lost Productivity at 60 mph**	
County	**Number of Lost-Lane-Mile Hours**	**Percent of District Lost-Lane-Mile Hours**	**Number of Lost-Lane-Mile Hours**	**Percent of District Lost-Lane-Mile Hours**
Riverside	46,000	74.6	444,000	52.7
San Bernardino	16,000	25.4	398,000	47.3
Total	62,000	100.0	841,000*	100.0

* The County figures for Lost Productivity at 60 mph do not sum exactly to the Total because of rounding to the nearest thousand.

SECTION 7.4. DISTRICT 8 BOTTLENECKS

Table 7.4 lists District 8's top twenty freeway bottleneck locations in 2009, identified by county, route, and post mile. Each of these bottlenecks will be examined by the district to determine whether a plan can be implemented to alleviate the bottleneck in the future. A map of these top bottleneck locations can be found at the end of this chapter.

Explanation of Bottlenecks

The suspected causes of the bottlenecks listed in Table 7.4 are summarized here. Many of the bottlenecks in District 8 were concentrated in Riverside County along SR–91, I–15 and I–215.

- The suspected causes of bottleneck No. 1 on SR–91 in Corona are traffic on the connectors to I–15 queuing onto SR–91 and heavy weaving from the Main Street on-ramp and the HOV lane egress.
- The suspected causes of bottleneck No. 2 on SR–91 in Riverside are two lane drops that begin just east of the SR–60/SR–91/I–215 interchange.
- The suspected causes of bottleneck No. 3 on SR–91 in Corona are heavy traffic volumes weaving and merging from the Lincoln Avenue on-ramp and the ingress/egress from the HOV lane.
- The suspected causes of bottleneck No. 4 on I–15 in San Bernardino County are a lane reduction on the connector to I–215 and merging traffic from I–215.
- The suspected cause of bottlenecks Nos. 5 and 19 on I–15 in Corona is heavy traffic from the connectors to the SR–91/I–15 interchange combined with merging and weaving from the Magnolia Avenue on-ramp.
- The suspected cause of bottleneck No. 6 on SR–91 is an HOV lane drop. There is a project planned to close the HOV gap from Adams Street to University Avenue that will begin construction in the last quarter of 2011.
- The suspected causes of bottlenecks Nos. 7, 10, 11 and 16, all in the same vicinity on SR–91, are heavy traffic volumes combined with weaving and merging traffic from the on-ramps.
- The suspected causes of bottlenecks Nos. 8 and 17 on I–215 in Moreno Valley are traffic weaving from the SR–60/I–215 connectors and merging from the Central/Watkins and Box Springs on-ramps.
- The suspected cause of bottleneck No. 9 on SR–91 in Corona is weaving traffic from the I–15 connectors combined with the merge from the McKinley Avenue on-ramp.
- The suspected cause of bottleneck No. 12 on I–215 in Riverside is merging and weaving from the Martin Luther King Boulevard on-ramp combined with an uphill grade that slows trucks.
- The suspected causes of bottleneck No. 13 on I–15 are a lane drop at Magnolia Avenue and merging traffic from the Ontario Avenue on-ramp.
- The suspected cause of bottleneck No. 14 on SR–60 in Riverside is heavy traffic from the connectors to the SR–60/SR–91/I–215 interchange combined with merging and weaving from the on-ramps.
- The suspected causes of bottleneck No. 15 on I–15 are heavy traffic and merges from the I–15/SR–60 interchange.

- The suspected cause of bottleneck No. 18 on SR–91 in Corona is heavy traffic volumes weaving and merging from the SR–71 connector combined with traffic merging from the Maple Avenue on-ramp.

- The suspected cause of bottleneck No. 20 on I–15 in Ontario is heavy traffic from the I–10/I–15 interchange connectors combined with weaving and merging from the 4th Street ramps.

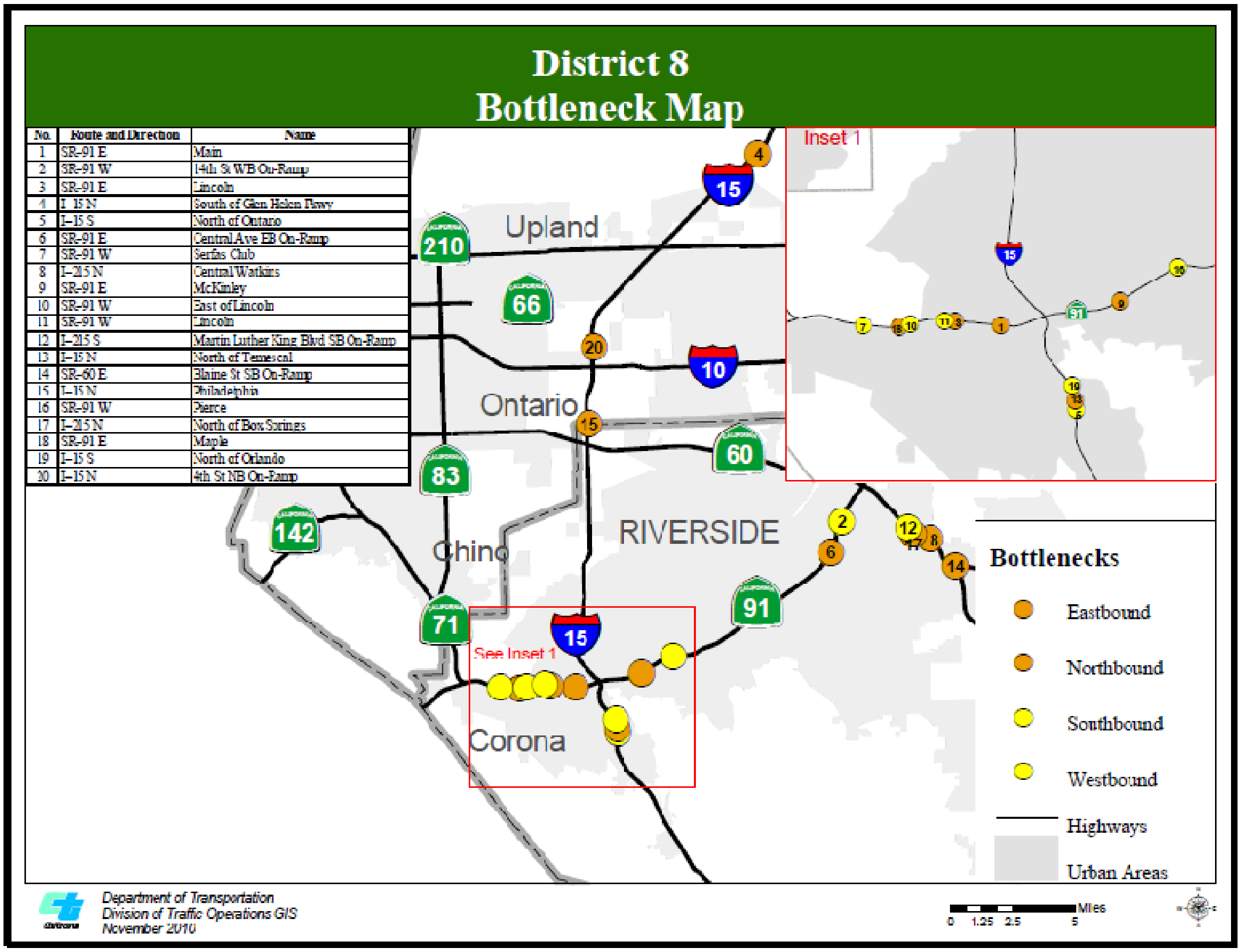
Beyond these twenty bottlenecks, the I–215/SR–60 southbound connector, eastbound I–10 from I–215 to I–210, westbound I–10 at Yucaipa Boulevard, westbound SR–91 at the Main Street/I–15 connector, eastbound SR–91 at the Riverside/Orange County line, westbound I–210 starting at I–10, and eastbound I–210 starting at I–215 experienced recurrent congestion caused by lane drops, weaving, merging, and heavy demand during peak periods.

Table 7.4

DISTRICT 8 BOTTLENECKS

No.	County	Route and Direction	Post Mile	Name	2009 AVHD (60 mph)
1	Riverside	SR–91 E	6.492	Main	199,000
2	Riverside	SR–91 W	19.899	14th St WB On-Ramp	186,000
3	Riverside	SR–91 E	5.504	Lincoln	153,000
4	San Bernardino	I–15 N	13.7	South of Glen Helen Pkwy	151,000
5	Riverside	I–15 S	39.239	North of Ontario	147,000
6	Riverside	SR–91 E	18.522	Central Ave EB On-Ramp	143,000
7	Riverside	SR–91 W	R3.555	Serfas Club	127,000
8	Riverside	I–215 N	39.643	Central/Watkins	121,000
9	Riverside	SR–91 E	9.23	McKinley	116,000
10	Riverside	SR–91 W	4.5	East of Lincoln	115,000
11	Riverside	SR–91 W	5.28	Lincoln	112,000
12	Riverside	I–215 S	40.76	Martin Luther King Blvd SB On-Ramp	77,000
13	Riverside	I–15 N	39.431	North of Temescal	77,000
14	Riverside	SR–60 E	R12.064	Blaine St SB On-Ramp	76,000
15	Riverside	I–15 N	52.27	Philadelphia	76,000
16	Riverside	SR–91 W	10.724	Pierce	73,000
17	Riverside	I–215 N	40.382	North of Box Springs	71,000
18	Riverside	SR–91 E	4.241	Maple	67,000
19	Riverside	I–15 S	39.77	North of Orlando	63,000
20	San Bernardino	I–15 N	109.97	4th St NB On-Ramp	62,000

SECTION 7.5. DISTRICT 8 BOTTLENECK MAP



No.	Route and Direction	Name
1	SR-91 E	Main
2	SR-91 W	14th St WB On-Ramp
3	SR-91 E	Lincoln
4	I-15 N	South of Glen Helen Pkwy
5	I-15 S	North of Ontario
6	SR-91 E	Central Ave EB On-Ramp
7	SR-91 W	Serfas Club
8	I-215 N	Central Watkins
9	SR-91 E	McKinley
10	SR-91 W	East of Lincoln
11	SR-91 W	Lincoln
12	I-215 S	Martin Luther King Blvd SB On-Ramp
13	I-15 N	North of Temescal
14	SR-60 E	Blaine St SB On-Ramp
15	I-15 N	Philadelphia
16	SR-91 W	Pierce
17	I-215 N	North of Box Springs
18	SR-91 E	Maple
19	I-15 S	North of Orlando
20	I-15 N	4th St NB On-Ramp

CHAPTER 8

DISTRICT 10: STOCKTON AREA

Caltrans District 10 is comprised of the following eight counties: Alpine, Amador, Calaveras, Mariposa, Merced, San Joaquin, Stanislaus, and Tuolumne. Caltrans has not installed any VDS in Alpine or Mariposa counties.

SECTION 8.1. DISTRICT 10 ANNUAL VEHICLE HOURS OF DELAY

Table 8.1–1 lists the AVHD by county within District 10. Most of the congestion in the district was created by commuting traffic between the San Joaquin Valley and the Bay Area along the I–205 corridor in San Joaquin County. Besides I–205, SR–99 and I–5 are traditionally the congested corridors within District 10. The delay figures for Merced County were higher than expected, and some of the detectors in this county will be investigated to determine whether they are configured correctly.

Table 8.1–1

DISTRICT 10 ANNUAL VEHICLE HOURS OF DELAY BY COUNTY

County	2009 AVHD (35 mph)	Percent of District Total (35 mph)	2009 AVHD (60 mph)	Percent of District Total (60 mph)
Amador	2,000	0.1	78,000	1.5
Calaveras	1,000	0.1	11,000	0.2
Merced	628,000	39.3	1,474,000	27.7
San Joaquin	685,000	42.9	2,803,000	52.6
Stanislaus	236,000	14.8	871,000	16.4
Tuolumne	44,000	2.8	88,000	1.7
Total	1,596,000	100.0	5,325,000	100.0

Table 8.1–2 lists the District 10 annual delay by day of week during 2009. For example, the "Sunday" listing of 135,000 represents the sum of the VHD in District 10 at the 35-mph threshold for all Sundays in 2009.

As it did statewide, the District 10 delay increased steadily from Sunday to Friday, which was the most congested day of the week on average. In total, weekend delay made up approximately 16 percent of all district delay at the 35-mph threshold, higher than the statewide average. The day with the least amount of congestion was Saturday.

Table 8.1–2

DISTRICT 10 ANNUAL VEHICLE HOURS OF DELAY BY DAY OF WEEK

Day	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
Sunday	135,000	8.5	263,000	4.9
Monday	196,000	12.3	970,000	18.2
Tuesday	207,000	13.0	817,000	15.3
Wednesday	279,000	17.5	910,000	17.1
Thursday	307,000	19.2	911,000	17.1
Friday	348,000	21.8	1,205,000	22.6
Saturday	125,000	7.8	249,000	4.7
Total	1,596,000*	100.0	5,325,000	100.0

* The Day of Week figures for AVHD at 35 mph do not sum exactly to the Total because of rounding to the nearest thousand.

Table 8.1–3 lists the District 10 annual delay by time of day, looking at weekdays only. The most congested weekday period in the district in 2009 was the midday period from 10:00 a.m. to 2:59 p.m., followed by the evening peak period.

Table 8.1–3

DISTRICT 10 ANNUAL VEHICLE HOURS OF DELAY BY WEEKDAY TIME OF DAY

Time	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
6:00 AM to 9:59 AM	213,000	15.9	843,000	17.5
10:00 AM to 2:59 PM	518,000	38.7	2,130,000	44.3
3:00 PM to 6:59 PM	327,000	24.5	1,126,000	23.4
7:00 PM to 5:59 AM	279,000	20.9	714,000	14.8
All Weekdays	1,337,000	100.0	4,813,000	100.0

SECTION 8.2. DISTRICT 10 DISBENEFITS OF CONGESTION

In 2009, Californians in District 10 lost 1.6 million vehicle hours because of congestion at the 35-mph threshold. District 10's congestion represents 2 percent of the statewide total.

8.2.1. Cost in Extra Fuel Burned

Californians in District 10 burned 2.7 million gallons of extra fuel during 2009 because of congestion at the 35-mph threshold, which produced costs for motorists of $8.2 million.

8.2.2. Cost in Time Lost

The cost of lost time (opportunity cost in terms of wages and salaries) caused by sub-35-mph congestion in District 10 was $25.4 million for 2009, or $70,000 a day.

8.2.3. Cost in Vehicle Emissions

The estimated delay at 35 mph created excess fuel consumption in District 10 that added 27,000 tons of CO_2 emissions into the air, compared with what would have been emitted at free-flow speeds.

SECTION 8.3. DISTRICT 10 LOST PRODUCTIVITY

Table 8.3 lists the lost-lane-mile hours for District 10 by county, at both the 35-mph and 60-mph thresholds. San Joaquin County had the most lost-lane-mile hours in the district in 2009. The lost-lane-mile hours for Merced County were higher than expected, and some of the detectors in this county will be investigated to determine whether they are configured correctly.

Table 8.3

DISTRICT 10 LOST PRODUCTIVITY BY COUNTY

County	Lost Productivity at 35 mph		Lost Productivity at 60 mph	
	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours
Amador	<1,000	1.1	69,000	4.7
Calaveras	<1,000	0.6	74,000	5.0
Merced	9,000	34.5	384,000	26.0
San Joaquin	12,000	47.1	744,000	50.3
Stanislaus	1,000	5.5	177,000	12.0
Tuolumne	3,000	11.0	31,000	2.1
Total*	25,000	100.0	1,478,000	100.0

* The Lost Productivity figures do not sum exactly to the Total because of rounding to the nearest thousand.

SECTION 8.4. DISTRICT 10 BOTTLENECKS

Table 8.4 lists District 10's top ten freeway bottleneck locations in 2009, identified by county, route, and post mile. Each of these bottlenecks will be examined by the district to determine whether a plan can be implemented to alleviate the bottleneck in the future. A map of these top bottleneck locations can be found at the end of this chapter.

Explanation of Bottlenecks

The suspected causes of the bottlenecks listed in Table 8.4 are summarized here. The magnitude of delay experienced in District 10 was smaller than in districts with larger urbanized areas, such as Districts 4 and 7. The number of days in which these bottlenecks were active was also lower, meaning that some of these bottlenecks might not have been entirely related to recurrent congestion but might have had other nonrecurrent causes.

- The suspected cause of bottleneck No. 1 on I–205 is traffic merging from the on-ramp.
- The suspected causes of bottleneck No. 2 on SR–99 are intermittent lane closures throughout 2009.
- The suspected cause of bottlenecks Nos. 3 and 6 is traffic merging from nearby on-ramps.
- The suspected cause of bottleneck No. 4 is a downstream lane drop. A programmed project would add an additional lane to this section of I–5.
- The suspected cause of bottleneck No. 5 on SR–12 is a downstream lane drop.
- The suspected cause of bottleneck No. 7 on SR–4 is that it is near the junction with I–5, in a high-traffic weaving area.
- The suspected cause of bottleneck No. 8 on SR–120 is traffic merging onto the nearby SR–99 off-ramp.
- The suspected cause of bottleneck No. 9 on SR–12 is a downstream signal.
- The suspected cause of bottleneck No. 10 on I–5 is high truck volume.

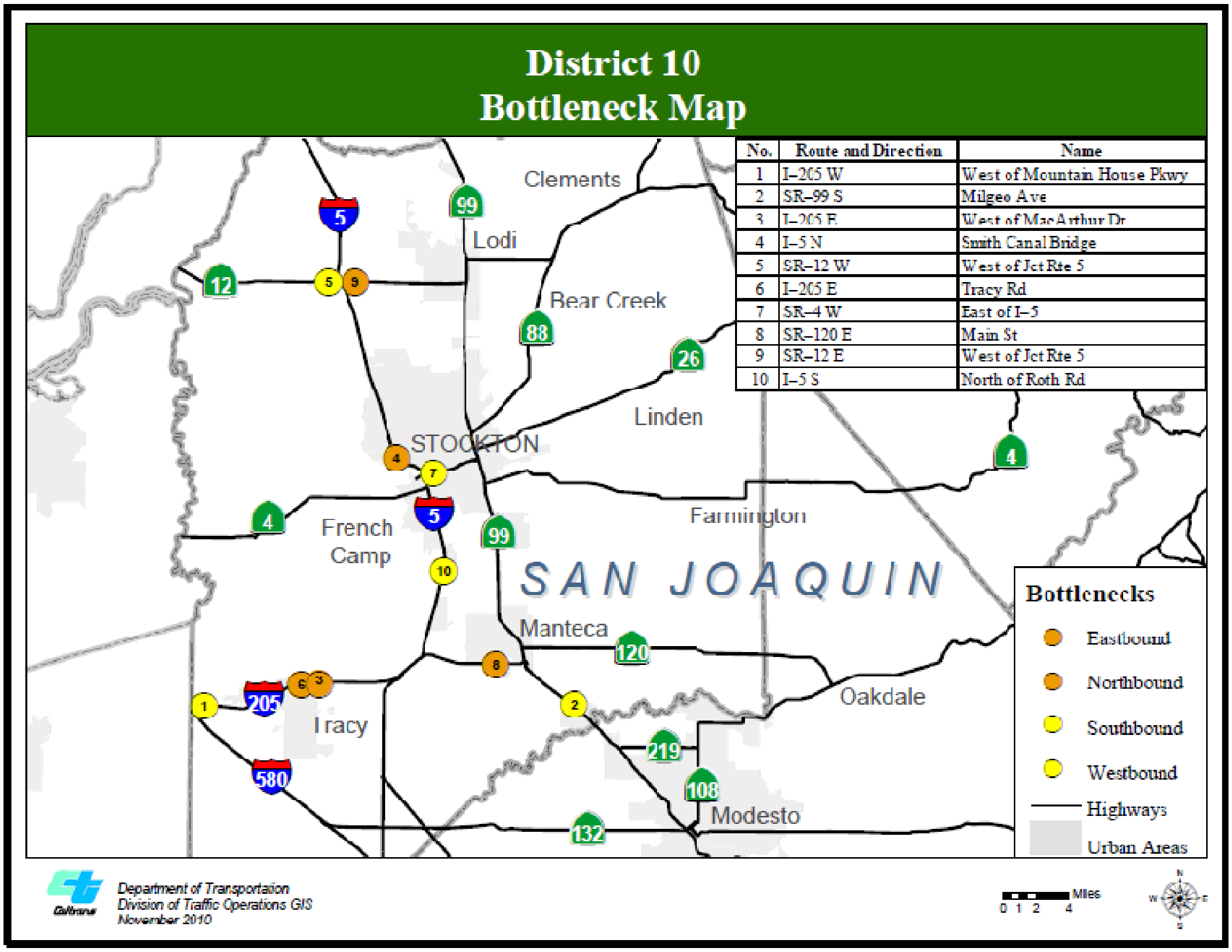
There are potential bottlenecks in Stanislaus County on SR–99 at locations in the city of Modesto between Pelandale Avenue and Hatch Road. There are plans to install additional automated detection on this corridor to capture this delay in the future.

Table 8.4

DISTRICT 10 BOTTLENECKS

No.	County	Route and Direction	Post Mile	Name	2009 AVHD (60 mph)
1	San Joaquin	I–205 W	0.761	West of Mountain House Pkwy	13,000
2	San Joaquin	SR–99 S	1.71	Milgeo Ave	8,000
3	San Joaquin	I–205 E	R8.058	West of MacArthur Dr	8,000
4	San Joaquin	I–5 N	28.364	Smith Canal Bridge	7,000
5	San Joaquin	SR–12 W	9.943	West of Jct Rte 5	5,000
6	San Joaquin	I–205 E	R6.966	Tracy Rd	5,000
7	San Joaquin	SR–4 W	R16.50	East of I–5	4,000
8	San Joaquin	SR–120 E	R5.05	Main St	4,000
9	San Joaquin	SR–12 E	9.856	West of Jct Rte 5	3,000
10	San Joaquin	I–5 S	R20.1	North of Roth Rd	3,000

SECTION 8.5. DISTRICT 10 BOTTLENECK MAP



CHAPTER 9

DISTRICT 11: SAN DIEGO AREA

Caltrans District 11 is comprised of two counties, Imperial and San Diego. Caltrans has not installed any VDS in Imperial County.

SECTION 9.1. DISTRICT 11 ANNUAL VEHICLE HOURS OF DELAY

Table 9.1–1 lists the AVHD by county within District 11. All of the recorded delay in the district in 2009 occurred in San Diego County.

Table 9.1–1

DISTRICT 11 ANNUAL VEHICLE HOURS OF DELAY BY COUNTY

County	2009 AVHD (35 mph)	Percent of District Total (35 mph)	2009 AVHD (60 mph)	Percent of District Total (60 mph)
San Diego	3,613,000	100.0	9,193,000	100.0
Total	3,613,000	100.0	9,193,000	100.0

Table 9.1–2 lists the District 11 annual delay by day of week during 2009. For example, the "Sunday" listing of 92,000 represents the sum of the VHD in District 11 at the 35-mph threshold for all Sundays in 2009.

As it did statewide, the District 11 level of delay increased steadily from Sunday to Friday, which was the most congested day of the week on average. In total, weekend delay made up approximately 8 percent of all district delay, lower than the statewide average. The day with the least amount of congestion was Sunday.

Table 9.1–2

DISTRICT 11 ANNUAL VEHICLE HOURS OF DELAY BY DAY OF WEEK

Day	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
Sunday	92,000	2.5	304,000	3.3
Monday	384,000	10.6	1,337,000	14.5
Tuesday	674,000	18.7	1,539,000	16.7
Wednesday	694,000	19.2	1,652,000	18.0
Thursday	764,000	21.1	1,771,000	19.3
Friday	818,000	22.6	2,087,000	22.7
Saturday	187,000	5.2	503,000	5.5
Total	3,613,000	100.0	9,193,000	100.0

Table 9.1–3 lists the District 11 annual delay by time of day, looking at weekdays only. The most congested weekday period in the district in 2009 was the evening peak period from 3:00 p.m. to 6:59 p.m., having more than half of the total weekday delay. The morning peak period had approximately one quarter of the delay. The night off-peak period had the least amount of delay.

Table 9.1–3

DISTRICT 11 ANNUAL VEHICLE HOURS OF DELAY BY WEEKDAY TIME OF DAY

Time	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
6:00 AM to 9:59 AM	838,000	25.1	2,095,000	25.0
10:00 AM to 2:59 PM	379,000	11.4	1,461,000	17.4
3:00 PM to 6:59 PM	2,012,000	60.3	4,409,000	52.6
7:00 PM to 5:59 AM	105,000	3.1	421,000	5.0
All Weekdays	3,334,000	100.0	8,386,000	100.0

SECTION 9.2. DISTRICT 11 DISBENEFITS OF CONGESTION

In 2009, Californians in District 11 lost 3.6 million vehicle hours because of congestion at the 35-mph threshold. District 11's congestion represents 4.5 percent of the statewide total.

9.2.1. Cost in Extra Fuel Burned

Californians in District 11 burned 6.2 million gallons of extra fuel during 2009 because of congestion at the 35-mph threshold, which produced costs for motorists of $18.6 million.

9.2.2. Cost in Time Lost

The cost of lost time (opportunity cost in terms of wages and salaries) caused by sub-35-mph congestion in District 11 was $57.4 million for 2009, or $157,000 a day.

9.2.3. Cost in Vehicle Emissions

The estimated delay at 35 mph created excess fuel consumption in District 11 that added 60,000 tons of CO_2 emissions into the air, compared with what would have been emitted at free-flow speeds.

SECTION 9.3. DISTRICT 11 LOST PRODUCTIVITY

Table 9.3 lists the lost-lane-mile hours for District 11 by county, at both the 35–mph and 60–mph thresholds.

Table 9.3

DISTRICT 11 LOST PRODUCTIVITY BY COUNTY

County	Lost Productivity at 35 mph		Lost Productivity at 60 mph	
	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours	Number of Lost-Lane-Mile Hours	Percent of District Lost-Lane-Mile Hours
San Diego	46,000	100.0	454,000	100.0
Total	46,000	100.0	454,000	100.0

SECTION 9.4. DISTRICT 11 BOTTLENECKS

Table 9.4 lists District 11's top twenty freeway bottleneck locations in 2009, identified by county, route, and post mile. Each of these bottlenecks will be examined by the district to determine whether a plan can be implemented to alleviate the bottleneck in the future. A map of these top bottleneck locations can be found at the end of this chapter.

Explanation of Bottlenecks

The suspected causes of the bottlenecks listed in Table 9.4 are summarized here.

A suspected cause of delay in all of the bottleneck locations is high traffic demand during the peak periods. Additional suspected causes of delay and construction projects planned to improve these locations are listed below, as applicable.

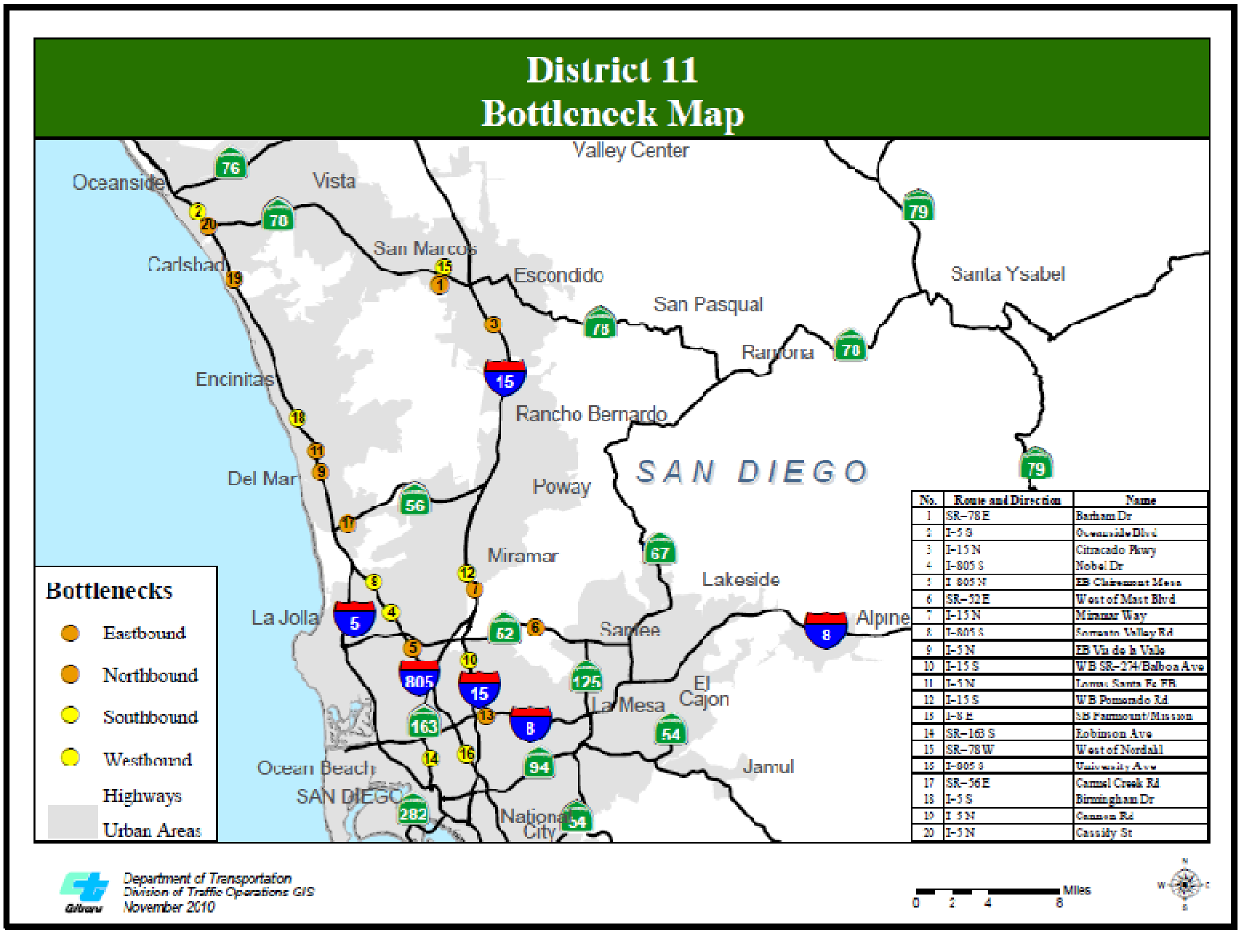
- A suspected cause of bottleneck No. 1 on SR–78 is traffic merging at the nearby Barham Drive/Woodland Park interchange. Projects to improve that interchange and construct auxiliary lanes are in the Project Approval and Environmental Documentation (PA & ED) phase.

- A suspected cause of bottleneck No. 2 on I–5 is traffic merging due to the nearby SR–78 connector. Ramp metering and managed lane projects are in construction in this area of I–5.

- A suspected cause of bottlenecks Nos. 3, 7, and 12 on I–15 is that managed lane construction activities were ongoing in this area during 2009.
- Bottlenecks Nos. 4 and 8 on I–805 are near each other and form a larger, extended area of delay. Interchange improvements and road widening projects are being studied for this area.
- A suspected cause of bottleneck No. 5 on I–805 is traffic merging due to the nearby SR–52 connector. Managed lanes are planned near this area.
- A suspected cause of bottleneck No. 6 on SR–52 is construction of an auxiliary lane in this area during 2009.
- A suspected cause of bottlenecks No. 9 on I–5 and No. 16 on I–805 is an uphill grade.
- For bottleneck No. 11 on I–5, an HOV lane project is in the construction phase.
- Suspected causes of bottleneck No. 13 on I–8 are traffic weaving and merging. A project to install traffic monitoring stations and changeable message signs in this area is in the PA & ED phase.
- Suspected causes of bottleneck No. 14 on SR–163 are an uphill grade and a lane drop from four to two lanes.
- A suspected cause of bottleneck No. 15 on SR–78 is merging traffic from the nearby junction with I–15. A project to construct auxiliary lanes in this area is in the PA & ED phase.
- A suspected cause of bottleneck No. 17 on SR–56 is merging traffic from I–15 and local roads. Construction of managed lanes or general-purpose lanes is under project study
- For bottlenecks Nos. 18, 19, and 20 on I–5, area projects to install ramp meters and HOV lanes are in the PA & ED phase and in the construction phase, respectively.

Table 9.4 **DISTRICT 11 BOTTLENECKS**					
No.	**County**	**Route and Direction**	**Post Mile**	**Name**	**2009 AVHD (60 mph)**
1	San Diego	SR–78 E	14.891	Barham Dr	315,000
2	San Diego	I–5 S	R52.354	Oceanside Blvd	140,000
3	San Diego	I–15 N	R28.888	Citracado Pkwy	133,000
4	San Diego	I–805 S	25	Nobel Dr	117,000
5	San Diego	I–805 N	22.63	EB Clairemont Mesa	90,000
6	San Diego	SR–52 E	11.55	West of Mast Blvd	88,000
7	San Diego	I–15 N	M13.446	Miramar Way	74,000
8	San Diego	I–805 S	26.954	Sorrento Valley Rd	71,000
9	San Diego	I–5 N	R36.23	EB Via de la Valle	70,000
10	San Diego	I–15 S	R9.301	WB SR–274/Balboa Ave	66,000
11	San Diego	I–5 N	R37.386	Lomas Santa Fe EB	65,000
12	San Diego	I–15 S	M14.358	WB Pomerado Rd	55,000
13	San Diego	I–8 E	6.262	SB Fairmount/Mission	55,000
14	San Diego	SR–163 S	2.49	Robinson Ave	52,000
15	San Diego	SR–78 W	14.82	West of Nordahl	50,000
16	San Diego	I–805 S	15.94	University Ave	46,000
17	San Diego	SR–56 E	T.89	Carmel Creek Rd	45,000
18	San Diego	I–5 S	R39.606	Birmingham Dr	43,000
19	San Diego	I–5 N	R48.138	Cannon Rd	43,000
20	San Diego	I–5 N	R51.436	Cassidy St	42,000

SECTION 9.5. DISTRICT 11 BOTTLENECK MAP



No.	Route and Direction	Name
1	SR-78 E	Barham Dr
2	I-5 S	Oceanside Blvd
3	I-15 N	Citracado Pkwy
4	I-805 S	Nobel Dr
5	I-805 N	EB Clairemont Mesa
6	SR-52 E	West of Mast Blvd
7	I-15 N	Miramar Way
8	I-805 S	Sorrento Valley Rd
9	I-5 N	EB Via de la Valle
10	I-15 S	WB SR-274/Balboa Ave
11	I-5 N	Lomas Santa Fe FR
12	I-15 S	WB Pomerado Rd
13	I-8 E	SB Fairmount/Mission
14	SR-163 S	Robinson Ave
15	SR-78 W	West of Nordahl
16	I-805 S	University Ave
17	SR-56 E	Carmel Creek Rd
18	I-5 S	Birmingham Dr
19	I-5 N	Cannon Rd
20	I-5 N	Cassidy St

CHAPTER 10

DISTRICT 12: ORANGE COUNTY

Caltrans District 12 is comprised only of Orange County.

SECTION 10.1. DISTRICT 12 ANNUAL VEHICLE HOURS OF DELAY

Table 10.1–1 lists the AVHD within District 12.

Table 10.1–1

DISTRICT 12 ANNUAL VEHICLE HOURS OF DELAY BY COUNTY

County	2009 AVHD (35 mph)	Percent of District Total (35 mph)	2009 AVHD (60 mph)	Percent of District Total (60 mph)
Orange	9,736,000	100.0	21,792,000	100.0
Total	9,736,000	100.0	21,792,000	100.0

Table 10.1–2 lists the District 12 annual delay by day of week during 2009. For example, the "Sunday" listing of 379,000 represents the sum of the VHD in District 12 at the 35-mph threshold for all Sundays in 2009.

As it did statewide, the District 12 level of delay increased steadily from Sunday to Friday, which was the most congested day of the week on average. In total, weekend delay made up approximately 12 percent of all district delay, similar to the statewide average. The day with the least amount of congestion was Sunday.

Table 10.1–2

DISTRICT 12 ANNUAL VEHICLE HOURS OF DELAY BY DAY OF WEEK

Day	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
Sunday	379,000	3.9	862,000	4.0
Monday	1,127,000	11.6	3,199,000	14.7
Tuesday	1,490,000	15.3	3,376,000	15.5
Wednesday	1,871,000	19.2	3,993,000	18.3
Thursday	1,969,000	20.2	4,155,000	19.1
Friday	2,113,000	21.7	4,506,000	20.7
Saturday	787,000	8.1	1,701,000	7.8
Total	9,736,000	100.0	21,792,000	100.0

Table 10.1–3 lists the District 12 delay by time of day, looking at weekdays only. The most congested weekday period in the district in 2009 was the evening peak period from 3:00 p.m. to 6:59 p.m., having approximately half of the total weekday delay. The morning peak period had almost one quarter of the delay. The day and night off-peak period had lower amounts of delay.

Table 10.1–3

DISTRICT 12 ANNUAL VEHICLE HOURS OF DELAY BY WEEKDAY TIME OF DAY

Time	2009 AVHD (35 mph)	Percent of Weekly Total (35 mph)	2009 AVHD (60 mph)	Percent of Weekly Total (60 mph)
6:00 AM to 9:59 AM	1,813,000	21.2	4,571,000	23.8
10:00 AM to 2:59 PM	1,357,000	15.8	3,825,000	19.9
3:00 PM to 6:59 PM	4,719,000	55.1	9,242,000	48.1
7:00 PM to 5:59 AM	680,000	7.9	1,590,000	8.3
All Weekdays	8,569,000	100.0	19,228,000	100.0

SECTION 10.2. DISTRICT 12 DISBENEFITS OF CONGESTION

In 2009, Californians in District 12 lost 9.7 million vehicle hours because of congestion at the 35-mph threshold. District 12's congestion represents 12.2 percent of the statewide total.

10.2.1. Cost in Extra Fuel Burned

Californians in District 12 burned 16.7 million gallons of extra fuel during 2009 because of congestion at the 35-mph threshold, which produced costs for motorists of $50.2 million.

10.2.2. Cost in Time Lost

The cost of lost time (opportunity cost in terms of wages and salaries) caused by sub-35-mph congestion in District 12 was $154.8 million for 2009, or $424,000 a day.

10.2.3. Cost in Vehicle Emissions

The estimated delay at 35 mph created excess fuel consumption in District 12 that added 162,000 tons of CO_2 emissions into the air, compared with what would have been emitted at free-flow speeds.

SECTION 10.3. DISTRICT 12 LOST PRODUCTIVITY

Table 10.3 lists the lost-lane-mile hours for District 12, at both the 35-mph and 60-mph thresholds.

Table 10.3

DISTRICT 12 LOST PRODUCTIVITY BY COUNTY

	Lost Productivity at 35 mph		**Lost Productivity at 60 mph**	
County	**Number of Lost-Lane-Mile Hours**	**Percent of District Lost-Lane-Mile Hours**	**Number of Lost-Lane-Mile Hours**	**Percent of District Lost-Lane-Mile Hours**
Orange	128,000	100.0	851,000	100.0
Total	128,000	100.0	851,000	100.0

SECTION 10.4. DISTRICT 12 BOTTLENECKS

Table 10.4 lists District 12's top twenty freeway bottleneck locations in 2009, identified by county, route, and post mile. Each of these bottlenecks will be examined by the district to determine whether a plan can be implemented to alleviate the bottleneck in the future. A map of these top bottleneck locations can be found at the end of this chapter.

Explanation of Bottlenecks

The suspected causes of the bottlenecks listed in Table 10.4 are summarized here. In Orange County, the major freeways are I–5, I–405, SR–22, SR–55, SR–57, and SR–91, and each of these routes appears on the district's top twenty bottlenecks list.

- The suspected cause of bottleneck No. 1 on I–405 in Fountain Valley is high traffic volume from the interchange with Brookhurst Street.
- The suspected cause of bottlenecks Nos. 2, 3, 4, and 18, all in the same vicinity on SR–91, is heavy traffic from East Santa Ana Canyon Road traveling onto the Gypsum Canyon Road on-ramp and merging with freeway traffic. In addition, a lane drop forces traffic to weave at this location.
- The suspected cause of bottleneck No. 5, not far from the end of the freeway on SR–55, is a downstream traffic signal at 19th Street and Newport Boulevard.

- The suspected cause of bottlenecks Nos. 6 and 19 on I–5 near 17th Street is a ramp configuration that results in weaving between on-ramp and off-ramp traffic.

- The suspected causes of bottleneck No. 7 on I–5 are two lane drops at Alicia Parkway and one lane drop at El Toro.

- The suspected cause of bottleneck No. 8 on SR–55, near the interchange with I–405 and the on-ramp from Dyer Road, is the accommodation of traffic from both northbound and southbound I–405 in the same area where additional traffic enters from Dyer Road and there is a lane drop.

- The suspected cause of bottleneck No. 9 on SR–57 is merging traffic from two on-ramps that are closely spaced.

- The suspected causes of bottlenecks Nos. 10, 11, and 17 are lane drops.

- The suspected causes of bottleneck No. 12 on I–405 are back-to-back merges.

- The suspected cause of bottleneck No. 13 on SR–91 is the nearby split between SR–55 and SR–91. At this location, the five-lane mainline splits into two lanes for SR–55 and three lanes for SR–91 and queuing from the SR–55 connector off-ramp blocks the SR–91 through-lanes when vehicles try to squeeze into the queued traffic.

- The suspected causes of bottleneck No. 14 on SR–57 are a short merge and a steep grade.

- The suspected causes of bottlenecks Nos. 15 and 16 are surges in demand from the nearby on-ramps.

- The suspected cause of bottleneck No. 20 on SR–91 is traffic entering the freeway at Weir Canyon Road. This traffic enters onto an auxiliary lane that ends at a weigh station.

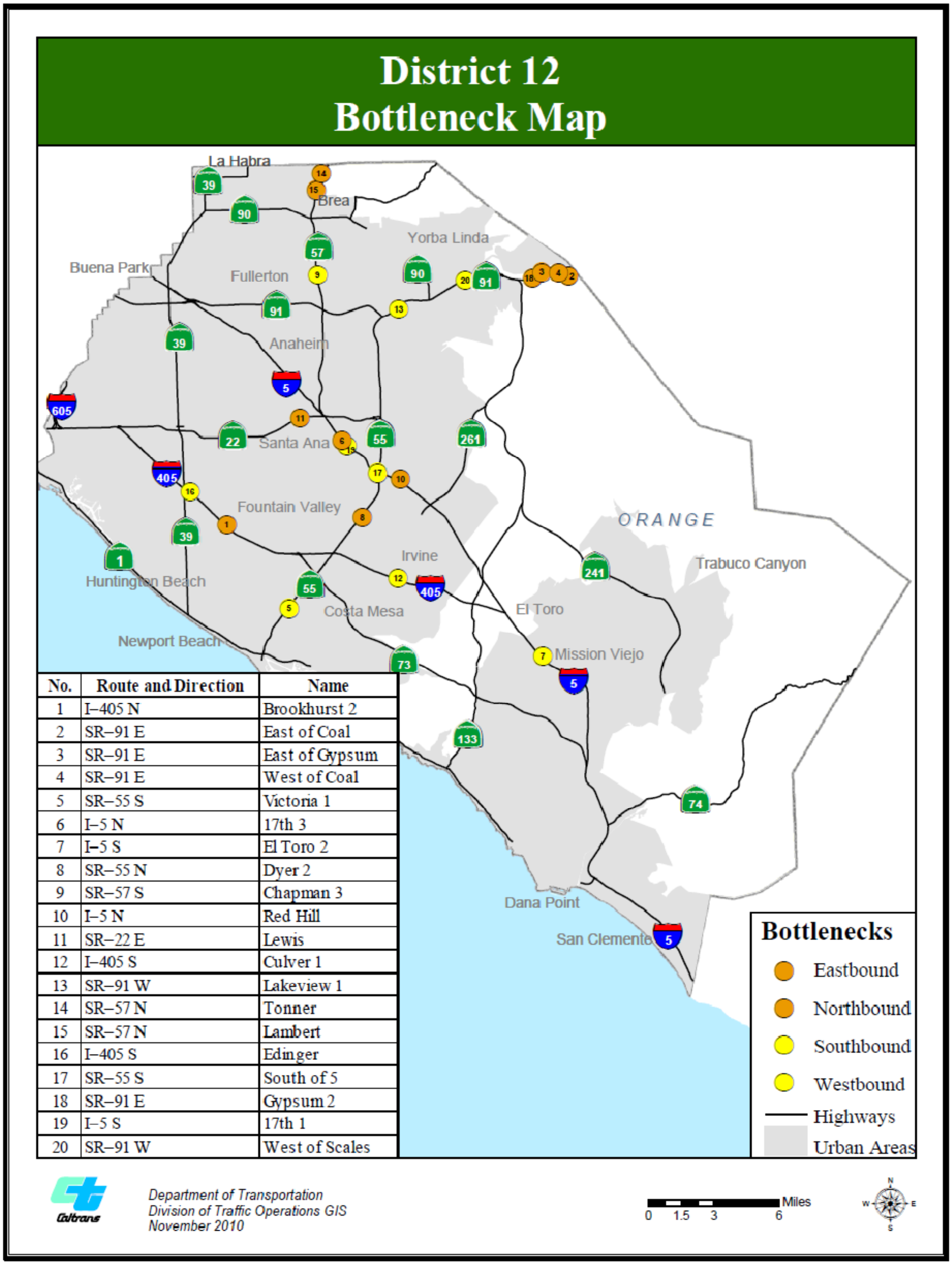
Beyond these twenty bottlenecks, other locations on SR–57, SR–22, and I–405 experienced recurrent congestion caused by lane drops, weaving, merging, and heavy demand during peak periods.

Table 10.4

DISTRICT 12 BOTTLENECKS

No.	County	Route and Direction	Post Mile	Name	2009 AVHD (60 mph)
1	Orange	I–405 N	13.97	Brookhurst 2	477,000
2	Orange	SR–91 E	R18.435	East of Coal	364,000
3	Orange	SR–91 E	R17.044	East of Gypsum	350,000
4	Orange	SR–91 E	18	West of Coal	322,000
5	Orange	SR–55 S	R2.77	Victoria 1	312,000
6	Orange	I–5 N	32.6	17th 3	260,000
7	Orange	I–5 S	18.7	El Toro 2	254,000
8	Orange	SR–55 N	R8.12	Dyer 2	234,000
9	Orange	SR–57 S	17.18	Chapman 3	201,000
10	Orange	I–5 N	29.24	Red Hill	195,000
11	Orange	SR–22 E	R9.44	Lewis	185,000
12	Orange	I–405 S	5.5	Culver 1	174,000
13	Orange	SR–91 W	R9.95	Lakeview 1	169,000
14	Orange	SR–57 N	22	Tonner	167,000
15	Orange	SR–57 N	21.16	Lambert	161,000
16	Orange	I–405 S	16.26	Edinger	145,000
17	Orange	SR–55 S	10.4	South of 5	134,000
18	Orange	SR–91 E	R16.6	Gypsum 2	127,000
19	Orange	I–5 S	32.25	17th 1	123,000
20	Orange	SR–91 W	R13.349	West of Scales	111,000

SECTION 10.5. DISTRICT 12 BOTTLENECK MAP



No.	Route and Direction	Name
1	I–405 N	Brookhurst 2
2	SR–91 E	East of Coal
3	SR–91 E	East of Gypsum
4	SR–91 E	West of Coal
5	SR–55 S	Victoria 1
6	I–5 N	17th 3
7	I–5 S	El Toro 2
8	SR–55 N	Dyer 2
9	SR–57 S	Chapman 3
10	I–5 N	Red Hill
11	SR–22 E	Lewis
12	I–405 S	Culver 1
13	SR–91 W	Lakeview 1
14	SR–57 N	Tonner
15	SR–57 N	Lambert
16	I–405 S	Edinger
17	SR–55 S	South of 5
18	SR–91 E	Gypsum 2
19	I–5 S	17th 1
20	SR–91 W	West of Scales

APPENDIX A

CALCULATIONS USED TO DETERMINE DISBENEFITS OF CONGESTION

Cost of lost time = total delay at 35 mph x $15.90 for cost of each hour of traveler's time. This figure represents the opportunity cost of travel time in terms of wages and salaries. An average vehicle occupancy of 1.15 is assumed in the $15.90 cost figure, as is a 9 percent truck volume and a 4 percent real discount rate. This figure comes from the Caltrans Division of Transportation Planning, Office of State Planning, Economic Analysis Branch.

Cost of lost time a day = cost of lost time (see above) ÷ 365. This figure thus represents the average for all days of the year, not just weekdays.

Wasted fuel (gallons) = total delay at 35 mph in VHD x 1.719 gallons for each vehicle hour of delay. This formula has been used in the HICOMP Annual Date Compilation since the 1990s.

Cost of extra fuel = wasted fuel (gallons) x $3.00 a gallon. This figure is based on the observed average unleaded gasoline price in 2009, provided by the Caltrans Economic Analysis Branch.

Emissions of CO_2 in tons (U.S., short) = wasted fuel (gallons) x 19.4 pounds of CO_2 produced for each gallon of burned gasoline ÷ 2,000 pounds a short ton. The formula of 19.4 pounds of CO_2 emissions from a gallon of gasoline is from the U.S. Environmental Protection Agency, "Emission Facts: Greenhouse Gas Emissions From a Typical Passenger Vehicle" (EPA420–F–05–004), February 2005, <http://www.epa.gov/oms/climate/420f05004.htm>, accessed on July 7, 2010.

APPENDIX B

GLOSSARY

Caltrans Performance Measurement System (CT PeMS): A traffic data collection, processing, and analysis tool for assessing the performance of the transportation system. The CT PeMS obtains 30-second detector count and occupancy data from Caltrans detectors in real-time from the district Transportation Management Centers (TMCs). The CT PeMS can be accessed at <http://pems.dot.ca.gov>.

Corridor System Management Plan (CSMP): A comprehensive, integrated management plan for increasing transportation options, decreasing congestion, and improving travel times in a transportation corridor. A CSMP includes all travel modes in a defined corridor—highways and freeways, parallel and connecting roadways, public transit (bus, bus rapid transit, light rail, and intercity rail), and bikeways—along with intelligent transportation technologies, which include ramp metering, coordinated traffic signals, changeable message signs for traveler information, incident management, bus/carpool lanes and car/vanpool programs, and transit strategies. A CSMP incorporates both capital and operational improvements. A corridor must have a CSMP to be eligible to receive funds from the Proposition 1B-funded Corridor Mobility Improvement Account and the Highway 99 Bond Programs.

County-route post mile: The mileage measure on a highway route from the southern to northern boundary of a county or from the western to eastern boundary, depending on the direction of the route. The post mile starts at zero at each county line.

Directional mile: A one-mile length of freeway has two directional miles, regardless of the number of lanes.

Floating vehicle: Either a fixed transmission sensor mounted in the engine compartment of a vehicle or a global positioning system device. The transmission sensor, or tachometer, counts the number of wheel rotations in 1 second and sends that data to a laptop computer. Software on the computer then translates this data into meaningful time, distance, and travel speed information. The global positioning system uses satellite technology to identify the location of the vehicle over time. Computer software identifies the freeway, direction of travel, and average speed of the vehicle.

Highway Congestion Monitoring Program (HICOMP): The MPR replaces the HICOMP Annual Data Compilation as the report that satisfies Caltrans' statutory obligation to report congestion data, as described in Government Code section 14032.6.

High-occupancy vehicle (HOV) lanes and managed lanes: Lanes on freeways restricted to vehicles carrying more than one person or to public transportation vehicles. Minimum vehicle occupancies can be either two or three people depending on the highway segment. These lanes are designed to encourage ridesharing and hybrid and electric car use. HOV lanes are a type of managed lane. Managed lanes can also include express lanes and toll lanes.

Integrated Corridor Management: Projects involve the installation of incident management and traffic management elements, such as changeable message signs, closed-circuit television cameras, ramp meters, variable advisory speed signs, and lane usage signs.

Nonrecurrent congestion: Congestion caused by events that occur irregularly, such as accidents, sporting events, maintenance, or construction.

Occupancy: In this report, when "occupancy" is mentioned as a data element collected by VDS, occupancy means the amount of time that a vehicle takes to pass over the detector. Occupancy is used to derive the speed of traffic. When discussing HOV lanes, occupancy means vehicle occupancy, or the number of people traveling in the vehicle.

Recurrent congestion: Congestion caused by traffic demand exceeding roadway capacity, regularly resulting in delay during peak periods.

Transportation Management Center Activity Log (TMCAL): A statewide data solution being implemented to track the activities performed by TMC operators, improving the capturing, archiving, and reporting of weather and incident data.

Vehicle detector stations (VDS): A logical grouping of automated detectors, usually referring to a set of detectors spanning a freeway at a particular location in one direction.

Vehicle hours of delay (VHD): The metric used to express the amount of additional time caused by congestion that vehicles spend on a section of road. This is the difference between the travel time at a threshold speed and the current speed (only calculated when the current speed is below the threshold speed). A threshold speed must be set to determine the VHD. In this report, 35 mph and 60 mph are the threshold speeds and delay is expressed in **annual VHD** (or **AVHD**)—the total delay for the year. The HICOMP Annual Data Compilation reported delay in **daily VHD** (or **DVHD**)—the daily average delay for the year, considering only weekday peak periods.

WeatherShare: A Caltrans research project to develop a single-source Web site that streamlines and integrates a variety of current available weather data from Caltrans Road Weather Information System sites, California Department of Water Resources stations, and other sources in the region, such as the Meteorological Assimilation Data Ingest System and MesoWest, which is easily accessible by incident responders and potentially by the traveling public.

APPENDIX C

HICOMP ANNUAL DATA COMPILATION

The table below lists the 2000–2008 DVHD figures found in the HICOMP Annual Data Compilation. Comparing the MPR 2009 findings to these figures is difficult because the data collection methodology changed in multiple ways. In an attempt to determine what the 2009 delay findings would have been had the HICOMP Annual Data Compilation methodology been employed, a subset of the VDS-collected data from 2009 was evaluated to approximate the old methodology. The resulting estimate of what the 2009 HICOMP Annual Data Compilation statewide delay figure would have been was 355,000 DVHD below 35 mph. To calculate this figure, the VDS-collected data were analyzed on a daily basis, looking only at Fridays (on average, the most congested day of the week) and only during the months of September and October (when most floating vehicle runs were conducted). The delay experienced on these days was averaged to arrive at DVHD. However, this DVHD figure is most likely below what the old methodology would have found for 2009 because the delay was calculated with data from all lanes (not one outside lane representing all lanes) and with the actual hourly vehicle flow (not the 2,000 to 2,200 VPHPL that were assumed in the old methodology).

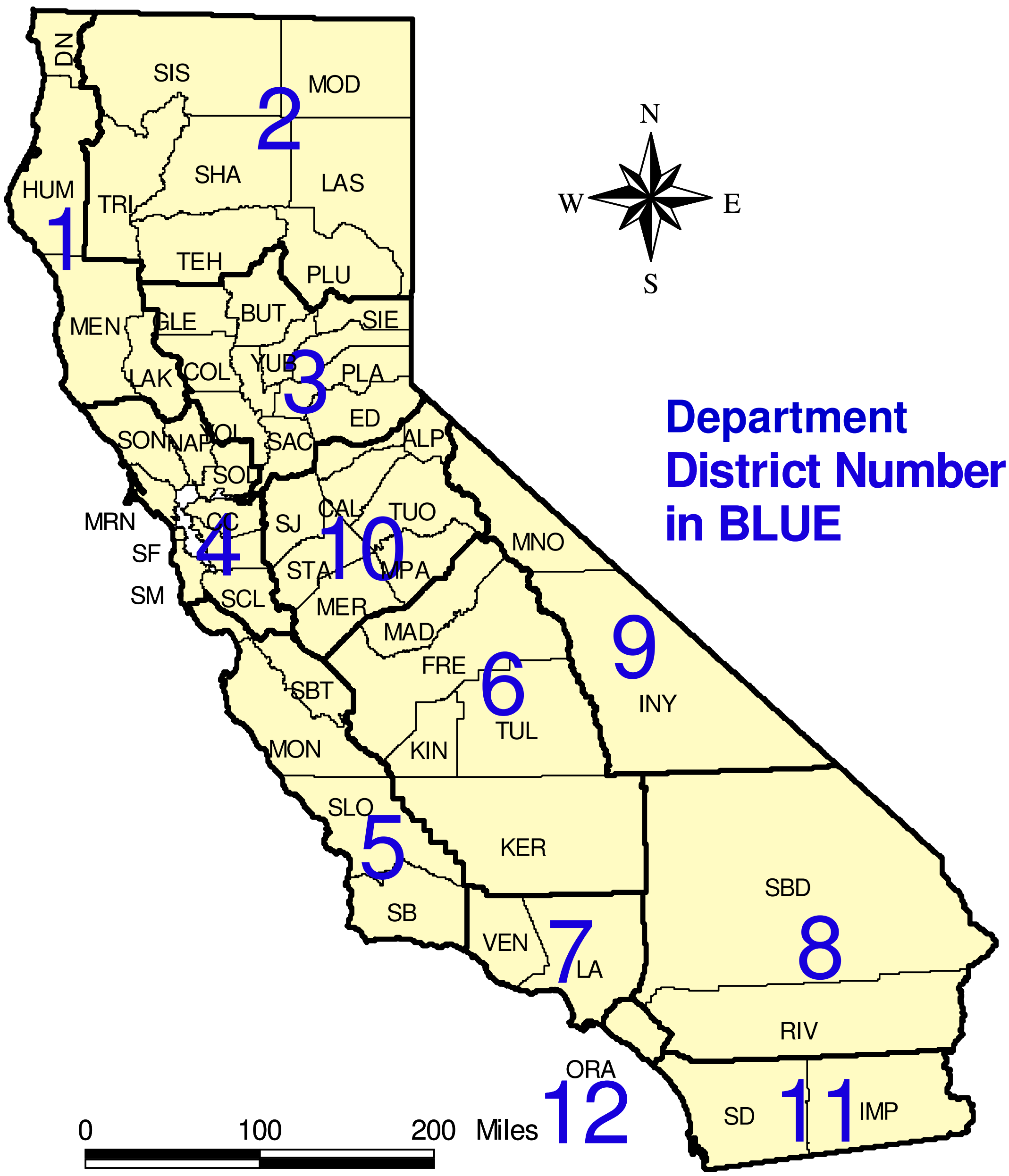
HICOMP ANNUAL DATA COMPILATION
DAILY VEHICLE HOURS OF DELAY BY DISTRICT, 2000–2008

District	2000	2001	2002	2003	2004	2005	2006	2007	2008
3	10,896	16,200	14,872	13,226	17,712	21,830	17,648	13,827	11,576
4	177,600	155,500	147,900	121,800	124,190	135,700	143,900	161,700	142,400
5	5,154	6,016	5,937	6,453	6,453	6,453	7,571	7,040	5,333
6	334	522	508	507	292	296	561	375	315
7	166,294	183,209	165,861	178,491	171,438	165,141	172,399	178,938	127,924
8	38,244	32,901	36,601	30,035	27,480	35,284	52,100	54,456	26,257
10	3,930	3,340	4,127	4,064	3,685	5,010	3,709	3,444	2,120
11	51,712	58,027	64,595	67,163	65,768	62,796	63,833	63,099	30,293
12	71,286	66,522	71,376	83,002	96,522	97,581	98,640	98,796	69,857
Total*	525,450	522,238	511,777	504,741	513,539	530,091	560,362	581,674	416,075

*District figures may not sum exactly to the Statewide totals because of rounding.

APPENDIX D

STATEWIDE MAP OF DISTRICTS



APPENDIX E

DISTRICT CONTACTS

District	Contact Person	Public Number	E-mail Address
3	Matt Taghipour	(916) 859–7950	matt_taghipour@dot.ca.gov
4	Ron Kyutoku	(510) 286–4640	ron_kyutoku@dot.ca.gov
5	Roger D. Barnes	(805) 748–2635	roger_d_barnes@dot.ca.gov
6	Albert Lee	(559) 488–4111	albert_lee@dot.ca.gov
7	Jamal Fakih	(213) 897–7612	jamal_l_fakih@dot.ca.gov
8	Maha Faqih	(909) 383–4914	maha_w_faqih@dot.ca.gov
10	Arlene Cordero	(209) 948–3869	arlene_cordero@dot.ca.gov
11	Shahin Sepassi	(858) 518–3912	shahin_sepassi@dot.ca.gov
12	Farid Nowshiravan	(949) 756–7639	farid_nowshiravan@dot.ca.gov
HQ	Jane Berner	(916) 654–2843	jane_berner@dot.ca.gov

For more information or additional copies of the "Mobility Performance Report 2009," please contact Jane Berner at (916) 654–2843 or by e-mail sent to <jane_berner@dot.ca.gov>.