I-215 Corridor System Management Plan

State of California
Department of Transportation
District 8

By

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Interstate 215

Corridor System Management Plan

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1 OVERVIEW

1.1.1 Definition of the I-215 CSMP Corridor

I-215 is a 54.5-mile long north-south Interstate Highway that traverses through the Counties of Riverside and San Bernardino. The southern terminus of I-215 is at the junction of I-15 in the City of Murrieta in southern Riverside County. It then runs north through Perris before joining SR-60 in Moreno Valley. I-215 splits from SR-60 at SR-91 in Riverside, where it then bisects a portion of the City of San Bernardino before terminating at I-15 near the community of Devore. **Figure 1-1** depicts the study area.

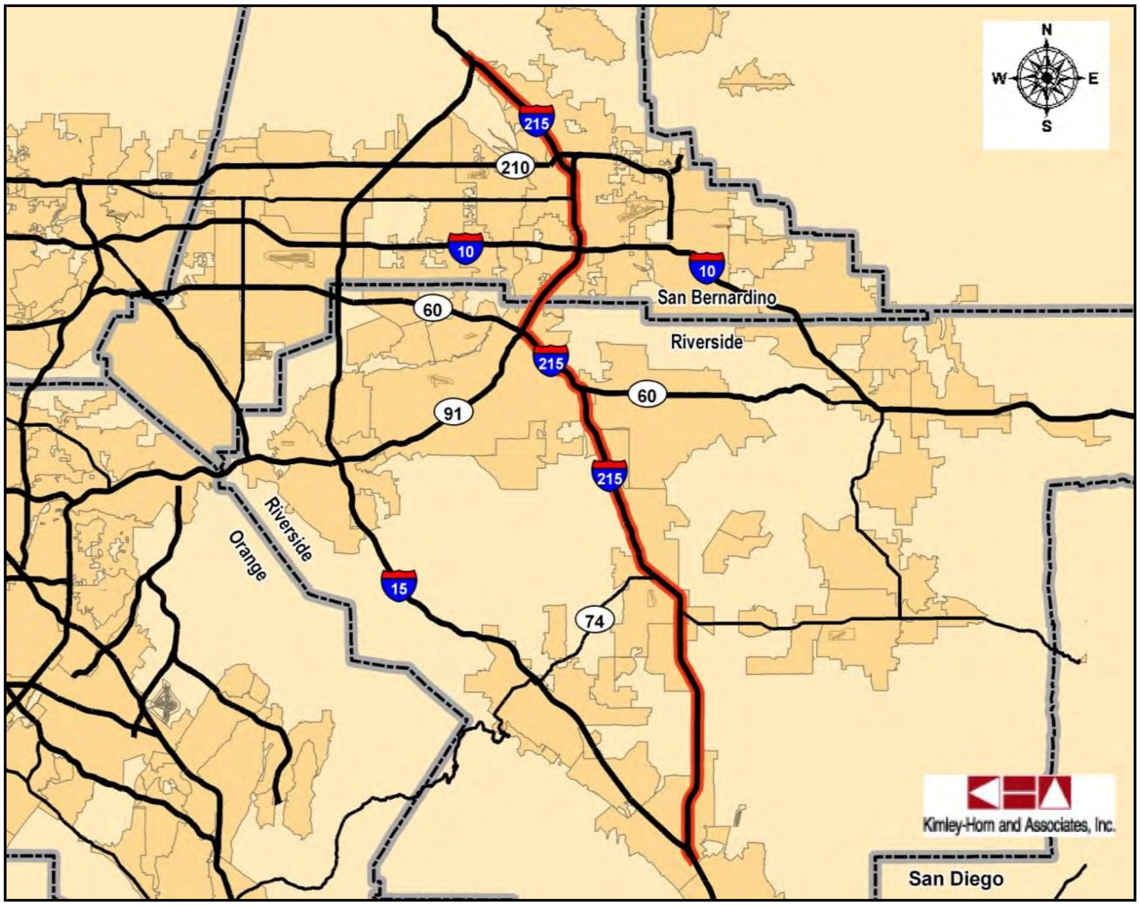

Figure 1-1 I-215 CSMP Study Area

This route is an alternative to I-15 for drivers traveling through the region, for example from Las Vegas or San Bernardino to the San Diego metropolitan area. The route also provides for intraregional mobility between the Cities of Temecula, Sun City, Perris, Moreno Valley, Riverside, Grand Terrace, Colton and San Bernardino. I-215 also provides access to California State University San Bernardino, University of California Riverside, Loma Linda Medical Center, San Bernardino International Airport, March Air Reserve Base, Glen Helen Regional Park, Riverside National Cemetery and major employment centers in both counties.

1.1.2 Purpose and Characteristics of a CSMP/CCPA

A Corridor System Management Plan (CSMP) is 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, intercity rail) and bikeways, along with intelligent transportation technologies (which could include ramp metering, coordinated traffic signals, changeable message signs for traveler information, incident management, bus/carpool lanes and carpool/vanpool programs, and transit strategies). A CSMP incorporates both capital and operational improvements. **Figure 1-2** depicts the concept of a CSMP.

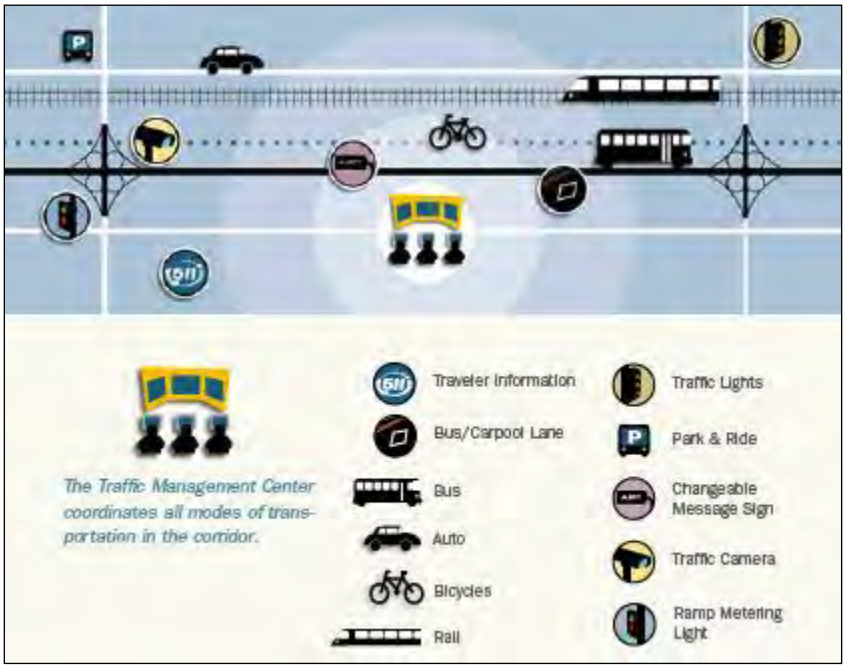

Figure 1-2 CSMP Concept
Source: Caltrans

The goal of a CSMP is to define how a transportation corridor is performing, understand why it is performing that way, and recommend system management strategies to address issues within the context of a long-range planning vision. Guided by the system management pyramid (**Figure 1-3**), a CSMP seeks to incorporate operational analysis into more traditional transportation planning processes at the corridor level. This is accomplished by conducting comprehensive performance assessments, analysis and evaluations leading to recommending system management strategies for the corridor.

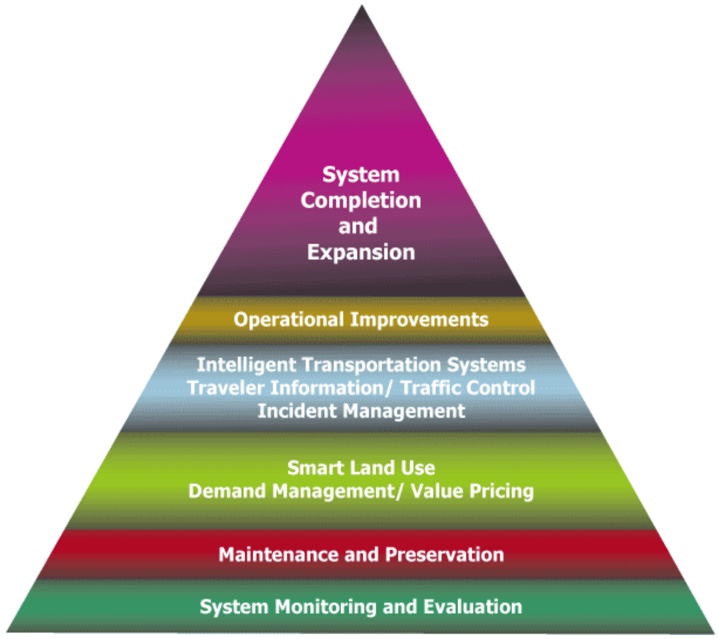

Figure 1-3 System Management Pyramid
Source: Caltrans

1.1.3 Project Approach

The first step in developing this CSMP was to prepare a comprehensive assessment of existing corridor characteristics and performance to identify where congestion, safety, or other mobility issues might be addressed through system management strategies. The second step was to apply a model system for forecasting travel flows for future years. The travel forecasting and simulation models were developed to identify the locations of future congestion, bottlenecks, and system inefficiency where system management strategies might be effective. The models were also designed to evaluate the potential benefits from system management strategies. The analysis for this CSMP is based on 2008 performance data.

1.1.4 Project Team

The CSMP was led by Caltrans District 8. Supporting Caltrans District 8 were the San Bernardino Associated Governments, San Bernardino County, the Riverside County Transportation Commission, Riverside County, the Southern California Association of Governments, and the following cities along the corridor: San Bernardino, Rialto, Colton, Grand Terrace, Moreno Valley, Perris, Menifee, and Murrieta.

1.1.5 Document Organization

The report is organized into five chapters: Chapter 2 provides a description of the existing (2008) characteristics of the I-215 corridor and any expected changes and planned improvements in the time frame of the CSMP (2020). Chapter 3 provides a summary of the baseline performance of the corridor for each year of analysis for 2008 and 2020. Chapter 4 identifies the set of system management improvement options that were considered and how they were grouped in the scenarios for testing. Chapter 5 presents the recommendations of the CSMP.

2 CORRIDOR DESCRIPTION

2.1.1 Corridor Roadway Facilities

As indicated in **Figure 2-1**, I-215 is currently a four-lane freeway (two lanes in each direction) from I-15 in Murrieta to "D" Street in Perris, and a six-lane freeway (three lanes in each direction) from "D" Street to its merge with SR-60 in eastern Riverside. Through the area where I-215 and SR-60 share the same roadway, the freeway has recently been expanded to include four general purpose lanes and one high occupancy vehicle (HOV) lane in each direction. From the SR-60/SR-91/I-215 interchange near downtown Riverside north to I-10, I-215 has three lanes in each direction. North of I-10 to Inland Center Drive, it currently has four lanes in each direction.

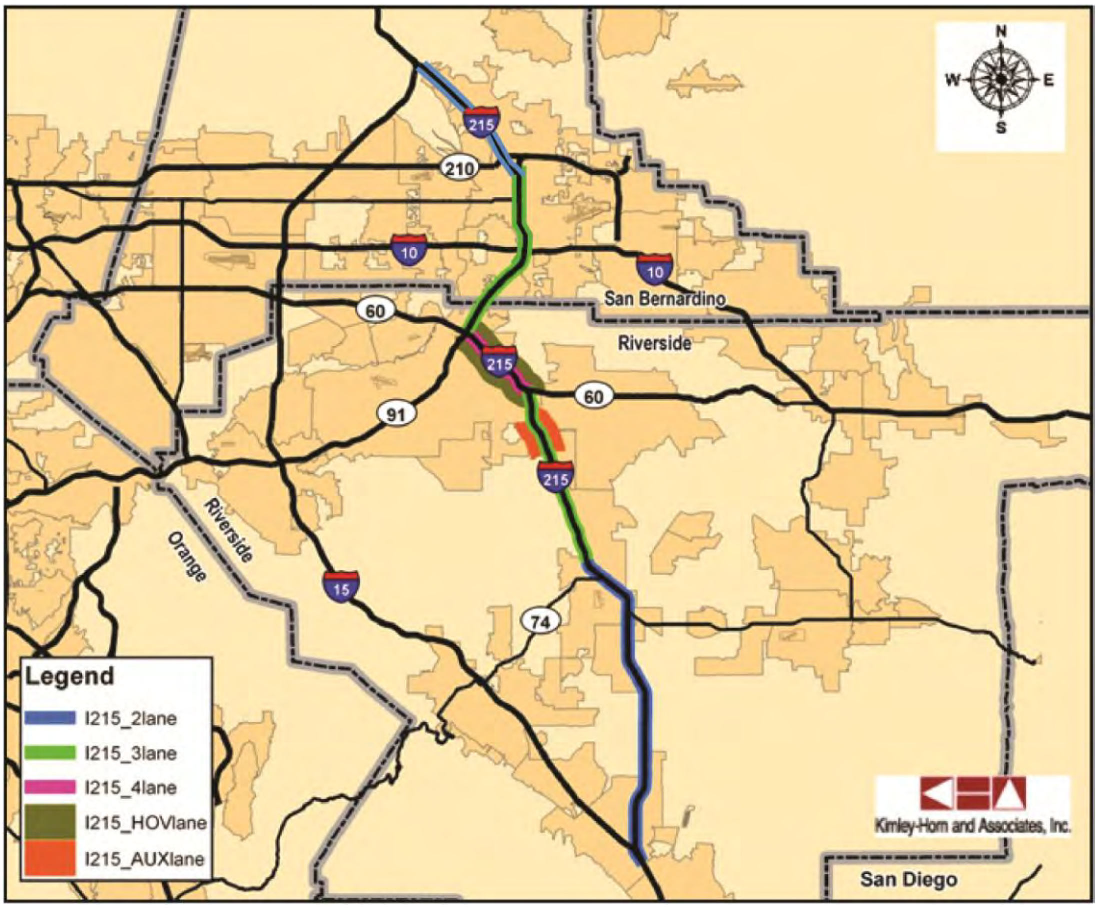

Figure 2-1 I-215 Lane Configuration

Figure 2-2 shows the Average Annual Daily Traffic (AADT) on I-215 in 2007 as reported by Caltrans, and the percentage of trucks along the corridor. The AADT in the corridor ranges from 84,000 cars just north of I-15 in Murrieta to 170,000 cars just north of where I-215 and SR-60 merge together in east Riverside. In Riverside County, the percentage of trucks ranges from 7.2% north of I-15 in Murrieta to a high of 14.5% just south of the merge with SR-60, and back to a low of 6.1% just south of the Riverside/San Bernardino county line. In San Bernardino, the observed truck percentages range from 7.2% to 9.6%.I-215 is part of the Surface Transportation Assistance Act (STAA) National Truck Network.

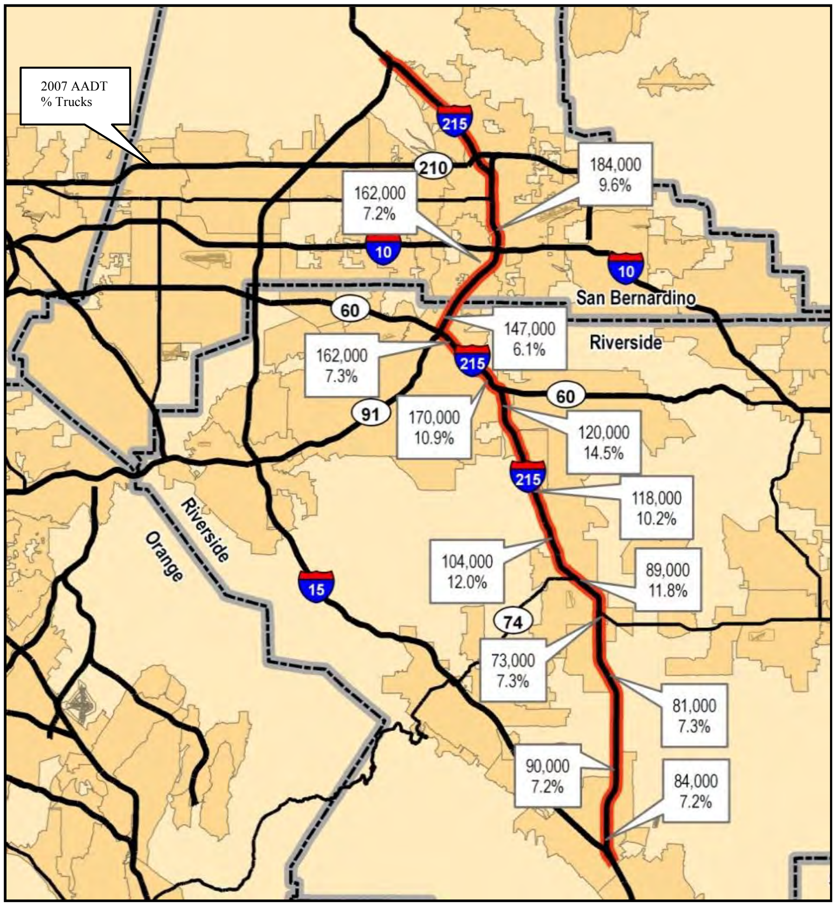

Figure 2-2 2007 Average Annual Daily Traffic (AADT) on I-215

2.1.2 Recent and Planned Roadway Improvements

Recently, the combined segment of I-215 and SR-60 (between the SR-60/SR-91/I-215 interchange near downtown Riverside and the SR-60/I-215 interchange in eastern Riverside) has been improved from a six-lane freeway to include six general purpose lanes and two HOV lanes. A southbound truck climbing lane and truck bypass was also completed. This project has included construction of two new freeway-to-freeway connectors at the SR-60/SR-91/I-215 interchange (northbound I-215 to westbound SR-91 and southbound I-215 to eastbound SR-60/I-215), as well as a truck bypass connector for eastbound trucks through the SR-60/I-215 interchange.

Planned roadway improvements within the corridor include:

- I-215 Widening - The entire project will expand and upgrade the I-215 from Interstate 10 to University Parkway. This estimated $800 million project has an expected completion date of 2013;
- I-215 BI County HOV Gap Closure - This 7.5 mile project extends from the Orange Show Road interchange in San Bernardino to the 60/91/215 interchange in Riverside. This project is due to be completed by late 2014;

- I-15/215 Interchange Reconfiguration - These improvements include the addition of one northbound lane and one southbound lane on I-15 between I-215 and Glen Helen Parkway, where the current freeway is three lanes in each direction;
- I-215 Barton Road Interchange, Grand Terrace;
- I-215 Mt Vernon Interchange, Colton; and
- I-215 Widening between Murrieta Hot Springs Road in Murrieta and Scott Road north of Murrieta. This is the southernmost section of RCTC's 29.25 mile freeway widening project between I-15 and State Route 60.

2.1.3 Current and Programmed Systems Management Strategies

2.1.4 Ramp Meters

Ramp metering has been initiated on I-215 with metering hardware being added to ramps whenever interchanges are reconstructed or ramps rebuilt. Ramp meters are located at the following on-ramps:

- Box Springs Road;
- Central Avenue/Watkins Drive;
- Martin Luther King Boulevard;
- University Parkway;
- Blaine Street; and
- Columbia Avenue.

2.1.5 Changeable Message Signs

There are two Changeable Message Signs (CMS) along the corridor. These are used to provide information to the traveling public. When the traveling public is made aware of the conditions of the corridor they may be able to plan their trip to avoid incidents or congestion. This may reduce demand on the corridor when it is running at capacity.

2.1.6 Closed Circuit Television Cameras

There are 16 Closed-Circuit Television (CCTV) camera locations along the corridor. These cameras can be used by Caltrans District 8 to assist with managing traffic within the corridor. Each of these cameras can be controlled by the district staff. In addition the cameras can be viewed by the public via the Caltrans District 8 website. **Figure 2-3** shows an image from the CCTV camera, as viewed by the Caltrans District 8 website.

Figure 2-3 Image from Caltrans District 8 CCTV Camera

2.1.7 Vehicle Detection Stations

There are 54 locations where there are Vehicle Detection Stations (VDS) along the corridor. These stations provide information on the performance of the corridor to operational staff and help them make appropriate improvements to the corridor. In addition, these VDSs are used to provide real-time speed information along the corridor.

2.1.8 HOV/Express Lanes

It is proposed that the entire length of the corridor have High Occupancy Vehicle (HOV) lanes implemented. There is a project underway to implement HOV lanes between the I-10 and the SR-60/SR-91 interchange. This project is due to be completed in 2015. There are currently no Express Lanes on I-215 and none are planned. **Figure 2-4** identifies all HOV and Express Lanes in Southern California including those on I-215.

2.1.9 Park and Ride

There are four major Park and Ride facilities located within the corridor. One is just south of Sun City in the southern most section of the corridor. Two are located near the SR-60/I-215 interchange and one is located at the SR-60/SR-91/I-215 interchange. While these are the major Park and Ride lots, other smaller lots are operated in the corridor. Local agencies also lease several lots for Park and Ride.

Figure 2-4 HOV/Express Lanes Map of Southern California

2.1.10 Traveler Information

The IE511.org service covers the area of the corridor. This provides real time traffic information, a bus and rail trip planner and helps coordinate a rideshare service.

The Caltrans District 8 website also offers a Real-time traffic information service. The service is located at http://www.dot.ca.gov/dist8/tmc/index.htm#. **Figure 2-5** shows an image of the website.

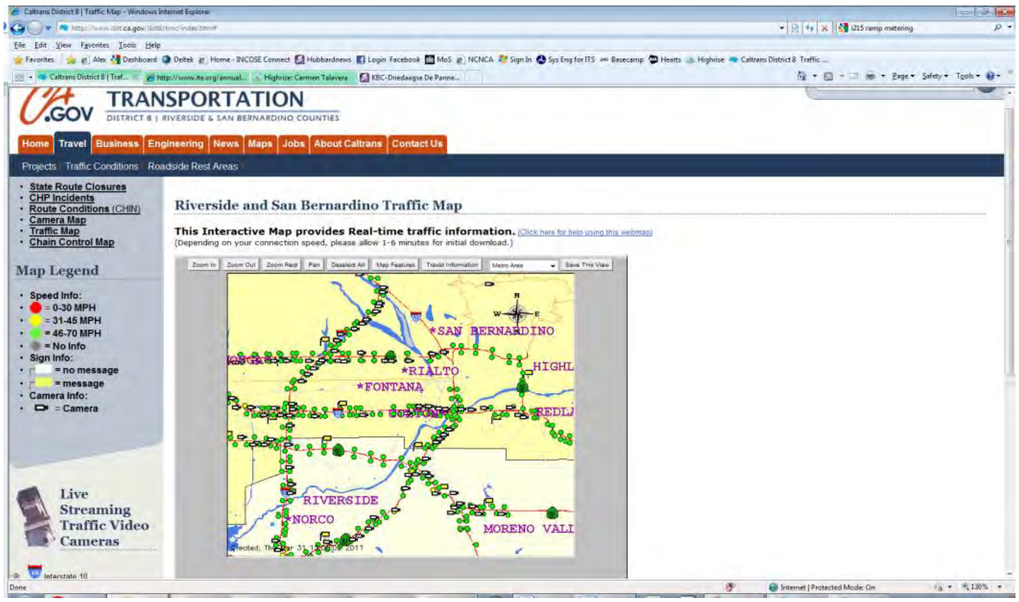

Figure 2-5 Caltrans District 8 Real-time traffic information website

2.1.11 Traffic Incident Management

Traffic Incident Management is a planned and coordinated program process to detect, respond to, and remove traffic incidents and restore traffic capacity as safely and quickly as possible. In the CSMP corridor, this coordinated process involves a number of public and private sector partners, including:

- Law Enforcement
- Fire and Rescue
- Emergency Medical Services
- Transportation
- Public Safety Communications
- Emergency Management
- Towing and Recovery
- Hazardous Materials Contractors
- Traffic Information Media

One of the key elements of the traffic incident management system on I-215 segment is the Freeway Service Patrol (FSP), which is jointly managed by Caltrans, the California Highway Patrol (CHP), SANBAG and RCTC. During commute periods tow trucks cover most of the I-215 corridor as well as other area freeways. The tow trucks rove specified beats and respond to collisions and vehicle breakdowns for emergency assistance and removal of vehicles to a safe place. The program is well received by the public as it acts to reduce non-recurring congestion as well as chances of further collisions.

2.1.12 Transit Facilities and Services

Within the corridor, the Riverside Transit Agency (RTA) operates bus service in Riverside County, Omnitrans operates bus service in San Bernardino County, and the Southern California Regional Rail Authority (SCRRA) operates a commuter rail service known as Metrolink. The RTA system map is shown in **Figure 2-6.** The Omnitrans system map is shown in **Figure 2-7.** The Metrolink system map is shown in **Figure 2-8.**

The two Metrolink commuter rail lines operating within the CSMP limits include the Riverside Line and the Inland Empire - Orange County Line. The Riverside Line has seven stops along its 59-mile route to Los Angeles. Twelve trains operate on the route on weekdays carrying 5,069 passengers per day. The Inland Empire – Orange County (IEOC) Line covers 100 miles of track and connects San Bernardino to Oceanside via Riverside and the SR-91 corridor. The 14 daily trains serve 14 stations and an average of 3,835 weekday riders.

In addition, a Metrolink extension from Riverside to the Perris Valley is planned. This service will use the existing rail line (the San Jacinto Branch Line) that is adjacent to I-215 from Central Avenue (north of the SR-60/215 interchange) all the way to "D" Street in Perris. The project's environmental document is currently out for public review. Service is projected to open in 2013.

By 2025 the proposed Metrolink extension is projected to serve 5,700 riders daily, saving them an estimated 3,800 hours of travel time per day (Source: SCRRA).

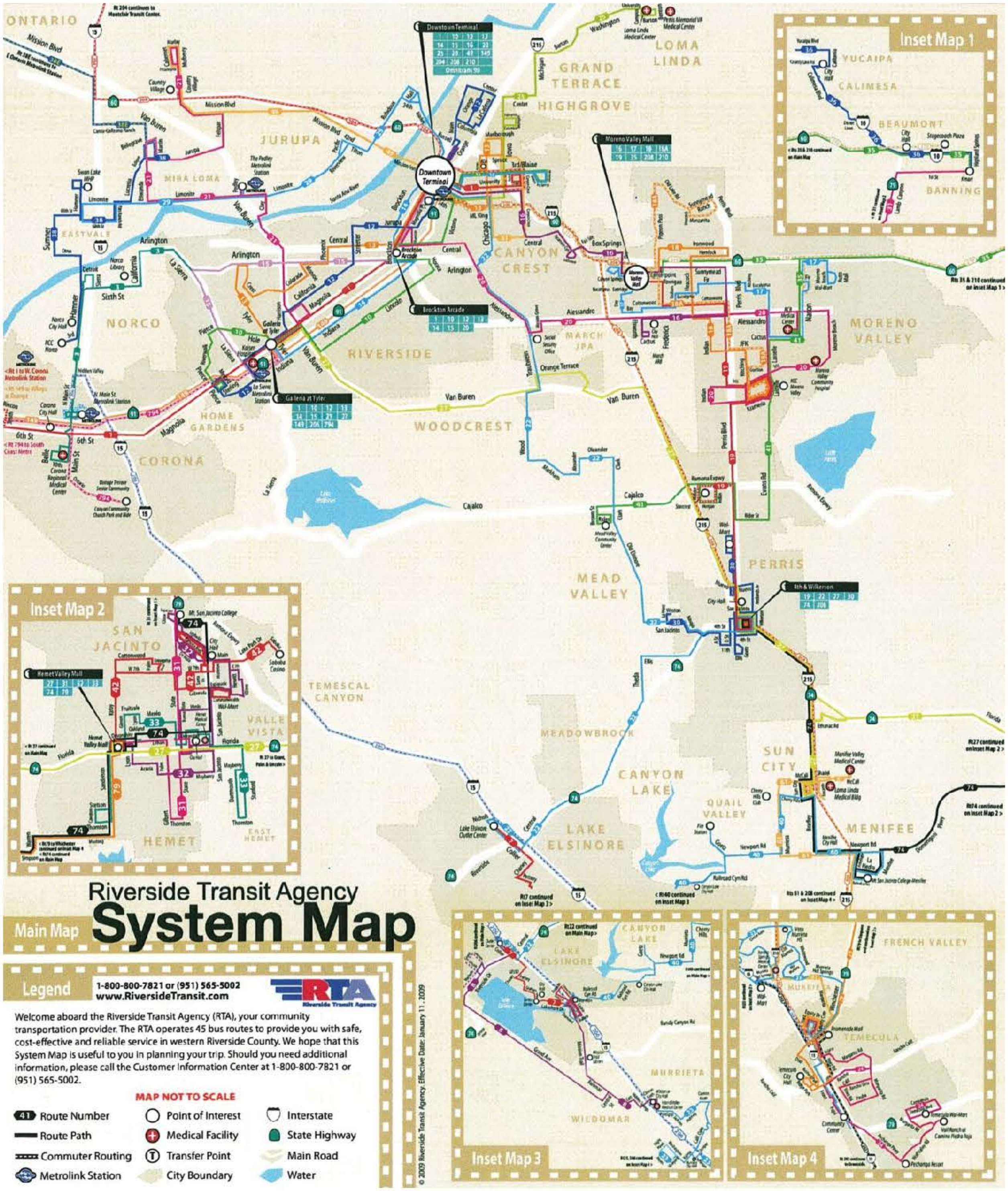

Figure 2-6 RTA System Map

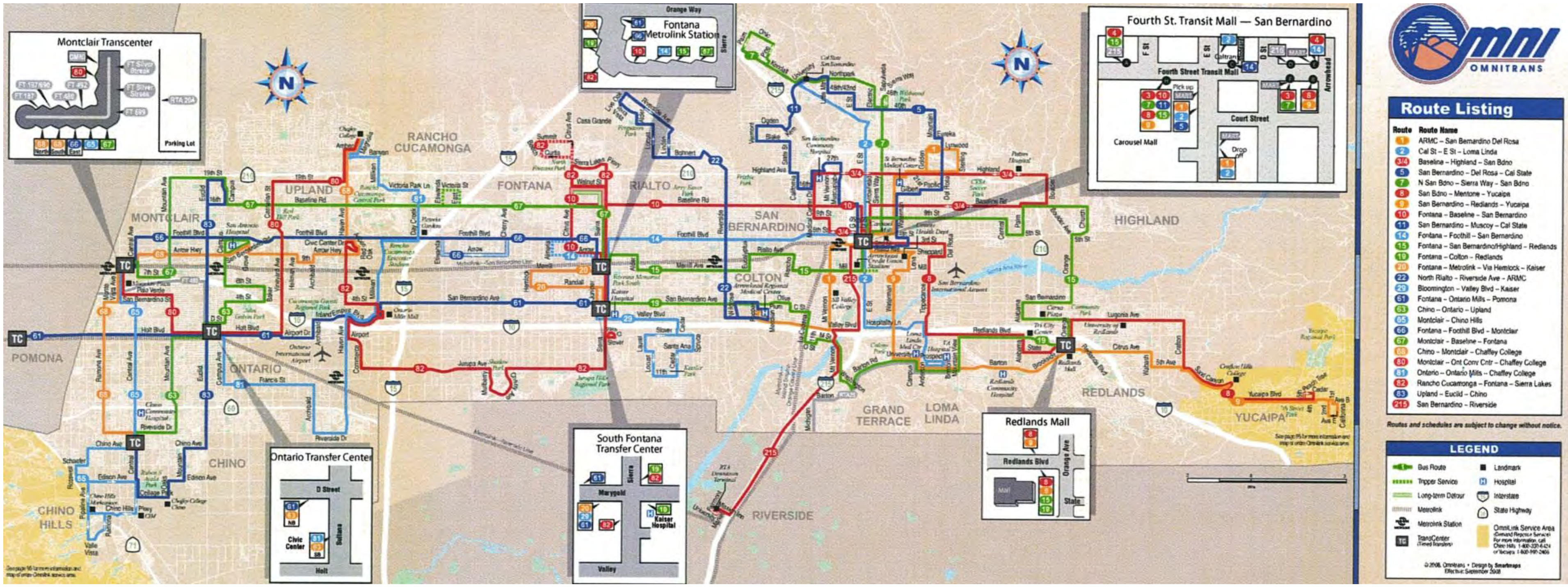

Figure 2-7 Omnitrans System Map

Figure 2-8 Metrolink System Map

2.1.13 Goods Movement and Intermodal Facilities

The route has a significant number of truck movements. Some sections of the freeway carry over 18000 AADT trucks. A number of these trucks have an origin or destination in the industrial areas that line the corridor.

The corridor has one intermodal facility, the Burlington Northern Santa Fe Railway (BNSF) intermodal facility at San Bernardino. The BNSF San Bernardino yard main purpose is the make-up of trains. Container and trailers are brought into the yard from the surrounding industrial areas and stored in the yard in preparation for loading. This facility operates 24 hours a day, 265 days a year.

The Union Pacific Mira Loma Auto Facility is also a major source of goods movement. The facility is a 256-acre automobile distribution center that is a vital link in the delivery of new vehicles to dealerships in Southern California. The facility operates 24 hours a day, 365 days a year. Eight trains a day originate or terminate at the facility. Vehicles are unloaded from the trains and then loaded onto trucks for distribution to Southern California.

2.1.14 Land Use Characteristics / Special Event Facilities / Trip Generators

The I-215 corridor study area is located in two counties, San Bernardino County and Riverside County. The northern section of the corridor is heavily populated, consisting of residential and industrial sections. The southern section of the corridor is less densely populated. The cities that the corridor runs through include: Murrieta, Sun City, Romoland, Perris, and Moreno Valley in the south and Box Springs, Riverside, Highgrove, Grand Terrace, Colton, San Bernardino, Muscoy, and Devore in the north. The southern section has just over 300,000 people, concentrated in the cities of Murrieta and Moreno Valley. The northern section has almost 600,000 people.

There are several major institutions, activity centers, special event facilities and recreational facilities that generate a substantial number of trips along the I-215 corridor. Their locations are shown on **Figure 2-9**.

- The Promenade in Temecula ("The Promenade Mall") is a regional shopping center located in Temecula, California, near the southern terminus of I-215. It has approximately one million square feet of shopping area on a 102-acre site.
- Diamond Valley Lake is located a few miles east of I-215 in the southern portion of the corridor, with its primary freeway access from I-215 via the Newport Road interchange. Operated by the Metropolitan Water District (MWD) and opened to the public in 2003, this reservoir is a regional recreational facility for boating, fishing, and hiking.
- Lake Perris is a state recreation area located east of I-215, with its primary access from the Ramona Expressway. Activities at this reservoir include camping and water sports as well as boating, fishing, and hiking.
- The March Air Reserve Base (ARB) and March Inland Port is located adjacent to I-215 between the Oleander Avenue and Cactus Avenue interchanges. A former Air Force Base, the March ARB now accommodates Air Reserve activities and shares runways with the Inland Port. The March Joint Powers Authority is planning and implementing new uses for currently vacant lands, reuse of existing facilities, and joint use of the airfield facilities for the development of an air cargo facility. In short, long-term economic gains in the form of developing a civilian air cargo center, and the growth and development of an employment center to account for 38,000 jobs, are projected.
- The Moreno Valley Mall at Towngate is a shopping mall located on the former site of the Riverside International Raceway in Moreno Valley, California. This is another regional shopping center located near the I-215 corridor. It has over 140 stores and more than one million square feet of shopping area.
- The University of California, Riverside (UCR) campus straddles the combined I-215/SR-60 freeway in Riverside. UCR is projected to be one of the UC system’s high growth campuses. The current enrollment is over 17,000 students with an expected population of almost 25,000 students by 2015.
- Downtown Riverside is located southwest of the SR-60/SR-91/I-215 interchange, and houses a concentration of government offices (city and county), as well as other businesses and offices and the main campus of Riverside Community College.

- Downtown San Bernardino is located east of I-215, and houses a concentration of government offices (City, County, and State of California) as well as other offices and commercial centers. San Bernardino Valley College is located on the west side of I-215, near the Inland Center Drive interchange.
- Inland Center Mall in San Bernardino has roughly 900,000 square feet of retail and is immediately adjacent to I-215 on island Center Drive.
- San Bernardino International Airport is located roughly three miles east of I-215and two mile north of I-10. It is the former Norton Air Force Base and also includes commercial businesses in the reuse.
- California State University at San Bernardino: a major campus of the California State University system located one mile east of I-215 on University Parkway.
- San Manuel Outdoor Amphitheatre in Devore can also be a major trip generator during special events.

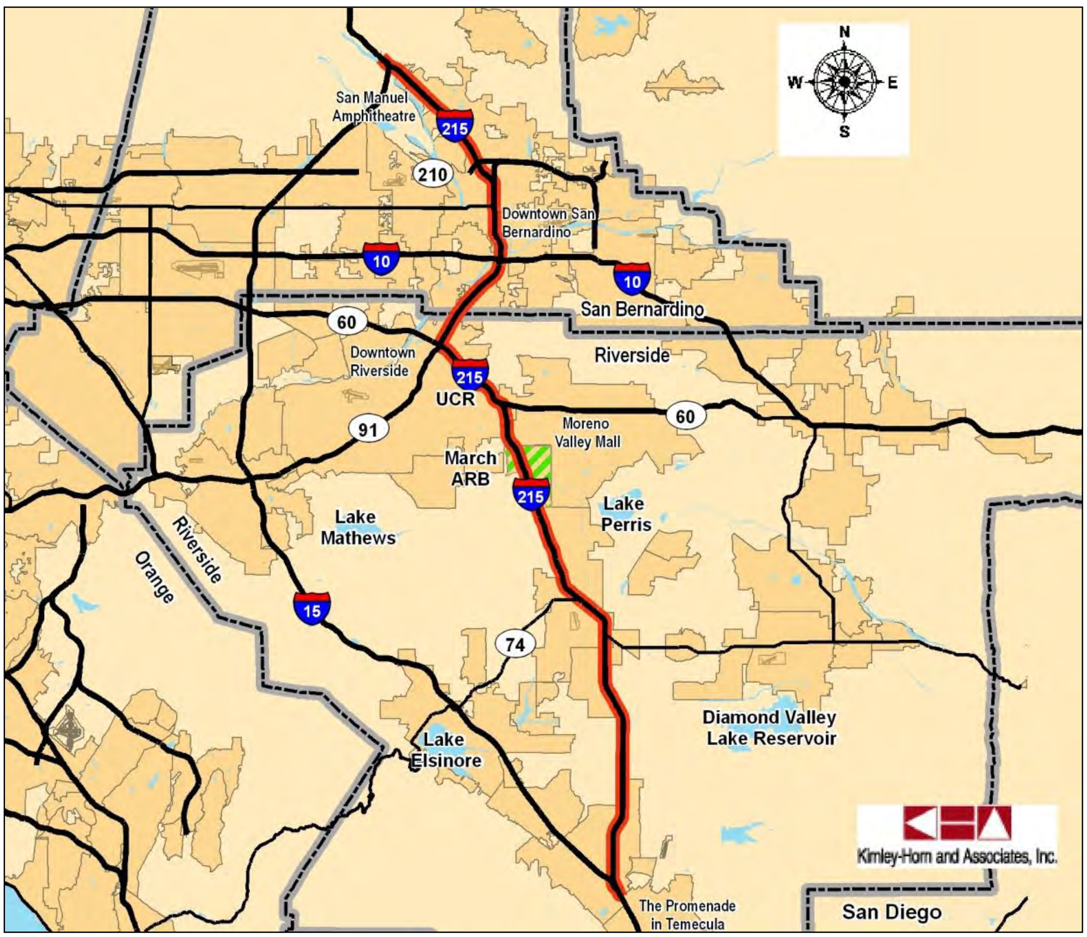

Figure 2-9 Major Trip Generators

3 COMPREHENSIVE CORRIDOR PERFORMANCE ASSESSMENT

This section summarizes the existing conditions of the I-215 corridor. The primary objective is to provide a sound technical basis for describing current traffic performance on the corridor. Four key measures are used to describe existing conditions in the corridor.

- Mobility describes how well the corridor moves people and freight; in terms of delay (Section 3.1) and travel time and reliability (Section 3.2);
- Productivity describes the lost lane miles due to inefficiencies (Section 3.3);
- Congestion Patterns and Bottlenecks describes the locations and causes of congestion as for existing conditions (Section 3.4) as well as for 2020 without improvements(Section 3.5) and
- Pavement Preservation describes the location of distressed pavement and quantity in lane-miles (Section 3.6).

3.1.1 Mobility (Delay)

Delay is defined as the total observed travel time less the travel time under non-congested conditions. Total delay is computed as the difference in travel time between actual congested conditions and free flow conditions (assumed to reflect speeds of 60 miles per hour).

Delay is reported as vehicle-hours of delay. The following formula is used to calculate total delay:

(Vehicles Affected per Hour)×(Distance)×(Duration)×[1/(Congested Speed)-1/60mph]

The „vehicles affected' portion of the formula is dependent on the methodology used. Some methods assume a fixed flow rate (e.g., 2,000 vehicles per hour per lane), while others use a measured or estimated flow rate. The distance is the length in which the congested speed prevails and the duration is the hours of congestion experienced below the threshold speed.

Total delay can be segmented into two components:

- Severe delay – delay that occurs when speeds are below 35 miles per hour; and
- Other delay – delay that occurs when speeds are between 35 miles per hour and 60 miles per hour

Severe delay represents breakdown conditions and is generally the focus of congestion mitigation strategies. "Other" delay represents conditions approaching the breakdown congestion, leaving the breakdown conditions, or areas that do not cause wide-spread breakdowns, but cause at least temporary slowdowns.

In order to combat congestion a focus on severe congestion is necessary, it is also important to review "other" congestion and understand its trends. This could allow for proactive intervention before the "other" congestion turns into severe congestion.

Figure 3-1 shows the average daily delay trends from 2006 to 2008 for the I-215 corridor. The estimates of vehicle hours of delay and travel time reported in this section were developed using a combination of data sources including PeMS data, floating car travel time runs, and counts.

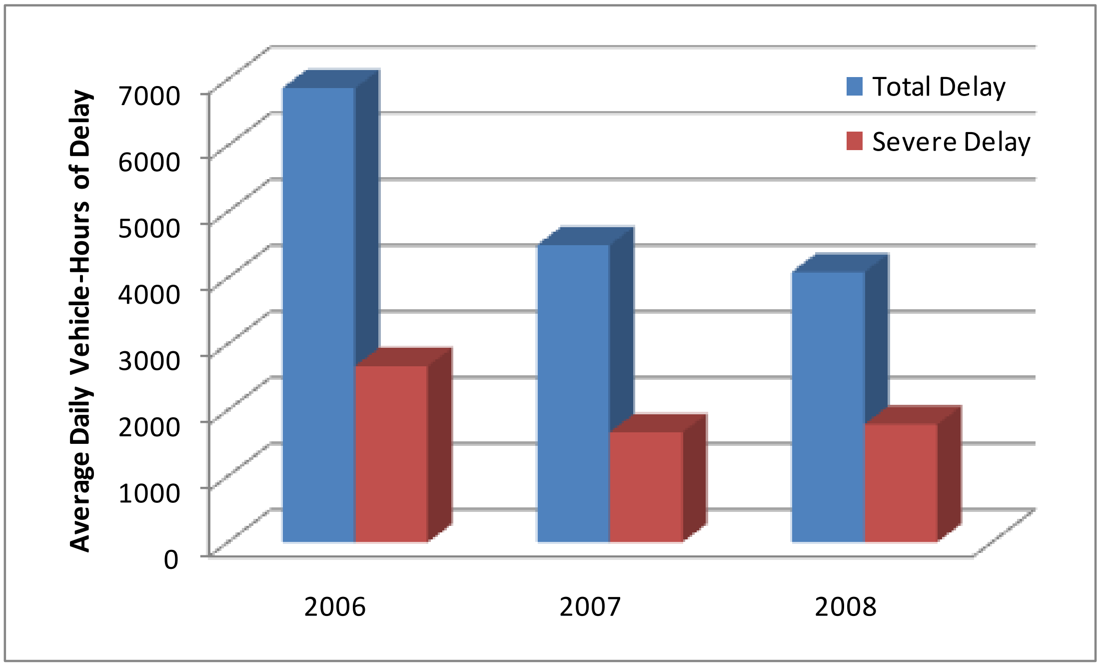

Figure 3-1 Average Daily Vehicle-Hours of Delay (2006-2008)

As shown on the figure above, the average daily total delay on the I-215 corridor has decreased from 6,870 vehicle-hours in 2006 to 4,086 vehicle-hours in 2008. Severe delay accounts for 37% - 44% of the total delay.

Figure 3-2 shows the peak hour vehicle-hours of delay for the I-215 corridor from I-15/I-215 interchange in the south to Auto Plaza Drive north of I-10 in 2008. I-215 southbound has the highest vehicle-hours of total delay during the PM peak hour. I-215 northbound has the highest vehicle-hours of severe delay during the PM peak hour.

The Caltrans State Highway Congestion Monitoring Program (HICOMP) report has been published by Caltrans annually since 1987. Delay is presented as average daily vehicle-hours of delay (DVHD), which represents the sum of all the delay experienced by commuters on the corridor.

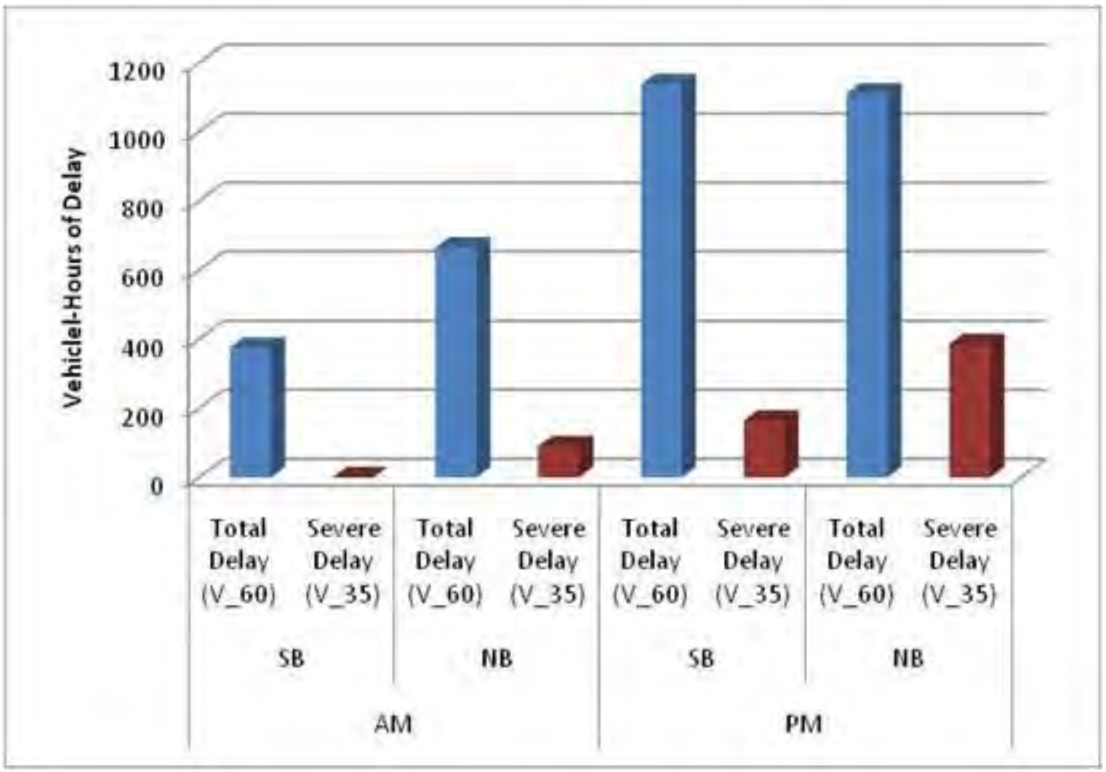

Figure 3-2 Peak Hour Vehicle-Hours Delay

3.1.2 Mobility (Travel Time and Reliability)

Travel time is measured as the amount of time it takes for a vehicle to traverse between two points on a roadway. The **Figure 3-3** shows the average peak period travel time on I-215 corridor from I-15/I-215 interchange in the south to Auto Plaza Drive north of I-10 – approximately 42 miles. Due to ongoing construction, the portion of the I-215 north of Auto Plaza Drive was not included in the travel time runs conducted by the CSMP team in January 2009.

The aggregated results show that the average travel times do not vary greatly from AM to PM or from SB to NB.

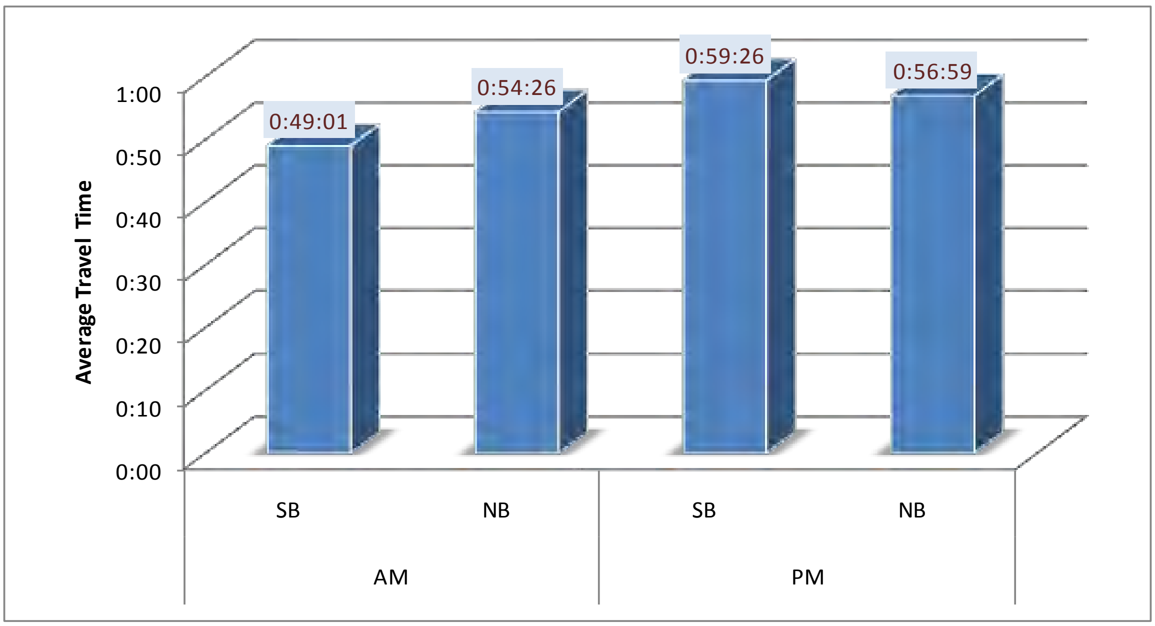

Figure 3-3 Average Peak Period Travel Time (2009)

3.1.3 Productivity

Productivity is a system efficiency measure used to analyze the effective capacity of the corridor. The highway productivity performance measure is calculated as the actual volume divided by the capacity of the highway.

As traffic flow approaches the capacity limits of a roadway, speeds decline and throughput drops dramatically. This loss in throughput is the lost productivity of the system. There are several ways to communicate productivity losses. The most common approach is to show lost productivity in terms of "equivalent lost lane-miles."

Lost lane-miles represent a theoretical level of capacity that would have to be added in order to achieve maximum productivity. For example, losing six lane-miles implies that adding a new lane along a six-mile section of freeway would improve productivity.

Figure 3-4 and **Figure 3-5** show the lost lane-miles on I-215 northbound and southbound in December 2008. The estimates of lost lane-miles were developed using estimates average speeds and volumes by segment developed from the combination of PeMS data, floating car travel time runs, and counts conducted by the CSMP team. This shows the number of lane-mile-hours lost due to the freeway operating under congested conditions. Generally, the northbound direction shows more congestion. This is to be addressed over the next several years in one segment of the corridor through the major widening project that is ongoing for I-215 through much of the City of San Bernardino from just north of I-10 to SR-210.

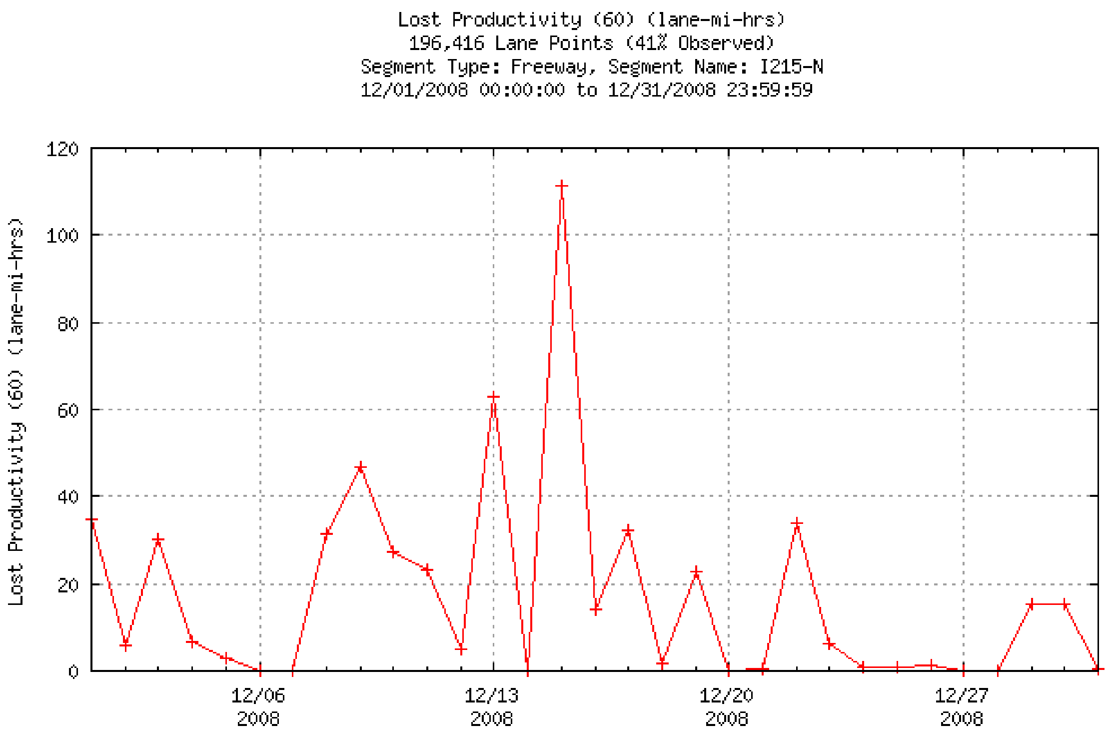

Figure 3-4 Lost Lane Miles on I-215 NB (December 2008)

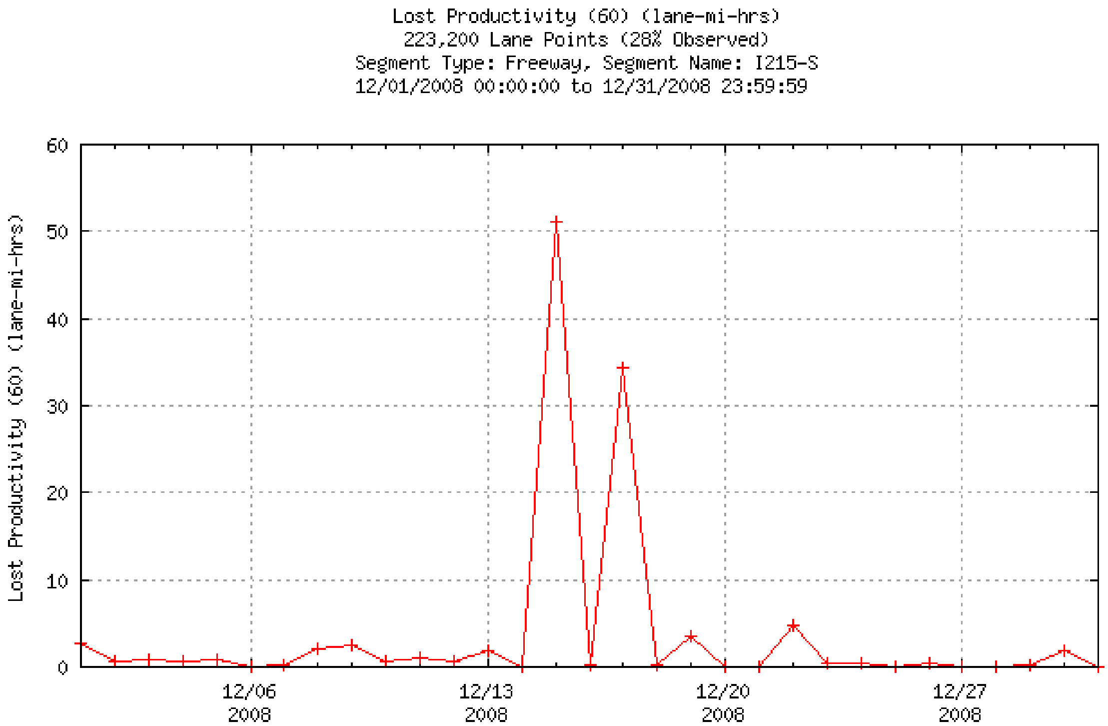

Figure 3-5 Lost Lane Miles on I-215 SB (December 2008)

Figure 3-6 illustrates the productivity loss on the I-215 corridor for the three years from 2006 to 2008.

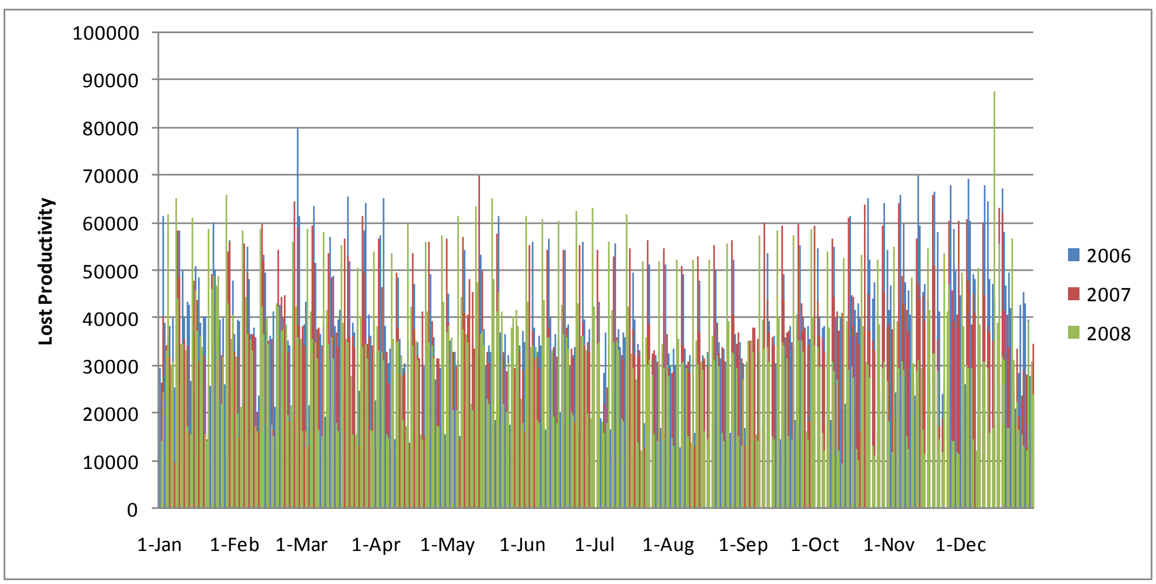

Figure 3-6 Lost Productivity from 2006 to 2008

3.1.4 Congestion and Bottlenecks

3.1.5 Congestion Patterns

As part of the Caltrans Highway Congestion Monitoring Program (HICOMP), congestion is defined as a "condition lasting for 15 minutes or longer when travel demand exceeds highway capacity and vehicular speeds decline to 35 mph or less during peak commute periods on a typical incident-free weekday." For a given facility, congestion is typically the result of either a regular bottleneck or a capacity drop due to traffic collisions. The former is termed recurrent congestion, while the latter is called non-recurrent congestion. HICOMP monitors only recurrent congestion and to the extent possible, excludes congestion caused by crashes or other incidents. The remainder of this section focuses on recurrent congestion in the corridor.

Bottlenecks are the primary cause of recurring congestion and lost productivity. A bottleneck is a road element in which traffic demand exceeds the capacity of the roadway facility. In most cases, a bottleneck is caused by a sudden reduction in capacity (e.g., a lane drop), heavy merging and weaving that the road cannot accommodate.

A "snapshot" of the current recurring congestion patterns and bottleneck locations was developed using a variety of sources, including the following:

- Caltrans Highway Congestion Monitoring Program (HICOMP) 2008 reports;
- Probe vehicle runs − Caltrans District 8 tach runs
- Aerial Photography (Google Earth, Live Search map)
- Field observations
- Simulation model outputs.

To support the evaluation of operational freeway improvements as part of this CSMP, macroscopic simulation models of the corridor were developed using the FREQ simulation software. The first step in this process was to develop and calibrate the Existing Conditions AM and PM peak period FREQ models. The primary objective applied in calibrating the Existing Conditions FREQ model was to reasonably match observed congestion patterns and bottleneck locations as described in the previous section. The Existing Conditions model process was documented in the *Existing Conditions FREQ Model Development and Calibration* memorandum (dated January 26, 2011).

3.1.6 Bottleneck Locations and Causality

Figure 3-7 and **Figure 3-8** depict existing patterns of congestion on I-215 for the AM and PM peak periods respectively. These patterns of congestion can be traced to specific bottlenecks. Each bottleneck is further discussed to identify the location and the root cause for the congestion The bottlenecks in the AM peak period are number 1 through 9 starting with the northbound bottlenecks (1 through 5) going the south end of the corridor to the north end and then southbound (6 through 9) going from the north end of the corridor to the south end. Many of the AM bottlenecks exist also in the PM peak period, and their numbers remain the same. New numbers are added for bottlenecks that exist only in the PM Peak (10 through 14) and they are also applied to the northbound side (10 and 11) and then the southbound side (12, 13 and 14).

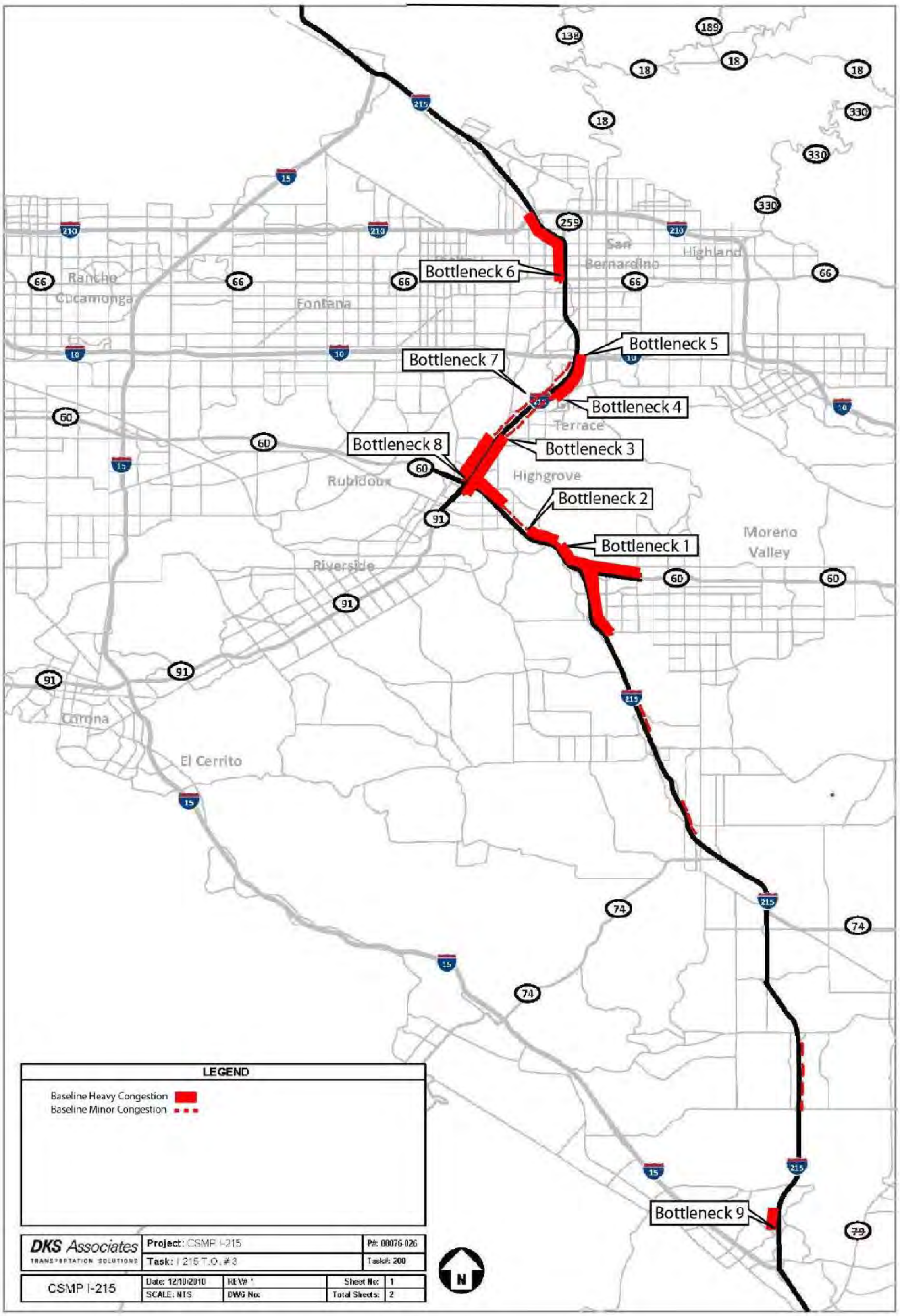

Figure 3-7 Existing (2008) I-215 AM Peak Congestion Patterns

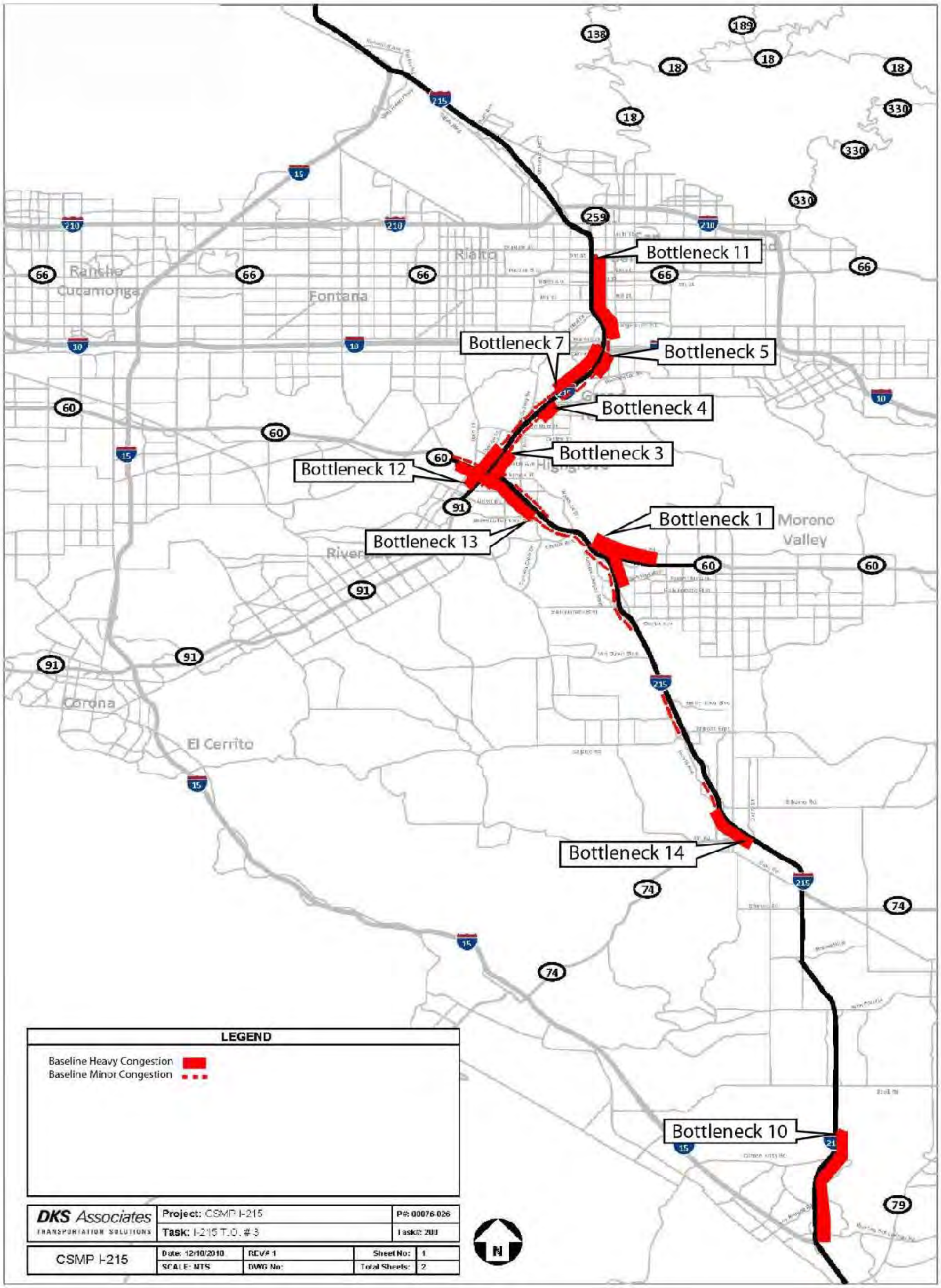

Figure 3-8 Existing (2008) I-215 PM Peak Congestion Pattern

Northbound AM

Bottleneck #1: Watkins Drive off-ramp to on-ramp

A northbound bottleneck appears at the Watkins Drive on and off ramps. This bottleneck is caused by the ending of the auxiliary lane at the Watkins off-ramp. During the AM peak period, queues can extend back to Heacock Street in on SR-60 and Eucalyptus Avenue on I-215. Within this queue, a secondary bottleneck occurs between the SR-60 merge and the Box Springs Road on-ramp. This secondary bottleneck occurs due to the high volume of merging traffic from SR-60, weaving of traffic to the HOV lane on the left side of I-215 and traffic merging from the Box Springs Road on-ramp on the right.

Bottleneck #2: MLK Boulevard to University Avenue

A northbound bottleneck appears between the MLK Boulevard on-ramp and the University Avenue off-ramp. This bottleneck is caused by the high on-ramp demand from MLK Boulevard. The queue from this bottleneck extends back and merges with that from Bottleneck #1.

Bottleneck #3: Columbia Avenue to Center Street

A northbound bottleneck appears between the Columbia Avenue on-ramp and the Center Street off-ramp. This bottleneck is caused by the high demand on the segment and the traffic entering from Columbia Avenue. Queues can extend back beyond the merge point on SR-91 and onto the connector from I-215. Within this queue, a secondary bottleneck exists between I-215/SR-90 merge and the off-ramp to Columbia Avenue. This bottleneck is caused by the high volume of merging traffic, the weaving of traffic to the Columbia Avenue off-ramp, and the ending of the auxiliary lane at the off-ramp.

Bottleneck #4: Barton Street to Washington Street

A northbound bottleneck exists on I-215 between the on-ramp from Barton Street and the off-ramp to E Washington Street. This bottleneck exists due to high demand. Queues from this bottleneck extend back through the bottleneck #3.

Bottleneck #5: Washington Street to I-10

A northbound bottleneck exists between the westbound Washington Street on-ramp and the I-10 off-ramp. This is due to high demand, a weaving movement, and an overload of the right lane due to the high volume of traffic exiting to I-10. Queues from this bottleneck extend back through the bottlenecks #3 and #4.

Southbound AM

Bottleneck #6: Orange Street to 6th Street

A southbound bottleneck exists between the Orange Street on-ramp and 6th street off-ramp. This bottleneck is caused by consecutive high-volume on-ramps from SR-259 and Orange Street. Queuing from the bottleneck extends up to the I-215/I-210 interchange. Within this queue, a secondary bottleneck occurs at the SR-259 merge. This secondary bottleneck occurs due to the high volume of merging traffic.

Bottleneck #7: Barton Street to Iowa Avenue

A southbound bottleneck exists between the Barton Road on-ramp and Iowa Avenue off-ramp. This bottleneck is caused by high demand. Queuing from the bottleneck can extend back to the I-215/I-10 interchange.

Bottleneck #8: Center Street to Columbia Avenue

A southbound bottleneck exists between the Center Street on-ramp and Columbia Avenue off-ramp. This bottleneck is caused by high demand. The queuing from this bottleneck can extend back into and merge with that from bottleneck #7.

Bottleneck #9: Los Alamos Road to Murrieta Hot Springs Road

A minor southbound bottleneck exists between the Los Alamos Road on-ramp and Murrieta Hot Springs Road off-ramp. This bottleneck is caused by high demand. Queuing from the bottleneck can extend back to just north of the Los Alamos Road off-ramp.

Northbound PM[1]

Bottleneck #10: Clinton Keith Road to I-15

This northbound bottleneck exists at interchanges at Murrieta Springs Road, Los Alamos Road, and Clinton Keith Road. The bottlenecks are caused by platoons of merging vehicles at on-ramp locations.

Bottleneck #1: SR-60 to Watkins Drive

Similar to the AM, congestion occurs on I-215 just north of the SR-60 junction. During the PM peak the primary bottleneck appears to occur between Box Springs Road on-ramp and the Watkins Drive off-ramp. Queues can extend back to Heacock Street in on SR-60 and Eucalyptus Avenue on I-215. This bottleneck is caused by high demand, weaving, and an auxiliary lane end at the Watkins Drive off-ramp. Within this queue, a secondary bottleneck occurs between the SR-60 merge and the Box Springs Road on-ramp. This secondary bottleneck occurs due to the high volume of merging traffic from SR-60, weaving of traffic to the HOV lane on the left side of I-215 and traffic merging from the Box Springs Road on-ramp on the right.

Bottleneck #3: Columbia Avenue to Center Street

A northbound bottleneck appears between the Columbia Avenue on-ramp and the Center Street off-ramp. This bottleneck is caused by the high demand on the segment and the entering traffic from Columbia Avenue. Queues can extend back beyond the merge point on SR-91 and onto the connector from I-215. Within this queue, a secondary bottleneck exists between I-215/SR-90 merge and the off-ramp to Columbia Avenue. This bottleneck is caused by the high volume of merging traffic, the weaving of traffic to the Columbia Avenue off-ramp, and the ending of the auxiliary lane at the off-ramp.

Bottleneck #4: Barton Street to Washington Street

A northbound bottleneck exists on I-215 between the on-ramp from Barton Street and the off-ramp to E Washington Street. This bottleneck exists due to high demand. Queues from this bottleneck extend back to Center Street.

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[1] Bottlenecks 10 through 14 exist only in the PM peak and that is why they appear out of sequence. In addition, not all AM bottleneck (1-9) exist in the PM peak.

Bottleneck #5: Washington Street to I-10

A northbound bottleneck exists between the westbound Washington Street on-ramp and the I-10 connector. This is due to high demand, a weaving movement, and an overload of the right lane. Queues from this bottleneck can extend back to Iowa Avenue. This bottleneck occurs in the AM.

Bottleneck #11: 10th Street to 13th Street

A northbound bottleneck exists between the 10th Street on-ramp and 13th street off-ramp. This is due to high demand. Queues from this bottleneck extend back to the I-10 interchange.

Southbound PM

Bottleneck #7: Washington Street to Iowa Avenue

Southbound bottlenecks exist at Washington Street, Barton Road on-ramp and Iowa Avenue off-ramp. These bottlenecks are caused by high demand and traffic merging onto the I-215 from I-10 as well as traffic exiting at Washington Street. Queuing from the bottlenecks can extend beyond the I-215/I-10 interchange.

Bottleneck #12: SR-91 - 14th Street to Central Avenue

A southbound bottleneck exists on SR-91 south of the I-215/SR-60/SR-91 interchange between the 14th Street on-ramp and the Central Avenue off-ramp. This bottleneck is caused by high demand and lane drops on SR-91. Queuing from the bottleneck can extend back to Columbia Avenue.

Bottleneck #13: University Avenue

A southbound bottleneck exists at the University Avenue off-ramp. This bottleneck is caused by the ending of the auxiliary lane at the off-ramp. Also contributing to congestion in this area are the high merging volumes from SR-91 and I-215, and the lane drop between the Blaine Street off and on ramps. Queuing from the bottleneck can extend back to west of the SR-60/SR-91 junctions, as well as onto the connector from I-215.

Bottleneck #14: E 4th Street/Redland Avenue (SR-74 West) to SR-74 - East

A southbound bottleneck exists between the East 4th Street/Redland Avenue on-ramp and the SR-74 East off-ramp. This bottleneck is caused by high demand. Queuing from the bottleneck can extend back to East Nuevo Road. Within this queue, a secondary bottleneck occurs between the North D Street off-ramp and the East 4th Street/Redland Avenue off-ramp due to the lane drop at North D Street.

3.1.7 Assessment of 2020 Corridor Performance without Programmed Improvements

The 2020 Scenario 1- No-Build uses the I-215 2008 roadway network as the baseline for traffic forecasting for 2020 and serves as the basis for comparison of the other scenario. To assess operating conditions under this scenario, the Existing Conditions models were revised to reflect forecasted demand levels, while the freeway geometrics were unchanged.

In general, conditions are projected to worsen significantly by 2020 under the No Build scenario. The congestion and queuing associated with many existing bottlenecks is expected to increase, while several new bottlenecks emerging. In addition to the fourteen bottlenecks that were identified in the analysis of existing conditions (number 1 through 14), ten new areas of significant congestion emerge in the 2020 baseline analysis. The new areas of congestion are designated by the letters A through J – A through D are all in the AM period and E through J are in the PM period. These locations are illustrated in **Figure 3-9** and **Figure 3-10** for the AM and PM peak periods respectively.

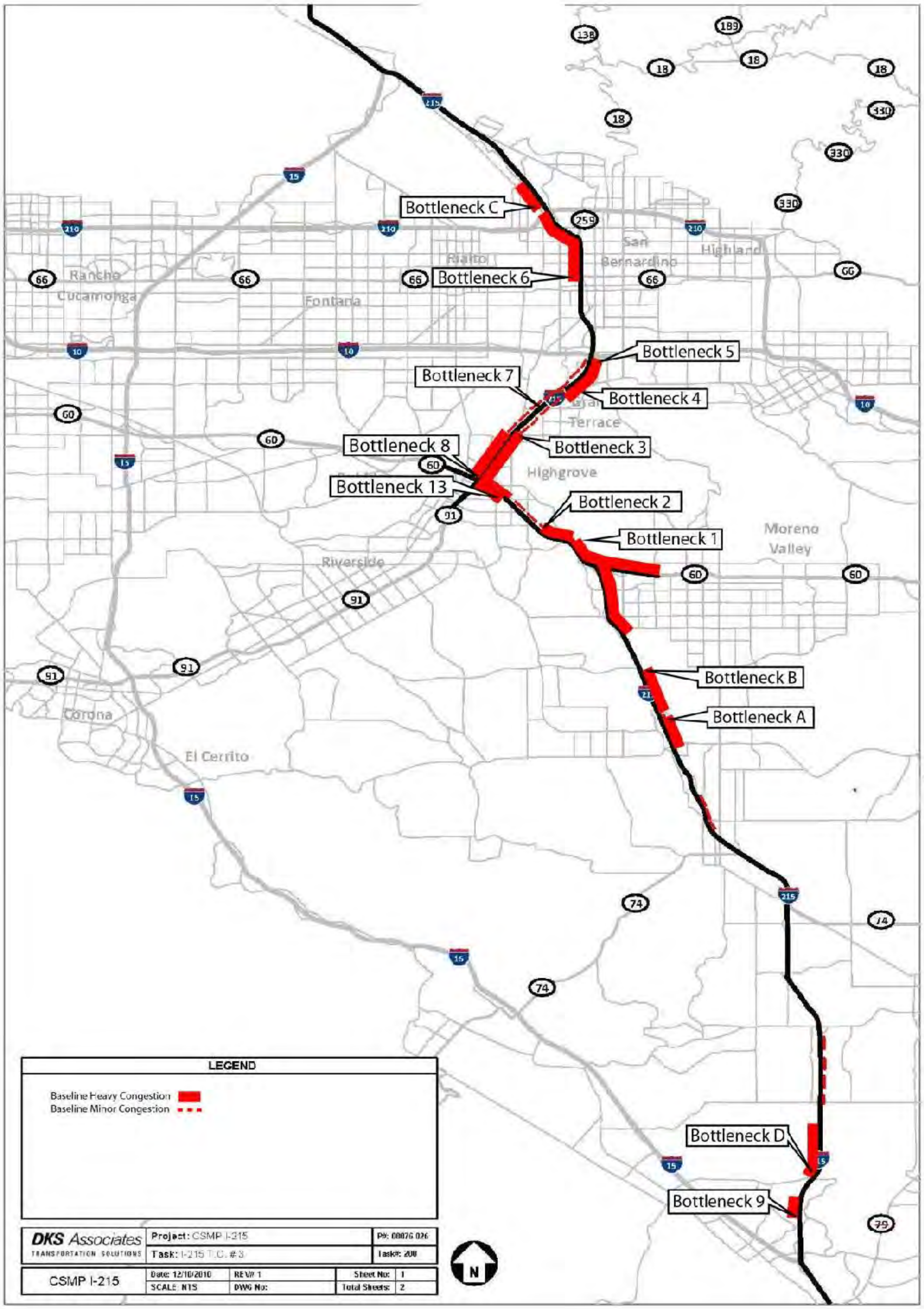

Figure 3-9 2020 Baseline AM Peak Congestion Patterns

Figure 3-10 2020 Baseline PM Peak Congestion Patterns

A summary of the forecasted operating conditions, with an emphasis on the identification of new bottlenecks, is provided below. A more detailed discussion of the FREQ modeling results for the 2020 Scenario 1- No-Build is presented in the memorandum titled *I-215 CSMP - 2020 No Build Conditions Analysis Results* (dated March 15, 2011).

3.1.8 Northbound AM

The level of congestion, both in terms of geographic limits and duration, is forecast to increase significantly through the central portion of the corridor. Numerous overlapping bottlenecks are projected between Ramona Expressway and the I-10 junction. Furthermore, significant congestion is forecast to be present at the end of the peak period (10:00 AM) in the segment from the SR-60 (East) junction and the Washington Street interchange.

Within the segment from the SR-60 (East) junction to the I-10 junction where significant existing congestion occurs, existing major bottlenecks that also appear in the 2020 No Build include those at Watkins Drive (bottleneck #1), MLK Boulevard to University Avenue (#2), Columbia Avenue to Center Street (#3), Barton Street to Washington Street (#4), and Washington to I-10 (#5). Within this segment several new secondary bottlenecks also emerge. Outside this area, new major bottlenecks projected to emerge include:

Bottleneck #A: Ramona Expressway to Harley Knox Boulevard

A southbound bottleneck exists between the Ramona Expressway on-ramp and the Harley Knox Boulevard off-ramp. This bottleneck is caused high demand. Queuing from the bottleneck can extend back to near North D Street.

Bottleneck #B: Harley Knox Boulevard to Van Buren Boulevard

A southbound bottleneck exists between the Harley Knox Boulevard on-ramp and the Van Buren Boulevard off-ramp. This bottleneck is caused high demand. Queuing from the bottleneck extends back to merge with that from bottleneck A.

3.1.9 Southbound AM

The increased demand forecast for 2020 is expected to result in a new bottleneck occurring just north of the I-210 junction, as well increased congestion in the segment between the I-10 and SR-60/SR-91 junctions. The FREQ model suggests minor bottlenecks just south of the SR-60/SR-91 junction, plus a significant in congestion within the southern portion of the corridor. Significant congestion is forecast to be present at the end of the peak period (10:00 AM) in the segment between the I-10 junction and the Center interchange, as well as in the southern portion of the I-215 corridor. Existing bottlenecks that also appear in the 2020 No Build include those between Orange Street and 6th off-ramp (bottleneck #6), Barton Street to Iowa Avenue (#7), Center Street to Columbia Avenue (#8), and Los Alamos Road to Murrieta Hot Springs Road (#9). Blaine Street/University Avenue (#13), which had been a bottleneck only in the PM in the existing conditions, appears as an AM bottleneck in the 2020 forecast. Other new bottlenecks projected to emerge include:

Bottleneck #C: University Parkway to I-210

A southbound bottleneck is projected between the University Parkway on-ramp and the westbound I-210 off-ramp. This bottleneck is caused high demand. Queuing from the bottleneck can extend back to north of the University Parkway off-ramp.

Bottleneck #D: Scott Road to Clinton Keith Road

A southbound bottleneck is projected between the Scott Road on-ramp and the Clinton Keith Road off-ramp. This bottleneck is caused high demand. Queuing from the bottleneck extends back to McCall Boulevard and merges with that from the downstream bottleneck 9.

3.1.10 Northbound PM

Significant congestion is forecasted for northbound I-215 during the PM peak period with existing bottlenecks increasing in severity and several new bottlenecks appearing. The most significant congestion is projected to occur in the SR-60/Box Springs Road area, in the segment between the SR-60/91 and I-10 junctions, and near the SR-259 diverge. This congestion is largely the result of existing bottlenecks. Minor congestion is projected near both the southern and northern limits of the corridor. Major bottlenecks in the model include those between the Clinton Keith Road to Scott Road (Bottleneck #10), SR-60 to Watkins Drive (#1), Columbia Avenue to Center Street (#3), Barton Street to Washington Street (#4), westbound Washington Street to I-10 (#5), 10th and 13th/Baseline (#11). New secondary or minor bottlenecks projected to emerge include:

Bottleneck #E: Auto Center Drive/Orange Show Road

A new secondary bottleneck is projected between the off and on ramps at Auto Center Drive/Orange Show Road due to the lane drop between these ramps. Queues from this bottleneck merges with that spilling back from the bottleneck at 13th/Baseline.

Bottleneck #F: Palm Avenue to Devore Road

A minor bottleneck is projected between the Palm Avenue on-ramp and the Devore Road off-ramp. This bottleneck is caused by high demand.

3.1.14 Southbound PM

Heavy congestion, with multiple bottlenecks, is projected for a majority of the corridor with queues starting around the I-210 junction and continuing in sections down to the southern end of the corridor. Existing bottlenecks that also appear in the 2020 No Build include those between Barton Street to Iowa Avenue (#7), on SR-91 between 14th Street and Spruce Street (#12), Blaine Street/University Avenue (#13), E 4th Street/Redland Avenue (SR-74 West) to SR-74 - East (#14) and Los Alamos Road to Murrieta Hot Springs Road (#9). Significant new bottlenecks that also emerge include:

Bottleneck G: Mill Street to Inland Center Drive

A southbound bottleneck emerges between the Mill Street on-ramp and Inland Center Drive off-ramp. This bottleneck is caused by high demand. Queuing from the bottleneck can extend back to SR-259.

Bottleneck H: Eucalyptus Avenue to Alessandro Boulevard

A southbound bottleneck emerges between the Eucalyptus Avenue on-ramp and Alessandro Boulevard off-ramp. This bottleneck is caused by high demand. Queuing from the bottleneck can extend back to MLK Boulevard.

Bottleneck I: Cactus Avenue and Van Buren Boulevard

Smaller southbound bottlenecks emerge at both the Cactus Avenue and Van Buren Boulevard on-ramps due to high demand. In both cases the queue can extend to the upstream interchanges.

Bottleneck J: WB Murrieta Hot Springs Road to I-15

A major southbound bottleneck emerges between the westbound Murrieta Hot Springs Road on-ramp and the junction with I-15. This bottleneck is caused high demand. Queuing from the bottleneck can extend back to Scott Road, and can encompass secondary bottlenecks at Scott Road, Clinton Keith Road, and Los Alamos Road.

3.1.15 Pavement Condition and Management Strategies

Pavement preservation is the sum of all the activities to provide and maintain serviceable roadways, including corrective and preventive maintenance, as well as minor rehabilitation. Pavement preservation does not include new pavement or pavement that requires major rehabilitation or reconstruction.

A pavement preservation program extends pavement life, enhances pavement performance, thereby ensuring cost-effectiveness and reducing user delays. In short, the goal is to meet customer needs.

Pavement preservation is an economical approach to addressing pavement needs. With pavement preservation, Caltrans gains the ability to improve pavement conditions and extend pavement life and performance without having to focus on more costly major rehabilitation work. The focus is on preserving the pavement asset while maximizing the economic efficiency of the investment. Pavement preservation provides greater value to the highway system and improves the satisfaction of highway users.

Figure 3-11 shows the basic concept of pavement preservation.

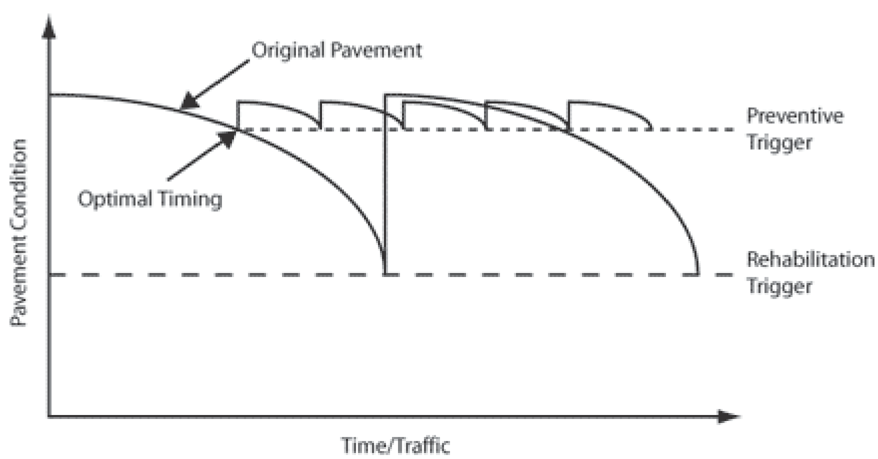

Figure 3-11 Pavement Preservation Concept
Source: FHWA

One of the primary criteria for evaluating pavement condition is pavement roughness. Pavement roughness is measured using a standardized scale, called the International Ride Index (IRI). The IRI is reported as inches of surface roughness per mile of pavement. A pavement with an IRI score of greater than 200 inches of surface roughness per mile is considered by most motorists to be uncomfortable or "unacceptable". New or recently rehabilitated pavement should provide an "excellent" ride to the motorist, which corresponds to less than 75 inches of surface roughness per mile.

The 2007 Pavement Condition Survey (PCS) identified 86.837 lane miles of I-215 as distressed pavement. **Table 3-1** depicts the nine most distressed segments on I-215.

Table 3-1 Most Distressed Pavement Segments on I-215

	County	Begin PM	End PM	Length
1	RIV	24.581	24.731	0.150
2	RIV	36.833	37.983	1.150
3	RIV	37.983	38.149	0.166
4	RIV	38.149	38.485	0.336
5	RIV	38.693	38.833	0.140
6	RIV	38.833	38.930	0.097
7	RIV	39.514	39.526	0.012
8	SBD	8.338	8.693	0.355
9	SBD	8.693	9.193	0.500

Source: Caltrans 2007 Pavement Condition Survey (PCS).

4 IMPROVEMENT SCENARIOS TESTED AND RESULTS

4.1.1 Strategies Considered

As described in the previous chapter, the I-215 corridor is subject to considerable congestion during both the AM and PM peak periods. Existing traffic demand on I-215 exceeds capacity on several segments during both peak periods. In the future years, without congestion mitigation strategies and improvements, traffic conditions on I-215 are expected to worsen. As part of this CSMP, a variety of strategies for improving operations along I-215 were considered. Some include physical improvements to increase the capacity of the freeway system, while others are more oriented to the operations and management of the system. These strategies, as reflected in various projects programmed or planned for the corridor, may be categorized as follows:

- Additional mixed flow through and auxiliary lanes;
- Interchange improvements;
- HOV lanes and;
- Ramp Metering.

Each of these strategies is further described in the following sections.

4.1.2 Mixed Flow Through and Auxiliary Lane Additions

The most direct approach for mitigating congestion, and to improve mobility and travel time reliability within the corridor, is to add or expand freeway capacity by adding mixed flow lanes or auxiliary lanes at locations where more travel lanes will relieve bottleneck points. Mixed flow lane additions projects proposed for the I-215 corridor include both auxiliary lane (a lane running from a highway entrance ramp to a subsequent highway exit ramp) and through lane (a continuous lane passing through multiple interchanges) widening. These projects directly provide additional capacity to help reduce congestion.

4.1.3 Interchange Improvements

Much of the congestion on I-215 like other urban freeways in the US is related to capacity issues and conflicts related to interchanges. Because of the complex and extensive linkage of I-215 with other area freeways (I-15, I-10, I-210, SR-60, and SR-91) and the high number of interchanges with local arterial streets (48), interchange design is critical to the operational success of I-215 and the rest of the roadway system in the corridor. Improvements considered in this category include adding new interchanges, adding new ramps, closing ramps, reconfiguration of existing ramps, adding or extending acceleration or deceleration lanes, widening ramps, and improvements to adjacent local streets at or near interchanges.

Ramp improvements can also relate directly to operation of the freeway, particularly as they relate to the use of ramp metering. Ramp improvements are often necessary to allow adequate storage of vehicles at ramp meters. The ramps on I-215 have been evaluated for the type and feasibility of geometric improvements, which include extending or realigning the ramp to provide additional acceleration distance, widening or extending the ramp to provide additional storage, and potentially widening the ramp at the meter to provide an HOV preferential lane and/or additional lane capacity. Because maximum metering rate is 900 vphpl, ramps with demands greater than

900 vphpl would require an additional lane at the meter limit line. Widening of off-ramps has also been evaluated where concern about back-up for ramp intersection might extend onto freeway lanes and produce congestion and limit access to the local street system.

In addition to accommodating operations or management strategies, interchange improvements can also re-distribute demand; improve merging diverging and weaving; and provide additional capacity at key bottleneck points.

4.1.4 HOV Lane Addition

The development of an HOV-lane system on I-215 is one of the top operations and management strategies being considered for the corridor and is a significant part of the CMIA projects. HOV lanes are generally implemented with the following objectives:

- To provide travel-time advantage for HOVs: carpools, vanpools, buses, hybrids and motorcycles
- To provide travel-time reliability for HOVs
- To entice single occupant vehicle (SOV) drivers to form carpools or use transit
- To increase the efficiency of the roadway

Some of the factors that determine the success of an HOV lane are as follows;

- Total future-year travel demand in the corridor
- Travel-time advantage for HOV lane users
- Hours over which the HOV lane offers a travel-time advantage
- Length of the HOV lane
- Concentration of employment along the corridor
- Enforcement

Expanded HOV lanes on I-215 could have a variety of potential benefits including reduced travel time and improved reliability of travel time for people in carpools, vanpools, buses, motorcycles and approved hybrid and low emitting vehicles, overall reduction in person hours of travel, reduced vehicle miles of travel, reduced gasoline consumption and reduced pollutant emissions. This is primarily the result of diversion of travelers from single occupant vehicles to HOV. A survey of HOV lane users in Southern California indicated that 50% of the lane users would drive alone if the HOV lane was not available[2]. In a similar survey in the Bay Area, two-thirds of the respondents said that the HOV lane had greatly influenced them to carpool[3].

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[2] Parsons Brinckerhoff, Quade and Douglas, ***HOV Performance Program Evaluation Report***, prepared for the Los Angeles County Metropolitan Transportation Authority, March 28, 2002, page 137.

[3] Loudon, William, Joseph Story, Lee Klieman, DKS and Doug Kimsey, MTC *"An Integrated HOV/Express Bus Master Plan for the San Francisco Bay Area"*, prepared for the TRB Annual Conference Washington, D.C., January 2004.

HOV lanes are most successful when they result in a shift of passengers from driving alone to carpooling, vanpooling or transit. Support facilities that facilitate the use of these higher occupancy modes can increase the effectiveness of new HOV lanes on I-215. Transit services and park-and-ride lots can be effective in supporting HOV lanes. A system of park-and-ride lots along the corridor can enhance the effectiveness of the lanes. These spaces can serve carpools and vanpools that might use the HOV lanes as well as long-distance transit services which will have stops in the park-and-ride lots along the corridors.

4.1.5 Ramp Metering

When freeways are congested because demand exceeds capacity, ramp meters can mitigate or minimize the impact of bottlenecks. This can be achieved by smoothing the entry of cars onto the freeway at the ramp. Ramp metering can help avoid a breakdown in mainline traffic flow by splitting up platoons of vehicles arriving from nearby signalized intersections and reducing turbulence in the merge area on the freeway. Spreading a thirty-second burst of vehicles over a full minute may result in only very short delays on the ramp while maintaining freeway speeds. By controlling the entry of vehicles onto the freeway, ramp metering may also reduce collisions in merge areas.

Metering effectively transfers excess demand (and delays) from mainline freeway bottlenecks to on-ramps, which, from a system perspective, may be a more efficient distribution of congestion. It is important to note that for metering to be most effective, it must be implemented not only at the on-ramp nearest a bottleneck, but also system-wide at multiple on-ramps upstream of the bottleneck. By controlling and re-distributing the entry of vehicles onto the freeway over time, ramp metering can delay the onset, reduce the maximum length, and hasten the dispersal of queues. These benefits may be increased when the safety effects of ramp metering are also taken into account.

A second potential impact of ramp metering is trip diversion. Trip diversion, or space redistribution, occurs when drivers choose other routes, largely in response to the delay at the ramp meters, either by selecting a different on-ramp or avoiding the freeway altogether. Though ramp delays may lead some drivers to seek alternative paths, the amount of such diversion is expected to be limited because any ramp delay is relatively short. And while metering may lead to the diversion of some shorter trips, it may also encourage drivers making longer trips to stay on the freeway. The mainline operational improvements and ramp delays associated with ramp metering may also discourage "ramp-hopping" where vehicles exit the freeway upstream of a bottleneck and re-enter just downstream.

HOV lanes and ramp metering are both freeway-management strategies that can be effective as elements of a tool-box of strategies, but are generally implemented for different and sometimes conflicting reasons. HOV lanes are generally implemented to increase the efficiency of a highway by giving a travel-time advantage to high-occupancy vehicles. This can result in vehicles with more occupants being moved faster than vehicles with only one occupant resulting in greater efficiency in the movement of people. The travel-time advantage can also provide the incentive needed for people to shift from driving alone to carpooling, vanpooling or use of transit and thereby reducing the number of vehicles on the highway. Both of these desired effects generally result only when there is a travel-time advantage for the HOV lane. Ramp metering is generally designed to improve the efficiency of a highway by smoothing the flow of vehicles entering the highway at on-ramps to avoid break-down conditions in the through lanes. When successful, ramp metering can increase the speed of the roadway lanes and allow greater throughput for the facility being metered. While potentially increasing the maximum vehicle throughput on the roadway, ramp metering may also reduce the travel-time advantage of the HOV lane if one exists on the metered facility.

Despite this potential conflict in purpose and effect of ramp metering and HOV lanes, ramp metering can also provide support to HOV lanes under certain circumstances. If there is adequate room on the on-ramp, an HOV bypass lane can be used to allow the HOVs to bypass the meter entirely or to be metered in a much shorter queue than the non-HOV vehicles. This can provide a significant travel-time advantage to the HOVs before they even get to the HOV lane. Ramp metering can also make it easier for HOVs to get to and from HOV lanes. When the freeway traffic is stop and go, the time penalty associated with weaving across mixed-flow lanes to get to an HOV lane can discourage many HOV-eligible drivers from using the lane.

Some recent research has also indicated that when mixed-flow lanes are stop and go, there is usually a negative impact on the speed in the HOV lane regardless of the volume of traffic in the HOV lane. Because it is more difficult to exit from the HOV lane when the traffic in the adjacent lane is stop and go the exiting vehicles can block traffic in the HOV lane lanes. Similarly, the entering vehicles may have to accelerate from a very slow speed to 50 or 60 miles per hour, and this acceleration period may delay vehicles in the HOV lane. Many drivers are also more cautious when their speed is much greater than that in the adjacent lane and so they will drive more slowly in the HOV lane because the mixed-flow lane is at stop and go conditions.

When the mixed-flow lanes are moving but at speed slower than the HOV lane, the ideal conditions may exist for HOV lane effectiveness. Ramp metering can be effective in achieving these ideal conditions and providing an additional travel-time advantage at the ramp.

4.1.6 Strategies Tested and Grouping of Strategies into Scenarios

These improvement options described in the previous section have all been given serious consideration in the I-215 corridor and are reflected in various projects programmed or planned for the corridor. For this CSMP, these projects were packaged into a set of scenarios for testing. These scenarios are described in the following sections.

4.1.7 Scenario 1 – 2020 No Build Baseline

This scenario uses the I-215 2008 roadway network as the baseline for traffic forecasting for 2020 and also serves as the basis for comparison of the other scenarios. The scenario includes ramp metering at locations where metering has recently been implemented.

4.1.8 Scenario 2 – RTIP Programmed (Non-HOV) Projects

This scenario added all roadway projects currently included in the 2010 Regional Transportation Improvement Program (RTIP) including the two CMIA projects on I-215 with one exception. The programmed project to add HOV lanes in each direction between the I-215/SR-60/SR-91 junction and the Orange Show Road interchange was moved to Scenario 3 to allow all testing of HOV lane additions in one scenario. The specific projects that were added to the FREQ model for 2020 include those identified in **Table 4-1**.

Table 4-1 RTIP Programmed Projects Included in Scenario 2

	Project ID	RTIP ID #	EA	PM Start	PM End	From	To	Detail	Scheduled Completion Date
Riverside County	R2-1	RIV070305	0F161	8.2	16	Murrieta Hot Springs	Scott RD I/C	Add one mixed flow lane in each direction	12/1/2013
	R2-2	RIV070309	0F162	15.5	28.1	Scott RD I/C	Nuevo Rd I/C	Add one mixed flow lane in each direction	1/7/2015
	R2-3	RIV011232	0A020	15.3	15.7	Scott RD I/C		Reconstruct I/C Add NB loop off and SB on Add ramp metering	9/24/2013
	R2-4	RIV050534	0J440	17.4	19.3	Newport Road I/C		Modify I/C from 6-8 lanes Add NB and SB loop on-ramps Add ramp metering	6/22/2015
	R2-5	RIV071275	0G980	30.7	31.1	Nuevo Rd	Oleander Ave	Widen off-ramps & Ramona Expressway I/C	2/3/2012
	R2-6	RIV060120	0E520	32.3	35.9	3.0 KM s/o Van Buren I/C	2.6 KM N/O Van Buren I/C	Reconstruct I/C Add NB on-ramp Add ramp metering	12/27/2013
San Bernardino County	S2-1	31850	0J070	0.8	1.8	Barton Rd I/C (part of bi-county)		Reconstruct I/C Add ramp metering	12/14/2016
	S2-2	SBD59204	44407	8.9	11.6	Massach-usetts Ave OC	University Parkway U/C	Add 210/215 connectors Replace 27th St OC Modify ramps Improve local streets Construct mixed flow lane, AUX Add ramp metering	11/15/2013
	S2-3	SBD59204	0E420	11.63		University Parkway		Widen OC, Add SB Loop on-ramp. Reconfigure Existing Ramp Add ramp metering	1/7/2015
	S2-4	20061201	0K710	16	17.8	s/o Devore I/C	I15 I/C	Realign I15 Widen connectors w/I215 Add NB truck by-pass	12/30/2015

4.1.9 Scenario 3 – 2020 RTIP Programmed + Other Funded or Planned Improvements

This scenario builds off of Scenario 2 and adds other funded or planned projects identified by corridor stakeholder agencies. They are projects that have been included in the Regional Transportation Plan (RTP) but were not in the 2010 RTIP. These planned and funded projects emphasize new HOV lanes, but also include auxiliary lanes or spot widening to the freeway, interchange modifications and additional ramp metering. The projects added in Scenario 3 are presented in **Table 4-2.**

Table 4-2 Planned Projects Included in Scenario 3

	Project ID	EA	PM Start	PM End	From	To	Detail	Scheduled Completion Date
Riverside County	R3-1	0F163	8	10	In Murrieta at the I-215 Connector	To I-15	Add a lane to SB Connector at Murrieta Hot Springs Rd.	TBD
	R3-2	32780	12.3	12.8	Clinton Keith Rd in Murrieta		Reconstruct I/C Add NB & SB loop on-ramps Add ramp metering	5/30/2011
	R3-3	46420	25.5	27	G Street	San Jacinto Ave	Re-align 215/74 ramps Add ramp metering	7/10/2013
	R3-4	0E760	35.2	36.6	Cactus Ave		Widen ramps Add NB aux lane Add ramp metering	11/20/2015
	R3-5	44931	38.0	38.9	n/o Eucalyptus Ave	S/O Box Springs Rd. I/C	Add HOV lane in each direction	6/12/2013
	R3-6	ON890	41.657		Blaine St Off Ramp/I-215	University Ave off Ramp/I-215	Extend Lane Number 4	11/1/2011
	R3-7	0M940	43.9	45.3	215/60/91 I/C	Orange Show Rd I/C	Add HOV lane in each direction	5/4/2015
San Bernardino County	S3-1	0M630	2.7		Mt Vernon Ave	Washington St	Reconstruct I/C	12/12/2016
	S3-2	00717	4.1	6.5	.4 KM s/o Orange Show Rd	.2 km s/o Rialto Ave U/C (seg. 3)	Add HOV lane Modify ramps Add ramp metering	6/2/2011
	S3-3	0071C	7.3	7.4	5th Street O/C		Extend HOV lanes Add ramp metering Bridge replacement	4/3/2009
	S3-4	0071V	6.4	9	.2 km s/o Redland Loop OH	.7 km n/o 16th OC	Add HOV lanes Modify ramps Add aux lanes Add ramp metering	9/13/2013
	S3-5	00711	5.5	10.5	Inland Center Drive OC	.6 km n/o 215/30 Sep	Construct one NB and one SB Aux Lane R/W for HOV	3/22/2001
	S3-6	00719	8.8	10.1	400 m n/o 16th St	State Route 210	Add a HOV Lane and Operational Improvements	11/15/2013

A significant element in Scenario 3 is the addition of HOV lanes. These included the following:

- Northbound HOV lane from Eucalyptus Avenue to Box Springs Road **(R3-5)**;
- Northbound HOV lane from SR-91 to Orange Show Road **(R3-7)**;
- Northbound HOV lane from Orange Show Road /Auto Center Drive to 2nd Street **(S3-2)**;
- Northbound HOV lane from 2nd Street to 16th Street **(S3-4)**;
- Northbound HOV lane from 16th Street to I-210/Highland on-ramp **(S3-6)**;
- Southbound HOV lane from WB I-210 on ramp to 16th Street **(S3-6)**;
- Southbound HOV lane from 16th Street to 2nd Street **(S3-4)**;
- Southbound HOV lane from 2nd Street to Orange Show Road /Auto Center Drive **(S3-2)**;
- Southbound HOV lane from Orange Show Road /Auto Center Drive to SR-91 **(R3-7)**; and
- Southbound HOV lane from Box Springs Road to Eucalyptus Avenue (**R3-5)**.

4.1.10 Scenario 4 – RTIP Programmed Projects with Ramp Metering

This scenario includes all RTIP programmed projects (Scenario 2) plus ramp metering at all on-ramps within the corridor not metered in Scenario 2. This excludes all freeway to freeway connections.

4.1.11 Scenario 5 – 2020 RTIP Programmed + Other Funded or Planned Improvements with Ramp Metering

This scenario includes all RTIP programmed and other funded or planned capacity enhancement projects (Scenario 3) plus ramp metering at all on-ramps within the corridor not metered in Scenario 3. This excludes all freeway to freeway connections. This scenario tests the full package of potential enhancements. It includes all of the capacity enhancements of scenarios 2 and 3 and includes ramp metering.

4.1.12 Summary Assessment of Benefits and Impacts of Improvement Scenarios

4.1.13 Simulation Results

As indicated in **Figure 4-1**, all of the scenarios produced a reduction in total Peak Period freeway travel time and delay when compared with the 2020 No Build baseline. Each scenario also produced a reduction for each direction and in each time period (AM peak and PM peak) with the exception of Scenario 2, which had a slight increase in freeway delay in the northbound direction in the PM peak period as indicated in **Table 4-3**. In this case, the small increase resulted from the re-distribution of traffic demands associated with the introduction of the new connectors between I-215 and I-210. All other scenarios produced significant reductions in freeway delay in each direction and each time period.

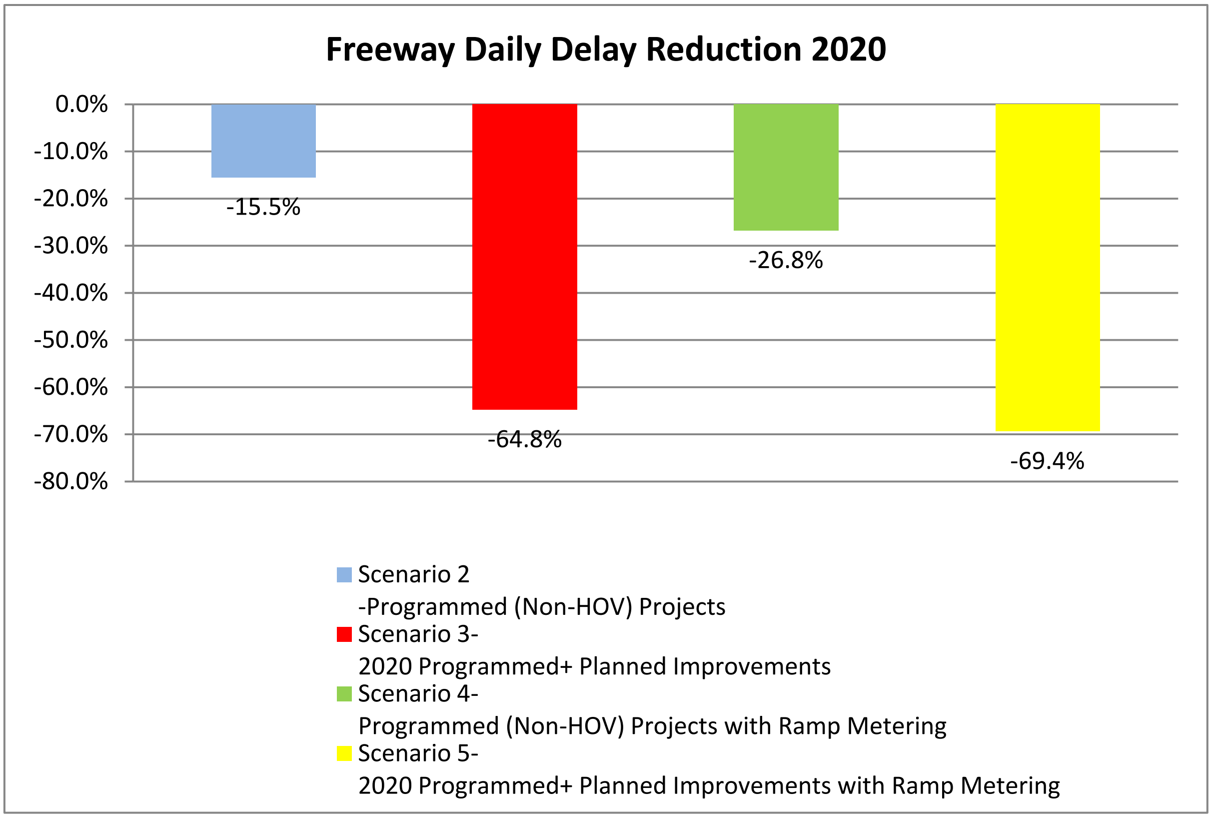

Figure 4-1 Freeway Daily Delay Reduction from the 2020 No-Build for each Scenario

Table 4-3 Scenario Evaluation Results

Performance Measure		Existing - 2008	2020				
			Scenario 1 -Baseline	Scenario 2 -Programmed (Non-HOV) Projects	Scenario 3- 2020 Programmed+ Planned Improvements	Scenario 4- Programmed (Non-HOV) Projects with Ramp Metering	Scenario 5- 2020 Programmed+ Planned Improvements with Ramp Metering
Average segment travel speed (mph)	GP lane (veh-hr)	50	38	41	52	43	53
	HOV Lane (veh-hr)	65	65	65	65	65	65
Freeway Hours of Travel	GP lane (veh-hr)	64,524	92,305	86,726	67,708	82,069	65,744
	HOV Lane (veh-hr)	588	1,246	1,249	3,641	1,249	3,641
	Total	65,112	93,551	87,975	71,349	83,318	69,385
Vehicle Miles of Travel	GP lane (veh-hr)	3,196,921	3,510,063	3,534,206	3,525,163	3,513,168	3,512,025
	HOV Lane (veh-hr)	38,253	81,052	81,180	236,618	81,179	236,618
	Total	3,235,174	3,591,115	3,615,386	3,761,781	3,594,347	3,748,643
Freeway Delay	(veh-hr)	15,340	38,303	32,354	13,475	28,020	11,714
Delay as a % of Total Freeway Travel Time		23.6%	40.9%	36.8%	18.9%	33.6%	16.9%
% Reduction in Freeway Delay vs Baseline				-15.5%	-64.8%	-26.8%	-69.4%

The effect of each scenario on specific bottlenecks is illustrated graphically in **Figure 4-2** and **Figure 4-3.** The effects of the four scenarios on existing and future baseline bottlenecks are described in **Table 4-4**. The impacts of the individual projects evaluated as part of this effort are summarized in **Table 4-5.**

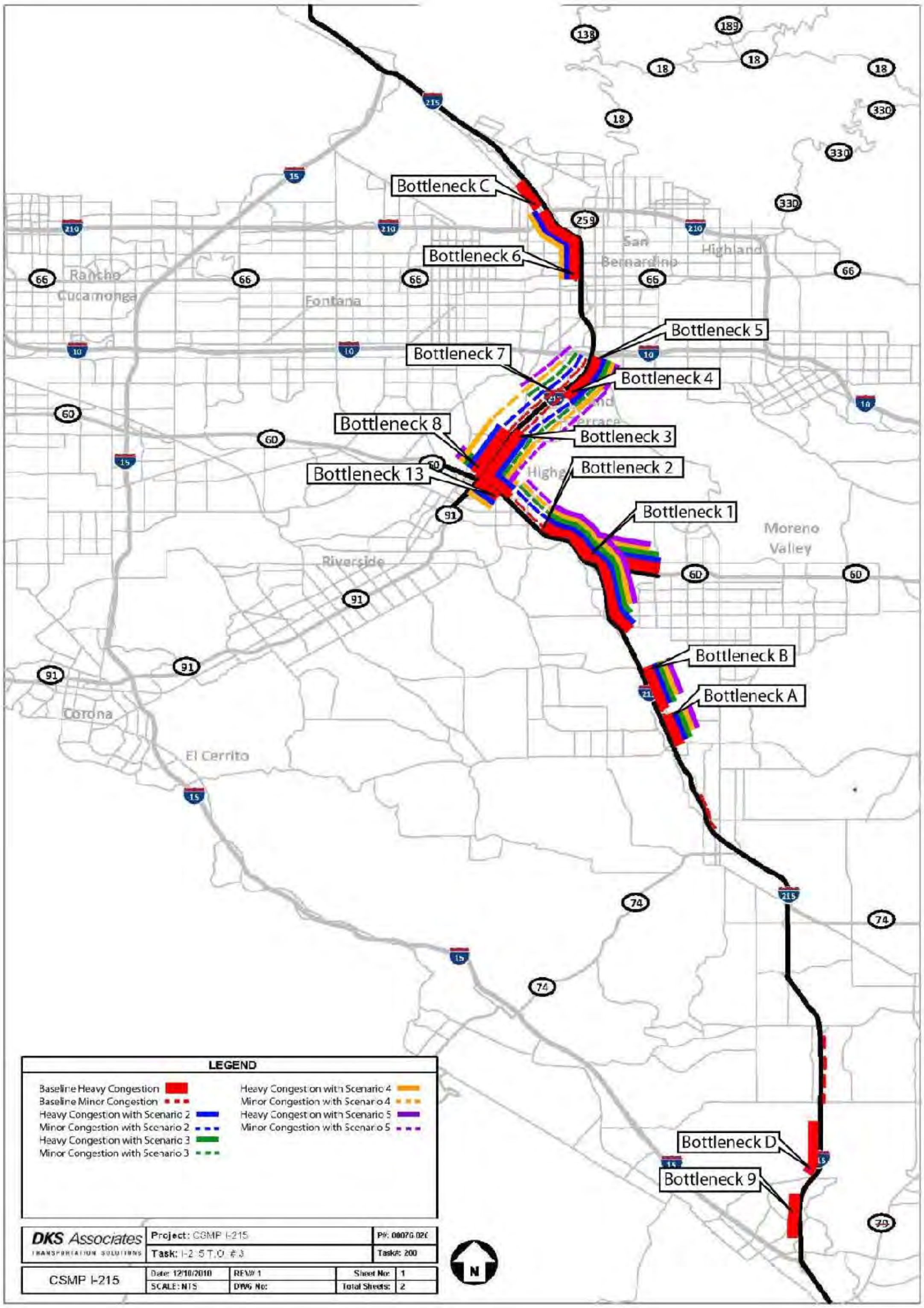

Figure 4-2 Impact of Scenarios on Baseline – AM Peak Congestion Patterns

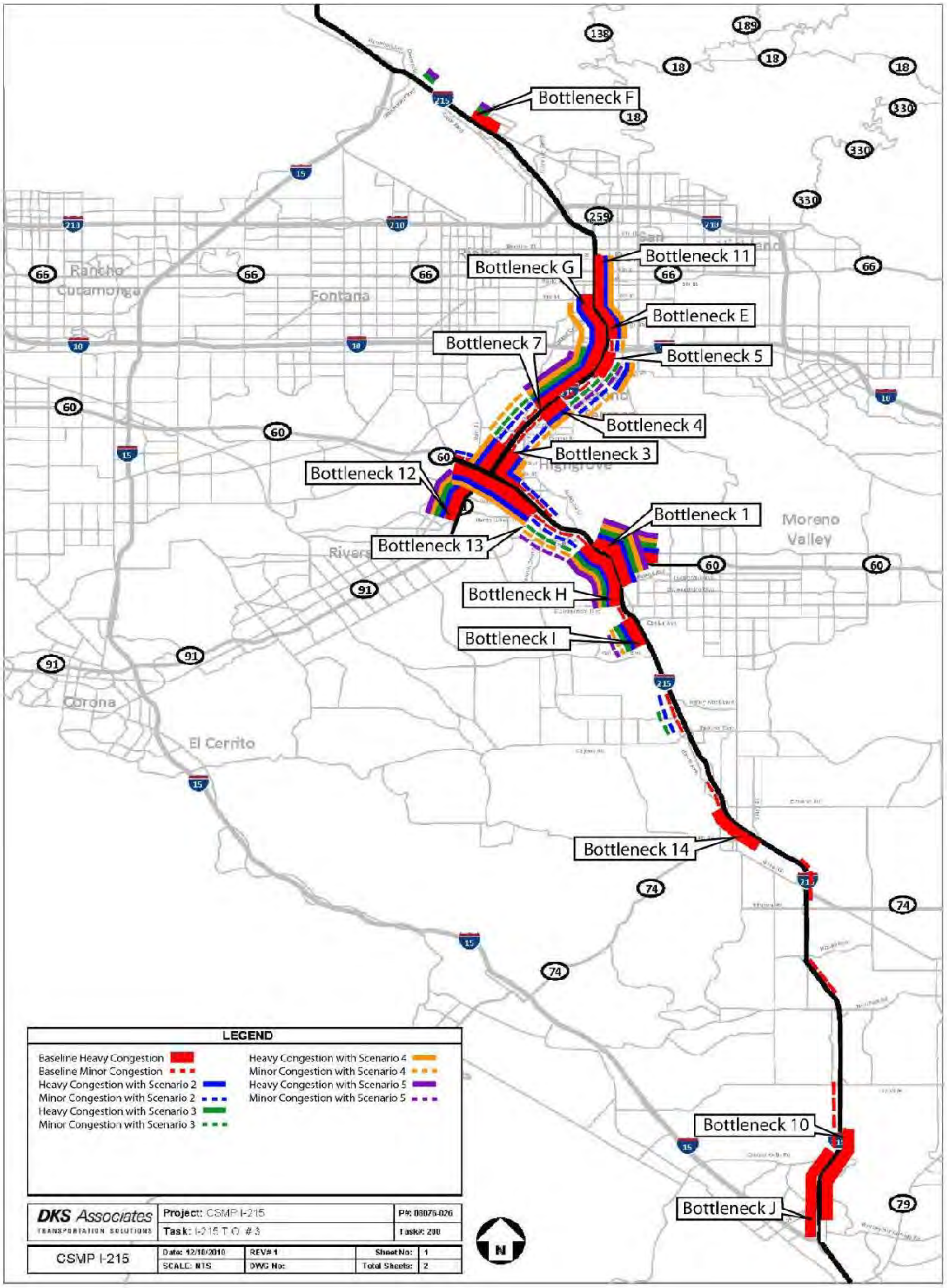

Figure 4-3 Impact of Scenarios on Baseline – PM Peak Congestion Patterns

Table 4-4 Effect of Scenario Improvements on Bottleneck and Points of Congestion

Bottleneck Location	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Northbound AM				
A - Ramona Expwy to Harley Knox Blvd	Ramp metering reduces delay **(R2-3, R2-4, R2-5)**	No significant change **(R3-2, R3-3)**	Ramp metering reduces delay	Ramp metering reduces delay
B - Harley Knox Blvd to Van Buren Blvd	No significant change	No significant change **(R3-2, R3-3)**	Ramp metering reduces delay	Ramp metering reduces delay
1 – Central Ave/Watkins Dr. off to on Secondary bottlenecks at SR-60 to Box Springs Rd and Box Springs Rd to Watkins Dr	No significant change	Slight reduction in delay **(R3-2, R3-3, R3-4, R3-5)**	Ramp metering reduces delay	Ramp metering reduces delay
2 – Martin Luther King Blvd to University Ave Secondary bottleneck at University Ave off to lane add	No significant change	Slight reduction in delay **(R3-2, R3-3, R3-4, R3-5)**	Ramp metering reduces delay	Ramp metering reduces delay
3 – Columbia Ave to Center St. Secondary bottleneck at SR-91 merge to Columbia Ave	No significant change	Congestion almost eliminated from SR-91 to I-10 by HOV lane addition and other capacity improvements **(R3-7)**	Ramp metering reduces delay	No significant change from Scenario 3
4 – Barton St to Washington St.	No significant change		No significant change	No significant change
5 – WB Washington St to I-10	No significant change		No significant change	No significant change

Table 4-4 Effect of Scenario Improvements on Bottleneck and Points of Congestion (cont.)

Bottleneck Location	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Southbound AM				
C – University Pkwy to I-210.	Bottleneck eliminated by a lengthened aux lane. **(S2-3)**	No congestion remains	No congestion remains	No congestion remains
6 – Orange St to 6th Street Secondary bottleneck at SR-259 merge	Conditions slightly worsen due to re-distribution of traffic associated with new I-210 connectors **(S2-2)**	Congestion eliminated from University to 6th Street by HOV lane addition, extension of third mixed-flow lane and other capacity improvements **(S3-2, S3-4, S3-5)**	Ramp metering reduces delay	No congestion remains
7 – Barton Rd to Iowa Ave/La Cadena Dr	No significant change	Significant reduction in congestion between I-10 and Columbia by addition of an HOV lane **(R3-7)**	Ramp metering reduces delay	No significant change
8 – Center St to Columbia Ave	No significant change		No significant change	No significant change
13 – Blaine St/University Ave	No significant change	Congestion eliminated by extension of aux lanes **(R3-6)**	No significant change	No significant change
D –Scott Rd to Clinton Keith Rd	Congestion at the south end of the corridor from Scott Road to Clifton Keith Road eliminated by the addition of a third mixed-flow lane. **(R2-1 & R2-2)**	No congestion remains	No congestion remains	No congestion remains
9 - Los Alamos Rd to Murrieta Hot Springs Rd		No congestion remains	No congestion remains	No congestion remains

Table 4-4 Effect of Scenario Improvements on Bottleneck and Points of Congestion (cont.)

Bottleneck Location	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Northbound PM				
10 – Clinton Keith Road to I-15	Bottleneck eliminated by addition of third mixed-flow lane. **(R2-1 & R2-3)**	No congestion remains **(R3-2)**	No congestion remains	No congestion remains
1 – Central Ave/Watkins Dr. off to on Secondary bottlenecks at SR-60 to Box Springs Rd and Box Springs Rd to Watkins Dr.	No significant change **(R2-6)**	Slight reduction in delay as a result of HOV lane extension **(R3-5)** and interchange improvements/ramp metering **(R3-2, R3-3 and R3-4)**	Ramp metering reduces delay	Ramp metering reduces delay
3 – Columbia Ave to Center St.	No significant change	Congestion almost eliminated between Columbia and I-10 by HOV lane addition, aux lane addition and other capacity improvements **(R3-7)**	Ramp metering reduces delay	No congestion remains
4 – Barton St to Washington St.	No significant change			No congestion remains
5 – WB Washington St to I-10	No significant change		Ramp metering reduces delay	No significant change
E – Auto Center Dr/Orange Show Rd	No significant change	Congestion eliminated between I-10 and Baseline by HOV lane addition, aux lane addition and other capacity improvements **(S3-4 & S3-5)**	No significant change	No congestion remains
11 – 10th St. to 13th St	Conditions slightly worsen due to re-distribution of traffic associated with new I-210 connectors **(S2-2)**		Ramp metering reduces delay	No congestion remains
F- Palm Ave to Devore Rd	Congestion eliminated by additional metering **(S2-1, s2-2, S2-3)** Also, improvements at I-15/I-215 junction help eliminate significant delays on connector from NB I-15. This benefit does not appear in results for I-215. **(S2-4)**	Increased congestion due to elimination of upstream bottlenecks **(R3-7, S3-4 & S3-5)**	No congestion remains	Ramp metering reduces delay

Table 4-4 Effect of Scenario Improvements on Bottleneck and Points of Congestion (cont.)

Bottleneck Location	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Southbound PM				
G –Mill St to Inland Center Dr	Slight reduction in delay with metering and re-distribution of traffic associated with new I-210 connector **(S2-2)**	Congestion between Mill St. and Inland Center Dr. eliminated by HOV lane addition, aux lane addition and other capacity improvements **(S3-4 & S3-5)**	Ramp metering reduces delay	No congestion remains
7 – Barton Rd to Iowa Ave/La Cadena Dr	No significant change	Bottleneck reduced significantly by HOV lane addition, aux lane addition and other capacity improvements **(R3-7, S3-2 & S3-4)**	Ramp metering reduces delay	Ramp metering reduces delay
12 – SR-91 - 14th St. to SR-91/Central Ave.	No significant change	Congestion increases near 14th because of reduction in upstream bottlenecks	Ramp metering reduces delay	No significant change
13 – Blaine Street/ University Ave	No significant change	Bottleneck between Blaine and University eliminated by extension of aux lane**(R3-6)**	No significant change	No congestion remains
H – Eucalyptus Avenue to Alessandro Blvd	No significant change	Congestion increases because of elimination of upstream bottleneck **(R3-6)**	No significant change	No significant change
I – Cactus Ave/Van Buren Boulevard	Slight reduction due to ramp metering **(R2-6)**	Slight reduction in delay	Ramp metering reduces delay	Ramp metering reduces delay
14 – E 4th St (SR-74) to Ramona Expwy.	Bottleneck eliminated by the addition of a third mixed-flow lane. **(R2-2)**	No significant change from Scenario 2	Ramp metering reduces delay	
J - Scott Rd to I-15	Congestion at the south end of the corridor from Scott Rd to I-15 eliminated by the addition of a third mixed-flow lane. **(R2-1 & R2-2)**	No congestion remains	No congestion remains	No congestion remains

Table 4-5 Summary of Project Impacts – Scenario 2

	Project ID	RTIP ID #	EA	PM Start	PM End	From	To	Detail	Scheduled Completion Date	Projected Operational Impacts
Riverside County	R2-1	RIV070305	0F161	8.2	16	Murrieta Hot Springs	Scott RD I/C	Add one mixed flow lane in each direction	12/1/2013	Produce significant reduction in delay. Relieve various areas of congestion in both directions during both peak periods (B/N 9, 10, 14, D; plus areas of minor congestion).
	R2-2	RIV070309	0F162	15.5	28.1	Scott RD I/C	Nuevo Rd I/C	Add one mixed flow lane in each direction	1/7/2015	
	R2-3	RIV011232	0A020	15.3	15.7	Scott RD I/C		Reconstruct I/C Add NB loop off and SB on Add ramp metering	9/24/2013	Help maintain or improve access. Improve local circulation. Can help reduce potential for off-ramp queues spilling back onto freeway mainline. Provides for implementation of ramp metering that can help improve mainline operations and safety by breaking up platoons.
	R2-4	RIV050534	0J440	17.4	19.3	Newport Road I/C		Modify I/C from 6-8 lanes Add NB and SB loop on-ramps Add ramp metering	6/22/2015	
	R2-5	RIV071275	0G980	30.7	31.1	Nuevo Rd	Oleander Ave	Widen off-ramps & Ramona Expressway I/C	2/3/2012	
	R2-6	RIV060120	0E520	32.3	35.9	3.0 KM s/o Van Buren I/C	2.6 KM N/O Van Buren I/C	Reconstruct I/C Add NB on-ramp Add ramp metering	12/27/2013	
San Bernardino County	S2-1	31850	0J070	0.8	1.8	Barton Rd I/C		Reconstruct I/C Add ramp metering	12/14/2016	
	S2-2	SBD59204	44407	8.9	11.6	Massachusetts Ave OC	University Parkway U/C	Add 210/215 connectors Replace 27th St OC Modify ramps Improve local streets Construct mixed flow lane, AUX Add ramp metering	11/15/2013	Improves overall system connectivity. Reduces demand on arterial network. Re-distribution of traffic demands associated with the introduction of the new connectors results in a slight increase in freeway delay in the northbound direction in

										the PM peak period.
	S2-3	SBD59204	0E420	11.63		University Parkway		Widen OC, Add SB Loop on-ramp. Reconfigure Existing Ramp Add ramp metering	1/7/2015	Improves access and local circulation. Auxiliary lane eliminates southbound bottleneck (B/N C). Metering at this location, plus that implemented as part of S2-1 and S2-2 help eliminate downstream bottleneck (B/N F).
	S2-4	20061201	0K710	16	17.8	s/o Devore I/C	I15 I/C	Realign I15 Widen connectors w/I215 Add NB truck by-pass	12/30/2015	Provides significant congestion relief during PM peak period, notably on I-15 northbound. By-pass reduces weaving and improves safety

Table 4-5 Summary of Project Impacts – Scenario 3

	Project ID	EA	PM Start	PM End	From	To	Detail	Scheduled Completion Date	Projected Benefit
Riverside County	R3-1	0F163	8	10	In Murrieta at the I-215 Connector	To I-15	Add a lane to SB Connector at Murrieta Hot Springs Rd.	TBD	Reduces delay. Eliminates bottleneck at south end of corridor (B/N J).
	R3-2	32780	12.3	12.8	Clinton Keith Rd in Murrieta		Reconstruct I/C Add NB & SB loop on-ramps Add ramp metering	5/30/2011	Help maintain or improve access. Improve local circulation. Can help reduce potential for off-ramp queues spilling back onto freeway mainline. Provides for implementation of ramp metering that can help improve mainline operations and safety by breaking up platoons.
	R3-3	46420	25.5	27	G Street	San Jacinto Ave	Re-align 215/74 ramps Add ramp metering	7/10/2013	
	R3-4	0E760	35.2	36.6	Cactus Ave		Widen ramps Add NB aux lane Add ramp metering	11/20/2015	
	R3-5	44931	38.0	38.9	n/o Eucalyptus Ave	S/O Box Springs Rd.	Add HOV lane in each direction	6/12/2013	Reduces delay and improves operations around SR-60 junction.

	Project ID	EA	PM Start	PM End	From	To	Detail	Scheduled Completion Date	Projected Benefit
						I/C			Reduces HOV weaving.
	R3-6	ON890	41.657		Blaine St Off Ramp/I-215	University Ave off Ramp/I-215	Extend Lane Number 4	11/1/2011	Reduces delay. Eliminates southbound PM bottleneck (B/N 13).
	R3-7	0M940	43.9	45.3	215/60/91 I/C	Orange Show Rd I/C	Add HOV lane in each direction	5/4/2015	Extends HOV network. Can encourage mode shift. Provides significant congestion relief and delay reduction. Greatly reduces congestion between SR-91 and I-10 in both directions (B/N 3, 4, 5, 7 and 8).
San Bernardino County	S3-1	0M630	2.7		Mt Vernon Ave	Washington St	Reconstruct I/C	12/12/2016	Help maintain or improve access. Improve local circulation. Provides for implementation of ramp metering that can help improve mainline operations and safety by breaking up platoons.
	S3-2	00717	4.1	6.5	.4 KM s/o Orange Show Rd	.2 km s/o Rialto Ave U/C (seg. 3)	Add HOV lane Modify ramps Add ramp metering	6/2/2011	Extends HOV network. Can encourage mode shift. Provides significant congestion relief and delay reduction. Eliminates congestion between I-10 and I-210 in both directions (B/N 6, 11and E).
	S3-3	0071C	7.3	7.4	5th Street O/C		Extend HOV lanes Add ramp metering Bridge replacement	4/3/2009	
	S3-4	0071V	6.4	9	.2 km s/o Redland Loop OH	.7 km n/o 16th OC	Add HOV lanes Modify ramps Add aux lanes Add ramp metering	9/13/2013	
	S3-5	00711	5.5	10.5	Inland Center Drive OC	.6 km n/o 215/30 Sep	Construct one NB and one SB Aux Lane R/W for HOV	3/22/2001	
	S3-6	00719	8.8	10.1	400 m n/o 16th St	State Route 210	Add a HOV Lane and Operational Improvements	11/15/2013	

Table 4-5 Summary of Project Impacts – Additional Ramp Metering – Scenarios 4 and 5

	Project ID	EA	PM Start	PM End	From	To	Detail	Scheduled Completion Date	Projected Benefit
	RM		Corridor-wide				Implement corridor-wide ramp metering		Breaks up platoons entering freeway. Improve mainline operations and reduces delay. Improves safety. Provides freeway management control during incidents.

4.3.2 Scenario 2 – 2020 No Build Baseline

For Scenario 2, the combination of mixed flow lane additions and interchange improvements produce a 15.5% reduction in total freeway delay during the weekday peak periods. Most of this improvement occurs as a result of the widening from 2 to 3 general purpose lanes between Murrieta Hot Springs Nuevo Rd (projects R2-1 and R2-2) in the southern part of the corridor that eliminates several bottlenecks, especially in the southbound direction. This fact is reflected in the directional delay reductions of nearly 42% and 20% for southbound travel during the AM and PM peak periods respectively.

The various interchange improvement projects included in this scenario (R2-3, R2-4, R2-5, R2-6, S2-1 and S2-3) will help maintain or improve access, and improve local circulation. These improvements can also help freeway operations by reducing the potential for off-ramp queues spilling back onto freeway mainline and by implementing additional ramp metering. The auxiliary lane addition associated with improvements at the University Parkway interchange (project S2-3) will also directly alleviate the bottleneck in this area.

The new freeway-to-freeway connectors between I-215 and I-210 (project S2-3) will improve overall system connectivity and will improve operating conditions on local streets by reducing arterial demands. As indicated above, the re-distribution of traffic demands associated with the introduction of the new connectors between I-215 and I-210 results in a slight increase in freeway delay in the northbound direction in the PM peak period.

The improvements at the I-15/I-215 north junction (project S2-4) will provide significant congestion relief during PM peak period, notably on I-15 northbound. The truck by-pass included as part of this project will also reduce weaving and improve safety in this area.

4.3.3 Scenario 3 – 2020 Programmed + Planned Improvements

The roadway widening in Scenario 3 for the HOV lane and auxiliary lanes produces significantly greater reduction in delay (nearly 65% compared to the Baseline) than the improvements in Scenario 2. The overall average speed during the peak commute periods in the general-purpose lanes is increased from 38 miles per hour in the 2020 Baseline to 52 mph in Scenario 3. Much of this improvement is associated with the addition of the HOV lanes and other operational improvements through the central portion of the corridor between the SR-60/SR-91 and I-210 junctions as provided through projects R3-7, S3-2, S3-3, S3-4, S3-5 and S3-6. These new HOV lanes help eliminate or significantly reduce several bottlenecks.

The widening of the southbound connector from I-215 to I-15 in Murrieta (R3-1) eliminates a PM peak period bottleneck. Likewise the extension of the auxiliary lane on southbound I-215 from the Blaine St off-ramp to the University Ave off-ramp (R3-6) eliminates the bottleneck in this area that is expected to occur during both peak periods in 2020. The extension of the HOV lanes south of the SR-60 junction to just north of Eucalyptus Ave (R3-5) is expected to reduce delay and improve operations around SR-60 junction, although it is not expected to eliminate congestion in this area.

The various interchange improvement projects included in this scenario (R3-2, R3-3, R3-4 and S3-1) will help maintain or improve access, and improve local circulation. These improvements can so help freeway operations by reducing the potential for off-ramp queues spilling back onto freeway mainline and by implementing additional ramp metering.

The additional ramp metering included in Scenario 3 also contributes to the improved operations, accounting for approximately 10% of the total freeway delay reduction.

4.3.4 Scenario 4 – Programmed Projects with Ramp Metering

In Scenario 4, when corridor-wide ramp metering is added to the physical improvements included in Scenario 2, the total freeway delay reduction increases to nearly 27%. In addition, this produces delay savings for each direction and in each time period ranging from a 14% reduction for the northbound AM to a 48.3% reduction for the southbound PM. Notably, the introduction of the corridor-wide ramp metering produces a reduction in freeway delay even in the northbound direction during the PM peak period.

4.3.5 Scenario 5 – Programmed and Planned Projects with Ramp Metering

In Scenario 5, when corridor-wide ramp metering is added to Scenario 3, total freeway delay drops by an additional 5% and the average speed increases to 53.5 in the general-purpose lanes. The relatively modest benefit of corridor-wide ramp metering reflects the fact that a significant number of on-ramps, especially those in the more-congested central portion of the corridor, are already assumed to be metered under Scenario 3.

The combination of improvements in Scenario 3 will have enough effect on bottlenecks and points of congestion to reduce the level of delay to below 2008 levels. With Scenario 3 improvements, delay will represent only 18.9% of total freeway travel time. When ramp metering is added in Scenario 5, delay represents only 16.8% of total freeway travel time.

5 RECOMMENDED CORRIDOR SYSTEM MANAGEMENT STRATEGIES

The I-215 corridor currently experiences considerable congestion during both the AM and PM periods. Existing traffic demand on I-215 exceeds capacity on several segments during both peak periods. In the future years, without congestion mitigation strategies and improvements, traffic conditions in the I-215 corridor are expected to worsen. By 2020, freeway delay is projected to more than double if improvements are not implemented.

As part of this CSMP effort, a number of physical capacity improvements, as well as ramp metering, were analyzed. While these improvements were shown to considerably reduce the level of congestion on I-215, consideration should be given to a variety of other system management strategies to maintain the realized improvements in delay from the programmed and planned projects. These include strategies to achieve the following:

- Maximize the efficiency of the existing roadway system, including local streets.
- Encourage increased use of other modes.
- Reduce the occurrence and impact of collisions and other incidents.
- Reduce or manage peak period vehicle travel demand.

The types of strategies that can be applied in the I-215 corridor to address existing and forecasted deficiencies include additional system management improvements, improvements to local streets, public transportation improvements, park-and-ride facilities, and demand management strategies. While these types of strategies were not expressly analyzed as part of this CSMP, and in some cases cannot be readily quantified, they represent important elements in a comprehensive program for managing mobility in the I-215 corridor. An overview of these types of strategies is provided below.

5.1.1 Planned and Programmed Capacity Improvements

Numerous physical capacity improvements have been identified and evaluated in the CSMP that increase the productivity of I-215. By making I-215 more attractive to use, fewer drivers will choose to use local streets for longer trips and this will reduce traffic volumes on local parallel arterials. The improvements tested include a combination of mixed flow through lane additions, auxiliary lane additions, HOV lane additions and interchange modifications. These improvements were found to significantly reduce, or even eliminate, congestion in the southern and central portions of the corridor. The interchange modifications may also be expected to improve operations on the corresponding local arterials by reducing back-up from ramps onto local streets.

In terms of delay reduction, the HOV lane additions and related improvements in the central portion of corridor offer the greatest potential benefit as this is where the level of existing and projected future congestion is the greatest. These improvements also help extend the regional HOV lane network and can encourage mode shift. The extension of the fourth lane on southbound I-215 from Blaine St to University Ave is also expected to produce significant delay reductions.

The general-purpose lane additions in the southern part of the corridor are expected to produce lower, but still significant, levels of congestion relief. These improvements eliminate several bottlenecks, especially in the southbound direction, and are important to maintaining mobility in that part of the corridor.

In general, the primary benefits of the various interchange improvement projects examined as part of this effort are to help maintain or improve access, and to improve local circulation. However, these improvements can also help freeway operations by reducing the potential for off-ramp queues spilling back onto freeway mainline and by implementing additional ramp metering. The auxiliary lane addition associated with improvements at the University Parkway interchange will also directly alleviate the bottleneck in this area. Meanwhile, the new freeway-to-freeway connectors between I-215 and I-210 (project S2-3) will improve overall system connectivity and will improve operating conditions on local streets by reducing arterial demands.

The stakeholder agencies in the corridor should continue to pursue funding of these capacity improvements in combination with other management strategies to avoid major capacity increases or to delay them as long as possible. Additionally, it is recommended that the local jurisdictions consider the existing level of connectivity and possibly even the construction of new frontage roads for proposed future commercial and residential development along the I-215 corridor. Other plausible strategies include the expansion of existing parallel roadways to reduce congestion and help preserve the mobility gains of the I-215 CMIA investments.

5.1.2 System Management

5.2.1 Surveillance and Monitoring

A core element of effective corridor management is surveillance and monitoring. Improvement in surveillance and monitoring is recommended to support the additional strategies recommended below. Support for continuous evaluation of system performance and the effectiveness of management strategies that are implemented is also recommended.

1. Continued installation of freeway mainline detectors for each lane to support freeway management strategies such as ramp metering.
2. Continued installation of detection and other ITS elements to support traveler information systems (such as 511 and Changeable Message Signs with expected travel times to select destinations), freeway service patrol (identifying locations where an incident has stopped or slowed traffic in one or more lanes.

5.2.2 Ramp Metering

Ramp metering will be an important element for managing the I-215 Corridor. When combined with other recommended strategies, ramp metering will increase productivity on the freeway. The following actions should be pursued to support ramp metering in the corridor:

1. Seek opportunities to increase the capacity of on-ramps to accommodate storage of metered vehicles where feasible.
2. Install underground ramp-metering infrastructure on all ramps that are rebuilt along with interchange reconstruction or as stand-alone projects.
3. Seek opportunities to construct auxiliary lanes and/or lengthen merge areas for ramps wherever roadway construction occurs on I-215.
4. Implement monitoring on the mainline to provide the information necessary to determine appropriate metering rates.